EXTERNAL SCIENTIFIC REPORT

Toxicity of pesticides to aquatic and terrestrial life stages of amphibians and occurrence, habitat use and exposure of amphibian species in agricultural environments[1]

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ABSTRACT

The aim of this study was to provide EFSA with information relating to assessment of the risk to amphibians posed by pesticide exposure. In the first part of the study the European amphibian species associated with agricultural habitats were identified with the aim of collating information for representative species such as body size and life-cycle. Also collated were the results of studies of amphibians in European agricultural habitats to provide information on activity in areas where they may be at risk of exposure to pesticides. Several studies of the use of agricultural habitats were found providing information on migration distances and associations with particular crops although the data is patchy. The second part of the study collated information useful to risk assessment for terrestrial habitats. Information was presented on possible assessment of dietary exposure but methods for estimating dermal exposure have not yet been developed due to lack of necessary information. Other routes of exposure such as soil ingestion and inhalation were considered but no methods specific to amphibians were found. Finally, toxicity data for both the aquatic and terrestrial stages were gathered for comparison with fish and bird/mammal data respectively. A substantial quantity of data was found for aquatic exposure and after quality assessment data for each time period were presented. Far less information was found for terrestrial amphibians and what is available is of variable quality. More information is required to allow the assesment of exposure, particularly dermal exposure and the relative toxicity of pesticides to terrestrial amphibians and other vertebrate groups.

KEY WORDS

Amphibian, risk-assessment, pesticide, toxicity, exposure, aquatic, terrestrial

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SUMMARY

The aim of this study was to provide EFSA with information relating to assessment of the risk to amphibians posed by pesticide exposure. In the first part of the study the European amphibian species associated with agricultural habitats were identified with the aim of collating information such as body size and life-cycle for representative species. Also collated were the results of studies of amphibians in European agricultural habitats to provide information on activity in areas where they may be at risk of exposure to pesticides.

Several European species were identified as being at risk from pesticide exposure given their presence in agricultural land and dependence on surface water in these environments for reproduction. This is confirmed by studies which have identified large proportions of the populations of some species as being present at the time of pesticide applications. It seems likely that migratory movements in spring would represent a worst case (e.g. migrating long distances across fields during spring applications).

Food intake can be estimated based on published data for the species of concern or by estimating food requirements as is done for birds and mammals by using allometric equations for reptiles. However, the feeding pattern of amphibians is far more variable than for birds and mammals where small species must usually feed every day. This makes it far more difficult to establish a daily food intake value or determine how likely the animal is to feed while contaminated food is available.

Dermal exposure is likely to be a major route of exposure due to the use of skin for respiration and water uptake and the potentially high rate of absorption of contaminants. However, there are as yet no methods that have been developed to assess this risk for amphibians in the natural environment. For effective risk assessment for this group there is an urgent need for further research in this area.

Even less information is available for other routes of exposure such as soil ingestion or inhalation although methods used for other small vertebrates to assess soil ingestion are likely to be suitable. While avoidance may have the potential to reduce exposure the evidence for this is mixed and would need to be assessed on case by case basis.

A large number of toxicity values were found for aquatic stages of amphibians suitable for comparison with fish data. A far smaller body of data was found for toxicity of pesticides to terrestrial phases both in numbers of values and range of compounds making comparisons with bird and mammal data more difficult.

While aquatic amphibians may be protected by existing aquatic risk assessments, it is recommended that more information is necessary for terrestrial amphibian risk assessment, particularly for the assessment of dermal risk and the relative toxicity of terrestrial stages of amphibians and other terrestrial vertebrates.

TABLE OF CONTENTS

TERMS OF REFERENCE AS PROVIDED BY EFSA

Consider the toxicity of pesticides to aquatic and terrestrial life stages of amphibians. The literature overview should provide the basis for a comparison of the sensitivity of amphibians with fish, birds and mammals.

Consider the occurrence of different amphibian species in agricultural landscapes. The aim is to find out which species occur in agricultural landscapes and how is the habitat use of the species. The literature review should provide a basis for an estimation of exposure of amphibians to pesticides during their different life stages.

This contract was awarded by EFSA to:

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INTRODUCTION AND OBJECTIVES

Exposure of amphibians to plant protection products may occur through direct absorption from contaminated water bodies in the aquatic phase, or ingestion of contaminated food or water, contact with sprayed surfaces or direct overspray in the terrestrial phase.

The aims of this project were to:

1. Provide information useful for risk assessment on a range of European species of amphibian that might be at risk of exposure.

2. Collate data on the toxicity of pesticides to amphibians suitable for comparison with other species such as fish, birds and mammals.

3. Identify other possible routes of exposure.

The findings for these are presented along with some recommendations about how they may be used and additional research that would assist in exposure assessment.

MATERIALS AND METHODS

A literature survey was conducted by the Fera Information Centre using a list of search terms as detailed in Appendix A. Databases searched were CAB Abstracts, AGRICOLA, AGRIS, Environmental Sciences, MEDLINE(R), Enviroline(R), Pollution Abstracts, Biosis Previews(R), ToxFile and Water Resources Abstracts. Further searches were made of the US EPA Ecotox database, the Reptile and Amphibian Toxicity Literature database (RATL), and key publications and reviews including Sparling et al. (2000, 2010), Wells (2007).

Original papers identified in the search were either obtained from Fera's stock of 10,000 books and monographs, and subscriptions to over 200 current journals. Where publications were not available in-house, these were obtained from inter-library loans or via the range of contacts and reciprocal agreements that Fera has with other special libraries relevant to Fera's areas of business. A literature database was created in EndNote and submitted to EFSA.

In the first stage of the study, a review was performed to identify key information on the use of agricultural (or similar) habitats by amphibians along with information useful for estimating exposure to pesticides. The review considered state-of-the-knowledge through search of information from scientific literature, study reports and other documents. Key publications included Ecotoxicology of Amphibians and Reptiles 2nd Edition (Sparling et al, 2010) and The Ecology and Behavior of Amphibians (Wells 2007). Detailed information (e.g. dietary information and body weight data), for representative (widespread and associated with agricultural environments) European species of frogs, toads and newts were collated. In the second stage, toxicity data for amphibians was collated for both aquatic and terrestrial phases where available. Any reports of studies identified as useful and not available in existing databases (e.g. US EPA ECOTOX database) were evaluated to assess their reliability.

1. Species at risk

Information found in the literature search and other sources identified was used to identify species at risk and obtain available information on use of agricultural habitat.

1.1. European species

Information on the amphibian species found in the 27 European Union countries from the IUCN redlist (www.iucnredlist.org) are shown in Tables 1 and 2 along with information on the 'artificial terrestrial' habitats in which they are found. Also shown are the risk assessment zones which are covered by their country distribution.

Table 1: Caudate amphibians found in the 27 European Union countries including country distribution associations with 'artificial terrestrial' habitats as defined by IUCN. Also included are the European zones (North, Central, South) in which each species is found.

Common name	Species	Countries (IUCN)	Artificial- Terrestrial (IUCN)	Zone(s)	Reference (Appendix N)
Golden-striped salamander	*Chioglossa lusitanica*	Portugal | Spain	Plantations	S	Arntzen et al (2009)
Sardinian brook salamander	*Euproctus platycephalus*	Italy	None	S	Romano et al (2009)
Sardinian cave salamander	*Atylodes genei/Hydromantes genei*	Italy	None	S	Andreone et al (2009)
Sharp-ribbed salamander	*Pleurodeles waltl*	Portugal | Spain	Pastureland	S	Beja et al (2009)
Olm	*Proteus anguinus*	France (introduced) | Italy | Slovenia |	None	C, S	Arntzen et al (2009)
Alpine salamander	*Salamandra atra*	Austria | France | Germany | Italy | Slovenia | [Switzerland]	Pastureland	C, S	Andreone et al (2009)
Lanza's alpine salamander	*Salamandra lanzai*	France | Italy	Pastureland	S	Sindaco et al (2009)
Fire salamander	*Salamandra salamandra*	Austria | Belgium | Bulgaria | Czech Republic | France | Germany | Greece | Hungary | Italy | Luxembourg | Netherlands | Poland | Portugal | Romania | Slovakia | Slovenia | Spain | [Switzerland]	Arable land | Pastureland | Plantations | Rural gardens | Urban areas	C, S	Kuzmin et al (2009)
Alpine newt	*Mesotriton alpestris*	Austria | Belgium | Bulgaria | Czech Republic | Denmark | France | Germany | Greece | Hungary | Italy | Luxembourg | Netherlands | Poland | Romania | Slovakia | Slovenia | Spain | [Switzerland] | United Kingdom (introduced)	Pastureland | Rural gardens	N, C, S	Arntzen et al (2009)
Great crested newt	*Triturus cristatus*	Austria | Belgium | Czech Republic | Denmark | Estonia | France | Germany | Hungary | Latvia | Lithuania | Luxembourg | Netherlands | Poland | Romania | Slovakia | Sweden | [Switzerland] | United Kingdom	Arable land | Pastureland | Rural gardens | Urban areas	N, C, S	Arntzen et al (2009)

Common name	Species	Countries (IUCN)	Artificial- Terrestrial (IUCN)	Zone(s)	Reference (Appendix N)
Marbled newt	*Triturus marmoratus*	France | Portugal | Spain	Arable land | Pastureland | Urban areas	S	Arntzen et al (2009)
Southern marbled newt	*Triturus pygmaeus*	Portugal | Spain	Arable land | Pastureland | Rural gardens	S	Arntzen et al (2009)
Carpathian newt	*Lissotriton montandoni*	Czech Republic | Germany (introduced) | Poland | Romania | Slovakia	Arable land | Pastureland | Rural gardens	C	Arntzen et al (2009)
Smooth newt	*Lissotriton vulgaris*	Austria | Belgium | Bulgaria | Czech Republic | Denmark | Estonia | Finland | France | Germany | Greece | Hungary | Ireland | Italy | Latvia | Luxembourg | Netherlands | Poland | Romania | Slovakia | Slovenia | Sweden | [Switzerland] | United Kingdom	Arable land | Pastureland | Plantations | Rural gardens | Urban areas	N, C, S	Arntzen et al (2009)
Palmate newt	*Lissotriton helveticus*	Belgium | France | Germany | Luxembourg | Netherlands | Portugal | Spain | [Switzerland] | United Kingdom	Arable land | Pastureland | Plantations | Rural gardens | Urban areas	C, S	Arntzen et al (2009)
Italian newt	*Lissotriton italicus*	Italy	Arable land | Pastureland | Rural gardens	S	Arntzen et al (2009)
Bosca's newt	*Lissotriton boscai*	Portugal | Spain	Arable land | Pastureland | Rural gardens	S	Arntzen et al (2009)
Corsican fire salamander	*Salamandra corsica*	France	None	S	Miaud et al (2009)
Ambrosi's cave salamander, Spezia cave salamander	*Speleomantes ambrosii*	Italy	None	S	Andreone et al (2009)
Monte Albo cave salamander, Stefani's salamander	*Speleomantes flavus*	Italy	None	S	Lecis et al (2009)
Imperial cave salamander, Scented cave salamander	*Speleomantes imperialis*	Italy	None	S	Andreone et al (2009)
Italian cave salamander	*Speleomantes italicus*	Italy	None	S	Andreone et al (2009)
Supramonte cCave salamander	*Speleomantes supramontis*	Italy	None	S	Andreone et al (2009)

Common name	Species	Countries (IUCN)	Artificial- Terrestrial (IUCN)	Zone(s)	Reference (Appendix N)
Pyrenean brook salamander, Pyrenean newt	*Calotriton asper/Euproctus asper*	France | Spain	None	S	Bosch et al (2009)
Corsican brook salamander, Corsican mountain newt	*Euproctus montanus*	France	None	S	Miaud et al (2009)
Luschan's salamander, Lycian salamander, Lycian's salamander	*Lyciasalamandra luschani/Mertensiella luschani*	Greece	None	S	Lymberakis et al (2009)
Spectacled salamander	*Salamandrina terdigitata*	Italy	None	S	Sindaco et al (2009)
Italian crested newt	*Triturus carnifex*	Austria | Czech Republic | Greece | Hungary | Italy | Netherlands (introduced) | Portugal (Azores - introduced) | Slovenia | [Switzerland] | United Kingdom (introduced).	Pastureland | Plantations | Rural gardens	C, S	Romano et al (2009)
Danube crested newt	*Triturus dobrogicus*	Austria | Bulgaria | Czech Republic | Hungary | Romania | Serbia | Slovakia	Arable land | Pastureland | Rural gardens | Urban areas	C, S	Arntzen et al (2009)
Southern crested newt	*Triturus karelinii*	Bulgaria | Greece |	Arable land | Pastureland | Rural gardens | Urban areas	S	Arntzen et al (2009)

Table 2: Anuran amphibians found in the 27 European Union countries including country distribution associations with 'artificial terrestrial' habitats as defined by IUCN. Also included are the European zones (North, Central, South) in which each species is found.

Common name	Species	Countries (IUCN)	Artificial- Terrestrial (IUCN)	Zone	Reference
Midwife toad	*Alytes obstetricans*	Belgium | France | Germany | Luxembourg | Netherlands | Portugal | Spain | [Switzerland] | United Kingdom (introduced)	Arable land | Pastureland | Urban areas	C, S	Bosch et al (2009)
European fire-bellied toad	*Bombina bombina*	Austria | Bulgaria | Czech Republic | Denmark | Germany | Greece | Hungary | Latvia | Lithuania | Poland | Romania | Slovakia | Slovenia | Sweden (reintroduced) | United Kingdom (introduced).	Arable land | Pastureland | Urban areas	N, C, S	Agasyan et al (2009)
Yellow-bellied toad	*Bombina variegata*	Austria | Bulgaria | Czech Republic | France | Germany | Greece | Hungary | Italy | Luxembourg | Netherlands | Poland | Romania | Slovakia | Slovenia | [Switzerland] | United Kingdom (introduced). Regionally extinct in Belgium.	Arable land | Pastureland | Urban areas	C, S	Kuzmin et al (2009)
Common toad	*Bufo bufo*	Austria | Belgium | Bulgaria | Czech Republic | Denmark | Estonia | Finland | France | Germany | Greece | Hungary | Italy | Latvia | Lithuania | Luxembourg | Netherlands | Poland | Portugal | Romania | Slovakia | Slovenia | Spain | Sweden | [Switzerland] | United Kingdom	Arable land | Pastureland | Plantations | Rural gardens | Urban areas	N, C, S	Agasyan et al (2009)
Natterjack toad	*Epidalea calamita/Bufo calamita*	Austria | Belgium | Czech Republic | Denmark | Estonia | France | Germany | Ireland | Latvia | Lithuania | Luxembourg | Netherlands | Poland | Portugal | Slovakia | Spain | Sweden | [Switzerland] | United Kingdom	Arable land | Pastureland | Rural gardens	N, C, S	Beja et al (2009)
European green toad	*Pseudepidalea viridis/Bufo viridis*	Austria | Bulgaria | Czech Republic | Estonia | France | Germany | Greece | Hungary | Italy | Latvia | Lithuania | Malta | Poland | Romania | Serbia | Slovakia | Slovenia | [Regionally extinct: Switzerland].	Arable land | Pastureland | Rural gardens | Urban areas	N, C, S	Agasyan et al (2009)
Painted frog	*Discoglossus pictus*	France (introduced) | Italy | Malta | Spain (introduced)	Arable land | Pastureland | Rural gardens	S	Bosch et al (2009)
Tyrrhenian painted frog	*Discoglossus sardus*	France | Italy	None	S	Andreone et al (2009)

Common name	Species	Countries (IUCN)	Artificial- Terrestrial (IUCN)	Zone	Reference
Common tree frog	*Hyla arborea*	Austria | Belgium | Bulgaria | Czech Republic | Denmark | France | Germany | Greece | Hungary | Italy | Latvia (reintroduced) | Lithuania | Luxembourg | Netherlands | Poland | Portugal | Romania | Slovakia | Slovenia | Spain | Sweden | [Switzerland]	Arable land | Pastureland | Rural gardens | Urban areas	N, C, S	Kaya et al (2009)
Stripeless tree frog	*Hyla meridionalis*	France | Italy | Portugal | Spain	None	S	Donaire-Barroso et al (2009)
Sardinian tree frog, Tyrrhenian tree frog	*Hyla sarda*	France | Italy	Urban areas	S	Andreone et al (2009)
Western spadefoot	*Pelobates cultripes*	France | Portugal | Spain	None	S	Beja et al (2009)
Common spadefoot	*Pelobates fuscus*	Austria | Belgium | Bulgaria | Czech Republic | Denmark | Estonia | France | Germany | Hungary | Italy | Latvia | Lithuania | Netherlands | Poland | Romania | Slovakia | Slovenia | Sweden. [Regionally extinct in Switzerland]	Arable land | Pastureland | Rural gardens | Urban areas	N, C, S	Agasyan et al (2009)
Eastern spadefoot	*Pelobates syriacus*	Bulgaria | Greece | Romania |	Arable land | Pastureland | Urban areas	C, S	Agasyan et al (2009)
Common frog	*Rana temporaria*	Austria | Belgium | Bulgaria | Czech Republic | Denmark | Finland | France | Germany | Greece | Hungary | Ireland | Italy | Luxembourg | Netherlands | Poland | Romania | Slovakia | Slovenia | Spain | Sweden | [Switzerland] | United Kingdom	Arable land | Pastureland | Plantations | Rural gardens | Urban areas	N, C, S	Kuzmin et al (2009)
Moor frog	*Rana arvalis*	Austria | Belgium | Czech Republic | Denmark | Estonia | Finland | France | Germany | Hungary | Latvia | Lithuania | Netherlands | Romania | Slovakia | Slovenia [Regionally extinct in Switzerland]	Arable land | Pastureland | Rural gardens | Urban areas	N, C, S	Kuzmin et al (2009)
Agile frog	*Rana dalmatina*	Austria | Belgium | Bulgaria | Czech Republic | Denmark | France | Germany | Greece | Hungary | Italy | Luxembourg | Romania | Slovakia | Slovenia | Spain | Sweden | [Switzerland] | United Kingdom.	None	N, C, S	Kaya et al (2009)

Common name	Species	Countries (IUCN)	Artificial- Terrestrial (IUCN)	Zone	Reference
Edible frog	*Pelophylax esculentus/Rana esculenta*	Austria | Belgium | Bulgaria | Czech Republic | Denmark | Estonia | France | Germany | Hungary | Italy | Latvia | Lithuania | Luxembourg | Netherlands | Poland | Romania | Slovakia | Slovenia | Spain (introduced) | Sweden | [Switzerland] | United Kingdom (introduced)	Arable land | Pastureland | Rural gardens | Urban areas	N, C, S	Kuzmin et al (2009)
Iberian frog	*Rana iberica*	Portugal | Spain	None	S	Tejedo et al (2008)
Pyrenean frog	*Rana pyrenaica*	France | Spain	None	S	Bosch et al (2009)
Marsh frog	*Pelophylax ridibundus/Rana ridibunda*	Austria | Belgium (introduced) | Bulgaria | Czech Republic | Denmark | France | Germany | Greece | Hungary | Latvia | Lithuania | Netherlands | Poland | Romania | Slovakia | Slovenia | Spain (introduced) | [Switzerland (introduced)] | United Kingdom (introduced). Regionally extinct in Estonia.	Arable land | Pastureland | Plantations | Rural gardens | Urban areas	N, C, S	Kuzmin et al (2009)
Pool frog	*Pelophylax lessonae/Rana lessonae*	Austria | Belgium | Czech Republic | Estonia | France | Germany | Hungary | Italy | Latvia | Lithuania | Luxembourg | Netherlands | Norway | Poland | Romania | Slovakia | Slovenia | Spain (introduced) | Sweden | [Switzerland] | United Kingdom (introduced).	Arable land | Pastureland | Plantations | Rural gardens | Urban areas	N, C, S	Kuzmin et al (2009)
Iberian midwife toad	*Alytes cisternasii*	Portugal | Spain	Pastureland	S	Beja et al (2009)
Mallorcan midwife toad	*Alytes muletensis*	Spain (Baleares)	Pastureland	S	Serra et al (2009)
Appenine yellow-bellied toad	*Bombina pachypus*	Italy	Arable land | Pastureland	S	Andreone et al (2009)
Iberian painted frog	*Discoglossus galganoi*	Portugal | Spain	Arable land | Pastureland	S	Bosch et al (2009)
Spanish painted frog	*Discoglossus jeanneae*	Spain	Pastureland	S	Bosch et al (2009)
Corsican painted frog	*Discoglossus montalentii*	France (Corsica)	None	S	Miaud et al (2009)
Parsley frog	*Pelodytes punctatus*	France | Italy | Portugal | Spain	None	S	Denoel et al (2009)
Italian tree frog	*Hyla intermedia*	Italy | Slovenia | [Switzerland].	Arable land: Urban areas	C, S	Andreone et al (2009)

Common name	Species	Countries (IUCN)	Artificial- Terrestrial (IUCN)	Zone	Reference
Balkan water frog	*Pelophylax kurtmuelleri/Rana balcanica*	Greece | Italy (Introduced).	Pastureland	S	Uzell et al (2009)
Epirus water frog	*Pelophylax epeiroticus/Rana epeirotica*	Greece	Plantations	S	Uzell et al (2009)
Greek stream frog	*Rana graeca*	Bulgaria | Greece	Pastureland	S	Lymberakis et al (2009)
Italian stream frog	*Rana italica*	Italy	None	S	Andreone et al (2009)
Italian agile frog	*Rana latastei*	Italy | Slovenia | [Switzerland].	Plantations	C, S	Sindaco et al (2009)
Perez's frog	*Pelophylax perezi/Rana perezi*	France | Portugal | Spain | United Kingdom (introduced).	Arable land | Urban areas	C, S	Bosch et al (2009)
Betic midwife toad, Southern midwife toad	*Alytes dickhilleni*	Spain	Pastureland	S	Bosch et al (2009)
Iberian parsley frog	*Pelodytes ibericus*	Portugal | Spain	Arable land | Pastureland	S	Bosch et al (2009)
Graf's hybrid frog	*Pelophylax grafi*	France | Spain	Arable land | Pastureland | Subtropical/Tropical Heavily Degraded Former Forest	S	Tejedo et al (2008)
Italian pool frog	*Pelophylax bergeri*	France | Italy.	None	S	Andreone et al (2009)
Italian edible frog, Italian hybrid frog	*Pelophylax hispanicus*	Italy	None	S	Andreone et al (2009)
Karpathos frog, Karpathos water frog	*Pelophylax cerigensis*	Greece	Arable land	S	Beerli et al (2009)
Cretan frog, Cretan water frog	*Pelophylax cretensis*	Greece	Plantations	S	Beerli et al (2009)
Levantine frog, Leavant water frog	*Pelophylax bedriagae*	Cyprus | Greece	Arable land | Pastureland	S	Papenfuss et al (2009)
American bullfrog	*Lithobates catesbeianus/Rana catesbeiana*	Introduced into - Belgium | France | Germany | Greece | Italy | Netherlands |Spain | United Kingdom	Arable land | Pastureland | Rural gardens | Urban areas	C, S	Santos-Barrera et al (2009)

1.2. Associations with agricultural habitats

Agricultural areas are often not good habitats for amphibians (e.g. Loman and Lardner 2006, 2009) although farm ponds are clearly important for breeding amphibians. Temporarily flooded areas of fields are also important summer habitats for amphibians (Dürr et al. 1999). After leaving permanent ponds amphibians may move into wet spots in fields. Such movements are particularly frequent after the metamorphosis of juveniles (Berger et al 2003). However, in this habitat they are particularly prone to damage due to cultivation activities (Dürr et al. 1999).

The literature search identified 155 papers that appear to associate amphibians from European countries with agricultural habitats. However, many studies either provide no further detail (e.g. on habitat uses) or were for pastures or other non arable habitats.

The IUCN red list data (Table 2) provides information on which species are associated with arable habitats and was therefore used to identify those species for which further information might be the most useful (Table 3).

Table 3: Summary of IUCN data indicating which species are associated with arable land.

Common name	Species	Zone(s)	Countries
Fire salamander	*Salamandra salamandra*	C, S	17
Great crested newt	*Triturus cristatus*	N, C, S	17
Marbled newt	*Triturus marmoratus*	S	3
Southern Marbled Newt	*Triturus pygmaeus*	S	2
Carpathian Newt	*Lissotriton montandoni*	C	5
Smooth newt	*Lissotriton vulgaris*	N, C, S	22
Palmate Newt	*Lissotriton helveticus*	C, S	8
Italian Newt	*Lissotriton italicus*	S	1
Bosca's Newt	*Lissotriton boscai*	S	2
Danube Crested Newt	*Triturus dobrogicus*	C, S	7
Southern Crested Newt	*Triturus karelinii*	S	2
Midwife toad	*Alytes obstetricans*	C, S	8
European fire-bellied toad	*Bombina bombina*	N, C, S	15
Yellow-bellied toad	*Bombina variegata*	C, S	15
Common toad	*Bufo bufo*	N, C, S	24
Natterjack toad	*Epidalea calamita/Bufo calamita*	N, C, S	18
European green toad	*Pseudepidalea viridis/Bufo viridis*	N, C, S	17
Painted frog	*Discoglossus pictus*	S	4
Common tree frog	*Hyla arborea*	N, C, S	21
Common spadefoot	*Pelobates fuscus*	N, C, S	18
Eastern spadefoot	*Pelobates syriacus*	C, S	3
Common frog	*Rana temporaria*	N, C, S	21
Moor frog	*Rana arvalis*	N, C, S	15
Edible frog	*Pelophylax esculentus/Rana esculenta*	N, C, S	21
Marsh frog	*Pelophylax ridibundus/Rana ridibunda*	N, C, S	18
Pool frog	*Pelophylax lessonae/Rana lessonae*	N, C, S	20
Appenine Yellow-bellied Toad	*Bombina pachypus*	S	1
Iberian Painted Frog	*Discoglossus galganoi*	S	2
Italian Tree Frog	*Hyla intermedia*	C, S	2
Perez's Frog	*Pelophylax perezi/Rana perezi*	C, S	4
Betic midwife toad, Southern midwife toad	*Alytes dickhilleni*	S	1
Iberian Parsley Frog	*Pelodytes ibericus*	S	2

Common name	Species	Zone(s)	Countries
Graf's hybrid frog	*Pelophylax grafi*	S	2
Karpathos Frog, Karpathos Water Frog	*Pelophylax cerigensis*	S	1
Levantine Frog, Leavant Water Frog	*Pelophylax bedriagae*	S	2
American bullfrog	*Lithobates catesbeianus/Rana catesbeiana*	C, S	8

According to this data 13 species (2 Caudata and 11 Anura) are found both in arable land and in all zones.

While the above data is helpful in indicating those species that are associated with agricultural habitats, the frequency of occurrence varies widely between species. For example, Berger et al (2003) in a study of the use of wet spots by amphibians during summer before soil cultivation found the following species in order of decreasing abundance: *Rana arvalis*, *Bufo bufo*, *Bombina bombina*, *Rana* kl. *esculenta*, *Bufo viridis*, *Pelobates fuscus*, *Hyla arborea*. In another study on agricultural land Berger et al (1999) ranked the species found in order of dominance (Table 4).

Table 4: Frequency of captures of species in a study of an agricultural area in Germany (Berger et al 1999)

Species	Dominance (%)
Pelobates fuscus	65
Rana arvalis	10
Triturus cristatus	8
Triturus vulgaris	5
Bombina bombina	5
Bufo viridis	4
Rana kl. esculenta	2
Bufo bufo	1
Bufo calamita	(4 heard over 3 years)
Hyla arborea	(2 heard over 3 years)

1.3. Studies of use of agricultural habitats

Apart from identifying the species associated with agricultural habitats, it is necessary to have information on the use of the habitat in terms of time spent in the habitat and distances moved/home range. This should include details of the seasonality of habitat use to determine whether exposure to pesticides is likely.

1.3.1. Movements in agricultural habitats

The literature search identified 192 studies of the movements of amphibians, a large number of which did not relate to studies in Europe (mainly USA, Canada, Australia and Japan). Only 22 of the European studies appeared to have been conducted in agricultural habitats. Those with potentially useful information are outlined below along with information from other sources found during the course of the project (Table 5).

Table 5: Summary of sources of information on movements of amphibians in agricultural areas.

Species	Habitat	Notes	Reference
a) Single species studies			
Bufo bufo	Pond flanked by pasture and arable fields.	Counts of migrating toads.	Hartel and Demeter (2005)
Bufo bufo	Agricultural landscape.	Mobile guiding fences were used to study the spring migratory behaviour. Data collected included morphometric data and timing of migration rather than habitat use.	Karl and Grosse (2010)
Bufo bufo	Arable fields.	Monitored foraging activities on fields.	Oldham and Swan (1992)
Bufo bufo	Study area of about 6 km^2 mainly composed of pasture and pine forest.	Activity and movements recorded using mark-recapture and thread bobbins.	Sinsch (1988a)
Bufo calamita	Semi-arid, agricultural landscape.	Radio-tracking study. Distances moved. Habitat included crop fields.	Miaud, et al (2000)
Bufo calamita	Landscape of intensive agricultural activity.	Radio-tracking study. Home range estimated. Habitat included crop fields.	Miaud. and Sanuy (2005)
Bufo calamita	Agricultural area of 200 ha including fields of winter cereals and pasture.	Radio-tracking of movements, distance moved.	Oromi et al (2010)
Bufo calamita	Study area of about 8 km^2 composed of sandy gravel pits, bare ground, pasture, and maize and wheat fields.	Activity and movements recorded using mark-recapture, thread bobbins and radio-tracking.	Sinsch (1988b)
Bufo calamita	Study area of about 8 km^2 composed of sandy gravel pits, bare ground, pasture, and maize and wheat fields.	Radio-tracking and marking systems (toe-clipping, microchips) used to follow the tracks of toads	Sinsch (1992)
Bufo viridis	Intensively used agricultural landscape.	Monitored the migration to the reproduction ponds in spring and the migration of juveniles.	Beckmann et al (2003).
Hyla arborea	Agricultural landscape mostly with fields of wheat and corn.	Harmonic direction finder used to track movements, distance moved.	Pellet et al (2006)
Rana catesbeiana	200ha area containing five water bodies, a network of ditches, woodlands, crops (mainly vineyards), a very populated area and wasteland.	Radio-tracking study of movements and home range. Crops avoided.	Berroneau et al (2007)
Rana temporaria	Agricultural area.	Radio tracking of activity. No data on use of fields, Area dominated by wet meadows.	Seitz et al (1992)
Rana temporaria	Pasture (1.2ha) surrounded by intensive agriculture (mostly wheat and rye).	Continuous radio-tracking.	Tramontano (1997)

Species	Habitat	Notes	Reference
Triturus cristatus	Wheat crop.	Observations of movements within crop fields using pitfall traps mid July to early November.	Cooke 1986
Triturus cristatus	Typical Central European agricultural landscape.	Migration distances of adults (photo identification) and juveniles (toe clipping) using drift fences and pitfall traps.	Kupfer, A. (1998)
b) Multiple species studies			
Bombina bombina *Pelobates fuscus* *Rana arvalis* *Triturus cristatus*	Arable land.	Used fence traps to monitor the activity of adults during spring migration including an assessment of coincidence with pesticide applications.	Berger et al (2011a)
Bufo bufo *Pelobates fuscus* *Triturus cristatus*	Arable land.	Study of movements of adults after leaving breeding ponds or set-aside areas near water.	Berger et al (2011b)
Bufo bufo *Pelobates fuscus* *Rana arvalis* *Rana temporaria* *Triturus cristatus* *Triturus vulgaris*	Landscape dominated by intensively cultivated fields (mainly barley).	Monitored diurnal activity (pit-fall traps) and velocity in study of risk of death on road through cultivated area. No details of use of agricultural land.	Hels and Buchwald (2001)
Bufo bufo *Mesotriton alpestris* *Rana arvalis* *Triturus vulgaris*	Tracked in sites described as agricultural.	Drift fences with pitfall traps used to determine migration distances. One site described as agricultural but none of the sites appear to include arable with transects in open areas mainly meadow.	Kovar et al (2009)
Rana dalmatina *Rana temporaria* *Triturus cristatus*	Agricultural landscape.	Return rates and long term capture history determined by implantation of passive integrated transponders (PIT) and toe-clipping (*Rana* spp.), photo identification of the belly pattern (*T. cristatus*). No details of use of arable land.	Hachtel et al. (2005).
Triturus alpestris (*Mesotriton alpestris*) *Triturus vulgaris*	Agricultural landscape.	Dispersal of newts determined using mark-recapture methods and allozyme markers.	Schmidt et al (2006)
Triturus cristatus *Triturus marmoratus*	Study area included pasture, orchard, arable and hedgerow.	Radio-tracking study of movements. Preferred areas with bushes, hedgerows and trees.	Jehle and Arntzen (2000)
Nine species	Intensively used agricultural landscape.	Spring migration of amphibians was investigated.	Greulich and Pflugmacher (2002)

Information on movements is outlined below on a species by species basis.

1.3.1.1. Movement information for *Bufo bufo*

Oldham and Swan (1992) found that toads (*Bufo bufo*) with ingested radio transmitters would move between 0 and 180m between daily recordings during the active season in spring and summer (but

were not tracked during migratory phase). Some were found to forage in arable fields at night up to 20m from the scrub they took refuge in during daylight. This suggests that total distance moved across the fields could be 40m or more.

Using night counts of migrating toads over two years (Hartel and Demeter 2005), breeding migration was found to last 19 to 36 days from mid March. In the study area the pasture land formed a corridor between the forest and the pond such that very few migrating toads were found on arable land. The furthest recorded toad was 450m from the pond near the forest area. No active toads were found when temperature was below 5°C. In periods of intense activity toad density within 10m from the pond was 0.16 toads/m^2 while at 150m distance this was 0.055 toads/m^2.

In a study of migration distances in March to April, maximum recorded movements in agricultural areas ranged from 450 to 518m. Maximal distances moved in other habitats ranged from 170-1835m (Kovar et al 2009).

In a study of movements towards the breeding pond (Sinsch et al. 1988a), toads were observed at 70-240m from the breeding pond and did not move directly towards the spawning site but entered the pond from any shore. Some paths deviated and allowed the pond to be approached via a ditch which terminated at the pond. Post spawning migration was also monitored with individuals recorded up to 1.6km from the pond. In May and June migratory behaviour decreased with animals staying in their 'home range' until autumn migration or hibernation. Of 29 toads observed, 23 hibernated at distances of 70-420m from the breeding pond while six hibernated in their summer home range 1060-1230m from the pond.

Berger et al (2011b) monitored movements of common toads on arable land using radio-telemetry during post breeding movements in August and September. Two types of behaviour were found depending on the amount of cover present on the field. Where fields were freshly ploughed, animals moved across these quickly, one animal moving 580m in one night. In stubble fields with volunteer cereals or rape only or set-aside, small daily movements were observed, often less than 10m. In one case an animal using such a field survived the field being ploughed and moved to adjacent set-aside land. Where animals remained on arable land, cover was found under plant material, in small mammal burrows or cracks under clods of earth. These resting places were often within 35m of non-arable areas. Toads tracked using the fluorescent dye method behaved in a similar fashion quickly traversing freshly ploughed fields and winter rape to reach areas with dense vegetation.

1.3.1.2. Movement information for *Bombina bombina*

In a study of migration distances in March to April, maximum recorded movement in an agricultural area was 167m. Maximal distances moved in other habitats ranged from 160-230m (Kovar et al 2009).

1.3.1.3. Movement information for *Bufo calamita*/*Epidalea calamita*

Radio-tagged individuals were tracked in barley fields on the way to (end of January to mid- April) and from (early April to September) breeding ponds (Miaud et al 2000). Maximum daily distances moved ranged from 22m to 577m in spring, and 125m to 353m after breeding. Maximum distances moved by a toad in each period were 934m and 4411m respectively. Marginal habitats such as ditches with vegetation and stone embankments were used as shelter sites.

Home range in an area of cereal agriculture was determined in a study by Miaud and Sanuy (2005). Median home range area was 0.5 ha (range 0.1-11 ha) during the breeding season (January-April). Home range size increased during the post-breeding season (April-September) with a median minimum concave polygon of 4.1 ha. Home ranges included crop fields but these were less preferred compared to other habitats. Order of habitat preference was stone embankments/ditches with reeds >

heaps of ground and stones > wasteland and ground embankment > crops. While crops represented 85% of the available habitat, only 43% of the recorded positions were in this habitat.

In a radio tracking study in a semi-arid agricultural area toads were found to be strictly noturnal moving only on nights following moderate to heavy rainfall (Oromi et al 2010). Daytime shelters and hibernacula were in areas between crop fields and bordering farm tracks. In spring (March-June) males moved an average distance of 341.5m (SD=172.7, range 56-576, N=6). In winter (January – March) females moved on average 331m (SD=165.4, range 91-469, N=4) while males moved an average of 946.4m (SD=531.0, range 555-1872, N=5).

In a study of activity during the breeding season (Sinsch 1988b), at the end of the first July calling period most males remained within 100m of the breeding site but one moved 340m to a maize field. After oviposition, one female was radio-tracked moving at 200-450m/night eventually reaching the edge of a wheat field 985m away.

Male and female toads were tracked between May and September in a study by Sinsch (1992). All males remained within the breeding area or close to where they were caught with median and maximum movements of 90 and 240m respectively. Females moved larger distances at 200-500m/night with a migratory range of 1.2 to 2.6km.

1.3.1.4. Movement information for *Bufo viridis*

In an intensively agricultural area green toads migrated to breeding ponds in April while juveniles migrated from the breeding pond between mid July and mid October (Beckmann et al. 2003).

1.3.1.5. Movement information for *Hyla arborea*

Harmonic detection finding was used in a study of movements in an agricultural area mostly consisting of fields of wheat and corn (Pellet 2006). Most animals did not move more than 40m from the release point indicating that this species does not move far from the spawning site during the breeding season. During the post breeding migration frogs moved between 18 and 440m from the release site during the first night. Of three frogs found after 48 hours, two were in natural meadows and one in a corn field but all within 50m of the release point. A further two frogs moved 860m (in less than 14h) and 660m (in less than 40h) in the direction of a riparian woodland considered to be the post-breeding habitat.

1.3.1.6. Movement information for *Mesotriton alpestris*/*Triturus alpestris*

In a study of migration distances in March to April, maximum recorded movement in an agricultural area was 167m. Maximal distances moved in other habitats ranged from 173-520m (Kovar et al 2009).

In a study of dispersal of newts in an agricultural landscape (Schmidt et al, 2006), no specific movement data was reported but the ponds between which dispersal was monitored were from 270 to 1800m apart.

1.3.1.7. Movement information for *Pelobates fuscus*

In a study of migration distances in March to April, maximum recorded movements in non agricultural areas ranged from 5-30m (Kovar et al 2009).

Berger et al (2011b) monitored movements of spadefoot toads on arable land using fluorescent dye during post breeding movements in August and September. Behaviour of the animals was dependent on the amount of cover as for *Bufo bufo.* Animals released on a seed furrow exhibited rapid directional movements of up to 260m at night. A few individuals dug themselves in on the field immediately after

release. Animals released on stubble fields with thick vegetation moved smaller distances (mostly less than 20m) or dug themselves in.

1.3.1.8. Movement information for *Rana arvalis*

In a study of migration distances in March to April, maximum recorded movement in a non agricultural area was 640m (Kovar et al 2009).

1.3.1.9. Movement information for *Rana dalmatina*

In a study of return rates of amphibians (Hachtel et al 2005), two adult males were re-caught at different ponds 800 and 920m from their original pond.

1.3.1.10. Movement infromation for *Rana temporaria*

In a study of the movements of the common frog (*Rana temporaria*) using implantable transmitters the daily movement during migration ranged from 0 to 155m (Seitz et al 1992). Frogs were tracked once or twice a day, in the morning and evening. Total migration distance from the origin over the course of the study ranged from 10 to 460m. No information was provided on the use of fields in an area dominated by wet meadows.

In a study of return rates of amphibians (Hachtel et al 2005), two adult males were re-caught at different ponds 925 and 1275m from their original pond. Two females were caught 825 and 860m from their original ponds.

In a study of migration distances in March to April, maximum recorded migration distance in a non agricultural area was 520m (Kovar et al 2009).

Tramontano (1997) used a continuous radio-tracking method (where each frog was located every 3h) to determine the fine scale movements in an agricultural area centred on a 1.2ha pasture. Animals were tagged in mid-April but continuous tracking took place for one week in mid- to late May in an area of 200ha when they were considered to be in their summer foraging sites. Of the 12 frogs selected for continuous radio-tracking, seven had migrated 220 to 380m from the pasture to other meadow and pond habitats. Two had stopped in the surrounding rye fields while the remainder remained in pond habitats within the pasture. Of the four remaining frogs for which signals could still be received but were not included in the continuous tracking group, three had migrated 500 to 710m from the breeding pond and the other spent the tracking period in an underground drainage pipe. Movements occurred in 27.2% of observations during the tracking period with 69% of movements of less than 2m. Only 5% of movements were of 20m or more with the longest movements taking place in rye fields. Of the two frogs in this habitat, one had returned to the meadow while the other continued its migration moving a further 186m total (148m straight line). Mean length of movements in the rye field was 7.1m in the day and 8.7m at night. Corresponding mean distances in meadow habitat were 1.4 and 1.2m respectively.

1.3.1.11. Movement information for *Salamandra salamandra*

In a study of migration distances in March to April, maximum recorded migration distance in a non agricultural area was 160m (Kovar et al 2009).

1.3.1.12. Movement information for *Triturus cristatus*

In a trapping study on *Triturus cristatus* in an arable area (Cooke 1986) mature wheat was a preferred habitat for adult newts. During the pre-harvest period more newts were trapped on arable land than in marsh or wood habitats with 90% of these being adults. Post harvest, significantly fewer captures were made on arable land with more caught in marsh wood and hedge due to movements of newtlets

(animals up to 64mm in length) which emerged just before harvest. No newtlets were caught on arable land.

In a study of migration of adult and juvenile newts using drift fences and pit fall traps, recaptures were made between 24 and 413 days with movements from first capture position ranging from 24 to 1290m (Kupfer 1998).

In a radio-tracking study of newts leaving the breeding pond from late June to the end of July (Jehle and Arntzen 2000) distances moved by animals of each sex were determined. Males moved an average of 15.6m (SD = 7.48, range 6.6 - 18.8, N = 4) and females moved an average of 36.8m (SD = 33.95, range 2.1 - 99.5, N = 9). One sub-adult moved 4.4m.

In a study of migration distances in March to April, maximum recorded migration distance in an agricultural area was 77m. Maximal distances moved in other habitats ranged from 227-249m (Kovar et al 2009).

In a study of migration distances of adults and juveniles in an agricultural area using drift fences and pitfall traps re-captures after 24 to 413 days the distance moved ranged from 240-1290m (Kupfer 1998). One female was found to have moved 950m over extensive arable land.

Berger et al (2011b) monitored movements of great crested newts on arable land using fluorescent dye during post breeding movements in August and September. Seven of ten animals marked sought thick vegetation after marking. Six of the animals were placed on a silage maize crop with remaining animals placed in seed furrows, or ploughed stubble fields of winter rape or winter wheat. Only two animals chose routes in the arable area with trails lost in stubble, the others retreating to thick vegetation. No animal moved more than 38m.

1.3.1.13. Movement information for *Triturus marmoratus*

In a radio-tracking study of newts leaving the breeding pond from late June to the end of July (Jehle and Arntzen 2000) distances moved by animals of each sex were determined. Males moved an average of 39.5m (SD = 43.24, range 4.6 - 145.7, N = 9) and females moved an average of 29.9m (SD = 24.17, range 10.3 - 62.2, N = 6).

1.3.1.14. Movement information for *Triturus vulgaris*/*Lissotriton vulgaris*

In a study of migration distances in March to April, maximum recorded migration distance in an agricultural area was 518m. Maximal distances moved in other habitats ranged from 160-455m (Kovar et al 2009).

In a study of dispersal of newts in an agricultural landscape (Schmidt et al, 2006), no specific movements data was reported but the ponds between which dispersal was monitored were from 270 to 1800m apart.

1.3.2. Proportion of time spent in agricultural habitats

While several studies have monitored movements in arable habitats, few (e.g. Tramontano 1997) contain detailed information with which to assess the fine scale patterns of use as are available for birds and mammals. Most of the available information can provide a worst case seasonal indication of whether animals may be present but cannot describe in detail the amount of time they may be present on the surface of a treated field and hence how much of their food they obtain there, or the potential for dermal exposure. This information would of course be painstaking to collect as unlike birds and mammals they may not forage every day as food requirements are far lower. Thus, much of the time they are tracked, they may be inactive but not on the field, perhaps in other habitats or at field margins.

Given this potentially punctuated pattern of risk, interpretation of the information may be problematic as the potential risk will depend on the activity state of the animal. It may therefore be necessary to make a worst case assessment and assume the animal is on the field for whatever period it spends in that habitat (or a high percentile value), rather than make a more realistic assessment of the probability that the animal is there at all.

1.3.3. Timing of terrestrial activity in relation to pesticide applications

Clearly the risk of exposure depends on the use of habitats treated with pesticides at the time of application and a period after this depending on the persistence of the compound or the application of subsequent treatments. While the potential coincidence of amphibians and pesticide treatments can be predicted using data on the timing of terrestrial activities and pesticide treatments, this is likely to be a very approximate estimate given the issues listed above (i.e. patterns of fine scale use of treated areas).

A recent study (Berger et al. 2011a) used fence traps to monitor migration of adults from winter quarters to spawning waters. As part of this study they determined the proportion of the population that coincided with soil working and sowing, the application of mineral and organic fertilisers and the application of plant protection products and growth regulators.

They found that herbicide applications to fodder peas, oats, sunflowers and blue lupins sometimes coincided with high levels of amphibian activity. For example, in one year 85% of the population of spadefoot toads (*Pelobates fuscus*) were active on the land at the time of an application of herbicide to fodder peas, while 20-50% of the population activity of fire-bellied toads (*Bombina bombina*), moor frogs (*Rana arvalis*) and great crested newts (*Triturus cristatus*) coincided with the application of herbicides to other crops.

High levels of coincidence of activity of all four species with application of fungicides to winter rape were also observed. For other winter cereal crops, only those species active later in the year (spadefoot toads and fire-bellied toads) had high levels of coincidence with applications. Average levels of activity of greater than 30% of the population were recorded.

Between 20 and 40% of the populations of the migration on land of these species coincided with the application of insecticides to winter rape. In one year, the coincidence of spadefoot toads with such applications was almost 90%. Application of insecticides to winter wheat did not overlap with the period during which amphibians were migrating to spawning waters.

Over 50% of the activity of fire-bellied toads coincided with applications of growth regulators to winter rye in one year with lower levels of coincidence (up to 25%) for applications to triticale. Coincidence of great crested newts and spadefoot toads with applications to winter rye and all three species with applications to winter wheat were also around this lower level.

1.4. Species information

Information potentially useful for future risk assessments on selected species associated with agricultural habitats was collated. The species for which detailed information were selected on the basis of their association with arable land, their distribution (e.g. present in all zones) and appearnace in studies of the use of agricultural habitats. The selected species were the great crested newt (*Triturius cristatus*), the smooth newt (*Lissotriton vulgaris*), the common frog (*Rana temporaria*), the common toad (*Bufo bufo*), the common tree frog (*Hyla arborea)*, the natterjack toad (*Hyla arborea*) and the common spadefoot (*Pelobates fuscus*). This data can be found in Appendices B to H.

1.5. Conclusions on species at risk

Several European species have been identified which would appear to be at risk from pesticide exposure given their presence in agricultural land and dependence on surface water in these environments for reproduction. This is confirmed by studies which have identified large proportions of the populations of some species at the time of pesticide applications. It seems likely that migratory movements in spring would represent a worst case e.g. migrating long distances across fields during spring applications.

2. Assessment of exposure

Given the life cycles of amphibians it is necessary to assess both aquatic and terrestrial risks to pesticides.

2.1. Aquatic exposure

Given the similarity in exposure for aquatic phases of amphibians it seems reasonable to use information gleaned for fish to assess the risk to amphibians as has been recommended previously. The toxicity data collated in this study should be compared with data for fish to develop suitable safety margins to deal with any uncertainty caused by the use of fish data as a surrogate for compounds not tested on amphibians.

2.2. Terrestrial exposure

Assessment of terrestrial exposure is complicated by the various routes of exposure that can occur and the relative lack of information available for assessment. These issues were recently reviewed by Bruhl et al (2011) and Smith et al (2007).

2.2.1. Food intake

Unlike birds and mammals, food intake is less likely to be the major source of exposure given the potential for dermal uptake.

2.2.1.1. Data on food intake for amphibians

Some information on food intake is available for amphibians, but most, if not all, comes from laboratory or controlled conditions and it is uncertain how this can be applied to the field. Larsen (1992) reports data from Larsen (1984) where voluntary feeding (and drinking) behaviour of the common toad (*Bufo bufo*) was monitored using video recordings for three 22-23.5h periods in March (Table 6).

Table 6: Mean measurements of feeding behaviour of common toads (*Bufo bufo*) fed mealworms for three 22-23.5h periods (Larsen 1992).

	Males			Females		
Measure	**Mean**	**Min**	**Max**	**Mean**	**Min**	**Max**
Weight (g)	29.7	26.0	33.0	77.0	60.0	86.0
Number feeding periods	4.2	2.0	9.0	3.7	3.0	6.0
Time feeding %	9.0	2.0	30.0	8.8	3.0	24.0
Mealworms eaten (g)	3.3	0.9	5.0	3.9	2.0	6.3

This data indicates the variability of daily feeding behaviour in terms of food eaten and time spent feeding.

Other approaches involve estimates of annual energy requirements for a given species. For example predicted annual food intake for a 30g male common toad (*Bufo bufo*) is 34kcal (142.4kJ) based on estimates of active days, length of feeding period and observed feeding activity (Larsen 1992). Again, it is difficult to translate this to a daily food intake estimate given the variability of feeding behaviour, effects of temperature and periods of inactivity and hibernation.

2.2.1.2. Estimating the food intake of amphibians

Ideally, estimates of food intake should be based on empirical data for the species concerned. However, this information is often not available for the species under consideration and it is necessary to estimate energy requirements and food consumption based on body size. While there is a large body of information on resting and active metabolic rate for amphibians (e.g. see reviews by Gatten et al, 1992; Pough et al, 1992; Wells 2007) no information was found in the initial search that would allow for assessment of food intake based on energy requirements as is done for birds and mammals (http://www.efsa.europa.eu/en/efsajournal/doc/1438.pdf), or is available for reptiles (Fryday and Thompson 2009). The doubly-labelled water technique as used for other groups of vertebrates (birds mammals and reptiles) is unsuitable for use with amphibians due to the higher rate of water turnover relative to energy expenditure (Speakman 1997). Therefore, unlike the other groups, there is no large body of literature on field metabolic rate or daily energy expenditure that can be used to develop allometric equations.

Other approaches include the heart rate technique which has not yet been validated for amphibians, and the use of accelerometry. The accelerometry technique for estimating energy expenditure involves measuring the body motion of animals having already calibrated the rate of oxygen consumption with the magnitude of motion. This approach was recently tested on amphibians by Halsey and White (2010). In this study of the cane toad (*Bufo marinus*) in Australia it was found that mean estimated VO_2 over the periods recorded was 5.5 times the resting VO_2 recorded in the laboratory. However, these values were for short periods of deployment of the data loggers amounting to a few hours at most. An earlier estimation for this species of 2.5 times resting VO_2 (Kearney et al 2008) was based on the fact that lizard field metabolic rates ranged from 1.1 to 5.1 times resting metabolic rate.

In a previous unpublished review of herpetofauna risk assessment (Fryday et al 2004 available at http://randd.defra.gov.uk/Default.aspx?Menu=Menu&Module=More&Location=None&Completed=0&ProjectID=7418) it was suggested that estimates of daily energy expenditure based on doubly-labelled water studies for lizards from Nagy et al (1999) may be suitable for estimating the energy requirements of amphibians. This is also the approach taken by the US EPA in their T-HERPS Version 1 model (http://www.epa.gov/oppefed1/models/terrestrial/index.htm). Here the allometric equation for food intake of iguanids from Nagy (1987) is used (EQ1).

EQ1 $FI = 0.013(Wt)^{0.773}$ (where FI = food ingestion [g/day]

Alternatively, the more recent equations for daily energy expenditure (DEE) of reptiles presented in Fryday and Thompson (2009) (available at http://www.efsa.europa.eu/it/scdocs/doc/13e.pdf) could be used. These estimates of energy requirements must be combined with the information on food energy content, food moisture content and assimilation efficiency as used in bird and mammal risk assessment to estimate daily food intake. As for reptiles, there is likely to be less available information on assimilation efficiency than for other vertebrates. No values of assimilation efficiency for European species were found. Those values found to date for other species are listed below.

2.2.1.3. Assimilation efficiencies for amphibians

Assimilation efficiency in southern toads (*Bufo terrestris*) fed house crickets was 73.70% (Smith 1976). While gut retention time was significantly longer at 20°C than at 30°C, assimilation efficiency was not different over this temperature range.

The assimilation efficiencies of two African reed frog species when fed on flies (Musca) were determined by Grafe et al (1992). Assimilation efficiencies in *Hyperolius viridiflavus ommatostictus* were 85/6% for gravid females, 84.6% for post-reproductive females and 87.7% for males. Assimilation efficiencies in at *Hyperolius marmoratus taeniatus* were 81.4% in juveniles, 84.3% in gravid females, 86.3% in post-reproductive females and 84.9% in males.

The assimilation efficiency of several species fed on mealworms was determined by Dimmitt and Ruibal (1980). Three temperatures from 20-30°C were used (Table 7).

Table 7: Assimilation efficiencies of amphibian species fed mealworms (Dimmitt and Ruibal (1980)

Temperature during experiments	**20°C**	**25°C**	**30°C**
Species tested	**Assimilation efficiency (%)**		
Bufo boreas	-	-	94
Bufo cognatus	94	94	94
Bufo punctatus -	-	92	-
Scaphiopus intermontanus	-	84	-
Scaphiopus hammondi	94	90	-
Scaphiopus couchi	-	92	95

In another species, the red-backed salamander (*Plethodon cinereus*) fed on fruit flies, temperature was found to affect assimilation efficiency. Assimilation efficiency at 10, 15 and 20°C were 91.4, 85.9 and 79.8% for males and 89.3, 85.6 and 79.9% for females respectively.

The effect of food type on assimilation efficiency was shown by Dimmit and Ruibal (1980) when *Scaphiopus couchi* was fed different foods. When fed mealworm larvae, assimilation efficiency was 92% but when fed adults the assimilation efficiency fell to 69%. When fed alate termites (*Gnathamitermes perplexus*) assimilation efficiency was 89%, but for scarabs (*Cyclocephala* spp. or *Phyllophaga* spp.) assimilation efficiency was 65-66%.

2.2.2. Dermal exposure

The risks to amphibians from dermal exposure to pesticides are higher than other groups due to a) the lack of hairs, feathers or scales which may form a partial barrier to exposure and b) the presence of specialised structures to enhance absorption (e.g. a vascularised pelvic patch). It can therefore be assumed that should amphibians come into contact with a contaminated substrate that at least some exposure will occur. A recent review of terrestrial risk (Bruhl et al. 2011) found that while dermal exposure and uptake is a significant threat to amphibians, exposure and toxicity studies for terrestrial life stages are scarce.

2.2.2.1. Literature found relating to dermal exposure

Forty-one references were found in the initial literature search relating to amphibian skin, dermal uptake, pesticide effects on transport across the skin and dermal toxicity studies (Table 8).

Table 8: References relating to dermal effects.

Subject	Reference(s)
Comparative dermal uptake rate of pesticides	Shah et al. (1983).
Comparison of percutaneous transport of pesticides through amphibian and mammal skin	Quaranta et al. (2009).
Dermal absorption malathion - ventral vs. dorsal skin - pelvic limb	Willens et al. (2006a). Willens et al. (2006b).
Dermal toxicity (malathion)	Baker (1985). Henson-Ramsey et al. (2008).
Dermal toxicity (Pyraclostrobin)	Belden et al. (2010).
Dermal toxicity (glyphosate)	Relyea (2005a). Xiao et al. (2007a). Xiao et al. (2007b).
Dermal toxicity (ammonium nitrate fertiliser)	Oldham et al. (1997).
Dermal toxicity (aldrin, , DDT, dieldrin, endrin, toxaphene)	Ferguson and Gilbert (1967).
Dermal toxicity (1,3,5-trinitrohexahydro-1,3,5-triazine - not pesticide)	Johnson et al. (2004).
Dermal toxicity (2,4-dinitrotoluene - not pesticide)	Johnson et al. (2007).
Dermal toxicity (2,4-D - percutaneous exposure)	Zaffaroni et al. (1986a).
Dermal toxicity y (MCPA - percutaneous exposure)	Zaffaroni et al. (1986b).
Dermal uptake (aquatic)	Venturino et al. (1998). Venturino et al. (2001).
Penetration of non-electrolytes through animal skin	Buerger and O'Brien (1965).
Percutaneous absorption rate (antibiotics)	Riviere et al. (1979).
Pesticide effect on cutaneous absorption of water (methoxychlor)	Idehara et al. (2000).
Pesticide effects on chloride secretion through skin	Lippe et al. (1992).
Pesticide effects on epidermis	Fenoglio et al. (2009).
Pesticide effects on transport across amphibian skin	Cassano et al. (2000). Cassano et al. (2003). Cassano et al. (2006). Czyzewska et al. (1983).
Pesticide induced inhibition of sodium transport in skin	Natochin et al. (1986). Natochin et al. (1987). Pogorzelska et al. (1982). Quevedo et al. (1992). Salibian (1983). Salibian and Marazzo (1995).
Review of terrestrial risk	Bruhl et al. (2011).

Subject	Reference(s)
Skin morphology	Andreone et al. (1993). Bingol-Ozakpinar and Murathanoglu (2011). Buron et al. (1988). Jakubowski (1989). Sokolov and Sakulina (1994).
Tests of potential for avoidance of pesticide contaminated surfaces, uptake of pesticide through skin, distribution and elimination of absorbed pesticides.	Mendez et al. (2009).
Water seeking response (uptake of water through ventral abdominal skin)	Hoffman, J. (2006).

While several studies were found containing data on the dermal toxicity of pesticides to terrestrial stages of amphibians, no methods for estimating the dermal exposure were found. Unlike food intake, the US EPA T-HERPS model does not take account of dermal exposure due to the lack of information necessary for routine assessment.

2.2.2.2. Dermal exposure studies

Details of the dermal toxicity studies listed above along with others identified from other sources (e.g. Bruhl et al. 2011) are given below (Table 9).

Table 9: Studies of the effects of dermal exposure (treated substrate, direct overspray or ventral application) on survival, behaviour and cholinesterase (ChE) inhibition.

Species	Stage (size)	Pesticide (Formulation/ purity)	Exposure method	Temp. (°C)	Endpoint	Dose	Effects	Reference
Northern cricket frog (*Acris gryllus*)	NR (22mm mean)	Aldrin (95%)	Filter paper	26.7±1.1 (80±2°F)	Mortality	3.1-4.7 µg/cm^2	36h TL50 (approx. dose leading to 50% mortality at 36h)	Ferguson and Gilbert (1967)
Southern cricket frog (*Acris crepitans*)	NR (21-25mm means)	Aldrin (95%)	Filter paper	26.7±1.1 (80±2°F)	Mortality	3.1-11.8 µg/cm^2	36h TL50 (approx. dose leading to 50% mortality at 36h)	Ferguson and Gilbert (1967)
Fowler's toad (*Bufo woodhousei fowleri*)	NR (20-28mm means)	Aldrin (95%)	Filter paper	26.7±1.1 (80±2°F)	Mortality	0.8-157 µg/cm^2	36h TL50 (approx. dose leading to 50% mortality at 36h)	Ferguson and Gilbert (1967)
Northern leopard frog (*Rana pipiens*)	Adult	Aminocarb (Matacil 1.4 OSC)	Aerial forest spray (field)	Ambient (Jun-Aug)	Behaviour	175 g a.i./ha	No significant effect on activity	Bracher and Bider (1982)
Wood frog (*Rana sylvatica*)	Adult	Aminocarb (Matacil 1.4 OSC)	Aerial forest spray (field)	Ambient (Jun-Aug)	Behaviour	175 g a.i./ha	No significant effect on activity	Bracher and Bider (1982)
American toad (*Bufo americanus*)	Adult	Aminocarb (Matacil 1.4 OSC)	Aerial forest spray (field)	Ambient (Jun-Aug)	Behaviour	175 g a.i./ha	Mixed results (evidence of both increases and decreases in activity) depending on measurement and site.	Bracher and Bider (1982)
American toad (*Bufo americanus*)	Metamorph (c. 0.26g)	Carbaryl (Sevin 22.5%)	Paper towel	-	Mortality; Feeding behaviour; Bodyweight	Saturated with 2mg a.i./L solution (24h exposure)	No mortality No effect on feeding behaviour No effect on growth	Webber et al. (2010)
Southern cricket frog (*Acris gryllus*)	NR (12-15mm, 0.4g)	DDT (100%)	Filter paper	-	Mortality	0.063 mg/cm2	3.3% mortality (after 36h)	Boyd et al. (1963)

Species	Stage (size)	Pesticide (Formulation/ purity)	Exposure method	Temp. (°C)	Endpoint	Dose	Effects	Reference
Southern cricket frog (*Acris gryllus*)	NR (12-15mm, 0.4g)	DDT (100%)	Filter paper	-	Mortality	0.094 mg/cm2	40% mortality (after 36h)	Boyd et al. (1963)
Southern cricket frog (*Acris gryllus*)	NR (12-15mm, 0.4g)	DDT (100%)	Filter paper	-	Mortality	0.126 mg/cm2	62.5% mortality (after 36h)	Boyd et al. (1963)
Southern cricket frog (*Acris gryllus*)	NR (12-15mm, 0.4g)	DDT (100%)	Filter paper	-	Mortality	0.141 mg/cm2	50% mortality (after 36h)	Boyd et al. (1963)
Southern cricket frog (*Acris gryllus*)	NR (12-15mm, 0.4g)	DDT (100%)	Filter paper	-	Mortality	0.157 mg/cm2	52.5% mortality (after 36h)	Boyd et al. (1963)
Southern cricket frog (*Acris gryllus*)	NR (16-19mm, 0.6g)	DDT (100%)	Filter paper	-	Mortality	0.471 mg/cm2	80% mortality (after 36h)	Boyd et al. (1963)
Southern cricket frog (*Acris gryllus*)	NR (16-19mm, 0.6g)	DDT (100%)	Filter paper	-	Mortality	0.628 mg/cm2	87.5% mortality (after 36h)	Boyd et al. (1963)
Southern cricket frog (*Acris gryllus*)	NR (16-19mm, 0.6g)	DDT (100%)	Filter paper	-	Mortality	0.786 mg/cm2	65.7% mortality (after 36h)	Boyd et al. (1963)
Southern cricket frog (*Acris crepitans*)	NR (21-25mm means)	DDT (98%)	Filter paper	26.7±1.1 (80±2°F)	Mortality	9.7-786 µg/cm^2	36h TL50 (approx. dose leading to 50% mortality at 36h)	Ferguson and Gilbert (1967)
Fowler's toad (*Bufo woodhousei fowleri*)	NR (20-28mm means)	DDT (98%)	Filter paper	26.7±1.1 (80±2°F)	Mortality	7.9-786 µg/cm^2	36h TL50 (approx. dose leading to 50% mortality at 36h)	Ferguson and Gilbert (1967)
Northern cricket frog (*Acris gryllus*)	NR (22mm mean)	Dieldrin (95%)	Filter paper	26.7±1.1 (80±2°F)	Mortality	4.7-6.3 µg/cm^2	36h TL50 (approx. dose leading to 50% mortality at 36h)	Ferguson and Gilbert (1967)
Southern cricket frog (*Acris crepitans*)	NR (21-25mm means)	Dieldrin (95%)	Filter paper	26.7±1.1 (80±2°F)	Mortality	3.1-13.4 µg/cm^2	36h TL50 (approx. dose leading to 50% mortality at 36h)	Ferguson and Gilbert (1967)

Species	Stage (size)	Pesticide (Formulation/ purity)	Exposure method	Temp. (°C)	Endpoint	Dose	Effects	Reference
Fowler's toad (*Bufo woodhousei fowleri*)	NR (20-28mm means)	Dieldrin (95%)	Filter paper	26.7±1.1 (80±2°F)	Mortality	1.6-84.8 µg/cm^2	36h TL50 (approx. dose leading to 50% mortality at 36h)	Ferguson and Gilbert (1967)
Northern cricket frog (*Acris gryllus*)	NR (22mm mean)	Endrin (98%)	Filter paper	26.7±1.1 (80±2°F)	Mortality	0.3-0.7 µg/cm^2	36h TL50 (approx. dose leading to 50% mortality at 36h)	Ferguson and Gilbert (1967)
Southern cricket frog (*Acris crepitans*)	NR (21-25mm means)	Endrin (98%)	Filter paper	26.7±1.1 (80±2°F)	Mortality	0.6-0.9 µg/cm^2	36h TL50 (approx. dose leading to 50% mortality at 36h)	Ferguson and Gilbert (1967)
Fowler's toad (*Bufo woodhousei fowleri*)	NR (20-28mm means)	Endrin (98%)	Filter paper	26.7±1.1 (80±2°F)	Mortality	0.5-1.5 µg/cm^2	36h TL50 (approx. dose leading to 50% mortality at 36h)	Ferguson and Gilbert (1967)
Emerald glass frog (*Centrolene prosoblepon*)	Juvenile	Glyphosate (Glyphos 35.4%) + Cosmo Flux	Overspray	25±2	Mortality	1.97 kg a.e./ha	LC1	Bernal et al. (2009b)
Emerald glass frog (*Centrolene prosoblepon*)	Juvenile	Glyphosate (Glyphos) + Cosmo Flux	Overspray	25±2	Mortality	4.5 kg a.e./ha	LC50	Bernal et al. (2009b)
Banded robber frog (*Pristimantis taeniatus*)	Adult	Glyphosate (Glyphos) + Cosmo Flux	Overspray	25±2	Mortality	1.93 kg a.e./ha	LC1	Bernal et al. (2009b)
Banded robber frog (*Pristimantis taeniatus*)	Adult	Glyphosate (Glyphos) + Cosmo Flux	Overspray	25±2	Mortality	5.6 kg a.e./ha	LC50	Bernal et al. (2009b)
Banded robber frog (*Pristimantis taeniatus*)	Adult	Glyphosate (Glyphos) + Cosmo Flux	Overspray	25±2	Mortality	1.93 kg a.e./ha	LC1	Bernal et al. (2009b)
Banded robber frog (*Pristimantis taeniatus*)	Adult	Glyphosate (Glyphos) + Cosmo Flux	Overspray	25±2	Mortality	5.6 kg a.e./ha	LC50	Bernal et al. (2009b)

Species	Stage (size)	Pesticide (Formulation/ purity)	Exposure method	Temp. (°C)	Endpoint	Dose	Effects	Reference
Common lesser toad (*Rhinella granulosa*)	Juvenile	Glyphosate (Glyphos) + Cosmo Flux	Overspray	25±2	Mortality	6.5 kg a.e./ha	LC50	Bernal et al. (2009b)
Daudin's tree frog (*Scinax ruber*)	Juvenile	Glyphosate (Glyphos) + Cosmo Flux	Overspray	25±2	Mortality	0.32 kg a.e./ha	LC1	Bernal et al. (2009b)
Daudin's tree frog (*Scinax ruber*)	Juvenile	Glyphosate (Glyphos) + Cosmo Flux	Overspray	25±2	Mortality	7.3 kg a.e./ha	LC50:	Bernal et al. (2009b)
South-American crested toad (*Rhinella typhonius*)	Juvenile	Glyphosate (Glyphos) + Cosmo Flux	Overspray	25±2	Mortality	1.56 kg a.e./ha	LC1	Bernal et al. (2009b)
South-American crested toad (*Rhinella typhonius*)	Juvenile	Glyphosate (Glyphos) + Cosmo Flux	Overspray	25±2	Mortality	14.8 kg a.e./ha	LC50	Bernal et al. (2009b)
Tungara frog (*Engystomops pustulosus*)	Juvenile	Glyphosate (Glyphos) + Cosmo Flux	Overspray	25±2	Mortality	7.02 kg a.e./ha	LC1	Bernal et al. (2009b)
Tungara frog (*Engystomops pustulosus*)	Juvenile	Glyphosate (Glyphos) + Cosmo Flux	Overspray	25±2	Mortality	19.6 kg a.e./ha	LC50	Bernal et al. (2009b)
Cane toad (*Rhinella marina*)	Juvenile	Glyphosate (Glyphos) + Cosmo Flux	Overspray	25±2	Mortality	5.08 kg a.e./ha	LC1	Bernal et al. (2009b)
Cane toad (*Rhinella marina*)	Juvenile	Glyphosate (Glyphos) + Cosmo Flux	Overspray	25±2	Mortality	22.8 kg a.e./ha	LC50	Bernal et al. (2009b)

Species	Stage (size)	Pesticide (Formulation/ purity)	Exposure method	Temp. (°C)	Endpoint	Dose	Effects	Reference
Yellow-striped poison frog (*Dendrobates truncatus*)	Adult	Glyphosate (Glyphos) + Cosmo Flux	Overspray	25±2	Mortality	>7.38 kg a.e./ha	LC1	Bernal et al. (2009b)
Yellow-striped poison frog (*Dendrobates truncatus*)	Adult	Glyphosate (Glyphos) + Cosmo Flux	Overspray	25±2	Mortality	>7.38 kg a.e./ha	LC50	Bernal et al. (2009b)
Wood frog (*Rana sylvatica*)	Juvenile (338±11 mg)	Glyphosate (Roundup)	Overspray	-	Mortality	1.6 mg a.i./m^2	68% mortality (after 24 h)	Relyea (2005a)
Woodhouse's toad (*Bufo woodhousii*)	Juvenile (471±40mg)	Glyphosate (Roundup)	Overspray	-	Mortality	1.6 mg a.i./m^2	86% mortality (after 24 h)	Relyea (2005a)
Gray tree frog (*Hyla versicolor*)	Juvenile (425±26mg)	Glyphosate (Roundup)	Overspray	-	Mortality	1.6 mg a.i./m^2	82% mortality (after 24 h)	Relyea (2005a)
Northern slimy salamander (*Plethodon glutinosus*)	Adult	Malathion (25% WP)	Filter paper	15	Behaviour ChE inhibition Digestive efficiency	3 x 5.6 kg/ha one week apart	No behavioural effect (response to prey, disturbance and endurance/ coordination) 34% ChE inhibitions No significant effect on digestion	Baker (1985)
Eastern red-backed salamander (*Plethodon cinereus*)	Adult	Malathion (25% WP)	Filter paper	15	Behaviour ChE inhibition	2 x 2.24–8.97 kg/ha one week apart	No behavioural effects No significant inhibition of ChE activity	Baker (1985)
Northern slimy salamander (*Plethodon glutinosus*)	Adult	Malathion (25% WP)	Sprayed forest floor (field)	Ambient (May-Aug)	Abundance ChE inhibition	10 x 5.6 kg/ha one week apart	No effect on abundance or ChE inhibition	Baker (1985)

Species	Stage (size)	Pesticide (Formulation/ purity)	Exposure method	Temp. (°C)	Endpoint	Dose	Effects	Reference
Tiger salamander (*Ambystoma tigrinum*)	Adult (75-104g)	Malathion (96.5%)	Soil	20	ChE inhibition	50 µg/cm^2, 1d exposure	50–65% ChE inhibition No overt symptoms (lethargy, tremors, decreased responsiveness, anorexia)	Henson-Ramsey et al. (2008)
Tiger salamander (*Ambystoma tigrinum*)	Adult (75-104g)	Malathion (96.5%)	Soil	20	ChE inhibition	50 µg/cm^2, 2d exposure	50–65% ChE inhibition No overt symptoms (lethargy, tremors, decreased responsiveness, anorexia)	Henson-Ramsey et al. (2008)
Tiger salamander (*Ambystoma tigrinum*)	Adult (75-104g)	Malathion (96.5%)	Soil (dermal) +dietary (earthworm)	20	ChE inhibition	50 µg/cm^2, 1d exposure + 2g earthworm at 1.1ppm (range 0.98-1.5)	50–65% ChE inhibition No overt symptoms (lethargy, tremors, decreased responsiveness, anorexia)	Henson-Ramsey et al. (2008)
Tiger salamander (*Ambystoma tigrinum*)	Adult (75-104g)	Malathion (96.5%)	Soil (dermal) +dietary (earthworm)	20	ChE inhibition	100 µg/cm^2, 2d exposure + 2g earthworm at 1.1ppm (range 0.98-1.5)	90% ChE inhibition No overt symptoms (lethargy, tremors, decreased responsiveness, anorexia)	Henson-Ramsey et al. (2008)
Woodhouse's toad (*Bufo woodhousii*)	Adult	Malathion (96.5%)	Ventral application	20-22	Mortality	0.0011 mg/g	0% mortality	Taylor et al. (1999)
Woodhouse's toad (*Bufo woodhousii*)	Adult	Malathion (96.5%)	Ventral application	20-22	Mortality	0.011 mg/g	40% mortality	Taylor et al. (1999)

Species	Stage (size)	Pesticide (Formulation/ purity)	Exposure method	Temp. (°C)	Endpoint	Dose	Effects	Reference
Great Plains toad (*Bufo cognatus*)	Juvenile	Propiconazole + trifloxystrobin (Stratego)	Overspray	26±1	Mortality	0.11+0.11 µg a.i./cm^2 (0.1 x app. rate)	0% mortality (after 72 h)	Belden et al. (2010)
Great Plains toad (*Bufo cognatus*)	Juvenile	Propiconazole + trifloxystrobin (Stratego)	Overspray	26±1	Mortality	1.1+1.1 µg a.i./cm^2 (1 x app. rate)	7% mortality (after 72 h)	Belden et al. (2010)
Great Plains toad (*Bufo cognatus*)	Juvenile	Propiconazole + trifloxystrobin (Stratego)	Overspray	26±1	Mortality	11+11 µg a.i./cm^2 (10 x app. rate)	90% mortality (after 72 h)	Belden et al. (2010)
Great Plains toad (*Bufo cognatus*)	Juvenile	Propiconazole + azoxystrobin (Quilt)	Overspray	26±1	Mortality	0.13+0.076 µg a.i./cm^2 (0.1 x app. rate)	4% mortality (after 72 h)	Belden et al. (2010)
Great Plains toad (*Bufo cognatus*)	Juvenile	Propiconazole + azoxystrobin (Quilt)	Overspray	26±1	Mortality	1.3+0.76 µg a.i./cm^2 (1 x app. rate)	22% mortality (after 72 h)	Belden et al. (2010)
Great Plains toad (*Bufo cognatus*)	Juvenile	Propiconazole + azoxystrobin (Quilt)	Overspray	26±1	Mortality	13+7.6 µg a.i./cm^2 (10 x app. rate)	17% mortality (after 72 h)	Belden et al. (2010)
Great Plains toad (*Bufo cognatus*)	Juvenile	Pyraclostrobin (Headline)	Overspray	26±1	Mortality	0.22µg a.i./cm^2 (0.1 x app. rate)	7% mortality (after 72 h)	Belden et al. (2010)
Great Plains toad (*Bufo cognatus*)	Juvenile	Pyraclostrobin (Headline)	Overspray	26±1	Mortality	2.2 µg a.i./cm^2 (1 x app. rate)	67% mortality (after 72 h)	Belden et al. (2010)
Great Plains toad (*Bufo cognatus*)	Juvenile	Pyraclostrobin (Headline)	Overspray	26±1	Mortality	22 µg a.i./cm^2 (10 x app. rate)	100% mortality (after 72 h)	Belden et al. (2010)
Southern cricket frog (*Acris crepitans*)	NR (21-25mm means)	Toxaphene (100% chlorinated camphenes)	Filter paper	26.7±1.1 (80±2°F)	Mortality	7.9-84.8 µg/cm^2	36h TL50 (approx. dose leading to 50% mortality at 36h)	Ferguson and Gilbert (1967)

Species	Stage (size)	Pesticide (Formulation/ purity)	Exposure method	Temp. (°C)	Endpoint	Dose	Effects	Reference
Fowler's toad (*Bufo woodhousei fowleri*)	NR (20-28mm means)	Toxaphene (100% chlorinated camphenes)	Filter paper	26.7±1.1 (80±2°F)	Mortality	8.5-786 µg/cm^2	36h TL50 (approx. dose leading to 50% mortality at 36h)	Ferguson and Gilbert (1967)

Xiao et al (2007a,b) also demonstrated effects of dermal exposure to glyphosate on heart activity and nerve impulse generation and conduction of *Bufo gargarizans*. Zaffaroni et al. (1986a) determined the LT50 for adult newts (*Triturus cristatus carnifex*) percutaneously exposed using solutions of 2,4-D (as Agroxone 5, 37% a.i.) at 18±2°C. Male newts (6.6cm SVL, 5.7g) exposed to 50-150ppm solutions had LT50 values of 440-14h. Females (7.5-7.6cm, 9.4g) exposed to 75 and 125ppm solutions had LT50 values of 132 and 52h respectively. In a similar study (Zaffaroni et al. 1986b), the effects of MCPA (as Agroxone 3, 25% a.i.) were tested under the same conditions. Male newts (7.1-7.3cm SVL, 7.1-7.6g) exposed to 1600 and 3200ppm solutions had LT50 values of 35 and 17h respectively. Females (7.5-7.6cm, 9.0-10.1g) exposed to 1600 and 3200ppm solutions had LT50 values of 45.5 and 21h respectively.

2.2.2.3. Estimating dermal exposure

Estimation of dermal uptake is complex compared to dietary exposure and depends on;

- surface area in contact with the contaminated substrate/medium
- water potential of the animal and substrate/medium
- physical properties of the chemical (e.g. molecular size)
- permeability of the skin.

Willens et al. (2006a,b) determined the absorption of malathion ^{14}C by anuran skin in two studies using different methods and tissues. In the first (Willens 2006a), skin samples taken from the dorsal and ventral areas of bullfrogs (*Rana catesbeiana*) and three marine toads (*Bufo marinus*) were tested in two-compartment Teflon flow-through diffusion cells perfused with modified amphibian Ringer's solution. Mean uptake through dorsal and ventral skin by bullfrogs was 68.51 and 81.38% respectively. The corresponding values for marine toads were 76.77 and 82.75%.

In a second study, the uptake of radio-labelled malathion was tested using the harvested perfused anuran pelvic limb (HPAPL) model. This method has the advantage of maintaining integrity of the skin from the pelvic limb, including the intact capillary network. Here, mean total absorption was 45.6±5.6% of the dose administered.

Birge et al. (2000) provides a formula (from Feder and Burggren 1992) for calculating the rate of uptake of a dissolved contaminant based on the assumption that it will move into the animal at the same rate as water is absorbed and is at the same concentration as the pore water or soil concentration.

Where empirical data is not available, allometric equations exist for estimating the surface area of amphibians. For example, equations are avaialble for 'all frogs' (Hutchinson et al. 1968) or salamanders (Whitford and Huthinson 1967). Estimates are reviewed in Talbot and Feder (1992) which also provides methods (based on data for bullfrogs) for estimating the area of different parts of the skin (e.g. dorsal, ventral thigh including pelvic patch) that may allow estimation of say overspray exposure or surface contact.

2.2.3. Inhalation

No information was found specific to the assessment of inhalation exposure for amphibians.

2.2.4. Soil intake

No information was found specifically for amphibians but assessments for other groups feeding on soil invertebrates based on food intake would appear to be suitable for amphibians. For example, Beyer et

al. (1994) estimated that soil ingestion rate in box turtles and Eastern painted turtles were 4.5% and 5.9% of the diet respectively.

2.2.5. Avoidance

Six studies were found that addressed avoidance and pesticides in amphibians. Three of these (Pauli et al. 1999, Wojtaszek et al 2004, 2005) referred to effects of exposure of tadpoles to pesticide formulations on the 'avoidance reaction' to a negative stimulus (prodding) rather than avoidance of pesticide contaminated habitats. The remaining three addressed avoidance of contaminated environments under laboratory conditions.

Gertzog et al (2011) determined the avoidance response of adult eastern red-backed salamanders (*Plethodon cinereus*) to a filter paper substrate contaminated with one of three formulations at 1%, 10% or 100% of the normal application rate. The tested formulations were Spectracide Brush Killer (9.74% 2,4-D + 4.78%Dichlorprop-p + 1.65% Dicamba + surfactant), Bayer Advanced Brushkiller Plus (8.8% Triclopyr + surfactant) and Roundup Weed and Grass Killer Concentrate Plus (18%Glyphosate isopropylamine salt + 0.73% Diquat dibromide + POEA). Salamanders avoided all formulations applied at full rate and Bayer Advanced Bruskiller and Roundup at 10% of the application rate. No formulation was avoided at 1% of the application rate.

Takahashi (2007) investigated the effects of contamination of potential oviposition sites with the formulation Roundup Weed and Grass Killer (18% Glyphosate isopropylamine salt + Diquat dibromide + 0.73% POEA) on the behaviour of the gray treefrog complex (*Hyla versicolor* and *Hyla chrysoscelis*). Frogs were found to avoid water treated at 2.4mg a.e./L when selection oviposition sites although it is unlikely that such a concentration would be encountered frequently.

Mendez et al (2009) exposed adult American toads (*Bufo americanus*) to soil contaminated with technical atrazine (99.2%) at field relevant concentrations (based on measured residues). These represented concentrations immediately after application and the lower levels found 50 days later. The toads did not show any avoidance of the treated soil.

Other studies have been made of the avoidance of nitrate fertilisers by amphibians. Egea-Serrano et al (2008) tested the avoidance of ammonium chloride, isolated or combined with sodium nitrite and sodium nitrate, in aquatic habitat by *Pelophylax perezi* froglets. Nitrogen contaminated treatments were not avoided although significant inter-individual variation in avoidance was observed.

Gaglione et al, (2011) tested the avoidance of urea contaminated substrates by red-backed salamanders (*Plethodon cinereus*). They found avoidance on both filter paper and soil substrates for this species although the response was often not clear until 60 to 120 minutes of exposure.

Marco et al, (2001) investigated the avoidance of urea contaminated paper towel substrate by three forest dwelling species (*Plethodon vehiculum, Rhyacotriton variegatus*, and *Taricha granulosa*). In this study all three species demonstrated avoidance of substrate treated with urea at a rate of 225 kg N/ha. In a similar study of the response of *Triturus boscai* to an ammonium nitrate contaminated filter paper substrate (Ortiz-Santaliestra et al. 2005) found a concentration related avoidance response.

However, while Hatch et al (2001) found that newly metamorphosed western toads (*Bufo boreas*) and cascades frogs (*Rana cascadae)* avoided paper towels contaminated with urea fertiliser, they did not avoid potentially lethal concentrations when applied to soil substrates. Juvenile long-toed salamanders (*Ambystoma macrodactylum*) also failed to avoid urea contaminated soil.

These results indicate that while amphibians can avoid some pesticide or fertiliser applications under certain conditions, the response seems to be mixed depending on the species, substrate and toxicant. It

is also likely that the response will be affected by constituents of formulations other than the active ingredient. Given this, it would seem safer to assume that treated areas are not avoidede by amphibians unless specific information is available for the species/contaminant/substrate system under consideration.

2.3. Conclusions on assessment of exposure

Food intake can be estimated based on published data for the species of concern or by estimating food requirements as is done for birds and mammals by using allometric equations for reptiles. However, the feeding pattern of amphibians is far more variable than for birds and mammals where small species must usually feed every day. This makes it far more difficult to establish a daily food intake value or determine how likely the animals is to feed while contaminated food is available.

Dermal exposure is likely to be a major route of exposure due to the use of skin for respiration and water uptake and the potentially high rate of absorption of contaminants. However, there are as yet no methods that have been developed to assess this risk for amphibians in the natural environment. For effective risk assessment for this group there is an urgent need for further research in this area.

Even less information is available for other routes of exposure such as soil ingestion or inhalation although methods used for other small vertebrates to assess soil ingestion are likely to be suitable. While avoidance may have the potential to reduce exposure the evidence for this is mixed and would need to be assessed on case by case basis.

3. Toxicity of pesticides to amphibians

An initial search of the US EPA ECOTOX database for LC50 data for amphibians was conducted to identify data already available. Data for pesticides in the search results by identifying data for compounds found the electronic Pesticide Manual (15th Edition). Thus the data contained data for not only pesticides but also some compounds from other uses that are present in pesticides (e.g, $CuSO_4$ and $HgCl_2$). The results of the literature search and other sources (e.g. Sparling et al. 2010) were also examined to check for further data.

3.1. Aquatic toxicity (LC50)

Some of LC50 data downloaded from the ECOTOX database were found to be incorrect or unsuitable as follows:

Table 10: Summary of issues found in downloaded ECOTOX LC50 data for amphibians.

Original source of data	Issue
Bernardini et al (1996)	Some data listed as for 'MCPA' was for another compound.
Chandurkar et al (1978)	Data listed data for Toxaphene (Camphechlor) was for mosquito larvae not amphibians (bullfrogs).
Hall and Kolbe (1980)	Data listed for fenthion and parathion for bullfrogs was actually fact an LD50 for ducklings fed exposed tadpoles.
Howe et al. (1998)	Some data retrieved in an amphibian search for alachlor and atrazine was for fish (channel catfish, rainbow trout).
Lajmanovich et al. (2003b)	Some data for glyphosate isopropylamine (Glyfos) and snouted treefrog tadpoles could not be found in the paper.

Relyea, R.A. (2005b)	Some data for LC50 values that include the effect of predatory stress are included in the ECOTOX data but it was felt better to omit these.
Zaffaroni et al. (1978)	Data for Maneb (Maneb 80) and *Triturus cristatus* described as LC50 is in fact the concentrations at which LT50 was measured (not LC50s).

After removing this data some 2124 LC50 values remained. Due to these issues, some of which were found early on in the collation of the data, it was decided as far as possible to check all of the data against the original source where this could be obtained. All values were assessed to determine if any further data should be omitted. Reasons for omission included:

- test material not defined (e.g. formulation or technical material),
- formulation data with no % a.i. information,
- lack of replication (animals per dose),
- no information on number of dose levels used.

In some cases where no detailed information on number of dose levels was found, but a standard method was used or other information indicated that sufficient doses were likely to have been used, the studies were accepted. In some cases the source language allowed the values to be checked but other details of the study could not be extracted. These values were also excluded. In total 737 values were omitted leaving 1387 LC50 values. These were divided into tables depending on test period duration (24h, 48h, 72h, 96h and 'all other durations').

The selected data for 96h studies is shown in Table 11. Data for other standard test durations (24, 48 and 72h) are shown in Appendices I to L. The data that was omitted is shown in Appendix M along with the reasons they were not included.

Table 11: 96h LC50 data for amphibians.

CAS	Pesticide name	% a.i.	Test material	Species	Stage	Temp. (°C)	Test type	Duration (h)	LC50 (mg/L)	LC50 based on	Reference	Data line
94757	2,4-D	99	Technical	*Rhinella arenarum*	Embryos	20±2	Renewal	96	9.06	Active ingredient	Aronzon et al (2011)	1323
94757	2,4-D	(79.7 g/100 cm^3 a.e.)	Formulation	*Rhinella arenarum*	Embryos	20±2	Renewal	96	3.36	Active ingredient	Aronzon et al (2011)	1324
94757	2,4-D	99	Technical	*Xenopus laevis*	Embryos	24-26	Renewal	96	>270	Active ingredient	Morgan et al (1996)	1325
94757	2,4-D	99	Technical	*Xenopus laevis*	Embryos	24-26	Renewal	96	254	Active ingredient	Morgan et al (1996)	1326
1929733	2,4-D	62.5	Technical	*Bufo woodhousei fowleri*	Tadpoles	15	Static	96	>10	Active ingredient	Mayer and Ellersieck (1986)	1330
94757	2,4-D	99	Technical	*Rhinella arenarum*	Tadpoles	20±2	Renewal	96	13.49	Active ingredient	Aronzon et al (2011)	1331
94757	2,4-D	(79.7 g/100 cm^3 a.e.)	Formulation	*Rhinella arenarum*	Tadpoles	20±2	Renewal	96	3.01	Active ingredient	Aronzon et al (2011)	1332
94804	2,4-D Butyl	79.7	Formulation	*Rhinella arenarum*	Tadpoles	20±1	Static	96	3.6	Active ingredient	Perez-Coll and Herkovits (2006)	1333
2008391	2,4-D-dimethylammonium	NR	Technical	*Pseudacris triseriata*	Tadpoles	15.5±0.5	Static	96	100	Active ingredient	Sanders (1970)	1337
504245	4-Aminopyridine	NR	Technical	*Rana sphenocephala*	Larvae	16	Static	96	2.4	Active ingredient	Marking and Chandler (1981)	1339

CAS	Pesticide name	% a.i.	Test material	Species	Stage	Temp. (°C)	Test type	Duration (h)	LC50 (mg/L)	LC50 based on	Reference	Data line
30560191	Acephate	97	Technical	*Ambystoma gracile*	Larvae	22	Renewal	96	8816	Active ingredient	Geen et al (1984)	1340
34256821	Acetochlor	50	Formulation	*Bufo bufo gargarizans*	Tadpoles	22±2	Renewal	96	1.32	Active ingredient	Yin et al (2008)	1342
107028	Acrolein	0.9608	Formulation	*Rhinella arenarum*	Larvae	20-22	Renewal	96	0.023	Active ingredient	Venturino et al (2007)	1343
107028	Acrolein	NR	(Technical)	*Xenopus laevis*	Tadpoles	17.2 (16.5-18.4)	Flow-through	96	0.007	Active ingredient	Holcombe et al (1987)	1344
107131	Acrylonitrile	NR	Technical (Analytical grade)	*Bufo bufo gargarizans*	Tadpoles	21±1	Flow-through	96	11.26	Active ingredient	Zhang et al (1996)	1345
107131	Acrylonitrile	NR	Technical (Analytical grade)	*Bufo bufo gargarizans*	Tadpoles	21±1	Flow-through	96	11.94	Active ingredient	Zhang et al (1996)	1346
15972608	Alachlor	99	Technical	*Xenopus laevis*	Embryos	22-26	Static-renewal	96	6.1	Active ingredient	Osano et al. (2002b)	1347
15972608	Alachlor	43	Formulation	*Bufo americanus*	Larvae	22±1.0	Static	96	3.3	Active ingredient	Howe et al. (1998)	1348
15972608	Alachlor	43	Formulation	*Bufo americanus*	Larvae	22±1.0	Static	96	3.9	Active ingredient	Howe et al. (1998)	1349
15972608	Alachlor	43	Formulation	*Rana pipiens*	Larvae	22±1.0	Static	96	11.5	Active ingredient	Howe et al. (1998)	1350
15972608	Alachlor	43	Formulation	*Rana pipiens*	Larvae	22±1.0	Static	96	3.5	Active ingredient	Howe et al. (1998)	1351
1646884	Aldoxycarb	98	Technical (Reference grade)	*Xenopus laevis*	Blastula	23±1	Renewal	96	>100	Active ingredient	Fort et al (1999b)	1352
1646884	Aldoxycarb	98	Technical (Reference grade)	*Xenopus laevis*	Blastula	23±1	Renewal	96	>100	Active ingredient	Fort et al (1999b)	1353

CAS	Pesticide name	% a.i.	Test material	Species	Stage	Temp. (°C)	Test type	Duration (h)	LC50 (mg/L)	LC50 based on	Reference	Data line
309002	Aldrin	90	Technical	*Bufo woodhousei fowleri*	Tadpoles	16	Static	96	0.068	Active ingredient	Mayer and Ellersieck (1986)	1354
309002	Aldrin	NR	Technical	*Bufo woodhousei fowleri*	Tadpoles	15.5±0.5	Static	96	0.15	Active ingredient	Sanders (1970)	1355
2032599	Aminocarb	75	Technical	*Rana clamitans*	Tadpoles	21±1	Static	96	118	Active ingredient	Lyons et al (1976)	1356
33089611	Amitraz	97.5	Technical (Analytical)	*Xenopus laevis*	Embryos	24 (23-25)	Static-renewal	96	3.27	Active ingredient	Osano et al. (2002a)	1357
1327533	Arsenous oxide	NR	Technical (Reagent grade)	*Rana hexadactyla*	Tadpoles	15 (13-16)	Renewal	96	0.249	Active ingredient (As)	Khangarot et al (1985b)	1358
1912249	Atrazine	NR	(Technical)	*Bufo americanus*	Embryos	19-22	Flow-through	96	>48	Active ingredient	Birge et al (1983)	1360
1912249	Atrazine	NR	(Technical)	*Rana catesbeiana*	Embryos	19-22	Flow-through	96	0.41	Active ingredient	Birge et al (1983)	1361
1912249	Atrazine	40.8	Formulation (Commercial grade)	*Xenopus laevis*	Embryos	24-26	Renewal	96	100	Active ingredient	Morgan et al (1996)	1364
1912249	Atrazine	40.8	Formulation (Commercial grade)	*Xenopus laevis*	Embryos	24-26	Renewal	96	126	Active ingredient	Morgan et al (1996)	1365
1912249	Atrazine	40.8	Formulation	*Bufo americanus*	Larvae	22±1.0	Static	96	10.7	Active ingredient	Howe et al. (1998)	1366
1912249	Atrazine	40.8	Formulation	*Bufo americanus*	Larvae	22±1.0	Static	96	26.5	Active ingredient	Howe et al. (1998)	1367
1912249	Atrazine	40.8	Formulation	*Rana pipiens*	Larvae	22±1.0	Static	96	14.5	Active ingredient	Howe et al. (1998)	1368
1912249	Atrazine	40.8	Formulation	*Rana pipiens*	Larvae	22±1.0	Static	96	47.6	Active ingredient	Howe et al. (1998)	1369
1912249	Atrazine	98	Technical	*Rhinella arenarum*	NR	20±2	Renewal	96	27.16	Active ingredient	Brodeur et al. (2009)	1370

CAS	Pesticide name	% a.i.	Test material	Species	Stage	Temp. (°C)	Test type	Duration (h)	LC50 (mg/L)	LC50 based on	Reference	Data line
1912249	Atrazine	80	Formulation	*Ptychadena bibroni*	Tadpoles	30±2	Semi-static-renewal	96	0.184	Active ingredient	Ezemonye and Tongo (2009)	1372
1912249	Atrazine	80	Formulation	*Ptychadena bibroni*	Tadpoles	30±2	Semi-static-renewal	96	0.245	Active ingredient	Ezemonye and Tongo (2009)	1373
1912249	Atrazine	80	Formulation	*Ptychadena bibroni*	Tadpoles	30±2	Semi-static-renewal	96	0.345	Active ingredient	Ezemonye and Tongo (2009)	1374
1912249	Atrazine	98	Technical	*Rana catesbeiana*	Tadpoles	15	NR	96	>16	Active ingredient	Wan et al (2006)	1376
1912249	Atrazine	48.5	Formulation	*Rana catesbeiana*	Tadpoles	15	NR	96	>480	Formulation	Wan et al (2006)	1377
1912249	Atrazine	98	Technical	*Rhinella arenarum*	Tadpoles	20±2	Renewal	96	27.16	Active ingredient	Brodeur et al (2009)	1378
11141176	Azadirachtin	4.5	Formulation	*Bufo marinus*	Larvae	22	Static	96	13.43	Active ingredient	Punzo and Parker (2005)	1379
11141176	Azadirachtin	4.5	Formulation	*Bufo marinus*	Larvae	22	Static	96	21.54	Active ingredient	Punzo and Parker (2005)	1380
11141176	Azadirachtin	4.5	Formulation	*Bufo marinus*	Larvae	22	Static	96	5.35	Active ingredient	Punzo and Parker (2005)	1381
11141176	Azadirachtin	4.5	Formulation	*Bufo marinus*	Larvae	22	Static	96	5.72	Active ingredient	Punzo and Parker (2005)	1382
11141176	Azadirachtin	4.5	Formulation	*Bufo marinus*	Larvae	22	Static	96	7.87	Active ingredient	Punzo and Parker (2005)	1383
11141176	Azadirachtin	4.5	Formulation	*Bufo quercicus*	Tadpoles	21	NR	96	11.34	Active ingredient	Punzo (1997)	1384
11141176	Azadirachtin	4.5	Formulation	*Bufo quercicus*	Tadpoles	21	NR	96	19.62	Active ingredient	Punzo (1997)	1385
11141176	Azadirachtin	4.5	Formulation	*Bufo quercicus*	Tadpoles	21	NR	96	4.39	Active ingredient	Punzo (1997)	1386
11141176	Azadirachtin	4.5	Formulation	*Bufo quercicus*	Tadpoles	21	NR	96	4.41	Active ingredient	Punzo (1997)	1387

CAS	Pesticide name	% a.i.	Test material	Species	Stage	Temp. (°C)	Test type	Duration (h)	LC50 (mg/L)	LC50 based on	Reference	Data line
11141176	Azadirachtin	4.5	Formulation	*Bufo quercicus*	Tadpoles	21	NR	96	6.12	Active ingredient	Punzo (1997)	1388
86500	Azinphos-methyl	99	Technical	*Xenopus laevis*	Eggs	23	Renewal	96	>7.62	Active ingredient	Schuytema et al (1994)	1389
86500	Azinphos-methyl	99	Technical	*Xenopus laevis*	Eggs	23	Renewal	96	>0.89	Active ingredient	Schuytema et al (1994)	1390
86500	Azinphos-methyl	99	Technical	*Xenopus laevis*	Eggs	24	Renewal	96	10.63	Active ingredient	Schuytema et al (1994)	1391
86500	Azinphos-methyl	99	Technical	*Xenopus laevis*	Eggs	23	Renewal	96	11.89	Active ingredient	Schuytema et al (1994)	1392
86500	Azinphos-methyl	99	Technical	*Xenopus laevis*	Eggs	23	Renewal	96	6.1	Active ingredient	Schuytema et al (1994)	1393
86500	Azinphos-methyl	99	Technical	*Xenopus laevis*	Eggs	24	Renewal	96	6.28	Active ingredient	Schuytema et al (1994)	1394
86500	Azinphos-methyl	22	Formulation	*Xenopus laevis*	Eggs	24	Renewal	96	1.6	Active ingredient	Schuytema et al (1994)	1395
86500	Azinphos-methyl	50	Formulation? (Product name)	*Rana clamitans*	Embryos	18.6	Renewal	96	>5.0	Active ingredient	Harris et al (1998)	1396
86500	Azinphos-methyl	50	Formulation? (Product name)	*Rana clamitans*	Embryos	18.1	Renewal	96	>5.0	Active ingredient	Harris et al (1998)	1397
86500	Azinphos-methyl	22	Formulation	*Ambystoma gracile*	larvae	20	Continuous-flow through	96	1.67	Active ingredient	Nebeker et al (1998)	1398
86500	Azinphos-methyl	22	Formulation	*Ambystoma maculatum*	larvae	20	Continuous-flow through	96	1.90	Active ingredient	Nebeker et al (1998)	1399
86500	Azinphos-methyl	99	Technical	*Rhinella arenarum*	Larvae	16±1	Static	96	10.44	Active ingredient	Ferrari et al (2004)	1400
86500	Azinphos-methyl	93	Technical	*Bufo woodhousei fowleri*	Tadpoles	15	Static	96	0.109	Active ingredient	Mayer and Ellersieck (1986)	1401

CAS	Pesticide name	% a.i.	Test material	Species	Stage	Temp. (°C)	Test type	Duration (h)	LC50 (mg/L)	LC50 based on	Reference	Data line
86500	Azinphos-methyl	NR	Technical	*Bufo woodhousei fowleri*	Tadpoles	15.5±0.5	Static	96	0.13	Active ingredient	Sanders (1970)	1402
86500	Azinphos-methyl	22	Formulation	*Pseudacris regilla*	Tadpoles	19	Continuous-flow through	96	1.47	Active ingredient	Nebeker et al (1998)	1403
86500	Azinphos-methyl	99	Technical	*Pseudacris regilla*	Tadpoles	19	Continuous-flow through	96	>3.60	Active ingredient	Nebeker et al (1998)	1404
86500	Azinphos-methyl	99	Technical	*Pseudacris regilla*	Tadpoles	23±1	Renewal	96	4.14	Active ingredient	Schuytema et al (1995)	1405
86500	Azinphos-methyl	22	Formulation	*Pseudacris regilla*	Tadpoles	24±1	Renewal	96	0.46	Active ingredient	Schuytema et al (1995)	1406
86500	Azinphos-methyl	22	Formulation	*Pseudacris regilla*	Tadpoles	24±1	Renewal	96	0.84	Active ingredient	Schuytema et al (1995)	1407
86500	Azinphos-methyl	93	Technical	*Pseudacris triseriata*	Tadpoles	15	Static	96	3.2	Active ingredient	Mayer and Ellersieck (1986)	1408
86500	Azinphos-methyl	22	Formulation	*Xenopus laevis*	Tadpoles	24±1	Renewal	96	0.42	Active ingredient	Schuytema et al (1995)	1409
86500	Azinphos-methyl	99	Technical	*Xenopus laevis*	Tadpoles	23±1	Renewal	96	2.94	Active ingredient	Schuytema et al (1995)	1410
86500	Azinphos-methyl	22	Formulation	*Xenopus laevis*	Tadpoles	24±1	Renewal	96	0.59	Active ingredient	Schuytema et al (1995)	1411
23184669	Butachlor	50	Formulation	*Bufo bufo gargarizans*	Tadpoles	22±2	Renewal	96	0.76	Active ingredient	Yin et al (2008)	1414
23184669	Butachlor	60	Formulation	*Fejervarya limnocharis*	Tadpoles	26	Renewal	96	0.87	Active ingredient	Liu et al (2011)	1416
23184669	Butachlor	50	Formulation	*Fejervarya multistriata*	Tadpoles	21-27	Renewal	96	1.30	Formulation	Geng et al (2005)	1417
23184669	Butachlor	50	Formulation	*Microhyla ornata*	Tadpoles	21-27	Renewal	96	0.53	Formulation	Geng et al (2005)	1418

CAS	Pesticide name	% a.i.	Test material	Species	Stage	Temp. (°C)	Test type	Duration (h)	LC50 (mg/L)	LC50 based on	Reference	Data line
23184669	Butachlor	50	Formulation	*Polypedates megacephalus*	Tadpoles	21-27	Renewal	96	1.52	Formulation	Geng et al (2005)	1419
8001352	Camphechlor	100	Technical	*Bufo woodhousei fowleri*	Tadpoles	15	Static	96	0.15	Active ingredient	Mayer and Ellersieck (1986)	1420
8001352	Camphechlor	NR	Technical	*Bufo woodhousei fowleri*	Tadpoles	15.5±0.5	Static	96	0.14	Active ingredient	Sanders (1970)	1421
8001352	Camphechlor	100	Technical	*Pseudacris triseriata*	Tadpoles	15	Static	96	0.39	Active ingredient	Mayer and Ellersieck (1986)	1422
8001352	Camphechlor	NR	Technical	*Pseudacris triseriata*	Tadpoles	15.5±0.5	Static	96	0.5	Active ingredient	Sanders (1970)	1423
63252	Carbaryl	99.7	Technical	*Xenopus laevis*	Embryos	23±1	Static, non-renewal	96	15.25	Active ingredient	Zaga et al (1998)	1425
63252	Carbaryl	99	Technical	*Rhinella arenarum*	Larvae	16±1	Static	96	24.64	Active ingredient	Ferrari et al (2004)	1426
63252	Carbaryl	50	Formulation	*Rana tigrina*	NR	NR	Static	96	11.7	Active ingredient	Marian et al (1983)	1427
63252	Carbaryl	50	Formulation	*Rana tigrina*	NR	NR	Static	96	6.2	Active ingredient	Marian et al (1983)	1428
63252	Carbaryl	50	Formulation	*Rana tigrina*	NR	NR	Static	96	6.3	Active ingredient	Marian et al (1983)	1429
63252	Carbaryl	99.7	Technical	*Bufo boreas*	Tadpoles	22	Static	96	12.31	Active ingredient	Dwyer et al (1999)	1430
63252	Carbaryl	99.7	Technical	*Bufo boreas ssp. boreas*	Tadpoles	22	Static	96	12.31	Active ingredient	Dwyer et al (2005)	1431
63252	Carbaryl	NR	Formulation	*Bufo marinus*	Tadpoles	NR	Static	96	2.1	Active ingredient	Tejada et al (1994)	1432
63252	Carbaryl	99.7	Technical	*Hyla versicolor*	Tadpoles	23±1	Static, non-renewal	96	2.47	Active ingredient	Zaga et al (1998)	1433

CAS	Pesticide name	% a.i.	Test material	Species	Stage	Temp. (°C)	Test type	Duration (h)	LC50 (mg/L)	LC50 based on	Reference	Data line
63252	Carbaryl	99.7	Technical	*Rana clamitans*	Tadpoles	27	Static	96	11.32	Active ingredient	Boone and Bridges (1999)	1436
63252	Carbaryl	99.7	Technical	*Rana clamitans*	Tadpoles	22	Static	96	17.36	Active ingredient	Boone and Bridges (1999)	1437
63252	Carbaryl	99.7	Technical	*Rana clamitans*	Tadpoles	17	Static	96	22.02	Active ingredient	Boone and Bridges (1999)	1438
63252	Carbaryl	NR	(Technical)	*Rana sphenocephala*	Tadpoles	22	Static	96	8.4	Active ingredient	Bridges et al (2002)	1440
63252	Carbaryl	99.7	Technical	*Xenopus laevis*	Tadpoles	23±1	Static, non-renewal	96	1.73	Active ingredient	Zaga et al (1998)	1442
10605217	Carbendazim	>96	Technical	*Xenopus laevis*	Embryos	24±0.5	Renewal	96	0.001072	Active ingredient	Yoon et al (2008)	1443
1563662	Carbofuran	75	Technical	*Microhyla ornata*	Embryos	NR	Renewal	96	44.23	Active ingredient	Pawar and Katdare (1984)	1446
1563662	Carbofuran	75	Formulation	*Microhyla ornata*	Tadpoles	25±1	Renewal	96	13.47	Formulation	Pawar and Katdare (1983)	1447
1563662	Carbofuran	75	Technical	*Microhyla ornata*	Tadpoles	NR	Renewal	96	13.47	Active ingredient	Pawar and Katdare (1984)	1448
1563662	Carbofuran	3	Formulation	*Rana hexadactyla*	Tadpoles	29	Static?	96	7.8	Active ingredient	Andrews and George (1991)	1449
786196	Carbophenothion	NR	Technical	*Pseudacris triseriata*	Tadpoles	15.5±0.5	Static	96	0.028	Active ingredient	Sanders (1970)	1451
90982324	Chlorimuron-ethyl	75	Formulation	*Bufo bufo gargarizans*	Tadpoles	22±2	Renewal	96	164	Active ingredient	Yin et al (2008)	1453
2921882	Chlorpyrifos	99.8	Technical	*Xenopus laevis*	Embryos	24.7	Renewal	96	2.41	Active ingredient	El-Merhibi et al (2004)	1454

CAS	Pesticide name	% a.i.	Test material	Species	Stage	Temp. (°C)	Test type	Duration (h)	LC50 (mg/L)	LC50 based on	Reference	Data line
2921882	Chlorpyrifos	99.5	Technical	*Ambystoma mexicanum*	Larvae	20±1	Static-renewal	96	1.36	Active ingredient	Robles-Mendoza et al (2009)	1455
2921882	Chlorpyrifos	99.2	Technical	*Xenopus laevis*	NR	24±0.2	Static	96	0.564	Active ingredient	Richards (2000)	1456
2921882	Chlorpyrifos	99.2	Technical	*Xenopus laevis*	NR	24±0.2	Static	96	14.6	Active ingredient	Richards (2000)	1457
2921882	Chlorpyrifos	40	Formulation	*Bufo bufo gargarizans*	Tadpoles	20.5-22.5	Renewal	96	0.80	Active ingredient	Yin et al (2009)	1458
2921882	Chlorpyrifos	99.5	Technical	*Rana dalmatina*	Tadpoles	22±1	Static	96	5.174	Active ingredient	Bernabo et al 2011	1461
1332407	Copper oxychloride	99	Formulation	*Rana catesbeiana*	Tadpoles	22.7±0.9	Static	96	2.4	Active ingredient	Ferreira et al (2004)	1463
1332407	Copper oxychloride	99	Formulation	*Rana catesbeiana*	Tadpoles	23.71±0.35	Static	96	2.83	Active ingredient	Lombardi et al (2002)	1464
7758987	Copper sulfate	NR	Technical	*Ambystoma opacum*	Eggs	20-24	Renewal	96	3.59	Active ingredient (Cu)	Birge and Black (1979)	1465
7758987	Copper sulfate	NR	Technical	*Rana pipiens*	Eggs	20-24	Renewal	96	0.06	Active ingredient (Cu)	Birge and Black (1979)	1466
7758987	Copper sulfate	100	Active ingredient	*Epidalea calamita*	Embryos	20	NR	96	0.22	Active ingredient (Cu)	Garcia-Munoz et al (2009)	1467
7758987	Copper sulfate	100	Active ingredient	*Epidalea calamita*	Embryos	20	NR	96	0.08	Active ingredient (Cu)	Garcia-Munoz et al (2009)	1468
7758987	Copper sulfate	39.81	Technical	*Xenopus laevis*	Embryos	24±0.5	Renewal	96	1.25	Active ingredient	Fort and Stover (1996)	1469
7758987	Copper sulfate	39.81	Technical	*Xenopus laevis*	Embryos	24±0.5	Renewal	96	1.38	Active ingredient	Fort and Stover (1996)	1470

CAS	Pesticide name	% a.i.	Test material	Species	Stage	Temp. (°C)	Test type	Duration (h)	LC50 (mg/L)	LC50 based on	Reference	Data line
7758987	Copper sulfate	100	Active ingredient	*Epidalea calamita*	Larvae	20	NR	96	0.11	Active ingredient (Cu)	Garcia-Munoz et al (2009)	1473
7758987	Copper sulfate	NR	Technical (Reagent grade)	*Rana tigrina*	Larvae	26.5 (24-27.5)	Static	96	0.389	Active ingredient (Cu)	Khangarot et al (1981)	1474
7758987	Copper sulfate	39.81	Technical	*Xenopus laevis*	Larvae	24±0.5	Renewal	96	0.15	Active ingredient	Fort and Stover (1996)	1475
7758987	Copper sulfate	39.81	Technical	*Xenopus laevis*	Larvae	24±0.5	Renewal	96	0.42	Active ingredient	Fort and Stover (1996)	1476
7758987	Copper sulfate	39.81	Technical	*Xenopus laevis*	Larvae	24±0.5	Renewal	96	1.08	Active ingredient	Fort and Stover (1996)	1477
7758987	Copper sulfate	39.81	Technical	*Xenopus laevis*	Larvae	24±0.5	Renewal	96	0.24	Active ingredient	Fort and Stover (1996)	1478
7758987	Copper sulfate	39.81	Technical	*Xenopus laevis*	Larvae	24±0.5	Renewal	96	0.65	Active ingredient	Fort and Stover (1996)	1479
7758987	Copper sulfate	39.81	Technical	*Xenopus laevis*	Larvae	24±0.5	Renewal	96	1.15	Active ingredient	Fort and Stover (1996)	1480
7758987	Copper sulfate	25.5	Technical	*Bufo boreas*	Tadpoles	22	Static	96	0.12	Active ingredient	Dwyer et al (1999)	1481
7758987	Copper sulfate	25.5	Technical	*Bufo boreas*	Tadpoles	22	Static	96	0.12	Active ingredient	Dwyer et al (2005)	1482
7758987	Copper sulfate	NR	Technical	*Bufo bufo*	Tadpoles	20±0.5	Static	96	0.08	Active ingredient	Garcia-Munoz et al (2010)	1483
7758987	Copper sulfate	NR	Technical	*Bufo bufo*	Tadpoles	20±0.5	Static	96	0.09	Active ingredient	Garcia-Munoz et al (2010)	1484
7758987	Copper sulfate	NR	Technical	*Bufo melanostictus*	Tadpoles	31 (29-34)	Static	96	0.32	Active ingredient (Cu)	Khangarot and Ray (1987)	1485
7758987	Copper sulfate	NR	Technical	*Discoglossus jeanneae*	Tadpoles	20±0.5	Static	96	0.08	Active ingredient	Garcia-Munoz et al (2010)	1486
7758987	Copper sulfate	NR	Technical	*Discoglossus jeanneae*	Tadpoles	20±0.5	Static	96	0.10	Active ingredient	Garcia-Munoz et al (2010)	1487

CAS	Pesticide name	% a.i.	Test material	Species	Stage	Temp. (°C)	Test type	Duration (h)	LC50 (mg/L)	LC50 based on	Reference	Data line
7758987	Copper sulfate	NR	Technical	*Epidalea calamita*	Tadpoles	20±0.5	Static	96	0.08	Active ingredient	Garcia-Munoz et al (2010)	1488
7758987	Copper sulfate	NR	Technical	*Epidalea calamita*	Tadpoles	20±0.5	Static	96	0.10	Active ingredient	Garcia-Munoz et al (2010)	1489
7758987	Copper sulfate	NR	Technical	*Lithobates catesbeianus*	Tadpoles	21±2	Renewal	96	3.96	Active ingredient	Ossana et al (2010)	1490
7758987	Copper sulfate	NR	NR	*Microhyla ornata*	Tadpoles	25.5-26	Renewal	96	5.04	Active ingredient	Rao and Madhyastha (1987)	1491
7758987	Copper sulfate	NR	NR	*Microhyla ornata*	Tadpoles	25.5-26	Renewal	96	5.38	Active ingredient	Rao and Madhyastha (1987)	1492
7758987	Copper sulfate	NR	Technical	*Pelobates cultripes*	Tadpoles	20±0.5	Static	96	0.22	Active ingredient	Garcia-Munoz et al (2010)	1493
7758987	Copper sulfate	NR	Technical	*Pelobates cultripes*	Tadpoles	20±0.5	Static	96	0.22	Active ingredient	Garcia-Munoz et al (2010)	1494
7758987	Copper sulfate	NR	Technical	*Pelophylax perezi*	Tadpoles	20±0.5	Static	96	0.36	Active ingredient	Garcia-Munoz et al (2010)	1495
7758987	Copper sulfate	NR	Technical	*Pelophylax perezi*	Tadpoles	20±0.5	Static	96	0.57	Active ingredient	Garcia-Munoz et al (2010)	1496
7758987	Copper sulfate	NR	Technical (Reagent grade)	*Rana hexadactyla*	Tadpoles	15 (13-17)	Renewal	96	0.039	Active ingredient (Cu)	Khangarot et al (1984)	1497
7758987	Copper sulfate	25.5 % (Cu)	(Technical)	*Rana sphenocephala*	Tadpoles	22	Static	96	0.23	Active ingredient	Bridges et al (2002)	1500
52315078	Cypermethrin	10	Formulation	*Bufo melanostictus*	Tadpoles	20	Static	96	0.0090	Active ingredient	Saha and Kaviraj (2008)	1502
52315078	Cypermethrin	10	Formulation	*Bufo melanostictus*	Tadpoles	20	Static	96	0.0060	Active ingredient	Saha and Kaviraj (2008)	1503
52315078	Cypermethrin	95	Technical	*Hypsiboas pulchellus*	Tadpoles	25±1	Renewal	96	0.4797	Active ingredient	Agostini et al 2010	1504

CAS	Pesticide name	% a.i.	Test material	Species	Stage	Temp. (°C)	Test type	Duration (h)	LC50 (mg/L)	LC50 based on	Reference	Data line
52315078	Cypermethrin	25	Formulation	*Hypsiboas pulchellus*	Tadpoles	25±1	Renewal	96	0.1752	Active ingredient	Agostini et al 2010	1505
52315078	Cypermethrin	25	Formulation	*Physalaemus biligonigerus*	Tadpoles	22±2	Renewal	96	0.129	Active ingredient	Izaguirre et al (2000)	1506
72548	DDD	97	Technical	*Xenopus laevis*	Embryos	24±0.5	Renewal	96	4.77	Active ingredient	Saka (2004)	1509
50293	DDT	98	Technical	*Xenopus laevis*	Embryos	24±0.5	Renewal	96	14.71	Active ingredient	Saka (2004)	1511
50293	DDT	99	Technical	*Bufo woodhousei fowleri*	Tadpoles	16	Static	96	0.03	Active ingredient	Mayer and Ellersieck (1986)	1512
50293	DDT	99	Technical	*Bufo woodhousei fowleri*	Tadpoles	16	Static	96	0.1	Active ingredient	Mayer and Ellersieck (1986)	1513
50293	DDT	99	Technical	*Bufo woodhousei fowleri*	Tadpoles	16	Static	96	0.75	Active ingredient	Mayer and Ellersieck (1986)	1514
50293	DDT	99	Technical	*Bufo woodhousei fowleri*	Tadpoles	16	Static	96	1	Active ingredient	Mayer and Ellersieck (1986)	1515
50293	DDT	99.9	Technical	*Bufo woodhousei fowleri*	Tadpoles	15.5±0.5	Static	96	1	Active ingredient	Sanders (1970)	1516
50293	DDT	99.9	Technical	*Bufo woodhousei fowleri*	Tadpoles	15.5±0.5	Static	96	0.75	Active ingredient	Sanders (1970)	1517
50293	DDT	99.9	Technical	*Bufo woodhousei fowleri*	Tadpoles	15.5±0.5	Static	96	0.1	Active ingredient	Sanders (1970)	1518
50293	DDT	99.9	Technical	*Bufo woodhousei fowleri*	Tadpoles	15.5±0.5	Static	96	0.03	Active ingredient	Sanders (1970)	1519

CAS	Pesticide name	% a.i.	Test material	Species	Stage	Temp. (°C)	Test type	Duration (h)	LC50 (mg/L)	LC50 based on	Reference	Data line
50293	DDT	99	Technical	*Pseudacris triseriata*	Tadpoles	15	Static	96	0.8	Active ingredient	Mayer and Ellersieck (1986)	1520
50293	DDT	NR	Technical	*Pseudacris triseriata*	Tadpoles	15.5±0.5	Static	96	0.8	Active ingredient	Sanders (1970)	1521
52918635	Deltamethrin	99-99.8	Technical	*Rhinella arenarum*	NR	20±1	Renewal	96	0.0044	Active ingredient	Salibian (1992)	1522
52918635	Deltamethrin	99-99.8	Technical	*Rhinella arenarum*	NR	20±1	Renewal	96	0.0045	Active ingredient	Salibian (1992)	1523
333415	Diazinon	NR	Formulation	*Rana clamitans*	Embryos	18.1	Renewal	96	>0.025	Active ingredient	Harris et al (1998)	1525
333415	Diazinon	NR	Technical	*Rana clamitans*	Embryos	18.1	Renewal	96	>0.05	Active ingredient	Harris et al (1998)	1526
333415	Diazinon	60	Formulation	*Xenopus laevis*	Embryos	24±1	Static	96	9.84	Active ingredient	Modra et al (2011)	1527
333415	Diazinon	60	Formulation	*Xenopus laevis*	Embryos	24±1	Static	96	12.64	Active ingredient	Modra et al (2011)	1528
333415	Diazinon	100	Formulation	*Xenopus laevis*	Embryos	24	Renewal	96	9.84	Active ingredient	Modra et al. (2011)	1529
333415	Diazinon	100	Formulation	*Xenopus laevis*	Embryos	24	Renewal	96	12.64	Active ingredient	Modra et al. (2011)	1530
333415	Diazinon	99	Technical	*Rana boylii*	Tadpoles	NR	Static	96	7.488	Active ingredient	Sparling and Fellers (2007)	1534
62737	Dichlorvos	80	Formulation	*Bufo melanostictus*	Tadpoles	21-27	Renewal	96	51.64	Formulation	Geng et al (2005)	1537
62737	Dichlorvos	80	Formulation	*Fejervarya multistriata*	Tadpoles	21-27	Renewal	96	10.53	Formulation	Geng et al (2005)	1538
62737	Dichlorvos	80	Formulation	*Microhyla ornata*	Tadpoles	21-27	Renewal	96	0.78	Formulation	Geng et al (2005)	1539
62737	Dichlorvos	80	Formulation	*Polypedates megacephalus*	Tadpoles	21-27	Renewal	96	12.94	Formulation	Geng et al (2005)	1540

CAS	Pesticide name	% a.i.	Test material	Species	Stage	Temp. (°C)	Test type	Duration (h)	LC50 (mg/L)	LC50 based on	Reference	Data line
60571	Dieldrin	92	Technical	*Xenopus laevis*	embryo-larval	22.8	Renewal	96	>0.1792	Active ingredient	Schuytema et al (1991)	1541
60571	Dieldrin	85	Technical	*Bufo woodhousei fowleri*	Tadpoles	15	Static	96	0.15	Active ingredient	Mayer and Ellersieck (1986)	1542
60571	Dieldrin	NR	Technical	*Bufo woodhousei fowleri*	Tadpoles	15.5±0.5	Static	96	0.15	Active ingredient	Sanders (1970)	1543
60571	Dieldrin	85	Technical	*Pseudacris triseriata*	Tadpoles	15	Static	96	0.1	Active ingredient	Mayer and Ellersieck (1986)	1544
60571	Dieldrin	NR	Technical	*Pseudacris triseriata*	Tadpoles	15.5±0.5	Static	96	0.1	Active ingredient	Sanders (1970)	1545
60571	Dieldrin	92	Technical	*Rana catesbeiana*	Tadpoles	22.8	Renewal	96	0.0303	Active ingredient	Schuytema et al (1991)	1546
60571	Dieldrin	92	Technical	*Rana catesbeiana*	Tadpoles	22.8	Renewal	96	0.0087	Active ingredient	Schuytema et al (1991)	1547
60571	Dieldrin	92	Technical	*Rana pipiens*	Tadpoles	22.8	Renewal	96	0.0713	Active ingredient	Schuytema et al (1991)	1548
60571	Dieldrin	92	Technical	*Xenopus laevis*	Tadpoles	22	Flow-through	96	0.0468	Active ingredient	Schuytema et al (1991)	1549
60571	Dieldrin	92	Technical	*Xenopus laevis*	Tadpoles	22.8	Renewal	96	0.0404	Active ingredient	Schuytema et al (1991)	1550
60571	Dieldrin	92	Technical	*Xenopus laevis*	Tadpoles	22.8	Renewal	96	0.0495	Active ingredient	Schuytema et al (1991)	1551
60515	Dimethoate	30	Formulation	*Rana cyanophlyctis*	Adults	23±0.2	Renewal	96	36.0	Active ingredient	Mudgall and Patil (1987)	1552
60515	Dimethoate	30	Formulation	*Rana cyanophlyctis*	Adults	23±0.2	Renewal	96	39.0	Active ingredient	Mudgall and Patil (1987)	1553
60515	Dimethoate	40	Formulation	*Hyla versicolor*	Larvae	22±1	Static	96	20.27	Active ingredient	Sayim and Kaya (2006)	1554
60515	Dimethoate	40	Formulation	*Hyla versicolor*	Larvae	22±1	Static	96	37.37	Active ingredient	Sayim and Kaya (2006)	1555

CAS	Pesticide name	% a.i.	Test material	Species	Stage	Temp. (°C)	Test type	Duration (h)	LC50 (mg/L)	LC50 based on	Reference	Data line
330541	Diuron	99.8	Technical	*Xenopus laevis*	Embryos	24	Renewal	96	>29.1	Active ingredient	Schuytema and Nebeker (1998)	1558
330541	Diuron	99.8	Technical	*Xenopus laevis*	Embryos	24	Renewal	96	>29.1	Active ingredient	Schuytema and Nebeker (1998)	1559
115297	Endosulfan	47	Formulation	*Rana clamitans*	Embryos	18.1	Renewal	96	>4.7	Active ingredient	Harris et al (1998)	1562
115297	Endosulfan	47	Formulation	*Rana clamitans*	Embryos	18.6	Renewal	96	>11.75	Active ingredient	Harris et al (1998)	1563
115297	Endosulfan	99	Technical	*Bufo boreas*	Tadpoles	17.9-20.8	Renewal	96	0.0761	Active ingredient	Jones et al (2009)	1565
115297	Endosulfan	99	Technical	*Bufo bufo*	Tadpoles	22±1	Static	96	0.43	Active ingredient	Bernabo et al (2008)	1566
115297	Endosulfan	35	Formulation	*Bufo melanostictus*	Tadpoles	25±2	Renewal	96	0.020	Active ingredient	Mithra and Abhik (2002)	1567
115297	Endosulfan	99	Technical	*Hyla versicolor*	Tadpoles	17.9-20.8	Renewal	96	0.009	Active ingredient	Jones et al (2009)	1568
115297	Endosulfan	35	Formulation	*Limnonectes limnocharis*	Tadpoles	25±2	Renewal	96	0.0013	Active ingredient	Mithra and Abhik (2002)	1569
115297	Endosulfan	35	Formulation	*Microhyla ornata*	Tadpoles	25±2	Renewal	96	0.00016	Active ingredient	Mithra and Abhik (2002)	1570
115297	Endosulfan	99	Technical	*Pseudacris crucifer*	Tadpoles	17.9-20.8	Renewal	96	0.120	Active ingredient	Jones et al (2009)	1571
115297	Endosulfan	99	Technical	*Pseudacris regilla*	Tadpoles	17.9-20.8	Renewal	96	0.0214	Active ingredient	Jones et al (2009)	1572
115297	Endosulfan	99	Technical	*Rana cascadae*	Tadpoles	17.9-20.8	Renewal	96	0.015	Active ingredient	Jones et al (2009)	1573
115297	Endosulfan	99	Technical	*Rana catesbeiana*	Tadpoles	17.9-20.8	Renewal	96	0.0013	Active ingredient	Jones et al (2009)	1574
115297	Endosulfan	99	Technical	*Rana clamitans*	Tadpoles	17.9-20.8	Renewal	96	0.0032	Active ingredient	Jones et al (2009)	1575

CAS	Pesticide name	% a.i.	Test material	Species	Stage	Temp. (°C)	Test type	Duration (h)	LC50 (mg/L)	LC50 based on	Reference	Data line
115297	Endosulfan	35	Formulation	*Rana hexadactyla*	Tadpoles	29	Static?	96	0.509	Active ingredient	Andrews and George (1991)	1576
115297	Endosulfan	90	Technical	*Rana tigrina*	Tadpoles	20±2	Static	96	0.0018	Active ingredient	Gopal et al (1981)	1578
145733	Endothal	53	Formulation	*Bufo woodhousei fowleri*	Tadpoles	15	Static	96	1.2	Active ingredient	Mayer and Ellersieck (1986)	1579
66330889	Endothal-mono(N,N-dimethylalkylammonium), endothall mono(N,N-dimethylalkylamine)	NR	Technical	*Bufo woodhousei fowleri*	Tadpoles	15.5±0.5	Static	96	1.2	Active ingredient	Sanders (1970)	1580
72208	Endrin	99.6	Technical	*Rana catesbeiana*	NR	18.9 (17.4-21.2)	Flow-through	96	0.0025	Active ingredient	Thurston et al (1985)	1582
72208	Endrin	99	Technical	*Bufo woodhousei fowleri*	Tadpoles	15	Static	96	0.12	Active ingredient	Mayer and Ellersieck (1986)	1583
72208	Endrin	NR	Technical	*Bufo woodhousei fowleri*	Tadpoles	15.5±0.5	Static	96	0.12	Active ingredient	Sanders (1970)	1584
72208	Endrin	99	Technical	*Pseudacris triseriata*	Tadpoles	15	Static	96	0.18	Active ingredient	Mayer and Ellersieck (1986)	1585
72208	Endrin	NR	Technical	*Pseudacris triseriata*	Tadpoles	15.5±0.5	Static	96	0.18	Active ingredient	Sanders (1970)	1586
66230044	Esfenvalerate	5	Formulation	*Xenopus laevis*	Embryos	24±0.5	Renewal	96	>0.15	Active ingredient	Larsen and Sorensen (2004)	1588

CAS	Pesticide name	% a.i.	Test material	Species	Stage	Temp. (°C)	Test type	Duration (h)	LC50 (mg/L)	LC50 based on	Reference	Data line
66230044	Esfenvalerate	85	Technical	*Rana pipiens*	Tadpoles	22	Static	96	0.00729	Active ingredient	Materna et al (1995)	1589
122145	Fenitrothion	97	Technical	*Microhyla ornata*	Embryos	NR	Renewal	96	3.21	Active ingredient	Pawar and Katdare (1984)	1591
122145	Fenitrothion	NR	Formulation	*Microhyla ornata*	Tadpoles	25±1	Renewal	96	1.14	Formulation	Pawar and Katdare (1983)	1592
122145	Fenitrothion	97	Technical	*Microhyla ornata*	Tadpoles	NR	Renewal	96	1.14	Active ingredient	Pawar and Katdare (1984)	1593
122145	Fenitrothion	97	Technical	*Rana clamitans*	Tadpoles	21±1	Static	96	4.9	Active ingredient	Lyons et al (1976)	1594
93721	Fenoprop	NR	Technical	*Pseudacris triseriata*	Tadpoles	15.5±0.5	Static	96	10	Active ingredient	Sanders (1970)	1598
120068373	Fipronil	98	Technical	*Xenopus laevis*	Tadpoles	25	Static-renewal	96	0.85	Active ingredient	Overmyer et al (2007)	1600
58899	Gamma-HCH	NR	Technical	*Bufo woodhousei fowleri*	Tadpoles	15.5±0.5	Static	96	4.4	Active ingredient	Sanders (1970)	1601
58899	Gamma-HCH	NR	Technical	*Pseudacris triseriata*	Tadpoles	15.5±0.5	Static	96	2.7	Active ingredient	Sanders (1970)	1602
608731	Gamma-HCH, alpha-HCH, lindane	NR	Technical	*Microhyla ornata*	Embryos	NR	Renewal	96	23.37	Active ingredient	Pawar and Katdare (1984)	1603
608731	Gamma-HCH, alpha-HCH, lindane	41.5	Technical	*Bufo woodhousei fowleri*	Tadpoles	15	Static	96	4.35	Active ingredient	Mayer and Ellersieck (1986)	1604
608731	Gamma-HCH, alpha-HCH, lindane	NR	Technical	*Bufo woodhousei fowleri*	Tadpoles	15.5±0.5	Static	96	3.2	Active ingredient	Sanders (1970)	1605

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319846	Gamma-HCH, alpha-HCH, lindane	NR	Formulation	*Microhyla ornata*	Tadpoles	25±1	Renewal	96	7.27	Formulation	Pawar and Katdare (1983)	1606
608731	Gamma-HCH, alpha-HCH, lindane	NR	Technical	*Microhyla ornata*	Tadpoles	NR	Renewal	96	7.27	Active ingredient	Pawar and Katdare (1984)	1607
58899	Gamma-HCH, lindane	99	Technical	*Bufo woodhousei fowleri*	Tadpoles	15	Static	96	3.2	Active ingredient	Mayer and Ellersieck (1986)	1608
58899	Gamma-HCH, lindane	99	Technical	*Pseudacris triseriata*	Tadpoles	15	Static	96	2.65	Active ingredient	Mayer and Ellersieck (1986)	1609
77065	Gibberellic acid	NR	Formulation	*Xenopus laevis*	Embryos	23±1	Static-renewal	96	1117.50	Active ingredient	Boga et al (2009)	1611
1071836	Glyphosate	96	Technical	*Crinia insignifera*	Adults	20±2	Renewal	96	78.0	Active ingredient	Bidwell and Gorrie (1995)	1612
1071836	Glyphosate	48.7	Formulation	*Ambystoma gracile*	Larvae	17.9-20.5	Renewal	96	2.8	Active ingredient	Relyea and Jones (2009)	1613
1071836	Glyphosate	48.7	Formulation	*Ambystoma laterale*	Larvae	17.9-20.5	Renewal	96	3.2	Active ingredient	Relyea and Jones (2009)	1614
1071836	Glyphosate	48.7	Formulation	*Ambystoma maculatum*	Larvae	17.9-20.5	Renewal	96	2.8	Active ingredient	Relyea and Jones (2009)	1615
1071836	Glyphosate	48.7	Formulation	*Notophthalmus viridescens*	Larvae	17.9-20.5	Renewal	96	2.7	Active ingredient	Relyea and Jones (2009)	1616
1071836	Glyphosate	48.7	Formulation	*Bufo americanus*	Tadpoles	(in graphs)	Static	96	3.93	Active ingredient	Jones et al (2010)	1617
1071836	Glyphosate	48.7	Formulation	*Bufo americanus*	Tadpoles	17.9-20.5	Renewal	96	1.2	Active ingredient	Relyea and Jones (2009)	1618
1071836	Glyphosate	48.7	Formulation	*Bufo boreas*	Tadpoles	17.9-20.5	Renewal	96	2.0	Active ingredient	Relyea and Jones (2009)	1619
1071836	Glyphosate	35.4	Formulation	*Centrolene prosoblepon*	Tadpoles	23±1.5	Renewal	96	2.41	Active ingredient	Bernal et al (2009a)	1620

CAS	Pesticide name	% a.i.	Test material	Species	Stage	Temp. (°C)	Test type	Duration (h)	LC50 (mg/L)	LC50 based on	Reference	Data line
1071836	Glyphosate	35.4	Formulation	*Dendrosophus microcephalus*	Tadpoles	23±1.5	Renewal	96	1.20	Active ingredient	Bernal et al (2009a)	1621
1071836	Glyphosate	35.4	Formulation	*Engystomops pustulosus*	Tadpoles	23±1.5	Renewal	96	2.79	Active ingredient	Bernal et al (2009a)	1622
1071836	Glyphosate	48.7	Formulation	*Hyla versicolor*	Tadpoles	17.9-20.5	Renewal	96	1.7	Active ingredient	Relyea and Jones (2009)	1623
1071836	Glyphosate	35.4	Formulation	*Hypsiboas crepitans*	Tadpoles	23±1.5	Renewal	96	2.06	Active ingredient	Bernal et al (2009a)	1624
1071836	Glyphosate	35.4	Formulation	*Hypsiboas crepitans*	Tadpoles	(in graph)	Static (over-spray)	96	7.20	Active ingredient	Bernal et al (2009b)	1625
1071836	Glyphosate	96	Technical	*Litoria moorei*	Tadpoles	20±2	Renewal	96	110.8	Active ingredient	Bidwell and Gorrie (1995)	1626
1071836	Glyphosate	48.7	Formulation	*Pseudacris crucifer*	Tadpoles	17.9-20.5	Renewal	96	0.8	Active ingredient	Relyea and Jones (2009)	1627
1071836	Glyphosate	48.7	Formulation	*Rana cascadae*	Tadpoles	17.9-20.5	Renewal	96	1.7	Active ingredient	Relyea and Jones (2009)	1628
1071836	Glyphosate	48.7	Formulation	*Rana catesbeiana*	Tadpoles	17.9-20.5	Renewal	96	0.8	Active ingredient	Relyea and Jones (2009)	1629
1071836	Glyphosate	48.7	Formulation	*Rana clamitans*	Tadpoles	17.9-20.5	Renewal	96	1.4	Active ingredient	Relyea and Jones (2009)	1630
1071836	Glyphosate	48.7	Formulation	*Rana pipiens*	Tadpoles	17.9-20.5	Renewal	96	1.5	Active ingredient	Relyea and Jones (2009)	1631
1071836	Glyphosate	48.7	Formulation	*Rana sylvatica*	Tadpoles	(in graphs)	Static	96	4.27	Active ingredient	Jones et al (2010)	1632
1071836	Glyphosate	48.7	Formulation	*Rana sylvatica*	Tadpoles	17.9-20.5	Renewal	96	1.9	Active ingredient	Relyea and Jones (2009)	1633
1071836	Glyphosate	35.4	Formulation	*Rhinella granulosa*	Tadpoles	23±1.5	Renewal	96	2.35	Active ingredient	Bernal et al (2009a)	1634
1071836	Glyphosate	35.4	Formulation	*Rhinella granulosa*	Tadpoles	(in graph)	Static (overspray)	96	7.17	Active ingredient	Bernal et al (2009b)	1635

CAS	Pesticide name	% a.i.	Test material	Species	Stage	Temp. (°C)	Test type	Duration (h)	LC50 (mg/L)	LC50 based on	Reference	Data line
1071836	Glyphosate	35.4	Formulation	*Rhinella marina*	Tadpoles	23±1.5	Renewal	96	2.73	Active ingredient	Bernal et al (2009a)	1636
1071836	Glyphosate	35.4	Formulation	*Rhinella marina*	Tadpoles	(in graph)	Static (overspray)	96	5.96	Active ingredient	Bernal et al (2009b)	1637
1071836	Glyphosate	35.4	Formulation	*Rhinella typhonius*	Tadpoles	23±1.5	Renewal	96	1.50	Active ingredient	Bernal et al (2009a)	1638
1071836	Glyphosate	35.4	Formulation	*Scinax ruber*	Tadpoles	23±1.5	Renewal	96	1.64	Active ingredient	Bernal et al (2009a)	1639
1071836	Glyphosate	35.4	Formulation	*Scinax ruber*	Tadpoles	(in graph)	Static (overspray)	96	6.90	Active ingredient	Bernal et al (2009b)	1640
38641940	Glyphosate isopropylamine	36	Formulation	*Bufo Americanus*	Tadpoles	15±1	Static	96	<4	Active ingredient (a.e.)	Howe et al. (2004)	1641
38641940	Glyphosate isopropylamine	36	Formulation	*Bufo Americanus*	Tadpoles	15±1	Static	96	8	Active ingredient (a.e.)	Howe et al. (2004)	1642
38641940	Glyphosate isopropylamine	36	Formulation	*Rana clamitans*	Tadpoles	20±1	Static	96	2	Active ingredient (a.e.)	Howe et al. (2004)	1643
38641940	Glyphosate isopropylamine	36	Formulation	*Rana clamitans*	Tadpoles	20±1	Static	96	2.2	Active ingredient (a.e.)	Howe et al. (2004)	1644
38641940	Glyphosate isopropylamine	36	Formulation	*Rana clamitans*	Tadpoles	20±1	Static	96	7.1	Active ingredient (a.e.)	Howe et al. (2004)	1645
38641940	Glyphosate isopropylamine	36	Formulation	*Rana clamitans*	Tadpoles	20±1	Static	96	8.9	Active ingredient (a.e.)	Howe et al. (2004)	1646
38641940	Glyphosate isopropylamine	57	Technical	*Rana clamitans*	Tadpoles	20±1	Static	96	>17.9	Active ingredient (a.e.)	Howe et al. (2004)	1647

CAS	Pesticide name	% a.i.	Test material	Species	Stage	Temp. (°C)	Test type	Duration (h)	LC50 (mg/L)	LC50 based on	Reference	Data line
38641940	Glyphosate isopropylamine	36	Formulation	*Rana clamitans*	Tadpoles	20±1	Static	96	>17.9	Active ingredient (a.e.)	Howe et al. (2004)	1648
38641940	Glyphosate isopropylamine	36	Formulation	*Rana clamitans*	Tadpoles	20±1	Static	96	>17.9	Active ingredient (a.e.)	Howe et al. (2004)	1649
38641940	Glyphosate isopropylamine	36	Formulation	*Rana pipiens*	Tadpoles	20±1	Static	96	2.9	Active ingredient (a.e.)	Howe et al. (2004)	1650
38641940	Glyphosate isopropylamine	36	Formulation	*Rana pipiens*	Tadpoles	15±1	Static	96	6.5	Active ingredient (a.e.)	Howe et al. (2004)	1651
38641940	Glyphosate isopropylamine	36	Formulation	*Rana sylvatica*	Tadpoles	15±1	Static	96	5.1	Active ingredient (a.e.)	Howe et al. (2004)	1652
38641940	Glyphosate isopropylamine	36	Formulation	*Rana sylvatica*	Tadpoles	15±1	Static	96	>8	Active ingredient (a.e.)	Howe et al. (2004)	1653
38641940	Glyphosate isopropylamine	48	Formulation	*Scinax nasicus*	Tadpoles	22±2.0	Static-renewal	96	1.27	Active ingredient (calc)	Lajmanovich et al. (2003a)	1654
38641940	Glyphosate isopropylammonium	36	Formulation	*Crinia insignifera*	Adults	20±2	Renewal	96	39.7	Active ingredient	Bidwell and Gorrie (1995)	1655
38641940	Glyphosate isopropylammonium	35.6	Formulation	*Bufo americanus*	Embryos	23±2	Static-renewal	96	4.8	Active ingredient	Edgington et al. (2004)	1656
38641940	Glyphosate isopropylammonium	35.6	Formulation	*Bufo americanus*	Embryos	23±2	Static-renewal	96	6.4	Active ingredient	Edgington et al. (2004)	1657
38641940	Glyphosate isopropylammonium	35.6	Formulation	*Rana clamitans*	Embryos	23±2	Static-renewal	96	4.1	Active ingredient	Edgington et al. (2004)	1658

CAS	Pesticide name	% a.i.	Test material	Species	Stage	Temp. (°C)	Test type	Duration (h)	LC50 (mg/L)	LC50 based on	Reference	Data line
38641940	Glyphosate isopropylammonium	35.6	Formulation	*Rana clamitans*	Embryos	23±2	Static-renewal	96	5.3	Active ingredient	Edgington et al. (2004)	1659
38641940	Glyphosate isopropylammonium	35.6	Formulation	*Rana pipiens*	Embryos	23±2	Static-renewal	96	15.1	Active ingredient	Edgington et al. (2004)	1660
38641940	Glyphosate isopropylammonium	35.6	Formulation	*Rana pipiens*	Embryos	23±2	Static-renewal	96	7.5	Active ingredient	Edgington et al. (2004)	1661
38641940	Glyphosate isopropylammonium	35.6	Formulation	*Xenopus laevis*	Embryos	23±2	Static-renewal	96	15.6	Active ingredient	Edgington et al. (2004)	1662
38641940	Glyphosate isopropylammonium	35.6	Formulation	*Xenopus laevis*	Embryos	23±2	Static-renewal	96	7.9	Active ingredient	Edgington et al. (2004)	1663
38641940	Glyphosate isopropylammonium	35.6	Formulation	*Xenopus laevis*	Embryos	24±0.5	Static-renewal	96	6.9	Active ingredient	Edgington et al. (2004)	1664
38641940	Glyphosate isopropylammonium	35.6	Formulation	*Xenopus laevis*	Embryos	24±0.5	Static-renewal	96	6.9	Active ingredient	Edgington et al. (2004)	1665
38641940	Glyphosate isopropylammonium	35.6	Formulation	*Xenopus laevis*	Embryos	24±0.5	Static-renewal	96	11.8	Active ingredient	Edgington et al. (2004)	1666
38641940	Glyphosate isopropylammonium	35.6	Formulation	*Xenopus laevis*	Embryos	24±0.5	Static-renewal	96	13.9	Active ingredient	Edgington et al. (2004)	1667
38641940	Glyphosate isopropylammonium	48	Formulation	*Xenopus laevis*	Embryos	24±0.5	Static-renewal	96	604.3	Active ingredient	Edgington et al. (2004)	1668
38641940	Glyphosate isopropylammonium	48	Formulation	*Xenopus laevis*	Embryos	24±0.5	Static-renewal	96	645.2	Active ingredient	Edgington et al. (2004)	1669

CAS	Pesticide name	% a.i.	Test material	Species	Stage	Temp. (°C)	Test type	Duration (h)	LC50 (mg/L)	LC50 based on	Reference	Data line
38641940	Glyphosate isopropylammonium	48	Formulation	*Xenopus laevis*	Embryos	24±0.5	Static-renewal	96	4341.6	Active ingredient	Edgington et al. (2004)	1670
38641940	Glyphosate isopropylammonium	48	Formulation	*Xenopus laevis*	Embryos	24±0.5	Static-renewal	96	6419	Active ingredient	Edgington et al. (2004)	1671
38641940	Glyphosate isopropylammonium	35.6	Formulation	*Xenopus laevis*	Embryos	24	Static-renewal	96	9.3	Active ingredient	Perkins et al (2000)	1672
38641940	Glyphosate isopropylammonium	48	Formulation	*Xenopus laevis*	Embryos	24	Static-renewal	96	7296.8	Active ingredient	Perkins et al (2000)	1673
38641940	Glyphosate isopropylammonium	35.6	Formulation	*Bufo americanus*	Larvae	22±1	Static-renewal	96	1.7	Active ingredient	Edgington et al. (2004)	1674
38641940	Glyphosate isopropylammonium	35.6	Formulation	*Bufo americanus*	Larvae	22±1	Static-renewal	96	2.9	Active ingredient	Edgington et al. (2004)	1675
38641940	Glyphosate isopropylammonium	35.6	Formulation	*Rana clamitans*	Larvae	22±1	Static-renewal	96	1.4	Active ingredient	Edgington et al. (2004)	1676
38641940	Glyphosate isopropylammonium	35.6	Formulation	*Rana clamitans*	Larvae	22±1	Static-renewal	96	3.5	Active ingredient	Edgington et al. (2004)	1677
38641940	Glyphosate isopropylammonium	35.6	Formulation	*Rana clamitans*	Larvae	20.30±0.12	Lentic	96	2.7	Active ingredient	Wojtaszek et al (2004)	1678
38641940	Glyphosate isopropylammonium	35.6	Formulation	*Rana clamitans*	Larvae	20.26±0.13	Lentic	96	4.34	Active ingredient	Wojtaszek et al (2004)	1679
38641940	Glyphosate isopropylammonium	35.6	Formulation	*Rana pipiens*	Larvae	22±1	Static-renewal	96	1.1	Active ingredient	Edgington et al. (2004)	1680

CAS	Pesticide name	% a.i.	Test material	Species	Stage	Temp. (°C)	Test type	Duration (h)	LC50 (mg/L)	LC50 based on	Reference	Data line
38641940	Glyphosate isopropylammonium	35.6	Formulation	*Rana pipiens*	Larvae	22±1	Static-renewal	96	1.8	Active ingredient	Edgington et al. (2004)	1681
38641940	Glyphosate isopropylammonium	35.6	Formulation	*Rana pipiens*	Larvae	20.26±0.13	Lentic	96	11.47	Active ingredient	Wojtaszek et al (2004)	1682
38641940	Glyphosate isopropylammonium	35.6	Formulation	*Rana pipiens*	Larvae	20.30±0.12	Lentic	96	4.25	Active ingredient	Wojtaszek et al (2004)	1683
38641940	Glyphosate isopropylammonium	35.6	Formulation	*Xenopus laevis*	Larvae	22±1	Static-renewal	96	0.88	Active ingredient	Edgington et al. (2004)	1684
38641940	Glyphosate isopropylammonium	35.6	Formulation	*Xenopus laevis*	Larvae	22±1	Static-renewal	96	2.1	Active ingredient	Edgington et al. (2004)	1685
38641940	Glyphosate isopropylammonium	NR	Technical	*Crinia insignifera*	NR	NR	Static	96	78	Active ingredient	Office of Pesticide Programs (2000)	1686
38641940	Glyphosate isopropylammonium	NR	Formulation	*Crinia insignifera*	Tadpoles	NR	Static	96	39.7	Formulation	Office of Pesticide Programs (2000)	1687
38641940	Glyphosate isopropylammonium	36	Formulation	*Litoria moorei*	Tadpoles	20±2	Renewal	96	7.66	Active ingredient	Bidwell and Gorrie (1995)	1688
38641940	Glyphosate isopropylammonium	48	Formulation	*Scinax nasicus*	Tadpoles	22±2	Renewal	96	1.5024	Active ingredient (calc)	Lajmanovich et al. (2003b)	1689
38641940	Glyphosate isopropylammonium	48	Formulation	*Scinax nasicus*	Tadpoles	22±2	Static	96	2.5296	Active ingredient (calculated)	Lajmanovich et al. (2003b)	1690

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81591813	Glyphosate trimesium	36	Formulation	*Rana clamitans*	Tadpoles	20±1	Static	96	>17.9	Active ingredient (a.e.)	Howe et al. (2004)	1691
76448	Heptachlor	99	Technical	*Bufo woodhousei fowleri*	Tadpoles	15	Static	96	0.435	Active ingredient	Mayer and Ellersieck (1986)	1692
76448	Heptachlor	NR	Technical	*Bufo woodhousei fowleri*	Tadpoles	15.5±0.5	Static	96	0.44	Active ingredient	Sanders (1970)	1693
0	Imazapyr	NR	Technical	*Rana catesbeiana*	Tadpoles	22	Static-renewal	96	799.6	Active ingredient	Trumbo and Waligora (2009)	1694
0	Imazapyr	27.6	Formulation	*Rana catesbeiana*	Tadpoles	22	Static-renewal	96	14.7	Active ingredient	Trumbo and Waligora (2009)	1695
0	Imazapyr	28.7	Formulation	*Rana catesbeiana*	Tadpoles	22	Static-renewal	96	1739	Active ingredient	Trumbo and Waligora (2009)	1696
138261413	Imidacloprid	>95	Technical	*Rana limnocharis*	Tadpoles	20±1	Renewal	96	82	Active ingredient	Feng et al (2004)	1697
138261413	Imidacloprid	>95	Technical	*Rana nigromaculata*	Tadpoles	20±1	Renewal	96	129	Active ingredient	Feng et al (2004)	1698
121755	Malathion	NR	Technical	*Rhinella arenarum*	Larvae	NR	Renewal	96	19.2	Active ingredient	Venturino et al (1992)	1701
121755	Malathion	NR	Formulation	*Bufo marinus*	Tadpoles	NR	Static	96	1.5	Active ingredient	Tejada et al (1994)	1702
121755	Malathion	NR	Technical	*Bufo woodhousei*	Tadpoles	NR	Static	96	0.42	Active ingredient	Office of Pesticide Programs (2000)	1703
121755	Malathion	95	Technical	*Bufo woodhousei fowleri*	Tadpoles	15	Static	96	0.42	Active ingredient	Mayer and Ellersieck (1986)	1704

CAS	Pesticide name	% a.i.	Test material	Species	Stage	Temp. (°C)	Test type	Duration (h)	LC50 (mg/L)	LC50 based on	Reference	Data line
121755	Malathion	NR	Technical	*Bufo woodhousei fowleri*	Tadpoles	15.5±0.5	Static	96	0.42	Active ingredient	Sanders (1970)	1705
121755	Malathion	95	Technical	*Pseudacris triseriata*	Tadpoles	15	Static	96	0.2	Active ingredient	Mayer and Ellersieck (1986)	1706
121755	Malathion	NR	Technical	*Pseudacris triseriata*	Tadpoles	NR	Static	96	0.2	Active ingredient	Office of Pesticide Programs (2000)	1707
121755	Malathion	NR	Technical	*Pseudacris triseriata*	Tadpoles	15.5±0.5	Static	96	0.2	Active ingredient	Sanders (1970)	1708
121755	Malathion	99	Technical	*Rana boylii*	Tadpoles	NR	Static	96	2.137	Active ingredient	Sparling and Fellers (2007)	1709
121755	Malathion	50	Formulation	*Rana hexadactyla*	Tadpoles	29	Static?	96	4.14	Active ingredient	Andrews and George (1991)	1710
121755	Malathion	25	Formulation	*Rana ridibunda*	Tadpoles	NR	Static	96	29	Active ingredient	Sayim (2008)	1712
121755	Malathion	95	Technical	*Rana ridibunda*	Tadpoles	NR	Static	96	38	Active ingredient	Sayim (2008)	1713
8018017	Mancozeb	78	Formulation	*Bufo americanus*	embryos	20±1	Static-renewal	96	1.40	Active ingredient	Harris et al (2000)	1715
8018017	Mancozeb	76-80	Formulation	*Rana clamitans*	Embryos	18.1	Renewal	96	0.96	Active ingredient	Harris et al (1998)	1716
8018017	Mancozeb	76-80	Formulation	*Rana clamitans*	Embryos	18.6	Renewal	96	2.21	Active ingredient	Harris et al (1998)	1717
8018017	Mancozeb	78	Formulation	*Rana pipiens*	Embryos	20±1	Static-renewal	96	0.20	Active ingredient	Harris et al (2000)	1718
8018017	Mancozeb	NR	Formulation	*Bufo marinus*	Tadpoles	NR	Static	96	0.12	Active ingredient	Tejada et al (1994)	1719
12427382	Maneb	95	Technical (Reference grade)	*Xenopus laevis*	Blastula	23±1	Renewal	96	2.1	Active ingredient	Fort et al (1999b)	1720

CAS	Pesticide name	% a.i.	Test material	Species	Stage	Temp. (°C)	Test type	Duration (h)	LC50 (mg/L)	LC50 based on	Reference	Data line
12427382	Maneb	95	Technical (Reference grade)	*Xenopus laevis*	Blastula	23±1	Renewal	96	7.2	Active ingredient	Fort et al (1999b)	1721
73250687	Mefenacet	99	Technical	*Silurana tropicalis*	Tadpoles	25±1	Renewal	96	2.70	Active ingredient	Saka (2010)	1723
7487947	Mercuric chloride	NR	(Technical)	*Microhyla ornata*	Eggs	21-25	Static	96	0.1704	Active ingredient	Ghate and Mulherkar (1980)	1727
7487947	Mercuric chloride	NR	(Technical)	*Bufo punctatus*	Embryos	19-22	Static-renewal	96	0.0368	Active ingredient	Birge et al (1983)	1728
7487947	Mercuric chloride	NR	(Technical)	*Bufo woodhousei fowleri*	Embryos	19-22	Static-renewal	96	0.0659	Active ingredient	Birge et al (1983)	1729
7487947	Mercuric chloride	NR	(Technical)	*Gastrophryne carolinensis*	Embryos	19-22	Static-renewal	96	0.0013	Active ingredient	Birge et al (1983)	1730
7487947	Mercuric chloride	NR	(Technical)	*Hyla chrysoscelis*	Embryos	19-22	Static-renewal	96	0.0024	Active ingredient	Birge et al (1983)	1731
7487947	Mercuric chloride	NR	(Technical)	*Rana grylio*	Embryos	19-22	Static-renewal	96	0.0672	Active ingredient	Birge et al (1983)	1732
7487947	Mercuric chloride	NR	(Technical)	*Rana pipiens*	Embryos	19-22	Static-renewal	96	0.0073	Active ingredient	Birge et al (1983)	1733
7487947	Mercuric chloride	NR	Technical	*Bufo melanostictus*	Tadpoles	31 (29-34)	Static	96	0.0436	Active ingredient (Hg)	Khangarot and Ray (1987)	1734
7487947	Mercuric chloride	NR	(Technical)	*Bufo melanostictus*	Tadpoles	22-24	Static	96	0.25	Active ingredient	Paulose (1988)	1735
7487947	Mercuric chloride	NR	(Technical)	*Microhyla ornata*	Tadpoles	21-25	Static	96	0.1184	Active ingredient	Ghate and Mulherkar (1980)	1736
7487947	Mercuric chloride	NR	NR	*Microhyla ornata*	Tadpoles	25.5-26	Renewal	96	1.12	Active ingredient	Rao and Madhyastha (1987)	1737

CAS	Pesticide name	% a.i.	Test material	Species	Stage	Temp. (°C)	Test type	Duration (h)	LC50 (mg/L)	LC50 based on	Reference	Data line
7487947	Mercuric chloride	NR	NR	*Microhyla ornata*	Tadpoles	25.5-26	Renewal	96	1.43	Active ingredient	Rao and Madhyastha (1987)	1738
7487947	Mercuric chloride	NR	(Technical)	*Rana breviceps*	Tadpoles	22-24	Static	96	0.28	Active ingredient	Paulose (1988)	1739
7487947	Mercuric chloride	98	Technical	*Rana heckscheri*	Tadpoles	21±1	Static	96	0.68	Active ingredient	Punzo (1993a)	1740
7487947	Mercuric chloride	NR	Technical (Reagent grade)	*Rana hexadactyla*	Tadpoles	15 (13-16)	Renewal	96	0.051	Active ingredient (Hg)	Khangarot et al (1985b)	1741
2032657	Methiocarb	NR	Technical	*Rana sphenocephala*	Larvae	16	Static	96	8.7	Active ingredient	Marking and Chandler (1981)	1742
2032657	Methiocarb	NR	Technical	*Rana sphenocephala*	Larvae	NR	Static	96	8.7	Active ingredient	Office of Pesticide Programs (2000)	1743
72435	Methoxychlor	98	Technical	*Pseudacris triseriata*	Tadpoles	15	Static	96	0.333	Active ingredient	Mayer and Ellersieck (1986)	1744
72435	Methoxychlor	NR	Technical	*Pseudacris triseriata*	Tadpoles	15.5±0.5	Static	96	0.33	Active ingredient	Sanders (1970)	1745
51218452	Metolachlor	99	Technical	*Xenopus laevis*	Embryos	22-26	Static-renewal	96	13.6	Active ingredient	Osano et al. (2002b)	1746
51218452	Metolachlor	97.2	Technical	*Rana catesbeiana*	Tadpoles	15	NR	96	14	Active ingredient	Wan et al (2006)	1747
7786347	Mevinphos	60	Technical	*Pseudacris triseriata*	Tadpoles	16	Static	96	>3.2	Active ingredient	Mayer and Ellersieck (1986)	1748
2212671	Molinate	98	Technical	*Bufo woodhousei fowleri*	Tadpoles	16	Static	96	26	Active ingredient	Mayer and Ellersieck (1986)	1750

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2212671	Molinate	NR	Technical	*Bufo woodhousei fowleri*	Tadpoles	15.5±0.5	Static	96	14	Active ingredient	Sanders (1970)	1751
6923224	Monocrotophos	>90	Technical	*Xenopus laevis*	Embryos	23	Static	96	>100	Active ingredient	Snawder and Chambers (1989)	1753
2163806	MSMA	47.7	Formulation	*Xenopus laevis*	Adults	22	Static	96	1132.4	Active ingredient	Schultz and Dumont (1984)	1754
2163806	MSMA	47.7	Formulation	*Xenopus laevis*	Embryos	22	Static	96	225.0	Active ingredient	Schultz and Dumont (1984)	1755
88671890	Myclobutanil	38-42	Formulation	*Rana clamitans*	Embryos	18.6	Renewal	96	>10.0	Active ingredient	Harris et al (1998)	1756
94804	NA	NR	Technical	*Rhinella arenarum*	Tadpoles	20±1	Static	96	0.07	Active ingredient (Cu)	Perez-Coll and Herkovits (2006)	1757
300765	Naled	NR	Technical	*Pseudacris triseriata*	Tadpoles	15.5±0.5	Static	96	1.7	Active ingredient	Sanders (1970)	1758
91203	Naphthalene	NR	Technical (Reagent grade)	*Xenopus laevis*	Larvae	28	Flow-through	96	2.1	Active ingredient	Edmisten and Bantle (1982)	1759
91203	Naphthalene	NR	Technical (Reagent grade)	*Xenopus laevis*	Larvae	28	Flow-through	96	2.1	Active ingredient	Edmisten and Bantle (1982)	1760
111991094	Nicosulfuron	88	Technical	*Xenopus laevis*	Embryos	24±0.5	Renewal	96	12.3	Active ingredient	Fort et al (1999a)	1761
111991094	Nicosulfuron	99.5	Technical	*Xenopus laevis*	Embryos	24±0.5	Renewal	96	>25	Active ingredient	Fort et al (1999a)	1762
112050	Nonanoic acid	98	Technical	*Xenopus laevis*	Embryos	NR	Renewal	96	32.7	Active ingredient	Dawson et al (1996)	1766
76738620	Paclobutrazol	98.25	Technical	*Bufo bufo gargarizans*	Tadpoles	22±1	Renewal	96	9.1	Active ingredient	Liu et al (1995)	1769

CAS	Pesticide name	% a.i.	Test material	Species	Stage	Temp. (°C)	Test type	Duration (h)	LC50 (mg/L)	LC50 based on	Reference	Data line
76738620	Paclobutrazol	98.25	Technical	*Bufo bufo gargarizans*	Tadpoles	22±1	Renewal	96	9.1	Active ingredient	Liu et al (1996)	1770
4685147	Paraquat	42	Technical	*Bufo bufo gargarizans*	Tadpoles	22±2	Renewal	96	20.1	Active ingredient	Yin et al (2008)	1772
1910425	Paraquat dichloride	95	Technical	*Rana pipiens*	Embryos	22-25	Renewal	96	1.3	Active ingredient	Linder et al (1990)	1774
1910425	Paraquat dichloride	29.1	Formulation	*Rana pipiens*	Embryos	22-25	Renewal	96	0.5	Active ingredient	Linder et al (1990)	1775
1910425	Paraquat dichloride	29.1	Formulation	*Xenopus laevis*	Embryos	22-25	Renewal	96	>8.1	Active ingredient	Linder et al (1990)	1776
1910425	Paraquat dichloride	95	Technical	*Xenopus laevis*	Embryos	22-25	Renewal	96	8.1	Active ingredient	Linder et al (1990)	1777
1910425	Paraquat dichloride	42	Technical	*Bufo woodhousei fowleri*	Tadpoles	16	Static	96	15	Active ingredient	Mayer and Ellersieck (1986)	1778
1910425	Paraquat dichloride	NR	Technical	*Bufo woodhousei fowleri*	Tadpoles	15.5±0.5	Static	96	26	Active ingredient	Sanders (1970)	1779
1910425	Paraquat dichloride	42	Technical	*Pseudacris triseriata*	Tadpoles	16	Static	96	28	Active ingredient	Mayer and Ellersieck (1986)	1780
1910425	Paraquat dichloride	NR	Technical	*Pseudacris triseriata*	Tadpoles	15.5±0.5	Static	96	28	Active ingredient	Sanders (1970)	1781
1910425	Paraquat dichloride	27.6	Formulation	*Scinax nasica*	Tadpoles	16±1	Static-renewal	96	21.99	Active ingredient	Lajmanovich et al. (1998)	1782
56382	Parathion	>90	Technical	*Xenopus laevis*	Embryos	23	Static	96	14.7	Active ingredient	Snawder and Chambers (1989)	1783
56382	Parathion	98.7	Technical	*Bufo woodhousei fowleri*	Tadpoles	15	Static	96	>1	Active ingredient	Mayer and Ellersieck (1986)	1784

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56382	Parathion	98.7	Technical	*Pseudacris triseriata*	Tadpoles	15	Static	96	1.08	Active ingredient	Mayer and Ellersieck (1986)	1785
56382	Parathion	NR	Technical	*Pseudacris triseriata*	Tadpoles	15.5±0.5	Static	96	1	Active ingredient	Sanders (1970)	1786
298000	Parathion-methyl, methyl parathion	50	Formulation	*Rana cyanophlyctis*	Adults	23±0.2	Renewal	96	11.5	Active ingredient	Mudgall and Patil (1987)	1787
298000	Parathion-methyl, methyl parathion	50	Formulation	*Rana cyanophlyctis*	Adults	23±0.2	Renewal	96	8.0	Active ingredient	Mudgall and Patil (1987)	1788
298000	Parathion-methyl, methyl parathion	90	Technical	*Pseudacris triseriata*	Tadpoles	15	Static	96	3.7	Active ingredient	Mayer and Ellersieck (1986)	1789
298000	Parathion-methyl, methyl parathion	99	Technical	*Rana tigrina*	Tadpoles	20-21	Static	96	3.1	Active ingredient	Luo et al (2003)	1793
87865	Pentachlorophenol	100	Technical	*Xenopus laevis*	Embryos	24±0.5	Renewal	96	0.52	Active ingredient	Fort and Stover (1996)	1795
87865	Pentachlorophenol	100	Technical	*Xenopus laevis*	Embryos	24±0.5	Renewal	96	0.56	Active ingredient	Fort and Stover (1996)	1796
87865	Pentachlorophenol	100	Technical	*Xenopus laevis*	Larvae	24±0.5	Renewal	96	0.05	Active ingredient	Fort and Stover (1996)	1799
87865	Pentachlorophenol	100	Technical	*Xenopus laevis*	Larvae	24±0.5	Renewal	96	0.12	Active ingredient	Fort and Stover (1996)	1800
87865	Pentachlorophenol	100	Technical	*Xenopus laevis*	Larvae	24±0.5	Renewal	96	0.35	Active ingredient	Fort and Stover (1996)	1801
87865	Pentachlorophenol	100	Technical	*Xenopus laevis*	Larvae	24±0.5	Renewal	96	0.06	Active ingredient	Fort and Stover (1996)	1802
87865	Pentachlorophenol	100	Technical	*Xenopus laevis*	Larvae	24±0.5	Renewal	96	0.15	Active ingredient	Fort and Stover (1996)	1803
87865	Pentachlorophenol	100	Technical	*Xenopus laevis*	Larvae	24±0.5	Renewal	96	0.42	Active ingredient	Fort and Stover (1996)	1804

CAS	Pesticide name	% a.i.	Test material	Species	Stage	Temp. (°C)	Test type	Duration (h)	LC50 (mg/L)	LC50 based on	Reference	Data line
87865	Pentachlorophenol	99	Technical	*Rana catesbeiana*	NR	17.7 (17.2-18.2)	Flow-through	96	0.207	Active ingredient	Thurston et al (1985)	1806
87865	Pentachlorophenol	99	Technical	*Bufo boreas*	Tadpoles	22	Static	96	0.37	Active ingredient	Dwyer et al (1999)	1807
87865	Pentachlorophenol	99	Technical	*Bufo boreas*	Tadpoles	22	Static	96	0.37	Active ingredient	Dwyer et al (2005)	1808
87865	Pentachlorophenol	NR	(Technical)	*Rana sphenocephala*	Tadpoles	22	Static	96	0.14	Active ingredient	Bridges et al (2002)	1810
52645531	Permethrin	99	Technical (Reference grade)	*Xenopus laevis*	Blastula	23±1	Renewal	96	0.3	Active ingredient	Fort et al (1999b)	1811
52645531	Permethrin	99	Technical (Reference grade)	*Xenopus laevis*	Blastula	23±1	Renewal	96	0.7	Active ingredient	Fort et al (1999b)	1812
52645531	Permethrin	93	Technical	*Rana catesbeiana*	NR	17.6 (17.3-18)	Flow-through	96	0.115	Active ingredient	Thurston et al (1985)	1814
52645531	Permethrin	95.2	Technical	*Bufo boreas*	Tadpoles	22	Static	96	>10	Active ingredient	Dwyer et al (1999)	1815
52645531	Permethrin	95.2	Technical	*Bufo boreas*	Tadpoles	22	Static	96	>10	Active ingredient	Dwyer et al (2005)	1816
52645531	Permethrin	38	Formulation	*Rana catesbeiana*	Tadpoles	24±1	Static	96	7.033	Active ingredient	Jolly et al (1978a)	1817
52645531	Permethrin	NR	(Technical)	*Rana sphenocephala*	Tadpoles	22	Static	96	18.2	Active ingredient	Bridges et al (2002)	1818
732116	Phosmet	50	Formulation	*Rana clamitans*	Embryos	18.6	Renewal	96	>12.5	Active ingredient	Harris et al (1998)	1820
51036	Piperonyl butoxide	90	Technical	*Xenopus laevis*	Embryos	24.7	Renewal	96	68	Active ingredient	El-Merhibi et al (2004)	1825
51036	Piperonyl butoxide	100	Technical	*Pseudacris triseriata*	Tadpoles	15	Static	96	0.21	Active ingredient	Mayer and Ellersieck (1986)	1826

CAS	Pesticide name	% a.i.	Test material	Species	Stage	Temp. (°C)	Test type	Duration (h)	LC50 (mg/L)	LC50 based on	Reference	Data line
51036	Piperonyl butoxide	NR	Technical	*Pseudacris triseriata*	Tadpoles	15.5±0.5	Static	96	1	Active ingredient	Sanders (1970)	1827
23103982	Pirimicarb	50	Formulation	*Rhinella arenarum*	Tadpoles	25±1	Renewal	96	111.80	Active ingredient	Candioti et al (2010)	1828
23103982	Pirimicarb	50	Formulation	*Rhinella arenarum*	Tadpoles	25±1	Renewal	96	90.85	Active ingredient	Candioti et al (2010)	1829
-	POEA (surfactant)	71	Technical	*Rana clamitans*	Tadpoles	20±1	Static	96	2.2	Active ingredient	Howe et al. (2004)	1834
67747095	Prochloraz	NR	Technical	*Xenopus laevis*	Embryos	24±0.5	Renewal	96	4.50	Active ingredient	Larsen and Sorensen (2004)	1836
41198087	Profenofos	40	Formulation	*Rana spinosa*	Tadpoles	21±1	Renewal	96	0.58	Active ingredient	Li et al (2010)	1837
83794	Rotenone	5	Formulation	*Rana sphenocephala*	Larvae	NR	Static	96	0.5	Formulation	Office of Pesticide Programs (2000)	1845
83794	Rotenone	NR	(Technical)	*Xenopus laevis*	Tadpoles	17.2 (16.5-18.4)	Flow-through	96	>0.04	Active ingredient	Holcombe et al (1987)	1850
122349	Simazine	89	Formulation	*Rana catesbeiana*	Tadpoles	15	NR	96	1780	Formulation	Wan et al (2006)	1851
1014706	Simetryn	99.9	Technical	*Silurana tropicalis*	Tadpoles	25±1	Renewal	96	3.70	Active ingredient	Saka (2010)	1852
131522	Sodium pentachlorophenoxide	90	Technical	*Ambystoma mexicanum*	Larvae	20±1	Renewal	96	0.21	Active ingredient	Saka (2003)	1853
131522	Sodium pentachlorophenoxide	90	Technical	*Ambystoma mexicanum*	Larvae	20±1	Renewal	96	0.18	Active ingredient	Saka (2003)	1854
131522	Sodium pentachlorophenoxide	90	Technical	*Ambystoma mexicanum*	Larvae	20±1	Renewal	96	0.17	Active ingredient	Saka (2003)	1855

CAS	Pesticide name	% a.i.	Test material	Species	Stage	Temp. (°C)	Test type	Duration (h)	LC50 (mg/L)	LC50 based on	Reference	Data line
131522	Sodium pentachlorophenoxide	90	Technical	*Ambystoma mexicanum*	Larvae	20±1	Renewal	96	0.14	Active ingredient	Saka (2003)	1856
131522	Sodium pentachlorophenoxide	90	Technical	*Ambystoma mexicanum*	Larvae	20±1	Renewal	96	0.19	Active ingredient	Saka (2003)	1857
131522	Sodium pentachlorophenoxide	90	Technical	*Ambystoma mexicanum*	Larvae	20±1	Renewal	96	0.14	Active ingredient	Saka (2003)	1858
131522	Sodium pentachlorophenoxide	90	Technical	*Ambystoma mexicanum*	Larvae	20±1	Renewal	96	0.17	Active ingredient	Saka (2003)	1859
131522	Sodium pentachlorophenoxide	90	Technical	*Ambystoma mexicanum*	Larvae	20±1	Renewal	96	0.14	Active ingredient	Saka (2003)	1860
131522	Sodium pentachlorophenoxide	90	Technical	*Ambystoma mexicanum*	Larvae	20±1	Renewal	96	0.18	Active ingredient	Saka (2003)	1861
131522	Sodium pentachlorophenoxide	90	Technical	*Bufo japonicus formosus*	Larvae	20±1	Renewal	96	0.20	Active ingredient	Saka (1999)	1862
131522	Sodium pentachlorophenoxide	90	Technical	*Bufo japonicus formosus*	Larvae	20±1	Renewal	96	0.15	Active ingredient	Saka (1999)	1863
131522	Sodium pentachlorophenoxide	90	Technical	*Bufo japonicus formosus*	Larvae	20±1	Renewal	96	0.12	Active ingredient	Saka (1999)	1864
131522	Sodium pentachlorophenoxide	90	Technical	*Cynops pyrrhogaster*	Larvae	20±1	Renewal	96	0.26	Active ingredient	Saka (1999)	1865
131522	Sodium pentachlorophenoxide	90	Technical	*Cynops pyrrhogaster*	Larvae	20±1	Renewal	96	0.12	Active ingredient	Saka (1999)	1866

CAS	Pesticide name	% a.i.	Test material	Species	Stage	Temp. (°C)	Test type	Duration (h)	LC50 (mg/L)	LC50 based on	Reference	Data line
131522	Sodium pentachlorophenoxide	90	Technical	*Cynops pyrrhogaster*	Larvae	20±1	Renewal	96	0.07	Active ingredient	Saka (1999)	1867
131522	Sodium pentachlorophenoxide	90	Technical	*Hyla japonica*	Larvae	20±1	Renewal	96	0.17	Active ingredient	Saka (1999)	1868
131522	Sodium pentachlorophenoxide	90	Technical	*Hyla japonica*	Larvae	20±1	Renewal	96	0.16	Active ingredient	Saka (1999)	1869
131522	Sodium pentachlorophenoxide	90	Technical	*Hyla japonica*	Larvae	20±1	Renewal	96	0.18	Active ingredient	Saka (1999)	1870
131522	Sodium pentachlorophenoxide	90	Technical	*Rana nigromaculata*	Larvae	20±1	Renewal	96	0.21	Active ingredient	Saka (1999)	1871
131522	Sodium pentachlorophenoxide	90	Technical	*Rana nigromaculata*	Larvae	20±1	Renewal	96	0.12	Active ingredient	Saka (1999)	1872
131522	Sodium pentachlorophenoxide	90	Technical	*Rana nigromaculata*	Larvae	20±1	Renewal	96	0.12	Active ingredient	Saka (1999)	1873
131522	Sodium pentachlorophenoxide	90	Technical	*Rhacophorus arboreus*	Larvae	20±1	Renewal	96	0.29	Active ingredient	Saka (1999)	1874
131522	Sodium pentachlorophenoxide	90	Technical	*Rhacophorus arboreus*	Larvae	20±1	Renewal	96	0.21	Active ingredient	Saka (1999)	1875
131522	Sodium pentachlorophenoxide	90	Technical	*Xenopus laevis*	Larvae	20±1	Renewal	96	0.26	Active ingredient	Saka (1999)	1876
131522	Sodium pentachlorophenoxide	90	Technical	*Xenopus laevis*	Larvae	20±1	Renewal	96	0.21	Active ingredient	Saka (1999)	1877

CAS	Pesticide name	% a.i.	Test material	Species	Stage	Temp. (°C)	Test type	Duration (h)	LC50 (mg/L)	LC50 based on	Reference	Data line
131522	Sodium pentachlorophenoxide	90	Technical	*Xenopus laevis*	Larvae	20±1	Renewal	96	0.17	Active ingredient	Saka (1999)	1878
131522	Sodium pentachlorophenoxide	90	Technical	*Xenopus laevis*	Larvae	20±1	Renewal	96	0.28	Active ingredient	Saka (2003)	1879
131522	Sodium pentachlorophenoxide	90	Technical	*Xenopus laevis*	Larvae	20±1	Renewal	96	0.25	Active ingredient	Saka (2003)	1880
131522	Sodium pentachlorophenoxide	90	Technical	*Xenopus laevis*	Larvae	20±1	Renewal	96	0.24	Active ingredient	Saka (2003)	1881
131522	Sodium pentachlorophenoxide	90	Technical	*Xenopus laevis*	Larvae	20±1	Renewal	96	0.22	Active ingredient	Saka (2003)	1882
131522	Sodium pentachlorophenoxide	90	Technical	*Xenopus laevis*	Larvae	20±1	Renewal	96	0.18	Active ingredient	Saka (2003)	1883
131522	Sodium pentachlorophenoxide	90	Technical	*Xenopus laevis*	Larvae	20±1	Renewal	96	0.17	Active ingredient	Saka (2003)	1884
131522	Sodium pentachlorophenoxide	90	Technical	*Xenopus laevis*	Larvae	20±1	Renewal	96	0.17	Active ingredient	Saka (2003)	1885
131522	Sodium pentachlorophenoxide	90	Technical	*Xenopus laevis*	Larvae	20±1	Renewal	96	0.15	Active ingredient	Saka (2003)	1886
131522	Sodium pentachlorophenoxide	90	Technical	*Xenopus laevis*	Larvae	20±1	Renewal	96	0.16	Active ingredient	Saka (2003)	1887
131522	Sodium pentachlorophenoxide	90	Technical	*Xenopus laevis*	Larvae	20±1	Renewal	96	0.15	Active ingredient	Saka (2003)	1888

CAS	Pesticide name	% a.i.	Test material	Species	Stage	Temp. (°C)	Test type	Duration (h)	LC50 (mg/L)	LC50 based on	Reference	Data line
131522	Sodium pentachlorophenoxide	90	Technical	*Xenopus laevis*	Larvae	20±1	Renewal	96	0.14	Active ingredient	Saka (2003)	1889
131522	Sodium pentachlorophenoxide	90	Technical	*Xenopus laevis*	Larvae	20±1	Renewal	96	0.13	Active ingredient	Saka (2003)	1890
131522	Sodium pentachlorophenoxide	90	Technical	*Xenopus laevis*	Larvae	20±1	Renewal	96	0.15	Active ingredient	Saka (2003)	1891
131522	Sodium pentachlorophenoxide	NR	Technical (Reagent grade)	*Rana hexadactyla*	Tadpoles	14 (12-17)	Renewal	96	0.01844	Active ingredient	Khangarot et al (1985c)	1893
74222972	Sulfometuron-methyl	85	Technical	*Xenopus laevis*	Embryos	24±0.5	Renewal	96	24.3	Active ingredient	Fort et al (1999a)	1894
74222972	Sulfometuron-methyl	99.5	Technical	*Xenopus laevis*	Embryos	24±0.5	Renewal	96	>25	Active ingredient	Fort et al (1999a)	1895
72548	TDE	99	Technical	*Bufo woodhousei fowleri*	Tadpoles	16	Static	96	0.14	Active ingredient	Mayer and Ellersieck (1986)	1896
72548	TDE	NR	Technical	*Bufo woodhousei fowleri*	Tadpoles	15.5±0.5	Static	96	0.14	Active ingredient	Sanders (1970)	1897
72548	TDE	NR	Technical	*Pseudacris triseriata*	Tadpoles	15.5±0.5	Static	96	0.4	Active ingredient	Sanders (1970)	1898
3383968	Temephos	44.6	Formulation	*Rana clamitans*	Tadpoles	20-21	Renewal	96	0.00189	Active ingredient	Sparling et al (1997)	1899
28249776	Thiobencarb	50	Formulation	*Bufo japonicus formosus*	Larvae	20±1	Renewal	96	1.69	Active ingredient	Saka (1999)	1901
28249776	Thiobencarb	50	Formulation	*Bufo japonicus formosus*	Larvae	20±1	Renewal	96	1.82	Active ingredient	Saka (1999)	1902
28249776	Thiobencarb	50	Formulation	*Bufo japonicus formosus*	Larvae	20±1	Renewal	96	2.19	Active ingredient	Saka (1999)	1903

CAS	Pesticide name	% a.i.	Test material	Species	Stage	Temp. (°C)	Test type	Duration (h)	LC50 (mg/L)	LC50 based on	Reference	Data line
28249776	Thiobencarb	50	Formulation	*Cynops pyrrhogaster*	Larvae	20±1	Renewal	96	3.68	Active ingredient	Saka (1999)	1904
28249776	Thiobencarb	50	Formulation	*Cynops pyrrhogaster*	Larvae	20±1	Renewal	96	3.18	Active ingredient	Saka (1999)	1905
28249776	Thiobencarb	50	Formulation	*Cynops pyrrhogaster*	Larvae	20±1	Renewal	96	2.83	Active ingredient	Saka (1999)	1906
28249776	Thiobencarb	99	Technical	*Cynops pyrrhogaster*	Larvae	20±1	Renewal	96	2.98	Active ingredient	Saka (1999)	1907
28249776	Thiobencarb	50	Formulation	*Hyla japonica*	Larvae	20±1	Renewal	96	1.42	Active ingredient	Saka (1999)	1908
28249776	Thiobencarb	50	Formulation	*Hyla japonica*	Larvae	20±1	Renewal	96	1.56	Active ingredient	Saka (1999)	1909
28249776	Thiobencarb	50	Formulation	*Hyla japonica*	Larvae	20±1	Renewal	96	2.10	Active ingredient	Saka (1999)	1910
28249776	Thiobencarb	50	Formulation	*Rana nigromaculata*	Larvae	20±1	Renewal	96	2.45	Active ingredient	Saka (1999)	1911
28249776	Thiobencarb	50	Formulation	*Rana nigromaculata*	Larvae	20±1	Renewal	96	1.97	Active ingredient	Saka (1999)	1912
28249776	Thiobencarb	50	Formulation	*Rana nigromaculata*	Larvae	20±1	Renewal	96	2.02	Active ingredient	Saka (1999)	1913
28249776	Thiobencarb	50	Formulation	*Rhacophorus arboreus*	Larvae	20±1	Renewal	96	2.15	Active ingredient	Saka (1999)	1914
28249776	Thiobencarb	50	Formulation	*Rhacophorus arboreus*	Larvae	20±1	Renewal	96	2.13	Active ingredient	Saka (1999)	1915
28249776	Thiobencarb	50	Formulation	*Xenopus laevis*	Larvae	20±1	Renewal	96	2.15	Active ingredient	Saka (1999)	1916
28249776	Thiobencarb	50	Formulation	*Xenopus laevis*	Larvae	20±1	Renewal	96	1.32	Active ingredient	Saka (1999)	1917
28249776	Thiobencarb	50	Formulation	*Xenopus laevis*	Larvae	20±1	Renewal	96	1.88	Active ingredient	Saka (1999)	1918
28249776	Thiobencarb	99	Technical	*Xenopus laevis*	Larvae	20±1	Renewal	96	1.45	Active ingredient	Saka (1999)	1919

CAS	Pesticide name	% a.i.	Test material	Species	Stage	Temp. (°C)	Test type	Duration (h)	LC50 (mg/L)	LC50 based on	Reference	Data line
28249776	Thiobencarb	98	Technical	*Silurana tropicalis*	Tadpoles	25±1	Renewal	96	0.752	Active ingredient	Saka (2010)	1920
59669260	Thiodicarb	NR	Formulation	*Bufo marinus*	Tadpoles	NR	Static	96	0.04	Active ingredient	Tejada et al (1994)	1921
137268	Thiram	80	Formulation	*Xenopus laevis*	Tadpoles	20±0.5	NR	96	0.013	Active ingredient	Seuge et al (1983)	1922
137268	Thiram	80	Formulation	*Xenopus laevis*	Tadpoles	20±0.5	NR	96	0.021	Active ingredient	Seuge et al (1983)	1923
78488	Tribufos	95	Technical	*Bufo woodhousei fowleri*	Tadpoles	15	Static	96	0.45	Active ingredient	Mayer and Ellersieck (1986)	1924
78488	Tribufos	NR	Technical	*Bufo woodhousei fowleri*	Tadpoles	15.5±0.5	Static	96	0.42	Active ingredient	Sanders (1970)	1925
76039	Trichloroacetic acid	NR	(Technical)	*Xenopus laevis*	Embryos	23±1	Renewal	96	4430	Active ingredient	Fort et al (1993)	1927
0	Triclopyr	NR	Technical	*Rana catesbeiana*	Tadpoles	22	Static-renewal	96	814.1	Active ingredient	Trumbo and Waligora (2009)	1928
0	Triclopyr	44.4	Formulation	*Rana catesbeiana*	Tadpoles	22	Static-renewal	96	174.5	Active ingredient	Trumbo and Waligora (2009)	1929
64700567	Triclopyr-butotyl	48	Formulation	*Bufo americanus*	Embryos	23±2	Renewal	96	12.0	Active ingredient	Edgington et al. (2003)	1930
64700567	Triclopyr-butotyl	48	Formulation	*Bufo americanus*	Embryos	23±2	Renewal	96	15.1	Active ingredient	Edgington et al. (2003)	1931
64700567	Triclopyr-butotyl	48	Formulation	*Rana clamitans*	Embryos	23±2	Renewal	96	19.0	Active ingredient	Edgington et al. (2003)	1932
64700567	Triclopyr-butotyl	48	Formulation	*Rana clamitans*	Embryos	23±2	Renewal	96	24.6	Active ingredient	Edgington et al. (2003)	1933
64700567	Triclopyr-butotyl	48	Formulation	*Rana pipiens*	Embryos	23±2	Renewal	96	16.2	Active ingredient	Edgington et al. (2003)	1934

CAS	Pesticide name	% a.i.	Test material	Species	Stage	Temp. (°C)	Test type	Duration (h)	LC50 (mg/L)	LC50 based on	Reference	Data line
64700567	Triclopyr-butotyl	48	Formulation	*Rana pipiens*	Embryos	23±2	Renewal	96	23.3	Active ingredient	Edgington et al. (2003)	1935
64700567	Triclopyr-butotyl	48	Formulation	*Xenopus laevis*	Embryos	23±2	Renewal	96	13.7	Active ingredient	Edgington et al. (2003)	1936
64700567	Triclopyr-butotyl	48	Formulation	*Xenopus laevis*	Embryos	23±2	Renewal	96	8.3	Active ingredient	Edgington et al. (2003)	1937
64700567	Triclopyr-butotyl	48	Formulation	*Xenopus laevis*	Embryos	24	Static-renewal	96	10.0	Active ingredient	Perkins et al (2000)	1938
64700567	Triclopyr-butotyl	48	Formulation	*Bufo americanus*	Larvae	21±1	Renewal	96	0.9	Active ingredient	Edgington et al. (2003)	1939
64700567	Triclopyr-butotyl	48	Formulation	*Bufo americanus*	Larvae	21±1	Renewal	96	2.1	Active ingredient	Edgington et al. (2003)	1940
64700567	Triclopyr-butotyl	48	Formulation	*Rana clamitans*	Larvae	20.3	Lentic	96	3.01	Active ingredient	Wojtaszek et al (2005)	1941
64700567	Triclopyr-butotyl	48	Formulation	*Rana pipiens*	Larvae	21±1	Renewal	96	0.8	Active ingredient	Edgington et al. (2003)	1942
64700567	Triclopyr-butotyl	48	Formulation	*Rana pipiens*	Larvae	21±1	Renewal	96	0.9	Active ingredient	Edgington et al. (2003)	1943
64700567	Triclopyr-butotyl	48	Formulation	*Rana pipiens*	Larvae	20.26	Lentic	96	2.79	Active ingredient	Wojtaszek et al (2005)	1944
64700567	Triclopyr-butotyl	48	Formulation	*Rana pipiens*	Larvae	20.3	Lentic	96	3.29	Active ingredient	Wojtaszek et al (2005)	1945
64700567	Triclopyr-butotyl	48	Formulation	*Xenopus laevis*	Larvae	21±1	Renewal	96	1.0	Active ingredient	Edgington et al. (2003)	1946
64700567	Triclopyr-butotyl	48	Formulation	*Xenopus laevis*	Larvae	21±1	Renewal	96	1.7	Active ingredient	Edgington et al. (2003)	1947
57213691	Triclopyr-triethylammonium	36	Formulation	*Xenopus laevis*	Embryos	24	Static-renewal	96	159.0	Active ingredient	Perkins et al (2000)	1948
1582098	Trifluralin	52	Formulation	*Bombina bombina*	Larvae	22±1	Renewal	96	19.6	Active ingredient	Sayim (2010)	1950

CAS	Pesticide name	% a.i.	Test material	Species	Stage	Temp. (°C)	Test type	Duration (h)	LC50 (mg/L)	LC50 based on	Reference	Data line
1582098	Trifluralin	NR	Technical	*Bufo woodhousei fowleri*	Tadpoles	15.5±0.5	Static	96	0.1	Active ingredient	Sanders (1970)	1951
1582098	Trifuralin	95.9	Technical	*Bufo woodhousei fowleri*	Tadpoles	15	Static	96	0.11	Active ingredient	Mayer and Ellersieck (1986)	1952
1582098	Trifuralin	95.9	Technical	*Bufo woodhousei fowleri*	Tadpoles	15	Static	96	0.115	Active ingredient	Mayer and Ellersieck (1986)	1953

3.2. Dosing toxicity studies (LD50)

The toxicity data found from dosing studies (LD50) on amphibians is shown in Table 12. While most of this data was for adult terrestrial phase amphibians, one study (Cole and Casida 1983) included data for tadpoles of the bullfrog (*Rana catesbeiana*).

Toxicity data for terrestrial phase amphibians was limited with few studies providing sufficient information on replication or dose levels for the data to be considered reliable (e.g. Froese et al. 2009, Gromysz-Kalkowska and Szubartowska 1993a, 1993b, Indra et al. 1997, Joseph and Rao 1990, Juarez and Guzman 1988, Krishnappa and Venkateshwarlu 2007, McComb et al. 2008, Srivastava et al. 1988). While animals per dose level in Pradhan and Dasgupta (1992) were not defined, the number of animals tested suggests that this study may also be acceptable.

Table 12: LD50 data from dosing studies on amphibians.

Pesticide	% a.i.	Test mate-rial	Species	Stage	Temp. °C	Exposure type	Dur. (h)	Dose levels	Anim. /dose	LD50 (mg/kg) (95% CL)	Comments	Reference
Aldrin	NR	Tech.	*Rana hexadactyla*	Adult (55g)	27±2	Oral (intub.)	24	6	10	2.2	Assume data based on active ingredient.	Joseph and Rao (1990)
Aldrin	NR	Tech.	*Rana hexadactyla*	Adult (55g)	27±2	Oral (intub.)	48	6	10	2.5	Assume data based on active ingredient.	Joseph and Rao (1990)
Aldrin	30	Form.	*Rana tigrina*	Adult (40-60g)	19-20	Oral	24	13	10	75 (66.6-85.4)	Dose described as formulation (Aldrin 30% EC). Data here is for active ingredient calculated assuming 30% active ingredient.	Srivastava et al (1988)
Aldrin	30	Form.	*Rana tigrina*	Adult (40-60g)	19-20	Oral	48	13	10	41.4 (33.1-51.7)	Dose described as formulation (Aldrin 30% EC). Data here is for active ingredient calculated assuming 30% active ingredient.	Srivastava et al (1988)
Carbaryl	50	NR	*Rana catesbeiana*	NR	NR	Oral (capsule)	336	NR	NR	>4000	Basis of LD50 value unclear. Based on data for 3 males. Toxicity to 3 month old mallard >2564mg/kg. Toxicity to 2 month old Japanese quail 2290mg/kg.	Hudson et al (1984)
Carbaryl	NR	NR	*Limnonectes limnocharis*	Adult (1.8-2g)	NR	IP	96	9	10	125	Assuming values are for active ingredient.	Krishnappa and Venkateshwarlu (2007)
Carbaryl	50	Form.	*Rana tigrina*	Adult	NR	IP	96	NR	NR	320	Calculated active ingredient LD50 assuming 50% carbaryl.	Sampath and Elango (1997)

Pesticide	% a.i.	Test mate-rial	Species	Stage	Temp. °C	Exposure type	Dur. (h)	Dose levels	Anim. /dose	LD50 (mg/kg) (95% CL)	Comments	Reference
Carbaryl	50	Form.	*Hoplobatrachus tigerinus*	Adult (40g)	NR	IP	96	8	0	320	Assuming presented data is for 50% formulation. LD50 of formulation 640 mg/kg (dose range 500-700mg/kg).	Sampath et al (1992)
Chlorpyrifos	94.5	NR	*Rana catesbeiana*	NR	NR	Oral (capsule)	336	NR	NR	>400	Basis of LD50 value unclear, assume active ingredient based on purity. Based on data for 2 males. Toxicity to mallard 75.6-112mg/kg. Toxicity to 2-2.5 months old Japanese quail 15.9-17.8mg/kg.	Hudson et al (1984)
Cypermethrin [(1R,αS)-cis-isomer]	NR	Tech.	*Rana pipiens pipiens*	Adult (20-0g)	20	SC	24	NR	NR	0.16 (0.12-0.24)	Assumed data based on active ingredient. Animals per dose level not defined but 28-34 total used.	Cole and Casida (1983)
Cypermethrin [(1R,αS)-cis-isomer]	NR	Tech.	*Rana catesbeiana*	Tad. (10-15g)	20	IP	24	NR	NR	0.04 (0.01-0.24)	Assumed data based on active ingredient. Animals per dose level not defined but 32-45 total used.	Cole and Casida (1983)
Cypermethrin [(1R,αS)-trans-isomer]	NR	Tech.	*Rana pipiens pipiens*	Adult (20-30g)	20	SC	24	NR	NR	0.65 (0.41-1.0)	Assumed data based on active ingredient. Animals per dose level not defined but 28-34 total used.	Cole and Casida (1983)
Cypermethrin [(1R,αS)-trans-isomer]	NR	Tech.	*Rana catesbeiana*	Tad. (10-15g)	20	IP	24	NR	NR	0.20 (0.06-0.41)	Assumed data based on active ingredient. Animals per dose level not defined but 32-35 total used.	Cole and Casida (1983)
DDT	NR	NR	*Rana temporaria*	Adult	15	Oral (capsule)	480	NR	NR	7.6	Basis for LD50 data unclear. Data for 3d, 4d and 95% CL provided but in graph with log scale.	Harri et al (1979)

Pesticide	% a.i.	Test mate-rial	Species	Stage	Temp. °C	Exposure type	Dur. (h)	Dose levels	Anim. /dose	LD50 (mg/kg) (95% CL)	Comments	Reference
DDT	77.2	NR	*Rana catesbeiana*	NR	NR	Oral (capsule)	336	NR	NR	>2000	Basis of LD50 value unclear. Based on data for 3 females. Toxicity to 3 month old mallard >2240mg/kg. Toxicity to 2 month old Japanese quail 841mg/kg.	Hudson et al (1984)
Deltamethrin	NR	Tech.	*Rana pipiens pipiens*	Adult (20-30g)	20	SC	24	NR	NR	0.35 (0.19-0.62)	Assumed data based on active ingredient. Animals per dose level not defined but 28-34 total used.	Cole and Casida (1983)
Deltamethrin	NR	Tech.	*Rana catesbeiana*	Tad. (10-15g)	20	IP	24	NR	NR	0.13 (0.05-0.34)	Assumed data based on active ingredient. Animals per dose level not defined but 32-45 total used.	Cole and Casida (1983)
Deltamethrin	99	Tech.	*Ambystoma tigrinum*	Adult	20-22	Oral (in food)	96	7	2	c. 7.5	Data based on activ ingredient. Value is estimate based on 0% mortality at 5mg/kg and 100% mortality at 10mg/kg	Froese et al (2009)
Demeton	92	NR	*Rana catesbeiana*	NR	NR	Oral (capsule)	336	NR	NR	562 (178-1780)	Basis of LD50 value unclear, assume active ingredient based on purity. Based on data for 8 males. Toxicity to 3 months old mallard 7.19mg/kg. Toxicity to 2 months old Japanese quail 8.48mg/kg.	Hudson et al (1984)

Pesticide	% a.i.	Test mate-rial	Species	Stage	Temp. °C	Exposure type	Dur. (h)	Dose levels	Anim. /dose	LD50 (mg/kg) (95% CL)	Comments	Reference
DFP	NR	Tech.	*Bufo viridis*	Adult (18-45g)	25	Injection (dorsal lymph sac)	NR	NR	NR	1450	Data appears to be for active ingredient. Minimum 25 animals. Toxicity to white mice was 4.0mg/kg (subcutaneous).	Edery and Schatzberg-Porath (1960)
Diazinon	89	NR	*Rana catesbeiana*	NR	NR	Oral (capsule)	336	NR	NR	>2000	Basis of LD50 value unclear, assume active ingredient based on purity. Based on data for 4 females. Toxicity to 3-4 months old mallard 3.54g/kg.	Hudson et al (1984)
Dicrotophos	98	NR	*Rana catesbeiana*	NR	NR	Oral (capsule)	336	NR	NR	2000 (602-6640)	Basis of LD50 value unclear, assume active ingredient based on purity. Based on data for 8 males. Test material is 98% α isomer. Toxicity to 3 months old mallard 4.24mg/kg. Toxicity to 2.5 month old Japanese quail 4.32mg/kg.	Hudson et al (1984)
Dimefox	NR	Tech.	*Bufo viridis*	Adult (18-45g)	25	Injection (dorsal lymph sac)	NR	NR	NR	1410	Data appears to be for active ingredient. Minimum 25 animals. Toxicity to white mice was 4.4mg/kg (intraperitoneal).	Edery and Schatzberg-Porath (1960)

Pesticide	% a.i.	Test mate-rial	Species	Stage	Temp. °C	Exposure type	Dur. (h)	Dose levels	Anim. /dose	LD50 (mg/kg) (95% CL)	Comments	Reference
Dimethoate	90	Tech.	*Bufo melanostictus*	Adult male (70 ±10g)	NR	Oral	24	7	NR	900	Assumed data is for active ingredient. Animals per dose level not defined. Test animals composed of 4 test groups of 20 animals with a parallel group of equal number of control animals.	Pradhan and Dasgupta (1992)
Dimethoate	90	Tech.	*Bufo melanostictus*	Adult male (70 ±10g)	NR	Oral	96	7	NR	810	Assumed data is for active ingredient. Animals per dose level not defined. Test animals composed of 4 test groups of 20 animals with a parallel group of equal number of control animals.	Pradhan and Dasgupta (1992)
Dimethoate	90	Tech.	*Bufo melanostictus*	Adult male (70 ±10g)	NR	Oral	168	7	NR	730	Assumed data is for active ingredient. Animals per dose level not defined. Test animals composed of 4 test groups of 20 animals with a parallel group of equal number of control animals.	Pradhan and Dasgupta (1992)
Dimethoate	90	Tech.	*Bufo melanostictus*	Adult male (70 ±10g)	NR	Oral	240	7	NR	705	Assumed data is for active ingredient. Animals per dose level not defined. Test animals composed of 4 test groups of 20 animals with a parallel group of equal number of control animals.	Pradhan and Dasgupta (1992)

Pesticide	% a.i.	Test mate-rial	Species	Stage	Temp. °C	Exposure type	Dur. (h)	Dose levels	Anim. /dose	LD50 (mg/kg) (95% CL)	Comments	Reference
Dimethoate	90	Tech.	*Bufo melanostictus*	Adult female (70 ±10g)	NR	Oral	24	7	NR	1900	Assumed data is for active ingredient. Animals per dose level not defined. Test animals composed of 4 test groups of 20 animals with a parallel group of equal number of control animals.	Pradhan and Dasgupta (1992)
Dimethoate	90	Tech.	*Bufo melanostictus*	Adult female (70 ±10g)	NR	Oral	96	7	NR	1750	Assumed data is for active ingredient. Animals per dose level not defined. Test animals composed of 4 test groups of 20 animals with a parallel group of equal number of control animals.	Pradhan and Dasgupta (1992)
Dimethoate	90	Tech.	*Bufo melanostictus*	Adult female (70 ±10g)	NR	Oral	168	7	NR	1500	Assumed data is for active ingredient. Animals per dose level not defined. Test animals composed of 4 test groups of 20 animals with a parallel group of equal number of control animals.	Pradhan and Dasgupta (1992)
Dimethoate	90	Tech.	*Bufo melanostictus*	Adult female (70 ±10g)	NR	Oral	240	7	NR	1390	Assumed data is for active ingredient. Animals per dose level not defined. Test animals composed of 4 test groups of 20 animals with a parallel group of equal number of control animals.	Pradhan and Dasgupta (1992)

Pesticide	% a.i.	Test mate-rial	Species	Stage	Temp. °C	Exposure type	Dur. (h)	Dose levels	Anim. /dose	LD50 (mg/kg) (95% CL)	Comments	Reference
Ekatin	NR	NR	*Rana temporaria*	NR	-	-	-	-	-	2480	Data is for females as reported in Gromysz-Kalkowska and Szubartowska (1993). No further details listed.	Szubartowska (1990)
Ekatin	NR	NR	*Rana temporaria*	NR	-	-	-	-	-	2600	Data is for males as reported in Gromysz-Kalkowska and Szubartowska (1993). No further details listed.	Szubartowska (1990)
Fenitrothion	NR	Form.	*Rana temporaria*	Adult male (21-56g)	NR	SC	3	5	11	2400	Not clear whether data is for formulation or active ingredient, comparisons with other studies/species suggests active ingredient. Value based on Trevan's method. Value was 2342mg/kg using the method of Reed and Muench.	Gromysz-Kalkowska and Szubartowska (1993b)
Fenitrothion	NR	Form.	*Rana temporaria*	Adult female (21-56g)	NR	SC	3	5	11	2220	Not clear whether data is for formulation or active ingredient, comparisons with other studies/species suggests active ingredient. Value based on Trevan's method. Value was 2182mg/kg using the method of Reed and Muench.	Gromysz-Kalkowska and Szubartowska (1993b)
Fenpropathrin (S)	NR	Tech.	*Rana pipiens pipiens*	Adult (20-30g)	20	SC	24	NR	NR	0.27 (0.12-0.63)	Assumed data based on active ingredient. Animals per dose level not defined but 28-34 total used.	Cole and Casida (1983)

Pesticide	% a.i.	Test mate-rial	Species	Stage	Temp. °C	Exposure type	Dur. (h)	Dose levels	Anim. /dose	LD50 (mg/kg) (95% CL)	Comments	Reference
Fenvalerate (SS)	NR	Tech.	*Rana pipiens pipiens*	Adult (20-30g)	20	SC	24	NR	NR	0.13 (0.09-0.19)	Assumed data based on active ingredient. Animals per dose level not defined but 28-34 total used.	Cole and Casida (1983)
Glyphosate	NR	Tech.	*Taricha granulosa*	Adult	NR	IP	96	'3-5'	'3-4'	1250 (1030-1430)	Assumed data is for active ingredient. Up and down method used to establish LD50 (n = 30).	McComb et al (2008)
Glyphosate	NR	Tech.	*Taricha granulosa*	Adult	NR	IP	96	'3-5'	'3-4'	>2600	Assumed data is for active ingredient. Up and down method used to establish LD50 (n = 15).	McComb et al (2008)
Glyphosate	NR	Tech.	*Ensatina eschscholtzii*	Adult	NR	Oral (gavage)	96	'3-5'	'3-4'	1070 (700-1640)	Assumed data is for active ingredient. Up and down method used to establish LD50 (n = 10).	McComb et al (2008)
Glyphosate	NR	Tech.	*Ascaphus truei*	Adult	NR	IP	96	'3-5'	'3-4'	>2000	Assumed data is for active ingredient. Up and down method used to establish LD50 (n = 5).	McComb et al (2008)
Glyphosate	NR	Tech.	*Dicamptodon ensatus*	Adult	NR	IP	96	'3-5'	'3-4'	<2000	Assumed data is for active ingredient. Up and down method used to establish LD50 (n = 3).	McComb et al (2008)
Glyphosate	NR	Tech.	*Plethodon vehiculum*	Adult	NR	IP	96	'3-5'	'3-4'	1170	Assumed data is for active ingredient. Up and down method used to establish LD50 (n = 9).	McComb et al (2008)
Kadethrin [cis-isomer]	NR	Tech.	*Rana pipiens pipiens*	Adult (20-30g)	20	SC	24	NR	NR	1.2 (0.63-2.4)	Assumed data based on active ingredient. Animals per dose level not defined but 28-34 total used.	Cole and Casida (1983)
Mevinphos	NR	NR	*Bufo arenarum*	Adult	NR	Injections (lymph sac)	96	NR	NR	850	Basis of LD50 data not clear (test material not defined).	Juarez and Guzman (1984)

Pesticide	% a.i.	Test mate-rial	Species	Stage	Temp. °C	Exposure type	Dur. (h)	Dose levels	Anim. /dose	LD50 (mg/kg) (95% CL)	Comments	Reference
Mevinphos (Fosdrin)	NR	NR	*Bufo arenarum*	Adult (90-95g)	20±2	Injections (lymph sac)	96	7	12	880 (850-938)	Basis of LD50 data not clear (test material not defined).	Juarez and Guzman (1988)
Mexacarbate	≥ 99	Tech.	*Rana catesbeiana*	NR	0	Oral (capsule)	336	NR	NR	566 (283-1131)	Basis of LD50 value unclear, assume active ingredient based on purity. Based on data for 8 males. Toxicity to old mallard 2.98-4.20mg/kg. Toxicity to 2-3 months old Japanese quail 3.21mg/kg.	Hudson et al (1984)
Mexacarbate	≥ 99	Tech.	*Rana catesbeiana*	NR	NR	Oral (capsule)	336	NR	NR	283-800	Data based on active ingredient. Based on data for 14 animals. Toxicity to mallard 3.0-4.2mg/kg. Toxicity to Coturnix quail 2.5 months old 3.21mg/kg. Toxicity to albino rat 14.1 mg/kg.	Tucker and Crabtree (1969)
Nabam	93	NR	*Rana catesbeiana*	NR	NR	Oral (capsule)	336	NR	NR	420 (250-707)	Basis of LD50 value unclear, assume active ingredient based on purity. Based on data for 6 females. Toxicity to 3-4 months old mallard >2560mg/kg. Toxicity to 2 month old Japanese quail 2120mg/kg.	Hudson et al (1984)
Paraoxon	0	Tech.	*Bufo viridis*	Adult (18-45g)	16	Injection (dorsal lymph sac)	NR	NR	NR	188	Data appears to be for active ingredient. Minimum 25 animals. Toxicity to white mice was 1.13mg/kg (subcutaneous).	Edery and Schatzberg-Porath (1960)

Pesticide	% a.i.	Test mate-rial	Species	Stage	Temp. °C	Exposure type	Dur. (h)	Dose levels	Anim. /dose	LD50 (mg/kg) (95% CL)	Comments	Reference
Paraoxon	0	Tech.	*Rana ridibunda*	Adult (18-45g)	16	Injection (dorsal lymph sac)	NR	NR	NR	91	Data appears to be for active ingredient. Minimum 25 animals. Toxicity to white mice was 1.13mg/kg (subcutaneous).	Edery and Schatzberg-Porath (1960)
Paraoxon	90	Tech.	*Rana pipiens*	Adult male (28.5g)	NR	IP	24	NR	NR	44	Animals per dose level not defined. Test animals composed of 4 test groups of 20 animals with a parallel group of equal number of control animals.	Potter and O'Brien (1963)
Paraquat dichloride	25	Form.	*Rana esculenta*	Adult (45-50g)	NR	SC	72	NR	10	260	Data appears to be for active ingredient (PQ). Animals maintained in water. LD100 (72h) = 360mg/kg.	Barabas et al (1985)
Parathion	0	Tech.	*Bufo viridis*	Adult (18-45g)	16	Injection (dorsal lymph sac)	NR	NR	NR	967	Data appears to be for active ingredient. Minimum 25 animals. Toxicity to white mice was 14.0mg/kg (intraperitoneal).	Edery and Schatzberg-Porath (1960)
Parathion	NR	NR	*Bufo arenarum*	Adult	NR	Injections (lymph sac)	96	NR	NR	3352	Basis of LD50 data not clear (test material not defined).	Juarez and Guzman (1984)
Parathion	NR	NR	*Bufo arenarum*	Adult (90-95g)	20±2	Injections (lymph sac)	96	7	12	2250 (1510-3352)	Basis of LD50 data not clear (test material not defined).	Juarez and Guzman (1988)
Permethrin [(1R)-cis-isomer]	NR	Tech.	*Rana pipiens pipiens*	Adult (20-30g)	20	SC	24	NR	NR	0.14 (0.11-0.17)	Assumed data based on active ingredient. Animals per dose level not defined but 28-34 total used.	Cole and Casida (1983)

Pesticide	% a.i.	Test mate-rial	Species	Stage	Temp. °C	Exposure type	Dur. (h)	Dose levels	Anim. /dose	LD50 (mg/kg) (95% CL)	Comments	Reference
Permethrin [(1R)-trans-isomer]	NR	Tech.	*Rana pipiens pipiens*	Adult (20-30g)	20	SC	24	NR	NR	7.5 (5.2-10.9)	Assumed data based on active ingredient. Animals per dose level not defined but 28-34 total used.	Cole and Casida (1983)
Phenothrin [(1R)-cis-isomer]	NR	Tech.	*Rana pipiens pipiens*	Adult (20-30g)	20	SC	24	NR	NR	6 (3.9-9.2)	Assumed data based on active ingredient. Animals per dose level not defined but 28-34 total used.	Cole and Casida (1983)
Phenothrin [(1R)-trans-isomer]	NR	Tech.	*Rana pipiens pipiens*	Adult (20-30g)	20	SC	24	NR	NR	>20	Assumed data based on active ingredient. Animals per dose level not defined but 28-34 total used.	Cole and Casida (1983)
Phorate	98.8	NR	*Rana catesbeiana*	NR	NR	Oral (capsule)	336	NR	NR	85.2 (59.3-122)	Basis of LD50 value unclear, assume active ingredient based on purity. Based on data for 16 females. Toxicity to mallard 0.616-2.55mg/kg.	Hudson et al (1984)
Phosacetim	95	NR	*Rana catesbeiana*	NR	NR	Oral (capsule)	336	NR	NR	>2000	Basis of LD50 value unclear, assume active ingredient based on purity. Based on data for 2 males. Toxicity to 3-4 months old mallard 24.0mg/kg.	Hudson et al (1984)
Phosphamidon	85	Tech.	*Polypedates maculatus*	Adult male (12-15g)	NR	IP	120	10	10	1.4	Assumed data is for active ingredient. States that LD50 also estimated at 3, 6, 12, 24, 48, 72, 96 and 120h but this data not presented.	Indra et al (1997)
Phosphamidon	NR	NR	*Bufo arenarum*	Adult	NR	Injections (lymph sac)	96	NR	NR	1195	Basis of LD50 data not clear (test material not defined).	Juarez and Guzman (1984)

Pesticide	% a.i.	Test mate-rial	Species	Stage	Temp. °C	Exposure type	Dur. (h)	Dose levels	Anim. /dose	LD50 (mg/kg) (95% CL)	Comments	Reference
Phosphamidon	NR	NR	*Bufo arenarum*	Adult (90-95g)	20±2	Injections (lymph sac)	96	7	12	1180 (922-1510)	Basis of LD50 data not clear (test material not defined).	Juarez and Guzman (1988)
Propoxur	97	NR	*Rana catesbeiana*	NR	NR	Oral (capsule)	336	NR	NR	595 (500-707)	Basis of LD50 value unclear, assume active ingredient based on purity. Based on data for 8 males. Toxicity to 4-6 months old mallard 9.44-11.9mg/kg. Toxicity to 20 months old Japanese quail 28.3mg/kg.	Hudson et al (1984)
Pyrethrins	NR	Tech.	*Rana pipiens pipiens*	Adult (20-30g)	20	SC	24	NR	NR	5.8 (4.9-7.0)	Assumed data based on active ingredient. Animals per dose level not defined but 28-34 total used.	Cole and Casida (1983)
Resmethrin [(1RS)-cis-isomer]	NR	Tech.	*Rana pipiens pipiens*	Adult (20-30g)	20	SC	24	NR	NR	1.3 (1.0-1.6)	Assumed data based on active ingredient. Animals per dose level not defined but 28-34 total used.	Cole and Casida (1983)
Resmethrin [(1RS)-cis-isomer]	NR	Tech.	*Rana catesbeiana*	Tad. (10-15g)	20	IP	24	NR	NR	1.2 (0.83-1.6)	Assumed data based on active ingredient. Animals per dose level not defined but 32-45 total used.	Cole and Casida (1983)
Resmethrin [(1RS)-trans-isomer]	NR	Tech.	*Rana pipiens pipiens*	Adult (20-30g)	20	SC	24	NR	NR	>60	Assumed data based on active ingredient. Animals per dose level not defined but 28-34 total used.	Cole and Casida (1983)
Resmethrin [(1RS)-trans-isomer]	NR	Tech.	*Rana catesbeiana*	Tad. (10-15g)	20	IP	24	NR	NR)	5.6 (3.6-8.8)	Assumed data based on active ingredient. Animals per dose level not defined but 32-45 total used.	Cole and Casida (1983)

Pesticide	% a.i.	Test mate-rial	Species	Stage	Temp. °C	Exposure type	Dur. (h)	Dose levels	Anim. /dose	LD50 (mg/kg) (95% CL)	Comments	Reference
S-Bioallethrin	NR	Tech.	*Rana pipiens pipiens*	Adult (20-30g)	20	SC	24	NR	NR	1.7 (1.3-2.4)	Assumed data based on active ingredient. Animals per dose level not defined but 28-34 total used.	Cole and Casida (1983)
Sodium fluoroacetate	NR	NR)	*Rana pipiens*	Adult	NR	SC	NR	NR	NR	25	Test material not defined but likely to be technical given nature of data reported	Chenoweth (1949)
Sodium fluoroacetate	≥90	NR	*Rana catesbeiana*	NR	NR	Oral (capsule)	336	NR	NR	54.4 (25.6-115)	Basis of LD50 value unclear, assume active ingredient based on purity. Based on data for 12 males. Toxicity to mallard 5.97-9.11 mg/kg. Toxicity to 3 months old Japanese quail 12.8mg/kg.	Hudson et al (1984)
Sodium fluoroacetate	92/95.8	Form./Tech.	*Limnodynastes tasmaniensis*	Adult (4.6g)	12-20	IP	NR	≥4	NR	c. 60	Only approximate estimate based on testing 7 animals. No duration for observations but mortalities occurred between 36.8h and 98.3h.	McIlroy et al (1985)
Sodium monofluoroacetate	NR	NR	*Xenopus laevis*	Adult	NR	SC/IP	NR	NR	NR	>500	Test material not defined but likely to be technical given nature of data reported	Chenoweth (1949)
Sodium monofluoroacetate	NR	NR	*Rana pipiens*	Adult	NR	SC	NR	NR	NR	150	Test material not defined but likely to be technical given nature of data reported	Chenoweth (1949)

Pesticide	% a.i.	Test mate-rial	Species	Stage	Temp. °C	Exposure type	Dur. (h)	Dose levels	Anim. /dose	LD50 (mg/kg) (95% CL)	Comments	Reference
Strychnine	98	NR	*Rana catesbeiana*	NR	NR	Oral (capsule)	336	NR	NR	2.21 (1.56-3.12)	Basis of LD50 value unclear, assume active ingredient based on purity. Based on data for 4 males. Toxicity to mallard 2.00-5.88mg/kg. Toxicity to 2 months old Japanese quail 22.6mg/kg.	Hudson et al (1984)
Temephos	92	NR	*Rana catesbeiana*	NR	NR	Oral (capsule)	336	NR	NR	>2000	Basis of LD50 value unclear, assume active ingredient based on purity. Based on data for 3 females. Toxicity to 4-7 months old mallard >2240mg/kg. Toxicity to 2 months old Japanese quail 84.1mg/kg.	Hudson et al (1984)
TEPA	72.5	NR	*Rana catesbeiana*	NR	NR	Oral (capsule)	336	NR	NR	500 (250-1000)	Basis of LD50 value unclear. Based on data for 8 males. Toxicity to 3-4 months old mallard 8.54mg/kg. Toxicity to 2 months old Japanese quail >20.0mg/kg.	Hudson et al (1984)
TEPP	NR	Tech.	*Bufo viridis*	Adult (18-45g)	25	Injection (dorsal lymph sac)	NR	NR	NR	540	Data appears to be for active ingredient. Minimum 25 animals. Toxicity to white mice was 0.52mg/kg (subcutaneous).	Edery and Schatzberg-Porath (1960)
TEPP	NR	Tech.	*Rana ridibunda*	Adult (18-45g)	25	Injection (dorsal lymph sac)	NR	NR	NR	34	Data appears to be for active ingredient. Minimum 25 animals. Toxicity to white mice was 0.52mg/kg (subcutaneous).	Edery and Schatzberg-Porath (1960)

Pesticide	% a.i.	Test mate-rial	Species	Stage	Temp. °C	Exposure type	Dur. (h)	Dose levels	Anim. /dose	LD50 (mg/kg) (95% CL)	Comments	Reference
TEPP	40	NR	*Rana catesbeiana*	NR	NR	Oral (capsule)	336	NR	NR	112 (70.7-178)	Basis of LD50 value unclear. Based on data for 9 females. Test material contains 40% TEPP, 60% other ethyl phosphates. Toxicity to 3-4 months old mallard 3.56.	Hudson et al (1984)
Tetrachlor-vinphos	24	Form.	*Rana temporaria*	Adult females (20-55g)	NR	SC	3	5	11	151	Not clear whether data is for formulation or active ingredient but comparisons with other studies suggests active ingredient.	Gromysz-Kalkowska and Szubartowska (1993a)
Tetrachlor-vinphos	24	Form.	*Rana temporaria*	Adult males (20-55g)	NR	SC	3	5	11	192	Not clear whether data is for formulation or active ingredient but comparisons with other studies suggests active ingredient.	Gromysz-Kalkowska and Szubartowska (1993a)
Tetramethrin [(1R)-cis-isomer]	NR	Tech.	*Rana pipiens pipiens*	Adult (20-30g)	20	SC	24	NR	NR	1.8 (1.2-2.6)	Assumed data based on active ingredient. Animals per dose level not defined but 28-34 total used.	Cole and Casida (1983)
Tetramethrin [(1R)-trans-isomer]	NR	Tech.	*Rana pipiens pipiens*	Adult (20-30g)	20	SC	24	NR	NR	>20	Assumed data based on active ingredient. Animals per dose level not defined but 28-34 total used.	Cole and Casida (1983)
Trichlorfon	NR	NR	*Rana temporaria*	NR	-	-	-	-	-	2040	Data is for females as reported in Gromysz-Kalkowska and Szubartowska (1993). No further details listed.	Szubartowska unpub.

Pesticide	% a.i.	Test mate-rial	Species	Stage	Temp. °C	Exposure type	Dur. (h)	Dose levels	Anim. /dose	LD50 (mg/kg) (95% CL)	Comments	Reference
Trichlorfon	NR	NR	*Rana temporaria*	NR	-	-	-	-	-	2260	Data is for males as reported in Gromysz-Kalkowska and Szubartowska (1993). No further details listed.	Szubartowska unpub.

The limited range and variable quality of the LD50 data retrieved make any comparison with bird and mammal data problematic, except perhaps where they were tested in the same study under the same conditions (Edery and Schatzberg-Porath 1960, Hudson et al. 1984 and Tucker and Crabtree 1969). This information is summarized in Table 13.

Table 13: Comparisons of amphibian, bird and mammal toxicity (LD50 in mg/kg) where they are reported in the same study.

Pesticide	Species	Amphibian	Mallard	Quail	Mouse	Rat	Reference
Carbaryl	*Rana catesbeiana*	>4000	>2564	2290			Hudson et al (1984)
Chlorpyrifos	*Rana catesbeiana*	>400	75.6-112	15.9-17.8			Hudson et al (1984)
DDT	*Rana catesbeiana*	>2000	>2240	841			Hudson et al (1984)
Demeton	*Rana catesbeiana*	562	7.19	8.48			Hudson et al (1984)
DFP	*Bufo viridis*	1450			4.0		Edery and Schatzberg-Porath (1960)
Diazinon	*Rana catesbeiana*	>2000	3.54				Hudson et al (1984)
Dicrotophos	*Rana catesbeiana*	2000	4.24	4.32			Hudson et al (1984)
Dimefox	*Bufo viridis*	1410			4.4		Edery and Schatzberg-Porath (1960)
Mexacarbate	*Rana catesbeiana*	566	2.98-4.20	3.21			Hudson et al (1984)
Mexacarbate	*Rana catesbeiana*	283-800	3.0-4.2	3.21		14.1	Tucker and Crabtree (1969)
Nabam	*Rana catesbeiana*	420	>2560	2120			Hudson et al (1984)
Paraoxon	*Bufo viridis*	188			1.13		Edery and Schatzberg-Porath (1960)
Paraoxon	*Rana ridibunda*	91			1.13		Edery and Schatzberg-Porath (1960)
Parathion	*Bufo viridis*	967			14.0		Edery and Schatzberg-Porath (1960)
Phorate	*Rana catesbeiana*	85.2	0.616-2.55				Hudson et al (1984)
Phosacetim	*Rana catesbeiana*	>2000	24				Hudson et al (1984)
Propoxur	*Rana catesbeiana*	595	9.44-11.9	28.3			Hudson et al (1984)
Sodium fluoroacetate	*Rana catesbeiana*	54.4	5.97-9.11	12.8			Hudson et al (1984)
Strychnine	*Rana catesbeiana*	2.21	2.00-5.88	22.6			Hudson et al (1984)
Temephos	*Rana catesbeiana*	>2000	>2240	>20			Hudson et al (1984)

Pesticide	Species	Amphibian	Mallard	Quail	Mouse	Rat	Reference
TEPA	*Rana catesbeiana*	500	8.54	>20.0			Hudson et al (1984)
TEPP	*Bufo viridis*	540			0.52		Edery and Schatzberg-Porath (1960)
TEPP	*Rana catesbeiana*	112	3.56				Hudson et al (1984)
TEPP	*Rana ridibunda*	34			0.52		Edery and Schatzberg-Porath (1960)

This data indicates that in most cases amphibians were less sensitive than birds and mammals with the exceptions of tests with nabam and strychnine.

3.3. Conclusions on toxicity data

A large number of toxicity values were found for aquatic stages of amphibians suitable for comparison with fish data. A far smaller body of data was found for toxicity of pesticides to terrestrial phases both in numbers of values and range of compounds making comparisons with bird and mammal data more difficult.

RECOMMENDATIONS

- More research on the fine scale use of agricultural land at the times of greatest exposure risk would help improve predictions of the potential of exposure of amphibians, which species are at greatest risk and which applications present the greatest threat.

- The data on aquatic toxicity identified in the course of the study should be used to refine the use of current aquatic risk assessments if necessary so that they are sufficiently protective of amphibians.

- If risk assessments are to be conducted for terrestrial amphibians, methods must be developed that will estimate the extent of dermal exposure under field conditions. However, estimating dermal exposure and exposure through food will not allow full risk assessment in the absence of reliable amphibian or suitable surrogate toxicity data.

REFERENCES

Abbasi SA and Soni R, 1991. Evaluation of water quality criteria for four common pesticides on the basis of computer-aided studies, Indian Journal of Environmental Health, 33(1), 22-24

Agostini GM, Natale GS and Ronco AE, 2010. Lethal and sublethal effects of cypermethrin to *Hypsiboas pulchellus* tadpoles, Ecotoxicology 19(8), 1545-1550.

Alam MDN, 1989. Toxicity of Metacid and Ekalux to tadpoles of skipper frog *Rana cyanophlyctis,* Journal of Ecobiology 1(3), 163-167.

Alam MN and Shafi M, 1991. Toxicity of two agricultural chemicals Metacid 50 and Ekalux EC 25 to tadpoles of *Rana tigrina*, Environment and Ecology, 9(4), 870-872.

Andreone F and Pavignano I, 1988. Observations on the Breeding Migration of *Pelobates fuscus insubricus* Cornalia 1873 at a Ditch in North Western Italy Amphibia Anura Pelobatidae, Museo Regionale di Scienze Naturali Bollettino 6(1), 241-250.

Andreone F, Dore B, Usai P and Paraninfo A, 1993. Skin morphology in larval, paedomorphic and metamorphosed alpine newts, Triturus alpestris apuanus, Alytes (Paris), 11(1), 25-35.

Andrews MI and George S, 1991. Toxic effects of pesticides on tadpoles of frog *Rana hexadactyla*. Journal of Ecotoxicology and Environmental Monitoring, 1(2), 142-147.

Anguiano OL, Montagna CM, Chifflet de Llamas M, Gauna L, and Pechen de D'Angelo AM, 1994. Comparative toxicity of parathion in early embryos and larvae of the toad, *Bufo arenarum* Hensel, Bulletin of Environmental Contamination and Toxicology, 52(5), 649-655

Arnold N and Ovenden D, 2002, A Field Guide to the Reptiles and amphibians of Britain and Europe, 2nd Edition, Collins, London.

Arntzen JW and Teunis SFM, 1993. A six year study on the population dynamics of the crested newt (*Triturus cristatus*) following the colonization of a newly created pond, Herpetological Journal, 3(3), 99-110.

Aronzon CM, Sandoval MT, Herkovits J and Perez Coll CS, 2011. Stage-dependent toxicity of 2,4-Dichlorophenoxyacetic on the embryonic development of a South American toad, *Rhinella arenarum*, Environmental Toxicology and Chemistry, 26(4), 373-381.

Avery RA, 1968, Food and feeding relations of three species of Triturus (Amphibia Urodela) during the aquatic phases, Oikos, 19(2), 408-412.

Babik W and Rafinski J, 2004. Relationship between morphometric and genetic variation in pure and hybrid populations of the smooth and Montandon's newt (*Triturus vulgaris* and *T. montandoni*), Journal of Zoology (London) 262(2), 135-143.

Bacchetta R, Mantecca P, Andrioletti M, Vismara C and Vailati G, 2008. Axial-skeletal defects caused by carbaryl in *Xenopus laevis* embryos. Science of the Total Environment, 392(1), 110-118.

Baker KN, 1985. Laboratory and field experiments on the response by two species of woodland salamanders to malathion-treated substrates. Archives of Environmental Contamination and Toxicology, 14(6), 685–691.

Barabas K, Szabo L and Matkovics B, 1985. Effects of Gramoxone and cooling on the antioxidant enzymes of frog (*Rana esculenta*). Acta Biolica Hungarica, 36(3-4), 295-300.

Baumann K, 1997. The population ecology of the common spadefoot toad (*Pelobates fuscus* near Leiferde (district Gifhorn, Germany) with special regard to the effect of its artificial relocation into a new breeding-pond, Braunschweiger Naturkundliche Schriften 5(2), 249-267.

Baumgartner C, Bitschi N, Ellinger N, Gollmann B, Gollmann G, Kock M, Lebeth E and Waringer-Loschenkohl A, 1996. [Spawning and embryonic development in syntopic Rana dalmatina Bonaparte, 1840, and Rana temporaria Linnaeus, 1758 (Anura: Ranidae).] Laichablage und Embryonalentwicklung von Springfrosch (Rana dalmatina Bonaparte, 1840) und Grasfrosch (Rana temporaria Linnaeus, 1758) in einem syntopen Vorkommen (Anura: Ranidae), Herpetozoa 9(3-4), 133-150.

Beckmann H, Schneeweiss N and Greulich K, 2003. The green toad (Bufo viridis Laurenti 1768) in an intensively used agricultural landscape of Brandenburg [Die Wechselkrote (Bufo viridis Laurenti, 1768) in einer intensiv genutzten Agrarlandschaft Brandenburgs.]. Mertensiella, 14, 218-228.

Beebee TJC, 1979. A review of scientific information pertaining to the natterjack toad *Bufo calamita* throughout its geographical range, Biological Conservation, 16, 107-134.

Belden J, McMurry S, Smith L and Reilley P, 2010. Acute toxicity of fungicide formulations to amphibians at environmentally relevant concentrations, Environmental Toxicology and Chemistry, 29(11), 2477-2480.

Bender B, 1994. [Body length variation in adult common toads (Bufo bufo) in Bielefeld.] Variation der Korperlange adulter Erdkroten (*Bufo bufo*) in Bielefeld, Bericht des Naturwissenschaftlichen Vereins fuer Bielefeld und Umgegend E: 3-6.

Bender B, 1997. [Large variations in adult common toads of different populations in Bielefeld.] Grossenunterschiede bei adulten Erdkroten verschiedener Populationen in Bielefeld. Bericht des Naturwissenschaftlichen Vereins fuer Bielefeld und Umgegend E: 5-19.

Berger G, Pfeffer H and Schobert H, 2011a. Zeitliches Zusammentreffen von Amphibien mit Maßnahmen der Ackerbewirtschaftung während des Landaufenthaltes der Tiere [Coincidence in time of amphibians on arable land with farming activities]. In: Berger G, Pfeffer H, Kalettka Th [Eds.]. Amphibienschutz in kleingewässerreichen Ackerbaugebieten [Amphibian conservation in small water-rich agricultural areas]: Natur & Text, Ransdorf, 161-190.

Berger G, Pfeffer H, Kachele H, Andreas S and Hoffmann J, 2003. Nature protection in agricultural landscapes by setting aside unproductive areas and ecotones within arable fields ("Infield Nature Protection Spots"), Journal for Nature Conservation, 11(3), 221-233.

Berger G, Pfeffer H, Schütz Ch, Schönbrodt Th, Braun S and Hütz W, 2011b. Raumnutzung von Amphibien im Untersuchungsgebiet Eggersdorf [Space use of amphibians in the study area Eggersdorf]. In: Berger G, Pfeffer H, Kalettka Th [Eds.]. Amphibienschutz in kleingewässerreichen Ackerbaugebieten [Amphibian conservation in small water-rich agricultural areas]: Natur & Text, Ransdorf, 127-160.

Berger G, Schonbrodt T, Langer C and Kretschmer H, 1999. The agricultural landscape of the region Lebusplatte as habitat for amphibians [Die Agrarlandschaft der Lebusplatte als Lebensraum fur Amphibien.]. Rana Sonderheft, 3, 81-99.

Bernabo I, Brunelli E, Berg C, Bonacci A and Tripepi S, 2008. Endosulfan acute toxicity in *Bufo bufo* gills: ultrastructural changes and nitric oxide synthase localization, Aquatic Toxicology, 86(3), 447-456.

Bernabo I, Sperone E, Tripepi S and Brunelli E, 2011. Toxicity of chlorpyrifos to larval *Rana dalmatina*: acute and chronic effects on survival, development, growth and gill apparatus, Archives of Environmental Contamination and Toxicology, 61(4), 704-718.

Bernal MH, Solomon KR and Carrasquilla G, 2009a. Toxicity of formulated glyphosate (Glyphos) and cosmo-flux to larval Colombian frogs 1. Laboratory acute toxicity. (Special Issue: Production of illicit drugs, the environment, and human health), Journal of Toxicology and Environmental Health. Part A, 72(15/16). 961-965.

Bernal MH, Solomon KR and Carrasquilla G, 2009b. Toxicity of formulated glyphosate (Glyphos) and cosmo-flux to larval and juvenile Colombian frogs 2. Field and laboratory microcosm acute toxicity. (Special Issue: Production of illicit drugs, the environment, and human health). Journal of Toxicology and Environmental Health. Part A, 72(15/16), 966-973.

Bernardini G, Spinelli O, Presutti C, Vismara C, Bolzacchini E, Orlandi M and Settimi R, 1996. Evaluation of the developmental toxicity of the pesticide MCPA and its contaminants phenol and chlorocresol, Environmental Toxicology and Chemistry, 15(5), 754-760.

Berroneau M, Detaint M and Coic C, 2007. First results of the telemetry study of Bullfrogs in Gironde (September 2004-June 2005), Bulletin de la Societe Herpetologique de France, 121, 21-33.

Beyer WN, Connor EE and Gerould S, 1994. Estimates of Soil Ingestion by Wildlife. Journal of Wildlife Management, 58, 375-382.

Bidwell JR and Gorrie JR, 1995. Acute toxicity of a herbicide to selected frog species. Final Report., Department of Environmental Protection, Technical Series 79, Perth, Western Australia: 9 p.

Bingol-Ozakpinar O. and Murathanoglu O, 2011. The morphology of the dorsal and ventral skin of Triturus karelinii (Caudata: Salamandridae), Biologia 66(2), 349-356.

Birge WJ and Black JA, 1979. Effects of copper on embryonic and juvenile stages of aquatic animals. In: Nriagu JO (Ed.), Copper in the Environment, J.Wiley and Sons, NY, 373-399.

Birge WJ, 1978. Aquatic toxicology of trace elements of coal and fly ash. In: J.H.Thorp and J.W.Gibbons (Eds.), Department of Energy Symposium Series., Energy and Environmental Stress in Aquatic Systems, Augusta, GA48, 219-240.

Birge WJ, Black JA, Westerman AG and Hudson JE, 1979. The effects of mercury on reproduction of fish and amphibians. In: Nriagu O (Ed.), The Biogeochemistry of Mercury in the Environment, Chapter 23, Elsevier/North-Holland Biomedical Press, 629-655.

Birge WJ, Black JA, Westerman AG and Ramey BA, 1983. Fish and amphibian embryos - a model system for evaluating teratogenicity. Fundamental and Applied Toxicology, 3, 237-242.

Birge WJ, Hudson JE, Black JA and Westerman AG, 1978. Embryo-larval bioassays on inorganic coal elements and in situ biomonitoring of coal-waste effluents. In: Symposium, US.Fish and Wildlife Service., Dec.3-6, 1978, Surface Mining Fish and Wildlife needs in Eastern US, WV, 97-104.

Birge WJ, Westerman AG and Spromberg JA, 2000. Comparative toxicology and risk assessment of amphibians. In: Ecotoxicology of amphibians and reptiles. Sparling DW, Linder G and Bishop CA eds. SETAC Press, Pensacola, 727-791.

Blackith RM and Speight MCD, 1974. Food and feeding habits of the frog *Rana temporaria* in bogland habitats in the West of Ireland, Journal of Zoology, 172(1), 67-79.

Bobka MS, Jaeger RG and Donald C. McNaught DC, 1981. Temperature dependent assimilation efficiencies of two species of terrestrial salamanders, Copeia, 1981(2), 417-421.

Boga A, Binokay S and Sertdemir Y, 2009. The toxicity and teratogenicity of gibberellic acid (GA(3)) based on the frog embryo teratogenesis assay-Xenopus (FETAX). Turkish Journal of Biology, 33(3), 181-188.

Boomsma JJ and Arntzen JW, 1985, Abundance, growth and feeding of natterjack toads (*Bufo calamita*) in a 4-year-old artificial habitat, Journal of Applied Ecology, 22(2), 395-405.

Boone MD and Bridges CM, 1999. The effect of temperature on the potency of carbaryl for survival of tadpoles of the green frog (*Rana clamitans*), Environmental Toxicology and Chemistry, 18(7), 1482-1484.

Bottger A, 1988. Belastung der Anwohner von Chemisch-Reinigungsanlegen durch Tetrachlorethylen. Vortrag: 30

Boyd CE, Vinson SB and Ferguson DD, 1963. Possible DDT resistance in two species of frogs, Copeia, 2, 426–429.

Bracher GA and Bider JR, 1982. Changes in terrestrial animal activity of a forest community after an application of aminocarb (Matacil), Canadian Journal of Zoology 60(8), 1981-1997.

Bridges CM, Dwyer FJ, Hardesty DK, and Whites DW, 2002. Comparative contaminant toxicity: are amphibian larvae more sensitive than fish?. Bulletin of Environmental Contamination and Toxicology, 69(4), 562-569.

Brodeur JC, Svartz G, Perez-Coll CS. Marino DJG and Herkovits J, 2009. Comparative susceptibility to atrazine of three developmental stages of *Rhinella arenarum* and influence on metamorphosis:

Non-monotonous acceleration of the time to climax and delayed tail resorption, Aquatic Toxicology (Amsterdam), 91(2), 161-170.

Brooke L, 1989. Results of freshwater exposures with the chemicals 2,4-D and diazinon to the larval leopard frog (*Rana pipiens*), juvenile fathead minnows (*Pimephales promelas*), larval midge (*Chironomus riparius*) and adult Oligochaete Wo. February 15th Memo to R.Spehar, U.S.EPA, Duluth, MN, 6 p.

Bruhl CA, Pieper S and Weber B, 2011. Amphibians at risk? Susceptibility of terrestrial amphibian life stages to pesticides, Environmental Toxicology and Chemistry, 30(11), 2465-2472.

Budischak SA, Belden LK and Hopkins WA, 2009. Relative toxicity of malathion to trematode-infected and noninfected *Rana palustris* tadpoles, Archives of Environmental Contamination and Toxicology, 56(1), 123-128.

Buerger AA and O'Brien RD, 1965. Penetration of non-electrolytes through animal integuments, Journal of Cellular Physiology, 66(2), 227-233.

Buron MI, Navas P, Garcia-Herdugo G and Morre DJ, 1988. Plasma Membranes from Amphibian Epidermis Subfractionation by Preparative Free-Flow Electrophoresis, Morre, DJ., et al. (Ed.). Progress in Clinical and Biological Research, Vol. 270. Cell-Free Analysis of Membrane Traffic; Conference, Heidelberg, West Germany, October 1-4, 1986. Xx+460p. Alan R. Liss, Inc.: New York, New York, USA. Illus. 69-74.

Cadenovic N and Vukov T, 2007. Morphological traits of common toad *Bufo bufo* (Bufonidae) from Biogradsko Lake, Natura Montenegrina, 101-109.

Candioti JV, Natale GS, Soloneski S, Ronco AE and Larramendy ML, 2010. Sublethal and lethal effects on *Rhinella arenarum* (Anura, Bufonidae) tadpoles exerted by the pirimicarb-containing technical formulation insecticide Aficida[R], Chemosphere,78(3): 249-255.

Capaldo, A, Gay F, De Falco M, Virgilio F, Valiante S, Laforgia V and Varano L, 2006. The newt *Triturus carnifex* as a model for monitoring the ecotoxic impact of the fungicide thiophanate-methyl: adverse effects on the adrenal gland, Comparative Biochemistry and Physiology. C, Toxicology and Pharmacology, 143(1), 86-93.

Carroll EA, Sparks TH, Collinson N and Beebee TJC, 2009. Influence of temperature on the spatial distribution of first spawning dates of the common frog (Rana temporaria) in the UK, Global Change Biology 15(2), 467-473.

Cassano G, Bellantuono V, Ardizzone C and Lippe C, 2003. Pyrethroid stimulation of ion transport across frog skin, Environmental Toxicology and Chemistry, 22(6), 1330-1334.

Cassano G, Bellantuono V, Ardizzone C and Lippe C, 2006. Atrazine increases the sodium absorption in frog (Rana esculenta) skin, Environmental Toxicology and Chemistry, 25(2), 509-513.

Cassano G, Bellantuono V, Quaranta A, Ippolito C, Ardizzone C and Lippe C, 2000. Interaction of pyrethroids with ion transport pathways present in frog skin, Environmental Toxicology and Chemistry, 19(11), 2720-2724.

Chandler JH Jr. and Marking LL, 1982. Toxicity of rotenone to selected aquatic invertebrates and frog larvae, Progressive Fish-Culturist, 44(2), 78-80.

Chandurkar PS, Matsumura F and Ikeda T, 1978. Identification and toxicity of Toxicant AC, a toxic component of toxaphene, Chemosphere, 7(2), 123-130.

Chapparadhalli JS and Kanamadi RD, 1995. Effect of sublethal concentration of mercurial fungicide emisan-(R) on ovary and fat bodies of frog, *Rana cyanophlyctis* (Schn.), Indian Journal of Experimental Biology, 33(6), 466-468.

Chenoweth MB, 1949. Monofluoroacetic acid and related compounds, Journal of Pharmacology and Experimental Therapeutics, 97, 383-424.

Cicort-Lucaciu A.-S, Ardeleanu A, Cupsa D, Naghi N and Dalea A, 2005. The trophic spectrum of a Triturus cristatus (Laurentus 1768) population from Plopis Mountains area (Bihor County, Romania), North-Western Journal of Zoology, 1, 31-39.

Cicort-Lucaciu A-S, A. David A, Lezau O, Pal A and Ovlachi K, 2009. The dynamics of the number of individuals during the breeding period for more *L. vulgaris* and *T. cristatus* populations, Herpetologica Romanica, 1, 19-23.

Cicort-Lucaciu, A.-S., A. David, Covaci R, Toader S and Diaconu I, 2007. Feeding of some *Triturus cristatus* population in Turt area (Oas Mountains, Romania), Herpetologica Romanica, 1, 30-37.

Cogalniceanu D and Miaud C, 2003. Population age structure and growth in four syntopic amphibian species inhabiting a large river floodplain, Canadian Journal of Zoology, 81(6), 1096-1106.

Cogalniceanu D, Aioanei F, Ciubuc C and Vadineanu A, 1998. Food and feeding habits in a population of common spadefoot toads (Pelobates fuscus) from an island in the lower Danube floodplain, Alytes (Paris), 15(4), 145-157.

Cogalniceanu D, Cristofor S and Vadineanu A, 1997. The dynamics of amphibian communities on two islands of the lower Danube floodplain. Preliminary results. Herpetologia Bonnensis. W. Bohme, W. Bischoff and T. Ziegler. 23-27 August 1995, Bonn, Germany. Societas Europaea Herpetologica, Bonn, Proceedings of the 8th Ordinary General Meeting of the Societas Europaea Herpetologica, 71-80.

Cogalniceanu D, Palmer MW and Constantin C, 2000. Feeding in anuran communities on islands in the Danube floodplain, Amphibia-Reptilia, 22, 1-19.

Cole LM and Casida JE, 1983. Pyrethroid toxicology in the frog. Pesticide Biochemistry and Physiology, 20, 217-224.

Cooke A. 1986. The warty newt Triturus cristatus at Shillow Hill: ranging on arable land. Huntingdonshire Fauna and Flora Society Annual Report 38, 40-44.

Cornish CA, R. S. Oldham RS, Bullock DJ and Bullock JA, 1995.Comparison of the diet of adult toads *(Bufo bufo* L.) with pitfall trap catches, Herpetological Journal, 5, 236-238.

Covaciu-Marcov SD, Alfred Ş. Cicort-Lucaciu AS, Mitrea I, Sas I, Căuş AV and Cupşa D, 2010. Feeding of three syntopic newt species (*Triturus cristatus*, *Mesotriton alpestris* and *Lissotriton vulgaris*) from Western Romania, North-Western Journal of Zoology, 6(1), 95-108.

Czyzewska K, Kontek M and Knapowski J, 1983. Monocrotophos effect on the bioelectric parameters of rabbit intestine and frog skin, Acta Physiologica Polonica 34(1), 111-116.

David A, Ferenţi S, Hodişan O, Horia B-V1 and Gale O, 2009a. The food analysis of a *Triturus cristatus* population near Igneşti locality, Arad County, Romania, Herpetologica Romanica, 3, 47-52.

David A, Lezau O, Sas I, Mosu AG, Puskás A, 2009b. The trophic spectrum of a *Hyla arborea* population from the Foieni area, Satu Mare County, Romania, Muzeul Olteniei Craiova. Oltenia. Studii si comunicari. stiintele Naturii, Tom. XXV/2009, 180-186.

Dawson DA, Fort DJ, Smith GJ, Newell DL and Bantle JA, 1988. Evaluation of the developmental toxicity of nicotine and cotinine with Frog Embryo Teratogenesis Assay: Xenopus, Teratogenesis Carcinogenesis and Mutagenesis, 8(6), 329-338.

Dawson DA, Schultz TW and Hunter RS, 1996. Developmental toxicity of carboxylic acids to *Xenopus* embryos: a quantitative structure-activity relationship and computer-automated structure, Teratogenesis Carcinogenesis and Mutagenesis, 16, 109-124.

De Zwart D and Slooff W, 1987. Toxicity of mixtures of heavy metals and petrochemicals to *Xenopus laevis*, Bulletin of Environmental Contamination and Toxicology, 38, 345-351.

Denton, J. S. and T. J. C. Beebee, 1993. Density-related features of natterjack toad (Bufo calamita) populations in Britain, Journal of Zoology (London), 229(1): 105-119.

Deshmukh PB and Keshavan R, 1984. Acute toxicity of DDT and sevin to the bullfrog, *Rana tigrina*, Journal of Current Biosciences, 1(4), 141-145.

Diaz-Paniagua C, 1988. Temporal segregation in larval amphibian communities in temporary ponds at a locality in SW Spain, Amphibia Reptilia**,** 9(1), 15-26.

Dimancea N and Covaciu Marcov SD, 2009, The trophic spectrum of a *Bufo bufo* population (Amphibia) from Iezer Mountain, Argeş County, Romania, University of Craiova Vol. XIV (XLX), 469-474.

Dimmitt MA and Ruibal R, 1980. Exploitation of food resources by spadefoot toads (Scaphiopus), Copeia, 1980(4), 854-862.

Dinehart SK, Smith LM, McMurry ST, Smith PN, Anderson TA and Haukos DA, 2010. Acute and chronic toxicity of Roundup Weathermax (R) and Ignite (R) 280 SL to larval *Spea multiplicata* and *S. bombifrons* from the Southern High Plains, USA, Environmental Pollution 158(8), 2610-2617.

Dürr S, Berger G and und Kretschmer H, 1999. Effekte acker- und pflanzenbaulicher Bewirtschaftung auf Amphibien und Empfehlungen für die Bewirtschaftung in Amphibien-Reproduktionszentren [Effects of cultivation methods on amphibians and recommendations for the management of amphibian-reproduction centers], Rana Sonderheft, 3, 101-116.

Dwyer FJ, Hardesty DK, Henke CE, Ingersoll CG, Whites DW, Mount DR and Bridges CM, 1999. Assessing Contaminant Sensitivity of Endangered and Threatened Species: Toxicant Classes. EPA 600/R-99/098, U.S.EPA, Washington, D.C., 15 p.

Dwyer FJ, Mayer FL, Sappington LC, Buckler DR, Bridges CM, Greer IE, Hardesty DK, Henke CE, and Ingers CG, 2005. Assessing contaminant sensitivity of endangered and threatened aquatic species: Part I. Acute toxicity of five chemicals, Archives of Environmental Contamination and Toxicology, 48(2), 143-154.

Edery H and Schatzberg-Porath G, 1960. Studies on the effect of organophosphorus insecticides on amphibians, Archives Internationales de Pharmacodynamie et de Therapie, 124, 212-224.

Edginton AN, Sheridan PM, Stephenson GR, Thompson DG and Boermans HJ, 2004a. Comparative effects of pH and Vision herbicide on two life stages of four anuran amphibian species, Environmental Toxicology and Chemistry, 23(4), 815-822.

Edginton AN, Sheridan PM, Boermans HJ, Thompson DG, Holt JD and Stephenson GR, 2004b. A comparison of two factorial designs, a complete 3x3 factorial and a central composite rotatable design, for use in binomial response experiments in aquatic toxicology, Archives of Environmental Contamination and Toxicology, 46(2), 216-223.

Edginton AN, Stephenson GR, Sheridan PM, Thompson DG, and Boermans HJ, 2003. Effect of pH and Release on two life stages of four anuran amphibians, Environmental Toxicology and Chemistry, 22(11), 2673-2678.

Edmisten GE and Bantle JA, 1982. Use of *Xenopus laevis* larvae in 96-hour, flow-through toxicity tests with naphthalene, Bulletin of Environmental Contamination and Toxicology, 29, 392-399.

EFSA, 2009. Guidance Document on Risk Assessment for Birds & Mammals on request from EFSA. EFSA Journal 2009; 7(12):1438.

Egea-Serrano A, Tejedo M and Torralva, Mar, 2008. Analysis of the avoidance of nitrogen fertilizers in the water column by juvenile Iberian water frog, *Pelophylax perezi* (Seoane, 1885), in laboratory conditions, Bulletin of Environmental Contamination and Toxicology, 80(2), 178-183.

Elliott-Feeley E and Armstrong JB, 1982. Effects of fenitrothion and carbaryl on *Xenopus laevis* development, Toxicology, 22(2), 319-335.

Elmberg J, 1990. Long-term survival length of breeding season and operational sex ratio in a boreal population of common frogs *Rana temporaria* L., Canadian Journal of Zoology 68(1), 121-127.

Elmberg J, 1991. Factors affecting male yearly mating success in the common frog *Rana temporaria*." Behavioral Ecology & Sociobiology 28(2): 125-132.

El-Merhibi A, Kumar A and Smeaton T, 2004. Role of piperonyl butoxide in the toxicity of chlorpyrifos to *Ceriodaphnia dubia* and *Xenopus laevis*, Ecotoxicology and Environmental Safety, 57(2), 202-212.

El-Shazly MM and El-Sharnoubi ED, 2000. Toxicity of a neem (*Azadirachta indica*) insecticide to certain aquatic organisms, Journal of the Egyptian Society of Parasitology, 30(1), 221-231.

Ezemonye LIN and Ilechie I, 2007. Acute and chronic effects of organophosphate pesticides (Basudin) to amphibian tadpoles (*Ptychadena bibroni*), African Journal of Biotechnology, 6(13), 1554-1558.

Ezemonye LIN and Tongo I, 2009. Lethal and sublethal effects of atrazine to amphibian larvae, Jordan Journal of Biological Sciences 2(1), 29-36.

Farringer JE, 1972. The determination of the acute toxicity of rotenone and Bayer 73 to selected aquatic organisms. M.S.Thesis, University of Wisconsin-LaCrosse, WI, 32 p.

Fasola M and Canova L, 1992. Residence in water by the newts *Triturus vulgaris*, *Triturus cristatus* and *Triturus alpestris* in a pond in northern Italy, Amphibia Reptilia, 13(3), 227-233.

Feder ME and Burggren WW, 1992. Environmental Physiology of the Amphibians. University of Chicago Press, London.

Feng S, Kong Z, Wang X, Zhao L and Peng P, 2004. Acute toxicity and genotoxicity of two novel pesticides on amphibian, *Rana* N. *Hallowell*, Chemosphere, 56(5), 457-463.

Fenoglio C, Grosso A, Boncompagni E, Gandini C, Milanesi G and Barni S, 2009. Exposure to heptachlor: Evaluation of the effects on the larval and adult epidermis of Rana kl. esculenta, Aquatic Toxicology 91(2), 151-160.

Ferguson DE and Gilbert CC, 1967. Tolerances of three species of anuran amphibians to five chlorinated hydrocarbon insecticides, J.Miss.Acad.Sci., 13, 135-138.

Ferrari A, Anguiano OL, Soleno J, Venturino A and Pechen de D'Angelo AM, 2004. Different susceptibility of two aquatic vertebrates (*Oncorhynchus mykiss* and *Bufo arenarum*) to azinphos methyl and carbaryl, Comparative Biochemistry and Physiology. C, Toxicology and Pharmacology,139(4), 239-243.

Ferreira CM, Lombardi JV, Machado Neto JG, Bueno-Guimaraes HM, Soares SRC and Saldiva PHN, 2004. Effects of copper oxychloride in Rana catesbeiana tadpoles: toxicological and bioaccumulative aspects, Bulletin of Environmental Contamination and Toxicology, 73(3), 465-470.

Fort DJ and Stover EL, 1996. Effect of low-level copper and pentachlorophenol exposure on various early life stages of *Xenopus laevis*, In: D.A.Bengtson and D.S.Henshel (Eds.), Environmental

Toxicology and Risk Assessment: Biomarkers and Risk Assessment, 5th Volume, ASTM STP 1306, Philadelphia, PA, 188-203.

Fort DJ, Rogers R, Copley H, Bruning L, Stover EL and Rapaport D, 1999a. Effect of sulfometuron methyl and nicrosulfuron on development and metamorphosis in *Xenopus laevis*: Impact of purity, Environmental Toxicology and Chemistry, 18(12), 2934-2940.

Fort DJ, Rogers RL, Copley HF, Bruning LA, Stover EL, Helgen JC, and Burkhart JG, 1999b. Progress toward identifying causes of maldevelopment induced in *Xenopus* by pond water and sediment extracts from Minnesota, USA, Environmental Toxicology and Chemistry, 18(10), 2316-2324.

Fort DJ, Rogers RL, Thomas JH, Buzzard BO, Noll AM and Spaulding CD, 2004. Comparative sensitivity of *Xenopus tropicalis* and *Xenopus laevis* as test species for the FETAX model, Journal of Applied Toxicology, 24(6), 443-457.

Fort DJ, Stover EL and Bantle JA, 1996. Integrated ecological hazard assessment of waste site soil extracts using FETAX and short-term fathead minnow teratogenesis assay. In: La Point TW, Price FT, and Little EE.(Eds.), Environmental Toxicology and Risk Assessment, 4th Volume, ASTM STP 1262, Philadelphia, PA, 93-109.

Fort DJ, Stover EL, Rayburn JR, Hull M, and Bantle JA, 1993. Evaluation of the developmental toxicity of trichloroethylene and detoxification metabolites using *Xenopus*, Teratogenesis Carcinogenesis and Mutagenesis, 13(1), 35-45.

Francillon-Viellot H, Arntzen JW and Geraudie J, 1990. Age growth and longevity of sympatric Triturus cristatus Triturus marmoratus and their hybrids Amphibia Urodela a skeletochronological comparison, Journal of Herpetology, 24(1), 13-22.

Francis-Floyd R, Gildea J, Reed P and Klinger R, 1997. Use of Bayluscide (Bayer 73) for snail control in fish ponds, Journal of Aquatic Animal Health 9(1), 41-48.

Frazer JFD, 1966. A breeding colony of toads *Bufo bufo* L. in Kent. British Journal of Herpetology, 3, 236-252.

Frazer JFD, 1983 Reptiles and Amphibians in Britain. Bloomsbury Books, London.

Friedl TWP and Klump GM, 1997. Some aspects of population biology in the European treefrog, *Hyla arborea*, Herpetologica 53(3), 321-330.

Friedl TWP and Klump GM, 2005. Sexual selection in the lek-breeding European treefrog: body size, chorus attendance, random mating and good genes, Animal Behaviour 70(5), 1141-1154.

Froese JMW, Smits JEG, Forsyth DJ and Wickstrom ML, 2009. Toxicity and immune system effects of dietary deltamethrin exposure in tiger salamanders (*Ambystoma tigrinum*), Journal of Toxicology and Environmental Health. Part A, 72(8), 518-526.

Fryday S and Thompson H, 2009. Literature reviews on ecotoxicology of chemicals with a special focus on plant protection products. Lot 1. Exposure of reptiles to plant protection products. EFSA (CFT/EFSA/PPR/2008/01).

Gaglione CM, O'Meara EM, Pence KL, Petterson AC, Smith GR and Rettig JE, 2011. Red-backed Salamander, Plethodon cinereus (Green, 1818): avoidance of urea. Herpetology Notes, 275-277.

Garcia-Munoz E, Guerrero F and Parra G, 2009. Effects of copper sulfate on growth, development, and escape behavior in *Epidalea calamita* embryos and larvae, Archives of Environmental Contamination and Toxicology, 56(3), 557-565.

Garcia-Munoz E, Guerrero F and Parra G, 2010. Intraspecific and interspecific tolerance to copper sulphate in five iberian amphibian species at two developmental stages. Archives of Environmental Contamination and Toxicology, 59(2), 312-321.

Gasc JP, Cabela A, Crnobrnja-Isailovic J, Dolmen D, Grossenbacher K, Haffner P, Lescure J, Martens H, Martínez Rica J.P, Maurin H, Oliveira M.E, Sofianidou T.S, Veith M and Zuiderwijk A, (eds), 1997. Atlas of amphibians and reptiles in Europe, Collection Patrimoines Naturels, 29, Societas Europaea Herpetologica, Muséum National d'Histoire Naturelle & Service du Patrimoine Naturel, Paris, 496 pp.

Gatten RE Jr,Miller K and Full RJ, 1992. Energetics at rest and during locomotion. In: Feder ME and Burggren WW Eds. Environmental Physiology of the Amphibians. University of Chicago Press, London. 314-377.

Geen GH, McKeown BA, WatsonTA and Parker DB, 1984. Effects of acephate (Orthene) on development and survival of the salamander, *Ambystoma gracile* (Baird), Journal of Environmental Science and Health Part B-Pesticides Food Contaminants and Agricultural Wastes, 19(2), 157-170.

Geng BR, Yao D and Xue QQ, 2005. Acute toxicity of the pesticide dichlorvos and the herbicide butachlor to tadpoles of four anuran species. Bulletin of Environmental Contamination and Toxicology, 75(2), 343-349.

Gertzog BJ, Kaplan LJ, Nichols D, Smith GR and Rettig JE, 2011. Avoidance of three herbicide formulations by eastern red-backed salamanders (*Plethodon cinereus*), Herpetological Conservation and Biology 6(2), 237-241.

Ghate HV and Mulherkar L, 1980. Effect of mercuric chloride on embryonic development of the frog *Microhyla ornata*, Indian Journal of Experimental Biology, 18(10), 1094-1096.

Gittins SP, 1987. The diet of the common toad (Bufo bufo) around a pond in Wales, Amphibia-Reptilia, 8, 13-17.

Gittins SP, Parker AG and Slater FM, 1980, Population Characteristics of the Common Toad (Bufo bufo) Visiting a Breeding Site in Mid-Wales, Journal of Animal Ecology, 49(1), 161-173.

Gopal K, Khanna RN, Anand M, and Gupta GSD, 1981. The acute toxicity of endosulfan to fresh-water organisms, Toxicology Letters, 7, 453-456.

Gosa A and Vignes JC, 2000. Twenty four hours in the common frog postmetamorphic diet (*Rana temporaria*) [Veinticuatro horas en la dieta de los metamorfoseados de la rana bermeja (*Rana temporaria*).], Revista Espanola de Herpetologia 14, 5-18.

Grafe TU, Schmuck R and Linsenmair KE, 1992. Reproductive energetics of the African reed frogs, Hyperolius viridiflavus and Hyperoliusmarmoratus, Physiological Zoology, 65(1), 153-171.

Greulich K and Pflugmacher S, 2002. Untersuchungen zur Wasserqualitaet eines Reproduktionsgewaessers von Amphibien. [Investigations on the water quality of a reproduction pond of amphibians.], Herpetofauna (Weinstadt) 24(141), 5-10.

Gromysz-Kalkowska K and Szubartowska E, 1993a. Toxicity of tetrachlorvinfos to *Rana temporaria* L., Comparative Biochemistry and Physiology. C, Comparative Pharmacology and Toxicology, 105(2), 285-290.

Gromysz-Kalkowska K and Szubartowska E, 1993b. Evaluation of fenitrothion toxicity to *Rana temporaria* L., Bulletin of Environmental Contamination and Toxicology, 50(1), 116-124.

Grosse W-R, 1998. Wanderungen der Juvenes und Rufe des Laubfrosches *(Hyla arborea* L.) (Anura: Hylidae) im Herbst [Migrations of juveniles and calls of the European tree frog (Hyla arborea (L.)) (Anura: Hylidae) in autumn], Salamandra 34(4), 309-322.

Grossenbacher K, 2002. First results of a 20-year-study on common toad Bufo bufo in the Swiss Alps, Biota (Race) 3(1-2), 43-48.

Hachtel M, Ortmann D, Kupfer A, Sander U, Schmidt P and Weddeling K, 2005. Return rates and long-term capture history of amphibians in an agricultural landscape near Bonn (Germany), Russian Journal of Herpetology 12(Supplement), 146-149.

Hall RJ and Kolbe E, 1980. Bioconcentration of organophosphorus pesticides to hazardous levels by amphibians, Journal of Toxicology and Environmental Health, 6(4), 853-860.

Halsey LG and White CR, 2010. Measuring energetics and behaviour using accelerometry in cane toads *Bufo marinus*. PLoS ONE 5(4):1-8.

Harri MNE, Laitinen J and Valkama EL, 1979. Toxicity and retention of DDT in adult frogs *Rana temporaria* L., Environmental Pollution, 20, 45-55.

Harris ML, Bishop CA, Struger J, Ripley B and Bogart JP, 1998. The functional integrity of northern leopard frog (*Rana pipiens*) and green frog (*Rana clamitans*) populations in orchard wetlands. II. Effects of pesticides and eutrophic conditions on early life stage development, Environmental Toxicology and Chemistry, 17(7), 1351-1363.

Harris ML, Chora L, Bishop CA and Bogart JP, 2000. Species- and age related differences in susceptibility to pesticide exposure for two amphibians, *Rana pipiens*, and *Bufo americanus*, Bulletin of Environmental Contamination and Toxicology, 64, 263-270.

Hartel T and Demeter L, 2005. The breeding migration and population characteristics of a common toad (Bufo bufo, Linnaeus 1758) population visiting a seminatural pond in Sighisoara, Transylvanian Review of Systematical and Ecological Research, 2, 145-154.

Hartel T, 2005. Aspects of breeding activity of *Rana dalmatina* and *Rana temporaria* reproducing in a seminatural pond, North-Western Journal of Zoology 1, 5-13.

Hashimoto Y and Nishiuchi Y, 1981. Establishment of bioassay methods for the evaluation of acute toxicity of pesticides to aquatic organisms, Journal of Pesticide Science, 6(2), 257-264.

Hatch, A. C., L. K. Belden, Scheessele Erin and Blaustein AR, 2001. Juvenile amphibians do not avoid potentially lethal levels of urea on soil substrate. Environmental Toxicology and Chemistry 20(10), 2328-2335.

Hattori K, 1974, Toxicity of difenphos (Abate) in the amphibia. Rep.Hokkaido Inst.Public Health /Hokkaidoritsu Eisei Kenkyusho-ho24, 152-153.

Hels T and Buchwald E, 2001. The effect of road kills on amphibian populations, Biological Conservation, 99(3), 331-340.

Henson-Ramsey H, Kennedy-Stoskopf S, Levine JF, Taylor SK, Shea D and Stoskopf MK, 2008. Acute toxicity and tissue distributions of malathion in Ambystoma tigrinum, Archives of Environmental Contamination and Toxicology 55(3), 481-487.

Hodisan OI, Benchiş A, Gabrian D, Badar L and Toader S, 2010, The trophic spectrum of two brown frog populations *(Rana dalmatina* and *Rana temporaria*) from Baia de Fier area, Romania, Herpetologica Romanica, 4, 7-16.

Hofer R and Lackner R, 2006. Nutritional status of tadpole populations of *Rana temporaria* in the Central Alps (Austria), Berichte des Naturwissenschaftlich Medizinischen Vereins in Innsbruck, 93, 147-159.

Hoffman J, 2006. Interpopulation differences in water-seeking behaviour in the green toad Bufo viridis, Herpetological Journal, 16(1), 47-53.

Hoglund J and Robertson JGM, 1987. Random mating by size in a population of common toads *Bufo bufo*, Amphibia Reptilia, 8(4), 321-330.

Holcombe GW, Phipps GL, Sulaiman AH and Hoffman AD, 1987. Simultaneous multiple species testing: acute toxicity of 13 chemicals to 12 diverse freshwater amphibian, fish, and invertebrate families. Archives of Environmental Contamination and Toxicology, 16, 697-710.

Hooftman RN, Adema DMM, and Kauffman-Van Bommel J, 1989. Developing a set of test methods for the toxicological analysis of the pollution degree of waterbottoms. Rep.No.16105, Netherlands Organization for Applied Scientific Research, 68 p.

Howe CM, Berrill M, Pauli BD, Helbing CC, Werry K and Veldhoen N, 2004. Toxicity of glyphosate-based pesticides to four North American frog species. Environmental Toxicology and Chemistry, 23(8),1928-1938.

Howe GE, Gillis R and Mowbray RC, 1998. Effect of chemical synergy and larval stage on the toxicity of atrazine and alachlor to amphibian larvae, Environmental Toxicology and Chemistry, 17(3),519-525.

Hudson RH, Tucker RK and Haegele MA, 1984. Handbook of Toxicity of Pesticides to Wildlife. Resource Publication 153, Fish and Wildlife Service, U.S. Department of the Interior, 90 p.

Huste, A, Clobert J and Miaud C, 2006. The movements and breeding site fidelity of the natterjack toad (Bufo calamita) in an urban park near Paris (France) with management recommendations, Amphibia-Reptilia, 27(4), 561-568.

Hutchinson VH, Whitford WG and Kohl M, 1968. Relation of body size and surface area to gas exchange in anurans. Physiological Zoology 41, 65-85.

Idehara S, Tsurumi S and Kamishima Y, 2000. Effects of an endocrine disrupter on the cutaneous water absorption of Japanese tree-frogs, Zoological Science 17(Supplement), 55.

Indra N, Karpagaganapathy PR, Meenakshi V and Vijayalakshmi S, 1997. Changes in the behaviour and oxygen consumption of the frog exposed to median lethal dose of phosphamidon. Journal of Ecotoxicology and Environmental Monitoring, 7(4), 233-236.

Izaguirre MF, Lajmanovich RC, Peltzer PM, Soler AP, and Casco VH, 2000. Cypermethrin-induced apoptosis in the telencephalon of *Physalaemus biligonigerus* tadpoles (Anura: Leptodactylidae), Bulletin of Environmental Contamination and Toxicology, 65(4), 501-507.

Jakubowski M, 1989. Skin Vascularization in Fishes Compared with That in Amphibians. Splechtna, H. and Hilgers H (Ed.). Fortschritte Der Zoologie, Band 35. Trends in Vertebrate Morphology; (Progress in Zoology, Vol. 35. Trends in Vertebrate Morphology; 2nd International Symposium, Vienna, Austria, 1986). Xxxii+647p. Gustav Fischer Verlag: Stuttgart, West Germany; New York, New York, USA. Illus. 542-545.

Jayakumar K and Kandeepan C, 2009. Effect of pesticides on growth and oxygen consumption in the tadpoles of *Bufo bufo*, Journal of Ecobiology, 25(2), 111-119.

Jayaprakash I and Madhyastha MN, 1989. Toxicity of Bordeaux mixture to the tadpoles of frog *Microhyla ornata*, Environment and Ecology, 7(2), 514-516.

Jayawardena UA, Navaratne AN, Amerasinghe PH and Rajakaruna RS, 2011. Acute and chronic toxicity of four commonly used agricultural pesticides on the Asian common toad, *Bufo melanostictus* Schneider, Journal of the National Science Foundation of Sri Lanka 39(3), 267-276.

Jayawardena UA, Rajakaruna RS, Navaratne AN and Amerasinghe PH, 2010. Toxicity of agrochemicals to common hourglass tree frog (*Polypedates cruciger*) in acute and chronic exposure, International Journal of Agriculture and Biology, 12(5), 641-648.

Jehle R and Arntzen JW, 2000. Post-breeding migrations of newts (*Triturus cristatus and T. marmoratus*) with contrasting ecological requirements, Journal of Zoology, 251(3), 297-306.

Johnson CR, 1976. Herbicide toxicities in some Australian anurans and the effect of subacute dosages on temperature tolerance. Zoological Journal of the Linnean Society, 59(1), 79-83.

Johnson MS, Paulus HI, Salice CJ, Checkai RT and Simini M, 2004. Toxicologic and histopathologic response of the terrestrial salamander Plethodon cinereus to soil exposures of 1,3,5-trinitrohexahydro-1,3,5-triazine, Archives of Environmental Contamination and Toxicology, 47(4), 496-501.

Johnson MS, Suski J and Bazar MA, 2007. Toxicological responses of red-backed salamanders (Plethodon cinereus) to subchronic soil exposures of 2,4-dinitrotoluene, Environmental Pollution, 147(3), 604-608.

Jolly AL Jr., Avault JW Jr, Koonce KL and Graves JB, 1978a. Acute toxicity of permethrin to several aquatic animals. Transactions of the American Fisheries Society, 107(6), 825-827.

Jolly AL, Graves JB, Avault JW and Koonce KL, 1978b. Effects of a new insecticide on aquatic animals, Louisiana Agriculture, 21(2), 3,16.

Joly P, 1991. Variation in size and fecundity between neighbouring populations in the common frog *Rana temporaria*, Alytes, 9(3), 79-88.

Jones DK, Hammond JI and Relyea RA, 2009. Very highly toxic effects of endosulfan across nine species of tadpoles: lag effects and family-level sensitivity, Environmental Toxicology and Chemistry, 28(9), 1939-1945.

Jones DK, Hammond JI and Relyea RA, 2010. Roundup (R) and amphibians: The importance of concentration, application time, and stratification, Environmental Toxicology and Chemistry, 29(9), 2016-2025.

Jones DK, Hammond JI and Relyea RA, 2011. Competitive stress can make the herbicide Roundup (R) more deadly to larval amphibians. Environmental Toxicology and Chemistry 30(2), 446-454.

Jonsson KI, Herczeg G, O'Hara RB, Soderman F, ter Schure AFH, Larsson P and Merila J, 2009. Sexual patterns of prebreeding energy reserves in the common frog *Rana temporaria* along a latitudinal gradient, Ecography 32(5), 831-839.

Joseph KV and Rao KJ, 1990. Toxic effects of aldrin on histopathology of intestine in the frog *Rana hexadactyla,* Journal of Ecobiology, 2(2), 161-165.

Juarez A and Guzman JA, 1984. Determination of LD-50 of 3 organophosphorus insecticides in *Bufo Arenarum* H., Comunicaciones Biologicas, 2(4), 513.

Juarez AO and Guzman JA, 1988. Acute toxicity of mevinphos parathion and phosphamidon to toad *Bufo Arenarum* H., Comunicaciones Biologicas, 6(3), 259-264.

Kalezic ML, Cvetkovic D, Djorovic A and Dzukic G, 1996. Alternative life-history pathways: Paedomorphosis and adult fitness in European newts (*Triturus vulgaris* and *T. alpestris*), Journal of Zoological Systematics & Evolutionary Research 34(1), 1-7.

Karl S and Grosse W-R, 2010. Comparison of two common toad (Bufo bufo LINNEAUS, 1758) breeding populations in ponds of the Halle (Saale) region (Saxony-Anhalt), Hercynia, 43(2), 319-336.

Kearney M, Phillips BL, Tracy CR, Christian KA, Betts G and Warren P. Porter WP, 2008. Modelling species distributions without using species distributions: the cane toad in Australia under current and future climates, Ecography, 31, 423-434.

Kennedy IJJ., and K. Sampath. 2001. Short-term and long-term survival studies in *Rana tigrina* tadpoles with reference to methyl parathion toxicity, Journal of Environmental Biology, 22(4), 267-271.

Kerby JL, 2006. Pesticide effects on amphibians: A community ecology perspective. Ph.D.Thesis, Univ.of California, Davis, CA, 146 p.

Khangarot BS and Ray PK, 1987. Sensitivity of toad tadpoles, *Bufo melanostictus* (Schneider), to heavy metals, Bulletin of Environmental Contamination and Toxicology, 38(3), 523-527.

Khangarot BS, Mathur S and Durve VS, 1981. Studies on the acute toxicity of copper on selected freshwater organisms, Science and Culture, 47(12), 429-431.

Khangarot BS, Sehgal A and Bhasin MK, 1984. Protective action of chelating agent EDTA on copper and zinc toxicity to frog tadpoles, National Academy Science Letters-India, 7(6), 201-203.

Khangarot BS, Sehgal A and Bhasin MK, 1985a. "Man and Biosphere" - Studies on the Sikkim Himalayas. Part 4: Effects of chelating agent EDTA on the acute toxicity of copper and zinc on tadpoles of the Frog *Rana hexadactyla*, Acta Hydrochimica Et Hydrobiologica, 13(1), 121-125.

Khangarot BS, Sehgal A and Bhasin MK, 1985b. "Man and Biosphere" - Studies on the Sikkim Himalayas. Part 5: Acute toxicity of selected heavy metals on the tadpoles of *Rana hexadactyla*, Acta Hydrochimica Et Hydrobiologica, 13(2): 259-263.

Khangarot BS, Sehgal A and Bhasin MK, 1985c. "Man and Biosphere" - Studies on the Sikkim Himalayas. Part 6: Toxicity of selected pesticides to frog tadpole *Rana hexadactyla* (Lesson), Acta Hydrochimica Et Hydrobiologica, 13(3): 391-394.

King JJ and Wagner RS, 2010. Toxic effects of the herbicide Roundup [R] Regular on Pacific northwestern amphibians, Northwestern Naturalist, 91(3), 318-324.

Koehler A, Sadowska J, Olszewska J, Trzeciak P, Berger-Tal O, and Tracy CR, 2011. Staying warm or moist? Operative temperature and thermal preferences of common frogs (Rana temporaria), and effects on locomotion, Herpetological Journal, 21(1), 17-26.

Kovács E-A, Sas I, Covaciu-Marcov S-D, Hartel T, Cupsa D and Groza M, 2007. Seasonal variation in the diet of a population of *Hyla arborea* from Romania, Amphibia-Reptilia 28, 485-491.

Kovacs I, Bodenciu E, Bodenciu C, Nagy R and Pintea C, 2010a. Data upon the feeding of some newt populations (*Triturus cristatus* and *Lissotriton vulgaris*) from Almas-Agrij Depression, Salaj County, Romania, South-Western Journal of Horticulture Biology and Environment, 1(1), 29-55.

Kovács I, David A, Ferenti S, and Dimancea N, 2010b. The food composition of two brown frog populations *(Rana dalmatina* and *Rana temporaria*) from S_laj County, Romania, Biharean Biologist, 4(1), 7-14.

Kovar, R. and Brabec M, 2007. Reproduction strategy of Bufo bufo (Amphibia: Anura) in the Strnady breeding pond, Czech Republic, Acta Societatis Zoologicae Bohemicae ,71(3-4), 173-192.

Kovar R, Brabec M, Vita R and Bocek R, 2009. Spring migration distances of some Central European amphibian species, Amphibia Reptilia, 30(3), 367-378.

Krishnappa GR and Venkateshwarlu M, 2007. Genotoxic effects of carbaryl on Indian cricket frog Limnonectes limnocharis of Western Ghats, Bioscan 2(1), 15-20.

Kumar S, 1999. Morphological and anatomical alterations in tadpole larvae of frog, *Rana tigrina* Daudin, 1802 due to toxic effect of copper, zinc and lead, Journal of Advanced Zoology 20(2): 90-94.

Kupfer A, 1998. Migration-distances of some crested newts (Triturus cristatus) within an agricultural landscape [Wanderstrecken einzelner Kammolche (Triturus cristatus) in einem Agrarlebensraum.], Zeitschrift fuer Feldherpetologie, 5(1-2), 238-242.

Kuzmin SL, 1997. Feeding of amphibians during metamorphosis, Amphibia-Reptilia, 18(2), 121-131.

Kyriakopoulou-Sklavounou P and Grumiro I, 2002. Body size and age assessment among breeding populations of the tree frog *Hyla arborea* in northern Greece, Amphibia-Reptilia 23(2), 219-224.

La Clair JJ, Bantle JA and Dumont J, 1998. Photoproducts and metabolites of a common insect growth regulator produce developmental deformities in *Xenopus*, Environmental Science and Technology, 32(10), 1453-1461.

Lajmanovich RC, Sandoval MT and Peltzer PM, 2003a. Induction of mortality and malformation in *Scinax nasicus* tadpoles exposed to glyphosate formulations, Bulletin of Environmental Contamination and Toxicology, 70(3), 612-618.

Lajmanovich R, Lorenzatti E, Maitre MI, Enrique S, and Peltzer P, 2003b. Comparative acute toxicity of the commercial herbicides glyphosate to neotropical tadpoles *Scinax nasicus* (Anura: Hylidae), Fresenius Environmental Bulletin, 12(4), 364-367.

Lajmanovich RC, Attademo AM, Peltzer PM, Junges CM and Cabagna MC, 2011. Toxicity of four herbicide formulations with glyphosate on *Rhinella arenarum* (Anura: Bufonidae) tadpoles: B-esterases and glutathione S -transferase inhibitors, Archives of Environmental Contamination and Toxicology, 60(4), 681-689.

Lajmanovich RC, Izaguirre MF and Casco VH, 1998. Paraquat tolerance and alteration of internal gill structure of *Scinax nasica* tadpoles (Anura : Hylidae), Archives of Environmental Contamination and Toxicology, 34, 364-369.

Lande SP and Guttman SI, 1973. The effects of copper sulfate on the growth and mortality rate of *Rana pipiens* tadpoles, Herpetologica, 29(1), 22-27.

Larsen J and Sorensen I, 2004. The effect of esfenvalerate and prochloraz on amphibians with special reference to *Xenopus laevis* and *Bombina bombina*, Bekaempelsesmiddelforskning fra Miljostyrelsen, 1-67.

Larsen J, Sorensen I and Gustavson K, 2004. The effects of selected pyrethroids on embryos of *Bombina bombina* during different culture and semi-field conditions, Bekaempelsesmiddelforskning fra Miljostyrelsen, 1-69.

Larsen LO, 1992. Feeding and digestion. In: ME and Burggren WW Eds. Environmental Physiology of the Amphibians. University of Chicago Press, London. 378-394.

Leskovar C and Sinsch, 2005. Harmonic direction finding: A novel tool to monitor the dispersal of small-sized anurans, Herpetological Journal 15(3), 173-180.

Leskovar C, Oromi N, Sanuy D and Sinsch U, 2006. Demographic life history traits of reproductive natterjack toads (Bufo calamita) vary between northern and southern latitudes, Amphibia-Reptilia 27(3), 365-375.

Li X, Li S,Liu S and Zhu G, 2010. Lethal effect and in vivo genotoxicity of profenofos to Chinese native amphibian (*Rana spinosa*) tadpoles, Archives of Environmental Contamination and Toxicology, 59(3), 478-483.

Linder G, Barbitta J and Kwaiser T, 1990. Short-term amphibian toxicity tests and paraquat toxicity assessment. In: Landis WG and Van der Schalie WH (Eds.), Aquatic Toxicology and Risk Assessment, Vol.13, ASTM STP 1096, Philadelphia, PA, 189-198.

Lippe C, Bellantuono V, Valenti G and Ardizzone C, 1992. The nature of chloride secretion, induced by carbaryl, across the isolated skin of Rana esculenta, Comparative Biochemistry & Physiology C Comparative Pharmacology & Toxicology, 103(2), 387-389.

Liu W, Wang C, Wang T, Fellers GM, Lai B and Kam Y, 2011. Impacts of the herbicide butachlor on the larvae of a paddy field breeding frog (*Fejervarya limnocharis*) in subtropical Taiwan. Ecotoxicology, 20(2), 377-384.

Liu Z, Zhou F, and Jin H, 1995. Relationship between bioaccumulation, distribution of met and lipid content of aquatic organisms, Journal of Environmental Sciences, 7(2), 212-217.

Liu ZT, Kong ZM, Zhou F and Wang LS, 1996. Bioconcentration and toxicity effect on lipid content of aquatic organisms, Bulletin of Environmental Contamination and Toxicology, 56(1), 135-142.

Loman J, 2002. Temperature, genetic and hydroperiod effects on metamorphosis of brown frogs Rana arvalis and R. temporaria in the field. Journal of Zoology (London). **258**(1): 115-129.

Loman J and Lardner B, 2006. Does pond quality limit frogs Rana arvalis and Rana temporaria in agricultural landscapes? A field experiment, Journal of Applied Ecology, 43, 690–700.

Loman J and Lardner B, 2009. Does landscape and habitat limit the frogs Rana arvalis and Rana temporaria in agricultural landscapes? A field experiment, Applied Herpetology, 6, 227–236.

Lombardi JV, Perpetuo TR, Ferreira CM, Machado Neto JG and Marques HLA, 2002. Acute toxicity of the fungicide copper oxychloride to tadpoles of the bullfrog *Rana catesbeiana*, Bulletin of Environmental Contamination and Toxicology, 69(3), 415-420.

Luo YC, Zeng QR, Wu G, Luan ZK, Yang RB and Liao BH, 2003. Effect of beta-cyclodextrin compounds on the solubilization of three selected pesticides and their toxicity with methyl parathion to *Rana tigrina* tadpoles, Bulletin of Environmental Contamination and Toxicology, 70(5), 998-1005.

Lyons DB, Buckner CH, McLeod BB and Sundaram KMS, 1976. The Effects of Fenitrothion, Matacil and Orthene on Frog Larvae. Rep.No.CC-X-129, Chemical Control Research Institute, Environment Canada, Ottawa, Ontario: 86 p.

Malmgren JC and Thollesson M, 1999. Sexual size and shape dimorphism in two species of newts, *Triturus cristatus* and *T. vulgaris* (Caudata: Salamandridae), Journal of Zoology, 249(2), 127-136.

Malmgren JC, 2002. How does a newt find its way from a pond? Migration patterns after breeding and metamorphosis in great crested newts (*Triturus cristatus*) and smooth newts (*T. vulgaris*), Herpetological Journal 12(1), 29-35.

Mann RM and Bidwell JR, 1999. The toxicity of glyphosate and several glyphosate formulations to four species of southwestern Australian frogs, Archives of Environmental Contamination and Toxicology, 36, 193-199.

Marangoni F, Tejedo M and Gomez-Mestre I, 2008. Extreme reduction in body size and reproductive output associated with sandy substrates in two anuran species, Amphibia-Reptilia, 29(4), 541-553.

Marchal-Segault MD, 1976, Toxicity of some insecticides on *Bufo-bufo* tadpoles, Bulletin d'Ecologie, 7(4), 411-416.

Marco A, Cash D, Belden L and Blaustein A, 2001, Sensitivity to urea fertilization in three amphibian species. Archives of Environmental Contamination and Toxicology, 40, 406-409.

Marian MP, Arul V and Pandian TJ, 1983. Acute and chronic effects of carbaryl on survival, growth, and metamorphosis in the bullfrog (*Rana tigrina*), Archives of Environmental Contamination and Toxicology, 12(3), 271-275.

Marking LL and Chandler JH Jr., 1981. Toxicity of six bird control chemicals to aquatic organisms, Bulletin of Environmental Contamination and Toxicology, 26(6), 705-716.

Marnell F, 1996. Aspects of the population ecology of smooth newts *Triturus vulgaris* L. at a pond in County Dublin, Biology and Environment 96B(2), 113-116.

Materna EJ, Rabeni CF and LaPoint TW, 1995. Effects of the synthetic pyrethroid insecticide, esfenvalerate, on larval leopard frogs (*Rana* spp.), Environmental Toxicology and Chemistry, 14(4), 613-622.

Mathavan S and Velpandi A, 1984. Toxicity of *Bacillus sphaericus* strains to selected target and non-target aquatic organisms, Indian Journal of Medical Research 80, 653-657.

Mayer FL Jr. and Ellersieck MR, 1986. Manual of acute toxicity: interpretation and data base for 410 chemicals and 66 species of freshwater animals, Resource Publication No.160, U.S.Department of the Interior, Fish and Wildlife Service, Washington, DC, 505 p.

McComb BC, Curtis L, Chambers CL, Newton M and Bentson K 2008. Acute toxic hazard evaluations of glyphosate herbicide on terrestrial vertebrates of the Oregon coast range, Environmental Science and Pollution Research, 15(3), 266-272.

McIlroy JC, King DR and Oliver AJ, 1985. The sensitivity of Australian animals to 1080 poison .8. Amphibians and reptiles, Australian Wildlife Research, 12(1), 113-118.

Mendez SIS, Tillitt DE, Rittenhouse TAG and Semlitsch RD, 2009. Behavioral response and kinetics of terrestrial atrazine exposure in American toads (*Bufo americanus*), Archives of Environmental Contamination and Toxicology 57(3), 590-597.

Miaud C and Sanuy D, 2005. Terrestrial habitat preferences of the natterjack toad during and after the breeding season in a landscape of intensive agricultural activity, Amphibia-Reptilia, 26(3), 359-366.

Miaud C, Guyetant R and Elmberg J, 1999. Variations in life-history traits in the common frog *Rana temporaria* (Amphibia: Anura): A literature review and new data from the French Alps, Journal of Zoology 249(1), 61-73.

Miaud C, Sanuy D and Avrillier J-N, 2000. Terrestrial movements of the natterjack toad *Bufo calamita* (Amphibia, Anura) in a semi-arid, agricultural landscape, Amphibia-Reptilia 21(3), 357-369.

Mithra D and Abhik G, 2002. Acute toxicity of endosulfan on three anuran tadpoles, Journal of Ecotoxicology and Environmental Monitoring, 12(1), 61-65.

Modra H, Vrskova D, Macova S, Kohoutkova J, Hajslova J, Haluzova I and Svobodova Z, 2011. Comparison of diazinon toxicity to embryos of *Xenopus laevis* and *Danio rerio*; Degradation of diazinon in water, Bulletin of Environmental Contamination and Toxicology, 86(6), 601-604.

Moore MT, Pierce JR, Milam CD, Farris JL and Winchester EL, 1998. Responses of non-target aquatic organisms to aqueous propanil exposure, Bulletin of Environmental Contamination and Toxicology, 61, 169-174.

Morgan MK, Scheuerman PR, Bishop CS and Pyles RA, 1996. Teratogenic potential of atrazine and 2,4-D using FETAX, Journal of Toxicology and Environmental Health, 48(2), 151-168.

Mudgall CF and Patil HS, 1987. Toxic effects of dimethoate and methyl parathion on glycogen reserves of male and female *Rana cyanophlyctis*, Journal of Environmental Biology, 8(3), 237-244.

Mudgall CF and Patil SS, 1988. Toxicity of lead and mercury to frogs *Rana cyanophlyctis* and *Rana tigerina*, Environment and Ecology, 6(2), 506-507.

Munk Nielsen S and Dige T, 1995. A one season study of the common spadefoot, *Pelobates fuscus*, Memoranda Societatis pro Fauna et Flora Fennica, 71(3-4), 106-108.

Nagy KA, 1987. Field metabolic rate and food requirement scaling in mammals and birds. Ecological Monographs, 57, 111-128.

Nagy KA, Girard IA and Brown TK, 1999. Energetics of free-ranging mammals, reptiles, and birds. Annual Review of Nutrition, 19**,** 247-277.

Natochin YV, E. A. Lavrova EA and Khripak AV, 1987. Inhibition of membrane transport of sodium in the toxicity mechanism of fenvalerate and cypermethrin, Journal of Ichthyology, 27(2), 10-12.

Natochin YV, Lavrova EA and Khripak AV, 1986. Inhibition of Sodium Membrane Transport in the Mechanism of Fenvalerate and Cypermethrin Ichthyotoxicity, Voprosy Ikhtiologii, 26(6), 998-1002.

Naumov B and Tzankov N, 2009. Sexual size dimorphism in genus Triturus Rafinesque, 1815 (Amphibia: Salamandridae) in Bulgaria - preliminary results, Biotechnology and Biotechnological Equipment 88(Special Edition), 85-88.

Nebeker AV, Schuytema GS, Griffis WL and Cataldo A, 1998. Impact of guthion on survival and growth of the frog *Pseudacris regilla* and the salamanders *Ambystoma gracile* and *Ambystoma maculatum*, Archives of Environmental Contamination and Toxicology, 35, 48-51.

Nicoara A, Nicoara M and Bianchini F, 2005. Diet composition during breeding period in populations of Bufo viridis, Pelobates fuscus and Rana esculenta complex from Ciric River's basin (Iasi, Romania), Analele Stiintifice ale Universitatii "Al. I. Cuza" din Iasi Sectiunea Biologie Animala: 179-187.

Nishiuchi Y and Yoshida K, 1975. Effects of pesticides on tadpoles. Part 3. Bull. Agric. Chem. Insp. Stn. (Tokyo), 14, 66-68.

Nishiuchi Y, 1975. Toxicity of formulated pesticides to some fresh-water organisms. XXX, Suisan Zoshoku, 23(2), 88-91.

Nishiuchi Y, 1976, Toxicity of formulated pesticides to some fresh water organisms. XXXIX, Suisan Zoshoku, 24(3), 102-105.

Nishiuchi Y, 1979. Toxicity of pesticides to some fresh water organisms. XXXXX, Suisan Zoshoku, 27(1), 56-60.

Nishiuchi Y, 1980a. Toxicity of formulated pesticides to fresh water organisms LXXII, Suisan Zoshoku, 7(4), 238-244.

Nishiuchi Y, 1980b. Toxicity of formulated pesticides to fresh water organisms. LXXIV, Suisan Zoshoku, 8(2), 107-112.

Nishiuchi Y, 1990, Toxicity of pesticides to some aquatic animals. XI. Toxicity of some pesticides to tadpoles. C. A. Sel. -Environ. Pollut., 8, 3-72754Y.

Nishiuchi Y, Iwamura H and Asano K, 1985. Toxicity of pesticides to some aquatic animals. VI. Acute toxicity of latest registered pesticides to some aquatic animals, Ecological Chemistry,8(12), 13-15.

Nobili G and Accordi F, 1997. Body size, age and fecundity variation in different populations of the smooth newt Triturus vulgaris meridionalis in central Italy, Italian Journal of Zoology (Modena), 64(4), 313-318.

Office of Pesticide Programs, 2000. Pesticide Ecotoxicity Database (Formerly: Environmental Effects Database (EEDB)). Environmental Fate and Effects Division, U.S. EPA, Washington, D.C.

Okudaira H, 1973. Hymexazol, a new plant protecting agent. V. Safety tests, Annu.Rep.Sankyo Res.Lab.(Sankyo Kenkyusho Nempo), 73(25), 48-51.

Oldham RS and Swan MJS, 1992. Effects of ingested radio transmitters on *Bufo bufo* and *Rana temporaria*, Herpetological Journal, 2(3), 82-85.

Oldham RS, Latham DM, Hilton-Brown D, Towns M, Cooke AS and Burn A, 1997. The effect of ammonium nitrate fertiliser on frog (Rana temporaria) survival, Agriculture Ecosystems and Environment, 61(1), 69-74.

Oliveira-Filho EC and Paumgartten FJR, 2000. Toxicity of *Euphorbia milii* latex and niclosamide to snails and non-target aquatic species, Ecotoxicology and Environmental Safety, 46(3), 342-350.

Oromi N, Sanuy D and Sinsch U, 2010. Thermal ecology of natterjack toads (*Bufo calamita*) in a semiarid landscape, Journal of Thermal Biology, 35(1), 34-40.

Ortiz-Santaliestra ME, Marco A and Lizana M, 2005, Sensitivity and behavior of the Iberian newt, *Triturus boscai*, under terrestrial exposure to ammonium nitrate. Bulletin of Environmental Contamination and Toxicology, 75, 662-669.

Osano O, Admiraal W and Otieno D, 2002b. Developmental disorders in embryos of the frog *Xenopus laevis* induced by chloroacetanilide herbicides and their degradation products, Environmental Toxicology and Chemistry, 21(2), 375-379.

Osano O, Oladimeji AA, Kraak MHS and Admiraal W, 2002a. Teratogenic effects of amitraz, 2,4-Dimethylaniline, and paraquat on developing frog (*Xenopus*) embryos, Archives of Environmental Contamination and Toxicology, 43(1), 42-49.

Ossana NA, Castane PM, Poletta GL, Mudry MD and Salibian A, 2010. Toxicity of waterborne copper in premetamorphic tadpoles of *Lithobates catesbeianus* (Shaw, 1802), Bulletin of Environmental Contamination and Toxicology, 84(6), 712-715.

Overmyer JP, Rouse DR, Avants JK, Garrison AW, DeLorenzo ME, Chung KW, Key PB, Wilson WA and Black MC, 2007. Toxicity of fipronil and its enantiomers to marine and freshwater non-targets, Journal of Environmental Science and Health. Part B, Pesticides, Food Contaminants, and Agricultural Wastes, 42(5), 471-480.

Ozmen M, Sener S, Mete A and Kucukbay H, 1999. In vitro and in vivo acetylcholinesterase-inhibiting effect of new classes of organophosphorus compounds, Environmental Toxicology and Chemistry, 18(2), 241-246.

Pan DY and Liang XM, 1993. Safety study of pesticides on bog frog, a predatory natural enemy of pest in paddy field, Journal of Hunan Agricultural College ,19(1), 47-54.

Papis E, Bernardini G, Gornati R and Prati M, 2006. Triadimefon causes branchial arch malformations in *Xenopus laevis* embryos, Environmental Science and Pollution Research, 13(4), 251-255.

Pauli BD, Coulson DR and Berrill M, 1999. Sensitivity of amphibian embryos and tadpoles to Mimic[R] 240 LV insecticide following single or double exposures, Environmental Toxicology and Chemistry 18(11), 2538-2544.

Paulose PV, 1988. Comparative study of inorganic and organic mercury poisoning on selected freshwater organisms, Journal of Environmental Biology, 9(2), 203-206.

Pavignano I, 1989. Studies on the biology of the tree frog *Hyla arborea* during the breeding season in north western Italy Amphibia Anura Hylidae, Alytes 8(1), 17-21.

Pawar KR and Katdare M, 1983. Toxicity of sumithion, BHC and furadan to the tadpoles of the frog *Microhyla ornata*, Indian Journal of Environmental Health, 25(3), 214-217.

Pawar KR and Katdare M, 1984. Toxic and teratogenic effects of fenitrothion, BHC and carbofuran on embryonic development of the frog *Microhyla ornata*, Toxicology Letters , 22(1), 7-13.

Pellet J, Rechsteiner L, Skrivervik AK, Zuercher J-F and Perrin N, 2006. Use of the Harmonic Direction Finder to study the terrestrial habitats of the European tree frog (*Hyla arborea*), Amphibia-Reptilia, 27(1), 138-142.

Perez-Coll CS and Herkovits J, 2006. Synergistic effects of copper and butylic ester of 2,4-Dichlorophenoxyacetic acid (Esternon Ultra) on amphibian embryos, International Journal of Environmental Research and Public Health, 3(4), 343-347.

Perkins PJ, Boermans HJ and Stephenson GR, 2000. Toxicity of glyphosate and triclopyr using the Frog Embryo Teratogenesis Assay – Xenopus, Environmental Toxicology and Chemistry, 19(4), 940-945.

Pfeffer H, Kalettka Th, Stachow U and Drews H, 2011. Ökologie und Gefährdung von Amphibien [Ecology and vulnerability of amphibians]. In: Berger G, Pfeffer H, Kalettka Th [Eds.]. Amphibienschutz in kleingewässerreichen Ackerbaugebieten [Amphibian conservation in small water-rich agricultural areas]: Natur & Text, Ransdorf, 37-52.

Pintar M, 1984. On the bionomics of frogs anura from the alluvial plain of the Danube River in the environs of Vienna Stockerau Austria, Folia Zoologica**,** 33(3), 263-276.

Plăiaşu R, Băncilă R and Cogălniceanu D, 2010. Body size variation in *Rana temporaria* populations inhabiting extreme environments, Ovidius University Annals, Biology-Ecology Series 14: 121-126.

Pogorzelska H, Knapowski J and Kontek M, 1982. Effect of certain pesticides on active sodium transport in the epithelium of isolated frog skin, Acta Physiologica Polonica, 33(3), 189-197.

Potter JL and O'Brien RD, 1963. The relation between toxicity and metabolism of paraoxon in the frog, mouse and cockroach, Entomologia Experimentalis et Applicata, 6, 319-325.

Pough FH, Magnusson WE, Ryan MJ Wells KD and Taigen TL, 1992. Behavioural energetics. In: Feder ME and Burggren WW Eds. Environmental Physiology of the Amphibians. University of Chicago Press, London. 395-436.

Pradhan PK and Dasgupta S, 1992. Estimation of acute and chronic oral LD-50 of dimethoate in toad (*Bufo melanostictus*), Indian Journal of Physiology and Allied Sciences, 46(3), 121-126.

Premkumar DRD and Mathavan S, 1987. Efficacy of a synthetic pyrethroid, decamethrin to selected target and non-target organisms. In: Reuben R (Ed.), Proceedings of the Symposium 'Alternatives to Synthetic Insecticides in Integrated Pest Management Systems', March 30-31, 1987, Centre for Research in Medical Entomology, Madurai, India, 171-175.

Procaccini DJ and Doyle CM, 1970. Streptomycin induced teratogenesis in developing and regenerating amphibians, Oncology, 24(5), 378-387.

Punzo F and Parker M, 2005. Effects of azadirachtin on mortality, fertilization, and swimming speed in larvae of the cane toad, *Bufo marinus* (Anura: Bufonidae), Journal of Environmental Biology, 26(4), 687-692.

Punzo F, 1993a. Effect of mercuric chloride on fertilization and larval development in the river frog, *Rana heckscheri* (Wright) (Anura: Ranidae), Bulletin of Environmental Contamination and Toxicology, 51(4), 575-581.

Punzo F, 1993b. Ovarian effects of a sublethal concentration of mercuric-chloride in the river frog, *Rana heckscheri* (Anura, Ranidae), Bulletin of Environmental Contamination and Toxicology, 50(3), 385-391.

Punzo F, 1997. The effects of azadirachtin on larval stages of the oak toad, *Bufo quercicus* (Holbrook), Florida Scientist, 60(3), 158-165.

Quaranta A, Bellantuono V, Cassano G and Lippe C, 2009. Why amphibians are more sensitive than mammals to xenobiotics, PLoS One 4(11), Article No. e7699.

Quevedo L, Montoya G, Ferraris R and Venegas W, 1992. Inhibition of the sodium transport by pentachlorophenol PCP in Toad Skin Pleurodema thaul, Comparative Biochemistry & Physiology C Pharmacology Toxicology and Endocrinology, 101(2), 365-369.

Rao IJ and Madhyastha MN, 1987. Toxicities of some heavy metals to the tadpoles of frog, *Microhyla ornata* (Dumeril & Bibron), Toxicology Letters, 36(2), 205-208.

Reading CJ, 1990. A comparison of size and body weights of common toads *Bufo bufo* from two sites in southern England UK, Amphibia Reptilia, 11(2), 155-164.

Reading CJ, 1991. The relationship between body length, age and sexual maturity in the common toad, *Bufo bufo*, Holarctic Ecology, 14(4), 245-249.

Reading CJ, 1998. The Effect of winter temperatures on the timing of breeding activity in the common toad Bufo bufo, Oecologia, 117(4), 469-475.

Relyea RA and Jones DK, 2009. The toxicity of Roundup Original Max[R] to 13 species of larval amphibians, Environmental Toxicology and Chemistry, 28(9), 2004-2008.

Relyea RA, 2003. Predator cues and pesticides: A double dose of danger for amphibians, Ecological Applications, 13(6), 1515-1521.

Relyea RA, 2004. Synergistic impacts of malathion and predatory stress on six species of North American tadpoles, Environmental Toxicology and Chemistry, 23(4), 1080-1084.

Relyea RA, 2005a. The lethal impact of roundup on aquatic and terrestrial amphibians, Ecological Applications, 15(4), 1118-1124.

Relyea RA, 2005b. The lethal impacts of roundup and predatory stress on six species of North American Tadpoles, Archives of Environmental Contamination and Toxicology, 48(3), 351-357.

Renuka MR and Andrews MI, 2009. Effects of Nuvacron on carbohydrate metabolism of the green frog *Euphlyctis hexadactylus*. Journal of Ecobiology, 25(1), 39-44.

Richards SM and Kendall RJ, 2002. Biochemical effects of chlorpyrifos on two developmental stages of *Xenopus laevis*, Environmental Toxicology and Chemistry, 21(9), 1826-1835.

Richards SM, 2000. Chlorpyrifos: Exposure and Effects in Passerines and Anurans. Ph.D.Thesis, Texas Tech.Univ., Lubbock, TX: 147 p.

Riviere JE, Shapiro DP and Coppoc GL, 1979. Percutaneous absorption of gentamicin by the leopard frog, Rana pipiens, Journal of Veterinary Pharmacology and Therapeutics, 2(3), 235-239.

Robles-Mendoza C, Garcia-Basilio C, Cram-Heydrich S, Hernandez-Quiroz M and Vanegas-Perez C, 2009. Organophosphorus pesticides effect on early stages of the axolotl *Ambystoma mexicanum* (Amphibia: Caudata), Chemosphere, 74(5), 703-710.

Rot-Nikcevic I, Sidorovska V, Dzukic G and Kalezic ML, 2001. Sexual size dimorphism and life history traits of two European spadefoot toads (Pelobates fuscus and P. syriacus) in allopatry and sympatry, Annales Series Historia Naturalis, 23, 107-120.

Ryser J, 1996. Comparative life histories of a low- and a high-elevation population of the common frog Rana temporaria, Amphibia Reptilia 17(3), 183-195.

Saha S and Kaviraj A, 2008. Acute toxicity of synthetic pyrethroid cypermethrin to some freshwater organisms, Bulletin of Environmental Contamination and Toxicology, 80(1), 49-52.

Saka M, 1999. Acute toxicity tests on Japanese amphibian larvae using thiobencarb, a component of rice paddy herbicides, Herpetological Journal, 9(2), 73-81.

Saka M, 2003. Examination of an amphibian-based assay using the larvae of *Xenopus laevis* and *Ambystoma mexicanum*, Ecotoxicology and Environmental Safety, 55(1), 38-45.

Saka M, 2004. Developmental toxicity of p,p' -dichlorodiphenyltrichloroethane, 2,4,6-trinitrotoluene, their metabolites, and benzo[a]pyrene in *Xenopus laevis* embryos, Environmental Toxicology and Chemistry, 23(4), 1065-1073.

Saka M, 2010. Acute toxicity of rice paddy herbicides simetryn, mefenacet, and thiobencarb to *Silurana tropicalis* tadpoles, Ecotoxicology and Environmental Safety, 73(6), 1165-1169.

Salibian A and Marazzo JL, 1995. Studies on the effects of deltamethrin on sodium net transport through the in vivo amphibian skin, Biomedical and Environmental Sciences, 8(2), 164-168.

Salibian A, 1992. Effects of Deltamethrin on the South American Toad, *Bufo arenarum*, tadpoles, Bulletin of Environmental Contamination and Toxicology, 48(4): 616-621

Salibian A, 1983. Studies on the effect of the pyrethroid insecticide Decamethrin on ionic transport through the in vitro skin of Rana esculenta, Comparative Biochemistry & Physiology. C, Comparative Pharmacology and Toxicology, 76(1), 157-62.

Sampath K and Elango P, 1997. Lipid metabolism in common frog (*Rana tigrina*) exposed to carbaryl, Journal of Environmental Biology, 18(1), 23-26.

Sampath K, Elango P and Thanalakshmi S, 1992. Effect of carbaryl (Sevin) on the carbohydrate metabolism of the common frog *Rana tigrina*. Environment and Ecology,10(2), 278-281.

Sampath K, Kennedy IJJ and James R, 2002. Pesticide impact on excretory physiology of the common frog, *Rana tigrina* (Daud) Tadpoles, Bulletin of Environmental Contamination and Toxicology, 68(5), 652-659.

Sanders HO, 1970. Pesticide toxicities to tadpoles of the western chorus frog *Pseudacris triseriata* and Fowler's Toad *Bufo woodhousii fowleri*, Copeia, 2, 246-251.

Sayim F and Kaya U, 2006. Effects of dimethoate on tree frog (*Hyla arborea*) larvae, Turkish Journal of Zoology, 30(3), 261-266.

Sayim F, 2008. Acute toxic effects of malathion on the 21st stage larvae of the marsh frog, Turkish Journal of Zoology, 32, 99-106.

Sayim F, 2010. Toxicity of trifluralin on the embryos and larvae of the red-bellied toad, *Bombina bombina*, Turkish Journal of Zoology, 34(4), 479-486.

Schmidt P, Weddeling K, Meike T, Rottscheidt R, Tarkhnishvili DN and Hachtel M, 2006. Dispersal of Triturus alpestris and T. vulgaris in agricultural landscapes - comparing estimates from allozyme markers and capture-mark-recapture analysis, Herpetologia Bonnensis II. Proceedings of the 13th Congress of the Societas Europaea Herpetologica, 27 September - 2 October 2005, Bonn, Germany. Vences M, Joern K, Thomas Z and Wolfgang B (Eds.), Societas Europaea Herpetologica, Bonn, 139-143.

Schonert A and Schonert B, 2008. Number and biometrical data of great crested newts (*Triturus cristatus*) at a pond in Berlin [Anzahl und biometrische Daten von Kammmolchen (*Triturus cristatus*) eines Berliner Kleingewaessers.], Zeitschrift fuer Feldherpetologie, 15(2), 203-214.

Schultz TW and Dumont JN, 1984. Teratogenicity and embryotoxicity of monosodium methanearsonate herbicide, Transactions of the American Microscopical Society, 103(4), 263-274.

Schuytema GS and Nebeker AV, 1998. Comparative toxicity of diuron on survival and growth of Pacific treefrog, bullfrog, red-legged frog, and African clawed frog embryos and tadpoles, Archives of Environmental Contamination and Toxicology, 34(4), 370-376.

Schuytema GS, Nebeker AV and Griffis WL, 1994. Toxicity of Guthion and Guthion 2S to *Xenopus laevis* embryos, Archives of Environmental Contamination and Toxicology, 27(2), 250-255.

Schuytema GS, Nebeker AV and Griffis WL, 1995. Comparative toxicity of Guthion and Guthion 2S to *Xenopus laevis* and *Pseudacris regilla* tadpoles, Bulletin of Environmental Contamination and Toxicology, 54(3), 382-388.

Schuytema GS, Nebeker AV, Griffis WL and Wilson KN, 1991. Teratogenesis, toxicity, and bioconcentration in frogs exposed to dieldrin, Archives of Environmental Contamination and Toxicology, 21: 332-350.

Seitz A, Faller-Doepner U and Reh W, 1992. Radio-tracking of the common frog (*Rana temporaria*), In: Priede IG and Swift SM [Eds]. Wildlife telemetry: remote monitoring and tracking of animals. Ellis Horwood, London, 484-489.

Seuge J, Marchal-Segault D and Bluzat R, 1983. Acute toxicity of a dithiocarbamate fungicide, thiram, on several animals species of freshwater (Toxicite Aigue d'un Fongicide Dithiocarbamate, le Thirame, vis-a-vis de Plusieurs Especes Animales d'eau Douce), Environmental Pollution Series A-Ecological and Biological, 31(3), 177-189.

Shah PV, Monroe RJ, Shah PV, Monroe RJ and Guthrie FE, 1983. Comparative penetration of insecticides in target and non-target species, Drug and Chemical Toxicology, 6(2), 155-179.

Sinsch U and Leskovar C, 2011. Does thermoregulatory behaviour of green toads (*Bufo viridis*) constrain geographical range in the west? A comparison with the performance of syntopic natterjacks (*Bufo calamita*), Journal of Thermal Biology 36(6), 346-354.

Sinsch U and Seidel, 1995. Dynamics of local and temporal breeding assemblages in a *Bufo calamita* metapopulation, Australian Journal of Ecology 20(3), 351-361.

Sinsch U, 1988a. Seasonal changes in the migratory behavior of the toad *Bufo bufo* direction and magnitude of movements, Oecologia, 76(3), 390-398.

Sinsch U, 1988b. Temporal spacing of breeding activity in the natterjack toad *Bufo calamita*, Oecologia 76(3), 399-407.

Sinsch U, 1992. Structure and dynamic of a natterjack toad metapopulation Bufo calamita, Oecologia 90(4), 489-499.

Sinsch U, Marangoni F, Oromi N, Leskovar C, Sanuy D and Tejedo M, 2010. Proximate mechanisms determining size variability in natterjack toads, Journal of Zoology, 281(4), 272-281.

Slooff W and Baerselman R, 1980. Comparison of the usefulness of the Mexican axolotl (*Ambystoma mexicanum*) and the clawed toad (*Xenopus laevis*) in toxicological bioassays, Bulletin of Environmental Contamination and Toxicology, 24(3), 439-443.

Slooff W, 1982. A comparative study on the short-term effects of 15 chemicals on fresh water organisms of different tropic levels. National Technical Information Service, Springfield, VA, 25 p.

Smith GC, 1976. Ecological energetics of three species of ectothermic vertebrates, Ecology, 57(2), 252-264.

Smith M, 1951. The British Amphibians and Reptiles, New Naturalist Series Number 20, Collins, London.

Smith PN, George P. Cobb GP, Godard-Codding Ca, Dale Hoff D, McMurry ST, Rainwater TR and Kevin D. Reynolds KD, 2007. Contaminant exposure in terrestrial vertebrates, Environmental Pollution, 150, 41-64.

Snawder JE and Chambers JE, 1989. Toxic and developmental effects of organophosphorus insecticides in embryos of the South African clawed frog, Journal of Environmental Science and Health Part B Pesticides Food Contaminants and Agricultural Wastes, 24(3), 205-218.

Sokolov VE and Sakulina NA, 1994. Morphology of the skin of Hyla arborea and Hyla japonica (Amphibia, Anura, Hylidae), Zoologicheskii Zhurnal, 73(12), 81-86.

Sparling DW and Fellers G, 2007. Comparative toxicity of chlorpyrifos, diazinon, malathion and their oxon derivatives to larval *Rana boylii*, Environmental Pollution, 147(3), 535-539.

Sparling DW and Fellers GM, 2009. Toxicity of two insecticides to California, USA, anurans and its relevance to declining amphibian populations, Environmental Toxicology and Chemistry, 28(8), 1696-1703.

Sparling DW, Linder G and Bishop CA, 2000. Ecotoxicology of Amphibians and Reptiles, Society of Environmental Toxiciology and Chemistry (SETAC), Pensacola FL.

Sparling DW, Linder G, Bishop CA and Krest S, 2010. Ecotoxicology of Amphibians and Reptiles, Second Edition. CRC Press, Taylor & Francis Group, Boca Raton, FL.

Sparling DW, Lowe TP and Pinkney AE, 1997. Toxicity of Abate [R] to green frog tadpoles, Bulletin of Environmental Contamination and Toxicology, 58(3), 475-481.

Speakman JR, 1997. Doubly Labelled Water: Theory and Practice, Chapman and Hall, London.

Sreenivasan A and Swaminathan GK, 1967. Toxicity of six organophosphorus insecticides to fish, Current Science (Bangalore), 36(15), 397-398

Srivastava A, Kumar A and Singh MP, 1988. Toxicity of aldrin in frog *Rana Tigrina* Daudin, Uttar Pradesh Journal of Zoology, 8(2), 186-190.

Sumanadasa, DM, Wijesinghe MR, and Ratnasooriya WD, 2008. Effects of diazinon on larvae of the Asian common toad (*Bufo melanostictus*, Schneider 1799), Environmental Toxicology and Chemistry, 27(11), 2320-2325.

Szekely P and Nemes S, 2002. Sex ratio and sexual dimorphism in a population of *Pelobates fuscus* from Transylvania, Romania, Zeitschrift fuer Feldherpetologie 9(2), 211-216.

Sztatecsny M and Schabetsberger R, 2005. Into thin air: vertical migration, body condition, and quality of terrestrial habitats of alpine common toads, *Bufo bufo*, Canadian Journal of Zoology, 83(6), 788-796.

Szubartowska E, 1990. Changes in the blood of *Rana temporaria* L. after different doses of ekatin, Annales Univ. M. Curie-Slodowska, 45, 67-68.

Takahashi M, 2007. Oviposition site selection: pesticide avoidance by gray treefrogs, Environmental Toxicology and Chemistry 26(7), 1476-1480.

Talbot CR and Feder ME, 1992. Relationships among Cutaneous Surface Area, Cutaneous Mass, and Body Mass in Frogs: A Reappraisal, Physiological Zoology, 65(6), 1135-1147.

Taylor SK, Williams ES and Mills KW, 1999. Effects of malathion on disease susceptibility in Woodhouse's toads, Journal of Wildlife Diseases, 35, 536–541.

Tejada AW, Bajet CM, Magbauna MG, Gambalan NB, Araez LC and Magallona ED, 1994. Toxicity of pesticides to target and non-target fauna of the lowland rice ecosystem. In: Widianarko B, Vink K and Van Straalen NM (Eds.), Environmental Toxicology in South East Asia, VU Univ.Press, Amsterdam, Netherlands, 89-103.

Tejedo M, 1992. Effects of body size and timing of reproduction on reproductive success in female natterjack toads (*Bufo calamita*), Journal of Zoology (London), 228(4), 545-555.

Tejedo M, 1993. Size dependent vulnerability and behavioral responses of tadpoles of two anuran species of beetle larvae predators, Herpetologica 49(3), 287-294.

Thenmozhi K and Ramaswamy G, 2008. Toxicological and histopathological effect of Phosphamidon on liver of the Indian skipper frog. Journal of Ecobiology, 22(4), 337-347.

Thurston RV, Gilfoil TA, Meyn EL, Zajdel RK, Aoki TL and Veith GD, 1985. Comparative toxicity of ten organic chemicals to ten common aquatic species, Water Research, 19(9), 1145-1155.

Thybaud E, 1990. Toxicite aigue et bioconcentration du lindane et de la deltamethrine par les tetards de *Rana temporaria* et les Gambusies (*Gambusia affinis*), Hydrobiologia, 190(2), 137-145.

Tomašević N, Cvetković D, Miaud C, Aleksić I and Crnobrnja-Isailović J, 2008. Interannual variation in life history traits between neighbouring populations of the widespread amphibian *Bufo bufo*, Rev. Écol. (Terre Vie), 63, 371-381.

Tramontano R, 1997. Continuous radio tracking of the common frog, Rana temporaria, Herpetologia Bonnensis. Proceedings of the 8th Ordinary General Meeting of the Societas Europaea Herpetologica, 23-27 August 1995, Bonn, Germany. Bohme W, Wolfgang B and Thomas Z, Societas Europaea Herpetologica, Bonn, 359-365.

Trumbo J and Waligora D, 2009. The impact of the herbicides imazapyr and triclopyr triethylamine on bullfrog tadpoles, California Fish and Game, 95(3), 122-127.

Tucker RK and Crabtree DG, 1969. Toxicity of Zectran insecticide to several wildlife species, Journal of Economic Entomology, 62(6), 1307-1310.

Van Buskirk J, 2007. Body size, competitive interactions, and the local distribution of Triturus newts, Journal of Animal Ecology, 76(3), 559-67.

Vardia HK, Rao PS and Durve VS, 1984. Sensitivity of toad larvae to 2,4-D and endosulfan pesticides. Archiv fur Hydrobiologie, 100(3), 395-400.

Venturino A, Bergoc RM and Pechen AM, 1998. Kinetic models of lipophilic compound uptake and bioelimination in amphibians during the aquatic stages, Journal of Biological Systems, 6(1), 85-94.

Venturino A, Gauna L, Bergoc RM and Pechen de D'Angelo AM, 2001. Toxicokinetics of malathion in larval stages of the toad Bufo arenarum (Hensel): effect of exogenous spermidine, Pesticide Biochemistry and Physiology, 70(3), 142-150.

Venturino A, Gauna LE, Bergoc RM and D'Angelo AMP, 1992. Effect of exogenously applied polyamines on malathion toxicity in the toad *Bufo arenarum* Hensel, Archives of Environmental Contamination and Toxicology, 22, 135-139.

Venturino A, Montagna CM and Pechen de D'Angelo AM, 2007. Risk Assessment of Magnacide H Herbicide at Rio Colorado Irrigation Channels (Argentina). Tier 3: Studies on Native Species, Environmental Toxicology and Chemistry, 26(1), 177-182

Verrell PA, 1986, Body size, age and reproduction in the smooth newt, Triturus vulgaris, Journal of Zoology, London (A), 210, 89-100.

Verrell PA, Halliday TR and Griffiths ML, 1986, The annual reproductive cycle of the smooth newt (Triturus vulgaris) in England, Journal of Zoology, London (A), 210, 101-119.

Vignoli L,.Luiselli L and Bologna MA, 2009, Dietary patterns and overlap in an amphibian assemblage at a pond in Mediterranean Central Italy, Vie et Milieu, 59(1), 47-57.

Vismara C, Battista V, Vailati G and Bacchetta R, 2000. Paraquat induced embryotoxicity on *Xenopous laevis* development, Aquatic Toxicology, 49, 171-179.

Vogrin M and Miklic A, 2005. Mating patterns of common toad *Bufo bufo* in a Slovenian pond, Acta Zoologica Sinica, 51(3), 513-515.

Wan MT, Buday C, Schroeder G, Kuo J and Pasternak J, 2006. Toxicity to *Daphnia magna*, *Hyalella azteca*, *Oncorhynchus kisutch*, *Oncorhynchus mykiss*, *Oncorhynchus tshawytscha*, and *Rana catesbeiana* of atrazine, metolachlor, simazine, and their formulated products, Bulletin of Environmental Contamination and Toxicology, 76(1), 52-58.

Webber NR, Michelle DB and Distel CA, 2010. Effects of aquatic and terrestrial carbaryl exposure on feeding ability, growth, and survival of American toads, Environmental Toxicology and Chemistry, 29, 2323–2327.

Wells KD, 2007. The Ecology and Behavior of Amphibians. The University of Chicago Press, Chicago IL.

Wheater CP, 1986. Prey - Size and parasite relationships in the common toad *Bufo bufo*. Herpetological Journal, 1, 62-66.

Whitford WG and Hutchinson VH, 1967. Body size and metabolic rate in salamanders. Physiological Zoology, 40, 127-133.

Wijesinghe, MR, Bandara MGDK, Ratnasooriya WD and Lakraj GP, 2011. Chlorpyrifos-induced toxicity in Duttaphrynus melanostictus (Schneider 1799) Larvae. Archives of Environmental Contamination & Toxicology 60(4): 690-696.

Willens S, Stoskopf MK, Baynes RE, Lewbart GA, Taylor SK and Kennedy-Stoskopf S, 2006a. Percutaneous malathion absorption by anuran skin in flow-through diffusion cells, Environmental Toxicology and Pharmacology, 22(3), 255-262.

Willens S, Stoskopf MK, Baynes RE, Lewbart GA, Taylor SK and Kennedy-Stoskopf, S, 2006b. Percutaneous malathion absorption in the harvested perfused anuran pelvic limb, Environmental Toxicology and Pharmacology, 22(3), 263-267.

Wohlgemuth E, 1977. Toxicity of endrin to some species of aquatic vertebrates, Prirodovedne Prace Ustavu Ceskoslovenske Akademie Ved v Brne, 11(6):1-38.

Wojtaszek BF, Buscarini TM, Chartrand DT, Stephenson GR and Thompson DG, 2005. Effect of Release herbicide on mortality, avoidance response, and growth of amphibian larvae in two forest wetlands, Environmental Toxicology and Chemistry, 24(10), 2533-2544.

Wojtaszek BF, Staznik B, Chartrand DT, Stephenson GR and Thompson DG, 2004. Effects of Vision herbicide on mortality, avoidance response, and growth of amphibian larvae in two forest wetlands, Environmental Toxicology and Chemistry, 23(4), 832-842.

Wu C, Zhao X, Wu S, Cheng L, Wang Y, Chang T, Yu R and Ping L, 2011a. Toxicity and risk of herbicide cyhalofop-butyl on *Rana limnocharis*, Acta Agriculturae Zhejiangensis, 23(4), 771-775.

Wu S, Wu C, Chen L, Cang T, Yu R, Wang Y and Zhao X, 2011b. Acute toxicity and risk assessment of chloropicrin to environmental organism, Nongyaoxue Xuebao, 13(1), 47-52.

Xiao Y-H, Zhu S-Q, Li X-H and Jiang P, 2007a. Influences of the herbicide glyphosate-isopropylammonium solution on heart activities of Bufo gargarizans, Acta Zoologica Sinica, 53(4), 668-673.

Xiao Y-H,. Long W-W, Luo S-C, Yin C-P and Long J, 2007b. The influences of the herbicide glyphosate on nerve impulse generation and conduction of Bufo gargarizans, Acta Ecologica Sinica, 27(3), 1177-1184.

Xue Q, Yao D, Huang Z, Ke Q, Wen X and Geng B, 2005. Acute toxicity of pesticide dichlorvos and herbicide butachlor to *Microhyla ornata* tadpoles, Sichuan Journal of Zoology, 24(2), 209-212.

Yasmeen N and Nayeemunnisa, 1985, Effects of methyl parathion on the rate of oxygen consumption of tadpoles of frog, *Rana cyanophlictis*. Current Science (Bangalore), 54(13), 649-651.

Yesilada E, Ozmen M, Yesilada O and Mete A, 2006. Toxicity of azinphosmethyl on *Drosophila melanogaster* and *Bufo viridis*, Fresenius Environmental Bulletin, 15(6), 503-507.

Yin X, Zhu G, Li X and Liu S, 2009. Genotoxicity evaluation of chlorpyrifos to amphibian Chinese toad (Amphibian: Anura) by Comet assay and Micronucleus test. Mutation Research, Genetic Toxicology and Environmental Mutagenesis, 680(1/2), 2-6.

Yin XH, Li SN, Zhang L, Zhu GN and Zhuang HS, 2008. Evaluation of DNA damage in chinese toad (bufo bufo gargarizans) after in vivo exposure to sublethal concentrations of four herbicides using the Comet assay, Ecotoxicology, 17(4), 280-286.

Yoon CS, Jin JH, Park JH, Yeo CY, Kim SJ, Hwang YG, Hong SJ, and Cheong SW, 2008. Toxic effects of carbendazim and n-butyl isocyanate, metabolites of the fungicide benomyl, on early development in the African clawed frog, *Xenopus laevis*, Environmental Toxicology,23(1), 131-144.

Yu L, Zhang X, Yuan J, Cao Q, Liu J, Zhu P and Shi H, 2011. Teratogenic effects of triphenyltin on embryos of amphibian (Xenopus tropicalis): a phenotypic comparison with the retinoid X and retinoic acid receptor ligands, Journal of Hazardous Materials, 192(3), 1860-1868.

Zaffaroni NP, Arias E, Capodanno G and Zavanella T, 1978. The toxicity of manganese ethylenebisdithiocarbamate to the adult newt, Triturus cristatus, Bulletin of Environmental Contamination and Toxicology, 20(2), 261-267.

Zaffaroni NP, Zavanella T, Cattaneo A and Arias E, 1986a. The toxicity of 2 4-D to the adult crested newt Triturus cristatus carnifex, Environmental Research, 41(1), 79-87.

Zaffaroni NP, Zavanella T, Ferrari ML and Arias, E, 1986b. Toxicity of 2 methyl-4-chlorophenoxyacetic-acid to the adult crested newt Triturus cristatus carnifex. Environmental Research, 41(1), 201-206.

Zaga A, Little EE, Rabeni CF and Ellersieck MR, 1998. Photoenhanced toxicity of a carbamate insecticide to early life stage anuran amphibians, Environmental Toxicology and Chemistry, 17(12), 2543-2553.

Zeng Q, Liao B, Luo Y, Liu C and Tang H, 2003. Inclusion effects of highly water-soluble cyclodextrins on the solubility, photodegradation, and acute toxicity of methyl parathion, Bulletin of Environmental Contamination and Toxicology, 71(4), 668-674.

Zhang Q, Guo X, Li M and Zhou W, 2007. Studies on the acute toxicity of dimethoate to tadpole of *Rana chaochiaoensis*. Journal of Yunnan Agricultural University, 22(5), 779-782.

Zhang T, Jin H and Zhu H, 1996. Quality criteria of acrylonitrile for the protection of aquatic life in China, Chemosphere, 32(10), 2083-2093.

APPENDICES

A. SEARCH LOGIC

EFSA Contract CT/EFSA/PRAS/2011/02 Lot 6 - Search logic as text:

Amphibia_IIIc

temp 20120312

1. amphibia*.mp. [mp=ab, bc, bo, bt, cb, cc, ds, ge, gn, mc, mi, mq, or, ps, sq, st, ti, tm, tn, ot, hw, nm, rs, ui]

2. (Frog* or Toad* or Bullfrog* or Newt* or Salamander* or Caecilian* or Spadefoot).mp. [mp=ab, bc, bo, bt, cb, cc, ds, ge, gn, mc, mi, mq, or, ps, sq, st, ti, tm, tn, ot, hw, nm, rs, ui]

3. 1 or 2

4. agrochemical*.mp. [mp=ab, bc, bo, bt, cb, cc, ds, ge, gn, mc, mi, mq, or, ps, sq, st, ti, tm, tn, ot, hw, nm, rs, ui]

5. plant protection product*.mp. [mp=ab, bc, bo, bt, cb, cc, ds, ge, gn, mc, mi, mq, or, ps, sq, st, ti, tm, tn, ot, hw, nm, rs, ui]

6. plant protection compound*.mp. [mp=ab, bc, bo, bt, cb, cc, ds, ge, gn, mc, mi, mq, or, ps, sq, st, ti, tm, tn, ot, hw, nm, rs, ui]

7. plant protection chemical*.mp. [mp=ab, bc, bo, bt, cb, cc, ds, ge, gn, mc, mi, mq, or, ps, sq, st, ti, tm, tn, ot, hw, nm, rs, ui]

8. (Pesticid* or insecticid* or Acaricid* or Nematicid* or Molluscicid*).mp. [mp=ab, bc, bo, bt, cb, cc, ds, ge, gn, mc, mi, mq, or, ps, sq, st, ti, tm, tn, ot, hw, nm, rs, ui]

9. (Herbicid* or Fungicid*).mp. [mp=ab, bc, bo, bt, cb, cc, ds, ge, gn, mc, mi, mq, or, ps, sq, st, ti, tm, tn, ot, hw, nm, rs, ui]

10. rodenticid*.mp. [mp=ab, bc, bo, bt, cb, cc, ds, ge, gn, mc, mi, mq, or, ps, sq, st, ti, tm, tn, ot, hw, nm, rs, ui]

11. 4 or 5 or 6 or 7 or 8 or 9 or 10

12. 3 and 11

13. remove duplicates from 12

14. agricult*.mp. [mp=ab, bc, bo, bt, cb, cc, ds, ge, gn, mc, mi, mq, or, ps, sq, st, ti, tm, tn, ot, hw, nm, rs, ui]

15. environment*.mp. [mp=ab, bc, bo, bt, cb, cc, ds, ge, gn, mc, mi, mq, or, ps, sq, st, ti, tm, tn, ot, hw, nm, rs, ui]

16. habitat*.mp. [mp=ab, bc, bo, bt, cb, cc, ds, ge, gn, mc, mi, mq, or, ps, sq, st, ti, tm, tn, ot, hw, nm, rs, ui]

17. (land or lands).mp. [mp=ab, bc, bo, bt, cb, cc, ds, ge, gn, mc, mi, mq, or, ps, sq, st, ti, tm, tn, ot, hw, nm, rs, ui]

18. 15 or 16 or 17

19. 14 and 18

20. farmland*.mp. [mp=ab, bc, bo, bt, cb, cc, ds, ge, gn, mc, mi, mq, or, ps, sq, st, ti, tm, tn, ot, hw, nm, rs, ui]

21. (arable or pasture* or grassland* or meadow*).mp. [mp=ab, bc, bo, bt, cb, cc, ds, ge, gn, mc, mi, mq, or, ps, sq, st, ti, tm, tn, ot, hw, nm, rs, ui]

22. (plantation* or orchard* or vine or fruit).mp. [mp=ab, bc, bo, bt, cb, cc, ds, ge, gn, mc, mi, mq, or, ps, sq, st, ti, tm, tn, ot, hw, nm, rs, ui]

23. (rural garden* or small holding*).mp. [mp=ab, bc, bo, bt, cb, cc, ds, ge, gn, mc, mi, mq, or, ps, sq, st, ti, tm, tn, ot, hw, nm, rs, ui]

24. (field or mainfield or crop or crops or headland*).mp. [mp=ab, bc, bo, bt, cb, cc, ds, ge, gn, mc, mi, mq, or, ps, sq, st, ti, tm, tn, ot, hw, nm, rs, ui]

25. (hedgerow* or ditch* or pond or ponds or surface water).mp. [mp=ab, bc, bo, bt, cb, cc, ds, ge, gn, mc, mi, mq, or, ps, sq, st, ti, tm, tn, ot, hw, nm, rs, ui]

26. 19 or 20 or 21 or 22 or 23 or 24 or 25

27. 3 and 26

28. 27 not 12

29. europe*.mp. [mp=ab, bc, bo, bt, cb, cc, ds, ge, gn, mc, mi, mq, or, ps, sq, st, ti, tm, tn, ot, hw, nm, rs, ui]

30. (Austria or Belgium or Bulgaria or Cyprus or Czech Republic or Denmark or Estonia or Finland or France or Germany or Greece or Hungary or Ireland or Italy or Latvia or Lithuania or Luxembourg or Malta or Netherlands or Poland or Portugal or Romania or Slovakia or Slovenia or Spain or Sweden or United Kingdom).mp. [mp=ab, bc, bo, bt, cb, cc, ds, ge, gn, mc, mi, mq, or, ps, sq, st, ti, tm, tn, ot, hw, nm, rs, ui]

31. 29 or 30

32. 28 and 31

33. remove duplicates from 32

34. (Toxic* or ecotox* or poisoning or LD50 or LC50).mp. [mp=ab, bc, bo, bt, cb, cc, ds, ge, gn, mc, mi, mq, or, ps, sq, st, ti, tm, tn, ot, hw, nm, rs, ui]

35. (Endocrine adj disrupt*).mp. [mp=ab, bc, bo, bt, cb, cc, ds, ge, gn, mc, mi, mq, or, ps, sq, st, ti, tm, tn, ot, hw, nm, rs, ui]

36. (Sublethal* or chronic or susceptib* or Harmful*).mp. [mp=ab, bc, bo, bt, cb, cc, ds, ge, gn, mc, mi, mq, or, ps, sq, st, ti, tm, tn, ot, hw, nm, rs, ui]

37. (Contamina* or residu*).mp. [mp=ab, bc, bo, bt, cb, cc, ds, ge, gn, mc, mi, mq, or, ps, sq, st, ti, tm, tn, ot, hw, nm, rs, ui]

38. 34 or 35 or 36 or 37

39. (Exposure or Dermal* or absorption or Spray* or Overspray* or Granule* or pellet* or bait*).mp. [mp=ab, bc, bo, bt, cb, cc, ds, ge, gn, mc, mi, mq, or, ps, sq, st, ti, tm, tn, ot, hw, nm, rs, ui]

40. (Seed adj treatment*).mp. [mp=ab, bc, bo, bt, cb, cc, ds, ge, gn, mc, mi, mq, or, ps, sq, st, ti, tm, tn, ot, hw, nm, rs, ui]

41. (tank adj mix*).mp. [mp=ab, bc, bo, bt, cb, cc, ds, ge, gn, mc, mi, mq, or, ps, sq, st, ti, tm, tn, ot, hw, nm, rs, ui]

42. (Risk adj assessment*).mp. [mp=ab, bc, bo, bt, cb, cc, ds, ge, gn, mc, mi, mq, or, ps, sq, st, ti, tm, tn, ot, hw, nm, rs, ui]

43. 39 or 40 or 41 or 42

44. 39 or 40 or 41

45. 3 and 44

46. 38 and 45

47. 46 not 12

48. 47 not 32

49. remove duplicates from 48

50. 49 use caba

51. (Food* adj3 intake*).mp. [mp=ab, bc, bo, bt, cb, cc, ds, ge, gn, mc, mi, mq, or, ps, sq, st, ti, tm, tn, ot, hw, nm, rs, ui]

52. (Food* adj3 consumption*).mp. [mp=ab, bc, bo, bt, cb, cc, ds, ge, gn, mc, mi, mq, or, ps, sq, st, ti, tm, tn, ot, hw, nm, rs, ui]

53. ((Foraging or feeding) adj activit*).mp. [mp=ab, bc, bo, bt, cb, cc, ds, ge, gn, mc, mi, mq, or, ps, sq, st, ti, tm, tn, ot, hw, nm, rs, ui]

54. Metaboli*.mp. [mp=ab, bc, bo, bt, cb, cc, ds, ge, gn, mc, mi, mq, or, ps, sq, st, ti, tm, tn, ot, hw, nm, rs, ui]

55. (Energy adj expenditure*).mp. [mp=ab, bc, bo, bt, cb, cc, ds, ge, gn, mc, mi, mq, or, ps, sq, st, ti, tm, tn, ot, hw, nm, rs, ui]

56. Diet*.mp. [mp=ab, bc, bo, bt, cb, cc, ds, ge, gn, mc, mi, mq, or, ps, sq, st, ti, tm, tn, ot, hw, nm, rs, ui]

57. 51 or 52 or 53 or 54 or 55 or 56

58. (Habitat* or behaviour* or bodyweight* or movement* or migrat*).mp. [mp=ab, bc, bo, bt, cb, cc, ds, ge, gn, mc, mi, mq, or, ps, sq, st, ti, tm, tn, ot, hw, nm, rs, ui]

59. (Home adj range*).mp. [mp=ab, bc, bo, bt, cb, cc, ds, ge, gn, mc, mi, mq, or, ps, sq, st, ti, tm, tn, ot, hw, nm, rs, ui]

60. (activit* or travel*).mp. [mp=ab, bc, bo, bt, cb, cc, ds, ge, gn, mc, mi, mq, or, ps, sq, st, ti, tm, tn, ot, hw, nm, rs, ui]

61. (Life adj cycle*).mp. [mp=ab, bc, bo, bt, cb, cc, ds, ge, gn, mc, mi, mq, or, ps, sq, st, ti, tm, tn, ot, hw, nm, rs, ui]

62. (Annual adj cycle).mp. [mp=ab, bc, bo, bt, cb, cc, ds, ge, gn, mc, mi, mq, or, ps, sq, st, ti, tm, tn, ot, hw, nm, rs, ui]

63. (Population adj densit*).mp. [mp=ab, bc, bo, bt, cb, cc, ds, ge, gn, mc, mi, mq, or, ps, sq, st, ti, tm, tn, ot, hw, nm, rs, ui]

64. (Body adj size*).mp. [mp=ab, bc, bo, bt, cb, cc, ds, ge, gn, mc, mi, mq, or, ps, sq, st, ti, tm, tn, ot, hw, nm, rs, ui]

65. (Body adj length*).mp. [mp=ab, bc, bo, bt, cb, cc, ds, ge, gn, mc, mi, mq, or, ps, sq, st, ti, tm, tn, ot, hw, nm, rs, ui]

66. 58 or 59 or 60 or 61 or 62 or 63 or 64 or 65

67. 57 or 66

68. 3 and 67

69. 38 or 44

70. 68 and 69

71. 31 and 70

72. 71 not 12

73. 72 not 32

74. 73 not 50

75. remove duplicates from 74

76. (radio-track* or telemetr*).mp. [mp=ab, bc, bo, bt, cb, cc, ds, ge, gn, mc, mi, mq, or, ps, sq, st, ti, tm, tn, ot, hw, nm, rs, ui]

77. tracking*.mp. [mp=ab, bc, bo, bt, cb, cc, ds, ge, gn, mc, mi, mq, or, ps, sq, st, ti, tm, tn, ot, hw, nm, rs, ui]

78. 76 or 77

79. 3 and 78

80. remove duplicates from 79

81. exp amphibia/ or exp "chordata: general and systematic - amphibia"/

82. amphibia/ or exp persicaria amphibia/ or exp "proteus (amphibia)"/ or exp rorippa amphibia/

83. amphibians/ or exp anura/ or exp urodela/

84. exp amphibia/

85. (Anura or Urodea or Caudata or Bufionidae or Ambystomatidae or Proteidae).mp. [mp=ab, bc, bo, bt, cb, cc, ds, ge, gn, mc, mi, mq, or, ps, sq, st, ti, tm, tn, ot, hw, nm, rs, ui]

86. 3 or 81 or 82 or 83 or 84 or 85

87. 11 and 86

88. 87 not 12

89. remove duplicates from 88

90. (lake or lakes or wetland* or river* or damps or stream or streams or lotic or lentic).mp. [mp=ab, bc, bo, bt, cb, cc, ds, ge, gn, mc, mi, mq, or, ps, sq, st, ti, tm, tn, ot, hw, nm, rs, ui]

91. (bog or bogs or bogland).mp. [mp=ab, bc, bo, bt, cb, cc, ds, ge, gn, mc, mi, mq, or, ps, sq, st, ti, tm, tn, ot, hw, nm, rs, ui]

92. 26 or 90 or 91

93. 86 and 92

94. 31 and 93

95. 94 not 32

96. remove duplicates from 95

97. (lethal* or neurotox* or renotox* or hepatotox*).mp. [mp=ab, bc, bo, bt, cb, cc, ds, ge, gn, mc, mi, mq, or, ps, sq, st, ti, tm, tn, ot, hw, nm, rs, ui]

98. 38 or 97

99. 86 and 98

100. 43 and 99

101. 89 or 96

102. 100 not 101

103. remove duplicates from 102

104. 103 not 49

105. (sedentarity or permanence or pattern or longevity or deform*).mp. [mp=ab, bc, bo, bt, cb, cc, ds, ge, gn, mc, mi, mq, or, ps, sq, st, ti, tm, tn, ot, hw, nm, rs, ui]

106. morpholog*.mp. [mp=ab, bc, bo, bt, cb, cc, ds, ge, gn, mc, mi, mq, or, ps, sq, st, ti, tm, tn, ot, hw, nm, rs, ui]

107. 105 or 106

108. 86 and 107

109. 31 and 108

110. remove duplicates from 109

111. 13 or 33 or 49 or 75 or 89 or 96 or 104

112. 110 not 111

113. 112 use b12o85

114. 112 use caba

115. 112 use mesz

116. 112 use z12r93

B. SPECIES INFORMATION – GREAT CRESTED NEWT (*TRITURUS CRISTATUS*)

EU distribution

Austria, Belgium, Czech Republic, Denmark, Estonia, France, Germany, Hungary, Latvia, Lithuania, Luxembourg, Netherlands, Poland, Romania, Slovakia, Sweden, United Kingdom

Information sources

Basic information on this species can be found in general field guides (e.g. Arnold and Ovenden 2002) or in online resources such as:

AmphibiaWeb	http://amphibiaweb.org/cgi-bin/amphib_query?query_src=aw_search_index&where-genus=Triturus&where-species=cristatus&rel-genus=equals&rel-species=equals
Reptiles & Amphibiens de France	http://www.herpfrance.com/amphibian/great_crested_newt_triturus_cristatus.php
Arkive	http://www.arkive.org/great-crested-newt/triturus-cristatus/#text=All
The IUCN red list	http://www.iucnredlist.org/details/full/22212/0

Further details on distribution can be found in the 'Atlas of amphibians and reptiles in Europe' (Gasc et al 1997).

Map is available at:	http://www.seh-herpetology.org/images/atlas/pdf/caudata/tricri.pdf (including *T. carnifex, T. dobrogicus, T. karelinii)*

Below is more detailed information on body size (length and weight), metabolic rate, diet and seasonal activity found during the course of the review.

1. Body size

Table 14: Bodyweight of *Triturus cristatus*

Age	Sex	Season	Mean	SD/SE	Units	Min.	Max.	N	Country	Habitat	Notes	Reference
Sud-adult	-	-	-	-	g	0.4	2.9		Germany	Garden	Immigrating newts	Schonert and Schonert (2008)
Adult	F	-	-	-	g	3.0	12.4		Germany	Garden	Immigrating newts	Schonert and Schonert (2008)
Adult	M	-	-	-	g	2.4	10.8		Germany	Garden	Immigrating newts	Schonert and Schonert (2008)
Metamorph	-	Summer	1.26	0.35 SD	g	-	-		Switzerland	Artificial	At metamorphosis	Van Buskirk (2007)
Adult	M	All year	8.6	2.0 SD	g	-	-		Italy	Mountain	Reproductive	Fasola and Canova (1992)
Adult	F	All year	11.4	3.0 SD	g	-	-		Italy	Mountain	Reproductive	Fasola and Canova (1992)
Adult	M	All year	9.1	2.7 SD	g	-	-		Italy	Mountain	Non-reproductive	Fasola and Canova (1992)
Adult	F	All year	11.1	3.9 SD	g	-	-		Italy	Mountain	Non-reproductive	Fasola and Canova (1992)
Adult	M,	Summer	6.2	-	g	-	-	1	France	Pasture, orchard, arable	Emigrating from breeding pond	Jehle and Arntzen (2000)
Adult	M	Summer	7.5	-	g	-	-	1	France	Pasture, orchard, arable	Emigrating from breeding pond	Jehle and Arntzen (2000)
Adult	M	Summer	7.3	-	g	-	-	1	France	Pasture, orchard, arable	Emigrating from breeding pond	Jehle and Arntzen (2000)
Adult	M	Summer	6.9	-	g	-	-	1	France	Pasture, orchard, arable	Emigrating from breeding pond	Jehle and Arntzen (2000)
Adult	F	Summer	6.9	-	g	-	-	1	France	Pasture, orchard, arable	Emigrating from breeding pond	Jehle and Arntzen (2000)
Adult	F	Summer	8.0	-	g	-	-	1	France	Pasture, orchard, arable	Emigrating from breeding pond	Jehle and Arntzen (2000)
Adult	F	Summer	7.5	-	g	-	-	1	France	Pasture, orchard, arable	Emigrating from breeding pond	Jehle and Arntzen (2000)

Age	Sex	Season	Mean	SD/SE	Units	Min.	Max.	N	Country	Habitat	Notes	Reference
Adult	F	Summer	8.5	-	g	-	-	1	France	Pasture, orchard, arable	Emigrating from breeding pond	Jehle and Arntzen (2000)
Adult	F	Summer	9.4	-	g	-	-	1	France	Pasture, orchard, arable	Emigrating from breeding pond	Jehle and Arntzen (2000)
Adult	F	Summer	6.0	-	g	-	-	1	France	Pasture, orchard, arable	Emigrating from breeding pond	Jehle and Arntzen (2000)
Adult	F	Summer	7.0	-	g	-	-	1	France	Pasture, orchard, arable	Emigrating from breeding pond	Jehle and Arntzen (2000)
Adult	F	Summer	7.0	-	g	-	-	1	France	Pasture, orchard, arable	Emigrating from breeding pond	Jehle and Arntzen (2000)
Adult	F	Summer	9.0	-	g	-	-	1	France	Pasture, orchard, arable	Emigrating from breeding pond	Jehle and Arntzen (2000)
Sub-adult	-	Summer	4.8	-	g	-	-	1	France	Pasture, orchard, arable	Emigrating from breeding pond	Jehle and Arntzen (2000)

Table 15: Body length of *Triturus cristatus*

Age	Sex	Season	Mean	SD/SE	Units	Min.	Max.	N	Country	Habitat	Notes	Reference
≤3mo.	-	-	-	-	mm total	55	60	-	UK	-	At metamorphosis	Frazer (1983)
≤3mo.	-	-	55	-	mm total	-	-	-	UK	-	At metamorphosis	Frazer (1983)
3.5 mo.	-	-	>80	-	mm total	-	-	-	UK	-	At metamorphosis	Frazer (1983)
Year 1		-	-	-	mm total	43	62	-	UK	-		Frazer (1983)
Year 1		-	-	-	mm total	70	80	-	UK	-		Frazer (1983)
Year 2		-	-	-	mm total	81	100	-	UK	-		Frazer (1983)
Adult		-	-	-	mm total	87	118	-	UK	-	Year 3	Frazer (1983)
Adult		-	-	-	mm total	118	150	-	UK	-	Year 4	Frazer (1983)
A	M	-	120	-	mm total	110	140	-	UK	-		Frazer (1983)
A	F	-	111	-	mm total	128	157	-	UK	-		Frazer (1983)
A	M	-	-	-	mm total	-	145	-	UK	-	Maximum size recorded	Frazer (1983)
A	F	-	-	-	mm total	-	162	-	UK	-	Maximum size recorded	Frazer (1983)

Age	Sex	Season	Mean	SD/SE	Units	Min.	Max.	N	Country	Habitat	Notes	Reference
Sud-adult	-	-	-	-	mm total	41	98	-	Germany	Garden	Immigrating newts	Schonert and Schonert (2008)
Adult	F	-	-	-	mm total	83	148	-	Germany	Garden	Immigrating newts	Schonert and Schonert (2008)
Adult	M	-	-	-	mm total	82	161	-	Germany	Garden	Immigrating newts	Schonert and Schonert (2008)
Adult	M	-	62.5	7.63 SD	mm SVL	-	80	-	France	'Pond'	-	Francillon-Viellot et al (1990)
Adult	F	-	69.7	6.17 SD	mm SVL	-	80	-	France	'Pond'	-	Francillon-Viellot et al (1990)
Adult	M	-	67.33	0.83 SE	mm SVL	54.0	78.7	43	Sweden, Norway, Denmark, Finland	Museum specimens	Tail length 47.56±0.70 SE (range 38.4-54.9)	Malmgren and Thollesson (1999)
Adult	F	-	71.21	0.61 SE	mm SVL	59.4	82.9	71	Sweden, Norway, Denmark, Finland	Museum specimens	Tail length 53.88±0.56 (range42.1-62.2)	Malmgren and Thollesson (1999)
Adult	M	-	68.38	2.22 SD	mm SVL	65.00	71.00	8	Bulgaria	Mountain	Tail length 51,14±1.57 SD (range 49.0-54.0)	Naumov and Tzankov (2009)
Adult	F	-	73.67	8.39 SD	mm SVL	64.00	79.00	3	Bulgaria	Mountain	Tail length 59.00±7.94 SD (range 50.0-65.0)	Naumov and Tzankov (2009)
Adult	M	-	58.5	5.6 SD	mm SVL	-	-	17	France	Sand quarry (abandoned)	Young adults (3y)	Arntzen and Teunis (1993)
Adult	F	-	61.4	4.4 SD	mm SVL	-	-	13	France	Sand quarry (abandoned)	Young adults (3y)	Arntzen and Teunis (1993)
Juvenile	-	-	44.4	4.0 SD	mm SVL	-	-	30	France	Sand quarry (abandoned)		Arntzen and Teunis (1993)
Juvenile	-	-	42.0	5.3 SD	mm SVL	-	-	202	France	Sand quarry (abandoned)		Arntzen and Teunis (1993)
Adult	M	All year	65	8 SD	mm SVL	-	-		Italy	Mountain	Reproductive	Fasola and Canova (1992)

Age	Sex	Season	Mean	SD/SE	Units	Min.	Max.	N	Country	Habitat	Notes	Reference
Adult	F	All year	72	9 SD	mm SVL	-	-		Italy	Mountain	Reproductive	Fasola and Canova (1992)
Adult	M	All year	70	10 SD	mm SVL	-	-		Italy	Mountain	Non-reproductive	Fasola and Canova (1992)
Adult	F	All year	74	10 SD	mm SVL	-	-		Italy	Mountain	Non-reproductive	Fasola and Canova (1992)

2. Metabolic rate

Table 16: Metabolic rate of *Triturus cristatus* (oxygen)

Age	Sex	Weight (g)	Season	Mean	SD/SE	Units	Min.	Max.	N	Country	Temp (°C)	Notes	Reference
Adult		7	-	0.055	-	ml/g/h	-	-	-	-	10	Resting	Gatten et al. (1992)

3. Diet

Table 17: Diet of *Triturus cristatus* in ponds in the UK (Avery 1968)

Age	Sex	Food type	Mean number	Season	N	Country	Habitat	Notes
Adult	-	Diptera (larvae and pupae)	5.3	Spring	16	UK	'Pond'	Diet in pond, April.
Adult	-	Copepoda	1.4	Spring	16	UK	'Pond'	Diet in pond, April.
Adult	-	Cladocera	0.6	Spring	16	UK	'Pond'	Diet in pond, April.
Adult	-	Ostracoda	2.5	Spring	16	UK	'Pond'	Diet in pond, April.
Adult	-	Asellus	9.1	Spring	16	UK	'Pond'	Diet in pond, April.
Adult	-	Gastropoda	7.0	Spring	16	UK	'Pond'	Diet in pond, April.
Adult	-	Ephemoptera nymphs	0.4	Spring	16	UK	'Pond'	Diet in pond, April.
Adult	-	Odonata nymphs	0.2	Spring	16	UK	'Pond'	Diet in pond, April.
Adult	-	Coleoptera larvae	0.1	Spring	16	UK	'Pond'	Diet in pond, April.
Adult	-	Newt egg	0.1	Spring	16	UK	'Pond'	Diet in pond, April.

Table 18: Diet of *Triturus cristatus* in Romania (Kovacs et al. 2010a). Empty stomachs were found in 2.22% of newts sampled.

Age	Sex	Food type	Relative abundance (%)	Frequency (%)	Season	N	Country	Habitat	Notes
Adult	-	Annelida – Oligochaeta	12.4	48.9	Spring/Summer	90	Romania	-	Totals all sites April/June
Adult	-	Gastropoda (terrestrial)	0.58	4.44	Spring/Summer	90	Romania	-	Totals all sites April/June
Adult	-	Bivalvia	0.58	4.44	Spring/Summer	90	Romania	-	Totals all sites April/June
Adult	-	Crustacea – Cladocera	19	8.89	Spring/Summer	90	Romania	-	Totals all sites April/June
Adult	-	Crustacea – Ostracoda	7.2	17.8	Spring/Summer	90	Romania	-	Totals all sites April/June
Adult	-	Coleoptera- Dytiscidae (larvae)	2.02	11.1	Spring/Summer	90	Romania	-	Totals all sites April/June
Adult	-	Coleoptera- Dytiscidae	0.29	2.22	Spring/Summer	90	Romania	-	Totals all sites April/June
Adult	-	Coleoptera – Carabidae	0.29	2.22	Spring/Summer	90	Romania	-	Totals all sites April/June
Adult	-	Coleoptera (terrestrial)	0.58	4.44	Spring/Summer	90	Romania	-	Totals all sites April/June
Adult	-	Coleoptera (undetermined)	0.58	4.44	Spring/Summer	90	Romania	-	Totals all sites April/June
Adult	-	Diptera - Nematocera (larvae)	21.3	31.1	Spring/Summer	90	Romania	-	Totals all sites April/June
Adult	-	Diptera – Brachycera	0.29	2.22	Spring/Summer	90	Romania	-	Totals all sites April/June
Adult	-	Lepidoptera (larvae)	2.02	15.6	Spring/Summer	90	Romania	-	Totals all sites April/June
Adult	-	Trichoptera (larvae)	4.61	22.2	Spring/Summer	90	Romania	-	Totals all sites April/June
Adult	-	Anura (larvae)	28.2	37.8	Spring/Summer	90	Romania	-	Totals all sites April/June

Table 19: Diet of *Triturus cristatus* in Romania (David et al. 2009a).

Age	Sex	Food type	Relative abundance (%)	Frequency (%)	Season	N	Country	Habitat	Notes
Adult	M/F	Anelida, Oligocheta	1.79	14.2	Spring	113	Romania	Small ponds	55 F and 58 M
Adult	M/F	Gastropoda, snail (terrestrial)	0.77	4.42	Spring	113	Romania	Small ponds	55 F and 58 M
Adult	M/F	Gastropoda, snail (aquatic)	2.73	12.4	Spring	113	Romania	Small ponds	55 F and 58 M
Adult	M/F	Crustacean, Cladocera	56.30	30.1	Spring	113	Romania	Small ponds	55 F and 58 M
Adult	M/F	Crustacean, Ostracoda	0.68	2.65	Spring	113	Romania	Small ponds	55 F and 58 M
Adult	M/F	Crustacean, Copepoda	11.80	19.5	Spring	113	Romania	Small ponds	55 F and 58 M
Adult	M/F	Ephemeroptera (larvae)	0.17	1.77	Spring	113	Romania	Small ponds	55 F and 58 M

Age	Sex	Food type	Relative abundance (%)	Frequency (%)	Season	N	Country	Habitat	Notes
Adult	M/F	Odonata (larvae)	0.09	0.88	Spring	113	Romania	Small ponds	55 F and 58 M
Adult	M/F	Heteroptera (aquatic)	0.09	0.88	Spring	113	Romania	Small ponds	55 F and 58 M
Adult	M/F	Trichoptera (larvae)	15.80	69	Spring	113	Romania	Small ponds	55 F and 58 M
Adult	M/F	Coleoptera, Dytiscida (larvae)	1.28	12.4	Spring	113	Romania	Small ponds	55 F and 58 M
Adult	M/F	Coleoptera (terrestrial)	1.02	8.85	Spring	113	Romania	Small ponds	55 F and 58 M
Adult	M/F	Diptera, Nematocera (larvae)	1.19	9.73	Spring	113	Romania	Small ponds	55 F and 58 M
Adult	M/F	Diptera, Nematocera, Culicida	0.09	0.88	Spring	113	Romania	Small ponds	55 F and 58 M
Adult	M/F	Diptera, Brahicera	0.17	1.77	Spring	113	Romania	Small ponds	55 F and 58 M
Adult	M/F	Diptera, Brahicera (larvae) aquatic	0.17	1.77	Spring	113	Romania	Small ponds	55 F and 58 M
Adult	M/F	Hymenoptera, Formicida	0.09	0.88	Spring	113	Romania	Small ponds	55 F and 58 M
Adult	M/F	Anura (larvae)	5.71	23.9	Spring	113	Romania	Small ponds	55 F and 58 M

Further detailed information on the diet of *Triturus cristatus* indicating variation between sampling date and sampling site can be found in Cicort-Lucaciu et al. (2005, 2007), Covaciu-Marcov et al. (2010).

4. Seasonal activities

Data on seasonal activity is greatly affected by factors such as habitat, latitude, altitude, local climate, annual differences in temperature and the permanence or other wise of the breeding pond. It is therefore recommended that local information for the zone/country/area under consideration be consulted.

Seasonal activity of *Triturus cristatus* in Germany based on information in Pfeffer et al. (2011). Darker area represents the main period of activity.

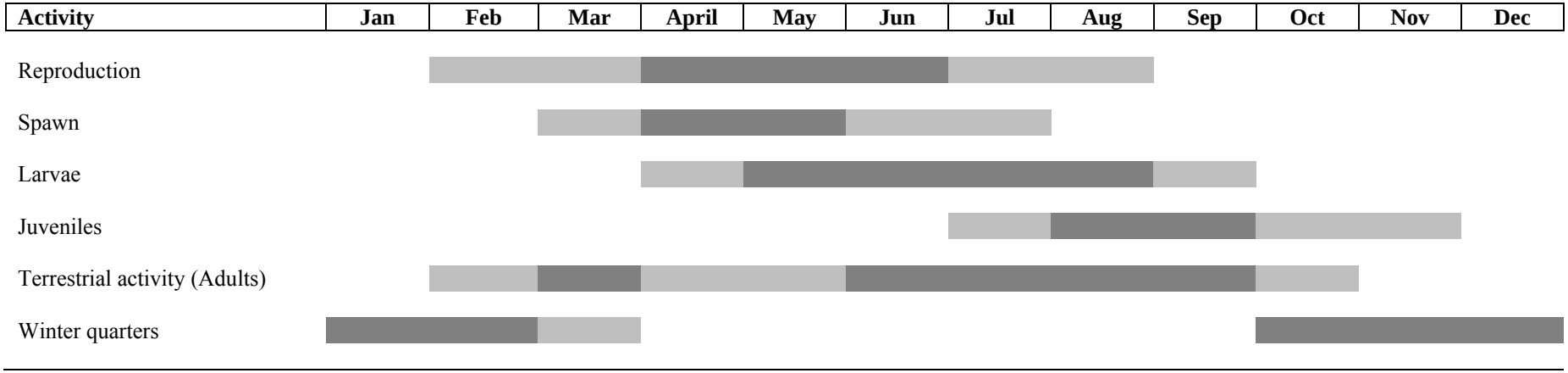

Table 20: Seasonal activities of *Triturus cristatus*.

Begin	Peak	End	Country	Habitat	Notes	Reference
Mating/laying						
End February-beginning March	Early/mid April	End April-mid May	Romania	Near forest	Aquatic phase	Cicort-Lucaciu et al (2009)
Emigration						
10 June	-	8 August	Sweden	Cattle pond, pasture, spinney	Onset of emigration from breeding pond, 'older' (non-metamorphs) (1997 data)	Malmgren (2002)
27 July	-	23 October	Sweden	Cattle pond, pasture, spinney	Onset of emigration from breeding pond, metamorphs (1997 data)	Malmgren (2002)
21 May	-	29 July	Sweden	Cattle pond, pasture, spinney	Onset of emigration from breeding pond, 'older' (non-metamorphs) (1998 data)	Malmgren (2002)
18 June	-	3 November	Sweden	Cattle pond, pasture, spinney	Onset of emigration from breeding pond, metamorphs (1998 data)	Malmgren (2002)
1 June	-	19 July	Sweden	Cattle pond, pasture, spinney	Onset of emigration from breeding pond, 'older' (non-metamorphs) (1999 data)	Malmgren (2002)
30 June	-	21 October	Sweden	Cattle pond, pasture, spinney	Onset of emigration from breeding pond, metamorphs (1999 data)	Malmgren (2002)

5. Other information

Table 21: Age and longevity of *Triturus cristatus*.

Sex	Season	Mean	SD/SE	Units	Min.	Max.	N	Country	Habitat	Notes	Reference
F	-	-	-	y	-	10	1	Germany	Agricultural		Hachtel et al (2005)
F	-	-	-	y	-	8	1	Germany	Agricultural		Hachtel et al (2005)
M	-	-	-	y	-	8	1	Germany	Agricultural		Hachtel et al (2005)
M	-	-	-	y	-	12+		France	'Pond'	Based on LAG	Francillon-Viellot et al (1990)
M	-	-	-	y	-	14		France	'Pond'	Based on LAG	Francillon-Viellot et al (1990)

C. SPECIES INFORMATION – SMOOTH NEWT (*LISSOTRITON VULGARIS, TRITURUS VULGARIS*)

EU distribution

Austria, Belgium, Bulgaria, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Luxembourg, Netherlands, Poland, Romania, Slovakia, Slovenia, Sweden, United Kingdom

Information sources

Basic information on this species can be found in general field guides (e.g. Arnold and Ovenden 2002) or in online resources such as:

AmphibiaWeb	http://amphibiaweb.org/cgi-bin/amphib_query?query_src=aw_search_index&where-genus=Lissotriton&where-species=vulgaris&rel-genus=equals&rel-species=equals
Reptiles & Amphibiens de France	http://www.herpfrance.com/amphibian/common_newt_lissotriton_vulgaris.php
Arkive	http://www.arkive.org/common-frog/rana-temporaria/#text=All
The IUCN red list	http://www.arkive.org/smooth-newt/triturus-vulgaris/#text=All

Further details on distribution can be found in the 'Atlas of amphibians and reptiles in Europe' (Gasc et al 1997).

Map is available at: http://www.seh-herpetology.org/images/atlas/pdf/caudata/trivul.pdf

Below is more detailed information on body size (length and weight), metabolic rate, diet and seasonal activity found during the course of the review.

1. Body size

Table 22: Bodyweight of *Triturus vulgaris*.

Age	Sex	Season	Mean	SD/SE	Units	Min.	Max.	N	Country	Habitat	Notes	Reference
Adult	M	All year	1.6	0.2 SD	g	-	-	-	Italy	Mountain	Reproductive	Fasola and Canova (1992)
Adult	F	All year	1.9	0.4 SD	g	-	-	-	Italy	Mountain	Reproductive	Fasola and Canova (1992)
Adult	M	-	2.42	0.41 SD	g	-	-	63	Ireland	-	February-June	Marnell (1996)
Adult	F	-	2.49	0.47 SD	g	-	-	39	Ireland	-	February-June	Marnell (1996)

Table 23: Body length of Triturus cristatus.

Age	Sex	Season	Mean	SD/SE	Units	Min.	Max.	N	Country	Habitat	Notes	Reference
≤3mo.	-	-	-	-	mm total	25	30	-	UK	-	At metamorphosis	Frazer (1983)
≤3mo.	-	-	-	-	mm total	25	35	-	UK	-	At metamorphosis	Frazer (1983)
3.5 mo.	-	-	>35	-	mm total	-	-	-	UK	-	At metamorphosis	Frazer (1983)
Year 1		-	-	-	mm total	34	45	-	UK	-		Frazer (1983)
Year 2		-	-	-	mm total	48	60	-	UK	-		Frazer (1983)
Year 3		-	-	-	mm total	58	70	-	UK	-		Frazer (1983)
Year 4		-	-	-	mm total	78	90	-	UK	-		Frazer (1983)
Adult	M	-	79	-	mm total	46	100	-	UK	-		Frazer (1983)
Adult	F	-	76	-	mm total	50	93	-	UK	-		Frazer (1983)
Adult	M	-	-	-	mm total	-	109	-	UK	-	Maximum size recorded	Frazer (1983)
A	F	-	-	-	mm total	-	100	-	UK	-	Maximum size recorded	Frazer (1983)
A	M	-	40.40.	0.28 SE	mm SVL	35.1	47.4	88	Sweden, Norway, Denmark, Finland	Museum specimens	Tail length 37.51±0.38 SE (range 28.8-44.1)	Malmgren and Thollesson (1999)

Age	Sex	Season	Mean	SD/SE	Units	Min.	Max.	N	Country	Habitat	Notes	Reference
Adult	F	-	40.91	0.41 SE	mm SVL	34.8	47.2	72	Sweden, Norway, Denmark, Finland	Museum specimens	Tail length 34.81±0.39 SE (range26.7-41.9)	Malmgren and Thollesson (1999)
Adult	M	All year	36	3 SD	mm SVL	-		-	Italy	Mountain	Reproductive	Fasola and Canova (1992)
Adult	F	All year	39	3 SD	mm SVL	-	-	-	Italy	Mountain	Reproductive	Fasola and Canova (1992)
Adult	M	-	35.2	2.26 SD	mm SVL	-	-	24	Italy	Xeric, coastal	Pond C. Data are for *Triturus vulgaris merdionalis*.	Nobili and Accordi (1997)
Adult	M	-	34.7	2.41 SD	mm SVL	-	-	93	Italy	Xeric, coastal	Pond D. Data are for *Triturus vulgaris merdionalis*.	Nobili and Accordi (1997)
Adult	M	-	40.3	1.85 SD	mm SVL	-	-	34	Italy	Xeric, coastal	Pond F. Data are for *Triturus vulgaris merdionalis*.	Nobili and Accordi (1997)
Adult	F	-	36.2	1.75 SD	mm SVL	-	-	20	Italy	Xeric, coastal	Pond C. Data are for *Triturus vulgaris merdionalis*.	Nobili and Accordi (1997)
Adult	F	-	35.3	2.72 SD	mm SVL	-	-	54	Italy	Xeric, coastal	Pond D. Data are for *Triturus vulgaris merdionalis*.	Nobili and Accordi (1997)
Adult	F	-	42.05	2.55 SD	mm SVL	-	-	26	Italy	Xeric, coastal	Pond F. Data are for *Triturus vulgaris merdionalis*.	Nobili and Accordi (1997)
Adult	M	-	37.3	2.54 SD	mm SVL	-	-	63	Ireland	-	February-June. Tail length 46.3 (3.85 SD)	Marnell (1996)
Adult	F	-	38.7	2.72 SD	mm SVL	-	-	39	Ireland	-	February-June. Tail length 42.1 (3.135 SD)	Marnell (1996)
Adult	M	-	83.80	4.4 SD	mm total	75	95	63	Ireland	-	February-June	Marnell (1996)
Adult	F	-	80.85	4.9 SD	mm total	71	90	39	Ireland	-	February-June	Marnell (1996)

Age	Sex	Season	Mean	SD/SE	Units	Min.	Max.	N	Country	Habitat	Notes	Reference
Adult	F	-	37.84	0.34	mm SVL			103	Poland	-	Tail length 37.63 (0.42 SE)	Babik and Rafinski (2004)
Adult	M	-	37.11	0.30	mm SVL			65	Poland	-	Tail length 40.76 (0.51 SE)	Babik and Rafinski (2004)
Adult	M	All year	-	-	mm SVL	30.0	36.9	4	Romania	Wetland		Cogalniceanu and Miaud (2003)
Adult	F	All year	34.7	2.09 SD	mm SVL	30.9	39.8	17	Romania	Wetland		Cogalniceanu and Miaud (2003)
A	F	-	43.21	2.52 SE	mm SVL			19	-	High altitude	Metamorphic, preserved specimens	Kalezic et al (1996)
A	M	-	41.14	2.12 SE	mm SVL			18	-	High altitude	Metamorphic, preserved specimens	Kalezic et al (1996)
A	M	Spring	45.5	2.9 SD	mm SVL			26	UK	-		Verrell (1986)
A	F	Spring	45.08	4.1 SD	mm SVL			24	UK	-		Verrell (1986)

2. Metabolic rate

Table 24: Metabolic rate of Triturus cristatus (oxygen).

Age	Sex	Weight (g)	Season	Mean	SD/SE	Units	Min.	Max.	N	Country	Temp (°C)	Notes	Reference
Adult	-	8.75	-	0.0986	-	ml/g/h	-	-	-	-	6	Resting	Gatten et al. (1992)
Adult	-	-	-	0.1125	-	ml/g/h	-	-	-	-	10	Resting	Gatten et al. (1992)
Adult	-	8.75	-	0.0929	-	ml/g/h	-	-	-	-	15	Resting	Gatten et al. (1992)
Adult	-	-	-	0.2161	-	ml/g/h	-	-	-	-	20	Resting	Gatten et al. (1992)
Adult	-	8.75	-	0.1859	-	ml/g/h	-	-	-	-	25	Resting	Gatten et al. (1992)

3. Diet

Table 25: Diet of *Triturus vulgaris* in Italy (Vignoli et al. 2009).

Age	Sex	Food type	Season	Frequency of occurrence	Relative abundance (numeric)	Relative abundance (volumetric)	N	Country	Habitat	Notes
Adult	-	Isopoda	All year	0.06	0.005	0.018	38	Italy	Abandoned quarry	Terrestrial prey
Adult	-	Aranea	All year	0.09	0.009	0.008	38	Italy	Abandoned quarry	Terrestrial prey
Adult	-	Miriapoda	All year	0.06	0.005	0.008	38	Italy	Abandoned quarry	Terrestrial prey
Adult	-	Collembola	All year	0.03	0.002	0.0001	38	Italy	Abandoned quarry	Terrestrial prey
Adult	-	Brachycera	All year	0.03	0.002	0.001	38	Italy	Abandoned quarry	Terrestrial prey
Adult	-	Brachycera L.	All year	0.03	0.002	0.002	38	Italy	Abandoned quarry	Terrestrial prey
Adult	-	Hexapoda n.d.	All year	0.13	0.013	0.001	38	Italy	Abandoned quarry	Terrestrial prey
Adult	-	Gastropoda acq.	All year	0.09	0.009	0.021	38	Italy	Abandoned quarry	Aquatic prey
Adult	-	Copepoda	All year	0.38	0.082	0.015	38	Italy	Abandoned quarry	Aquatic prey
Adult	-	Caldocera	All year	0.63	0.532	0.205	38	Italy	Abandoned quarry	Aquatic prey
Adult	-	Ostracoda	All year	0.38	0.094	0.018	38	Italy	Abandoned quarry	Aquatic prey
Adult	-	Zygoptera L	All year	0.13	0.011	0.015	38	Italy	Abandoned quarry	Aquatic prey
Adult	-	Anisoptera L	All year	0.31	0.09	0.43	38	Italy	Abandoned quarry	Aquatic prey
Adult	-	Ephemeroptera L	All year	0.19	0.016	0.029	38	Italy	Abandoned quarry	Aquatic prey
Adult	-	Coleoptera acq.	All year	0.22	-	-	38	Italy	Abandoned quarry	Aquatic prey
Adult	-	Coleoptera acq. L	All year	0.16	0.046	0.08	38	Italy	Abandoned quarry	Aquatic prey
Adult	-	Nematocera L	All year	0.44	0.058	0.098	38	Italy	Abandoned quarry	Aquatic prey
Adult	-	Amphibia ova	All year	0.09	0.025	0.052	38	Italy	Abandoned quarry	Aquatic prey

Table 26: Diet of *Triturus vulgaris* in ponds in the UK (Avery 1968).

Age	Sex	Food type	Mean number	Season	N	Country	Habitat	Notes
Adult	-	Diptera (larvae and pupae)	10.2	Spring	32	UK	'Pond 1'	Diet in pond, April.
Adult	-	Copepoda	0.4	Spring	32	UK	'Pond 1'	Diet in pond, April.
Adult	-	Cladocera	0.1	Spring	32	UK	'Pond 1'	Diet in pond, April.
Adult	-	Ostracoda	1.8	Spring	32	UK	'Pond 1'	Diet in pond, April.
Adult	-	Asellus	0.7	Spring	32	UK	'Pond 1'	Diet in pond, April.
Adult	-	Gastropoda	1.5	Spring	32	UK	'Pond 1'	Diet in pond, April.
Adult	-	Ephemoptera nymphs	0.3	Spring	32	UK	'Pond 1'	Diet in pond, April.
Adult	-	Odonata nymphs	0.1	Spring	32	UK	'Pond 1'	Diet in pond, April.
Adult	-	Coleoptera larvae	0.3	Spring	32	UK	'Pond 1'	Diet in pond, April.
Adult	-	Hemiptera	0.3	Spring	32	UK	'Pond 1'	Diet in pond, April.
Adult	-	Coleoptera	0.1	Spring	32	UK	'Pond 1'	Diet in pond, April.
Adult	-	Diptera (larvae and pupae)	0.9	Spring	53	UK	'Pond 2'	Diet in pond, all year.
Adult	-	Copepoda	0.5	Spring	53	UK	'Pond 2'	Diet in pond, all year.
Adult	-	Cladocera	0.4	Spring	53	UK	'Pond 2'	Diet in pond, all year.
Adult	-	Ostracoda	0.2	Spring	53	UK	'Pond 2'	Diet in pond, all year.
Adult	-	Asellus	0.3	Spring	53	UK	'Pond 2'	Diet in pond, all year.
Adult	-	Odonata nymphs	0.1	Spring	53	UK	'Pond 2'	Diet in pond, all year.
Adult	-	Coleoptera larvae	0.1	Spring	53	UK	'Pond 2'	Diet in pond, all year.
Adult	-	Hemiptera	0.1	Spring	53	UK	'Pond 2'	Diet in pond, all year.
Adult	-	Hydrachnellae	0.1	Spring	53	UK	'Pond 2'	Diet in pond, all year.

Table 27: Diet of *Lissotriton vulgaris* in Romania (Kovacs et al. 2010a). Empty stomachs were found in 7.92% of newts sampled.

Age	Sex	Food type	Relative abundance (%)	Frequency (%)	Season	N	Country	Habitat	Notes
Adult	-	Nematoda	3.32	5.49	Spr/Sum	164	Romania	-	Totals all sites April/June
Adult	-	Annelida – Oligochaeta	0.33	1.83	Spr/Sum	164	Romania	-	Totals all sites April/June
Adult	-	Gastropoda (aquatic)	0.11	0.61	Spr/Sum	164	Romania	-	Totals all sites April/June
Adult	-	Bivalvia	0.33	1.83	Spr/Sum	164	Romania	-	Totals all sites April/June
Adult	-	Arachnida – Araneae	0.22	1.22	Spr/Sum	164	Romania	-	Totals all sites April/June
Adult	-	Crustacea – Cladocera	26.7	14	Spr/Sum	164	Romania	-	Totals all sites April/June
Adult	-	Crustacea – Ostracoda	39.9	32.3	Spr/Sum	164	Romania	-	Totals all sites April/June
Adult	-	Crustacea – Copepoda	0.33	0.61	Spr/Sum	164	Romania	-	Totals all sites April/June
Adult	-	Ephemeroptera (larvae)	0.44	2.44	Spr/Sum	164	Romania	-	Totals all sites April/June
Adult	-	Plecoptera (larvae)	0.77	3.66	Spr/Sum	164	Romania	-	Totals all sites April/June
Adult	-	Homoptera – Aphidinea	0.11	0.61	Spr/Sum	164	Romania	-	Totals all sites April/June
Adult	-	Coleoptera- Dytiscidae	2.1	6.71	Spr/Sum	164	Romania	-	Totals all sites April/June
Adult	-	Coleoptera- Dytiscidae (larvae)	3.21	12.2	Spr/Sum	164	Romania	-	Totals all sites April/June
Adult	-	Coleoptera (terrestrial)	0.55	3.05	Spr/Sum	164	Romania	-	Totals all sites April/June
Adult	-	Diptera - Nematocere (larvae)	9.4	32.3	Spr/Sum	164	Romania	-	Totals all sites April/June
Adult	-	Diptera – Nematocera	0.88	1.22	Spr/Sum	164	Romania	-	Totals all sites April/June
Adult	-	Diptera – Brachycera	0.11	0.61	Spr/Sum	164	Romania	-	Totals all sites April/June
Adult	-	Lepidoptera (larvae)	0.22	1.22	Spr/Sum	164	Romania	-	Totals all sites April/June
Adult	-	Trichoptera (larvae)	4.09	19.5	Spr/Sum	164	Romania	-	Totals all sites April/June
Adult	-	Anura (larvae)	6.86	24.4	Spr/Sum	164	Romania	-	Totals all sites April/June

Table 28: Diet of newly metamorphosed *Triturus vulgaris* (Kuzmin 1997)

Age	Sex	Food type	Relative abundance (%)	SD/SE	N	Country	Habitat	Notes
Juvenile	-	Gastropoda	14.1	-	25	Russia	-	Newly metamorphosed (Stage 56). A further 2 stomachs were empty.
Juvenile	-	Collembola	52.0	-	25	Russia	-	Newly metamorphosed (Stage 56). A further 2 stomachs were empty.
Juvenile	-	Diptera larvae	19.6	-	25	Russia	-	Newly metamorphosed (Stage 56). A further 2 stomachs were empty.
Juvenile	-	Other taxa	13.0	-	25	Russia	-	Newly metamorphosed (Stage 56). A further 2 stomachs were empty.

Further detailed information on the diet of *Lissotriton*/*Triturus vulgaris* indicating variation between sampling date and sampling site can be found in Cicort-Lucaciu et al. (2005, 2007), Covaciu-Marcov et al. (2010).

4. Seasonal activities

Data on seasonal activity is greatly affected by factors such as habitat, latitude, altitude, local climate, annual differences in temperature and the permanence or other wise of the breeding pond. It is therefore recommended that local information for the zone/country/area under consideration be consulted.

Seasonal activity of *Lissotriton vulgaris* in Germany based on information in Pfeffer et al. (2011). Darker area represents the main period of activity.

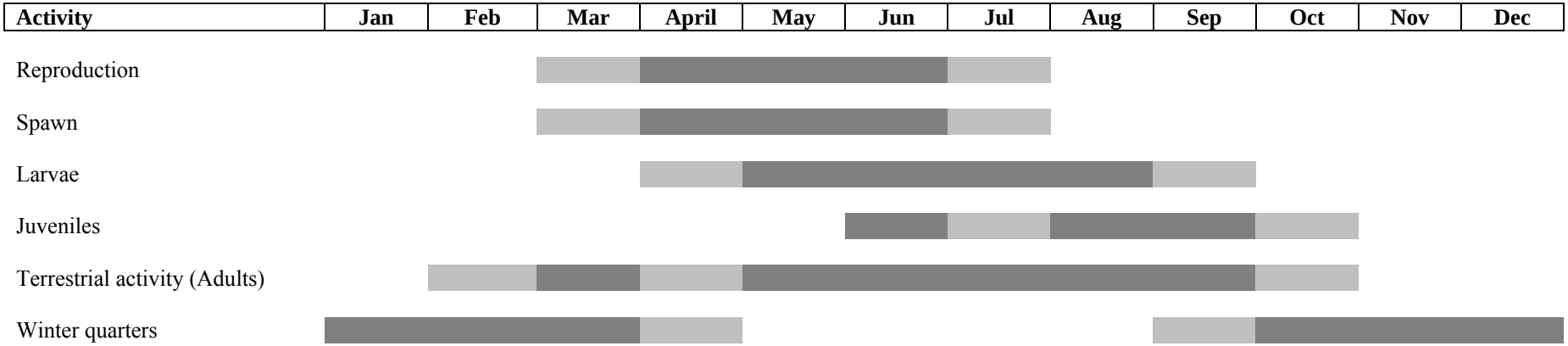

Table 29: Seasonal activities of *Lissotriton vulgaris*.

Begin	Peak	End	Country	Habitat	Notes	Reference
Mating/laying						
End February-beginning March	Early/mid April	End April-mid May	Romania	Near forest	Aquatic phase	Cicort-Lucaciu et al (2009)
Mid May		Early July	UK	-	Egg laying	Verrell et al (1986)
Emigration						
16 June	-	16 September	Sweden	Cattle pond, pasture, spinney	Onset of emigration from breeding pond, 'older' (non-metamorphs) (1997 data)	Malmgren (2002)
3 August	-	16 November	Sweden	Cattle pond, pasture, spinney	Onset of emigration from breeding pond, metamorphs (1997 data)	Malmgren (2002)
1 June	-	10 September	Sweden	Cattle pond, pasture, spinney	Onset of emigration from breeding pond, 'older' (non-metamorphs) (1998 data)	Malmgren (2002)
9 August	-	29 October	Sweden	Cattle pond, pasture, spinney	Onset of emigration from breeding pond, metamorphs (1998 data)	Malmgren (2002)
24 May	-	23 September	Sweden	Cattle pond, pasture, spinney	Onset of emigration from breeding pond, 'older' (non-metamorphs) (1999 data)	Malmgren (2002)
23 August	-	21 October	Sweden	Cattle pond, pasture, spinney	Onset of emigration from breeding pond, metamorphs (1999 data)	Malmgren (2002)
Early July	-	Late December	UK	-	Adults	Verrell et al (1986)
September	-	November	UK	-	Young	Verrell et al (1986)
Spring migration						
February		Early July	UK	-		Verrell et al (1986)

5. Other information

Table 30: Age/longevity of *Triturus vulgaris*.

Age	Sex	Season	Mean	SD/SE	Units	Min.	Max.	N	Country	Habitat	Notes	Reference
Adult	F	-			y		6	3	Romania	Wetland		Cogalniceanu and Miaud (2003)
Adult	F	-	6.95	1.22 SE	y	4	9	19	-	High altitude	Metamorphic, preserved specimens	Kalezic et al (1996)
Adult	M	-	7.06	1.06 SE	y	5	9	18	-	High altitude	Metamorphic, preserved specimens	Kalezic et al (1996)

D. SPECIES INFORMATION – COMMON FROG (*RANA TEMPORARIA*)

EU distribution

Austria, Belgium, Bulgaria, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Luxembourg, Netherlands, Poland, Romania, Slovakia, Slovenia, Spain, Sweden, [Switzerland], United Kingdom

Sources of information

Basic information on this species can be found in general field guides (e.g. Arnold and Ovenden 2002) or in online resources such as:

AmphibiaWeb	http://amphibiaweb.org/cgi-bin/amphib_query?query_src=aw_search_index&where-genus=Rana&where-species=temporaria&rel-genus=equals&rel-species=equals
Reptiles & Amphibiens de France	http://www.herpfrance.com/amphibian/common_frog_rana_temporaria.php
Arkive	http://www.arkive.org/common-frog/rana-temporaria/#text=All
The IUCN red list	http://www.iucnredlist.org/details/full/58734/0

Further details on distribution can be found in the 'Atlas of amphibians and reptiles in Europe' (Gasc et al 1997).

Map is available at: http://www.seh-herpetology.org/images/atlas/pdf/anura/rantem.pdf

Below is more detailed information on body size (length and weight), metabolic rate, diet and seasonal activity found during the course of the review.

1. Body size

Table 31: Bodyweight of *Rana temporaria*.

Age	Sex	Season	Mean	SD/SE	Units	Min.	Max.	N	Country	Habitat	Notes	Reference
Adult	M/F	Spring	37.0	6.4 SD	g	26.7	46.3	18	Germany	Lowlands	4 females and 14 males	Seitz et al (1992)
Adult	M	-	-	-	g	-	49	1	UK	-		Smith (1951)
Adult	F	-	-	-	g	-	72	3	UK	-		Smith (1951)
Adult	F	-	-	-	g	42	43	-	UK	-	Pre-spawning	Smith (1951)
Adult	F	-	-	-	g	28	28.5	-	UK	-	Post-spawning	Smith (1951)
Adult	M/F	-	-	-	g	11	47	14	UK	-		Oldham and Swan (1992)
Adult	M/F	-	-	-	g	20	55	132	Poland	-		Gromysz-Kalkowska and Szubartowska (1993a)
Adult	M/F	November/ December	-	-	g	21	56	132	Poland	-		Gromysz-Kalkowska and Szubartowska (1993b)
Juvenile	-	-	341	21	mg	-	-	6	Austria	Alps	Froglets at metamorphosis (length of larvae 42.8 mm)	Hofer and Lackner (2006)
Juvenile	-	-	97	4	mg	-	-	7	Austria	Alps	Froglets at metamorphosis (length of larvae 29.4 mm)	Hofer and Lackner (2006)
Adult	M	Breeding	26.5	7.9 SD	g	-	-	87	France	Mixed	Site A, 1986	Joly (1991)
Adult	M	Breeding	26.0	6.3 SD	g	-	-	63	France	Mixed	Site A, 1987	Joly (1991)
Adult	F	Breeding	30.1	9.4 SD	g	-	-	46	France	Mixed	Site A, 1986	Joly (1991)
Adult	F	Breeding	29.2	12.0 SD	g	-	-	70	France	Mixed	Site A, 1987	Joly (1991)
Adult	M	Breeding	16.0	5.3 SD	g	-	-	79	France	Mixed	Site B, 1986	Joly (1991)
Adult	M	Breeding	17.2	4.7 SD	g	-	-	79	France	Mixed	Site B, 1987	Joly (1991)
Adult	F	Breeding	23.6	11.9 SD	g	-	-	40	France	Mixed	Site B, 1986	Joly (1991)
Adult	F	Breeding	14.6	6.3 SD	g	-	-	48	France	Mixed	Site B, 1987	Joly (1991)
Adult	F	Breeding	40.0	8.2 SD	g	-	-	28	Sweden	-		Elmberg (1991)
Juvenile	-		6.85	3.3 SD	g	1.2	14.8	116	Austria	Alluvial plain	Total for all sites	Pintar (1984)

Age	Sex	Season	Mean	SD/SE	Units	Min.	Max.	N	Country	Habitat	Notes	Reference
Adult	M		32.3	10.2 SD	g	12.9	52.0	38	Austria	Alluvial plain	Total for all sites	Pintar (1984)
Adult	F		-	-	g	15.5	80.0	27	Austria	Alluvial plain	Total for all sites	Pintar (1984)
Adult	F	Summer	18.96	5.17 SD	g	10.5	27.3		Finland	-	Latitude 69°	Plăiaşu et al (2010)
Adult	F	Summer	14.31	4.91 SD	g	9.1	24.8		Finland	-	Latitude 67.2°	Plăiaşu et al (2010)
Adult	F	Autumn	34.69	12.49 SD	g	14.07	57.15		Romania	-	Latitude 45°	Plăiaşu et al (2010)
Adult	M	Summer	17.27	3.18 SD	g	12.6	22.9		Finland	-	Latitude 69°	Plăiaşu et al (2010)
Adult	M	Summer	15.85	4.34 SD	g	10	24.2		Finland	-	Latitude 67.2°	Plăiaşu et al (2010)
Adult	M	Autumn	36.20	11.40 SD	g	13.78	59.2		Romania	-	Latitude 45°	Plăiaşu et al (2010)
Juvenile	-	Summer	4.33	3.27 SD	g	1.1	10.4		Finland	-	Latitude 69°	Plăiaşu et al (2010)
Juvenile	-	Summer	7.78	2.85 SD	g	1	13.2		Finland	-	Latitude 67.2°	Plăiaşu et al (2010)
Juvenile	-	Autumn	9.28	5.86 SD	g	1.7	15.04		Romania	-	Latitude 45°	Plăiaşu et al (2010)

Table 32: Body length of *Rana temporaria*.

Age	Sex	Season	Mean	SD/SE	Units	Min.	Max.	N	Country	Habitat	Notes	Reference
2d	-	-	10.5	-	mm total	-	-		Czech Republic	-	With external gills	Wohlgemuth (1977)
8d	-	-	14.0	-	mm total	-	-		Czech Republic	-	Internal gills, no limbs	Wohlgemuth (1977)
16d	-	-	28.0	-	mm total	-	-		Czech Republic	-	Internal gills, no limbs	Wohlgemuth (1977)
45d	-	-	18.7	-	mm total	-	-		Czech Republic	-	With internal gills	Wohlgemuth (1977)
86d	-	-	27.2	-	mm total	-	-		Czech Republic	-	With pelvic limbs	Wohlgemuth (1977)
107d		-	30.8	-	mm total	-	-		Czech Republic	-	Pelvic and thoracic limbs	Wohlgemuth (1977)
Juvenile	-	-		-	mm SVL	-	-	6	Italy	Alps	At metamorphosis	Hofer and Lackner (2006)
Adult	-	-	41.5	9.6 SD	mm SVL	27	70	50	Poland	Pine forest		Koehler et al (2011)
Adult	M	Breeding	66.1	6.4 SD	mm SVL	-	-	87	France	Mixed	Site A, 1986	Joly (1991)
Adult	M	Breeding	61.7	5.1 SD	mm SVL	-	-	63	France	Mixed	Site A, 1987	Joly (1991)
Adult	F	Breeding	67.2	6.8 SD	mm SVL	-	-	46	France	Mixed	Site A, 1986	Joly (1991)

Age	Sex	Season	Mean	SD/SE	Units	Min.	Max.	N	Country	Habitat	Notes	Reference
Adult	F	Breeding	63.8	7.5 SD	mm SVL	-	-	70	France	Mixed	Site A, 1987	Joly (1991)
Adult	M	Breeding	56.4	5.3 SD	mm SVL	-	-	79	France	Mixed	Site B, 1986	Joly (1991)
Adult	M	Breeding	54.6	4.1 SD	mm SVL	-	-	79	France	Mixed	Site B, 1987	Joly (1991)
Adult	F	Breeding	61.8	9.1 SD	mm SVL	-	-	40	France	Mixed	Site B, 1986	Joly (1991)
Adult	F	Breeding	52.6	5.8 SD	mm SVL	-	-	48	France	Mixed	Site B, 1987	Joly (1991)
Adult	F	Breeding	76.1	5.5 SD	mm SVL	-	-	37	Sweden	-		Elmberg (1991)
Adult	M	Breeding	71.1	-	mm SVL	-	-	7	Sweden	-	Mated males, even sex ratio, natural density.	Elmberg (1991)
Adult	M	Breeding	71.6	-	mm SVL	-	-	10	Sweden	-	Mated males, even sex ratio, natural density.	Elmberg (1991)
Adult	M	Breeding	71.8	-	mm SVL	-	-	6	Sweden	-	Mated males, even sex ratio, natural density.	Elmberg (1991)
Adult	M	Breeding	64.5	5.6 SD	mm SVL	-	-	56	Sweden	-	Latitude 55.4°N	Jonsson et al. (2009)
Adult	F	Breeding	63.0	6.3 SD	mm SVL	-	-	33	Sweden	-	Latitude 55.4°N	Jonsson et al. (2009)
Adult	M	Breeding	65.9	4.9 SD	mm SVL	-	-	44	Sweden	-	Latitude 56.2°N	Jonsson et al. (2009)
Adult	F	Breeding	68.6	7.7 SD	mm SVL	-	-	27	Sweden	-	Latitude 56.2°N	Jonsson et al. (2009)
Adult	M	Breeding	76.1	5.2 SD	mm SVL	-	-	9	Sweden	-	Latitude 59.9°N	Jonsson et al. (2009)
Adult	F	Breeding	79.1	3.2 SD	mm SVL	-	-	4	Sweden	-	Latitude 59.9°N	Jonsson et al. (2009)
Adult	M	Breeding	72.8	4.9 SD	mm SVL	-	-	50	Sweden	-	Latitude 60.0°N	Jonsson et al. (2009)
Adult	F	Breeding	76.8	6.6 SD	mm SVL	-	-	22	Sweden	-	Latitude 60.0°N	Jonsson et al. (2009)
Adult	M	Breeding	75.9	6.3 SD	mm SVL	-	-	35	Sweden	-	Latitude 64.3°N	Jonsson et al. (2009)
Adult	F	Breeding	83.2	4.9 SD	mm SVL	-	-	20	Sweden	-	Latitude 64.3°N	Jonsson et al. (2009)
Adult	M	Breeding	79.7	2.9 SD	mm SVL	-	-	29	Sweden	-	Latitude 65.5°N	Jonsson et al. (2009)
Adult	F	Breeding	82.7	4.7 SD	mm SVL	-	-	13	Sweden	-	Latitude 65.5°N	Jonsson et al. (2009)
Adult	M	Breeding	69.2	3.1 SD	mm SVL	-	-	46	Sweden	-	Latitude 67.5°N	Jonsson et al. (2009)
Adult	F	Breeding	71.7	4.3 SD	mm SVL	-	-	43	Sweden	-	Latitude 67.5°N	Jonsson et al. (2009)
Adult	M	Breeding	72.4	3.6 SD	mm SVL	-	-	29	Sweden	-	Latitude 69.1°N	Jonsson et al. (2009)
Adult	F	Breeding	78.3	3.8 SD	mm SVL	-	-	21	Sweden	-	Latitude 69.1°N	Jonsson et al. (2009)
Adult	M	Breeding	77.8	3.04 SD	mm SVL	70.4	82.6	30	France	Alps		Miaud et al. (1999)
Adult	F	Breeding	86.3	2.1 SD	mm SVL	82.3	90.2	32	France	Alps		Miaud et al. (1999)

Age	Sex	Season	Mean	SD/SE	Units	Min.	Max.	N	Country	Habitat	Notes	Reference
Juv.	-	Breeding	16.1	1.27 SD	mm SVL	14	18	21	France	Alps	Newly metamorphosed	Miaud et al. (1999)
Adult	M	Breeding	74.25		mm SVL	-	-		Sweden	Park pond, residential.	Returning frogs	Elmberg (1990)
Adult	M	Breeding	74.26		mm SVL	-	-		Sweden	Park pond, residential.	Non-returning frogs	Elmberg (1990)
Adult	F	Breeding	79.0	7 SD	mm SVL	-	-	8	Sweden	Park pond, residential.	Returning frogs	Elmberg (1990)
Adult	F	Breeding	80.1	6 SD	mm SVL	-	-	68	Sweden	Park pond, residential.	Non-returning frogs	Elmberg (1990)
Adult	M	Breeding			mm SVL	63	85		Switzerland	Alps		Ryser (1996)
Adult	F	Breeding			mm SVL	65	94		Switzerland	Alps		Ryser (1996)
Juvenile	-		40.4	6.15 SD	mm SVL	24.1	54.0	116	Austria	Alluvial plain	Total for all sites	Pintar (1984)
Adult	M		68.3	7.5 SD	mm SVL	54.4	78.0	38	Austria	Alluvial plain	Total for all sites	Pintar (1984)
Adult	F		-	-	mm SVL	55.2	90.0	27	Austria	Alluvial plain	Total for all sites	Pintar (1984)
Adult	F	Summer	71.24	6.00 SD	mm SVL	62	85.6	-	Finland	-	Latitude 69°	Plăiaşu et al (2010)
Adult	F	Summer	61.15	4.15 SD	mm SVL	55.1	67.9	-	Finland	-	Latitude 67.2°	Plăiaşu et al (2010)
Adult	F	Autumn	76.78	10.29 SD	mm SVL	55.7	91.8	-	Romania	-	Latitude 45°	Plăiaşu et al (2010)
Adult	M	Summer	69.89	4.45 SD	mm SVL	63.4	75	-	Finland	-	Latitude 69°	Plăiaşu et al (2010)
Adult	M	Summer	62.46	3.37 SD	mm SVL	57.8	70.6	-	Finland	-	Latitude 67.2°	Plăiaşu et al (2010)
Adult	M	Autumn	73.41	7.41 SD	mm SVL	55.6	84.7	-	Romania	-	Latitude 45°	Plăiaşu et al (2010)
Juvenile	-	Summer	42.17	11.28 SD	mm SVL	28.3	59.7	-	Finland	-	Latitude 69°	Plăiaşu et al (2010)
Juvenile	-	Summer	45.95	6.95 SD	mm SVL	24.2	55.5	-	Finland	-	Latitude 67.2°	Plăiaşu et al (2010)
Juvenile	-	Autumn	44.80	12.30 SD	mm SVL	27.8	59.8	-	Romania	-	Latitude 45°	Plăiaşu et al (2010)

2. Metabolic rate

Table 33: Metabolic rate of *Rana temporaria* (oxygen).

Age	Sex	Weight (g)	Season	Mean	SD/SE	Units	Min.	Max.	N	Country	Temp (°C)	Notes	Reference
Adult	-	38.53	-	0.0261	-	ml/g/h	-	-	-	-	6	Resting	Gatten et al. (1992)
Adult	-	44	-	0.0275	-	ml/g/h	-	-	-	-	9.5	Resting	Gatten et al. (1992)
Adult	-		Summer	0.0534	-	ml/g/h	-	-	-	-	10	Resting	Gatten et al. (1992)
Adult	-		Winter	0.0414	-	ml/g/h	-	-	-	-	-	Resting	Gatten et al. (1992)
Adult	-	38	-	0.0214	-	ml/g/h	-	-	-	-	-	Resting, acclimated	Gatten et al. (1992)
Adult	-	53	-	0.044	-	ml/g/h	-	-	-	-	10.4	Resting	Gatten et al. (1992)
Adult	-	30	-	0.0199	-	ml/g/h	-	-	-	-	14	Resting	Gatten et al. (1992)
Adult	-	39	-	0.0072	-	ml/g/h	-	-	-	-	15	Resting	Gatten et al. (1992)
Adult	-	38.53	-	0.0675	-	ml/g/h	-	-	-	-	-	Resting	Gatten et al. (1992)
Adult	-	35	-		-	ml/g/h	-	-	-	-	15.1	Resting	Gatten et al. (1992)
Adult	-	43	-	0.0784	-	ml/g/h	-	-	-	-	17	Resting	Gatten et al. (1992)
Adult	-	38	-	0.0417	-	ml/g/h	-	-	-	-	19	Resting	Gatten et al. (1992)
Adult	-	39.6	-	0.0686	-	ml/g/h	-	-	-	-	19.2	Resting	Gatten et al. (1992)
Adult	-	15.8	-	0.1	-	ml/g/h	-	-	-	-	20	Resting	Gatten et al. (1992)
Adult	M	37.5	-	0.157	-	ml/g/h	-	-	-	-	-	Resting	Gatten et al. (1992)
Adult	-	25	-	0.07	-	ml/g/h	-	-	-	-	-	Resting	Gatten et al. (1992)
Adult	-	-	Winter	0.081	-	ml/g/h	-	-	-	-	22	Resting	Gatten et al. (1992)
Adult	-	-	Summer	0.142	-	ml/g/h	-	-	-	-	-	Resting	Gatten et al. (1992)
Adult	-	53	-	0.115	-	ml/g/h	-	-	-	-	-	Resting	Gatten et al. (1992)
Adult	-	42.5	-	0.103	-	ml/g/h	-	-	-	-	23	Resting	Gatten et al. (1992)
Adult	-	21.6	-	0.16	-	ml/g/h	-	-	-	-	24.6	Resting	Gatten et al. (1992)
Adult	-	31.1	-	0.1266	-	ml/g/h	-	-	-	-	24.8	Resting	Gatten et al. (1992)
Adult	-	-	Summer	0.117	-	ml/g/h	-	-	-	-	25	Resting	Gatten et al. (1992)
Adult	-	-	Winter	0.081	-	ml/g/h	-	-	-	-	-	Resting	Gatten et al. (1992)
Adult	-	38.53	-	0.1984	-	ml/g/h	-	-	-	-	-	Resting	Gatten et al. (1992)
Adult	-	32.8	-	0.0631	-	ml/g/h	-	-	-	-	26.3	Resting	Gatten et al. (1992)

3. Diet

Table 34: Diet of *Rana temporaria* in Ireland (Blackith and Speight 1974). Habitat was blanket bog, grassland and fertilised plots.

Age	Sex	Food type	Spring	Summer	Autumn	N_{sp},N_{su},N_{au}	Country	Habitat	Measure	Notes
Adult	-	Earthworms	4	<1	<1	19, 17, 34	Ireland	Mixed	% total no. of prey	May, June, Sep/Oct.
Adult	-	Slugs	25	2	3	19, 17, 34	Ireland	Mixed	% total no. of prey	May, June, Sep/Oct.
Adult	-	Snails	3	1	3	19, 17, 34	Ireland	Mixed	% total no. of prey	May, June, Sep/Oct.
Adult	-	Isopoda	<1	0	<1	19, 17, 34	Ireland	Mixed	% total no. of prey	May, June, Sep/Oct.
Adult	-	Diplopoda	7	0	0	19, 17, 34	Ireland	Mixed	% total no. of prey	May, June, Sep/Oct.
Adult	-	Chilopoda	<1	<1	<1	19, 17, 34	Ireland	Mixed	% total no. of prey	May, June, Sep/Oct.
Adult	-	Arachnida	18	20	15	19, 17, 34	Ireland	Mixed	% total no. of prey	May, June, Sep/Oct.
Adult	-	Collembola	4	9	12	19, 17, 34	Ireland	Mixed	% total no. of prey	May, June, Sep/Oct.
Adult	-	Orthoptera	0	0	<1	19, 17, 34	Ireland	Mixed	% total no. of prey	May, June, Sep/Oct.
Adult	-	Neuroptera larvae	0	0	4	19, 17, 34	Ireland	Mixed	% total no. of prey	May, June, Sep/Oct.
Adult	-	Mecoptera larvae	0	0	<1	19, 17, 34	Ireland	Mixed	% total no. of prey	May, June, Sep/Oct.
Adult	-	Lepidoptera larvae	4	11	6	19, 17, 34	Ireland	Mixed	% total no. of prey	May, June, Sep/Oct.
Adult	-	Homoptera	0	<1	5	19, 17, 34	Ireland	Mixed	% total no. of prey	May, June, Sep/Oct.
Adult	-	Heteroptera	4	6	1	19, 17, 34	Ireland	Mixed	% total no. of prey	May, June, Sep/Oct.
Adult	-	Diptera adults	16	12	16	19, 17, 34	Ireland	Mixed	% total no. of prey	May, June, Sep/Oct.
Adult	-	Diptera larvae	<1	<1	7	19, 17, 34	Ireland	Mixed	% total no. of prey	May, June, Sep/Oct.
Adult	-	Hymenoptera adults	0	2	11	19, 17, 34	Ireland	Mixed	% total no. of prey	May, June, Sep/Oct.
Adult	-	Hymenoptera larvae	0	<1	<1	19, 17, 34	Ireland	Mixed	% total no. of prey	May, June, Sep/Oct.
Adult	-	Coleoptera adults	12	33	12	19, 17, 34	Ireland	Mixed	% total no. of prey	May, June, Sep/Oct.
Adult	-	Coleoptera larvae	0	0	2	19, 17, 34	Ireland	Mixed	% total no. of prey	May, June, Sep/Oct.

Table 35: Diet of *Rana temporaria* in France (Gosa and Vignes 2000)

Age	Sex	Food type	% total no. of prey	% frequency	Season	N	Country	Habitat	Notes
Juvenile.	-	Oligochaeta	0.96	2.15	Spring	232	France	Woodland	Post-metamorphic
Juvenile	-	Pseudoscorpions	0.41	1.29	Spring	232	France	Woodland	Post-metamorphic
Juvenile	-	Aranaea	2.89	8.62	Spring	232	France	Woodland	Post-metamorphic
Juvenile	-	Acari	14.03	28.44	Spring	232	France	Woodland	Post-metamorphic
Juvenile.	-	Collembola	19.12	29.74	Spring	232	France	Woodland	Post-metamorphic
Juvenile	-	Protura	0.41	1.29	Spring	232	France	Woodland	Post-metamorphic
Juvenile	-	Psocoptera	0.28	0.43	Spring	232	France	Woodland	Post-metamorphic
Juvenile	-	Thysanoptera	0.14	0.43	Spring	232	France	Woodland	Post-metamorphic
Juvenile.	-	Homoptera	8.66	12.93	Spring	232	France	Woodland	Post-metamorphic
Juvenile	-	Hymenoptera	6.19	15.94	Spring	232	France	Woodland	Post-metamorphic
Juvenile	-	Coleoptera adults	1.65	4.74	Spring	232	France	Woodland	Post-metamorphic
Juvenile	-	Coloeoptera larvae	0.69	1.72	Spring	232	France	Woodland	Post-metamorphic
Juvenile.	-	Trichoptera adults	0.14	0.43	Spring	232	France	Woodland	Post-metamorphic
Juvenile.	-	Trichoptera larvae	0.55	0.86	Spring	232	France	Woodland	Post-metamorphic
Juvenile	-	Lepidoptera adults	0.14	0.43	Spring	232	France	Woodland	Post-metamorphic
Juvenile	-	Lepidoptera larvae	1.37	3.44	Spring	232	France	Woodland	Post-metamorphic
Juvenile	-	Diptera adults	24.84	46.98	Spring	232	France	Woodland	Post-metamorphic
Juvenile	-	Diptera larvae	13.34	22.84	Spring	232	France	Woodland	Post-metamorphic
Juvenile	-	Insecta (unidentified)	4.54	13.79	Spring	232	France	Woodland	Post-metamorphic

Table 36: Diet of *Rana temporaria* in Romania (Hodisan et al 2010).

Age	Sex	Food type	Amount (%)	Frequency (%)	Season	N	Country	Habitat
Adult	-	Oligocheta-Lumbricidae	1.14	5.88	Summer	34	Romania	Stream, sandy bank
Adult	-	Gasteropoda –snails	2.85	14.71	Summer	34	Romania	Stream, sandy bank
Adult	-	Gasteropoda – Limax	2.85	8.82	Summer	34	Romania	Stream, sandy bank
Adult	-	Isopoda	2.85	5.88	Summer	34	Romania	Stream, sandy bank
Adult	-	Arahnida-Araneida	8.57	41.18	Summer	34	Romania	Stream, sandy bank
Adult	-	Arahnida – Opilionida	1.71	8.82	Summer	34	Romania	Stream, sandy bank
Adult	-	Miriapoda – Diplopoda	1.14	5.88	Summer	34	Romania	Stream, sandy bank
Adult	-	Orthoptera	3.42	17.65	Summer	34	Romania	Stream, sandy bank
Adult	-	Dermaptera	5.71	23.53	Summer	34	Romania	Stream, sandy bank
Adult	-	Homoptera – Cicadelloidae	4.57	20.59	Summer	34	Romania	Stream, sandy bank
Adult	-	Heteroptera	3.42	14.71	Summer	34	Romania	Stream, sandy bank
Adult	-	Blatoidea	0.57	2.94	Summer	34	Romania	Stream, sandy bank
Adult	-	Coleoptera – Cantharidae	0.57	2.94	Summer	34	Romania	Stream, sandy bank
Adult	-	Coleoptera – Crysomelidae	1.71	8.82	Summer	34	Romania	Stream, sandy bank
Adult	-	Coleoptera – Coccinelidae	0.57	2.94	Summer	34	Romania	Stream, sandy bank
Adult	-	Coleoptera – Carabidae	14.29	47.06	Summer	34	Romania	Stream, sandy bank
Adult	-	Coleoptera – Curculionidae	2.85	11.76	Summer	34	Romania	Stream, sandy bank
Adult	-	Coleoptera – Elateridae	0.57	2.94	Summer	34	Romania	Stream, sandy bank
Adult	-	Coleoptera – Stafilinidae	1.71	8.82	Summer	34	Romania	Stream, sandy bank
Adult	-	Coleoptera - undeterm.	14.86	52.94	Summer	34	Romania	Stream, sandy bank
Adult	-	Coleoptera (larvae)	1.14	2.94	Summer	34	Romania	Stream, sandy bank
Adult	-	Lepidoptera	0.57	2.94	Summer	34	Romania	Stream, sandy bank
Adult	-	Lepidoptera (larvae)	9.14	32.35	Summer	34	Romania	Stream, sandy bank
Adult	-	Diptera – Nematocera	0.57	2.94	Summer	34	Romania	Stream, sandy bank
Adult	-	Diptera - Nematocera (larvae) (aquatic)	2.85	2.94	Summer	34	Romania	Stream, sandy bank
Adult	-	Diptera - Brahicera (Muscidae)	2.28	11.76	Summer	34	Romania	Stream, sandy bank
Adult	-	Hymenoptera – Formicidae	4.57	20.59	Summer	34	Romania	Stream, sandy bank
Adult	-	Hymenoptera - undetermined	2.85	14.71	Summer	34	Romania	Stream, sandy bank

Table 37: Diet of *Rana temporaria* in Romania (Kovacs et al 2010b)

Age	Sex	Food type	Amount (%)	Frequency (%)	Season	N	Country	Habitat
Adult	-	Anelida – Oligocheta	0.45	4.76	Autumn	21	Romania	Swamp
Adult	-	Gastropoda – snails	10.7	47.6	Autumn	21	Romania	Swamp
Adult	-	Gastropoda - limax	1.34	9.52	Autumn	21	Romania	Swamp
Adult	-	Crustacea- Isopoda	1.79	19	Autumn	21	Romania	Swamp
Adult	-	Arahnida – Pseudoscorpionida	0.89	9.52	Autumn	21	Romania	Swamp
Adult	-	Arahnida - Araneida	14.3	76.2	Autumn	21	Romania	Swamp
Adult	-	Arahnida - Opilionida	0.45	4.76	Autumn	21	Romania	Swamp
Adult	-	Myriapoda – Chilopoda	2.23	19	Autumn	21	Romania	Swamp
Adult	-	Myriapoda - Diplopoda	9.82	57.1	Autumn	21	Romania	Swamp
Adult	-	Colembola	0.45	4.76	Autumn	21	Romania	Swamp
Adult	-	Ortoptera	2.68	23.8	Autumn	21	Romania	Swamp
Adult	-	Dermaptera	0.45	4.76	Autumn	21	Romania	Swamp
Adult	-	Heteroptera	2.23	23.8	Autumn	21	Romania	Swamp
Adult	-	Homoptera - Cicadina	3.57	23.8	Autumn	21	Romania	Swamp
Adult	-	Lepidoptera [larvae]	18.3	95.2	Autumn	21	Romania	Swamp
Adult	-	Lepidoptera	0.45	4.76	Autumn	21	Romania	Swamp
Adult	-	Coleoptera [larvae]	2.68	9.52	Autumn	21	Romania	Swamp
Adult	-	Coleoptera – undetermined	8.93	47.6	Autumn	21	Romania	Swamp
Adult	-	Coleoptera - Carabidae	6.7	42.9	Autumn	21	Romania	Swamp
Adult	-	Coleoptera - Crysomelidae	2.68	19	Autumn	21	Romania	Swamp
Adult	-	Coleoptera - Coccinelidae	0.89	9.52	Autumn	21	Romania	Swamp
Adult	-	Coleoptera - Curculionidae	0.89	9.52	Autumn	21	Romania	Swamp
Adult	-	Coleoptera - Scarabeidae	1.79	14.3	Autumn	21	Romania	Swamp
Adult	-	Coleoptera - Stafilinidae	0.89	9.52	Autumn	21	Romania	Swamp
Adult	-	Coleoptera - Cantaridae	0.31	2.22 - -	Autumn	21	Romania	Swamp
Adult	-	Diptera - Brahicera	1.34	14.3	Autumn	21	Romania	Swamp
Adult	-	Neuroptera	0.61	4.44 - -	Autumn	21	Romania	Swamp
Adult	-	Hymenoptera - undetermined	1.34	14.3	Autumn	21	Romania	Swamp
Adult	-	Hymenoptera - Formicidae	1.79	9.52	Autumn	21	Romania	Swamp

Table 38: Diet of newly metamorphosed *Rana temporaria* (Kuzmin 1997)

Age	Sex	Food type	Relative abundance (%)	SD/SE	N	Country	Habitat	Notes
Juvenile	-	Collembola	56.3	-	5	Russia	-	Newly metamorphosed (Stage 46). All stomachs examined contained food.
Juvenile	-	Acarina	12.5	-	5	Russia	-	Newly metamorphosed (Stage 46). All stomachs examined contained food.
Juvenile	-	Hymenoptera	12.5	-	5	Russia	-	Newly metamorphosed (Stage 46). All stomachs examined contained food.
Juvenile	-	Diptera, adult	18.8	-	5	Russia	-	Newly metamorphosed (Stage 46). All stomachs examined contained food.

4. Seasonal activities

Data on seasonal activity is greatly affected by factors such as habitat, latitude, altitude, local climate, annual differences in temperature and the permanence or other wise of the breeding pond. It is therefore recommended that local information for the zone/country/area under consideration be consulted.

Seasonal activity of *Rana temporaria* in Germany based on information in Pfeffer et al. (2011). Darker area represents the main period of activity.

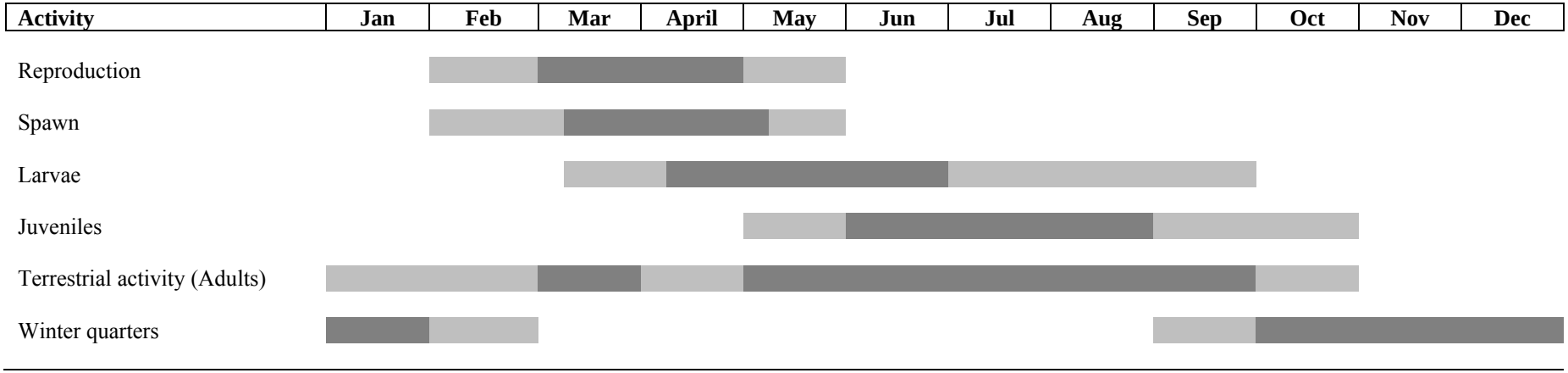

Table 39: Seasonal activities of *Rana temporaria*.

Begin	Peak	End	Country	Habitat	Notes	Reference
Mating/laying						
End March	1 April	Early April	Austria	-	Spawning period	Baumgartner al. (1996)
End February	Early March	Mid March	UK	-	Spawning period based on annual means.	Carroll et al. (2009)
Mid January	Early March	Mid-April	UK	-	Main spawning period range based on graph data.	Carroll et al. (2009)
End April/early May	Early – mid May		Sweden	Park pond, residential area.	Mean duration of breeding period 20d (5.4d pre-spawn, 14.7d spawning)	Elmberg (1990)
Mid-February	Mid-March	End March	Romania	-	First calling male (pre-spawning period mean 4 days, SD=3.69)	Hartel (2005)
Early March	Mid-March	Early April	Romania	-	First deposited egg mass (egg deposition period ≤ 6d)	Hartel (2005)
Hatching						
Early april	Mid-April	Late April	Austria			Baumgartner al. (1996)
Metamorphosis						
Early June		Early August	Sweden			Loman (2002)
Hibernation						
Late September/October	-	Late April	Sweden	River, residential area		Elmberg (1990)

5. Other information

Table 40: Age at sexual maturity in *Rana temporaria*.

Sex	Season	Mean	SD/SE	Units	Min.	Max.	N	Country	Habitat	Reference
M	-	4-5	-	y	-	-	-	France	Alps	Miaud et al. (1999)
F	-	5	-	y	-	-	-	France	Alps	Miaud et al. (1999)

Table 41: Length at sexual maturity in *Rana temporaria*.

Age	Sex	Season	Mean	SD/SE	Units	Min.	Max.	N	Country	Habitat	Reference
4-5y	M	-	72.9	-	mm SVL	-	-	-	France	Alps	Miaud et al. (1999)
5y	F	-	83.6	-	mm SVL	-	-	-	France	Alps	Miaud et al. (1999)

Table 42: Age/longevity of *Rana temporaria*.

Sex	Season	Mean	SD/SE	Units	Min.	Max.	N	Country	Habitat	Notes	Reference
F	-	11		y	-	-	1	Germany	Agricultural		Hachtel et al (2005)
F	-	10		y	-	-	1	Germany	Agricultural		Hachtel et al (2005)
M	-	10		y	-	-	1	Germany	Agricultural		Hachtel et al (2005)
F	-	8		y	-	-	1	Germany	Agricultural		Hachtel et al (2005)
F	-	7		y	-	-	1	Germany	Agricultural		Hachtel et al (2005)
F	-	7		y	-	-	1	Germany	Agricultural		Hachtel et al (2005)
M	-	6		y	-	-	1	Germany	Agricultural		Hachtel et al (2005)
M	-	15		y	-	-	-	France	Alps		Miaud et al. (1999)
F	-	12		y	-	-	-	France	Alps		Miaud et al. (1999)
M	-	6.6		y	-	-	-	Switzerland	Alps	Mean age (range for all frogs 4-13y)	Ryser (1996)
F	-	8.8		y	-	-	-	Switzerland	Alps	Mean age (range for all frogs 4-13y)	Ryser (1996)

E. SPECIES INFORMATION – COMMON TOAD (*BUFO BUFO*)

EU distribution

Austria, Belgium, Bulgaria, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Italy, Latvia, Lithuania, Luxembourg, Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, [Switzerland], United Kingdom

Sources of information

Basic information on this species can be found in general field guides (e.g. Arnold and Ovenden 2002) or in online resources such as:

AmphibiaWeb	http://amphibiaweb.org/cgi-bin/amphib_query?query_src=aw_search_index&where-genus=Bufo&where-species=bufo&rel-genus=equals&rel-species=equals
Reptiles & Amphibiens de France	http://www.herpfrance.com/amphibian/common_toad_bufo_bufo.php
Arkive	http://www.arkive.org/common-toad/bufo-bufo/#text=All
The IUCN red list	http://www.iucnredlist.org/details/full/54596/0

Further details on distribution can be found in the 'Atlas of amphibians and reptiles in Europe' (Gasc et al 1997).

Map is available at: http://www.seh-herpetology.org/images/atlas/pdf/anura/bufbuf.pdf

Below is more detailed information on body size (length and weight), metabolic rate, diet and seasonal activity found during the course of the review.

1. Body size

Table 43: Bodyweight of *Bufo bufo*.

Age	Sex	Season	Mean	SD/SE	Units	Min.	Max.	N	Country	Habitat	Notes	Reference
Adult	M	-	20	-	g	7	50		UK	-		Frazer (1966, 1983)
Adult	F	-	30	-	g	5	120		UK	-		Frazer (1966, 1983)
Adult	M	-	44.50	6.46 SD	g	33.0	56.0	26	Montenegro	Lake		Cadenovic and Vukov (2007)
Adult	F	-	141.07	31.14 SD	g	97.0	230.0	15	Montenegro	Lake		Cadenovic and Vukov (2007)
Juvenile	-	-	5.8	4.4 SD	g	0.4	19.7	229	Austria	Alluvial plain	Total for all sites	Pintar (1984)
Subadult	-	-	22.0	9.0 SD	g	14.0	43.0	70	Austria	Alluvial plain	Total for all sites	Pintar (1984)
Adult	M	-	38.3	8.6 SD	g	14.7	60.0	251	Austria	Alluvial plain	Total for all sites	Pintar (1984)
Adult	F	-	88.6	36.4 SD	g	21.5	168.0	173	Austria	Alluvial plain	Total for all sites	Pintar (1984)
Adult	F	-	-	-	g	49	109	14	Austria	Alps	Radio-tracked	Sztatecsny, and Schabetsberger (2005)
Adult	M	-	-	-	g	33	34	4	Austria	Alps	Radio-tracked	Sztatecsny, and Schabetsberger (2005)
Adult	M	Spring	20.3	4.0 SD	g	-	-	198	UK	Lake		Gittins et al (1980)
Adult	F	Spring	41.3	9.0 SD	g	-	-	90	UK	Lake	Gravid females	Gittins et al (1980)
Adult	F	Spring	37.8	7.5 SD	g	-	-	50	UK	Lake	Spent females	Gittins et al (1980)

Regression equations for Body weight vs. Body length are available in Reading (1990).

Table 44: Body length of *Bufo bufo*.

Age	Sex	Season	Mean	SD/SE	Units	Min.	Max.	N	Country	Habitat	Notes	Reference
Adult	M	Spring	68.65	-	mm SVL	53.8	82.0	164	Romania	Agricultural	Migrating (2001)	Hartel and Demeter (2005)
Adult	M	Spring	68.05	-	mm SVL	55.6	84.2	134	Romania	Agricultural	Migrating (2002)	Hartel and Demeter (2005)
Adult	F	Spring	94.7	-	mm SVL	70.12	114.8	71	Romania	Agricultural	Migrating (2001)	Hartel and Demeter (2005)
Adult	F	Spring	86.10	-	mm SVL	70.10	113.4	54	Romania	Agricultural	Migrating (2002)	Hartel and Demeter (2005)
Adult	M	Spring	-	-	mm SVL	70	82	29	Sweden	'Pond'	In spawning pairs (approx. from graph)	Hoglund and Robertson (1987)
Adult	F	Spring	-	-	mm SVL	95	115	29	Sweden	'Pond'	In spawning pairs (approx. from graph)	Hoglund and Robertson (1987)
Adult	M	Spring	74.7	5.14 SD	mm SVL	-	-	219	Sweden	'Pond'	Population sample	Hoglund and Robertson (1987)
Adult	M	Spring	75.0	5.14 SD	mm SVL	-	-	107	Sweden	'Pond'	Amplexus	Hoglund and Robertson (1987)
Adult	M	Spring	76.9	5.84 SD	mm SVL	-	-	29	Sweden	'Pond'	Spawning	Hoglund and Robertson (1987)
Adult	F	Spring	-	-	mm SVL	55	92		Germany	-	Bielefeld	Bender (1994)
Adult	M	Spring	-	-	mm SVL	43	75		Germany	-	Bielefeld	Bender (1994)
Adult	F	Spring	79	5.9	mm SVL	61	91	81	Germany	-	Bielefeld	Bender (1997)
Adult	F	Spring	78	6.8	mm SVL	57	92	30	Germany	-	Bielefeld	Bender (1997)
Adult	F	Spring	76	4.7	mm SVL	60	88	68	Germany	-	Bielefeld	Bender (1997)
Adult	F	Spring	75	4.4	mm SVL	67	90	30	Germany	-	Bielefeld	Bender (1997)
Adult	F	Spring	76	3.5	mm SVL	72	83	8	Germany	-	Bielefeld	Bender (1997)
Adult	F	Spring	80	3.3	mm SVL	73	85	9	Germany	-	Bielefeld	Bender (1997)
Adult	F	Spring	75	6.2	mm SVL	61	91	145	Germany	-	Bielefeld	Bender (1997)
Adult	M	Spring	63	4.3	mm SVL	48	75	213	Germany	-	Bielefeld	Bender (1997)
Adult	M	Spring	62	3.5	mm SVL	51	72	119	Germany	-	Bielefeld	Bender (1997)
Adult	M	Spring	62	4.3	mm SVL	50	75	338	Germany	-	Bielefeld	Bender (1997)
Adult	M	Spring	60	5.2	mm SVL	50	70	78	Germany	-	Bielefeld	Bender (1997)
Adult	M	Spring	60	3.2	mm SVL	55	65	11	Germany	-	Bielefeld	Bender (1997)
Adult	M	Spring	59	6.6	mm SVL	45	71	23	Germany	-	Bielefeld	Bender (1997)
Adult	M	Spring	59	4.7	mm SVL	49	76	215	Germany	-	Bielefeld	Bender (1997)

Age	Sex	Season	Mean	SD/SE	Units	Min.	Max.	N	Country	Habitat	Notes	Reference
Adult	M	Spring	68.05	4.91 SD	mm SVL	50	85	2957	UK	-	Breeding population 'Purbeck'	Reading (1990)
Adult	F	Spring	86.97	6.88 SD	mm SVL	66	110	620	UK	-	Breeding population 'Purbeck'	Reading (1990)
Adult	M	Spring	61.81	4.44 SD	mm SVL	46	76	2828	UK	-	Breeding population 'Portland'	Reading (1990)
Adult	F	Spring	76.78	5.65 SD	mm SVL	59	94	1054	UK		Breeding population 'Portland'	Reading (1990)
Adult	M	Spring	75	-	mm SVL	57	98	1417	Slovenia	Agricultural (meadows)		Vogrin and Miklic (2005)
Adult	F	Spring	98	-	mm SVL	82	120	97	Slovenia	Agricultural (meadows)		Vogrin and Miklic (2005)
Adult	M	Spring	83	-	mm SVL	56	87	355	Slovenia	Agricultural (meadows)	In amplexus	Vogrin and Miklic (2005)
Adult A	F	Spring	98	-	mm SVL	80	120	355	Slovenia	Agricultural (meadows)	In amplexus	Vogrin and Miklic (2005)
Adult A	M	-	73.71	4.15 SD	mm SVL	64.28	82.54	26	Montenegro	Lake		Cadenovic and Vukov (2007)
Adult A	F	-	100.64	5.09 SD	mm SVL	90.94	109.94	15	Montenegro	Lake		Cadenovic and Vukov (2007)
Juvenile	-	-	35.3	9.2 SD	mm SVL	16.0	49.5	229	Austria	Alluvial plain	Total for all sites	Pintar (1984)
Subadult	-	-	54.4	4.5 SD	mm SVL	50.4	65.1	70	Austria	Alluvial plain	Total for all sites	Pintar (1984)
Adult	M	-	67.3	5.7 SD	mm SVL	50.3	78.8	251	Austria	Alluvial plain	Total for all sites	Pintar (1984)
Adult	F	-	87.5	14.4 SD	mm SVL	52.0	112.6	173	Austria	Alluvial plain	Total for all sites	Pintar (1984)
Adult	F	-	-	-	mm SVL	76	90	14	Austria	Alps	Radio-tracked	Sztatecsny, and Schabetsberger (2005)

Age	Sex	Season	Mean	SD/SE	Units	Min.	Max.	N	Country	Habitat	Notes	Reference
Adult	M	-	-	-	mm SVL	65	71	4	Austria	Alps	Radio-tracked	Sztatecsny, and Schabetsberger (2005)
Adult	M	-	57.4	-	mm SVL	-	-	5	UK	Dune	Birkdale, 4y old.	Denton and Beebee (1993)
Adult	F	-	64.4	-	mm SVL	-	-	5	UK	Dune	Birkdale, 4y old.	Denton and Beebee (1993)
Adult	M	-	67.4	0.68 SE	mm SVL	55.9	80.9	47	Serbia	Agricultural	Trešnja 2001	Tomašević et al (2008)
Adult	M	-	67.0	0.61 SE	mm SVL	59.7	76.1	44	Serbia	Agricultural	Trešnja 2002	Tomašević et al (2008)
Adult	M	-	73.2	2.79 SE	mm SVL	63.1	84.4	7	Serbia	Agricultural	Zuce 2001	Tomašević et al (2008)
Adult	M	-	68.2	1.49 SE	mm SVL	60.4	72.8	9	Serbia	Agricultural	Zuce 2002	Tomašević et al (2008)
Adult	M	-	70.4	0.70 SE	mm SVL	63.9	77.6	25	Serbia	Agricultural	Zuce 2003	Tomašević et al (2008)
Adult	F	-	92.0	1.64 SE	mm SVL	78.5	112.8	23	Serbia	Agricultural	Trešnja 2001	Tomašević et al (2008)
Adult	F	-	90.7	1.55 SE	mm SVL	72.2	98.5	20	Serbia	Agricultural	Trešnja 2002	Tomašević et al (2008)
Adult	F	-	96.9	1.50 SE	mm SVL	90.4	107.9	14	Serbia	Agricultural	Trešnja 2003	Tomašević et al (2008)
Adult	F	-	97.0	1.97 SE	mm SVL	89.9	104.5	8	Serbia	Agricultural	Zuce 2001	Tomašević et al (2008)
Adult	F	-	95.3	2.84 SE	mm SVL	84.4	111.9	10	Serbia	Agricultural	Zuce 2002	Tomašević et al (2008)
Adult	F	-	96.5	1.37 SE	mm SVL	78.3	110.1	33	Serbia	Agricultural	Zuce 2003	Tomašević et al (2008)
Adult	M	Spring	59.3	4.1 SD	mm SVL	-	-	198	UK	Lake		Gittins et al (1980)
Adult	F	Spring	73.9	5.0 SD	mm SVL	-	-	90	UK	Lake	Gravid females	Gittins et al (1980)
Adult	F	Spring	73.7	5.1 SD	mm SVL	-	-	50	UK	Lake	Spent females	Gittins et al (1980)
Adult	M	Spring	67.0	3.82 SD	mm SVL	60	82	41	UK	Wet scrub woodland	At first breeding	Reading (1991)
Adult	M	Spring	67.3	2.43 SD	mm SVL	66	70	7	UK	Wet scrub woodland	At second breeding	Reading (1991)

Age	Sex	Season	Mean	SD/SE	Units	Min.	Max.	N	Country	Habitat	Notes	Reference
Adult	F	Spring	85.7	9.09 SD	mm SVL	77	105	7	UK	Wet scrub woodland	Breeding	Reading (1991)

2. Metabolic rate of *Bufo bufo*.

Table 45: Metabolic rate in *Bufo bufo* (oxygen).

Age	Sex	Weight (g)	Season	Mean	SD/SE	Units	Min.	Max.	N	Country	Temp (°C)	Notes	Reference
Adult	-	28.59	-	0.0713	-	ml/g/h	-	-	-	-	6	Resting	Gatten et al. (1992)
Adult	-	76.13	-	0.0229	-	ml/g/h	-	-	-	-	6	Resting	Gatten et al. (1992)
Adult	-	28.59	-	0.1693	-	ml/g/h	-	-	-	-	15	Resting	Gatten et al. (1992)
Adult	-	76.13	-	0.0375	-	ml/g/h	-	-	-	-	15	Resting	Gatten et al. (1992)
Adult	-	43	-	0.1122	-	ml/g/h	-	-	-	-	17	Resting	Gatten et al. (1992)
Adult	-	29	-	0.169	-	ml/g/h	-	-	-	-	20	Resting, restrained	Gatten et al. (1992)
Adult	-	29	-	0.135	-	ml/g/h	-	-	-	-	20	Resting, restrained	Gatten et al. (1992)
Adult	-	28.59	-	0.1604	-	ml/g/h	-	-	-	-	25	Resting	Gatten et al. (1992)
Adult	-	76.13	-	0.1266	-	ml/g/h	-	-	-	-	25	Resting	Gatten et al. (1992)

3. Diet

Table 46: Diet of *Bufo bufo* in Italy (Vignoli et al. 2009).

Age	Sex	Food type	Season	Frequency of occurrence	Relative abundance (numeric)	Relative abundance (volumetric)	N	Country	Habitat	Notes
Adult	-	Gastropoda terrestrial.	All year	0.67	0.08	0.055	13	Italy	Abandoned quarry	Terrestrial prey
Adult	-	Isopoda	All year	0.50	0.15	0.077	13	Italy	Abandoned quarry	Terrestrial prey
Adult	-	Aranea	All year	0.50	0.12	0.028	13	Italy	Abandoned quarry	Terrestrial prey
Adult	-	Miriapoda	All year	0.67	0.13	0.114	13	Italy	Abandoned quarry	Terrestrial prey
Adult	-	Dermaptera	All year	0.17	0.01	0.002	13	Italy	Abandoned quarry	Terrestrial prey
Adult	-	Lepidoptera larvae	All year	-	0.02	0.039	13	Italy	Abandoned quarry	Terrestrial prey
Adult	-	Colioptera terrestrial	All year	0.67	0.17	0.535	13	Italy	Abandoned quarry	Terrestrial prey
Adult	-	Formicidae	All year	0.83	0.19	0.026	13	Italy	Abandoned quarry	Terrestrial prey
Adult	-	Hexapoda Undetermined	All year	0.50	0.06	0.004	13	Italy	Abandoned quarry	Terrestrial prey
Adult	-	Coleoptera aquatic	All year	0.33	-	-	13	Italy	Abandoned quarry	Aquatic prey
Adult	-	Coleoptera aquatic larvae	All year	-	0.07	0.122	13	Italy	Abandoned quarry	Aquatic prey

Table 47: Diet of *Bufo bufo* of different body sizes (Wheater 1986).

Age	Sex	Food type	SVL < 20 mm (n = 84)	SVL 20-30 mm (n =67)	SVL 30-40 mm (n = 20)	SVL >40 mm (n = 17)	Measure	Country	Habitat
-	-	Isopoda	0	0.34	0.4	0.47	Mean items per toad	UK	Mere, marsh
-	-	Acari	4.24	3.03	1.35	0.24	Mean items per toad	UK	Mere, marsh
-	-	Opilones	0.01	0.39	0.25	0.76	Mean items per toad	UK	Mere, marsh
-	-	Pseudoscorpiones	0.01	0	0	0	Mean items per toad	UK	Mere, marsh
-	-	Aranae	0.44	0.81	1.05	0.88	Mean items per toad	UK	Mere, marsh
-	-	Myriapoda	0.06	0.19	0.4	1.29	Mean items per toad	UK	Mere, marsh
-	-	Collembola	1.49	1.39	0.8	0.12	Mean items per toad	UK	Mere, marsh
-	-	Orthoptera	0.02	0.07	0.05	0.06	Mean items per toad	UK	Mere, marsh
-	-	Dermaptera	0	0	0	0.06	Mean items per toad	UK	Mere, marsh
-	-	Aphidoidea	0.07	0.13	0.1	0	Mean items per toad	UK	Mere, marsh
-	-	Other Hemiptera	0.01	0.24	0	0	Mean items per toad	UK	Mere, marsh
-	-	Carabidae	0.12	0.43	0.4	0.76	Mean items per toad	UK	Mere, marsh
-	-	Staphylinidae	0.44	1.06	1.4	0.41	Mean items per toad	UK	Mere, marsh
-	-	Other Coleoptera	0.27	0.61	0.41	0.29	Mean items per toad	UK	Mere, marsh
-	-	Larval Coleoptera	0.12	0.27	0.25	0	Mean items per toad	UK	Mere, marsh
-	-	Larval Lepidoptera	0.01	0.01	0.1	0.18	Mean items per toad	UK	Mere, marsh
-	-	Diptera	0.27	0.42	0.5	0.29	Mean items per toad	UK	Mere, marsh
-	-	Larval Diptera	0.58	0.31	0.25	0.24	Mean items per toad	UK	Mere, marsh
-	-	Neuroptera	0	0	0.05	0	Mean items per toad	UK	Mere, marsh
-	-	Formicidae	0.99	2.34	1.35	0.24	Mean items per toad	UK	Mere, marsh
-	-	Ichneumonidae	0.06	0	0.1	0.12	Mean items per toad	UK	Mere, marsh
-	-	Mollusca	0.02	0.22	0.1	0.12	Mean items per toad	UK	Mere, marsh

Table 48: Diet of *Bufo bufo* in the UK (Cornish et al. 1995).

Age	Sex	Food type	Season	Frequency of occurrence (%)	Relative abundance (%)	N	Country	Habitat
Adult	M/F	Oligochaeta	Summer	0	0.00	13	UK	Plantation
Adult	M/F	Araneae	Summer	70	4.44	13	UK	Plantation
Adult	M/F	Opiliones	Summer	54	1.83	13	UK	Plantation
Adult	M/F	Acari	Summer	8	0.26	13	UK	Plantation
Adult	M/F	Isopoda	Summer	16	7.31	13	UK	Plantation
Adult	M/F	Diplopoda	Summer	47	4.18	13	UK	Plantation
Adult	M/F	Chilopoda	Summer	23	0.78	13	UK	Plantation
Adult	M/F	Collembola	Summer	16	0.78	13	UK	Plantation
Adult	M/F	Dermaptera	Summer	85	16.45	13	UK	Plantation
Adult	M/F	Heteroptera	Summer	8	0.26	13	UK	Plantation
Adult	M/F	Hom optera	Summer	77	4.18	13	UK	Plantation
Adult	M/F	Lepidoptera (larva)	Summer	39	1.31	13	UK	Plantation
Adult	M/F	Diptera (adult)	Summer	100	19.06	13	UK	Plantation
Adult	M/F	Diptera (larva)	Summer	8	1.04	13	UK	Plantation
Adult	M/F	Hymenoptera	Summer	77	4.18	13	UK	Plantation
Adult	M/F	Carabidae	Summer	70	4.18	13	UK	Plantation
Adult	M/F	Staphylinidae	Summer	70	3.66	13	UK	Plantation
Adult	M/F	Curculionidae	Summer	85	12.79	13	UK	Plantation
Adult	M/F	Other Coleoptera	Summer	100	9.66	13	UK	Plantation
Adult	M/F	Coleoptera (larva)	Summer	54	2.61	13	UK	Plantation
Adult	M/F	Pulmonata	Summer	31	1.04	13	UK	Plantation

Table 49: Diet of *Bufo bufo* in Romania (Dimancea and Covaciu-Marcov 2009).

Age	Sex	Food type	Season	Frequency of occurrence (%)	Relative abundance (%)	N	Country	Habitat
Adult	-	Lumbricidae	Summer	0.18	2.86	35	Romania	Coniferous forest
Adult	-	Gasteropoda-snail (t.)	Summer	3.21	28.57	35	Romania	Coniferous forest
Adult	-	Gasteropoda-Limax	Summer	0.54	5.71	35	Romania	Coniferous forest
Adult	-	Pseudoscorpionida	Summer	0.36	5.71	35	Romania	Coniferous forest
Adult	-	Arachnida-Opiliones	Summer	1.79	20	35	Romania	Coniferous forest
Adult	-	Arachnida – Araneae	Summer	3.57	42.86	35	Romania	Coniferous forest
Adult	-	Arachnida Acarina	Summer	0.54	8.57	35	Romania	Coniferous forest
Adult	-	Crustacean-Isopoda (t.)	Summer	0.18	2.86	35	Romania	Coniferous forest
Adult	-	Myriapoda – Diplopoda	Summer	3.21	22.86	35	Romania	Coniferous forest
Adult	-	Myriapoda-Chilopoda	Summer	2.68	37.14	35	Romania	Coniferous forest
Adult	-	Collembola	Summer	1.07	5.71	35	Romania	Coniferous forest
Adult	-	Dermaptera	Summer	0.18	2.86	35	Romania	Coniferous forest
Adult	-	Heteroptera	Summer	0.89	14.29	35	Romania	Coniferous forest
Adult	-	Homoptera -Cicadas	Summer	1.07	11.43	35	Romania	Coniferous forest
Adult	-	Homoptera-Aphids	Summer	0.18	2.86	35	Romania	Coniferous forest

Age	Sex	Food type	Season	Frequency of occurrence (%)	Relative abundance (%)	N	Country	Habitat
Adult	-	Coleoptera –undet.	Summer	2.32	22.86	35	Romania	Coniferous forest
Adult	-	Coleoptera - Carabidae	Summer	3.04	34.29	35	Romania	Coniferous forest
Adult	-	Coleoptera - Elateridae	Summer	0.18	2.86	35	Romania	Coniferous forest
Adult	-	Coleoptera - Curculinoidae	Summer	2.5	37.14	35	Romania	Coniferous forest
Adult	-	Coleoptera - Chrysomelidae	Summer	0.18	2.86	35	Romania	Coniferous forest
Adult	-	Coleoptera - Staphylinidae	Summer	1.61	8.57	35	Romania	Coniferous forest
Adult	-	Panorpata	Summer	0.18	2.86	35	Romania	Coniferous forest
Adult	-	Lepidoptera	Summer	0.54	8.57	35	Romania	Coniferous forest
Adult	-	Lepidoptera (L.)	Summer	0.54	5.71	35	Romania	Coniferous forest
Adult	-	Nematocera undet.	Summer	2.5	14.29	35	Romania	Coniferous forest
Adult	-	Nematocera Typulidae	Summer	0.89	5.71	35	Romania	Coniferous forest
Adult	-	Brahicera (adults)	Summer	3.57	40	35	Romania	Coniferous forest
Adult	-	Brahicera (L.)	Summer	0.54	2.86	35	Romania	Coniferous forest
Adult	-	Hymenoptera- undet.	Summer	1.79	14.29	35	Romania	Coniferous forest
Adult	-	Hymenoptera - Formicidae	Summer	60	57.14	35	Romania	Coniferous forest

Table 50: Diet of newly metamorphosed *Bufo bufo* (Kuzmin 1997)

Age	Sex	Food type	Relative abundance (%)	SD/SE	N	Country	Habitat	Notes
Juvenile	-	Acarina	65.1	-	12	Russia	-	Newly metamorphosed (Stage 46). A further 6 stomachs were empty.
Juvenile	-	Collembola	20.6	-	12	Russia	-	Newly metamorphosed (Stage 46) . A further 6 stomachs were empty.
Juvenile	-	Other taxa	14.3	-	12	Russia	-	Newly metamorphosed (Stage 46) . A further 6 stomachs were empty.

Table 51: Size of food items consumed by *Bufo bufo* in the UK (Gittins 1987).

Age	Sex	Food type	Season	Number of items	Mean length (mm)	Min. (mm)	Max. (mm)	Country	Habitat	Notes
Adult/Juvenile	M/F	Oligochaeta	All year	4	16.8	3	40	UK	Lake	Data from 161 stomachs
Adult/Juvenile	M/F	Pulmonata	All year	8	3.0	2	4	UK	Lake	Data from 161 stomachs
Adult/Juvenile	M/F	Isopoda	All year	13	7.9	2	15	UK	Lake	Data from 161 stomachs
Adult/Juvenile	M/F	Diplopoda	All year	40	13.2	5	32	UK	Lake	Data from 161 stomachs
Adult/Juvenile	M/F	Chilopoda	All year	12	13.6	4	31	UK	Lake	Data from 161 stomachs
Adult/Juvenile	M/F	Collembola	All year	40	3.9	2	9	UK	Lake	Data from 161 stomachs
Adult/Juvenile	M/F	Heteroptera	All year	12	4.2	2	7	UK	Lake	Data from 161 stomachs
Adult/Juvenile	M/F	Lepidoptera	All year	16	11.8	3	23	UK	Lake	Data from 161 stomachs
Adult/Juvenile	M/F	Diptera	All year	30	3.8	1	9	UK	Lake	Data from 161 stomachs
Adult/Juvenile	M/F	Hymenoptera (Formicoidea)	All year	18	4.8	3	6	UK	Lake	Data from 161 stomachs
Adult/Juvenile	M/F	Coleoptera	All year	170	5.9	2	18	UK	Lake	Data from 161 stomachs
Adult/Juvenile	M/F	Coleoptera larvae	All year	13	9.2	4	21	UK	Lake	Data from 161 stomachs
Adult/Juvenile	M/F	Aranea	All year	43	4.6	1	11	UK	Lake	Data from 161 stomachs
Adult/Juvenile	M/F	Opiliones	All year	17	2.6	2	6	UK	Lake	Data from 161 stomachs
Adult/Juvenile	M/F	Acari	All year	33	1.5	1	5	UK	Lake	Data from 161 stomachs

4. Seasonal activities

Data on seasonal activity is greatly affected by factors such as habitat, latitude, altitude, local climate, annual differences in temperature and the permanence or other wise of the breeding pond. It is therefore recommended that local information for the zone/country/area under consideration be consulted.

Seasonal activity of *Bufo bufo* in Germany based on information in Pfeffer et al. (2011). Darker area represents the main period of activity.

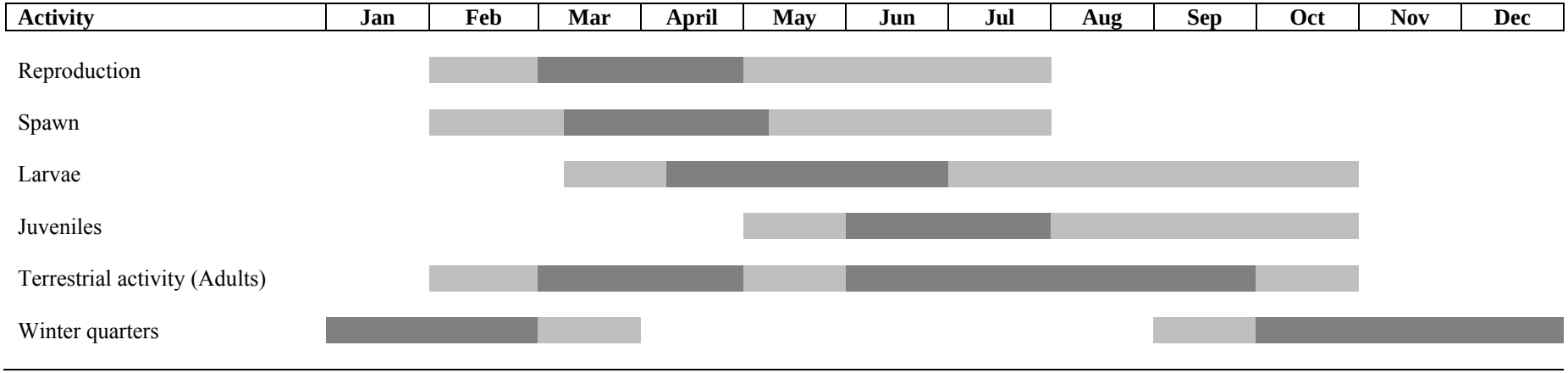

Table 52: Seasonal activities of *Bufo bufo*.

Begin	Peak	End	Country	Habitat	Notes	Reference
Mating/laying						
Mid April	-	Late April	Germany	Forest/pasture	May last around 1 week, timing may vary annually	Sinsch (1988a)
2 February	-	13 February	UK	Flooded clay pit	'Early' breeding years	Reading (1998)
25 February	-	8 March	UK	Flooded clay pit	'Average' breeding years	Reading (1998)
16 March	-	23 March	UK	Flooded clay pit	'Late' breeding years	Reading (1998)
Larval stage						
Mid January	Mid February	Mid April	Spain	Nature reserve	1985 data	Diaz-Paniagua (1988)
Summer movements						
Early June	-	End September	Germany	Forest/pasture		Sinsch (1988a)
Autumn migration						
Mid September	-	Early November	Germany	Forest/pasture		Sinsch (1988a)
Hibernation						
Beginning November	-	End March	Germany	Forest/pasture		Sinsch (1988a)
Spring migration						
End March/beginning April	-	Early May	Germany	Forest/pasture		Sinsch (1988a)
Mid-March	-	April	Czech Republic	-	32d on average	Kovar and Brabec (2007)

5. Other information

Table 53: Age/longevity of *Bufo bufo*.

Sex	Season	Mean	SD/SE	Units	Min.	Max.	N	Country	Habitat	Notes	Reference
M		5.2	-	y	-	-	-	Czech republic	'Breeding pond'	Average age (mature in 2-6 years).	Kovar and Brabec (2007)
F		5.5	-	y	-	-	-	Czech republic	'Breeding pond'	Average age (mature in 3-6 years).	Kovar and Brabec (2007)
M	Breeding	-	-	y	5	25	-	Switzerland	Alps	Range of ages at breeding pond.	Grossenbacher (2002)
F	Breeding	-	-	y	8	20	-	Switzerland	Alps	Range of ages at breeding pond.	Grossenbacher (2002)

Table 54: Home range estimates for *Bufo bufo*.

Age	Sex	Season	Mean	SD/SE	Units	Min.	Max.	N	Country	Habitat	Notes	Reference
-	M/F	Outside breeding season	351	247 SD	m^2			3	UK	Heath	Woolmer. Convex polygon, n = toads with ≥ 4 sightings.	Denton and Beebee (1993)
-	M/F	Outside breeding season	508	-	m^2			1	UK	Dune	Birkdale. Convex polygon, n = toads with ≥ 4 sightings.	Denton and Beebee (1993)

F. SPECIES INFORMATION – COMMON TREE FROG (*HYLA ARBOREA*)

EU distribution

Austria, Belgium, Bulgaria, Czech Republic, Denmark, France, Germany, Greece, Hungary, Italy, Latvia (reintroduced), Lithuania, Luxembourg, Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, [Switzerland]

Sources of information

Basic information on this species can be found in general field guides (e.g. Arnold and Ovenden 2002) or in online resources such as:

AmphibiaWeb	http://amphibiaweb.org/cgi-bin/amphib_query?query_src=aw_search_index&where-genus=Hyla&where-species=arborea&rel-genus=equals&rel-species=equals
Reptiles & Amphibiens de France	http://www.herpfrance.com/amphibian/common_tree_frog_hyla_arborea.php
Arkive	http://www.arkive.org/common-tree-frog/hyla-arborea/#text=All
The IUCN red list	http://www.iucnredlist.org/details/full/10351/0

Further details on distribution can be found in the 'Atlas of amphibians and reptiles in Europe' (Gasc et al 1997).

Map is available at: http://www.seh-herpetology.org/images/atlas/pdf/anura/hylarb.pdf
(including *Hyla intermedia* and *Hyla sarda*)

Below is more detailed information on body size (length and weight), metabolic rate, diet and seasonal activity found during the course of the review.

1. Body size

Table 55: Bodyweight of *Hyla arborea*.

Age	Sex	Season	Mean	SD/SE	Units	Min.	Max.	N	Country	Habitat	Notes	Reference
Adult	M/F	-	6		g				Switzerland	Agricultural		Pellet et al (2006)
Adult	M	Summer	4.4	-	g	-	-	1	Germany	Nature reserve	Periphery of summer habitat, animal 12.	Grosse (1998)
Juvenile	-	Summer	0.9	-	g	-	-	1	Germany	Nature reserve	Periphery of summer habitat, animal 14.	Grosse (1998)
Juvenile	-	Summer	1.1	-	g	-	-	1	Germany	Nature reserve	Periphery of summer habitat, animal 15.	Grosse (1998)
Adult	M	Summer	3.3	-	g	-	-	1	Germany	Nature reserve	Periphery of summer habitat, animal 16.	Grosse (1998)
Adult	M	Summer	4	-	g	-	-	1	Germany	Nature reserve	Periphery of summer habitat, animal 24.	Grosse (1998)
Juvenile	-	Summer	0.6	-	g	-	-	10	Germany	Nature reserve	Size in August, 1995 data.	Grosse (1998)
Juvenile	-	Autumn	1.3	0.6 SD	g	0.9	2.8	15	Germany	Nature reserve	Size in September, 1995 data	Grosse (1998)
Juvenile	-	Autumn	1.9	1.1 SD	g	0.9	3.3	11	Germany	Nature reserve	Size in October, 1995 data.	Grosse (1998)
Juvenile	-	Autumn	1.6	0.8 SD	g	0.9	3.3	14	Germany	Nature reserve	Size in early October 1995. Summer habitat.	Grosse (1998)
Juvenile	-	Autumn	0.7	0.2 SD	g	0.5	1.1	14	Germany	Nature reserve	Size in mid October 1996. Summer habitat.	Grosse (1998)
Juvenile	-	Autumn	1.3	0.6 SD	g	0.9	2.9	16	Germany	Nature reserve	Size at end of September 1997. Summer habitat.	Grosse (1998)

Table 56: Body length of *Hyla arborea*.

Age	Sex	Season	Mean	SD/SE	Units	Min.	Max.	N	Country	Habitat	Notes	Reference
Adult	M	Breeding	39.5	3.01 SD	mm SVL	32.2	45.8	75	Greece	Temporary ponds, lakes.	Collected March to May.	Kyriakopoulou-Sklavounou and Grumiro (2002)
Adult	F	Breeding	43.7	4.82 SD	mm SVL	32.6	47.0	9	Greece	Temporary ponds, lakes.	Collected March to May.	Kyriakopoulou-Sklavounou and Grumiro (2002)
Adult	M	Breeding	44.5	2.4 SD	mm SVL	37	49	38	Germany	Woods, meadow, peat bog.	1990 data	Friedl and Klump (1997, 2005)
Adult	F	Breeding	45.9	2.2 SD	mm SVL	41	50	23	Germany	Woods, meadow, peat bog.	1990 data	Friedl and Klump (1997, 2005)
Adult	M	Breeding	42.0	2.9 SD	mm SVL	36	48	56	Germany	Woods, meadow, peat bog.	1991 data	Friedl and Klump (1997, 2005)
Adult	F	Breeding	43.2	3.6 SD	mm SVL	38	49	26	Germany	Woods, meadow, peat bog.	1991 data	Friedl and Klump (1997, 2005)
Adult	M	Summer	45	-	mm SVL	-	-	1	Germany	Nature reserve	Periphery of summer habitat, animal 1.	Grosse (1998)
Adult	F	Summer	48	-	mm SVL	-	-	1	Germany	Nature reserve	Periphery of summer habitat, animal 2.	Grosse (1998)
Adult	M	Summer	40	-	mm SVL	-	-	1	Germany	Nature reserve	Periphery of summer habitat, animal 3.	Grosse (1998)
Adult	M	Summer	40	-	mm SVL	-	-	1	Germany	Nature reserve	Periphery of summer habitat, animal 4.	Grosse (1998)
Adult	M	Summer	36	-	mm SVL	-	-	1	Germany	Nature reserve	Periphery of summer habitat, animal 5.	Grosse (1998)

Age	Sex	Season	Mean	SD/SE	Units	Min.	Max.	N	Country	Habitat	Notes	Reference
Juvenile	-	Summer	24	-	mm SVL	-	-	1	Germany	Nature reserve	Periphery of summer habitat, animal 6.	Grosse (1998)
Juvenile	-	Summer	24	-	mm SVL	-	-	1	Germany	Nature reserve	Periphery of summer habitat, animal 7.	Grosse (1998)
Juvenile	-	Summer	25	-	mm SVL	-	-	1	Germany	Nature reserve	Periphery of summer habitat, animal 8.	Grosse (1998)
Adult	F	Summer	28	-	mm SVL	-	-	1	Germany	Nature reserve	Periphery of summer habitat, animal 9.	Grosse (1998)
Juvenile	-	Summer	26	-	mm SVL	-	-	1	Germany	Nature reserve	Periphery of summer habitat, animal 10.	Grosse (1998)
Juvenile	-	Summer	26	-	mm SVL	-	-	1	Germany	Nature reserve	Periphery of summer habitat, animal 11.	Grosse (1998)
Adult	M	Summer	36	-	mm SVL	-	-	1	Germany	Nature reserve	Periphery of summer habitat, animal 12.	Grosse (1998)
Adult	M	Summer	32	-	mm SVL	-	-	1	Germany	Nature reserve	Periphery of summer habitat, animal 13.	Grosse (1998)
Juvenile	-	Summer	25	-	mm SVL	-	-	1	Germany	Nature reserve	Periphery of summer habitat, animal 14.	Grosse (1998)
Juvenile	-	Summer	26	-	mm SVL	-	-	1	Germany	Nature reserve	Periphery of summer habitat, animal 15.	Grosse (1998)
Adult	M	Summer	31	-	mm SVL	-	-	1	Germany	Nature reserve	Periphery of summer habitat, animal 16.	Grosse (1998)

Age	Sex	Season	Mean	SD/SE	Units	Min.	Max.	N	Country	Habitat	Notes	Reference
Juvenile	-	Summer	27	-	mm SVL	-	-	1	Germany	Nature reserve	Periphery of summer habitat, animal 17.	Grosse (1998)
Juvenile	-	Summer	24	-	mm SVL	-	-	1	Germany	Nature reserve	Periphery of summer habitat, animal 18.	Grosse (1998)
Juvenile	-	Summer	27	-	mm SVL	-	-	1	Germany	Nature reserve	Periphery of summer habitat, animal 19.	Grosse (1998)
Adult	M	Summer	34	-	mm SVL	-	-	1	Germany	Nature reserve	Periphery of summer habitat, animal 20.	Grosse (1998)
Adult	M	Summer	36	-	mm SVL	-	-	1	Germany	Nature reserve	Periphery of summer habitat, animal 21.	Grosse (1998)
Adult	M	Summer	35	-	mm - SVL	-	-	1	Germany	Nature reserve	Periphery of summer habitat, animal 22.	Grosse (1998)
Juvenile	-	Summer	26	-	mm SVL	-	-	1	Germany	Nature reserve	Periphery of summer habitat, animal 23.	Grosse (1998)
Adult	M	Summer	35	-	mm SVL	-	-	1	Germany	Nature reserve	Periphery of summer habitat, animal 24.	Grosse (1998)
Juvenile	-	Summer	28	-	mm SVL	-	-	1	Germany	Nature reserve	Periphery of summer habitat, animal 25.	Grosse (1998)
Adult	M	Summer	32	-	mm SVL	-	-	1	Germany	Nature reserve	Periphery of summer habitat, animal 26.	Grosse (1998)
Juvenile	-	Summer	19.3	1.4 SD	mm SVL	17	21	10	Germany	Nature reserve	Size in August, 1995 data.	Grosse (1998)
Juvenile	-	Autumn	24.1	4.3 SD	mm SVL	20	32	15	Germany	Nature reserve	Size in September, 1995 data	Grosse (1998)

Age	Sex	Season	Mean	SD/SE	Units	Min.	Max.	N	Country	Habitat	Notes	Reference
Juvenile	-	Autumn	26.9	2.6 SD	mm SVL	24	32	16	Germany	Nature reserve	Size in October, 1995 data.	Grosse (1998)
Juvenile	-	Autumn	25.5	3.5 SD	mm SVL	21	31	20	Germany	Nature reserve	Size in early October 1995. Summer habitat.	Grosse (1998)
Juvenile	-	Autumn	19.4	1.5 SD	mm SVL	18	22	14	Germany	Nature reserve	Size in mid October 1996. Summer habitat.	Grosse (1998)
Juvenile	-	Autumn	24.3	4.1 SD	mm SVL	14	32	20	Germany	Nature reserve	Size at end of September 1997. Summer habitat.	Grosse (1998)

2. Metabolic rate

Table 57: Metabolic rate in *Hyla arborea* (oxygen).

Age	Sex	Weight (g)	Season	Mean	SD/SE	Units	Min.	Max.	N	Country	Temp (°C)	Notes	Reference
A	-	7.78	-	0.314	-	ml/g/h	-	-	-	-	18.5	Resting	Gatten et al. (1992)

3. Diet

Table 58: Diet of *Hyla arborea* (Cogalniceanu et al. 2000). No treefrogs sampled were found to have empty stomachs.

Food type	Number of stomachs	Relative abundance (%)	Frequency (% stomachs)	N	Season	Country	Habitat
Gastropoda, Pulmonata	1	1.35	3.70	34	All year	Romania	Islands in floodplain
Arachnida, Araneae	5	6.76	14.81	34	All year	Romania	Islands in floodplain
Insecta, adults	3	4.05	11.11	34	All year	Romania	Islands in floodplain
Heteroptera	2	2.7	7.41	34	All year	Romania	Islands in floodplain
Lepidoptera	3	4.05	7.41	34	All year	Romania	Islands in floodplain
Orthoptera	1	1.35	3.70	34	All year	Romania	Islands in floodplain
Homoptera, Cicadidae	34	45.9	51.85	34	All year	Romania	Islands in floodplain
Hymenoptera, undetermined	2	2.7	7.41	34	All year	Romania	Islands in floodplain
Hymenoptera, Formicidae	8	10.8	18.52	34	All year	Romania	Islands in floodplain
Diptera, adults, undetermined	1	1.35	3.70	34	All year	Romania	Islands in floodplain
Diptera, Muscidae, adults	2	2.7	7.41	34	All year	Romania	Islands in floodplain
Diptera, Chironomidae	1	1.35	3.70	34	All year	Romania	Islands in floodplain
Coleoptera, undetermined	4	5.41	14.81	34	All year	Romania	Islands in floodplain
Coleoptera, Carabidae, adults	1	1.35	3.70	34	All year	Romania	Islands in floodplain
Coleoptera, Chrysomelidae	5	6.76	14.81	34	All year	Romania	Islands in floodplain
Coleoptera, Elateridae	1	1.35	3.70	34	All year	Romania	Islands in floodplain

Table 59: Diet of *Hyla arborea* in Romania (David et al. 2009b).

Food type	Relative abundance (% weight)	Frequency (%)	N	Season	Country	Habitat	Notes
Gastropoda-snails	2.78	10.7	146	Summer	Romania	Oak forest	92 females, 54 males
Gastropoda-Limax	0.19	0.82	146	Summer	Romania	Oak forest	92 females, 54 males
Crustacean-Isopoda (terretrial)	7.96	20.5	146	Summer	Romania	Oak forest	92 females, 54 males
Arahnida Pseudoscorpionida	0.19	0.82	146	Summer	Romania	Oak forest	92 females, 54 males
Arachnida-Acaria	0.19	0.82	146	Summer	Romania	Oak forest	92 females, 54 males
Arachnida-Araneida	16.5	50.8	146	Summer	Romania	Oak forest	92 females, 54 males
Myriapoda-Chilopoda	0.19	0.82	146	Summer	Romania	Oak forest	92 females, 54 males
Myriapoda-Diplopoda	1.67	7.38	146	Summer	Romania	Oak forest	92 females, 54 males
Ephemeroptera	0.19	0.82	146	Summer	Romania	Oak forest	92 females, 54 males
Ortoptera	0.19	0.82	146	Summer	Romania	Oak forest	92 females, 54 males
Plecoptera	0.19	0.82	146	Summer	Romania	Oak forest	92 females, 54 males
Heteroptera(terrestrial)	2.22	8.2	146	Summer	Romania	Oak forest	92 females, 54 males
Homoptera-Cicadina	2.22	8.2	146	Summer	Romania	Oak forest	92 females, 54 males
Lepidoptera (larvae)	8.33	23.8	146	Summer	Romania	Oak forest	92 females, 54 males
Lepidoptera	4.07	17.2	146	Summer	Romania	Oak forest	92 females, 54 males
Trihoptera	0.19	0.82	146	Summer	Romania	Oak forest	92 females, 54 males
Coleoptera-undetermined	4.26	17.2	146	Summer	Romania	Oak forest	92 females, 54 males
Coleoptera-Carabidae	1.48	5.74	146	Summer	Romania	Oak forest	92 females, 54 males
Coleoptera-Cryzomelidae	3.15	10.7	146	Summer	Romania	Oak forest	92 females, 54 males
Coleoptera-Coccinelidae	0.37	0.82	146	Summer	Romania	Oak forest	92 females, 54 males
Coleoptera-Curculionidae	3.7	13.1	146	Summer	Romania	Oak forest	92 females, 54 males
Coleoptera-Elateridae	2.41	9.02	146	Summer	Romania	Oak forest	92 females, 54 males
Coleoptera-Stafilinidae	0.19	0.82	146	Summer	Romania	Oak forest	92 females, 54 males
Coleoptera-Cantaridae	1.11	4.1	146	Summer	Romania	Oak forest	92 females, 54 males
Diptera-Nematocera	14.3	36.1	146	Summer	Romania	Oak forest	92 females, 54 males
Diptera-Brahicera (larvae)	1.11	4.92	146	Summer	Romania	Oak forest	92 females, 54 males
Diptera-Brahicera	7.41	27	146	Summer	Romania	Oak forest	92 females, 54 males
Neuroptera	0.19	0.82	146	Summer	Romania	Oak forest	92 females, 54 males
Hymenoptera-undetermined.	1.48	5.74	146	Summer	Romania	Oak forest	92 females, 54 males
Hymenoptera-Formicidae	9.07	23	146	Summer	Romania	Oak forest	92 females, 54 males
Hymenoptera-Apidae	0.19	0.82	146	Summer	Romania	Oak forest	92 females, 54 males

Food type	Relative abundance (% weight)	Frequency (%)	N	Season	Country	Habitat	Notes
Panorpata	0.56	1.64	146	Summer	Romania	Oak forest	92 females, 54 males
Blatoidea	1.85	7.38	146	Summer	Romania	Oak forest	92 females, 54 males

Seasonal variation in the diet of a population of *Hyla arborea* is presented in Kovács et al (2007).

4. Seasonal activities

Data on seasonal activity is greatly affected by factors such as habitat, latitude, altitude, local climate, annual differences in temperature and the permanence or other wise of the breeding pond. It is therefore recommended that local information for the zone/country/area under consideration be consulted.

Seasonal activity of *Hyla arborea* in Germany based on information in Pfeffer et al. (2011). Darker area represents the main period of activity.

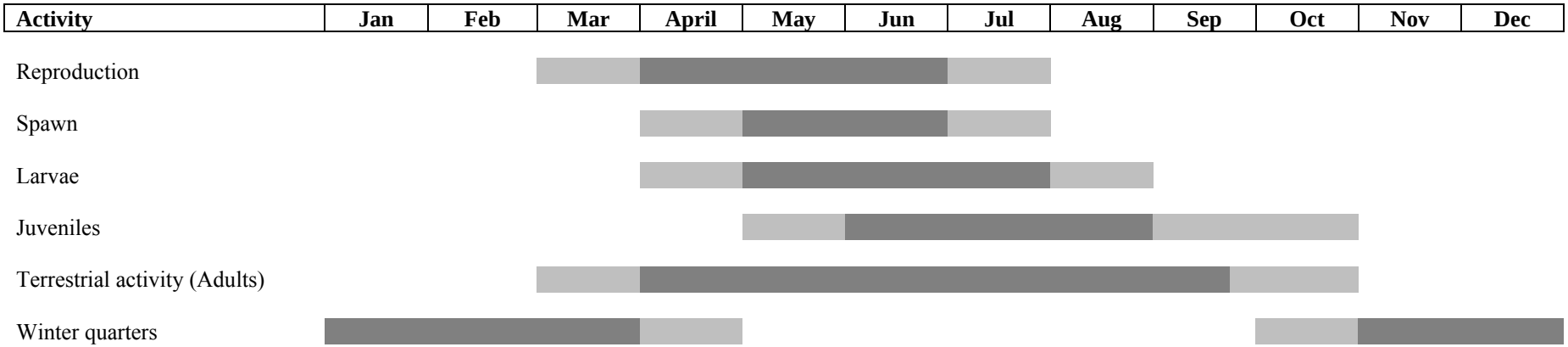

Table 60: Seasonal activities of *Hyla arborea*.

Begin	Peak	End	Country	Habitat	Notes	Reference
Mating/laying						
March	-	May	Greece	Temporary ponds, lakes.		Kyriakopoulou-Sklavounou and Grumiro (2002)
Mid April	April/May	Mid/late May	Italy	Ditches	2 peaks separated by 5-10d	Pavignano (1989)
Early May	-	Early July	Germany	Woods, meadow, peat bog.	1990 data	Friedl and Klump (1997, 2005)
End April	-	Early July	Germany	Woods, meadow, peat bog.	1991 data	Friedl and Klump (1997, 2005)
Larval period						
Start May	-	Mid July	Italy	Ditches	Duration 66-67d	Pavignano (1989)
Hibernation						
November	-	February	Greece	Temporary ponds, lakes.		Kyriakopoulou-Sklavounou and Grumiro (2002)

5. Other information

Table 61: Age/longevity in *Hyla arborea*.

Age	Sex	Season	Mean	SD/SE	Units	Min.	Max.	N	Country	Habitat	Notes	Reference
Adult	M	Breeding	3.74	0.98 SD	y	2	6	75	Greece	Temporary ponds, lakes.	Collected March to May.	Kyriakopoulou-Sklavounou and Grumiro (2002)
Adult	F	Breeding	4.7	1.05 SD	y	3	6	9	Greece	Temporary ponds, lakes.	Collected March to May.	Kyriakopoulou-Sklavounou and Grumiro (2002)
Adult	M	Breeding	3.43	1.07 SD	y	1	5	37	Germany	Woods, meadow, peat bog.	1990 data	Friedl and Klump (1997, 2005)
Adult	F	Breeding	3.80	0.82 SD	y	3	5	25	Germany	Woods, meadow, peat bog.	1990 data	Friedl and Klump (1997, 2005)
Adult	M	Breeding	2.82	1.39 SD	y	2	6	56	Germany	Woods, meadow, peat bog.	1991 data	Friedl and Klump (1997, 2005)
Adult	F	Breeding	2.85	1.26 SD	y	2	6	26	Germany	Woods, meadow, peat bog.	1991 data	Friedl and Klump (1997, 2005)

G. SPECIES INFORMATION – NATTERJACK TOAD (*EPIDALEA CALAMITA, BUFO CALAMITA*)

EU distribution

Austria, Belgium, Czech Republic, Denmark, Estonia, France, Germany, Ireland, Latvia, Lithuania, Luxembourg, Netherlands, Poland, Portugal, Slovakia, Spain, Sweden, [Switzerland], United Kingdom

Sources of information

Basic information on this species can be found in general field guides (e.g. Arnold and Ovenden 2002) or in online resources such as:

AmphibiaWeb	http://amphibiaweb.org/cgi-bin/amphib_query?query_src=aw_search_index&where-genus=Epidalea&where-species=calamita&rel-genus=equals&rel-species=equals
Reptiles & Amphibiens de France	http://www.herpfrance.com/amphibian/natterjack_toad_bufo_calamita.php
Arkive	http://www.arkive.org/natterjack-toad/bufo-calamita/#text=All
The IUCN red list	http://www.iucnredlist.org/details/full/54598/0

Further details on distribution can be found in the 'Atlas of amphibians and reptiles in Europe' (Gasc et al 1997).

Map is available at: http://www.seh-herpetology.org/images/atlas/pdf/anura/bufcal.pdf

Below is more detailed information on body size (length and weight), metabolic rate, diet and seasonal activity found during the course of the review.

1. Body size

Table 62: Bodyweight of *Bufo calamita*.

Age	Sex	Season	Mean	SD/SE	Units	Min.	Max.	N	Country	Habitat	Notes	Reference
Adult	M	Spring	52.1	-	g	-	-	1	Spain	Agricultural	March-June	Oromi et al (2010)
Adult	M	Spring	42.1	-	g	-	-	1	Spain	Agricultural	March-June	Oromi et al (2010)
Adult	M	Spring	62.4	-	g	-	-	1	Spain	Agricultural	March-June	Oromi et al (2010)
Adult	M	Spring	49.0	-	g	-	-	1	Spain	Agricultural	March-June	Oromi et al (2010)
Adult	M	Spring	52.2	-	g	-	-	1	Spain	Agricultural	March-June	Oromi et al (2010)
Adult	M	Spring	30.8	-	g	-	-	1	Spain	Agricultural	March-May	Oromi et al (2010)
Adult	M	Winter	38.0	-	g	-	-	1	Spain	Agricultural	Jan-March	Oromi et al (2010)
Adult	F	Winter	56.5	-	g	-	-	1	Spain	Agricultural	Jan-March	Oromi et al (2010)
Adult	M	Winter	31.8	-	g	-	-	1	Spain	Agricultural	Jan-March	Oromi et al (2010)
Adult	F	Winter	30.4	-	g	-	-	1	Spain	Agricultural	Jan-March	Oromi et al (2010)
Adult	M	Winter	25.8	-	g	-	-	1	Spain	Agricultural	Jan-March	Oromi et al (2010)
Adult	M	Winter	21.8	-	g	-	-	1	Spain	Agricultural	Jan-March	Oromi et al (2010)
Adult	F	Winter	41.7	-	g	-	-	1	Spain	Agricultural	Jan-March	Oromi et al (2010)
Adult	M	Winter	44.9	-	g	-	-	1	Spain	Agricultural	Jan-March	Oromi et al (2010)
Adult	F	Winter	54.7	-	g	-	-	1	Spain	Agricultural	Jan-March	Oromi et al (2010)
Adult	F	Winter / Spring		-	g	9	65	-	Spain	-	Approximate values from graph	Tejedo (1992)
Adult	M/F	-	31.7	-	g	-	-	95/53	Spain	-	'Pedroso' (estimated from graph)	Marangoni et al (2008)
Adult	M/F	-	28.0	-	g	-	-	60/43	Spain	-	'Navas' (estimated from graph)	Marangoni et al (2008)
Adult	M/F	-	43.0	-	g	-	-	22/3	Spain	-	'Gerena' (estimated from graph)	Marangoni et al (2008)
Adult	M/F	-	22.6	-	g	-	-	28/1	Spain	-	'Sanlúcar' (estimated from graph)	Marangoni et al (2008)
Adult	M/F	-	21.1	-	g	-	-	59/54	Spain	-	'Juncosilla' (estimated from graph)	Marangoni et al (2008)

Age	Sex	Season	Mean	SD/SE	Units	Min.	Max.	N	Country	Habitat	Notes	Reference
Adult	M/F	-	11.7	-	g	-	-	31/31	Spain	-	'Bodegones' (estimated from graph)	Marangoni et al (2008)
Adult	M/F	-	15.2	-	g	-	-	36/37	Spain	-	'Abalario' (estimated from graph)	Marangoni et al (2008)
Adult	M/F	-	10.2	-	g	-	-	80/37	Spain	-	'Reserva Biológica de Doñana' (estimated from graph)	Marangoni et al (2008)
Adult	M	Winter	47.4	-	g	-	-	1	Spain	Agricultural (semi-arid)	Breeding period (January)	Miaud et al (2000)
Adult	F	Winter	52.6	-	g	-	-	1	Spain	Agricultural (semi-arid)	Breeding period (January)	Miaud et al (2000)
Adult	F	Winter	52.6	-	g	-	-	1	Spain	Agricultural (semi-arid)	Breeding period (January)	Miaud et al (2000)
Adult	F	Winter	48.2	-	g	-	-	1	Spain	Agricultural (semi-arid)	Breeding period (January)	Miaud et al (2000)
Adult	F	Winter	59.5	-	g	-	-	1	Spain	Agricultural (semi-arid)	Breeding period (January)	Miaud et al (2000)
Adult	F	Winter	59.6	-	g	-	-	1	Spain	Agricultural (semi-arid)	Breeding period (January)	Miaud et al (2000)
Adult	M	Winter	47.7	-	g	-	-	1	Spain	Agricultural (semi-arid)	Breeding period (January)	Miaud et al (2000)
Adult	F	Winter	58.0	-	g	-	-	1	Spain	Agricultural (semi-arid)	Breeding period (January)	Miaud et al (2000)
Adult	M	Winter	52.4	-	g	-	-	1	Spain	Agricultural (semi-arid)	Breeding period (January)	Miaud et al (2000)
Adult	F	Winter	61.0	-	g	-	-	1	Spain	Agricultural (semi-arid)	Breeding period (January)	Miaud et al (2000)
Adult	M	Winter	49.3	-	g	-	-	1	Spain	Agricultural (semi-arid)	Breeding period (January)	Miaud et al (2000)
Adult	F	Winter	57.8	-	g	-	-	1	Spain	Agricultural (semi-arid)	Breeding period	Miaud et al (2000)
Adult	M	Winter	46.0	-	g	-	-	1	Spain	Agricultural (semi-arid)	Breeding period (January)	Miaud et al (2000)

Age	Sex	Season	Mean	SD/SE	Units	Min.	Max.	N	Country	Habitat	Notes	Reference
Adult	F	Winter	58.0	-	g	-	-	1	Spain	Agricultural (semi-arid)	Breeding period (January)	Miaud et al (2000)
Adult	F	Winter	57.4	-	g	-	-	1	Spain	Agricultural (semi-arid)	Breeding period (January)	Miaud et al (2000)
Adult	M	Winter	31.0	-	g	-	-	1	Spain	Agricultural (semi-arid)	Breeding period (January)	Miaud et al (2000)
Adult	M	Winter	47.3	-	g	-	-	1	Spain	Agricultural (semi-arid)	Breeding period (January)	Miaud et al (2000)
Adult	F	Winter	25.2	-	g	-	-	1	Spain	Agricultural (semi-arid)	Breeding period (January)	Miaud et al (2000)
Adult	M	Winter	53.4	-	g	-	-	1	Spain	Agricultural (semi-arid)	Breeding period (January)	Miaud et al (2000)
Adult	M	Summer	13.8	-	g	-	-	1	Germany	Included sandy gravel pits and arable land.	'Urmitz'. Male 1	Sinsch and Leskovar (2011)
Adult	M	Summer	14.8	-	g	-	-	1	Germany	Included sandy gravel pits and arable land.	'Urmitz'. Male 2	Sinsch and Leskovar (2011)
Adult	M	Summer	16.3	-	g	-	-	1	Germany	Included sandy gravel pits and arable land.	'Urmitz'. Male 3	Sinsch and Leskovar (2011)
Adult	M	Summer	16.3	-	g	-	-	1	Germany	Included sandy gravel pits and arable land.	'Urmitz'. Male 4	Sinsch and Leskovar (2011)
Adult	M	Summer	15.1	-	g	-	-	1	Germany	Included sandy gravel pits and arable land.	'Urmitz'. Male 5	Sinsch and Leskovar (2011)

Age	Sex	Season	Mean	SD/SE	Units	Min.	Max.	N	Country	Habitat	Notes	Reference
Adult	M	Summer	13.7	-	g	-	-	1	Germany	Included sandy gravel pits and arable land.	'Urmitz'. Male 6	Sinsch and Leskovar (2011)
Adult	F	Summer	19.3	-	g	-	-	1	Germany	Included sandy gravel pits and arable land.	'Urmitz'. Female 7	Sinsch and Leskovar (2011)
Adult	M	Summer	24.3	-	g	-	-	1	Germany	Included sandy gravel pits and arable land.	'Urmitz'. Male 8	Sinsch and Leskovar (2011)
Adult	F	Summer	24.5	-	g	-	-	1	Germany	Included sandy gravel pits and arable land.	'Urmitz'. Female 9	Sinsch and Leskovar (2011)
Adult	F	Autumn	32.3	-	g	-	-	1	Germany	Included sandy gravel pits and arable land.	'Urmitz'. Female 10	Sinsch and Leskovar (2011)
Adult	F	Autumn	17.2	-	g	-	-	1	Germany	Included sandy gravel pits and arable land.	'Urmitz'. Female 11	Sinsch and Leskovar (2011)
Adult	M	Autumn	22.7	-	g	-	-	1	Germany	Included sandy gravel pits and arable land.	'Urmitz'. Male 12	Sinsch and Leskovar (2011)
Adult	F	Autumn	37.2	-	g	-	-	1	Germany	Included sandy gravel pits and arable land.	'Urmitz'. Female 13	Sinsch and Leskovar (2011)

Age	Sex	Season	Mean	SD/SE	Units	Min.	Max.	N	Country	Habitat	Notes	Reference
Adult	F	Autumn	23.3	-	g	-	-	1	Germany	Included sandy gravel pits and arable land.	'Urmitz'. Female 14	Sinsch and Leskovar (2011)
Adult	M	Autumn	17.8	-	g	-	-	1	Germany	Included sandy gravel pits and arable land.	'Urmitz'. Male 15	Sinsch and Leskovar (2011)
Adult	M	Autumn	29.6	-	g	-	-	1	Germany	Included sandy gravel pits and arable land.	'Urmitz'. Male 16	Sinsch and Leskovar (2011)
Adult	M	Autumn	21.9	-	g	-	-	1	Germany	Included sandy gravel pits and arable land.	'Urmitz'. Male 17	Sinsch and Leskovar (2011)
Adult	F	Autumn	37.9	-	g	-	-	1	Germany	Included sandy gravel pits and arable land.	'Urmitz'. Female 18	Sinsch and Leskovar (2011)
Adult	M	Autumn	25.0	-	g	-	-	1	Germany	Included sandy gravel pits and arable land.	'Urmitz'. Male 19	Sinsch and Leskovar (2011)
Adult	M	Autumn	12.6	-	g	-	-	1	Germany	Included sandy gravel pits and arable land.	'Urmitz'. Male 20	Sinsch and Leskovar (2011)
Adult	M	Autumn	12.5	-	g	-	-	1	Germany	Included sandy gravel pits and arable land.	'Urmitz'. Male 21	Sinsch and Leskovar (2011)

Age	Sex	Season	Mean	SD/SE	Units	Min.	Max.	N	Country	Habitat	Notes	Reference
Adult	F	Autumn	17.8	-	g	-	-	1	Germany	Included sandy gravel pits and arable land.	'Urmitz'. Female 22	Sinsch and Leskovar (2011)
Adult	F	Autumn	35.8	-	g	-	-	1	Germany	Included sandy gravel pits and arable land.	'Urmitz'. Female 23	Sinsch and Leskovar (2011)

Table 63: Body length of *Bufo calamita*.

Age	Sex	Season	Mean	SD/SE	Units	Min.	Max.	N	Country	Habitat	Notes	Reference
Adult	M	Spring	76.0	-	mm SVL	-	-	1	Spain	Agricultural	March-June	Oromi et al (2010)
Adult	M	Spring	72.4	-	mm SVL	-	-	1	Spain	Agricultural	March-June	Oromi et al (2010)
Adult	M	Spring	82.9	-	mm SVL	-	-	1	Spain	Agricultural	March-June	Oromi et al (2010)
Adult	M	Spring	77.8	-	mm SVL	-	-	1	Spain	Agricultural	March-June	Oromi et al (2010)
Adult	M	Spring	75.6	-	mm SVL	-	-	1	Spain	Agricultural	March-June	Oromi et al (2010)
Adult	M	Spring	70.0	-	mm SVL	-	-	1	Spain	Agricultural	March-May	Oromi et al (2010)
Adult	M	Winter	74.0	-	mm SVL	-	-	1	Spain	Agricultural	Jan-March	Oromi et al (2010)
Adult	F	Winter	80.0	-	mm SVL	-	-	1	Spain	Agricultural	Jan-March	Oromi et al (2010)
Adult	M	Winter	70.0	-	mm SVL	-	-	1	Spain	Agricultural	Jan-March	Oromi et al (2010)
Adult	F	Winter	66.0	-	mm SVL	-	-	1	Spain	Agricultural	Jan-March	Oromi et al (2010)
Adult	M	Winter	68.0	-	mm SVL	-	-	1	Spain	Agricultural	Jan-March	Oromi et al (2010)
Adult	M	Winter	60.0	-	mm SVL	-	-	1	Spain	Agricultural	Jan-March	Oromi et al (2010)
Adult	F	Winter	71.0	-	mm SVL	-	-	1	Spain	Agricultural	Jan-March	Oromi et al (2010)
Adult	M	Winter	75.0	-	mm SVL	-	-	1	Spain	Agricultural	Jan-March	Oromi et al (2010)
Adult	F	Winter	74.0	-	mm SVL	-	-	1	Spain	Agricultural	Jan-March	Oromi et al (2010)
Adult	M/F	-	72.2	-	mm SVL	-	-	95/53	Spain	-	'Pedroso' (estimated from graph)	Marangoni et al (2008)
Adult	M/F	-	70.3	-	mm SVL	-	-	60/43	Spain	-	'Navas' (estimated from graph)	Marangoni et al (2008)
Adult	M/F	-	79.6	-	mm SVL	-	-	22/3	Spain	-	'Gerena' (estimated from graph)	Marangoni et al (2008)

Age	Sex	Season	Mean	SD/SE	Units	Min.	Max.	N	Country	Habitat	Notes	Reference
Adult	M/F	-	64.2	-	mm SVL	-	-	28/1	Spain	-	'Sanlúcar' (estimated from graph)	Marangoni et al (2008)
Adult	M/F	-	66.4	-	mm SVL	-	-	59/54	Spain	-	'Juncosilla' (estimated from graph)	Marangoni et al (2008)
Adult	M/F	-	54.2	-	mm SVL	-	-	31/31	Spain	-	'Bodegones' (estimated from graph)	Marangoni et al (2008)
Adult	M/F	-	59.4	-	mm SVL	-	-	36/37	Spain	-	'Abalario' (estimated from graph)	Marangoni et al (2008)
Adult	M/F	-	51.3	-	mm SVL	-	-	80/37	Spain	-	'Reserva Biológica de Doñana' (estimated from graph)	Marangoni et al (2008)
Adult	M/F	-	47.5	1.0 SE	mm SVL	-	-		Spain	Coastal sand dunes	'Reserva Biologica de Doñana', 1st year size	Sinsch et al (2010)
Adult	M/F	-	58.3	1.0 SE	mm SVL	-	-		Spain	Mediterranean mountains	'Navas', 1st year size	Sinsch et al (2010)
Adult	M/F	-	59.7	1.4 SE	mm SVL	-	-		Spain	Semi-arid arable plains	'Mas de Melons', 1st year size	Sinsch et al (2010)
Adult	M/F	-	63.7	1.2 SE	mm SVL	-	-	-	Spain	Semi-arid arable plains	'Balaguer', 1st year size	Sinsch et al (2010)
Adult	M/F	Spring	34.8	1.1 SE	mm SVL	-	-	-	Germany	Flood plain	'Urmitz', 1st year size	Sinsch et al (2010)
Adult	M/F	Summer	30.8	1.1 SE	mm SVL			-	Germany	Flood plain	'Urmitz', 1st year size	Sinsch et al (2010)
Adult	M	Spring	58.3	1.8 SE	mm SVL	-	75 (at 5y)	4	Germany	Sandy gravel pits, fallow, arable	'Urmitz'. Size at first breeding (2y), spring cohort.	Leskovar et al (2006)
Adult	F	Spring	55.0	7.0 SE	mm SVL	-	77 (at 8y)	2	Germany	Sandy gravel pits, fallow, arable	'Urmitz'. Size at first breeding (2y), spring cohort.	Leskovar et al (2006)

Age	Sex	Season	Mean	SD/SE	Units	Min.	Max.	N	Country	Habitat	Notes	Reference
Adult	M	Summer	54.2	2.7 SE	mm SVL	-	71 (at4y)	6	Germany	Sandy gravel pits, fallow, arable	'Urmitz'. Size at first breeding (2y), summer cohort.	Leskovar et al (2006)
Adult	F	Summe	57.5	0.5 SE	mm SVL	-	74 (at7y)	2	Germany	Sandy gravel pits, fallow, arable	'Urmitz'. Size at first breeding (2y), summer cohort.	Leskovar et al (2006)
Adult	M	Spring	77.6	2.0 SE	mm SVL	-	90 (at 4y)	8	Spain	Clay/gravel pits, arable land	'Balaguer'. Size at first breeding (2y), spring cohort.	Leskovar et al (2006)
Adult	F	Spring	81.0	3.5 SE	mm SVL	-	88 (at 3y)	3	Spain	Clay/gravel pits, arable land	'Balaguer'. Size at first breeding (2y), spring cohort.	Leskovar et al (2006)
Adult	M	Spring	76.0	2.5 SE	mm SVL	-	91 (at 5y)	3	Spain	Pasture, arable land (winter cereals)	'Mas de Melons'. Size at first breeding (2y), spring cohort.	Leskovar et al (2006)
Adult	F	Spring	81.0	-	mm SVL	-	95 (at 7y)	1	Spain	Pasture, arable land (winter cereals)	'Mas de Melons'. Size at first breeding (3y), spring cohort.	Leskovar et al (2006)
Adult	M/F	-	60		mm SVL	-	-	-	UK	Heath	Woolmer, 3y old.	Denton and Beebee (1993)
Adult	M/F	-	54.2		mm SVL	-	-	-	UK	Dune	Birkdale, 3y old.	Denton and Beebee (1993)
Adult	M/F	-	52.6		mm SVL	-	-	-	UK	Marsh	Dunnerholme, 3y old.	Denton and Beebee (1993)
Juvenile	M/F	-	25.7	4.2 SD	mm SVL	-	-	23	UK	Heath	Woolmer, end of year 1, 3 mo post metamorphosis.	Denton and Beebee (1993)
Adult	M/F	-	46.6	3.7 SD	mm SVL	-	-	19	UK	Heath	Woolmer, end of year 2, 15 mo post metamorphosis.	Denton and Beebee (1993)
Juvenile	M/F	-	<15.0	-	mm SVL	-	-	-	UK	Marsh	Dunnerholme, end of year 1, 3 mo post metamorphosis.	Denton and Beebee (1993)

Age	Sex	Season	Mean	SD/SE	Units	Min.	Max.	N	Country	Habitat	Notes	Reference
Adult	M/F	-	30.6	3.9 SD	mm SVL	-	-	15	UK	Marsh	Dunnerholme, end of year 2, 15 mo post metamorphosis.	Denton and Beebee (1993)
Juvenile	M/F	-	26.5 (median)	-	mm SVL	18.5	34.5	87	Germany	-	'Urmitz', experiment 1.	Leskovar and Sinsch (2005)
Juvenile	M/F	-	32.5 (median)	-	mm SVL	22.0	44.0	92	Germany	-	'Urmitz', experiment 2.	Leskovar and Sinsch (2005)
Adult	M	Summer	55	-	mm SVL	-	-	1	Germany	Included sandy gravel pits and arable land.	'Urmitz'. Male 1	Sinsch and Leskovar (2011)
Adult	M	Summer	58	-	mm SVL	-	-	1	Germany	Included sandy gravel pits and arable land.	'Urmitz'. Male 2	Sinsch and Leskovar (2011)
Adult	M	Summer	64	-	mm SVL	-	-	1	Germany	Included sandy gravel pits and arable land.	'Urmitz'. Male 3	Sinsch and Leskovar (2011)
Adult	M	Summer	60	-	mm SVL	-	-	1	Germany	Included sandy gravel pits and arable land.	'Urmitz'. Male 4	Sinsch and Leskovar (2011)
Adult	M	Summer	52	-	mm SVL	-	-	1	Germany	Included sandy gravel pits and arable land.	'Urmitz'. Male 5	Sinsch and Leskovar (2011)
Adult	M	Summer	51	-	mm SVL	-	-	1	Germany	Included sandy gravel pits and arable land.	'Urmitz'. Male 6	Sinsch and Leskovar (2011)
Adult	F	Summer	57	-	mm SVL	-	-	1	Germany	Included sandy gravel pits and arable land.	'Urmitz'. Female 7	Sinsch and Leskovar (2011)
Adult	M	Summer	63	-	mm SVL	-	-	1	Germany	Included sandy gravel pits and arable land.	'Urmitz'. Male 8	Sinsch and Leskovar (2011)
Adult	F	Summer	61	-	mm SVL	-	-	1	Germany	Included sandy gravel pits and arable land.	'Urmitz'. Female 9	Sinsch and Leskovar (2011)

Age	Sex	Season	Mean	SD/SE	Units	Min.	Max.	N	Country	Habitat	Notes	Reference
Adult	F	Autumn	63	-	mm SVL	-	-	1	Germany	Included sandy gravel pits and arable land.	'Urmitz'. Female 10	Sinsch and Leskovar (2011)
Adult	F	Autumn	55	-	mm SVL	-	-	1	Germany	Included sandy gravel pits and arable land.	'Urmitz'. Female 11	Sinsch and Leskovar (2011)
Adult	M	Autumn	59	-	mm SVL	-	-	1	Germany	Included sandy gravel pits and arable land.	'Urmitz'. Male 12	Sinsch and Leskovar (2011)
Adult	F	Autumn	68	-	mm SVL	-	-	1	Germany	Included sandy gravel pits and arable land.	'Urmitz'. Female 13	Sinsch and Leskovar (2011)
Adult	F	Autumn	60	-	mm SVL	-	-	1	Germany	Included sandy gravel pits and arable land.	'Urmitz'. Female 14	Sinsch and Leskovar (2011)
Adult	M	Autumn	57	-	mm SVL	-	-	1	Germany	Included sandy gravel pits and arable land.	'Urmitz'. Male 15	Sinsch and Leskovar (2011)
Adult	M	Autumn	62	-	mm SVL	-	-	1	Germany	Included sandy gravel pits and arable land.	'Urmitz'. Male 16	Sinsch and Leskovar (2011)
Adult	M	Autumn	57	-	mm SVL	-	-	1	Germany	Included sandy gravel pits and arable land.	'Urmitz'. Male 17	Sinsch and Leskovar (2011)
Adult	F	Autumn	68	-	mm SVL	-	-	1	Germany	Included sandy gravel pits and arable land.	'Urmitz'. Female 18	Sinsch and Leskovar (2011)
Adult	M	Autumn	60	-	mm SVL	-	-	1	Germany	Included sandy gravel pits and arable land.	'Urmitz'. Male 19	Sinsch and Leskovar (2011)
Adult	M	Autumn	50	-	mm SVL	-	-	1	Germany	Included sandy gravel pits and arable land.	'Urmitz'. Male 20	Sinsch and Leskovar (2011)

Age	Sex	Season	Mean	SD/SE	Units	Min.	Max.	N	Country	Habitat	Notes	Reference
Adult	M	Autumn	47	-	mm SVL	-	-	1	Germany	Included sandy gravel pits and arable land.	'Urmitz'. Male 21	Sinsch and Leskovar (2011)
Adult	F	Autumn	53	-	mm SVL	-	-	1	Germany	Included sandy gravel pits and arable land.	'Urmitz'. Female 22	Sinsch and Leskovar (2011)
Adult	F	Autumn	63	-	mm SVL	-	-	1	Germany	Included sandy gravel pits and arable land.	'Urmitz'. Female 23	Sinsch and Leskovar (2011)

Table 64: Growth rate of *Bufo calamita*.

Age	Sex	Season	Mean	SD/SE	Units	Min.	Max.	N	Country	Habitat	Notes	Reference
Adult	M/F	-	3.8	-	mm/y SVL	-	-	-	UK	Heath	Woolmer, from 3-6y old.	Denton and Beebee (1993)
Adult	M/F	-	3.1	-	mm/y SVL	-	-	-	UK	Dune	Birkdale, from 3-6y old.	Denton and Beebee (1993)
Adult	M/F	-	2.0	-	mm/y SVL	-	-	-	UK	Marsh	Dunnerholme, from 3-6y old.	Denton and Beebee (1993)

2. Metabolic rate

Table 65: Metabolic rate in *Bufo calamita* (oxygen).

Age	Sex	Weight (g)	Season	Mean	SD/SE	Units	Min.	Max.	N	Country	Temp (°C)	Notes	Reference
Adult	-	8.67	-	0.0589	-	ml/g/h	-	-	-	-	20	Resting	Gatten et al. (1992)
Adult	-	8.7	-	0.058	-	ml/g/h	-	-	-	-	20	Resting	Gatten et al. (1992)

3. Diet

Table 66: Diet of *Bufo calamita* in the Nertherlands (Boomsma and Arntzen 1985).

Age	Sex	Food type	Spring	SD/SE	N	Summer	SD/SE	N	Country	Habitat	Measure	Notes
-	-	Collembola	9	3 SE	20	47	8 SE	52	Netherlands	Artificially-raised site, 4y old	Mean number	Pit fall trapping May and August
-	-	Araneae <3 mm	7	1 SE	20	6	1 SE	52	Netherlands	Artificially-raised site, 4y old	Mean number	Pit fall trapping May and August
-	-	Diptera <5 mm	2	0 SE	20	2	1 SE	52	Netherlands	Artificially-raised site, 4y old	Mean number	Pit fall trapping May and August
-	-	Araneae >3 mm	1	0 SE	20	1	0 SE	52	Netherlands	Artificially-raised site, 4y old	Mean number	Pit fall trapping May and August
-	-	Hemiptera	1	0 SE	20	4	1 SE	52	Netherlands	Artificially-raised site, 4y old	Mean number	Pit fall trapping May and August
-	-	Hymenoptera	1	0 SE	20	2	0 SE	52	Netherlands	Artificially-raised site, 4y old	Mean number	Pit fall trapping May and August
-	-	Coleoptera >5 mm	2	1 SE	20	2	0 SE	52	Netherlands	Artificially-raised site, 4y old	Mean number	Pit fall trapping May and August
-	-	Acari	1	0 SE	20	5	1 SE	52	Netherlands	Artificially-raised site, 4y old	Mean number	Pit fall trapping May and August
-	-	Coleoptera <5 mm	19	5 SE	20	2	0 SE	52	Netherlands	Artificially-raised site, 4y old	Mean number	Pit fall trapping May and August
-	-	larvae	1	0 SE	20	2	0 SE	52	Netherlands	Artificially-raised site, 4y old	Mean number	Pit fall trapping May and August

Table 67: Diet of *Bufo calamita* in Spain (taken from review byBeebee 1979).

Age	Sex	Food type	% total number of prey	N	Country	Habitat	Notes
-	-	Debris	<2	10	Spain	-	Samples taken from all over Spain
-	-	Scorpions	<0.5	10	Spain	-	Samples taken from all over Spain
-	-	Insect larvae	9	10	Spain	-	Samples taken from all over Spain
-	-	Orthoptera	<0.5	10	Spain	-	Samples taken from all over Spain
-	-	Hemiptera	<0.5	10	Spain	-	Samples taken from all over Spain
-	-	Coleoptera	29	10	Spain	-	Samples taken from all over Spain
-	-	Hymenoptera	54	10	Spain	-	Samples taken from all over Spain
-	-	Dermaptera	4	10	Spain	-	Samples taken from all over Spain

Table 68: Diet of *Bufo calamita* in England (taken from review byBeebee 1979).

Age	Sex	Food type	% total number of prey	% stomachs in which present	% of total by weight	N	Country	Habitat	Notes
-	-	Debris	<0.5	4	<0.5	28	UK (England)	-	Sampled April to September
-	-	Hemiptera	11	69	<1.0	28	UK (England)	-	Sampled April to September
-	-	Coleoptera	17	93	23	28	UK (England)	-	Sampled April to September
-	-	Hymenoptera	20	79	1.6	28	UK (England)	-	Sampled April to September
-	-	Dermaptera	1.5	36	3.5	28	UK (England)	-	Sampled April to September
-	-	Collembola	2.5	10	<0.5	28	UK (England)	-	Sampled April to September
-	-	Neuroptera	0.5	11	<0.5	28	UK (England)	-	Sampled April to September
-	-	Trichoptera	2.5	18	3	28	UK (England)	-	Sampled April to September
-	-	Lepidoptera	2.5	28	10.5	28	UK (England)	-	Sampled April to September
-	-	Diptera	29	66	34	28	UK (England)	-	Sampled April to September
-	-	Crustacea	1	8	3	28	UK (England)	-	Sampled April to September
-	-	Myriapoda	3	41	10.5	28	UK (England)	-	Sampled April to September
-	-	Arachnida	9	69	7	28	UK (England)	-	Sampled April to September
-	-	Mollusca	0.5	15	<1.0	28	UK (England)	-	Sampled April to September
-	-	Annelida	0.5	9	<1.0	28	UK (England)	-	Sampled April to September

4. Seasonal activities

Data on seasonal activity is greatly affected by factors such as habitat, latitude, altitude, local climate, annual differences in temperature and the permanence or other wise of the breeding pond. It is therefore recommended that local information for the zone/country/area under consideration be consulted.

Seasonal activity of *Bufo calamita* in Germany based on information in Pfeffer et al. (2011). Darker area represents the main period of activity.

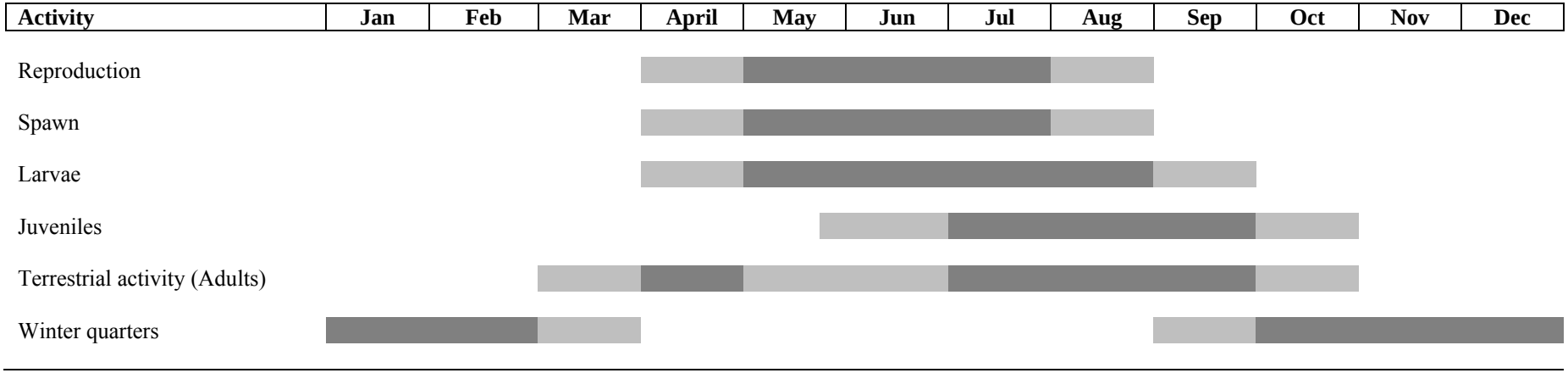

Table 69: Seasonal activities of *Bufo calamita*.

Begin	Peak	End	Country	Habitat	Notes	Reference
Mating/laying						
(early) April (main) late May (late) mid July	- - -	mid-May early July August	Germany	Agricultural	3 breeding periods, 9 calling periods throughout breeding season	Sinsch (1988b)
(early) early May (main) mid June (late) end July	Early May Late June Late July	Mid-May Early July Mid August	Germany	-	3 breeding periods, 1991 data	Sinsch and Seidel (1995)
(early) mid April (main) mid June	- 21/22 June	Early June Mid July	Germany	-	2 breeding periods, 1992 data	Sinsch and Seidel (1995)
(early) mid April (main) mid June	Early May -	Early June Mid July	Germany	-	2 breeding periods, 1993 data	Sinsch and Seidel (1995)
(early) early May (main) early June (late) late July	- - -	Late May Early July End July	Germany	-	3 breeding periods, 1994 data	Sinsch and Seidel (1995)
End January	-	-	Spain	Temporary pond		Tejedo (1993)
February	April	-	Spain	Agricultural (semi-arid)	Breeding period	Miaud et al (2000)
Early April	-	Mid July	France	Urban park	Some sporadic calling activities recorded in late July and August	Huste et al (2006)
Early June	-	End July	Germany	Agricultural	1986 data	Sinsch (1992)
Early April	-	End July	Germany	Agricultural	1987 data	Sinsch (1992)
Early April	-	Mid July	Germany	Agricultural	1988 data	Sinsch (1992)
Early April	-	Early July	Germany	Agricultural	1989 data	Sinsch (1992)
Begin April	-	Early August	Germany	Agricultural	1990 data	Sinsch (1992)
Late April	-	End July	Germany	Agricultural	1991 data	Sinsch (1992)
April		September	Spain, S France	-	Review	Beebee (1979)
April		June	Poland, UK	-	Review	Beebee (1979)
End March			Switzerland	-	Review	Beebee (1979)
Larval period						
Early February	Late February	Late April	Spain	Nature reserve	1979 data	Diaz-Paniagua (1988)
1st Mid January 2nd Mid April	Mid February Mid May	Mid April Mid June	Spain	Nature reserve	2 Periods/peaks (1985 data)	Diaz-Paniagua (1988)

Begin	Peak	End	Country	Habitat	Notes	Reference
Autumn migration						
April		September	Spain	Agricultural (semi-arid)	Post breeding activity period	Miaud et al (2000)

5. Other information

Table 70: Home range of *Bufo calamita*.

Age	Sex	Season	Mean	SD/SE	Units	Min.	Max.	N	Country	Habitat	Notes	Reference
-	M/F	Outside breeding season	691	601 SD	m^2	-	-	28	UK	Heath	Woolmer. Convex polygon, n = toads with ≥ 4 sightings.	Denton and Beebee (1993)
-	M/F	Outside breeding season	920	650 SD	m^2	-	-	5	UK	Dune	Birkdale. Convex polygon, n = toads with ≥ 4 sightings.	Denton and Beebee (1993)
-	M/F	Outside breeding season	2160	1232 SD	m^2	-	-	7	UK	Marsh	Dunnerholme. Convex polygon, n = toads with ≥ 4 sightings.	Denton and Beebee (1993)
-	-	Breeding	0.5 (median)	-	ha	0.1	10.7	13	Spain	Agricultural	January to April	Miaud and Sanuy (2005)
-	-	Post-breeding	4.1 (median)	-	ha	0.2	29	11	Spain	Agricultural	April to September (minimum concave polygon)	Miaud and Sanuy (2005)
-	-	Post-breeding	6.5 (median)	-	ha	1.3	41.0	11	Spain	Agricultural	April to September (minimum convex polygon)	Miaud and Sanuy (2005)

Table 71: Population density in *Bufo calamita*.

Age	Sex	Season	Mean	SD/SE	Units	Min.	Max.	N	Country	Habitat	Notes	Reference
-	M/F	Summer/autumn	6.2	0.4 SD	toads/ha/h	-	-	-	UK	Heath	Observed density (Woolmer)	Denton and Beebee (1993)
-	M/F	Summer/autumn	44.0	11.4 SD	toads/ha/h	-	-	-	UK	Heath	Observed density (Sandy)	Denton and Beebee (1993)
-	M/F	Summer/autumn	12.5	0.8 SD	toads/ha/h	-	-	-	UK	Dune	Observed density (Birkdale)	Denton and Beebee (1993)
-	M/F	Summer/autumn	9.8	0 SD	toads/ha/h	-	-	-	UK	Dune	Observed density (Sandscale)	Denton and Beebee (1993)
-	M/F	Summer/autumn	23.8	6.2 SD	toads/ha/h	-	-	-	UK	Marsh	Observed density (Dunnerholme)	Denton and Beebee (1993)
-	M/F	Summer/autumn	11.5	2.3 SD	toads/ha/h	-	-	-	UK	Marsh	Observed density (Sandside)	Denton and Beebee (1993)
-	M/F	Summer/autumn	26.6	21.6 SD	toads/ha/h	-	-	-	UK	Rubble	Observed density (Millom)	Denton and Beebee (1993)

Table 72: Age/longevity of *Bufo calamita*.

Sex	Mean	Median	SD/SE	Units	Min.	Max.	N	Country	Habitat	Notes	Reference
M		4	-	y	-	7	-	Germany	Sandy gravel pits, fallow, arable	'Urmitz'. Based on LAGs, spring cohort.	Leskovar et al (2006)
F		5	-	y	-	8	-	Germany	Sandy gravel pits, fallow, arable	'Urmitz'. Based on LAGs, spring cohort.	Leskovar et al (2006)
M		3	-	y	-	6	-	Germany	Sandy gravel pits, fallow, arable	'Urmitz'. Based on LAGs, summer cohort.	Leskovar et al (2006)
F		3	-	y	-	7	-	Germany	Sandy gravel pits, fallow, arable	'Urmitz'. Based on LAGs, summer cohort.	Leskovar et al (2006)
M		4	-	y	-	7	-	Spain	Clay/gravel pits, arable land	'Balaguer'. Based on LAGs, spring cohort.	Leskovar et al (2006)
F		3	-	y	-	5	-	Spain	Clay/gravel pits, arable land	'Balaguer'. Based on LAGs, spring cohort.	Leskovar et al (2006)

Sex	Mean	Median	SD/SE	Units	Min.	Max.	N	Country	Habitat	Notes	Reference
M		4	-	y	-	8	-	Spain	Pasture, arable land (winter cereals)	'Mas de Melons'. Based on LAGs, spring cohort.	Leskovar et al (2006)
F		4	-	y	-	7	-	Spain	Pasture, arable land (winter cereals)	'Mas de Melons'. Based on LAGs, spring cohort.	Leskovar et al (2006)
M	3.8		-	y	-	6	-	UK	Heath	Woolmer	Denton and Beebee (1993)
F	5.5		-	y	-	13	-	UK	Heath	Woolmer	Denton and Beebee (1993)
M	3.7		-	y	-	7	-	UK	Dune	Birkdale	Denton and Beebee (1993)
F	5.0		-	y	-	9	-	UK	Dune	Birkdale	Denton and Beebee (1993)
M	4.6		-	y	-	9	-	UK	Marsh	Dunnerholme	Denton and Beebee (1993)
F	4.6		-	y	-	8	-	UK	Marsh	Dunnerholme	Denton and Beebee (1993)

H. SPECIES INFORMATION – COMMON SPADEFOOT (*PELOBATES FUSCUS*)

EU distribution

Austria, Belgium, Bulgaria, Czech Republic, Denmark, Estonia, France, Germany, Hungary, Italy, Latvia, Lithuania, Netherlands, Poland, Romania, Slovakia, Slovenia, Sweden.

Sources of information

Basic information on this species can be found in general field guides (e.g. Arnold and Ovenden 2002) or in online resources such as:

AmphibiaWeb http://amphibiaweb.org/cgi-bin/amphib_query?query_src=aw_search_index&where-genus=Pelobates&where-species=fuscus&rel-genus=equals&rel-species=equals

Reptiles & Amphibiens de France http://www.herpfrance.com/amphibian/common_spadefoot_toad_pelobates_fuscus.php

The IUCN red list http://www.iucnredlist.org/details/full/16498/0

Further details on distribution can be found in the 'Atlas of amphibians and reptiles in Europe' (Gasc et al 1997).

Map is available at: http://www.seh-herpetology.org/images/atlas/pdf/anura/pelfus.pdf

Below is more detailed information on body size (length and weight), metabolic rate, diet and seasonal activity found during the course of the review.

1. Body size

Table 73: Bodyweight of *Pelobates fuscus*.

Age	Sex	Season	Mean	SD/SE	Units	Min.	Max.	N	Country	Habitat	Notes	Reference
Juvenile	-	-	3.7	2.5 SD	g	2.2	10.3	8	Austria	Alluvial plain	Total for all sites	Pintar (1984)
Adult	M	-	10.1	3.5 SD	g	4.3	16.5	34	Austria	Alluvial plain	Total for all sites	Pintar (1984)
Adult	F	-	18.8	8.5 SD	g	6.0	34.7	24	Austria	Alluvial plain	Total for all sites	Pintar (1984)
Adult	F	Spring	32.3	7.5	g	-	-	-	Romania	-		Szekely and Nemes (2002)
Adult	M	Spring	21.0	4.1	g	-	-	-	Romania	-		Szekely and Nemes (2002)
Adult	M	Spring	-	-	g	10	15	22	Italy	Drainage ditch	Data is for *Pelobates fuscus insubricus*	Andreone,and Pavignano (1988)
Adult	F	Spring	-	-	g	16	23	11	Italy	Drainage ditch	Data is for *Pelobates fuscus insubricus*	Andreone,and Pavignano (1988)
Adult	-	Breeding	-	-	g	21	29	-	Denmark	Agricultural		Munk-Nielsen and Dige (1995)
Adult	M	-	10.37	1.18 SD	g	8.73	12.06	5	Serbia	-	Utrine	Rot-Nikcevic et al (2001)
Adult	F	-	17.18	6.45 SD	g	10.22	32.95	26	Serbia	-	Utrine	Rot-Nikcevic et al (2001)
Adult	M	-	12.54	2.69 SD	g	7.79	18.57	39	Serbia	-	Cavolj	Rot-Nikcevic et al (2001)
Adult	F	-	19.14	5.82 SD	g	8.87	32.49	28	Serbia	-	Cavolj	Rot-Nikcevic et al (2001)
Adult	M	-	8.43	3.10 SD	g	4.00	14.83	16	Serbia	-	Lesino kopovo	Rot-Nikcevic et al (2001)
Adult	F	-	12.81	4.37 SD	g	4.50	24.01	27	Serbia	-	Lesino kopovo	Rot-Nikcevic et al (2001)

Table 74: Body length of *Pelobates fuscus*.

Age	Sex	Season	Mean	SD/SE	Units	Min.	Max.	N	Country	Habitat	Notes	Reference
Juvenile	-	-	31.8	2.4 SD	mm SVL	27.1	33.6	8	Austria	Alluvial plain	Total for all sites	Pintar (1984)
Adult	M	-	42.8	4.8 SD	mm SVL	35.2	53.8	34	Austria	Alluvial plain	Total for all sites	Pintar (1984)
Adult	F	-	51.8	7.15 SD	mm SVL	40	58	24	Austria	Alluvial plain	Total for all sites	Pintar (1984)
Adult	F	Spring	64.1	5.7	mm SVL	-	-	-	Romania	-		Szekely and Nemes (2002)
Adult	M	Spring	55.2	3.5	mm SVL	-	-	-	Romania	-		Szekely and Nemes (2002)
Adult	M	Spring	-	-	mm SVL	40	58	22	Italy	Drainage ditch	Data is for *Pelobates fuscus insubricus*	Andreone,and Pavignano (1988)
Adult	F	Spring	-	-	mm SVL	55	63	11	Italy	Drainage ditch	Data is for *Pelobates fuscus insubricus*	Andreone,and Pavignano (1988)
Adult	M	-	44.79	2.77 SD	mm SVL	41.21	48.08	5	Serbia	-	Utrine	Rot-Nikcevic et al (2001)
Adult	F	-	53.71	5.22 SD	mm SVL	46.45	65.16	26	Serbia	-	Utrine	Rot-Nikcevic et al (2001)
Adult	M	-	46.00	3.12 SD	mm SVL	40.57	56.65	39	Serbia	-	Cavolj	Rot-Nikcevic et al (2001)
Adult	F	-	54.02	4.46 SD	mm SVL	47.07	62.15	28	Serbia	-	Cavolj	Rot-Nikcevic et al (2001)
Adult	M	-	43.93	3.89 SD	mm SVL	36.36	49.51	16	Serbia	-	Lesino kopovo	Rot-Nikcevic et al (2001)
Adult	F	-	45.38	9.17 SD	mm SVL	41.40	57.94	27	Serbia	-	Lesino kopovo	Rot-Nikcevic et al (2001)
Juvenile	-	-	32.74	3.08 SD	mm SVL	27.38	36.64	14	Serbia	-	Utrine	Rot-Nikcevic et al (2001)
Juvenile	-	-	30.26	1.46 SD	mm SVL	27.97	34.01	17	Serbia	-	Cavolj	Rot-Nikcevic et al (2001)

2. Metabolic rate

No metabolic rate data was found for this species.

3. Diet

Table 75: Diet of *Pelobates fuscus* in Romania (Nicoara et al. 2005).

Food type	Relative abundance (%)	Frequency (% stomachs)	N	Season	Country	Habitat	Notes
Araneida (Arachnida)	16.1	33.3	15	Breeding	Romania	River basin	Collected March-June
Isopoda (Crustacea)	3.2	6.6	15	Breeding	Romania	River basin	Collected March-June
Podura aquatica (Collembola)	16.1	6.6	15	Breeding	Romania	River basin	Collected March-June
Odonata	3.2	6.6	15	Breeding	Romania	River basin	Collected March-June
Nepa rubra (Heteroptera)	3.2	6.6	15	Breeding	Romania	River basin	Collected March-June
Ranatra linearis (Heteroptera)	3.2	6.6	15	Breeding	Romania	River basin	Collected March-June
Aphida (Homoptera)	3.2	6.6	15	Breeding	Romania	River basin	Collected March-June
Cicade (Homoptera)	6.45	6.6	15	Breeding	Romania	River basin	Collected March-June
Larvae (Coleoptera)	3.2	6.6	15	Breeding	Romania	River basin	Collected March-June
Carabidae (Coleoptera)	13	26.6	15	Breeding	Romania	River basin	Collected March-June
Gastroidea cyanea (larvae) (Coleoptera)	3.2	6.6	15	Breeding	Romania	River basin	Collected March-June
Octhebius impressus(larvae) (Coleoptera)	3.2	6.6	15	Breeding	Romania	River basin	Collected March-June
Staphylinidae (Coleoptera)	3.2	6.6	15	Breeding	Romania	River basin	Collected March-June
Cantharide (Coleoptera)	3.2	6.6	15	Breeding	Romania	River basin	Collected March-June
Nematocera adults (Diptera)	3.2	6.6	15	Breeding	Romania	River basin	Collected March-June
Brachycera adults (Diptera)	3.2	6.6	15	Breeding	Romania	River basin	Collected March-June
Apidae (Hymenoptera)	3.2	6.6	15	Breeding	Romania	River basin	Collected March-June
Unidentified macroinvertebrates	6.45	13.3	15	Breeding	Romania	River basin	Collected March-June

Table 76: Diet of *Pelobates fuscus* (Cogalniceanu et al. 1998). Sample consisted of 190 specimens (182 juveniles/subadults, 8 adults).

Food type	Number of stomachs	Relative abundance (%)	Frequency (% stomachs)	N	Season	Country	Habitat	Notes
Platyhelminths	1	0.15	0.84	119	All year	Romania	Island in flood plain	119 of 190 contained food
Oligochaeta (Annelida)	5	0.75	4.20	119	All year	Romania	Island in flood plain	119 of 190 contained food
Oniscoidea (Crustacea, Isopoda)	53	7.98	24.36	119	All year	Romania	Island in flood plain	119 of 190 contained food
Pulmonata (Gastropoda)	127	19.12	52.10	119	All year	Romania	Island in flood plain	119 of 190 contained food
Juliformia (Diplopoda)	36	5.42	23.52	119	All year	Romania	Island in flood plain	119 of 190 contained food
Lithobiomorpha (Chilopoda)	8	1.20	4.20	119	All year	Romania	Island in flood plain	119 of 190 contained food
Acari (Arachnida)	12	1.80	8.40	119	All year	Romania	Island in flood plain	119 of 190 contained food
Araneae (Arachnida)	29	4.36	19.32	119	All year	Romania	Island in flood plain	119 of 190 contained food
Opilionidae (Arachnida)	2	0.30	1.68	119	All year	Romania	Island in flood plain	119 of 190 contained food
Insecta, adults (undetermined)	7	1.05	5.04	119	All year	Romania	Island in flood plain	119 of 190 contained food
Insecta, larvae (undetermined)	14	2.10	10.08	119	All year	Romania	Island in flood plain	119 of 190 contained food
Collembola (undetermined)	17	2.56	7.56	119	All year	Romania	Island in flood plain	119 of 190 contained food
Entomobryidae (Collembola)	9	1.35	4.20	119	All year	Romania	Island in flood plain	119 of 190 contained food
Sminthuridae (Collembola)	21	3.16	9.24	119	All year	Romania	Island in flood plain	119 of 190 contained food
Forficula spp. (Dermaptera)	4	0.60	3.36	119	All year	Romania	Island in flood plain	119 of 190 contained food
Hemiptera	3	0.45	2.52	119	All year	Romania	Island in flood plain	119 of 190 contained food
Lepidoptera, larvae	22	3.31	14.28	119	All year	Romania	Island in flood plain	119 of 190 contained food
Orthoptera	3	0.45	2.52	119	All year	Romania	Island in flood plain	119 of 190 contained food
Homoptera (undetermined)	4	0.60	3.36	119	All year	Romania	Island in flood plain	119 of 190 contained food
Aphididae (Homoptera)	17	2.56	7.56	119	All year	Romania	Island in flood plain	119 of 190 contained food
Cicadidae (Homoptera)	12	1.80	9.24	119	All year	Romania	Island in flood plain	119 of 190 contained food
Hymenoptera, undeteremined	16	2.40	10.08	119	All year	Romania	Island in flood plain	119 of 190 contained food
Formicidae (Hymenoptera)	124	18.67	25.12	119	All year	Romania	Island in flood plain	119 of 190 contained food
Diptera adults (undetermined)	9	1.35	5.04	119	All year	Romania	Island in flood plain	119 of 190 contained food
Diptera larvae (undetermined)	6	0.90	3.36	119	All year	Romania	Island in flood plain	119 of 190 contained food
Muscidae adults (Diptera)	4	0.60	3.36	119	All year	Romania	Island in flood plain	119 of 190 contained food
Muscidae larvae (Diptera)	7	1.05	1.68	119	All year	Romania	Island in flood plain	119 of 190 contained food
Culicidae (Diptera)	7	1.05	4.20	119	All year	Romania	Island in flood plain	119 of 190 contained food
Coleoptera, undetermined	29	4.36	19.38	119	All year	Romania	Island in flood plain	119 of 190 contained food
Carabidae adults (Coleoptera)	26	3.91	15.12	119	All year	Romania	Island in flood plain	119 of 190 contained food

Carabidae larvae (Coleoptera)	6	0.90	4.20	119	All year	Romania	Island in flood plain	119 of 190 contained food
Chrysomelidae (Coleoptera)	6	0.90	4.20	119	All year	Romania	Island in flood plain	119 of 190 contained food
Curculionidae (Coleoptera)	6	0.90	5.04	119	All year	Romania	Island in flood plain	119 of 190 contained food
Coccinellidae (Coleoptera)	2	0.30	1.68	119	All year	Romania	Island in flood plain	119 of 190 contained food
Elateridae (Coleoptera)	3	0.45	1.68	119	All year	Romania	Island in flood plain	119 of 190 contained food
Staphylinidae (Coleoptera)	6	0.90	5.04	119	All year	Romania	Island in flood plain	119 of 190 contained food
Sylphidae (Coleoptera)	1	0.15	0.84	119	All year	Romania	Island in flood plain	119 of 190 contained food

Table 77: Diet of *Pelobates fuscus* (Cogalniceanu et al. 2000). Proportion with empty stomachs was 38%.

Food type	Number of stomachs	Relative abundance (%)	Frequency (% stomachs)	N	Season	Country	Habitat
Annelida, Oligochaeta	5	0.75	4.20	170	All year	Romania	Islands in floodplain
Crustacea, Isopoda, Oniscoidea	53	7.98	24.37	170	All year	Romania	Islands in floodplain
Gastropoda, Pulmonata	127	19.2	52.10	170	All year	Romania	Islands in floodplain
Diplopoda, Julida	36	5.42	23.53	170	All year	Romania	Islands in floodplain
Chilopoda, Lithobiomorpha	8	1.2	4.20	170	All year	Romania	Islands in floodplain
Arachnida, Acarina	12	1.81	8.40	170	All year	Romania	Islands in floodplain
Arachnida, Araneae	28	4.22	18.49	170	All year	Romania	Islands in floodplain
Insecta, adults	11	1.65	8.40	170	All year	Romania	Islands in floodplain
Insecta, larvae	14	2.11	10.92	170	All year	Romania	Islands in floodplain
Collembola	47	7.08	21.01	170	All year	Romania	Islands in floodplain
Heteroptera	3	0.45	2.52	170	All year	Romania	Islands in floodplain
Lepidoptera	22	3.31	14.29	170	All year	Romania	Islands in floodplain
Orthoptera	3	0.45	2.52	170	All year	Romania	Islands in floodplain
Homoptera, undetermined	4	0.6	3.36	170	All year	Romania	Islands in floodplain
Homoptera, Aphididae	17	2.56	7.56	170	All year	Romania	Islands in floodplain
Homoptera, Cicadidae	12	1.81	9.24	170	All year	Romania	Islands in floodplain
Hymenoptera, undetermined	14	2.11	8.40	170	All year	Romania	Islands in floodplain
Hymenoptera, Formicidae	124	18.7	42.02	170	All year	Romania	Islands in floodplain
Hymenoptera, Ichneumonidae	2	0.3	1.68	170	All year	Romania	Islands in floodplain
Diptera, adults, undetermined	9	1.36	5.04	170	All year	Romania	Islands in floodplain
Diptera, larvae, undetermined	6	0.9	3.36	170	All year	Romania	Islands in floodplain
Diptera, Muscidae, adults	4	0.6	3.36	170	All year	Romania	Islands in floodplain

Food type	Number of stomachs	Relative abundance (%)	Frequency (% stomachs)	N	Season	Country	Habitat
Diptera, Muscidae, larvae	7	1.05	1.68	170	All year	Romania	Islands in floodplain
Diptera, Culicidae	7	1.05	4.20	170	All year	Romania	Islands in floodplain
Coleoptera, undetermined	29	4.37	18.49	170	All year	Romania	Islands in floodplain
Coleoptera, Carabidae, adults	26	3.92	15.13	170	All year	Romania	Islands in floodplain
Coleoptera, Carabidae, larvae	6	0.9	4.20	170	All year	Romania	Islands in floodplain
Coleoptera, Chrysomelidae	6	0.9	4.20	170	All year	Romania	Islands in floodplain
Coleoptera, Curculionidae	6	0.9	5.04	170	All year	Romania	Islands in floodplain
Coleoptera, Coccinelidae	2	0.3	1.68	170	All year	Romania	Islands in floodplain
Coleoptera, Elateridae	3	0.45	1.68	170	All year	Romania	Islands in floodplain
Coleoptera, Staphylinidae	6	0.9	5.04	170	All year	Romania	Islands in floodplain
Coleoptera, Scarabeidae	1	0.15	0.84	170	All year	Romania	Islands in floodplain
Other	4	0.6	3.36	170	All year	Romania	Islands in floodplain

3. Seasonal activities

Data on seasonal activity is greatly affected by factors such as habitat, latitude, altitude, local climate, annual differences in temperature and the permanence or other wise of the breeding pond. It is therefore recommended that local information for the zone/country/area under consideration be consulted.

Seasonal activity of *Pelobates fuscus* in Germany based on information in Pfeffer et al. (2011). Darker area represents the main period of activity.

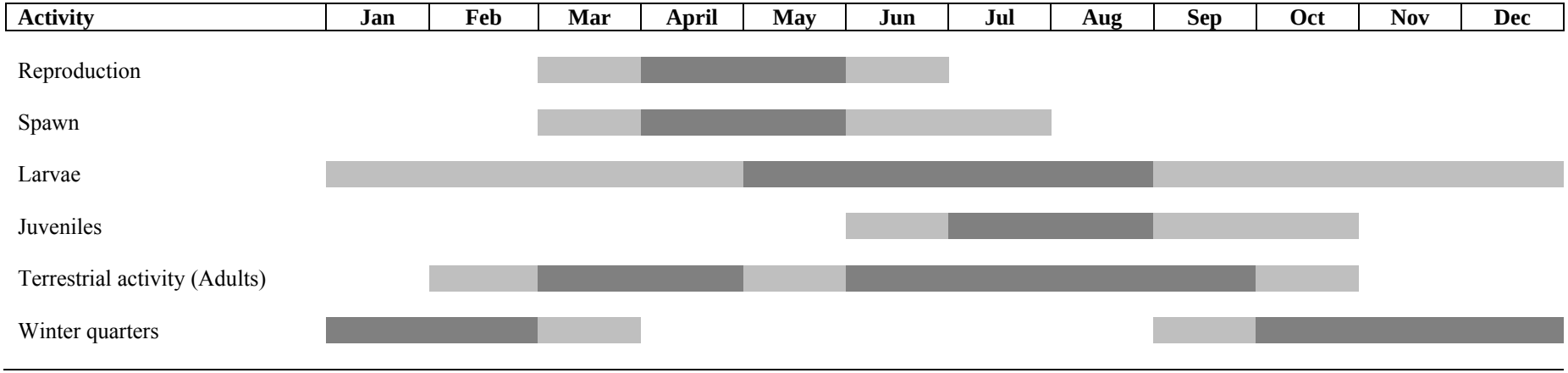

Table 78: Seasonal activities of *Pelobates fuscus*.

Begin	Peak	End	Country	Habitat	Notes	Reference
Mating/laying						
March		June	Romania	River basin		Nicoara et al (2005)
Spring migration						
20 March	7 April (median)	-	Germany	-		Baumann (1997)
24 March	7 April (median)	-	Germany	-		Baumann (1997)
16 March	31 March (median)	-	Germany	-		Baumann (1997)
19 February	28 March (median)	-	Germany	-		Baumann (1997)
18 February	19 March (median)	-	Germany	-		Baumann (1997)
6 March	19 March (median)	-	Germany	-		Baumann (1997)
10 march	3 April (median)	-	Germany	-		Baumann (1997)
14 March	18 March (median)	-	Germany	-		Baumann (1997)
8 March	23 March (median)	-	Germany	-		Baumann (1997)

5. Other information

Table 79: Age/longevity of *Pelobates fuscus*.

Sex	Mean	SD/SE	Units	Min.	Max.	N	Country	Habitat	Notes	Reference
M	5.00	2.00 SD	y	2	6	4	Serbia	-	Utrine	Rot-Nikcevic et al (2001)
F	7.93	2.55 SD	y	4	14	15	Serbia	-	Cavolj	Rot-Nikcevic et al (2001)
M	10.21	2.73 SD	y	6	16	37	Serbia	-	Lesino kopovo	Rot-Nikcevic et al (2001)
F	8.32	2.10 SD	y	3	13	22	Serbia	-	Utrine	Rot-Nikcevic et al (2001)
M	7.89	2.80 SD	y	4	14	9	Serbia	-	Cavolj	Rot-Nikcevic et al (2001)
F	8.00	2.64 SD	y	4	13	11	Serbia	-	Lesino kopovo	Rot-Nikcevic et al (2001)

Table 80: Age at sexual maturity for *Pelobates fuscus*.

Sex	Mean	SD/SE	Units	Min.	Max.	N	Country	Habitat	Notes	Reference
M	2.00	0.00 SD	y	2	2	2	Serbia	-	Utrine	Rot-Nikcevic et al (2001)
F	3.27	0.79 SD	y	2	4	11	Serbia	-	Cavolj	Rot-Nikcevic et al (2001)
M	2.78	0.55 SD	y	2	4	18	Serbia	-	Lesino kopovo	Rot-Nikcevic et al (2001)
F	2.75	0.62 SD	y	2	4	12	Serbia	-	Utrine	Rot-Nikcevic et al (2001)
M	3.50	0.84 SD	y	3	5	6	Serbia	-	Cavolj	Rot-Nikcevic et al (2001)
F	3.60	0.84 SD	y	2	5	10	Serbia	-	Lesino kopovo	Rot-Nikcevic et al (2001)

I. SELECTED 24H LC50 DATA

Table 81: 24h LC50 data for amphibians.

CAS	Pesticide name	% a.i.	Test material	Species	Stage	Temp. (°C)	Test type	Duration (h)	LC50 (mg/L)	LC50 based on	Reference	Data line
94757	2,4-D	99	Technical	*Rhinella arenarum*	Embryo /larval	20±2	Renewal	24	14.82	Active ingredient	Aronzon et al (2011)	65
94757	2,4-D	99	Technical	*Rhinella arenarum*	Embryo /larval	20±2	Renewal	24	13.14	Active ingredient	Aronzon et al (2011)	66
94757	2,4-D	99	Technical	*Rhinella arenarum*	Embryo /larval	20±2	Renewal	24	14.47	Active ingredient	Aronzon et al (2011)	67
94757	2,4-D	99	Technical	*Rhinella arenarum*	Embryo /larval	20±2	Renewal	24	14.12	Active ingredient	Aronzon et al (2011)	68
94757	2,4-D	99	Technical	*Rhinella arenarum*	Embryo /larval	20±2	Renewal	24	13.42	Active ingredient	Aronzon et al (2011)	69
94757	2,4-D	(79.7 g/100 cm^3 a.e.)	Formulation	*Rhinella arenarum*	Embryo /larval	20±2	Renewal	24	5.27	Active ingredient	Aronzon et al (2011)	70
94757	2,4-D	(79.7 g/100 cm^3 a.e.)	Formulation	*Rhinella arenarum*	Embryo /larval	20±2	Renewal	24	2.24	Active ingredient	Aronzon et al (2011)	71
94757	2,4-D	(79.7 g/100 cm^3 a.e.)	Formulation	*Rhinella arenarum*	Embryo /larval	20±2	Renewal	24	4.24	Active ingredient	Aronzon et al (2011)	72
94757	2,4-D	(79.7 g/100 cm^3 a.e.)	Formulation	*Rhinella arenarum*	Embryo /larval	20±2	Renewal	24	1.47	Active ingredient	Aronzon et al (2011)	73

CAS	Pesticide name	% a.i.	Test material	Species	Stage	Temp. (°C)	Test type	Duration (h)	LC50 (mg/L)	LC50 based on	Reference	Data line
94757	2,4-D	(79.7 g/100 cm^3 a.e.)	Formulation	*Rhinella arenarum*	Embryo /larval	20±2	Renewal	24	2.35	Active ingredient	Aronzon et al (2011)	74
94757	2,4-D	99	Technical	*Rhinella arenarum*	Embryos	20±2	Renewal	24	10.34	Active ingredient	Aronzon et al (2011)	75
94757	2,4-D	(79.7 g/100 cm^3 a.e.)	Formulation	*Rhinella arenarum*	Embryos	20±2	Renewal	24	3.89	Active ingredient	Aronzon et al (2011)	76
94757	2,4-D	99	Technical	*Rhinella arenarum*	Embryos	20±2	Renewal	24	11.16	Active ingredient	Aronzon et al (2011)	77
94757	2,4-D	99	Technical	*Rhinella arenarum*	Embryos	20±2	Renewal	24	14.47	Active ingredient	Aronzon et al (2011)	78
94757	2,4-D	(79.7 g/100 cm^3 a.e.)	Formulation	*Rhinella arenarum*	Embryos	20±2	Renewal	24	4.00	Active ingredient	Aronzon et al (2011)	79
94757	2,4-D	(79.7 g/100 cm^3 a.e.)	Formulation	*Rhinella arenarum*	Embryos	20±2	Renewal	24	5.17	Active ingredient	Aronzon et al (2011)	80
1929733	2,4-D	62.5	Technical	*Bufo woodhousei fowleri*	Tadpoles	15	Static	24	>10	Active ingredient	Mayer and Ellersieck (1986)	82
94757	2,4-D	99	Technical	*Rhinella arenarum*	Tadpoles	20±2	Renewal	24	15.94	Active ingredient	Aronzon et al (2011)	83
94757	2,4-D	(79.7 g/100 cm^3 a.e.)	Formulation	*Rhinella arenarum*	Tadpoles	20±2	Renewal	24	3.88	Active ingredient	Aronzon et al (2011)	84
94757	2,4-D	99	Technical	*Rhinella arenarum*	Tadpoles	20±2	Renewal	24	15.92	Active ingredient	Aronzon et al (2011)	85

CAS	Pesticide name	% a.i.	Test material	Species	Stage	Temp. (°C)	Test type	Duration (h)	LC50 (mg/L)	LC50 based on	Reference	Data line
94757	2,4-D	(79.7 g/100 cm^3 a.e.)	Formulation	*Rhinella arenarum*	Tadpoles	20±2	Renewal	24	3.91	Active ingredient	Aronzon et al (2011)	86
94804	2,4-D Butyl	79.7	Formulation	*Rhinella arenarum*	Tadpoles	20±1	Static	24	4	Active ingredient	Perez-Coll and Herkovits (2006)	87
2008391	2,4-D-dimethylammonium	NR	Technical	*Pseudacris triseriata*	Tadpoles	15.5±0.5	Static	24	100	Active ingredient	Sanders (1970)	103
504245	4-Aminopyridine	NR	Technical	*Rana sphenocephala*	Larvae	16	Static	24	7.2	Active ingredient	Marking and Chandler (1981)	104
30560191	Acephate	90	Technical	*Rana clamitans*	Tadpoles	21±1	Static	24	6433	Active ingredient	Lyons et al (1976)	107
15972608	Alachlor	43	Formulation	*Bufo americanus*	Larvae	22±1.0	Static	24	4.3	Active ingredient	Howe et al. (1998)	108
15972608	Alachlor	43	Formulation	*Bufo americanus*	Larvae	22±1.0	Static	24	5.7	Active ingredient	Howe et al. (1998)	109
15972608	Alachlor	43	Formulation	*Rana pipiens*	Larvae	22±1.0	Static	24	14.9	Active ingredient	Howe et al. (1998)	110
15972608	Alachlor	43	Formulation	*Rana pipiens*	Larvae	22±1.0	Static	24	7.3	Active ingredient	Howe et al. (1998)	111
309002	Aldrin	NR	Technical	*Rana hexadactyla*	Adults	27±2	Static	24	2.6	Active ingredient	Joseph and Rao (1990)	118
309002	Aldrin	90	Technical	*Bufo woodhousei fowleri*	Tadpoles	16	Static	24	>0.18	Active ingredient	Mayer and Ellersieck (1986)	119
309002	Aldrin	NR	Technical	*Bufo woodhousei fowleri*	Tadpoles	15.5±0.5	Static	24	2	Active ingredient	Sanders (1970)	120
2032599	Aminocarb	75	Technical	*Rana clamitans*	Tadpoles	21±1	Static	24	247	Active ingredient	Lyons et al (1976)	133

CAS	Pesticide name	% a.i.	Test material	Species	Stage	Temp. (°C)	Test type	Duration (h)	LC50 (mg/L)	LC50 based on	Reference	Data line
2032599	Aminocarb	75	Technical	*Rana clamitans*	Tadpoles	21±1	Static	24	234	Active ingredient	Lyons et al (1976)	134
33089611	Amitraz	97.5	Technical (Analytical)	*Xenopus laevis*	Embryos	24 (23-25)	Static-renewal	24	5<LC50 <10	Active ingredient	Osano et al. (2002a)	135
1327533	Arsenous oxide	NR	Technical (Reagent grade)	*Rana hexadactyla*	Tadpoles	15 (13-16)	Renewal	24	0.368	Active ingredient (As)	Khangarot et al (1985b)	138
1912249	Atrazine	40.8	Formulation	*Bufo americanus*	Larvae	22±1.0	Static	24	15.8	Active ingredient	Howe et al. (1998)	140
1912249	Atrazine	40.8	Formulation	*Bufo americanus*	Larvae	22±1.0	Static	24	66.4	Active ingredient	Howe et al. (1998)	141
1912249	Atrazine	40.8	Formulation	*Rana pipiens*	Larvae	22±1.0	Static	24	45.3	Active ingredient	Howe et al. (1998)	142
1912249	Atrazine	40.8	Formulation	*Rana pipiens*	Larvae	22±1.0	Static	24	69.7	Active ingredient	Howe et al. (1998)	143
1912249	Atrazine	98	Technical	*Rana catesbeiana*	Tadpoles	15	NR	24	>16	Active ingredient	Wan et al (2006)	144
1912249	Atrazine	48.5	Formulation	*Rana catesbeiana*	Tadpoles	15	NR	24	>480	Formulation	Wan et al (2006)	145
86500	Azinphos-methyl	23	Formulation	*Bufo viridis*	Tadpoles	23±1	Static	24	6.57	Active ingredient	Yesilada et al (2006)	146
86500	Azinphos-methyl	93	Technical	*Bufo woodhousei fowleri*	Tadpoles	15	Static	24	0.71	Active ingredient	Mayer and Ellersieck (1986)	147
86500	Azinphos-methyl	NR	Technical	*Bufo woodhousei fowleri*	Tadpoles	15.5±0.5	Static	24	0.68	Active ingredient	Sanders (1970)	148
86500	Azinphos-methyl	93	Technical	*Pseudacris triseriata*	Tadpoles	15	Static	24	>3.2	Active ingredient	Mayer and Ellersieck (1986)	149
86500	Azinphos-methyl	23	Formulation	*Rana ridibunda*	Tadpoles	23±1	Static	24	7.18	Active ingredient	Ozmen et al (1999)	150

CAS	Pesticide name	% a.i.	Test material	Species	Stage	Temp. (°C)	Test type	Duration (h)	LC50 (mg/L)	LC50 based on	Reference	Data line
23184669	Butachlor	50	Formulation	*Bufo melanostictus*	Tadpoles	21-27	Renewal	24	1.70	Formulation	Geng et al (2005)	168
23184669	Butachlor	50	Formulation	*Microhyla ornata*	Tadpoles	21-27	Renewal	24	1.69	Formulation	Geng et al (2005)	169
23184669	Butachlor	50	Formulation	*Microhyla ornata*	Tadpoles	23-27	Static-renewal	24	0.001685	Active ingredient	Xue et al (2005)	170
23184669	Butachlor	50	Formulation	*Polypedates megacephalus*	Tadpoles	21-27	Renewal	24	2.67	Formulation	Geng et al (2005)	171
8001352	Camphechlor	100	Technical	*Bufo woodhousei fowleri*	Tadpoles	15	Static	24	0.56	Active ingredient	Mayer and Ellersieck (1986)	174
8001352	Camphechlor	NR	Technical	*Bufo woodhousei fowleri*	Tadpoles	15.5±0.5	Static	24	0.6	Active ingredient	Sanders (1970)	175
8001352	Camphechlor	100	Technical	*Pseudacris triseriata*	Tadpoles	15	Static	24	5.6	Active ingredient	Mayer and Ellersieck (1986)	176
8001352	Camphechlor	NR	Technical	*Pseudacris triseriata*	Tadpoles	15.5±0.5	Static	24	1.7	Active ingredient	Sanders (1970)	177
63252	Carbaryl	100	Technical	*Xenopus laevis*	Embryos	18	Static	24	4.7	Active ingredient	Elliott-Feeley and Armstrong (1982)	179
63252	Carbaryl	50	Formulation	*Rana tigrina*	NR	NR	Static	24	1.28	Active ingredient	Marian et al (1983)	180
63252	Carbaryl	99.7	Technical	*Bufo boreas*	Tadpoles	22	Static	24	>21	Active ingredient	Dwyer et al (1999)	181
63252	Carbaryl	97-99	Technical	*Bufo bufo*	Tadpoles	20±1	Static?	24	21.15	Active ingredient	Marchal-Segault (1976)	182
63252	Carbaryl	99.7	Technical	*Rana clamitans*	Tadpoles	27	Static	24	17.57	Active ingredient	Boone and Bridges (1999)	183

CAS	Pesticide name	% a.i.	Test material	Species	Stage	Temp. (°C)	Test type	Duration (h)	LC50 (mg/L)	LC50 based on	Reference	Data line
63252	Carbaryl	99.7	Technical	*Rana clamitans*	Tadpoles	22	Static	24	22.55	Active ingredient	Boone and Bridges (1999)	184
63252	Carbaryl	99.7	Technical	*Rana clamitans*	Tadpoles	17	Static	24	<30	Active ingredient	Boone and Bridges (1999)	185
786196	Carbophenothion	NR	Technical	*Pseudacris triseriata*	Tadpoles	15.5±0.5	Static	24	0.1	Active ingredient	Sanders (1970)	190
2921882	Chlorpyrifos	40	Formulation	*Bufo bufo gargarizans*	Tadpoles	20.5-22.5	Renewal	24	3.63	Active ingredient	Yin et al (2009)	214
2921882	Chlorpyrifos	99	Technical	*Rana boylii*	Tadpoles	NR	Static	24	3.005	Active ingredient	Sparling and Fellers (2007)	215
7758987	Copper sulfate	NR	Technical (Reagent grade)	*Rana tigrina*	Larvae	26.5 (24-27.5)	Static	24	0.693	Active ingredient (Cu)	Khangarot et al (1981)	219
7758987	Copper sulfate	25.5	Technical	*Bufo boreas*	Tadpoles	22	Static	24	0.16	Active ingredient	Dwyer et al (1999)	221
7758987	Copper sulfate	NR	Technical	*Bufo melanostictus*	Tadpoles	31 (29-34)	Static	24	0.843	Active ingredient (Cu)	Khangarot and Ray (1987)	222
7758987	Copper sulfate	NR	NR	*Microhyla ornata*	Tadpoles	25.5-26	Renewal	24	5.61	Active ingredient	Rao and Madhyastha (1987)	223
7758987	Copper sulfate	NR	NR	*Microhyla ornata*	Tadpoles	25.5-26	Renewal	24	6.04	Active ingredient	Rao and Madhyastha (1987)	224
7758987	Copper sulfate	NR	Technical (Reagent grade)	*Rana hexadactyla*	Tadpoles	15 (13-17)	Static	24	0.045	Active ingredient (Cu)	Khangarot et al (1984)	225
52315078	Cypermethrin	10	Formulation	*Bufo melanostictus*	Tadpoles	20	Static	24	0.0182	Active ingredient	Saha and Kaviraj (2008)	234
52315078	Cypermethrin	10	Formulation	*Bufo melanostictus*	Tadpoles	20	Static	24	0.0182	Active ingredient	Saha and Kaviraj (2008)	235

CAS	Pesticide name	% a.i.	Test material	Species	Stage	Temp. (°C)	Test type	Duration (h)	LC50 (mg/L)	LC50 based on	Reference	Data line
52315078	Cypermethrin	25	Formulation	*Physalaemus biligonigerus*	Tadpoles	22±2	Static	24	1.012	Active ingredient	Izaguirre et al (2000)	236
50293	DDT	NR	Technical	*Bufo bufo*	Tadpoles	20±1	Static?	24	1.00	Active ingredient	Marchal-Segault (1976)	241
50293	DDT	99	Technical	*Bufo woodhousei fowleri*	Tadpoles	16	Static	24	1.4	Active ingredient	Mayer and Ellersieck (1986)	242
50293	DDT	99	Technical	*Bufo woodhousei fowleri*	Tadpoles	16	Static	24	2.2	Active ingredient	Mayer and Ellersieck (1986)	243
50293	DDT	99	Technical	*Bufo woodhousei fowleri*	Tadpoles	16	Static	24	2.4	Active ingredient	Mayer and Ellersieck (1986)	244
50293	DDT	99	Technical	*Bufo woodhousei fowleri*	Tadpoles	16	Static	24	5.3	Active ingredient	Mayer and Ellersieck (1986)	245
50293	DDT	99	Technical	*Bufo woodhousei fowleri*	Tadpoles	16	Static	24	5.4	Active ingredient	Mayer and Ellersieck (1986)	246
50293	DDT	99.9	Technical	*Bufo woodhousei fowleri*	Tadpoles	15.5±0.5	Static	24	2.4	Active ingredient	Sanders (1970)	247
50293	DDT	99.9	Technical	*Bufo woodhousei fowleri*	Tadpoles	15.5±0.5	Static	24	5.3	Active ingredient	Sanders (1970)	248
50293	DDT	99.9	Technical	*Bufo woodhousei fowleri*	Tadpoles	15.5±0.5	Static	24	5.4	Active ingredient	Sanders (1970)	249
50293	DDT	99.9	Technical	*Bufo woodhousei fowleri*	Tadpoles	15.5±0.5	Static	24	2.2	Active ingredient	Sanders (1970)	250

CAS	Pesticide name	% a.i.	Test material	Species	Stage	Temp. (°C)	Test type	Duration (h)	LC50 (mg/L)	LC50 based on	Reference	Data line
50293	DDT	99.9	Technical	*Bufo woodhousei fowleri*	Tadpoles	15.5±0.5	Static	24	1.4	Active ingredient	Sanders (1970)	251
50293	DDT	99	Technical	*Pseudacris triseriata*	Tadpoles	15	Static	24	1.4	Active ingredient	Mayer and Ellersieck (1986)	252
50293	DDT	NR	Technical	*Pseudacris triseriata*	Tadpoles	15.5±0.5	Static	24	1.4	Active ingredient	Sanders (1970)	253
62737	Dichlorvos	80	Formulation	*Fejervarya multistriata*	Tadpoles	21-27	Renewal	24	57.38	Formulation	Geng et al (2005)	271
62737	Dichlorvos	80	Formulation	*Microhyla ornata*	Tadpoles	21-27	Renewal	24	3.13	Formulation	Geng et al (2005)	272
62737	Dichlorvos	80	Formulation	*Microhyla ornata*	Tadpoles	23-27	Static-renewal	24	0.003128	Active ingredient	Xue et al (2005)	273
62737	Dichlorvos	80	Formulation	*Polypedates megacephalus*	Tadpoles	21-27	Renewal	24	44.78	Formulation	Geng et al (2005)	274
60571	Dieldrin	85	Technical	*Bufo woodhousei fowleri*	Tadpoles	15	Static	24	1.4	Active ingredient	Mayer and Ellersieck (1986)	276
60571	Dieldrin	NR	Technical	*Bufo woodhousei fowleri*	Tadpoles	15.5±0.5	Static	24	1.1	Active ingredient	Sanders (1970)	277
60571	Dieldrin	85	Technical	*Pseudacris triseriata*	Tadpoles	15	Static	24	0.23	Active ingredient	Mayer and Ellersieck (1986)	278
60571	Dieldrin	NR	Technical	*Pseudacris triseriata*	Tadpoles	15.5±0.5	Static	24	0.23	Active ingredient	Sanders (1970)	279
60515	Dimethoate	30	Formulation	*Rana cyanophlyctis*	Adults	23±0.2	Renewal	24	51.4	Active ingredient	Mudgall and Patil (1987)	280
115297	Endosulfan	35	Formulation	*Bufo melanostictus*	Tadpoles	25±2	Static	24	0.057	Active ingredient	Mithra and Abhik (2002)	299
115297	Endosulfan	35	Formulation	*Limnonectes limnocharis*	Tadpoles	25±2	Static	24	0.0066	Active ingredient	Mithra and Abhik (2002)	300

CAS	Pesticide name	% a.i.	Test material	Species	Stage	Temp. (°C)	Test type	Duration (h)	LC50 (mg/L)	LC50 based on	Reference	Data line
115297	Endosulfan	35	Formulation	*Microhyla ornata*	Tadpoles	25±2	Static	24	0.0025	Active ingredient	Mithra and Abhik (2002)	301
115297	Endosulfan	90	Technical	*Rana tigrina*	Tadpoles	20±2	Static	24	0.0021	Active ingredient	Gopal et al (1981)	302
145733	Endothal	53	Formulation	*Bufo woodhousei fowleri*	Tadpoles	15	Static	24	3.2	Active ingredient	Mayer and Ellersieck (1986)	303
66330889	Endothal-mono(N,N-dimethylalkylammonium), endothall mono(N,N-dimethylalkylamine)	NR	Technical	*Bufo woodhousei fowleri*	Tadpoles	15.5±0.5	Static	24	3.2	Active ingredient	Sanders (1970)	304
72208	Endrin	99	Technical	*Bufo woodhousei fowleri*	Tadpoles	15	Static	24	0.57	Active ingredient	Mayer and Ellersieck (1986)	305
72208	Endrin	NR	Technical	*Bufo woodhousei fowleri*	Tadpoles	15.5±0.5	Static	24	0.57	Active ingredient	Sanders (1970)	306
72208	Endrin	99	Technical	*Pseudacris triseriata*	Tadpoles	15	Static	24	0.29	Active ingredient	Mayer and Ellersieck (1986)	307
72208	Endrin	NR	Technical	*Pseudacris triseriata*	Tadpoles	15.5±0.5	Static	24	0.29	Active ingredient	Sanders (1970)	308
72208	Endrin	21.24	Formulation	*Rana temporaria*	Tadpoles	20	Static	24	0.1133	Active ingredient	Wohlgemuth (1977)	310
72208	Endrin	21.24	Formulation	*Rana temporaria*	Tadpoles	20	Static	24	1.1375	Active ingredient	Wohlgemuth (1977)	311
72208	Endrin	21.24	Formulation	*Rana temporaria*	Tadpoles	20	Static	24	0.1605	Active ingredient	Wohlgemuth (1977)	312

CAS	Pesticide name	% a.i.	Test material	Species	Stage	Temp. (°C)	Test type	Duration (h)	LC50 (mg/L)	LC50 based on	Reference	Data line
72208	Endrin	21.24	Formulation	*Rana temporaria*	Tadpoles	20	Static	24	2.0086	Active ingredient	Wohlgemuth (1977)	313
72208	Endrin	21.24	Formulation	*Rana temporaria*	Tadpoles	20	Static	24	0.2417	Active ingredient	Wohlgemuth (1977)	314
72208	Endrin	21.24	Formulation	*Rana temporaria*	Tadpoles	20	Static	24	0.9886	Active ingredient	Wohlgemuth (1977)	315
122145	Fenitrothion	97	Technical	*Xenopus laevis*	Embryos	30	Static	24	0.33	Active ingredient	Elliott-Feeley and Armstrong (1982)	318
122145	Fenitrothion	97	Technical	*Xenopus laevis*	Embryos	18	Static	24	>10	Active ingredient	Elliott-Feeley and Armstrong (1982)	319
122145	Fenitrothion	97	Technical	*Xenopus laevis*	Embryos	25	Static	24	>10	Active ingredient	Elliott-Feeley and Armstrong (1982)	320
122145	Fenitrothion	97	Technical	*Rana clamitans*	Tadpoles	21±1	Static	24	9.9	Active ingredient	Lyons et al (1976)	321
93721	Fenoprop	NR	Technical	*Bufo woodhousei fowleri*	Tadpoles	15.5±0.5	Static	24	22	Active ingredient	Sanders (1970)	325
93721	Fenoprop	NR	Technical	*Pseudacris triseriata*	Tadpoles	15.5±0.5	Static	24	20	Active ingredient	Sanders (1970)	327
55389	Fenthion	96.8-97.2	Technical	*Bufo bufo*	Tadpoles	20±1	Static?	24	2.35	Active ingredient	Marchal-Segault (1976)	328
58899	Gamma-HCH	NR	Technical	*Bufo woodhousei fowleri*	Tadpoles	15.5±0.5	Static	24	13	Active ingredient	Sanders (1970)	334
58899	Gamma-HCH	NR	Technical	*Bufo woodhousei fowleri*	Tadpoles	15.5±0.5	Static	24	14	Active ingredient	Sanders (1970)	335

CAS	Pesticide name	% a.i.	Test material	Species	Stage	Temp. (°C)	Test type	Duration (h)	LC50 (mg/L)	LC50 based on	Reference	Data line
58899	Gamma-HCH	NR	Technical	*Pseudacris triseriata*	Tadpoles	15.5±0.5	Static	24	4	Active ingredient	Sanders (1970)	336
608731	Gamma-HCH, alpha-HCH, lindane	41.5	Technical	*Bufo woodhousei fowleri*	Tadpoles	15	Static	24	13.2	Active ingredient	Mayer and Ellersieck (1986)	337
608731	Gamma-HCH, alpha-HCH, lindane	NR	Technical	*Bufo woodhousei fowleri*	Tadpoles	15.5±0.5	Static	24	13	Active ingredient	Sanders (1970)	338
58899	Gamma-HCH, lindane	99	Technical	*Bufo woodhousei fowleri*	Tadpoles	15	Static	24	13.7	Active ingredient	Mayer and Ellersieck (1986)	339
58899	Gamma-HCH, lindane	99	Technical	*Pseudacris triseriata*	Tadpoles	15	Static	24	4	Active ingredient	Mayer and Ellersieck (1986)	340
1071836	Glyphosate	96	Technical	*Crinia insignifera*	Adults	20±2	Renewal	24	89.6	Active ingredient	Bidwell and Gorrie (1995)	343
1071836	Glyphosate	50.2	Formulation	*Bufo boreas*	Larvae	18 (room temp.)	NR	24	2.66	Active ingredient	King and Wagner (2010)	344
1071836	Glyphosate	50.2	Formulation	*Pseudacris regilla*	Larvae	18 (room temp.)	NR	24	0.43	Active ingredient	King and Wagner (2010)	345
1071836	Glyphosate	50.2	Formulation	*Rana cascadae*	Larvae	18 (room temp.)	NR	24	2.11	Active ingredient	King and Wagner (2010)	346
1071836	Glyphosate	50.2	Formulation	*Rana luteiventris*	Larvae	18 (room temp.)	NR	24	1.65	Active ingredient	King and Wagner (2010)	347
1071836	Glyphosate	96	Technical	*Litoria moorei*	Tadpoles	20±2	Renewal	24	127.0	Active ingredient	Bidwell and Gorrie (1995)	348
1071836	Glyphosate	NR	Technical	*Litoria moorei*	Tadpoles	23.4-25.4	Static	24	88.6	Active ingredient	Mann & Bidwell (1999)	349

CAS	Pesticide name	% a.i.	Test material	Species	Stage	Temp. (°C)	Test type	Duration (h)	LC50 (mg/L)	LC50 based on	Reference	Data line
1071836	Glyphosate	74.7	Formulation	*Rhinella arenarum*	Tadpoles	22 ± 2	Static	24	2.42	Active ingredient	Lajmanovich et al (2011)	350
1071836	Glyphosate	48	Formulation	*Rhinella arenarum*	Tadpoles	22 ± 2	Static	24	38.76	Active ingredient	Lajmanovich et al (2011)	351
1071836	Glyphosate	48	Formulation	*Rhinella arenarum*	Tadpoles	22 ± 2	Static	24	73.77	Active ingredient	Lajmanovich et al (2011)	352
1071836	Glyphosate	48	Formulation	*Rhinella arenarum*	Tadpoles	22 ± 2	Static	24	77.52	Active ingredient	Lajmanovich et al (2011)	353
38641940	Glyphosate isopropylamine	36	Formulation	*Bufo Americanus*	Tadpoles	15±1	Static	24	4.2	Active ingredient (a.e.)	Howe et al. (2004)	354
38641940	Glyphosate isopropylamine	36	Formulation	*Bufo Americanus*	Tadpoles	15±1	Static	24	>8	Active ingredient (a.e.)	Howe et al. (2004)	355
38641940	Glyphosate isopropylamine	60.5	Technical	*Crinia insignifera*	Tadpoles	19.0-21.3	Static	24	>466	Active ingredient	Mann & Bidwell (1999)	356
38641940	Glyphosate isopropylamine	60.5	Technical	*Heleioporus eyrei*	Tadpoles	19.0-21.3	Static	24	>373	Active ingredient	Mann & Bidwell (1999)	357
38641940	Glyphosate isopropylamine	60.5	Technical	*Limnodynastes dorsalis*	Tadpoles	19.0-21.3	Static	24	>400	Active ingredient	Mann & Bidwell (1999)	358
38641940	Glyphosate isopropylamine	60.5	Technical	*Litoria moorei*	Tadpoles	23.4-25.4	Static	24	>343	Active ingredient	Mann & Bidwell (1999)	359
38641940	Glyphosate isopropylamine	36	Formulation	*Rana clamitans*	Tadpoles	20±1	Static	24	2.0	Active ingredient (a.e.)	Howe et al. (2004)	360
38641940	Glyphosate isopropylamine	36	Formulation	*Rana clamitans*	Tadpoles	20±1	Static	24	2.3	Active ingredient (a.e.)	Howe et al. (2004)	361

CAS	Pesticide name	% a.i.	Test material	Species	Stage	Temp. (°C)	Test type	Duration (h)	LC50 (mg/L)	LC50 based on	Reference	Data line
38641940	Glyphosate isopropylamine	36	Formulation	*Rana clamitans*	Tadpoles	20±1	Static	24	>8	Active ingredient (a.e.)	Howe et al. (2004)	362
38641940	Glyphosate isopropylamine	36	Formulation	*Rana clamitans*	Tadpoles	20±1	Static	24	9.0	Active ingredient (a.e.)	Howe et al. (2004)	363
38641940	Glyphosate isopropylamine	57	Technical	*Rana clamitans*	Tadpoles	20±1	Static	24	>17.9	Active ingredient (a.e.)	Howe et al. (2004)	364
38641940	Glyphosate isopropylamine	36	Formulation	*Rana clamitans*	Tadpoles	20±1	Static	24	>17.9	Active ingredient (a.e.)	Howe et al. (2004)	365
38641940	Glyphosate isopropylamine	36	Formulation	*Rana clamitans*	Tadpoles	20±1	Static	24	>17.9	Active ingredient (a.e.)	Howe et al. (2004)	366
38641940	Glyphosate isopropylamine	36	Formulation	*Rana pipiens*	Tadpoles	20±1	Static	24	3.7	Active ingredient (a.e.)	Howe et al. (2004)	367
38641940	Glyphosate isopropylamine	36	Formulation	*Rana pipiens*	Tadpoles	15±1	Static	24	>8	Active ingredient (a.e.)	Howe et al. (2004)	368
38641940	Glyphosate isopropylamine	36	Formulation	*Rana sylvatica*	Tadpoles	15±1	Static	24	5.6	Active ingredient (a.e.)	Howe et al. (2004)	369
38641940	Glyphosate isopropylamine	36	Formulation	*Rana sylvatica*	Tadpoles	15±1	Static	24	>8	Active ingredient (a.e.)	Howe et al. (2004)	370
38641940	Glyphosate isopropylamine	48	Formulation	*Scinax nasicus*	Tadpoles	22±2.0	Static-renewal	24	2.29	Active ingredient (calc)	Lajmanovich et al. (2003a)	371
38641940	Glyphosate isopropylammonium	36	Formulation	*Crinia insignifera*	Adults	20±2	Renewal	24	52.6	Active ingredient	Bidwell and Gorrie (1995)	372

CAS	Pesticide name	% a.i.	Test material	Species	Stage	Temp. (°C)	Test type	Duration (h)	LC50 (mg/L)	LC50 based on	Reference	Data line
38641940	Glyphosate isopropylammonium	36	Formulation	*Crinia insignifera*	Juvenile	20±2	Renewal	24	88.7	Active ingredient	Bidwell and Gorrie (1995)	373
38641940	Glyphosate isopropylammonium	36	Formulation	*Crinia insignifera*	Tadpoles	19.0-21.3	Static	24	3.6	Active ingredient	Mann & Bidwell (1999)	374
38641940	Glyphosate isopropylammonium	36	Formulation	*Crinia insignifera*	Tadpoles	19.0-21.3	Static	24	>494	Active ingredient	Mann & Bidwell (1999)	375
38641940	Glyphosate isopropylammonium	36	Formulation	*Heleioporus eyrei*	Tadpoles	19.0-21.3	Static	24	8.6	Active ingredient	Mann & Bidwell (1999)	376
38641940	Glyphosate isopropylammonium	36	Formulation	*Heleioporus eyrei*	Tadpoles	19.0-21.3	Static	24	>427	Active ingredient	Mann & Bidwell (1999)	377
38641940	Glyphosate isopropylammonium	36	Formulation	*Limnodynastes dorsalis*	Tadpoles	19.0-21.3	Static	24	4.6	Active ingredient	Mann & Bidwell (1999)	378
38641940	Glyphosate isopropylammonium	36	Formulation	*Limnodynastes dorsalis*	Tadpoles	19.0-21.3	Static	24	>400	Active ingredient	Mann & Bidwell (1999)	379
38641940	Glyphosate isopropylammonium	36	Formulation	*Litoria moorei*	Tadpoles	20±2	Renewal	24	12.7	Active ingredient	Bidwell and Gorrie (1995)	380
38641940	Glyphosate isopropylammonium	36	Formulation	*Litoria moorei*	Tadpoles	23.4-25.4	Static	24	3.1	Active ingredient	Mann & Bidwell (1999)	381
38641940	Glyphosate isopropylammonium	36	Formulation	*Litoria moorei*	Tadpoles	23.4-25.4	Static	24	333	Active ingredient	Mann & Bidwell (1999)	382
81591813	Glyphosate trimesium	48	Formulation	*Crinia insignifera*	Tadpoles	19.0-21.3	Static	24	13.1	Active ingredient	Mann & Bidwell (1999)	383

CAS	Pesticide name	% a.i.	Test material	Species	Stage	Temp. (°C)	Test type	Duration (h)	LC50 (mg/L)	LC50 based on	Reference	Data line
81591813	Glyphosate trimesium	48	Formulation	*Heleioporus eyrei*	Tadpoles	19.0-21.3	Static	24	16.6	Active ingredient	Mann & Bidwell (1999)	384
81591813	Glyphosate trimesium	48	Formulation	*Limnodynastes dorsalis*	Tadpoles	19.0-21.3	Static	24	14.7	Active ingredient	Mann & Bidwell (1999)	385
81591813	Glyphosate trimesium	48	Formulation	*Litoria moorei*	Tadpoles	23.4-25.4	Static	24	10.4	Active ingredient	Mann & Bidwell (1999)	386
81591813	Glyphosate trimesium	36	Formulation	*Rana clamitans*	Tadpoles	20±1	Static	24	>17.9	Active ingredient (a.e.)	Howe et al. (2004)	387
76448	Heptachlor	99	Technical	*Bufo woodhousei fowleri*	Tadpoles	15	Static	24	0.844	Active ingredient	Mayer and Ellersieck (1986)	389
76448	Heptachlor	NR	Technical	*Bufo woodhousei fowleri*	Tadpoles	15.5±0.5	Static	24	0.85	Active ingredient	Sanders (1970)	390
138261413	Imidacloprid	>95	Technical	*Rana limnocharis*	Tadpoles	20±1	Renewal	24	235	Active ingredient	Feng et al (2004)	397
138261413	Imidacloprid	>95	Technical	*Rana nigromaculata*	Tadpoles	20±1	Renewal	24	268	Active ingredient	Feng et al (2004)	398
121755	Malathion	95	Technical	*Bufo woodhousei fowleri*	Tadpoles	15	Static	24	1.9	Active ingredient	Mayer and Ellersieck (1986)	407
121755	Malathion	NR	Technical	*Bufo woodhousei fowleri*	Tadpoles	15.5±0.5	Static	24	1.9	Active ingredient	Sanders (1970)	408
121755	Malathion	95	Technical	*Pseudacris triseriata*	Tadpoles	15	Static	24	0.56	Active ingredient	Mayer and Ellersieck (1986)	409
121755	Malathion	NR	Technical	*Pseudacris triseriata*	Tadpoles	15.5±0.5	Static	24	0.56	Active ingredient	Sanders (1970)	410

CAS	Pesticide name	% a.i.	Test material	Species	Stage	Temp. (°C)	Test type	Duration (h)	LC50 (mg/L)	LC50 based on	Reference	Data line
73250687	Mefenacet	99	Technical	*Silurana tropicalis*	Tadpoles	25±1	Renewal	24	3.06	Active ingredient	Saka (2010)	433
7487947	Mercuric chloride	NR	Technical	*Bufo melanostictus*	Tadpoles	31 (29-34)	Static	24	0.0528	Active ingredient (Hg)	Khangarot and Ray (1987)	439
7487947	Mercuric chloride	NR	(Technical)	*Bufo melanostictus*	Tadpoles	22-24	Static	24	0.48	Active ingredient	Paulose (1988)	440
7487947	Mercuric chloride	NR	NR	*Microhyla ornata*	Tadpoles	25.5-26	Renewal	24	2.04	Active ingredient	Rao and Madhyastha (1987)	441
7487947	Mercuric chloride	NR	NR	*Microhyla ornata*	Tadpoles	25.5-26	Renewal	24	2.41	Active ingredient	Rao and Madhyastha (1987)	442
7487947	Mercuric chloride	NR	(Technical)	*Rana breviceps*	Tadpoles	22-24	Static	24	0.65	Active ingredient	Paulose (1988)	443
7487947	Mercuric chloride	NR	Technical (Reagent grade)	*Rana hexadactyla*	Tadpoles	15 (13-16)	Renewal	24	0.762	Active ingredient (Hg)	Khangarot et al (1985b)	444
2032657	Methiocarb	NR	Technical	*Rana sphenocephala*	Larvae	16	Static	24	8.5	Active ingredient	Marking and Chandler (1981)	445
72435	Methoxychlor	98	Technical	*Bufo woodhousei fowleri*	Tadpoles	15	Static	24	1	Active ingredient	Mayer and Ellersieck (1986)	449
72435	Methoxychlor	NR	Technical	*Bufo woodhousei fowleri*	Tadpoles	15.5±0.5	Static	24	0.76	Active ingredient	Sanders (1970)	450
72435	Methoxychlor	98	Technical	*Pseudacris triseriata*	Tadpoles	15	Static	24	0.442	Active ingredient	Mayer and Ellersieck (1986)	451
72435	Methoxychlor	NR	Technical	*Pseudacris triseriata*	Tadpoles	15.5±0.5	Static	24	0.44	Active ingredient	Sanders (1970)	452

CAS	Pesticide name	% a.i.	Test material	Species	Stage	Temp. (°C)	Test type	Duration (h)	LC50 (mg/L)	LC50 based on	Reference	Data line
51218452	Metolachlor	97.2	Technical	*Rana catesbeiana*	Tadpoles	15	NR	24	>25	Active ingredient	Wan et al (2006)	453
7786347	Mevinphos	60	Technical	*Pseudacris triseriata*	Tadpoles	16	Static	24	>3.2	Active ingredient	Mayer and Ellersieck (1986)	455
2212671	Molinate	98	Technical	*Bufo woodhousei fowleri*	Tadpoles	16	Static	24	33	Active ingredient	Mayer and Ellersieck (1986)	458
2212671	Molinate	NR	Technical	*Bufo woodhousei fowleri*	Tadpoles	15.5±0.5	Static	24	33	Active ingredient	Sanders (1970)	459
94804	NA	NR	Technical	*Rhinella arenarum*	Tadpoles	20±1	Static	24	0.12	Active ingredient (Cu)	Perez-Coll and Herkovits (2006)	460
300765	Naled	NR	Technical	*Pseudacris triseriata*	Tadpoles	15.5±0.5	Static	24	2.2	Active ingredient	Sanders (1970)	465
1420048	Niclosamide	70	Formulation	*Rana catesbeiana*	Tadpoles	28	Static	24	0.1386	Active ingredient (calc)	Francis-Floyd et al (1997)	467
1420048	Niclosamide	NR	Formulation	*Rana catesbeiana*	Tadpoles	24±1	Static	24	0.17	Active ingredient	Oliveira-Filho and Paumgartten (2000)	468
1420048	Niclosamide	70	Formulation	*Scaphiopus holbrookii*	Tadpoles	28	Static	24	0.1386	Active ingredient (calc)	Francis-Floyd et al (1997)	469
76738620	Paclobutrazol	98.25	Technical	*Bufo bufo gargarizans*	Tadpoles	22±1	Renewal	24	15.6	Active ingredient	Liu et al (1995)	481
76738620	Paclobutrazol	98.25	Technical	*Bufo bufo gargarizans*	Tadpoles	22±1	Renewal	24	15.6	Active ingredient	Liu et al (1996)	482
4685147	Paraquat	99	Technical (Analytical grade)	*Xenopus laevis*	Embryos	24 (23-25)	Static-renewal	24	>10	Active ingredient	Osano et al. (2002a)	483

CAS	Pesticide name	% a.i.	Test material	Species	Stage	Temp. (°C)	Test type	Duration (h)	LC50 (mg/L)	LC50 based on	Reference	Data line
1910425	Paraquat dichloride	42	Technical	*Bufo woodhousei fowleri*	Tadpoles	16	Static	24	56	Active ingredient	Mayer and Ellersieck (1986)	494
1910425	Paraquat dichloride	NR	Technical	*Bufo woodhousei fowleri*	Tadpoles	15.5±0.5	Static	24	54	Active ingredient	Sanders (1970)	495
1910425	Paraquat dichloride	42	Technical	*Pseudacris triseriata*	Tadpoles	16	Static	24	43	Active ingredient	Mayer and Ellersieck (1986)	496
1910425	Paraquat dichloride	NR	Technical	*Pseudacris triseriata*	Tadpoles	15.5±0.5	Static	24	43	Active ingredient	Sanders (1970)	497
1910425	Paraquat dichloride	27.6	Formulation	*Scinax nasica*	Tadpoles	16±1	Static-renewal	24	38.96	Active ingredient	Lajmanovich et al. (1998)	498
56382	Parathion	98.7	Technical	*Bufo woodhousei fowleri*	Tadpoles	15	Static	24	>1	Active ingredient	Mayer and Ellersieck (1986)	499
56382	Parathion	98.7	Technical	*Pseudacris triseriata*	Tadpoles	15	Static	24	1.6	Active ingredient	Mayer and Ellersieck (1986)	500
56382	Parathion	NR	Technical	*Pseudacris triseriata*	Tadpoles	15.5±0.5	Static	24	1.6	Active ingredient	Sanders (1970)	501
298000	Parathion-methyl, methyl parathion	50	Formulation	*Rana cyanophlyctis*	Adults	23±0.2	Renewal	24	30.0	Active ingredient	Mudgall and Patil (1987)	502
298000	Parathion-methyl, methyl parathion	50	Formulation	*Rana cyanophlyctis*	Adults	23±0.2	Renewal	24	37.0	Active ingredient	Mudgall and Patil (1987)	503
298000	Parathion-methyl, methyl parathion	90	Technical	*Pseudacris triseriata*	Tadpoles	15	Static	24	7.6	Active ingredient	Mayer and Ellersieck (1986)	504
298000	Parathion-methyl, methyl parathion	99	Technical	*Rana tigrina*	Tadpoles	20-21	Static	24	4.9	Active ingredient	Luo et al (2003)	507

CAS	Pesticide name	% a.i.	Test material	Species	Stage	Temp. (°C)	Test type	Duration (h)	LC50 (mg/L)	LC50 based on	Reference	Data line
87865	Pentachlorophenol	99	Technical	*Bufo boreas*	Tadpoles	22	Static	24	>0.42	Active ingredient	Dwyer et al (1999)	511
52645531	Permethrin	95.2	Technical	*Bufo boreas*	Tadpoles	22	Static	24	>10	Active ingredient	Dwyer et al (1999)	519
51036	Piperonyl butoxide	100	Technical	*Pseudacris triseriata*	Tadpoles	15	Static	24	0.28	Active ingredient	Mayer and Ellersieck (1986)	526
51036	Piperonyl butoxide	NR	Technical	*Pseudacris triseriata*	Tadpoles	15.5±0.5	Static	24	1.8	Active ingredient	Sanders (1970)	527
23103982	Pirimicarb	50	Formulation	*Rhinella arenarum*	Tadpoles	25±1	Renewal	24	201.00	Active ingredient	Candioti et al (2010)	529
23103982	Pirimicarb	50	Formulation	*Rhinella arenarum*	Tadpoles	25±1	Renewal	24	119.80	Active ingredient	Candioti et al (2010)	530
-	POEA (surfactant)	71	Technical	*Rana clamitans*	Tadpoles	20±1	Static	24	2.4	Active ingredient	Howe et al. (2004)	531
41198087	Profenofos	40	Formulation	*Rana spinosa*	Tadpoles	21±1	Renewal	24	1.59	Active ingredient	Li et al (2010)	535
122349	Simazine	89	Formulation	*Rana catesbeiana*	Tadpoles	15	NR	24	>2000	Formulation	Wan et al (2006)	554
1014706	Simetryn	99.9	Technical	*Silurana tropicalis*	Tadpoles	25±1	Renewal	24	16.90	Active ingredient	Saka (2010)	555
131522	Sodium pentachlorophenoxide	90	Technical	*Ambystoma mexicanum*	Larvae	20±1	Renewal	24	0.38	Active ingredient	Saka (2003)	557
131522	Sodium pentachlorophenoxide	90	Technical	*Ambystoma mexicanum*	Larvae	20±1	Renewal	24	0.30	Active ingredient	Saka (2003)	558
131522	Sodium pentachlorophenoxide	90	Technical	*Ambystoma mexicanum*	Larvae	20±1	Renewal	24	0.27	Active ingredient	Saka (2003)	559
131522	Sodium pentachlorophenoxide	90	Technical	*Ambystoma mexicanum*	Larvae	20±1	Renewal	24	0.24	Active ingredient	Saka (2003)	560

CAS	Pesticide name	% a.i.	Test material	Species	Stage	Temp. (°C)	Test type	Duration (h)	LC50 (mg/L)	LC50 based on	Reference	Data line
131522	Sodium pentachlorophenoxide	90	Technical	*Ambystoma mexicanum*	Larvae	20±1	Renewal	24	0.19	Active ingredient	Saka (2003)	561
131522	Sodium pentachlorophenoxide	90	Technical	*Ambystoma mexicanum*	Larvae	20±1	Renewal	24	0.19	Active ingredient	Saka (2003)	562
131522	Sodium pentachlorophenoxide	90	Technical	*Ambystoma mexicanum*	Larvae	20±1	Renewal	24	0.20	Active ingredient	Saka (2003)	563
131522	Sodium pentachlorophenoxide	90	Technical	*Ambystoma mexicanum*	Larvae	20±1	Renewal	24	0.16	Active ingredient	Saka (2003)	564
131522	Sodium pentachlorophenoxide	90	Technical	*Ambystoma mexicanum*	Larvae	20±1	Renewal	24	0.24	Active ingredient	Saka (2003)	565
131522	Sodium pentachlorophenoxide	90	Technical	*Bufo japonicus formosus*	Larvae	20±1	Renewal	24	0.29	Active ingredient	Saka (1999)	566
131522	Sodium pentachlorophenoxide	90	Technical	*Bufo japonicus formosus*	Larvae	20±1	Renewal	24	0.17	Active ingredient	Saka (1999)	567
131522	Sodium pentachlorophenoxide	90	Technical	*Bufo japonicus formosus*	Larvae	20±1	Renewal	24	0.17	Active ingredient	Saka (1999)	568
131522	Sodium pentachlorophenoxide	90	Technical	*Cynops pyrrhogaster*	Larvae	20±1	Renewal	24	0.31	Active ingredient	Saka (1999)	569
131522	Sodium pentachlorophenoxide	90	Technical	*Cynops pyrrhogaster*	Larvae	20±1	Renewal	24	0.15	Active ingredient	Saka (1999)	570
131522	Sodium pentachlorophenoxide	90	Technical	*Cynops pyrrhogaster*	Larvae	20±1	Renewal	24	0.10	Active ingredient	Saka (1999)	571

CAS	Pesticide name	% a.i.	Test material	Species	Stage	Temp. (°C)	Test type	Duration (h)	LC50 (mg/L)	LC50 based on	Reference	Data line
131522	Sodium pentachlorophenoxide	90	Technical	*Hyla japonica*	Larvae	20±1	Renewal	24	0.22	Active ingredient	Saka (1999)	572
131522	Sodium pentachlorophenoxide	90	Technical	*Hyla japonica*	Larvae	20±1	Renewal	24	0.17	Active ingredient	Saka (1999)	573
131522	Sodium pentachlorophenoxide	90	Technical	*Hyla japonica*	Larvae	20±1	Renewal	24	0.26	Active ingredient	Saka (1999)	574
131522	Sodium pentachlorophenoxide	90	Technical	*Rana nigromaculata*	Larvae	20±1	Renewal	24	0.21	Active ingredient	Saka (1999)	575
131522	Sodium pentachlorophenoxide	90	Technical	*Rana nigromaculata*	Larvae	20±1	Renewal	24	0.12	Active ingredient	Saka (1999)	576
131522	Sodium pentachlorophenoxide	90	Technical	*Rana nigromaculata*	Larvae	20±1	Renewal	24	0.12	Active ingredient	Saka (1999)	577
131522	Sodium pentachlorophenoxide	90	Technical	*Rhacophorus arboreus*	Larvae	20±1	Renewal	24	0.29	Active ingredient	Saka (1999)	578
131522	Sodium pentachlorophenoxide	90	Technical	*Rhacophorus arboreus*	Larvae	20±1	Renewal	24	0.27	Active ingredient	Saka (1999)	579
131522	Sodium pentachlorophenoxide	90	Technical	*Xenopus laevis*	Larvae	20±1	Renewal	24	0.31	Active ingredient	Saka (1999)	580
131522	Sodium pentachlorophenoxide	90	Technical	*Xenopus laevis*	Larvae	20±1	Renewal	24	0.21	Active ingredient	Saka (1999)	581
131522	Sodium pentachlorophenoxide	90	Technical	*Xenopus laevis*	Larvae	20±1	Renewal	24	0.21	Active ingredient	Saka (1999)	582

CAS	Pesticide name	% a.i.	Test material	Species	Stage	Temp. (°C)	Test type	Duration (h)	LC50 (mg/L)	LC50 based on	Reference	Data line
131522	Sodium pentachlorophenoxide	90	Technical	*Xenopus laevis*	Larvae	20±1	Renewal	24	0.39	Active ingredient	Saka (2003)	583
131522	Sodium pentachlorophenoxide	90	Technical	*Xenopus laevis*	Larvae	20±1	Renewal	24	0.30	Active ingredient	Saka (2003)	584
131522	Sodium pentachlorophenoxide	90	Technical	*Xenopus laevis*	Larvae	20±1	Renewal	24	0.24	Active ingredient	Saka (2003)	585
131522	Sodium pentachlorophenoxide	90	Technical	*Xenopus laevis*	Larvae	20±1	Renewal	24	0.22	Active ingredient	Saka (2003)	586
131522	Sodium pentachlorophenoxide	90	Technical	*Xenopus laevis*	Larvae	20±1	Renewal	24	0.22	Active ingredient	Saka (2003)	587
131522	Sodium pentachlorophenoxide	90	Technical	*Xenopus laevis*	Larvae	20±1	Renewal	24	0.22	Active ingredient	Saka (2003)	588
131522	Sodium pentachlorophenoxide	90	Technical	*Xenopus laevis*	Larvae	20±1	Renewal	24	0.20	Active ingredient	Saka (2003)	589
131522	Sodium pentachlorophenoxide	90	Technical	*Xenopus laevis*	Larvae	20±1	Renewal	24	0.17	Active ingredient	Saka (2003)	590
131522	Sodium pentachlorophenoxide	90	Technical	*Xenopus laevis*	Larvae	20±1	Renewal	24	0.16	Active ingredient	Saka (2003)	591
131522	Sodium pentachlorophenoxide	90	Technical	*Xenopus laevis*	Larvae	20±1	Renewal	24	0.15	Active ingredient	Saka (2003)	592
131522	Sodium pentachlorophenoxide	90	Technical	*Xenopus laevis*	Larvae	20±1	Renewal	24	0.16	Active ingredient	Saka (2003)	593

CAS	Pesticide name	% a.i.	Test material	Species	Stage	Temp. (°C)	Test type	Duration (h)	LC50 (mg/L)	LC50 based on	Reference	Data line
131522	Sodium pentachlorophenoxide	90	Technical	*Xenopus laevis*	Larvae	20±1	Renewal	24	0.16	Active ingredient	Saka (2003)	594
131522	Sodium pentachlorophenoxide	90	Technical	*Xenopus laevis*	Larvae	20±1	Renewal	24	0.21	Active ingredient	Saka (2003)	595
131522	Sodium pentachlorophenoxide	NR	Technical (Reagent grade)	*Rana hexadactyla*	Tadpoles	14 (12-17)	Static	24	0.058	Active ingredient	Khangarot et al (1985c)	598
72548	TDE	99	Technical	*Bufo woodhousei fowleri*	Tadpoles	16	Static	24	0.709	Active ingredient	Mayer and Ellersieck (1986)	599
72548	TDE	NR	Technical	*Bufo woodhousei fowleri*	Tadpoles	15.5±0.5	Static	24	0.7	Active ingredient	Sanders (1970)	600
72548	TDE	NR	Technical	*Pseudacris triseriata*	Tadpoles	15.5±0.5	Static	24	0.61	Active ingredient	Sanders (1970)	601
3383968	Temephos	5	Formulation	*Hynobius retardatus*	Larvae	NR	Static	24	3.97	Formulation	Office of Pesticide Programs (2000)	603
3383968	Temephos	5	Formulation	*Rana chensinensis*	Larvae	NR	Static	24	4.18	Formulation	Office of Pesticide Programs (2000)	604
28249776	Thiobencarb	50	Formulation	*Bufo japonicus formosus*	Larvae	20±1	Renewal	24	3.86	Active ingredient	Saka (1999)	612
28249776	Thiobencarb	50	Formulation	*Bufo japonicus formosus*	Larvae	20±1	Renewal	24	3.38	Active ingredient	Saka (1999)	613
28249776	Thiobencarb	50	Formulation	*Bufo japonicus formosus*	Larvae	20±1	Renewal	24	3.35	Active ingredient	Saka (1999)	614
28249776	Thiobencarb	50	Formulation	*Cynops pyrrhogaster*	Larvae	20±1	Renewal	24	5.11	Active ingredient	Saka (1999)	615

CAS	Pesticide name	% a.i.	Test material	Species	Stage	Temp. (°C)	Test type	Duration (h)	LC50 (mg/L)	LC50 based on	Reference	Data line
28249776	Thiobencarb	50	Formulation	*Cynops pyrrhogaster*	Larvae	20±1	Renewal	24	3.64	Active ingredient	Saka (1999)	616
28249776	Thiobencarb	50	Formulation	*Cynops pyrrhogaster*	Larvae	20±1	Renewal	24	5.00	Active ingredient	Saka (1999)	617
28249776	Thiobencarb	99	Technical	*Cynops pyrrhogaster*	Larvae	20±1	Renewal	24	4.23	Active ingredient	Saka (1999)	618
28249776	Thiobencarb	50	Formulation	*Hyla japonica*	Larvae	20±1	Renewal	24	5.24	Active ingredient	Saka (1999)	619
28249776	Thiobencarb	50	Formulation	*Hyla japonica*	Larvae	20±1	Renewal	24	4.12	Active ingredient	Saka (1999)	620
28249776	Thiobencarb	50	Formulation	*Hyla japonica*	Larvae	20±1	Renewal	24	3.81	Active ingredient	Saka (1999)	621
28249776	Thiobencarb	50	Formulation	*Rana nigromaculata*	Larvae	20±1	Renewal	24	3.73	Active ingredient	Saka (1999)	622
28249776	Thiobencarb	50	Formulation	*Rana nigromaculata*	Larvae	20±1	Renewal	24	3.18	Active ingredient	Saka (1999)	623
28249776	Thiobencarb	50	Formulation	*Rana nigromaculata*	Larvae	20±1	Renewal	24	3.59	Active ingredient	Saka (1999)	624
28249776	Thiobencarb	50	Formulation	*Rhacophorus arboreus*	Larvae	20±1	Renewal	24	6.22	Active ingredient	Saka (1999)	625
28249776	Thiobencarb	50	Formulation	*Rhacophorus arboreus*	Larvae	20±1	Renewal	24	3.99	Active ingredient	Saka (1999)	626
28249776	Thiobencarb	50	Formulation	*Xenopus laevis*	Larvae	20±1	Renewal	24	6.49	Active ingredient	Saka (1999)	627
28249776	Thiobencarb	50	Formulation	*Xenopus laevis*	Larvae	20±1	Renewal	24	4.05	Active ingredient	Saka (1999)	628
28249776	Thiobencarb	50	Formulation	*Xenopus laevis*	Larvae	20±1	Renewal	24	3.40	Active ingredient	Saka (1999)	629
28249776	Thiobencarb	99	Technical	*Xenopus laevis*	Larvae	20±1	Renewal	24	4.75	Active ingredient	Saka (1999)	630
28249776	Thiobencarb	98	Technical	*Silurana tropicalis*	Tadpoles	25±1	Renewal	24	1.77	Active ingredient	Saka (2010)	631

CAS	Pesticide name	% a.i.	Test material	Species	Stage	Temp. (°C)	Test type	Duration (h)	LC50 (mg/L)	LC50 based on	Reference	Data line
137268	Thiram	80	Formulation	*Xenopus laevis*	Tadpoles	20±0.5	NR	24	0.017	Active ingredient	Seuge et al (1983)	632
137268	Thiram	80	Formulation	*Xenopus laevis*	Tadpoles	20±0.5	NR	24	0.025	Active ingredient	Seuge et al (1983)	633
78488	Tribufos	95	Technical	*Bufo woodhousei fowleri*	Tadpoles	15	Static	24	0.64	Active ingredient	Mayer and Ellersieck (1986)	634
78488	Tribufos	NR	Technical	*Bufo woodhousei fowleri*	Tadpoles	15.5±0.5	Static	24	1.2	Active ingredient	Sanders (1970)	635
1582098	Trifluralin	49	Formulation	*Bombina bombina*	Larvae	22±1	Renewal	24	42.1	Active ingredient	Sayim (2010)	637
1582098	Trifluralin	NR	Technical	*Bufo woodhousei fowleri*	Tadpoles	15.5±0.5	Static	24	0.18	Active ingredient	Sanders (1970)	638
1582098	Trifuralin	95.9	Technical	*Bufo woodhousei fowleri*	Tadpoles	15	Static	24	0.18	Active ingredient	Mayer and Ellersieck (1986)	639
1582098	Trifuralin	95.9	Technical	*Bufo woodhousei fowleri*	Tadpoles	15	Static	24	0.2	Active ingredient	Mayer and Ellersieck (1986)	640

J. SELECTED 48H LC50 DATA

Table 82: 48h LC50 data for amphibians.

CAS	Pesticide name	% a.i.	Test material	Species	Stage	Temp. (°C)	Test type	Duration (h)	LC50 (mg/L)	LC50 based on	Reference	Data line
94757	2,4-D	99	Technical	*Rhinella arenarum*	Embryos	20±2	Renewal	48	10.18	Active ingredient	Aronzon et al (2011)	642
94757	2,4-D	(79.7 g/100 cm^3 a.e.)	Formulation	*Rhinella arenarum*	Embryos	20±2	Renewal	48	3.83	Active ingredient	Aronzon et al (2011)	643
94757	2,4-D	99	Technical	*Rhinella arenarum*	Tadpoles	20±2	Renewal	48	13.79	Active ingredient	Aronzon et al (2011)	645
94757	2,4-D	(79.7 g/100 cm^3 a.e.)	Formulation	*Rhinella arenarum*	Tadpoles	20±2	Renewal	48	3.46	Active ingredient	Aronzon et al (2011)	646
94804	2,4-D Butyl	79.7	Formulation	*Rhinella arenarum*	Tadpoles	20±1	Static	48	4	Active ingredient	Perez-Coll and Herkovits (2006)	647
107131	Acrylonitrile	NR	Technical (Analytical grade)	*Bufo bufo gargarizans*	Tadpoles	21±1	Flow-through	48	13.41	Active ingredient	Zhang et al (1996)	655
107131	Acrylonitrile	NR	Technical (Analytical grade)	*Bufo bufo gargarizans*	Tadpoles	21±1	Flow-through	48	15.07	Active ingredient	Zhang et al (1996)	656
309002	Aldrin	NR	Technical	*Rana hexadactyla*	Adults	27±2	Static	48	2.4	Active ingredient	Joseph and Rao (1990)	657
309002	Aldrin	90	Technical	*Bufo woodhousei fowleri*	Tadpoles	16	Static	48	0.148	Active ingredient	Mayer and Ellersieck (1986)	658

CAS	Pesticide name	% a.i.	Test material	Species	Stage	Temp. (°C)	Test type	Duration (h)	LC50 (mg/L)	LC50 based on	Reference	Data line
309002	Aldrin	NR	Technical	*Bufo woodhousei fowleri*	Tadpoles	15.5±0.5	Static	48	0.68	Active ingredient	Sanders (1970)	659
2032599	Aminocarb	75	Technical	*Rana clamitans*	Tadpoles	21±1	Static	48	206	Active ingredient	Lyons et al (1976)	661
33089611	Amitraz	97.5	Technical (Analytical)	*Xenopus laevis*	Embryos	24 (23-25)	Static-renewal	48	5<LC50<10	Active ingredient	Osano et al. (2002a)	662
1327533	Arsenous oxide	NR	Technical (Reagent grade)	*Rana hexadactyla*	Tadpoles	15 (13-16)	Renewal	48	0.27	Active ingredient (As)	Khangarot et al (1985b)	664
1912249	Atrazine	98	Technical	*Rana catesbeiana*	Tadpoles	15	NR	48	>16	Active ingredient	Wan et al (2006)	670
1912249	Atrazine	48.5	Formulation	*Rana catesbeiana*	Tadpoles	15	NR	48	>480	Formulation	Wan et al (2006)	671
86500	Azinphos-methyl	NR	Technical	*Bufo woodhousei fowleri*	Tadpoles	15.5±0.5	Static	48	0.31	Active ingredient	Sanders (1970)	672
23184669	Butachlor	50	Formulation	*Bufo melanostictus*	Tadpoles	21-27	Renewal	48	1.18	Formulation	Geng et al (2005)	679
23184669	Butachlor	50	Formulation	*Fejervarya multistriata*	Tadpoles	21-27	Renewal	48	1.46	Formulation	Geng et al (2005)	680
23184669	Butachlor	50	Formulation	*Microhyla ornata*	Tadpoles	21-27	Renewal	48	0.85	Formulation	Geng et al (2005)	681
23184669	Butachlor	50	Formulation	*Microhyla ornata*	Tadpoles	23-27	Static-renewal	48	0.000940	Active ingredient	Xue et al (2005)	682
23184669	Butachlor	50	Formulation	*Polypedates megacephalus*	Tadpoles	21-27	Renewal	48	2.62	Formulation	Geng et al (2005)	683
8001352	Camphechlor	NR	Technical	*Bufo woodhousei fowleri*	Tadpoles	15.5±0.5	Static	48	0.29	Active ingredient	Sanders (1970)	687
8001352	Camphechlor	NR	Technical	*Pseudacris triseriata*	Tadpoles	15.5±0.5	Static	48	0.7	Active ingredient	Sanders (1970)	688

CAS	Pesticide name	% a.i.	Test material	Species	Stage	Temp. (°C)	Test type	Duration (h)	LC50 (mg/L)	LC50 based on	Reference	Data line
63252	Carbaryl	50	Formulation	*Rana tigrina*	NR	NR	Static	48	8.25	Active ingredient	Marian et al (1983)	691
63252	Carbaryl	99.7	Technical	*Bufo boreas*	Tadpoles	22	Static	48	>21	Active ingredient	Dwyer et al (1999)	692
63252	Carbaryl	97-99	Technical	*Bufo bufo*	Tadpoles	20±1	Static?	48	19.50	Active ingredient	Marchal-Segault (1976)	693
63252	Carbaryl	NR	Formulation	*Bufo marinus*	Tadpoles	NR	Static	48	>5	Active ingredient	Tejada et al (1994)	695
63252	Carbaryl	99.7	Technical	*Rana clamitans*	Tadpoles	27	Static	48	16.17	Active ingredient	Boone and Bridges (1999)	696
63252	Carbaryl	99.7	Technical	*Rana clamitans*	Tadpoles	22	Static	48	21.76	Active ingredient	Boone and Bridges (1999)	697
63252	Carbaryl	99.7	Technical	*Rana clamitans*	Tadpoles	17	Static	48	26.01	Active ingredient	Boone and Bridges (1999)	698
786196	Carbophenothion	NR	Technical	*Pseudacris triseriata*	Tadpoles	15.5±0.5	Static	48	0.05	Active ingredient	Sanders (1970)	705
2921882	Chlorpyrifos	40	Formulation	*Bufo bufo gargarizans*	Tadpoles	20.5-22.5	Renewal	48	1.17	Active ingredient	Yin et al (2009)	713
2921882	Chlorpyrifos	40	Formulation	*Bufo melanostictus*	Tadpoles	NR	Static	48	0.59	Active ingredient	Jayawardena et al (2011)	714
2921882	Chlorpyrifos	40	Formulation	*Polypedates cruciger*	Tadpoles	NR	Static	48	0.48	Active ingredient	Jayawardena et al (2010)	715
1332407	Copper oxychloride	99	Formulation	*Rana catesbeiana*	Tadpoles	22.7±0.9	Static	48	4.3	Active ingredient	Ferreira et al (2004)	719
7758987	Copper sulfate	NR	Technical (Reagent grade)	*Rana tigrina*	Larvae	26.5 (24-27.5)	Static	48	0.47	Active ingredient (Cu)	Khangarot et al (1981)	720
7758987	Copper sulfate	NR	Technical (Analytical)	*Xenopus laevis*	Larvae	20±1	Static	48	1.7	Active ingredient	De Zwart and Slooff (1987)	721

CAS	Pesticide name	% a.i.	Test material	Species	Stage	Temp. (°C)	Test type	Duration (h)	LC50 (mg/L)	LC50 based on	Reference	Data line
7758987	Copper sulfate	25.5	Technical	*Bufo boreas*	Tadpoles	22	Static	48	0.14	Active ingredient	Dwyer et al (1999)	722
7758987	Copper sulfate	NR	Technical	*Bufo melanostictus*	Tadpoles	31 (29-34)	Static	48	0.446	Active ingredient (Cu)	Khangarot and Ray (1987)	723
7758987	Copper sulfate	NR	Technical	*Lithobates catesbeianus*	Tadpoles	21±2	Renewal	48	9.49	Active ingredient	Ossana et al (2010)	724
7758987	Copper sulfate	NR	NR	*Microhyla ornata*	Tadpoles	25.5-26	Renewal	48	5.31	Active ingredient	Rao and Madhyastha (1987)	725
7758987	Copper sulfate	NR	NR	*Microhyla ornata*	Tadpoles	25.5-26	Renewal	48	5.74	Active ingredient	Rao and Madhyastha (1987)	726
7758987	Copper sulfate	NR	Technical (Reagent grade)	*Rana hexadactyla*	Tadpoles	15 (13-17)	Renewal	48	0.042	Active ingredient (Cu)	Khangarot et al (1984)	727
52315078	Cypermethrin	10	Formulation	*Bufo melanostictus*	Tadpoles	20	Static	48	0.0120	Active ingredient	Saha and Kaviraj (2008)	733
52315078	Cypermethrin	10	Formulation	*Bufo melanostictus*	Tadpoles	20	Static	48	0.0120	Active ingredient	Saha and Kaviraj (2008)	734
52315078	Cypermethrin	25	Formulation	*Physalaemus biligonigerus*	Tadpoles	22±2	Renewal	48	0.592	Active ingredient	Izaguirre et al (2000)	735
50293	DDT	NR	Technical	*Bufo bufo*	Tadpoles	20±1	Static?	48	0.65	Active ingredient	Marchal-Segault (1976)	740
50293	DDT	99.9	Technical	*Bufo woodhousei fowleri*	Tadpoles	15.5±0.5	Static	48	1	Active ingredient	Sanders (1970)	742
50293	DDT	99.9	Technical	*Bufo woodhousei fowleri*	Tadpoles	15.5±0.5	Static	48	1.8	Active ingredient	Sanders (1970)	743
50293	DDT	99.9	Technical	*Bufo woodhousei fowleri*	Tadpoles	15.5±0.5	Static	48	1.3	Active ingredient	Sanders (1970)	744

CAS	Pesticide name	% a.i.	Test material	Species	Stage	Temp. (°C)	Test type	Duration (h)	LC50 (mg/L)	LC50 based on	Reference	Data line
50293	DDT	99.9	Technical	*Bufo woodhousei fowleri*	Tadpoles	15.5±0.5	Static	48	0.41	Active ingredient	Sanders (1970)	745
50293	DDT	99.9	Technical	*Bufo woodhousei fowleri*	Tadpoles	15.5±0.5	Static	48	0.75	Active ingredient	Sanders (1970)	746
50293	DDT	NR	Technical	*Pseudacris triseriata*	Tadpoles	15.5±0.5	Static	48	0.9	Active ingredient	Sanders (1970)	747
52918635	Deltamethrin	99-99.8	Technical	*Rhinella arenarum*	NR	20±1	Renewal	48	0.0119	Active ingredient	Salibian (1992)	750
52918635	Deltamethrin	99-99.8	Technical	*Rhinella arenarum*	NR	20±1	Renewal	48	0.0168	Active ingredient	Salibian (1992)	751
62737	Dichlorvos	80	Formulation	*Bufo melanostictus*	Tadpoles	21-27	Renewal	48	78.93	Formulation	Geng et al (2005)	762
62737	Dichlorvos	80	Formulation	*Fejervarya multistriata*	Tadpoles	21-27	Renewal	48	21.27	Formulation	Geng et al (2005)	763
62737	Dichlorvos	80	Formulation	*Microhyla ornata*	Tadpoles	21-27	Renewal	48	1.58	Formulation	Geng et al (2005)	764
62737	Dichlorvos	80	Formulation	*Microhyla ornata*	Tadpoles	23-27	Static-renewal	48	0.001576	Active ingredient	Xue et al (2005)	765
62737	Dichlorvos	80	Formulation	*Polypedates megacephalus*	Tadpoles	21-27	Renewal	48	26.41	Formulation	Geng et al (2005)	766
60571	Dieldrin	NR	Technical	*Bufo woodhousei fowleri*	Tadpoles	15.5±0.5	Static	48	0.4	Active ingredient	Sanders (1970)	769
60571	Dieldrin	NR	Technical	*Pseudacris triseriata*	Tadpoles	15.5±0.5	Static	48	0.22	Active ingredient	Sanders (1970)	770
60515	Dimethoate	30	Formulation	*Rana cyanophlyctis*	Adults	23±0.2	Renewal	48	43.3	Active ingredient	Mudgall and Patil (1987)	773
60515	Dimethoate	30	Formulation	*Rana cyanophlyctis*	Adults	23±0.2	Renewal	48	46.3	Active ingredient	Mudgall and Patil (1987)	774
60515	Dimethoate	40	Formulation	*Bufo melanostictus*	Tadpoles	NR	Static	48	3.56	Active ingredient	Jayawardena et al (2011)	775

CAS	Pesticide name	% a.i.	Test material	Species	Stage	Temp. (°C)	Test type	Duration (h)	LC50 (mg/L)	LC50 based on	Reference	Data line
60515	Dimethoate	40	Formulation	*Polypedates cruciger*	Tadpoles	NR	Static	48	3.36	Active ingredient	Jayawardena et al (2010)	776
115297	Endosulfan	35	Formulation	*Bufo melanostictus*	Tadpoles	25±2	Static	48	0.029	Active ingredient	Mithra and Abhik (2002)	789
115297	Endosulfan	35	Formulation	*Limnonectes limnocharis*	Tadpoles	25±2	Static	48	0.004	Active ingredient	Mithra and Abhik (2002)	790
115297	Endosulfan	35	Formulation	*Microhyla ornata*	Tadpoles	25±2	Static	48	0.0006	Active ingredient	Mithra and Abhik (2002)	791
115297	Endosulfan	90	Technical	*Rana tigrina*	Tadpoles	20±2	Static	48	0.0020	Active ingredient	Gopal et al (1981)	794
66330889	Endothal-mono(N,N-dimethylalkylammonium), endothall mono(N,N-dimethylalkylamine)	NR	Technical	*Bufo woodhousei fowleri*	Tadpoles	15.5±0.5	Static	48	1.8	Active ingredient	Sanders (1970)	795
72208	Endrin	NR	Technical	*Bufo woodhousei fowleri*	Tadpoles	15.5±0.5	Static	48	0.46	Active ingredient	Sanders (1970)	797
72208	Endrin	NR	Technical	*Pseudacris triseriata*	Tadpoles	15.5±0.5	Static	48	0.29	Active ingredient	Sanders (1970)	798
72208	Endrin	21.24	Formulation	*Rana temporaria*	Tadpoles	20	Static	48	0.2268	Active ingredient	Wohlgemuth (1977)	800
72208	Endrin	21.24	Formulation	*Rana temporaria*	Tadpoles	20	Static	48	0.0289	Active ingredient	Wohlgemuth (1977)	801
72208	Endrin	21.24	Formulation	*Rana temporaria*	Tadpoles	20	Static	48	0.0396	Active ingredient	Wohlgemuth (1977)	802
72208	Endrin	21.24	Formulation	*Rana temporaria*	Tadpoles	20	Static	48	0.6149	Active ingredient	Wohlgemuth (1977)	803
72208	Endrin	21.24	Formulation	*Rana temporaria*	Tadpoles	20	Static	48	0.7098	Active ingredient	Wohlgemuth (1977)	804

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72208	Endrin	21.24	Formulation	*Rana temporaria*	Tadpoles	20	Static	48	0.074	Active ingredient	Wohlgemuth (1977)	805
122145	Fenitrothion	97	Technical	*Rana clamitans*	Tadpoles	21±1	Static	48	7.8	Active ingredient	Lyons et al (1976)	809
93721	Fenoprop	NR	Technical	*Bufo woodhousei fowleri*	Tadpoles	15.5±0.5	Static	48	20	Active ingredient	Sanders (1970)	815
93721	Fenoprop	NR	Technical	*Pseudacris triseriata*	Tadpoles	15.5±0.5	Static	48	18	Active ingredient	Sanders (1970)	817
55389	Fenthion	96.8-97.2	Technical	*Bufo bufo*	Tadpoles	20±1	Static?	48	2.10	Active ingredient	Marchal-Segault (1976)	819
58899	Gamma-HCH	NR	Technical	*Bufo woodhousei fowleri*	Tadpoles	15.5±0.5	Static	48	5.4	Active ingredient	Sanders (1970)	832
58899	Gamma-HCH	NR	Technical	*Pseudacris triseriata*	Tadpoles	15.5±0.5	Static	48	3.8	Active ingredient	Sanders (1970)	833
608731	Gamma-HCH, alpha-HCH, lindane	NR	Technical	*Bufo woodhousei fowleri*	Tadpoles	15.5±0.5	Static	48	7.1	Active ingredient	Sanders (1970)	834
77182822	Glufosinate-ammonium	24.5	Formulation	*Spea bombifrons*	Tadpoles	22.28±0.09	Static?	48	3.55	Active ingredient	Dinehart et al (2010)	838
77182822	Glufosinate-ammonium	24.5	Formulation	*Spea bombifrons*	Tadpoles	19.00±0.04	Static?	48	3.70	Active ingredient	Dinehart et al (2010)	839
77182822	Glufosinate-ammonium	24.5	Formulation	*Spea multiplicata*	Tadpoles	22.28±0.09	Static?	48	5.55	Active ingredient	Dinehart et al (2010)	840
77182822	Glufosinate-ammonium	24.5	Formulation	*Spea multiplicata*	Tadpoles	19.00±0.04	Static?	48	4.85	Active ingredient	Dinehart et al (2010)	841
1071836	Glyphosate	96	Technical	*Crinia insignifera*	Adults	20±2	Renewal	48	83.6	Active ingredient	Bidwell and Gorrie (1995)	842
1071836	Glyphosate	36	Formulation	*Bufo melanostictus*	Tadpoles	NR	Static	48	16.54	Active ingredient	Jayawardena et al (2011)	843
1071836	Glyphosate	96	Technical	*Litoria moorei*	Tadpoles	20±2	Renewal	48	121.5	Active ingredient	Bidwell and Gorrie (1995)	844

CAS	Pesticide name	% a.i.	Test material	Species	Stage	Temp. (°C)	Test type	Duration (h)	LC50 (mg/L)	LC50 based on	Reference	Data line
1071836	Glyphosate	NR	Technical	*Litoria moorei*	Tadpoles	23.4-25.4	Static	48	81.2	Active ingredient	Mann & Bidwell (1999)	845
1071836	Glyphosate	36	Formulation	*Polypedates cruciger*	Tadpoles	NR	Static	48	5.40	Active ingredient	Jayawardena et al (2010)	846
1071836	Glyphosate	74.7	Formulation	*Rhinella arenarum*	Tadpoles	22 ± 2	Static	48	2.42	Active ingredient	Lajmanovich et al (2011)	847
1071836	Glyphosate	48	Formulation	*Rhinella arenarum*	Tadpoles	22 ± 2	Static	48	38.76	Active ingredient	Lajmanovich et al (2011)	848
1071836	Glyphosate	48	Formulation	*Rhinella arenarum*	Tadpoles	22 ± 2	Static	48	73.77	Active ingredient	Lajmanovich et al (2011)	849
1071836	Glyphosate	48	Formulation	*Rhinella arenarum*	Tadpoles	22 ± 2	Static	48	77.52	Active ingredient	Lajmanovich et al (2011)	850
1071836	Glyphosate	48.8	Formulation	*Spea bombifrons*	Tadpoles	22.28±0.09	Static?	48	2.03	Active ingredient	Dinehart et al (2010)	851
1071836	Glyphosate	48.8	Formulation	*Spea bombifrons*	Tadpoles	19.00±0.04	Static?	48	1.85	Active ingredient	Dinehart et al (2010)	852
1071836	Glyphosate	48.8	Formulation	*Spea multiplicata*	Tadpoles	22.28±0.09	Static?	48	2.30	Active ingredient	Dinehart et al (2010)	853
1071836	Glyphosate	48.8	Formulation	*Spea multiplicata*	Tadpoles	19.00±0.04	Static?	48	2.11	Active ingredient	Dinehart et al (2010)	854
38641940	Glyphosate isopropylamine	60.5	Technical	*Crinia insignifera*	Tadpoles	19.0-21.3	Static	48	>466	Active ingredient	Mann & Bidwell (1999)	855
38641940	Glyphosate isopropylamine	60.5	Technical	*Heleioporus eyrei*	Tadpoles	19.0-21.3	Static	48	>373	Active ingredient	Mann & Bidwell (1999)	856
38641940	Glyphosate isopropylamine	60.5	Technical	*Limnodynastes dorsalis*	Tadpoles	19.0-21.3	Static	48	>400	Active ingredient	Mann & Bidwell (1999)	857
38641940	Glyphosate isopropylamine	60.5	Technical	*Litoria moorei*	Tadpoles	23.4-25.4	Static	48	>343	Active ingredient	Mann & Bidwell (1999)	858

CAS	Pesticide name	% a.i.	Test material	Species	Stage	Temp. (°C)	Test type	Duration (h)	LC50 (mg/L)	LC50 based on	Reference	Data line
38641940	Glyphosate isopropylamine	48	Formulation	*Scinax nasicus*	Tadpoles	22±2.0	Static-renewal	48	1.59	Active ingredient (calc)	Lajmanovich et al. (2003a)	859
38641940	Glyphosate isopropylammonium	36	Formulation	*Crinia insignifera*	Adults	20±2	Renewal	48	49.4	Active ingredient	Bidwell and Gorrie (1995)	860
38641940	Glyphosate isopropylammonium	36	Formulation	*Crinia insignifera*	Juvenile	20±2	Renewal	48	51.8	Active ingredient	Bidwell and Gorrie (1995)	861
38641940	Glyphosate isopropylammonium	36	Formulation	*Crinia insignifera*	Tadpoles	19.0-21.3	Static	48	>494	Active ingredient	Mann & Bidwell (1999)	862
38641940	Glyphosate isopropylammonium	36	Formulation	*Heleioporus eyrei*	Tadpoles	19.0-21.3	Static	48	6.3	Active ingredient	Mann & Bidwell (1999)	863
38641940	Glyphosate isopropylammonium	36	Formulation	*Heleioporus eyrei*	Tadpoles	19.0-21.3	Static	48	>427	Active ingredient	Mann & Bidwell (1999)	864
38641940	Glyphosate isopropylammonium	36	Formulation	*Limnodynastes dorsalis*	Tadpoles	19.0-21.3	Static	48	3	Active ingredient	Mann & Bidwell (1999)	865
38641940	Glyphosate isopropylammonium	36	Formulation	*Limnodynastes dorsalis*	Tadpoles	19.0-21.3	Static	48	>400	Active ingredient	Mann & Bidwell (1999)	866
38641940	Glyphosate isopropylammonium	36	Formulation	*Litoria moorei*	Tadpoles	20±2	Renewal	48	11.6	Active ingredient	Bidwell and Gorrie (1995)	867
38641940	Glyphosate isopropylammonium	36	Formulation	*Litoria moorei*	Tadpoles	23.4-25.4	Static	48	2.9	Active ingredient	Mann & Bidwell (1999)	868
38641940	Glyphosate isopropylammonium	36	Formulation	*Litoria moorei*	Tadpoles	23.4-25.4	Static	48	328	Active ingredient	Mann & Bidwell (1999)	869

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81591813	Glyphosate trimesium	48	Formulation	*Crinia insignifera*	Tadpoles	19.0-21.3	Static	48	9	Active ingredient	Mann & Bidwell (1999)	870
81591813	Glyphosate trimesium	48	Formulation	*Heleioporus eyrei*	Tadpoles	19.0-21.3	Static	48	16.1	Active ingredient	Mann & Bidwell (1999)	871
81591813	Glyphosate trimesium	48	Formulation	*Limnodynastes dorsalis*	Tadpoles	19.0-21.3	Static	48	12	Active ingredient	Mann & Bidwell (1999)	872
76448	Heptachlor	NR	Technical	*Bufo woodhousei fowleri*	Tadpoles	15.5±0.5	Static	48	0.76	Active ingredient	Sanders (1970)	873
138261413	Imidacloprid	>95	Technical	*Rana limnocharis*	Tadpoles	20±1	Renewal	48	165	Active ingredient	Feng et al (2004)	875
138261413	Imidacloprid	>95	Technical	*Rana nigromaculata*	Tadpoles	20±1	Renewal	48	219	Active ingredient	Feng et al (2004)	876
121755	Malathion	NR	Formulation	*Bufo marinus*	Tadpoles	NR	Static	48	>5	Active ingredient	Tejada et al (1994)	889
121755	Malathion	NR	Technical	*Bufo woodhousei fowleri*	Tadpoles	15.5±0.5	Static	48	0.5	Active ingredient	Sanders (1970)	890
121755	Malathion	NR	Technical	*Pseudacris triseriata*	Tadpoles	15.5±0.5	Static	48	0.32	Active ingredient	Sanders (1970)	891
121755	Malathion	100	Technical	*Rana palustris*	Tadpoles	16.57±0.04	Static	48	15.2-17.7	Active ingredient	Budischak et al (2009)	894
8018017	Mancozeb	NR	Formulation	*Bufo marinus*	Tadpoles	NR	Static	48	>5	Active ingredient	Tejada et al (1994)	896
73250687	Mefenacet	99	Technical	*Silurana tropicalis*	Tadpoles	25±1	Renewal	48	2.95	Active ingredient	Saka (2010)	900
7487947	Mercuric chloride	NR	Technical (Analytical)	*Xenopus laevis*	Larvae	20±1	Static	48	0.1	Active ingredient	De Zwart and Slooff (1987)	904

CAS	Pesticide name	% a.i.	Test material	Species	Stage	Temp. (°C)	Test type	Duration (h)	LC50 (mg/L)	LC50 based on	Reference	Data line
7487947	Mercuric chloride	NR	(Technical)	*Ambystoma mexicanum*	Tadpoles	20±1	Static	48	0.4	Active ingredient	Slooff and Baerselman (1980)	907
7487947	Mercuric chloride	NR	Technical	*Bufo melanostictus*	Tadpoles	31 (29-34)	Static	48	0.0456	Active ingredient (Hg)	Khangarot and Ray (1987)	908
7487947	Mercuric chloride	NR	(Technical)	*Bufo melanostictus*	Tadpoles	22-24	Static	48	0.32	Active ingredient	Paulose (1988)	909
7487947	Mercuric chloride	NR	NR	*Microhyla ornata*	Tadpoles	25.5-26	Renewal	48	1.68	Active ingredient	Rao and Madhyastha (1987)	910
7487947	Mercuric chloride	NR	NR	*Microhyla ornata*	Tadpoles	25.5-26	Renewal	48	2.07	Active ingredient	Rao and Madhyastha (1987)	911
7487947	Mercuric chloride	NR	(Technical)	*Rana breviceps*	Tadpoles	22-24	Static	48	0.45	Active ingredient	Paulose (1988)	912
7487947	Mercuric chloride	NR	Technical (Reagent grade)	*Rana hexadactyla*	Tadpoles	15 (13-16)	Renewal	48	0.121	Active ingredient (Hg)	Khangarot et al (1985b)	913
7487947	Mercuric chloride	NR	(Technical)	*Xenopus laevis*	Tadpoles	20±1	Static	48	0.1	Active ingredient	Slooff and Baerselman (1980)	914
72435	Methoxychlor	98	Technical	*Bufo woodhousei fowleri*	Tadpoles	15	Static	48	0.1	Active ingredient	Mayer and Ellersieck (1986)	917
72435	Methoxychlor	NR	Technical	*Bufo woodhousei fowleri*	Tadpoles	15.5±0.5	Static	48	0.11	Active ingredient	Sanders (1970)	918
72435	Methoxychlor	NR	Technical	*Pseudacris triseriata*	Tadpoles	15.5±0.5	Static	48	0.42	Active ingredient	Sanders (1970)	919
51218452	Metolachlor	97.2	Technical	*Rana catesbeiana*	Tadpoles	15	NR	48	17	Active ingredient	Wan et al (2006)	921

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2212671	Molinate	NR	Technical	*Bufo woodhousei fowleri*	Tadpoles	15.5±0.5	Static	48	28	Active ingredient	Sanders (1970)	925
6923224	Monocrotophos	NR	Formulation	*Bufo marinus*	Tadpoles	NR	Static	48	60.7	Active ingredient	Tejada et al (1994)	927
94804	NA	NR	Technical	*Rhinella arenarum*	Tadpoles	20±1	Static	48	0.10	Active ingredient (Cu)	Perez-Coll and Herkovits (2006)	929
300765	Naled	NR	Technical	*Pseudacris triseriata*	Tadpoles	15.5±0.5	Static	48	2	Active ingredient	Sanders (1970)	930
1420048	Niclosamide	NR	Formulation	*Rana catesbeiana*	Tadpoles	24±1	Static	48	0.16	Active ingredient	Oliveira-Filho and Paumgartten (2000)	931
76738620	Paclobutrazol	98.25	Technical	*Bufo bufo gargarizans*	Tadpoles	22±1	Renewal	48	14.4	Active ingredient	Liu et al (1995)	939
76738620	Paclobutrazol	98.25	Technical	*Bufo bufo gargarizans*	Tadpoles	22±1	Renewal	48	14.4	Active ingredient	Liu et al (1996)	940
4685147	Paraquat	99	Technical (Analytical grade)	*Xenopus laevis*	Embryos	24 (23-25)	Static-renewal	48	14.55	Active ingredient	Osano et al. (2002a)	941
1910425	Paraquat dichloride	NR	Technical	*Bufo woodhousei fowleri*	Tadpoles	15.5±0.5	Static	48	25	Active ingredient	Sanders (1970)	946
1910425	Paraquat dichloride	NR	Technical	*Pseudacris triseriata*	Tadpoles	15.5±0.5	Static	48	37	Active ingredient	Sanders (1970)	947
1910425	Paraquat dichloride	27.6	Formulation	*Scinax nasica*	Tadpoles	16±1	Static-renewal	48	29.97	Active ingredient	Lajmanovich et al. (1998)	948
56382	Parathion	NR	Technical	*Pseudacris triseriata*	Tadpoles	15.5±0.5	Static	48	1.4	Active ingredient	Sanders (1970)	951
298000	Parathion-methyl, methyl parathion	50	Formulation	*Rana cyanophlyctis*	Adults	23±0.2	Renewal	48	17.7	Active ingredient	Mudgall and Patil (1987)	953

CAS	Pesticide name	% a.i.	Test material	Species	Stage	Temp. (°C)	Test type	Duration (h)	LC50 (mg/L)	LC50 based on	Reference	Data line
298000	Parathion-methyl, methyl parathion	50	Formulation	*Rana cyanophlyctis*	Adults	23±0.2	Renewal	48	24.0	Active ingredient	Mudgall and Patil (1987)	954
298000	Parathion-methyl, methyl parathion	NR	Formulation	*Bufo marinus*	Tadpoles	NR	Static	48	5.0	Active ingredient	Tejada et al (1994)	955
298000	Parathion-methyl, methyl parathion	99	Technical	*Rana limnocharis*	Tadpoles	20±1	Static	48	3.3	Active ingredient	Zeng et al (2003)	957
298000	Parathion-methyl, methyl parathion	99	Technical	*Rana tigrina*	Tadpoles	20-21	Static	48	3.9	Active ingredient	Luo et al (2003)	959
87865	Pentachlorophenol	NR	Technical	*Ambystoma mexicanum*	Adults	NR	Static	48	0.3	Active ingredient	Office of Pesticide Programs (2000)	960
87865	Pentachlorophenol	NR	(Technical)	*Ambystoma mexicanum*	Tadpoles	20±1	Static	48	0.30	Active ingredient	Slooff and Baerselman (1980)	963
87865	Pentachlorophenol	99	Technical	*Bufo boreas*	Tadpoles	22	Static	48	0.54	Active ingredient	Dwyer et al (1999)	964
87865	Pentachlorophenol	NR	(Technical)	*Xenopus laevis*	Tadpoles	20±1	Static	48	0.26	Active ingredient	Slooff and Baerselman (1980)	965
52645531	Permethrin	95.2	Technical	*Bufo boreas*	Tadpoles	22	Static	48	>10	Active ingredient	Dwyer et al (1999)	974
51036	Piperonyl butoxide	NR	Technical	*Pseudacris triseriata*	Tadpoles	15.5±0.5	Static	48	1.3	Active ingredient	Sanders (1970)	985
23103982	Pirimicarb	50	Formulation	*Rhinella arenarum*	Tadpoles	25±1	Renewal	48	111.80	Active ingredient	Candioti et al (2010)	986
23103982	Pirimicarb	50	Formulation	*Rhinella arenarum*	Tadpoles	25±1	Renewal	48	102.85	Active ingredient	Candioti et al (2010)	987

CAS	Pesticide name	% a.i.	Test material	Species	Stage	Temp. (°C)	Test type	Duration (h)	LC50 (mg/L)	LC50 based on	Reference	Data line
41198087	Profenofos	40	Formulation	*Rana spinosa*	Tadpoles	21±1	Renewal	48	1.14	Active ingredient	Li et al (2010)	991
709988	Propanil	43.5	Formulation	*Xenopus laevis*	NR	25±1	Static	48	8.13	Active ingredient	Moore et al (1998)	996
709988	Propanil	43.5	Formulation	*Xenopus laevis*	NR	25±1	Static	48	8.15	Active ingredient	Moore et al (1998)	997
709988	Propanil	43.5	Formulation	*Xenopus laevis*	NR	25±1	Static	48	8.23	Active ingredient	Moore et al (1998)	998
709988	Propanil	36	Formulation	*Bufo melanostictus*	Tadpoles	NR	Static	48	0.53	Active ingredient	Jayawardena et al (2011)	1000
709988	Propanil	36	Formulation	*Polypedates cruciger*	Tadpoles	NR	Static	48	0.80	Active ingredient	Jayawardena et al (2010)	1001
122349	Simazine	89	Formulation	*Rana catesbeiana*	Tadpoles	15	NR	48	>2000	Formulation	Wan et al (2006)	1030
1014706	Simetryn	99.9	Technical	*Silurana tropicalis*	Tadpoles	25±1	Renewal	48	10.68	Active ingredient	Saka (2010)	1031
131522	Sodium pentachlorophenoxide	90	Technical	*Ambystoma mexicanum*	Larvae	20±1	Renewal	48	0.23	Active ingredient	Saka (2003)	1033
131522	Sodium pentachlorophenoxide	90	Technical	*Ambystoma mexicanum*	Larvae	20±1	Renewal	48	0.21	Active ingredient	Saka (2003)	1034
131522	Sodium pentachlorophenoxide	90	Technical	*Ambystoma mexicanum*	Larvae	20±1	Renewal	48	0.26	Active ingredient	Saka (2003)	1035
131522	Sodium pentachlorophenoxide	90	Technical	*Ambystoma mexicanum*	Larvae	20±1	Renewal	48	0.21	Active ingredient	Saka (2003)	1036
131522	Sodium pentachlorophenoxide	90	Technical	*Ambystoma mexicanum*	Larvae	20±1	Renewal	48	0.19	Active ingredient	Saka (2003)	1037

CAS	Pesticide name	% a.i.	Test material	Species	Stage	Temp. (°C)	Test type	Duration (h)	LC50 (mg/L)	LC50 based on	Reference	Data line
131522	Sodium pentachlorophenoxide	90	Technical	*Ambystoma mexicanum*	Larvae	20±1	Renewal	48	0.18	Active ingredient	Saka (2003)	1038
131522	Sodium pentachlorophenoxide	90	Technical	*Ambystoma mexicanum*	Larvae	20±1	Renewal	48	0.17	Active ingredient	Saka (2003)	1039
131522	Sodium pentachlorophenoxide	90	Technical	*Ambystoma mexicanum*	Larvae	20±1	Renewal	48	0.14	Active ingredient	Saka (2003)	1040
131522	Sodium pentachlorophenoxide	90	Technical	*Ambystoma mexicanum*	Larvae	20±1	Renewal	48	0.23	Active ingredient	Saka (2003)	1041
131522	Sodium pentachlorophenoxide	90	Technical	*Bufo japonicus formosus*	Larvae	20±1	Renewal	48	0.29	Active ingredient	Saka (1999)	1042
131522	Sodium pentachlorophenoxide	90	Technical	*Bufo japonicus formosus*	Larvae	20±1	Renewal	48	0.15	Active ingredient	Saka (1999)	1043
131522	Sodium pentachlorophenoxide	90	Technical	*Bufo japonicus formosus*	Larvae	20±1	Renewal	48	0.12	Active ingredient	Saka (1999)	1044
131522	Sodium pentachlorophenoxide	90	Technical	*Cynops pyrrhogaster*	Larvae	20±1	Renewal	48	0.27	Active ingredient	Saka (1999)	1045
131522	Sodium pentachlorophenoxide	90	Technical	*Cynops pyrrhogaster*	Larvae	20±1	Renewal	48	0.14	Active ingredient	Saka (1999)	1046
131522	Sodium pentachlorophenoxide	90	Technical	*Cynops pyrrhogaster*	Larvae	20±1	Renewal	48	0.10	Active ingredient	Saka (1999)	1047
131522	Sodium pentachlorophenoxide	90	Technical	*Hyla japonica*	Larvae	20±1	Renewal	48	0.18	Active ingredient	Saka (1999)	1048

CAS	Pesticide name	% a.i.	Test material	Species	Stage	Temp. (°C)	Test type	Duration (h)	LC50 (mg/L)	LC50 based on	Reference	Data line
131522	Sodium pentachlorophenoxide	90	Technical	*Hyla japonica*	Larvae	20±1	Renewal	48	0.17	Active ingredient	Saka (1999)	1049
131522	Sodium pentachlorophenoxide	90	Technical	*Hyla japonica*	Larvae	20±1	Renewal	48	0.22	Active ingredient	Saka (1999)	1050
131522	Sodium pentachlorophenoxide	90	Technical	*Rana nigromaculata*	Larvae	20±1	Renewal	48	0.21	Active ingredient	Saka (1999)	1051
131522	Sodium pentachlorophenoxide	90	Technical	*Rana nigromaculata*	Larvae	20±1	Renewal	48	0.12	Active ingredient	Saka (1999)	1052
131522	Sodium pentachlorophenoxide	90	Technical	*Rana nigromaculata*	Larvae	20±1	Renewal	48	0.12	Active ingredient	Saka (1999)	1053
131522	Sodium pentachlorophenoxide	90	Technical	*Rhacophorus arboreus*	Larvae	20±1	Renewal	48	0.29	Active ingredient	Saka (1999)	1054
131522	Sodium pentachlorophenoxide	90	Technical	*Rhacophorus arboreus*	Larvae	20±1	Renewal	48	0.21	Active ingredient	Saka (1999)	1055
131522	Sodium pentachlorophenoxide	90	Technical	*Xenopus laevis*	Larvae	20±1	Renewal	48	0.26	Active ingredient	Saka (1999)	1056
131522	Sodium pentachlorophenoxide	90	Technical	*Xenopus laevis*	Larvae	20±1	Renewal	48	0.21	Active ingredient	Saka (1999)	1057
131522	Sodium pentachlorophenoxide	90	Technical	*Xenopus laevis*	Larvae	20±1	Renewal	48	0.17	Active ingredient	Saka (1999)	1058
131522	Sodium pentachlorophenoxide	90	Technical	*Xenopus laevis*	Larvae	20±1	Renewal	48	0.30	Active ingredient	Saka (2003)	1059

CAS	Pesticide name	% a.i.	Test material	Species	Stage	Temp. (°C)	Test type	Duration (h)	LC50 (mg/L)	LC50 based on	Reference	Data line
131522	Sodium pentachlorophenoxide	90	Technical	*Xenopus laevis*	Larvae	20±1	Renewal	48	0.28	Active ingredient	Saka (2003)	1060
131522	Sodium pentachlorophenoxide	90	Technical	*Xenopus laevis*	Larvae	20±1	Renewal	48	0.24	Active ingredient	Saka (2003)	1061
131522	Sodium pentachlorophenoxide	90	Technical	*Xenopus laevis*	Larvae	20±1	Renewal	48	0.22	Active ingredient	Saka (2003)	1062
131522	Sodium pentachlorophenoxide	90	Technical	*Xenopus laevis*	Larvae	20±1	Renewal	48	0.22	Active ingredient	Saka (2003)	1063
131522	Sodium pentachlorophenoxide	90	Technical	*Xenopus laevis*	Larvae	20±1	Renewal	48	0.22	Active ingredient	Saka (2003)	1064
131522	Sodium pentachlorophenoxide	90	Technical	*Xenopus laevis*	Larvae	20±1	Renewal	48	0.18	Active ingredient	Saka (2003)	1065
131522	Sodium pentachlorophenoxide	90	Technical	*Xenopus laevis*	Larvae	20±1	Renewal	48	0.17	Active ingredient	Saka (2003)	1066
131522	Sodium pentachlorophenoxide	90	Technical	*Xenopus laevis*	Larvae	20±1	Renewal	48	0.16	Active ingredient	Saka (2003)	1067
131522	Sodium pentachlorophenoxide	90	Technical	*Xenopus laevis*	Larvae	20±1	Renewal	48	0.15	Active ingredient	Saka (2003)	1068
131522	Sodium pentachlorophenoxide	90	Technical	*Xenopus laevis*	Larvae	20±1	Renewal	48	0.16	Active ingredient	Saka (2003)	1069
131522	Sodium pentachlorophenoxide	90	Technical	*Xenopus laevis*	Larvae	20±1	Renewal	48	0.13	Active ingredient	Saka (2003)	1070

CAS	Pesticide name	% a.i.	Test material	Species	Stage	Temp. (°C)	Test type	Duration (h)	LC50 (mg/L)	LC50 based on	Reference	Data line
131522	Sodium pentachlorophenoxide	90	Technical	*Xenopus laevis*	Larvae	20±1	Renewal	48	0.21	Active ingredient	Saka (2003)	1071
131522	Sodium pentachlorophenoxide	NR	Technical (Reagent grade)	*Rana hexadactyla*	Tadpoles	14 (12-17)	Renewal	48	0.0376	Active ingredient	Khangarot et al (1985c)	1075
72548	TDE	NR	Technical	*Bufo woodhousei fowleri*	Tadpoles	15.5±0.5	Static	48	0.32	Active ingredient	Sanders (1970)	1084
72548	TDE	NR	Technical	*Pseudacris triseriata*	Tadpoles	15.5±0.5	Static	48	0.5	Active ingredient	Sanders (1970)	1085
28249776	Thiobencarb	50	Formulation	*Bufo japonicus formosus*	Larvae	20±1	Renewal	48	2.74	Active ingredient	Saka (1999)	1087
28249776	Thiobencarb	50	Formulation	*Bufo japonicus formosus*	Larvae	20±1	Renewal	48	2.85	Active ingredient	Saka (1999)	1088
28249776	Thiobencarb	50	Formulation	*Bufo japonicus formosus*	Larvae	20±1	Renewal	48	2.54	Active ingredient	Saka (1999)	1089
28249776	Thiobencarb	50	Formulation	*Cynops pyrrhogaster*	Larvae	20±1	Renewal	48	4.16	Active ingredient	Saka (1999)	1090
28249776	Thiobencarb	50	Formulation	*Cynops pyrrhogaster*	Larvae	20±1	Renewal	48	3.53	Active ingredient	Saka (1999)	1091
28249776	Thiobencarb	50	Formulation	*Cynops pyrrhogaster*	Larvae	20±1	Renewal	48	4.43	Active ingredient	Saka (1999)	1092
28249776	Thiobencarb	99	Technical	*Cynops pyrrhogaster*	Larvae	20±1	Renewal	48	3.32	Active ingredient	Saka (1999)	1093
28249776	Thiobencarb	50	Formulation	*Hyla japonica*	Larvae	20±1	Renewal	48	3.77	Active ingredient	Saka (1999)	1094
28249776	Thiobencarb	50	Formulation	*Hyla japonica*	Larvae	20±1	Renewal	48	3.27	Active ingredient	Saka (1999)	1095
28249776	Thiobencarb	50	Formulation	*Hyla japonica*	Larvae	20±1	Renewal	48	3.20	Active ingredient	Saka (1999)	1096
28249776	Thiobencarb	50	Formulation	*Rana nigromaculata*	Larvae	20±1	Renewal	48	3.59	Active ingredient	Saka (1999)	1097

CAS	Pesticide name	% a.i.	Test material	Species	Stage	Temp. (°C)	Test type	Duration (h)	LC50 (mg/L)	LC50 based on	Reference	Data line
28249776	Thiobencarb	50	Formulation	*Rana nigromaculata*	Larvae	20±1	Renewal	48	2.50	Active ingredient	Saka (1999)	1098
28249776	Thiobencarb	50	Formulation	*Rana nigromaculata*	Larvae	20±1	Renewal	48	2.50	Active ingredient	Saka (1999)	1099
28249776	Thiobencarb	50	Formulation	*Rhacophorus arboreus*	Larvae	20±1	Renewal	48	3.68	Active ingredient	Saka (1999)	1100
28249776	Thiobencarb	50	Formulation	*Rhacophorus arboreus*	Larvae	20±1	Renewal	48	3.11	Active ingredient	Saka (1999)	1101
28249776	Thiobencarb	50	Formulation	*Xenopus laevis*	Larvae	20±1	Renewal	48	3.81	Active ingredient	Saka (1999)	1102
28249776	Thiobencarb	50	Formulation	*Xenopus laevis*	Larvae	20±1	Renewal	48	2.92	Active ingredient	Saka (1999)	1103
28249776	Thiobencarb	50	Formulation	*Xenopus laevis*	Larvae	20±1	Renewal	48	2.37	Active ingredient	Saka (1999)	1104
28249776	Thiobencarb	99	Technical	*Xenopus laevis*	Larvae	20±1	Renewal	48	3.36	Active ingredient	Saka (1999)	1105
28249776	Thiobencarb	98	Technical	*Silurana tropicalis*	Tadpoles	25±1	Renewal	48	1.16	Active ingredient	Saka (2010)	1108
59669260	Thiodicarb	NR	Formulation	*Bufo marinus*	Tadpoles	NR	Static	48	>5	Active ingredient	Tejada et al (1994)	1111
23564058	Thiophanate-methyl	96.2	Technical	*Triturus carnifex*	Adults	NR	NR	48	0.0096	Active ingredient	Capaldo et al (2006)	1114
137268	Thiram	80	Formulation	*Xenopus laevis*	Tadpoles	20±0.5	NR	48	0.014	Active ingredient	Seuge et al (1983)	1115
137268	Thiram	80	Formulation	*Xenopus laevis*	Tadpoles	20±0.5	NR	48	0.022	Active ingredient	Seuge et al (1983)	1116
78488	Tribufos	NR	Technical	*Bufo woodhousei fowleri*	Tadpoles	15.5±0.5	Static	48	0.76	Active ingredient	Sanders (1970)	1118
1582098	Trifluralin	50	Formulation	*Bombina bombina*	Larvae	22±1	Renewal	48	28.5	Active ingredient	Sayim (2010)	1124

CAS	Pesticide name	% a.i.	Test material	Species	Stage	Temp. (°C)	Test type	Duration (h)	LC50 (mg/L)	LC50 based on	Reference	Data line
1582098	Trifluralin	NR	Technical	*Bufo woodhousei fowleri*	Tadpoles	15.5±0.5	Static	48	0.17	Active ingredient	Sanders (1970)	1126

K. SELECTED 72H LC50 DATA

Table 83: 72h LC50 data for amphibians.

CAS	Pesticide name	% a.i.	Test material	Species	Stage	Temp. (°C)	Test type	Duration (h)	LC50 (mg/L)	LC50 based on	Reference	Data line
94757	2,4-D	99	Technical	*Rhinella arenarum*	Embryos	20±2	Renewal	72	9.55	Active ingredient	Aronzon et al (2011)	1135
94757	2,4-D	(79.7 g/100 cm^3 a.e.)	Formulation	*Rhinella arenarum*	Embryos	20±2	Renewal	72	3.46	Active ingredient	Aronzon et al (2011)	1136
94757	2,4-D	99	Technical	*Rhinella arenarum*	Tadpoles	20±2	Renewal	72	13.49	Active ingredient	Aronzon et al (2011)	1137
94757	2,4-D	(79.7 g/100 cm^3 a.e.)	Formulation	*Rhinella arenarum*	Tadpoles	20±2	Renewal	72	3.01	Active ingredient	Aronzon et al (2011)	1138
2032599	Aminocarb	75	Technical	*Rana clamitans*	Tadpoles	21±1	Static	72	161	Active ingredient	Lyons et al (1976)	1140
33089611	Amitraz	97.5	Technical (Analytical)	*Xenopus laevis*	Embryos	24 (23-25)	Static-renewal	72	5<LC50<10	Active ingredient	Osano et al. (2002a)	1141
1327533	Arsenous oxide	NR	Technical (Reagent grade)	*Rana hexadactyla*	Tadpoles	15 (13-16)	Renewal	72	0.27	Active ingredient (As)	Khangarot et al (1985b)	1142
1912249	Atrazine	98	Technical	*Rana catesbeiana*	Tadpoles	15	NR	72	>16	Active ingredient	Wan et al (2006)	1144
1912249	Atrazine	48.5	Formulation	*Rana catesbeiana*	Tadpoles	15	NR	72	>480	Formulation	Wan et al (2006)	1145
23184669	Butachlor	50	Formulation	*Fejervarya multistriata*	Tadpoles	21-27	Renewal	72	1.36	Formulation	Geng et al (2005)	1149

CAS	Pesticide name	% a.i.	Test material	Species	Stage	Temp. (°C)	Test type	Duration (h)	LC50 (mg/L)	LC50 based on	Reference	Data line
23184669	Butachlor	50	Formulation	*Microhyla ornata*	Tadpoles	21-27	Renewal	72	0.61	Formulation	Geng et al (2005)	1150
23184669	Butachlor	50	Formulation	*Polypedates megacephalus*	Tadpoles	21-27	Renewal	72	1.70	Formulation	Geng et al (2005)	1151
63252	Carbaryl	50	Formulation	*Rana tigrina*	NR	NR	Static	72	6.7	Active ingredient	Marian et al (1983)	1152
63252	Carbaryl	99.7	Technical	*Bufo boreas*	Tadpoles	22	Static	72	>21	Active ingredient	Dwyer et al (1999)	1153
63252	Carbaryl	97-99	Technical	*Bufo bufo*	Tadpoles	20±1	Static?	72	18.70	Active ingredient	Marchal-Segault (1976)	1154
63252	Carbaryl	99.7	Technical	*Rana clamitans*	Tadpoles	27	Static	72	14.88	Active ingredient	Boone and Bridges (1999)	1155
63252	Carbaryl	99.7	Technical	*Rana clamitans*	Tadpoles	22	Static	72	20.02	Active ingredient	Boone and Bridges (1999)	1156
63252	Carbaryl	99.7	Technical	*Rana clamitans*	Tadpoles	17	Static	72	24.8	Active ingredient	Boone and Bridges (1999)	1157
2921882	Chlorpyrifos	40	Formulation	*Bufo bufo gargarizans*	Tadpoles	20.5-22.5	Renewal	72	0.82	Active ingredient	Yin et al (2009)	1163
1332407	Copper oxychloride	99	Formulation	*Rana catesbeiana*	Tadpoles	22.7±0.9	Static	72	2.8	Active ingredient	Ferreira et al (2004)	1165
1332407	Copper oxychloride	99	Formulation	*Rana catesbeiana*	Tadpoles	23.71±0.35	Static	72	13.45	Active ingredient	Lombardi et al (2002)	1166
7758987	Copper sulfate	NR	Technical	*Bufo woodhousei fowleri*	Eggs	20-24	Renewal	72	35.99	Active ingredient (Cu)	Birge and Black (1979)	1167
7758987	Copper sulfate	NR	Technical	*Gastrophryne carolinensis*	Eggs	20-24	Renewal	72	0.05	Active ingredient (Cu)	Birge and Black (1979)	1168

CAS	Pesticide name	% a.i.	Test material	Species	Stage	Temp. (°C)	Test type	Duration (h)	LC50 (mg/L)	LC50 based on	Reference	Data line
7758987	Copper sulfate	NR	Technical	*Hyla chrysoscelis*	Eggs	20-24	Renewal	72	0.06	Active ingredient (Cu)	Birge and Black (1979)	1169
7758987	Copper sulfate	NR	(Technical)	*Rana pipiens*	Eggs	19.4 (SD 1.2)	Renewal	72	0.15	Active ingredient (Cu)	Lande and Guttman (1973)	1170
7758987	Copper sulfate	25.5	Technical	*Bufo boreas*	Tadpoles	22	Static	72	0.14	Active ingredient	Dwyer et al (1999)	1171
7758987	Copper sulfate	NR	Technical	*Lithobates catesbeianus*	Tadpoles	21±2	Renewal	72	6.89	Active ingredient	Ossana et al (2010)	1172
7758987	Copper sulfate	NR	NR	*Microhyla ornata*	Tadpoles	25.5-26	Renewal	72	5.14	Active ingredient	Rao and Madhyastha (1987)	1173
7758987	Copper sulfate	NR	NR	*Microhyla ornata*	Tadpoles	25.5-26	Renewal	72	5.54	Active ingredient	Rao and Madhyastha (1987)	1174
7758987	Copper sulfate	NR	Technical (Reagent grade)	*Rana hexadactyla*	Tadpoles	15 (13-17)	Renewal	72	0.039	Active ingredient (Cu)	Khangarot et al (1984)	1175
52315078	Cypermethrin	10	Formulation	*Bufo melanostictus*	Tadpoles	20	Static	72	0.0090	Active ingredient	Saha and Kaviraj (2008)	1179
52315078	Cypermethrin	10	Formulation	*Bufo melanostictus*	Tadpoles	20	Static	72	0.0060	Active ingredient	Saha and Kaviraj (2008)	1180
52315078	Cypermethrin	25	Formulation	*Physalaemus biligonigerus*	Tadpoles	22±2	Renewal	72	0.253	Active ingredient	Izaguirre et al (2000)	1181
50293	DDT	NR	Technical	*Bufo bufo*	Tadpoles	20±1	Static?	72	0.40	Active ingredient	Marchal-Segault (1976)	1182
52918635	Deltamethrin	99-99.8	Technical	*Rhinella arenarum*	NR	20±1	Renewal	72	0.0120	Active ingredient	Salibian (1992)	1183
52918635	Deltamethrin	99-99.8	Technical	*Rhinella arenarum*	NR	20±1	Renewal	72	0.0071	Active ingredient	Salibian (1992)	1184
62737	Dichlorvos	80	Formulation	*Bufo melanostictus*	Tadpoles	21-27	Renewal	72	54.91	Formulation	Geng et al (2005)	1186

CAS	Pesticide name	% a.i.	Test material	Species	Stage	Temp. (°C)	Test type	Duration (h)	LC50 (mg/L)	LC50 based on	Reference	Data line
62737	Dichlorvos	80	Formulation	*Fejervarya multistriata*	Tadpoles	21-27	Renewal	72	12.83	Formulation	Geng et al (2005)	1187
62737	Dichlorvos	80	Formulation	*Polypedates megacephalus*	Tadpoles	21-27	Renewal	72	17.45	Formulation	Geng et al (2005)	1188
60515	Dimethoate	30	Formulation	*Rana cyanophlyctis*	Adults	23±0.2	Renewal	72	39.0	Active ingredient	Mudgall and Patil (1987)	1189
60515	Dimethoate	30	Formulation	*Rana cyanophlyctis*	Adults	23±0.2	Renewal	72	41.2	Active ingredient	Mudgall and Patil (1987)	1190
115297	Endosulfan	35	Formulation	*Bufo melanostictus*	Tadpoles	25±2	Renewal	72	0.022	Active ingredient	Mithra and Abhik (2002)	1194
115297	Endosulfan	35	Formulation	*Limnonectes limnocharis*	Tadpoles	25±2	Renewal	72	0.0014	Active ingredient	Mithra and Abhik (2002)	1195
115297	Endosulfan	35	Formulation	*Microhyla ornata*	Tadpoles	25±2	Renewal	72	0.00025	Active ingredient	Mithra and Abhik (2002)	1196
72208	Endrin	21.24	Formulation	*Rana temporaria*	Tadpoles	20	Static	72	0.0147	Active ingredient	Wohlgemuth (1977)	1199
72208	Endrin	21.24	Formulation	*Rana temporaria*	Tadpoles	20	Static	72	0.0172	Active ingredient	Wohlgemuth (1977)	1200
72208	Endrin	21.24	Formulation	*Rana temporaria*	Tadpoles	20	Static	72	0.0243	Active ingredient	Wohlgemuth (1977)	1201
72208	Endrin	21.24	Formulation	*Rana temporaria*	Tadpoles	20	Static	72	0.2875	Active ingredient	Wohlgemuth (1977)	1202
72208	Endrin	21.24	Formulation	*Rana temporaria*	Tadpoles	20	Static	72	0.4253	Active ingredient	Wohlgemuth (1977)	1203
72208	Endrin	21.24	Formulation	*Rana temporaria*	Tadpoles	20	Static	72	0.0505	Active ingredient	Wohlgemuth (1977)	1204
122145	Fenitrothion	97	Technical	*Rana clamitans*	Tadpoles	21±1	Static	72	6.2	Active ingredient	Lyons et al (1976)	1206
55389	Fenthion	96.8-97.2	Technical	*Bufo bufo*	Tadpoles	20±1	Static?	72	2.00	Active ingredient	Marchal-Segault (1976)	1207
1071836	Glyphosate	96	Technical	*Crinia insignifera*	Adults	20±2	Renewal	72	72.0	Active ingredient	Bidwell and Gorrie (1995)	1210

CAS	Pesticide name	% a.i.	Test material	Species	Stage	Temp. (°C)	Test type	Duration (h)	LC50 (mg/L)	LC50 based on	Reference	Data line
1071836	Glyphosate	96	Technical	*Litoria moorei*	Tadpoles	20±2	Renewal	72	116.0	Active ingredient	Bidwell and Gorrie (1995)	1211
38641940	Glyphosate isopropylamine	48	Formulation	*Scinax nasicus*	Tadpoles	22±2.0	Static-renewal	72	1.55	Active ingredient (calc)	Lajmanovich et al. (2003a)	1212
38641940	Glyphosate isopropylammonium	36	Formulation	*Crinia insignifera*	Adults	20±2	Renewal	72	44.2	Active ingredient	Bidwell and Gorrie (1995)	1213
38641940	Glyphosate isopropylammonium	36	Formulation	*Litoria moorei*	Tadpoles	20±2	Renewal	72	10.6	Active ingredient	Bidwell and Gorrie (1995)	1214
138261413	Imidacloprid	>95	Technical	*Rana limnocharis*	Tadpoles	20±1	Renewal	72	116	Active ingredient	Feng et al (2004)	1215
138261413	Imidacloprid	>95	Technical	*Rana nigromaculata*	Tadpoles	20±1	Renewal	72	177	Active ingredient	Feng et al (2004)	1216
73250687	Mefenacet	99	Technical	*Silurana tropicalis*	Tadpoles	25±1	Renewal	72	2.79	Active ingredient	Saka (2010)	1222
7487947	Mercuric chloride	NR	NR	*Microhyla ornata*	Tadpoles	25.5-26	Renewal	72	1.19	Active ingredient	Rao and Madhyastha (1987)	1225
7487947	Mercuric chloride	NR	NR	*Microhyla ornata*	Tadpoles	25.5-26	Renewal	72	1.74	Active ingredient	Rao and Madhyastha (1987)	1226
7487947	Mercuric chloride	NR	Technical (Reagent grade)	*Rana hexadactyla*	Tadpoles	15 (13-16)	Renewal	72	0.068	Active ingredient (Hg)	Khangarot et al (1985b)	1227
51218452	Metolachlor	97.2	Technical	*Rana catesbeiana*	Tadpoles	15	NR	72	16	Active ingredient	Wan et al (2006)	1228
76738620	Paclobutrazol	98.25	Technical	*Bufo bufo gargarizans*	Tadpoles	22±1	Renewal	72	11	Active ingredient	Liu et al (1995)	1233
76738620	Paclobutrazol	98.25	Technical	*Bufo bufo gargarizans*	Tadpoles	22±1	Renewal	72	11	Active ingredient	Liu et al (1996)	1234

CAS	Pesticide name	% a.i.	Test material	Species	Stage	Temp. (°C)	Test type	Duration (h)	LC50 (mg/L)	LC50 based on	Reference	Data line
4685147	Paraquat	99	Technical (Analytical grade)	*Xenopus laevis*	Embryos	24 (23-25)	Static-renewal	72	3.3	Active ingredient	Osano et al. (2002a)	1235
1910425	Paraquat dichloride	27.6	Formulation	*Scinax nasica*	Tadpoles	16±1	Static-renewal	72	24.95	Active ingredient	Lajmanovich et al. (1998)	1236
298000	Parathion-methyl, methyl parathion	50	Formulation	*Rana cyanophlyctis*	Adults	23±0.2	Renewal	72	13.1	Active ingredient	Mudgall and Patil (1987)	1237
298000	Parathion-methyl, methyl parathion	50	Formulation	*Rana cyanophlyctis*	Adults	23±0.2	Renewal	72	13.8	Active ingredient	Mudgall and Patil (1987)	1238
298000	Parathion-methyl, methyl parathion	99	Technical	*Rana tigrina*	Tadpoles	20-21	Static	72	3.3	Active ingredient	Luo et al (2003)	1240
87865	Pentachlorophenol	99	Technical	*Bufo boreas*	Tadpoles	22	Static	72	0.52	Active ingredient	Dwyer et al (1999)	1241
52645531	Permethrin	95.2	Technical	*Bufo boreas*	Tadpoles	22	Static	72	>10	Active ingredient	Dwyer et al (1999)	1242
23103982	Pirimicarb	50	Formulation	*Rhinella arenarum*	Tadpoles	25±1	Renewal	72	111.80	Active ingredient	Candioti et al (2010)	1245
23103982	Pirimicarb	50	Formulation	*Rhinella arenarum*	Tadpoles	25±1	Renewal	72	74.85	Active ingredient	Candioti et al (2010)	1246
41198087	Profenofos	40	Formulation	*Rana spinosa*	Tadpoles	21±1	Renewal	72	0.77	Active ingredient	Li et al (2010)	1248
122349	Simazine	89	Formulation	*Rana catesbeiana*	Tadpoles	15	NR	72	2000	Formulation	Wan et al (2006)	1253
1014706	Simetryn	99.9	Technical	*Silurana tropicalis*	Tadpoles	25±1	Renewal	72	4.44	Active ingredient	Saka (2010)	1254
131522	Sodium pentachlorophenoxide	90	Technical	*Ambystoma mexicanum*	Larvae	20±1	Renewal	72	0.21	Active ingredient	Saka (2003)	1255

CAS	Pesticide name	% a.i.	Test material	Species	Stage	Temp. (°C)	Test type	Duration (h)	LC50 (mg/L)	LC50 based on	Reference	Data line
131522	Sodium pentachlorophenoxide	90	Technical	*Ambystoma mexicanum*	Larvae	20±1	Renewal	72	0.21	Active ingredient	Saka (2003)	1256
131522	Sodium pentachlorophenoxide	90	Technical	*Ambystoma mexicanum*	Larvae	20±1	Renewal	72	0.23	Active ingredient	Saka (2003)	1257
131522	Sodium pentachlorophenoxide	90	Technical	*Ambystoma mexicanum*	Larvae	20±1	Renewal	72	0.14	Active ingredient	Saka (2003)	1258
131522	Sodium pentachlorophenoxide	90	Technical	*Ambystoma mexicanum*	Larvae	20±1	Renewal	72	0.19	Active ingredient	Saka (2003)	1259
131522	Sodium pentachlorophenoxide	90	Technical	*Ambystoma mexicanum*	Larvae	20±1	Renewal	72	0.18	Active ingredient	Saka (2003)	1260
131522	Sodium pentachlorophenoxide	90	Technical	*Ambystoma mexicanum*	Larvae	20±1	Renewal	72	0.17	Active ingredient	Saka (2003)	1261
131522	Sodium pentachlorophenoxide	90	Technical	*Ambystoma mexicanum*	Larvae	20±1	Renewal	72	0.14	Active ingredient	Saka (2003)	1262
131522	Sodium pentachlorophenoxide	90	Technical	*Ambystoma mexicanum*	Larvae	20±1	Renewal	72	0.21	Active ingredient	Saka (2003)	1263
131522	Sodium pentachlorophenoxide	90	Technical	*Bufo japonicus formosus*	Larvae	20±1	Renewal	72	0.24	Active ingredient	Saka (1999)	1264
131522	Sodium pentachlorophenoxide	90	Technical	*Bufo japonicus formosus*	Larvae	20±1	Renewal	72	0.15	Active ingredient	Saka (1999)	1265
131522	Sodium pentachlorophenoxide	90	Technical	*Bufo japonicus formosus*	Larvae	20±1	Renewal	72	0.12	Active ingredient	Saka (1999)	1266

CAS	Pesticide name	% a.i.	Test material	Species	Stage	Temp. (°C)	Test type	Duration (h)	LC50 (mg/L)	LC50 based on	Reference	Data line
131522	Sodium pentachlorophenoxide	90	Technical	*Cynops pyrrhogaster*	Larvae	20±1	Renewal	72	0.26	Active ingredient	Saka (1999)	1267
131522	Sodium pentachlorophenoxide	90	Technical	*Cynops pyrrhogaster*	Larvae	20±1	Renewal	72	0.14	Active ingredient	Saka (1999)	1268
131522	Sodium pentachlorophenoxide	90	Technical	*Cynops pyrrhogaster*	Larvae	20±1	Renewal	72	0.09	Active ingredient	Saka (1999)	1269
131522	Sodium pentachlorophenoxide	90	Technical	*Hyla japonica*	Larvae	20±1	Renewal	72	0.17	Active ingredient	Saka (1999)	1270
131522	Sodium pentachlorophenoxide	90	Technical	*Hyla japonica*	Larvae	20±1	Renewal	72	0.16	Active ingredient	Saka (1999)	1271
131522	Sodium pentachlorophenoxide	90	Technical	*Hyla japonica*	Larvae	20±1	Renewal	72	0.22	Active ingredient	Saka (1999)	1272
131522	Sodium pentachlorophenoxide	90	Technical	*Rana nigromaculata*	Larvae	20±1	Renewal	72	0.21	Active ingredient	Saka (1999)	1273
131522	Sodium pentachlorophenoxide	90	Technical	*Rana nigromaculata*	Larvae	20±1	Renewal	72	0.12	Active ingredient	Saka (1999)	1274
131522	Sodium pentachlorophenoxide	90	Technical	*Rana nigromaculata*	Larvae	20±1	Renewal	72	0.12	Active ingredient	Saka (1999)	1275
131522	Sodium pentachlorophenoxide	90	Technical	*Rhacophorus arboreus*	Larvae	20±1	Renewal	72	0.29	Active ingredient	Saka (1999)	1276
131522	Sodium pentachlorophenoxide	90	Technical	*Rhacophorus arboreus*	Larvae	20±1	Renewal	72	0.21	Active ingredient	Saka (1999)	1277

CAS	Pesticide name	% a.i.	Test material	Species	Stage	Temp. (°C)	Test type	Duration (h)	LC50 (mg/L)	LC50 based on	Reference	Data line
131522	Sodium pentachlorophenoxide	90	Technical	*Xenopus laevis*	Larvae	20±1	Renewal	72	0.26	Active ingredient	Saka (1999)	1278
131522	Sodium pentachlorophenoxide	90	Technical	*Xenopus laevis*	Larvae	20±1	Renewal	72	0.21	Active ingredient	Saka (1999)	1279
131522	Sodium pentachlorophenoxide	90	Technical	*Xenopus laevis*	Larvae	20±1	Renewal	72	0.17	Active ingredient	Saka (1999)	1280
131522	Sodium pentachlorophenoxide	90	Technical	*Xenopus laevis*	Larvae	20±1	Renewal	72	0.28	Active ingredient	Saka (2003)	1281
131522	Sodium pentachlorophenoxide	90	Technical	*Xenopus laevis*	Larvae	20±1	Renewal	72	0.28	Active ingredient	Saka (2003)	1282
131522	Sodium pentachlorophenoxide	90	Technical	*Xenopus laevis*	Larvae	20±1	Renewal	72	0.24	Active ingredient	Saka (2003)	1283
131522	Sodium pentachlorophenoxide	90	Technical	*Xenopus laevis*	Larvae	20±1	Renewal	72	0.22	Active ingredient	Saka (2003)	1284
131522	Sodium pentachlorophenoxide	90	Technical	*Xenopus laevis*	Larvae	20±1	Renewal	72	0.22	Active ingredient	Saka (2003)	1285
131522	Sodium pentachlorophenoxide	90	Technical	*Xenopus laevis*	Larvae	20±1	Renewal	72	0.18	Active ingredient	Saka (2003)	1286
131522	Sodium pentachlorophenoxide	90	Technical	*Xenopus laevis*	Larvae	20±1	Renewal	72	0.18	Active ingredient	Saka (2003)	1287
131522	Sodium pentachlorophenoxide	90	Technical	*Xenopus laevis*	Larvae	20±1	Renewal	72	0.17	Active ingredient	Saka (2003)	1288

CAS	Pesticide name	% a.i.	Test material	Species	Stage	Temp. (°C)	Test type	Duration (h)	LC50 (mg/L)	LC50 based on	Reference	Data line
131522	Sodium pentachlorophenoxide	90	Technical	*Xenopus laevis*	Larvae	20±1	Renewal	72	0.16	Active ingredient	Saka (2003)	1289
131522	Sodium pentachlorophenoxide	90	Technical	*Xenopus laevis*	Larvae	20±1	Renewal	72	0.15	Active ingredient	Saka (2003)	1290
131522	Sodium pentachlorophenoxide	90	Technical	*Xenopus laevis*	Larvae	20±1	Renewal	72	0.14	Active ingredient	Saka (2003)	1291
131522	Sodium pentachlorophenoxide	90	Technical	*Xenopus laevis*	Larvae	20±1	Renewal	72	0.13	Active ingredient	Saka (2003)	1292
131522	Sodium pentachlorophenoxide	90	Technical	*Xenopus laevis*	Larvae	20±1	Renewal	72	0.17	Active ingredient	Saka (2003)	1293
131522	Sodium pentachlorophenoxide	NR	Technical (Reagent grade)	*Rana hexadactyla*	Tadpoles	14 (12-17)	Renewal	72	0.0287	Active ingredient	Khangarot et al (1985c)	1295
28249776	Thiobencarb	50	Formulation	*Bufo japonicus formosus*	Larvae	20±1	Renewal	72	2.10	Active ingredient	Saka (1999)	1297
28249776	Thiobencarb	50	Formulation	*Bufo japonicus formosus*	Larvae	20±1	Renewal	72	2.50	Active ingredient	Saka (1999)	1298
28249776	Thiobencarb	50	Formulation	*Bufo japonicus formosus*	Larvae	20±1	Renewal	72	2.28	Active ingredient	Saka (1999)	1299
28249776	Thiobencarb	50	Formulation	*Cynops pyrrhogaster*	Larvae	20±1	Renewal	72	4.16	Active ingredient	Saka (1999)	1300
28249776	Thiobencarb	50	Formulation	*Cynops pyrrhogaster*	Larvae	20±1	Renewal	72	3.24	Active ingredient	Saka (1999)	1301
28249776	Thiobencarb	50	Formulation	*Cynops pyrrhogaster*	Larvae	20±1	Renewal	72	3.24	Active ingredient	Saka (1999)	1302
28249776	Thiobencarb	99	Technical	*Cynops pyrrhogaster*	Larvae	20±1	Renewal	72	3.32	Active ingredient	Saka (1999)	1303

CAS	Pesticide name	% a.i.	Test material	Species	Stage	Temp. (°C)	Test type	Duration (h)	LC50 (mg/L)	LC50 based on	Reference	Data line
28249776	Thiobencarb	50	Formulation	*Hyla japonica*	Larvae	20±1	Renewal	72	2.50	Active ingredient	Saka (1999)	1304
28249776	Thiobencarb	50	Formulation	*Hyla japonica*	Larvae	20±1	Renewal	72	2.32	Active ingredient	Saka (1999)	1305
28249776	Thiobencarb	50	Formulation	*Hyla japonica*	Larvae	20±1	Renewal	72	2.72	Active ingredient	Saka (1999)	1306
28249776	Thiobencarb	50	Formulation	*Rana nigromaculata*	Larvae	20±1	Renewal	72	3.24	Active ingredient	Saka (1999)	1307
28249776	Thiobencarb	50	Formulation	*Rana nigromaculata*	Larvae	20±1	Renewal	72	2.10	Active ingredient	Saka (1999)	1308
28249776	Thiobencarb	50	Formulation	*Rana nigromaculata*	Larvae	20±1	Renewal	72	2.19	Active ingredient	Saka (1999)	1309
28249776	Thiobencarb	50	Formulation	*Rhacophorus arboreus*	Larvae	20±1	Renewal	72	2.39	Active ingredient	Saka (1999)	1310
28249776	Thiobencarb	50	Formulation	*Rhacophorus arboreus*	Larvae	20±1	Renewal	72	2.37	Active ingredient	Saka (1999)	1311
28249776	Thiobencarb	50	Formulation	*Xenopus laevis*	Larvae	20±1	Renewal	72	2.63	Active ingredient	Saka (1999)	1312
28249776	Thiobencarb	50	Formulation	*Xenopus laevis*	Larvae	20±1	Renewal	72	1.49	Active ingredient	Saka (1999)	1313
28249776	Thiobencarb	50	Formulation	*Xenopus laevis*	Larvae	20±1	Renewal	72	2.15	Active ingredient	Saka (1999)	1314
28249776	Thiobencarb	99	Technical	*Xenopus laevis*	Larvae	20±1	Renewal	72	2.34	Active ingredient	Saka (1999)	1315
28249776	Thiobencarb	98	Technical	*Silurana tropicalis*	Tadpoles	25±1	Renewal	72	0.85	Active ingredient	Saka (2010)	1316
137268	Thiram	80	Formulation	*Xenopus laevis*	Tadpoles	20±0.5	NR	72	0.013	Active ingredient	Seuge et al (1983)	1317
137268	Thiram	80	Formulation	*Xenopus laevis*	Tadpoles	20±0.5	NR	72	0.021	Active ingredient	Seuge et al (1983)	1318
1582098	Trifluralin	51	Formulation	*Bombina bombina*	Larvae	22±1	Renewal	72	21.6	Active ingredient	Sayim (2010)	1321

CAS	Pesticide name	% a.i.	Test material	Species	Stage	Temp. (°C)	Test type	Duration (h)	LC50 (mg/L)	LC50 based on	Reference	Data line
639587	Triphenyltin	95	Technical	*Xenopus tropicalis*	Embryos	26±0.5	Renewal	72	0.00525	Active ingredient	Yu et al (2011)	1322

L. SELECTED LC50 DATA FOR 'OTHER' TIME PERIODS (NOT 24, 48, 72 OR 96H)

Table 84: LC50 data for 'other' time periods (not 24, 48, 72 or 96h).

CAS	Pesticide name	% a.i.	Test material	Species	Stage	Temp. (°C)	Test type	Duration (h)	LC50 (mg/L)	LC50 based on	Reference	Data line
7758987	Copper sulfate	NR	Technical? (unclear in source)	*Rana tigrina*	Tadpoles	30.5±2.3	Static	1.5	16.8	NR ('Total' in ECOTOX database)	Kumar (1999)	2
7487947	Mercuric chloride	98	Technical	*Rana heckscheri*	Eggs	21±1	Static	3	1.43	Active ingredient	Punzo (1993a)	9
504245	4-Aminopyridine	NR	Technical	*Rana sphenocephala*	Larvae	16	Static	6	>30	Active ingredient	Marking and Chandler (1981)	14
63252	Carbaryl	99.7	Technical	*Bufo boreas*	Tadpoles	22	Static	6	>21	Active ingredient	Dwyer et al (1999)	17
7758987	Copper sulfate	25.5	Technical	*Bufo boreas*	Tadpoles	22	Static	6	>0.3	Active ingredient	Dwyer et al (1999)	18
1071836	Glyphosate	74.7	Formulation	*Rhinella arenarum*	Tadpoles	22 ± 2	Static	6	5.62	Active ingredient	Lajmanovich et al (2011)	21
1071836	Glyphosate	48	Formulation	*Rhinella arenarum*	Tadpoles	22 ± 2	Static	6	49.65	Active ingredient	Lajmanovich et al (2011)	22
1071836	Glyphosate	48	Formulation	*Rhinella arenarum*	Tadpoles	22 ± 2	Static	6	96.87	Active ingredient	Lajmanovich et al (2011)	23
1071836	Glyphosate	48	Formulation	*Rhinella arenarum*	Tadpoles	22 ± 2	Static	6	104.33	Active ingredient	Lajmanovich et al (2011)	24
2032657	Methiocarb	NR	Technical	*Rana sphenocephala*	Larvae	16	Static	6	9.7	Active ingredient	Marking and Chandler (1981)	27
87865	Pentachlorophenol	99	Technical	*Bufo boreas*	Tadpoles	22	Static	6	>0.7	Active ingredient	Dwyer et al (1999)	30

CAS	Pesticide name	% a.i.	Test material	Species	Stage	Temp. (°C)	Test type	Duration (h)	LC50 (mg/L)	LC50 based on	Reference	Data line
52645531	Permethrin	95.2	Technical	*Bufo boreas*	Tadpoles	22	Static	6	>10	Active ingredient	Dwyer et al (1999)	31
63252	Carbaryl	99.7	Technical	*Bufo boreas*	Tadpoles	22	Static	12	>21	Active ingredient	Dwyer et al (1999)	34
7758987	Copper sulfate	NR	Technical (Reagent grade)	*Rana tigrina*	Larvae	26.5 (24-27.5)	Static	12	1.996	Active ingredient (Cu)	Khangarot et al (1981)	38
7758987	Copper sulfate	25.5	Technical	*Bufo boreas*	Tadpoles	22	Static	12	0.19	Active ingredient	Dwyer et al (1999)	39
7758987	Copper sulfate	NR	Technical	*Bufo melanostictus*	Tadpoles	31 (29-34)	Static	12	1.97	Active ingredient (Cu)	Khangarot and Ray (1987)	40
7758987	Copper sulfate	NR	Technical (Reagent grade)	*Rana hexadactyla*	Tadpoles	15 (13-17)	Static	12	0.155	Active ingredient (Cu)	Khangarot et al (1984)	41
72208	Endrin	21.24	Formulation	*Rana temporaria*	Tadpoles	20	Static	12	1.2967	Active ingredient	Wohlgemuth (1977)	46
72208	Endrin	21.24	Formulation	*Rana temporaria*	Tadpoles	20	Static	12	2.3702	Active ingredient	Wohlgemuth (1977)	47
72208	Endrin	21.24	Formulation	*Rana temporaria*	Tadpoles	20	Static	12	2.5404	Active ingredient	Wohlgemuth (1977)	48
72208	Endrin	21.24	Formulation	*Rana temporaria*	Tadpoles	20	Static	12	0.3214	Active ingredient	Wohlgemuth (1977)	49
72208	Endrin	21.24	Formulation	*Rana temporaria*	Tadpoles	20	Static	12	3.9987	Active ingredient	Wohlgemuth (1977)	50
72208	Endrin	21.24	Formulation	*Rana temporaria*	Tadpoles	20	Static	12	0.4799	Active ingredient	Wohlgemuth (1977)	51
1071836	Glyphosate	74.7	Formulation	*Rhinella arenarum*	Tadpoles	22 ± 2	Static	12	3.26	Active ingredient	Lajmanovich et al (2011)	54
1071836	Glyphosate	48	Formulation	*Rhinella arenarum*	Tadpoles	22 ± 2	Static	12	47.25	Active ingredient	Lajmanovich et al (2011)	55
1071836	Glyphosate	48	Formulation	*Rhinella arenarum*	Tadpoles	22 ± 2	Static	12	77.52	Active ingredient	Lajmanovich et al (2011)	56

CAS	Pesticide name	% a.i.	Test material	Species	Stage	Temp. (°C)	Test type	Duration (h)	LC50 (mg/L)	LC50 based on	Reference	Data line
1071836	Glyphosate	48	Formulation	*Rhinella arenarum*	Tadpoles	22 ± 2	Static	12	84.06	Active ingredient	Lajmanovich et al (2011)	57
7487947	Mercuric chloride	NR	Technical	*Bufo melanostictus*	Tadpoles	31 (29-34)	Static	12	0.0698	Active ingredient (Hg)	Khangarot and Ray (1987)	59
87865	Pentachlorophenol	99	Technical	*Bufo boreas*	Tadpoles	22	Static	12	>0.7	Active ingredient	Dwyer et al (1999)	60
52645531	Permethrin	95.2	Technical	*Bufo boreas*	Tadpoles	22	Static	12	>10	Active ingredient	Dwyer et al (1999)	61
131522	Sodium pentachlorophenoxide	NR	Technical (Reagent grade)	*Rana hexadactyla*	Tadpoles	14 (12-17)	Static	12	0.083	Active ingredient	Khangarot et al (1985c)	63
3653483	MCPA	0	Technical (described as 'Purified' in study)	*Xenopus sp.*	Embryos	23±0.5	Renewal	112	3395.8	Active ingredient	Bernardini et al (1996)	1954
3653483	MCPA	0	Technical (described as 'Purified' in study)	*Xenopus sp.*	Embryos	23±0.5	Renewal	112	3607.7	Active ingredient	Bernardini et al (1996)	1955
63252	Carbaryl	99.8	Technical	*Xenopus laevis*	Embryos	23±0.5	Static	115	20.28	Active ingredient	Bacchetta et al (2008)	1956
94757	2,4-D	99	Technical	*Rhinella arenarum*	Embryos	20±2	Renewal	120	9.34	Active ingredient	Aronzon et al (2011)	1957
94757	2,4-D	(79.7 g/100 cm3 2,4-D a.e.)	Formulation	*Rhinella arenarum*	Embryos	20±2	Renewal	120	2.99	Active ingredient	Aronzon et al (2011)	1958
94757	2,4-D	99	Technical	*Rhinella arenarum*	Tadpoles	20±2	Renewal	120	13.39	Active ingredient	Aronzon et al (2011)	1959

CAS	Pesticide name	% a.i.	Test material	Species	Stage	Temp. (°C)	Test type	Duration (h)	LC50 (mg/L)	LC50 based on	Reference	Data line
94757	2,4-D	(79.7 g/100 cm3 2,4-D a.e.)	Formulation	*Rhinella arenarum*	Tadpoles	20±2	Renewal	120	3.01	Active ingredient	Aronzon et al (2011)	1960
66230044	Esfenvalerate	5	Formulation	*Bombina bombina*	Embryos	24±0.5	Renewal	120	>0.15	Active ingredient	Larsen and Sorensen (2004)	1962
66230044	Esfenvalerate	5	Formulation	*Bombina bombina*	Embryos	24±0.5	Renewal	120	>0.30	Active ingredient	Larsen et al (2004)	1963
1910425	Paraquat dichloride	98	Technical (Analytical grade)	*Xenopus laevis*	Larvae	23±0.5	Static	120	0.138	Active ingredient	Vismara et al (2000)	1964
56382	Parathion	NR	Technical	*Rhinella arenarum*	Embryos	NR	Static	120	20.2	Active ingredient	Anguiano et al (1994)	1965
56382	Parathion	NR	Technical	*Rhinella arenarum*	Larvae	NR	Static	120	4.5	Active ingredient	Anguiano et al (1994)	1966
67747095	Prochloraz	NR	Technical	*Bombina bombina*	Embryos	24±0.5	Renewal	120	>10.00	Active ingredient	Larsen and Sorensen (2004)	1968
1582098	Trifluralin	48	Formulation	*Bombina bombina*	Embryos	22±1	Renewal	120	9.40	Active ingredient	Sayim (2010)	1969
1582098	Trifluralin	53	Formulation	*Bombina bombina*	Larvae	22±1	Renewal	120	11.80	Active ingredient	Sayim (2010)	1970
94757	2,4-D	99	Technical	*Rhinella arenarum*	Embryos	20±2	Renewal	144	8.13	Active ingredient	Aronzon et al (2011)	1971
94757	2,4-D	(79.7 g/100 cm3 2,4-D a.e.)	Formulation	*Rhinella arenarum*	Embryos	20±2	Renewal	144	2.89	Active ingredient	Aronzon et al (2011)	1972
94757	2,4-D	99	Technical	*Rhinella arenarum*	Tadpoles	20±2	Renewal	144	13.39	Active ingredient	Aronzon et al (2011)	1973

CAS	Pesticide name	% a.i.	Test material	Species	Stage	Temp. (°C)	Test type	Duration (h)	LC50 (mg/L)	LC50 based on	Reference	Data line
94757	2,4-D	(79.7 g/100 cm3 2,4-D a.e.)	Formulation	*Rhinella arenarum*	Tadpoles	20±2	Renewal	144	3.01	Active ingredient	Aronzon et al (2011)	1974
94757	2,4-D	99	Technical	*Rhinella arenarum*	Embryos	20±2	Renewal	168	7.76	Active ingredient	Aronzon et al (2011)	1979
94757	2,4-D	(79.7 g/100 cm3 2,4-D a.e.)	Formulation	*Rhinella arenarum*	Embryos	20±2	Renewal	168	2.91	Active ingredient	Aronzon et al (2011)	1980
94757	2,4-D	99	Technical	*Rhinella arenarum*	Tadpoles	20±2	Renewal	168	13.40	Active ingredient	Aronzon et al (2011)	1981
94757	2,4-D	(79.7 g/100 cm3 2,4-D a.e.)	Formulation	*Rhinella arenarum*	Tadpoles	20±2	Renewal	168	2.58	Active ingredient	Aronzon et al (2011)	1982
94804	2,4-D Butyl	79.7	Formulation	*Rhinella arenarum*	Tadpoles	20±1	Static	168	3	Active ingredient	Perez-Coll and Herkovits (2006)	1983
1912249	Atrazine	98	Technical	*Rhinella arenarum*	NR	20±2	Renewal	168	20.11	Active ingredient	Brodeur et al. (2009)	1984
1912249	Atrazine	98	Technical	*Rhinella arenarum*	Tadpoles	20±2	Renewal	168	20.11	Active ingredient	Brodeur et al (2009)	1985
2921882	Chlorpyrifos	NR	Formulation	*Duttaphrynus melanostictus*	Tadpoles	26.2-28.1	Renewal	168	3.003	Active ingredient	Wijesinghe et al (2011)	1986
7758987	Copper sulfate	NR	Technical	*Bufo woodhousei fowleri*	Eggs	20-24	Renewal	168	26.96	Active ingredient (Cu)	Birge and Black (1979)	1987

CAS	Pesticide name	% a.i.	Test material	Species	Stage	Temp. (°C)	Test type	Duration (h)	LC50 (mg/L)	LC50 based on	Reference	Data line
7758987	Copper sulfate	NR	Technical	*Gastrophryne carolinensis*	Eggs	22±1	Renewal	168	0.04	Active ingredient (Cu)	Birge (1978)	1988
7758987	Copper sulfate	NR	Technical	*Gastrophryne carolinensis*	Eggs	20-24	Renewal	168	0.04	Active ingredient (Cu)	Birge and Black (1979)	1989
7758987	Copper sulfate	NR	Technical	*Hyla chrysoscelis*	Eggs	20-24	Renewal	168	0.04	Active ingredient (Cu)	Birge and Black (1979)	1990
60571	Dieldrin	92	Technical	*Xenopus laevis*	embryo-larval	22.8	Renewal	168	0.1679	Active ingredient	Schuytema et al (1991)	1991
1071836	Glyphosate	50.2	Formulation	*Ambystoma gracile*	Larvae	18 (room temp.)	NR	168	1.73	Active ingredient	King and Wagner (2010)	1992
1071836	Glyphosate	50.2	Formulation	*Ambystoma macrodactylum*	Larvae	18 (room temp.)	NR	168	1.85	Active ingredient	King and Wagner (2010)	1993
1071836	Glyphosate	50.2	Formulation	*Bufo boreas*	Larvae	18 (room temp.)	NR	168	2.08	Active ingredient	King and Wagner (2010)	1994
1071836	Glyphosate	50.2	Formulation	*Pseudacris regilla*	Larvae	18 (room temp.)	NR	168	0.32	Active ingredient	King and Wagner (2010)	1995
1071836	Glyphosate	50.2	Formulation	*Rana cascadae*	Larvae	18 (room temp.)	NR	168	1.40	Active ingredient	King and Wagner (2010)	1996
1071836	Glyphosate	50.2	Formulation	*Rana luteiventris*	Larvae	18 (room temp.)	NR	168	1.08	Active ingredient	King and Wagner (2010)	1997
7487947	Mercuric chloride	NR	Technical	*Gastrophryne carolinensis*	Eggs	22±1	Renewal	168	0.001	Active ingredient (Hg)	Birge (1978)	1998
94804	NA	NR	Technical	*Rhinella arenarum*	Tadpoles	20±1	Static	168	0.05	Active ingredient (Cu)	Perez-Coll and Herkovits (2006)	2000
13410010	Sodium selenate	NR	Technical	*Gastrophryne carolinensis*	Eggs	22±1	Renewal	168	0.09	Active ingredient (Se)	Birge (1978)	2001

CAS	Pesticide name	% a.i.	Test material	Species	Stage	Temp. (°C)	Test type	Duration (h)	LC50 (mg/L)	LC50 based on	Reference	Data line
64700567	Triclopyr-butotyl	48	Formulation	*Rana clamitans*	Embryos	23±2	Renewal	168	11.5	Active ingredient	Edgington et al. (2003)	2002
64700567	Triclopyr-butotyl	48	Formulation	*Rana clamitans*	Embryos	23±2	Renewal	168	18.2	Active ingredient	Edgington et al. (2003)	2003
86500	Azinphos-methyl	99	Technical	*Pseudacris regilla*	Tadpoles	23±1	Renewal	192	2.77	Active ingredient	Schuytema et al (1995)	2004
86500	Azinphos-methyl	22	Formulation	*Pseudacris regilla*	Tadpoles	24±1	Renewal	192	0.76	Active ingredient	Schuytema et al (1995)	2005
7758987	Copper sulfate	NR	Technical	*Ambystoma opacum*	Eggs	20-24	Renewal	192	0.77	Active ingredient (Cu)	Birge and Black (1979)	2006
7758987	Copper sulfate	NR	Technical	*Rana pipiens*	Eggs	20-24	Renewal	192	0.05	Active ingredient (Cu)	Birge and Black (1979)	2008
66230044	Esfenvalerate	5	Formulation	*Bombina bombina*	Embryos	20±0.5	Renewal	216	>0.30	Active ingredient	Larsen et al (2004)	2010
66230044	Esfenvalerate	5	Formulation	*Bombina bombina*	Embryos	204±0.5	Renewal	216	>0.30	Active ingredient	Larsen et al (2004)	2011
1912249	Atrazine	98	Technical	*Rhinella arenarum*	Embryos	20±2	Renewal	240	25.37	Active ingredient	Brodeur et al (2009)	2012
1912249	Atrazine	98	Technical	*Rhinella arenarum*	Embryos	20±2	Renewal	240	25.37	Active ingredient	Brodeur et al. (2009)	2013
1912249	Atrazine	98	Technical	*Rhinella arenarum*	NR	20±2	Renewal	240	14.48	Active ingredient	Brodeur et al. (2009)	2014
1912249	Atrazine	98	Technical	*Rhinella arenarum*	Tadpoles	20±2	Renewal	240	14.48	Active ingredient	Brodeur et al (2009)	2015
2921882	Chlorpyrifos	99.8	Technical	*Xenopus laevis*	Embryos	24.7	Renewal	240	0.0925	Active ingredient	El-Merhibi et al (2004)	2016
60571	Dieldrin	92	Technical	*Xenopus laevis*	Tadpoles	22	Flow-through	240	0.0029	Active ingredient	Schuytema et al (1991)	2017
330541	Diuron	99.8	Technical	*Pseudacris regilla*	Embryos	20	Renewal	240	>29.1	Active ingredient	Schuytema and Nebeker (1998)	2018

CAS	Pesticide name	% a.i.	Test material	Species	Stage	Temp. (°C)	Test type	Duration (h)	LC50 (mg/L)	LC50 based on	Reference	Data line
330541	Diuron	99.8	Technical	*Rana catesbeiana*	Tadpoles	24	Renewal	240	>29.1	Active ingredient	Schuytema and Nebeker (1998)	2019
1910425	Paraquat dichloride	29.1	Formulation	*Rana pipiens*	Embryos	22-25	Renewal	240	1.6	Active ingredient	Linder et al (1990)	2020
1910425	Paraquat dichloride	95	Technical	*Rana pipiens*	Embryos	22-25	Renewal	240	4.2	Active ingredient	Linder et al (1990)	2021
1910425	Paraquat dichloride	95	Technical	*Xenopus laevis*	Embryos	22-25	Renewal	240	4.2	Active ingredient	Linder et al (1990)	2022
1910425	Paraquat dichloride	29.1	Formulation	*Xenopus laevis*	Embryos	22-25	Renewal	240	6.2	Active ingredient	Linder et al (1990)	2023
51036	Piperonyl butoxide	90	Technical	*Xenopus laevis*	Embryos	24.7	Renewal	240	20.3	Active ingredient	El-Merhibi et al (2004)	2024
1071836	Glyphosate	48.7	Formulation	*Bufo americanus*	Tadpoles	(in graphs)	Static	264	2.30	Active ingredient	Jones et al (2010)	2025
1071836	Glyphosate	48.7	Formulation	*Rana sylvatica*	Tadpoles	(in graphs)	Static	264	2.44	Active ingredient	Jones et al (2010)	2026
86500	Azinphos-methyl	50	Formulation? (Product name)	*Rana clamitans*	Embryos	18.6	Renewal	312	2.61	Active ingredient	Harris et al (1998)	2027
115297	Endosulfan	47	Formulation	*Rana clamitans*	Embryos	18.6	Renewal	312	0.015	Active ingredient	Harris et al (1998)	2028
8018017	Mancozeb	76-80	Formulation	*Rana clamitans*	Embryos	18.6	Renewal	312	0.023	Active ingredient	Harris et al (1998)	2029
88671890	Myclobutanil	38-42	Formulation	*Rana clamitans*	Embryos	18.6	Renewal	312	>10.0	Active ingredient	Harris et al (1998)	2030
732116	Phosmet	50	Formulation	*Rana clamitans*	Embryos	18.6	Renewal	312	>12.5	Active ingredient	Harris et al (1998)	2031
1912249	Atrazine	98	Technical	*Rhinella arenarum*	Embryos	20±2	Renewal	336	14.41	Active ingredient	Brodeur et al (2009)	2032
1912249	Atrazine	98	Technical	*Rhinella arenarum*	Embryos	20±2	Renewal	336	14.41	Active ingredient	Brodeur et al. (2009)	2033

CAS	Pesticide name	% a.i.	Test material	Species	Stage	Temp. (°C)	Test type	Duration (h)	LC50 (mg/L)	LC50 based on	Reference	Data line
1912249	Atrazine	98	Technical	*Rhinella arenarum*	NR	20±2	Renewal	336	7.03	Active ingredient	Brodeur et al. (2009)	2034
1912249	Atrazine	98	Technical	*Rhinella arenarum*	NR	20±2	Renewal	336	18.27	Active ingredient	Brodeur et al. (2009)	2035
1912249	Atrazine	98	Technical	*Rhinella arenarum*	Tadpoles	20±2	Renewal	336	7.03	Active ingredient	Brodeur et al (2009)	2036
1912249	Atrazine	98	Technical	*Rhinella arenarum*	Tadpoles	20±2	Renewal	336	18.27	Active ingredient	Brodeur et al (2009)	2037
2921882	Chlorpyrifos	NR	Formulation	*Duttaphrynus melanostictus*	Tadpoles	26.2-28.1	Renewal	336	1.245	Active ingredient	Wijesinghe et al (2011)	2038
60571	Dieldrin	92	Technical	*Xenopus laevis*	embryo-larval	22.8	Renewal	336	0.0279	Active ingredient	Schuytema et al (1991)	2039
60571	Dieldrin	92	Technical	*Xenopus laevis*	Tadpoles	22	Flow-through	336	0.0109	Active ingredient	Schuytema et al (1991)	2040
330541	Diuron	99.8	Technical	*Pseudacris regilla*	Tadpoles	20	Renewal	336	10.8	Active ingredient	Schuytema and Nebeker (1998)	2041
330541	Diuron	99.8	Technical	*Pseudacris regilla*	Tadpoles	20	Renewal	336	19.6	Active ingredient	Schuytema and Nebeker (1998)	2042
330541	Diuron	99.8	Technical	*Rana aurora*	Tadpoles	20	Renewal	336	22.2	Active ingredient	Schuytema and Nebeker (1998)	2043
330541	Diuron	99.8	Technical	*Rana catesbeiana*	Tadpoles	24	Renewal	336	>29.1	Active ingredient	Schuytema and Nebeker (1998)	2044
330541	Diuron	99.8	Technical	*Xenopus laevis*	Tadpoles	24	Renewal	336	8.1	Active ingredient	Schuytema and Nebeker (1998)	2045
330541	Diuron	99.8	Technical	*Xenopus laevis*	Tadpoles	24	Renewal	336	14.5	Active ingredient	Schuytema and Nebeker (1998)	2046
1071836	Glyphosate	50.2	Formulation	*Ambystoma gracile*	Larvae	18 (room temp.)	NR	360	1.83	Active ingredient	King and Wagner (2010)	2048
1071836	Glyphosate	50.2	Formulation	*Ambystoma macrodactylum*	Larvae	18 (room temp.)	NR	360	1.55	Active ingredient	King and Wagner (2010)	2049
1071836	Glyphosate	50.2	Formulation	*Bufo boreas*	Larvae	18 (room temp.)	NR	360	1.95	Active ingredient	King and Wagner (2010)	2050

CAS	Pesticide name	% a.i.	Test material	Species	Stage	Temp. (°C)	Test type	Duration (h)	LC50 (mg/L)	LC50 based on	Reference	Data line
1071836	Glyphosate	50.2	Formulation	*Pseudacris regilla*	Larvae	18 (room temp.)	NR	360	0.30	Active ingredient	King and Wagner (2010)	2051
1071836	Glyphosate	50.2	Formulation	*Rana cascadae*	Larvae	18 (room temp.)	NR	360	1.33	Active ingredient	King and Wagner (2010)	2052
1071836	Glyphosate	50.2	Formulation	*Rana luteiventris*	Larvae	18 (room temp.)	NR	360	0.98	Active ingredient	King and Wagner (2010)	2053
1071836	Glyphosate	48.7	Formulation	*Hyla versicolor*	Tadpoles	(in graphs)	Static	372	2.04	Active ingredient	Jones et al (2011)	2059
1071836	Glyphosate	48.7	Formulation	*Hyla versicolor*	Tadpoles	(in graphs)	Static	372	2.29	Active ingredient	Jones et al (2011)	2060
1071836	Glyphosate	48.7	Formulation	*Hyla versicolor*	Tadpoles	(in graphs)	Static	372	1.71	Active ingredient	Jones et al (2011)	2061
1071836	Glyphosate	48.7	Formulation	*Rana catesbeiana*	Tadpoles	(in graphs)	Static	372	2.18	Active ingredient	Jones et al (2011)	2062
1071836	Glyphosate	48.7	Formulation	*Rana catesbeiana*	Tadpoles	(in graphs)	Static	372	2.12	Active ingredient	Jones et al (2011)	2063
1071836	Glyphosate	48.7	Formulation	*Rana catesbeiana*	Tadpoles	(in graphs)	Static	372	1.61	Active ingredient	Jones et al (2011)	2064
1071836	Glyphosate	48.7	Formulation	*Rana clamitans*	Tadpoles	(in graphs)	Static	372	2.58	Active ingredient	Jones et al (2011)	2065
1071836	Glyphosate	48.7	Formulation	*Rana clamitans*	Tadpoles	(in graphs)	Static	372	2.35	Active ingredient	Jones et al (2011)	2066
1071836	Glyphosate	48.7	Formulation	*Rana clamitans*	Tadpoles	(in graphs)	Static	372	2.18	Active ingredient	Jones et al (2011)	2067
86500	Azinphos-methyl	50	Formulation? (Product name)	*Rana clamitans*	Embryos	18.1	Pulse	384	>5.0	Active ingredient	Harris et al (1998)	2068
63252	Carbaryl	7.3	Formulation	*Bufo americanus*	Tadpoles	18.2-20.0	Static renewal (8d)	384	3.4	Active ingredient	Relyea (2003)	2069
63252	Carbaryl	7.3	Formulation	*Hyla versicolor*	Tadpoles	18.2-20.0	Static renewal (8d)	384	2.5	Active ingredient	Relyea (2003)	2070

CAS	Pesticide name	% a.i.	Test material	Species	Stage	Temp. (°C)	Test type	Duration (h)	LC50 (mg/L)	LC50 based on	Reference	Data line
63252	Carbaryl	7.3	Formulation	*Rana catesbeiana*	Tadpoles	18.2-20.0	Static renewal (8d)	384	2.3	Active ingredient	Relyea (2003)	2071
63252	Carbaryl	7.3	Formulation	*Rana catesbeiana*	Tadpoles	18.2-20.0	Static renewal (8d)	384	1.0	Active ingredient	Relyea (2003)	2072
63252	Carbaryl	7.3	Formulation	*Rana clamitans*	Tadpoles	18.2-20.0	Static renewal (8d)	384	2.6	Active ingredient	Relyea (2003)	2073
63252	Carbaryl	7.3	Formulation	*Rana clamitans*	Tadpoles	18.2-20.0	Static renewal (8d)	384	1.1	Active ingredient	Relyea (2003)	2074
63252	Carbaryl	7.3	Formulation	*Rana pipiens*	Tadpoles	18.2-20.0	Static renewal (8d)	384	2.2	Active ingredient	Relyea (2003)	2075
63252	Carbaryl	7.3	Formulation	*Rana sylvatica*	Tadpoles	18.2-20.0	Static renewal (8d)	384	1.2	Active ingredient	Relyea (2003)	2076
333415	Diazinon	NR	Formulation	*Rana clamitans*	Embryos	18.1	Pulse	384	0.0028	Active ingredient	Harris et al (1998)	2077
333415	Diazinon	NR	Technical	*Rana clamitans*	Embryos	18.1	Pulse	384	0.005	Active ingredient	Harris et al (1998)	2078
115297	Endosulfan	47	Formulation	*Rana clamitans*	Embryos	18.1	Pulse	384	0.015	Active ingredient	Harris et al (1998)	2079
38641940	Glyphosate isopropylammonium	25.2	Formulation	*Bufo americanus*	Tadpoles	20.1-20.2	Renewal	384	2.52	Active ingredient	Relyea (2005b)	2080
38641940	Glyphosate isopropylammonium	25.2	Formulation	*Hyla versicolor*	Tadpoles	20.1-20.3	Renewal	384	1.35	Active ingredient	Relyea (2005b)	2081
38641940	Glyphosate isopropylammonium	25.2	Formulation	*Rana catesbeiana*	Tadpoles	21.3-21.4	Renewal	384	2.07	Active ingredient	Relyea (2005b)	2082

CAS	Pesticide name	% a.i.	Test material	Species	Stage	Temp. (°C)	Test type	Duration (h)	LC50 (mg/L)	LC50 based on	Reference	Data line
38641940	Glyphosate isopropylammonium	25.2	Formulation	*Rana clamitans*	Tadpoles	21.2-21.3	Renewal	384	2.17	Active ingredient	Relyea (2005b)	2083
38641940	Glyphosate isopropylammonium	25.2	Formulation	*Rana pipiens*	Tadpoles	18.6-18.8	Renewal	384	2.46	Active ingredient	Relyea (2005b)	2084
38641940	Glyphosate isopropylammonium	25.2	Formulation	*Rana sylvatica*	Tadpoles	18.5-18.9	Renewal	384	1.32	Active ingredient	Relyea (2005b)	2085
121755	malathion	50.6	Formulation	*Bufo americanus*	Tadpoles	20.1-20.3	Static-renewal	384	5.90	Active ingredient	Relyea (2004)	2086
121755	malathion	50.6	Formulation	*Hyla versicolor*	Tadpoles	20.1-20.2	Static-renewal	384	4.13	Active ingredient	Relyea (2004)	2087
121755	malathion	50.6	Formulation	*Rana catesbeiana*	Tadpoles	21.2-21.5	Static-renewal	384	1.50	Active ingredient	Relyea (2004)	2088
121755	malathion	50.6	Formulation	*Rana clamitans*	Tadpoles	21.2-21.4	Static-renewal	384	3.65	Active ingredient	Relyea (2004)	2089
121755	malathion	50.6	Formulation	*Rana pipiens*	Tadpoles	18.6-18.7	Static-renewal	384	2.40	Active ingredient	Relyea (2004)	2090
121755	malathion	50.6	Formulation	*Rana sylvatica*	Tadpoles	18.7-19.0	Static-renewal	384	1.25	Active ingredient	Relyea (2004)	2091
8018017	Mancozeb	76-80	Formulation	*Rana clamitans*	Embryos	18.1	Pulse	384	0.20	Active ingredient	Harris et al (1998)	2092
1071836	Glyphosate	48.7	Formulation	*Bufo americanus*	Tadpoles	(in graphs)	Static	432	0.99	Active ingredient	Jones et al (2010)	2093
1071836	Glyphosate	48.7	Formulation	*Rana sylvatica*	Tadpoles	(in graphs)	Static	432	2.10	Active ingredient	Jones et al (2010)	2094
1912249	Atrazine	98	Technical	*Rhinella arenarum*	Embryos	20±2	Renewal	504	7.15	Active ingredient	Brodeur et al (2009)	2095
1912249	Atrazine	98	Technical	*Rhinella arenarum*	Embryos	20±2	Renewal	504	7.15	Active ingredient	Brodeur et al. (2009)	2096
1912249	Atrazine	98	Technical	*Rhinella arenarum*	NR	20±2	Renewal	504	2.32	Active ingredient	Brodeur et al. (2009)	2097

CAS	Pesticide name	% a.i.	Test material	Species	Stage	Temp. (°C)	Test type	Duration (h)	LC50 (mg/L)	LC50 based on	Reference	Data line
1912249	Atrazine	98	Technical	*Rhinella arenarum*	NR	20±2	Renewal	504	14.43	Active ingredient	Brodeur et al. (2009)	2098
1912249	Atrazine	98	Technical	*Rhinella arenarum*	Tadpoles	20±2	Renewal	504	2.32	Active ingredient	Brodeur et al (2009)	2099
1912249	Atrazine	98	Technical	*Rhinella arenarum*	Tadpoles	20±2	Renewal	504	14.43	Active ingredient	Brodeur et al (2009)	2100
60571	Dieldrin	92	Technical	*Rana catesbeiana*	embryo-larval	22.8	Renewal	504	0.0344	Active ingredient	Schuytema et al (1991)	2101
60571	Dieldrin	92	Technical	*Xenopus laevis*	embryo-larval	22.8	Renewal	504	0.0149	Active ingredient	Schuytema et al (1991)	2102
330541	Diuron	99.8	Technical	*Rana catesbeiana*	Tadpoles	24	Renewal	504	12.7	Active ingredient	Schuytema and Nebeker (1998)	2103
60571	Dieldrin	92	Technical	*Xenopus laevis*	Tadpoles	22	Flow-through	576	0.0055	Active ingredient	Schuytema et al (1991)	2104
1912249	Atrazine	98	Technical	*Rhinella arenarum*	NR	20±2	Renewal	672	12.63	Active ingredient	Brodeur et al. (2009)	2105
1912249	Atrazine	98	Technical	*Rhinella arenarum*	Tadpoles	20±2	Renewal	672	12.63	Active ingredient	Brodeur et al (2009)	2106
60571	Dieldrin	92	Technical	*Rana pipiens*	Tadpoles	22	Flow-through	672	0.0083	Active ingredient	Schuytema et al (1991)	2107
60571	Dieldrin	92	Technical	*Rana pipiens*	Tadpoles	22	Flow-through	672	0.0534	Active ingredient	Schuytema et al (1991)	2108
333415	Diazinon	NR	Formulation	*Bufo melanostictus*	Larvae	26.8-28.2	Renewal	720	6.2	Formulation	Sumanadasa et al. (2008)	2109
333415	Diazinon	NR	Formulation	*Bufo melanostictus*	Larvae	26.8-28.2	Renewal	720	7.5	Formulation	Sumanadasa et al. (2008)	2110
1910425	Paraquat dichloride	29.1	Formulation	*Rana pipiens*	Embryos	22-25	Renewal	720	1.6	Active ingredient	Linder et al (1990)	2111
1910425	Paraquat dichloride	95	Technical	*Rana pipiens*	Embryos	22-25	Renewal	720	3.1	Active ingredient	Linder et al (1990)	2112
1910425	Paraquat dichloride	95	Technical	*Xenopus laevis*	Embryos	22-25	Renewal	720	3.2	Active ingredient	Linder et al (1990)	2113

CAS	Pesticide name	% a.i.	Test material	Species	Stage	Temp. (°C)	Test type	Duration (h)	LC50 (mg/L)	LC50 based on	Reference	Data line
1910425	Paraquat dichloride	29.1	Formulation	*Xenopus laevis*	Embryos	22-25	Renewal	720	6.2	Active ingredient	Linder et al (1990)	2114
43121433	Triadimefon	NR	Technical	*Xenopus laevis*	Embryos	23	Renewal	up to Stage 47	18.74	Active ingredient	Papis et al (2006)	2124

M. OMITTED LC50 DATA

Table 85: Omitted LC50 data and reason for exclusion.

CAS	Pesticide name	% a.i.	Test material	Species	Stage	Temp. (°C)	Exposure type	Duration (h)	LC50 (mg/L)	LC50 based on	Reference	Data line	Reason for omission from main dataset
83794	Rotenone	5	Form.	*Rana spheno-cephala*	Larv.	16±1	Static	1	0.830	NR	Chandler and Marking (1982)	1	Lack of detail on methods and basis of values presented (active substance or formulation).
36335678	Butamifos	NR	?	*Bufo bufo japonicus*	Tad.	17.5	Static	3	22	?	Nishiuchi (1979)	3	Unable to check details (source language).
34681237	Butoxycarboxim	NR	?	*Bufo bufo japonicus*	Tad.	17.5	Static	3	>40	?	Nishiuchi (1979)	4	Unable to check details (source language).
533744	Dazomet	NR	?	*Bufo bufo japonicus*	Tad.	17.5	Static	3	>40	?	Nishiuchi (1979)	5	Unable to check details (source language).
93721	Fenoprop	NR	?	*Bufo bufo japonicus*	Tad.	17.5	Static	3	>40	?	Nishiuchi (1979)	6	Unable to check details (source language).
2631405	Isoprocarb	NR	?	*Bufo bufo japonicus*	Tad.	17.5	Static	3	28	?	Nishiuchi (1979)	7	Unable to check details (source language).
53780340	Mefluidide	NR	?	*Bufo bufo japonicus*	Tad.	17.5	Static	3	>40	?	Nishiuchi (1979)	8	Unable to check details (source language).
1129415	Metolcarb	NR	?	*Bufo bufo japonicus*	Tad.	17.5	Static	3	>40	?	Nishiuchi (1979)	10	Unable to check details (source language).
4418262	Paraquat	NR	?	*Bufo bufo japonicus*	Tad.	17.5	Static	3	>40	Form.	Nishiuchi (1979)	11	Unable to check details (source language).
83794	Rotenone	5	Form.	*Rana spheno-cephala*	Larv.	16±1	Static	3	0.775	NR	Chandler and Marking (1982)	12	Lack of detail on methods and basis of values presented (active substance or formulation).
4418262	Sodium dehydroacetic acid, dehydroacetic acid - sodium salt	NR	?	*Bufo bufo japonicus*	Tad.	17.5	Static	3	>40	?	Nishiuchi (1979)	13	Unable to check details (source language).

CAS	Pesticide name	% a.i.	Test material	Species	Stage	Temp. (°C)	Exposure type	Duration (h)	LC50 (mg/L)	LC50 based on	Reference	Data line	Reason for omission from main dataset
36335678	Butamifos	NR	?	*Bufo bufo japonicus*	Tad.	17.5	Static	6	10	?	Nishiuchi (1979)	15	Unable to check details (source language).
34681237	Butoxycarboxim	NR	?	*Bufo bufo japonicus*	Tad.	17.5	Static	6	>40	?	Nishiuchi (1979)	16	Unable to check details (source language).
533744	Dazomet	NR	?	*Bufo bufo japonicus*	Tad.	17.5	Static	6	>40	?	Nishiuchi (1979)	19	Unable to check details (source language).
93721	Fenoprop	NR	?	*Bufo bufo japonicus*	Tad.	17.5	Static	6	>40	?	Nishiuchi (1979)	20	Unable to check details (source language).
2631405	Isoprocarb	NR	?	*Bufo bufo japonicus*	Tad.	17.5	Static	6	28	?	Nishiuchi (1979)	25	Unable to check details (source language).
53780340	Mefluidide	NR	?	*Bufo bufo japonicus*	Tad.	17.5	Static	6	>40	?	Nishiuchi (1979)	26	Unable to check details (source language).
1129415	Metolcarb	NR	?	*Bufo bufo japonicus*	Tad.	17.5	Static	6	>40	?	Nishiuchi (1979)	28	Unable to check details (source language).
4418262	Paraquat	NR	?	*Bufo bufo japonicus*	Tad.	17.5	Static	6	>40	Form.	Nishiuchi (1979)	29	Unable to check details (source language).
83794	Rotenone	5	Form.	*Rana spheno-cephala*	Larv.	16±1	Static	6	0.635	NR	Chandler and Marking (1982)	32	Lack of detail on methods and basis of values presented (active substance or formulation).
4418262	Sodium dehydroacetic acid, dehydroacetic acid - sodium salt	NR	?	*Bufo bufo japonicus*	Tad.	17.5	Static	6	>40	Form.	Nishiuchi (1979)	33	Unable to check details (source language).
63252	Carbaryl	NR	Form.	*Rana hexadactyla*	Tad.	14 (12-17)	Static	12	150	Form.	Khangarot et al (1985c)	35	Data are for formulation (a.i. Content not defined).
10605217	Carbendazim	NR	Form.	*Rana hexadactyla*	Tad.	14 (12-17)	Static	12	26.3	Form.	Khangarot et al (1985c)	36	Data are for formulation (a.i. Content not defined).
1563662	Carbofuran	75	NR	*Rana hexadactyla*	Tad.	14 (12-17)	Static	12	150	Form.	Khangarot et al (1985c)	37	Test material not defined.

CAS	Pesticide name	% a.i.	Test material	Species	Stage	Temp. (°C)	Exposure type	Duration (h)	LC50 (mg/L)	LC50 based on	Reference	Data line	Reason for omission from main dataset
7758987	Copper sulfate	NR	Tech. (Reagent grade)	*Rana hexadactyla*	Tad.	15	Static	12	0.155	a.i. (Cu)	Khangarot et al (1985a)	42	Data appear to be the same as presented in Khangarot et al (1994).
60515	Dimethoate	NR	Form.	*Rana hexadactyla*	Tad.	14 (12-17)	Static	12	8.12	Form.	Khangarot et al (1985c)	43	Data are for formulation (a.i. Content not defined).
115297	Endosulfan	NR	NR	*Bufo melanostictus*	Larv.	25	Static	12	0.1459	?	Vardia et al (1984)	44	Test material not defined.
72208	Endrin	NR	Form.	*Rana hexadactyla*	Tad.	14 (12-17)	Static	12	6.6	Form.	Khangarot et al (1985c)	45	Data are for formulation (a.i. Content not defined).
55389	Fenthion	NR	Form.	*Rana hexadactyla*	Tad.	14 (12-17)	Static	12	1.56	Form.	Khangarot et al (1985c)	52	Data are for formulation (a.i. Content not defined).
58899	Gamma-HCH, lindane	6.5	Form.	*Rana hexadactyla*	Tad.	14 (12-17)	Static	12	5.97	Form.	Khangarot et al (1985c)	53	Data are for formulation.
121755	Malathion	NR	Form.	*Rana hexadactyla*	Tad.	14 (12-17)	Static	12	3.54	Form.	Khangarot et al (1985c)	58	Data are for formulation (a.i. Content not defined).
13171216	Phosphamidon	NR	NR	*Rana cyanophlyctis*	Adults	NR	NR	12	0.274	a.i.	Thenmozhi and Ramaswamy (2008)	62	Test material not defined.
81412433	Tridemorph	NR	Form.	*Rana hexadactyla*	Tad.	14 (12-17)	Static	12	0.82	Form.	Khangarot et al (1985c)	64	Data are for formulation (a.i. Content not defined).
94757	2,4-D	NR	NR	*Bufo melanostictus*	Larv.	25	Static	24	13.77	?	Vardia et al (1984)	81	Test material not defined.
2702729	2,4-D Sodium	NR	?	*Bufo bufo japonicus*	NR	25	Static	24	>40	?	Nishiuchi (1980b)	88	Unable to check details (source language).
2702729	2,4-D Sodium	NR	?	*Bufo bufo japonicus*	NR	25	Static	24	>40	?	Nishiuchi (1980b)	89	Unable to check details (source language).
2702729	2,4-D Sodium	NR	?	*Bufo bufo japonicus*	NR	25	Static	24	>40	?	Nishiuchi (1980b)	90	Unable to check details (source language).
2702729	2,4-D Sodium	NR	?	*Bufo bufo japonicus*	NR	25	Static	24	>40	?	Nishiuchi (1980b)	91	Unable to check details (source language).
2702729	2,4-D Sodium	NR	?	*Bufo bufo japonicus*	NR	25	Static	24	>40	?	Nishiuchi (1980b)	92	Unable to check details (source language).

CAS	Pesticide name	% a.i.	Test material	Species	Stage	Temp. (°C)	Exposure type	Duration (h)	LC50 (mg/L)	LC50 based on	Reference	Data line	Reason for omission from main dataset
2702729	2,4-D Sodium	NR	?	*Bufo bufo japonicus*	NR	25	Static	24	>40	?	Nishiuchi (1980b)	93	Unable to check details (source language).
2008391	2,4-D-dimethylammonium	NR	?	*Bufo bufo japonicus*	NR	25	Static	24	>40	?	Nishiuchi (1980b)	94	Unable to check details (source language).
2008391	2,4-D-dimethylammonium	NR	?	*Bufo bufo japonicus*	NR	25	Static	24	>40	?	Nishiuchi (1980b)	95	Unable to check details (source language).
2008391	2,4-D-dimethylammonium	NR	?	*Bufo bufo japonicus*	NR	25	Static	24	>40	?	Nishiuchi (1980b)	96	Unable to check details (source language).
2008391	2,4-D-dimethylammonium	NR	?	*Bufo bufo japonicus*	NR	25	Static	24	>40	?	Nishiuchi (1980b)	97	Unable to check details (source language).
2008391	2,4-D-dimethylammonium	NR	?	*Bufo bufo japonicus*	NR	25	Static	24	>40	?	Nishiuchi (1980b)	98	Unable to check details (source language).
2008391	2,4-D-dimethylammonium	NR	?	*Bufo bufo japonicus*	NR	25	Static	24	>40	?	Nishiuchi (1980b)	99	Unable to check details (source language).
2008391	2,4-D-dimethylammonium	NR	Form.	*Adelotus brevis*	Tad.	21-22	Static	24	255	Form.	Johnson (1976)	100	Data based on formulation, a.i. Content not defined.
2008391	2,4-D-dimethylammonium	NR	Form.	*Bufo marinus*	Tad.	21-22	Static	24	346	Form.	Johnson (1976)	101	Data based on formulation, a.i. Content not defined.
2008391	2,4-D-dimethylammonium	NR	Form.	*Limnodynastes peroni*	Tad.	21-22	Static	24	321	Form.	Johnson (1976)	102	Data based on formulation, a.i. Content not defined.
30560191	Acephate	NR	?	*Bufo vulgaris formosus*	NR	25	NR	24	>40	?	Nishiuchi (1980a)	105	Unable to check details (source language).
30560191	Acephate	NR	?	*Bufo bufo japonicus*	Tad.	25	Static	24	>40	?	Nishiuchi and Yoshida (1975)	106	Unable to check details (source language).
15972608	Alachlor	NR	?	*Bufo bufo japonicus*	NR	25	Static	24	11	?	Nishiuchi (1980b)	112	Unable to check details (source language).
15972608	Alachlor	NR	?	*Bufo bufo japonicus*	NR	25	Static	24	11	?	Nishiuchi (1980b)	113	Unable to check details (source language).

CAS	Pesticide name	% a.i.	Test material	Species	Stage	Temp. (°C)	Exposure type	Duration (h)	LC50 (mg/L)	LC50 based on	Reference	Data line	Reason for omission from main dataset
15972608	Alachlor	NR	?	*Bufo bufo japonicus*	NR	25	Static	24	12	?	Nishiuchi (1980b)	114	Unable to check details (source language).
15972608	Alachlor	NR	?	*Bufo bufo japonicus*	NR	25	Static	24	12	?	Nishiuchi (1980b)	115	Unable to check details (source language).
15972608	Alachlor	NR	?	*Bufo bufo japonicus*	NR	25	Static	24	12	?	Nishiuchi (1980b)	116	Unable to check details (source language).
15972608	Alachlor	NR	?	*Bufo bufo japonicus*	NR	25	Static	24	12	?	Nishiuchi (1980b)	117	Unable to check details (source language).
93710	Allidochlor	NR	?	*Bufo bufo japonicus*	NR	25	Static	24	2.8	?	Nishiuchi (1980b)	121	Unable to check details (source language).
93710	Allidochlor	NR	?	*Bufo bufo japonicus*	NR	25	Static	24	2.9	?	Nishiuchi (1980b)	122	Unable to check details (source language).
93710	Allidochlor	NR	?	*Bufo bufo japonicus*	NR	25	Static	24	3.3	?	Nishiuchi (1980b)	123	Unable to check details (source language).
93710	Allidochlor	NR	?	*Bufo bufo japonicus*	NR	25	Static	24	3.3	?	Nishiuchi (1980b)	124	Unable to check details (source language).
93710	Allidochlor	NR	?	*Bufo bufo japonicus*	NR	25	Static	24	3.4	?	Nishiuchi (1980b)	125	Unable to check details (source language).
93710	Allidochlor	NR	?	*Bufo bufo japonicus*	NR	25	Static	24	3.5	?	Nishiuchi (1980b)	126	Unable to check details (source language).
834128	Ametryn	NR	?	*Bufo bufo japonicus*	NR	25	Static	24	3.8	?	Nishiuchi (1980b)	127	Unable to check details (source language).
834128	Ametryn	NR	?	*Bufo bufo japonicus*	NR	25	Static	24	4	?	Nishiuchi (1980b)	128	Unable to check details (source language).
834128	Ametryn	NR	?	*Bufo bufo japonicus*	NR	25	Static	24	4.4	?	Nishiuchi (1980b)	129	Unable to check details (source language).
834128	Ametryn	NR	?	*Bufo bufo japonicus*	NR	25	Static	24	5.6	?	Nishiuchi (1980b)	130	Unable to check details (source language).
834128	Ametryn	NR	?	*Bufo bufo japonicus*	NR	25	Static	24	5.6	?	Nishiuchi (1980b)	131	Unable to check details (source language).
834128	Ametryn	NR	?	*Bufo bufo japonicus*	NR	25	Static	24	5.6	?	Nishiuchi (1980b)	132	Unable to check details (source language).
33089611	Amitraz	NR	?	*Bufo vulgaris formosus*	NR	25	NR	24	13	?	Nishiuchi (1980a)	136	Unable to check details (source language).
33089611	Amitraz	NR	?	*Bufo vulgaris formosus*	NR	25	NR	24	15	?	Nishiuchi (1980a)	137	Unable to check details (source language).

CAS	Pesticide name	% a.i.	Test material	Species	Stage	Temp. (°C)	Exposure type	Duration (h)	LC50 (mg/L)	LC50 based on	Reference	Data line	Reason for omission from main dataset
3337711	Asulam	NR	?	*Bufo bufo japonicus*	Tad.	25	Static	24	>40	?	Nishiuchi and Yoshida (1975)	139	Unable to check details (source language).
-	Bacillus sphaericus 1593M	NR	NR	*Rana bufo*	Tad.	NR	Static	24	0.22	a.i.	Mathavan and Velpandi (1984)	151	Test material not defined.
-	Bacillus sphaericus 1593M	NR	NR	*Rana bufo*	Tad.	NR	Static	24	0.47	a.i.	Mathavan and Velpandi (1984)	152	Test material not defined.
143447727	Bacillus sphaericus 2362	NR	NR	*Rana bufo*	Tad.	NR	Static	24	0.13	a.i.	Mathavan and Velpandi (1984)	153	Test material not defined.
143447727	Bacillus sphaericus 2362	NR	NR	*Rana bufo*	Tad.	NR	Static	24	0.30	a.i.	Mathavan and Velpandi (1984)	154	Test material not defined.
1861401	Benfluralin	NR	?	*Bufo bufo japonicus*	NR	25	Static	24	11	?	Nishiuchi (1980b)	155	Unable to check details (source language).
1861401	Benfluralin	NR	?	*Bufo bufo japonicus*	NR	25	Static	24	11	?	Nishiuchi (1980b)	156	Unable to check details (source language).
1861401	Benfluralin	NR	?	*Bufo bufo japonicus*	NR	25	Static	24	11	?	Nishiuchi (1980b)	157	Unable to check details (source language).
1861401	Benfluralin	NR	?	*Bufo bufo japonicus*	NR	25	Static	24	11	?	Nishiuchi (1980b)	158	Unable to check details (source language).
1861401	Benfluralin	NR	?	*Bufo bufo japonicus*	NR	25	Static	24	11	?	Nishiuchi (1980b)	159	Unable to check details (source language).
1861401	Benfluralin	NR	?	*Bufo bufo japonicus*	NR	25	Static	24	11	?	Nishiuchi (1980b)	160	Unable to check details (source language).
29104301	Benzoximate, benzomate	NR	?	*Bufo vulgaris formosus*	NR	25	NR	24	0.46	?	Nishiuchi (1980a)	161	Unable to check details (source language).
29104301	Benzoximate, benzomate	NR	?	*Bufo vulgaris formosus*	NR	25	NR	24	0.48	?	Nishiuchi (1980a)	162	Unable to check details (source language).
29104301	Benzoximate, benzomate	NR	?	*Bufo vulgaris formosus*	NR	25	NR	24	0.75	?	Nishiuchi (1980a)	163	Unable to check details (source language).
485314	Binapacryl	NR	?	*Bufo bufo japonicus*	NR	17.3-22.6	NR	24	0.35	?	Nishiuchi (1975)	164	Unable to check details (source language).

CAS	Pesticide name	% a.i.	Test material	Species	Stage	Temp. (°C)	Exposure type	Duration (h)	LC50 (mg/L)	LC50 based on	Reference	Data line	Reason for omission from main dataset
8011630	Bordeaux mixture (1 % $CuSO_4$ + 1% $CaCO_3$ in H_2O 1:1)	-	Form.	*Microhyla ornata*	Tad.	25.5-25.9	Static	24	4.62	Form.	Jayaprakash and Madhyastha (1989)	165	Unclear as to the basis of the toxicity data.
8011630	Bordeaux mixture (1 % $CuSO_4$ + 1% $CaCO_3$ in H_2O 1:1)	-	Form.	*Microhyla ornata*	Tad.	25.5-25.9	Static	24	4.92	Form.	Jayaprakash and Madhyastha (1989)	166	Unclear as to the basis of the toxicity data.
23184669	Butachlor	NR	?	*Bufo bufo japonicus*	Tad.	25	Static	24	1.8	?	Nishiuchi and Yoshida (1975)	167	Unable to check details (source language).
36335678	Butamifos	NR	?	*Bufo bufo japonicus*	Tad.	17.5	Static	24	3.3	?	Nishiuchi (1979)	172	Unable to check details (source language).
34681237	Butoxycarboxim	NR	?	*Bufo bufo japonicus*	Tad.	17.5	Static	24	>40	?	Nishiuchi (1979)	173	Unable to check details (source language).
133062	Captan	NR	?	*Bufo bufo japonicus*	NR	17.3-22.6	NR	24	0.2	?	Nishiuchi (1975)	178	Unable to check details (source language).
63252	Carbaryl	NR	Form.	*Rana hexadactyla*	Tad.	14 (12-17)	Static	24	150	Form.	Khangarot et al (1985c)	186	Data are for formulation (a.i. Content not defined).
10605217	Carbendazim	NR	?	*Bufo bufo japonicus*	Tad.	25	Static	24	>40	?	Nishiuchi and Yoshida (1975)	187	Unable to check details (source language).
10605217	Carbendazim	NR	Form.	*Rana hexadactyla*	Tad.	14 (12-17)	Static	24	26.3	Form.	Khangarot et al (1985c)	188	Data are for formulation (a.i. Content not defined).
1563662	Carbofuran	75	NR	*Rana hexadactyla*	Tad.	14 (12-17)	Static	24	150	Form.	Khangarot et al (1985c)	189	Test material not defined.
32861851	Chlomethoxyfen, chlormethoxynil	NR	?	*Bufo bufo japonicus*	Tad.	25	Static	24	>40	?	Nishiuchi and Yoshida (1975)	191	Unable to check details (source language).
57749	Chlordane	NR	?	*Bufo vulgaris formosus*	NR	25	NR	24	3.5	?	Nishiuchi (1980a)	192	Unable to check details (source language).
57749	Chlordane	NR	?	*Bufo vulgaris formosus*	NR	25	NR	24	4.2-4.4	?	Nishiuchi (1980a)	193	Unable to check details (source language).

CAS	Pesticide name	% a.i.	Test material	Species	Stage	Temp. (°C)	Exposure type	Duration (h)	LC50 (mg/L)	LC50 based on	Reference	Data line	Reason for omission from main dataset
57749	Chlordane	20	Form.	*Bufo bufo*	Tad.	NR	NR	24	0.41	a.i.	Jayakumar and Kandeepan (2009)	194	Insufficient detail of method used.
2274740	Chlorfensulphide	NR	?	*Bufo vulgaris formosus*	NR	25	NR	24	>42	?	Nishiuchi (1980a)	195	Unable to check details (source language).
2274740	Chlorfensulphide	NR	?	*Bufo vulgaris formosus*	NR	25	NR	24	19	?	Nishiuchi (1980a)	196	Unable to check details (source language).
2274740	Chlorfensulphide	NR	?	*Bufo vulgaris formosus*	NR	25	NR	24	28	?	Nishiuchi (1980a)	197	Unable to check details (source language).
2274740	Chlorfensulphide	NR	?	*Bufo vulgaris formosus*	NR	25	NR	24	36-38	?	Nishiuchi (1980a)	198	Unable to check details (source language).
470906	Chlorfenvinphos	NR	?	*Bufo vulgaris formosus*	NR	25	NR	24	4.5	?	Nishiuchi (1980a)	199	Unable to check details (source language).
470906	Chlorfenvinphos	NR	?	*Bufo vulgaris formosus*	NR	25	NR	24	4.8	?	Nishiuchi (1980a)	200	Unable to check details (source language).
470906	Chlorfenvinphos	NR	?	*Bufo vulgaris formosus*	NR	25	NR	24	5	?	Nishiuchi (1980a)	201	Unable to check details (source language).
470906	Chlorfenvinphos	NR	?	*Bufo vulgaris formosus*	NR	25	NR	24	5.2	?	Nishiuchi (1980a)	202	Unable to check details (source language).
470906	Chlorfenvinphos	NR	?	*Bufo vulgaris formosus*	NR	25	NR	24	5.3	?	Nishiuchi (1980a)	203	Unable to check details (source language).
510156	Chlorobenzilate	NR	?	*Bufo vulgaris formosus*	NR	25	NR	24	2.1	?	Nishiuchi (1980a)	204	Unable to check details (source language).
510156	Chlorobenzilate	NR	?	*Bufo vulgaris formosus*	NR	25	NR	24	2.3	?	Nishiuchi (1980a)	205	Unable to check details (source language).
510156	Chlorobenzilate	NR	?	*Bufo vulgaris formosus*	NR	25	NR	24	2.4	?	Nishiuchi (1980a)	206	Unable to check details (source language).
510156	Chlorobenzilate	NR	?	*Bufo vulgaris formosus*	NR	25	NR	24	3.2	?	Nishiuchi (1980a)	207	Unable to check details (source language).
101213	Chloropropham	NR	?	*Bufo bufo japonicus*	NR	25	Static	24	8.6	?	Nishiuchi (1980b)	208	Unable to check details (source language).
101213	Chloropropham	NR	?	*Bufo bufo japonicus*	NR	25	Static	24	8.6	?	Nishiuchi (1980b)	209	Unable to check details (source language).
101213	Chloropropham	NR	?	*Bufo bufo japonicus*	NR	25	Static	24	8.6	?	Nishiuchi (1980b)	210	Unable to check details (source language).

CAS	Pesticide name	% a.i.	Test material	Species	Stage	Temp. (°C)	Exposure type	Duration (h)	LC50 (mg/L)	LC50 based on	Reference	Data line	Reason for omission from main dataset
101213	Chloropropham	NR	?	*Bufo bufo japonicus*	NR	25	Static	24	8.6	?	Nishiuchi (1980b)	211	Unable to check details (source language).
101213	Chloropropham	NR	?	*Bufo bufo japonicus*	NR	25	Static	24	8.6	?	Nishiuchi (1980b)	212	Unable to check details (source language).
101213	Chloropropham	NR	?	*Bufo bufo japonicus*	NR	25	Static	24	8.6	?	Nishiuchi (1980b)	213	Unable to check details (source language).
2921882	Chlorpyrifos	NR	NR	*Rana tigrina*	Tad.	NR	NR	24	0.177	a.i.	Abbasi and Soni (1991)	216	Test material not defined, too little detail
5598130	Chlorpyrifos-methyl	NR	?	*Bufo vulgaris formosus*	NR	25	NR	24	1.8	?	Nishiuchi (1980a)	217	Unable to check details (source language).
5598130	Chlorpyrifos-methyl	NR	?	*Bufo vulgaris formosus*	NR	25	NR	24	2.3	?	Nishiuchi (1980a)	218	Unable to check details (source language).
7758987	Copper sulfate	NR	?	*Bufo bufo japonicus*	NR	17.3-22.6	NR	24	0.22	?	Nishiuchi (1975)	220	Unable to check details (source language).
7758987	Copper sulfate	NR	Tech. (Reagent grade)	*Rana hexadactyla*	Tad.	15	Static	24	0.045	a.i. (Cu)	Khangarot et al (1985a)	226	Data appear to be the same as presented in Khangarot et al (1994).
7758987	Copper sulfate	NR	Tech. (Reagent grade)	*Rana hexadactyla*	Tad.	15 (13-16)	Renewal	24	0.045	a.i. (Cu)	Khangarot et al (1985b)	227	Data appear to be the same as presented in Khangarot et al (1994).
1134232	Cycloate	NR	?	*Bufo bufo japonicus*	NR	17.3-22.6	NR	24	3.2	?	Nishiuchi (1975)	228	Unable to check details (source language).
122008859	Cyhalofop-butyl	?	?	*Rana limnocharis*	Tad.	NR	NR	24	0.718	a.i.	Wu et al (2011a)	229	Unable to check details (source language).
13121705	Cyhexatin	NR	?	*Bufo vulgaris formosus*	NR	25	NR	24	0.082	?	Nishiuchi (1980a)	230	Unable to check details (source language).
13121705	Cyhexatin	NR	?	*Bufo vulgaris formosus*	NR	25	NR	24	0.083	?	Nishiuchi (1980a)	231	Unable to check details (source language).
13121705	Cyhexatin	NR	?	*Bufo vulgaris formosus*	NR	25	NR	24	0.086	?	Nishiuchi (1980a)	232	Unable to check details (source language).
13121705	Cyhexatin	NR	?	*Bufo bufo japonicus*	Tad.	25	Static	24	0.085	?	Nishiuchi and Yoshida (1975)	233	Unable to check details (source language).
75990	Dalapon	NR	Form.	*Adelotus brevis*	Tad.	21-22	Static	24	11100	Form.	Johnson (1976)	237	Data based on formulation, a.i. Content not defined.

CAS	Pesticide name	% a.i.	Test material	Species	Stage	Temp. (°C)	Exposure type	Duration (h)	LC50 (mg/L)	LC50 based on	Reference	Data line	Reason for omission from main dataset
75990	Dalapon	NR	Form.	*Limnodyn-astes peroni*	Tad.	21-22	Static	24	3300	Form.	Johnson (1976)	238	Data based on formulation, a.i. Content not defined.
533744	Dazomet	NR	?	*Bufo bufo japonicus*	Tad.	17.5	Static	24	>40	?	Nishiuchi (1979)	239	Unable to check details (source language).
50293	DDT	NR	?	*Bufo vulgaris formosus*	NR	25	NR	24	>40	?	Nishiuchi (1980a)	240	Unable to check details (source language).
52918635	Deltamethrin	2.5	Form.	*Bufo bufo*	Tad.	NR	Static	24	0.14	Form.	Premkumar and Mathavan (1987)	254	Insufficient detail on methods.
52918635	Deltamethrin	2.5	Form.	*Bufo bufo*	Tad.	NR	Static	24	0.69	Form.	Premkumar and Mathavan (1987)	255	Insufficient detail on methods.
52918635	Deltamethrin	NR	NR	*Rana temporaria*	Tad.	18	Static	24	0.01335	?	Thybaud (1990)	256	Test material not defined.
10311849	Dialifos	NR	?	*Bufo vulgaris formosus*	NR	25	NR	24	3.2	?	Nishiuchi (1980a)	257	Unable to check details (source language).
10311849	Dialifos	NR	?	*Bufo vulgaris formosus*	NR	25	NR	24	36	?	Nishiuchi (1980a)	258	Unable to check details (source language).
10311849	Dialifos	NR	?	*Bufo vulgaris formosus*	NR	25	NR	24	4.2	?	Nishiuchi (1980a)	259	Unable to check details (source language).
10311849	Dialifos	NR	?	*Bufo vulgaris formosus*	NR	25	NR	24	5.6	?	Nishiuchi (1980a)	260	Unable to check details (source language).
10311849	Dialifos	NR	?	*Bufo vulgaris formosus*	NR	25	NR	24	14-15	?	Nishiuchi (1980a)	261	Unable to check details (source language).
10311849	Dialifos	NR	?	*Bufo bufo japonicus*	Tad.	25	Static	24	1.2	?	Nishiuchi and Yoshida (1975)	262	Unable to check details (source language).
1918009	Dicamba	NR	Form.	*Adelotus brevis*	Tad.	21-22	Static	24	220	Form.	Johnson (1976)	263	Data based on formulation, a.i. Content not defined.
1918009	Dicamba	NR	Form.	*Limnodyn-astes peroni*	Tad.	21-22	Static	24	205	Form.	Johnson (1976)	264	Data based on formulation, a.i. Content not defined.
1194656	Dichlobenil	NR	?	*Bufo bufo japonicus*	NR	25	Static	24	14	?	Nishiuchi (1980b)	265	Unable to check details (source language).

CAS	Pesticide name	% a.i.	Test material	Species	Stage	Temp. (°C)	Exposure type	Duration (h)	LC50 (mg/L)	LC50 based on	Reference	Data line	Reason for omission from main dataset
1194656	Dichlobenil	NR	?	*Bufo bufo japonicus*	NR	25	Static	24	15	?	Nishiuchi (1980b)	266	Unable to check details (source language).
1194656	Dichlobenil	NR	?	*Bufo bufo japonicus*	NR	25	Static	24	16	?	Nishiuchi (1980b)	267	Unable to check details (source language).
1194656	Dichlobenil	NR	?	*Bufo bufo japonicus*	NR	25	Static	24	17	?	Nishiuchi (1980b)	268	Unable to check details (source language).
1194656	Dichlobenil	NR	?	*Bufo bufo japonicus*	NR	25	Static	24	18	?	Nishiuchi (1980b)	269	Unable to check details (source language).
1194656	Dichlobenil	NR	?	*Bufo bufo japonicus*	NR	25	Static	24	21	?	Nishiuchi (1980b)	270	Unable to check details (source language).
60571	Dieldrin	NR	?	*Bufo vulgaris formosus*	NR	25	NR	24	>10	?	Nishiuchi (1980a)	275	Unable to check details (source language).
60515	Dimethoate	40	?	*Rana chaochiaoen-sis*	Tad.	20.5±0.5	NR	24	76.97	a.i.	Zhang et al (2007)	281	Unable to extract all details (source language).
60515	Dimethoate	NR	Form.	*Rana hexadactyla*	Tad.	14 (12-17)	Static	24	7.82	Form.	Khangarot et al (1985c)	282	Data are for formulation (a.i. Content not defined).
2274671	Dimethylvinphos	NR	?	*Bufo vulgaris formosus*	NR	25	NR	24	11	?	Nishiuchi (1980a)	283	Unable to check details (source language).
2274671	Dimethylvinphos	NR	?	*Bufo vulgaris formosus*	NR	25	NR	24	15	?	Nishiuchi (1980a)	284	Unable to check details (source language).
85007	Diquat dibromide	NR	?	*Bufo bufo japonicus*	NR	25	Static	24	140	?	Nishiuchi (1980b)	285	Unable to check details (source language).
85007	Diquat dibromide	NR	?	*Bufo bufo japonicus*	NR	25	Static	24	280	?	Nishiuchi (1980b)	286	Unable to check details (source language).
85007	Diquat dibromide	NR	?	*Bufo bufo japonicus*	NR	25	Static	24	300	?	Nishiuchi (1980b)	287	Unable to check details (source language).
85007	Diquat dibromide	NR	?	*Bufo bufo japonicus*	NR	25	Static	24	320	?	Nishiuchi (1980b)	288	Unable to check details (source language).
85007	Diquat dibromide	NR	?	*Bufo bufo japonicus*	NR	25	Static	24	330	?	Nishiuchi (1980b)	289	Unable to check details (source language).
85007	Diquat dibromide	NR	?	*Bufo bufo japonicus*	NR	25	Static	24	340	?	Nishiuchi (1980b)	290	Unable to check details (source language).
144218	DSMA	NR	NR	*Adelotus brevis*	Tad.	21-22	Static	24	600	Form.	Johnson (1976)	291	Test material not defined.

CAS	Pesticide name	% a.i.	Test material	Species	Stage	Temp. (°C)	Exposure type	Duration (h)	LC50 (mg/L)	LC50 based on	Reference	Data line	Reason for omission from main dataset
144218	DSMA	NR	NR	*Limnodynastes peroni*	Tad.	21-22	Static	24	324	Form.	Johnson (1976)	292	Test material not defined.
17109498	Edifenphos	NR	?	*Bufo bufo japonicus*	NR	17.3-22.6	NR	24	1.8	?	Nishiuchi (1975)	293	Unable to check details (source language).
115297	Endosulfan	NR	NR	*Bufo melanostictus*	Larv.	25	Static	24	0.1419	?	Vardia et al (1984)	294	Test material not defined.
115297	Endosulfan	NR	?	*Bufo vulgaris formosus*	NR	25	NR	24	1.3	?	Nishiuchi (1980a)	295	Unable to check details (source language).
115297	Endosulfan	NR	?	*Bufo vulgaris formosus*	NR	25	NR	24	1.5	?	Nishiuchi (1980a)	296	Unable to check details (source language).
115297	Endosulfan	NR	?	*Bufo vulgaris formosus*	NR	25	NR	24	2.3	?	Nishiuchi (1980a)	297	Unable to check details (source language).
115297	Endosulfan	NR	?	*Bufo vulgaris formosus*	NR	25	NR	24	3.2	?	Nishiuchi (1980a)	298	Unable to check details (source language).
72208	Endrin	NR	Form.	*Rana hexadactyla*	Tad.	14 (12-17)	Static	24	4.94	Form.	Khangarot et al (1985c)	309	Data are for formulation (a.i. Content not defined).
33813206	Etem	NR	?	*Bufo bufo japonicus*	NR	17.3-22.6	NR	24	0.08	?	Nishiuchi (1975)	316	Unable to check details (source language).
2593159	Etridiazole	NR	?	*Bufo bufo japonicus*	Tad.	25	Static	24	12	?	Nishiuchi and Yoshida (1975)	317	Unable to check details (source language).
93721	Fenoprop	NR	Form.	*Adelotus brevis*	Tad.	21-22	Static	24	77	Form.	Johnson (1976)	322	Data based on formulation, a.i. Content not defined.
93721	Fenoprop	NR	?	*Bufo bufo japonicus*	Tad.	17.5	Static	24	>40	?	Nishiuchi (1979)	323	Unable to check details (source language).
93721	Fenoprop	NR	Form.	*Bufo marinus*	Tad.	21-22	Static	24	60	Form.	Johnson (1976)	324	Data based on formulation, a.i. Content not defined.
93721	Fenoprop	NR	Form.	*Limnodynastes peroni*	Tad.	21-22	Static	24	35	Form.	Johnson (1976)	326	Data based on formulation, a.i. Content not defined.
55389	Fenthion	NR	Form.	*Rana hexadactyla*	Tad.	14 (12-17)	Static	24	1.42	Form.	Khangarot et al (1985c)	329	Data are for formulation (a.i. Content not defined).

CAS	Pesticide name	% a.i.	Test material	Species	Stage	Temp. (°C)	Exposure type	Duration (h)	LC50 (mg/L)	LC50 based on	Reference	Data line	Reason for omission from main dataset
51630581	Fenvalerate	20	Form.	*Bufo bufo*	Tad.	NR	NR	24	0.18	a.i.	Jayakumar and Kandeepan (2009)	330	Insufficient detail of method used.
640197	Fluoroacetamide	NR	?	*Bufo vulgaris formosus*	NR	25	NR	24	>40	?	Nishiuchi (1980a)	331	Unable to check details (source language).
13738631	Fluoronitrofen	NR	?	*Bufo bufo japonicus*	NR	17.3-22.6	NR	24	14	?	Nishiuchi (1975)	332	Unable to check details (source language).
133073	Folpet	NR	?	*Bufo bufo japonicus*	NR	17.3-22.6	NR	24	0.65	?	Nishiuchi (1975)	333	Unable to check details (source language).
58899	Gamma-HCH, lindane	6.5	Form.	*Rana hexadactyla*	Tad.	14 (12-17)	Static	24	5.97	Form.	Khangarot et al (1985c)	341	Data are for formulation.
58899	Gamma-HCH, lindane	NR	NR	*Rana temporaria*	Tad.	18	Static	24	8.63	?	Thybaud (1990)	342	Test material not defined.
76448	Heptachlor	NR	?	*Bufo vulgaris formosus*	NR	25	Static	24	>10	?	Nishiuchi (1980a)	388	Unable to check details (source language).
118741	Hexachlorobenzene	NR	?	*Bufo bufo japonicus*	NR	25	Static	24	>4.2	?	Nishiuchi (1980b)	391	Unable to check details (source language).
118741	Hexachlorobenzene	NR	?	*Bufo bufo japonicus*	NR	25	Static	24	>4.2	?	Nishiuchi (1980b)	392	Unable to check details (source language).
118741	Hexachlorobenzene	NR	?	*Bufo bufo japonicus*	NR	25	Static	24	>4.2	?	Nishiuchi (1980b)	393	Unable to check details (source language).
118741	Hexachlorobenzene	NR	?	*Bufo bufo japonicus*	NR	25	Static	24	>4.2	?	Nishiuchi (1980b)	394	Unable to check details (source language).
118741	Hexachlorobenzene	NR	?	*Bufo bufo japonicus*	NR	25	Static	24	>4.2	?	Nishiuchi (1980b)	395	Unable to check details (source language).
118741	Hexachlorobenzene	NR	?	*Bufo bufo japonicus*	NR	25	Static	24	>4.2	?	Nishiuchi (1980b)	396	Unable to check details (source language).
2631405	Isoprocarb	NR	?	*Bufo bufo japonicus*	Tad.	17.5	Static	24	23	?	Nishiuchi (1979)	399	Unable to check details (source language).
36614387	Isothioate	NR	?	*Bufo bufo japonicus*	Tad.	25	Static	24	7.3	?	Nishiuchi and Yoshida (1975)	400	Unable to check details (source language).
18854018	Isoxathion	NR	?	*Bufo bufo japonicus*	Tad.	25	Static	24	12	?	Nishiuchi and Yoshida (1975)	401	Unable to check details (source language).
21609905	Leptophos	NR	?	*Bufo vulgaris formosus*	NR	25	NR	24	15	?	Nishiuchi (1980a)	402	Unable to check details (source language).

CAS	Pesticide name	% a.i.	Test material	Species	Stage	Temp. (°C)	Exposure type	Duration (h)	LC50 (mg/L)	LC50 based on	Reference	Data line	Reason for omission from main dataset
21609905	Leptophos	NR	?	*Bufo vulgaris formosus*	NR	25	NR	24	18	?	Nishiuchi (1980a)	403	Unable to check details (source language).
21609905	Leptophos	NR	?	*Bufo vulgaris formosus*	NR	25	NR	24	26	?	Nishiuchi (1980a)	404	Unable to check details (source language).
21609905	Leptophos	NR	?	*Bufo vulgaris formosus*	NR	25	NR	24	27	?	Nishiuchi (1980a)	405	Unable to check details (source language).
21609905	Leptophos	NR	?	*Bufo vulgaris formosus*	NR	25	NR	24	56	?	Nishiuchi (1980a)	406	Unable to check details (source language).
121755	Malathion	NR	Form.	*Rana hexadactyla*	Tad.	14 (12-17)	Static	24	0.846	Form.	Khangarot et al (1985c)	411	Data are for formulation (a.i. Content not defined).
121755	Malathion	NR	NR	*Rana tigrina*	Tad.	NR	NR	24	2.07	a.i.	Abbasi and Soni (1991)	412	Test material not defined, too little detail
94746	MCPA	?	?	*Bufo bufo japonicus*	NR	17.3-22.6	NR	24	10	?	Nishiuchi (1975)	413	Unable to check details (source language).
5221169	MCPA potassium	NR	?	*Bufo bufo japonicus*	NR	25	Static	24	>130	?	Nishiuchi (1980b)	414	Unable to check details (source language).
5221169	MCPA potassium	NR	?	*Bufo bufo japonicus*	NR	25	Static	24	>130	?	Nishiuchi (1980b)	415	Unable to check details (source language).
5221169	MCPA potassium	NR	?	*Bufo bufo japonicus*	NR	25	Static	24	>130	?	Nishiuchi (1980b)	416	Unable to check details (source language).
5221169	MCPA potassium	NR	?	*Bufo bufo japonicus*	NR	25	Static	24	>130	?	Nishiuchi (1980b)	417	Unable to check details (source language).
5221169	MCPA potassium	NR	?	*Bufo bufo japonicus*	NR	25	Static	24	>130	?	Nishiuchi (1980b)	418	Unable to check details (source language).
5221169	MCPA potassium	NR	?	*Bufo bufo japonicus*	NR	25	Static	24	4.9	?	Nishiuchi (1980b)	419	Unable to check details (source language).
5221169	MCPA potassium	NR	?	*Bufo bufo japonicus*	Tad.	25	Static	24	>40	?	Nishiuchi and Yoshida (1975)	420	Unable to check details (source language).
25319908	MCPA-thioethyl	NR	?	*Bufo bufo japonicus*	NR	17.3-22.6	NR	24	5.5	?	Nishiuchi (1975)	421	Unable to check details (source language).
10443706	MCPB-ethyl	NR	?	*Bufo bufo japonicus*	NR	17.3-22.6	NR	24	5.0	?	Nishiuchi (1975)	422	Unable to check details (source language).
6062266	MCPB-sodium	NR	?	*Bufo bufo japonicus*	NR	25	Static	24	1.1	?	Nishiuchi (1980b)	423	Unable to check details (source language).

CAS	Pesticide name	% a.i.	Test material	Species	Stage	Temp. (°C)	Exposure type	Duration (h)	LC50 (mg/L)	LC50 based on	Reference	Data line	Reason for omission from main dataset
6062266	MCPB-sodium	NR	?	*Bufo bufo japonicus*	NR	25	Static	24	32	?	Nishiuchi (1980b)	424	Unable to check details (source language).
6062266	MCPB-sodium	NR	?	*Bufo bufo japonicus*	NR	25	Static	24	36	?	Nishiuchi (1980b)	425	Unable to check details (source language).
6062266	MCPB-sodium	NR	?	*Bufo bufo japonicus*	NR	25	Static	24	38	?	Nishiuchi (1980b)	426	Unable to check details (source language).
6062266	MCPB-sodium	NR	?	*Bufo bufo japonicus*	NR	25	Static	24	42	?	Nishiuchi (1980b)	427	Unable to check details (source language).
6062266	MCPB-sodium	NR	?	*Bufo bufo japonicus*	NR	25	Static	24	4.8	?	Nishiuchi (1980b)	428	Unable to check details (source language).
2595542	Mecarbam	NR	?	*Bufo vulgaris formosus*	NR	25	Static	24	14	?	Nishiuchi (1980a)	429	Unable to check details (source language).
2595542	Mecarbam	NR	?	*Bufo vulgaris formosus*	NR	25	Static	24	18	?	Nishiuchi (1980a)	430	Unable to check details (source language).
2595542	Mecarbam	NR	?	*Bufo vulgaris formosus*	NR	25	Static	24	24	?	Nishiuchi (1980a)	431	Unable to check details (source language).
2595542	Mecarbam	NR	?	*Bufo vulgaris formosus*	NR	25	Static	24	27	?	Nishiuchi (1980a)	432	Unable to check details (source language).
53780340	Mefluidide	NR	?	*Bufo bufo japonicus*	Tad.	17.5	Static	24	>40	?	Nishiuchi (1979)	434	Unable to check details (source language).
7487947	Mercuric chloride	NR	Tech.	*Rana tigrina*	Adults	23±1.0	Renewal	24	18.3	a.i.	Mudgall and Patil (1988)	435	Insufficient details on repilication and dose levels.
7487947	Mercuric chloride	NR	Tech.	*Rana tigrina*	Adults	23±1.0	Renewal	24	19.02	a.i.	Mudgall and Patil (1988)	436	Insufficient details on repilication and dose levels.
7487947	Mercuric chloride	NR	?	*Ambystoma mexicanum*	NR	20	NR	24	0.56	Total	Slooff (1982)	437	Unable to check details (source not retrieved).
7487947	Mercuric chloride	NR	?	*Xenopus laevis*	NR	20	NR	24	0.18-0.32	Total	Slooff (1982)	438	Unable to check details (source not retrieved).
16752775	Methomyl	NR	?	*Bufo vulgaris formosus*	NR	25	NR	24	>42	?	Nishiuchi (1980a)	446	Unable to check details (source language).
16752775	Methomyl	NR	?	*Bufo vulgaris formosus*	NR	25	NR	24	34	?	Nishiuchi (1980a)	447	Unable to check details (source language).
16752775	Methomyl	NR	?	*Bufo vulgaris formosus*	NR	25	NR	24	23-26	?	Nishiuchi (1980a)	448	Unable to check details (source language).

CAS	Pesticide name	% a.i.	Test material	Species	Stage	Temp. (°C)	Exposure type	Duration (h)	LC50 (mg/L)	LC50 based on	Reference	Data line	Reason for omission from main dataset
1129415	Metolcarb	NR	?	*Bufo bufo japonicus*	Tad.	17.5	Static	24	>40	?	Nishiuchi (1979)	454	Unable to check details (source language).
2212671	Molinate	NR	?	*Bufo bufo japonicus*	NR	17.3-2.6	NR	24	14	?	Nishiuchi (1975)	456	Unable to check details (source language).
2212671	Molinate	NR	?	*Bufo bufo japonicus*	Tad.	25	Static	24	34	?	Nishiuchi and Yoshida (1975)	457	Unable to check details (source language).
300765	Naled	NR	?	*Bufo vulgaris formosus*	NR	25	NR	24	19	?	Nishiuchi (1980a)	461	Unable to check details (source language).
300765	Naled	NR	?	*Bufo vulgaris formosus*	NR	25	NR	24	6.5	?	Nishiuchi (1980a)	462	Unable to check details (source language).
300765	Naled	NR	?	*Bufo vulgaris formosus*	NR	25	NR	24	2.3-2.7	?	Nishiuchi (1980a)	463	Unable to check details (source language).
300765	Naled	NR	?	*Bufo vulgaris formosus*	NR	25	NR	24	3.6-4.6	?	Nishiuchi (1980a)	464	Unable to check details (source language).
11141176	Neem (Azadirachtin)	NR	Form.	*Bufo regularis*	Tad.	NR	Static?	24	See formulation data	a.i.	El-Shazly and El-Sharnoubi (2000)	466	Insufficient detail on test method.
65305	Nicotine sulfate	NR	?	*Bufo vulgaris formosus*	NR	25	NR	24	>56	?	Nishiuchi (1980a)	470	Unable to check details (source language).
65305	Nicotine sulfate	NR	?	*Bufo vulgaris formosus*	NR	25	NR	24	56	?	Nishiuchi (1980a)	471	Unable to check details (source language).
4726141	Nitralin	NR	?	*Bufo bufo japonicus*	Tad.	25	Static	24	>40	?	Nishiuchi and Yoshida (1975)	472	Unable to check details (source language).
34622587	Orbencarb, orthobencarb	NR	?	*Bufo bufo japonicus*	NR	25	Static	24	2.4	?	Nishiuchi (1980b)	473	Unable to check details (source language).
34622587	Orbencarb, orthobencarb	NR	?	*Bufo bufo japonicus*	NR	25	Static	24	2.7	?	Nishiuchi (1980b)	474	Unable to check details (source language).
34622587	Orbencarb, orthobencarb	NR	?	*Bufo bufo japonicus*	NR	25	Static	24	2.7	?	Nishiuchi (1980b)	475	Unable to check details (source language).
34622587	Orbencarb, orthobencarb	NR	?	*Bufo bufo japonicus*	NR	25	Static	24	2.7	?	Nishiuchi (1980b)	476	Unable to check details (source language).
34622587	Orbencarb, orthobencarb	NR	?	*Bufo bufo japonicus*	NR	25	Static	24	2.7	?	Nishiuchi (1980b)	477	Unable to check details (source language).
34622587	Orbencarb, orthobencarb	NR	?	*Bufo bufo japonicus*	NR	25	Static	24	2.7	?	Nishiuchi (1980b)	478	Unable to check details (source language).

CAS	Pesticide name	% a.i.	Test material	Species	Stage	Temp. (°C)	Exposure type	Duration (h)	LC50 (mg/L)	LC50 based on	Reference	Data line	Reason for omission from main dataset
19666309	Oxadiazon	NR	?	*Bufo bufo japonicus*	Tad.	25	Static	24	2.8	?	Nishiuchi and Yoshida (1975)	479	Unable to check details (source language).
5259881	Oxicarboxin	NR	?	*Bufo bufo japonicus*	Tad.	25	Static	24	>40	?	Nishiuchi and Yoshida (1975)	480	Unable to check details (source language).
4685147	Paraquat	NR	Form.	*Adelotus brevis*	Tad.	21-22	Static	24	320	Form.	Johnson (1976)	484	Data based on formulation, a.i. Content not defined.
4418262	Paraquat	NR	?	*Bufo bufo japonicus*	Tad.	17.5	Static	24	>40	Form.	Nishiuchi (1979)	485	Unable to check details (source language).
4685147	Paraquat	NR	Form.	*Limnodyn-astes peroni*	Tad.	21-22	Static	24	204	Form.	Johnson (1976)	486	Data based on formulation, a.i. Content not defined.
1910425	Paraquat dichloride	NR	?	*Bufo bufo japonicus*	NR	17.3-22.6	NR	24	7.0	?	Nishiuchi (1975)	487	Unable to check details (source language).
1910425	Paraquat dichloride	NR	?	*Bufo bufo japonicus*	NR	25	Static	24	13	?	Nishiuchi (1980b)	488	Unable to check details (source language).
1910425	Paraquat dichloride	NR	?	*Bufo bufo japonicus*	NR	25	Static	24	2.5	?	Nishiuchi (1980b)	489	Unable to check details (source language).
1910425	Paraquat dichloride	NR	?	*Bufo bufo japonicus*	NR	25	Static	24	27	?	Nishiuchi (1980b)	490	Unable to check details (source language).
1910425	Paraquat dichloride	NR	?	*Bufo bufo japonicus*	NR	25	Static	24	3.2	?	Nishiuchi (1980b)	491	Unable to check details (source language).
1910425	Paraquat dichloride	NR	?	*Bufo bufo japonicus*	NR	25	Static	24	5.6	?	Nishiuchi (1980b)	492	Unable to check details (source language).
1910425	Paraquat dichloride	NR	?	*Bufo bufo japonicus*	NR	25	Static	24	9	?	Nishiuchi (1980b)	493	Unable to check details (source language).
298000	Parathion-methyl, methyl parathion	50	Form.	*Rana cyanophlyctis*	Tad.	NR	Static	24	8	Form.	Yasmeen and Nayeemunnisa (1985)	505	Too little detail. On conduct of study.
298000	Parathion-methyl, methyl parathion	NR	NR	*Rana tigrina*	Tad.	28±2	Renewal	24	6.28	NR	Kennedy and Sampath (2001)	506	Test material not defined, basis of LC50 value not defined.
1114712	Pebulate	NR	?	*Bufo bufo japonicus*	NR	17.3-22.6	NR	24	6.1	?	Nishiuchi (1975)	508	Unable to check details (source language).

CAS	Pesticide name	% a.i.	Test material	Species	Stage	Temp. (°C)	Exposure type	Duration (h)	LC50 (mg/L)	LC50 based on	Reference	Data line	Reason for omission from main dataset
87865	Pentachlorophenol	NR	?	*Ambystoma mexicanum*	NR	20	NR	24	0.56-1	Form.	Slooff (1982)	509	Unable to check details (source not retrieved).
87865	Pentachlorophenol	NR	?	*Xenopus laevis*	NR	20	NR	24	0.18-0.32	Form.	Slooff (1982)	510	Unable to check details (source not retrieved).
87865	Pentachlorophenol	NR	?	*Bufo bufo japonicus*	Tad.	20	Static	24	0.17-0.23	?	Nishiuchi (1976)	512	Unable to check details (source language).
2307688	Pentanochlor	NR	?	*Bufo bufo japonicus*	NR	25	Static	24	8	?	Nishiuchi (1980b)	513	Unable to check details (source language).
2307688	Pentanochlor	NR	?	*Bufo bufo japonicus*	NR	25	Static	24	8.4	?	Nishiuchi (1980b)	514	Unable to check details (source language).
2307688	Pentanochlor	NR	?	*Bufo bufo japonicus*	NR	25	Static	24	8.6	?	Nishiuchi (1980b)	515	Unable to check details (source language).
2307688	Pentanochlor	NR	?	*Bufo bufo japonicus*	NR	25	Static	24	8.6	?	Nishiuchi (1980b)	516	Unable to check details (source language).
2307688	Pentanochlor	NR	?	*Bufo bufo japonicus*	NR	25	Static	24	8.6	?	Nishiuchi (1980b)	517	Unable to check details (source language).
2307688	Pentanochlor	NR	?	*Bufo bufo japonicus*	NR	25	Static	24	8.6	?	Nishiuchi (1980b)	518	Unable to check details (source language).
2310170	Phosalone	NR	?	*Bufo vulgaris formosus*	NR	25	NR	24	4.6-4.8	?	Nishiuchi (1980a)	520	Unable to check details (source language).
2310170	Phosalone	NR	NR	*Rana tigrina*	Tad.	NR	NR	24	0.30	a.i.	Abbasi and Soni (1991)	521	Test material not defined, too little detail
13171216	Phosphamidon	NR	NR	*Rana cyanophlyctis*	Adults	NR	NR	24	0.272	a.i.	Thenmozhi and Ramaswamy (2008)	522	Test material not defined.
1918021	Picloram	NR	Form.	*Adelotus brevis*	Tad.	21-22	Static	24	143	Form.	Johnson (1976)	523	Data based on formulation, a.i. Content not defined.
1918021	Picloram	NR	Form.	*Adelotus brevis*	Tad.	21-22	Static	24	210	Form.	Johnson (1976)	524	Data based on formulation, a.i. Content not defined.
1918021	Picloram	NR	Form.	*Limnodynastes peroni*	Tad.	21-22	Static	24	120	Form.	Johnson (1976)	525	Data based on formulation, a.i. Content not defined.
23103982	Pirimicarb	NR	?	*Bufo vulgaris formosus*	NR	25	NR	24	>40	?	Nishiuchi (1980a)	528	Unable to check details (source language).

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39285046	Polynactin	NR	?	*Bufo bufo japonicus*	Tad.	25	Static	24	0.029	?	Nishiuchi and Yoshida (1975)	532	Unable to check details (source language).
14088712	Proclonol	NR	?	*Bufo vulgaris formosus*	NR	25	NR	24	0.82	?	Nishiuchi (1980a)	533	Unable to check details (source language).
14088712	Proclonol	NR	?	*Bufo vulgaris formosus*	NR	25	NR	24	0.86	?	Nishiuchi (1980a)	534	Unable to check details (source language).
2631370	Promecarb	NR	?	*Bufo bufo japonicus*	Tad.	25	Static	24	28	?	Nishiuchi and Yoshida (1975)	536	Unable to check details (source language).
7292162	Propaphos	NR	?	*Bufo bufo japonicus*	Tad.	25	Static	24	14	?	Nishiuchi and Yoshida (1975)	537	Unable to check details (source language).
2312358	Propargite	NR	?	*Bufo vulgaris formosus*	NR	25	NR	24	0.12	?	Nishiuchi (1980a)	538	Unable to check details (source language).
2312358	Propargite	NR	?	*Bufo vulgaris formosus*	NR	25	NR	24	0.25	?	Nishiuchi (1980a)	539	Unable to check details (source language).
2312358	Propargite	NR	?	*Bufo vulgaris formosus*	NR	25	NR	24	0.29	?	Nishiuchi (1980a)	540	Unable to check details (source language).
2312358	Propargite	NR	?	*Bufo vulgaris formosus*	NR	25	NR	24	0.19-0.2	?	Nishiuchi (1980a)	541	Unable to check details (source language).
23950585	Propyzamide	NR	?	*Bufo bufo japonicus*	Tad.	25	Static	24	>40	?	Nishiuchi and Yoshida (1975)	542	Unable to check details (source language).
119120	Pyridaphenthion	NR	?	*Bufo bufo japonicus*	Tad.	25	Static	24	10	?	Nishiuchi and Yoshida (1975)	543	Unable to check details (source language).
1086028	Pyridinitril	NR	?	*Bufo bufo japonicus*	NR	17.3-22.6	NR	24	0.023	?	Nishiuchi (1975)	544	Unable to check details (source language).
2797515	Quinoclamine	NR	?	*Bufo bufo japonicus*	NR	17.3-22.6	NR	24	0.62	?	Nishiuchi (1975)	545	Unable to check details (source language).
83794	Rotenone	5	Form.	*Rana spheno-cephala*	Larv.	16±1	Static	24	0.580	NR	Chandler and Marking (1982)	546	Lack of detail on methods and basis of values presented (active substance or formulation).
83794	Rotenone	NR	?	*Bufo vulgaris formosus*	NR	25	NR	24	0.052-0.058	?	Nishiuchi (1980a)	547	Unable to check details (source language).
83794	Rotenone	NR	?	*Bufo vulgaris formosus*	NR	25	NR	24	0.068-0.075	?	Nishiuchi (1980a)	548	Unable to check details (source language).

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83794	Rotenone	NR	?	*Bufo vulgaris formosus*	NR	25	NR	24	0.086-0.092	?	Nishiuchi (1980a)	549	Unable to check details (source language).
83794	Rotenone	20	Form.	*Rana pipiens*	NR	NR	Static	24	7.9	Form.	Farringer (1972)	550	Insufficient detail on methods used.
83794	Rotenone	20	Form.	*Rana pipiens*	NR	NR	Static	24	7.3	Form.	Farringer (1972)	551	Insufficient detail on methods used.
83794	Rotenone	5	Form.	*Rana pipiens*	NR	NR	Static	24	4.8	Form.	Farringer (1972)	552	Insufficient detail on methods used.
83794	Rotenone	5	Form.	*Rana pipiens*	NR	NR	Static	24	24	Form.	Farringer (1972)	553	Insufficient detail on methods used.
4418262	Sodium dehydroacetic acid, dehydroacetic acid - sodium salt	NR	?	*Bufo bufo japonicus*	Tad.	17.5	Static	24	>40	Form.	Nishiuchi (1979)	556	Unable to check details (source language).
131522	Sodium pentachlorophenoxide	NR	?	*Bufo bufo japonicus*	NR	17.3-22.6	NR	24	0.12	?	Nishiuchi (1975)	596	Unable to check details (source language).
131522	Sodium pentachlorophenoxide	NR	?	*Bufo bufo japonicus*	Tad.	25	Static	24	0.35	?	Nishiuchi and Yoshida (1975)	597	Unable to check details (source language).
3383968	Temephos	5	Form.	*Hynobius retardatus*	Larv.	17-18	Static	24	3.97	Form.	Hattori (1974)	602	Unable to check details (source language).
3383968	Temephos	5	Form.	*Rana chensinensis*	Tad.	17-18	Static	24	4.18	Form.	Hattori (1974)	605	Unable to check details (source language).
22248799	Tetrachlorvinphos	NR	?	*Bufo vulgaris formosus*	NR	25	NR	24	10	?	Nishiuchi (1980a)	606	Unable to check details (source language).
22248799	Tetrachlorvinphos	NR	?	*Bufo vulgaris formosus*	NR	25	NR	24	8.1	?	Nishiuchi (1980a)	607	Unable to check details (source language).
22248799	Tetrachlorvinphos	NR	?	*Bufo vulgaris formosus*	NR	25	NR	24	8.5	?	Nishiuchi (1980a)	608	Unable to check details (source language).
116290	Tetradifon	NR	?	*Bufo vulgaris formosus*	NR	25	NR	24	6.1	?	Nishiuchi (1980a)	609	Unable to check details (source language).
116290	Tetradifon	NR	?	*Bufo vulgaris formosus*	NR	25	NR	24	6.4	?	Nishiuchi (1980a)	610	Unable to check details (source language).

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148798	Thiabendazole	NR	?	*Bufo bufo japonicus*	Tad.	25	Static	24	15	?	Nishiuchi and Yoshida (1975)	611	Unable to check details (source language).
81412433	Tridemorph	NR	Form.	*Rana hexadactyla*	Tad.	14 (12-17)	Static	24	0.78	Form.	Khangarot et al (1985c)	636	Data are for formulation (a.i. Content not defined).
137304	Ziram	NR	?	*Bufo bufo japonicus*	NR	17.3-22.6	NR	24	0.21	?	Nishiuchi (1975)	641	Unable to check details (source language).
94757	2,4-D	NR	NR	*Bufo melanostictus*	Larv.	25	Static	48	9.03	?	Vardia et al (1984)	644	Test material not defined.
2702729	2,4-D Sodium	NR	Tech.	*Bufo bufo japonicus*	Tad.	25 (24-26)	Static	48	>40	a.i.	Hashimoto and Nishiuchi (1981)	648	Unable to check details (source language).
2008391	2,4-D-dimethylammonium	NR	Form.	*Adelotus brevis*	Tad.	21-22	Static	48	228	Form.	Johnson (1976)	649	Data based on formulation, a.i. Content not defined.
2008391	2,4-D-dimethylammonium	NR	Form.	*Bufo marinus*	Tad.	21-22	Static	48	333	Form.	Johnson (1976)	650	Data based on formulation, a.i. Content not defined.
2008391	2,4-D-dimethylammonium	NR	Form.	*Limnodynastes peroni*	Tad.	21-22	Static	48	300	Form.	Johnson (1976)	651	Data based on formulation, a.i. Content not defined.
2008391	2,4-D-dimethylammonium	55	Form.	*Rana limnocharis*	Tad.	NR	NR	48	1498.4	Form.	Pan and Liang (1993)	652	Unable to check details (source not retrieved).
30560191	Acephate	NR	?	*Bufo bufo japonicus*	Tad.	25	Static	48	>40	?	Nishiuchi and Yoshida (1975)	653	Unable to check details (source language).
30560191	Acephate	NR	?	*Rana brevipoda porosa*	Tad.	25	NR	48	>100	?	Nishiuchi (1990)	654	Unable to check details (source not retrieved).
319846	alpha-HCH	NR	Form.	*Bufo bufo japonicus*	Tad.	25 (24-26)	Static	48	24	Form.	Hashimoto and Nishiuchi (1981)	660	Unable to check details (source language).
101053	Anilazine	50	Form.	*Rana limnocharis*	Tad.	NR	NR	48	1.558	Form.	Pan and Liang (1993)	663	Unable to check details (source not retrieved).
3337711	Asulam	NR	?	*Bufo bufo japonicus*	Tad.	25	Static	48	>40	?	Nishiuchi and Yoshida (1975)	665	Unable to check details (source language).

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1912249	Atrazine	NR	NR	*Xenopus tropicalis*	Emb.	23±1	Renewal	48	22.3	a.i.	Fort et al (2004)	666	Test material not defined.
1912249	Atrazine	NR	NR	*Xenopus tropicalis*	Emb.	23±1	Renewal	48	19.4	a.i.	Fort et al (2004)	667	Test material not defined.
1912249	Atrazine	NR	NR	*Xenopus tropicalis*	Emb.	27±1	Renewal	48	27.5	a.i.	Fort et al (2004)	668	Test material not defined.
1912249	Atrazine	NR	NR	*Xenopus tropicalis*	Emb.	27±1	Renewal	48	31.8	a.i.	Fort et al (2004)	669	Test material not defined.
17804352	Benomyl	50	Form.	*Rana limnocharis*	Tad.	NR	NR	48	47.742	Form.	Pan and Liang (1993)	673	Unable to check details (source not retrieved).
8011630	Bordeaux mixture (1 % $CuSO_4$ + 1% $CaCO_3$ in H_2O 1:1)	-	Form.	*Microhyla ornata*	Tad.	25.5-25.9	Renewal	48	4.06	Form.	Jayaprakash and Madhyastha (1989)	674	Unclear as to the basis of the toxicity data.
8011630	Bordeaux mixture (1 % $CuSO_4$ + 1% $CaCO_3$ in H_2O 1:1)	-	Form.	*Microhyla ornata*	Tad.	25.5-25.9	Renewal	48	4.28	Form.	Jayaprakash and Madhyastha (1989)	675	Unclear as to the basis of the toxicity data.
18181801	Bromopropylate	NR	?	*Rana brevipoda porosa*	Tad.	25	NR	48	<1	?	Nishiuchi (1990)	676	Unable to check details (source not retrieved).
69327760	Buprofezin	25	Form.	*Rana limnocharis*	Tad.	NR	NR	48	284.05	Form.	Pan and Liang (1993)	677	Unable to check details (source not retrieved).
23184669	Butachlor	NR	?	*Bufo bufo japonicus*	Tad.	25	Static	48	1.8	?	Nishiuchi and Yoshida (1975)	678	Unable to check details (source language).
23184669	Butachlor	60	Form.	*Rana limnocharis*	Tad.	NR	NR	48	1.621	Form.	Pan and Liang (1993)	684	Unable to check details (source not retrieved).
36335678	Butamifos	NR	?	*Bufo bufo japonicus*	Tad.	17.5	Static	48	3	?	Nishiuchi (1979)	685	Unable to check details (source language).
34681237	Butoxycarboxim	NR	?	*Bufo bufo japonicus*	Tad.	17.5	Static	48	>40	?	Nishiuchi (1979)	686	Unable to check details (source language).
8001352	Camphechlor	40	Form.	*Rana limnocharis*	Tad.	NR	NR	48	0.012	Form.	Pan and Liang (1993)	689	Unable to check details (source not retrieved).

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133062	Captan	NR	Form.	*Bufo bufo japonicus*	Tad.	25 (24-26)	Static	48	3.0	Form.	Hashimoto and Nishiuchi (1981)	690	Unable to check details (source language).
63252	Carbaryl	NR	Form.	*Bufo bufo japonicus*	Tad.	25 (24-26)	Static	48	7.2	Form.	Hashimoto and Nishiuchi (1981)	694	Unable to check details (source language).
63252	Carbaryl	NR	Form.	*Rana hexadactyla*	Tad.	14 (12-17)	Renewal	48	107.9	Form.	Khangarot et al (1985c)	699	Data are for formulation (a.i. Content not defined).
10605217	Carbendazim	NR	?	*Bufo bufo japonicus*	Tad.	25	Static	48	>40	?	Nishiuchi and Yoshida (1975)	700	Unable to check details (source language).
10605217	Carbendazim	NR	Form.	*Rana hexadactyla*	Tad.	14 (12-17)	Renewal	48	22.73	Form.	Khangarot et al (1985c)	701	Data are for formulation (a.i. Content not defined).
10605217	Carbendazim	50	Form.	*Rana limnocharis*	Tad.	NR	NR	48	173.786	Form.	Pan and Liang (1993)	702	Unable to check details (source not retrieved).
1563662	Carbofuran	75	NR	*Rana hexadactyla*	Tad.	14 (12-17)	Renewal	48	150	Form.	Khangarot et al (1985c)	703	Test material not defined.
1563662	Carbofuran	75	Form.	*Rana limnocharis*	Tad.	NR	NR	48	11.226	Form.	Pan and Liang (1993)	704	Unable to check details (source not retrieved).
15263533	Cartap	NR	Form.	*Bufo bufo japonicus*	Tad.	25 (24-26)	Static	48	5.6	Form.	Hashimoto and Nishiuchi (1981)	706	Unable to check details (source language).
15263533	Cartap	50	Form.	*Rana limnocharis*	Tad.	NR	NR	48	0.143	Form.	Pan and Liang (1993)	707	Unable to check details (source not retrieved).
32861851	Chlomethoxyfen, chlormethoxynil	NR	?	*Bufo bufo japonicus*	Tad.	25	Static	48	>40	?	Nishiuchi and Yoshida (1975)	708	Unable to check details (source language).
6164983	Chlordimeform	25	Form.	*Rana limnocharis*	Tad.	NR	NR	48	39.639	Form.	Pan and Liang (1993)	709	Unable to check details (source not retrieved).
76062	Chloropicrin	?	?	*Rana limnocharis*	NR	NR	NR	48	2.18	a.i.	Wu et al (2011b)	710	Unable to check details (source language).
1897456	Chlorothalonil	NR	Tech.	*Bufo bufo japonicus*	Tad.	25 (24-26)	Static	48	0.16	a.i.	Hashimoto and Nishiuchi (1981)	711	Unable to check details (source language).

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1897456	Chlorothalonil	75	Form.	*Rana limnocharis*	Tad.	NR	NR	48	0.245	Form.	Pan and Liang (1993)	712	Unable to check details (source not retrieved).
2921882	Chlorpyrifos	40.7	Form.	*Rana limnocharis*	Tad.	NR	NR	48	2.401	Form.	Pan and Liang (1993)	716	Unable to check details (source not retrieved).
2921882	Chlorpyrifos	NR	NR	*Rana tigrina*	Tad.	NR	NR	48	0.152	a.i.	Abbasi and Soni (1991)	717	Test material not defined, too little detail
5902954	CMA, CAMA, calcium hyrogem methylarsenate	10	Form.	*Rana limnocharis*	Tad.	NR	NR	48	106.87	Form.	Pan and Liang (1993)	718	Unable to check details (source not retrieved).
7758987	Copper sulfate	NR	Tech. (Reagent grade)	*Rana hexadactyla*	Tad.	15	Static	48	0.042	a.i. (Cu)	Khangarot et al (1985a)	728	Data appear to be the same as presented in Khangarot et al (1994).
7758987	Copper sulfate	NR	Tech. (Reagent grade)	*Rana hexadactyla*	Tad.	15 (13-16)	Renewal	48	0.042	a.i. (Cu)	Khangarot et al (1985b)	729	Data appear to be the same as presented in Khangarot et al (1994).
122008859	Cyhalofop-butyl	?	?	*Rana limnocharis*	Tad.	NR	NR	48	0.677	a.i.	Wu et al (2011a)	730	Unable to check details (source language).
68085858	Cyhalothrin	2.5	Form.	*Rana limnocharis*	Tad.	NR	NR	48	0.004	Form.	Pan and Liang (1993)	731	Unable to check details (source not retrieved).
13121705	Cyhexatin	NR	?	*Bufo bufo japonicus*	Tad.	25	Static	48	0.075	?	Nishiuchi and Yoshida (1975)	732	Unable to check details (source language).
75990	Dalapon	NR	Form.	*Adelotus brevis*	Tad.	21-22	Static	48	5200	Form.	Johnson (1976)	736	Data based on formulation, a.i. Content not defined.
75990	Dalapon	NR	Form.	*Limnodynastes peroni*	Tad.	21-22	Static	48	2500	Form.	Johnson (1976)	737	Data based on formulation, a.i. Content not defined.
533744	Dazomet	NR	?	*Bufo bufo japonicus*	Tad.	17.5	Static	48	7.3	?	Nishiuchi (1979)	738	Unable to check details (source language).
50293	DDT	NR	Form.	*Anura*	Tad.	NR	NR	48	31	a.i.	Okudaira (1973)	739	Lack of detail on conduct of study.
50293	DDT	NR	Form.	*Bufo bufo japonicus*	Tad.	25 (24-26)	Static	48	31	Form.	Hashimoto and Nishiuchi (1981)	741	Unable to check details (source language).

CAS	Pesticide name	% a.i.	Test material	Species	Stage	Temp. (°C)	Exposure type	Duration (h)	LC50 (mg/L)	LC50 based on	Reference	Data line	Reason for omission from main dataset
50293	DDT	25	Form.	*Rana limnocharis*	Tad.	NR	NR	48	0.377	Form.	Pan and Liang (1993)	748	Unable to check details (source not retrieved).
75990	Delapon	NR	?	*Rana brevipoda porosa*	NR	25	NR	48	>100	?	Nishiuchi (1990)	749	Unable to check details (source not retrieved).
52918635	Deltamethrin	2.5	Form.	*Rana limnocharis*	Tad.	NR	NR	48	0.006	Form.	Pan and Liang (1993)	752	Unable to check details (source not retrieved).
52918635	Deltamethrin	NR	NR	*Rana temporaria*	Tad.	18	Static	48	0.01961	?	Thybaud (1990)	753	Test material not defined.
10311849	Dialifos	NR	?	*Bufo bufo japonicus*	Tad.	25	Static	48	1	?	Nishiuchi and Yoshida (1975)	754	Unable to check details (source language).
3566107	Diammonium ethylenebis (dithiocarbamate)	45	Form.	*Rana limnocharis*	Tad.	NR	NR	48	2.86	Form.	Pan and Liang (1993)	755	Unable to check details (source not retrieved).
333415	Diazinon	NR	Form.	*Bufo bufo japonicus*	Tad.	25 (24-26)	Static	48	14	Form.	Hashimoto and Nishiuchi (1981)	756	Unable to check details (source language).
333415	Diazinon	34	Form.	*Rana limnocharis*	Tad.	NR	NR	48	11.477	Form.	Pan and Liang (1993)	757	Unable to check details (source not retrieved).
333415	Diazinon	50	Form.	*Rana limnocharis*	Tad.	NR	NR	48	4.477	Form.	Pan and Liang (1993)	758	Unable to check details (source not retrieved).
1918009	Dicamba	NR	Form.	*Adelotus brevis*	Tad.	21-22	Static	48	202	Form.	Johnson (1976)	759	Data based on formulation, a.i. Content not defined.
1918009	Dicamba	NR	Form.	*Limnodynastes peroni*	Tad.	21-22	Static	48	166	Form.	Johnson (1976)	760	Data based on formulation, a.i. Content not defined.
120365	Dichlorprop	NR	?	*Rana brevipoda porosa*	Tad.	25	NR	48	>100	?	Nishiuchi (1990)	761	Unable to check details (source not retrieved).
62737	Dichlorvos	100	Form.	*Rana hexadactyla*	Tad.	28.5-28.8	Static	48	10	Form.	Sreenivasan and Swaminathan (1967)	767	Insufficient detail of methods used
62737	Dichlorvos	50	Form.	*Rana limnocharis*	Tad.	NR	NR	48	9.696	Form.	Pan and Liang (1993)	768	Unable to check details (source not retrieved).

CAS	Pesticide name	% a.i.	Test material	Species	Stage	Temp. (°C)	Exposure type	Duration (h)	LC50 (mg/L)	LC50 based on	Reference	Data line	Reason for omission from main dataset
60571	Dieldrin	18.5	Form.	*Rana limnocharis*	Tad.	NR	NR	48	0.104	Form.	Pan and Liang (1993)	771	Unable to check details (source not retrieved).
35367385	Diflubenzuron	NR	?	*Rana brevipoda porosa*	Tad.	25	NR	48	>100	?	Nishiuchi (1990)	772	Unable to check details (source not retrieved).
60515	Dimethoate	40	?	*Rana chaochiaoen-sis*	Tad.	20.5±0.5	NR	48	67.85	a.i.	Zhang et al (2007)	777	Unable to extract all details (source language).
60515	Dimethoate	NR	Form.	*Rana hexadactyla*	Tad.	14 (12-17)	Renewal	48	7.82	Form.	Khangarot et al (1985c)	778	Data are for formulation (a.i. Content not defined).
60515	Dimethoate	40	Form.	*Rana limnocharis*	Tad.	NR	NR	48	2.254	Form.	Pan and Liang (1993)	779	Unable to check details (source not retrieved).
88857	Dinoseb	NR	Tech.	*Bufo bufo japonicus*	Tad.	25 (24-26)	Static	48	0.55	a.i.	Hashimoto and Nishiuchi (1981)	780	Unable to check details (source language).
2764729	Diquat	NR	?	*Rana brevipoda porosa*	Tad.	25	NR	48	>100	?	Nishiuchi (1990)	781	Unable to check details (source not retrieved).
3347226	Dithianon	NR	?	*Rana brevipoda porosa*	Tad.	25	NR	48	<1	?	Nishiuchi (1990)	782	Unable to check details (source not retrieved).
144218	DSMA	NR	NR	*Adelotus brevis*	Tad.	21-22	Static	48	525	Form.	Johnson (1976)	783	Test material not defined.
144218	DSMA	NR	NR	*Limnodyn-astes peroni*	Tad.	21-22	Static	48	310	Form.	Johnson (1976)	784	Test material not defined.
13286323	EBP	40	Form.	*Rana limnocharis*	Tad.	NR	NR	48	8.23	Form.	Pan and Liang (1993)	785	Unable to check details (source not retrieved).
13286323	EBP	30	Form.	*Rana limnocharis*	Tad.	NR	NR	48	9.436	Form.	Pan and Liang (1993)	786	Unable to check details (source not retrieved).
115297	Endosulfan	NR	NR	*Bufo melanostictus*	Larv.	25	Static	48	0.1344	?	Vardia et al (1984)	787	Test material not defined.
115297	Endosulfan	NR	Form.	*Bufo bufo japonicus*	Tad.	25 (24-26)	Static	48	9.0	Form.	Hashimoto and Nishiuchi (1981)	788	Unable to check details (source language).
115297	Endosulfan	35	Form.	*Rana limnocharis*	Tad.	NR	NR	48	0.012	Form.	Pan and Liang (1993)	792	Unable to check details (source not retrieved).

CAS	Pesticide name	% a.i.	Test material	Species	Stage	Temp. (°C)	Exposure type	Duration (h)	LC50 (mg/L)	LC50 based on	Reference	Data line	Reason for omission from main dataset
115297	Endosulfan	NR	NR	*Rana tigrina*	Tad.	NR	NR	48	0.021	a.i.	Abbasi and Soni (1991)	793	Test material not defined, too little detail
72208	Endrin	NR	Form.	*Bufo bufo japonicus*	Tad.	25 (24-26)	Static	48	12	Form.	Hashimoto and Nishiuchi (1981)	796	Unable to check details (source language).
72208	Endrin	NR	Form.	*Rana hexadactyla*	Tad.	14 (12-17)	Renewal	48	0.85	Form.	Khangarot et al (1985c)	799	Data are for formulation (a.i. Content not defined).
66230044	Esfenvalerate	5	Form.	*Rana limnocharis*	Tad.	NR	NR	48	0.028	Form.	Pan and Liang (1993)	806	Unable to check details (source not retrieved).
2593159	Etridiazole	NR	?	*Bufo bufo japonicus*	Tad.	25	Static	48	12	?	Nishiuchi and Yoshida (1975)	807	Unable to check details (source language).
122145	Fenitrothion	NR	Form.	*Bufo bufo japonicus*	Tad.	25 (24-26)	Static	48	9.0	Form.	Hashimoto and Nishiuchi (1981)	808	Unable to check details (source language).
122145	Fenitrothion	50	Form.	*Rana limnocharis*	Tad.	NR	NR	48	11.723	Form.	Pan and Liang (1993)	810	Unable to check details (source not retrieved).
3766812	Fenobucarb	50	Form.	*Rana limnocharis*	Tad.	NR	NR	48	8.648	Form.	Pan and Liang (1993)	811	Unable to check details (source not retrieved).
93721	Fenoprop	NR	Form.	*Adelotus brevis*	Tad.	21-22	Static	48	60	Form.	Johnson (1976)	812	Data based on formulation, a.i. Content not defined.
93721	Fenoprop	NR	?	*Bufo bufo japonicus*	Tad.	17.5	Static	48	40	?	Nishiuchi (1979)	813	Unable to check details (source language).
93721	Fenoprop	NR	Form.	*Bufo marinus*	Tad.	21-22	Static	48	42	Form.	Johnson (1976)	814	Data based on formulation, a.i. Content not defined.
93721	Fenoprop	NR	Form.	*Limnodyn-astes peroni*	Tad.	21-22	Static	48	27	Form.	Johnson (1976)	816	Data based on formulation, a.i. Content not defined.
39515418	Fenpropathrin	20	Form.	*Rana limnocharis*	Tad.	NR	NR	48	0.002	Form.	Pan and Liang (1993)	818	Unable to check details (source not retrieved).
55389	Fenthion	NR	Form.	*Rana hexadactyla*	Tad.	14 (12-17)	Renewal	48	0.94	Form.	Khangarot et al (1985c)	820	Data are for formulation (a.i. Content not defined).

CAS	Pesticide name	% a.i.	Test material	Species	Stage	Temp. (°C)	Exposure type	Duration (h)	LC50 (mg/L)	LC50 based on	Reference	Data line	Reason for omission from main dataset
900958	Fentin acetate	NR	Tech.	*Bufo bufo japonicus*	Tad.	25 (24-26)	Static	48	0.33	a.i.	Hashimoto and Nishiuchi (1981)	821	Unable to check details (source language).
51810801	Fenvalerate	50	Form.	*Rana limnocharis*	Tad.	NR	NR	48	2.34	Form.	Pan and Liang (1993)	822	Unable to check details (source not retrieved).
51630581	Fenvalerate	20	Form.	*Rana limnocharis*	Tad.	NR	NR	48	0.191	Form.	Pan and Liang (1993)	823	Unable to check details (source not retrieved).
14484641	Ferbam	NR	Form.	*Bufo bufo japonicus*	Tad.	25 (24-26)	Static	48	4.2	Form.	Hashimoto and Nishiuchi (1981)	824	Unable to check details (source language).
640197	Fluoroacetamide	NR	Tech.	*Bufo bufo japonicus*	Tad.	25 (24-26)	Static	48	>40	a.i.	Hashimoto and Nishiuchi (1981)	825	Unable to check details (source language).
66332965	Flutolanil	NR	?	*Bufo bufo japonicus*	NR	NR	NR	48	>100	?	Nishiuchi et al (1985)	826	Unable to check details (source language).
66332965	Flutolanil	NR	?	*Bufo bufo japonicus*	NR	NR	NR	48	13	?	Nishiuchi et al (1985)	827	Unable to check details (source language).
66332965	Flutolanil	NR	?	*Bufo bufo japonicus*	NR	NR	NR	48	45	?	Nishiuchi et al (1985)	828	Unable to check details (source language).
66332965	Flutolanil	NR	?	*Rana brevipoda porosa*	NR	NR	NR	48	>100	?	Nishiuchi et al (1985)	829	Unable to check details (source language).
66332965	Flutolanil	NR	?	*Rana brevipoda porosa*	NR	NR	NR	48	10	?	Nishiuchi et al (1985)	830	Unable to check details (source language).
66332965	Flutolanil	NR	?	*Rana brevipoda porosa*	NR	NR	NR	48	25	?	Nishiuchi et al (1985)	831	Unable to check details (source language).
58899	Gamma-HCH, lindane	6.5	Form.	*Rana hexadactyla*	Tad.	14 (12-17)	Renewal	48	5.97	Form.	Khangarot et al (1985c)	835	Data are for formulation.
58899	Gamma-HCH, lindane	14.5	Form.	*Rana limnocharis*	Tad.	NR	NR	48	0.944	Form.	Pan and Liang (1993)	836	Unable to check details (source not retrieved).
58899	Gamma-HCH, lindane	NR	NR	*Rana temporaria*	Tad.	18	Static	48	5.88	?	Thybaud (1990)	837	Test material not defined.
10004441	Hymexazol	NR	Form.	*Anura*	Tad.	NR	NR	48	1000	a.i.	Okudaira (1973)	874	Lack of detail on conduct of study.

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26087478	Iprobenfos	NR	Form.	*Bufo bufo japonicus*	Tad.	25 (24-26)	Static	48	10	Form.	Hashimoto and Nishiuchi (1981)	877	Unable to check details (source language).
26087478	Iprobenfos	40	Form.	*Rana limnocharis*	Tad.	NR	NR	48	6.307	Form.	Pan and Liang (1993)	878	Unable to check details (source not retrieved).
2631405	Isoprocarb	NR	?	*Bufo bufo japonicus*	Tad.	17.5	Static	48	18	?	Nishiuchi (1979)	879	Unable to check details (source language).
2631405	Isoprocarb	NR	Form.	*Rana limnocharis*	Tad.	NR	NR	48	NR	Form.	Pan and Liang (1993)	880	Unable to check details (source not retrieved).
2631405	Isoprocarb	75	Form.	*Rana limnocharis*	Tad.	NR	NR	48	4.344	Form.	Pan and Liang (1993)	881	Unable to check details (source not retrieved).
24353615	Isopropyl O-(methoxyaminothiophosphoryl)salicylate, Isocarbophos	40	Form.	*Rana limnocharis*	Tad.	NR	NR	48	9.317	Form.	Pan and Liang (1993)	882	Unable to check details (source not retrieved).
50512351	Isoprothiolane	20	Form.	*Rana limnocharis*	Tad.	NR	NR	48	21.698	Form.	Pan and Liang (1993)	883	Unable to check details (source not retrieved).
50512351	Isoprothiolane	40	Form.	*Rana limnocharis*	Tad.	NR	NR	48	7.786	Form.	Pan and Liang (1993)	884	Unable to check details (source not retrieved).
36614387	Isothioate	NR	?	*Bufo bufo japonicus*	Tad.	25	Static	48	7.3	?	Nishiuchi and Yoshida (1975)	885	Unable to check details (source language).
18854018	Isoxathion	NR	?	*Bufo bufo japonicus*	Tad.	25	Static	48	5.3	?	Nishiuchi and Yoshida (1975)	886	Unable to check details (source language).
6980183	Kasugamycin	NR	Form.	*Bufo bufo japonicus*	Tad.	25 (24-26)	Static	48	6.4	Form.	Hashimoto and Nishiuchi (1981)	887	Unable to check details (source language).
6980183	Kasugamycin	NR	?	*Rana brevipoda porosa*	Tad.	25	NR	48	>100	?	Nishiuchi (1990)	888	Unable to check details (source not retrieved).
121755	Malathion	NR	Form.	*Rana hexadactyla*	Tad.	14 (12-17)	Renewal	48	0.613	Form.	Khangarot et al (1985c)	892	Data are for formulation (a.i. Content not defined).
121755	Malathion	50	Form.	*Rana limnocharis*	Tad.	NR	NR	48	2.271	Form.	Pan and Liang (1993)	893	Unable to check details (source not retrieved).
121755	Malathion	NR	NR	*Rana tigrina*	Tad.	NR	NR	48	1.99	a.i.	Abbasi and Soni (1991)	895	Test material not defined, too little detail

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12427382	Maneb	NR	Form.	*Anura*	Tad.	NR	NR	48	40	a.i.	Okudaira (1973)	897	Lack of detail on conduct of study.
3653483	MCPA	56	Form.	*Rana limnocharis*	Tad.	NR	NR	48	226.97	Form.	Pan and Liang (1993)	898	Unable to check details (source not retrieved).
5221169	MCPA potassium	NR	?	*Bufo bufo japonicus*	Tad.	25	Static	48	>40	?	Nishiuchi and Yoshida (1975)	899	Unable to check details (source language).
53780340	Mefluidide	NR	?	*Bufo bufo japonicus*	Tad.	17.5	Static	48	>40	?	Nishiuchi (1979)	901	Unable to check details (source language).
7487947	Mercuric chloride	NR	Tech.	*Rana tigrina*	Adults	23±1.0	Renewal	48	18.04	a.i.	Mudgall and Patil (1988)	902	Insufficient details on repilication and dose levels.
7487947	Mercuric chloride	NR	Tech.	*Rana tigrina*	Adults	23±1.0	Renewal	48	18.95	a.i.	Mudgall and Patil (1988)	903	Insufficient details on repilication and dose levels.
7487947	Mercuric chloride	NR	?	*Ambystoma mexicanum*	NR	20	NR	48	0.35	Total	Slooff (1982)	905	Unable to check details (source not retrieved).
7487947	Mercuric chloride	NR	?	*Xenopus laevis*	NR	20	NR	48	0.1	Total	Slooff (1982)	906	Unable to check details (source not retrieved).
10265926	Methamidophos	50	Form.	*Rana limnocharis*	Tad.	NR	NR	48	27.161	Form.	Pan and Liang (1993)	915	Unable to check details (source not retrieved).
16752775	Methomyl	NR	Tech.	*Bufo bufo japonicus*	Tad.	25 (24-26)	Static	48	>40	a.i.	Hashimoto and Nishiuchi (1981)	916	Unable to check details (source language).
2533826	Methylarsenic sulfide	10	Form.	*Rana limnocharis*	Tad.	NR	NR	48	0.931	Form.	Pan and Liang (1993)	920	Unable to check details (source not retrieved).
1129415	Metolcarb	NR	?	*Bufo bufo japonicus*	Tad.	17.5	Static	48	>40	?	Nishiuchi (1979)	922	Unable to check details (source language).
1129415	Metolcarb	20	Form.	*Rana limnocharis*	Tad.	NR	NR	48	16.749	Form.	Pan and Liang (1993)	923	Unable to check details (source not retrieved).
2212671	Molinate	NR	?	*Bufo bufo japonicus*	Tad.	25	Static	48	34	?	Nishiuchi and Yoshida (1975)	924	Unable to check details (source language).
2212671	Molinate	96	Form.	*Rana limnocharis*	Tad.	NR	NR	48	34.975	Form.	Pan and Liang (1993)	926	Unable to check details (source not retrieved).
24096535	N-3,5-dichlorophenylsuccinimide	30	Form.	*Rana limnocharis*	Tad.	NR	NR	48	93.271	Form.	Pan and Liang (1993)	928	Unable to check details (source not retrieved).

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4726141	Nitralin	NR	?	*Bufo bufo japonicus*	Tad.	25	Static	48	>40	?	Nishiuchi and Yoshida (1975)	932	Unable to check details (source language).
1836755	Nitrofen	NR	Form.	*Bufo bufo japonicus*	Tad.	25 (24-26)	Static	48	3.8	Form.	Hashimoto and Nishiuchi (1981)	933	Unable to check details (source language).
1836777	Nitrofen	20	Form.	*Rana limnocharis*	Tad.	NR	NR	48	6.195	Form.	Pan and Liang (1993)	934	Unable to check details (source not retrieved).
1836755	Nitrofen	25	Form.	*Rana limnocharis*	Tad.	NR	NR	48	40.059	Form.	Pan and Liang (1993)	935	Unable to check details (source not retrieved).
1113026	Omethoate	50	Form.	*Rana limnocharis*	Tad.	NR	NR	48	244.24	Form.	Pan and Liang (1993)	936	Unable to check details (source not retrieved).
19666309	Oxadiazon	NR	?	*Bufo bufo japonicus*	Tad.	25	Static	48	2.5	?	Nishiuchi and Yoshida (1975)	937	Unable to check details (source language).
5259881	Oxicarboxin	NR	?	*Bufo bufo japonicus*	Tad.	25	Static	48	15	?	Nishiuchi and Yoshida (1975)	938	Unable to check details (source language).
4685147	Paraquat	NR	Form.	*Adelotus brevis*	Tad.	21-22	Static	48	315	Form.	Johnson (1976)	942	Data based on formulation, a.i. Content not defined.
4685147	Paraquat	NR	Form.	*Bufo bufo japonicus*	Tad.	25 (24-26)	Static	48	14	Form.	Hashimoto and Nishiuchi (1981)	943	Unable to check details (source language).
4418262	Paraquat	NR	?	*Bufo bufo japonicus*	Tad.	17.5	Static	48	>40	Form.	Nishiuchi (1979)	944	Unable to check details (source language).
4685147	Paraquat	NR	Form.	*Limnodyn-astes peroni*	Tad.	21-22	Static	48	153	Form.	Johnson (1976)	945	Data based on formulation, a.i. Content not defined.
56382	Parathion	NR	NR	*Anura*	Tad.	NR	NR	48	7.2	a.i.	Okudaira (1973)	949	Lack of detail on conduct of study.
56382	Parathion	NR	Tech.	*Bufo bufo japonicus*	Tad.	25 (24-26)	Static	48	7.2	a.i.	Hashimoto and Nishiuchi (1981)	950	Unable to check details (source language).
56382	Parathion	50	Form.	*Rana limnocharis*	Tad.	NR	NR	48	4.744	Form.	Pan and Liang (1993)	952	Unable to check details (source not retrieved).
298000	Parathion-methyl, methyl parathion	50	Form.	*Rana limnocharis*	Tad.	NR	NR	48	11.482	Form.	Pan and Liang (1993)	956	Unable to check details (source not retrieved).

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298000	Parathion-methyl, methyl parathion	NR	NR	*Rana tigrina*	Tad.	28±2	Renewal	48	5.15	NR	Kennedy and Sampath (2001)	958	Test material not defined, basis of LC50 value not defined.
87865	Pentachlorophenol	NR	?	*Ambystoma mexicanum*	NR	20	NR	48	0.3	Form.	Slooff (1982)	961	Unable to check details (source not retrieved).
87865	Pentachlorophenol	NR	?	*Xenopus laevis*	NR	20	NR	48	2.6	Form.	Slooff (1982)	962	Unable to check details (source not retrieved).
52645531	Permethrin	NR	?	*Bufo bufo japonicus*	NR	NR	NR	48	>40	?	Nishiuchi et al (1985)	966	Unable to check details (source language).
52645531	Permethrin	NR	?	*Bufo bufo japonicus*	NR	NR	NR	48	13	?	Nishiuchi et al (1985)	967	Unable to check details (source language).
52645531	Permethrin	NR	?	*Bufo bufo japonicus*	NR	NR	NR	48	20	?	Nishiuchi et al (1985)	968	Unable to check details (source language).
52645531	Permethrin	NR	?	*Bufo bufo japonicus*	NR	NR	NR	48	20	?	Nishiuchi et al (1985)	969	Unable to check details (source language).
52645531	Permethrin	NR	?	*Rana brevipoda porosa*	NR	NR	NR	48	>40	?	Nishiuchi et al (1985)	970	Unable to check details (source language).
52645531	Permethrin	NR	?	*Rana brevipoda porosa*	NR	NR	NR	48	0.28	?	Nishiuchi et al (1985)	971	Unable to check details (source language).
52645531	Permethrin	NR	?	*Rana brevipoda porosa*	NR	NR	NR	48	0.35	?	Nishiuchi et al (1985)	972	Unable to check details (source language).
52645531	Permethrin	NR	?	*Rana brevipoda porosa*	NR	NR	NR	48	0.4	?	Nishiuchi et al (1985)	973	Unable to check details (source language).
62384	Phenylmercury acetate	NR	Form.	*Bufo bufo japonicus*	Tad.	25 (24-26)	Static	48	0.12	Form.	Hashimoto and Nishiuchi (1981)	975	Unable to check details (source language).
2310170	Phosalone	NR	NR	*Rana tigrina*	Tad.	NR	NR	48	0.23	a.i.	Abbasi and Soni (1991)	976	Test material not defined, too little detail
13171216	Phosphamidon	NR	NR	*Rana cyanophlyctis*	Adults	NR	NR	48	0.271	a.i.	Thenmozhi and Ramaswamy (2008)	977	Test material not defined.

CAS	Pesticide name	% a.i.	Test material	Species	Stage	Temp. (°C)	Exposure type	Duration (h)	LC50 (mg/L)	LC50 based on	Reference	Data line	Reason for omission from main dataset
13171216	Phosphamidon	50	Form.	*Rana limnocharis*	Tad.	NR	NR	48	209.585	Form.	Pan and Liang (1993)	978	Unable to check details (source not retrieved).
14816183	Phoxim	50	Form.	*Rana limnocharis*	Tad.	NR	NR	48	2.647	Form.	Pan and Liang (1993)	979	Unable to check details (source not retrieved).
27355222	Phthalide	NR	Form.	*Bufo bufo japonicus*	Tad.	25 (24-26)	Static	48	>40	Form.	Hashimoto and Nishiuchi (1981)	980	Unable to check details (source language).
27355222	Phthalide	50	Form.	*Rana limnocharis*	Tad.	NR	NR	48	1182.01	Form.	Pan and Liang (1993)	981	Unable to check details (source not retrieved).
1918021	Picloram	NR	Form.	*Adelotus brevis*	Tad.	21-22	Static	48	123	Form.	Johnson (1976)	982	Data based on formulation, a.i. Content not defined.
1918021	Picloram	NR	Form.	*Adelotus brevis*	Tad.	21-22	Static	48	182	Form.	Johnson (1976)	983	Data based on formulation, a.i. Content not defined.
1918021	Picloram	NR	Form.	*Limnodynastes peroni*	Tad.	21-22	Static	48	116	Form.	Johnson (1976)	984	Data based on formulation, a.i. Content not defined.
39285046	Polynactin	NR	?	*Bufo bufo japonicus*	Tad.	25	Static	48	0.018	?	Nishiuchi and Yoshida (1975)	988	Unable to check details (source language).
39285046	Polynactin	NR	?	*Rana brevipoda porosa*	Tad.	25	NR	48	<1	?	Nishiuchi (1990)	989	Unable to check details (source not retrieved).
32809168	Procymidone	50	Form.	*Rana limnocharis*	Tad.	NR	NR	48	371.17	Form.	Pan and Liang (1993)	990	Unable to check details (source not retrieved).
2631370	Promecarb	NR	?	*Bufo bufo japonicus*	Tad.	25	Static	48	28	?	Nishiuchi and Yoshida (1975)	992	Unable to check details (source language).
7287196	Prometryn	50	Form.	*Rana limnocharis*	Tad.	NR	NR	48	22.88	Form.	Pan and Liang (1993)	993	Unable to check details (source not retrieved).
1918167	Propachlor	11	Form.	*Rana limnocharis*	Tad.	NR	NR	48	1.705	Form.	Pan and Liang (1993)	994	Unable to check details (source not retrieved).
1918167	Propachlor	30	Form.	*Rana limnocharis*	Tad.	NR	NR	48	0.803	Form.	Pan and Liang (1993)	995	Unable to check details (source not retrieved).
709988	Propanil	NR	Tech.	*Bufo bufo japonicus*	Tad.	25 (24-26)	Static	48	2.5	a.i.	Hashimoto and Nishiuchi (1981)	999	Unable to check details (source language).

CAS	Pesticide name	% a.i.	Test material	Species	Stage	Temp. (°C)	Exposure type	Duration (h)	LC50 (mg/L)	LC50 based on	Reference	Data line	Reason for omission from main dataset
709988	Propanil	20	Form.	*Rana limnocharis*	Tad.	NR	NR	48	11.891	Form.	Pan and Liang (1993)	1002	Unable to check details (source not retrieved).
709988	Propanil	20	Form.	*Rana limnocharis*	Tad.	NR	NR	48	14.275	Form.	Pan and Liang (1993)	1003	Unable to check details (source not retrieved).
7292162	Propaphos	NR	?	*Bufo bufo japonicus*	Tad.	25	Static	48	14	?	Nishiuchi and Yoshida (1975)	1004	Unable to check details (source language).
114261	Propoxur	NR	Tech.	*Bufo bufo japonicus*	Tad.	25 (24-26)	Static	48	35	a.i.	Hashimoto and Nishiuchi (1981)	1005	Unable to check details (source language).
23950585	Propyzamide	NR	?	*Bufo bufo japonicus*	Tad.	25	Static	48	>40	?	Nishiuchi and Yoshida (1975)	1006	Unable to check details (source language).
13457186	Pyrazophos	NR	?	*Bufo bufo japonicus*	NR	NR	NR	48	>40	?	Nishiuchi et al (1985)	1007	Unable to check details (source language).
13457186	Pyrazophos	NR	?	*Bufo bufo japonicus*	NR	NR	NR	48	15	?	Nishiuchi et al (1985)	1008	Unable to check details (source language).
13457186	Pyrazophos	NR	?	*Rana brevipoda porosa*	NR	NR	NR	48	3.8	?	Nishiuchi et al (1985)	1009	Unable to check details (source language).
13457186	Pyrazophos	NR	?	*Rana brevipoda porosa*	NR	NR	NR	48	6.3	?	Nishiuchi et al (1985)	1010	Unable to check details (source language).
71561110	Pyrazoxyfen	NR	?	*Bufo bufo japonicus*	NR	NR	NR	48	>100	?	Nishiuchi et al (1985)	1011	Unable to check details (source language).
71561110	Pyrazoxyfen	NR	?	*Bufo bufo japonicus*	NR	NR	NR	48	7.5	?	Nishiuchi et al (1985)	1012	Unable to check details (source language).
71561110	Pyrazoxyfen	NR	?	*Rana brevipoda porosa*	NR	NR	NR	48	>100	?	Nishiuchi et al (1985)	1013	Unable to check details (source language).
71561110	Pyrazoxyfen	NR	?	*Rana brevipoda porosa*	NR	NR	NR	48	7.5	?	Nishiuchi et al (1985)	1014	Unable to check details (source language).
121299	Pyrethrin II. pyrethrins (pyrethrates)	NR	?	*Rana brevipoda porosa*	Tad.	25	NR	48	<1	?	Nishiuchi (1990)	1015	Unable to check details (source not retrieved).
119120	Pyridaphenthion	NR	?	*Bufo bufo japonicus*	Tad.	25	Static	48	7.5	?	Nishiuchi and Yoshida (1975)	1016	Unable to check details (source language).

CAS	Pesticide name	% a.i.	Test material	Species	Stage	Temp. (°C)	Exposure type	Duration (h)	LC50 (mg/L)	LC50 based on	Reference	Data line	Reason for omission from main dataset
119120	Pyridaphenthion	20	Form.	*Rana limnocharis*	Tad.	NR	NR	48	3.814	Form.	Pan and Liang (1993)	1017	Unable to check details (source not retrieved).
57369321	Pyroquilon	NR	?	*Bufo bufo japonicus*	NR	NR	Static	48	>100	?	Nishiuchi et al (1985)	1018	Unable to check details (source language).
57369321	Pyroquilon	NR	?	*Bufo bufo japonicus*	NR	NR	Static	48	>100	?	Nishiuchi et al (1985)	1019	Unable to check details (source language).
57369321	Pyroquilon	NR	?	*Bufo bufo japonicus*	NR	NR	Static	48	>40	?	Nishiuchi et al (1985)	1020	Unable to check details (source language).
57369321	Pyroquilon	NR	?	*Rana brevipoda porosa*	NR	NR	Static	48	>40	?	Nishiuchi et al (1985)	1021	Unable to check details (source language).
57369321	Pyroquilon	NR	?	*Rana brevipoda porosa*	NR	NR	Static	48	55	?	Nishiuchi et al (1985)	1022	Unable to check details (source language).
57369321	Pyroquilon	NR	?	*Rana brevipoda porosa*	NR	NR	Static	48	70	?	Nishiuchi et al (1985)	1023	Unable to check details (source language).
83794	Rotenone	NR	Tech.	*Bufo bufo japonicus*	Tad.	25 (24-26)	Static	48	0.33	a.i.	Hashimoto and Nishiuchi (1981)	1024	Unable to check details (source language).
74051802	Sethoxydim	NR	?	*Bufo bufo japonicus*	NR	NR	NR	48	15	?	Nishiuchi et al (1985)	1025	Unable to check details (source language).
74051802	Sethoxydim	NR	?	*Bufo bufo japonicus*	NR	NR	NR	48	7.5	?	Nishiuchi et al (1985)	1026	Unable to check details (source language).
74051802	Sethoxydim	NR	?	*Rana brevipoda porosa*	NR	NR	NR	48	3.8	?	Nishiuchi et al (1985)	1027	Unable to check details (source language).
74051802	Sethoxydim	NR	?	*Rana brevipoda porosa*	NR	NR	NR	48	7.3	?	Nishiuchi et al (1985)	1028	Unable to check details (source language).
122349	Simazine	NR	Form.	*Bufo bufo japonicus*	Tad.	25 (24-26)	Static	48	>100	Form.	Hashimoto and Nishiuchi (1981)	1029	Unable to check details (source language).

CAS	Pesticide name	% a.i.	Test material	Species	Stage	Temp. (°C)	Exposure type	Duration (h)	LC50 (mg/L)	LC50 based on	Reference	Data line	Reason for omission from main dataset
4418262	Sodium dehydroacetic acid, dehydroacetic acid - sodium salt	NR	?	*Bufo bufo japonicus*	Tad.	17.5	Static	48	>40	?	Nishiuchi (1979)	1032	Unable to check details (source language).
131522	Sodium pentachlorophenoxide	NR	NR	*Anura*	Tad.	NR	NR	48	0.25	a.i.	Okudaira (1973)	1072	Lack of detail on conduct of study.
131522	Sodium pentachlorophenoxide	NR	Form.	*Bufo bufo japonicus*	Tad.	25 (24-26)	Static	48	0.25	Form.	Hashimoto and Nishiuchi (1981)	1073	Unable to check details (source language).
131522	Sodium pentachlorophenoxide	NR	?	*Bufo bufo japonicus*	Tad.	25	Static	48	0.35	?	Nishiuchi and Yoshida (1975)	1074	Unable to check details (source language).
131522	Sodium pentachlorophenoxide	65	Form.	*Rana limnocharis*	Tad.	NR	NR	48	0.171	Form.	Pan and Liang (1993)	1076	Unable to check details (source not retrieved).
3689245	Sulfotep	40	Form.	*Rana limnocharis*	Tad.	NR	NR	48	0.526	Form.	Pan and Liang (1993)	1077	Unable to check details (source not retrieved).
7704349	Sulphur	50	?	*Rana limnocharis*	Tad.	NR	NR	48	2560	Form.	Pan and Liang (1993)	1078	Unable to check details (source not retrieved).
35400432	Sulprofos	NR	?	*Bufo bufo japonicus*	NR	NR	NR	48	>40	?	Nishiuchi et al (1985)	1079	Unable to check details (source language).
35400432	Sulprofos	NR	?	*Bufo bufo japonicus*	NR	NR	NR	48	23	?	Nishiuchi et al (1985)	1080	Unable to check details (source language).
35400432	Sulprofos	NR	?	*Rana brevipoda porosa*	NR	NR	NR	48	13	?	Nishiuchi et al (1985)	1081	Unable to check details (source language).
35400432	Sulprofos	NR	?	*Rana brevipoda porosa*	NR	NR	NR	48	3.5	?	Nishiuchi et al (1985)	1082	Unable to check details (source language).
1918189	SWEP	25	Form.	*Rana limnocharis*	Tad.	NR	NR	48	10.363	Form.	Pan and Liang (1993)	1083	Unable to check details (source not retrieved).
148798	Thiabendazole	NR	?	*Bufo bufo japonicus*	Tad.	25	Static	48	7.3	?	Nishiuchi and Yoshida (1975)	1086	Unable to check details (source language).

CAS	Pesticide name	% a.i.	Test material	Species	Stage	Temp. (°C)	Exposure type	Duration (h)	LC50 (mg/L)	LC50 based on	Reference	Data line	Reason for omission from main dataset
28249776	Thiobencarb	NR	Tech.	*Bufo bufo japonicus*	Tad.	25 (24-26)	Static	48	3.5	a.i.	Hashimoto and Nishiuchi (1981)	1106	Unable to check details (source language).
28249776	Thiobencarb	50	Form.	*Rana limnocharis*	Tad.	NR	NR	48	2.699	Form.	Pan and Liang (1993)	1107	Unable to check details (source not retrieved).
31895213	Thiocyclam	NR	?	*Rana brevipoda porosa*	Tad.	25	NR	48	<1	?	Nishiuchi (1990)	1109	Unable to check details (source not retrieved).
31895213	Thiocyclam	80	Form.	*Rana limnocharis*	Tad.	NR	NR	48	0.059	Form.	Pan and Liang (1993)	1110	Unable to check details (source not retrieved).
23564069	Thiophanate	50	Form.	*Rana limnocharis*	Tad.	NR	NR	48	472.286	Form.	Pan and Liang (1993)	1112	Unable to check details (source not retrieved).
23564058	Thiophanate methyl	NR	?	*Rana brevipoda porosa*	Tad.	25	NR	48	>100	?	Nishiuchi (1990)	1113	Unable to check details (source not retrieved).
43121433	Triadimefon	20	Form.	*Rana limnocharis*	Tad.	NR	NR	48	12.959	Form.	Pan and Liang (1993)	1117	Unable to check details (source not retrieved).
56359	Tributyltin oxide, Bis(tributyltin)oxide	NR	?	*Rana temporaria*	Larv.	20	Static	48	0.03508	Form.	Hooftman et al (1989)	1119	Unable to check details (source not retrieved).
52686	Trichlorfon	90	Form.	*Rana limnocharis*	Tad.	NR	NR	48	17.978	Form.	Pan and Liang (1993)	1120	Unable to check details (source not retrieved).
55335063	Triclopyr	NR	?	*Rana brevipoda porosa*	Tad.	25	NR	48	>100	?	Nishiuchi (1990)	1121	Unable to check details (source not retrieved).
41814782	Tricyclazole	20	Form.	*Rana limnocharis*	Tad.	NR	NR	48	19.425	Form.	Pan and Liang (1993)	1122	Unable to check details (source not retrieved).
81412433	Tridemorph	NR	Form.	*Rana hexadactyla*	Tad.	14 (12-17)	Renewal	48	0.53	Form.	Khangarot et al (1985c)	1123	Data are for formulation (a.i. Content not defined).
1582098	Trifluralin	NR	Form.	*Bufo bufo japonicus*	Tad.	25 (24-26)	Static	48	14	Form.	Hashimoto and Nishiuchi (1981)	1125	Unable to check details (source language).
83657221	Uniconazole	NR	?	*Bufo bufo japonicus*	NR	NR	NR	48	1100	?	Nishiuchi et al (1985)	1127	Unable to check details (source language).

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83657221	Uniconazole	NR	?	*Bufo bufo japonicus*	NR	NR	NR	48	13	?	Nishiuchi et al (1985)	1128	Unable to check details (source language).
83657221	Uniconazole	NR	?	*Rana brevipoda porosa*	NR	NR	NR	48	13	?	Nishiuchi et al (1985)	1129	Unable to check details (source language).
83657221	Uniconazole	NR	?	*Rana brevipoda porosa*	NR	NR	NR	48	680	?	Nishiuchi et al (1985)	1130	Unable to check details (source language).
2445070	Urbacid	50	Form.	*Rana limnocharis*	Tad.	NR	NR	48	10.773	Form.	Pan and Liang (1993)	1131	Unable to check details (source not retrieved).
12122677	Zineb	NR	Form.	*Anura*	Tad.	NR	NR	48	380	a.i.	Okudaira (1973)	1132	Lack of detail on conduct of study.
12122677	Zineb	NR	Form.	*Bufo bufo japonicus*	Tad.	25 (24-26)	Static	48	>40	Form.	Hashimoto and Nishiuchi (1981)	1133	Unable to check details (source language).
12122677	Zineb	80	Form.	*Rana limnocharis*	Tad.	NR	NR	48	31.25	Form.	Pan and Liang (1993)	1134	Unable to check details (source not retrieved).
30560191	Acephate	NR	?	*Bufo bufo japonicus*	Tad.	25	Static	72	>40	?	Nishiuchi and Yoshida (1975)	1139	Unable to check details (source language).
3337711	Asulam	NR	?	*Bufo bufo japonicus*	Tad.	25	Static	72	>40	?	Nishiuchi and Yoshida (1975)	1143	Unable to check details (source language).
8011630	Bordeaux mixture (1 % $CuSO_4$ + 1% $CaCO_3$ in H_2O 1:1)	-	Form.	*Microhyla ornata*	Tad.	25.5-25.9	Renewal	72	3.44	Form.	Jayaprakash and Madhyastha (1989)	1146	Unclear as to the basis of the toxicity data.
8011630	Bordeaux mixture (1 % $CuSO_4$ + 1% $CaCO_3$ in H_2O 1:1)	-	Form.	*Microhyla ornata*	Tad.	25.5-25.9	Renewal	72	3.76	Form.	Jayaprakash and Madhyastha (1989)	1147	Unclear as to the basis of the toxicity data.
23184669	Butachlor	NR	?	*Bufo bufo japonicus*	Tad.	25	Static	72	1.8	?	Nishiuchi and Yoshida (1975)	1148	Unable to check details (source language).
63252	Carbaryl	NR	Form.	*Rana hexadactyla*	Tad.	14 (12-17)	Renewal	72	63.89	Form.	Khangarot et al (1985c)	1158	Data are for formulation (a.i. Content not defined).

CAS	Pesticide name	% a.i.	Test material	Species	Stage	Temp. (°C)	Exposure type	Duration (h)	LC50 (mg/L)	LC50 based on	Reference	Data line	Reason for omission from main dataset
10605217	Carbendazim	NR	?	*Bufo bufo japonicus*	Tad.	25	Static	72	3.5	?	Nishiuchi and Yoshida (1975)	1159	Unable to check details (source language).
10605217	Carbendazim	NR	Form.	*Rana hexadactyla*	Tad.	14 (12-17)	Renewal	72	21.52	Form.	Khangarot et al (1985c)	1160	Data are for formulation (a.i. Content not defined).
1563662	Carbofuran	75	NR	*Rana hexadactyla*	Tad.	14 (12-17)	Renewal	72	133.2	Form.	Khangarot et al (1985c)	1161	Test material not defined.
32861851	Chlomethoxyfen, chlormethoxynil	NR	?	*Bufo bufo japonicus*	Tad.	25	Static	72	>40	?	Nishiuchi and Yoshida (1975)	1162	Unable to check details (source language).
2921882	Chlorpyrifos	NR	NR	*Rana tigrina*	Tad.	NR	NR	72	0.028	a.i.	Abbasi and Soni (1991)	1164	Test material not defined, too little detail
7758987	Copper sulfate	NR	Tech. (Reagent grade)	*Rana hexadactyla*	Tad.	15	Static	72	0.039	a.i. (Cu)	Khangarot et al (1985a)	1176	Data appear to be the same as presented in Khangarot et al (1994).
7758987	Copper sulfate	NR	Tech. (Reagent grade)	*Rana hexadactyla*	Tad.	15 (13-16)	Renewal	72	0.039	a.i. (Cu)	Khangarot et al (1985b)	1177	Data appear to be the same as presented in Khangarot et al (1994).
13121705	Cyhexatin	NR	?	*Bufo bufo japonicus*	Tad.	25	Static	72	0.07	?	Nishiuchi and Yoshida (1975)	1178	Unable to check details (source language).
10311849	Dialifos	NR	?	*Bufo bufo japonicus*	Tad.	25	Static	72	0.73	?	Nishiuchi and Yoshida (1975)	1185	Unable to check details (source language).
60515	Dimethoate	40	?	*Rana chaochiaoen-sis*	Tad.	20.5±0.5	NR	72	56.61	a.i.	Zhang et al (2007)	1191	Unable to extract all details (source language).
60515	Dimethoate	NR	Form.	*Rana hexadactyla*	Tad.	14 (12-17)	Renewal	72	7.82	Form.	Khangarot et al (1985c)	1192	Data are for formulation (a.i. Content not defined).
115297	Endosulfan	NR	NR	*Bufo melanostictus*	Larv.	25	Static	72	0.1283	?	Vardia et al (1984)	1193	Test material not defined.
115297	Endosulfan	NR	NR	*Rana tigrina*	Tad.	NR	NR	72	0.008	a.i.	Abbasi and Soni (1991)	1197	Test material not defined, too little detail
72208	Endrin	NR	Form.	*Rana hexadactyla*	Tad.	14 (12-17)	Renewal	72	0.372	Form.	Khangarot et al (1985c)	1198	Data are for formulation (a.i. Content not defined).

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2593159	Etridiazole	NR	?	*Bufo bufo japonicus*	Tad.	25	Static	72	12	?	Nishiuchi and Yoshida (1975)	1205	Unable to check details (source language).
55389	Fenthion	NR	Form.	*Rana hexadactyla*	Tad.	14 (12-17)	Renewal	72	0.94	Form.	Khangarot et al (1985c)	1208	Data are for formulation (a.i. Content not defined).
58899	Gamma-HCH, lindane	6.5	Form.	*Rana hexadactyla*	Tad.	14 (12-17)	Renewal	72	5.97	Form.	Khangarot et al (1985c)	1209	Data are for formulation.
36614387	Isothioate	NR	?	*Bufo bufo japonicus*	Tad.	25	Static	72	7.3	?	Nishiuchi and Yoshida (1975)	1217	Unable to check details (source language).
18854018	Isoxathion	NR	?	*Bufo bufo japonicus*	Tad.	25	Static	72	5.1	?	Nishiuchi and Yoshida (1975)	1218	Unable to check details (source language).
121755	Malathion	NR	Form.	*Rana hexadactyla*	Tad.	14 (12-17)	Renewal	72	0.613	Form.	Khangarot et al (1985c)	1219	Data are for formulation (a.i. Content not defined).
121755	Malathion	NR	NR	*Rana tigrina*	Tad.	NR	NR	72	1.64	a.i.	Abbasi and Soni (1991)	1220	Test material not defined, too little detail
5221169	MCPA potassium	NR	?	*Bufo bufo japonicus*	Tad.	25	Static	72	>40	?	Nishiuchi and Yoshida (1975)	1221	Unable to check details (source language).
7487947	Mercuric chloride	NR	Tech.	*Rana tigrina*	Adults	23±1.0	Renewal	72	16.74	a.i.	Mudgall and Patil (1988)	1223	Insufficient details on repilication and dose levels.
7487947	Mercuric chloride	NR	Tech.	*Rana tigrina*	Adults	23±1.0	Renewal	72	18.5	a.i.	Mudgall and Patil (1988)	1224	Insufficient details on repilication and dose levels.
2212671	Molinate	NR	?	*Bufo bufo japonicus*	Tad.	25	Static	72	34	?	Nishiuchi and Yoshida (1975)	1229	Unable to check details (source language).
4726141	Nitralin	NR	?	*Bufo bufo japonicus*	Tad.	25	Static	72	>40	?	Nishiuchi and Yoshida (1975)	1230	Unable to check details (source language).
19666309	Oxadiazon	NR	?	*Bufo bufo japonicus*	Tad.	25	Static	72	1.3	?	Nishiuchi and Yoshida (1975)	1231	Unable to check details (source language).
5259881	Oxicarboxin	NR	?	*Bufo bufo japonicus*	Tad.	25	Static	72	7.6	?	Nishiuchi and Yoshida (1975)	1232	Unable to check details (source language).
298000	Parathion-methyl, methyl parathion	NR	NR	*Rana tigrina*	Tad.	28±2	Renewal	72	4.63	NR	Kennedy and Sampath (2001)	1239	Test material not defined, basis of LC50 value not defined.

CAS	Pesticide name	% a.i.	Test material	Species	Stage	Temp. (°C)	Exposure type	Duration (h)	LC50 (mg/L)	LC50 based on	Reference	Data line	Reason for omission from main dataset
2310170	Phosalone	NR	NR	*Rana tigrina*	Tad.	NR	NR	72	0.160	a.i.	Abbasi and Soni (1991)	1243	Test material not defined, too little detail
13171216	Phosphamidon	NR	NR	*Rana cyanophlyctis*	Adults	NR	NR	72	0.269	a.i.	Thenmozhi and Ramaswamy (2008)	1244	Test material not defined.
39285046	Polynactin	NR	?	*Bufo bufo japonicus*	Tad.	25	Static	72	0.018	?	Nishiuchi and Yoshida (1975)	1247	Unable to check details (source language).
2631370	Promecarb	NR	?	*Bufo bufo japonicus*	Tad.	25	Static	72	28	?	Nishiuchi and Yoshida (1975)	1249	Unable to check details (source language).
7292162	Propaphos	NR	?	*Bufo bufo japonicus*	Tad.	25	Static	72	14	?	Nishiuchi and Yoshida (1975)	1250	Unable to check details (source language).
23950585	Propyzamide	NR	?	*Bufo bufo japonicus*	Tad.	25	Static	72	>40	?	Nishiuchi and Yoshida (1975)	1251	Unable to check details (source language).
119120	Pyridaphenthion	NR	?	*Bufo bufo japonicus*	Tad.	25	Static	72	7.3	?	Nishiuchi and Yoshida (1975)	1252	Unable to check details (source language).
131522	Sodium pentachlorophenoxide	NR	?	*Bufo bufo japonicus*	Tad.	25	Static	72	0.32	?	Nishiuchi and Yoshida (1975)	1294	Unable to check details (source language).
148798	Thiabendazole	NR	?	*Bufo bufo japonicus*	Tad.	25	Static	72	7.3	?	Nishiuchi and Yoshida (1975)	1296	Unable to check details (source language).
56359	Tributyltin oxide, Bis(tributyltin)oxide	NR	?	*Rana temporaria*	Larv.	20	Static	72	0.0086	Form.	Hooftman et al (1989)	1319	Unable to check details (source not retrieved).
81412433	Tridemorph	NR	Form.	*Rana hexadactyla*	Tad.	14 (12-17)	Renewal	72	0.53	Form.	Khangarot et al (1985c)	1320	Data are for formulation (a.i. Content not defined).
94757	2,4-D	NR	NR	*Bufo melanostictus*	Larv.	25	Static	96	8.05	?	Vardia et al (1984)	1327	Test material not defined.
94757	2,4-D	NR	(unclear in source)	*Rana pipiens*	Larv.	21.9±0.2	Flow-through	96	181	a.i.	Brooke (1989)	1328	Test material not defined
94757	2,4-D	NR	(unclear in source)	*Rana pipiens*	Larv.	21.6±0.4	Flow-through	96	1962	a.i.	Brooke (1989)	1329	Test material not defined
2008391	2,4-D-dimethylammonium	NR	Form.	*Adelotus brevis*	Tad.	21-22	Static	96	200	Form.	Johnson (1976)	1334	Data based on formulation, a.i. Content not defined.

CAS	Pesticide name	% a.i.	Test material	Species	Stage	Temp. (°C)	Exposure type	Duration (h)	LC50 (mg/L)	LC50 based on	Reference	Data line	Reason for omission from main dataset
2008391	2,4-D-dimethylammonium	NR	Form.	*Bufo marinus*	Tad.	21-22	Static	96	288	Form.	Johnson (1976)	1335	Data based on formulation, a.i. Content not defined.
2008391	2,4-D-dimethylammonium	NR	Form.	*Limnodynastes peroni*	Tad.	21-22	Static	96	287	Form.	Johnson (1976)	1336	Data based on formulation, a.i. Content not defined.
123886	2-methoxyethyl mercury chloride	6	Form.	*Rana cyanophlyctis*	Adults	NR	NR	96	1.98	a.i.	Chapparadhalli and Kanamadi (1995)	1338	Insufficient details of method used
30560191	Acephate	NR	?	*Bufo bufo japonicus*	Tad.	25	Static	96	>40	?	Nishiuchi and Yoshida (1975)	1341	Unable to check details (source language).
3337711	Asulam	NR	?	*Bufo bufo japonicus*	Tad.	25	Static	96	>40	?	Nishiuchi and Yoshida (1975)	1359	Unable to check details (source language).
1912249	Atrazine	NR	NR	*Xenopus laevis*	Emb.	23±1	Renewal	96	25.6	a.i.	Fort et al (2004)	1362	Test material not defined.
1912249	Atrazine	NR	NR	*Xenopus laevis*	Emb.	23±1	Renewal	96	24.5	a.i.	Fort et al (2004)	1363	Test material not defined.
1912249	Atrazine	98	Tech.	*Pseudacris regilla*	Tad.	14	Static	96	1.686	a.i.	Kerby (2006)	1371	Unable to check details (source not retrieved).
1912249	Atrazine	98	Tech.	*Rana boylii*	Tad.	14	Static	96	5.517	a.i.	Kerby (2006)	1375	Unable to check details (source not retrieved).
8011630	Bordeaux mixture (1 % $CuSO_4$ + 1% $CaCO_3$ in H_2O 1:1)	-	Form.	*Microhyla ornata*	Tad.	25.5-25.9	Renewal	96	2.86	Form.	Jayaprakash and Madhyastha (1989)	1412	Unclear as to the basis of the toxicity data.
8011630	Bordeaux mixture (1 % $CuSO_4$ + 1% $CaCO_3$ in H_2O 1:1)	-	Form.	*Microhyla ornata*	Tad.	25.5-25.9	Renewal	96	3.02	Form.	Jayaprakash and Madhyastha (1989)	1413	Unclear as to the basis of the toxicity data.
23184669	Butachlor	NR	?	*Bufo bufo japonicus*	Tad.	25	Static	96	1.8	?	Nishiuchi and Yoshida (1975)	1415	Unable to check details (source language).
63252	Carbaryl	NR	(unclear in source)	*Rana tigrina*	Adults	27±2	Static	96	70	a.i.	Deshmukh and Keshavan (1984)	1424	Test material not defined

CAS	Pesticide name	% a.i.	Test material	Species	Stage	Temp. (°C)	Exposure type	Duration (h)	LC50 (mg/L)	LC50 based on	Reference	Data line	Reason for omission from main dataset
63252	Carbaryl	99.5	Tech.	*Pseudacris regilla*	Tad.	14	Static	96	3.007	a.i.	Kerby (2006)	1434	Unable to check details (source not retrieved).
63252	Carbaryl	99.5	Tech.	*Rana boylii*	Tad.	14	Static	96	0.585	a.i.	Kerby (2006)	1435	Unable to check details (source not retrieved).
63252	Carbaryl	NR	Form.	*Rana hexadactyla*	Tad.	14 (12-17)	Renewal	96	55.34	Form.	Khangarot et al (1985c)	1439	Data are for formulation (a.i. Content not defined).
63252	Carbaryl	NR	NR	*Rana tigrina*	Tad.	26±1	Renewal	96	5.68	?	Sampath et al (2002)	1441	Test material not defined
10605217	Carbendazim	NR	?	*Bufo bufo japonicus*	Tad.	25	Static	96	3.5	?	Nishiuchi and Yoshida (1975)	1444	Unable to check details (source language).
10605217	Carbendazim	NR	Form.	*Rana hexadactyla*	Tad.	14 (12-17)	Renewal	96	16.02	Form.	Khangarot et al (1985c)	1445	Data are for formulation (a.i. Content not defined).
1563662	Carbofuran	75	NR	*Rana hexadactyla*	Tad.	14 (12-17)	Renewal	96	112.7	Form.	Khangarot et al (1985c)	1450	Test material not defined.
32861851	Chlomethoxyfen, chlormethoxynil	NR	?	*Bufo bufo japonicus*	Tad.	25	Static	96	>40	?	Nishiuchi and Yoshida (1975)	1452	Unable to check details (source language).
2921882	Chlorpyrifos	99.5	Tech.	*Pseudacris regilla*	Tad.	14	Static	96	0.122	a.i.	Kerby (2006)	1459	Unable to check details (source not retrieved).
2921882	Chlorpyrifos	99.5	Tech.	*Rana boylii*	Tad.	14	Static	96	0.205	a.i.	Kerby (2006)	1460	Unable to check details (source not retrieved).
2921882	Chlorpyrifos	NR	NR	*Rana tigrina*	Tad.	NR	NR	96	0.019	a.i.	Abbasi and Soni (1991)	1462	Test material not defined, too little detail
7758987	Copper sulfate	NR	Tech. (ACS grade)	*Xenopus laevis*	Emb.	24	Renewal	96	0.89	a.i. (Cu)	Fort et al (1996)	1471	Unable to check details (source not retrieved).
7758987	Copper sulfate	NR	Tech. (ACS grade)	*Xenopus laevis*	Emb.	24	Renewal	96	0.98	a.i. (Cu)	Fort et al (1996)	1472	Unable to check details (source not retrieved).
7758987	Copper sulfate	NR	Tech. (Reagent grade)	*Rana hexadactyla*	Tad.	15	Static	96	0.039	a.i. (Cu)	Khangarot et al (1985b)	1498	Data appear to be the same as presented in Khangarot et al (1994).

CAS	Pesticide name	% a.i.	Test material	Species	Stage	Temp. (°C)	Exposure type	Duration (h)	LC50 (mg/L)	LC50 based on	Reference	Data line	Reason for omission from main dataset
7758987	Copper sulfate	NR	Tech. (Reagent grade)	*Rana hexadactyla*	Tad.	15 (13-16)	Renewal	96	0.039	a.i. (Cu)	Khangarot et al (1985b)	1499	Data appear to be the same as presented in Khangarot et al (1994).
13121705	Cyhexatin	NR	?	*Bufo bufo japonicus*	Tad.	25	Static	96	0.07	?	Nishiuchi and Yoshida (1975)	1501	Unable to check details (source language).
75990	Dalapon	NR	Form.	*Adelotus brevis*	Tad.	21-22	Static	96	4200	Form.	Johnson (1976)	1507	Data based on formulation, a.i. Content not defined.
75990	Dalapon	NR	Form.	*Limnodynastes peroni*	Tad.	21-22	Static	96	2000	Form.	Johnson (1976)	1508	Data based on formulation, a.i. Content not defined.
50293	DDT	NR	(unclear in source)	*Rana tigrina*	Adults	27±2	Static	96	4000	a.i.	Deshmukh and Keshavan (1984)	1510	Test material not defined
10311849	Dialifos	NR	?	*Bufo bufo japonicus*	Tad.	25	Static	96	0.73	?	Nishiuchi and Yoshida (1975)	1524	Unable to check details (source language).
333415	Diazinon	99.3	Tech.	*Pseudacris regilla*	Tad.	14	Static	96	3.434	a.i.	Kerby (2006)	1531	Unable to check details (source not retrieved).
333415	Diazinon	NR	NR	*Ptychadena bibroni*	Tad.	30±2	Semi-static-renewal	96	See formulation data	a.i.	Ezemonye and Ilechie (2007)	1532	Test material not defined.
333415	Diazinon	99.3	Tech.	*Rana boylii*	Tad.	14	Static	96	1.715	a.i.	Kerby (2006)	1533	Unable to check details (source not retrieved).
1918009	Dicamba	NR	Form.	*Limnodynastes peroni*	NR	21-22	Static	96	106	Form.	Johnson (1976)	1535	Data based on formulation, a.i. Content not defined.
1918009	Dicamba	NR	Form.	*Adelotus brevis*	Tad.	21-22	Static	96	185	Form.	Johnson (1976)	1536	Data based on formulation, a.i. Content not defined.
60515	Dimethoate	40	?	*Rana chaochiaoensis*	Tad.	20.5±0.5	NR	96	52.80	a.i.	Zhang et al (2007)	1556	Unable to extract all details (source language).
60515	Dimethoate	NR	Form.	*Rana hexadactyla*	Tad.	14 (12-17)	Renewal	96	7.82	Form.	Khangarot et al (1985c)	1557	Data are for formulation (a.i. Content not defined).
144218	DSMA	NR	NR	*Adelotus brevis*	Tad.	21-22	Static	96	453	Form.	Johnson (1976)	1560	Test material not defined.

CAS	Pesticide name	% a.i.	Test material	Species	Stage	Temp. (°C)	Exposure type	Duration (h)	LC50 (mg/L)	LC50 based on	Reference	Data line	Reason for omission from main dataset
144218	DSMA	NR	NR	*Limnodyn-astes peroni*	Tad.	21-22	Static	96	271	Form.	Johnson (1976)	1561	Test material not defined.
115297	Endosulfan	NR	NR	*Bufo melanostictus*	Larv.	25	Static	96	0.123	?	Vardia et al (1984)	1564	Test material not defined.
115297	Endosulfan	NR	NR	*Rana tigrina*	Tad.	NR	NR	96	0.004	a.i.	Abbasi and Soni (1991)	1577	Test material not defined, too little detail
72208	Endrin	NR	?	*Rana catesbeiana*	NR	0	Flow-through	96	(7 nmol/L)	Form.	Bottger (1988)	1581	Unable to check details (source not retrieved).
72208	Endrin	NR	Form.	*Rana hexadactyla*	Tad.	14 (12-17)	Renewal	96	0.21	Form.	Khangarot et al (1985c)	1587	Data are for formulation (a.i. Content not defined).
2593159	Etridiazole	NR	?	*Bufo bufo japonicus*	Tad.	25	Static	96	12	?	Nishiuchi and Yoshida (1975)	1590	Unable to check details (source language).
93721	Fenoprop	NR	Form.	*Adelotus brevis*	Tad.	21-22	Static	96	54	Form.	Johnson (1976)	1595	Data based on formulation, a.i. Content not defined.
93721	Fenoprop	NR	Form.	*Bufo marinus*	Tad.	21-22	Static	96	34	Form.	Johnson (1976)	1596	Data based on formulation, a.i. Content not defined.
93721	Fenoprop	NR	Form.	*Limnodyn-astes peroni*	Tad.	21-22	Static	96	22	Form.	Johnson (1976)	1597	Data based on formulation, a.i. Content not defined.
55389	Fenthion	NR	Form.	*Rana hexadactyla*	Tad.	14 (12-17)	Renewal	96	0.84	Form.	Khangarot et al (1985c)	1599	Data are for formulation (a.i. Content not defined).
58899	Gamma-HCH, lindane	6.5	Form.	*Rana hexadactyla*	Tad.	14 (12-17)	Renewal	96	3.97	Form.	Khangarot et al (1985c)	1610	Data are for formulation.
36614387	Isothioate	NR	?	*Bufo bufo japonicus*	Tad.	25	Static	96	7.3	?	Nishiuchi and Yoshida (1975)	1699	Unable to check details (source language).
18854018	Isoxathion	NR	?	*Bufo bufo japonicus*	Tad.	25	Static	96	5.1	?	Nishiuchi and Yoshida (1975)	1700	Unable to check details (source language).
121755	Malathion	NR	Form.	*Rana hexadactyla*	Tad.	14 (12-17)	Renewal	96	0.59	Form.	Khangarot et al (1985c)	1711	Data are for formulation (a.i. Content not defined).
121755	Malathion	NR	NR	*Rana tigrina*	Tad.	NR	NR	96	1.41	a.i.	Abbasi and Soni (1991)	1714	Test material not defined, too little detail

CAS	Pesticide name	% a.i.	Test material	Species	Stage	Temp. (°C)	Exposure type	Duration (h)	LC50 (mg/L)	LC50 based on	Reference	Data line	Reason for omission from main dataset
5221169	MCPA potassium	NR	?	*Bufo bufo japonicus*	Tad.	25	Static	96	>40	?	Nishiuchi and Yoshida (1975)	1722	Unable to check details (source language).
7487947	Mercuric chloride	NR	(Tech.)	*Rana heckscheri*	Adults	0	NR	96	4.4	a.i.	Punzo (1993b)	1724	Lack of detail on methods used.
7487947	Mercuric chloride	NR	Tech.	*Rana tigrina*	Adults	23±1.0	Renewal	96	16.1	a.i.	Mudgall and Patil (1988)	1725	Insufficient details on repilication and dose levels.
7487947	Mercuric chloride	NR	Tech.	*Rana tigrina*	Adults	23±1.0	Renewal	96	18.3	a.i.	Mudgall and Patil (1988)	1726	Insufficient details on repilication and dose levels.
2212671	Molinate	NR	?	*Bufo bufo japonicus*	Tad.	25	Static	96	34	?	Nishiuchi and Yoshida (1975)	1749	Unable to check details (source language).
6923224	Monocrotophos	36	Form.	*Euphlyctis hexadactylus*	Adults	NR	NR	96	195	a.i.	Renuka and Andrews (2009)	1752	Lack of detail on methods used.
54115	Nicotine	NR	(unclear in source)	*Xenopus laevis*	Emb.	23-24	Renewal	96	20	a.i.	Dawson et al (1988)	1763	Test material not defined
54115	Nicotine	NR	(unclear in source)	*Xenopus laevis*	Emb.	23-24	Renewal	96	136	a.i.	Dawson et al (1988)	1764	Test material not defined
4726141	Nitralin	NR	?	*Bufo bufo japonicus*	Tad.	25	Static	96	>40	?	Nishiuchi and Yoshida (1975)	1765	Unable to check details (source language).
19666309	Oxadiazon	NR	?	*Bufo bufo japonicus*	Tad.	25	Static	96	1.3	?	Nishiuchi and Yoshida (1975)	1767	Unable to check details (source language).
5259881	Oxicarboxin	NR	?	*Bufo bufo japonicus*	Tad.	25	Static	96	3.8	?	Nishiuchi and Yoshida (1975)	1768	Unable to check details (source language).
4685147	Paraquat	NR	Form.	*Adelotus brevis*	Tad.	21-22	Static	96	262	Form.	Johnson (1976)	1771	Data based on formulation, a.i. Content not defined.
4685147	Paraquat	NR	Form.	*Limnodyn-astes peroni*	Tad.	21-22	Static	96	100	Form.	Johnson (1976)	1773	Data based on formulation, a.i. Content not defined.
298000	Parathion-methyl, methyl parathion	NR	Form.	*Rana cyanophlyctis*	Tad.	NR	Static	96	8.75	Form.	Alam (1989)	1790	Too little detail

CAS	Pesticide name	% a.i.	Test material	Species	Stage	Temp. (°C)	Exposure type	Duration (h)	LC50 (mg/L)	LC50 based on	Reference	Data line	Reason for omission from main dataset
298000	Parathion-methyl, methyl parathion	NR	Form.	*Rana tigrina*	Tad.	NR	Static	96	9.5	Form.	Alam and Shafi (1991)	1791	Test material not defined.
298000	Parathion-methyl, methyl parathion	NR	NR	*Rana tigrina*	Tad.	28±2	Renewal	96	1.36	NR	Kennedy and Sampath (2001)	1792	Test material not defined, basis of LC50 value not defined.
298000	Parathion-methyl, methyl parathion	NR	NR	*Rana tigrina*	Tad.	26±1	Renewal	96	4.86	?	Sampath et al (2002)	1794	Test material not defined
87865	Pentachlorophenol	NR	?	*Xenopus laevis*	Emb.	24	Renewal	96	0.39	Form.	Fort et al (1996)	1797	Unable to check details (source not retrieved).
87865	Pentachlorophenol	NR	?	*Xenopus laevis*	Emb.	24	Renewal	96	0.46	Form.	Fort et al (1996)	1798	Unable to check details (source not retrieved).
87865	Pentachlorophenol	NR	?	*Rana catesbeiana*	NR	0	Flow-through	96	(0.789 umol/L)	Form.	Bottger (1988)	1805	Unable to check details (source not retrieved).
87865	Pentachlorophenol	NR	?	*Bufo bufo japonicus*	Tad.	20	Static	96	0.1	?	Nishiuchi (1976)	1809	Unable to check details (source language).
52645531	Permethrin	NR	?	*Rana catesbeiana*	NR	0	Flow-through	96	(0.294 umol/L)	Form.	Bottger (1988)	1813	Unable to check details (source not retrieved).
2310170	Phosalone	NR	NR	*Rana tigrina*	Tad.	NR	NR	96	0.061	a.i.	Abbasi and Soni (1991)	1819	Test material not defined, too little detail
13171216	Phosphamidon	NR	NR	*Rana cyanophlyctis*	Adults	NR	NR	96	0.268	a.i.	Thenmozhi and Ramaswamy (2008)	1821	Test material not defined.
1918021	Picloram	NR	Form.	*Adelotus brevis*	Tad.	21-22	Static	96	154	Form.	Johnson (1976)	1822	Data based on formulation, a.i. Content not defined.
1918021	Picloram	NR	Form.	*Adelotus brevis*	Tad.	21-22	Static	96	95	Form.	Johnson (1976)	1823	Data based on formulation, a.i. Content not defined.
1918021	Picloram	NR	Form.	*Limnodynastes peroni*	Tad.	21-22	Static	96	105	Form.	Johnson (1976)	1824	Data based on formulation, a.i. Content not defined.

CAS	Pesticide name	% a.i.	Test material	Species	Stage	Temp. (°C)	Exposure type	Duration (h)	LC50 (mg/L)	LC50 based on	Reference	Data line	Reason for omission from main dataset
0	POEA	NR	(Tech.)	*Xenopus laevis*	Emb.	24±0.5	Static-renewal	96	1.4	a.i.	Edgington et al. (2004)	1830	Not pesticide.
0	POEA	NR	(Tech.)	*Xenopus laevis*	Emb.	24±0.5	Static-renewal	96	1.5	a.i.	Edgington et al. (2004)	1831	Not pesticide.
0	POEA	NR	(Tech.)	*Xenopus laevis*	Emb.	24±0.5	Static-renewal	96	3	a.i.	Edgington et al. (2004)	1832	Not pesticide.
0	POEA	NR	(Tech.)	*Xenopus laevis*	Emb.	24±0.5	Static-renewal	96	3.9	a.i.	Edgington et al. (2004)	1833	Not pesticide.
39285046	Polynactin	NR	?	*Bufo bufo japonicus*	Tad.	25	Static	96	0.018	?	Nishiuchi and Yoshida (1975)	1835	Unable to check details (source language).
2631370	Promecarb	NR	?	*Bufo bufo japonicus*	Tad.	25	Static	96	28	?	Nishiuchi and Yoshida (1975)	1838	Unable to check details (source language).
7292162	Propaphos	NR	?	*Bufo bufo japonicus*	Tad.	25	Static	96	14	?	Nishiuchi and Yoshida (1975)	1839	Unable to check details (source language).
23950585	Propyzamide	NR	?	*Bufo bufo japonicus*	Tad.	25	Static	96	>40	?	Nishiuchi and Yoshida (1975)	1840	Unable to check details (source language).
119120	Pyridaphenthion	NR	?	*Bufo bufo japonicus*	Tad.	25	Static	96	7.3	?	Nishiuchi and Yoshida (1975)	1841	Unable to check details (source language).
13593038	Quinalphos	NR	Form.	*Rana cyanophlyctis*	Tad.	NR	Static	96	8.0	Form.	Alam and Shafi (1989)	1842	Too little detail
13593038	Quinalphos	NR	Form.	*Rana tigrina*	Tad.	NR	Static	96	8.75	Form.	Alam and Shafi (1991)	1843	Test material not defined.
83794	Rotenone	5	Form.	*Rana spheno-cephala*	Larv.	16±1	Static	96	0.500	NR	Chandler and Marking (1982)	1844	Lack of detail on methods and basis of values presented (active substance or formulation).
83794	Rotenone	20	Form.	*Rana pipiens*	NR	NR	Static	96	3.2	Form.	Farringer (1972)	1846	Insufficient detail
83794	Rotenone	20	Form.	*Rana pipiens*	NR	NR	Static	96	4.6	Form.	Farringer (1972)	1847	Insufficient detail
83794	Rotenone	5	Form.	*Rana pipiens*	NR	NR	Static	96	4.8	Form.	Farringer (1972)	1848	Insufficient detail
83794	Rotenone	5	Form.	*Rana pipiens*	NR	NR	Static	96	5.8	Form.	Farringer (1972)	1849	Insufficient detail
131522	Sodium pentachlorophenoxide	NR	?	*Bufo bufo japonicus*	Tad.	25	Static	96	0.32	?	Nishiuchi and Yoshida (1975)	1892	Unable to check details (source language).
148798	Thiabendazole	NR	?	*Bufo bufo japonicus*	Tad.	25	Static	96	7.3	?	Nishiuchi and Yoshida (1975)	1900	Unable to check details (source language).

CAS	Pesticide name	% a.i.	Test material	Species	Stage	Temp. (°C)	Exposure type	Duration (h)	LC50 (mg/L)	LC50 based on	Reference	Data line	Reason for omission from main dataset
56359	Tributyltin oxide, Bis(tributyltin)oxide	NR	?	*Rana temporaria*	Larv.	20	Static	96	0.00165	Form.	Hooftman et al (1989)	1926	Unable to check details (source not retrieved).
81412433	Tridemorph	NR	Form.	*Rana hexadactyla*	Tad.	14 (12-17)	Renewal	96	0.41	Form.	Khangarot et al (1985c)	1949	Data are for formulation (a.i. Content not defined).
2921882	Chlorpyrifos	NR	NR	*Rana tigrina*	Tad.	NR	NR	120	0.011	a.i.	Abbasi and Soni (1991)	1961	Test material not defined, too little detail
13171216	Phosphamidon	NR	NR	*Rana cyanophlyctis*	Adults	NR	NR	120	0.268	a.i.	Thenmozhi and Ramaswamy (2008)	1967	Test material not defined.
2921882	Chlorpyrifos	NR	NR	*Rana tigrina*	Tad.	NR	NR	144	0.010	a.i.	Abbasi and Soni (1991)	1975	Test material not defined, too little detail
115297	Endosulfan	NR	NR	*Rana tigrina*	Tad.	NR	NR	144	0.007	a.i.	Abbasi and Soni (1991)	1976	Test material not defined, too little detail
121755	Malathion	NR	NR	*Rana tigrina*	Tad.	NR	NR	144	0.17	a.i.	Abbasi and Soni (1991)	1977	Test material not defined, too little detail
2310170	Phosalone	NR	NR	*Rana tigrina*	Tad.	NR	NR	144	0.012	a.i.	Abbasi and Soni (1991)	1978	Test material not defined, too little detail
7487947	Mercuric chloride	NR	?	*Xenopus laevis*	Eggs	12.2	Flow-through	168	0.00016	a.i. (Hg)	Birge et al (1979)	1999	Unable to check details (source not retrieved).
7758987	Copper sulfate	NR	?	*Ambystoma opacum*	Eggs	19-22	Renewal	192	0.77	a.i. (Cu)	Birge et al (1978)	2007	Unable to check details (source not retrieved).
7487947	Mercuric chloride	NR	?	*Ambystoma opacum*	Eggs	19-22	Renewal	192	0.11	a.i. (Hg)	Birge et al (1978)	2009	Unable to check details (source not retrieved).
786196	Carbophenothion	NR	NR	*Rana pipiens*	Adults	24	Renewal	360	155	NR	Kaplan and Glaczenski (1965)	2047	Test material not defined.
121755	Malathion	NR	NR	*Rana pipiens*	Adults	24	Renewal	360	150	NR	Kaplan and Glaczenski (1965)	2054	Test material not defined.
7786347	Mevinphos	NR	NR	*Rana pipiens*	Adults	24	Renewal	360	12	NR	Kaplan and Glaczenski (1965)	2055	Test material not defined.

CAS	Pesticide name	% a.i.	Test material	Species	Stage	Temp. (°C)	Exposure type	Duration (h)	LC50 (mg/L)	LC50 based on	Reference	Data line	Reason for omission from main dataset
56382	Parathion	NR	NR	*Rana pipiens*	Adults	24	Renewal	360	10	NR	Kaplan and Glaczenski (1965)	2056	Test material not defined.
152169	Schradan	NR	NR	*Rana pipiens*	Adults	24	Renewal	360	2900	NR	Kaplan and Glaczenski (1965)	2057	Test material not defined.
107493	TEPP	NR	NR	*Rana pipiens*	Adults	24	Renewal	360	60	NR	Kaplan and Glaczenski (1965)	2058	Test material not defined.
3810740	Streptomycin sesquisulfate	NR	NR	*Rana clamitans*	Larv.	15	Renewal	NR	1.3	a.i.	Procaccini and Doyle (1970)	2115	Lack of detail on basis of LC50 values.
3810740	Streptomycin sesquisulfate	NR	NR	*Rana clamitans*	Larv.	26	Renewal	NR	1.3	a.i.	Procaccini and Doyle (1970)	2116	Lack of detail on basis of LC50 values.
3810740	Streptomycin sesquisulfate	NR	NR	*Rana clamitans*	Larv.	15	Renewal	NR	1.3	a.i.	Procaccini and Doyle (1970)	2117	Lack of detail on basis of LC50 values.
3810740	Streptomycin sesquisulfate	NR	NR	*Rana clamitans*	Larv.	26	Renewal	NR	1.3	a.i.	Procaccini and Doyle (1970)	2118	Lack of detail on basis of LC50 values.
298000	Parathion-methyl, methyl parathion	NR	NR	*Rana tigrina*	Tad.	28±2	Renewal	NR (to metamorphosis)	1.3	NR	Kennedy and Sampath (2001)	2119	Test material not defined, basis of LC50 value not defined.
2921882	Chlorpyrifos	99	Tech.	*Pseudacris regilla*	Tad.	21-22	Renewal	To metamorphosis	0.365	a.i.	Sparling and Fellers (2009)	2120	Duration for LC50 not defined as dependent on time to metamorphosis.
2921882	Chlorpyrifos	99	Tech.	*Rana boylii*	Tad.	21-22	Renewal	To metamorphosis	0.0665	a.i.	Sparling and Fellers (2009)	2121	Duration for LC50 not defined as dependent on time to metamorphosis.
115297	Endosulfan	99	Tech.	*Pseudacris regilla*	Tad.	21-22	Renewal	To metamorphosis	0.0156	a.i.	Sparling and Fellers (2009)	2122	Duration for LC50 not defined as dependent on time to metamorphosis.

CAS	Pesticide name	% a.i.	Test material	Species	Stage	Temp. (°C)	Exposure type	Duration (h)	LC50 (mg/L)	LC50 based on	Reference	Data line	Reason for omission from main dataset
115297	Endosulfan	99	Tech.	*Rana boylii*	Tad.	21-22	Renewal	To metamorphosis	0.00055	a.i.	Sparling and Fellers (2009)	2123	Duration for LC50 not defined as dependent on time to metamorphosis.

N. CITATIONS FOR IUCN DATA

Agasyan A, Avci A, Tuniyev B, Isailovic JC, Lymberakis P, Andrén C, Cogalniceanu D, Wilkinson J, Ananjeva N, Üzüm N, Orlov N, Podloucky R, Tuniyev S, Kaya U, Stöck M, Khan MS, Kuzmin S, Tarkhnishvili D, Ishchenko V, Papenfuss T, Degani G, Ugurtas IH, Rastegar-Pouyani N, Disi AMM, Anderson S, Beebee T, Andreone F, 2009. Pseudepidalea viridis. In: IUCN 2012. IUCN Red List of Threatened Species. Version 2012.1. <www.iucnredlist.org>. Downloaded on 19 June 2012.

Agasyan A, Avci A, Tuniyev B, Isailovic JC, Lymberakis P, Andrén C, Cogalniceanu D, Wilkinson J, Ananjeva N, Üzüm N, Orlov N, Podloucky R, Tuniyev S, Kaya U, 2009. Pelobates fuscus. In: IUCN 2012. IUCN Red List of Threatened Species. Version 2012.1. <www.iucnredlist.org>. Downloaded on 19 June 2012.

Agasyan A, Aziz Avisi, Tuniyev B, Isailovic JC, Lymberakis P, Andrén C, Cogalniceanu D, Wilkinson J, Ananjeva N, Üzüm N, Orlov N, Podloucky R, Tuniyev S, Kaya U, 2009. Bombina bombina. In: IUCN 2012. IUCN Red List of Threatened Species. Version 2012.1. <www.iucnredlist.org>. Downloaded on 19 June 2012.

Agasyan A, Aziz Avisi, Tuniyev B, Isailovic JC, Lymberakis P, Andrén C, Cogalniceanu D, Wilkinson J, Ananjeva N, Üzüm N, Orlov N, Podloucky R, Tuniyev S, Kaya U, 2009. Bufo bufo. In: IUCN 2012. IUCN Red List of Threatened Species. Version 2012.1. <www.iucnredlist.org>. Downloaded on 19 June 2012.

Agasyan A, Tuniyev B, Isailovic JC, Lymberakis P, Andrén C, Cogalniceanu D, Wilkinson J, Ananjeva N, Üzüm N, Orlov N, Podloucky R, Tuniyev S, Kaya U, 2009, Pelobates syriacus. In: IUCN 2012. IUCN Red List of Threatened Species. Version 2012.1. <www.iucnredlist.org>. Downloaded on 19 June 2012.

Andreone F, Corti C, Sindaco R, Romano A, 2009. Pelophylax bergeri. In: IUCN 2012. IUCN Red List of Threatened Species. Version 2012.1. <www.iucnredlist.org>. Downloaded on 19 June 2012.

Andreone F, Corti C, Sindaco R, Romano A, 2009. Pelophylax hispanicus. In: IUCN 2012. IUCN Red List of Threatened Species. Version 2012.1. <www.iucnredlist.org>. Downloaded on 19 June 2012.

Andreone F, Corti C, Sindaco R, Romano A, 2009. Rana italica. In: IUCN 2012. IUCN Red List of Threatened Species. Version 2012.1. <www.iucnredlist.org>. Downloaded on 19 June 2012.

Andreone F, Corti C, Sindaco R, Romano A, Giachi F, Vanni S, Delfino G, 2009. Bombina pachypus. In: IUCN 2012. IUCN Red List of Threatened Species. Version 2012.1. <www.iucnredlist.org>. Downloaded on 19 June 2012.

Andreone F, Denoël M, Miaud C, Schmidt B, Edgar P, Vogrin M, Isailovic JC, Ajtic R, Corti C, Haxhiu I, 2009. Salamandra atra. In: IUCN 2012. IUCN Red List of Threatened Species. Version 2012.1. <www.iucnredlist.org>. Downloaded on 19 June 2012.

Andreone F, Edgar P, Corti C, Sindaco R, Romano A, 2009. Speleomantes ambrosii. In: IUCN 2012. IUCN Red List of Threatened Species. Version 2012.1. <www.iucnredlist.org>. Downloaded on 19 June 2012.

Andreone F, Edgar P, Corti C, Sindaco R, Romano A, 2009. Speleomantes italicus. In: IUCN 2012. IUCN Red List of Threatened Species. Version 2012.1. <www.iucnredlist.org>. Downloaded on 19 June 2012.

Andreone F, Lecis R, Edgar P, Corti C, Sindaco R, Romano A, 2009. Atylodes genei. In: IUCN 2012. IUCN Red List of Threatened Species. Version 2012.1. <www.iucnredlist.org>. Downloaded on 19 June 2012.

Andreone F, Lecis R, Edgar P, Corti C, Sindaco R, Romano A, 2009. Speleomantes imperialis. In: IUCN 2012. IUCN Red List of Threatened Species. Version 2012.1. <www.iucnredlist.org>. Downloaded on 19 June 2012.

Andreone F, Lecis R, Edgar P, Corti C, Sindaco R, Romano A, 2009. Speleomantes supramontis. In: IUCN 2012. IUCN Red List of Threatened Species. Version 2012.1. <www.iucnredlist.org>. Downloaded on 19 June 2012.

Andreone F, Lecis R, Miaud C, Corti C, Sindaco R, Romano A, 2009. Discoglossus sardus. In: IUCN 2012. IUCN Red List of Threatened Species. Version 2012.1. <www.iucnredlist.org>. Downloaded on 19 June 2012.

Andreone F, Miaud C, Cheylan M, Corti C, Geniez P, Sindaco R, Romano A, 2009. Hyla sarda. In: IUCN 2012. IUCN Red List of Threatened Species. Version 2012.1. <www.iucnredlist.org>. Downloaded on 19 June 2012.

Andreone F, Schmidt B, Vogrin M, Corti C, Sindaco R, Romano A, 2009. Hyla intermedia. In: IUCN 2012. IUCN Red List of Threatened Species. Version 2012.1. <www.iucnredlist.org>. Downloaded on 19 June 2012.

Arntzen JW, Andreone F, Corti C, Sindaco R, Romano A, 2009. Lissotriton italicus. In: IUCN 2012. IUCN Red List of Threatened Species. Version 2012.1. <www.iucnredlist.org>. Downloaded on 19 June 2012.

Arntzen JW, Beja P, Bosch J, Tejedo M, Lizana M, Jehle R, Martínez-Solano I, Salvador A, García-París M, Gil ER, Marquez R, Sá-Sousa P, Diaz Paniagua C, 2009. Triturus pygmaeus. In: IUCN 2012. IUCN Red List of Threatened Species. Version 2012.1. <www.iucnredlist.org>. Downloaded on 19 June 2012.

Arntzen JW, Beja P, Jehle R, Bosch J, Tejedo M, Lizana M, Martínez-Solano I, Salvador A, García-París M, Gil ER, Sá-Sousa P, Marquez R, 2009. Lissotriton boscai. In: IUCN 2012. IUCN Red List of Threatened Species. Version 2012.1. <www.iucnredlist.org>. Downloaded on 19 June 2012.

Arntzen JW, Bosch J, Denoël M, Tejedo M, Edgar P, Lizana M, Martínez-Solano I, Salvador A, García-París M, Gil ER, Sá-Sousa P, Marquez R, 2009. Chioglossa lusitanica. In: IUCN 2012. IUCN Red List of Threatened Species. Version 2012.1. <www.iucnredlist.org>. Downloaded on 19 June 2012.

Arntzen JW, Denoël M, Kuzmin S, Ishchenko V, Beja P, Andreone F, Jehle R, Nyström P, Miaud C, Anthony B, Schmidt B, Ogrodowczyk A, Ogielska M, Bosch J, Vogrin M, Tejedo M, 2009. Mesotriton alpestris. In: IUCN 2012. IUCN Red List of Threatened Species. Version 2012.1. <www.iucnredlist.org>. Downloaded on 19 June 2012.

Arntzen JW, Denoël M, Miaud C, Andreone F, Vogrin M, Edgar P, Isailovic JC, Ajtic R, Corti C, 2009. Proteus anguinus. In: IUCN 2012. IUCN Red List of Threatened Species. Version 2012.1. <www.iucnredlist.org>. Downloaded on 19 June 2012.

Arntzen JW, Jehle R, Bosch J, Miaud C, Tejedo M, Lizana M, Martínez-Solano I, Salvador A, García-París M, Gil ER, Sá-Sousa P, Marquez R, 2009. Triturus marmoratus. In: IUCN 2012. IUCN Red List of Threatened Species. Version 2012.1. <www.iucnredlist.org>. Downloaded on 19 June 2012.

Arntzen JW, Kuzmin S, Ananjeva N, Orlov N, Tuniyev B, Ogrodowczyk A, Ogielska M, Babik W, Cogalniceanu D, 2009. Lissotriton montandoni. In: IUCN 2012. IUCN Red List of Threatened Species. Version 2012.1. <www.iucnredlist.org>. Downloaded on 19 June 2012.

Arntzen JW, Kuzmin S, Jehle R, Denoël M, Anthony B, Miaud C, Babik W, Vogrin M, Tarkhnishvili D, Ishchenko V, Ananjeva N, Orlov N, Tuniyev B, Cogalniceanu D, Kovács T, Kiss I, 2009. Triturus dobrogicus. In: IUCN 2012. IUCN Red List of Threatened Species. Version 2012.1. <www.iucnredlist.org>. Downloaded on 19 June 2012.

Arntzen JW, Kuzmin S, Jehle R, Beebee T, Tarkhnishvili D, Ishchenko V, Ananjeva N, Orlov N, Tuniyev B, Denoël M, Nyström P, Anthony B, Schmidt B, Ogrodowczyk A, 2009. Triturus cristatus. In: IUCN 2012. IUCN Red List of Threatened Species. Version 2012.1. <www.iucnredlist.org>. Downloaded on 19 June 2012.

Arntzen JW, Kuzmin S, Beebee T, Papenfuss T, Sparreboom M, Ugurtas IH, Anderson S, Anthony B, Andreone F, Tarkhnishvili D, Ishchenko V, Ananjeva N, Orlov N, Tuniyev B, 2009. Lissotriton vulgaris. In: IUCN 2012. IUCN Red List of Threatened Species. Version 2012.1. <www.iucnredlist.org>. Downloaded on 19 June 2012.

Arntzen JW, Papenfuss T, Kuzmin S, Tarkhnishvili D, Ishchenko V, Tuniyev B, Sparreboom M, Rastegar-Pouyani N, Ugurtas IH, Anderson S, Babik W, Miaud C, Isailovic JC 2009. Triturus karelinii. In: IUCN 2012. IUCN Red List of Threatened Species. Version 2012.1. <www.iucnredlist.org>. Downloaded on 19 June 2012.

Arntzen JW, Beebee T, Jehle R, Denoël M, Schmidt B, Bosch J, Miaud C, Tejedo M, Lizana M, Martínez-Solano I, Salvador A, García-París M, Gil ER, Sá-Sousa P, Geniez P, 2009. Lissotriton helveticus. In: IUCN 2012. IUCN Red List of Threatened Species. Version 2012.1. <www.iucnredlist.org>. Downloaded on 19 June 2012.

Beerli P, Uzzell T, Lymberakis P, 2009. Pelophylax cerigensis. In: IUCN 2012. IUCN Red List of Threatened Species. Version 2012.1. <www.iucnredlist.org>. Downloaded on 19 June 2012.

Beerli P, Uzzell T, Lymberakis P, 2009. Pelophylax cretensis. In: IUCN 2012. IUCN Red List of Threatened Species. Version 2012.1. <www.iucnredlist.org>. Downloaded on 19 June 2012.

Beja P, Bosch J, Tejedo M, Edgar P, Donaire-Barroso D, Lizana M, Martínez-Solano I, Salvador A, García-París M, Gil ER, Slimani T , El Hassan El Mouden, Geniez P, Slimani T, 2009. Pleurodeles waltl. In: IUCN 2012. IUCN Red List of Threatened Species. Version 2012.1. <www.iucnredlist.org>. Downloaded on 19 June 2012.

Beja P, Bosch J, Tejedo M, Lizana M, Martínez-Solano I, Salvador A, García-París M, Gil ER, Pérez-Mellado V, Diaz Paniagua C, Cheylan M, Marquez R, Geniez P, 2009. Pelobates cultripes. In: IUCN 2012. IUCN Red List of Threatened Species. Version 2012.1. <www.iucnredlist.org>. Downloaded on 19 June 2012.

Beja P, Bosch J, Tejedo M, Lizana M, Martínez-Solano I, Salvador A, García-París M, Gil ER, Arntzen JW, Marquez R, Diaz Paniagua C, 2009. Alytes cisternasii. In: IUCN 2012. IUCN Red List of Threatened Species. Version 2012.1. <www.iucnredlist.org>. Downloaded on 19 June 2012.

Beja P, Kuzmin S, Beebee T, Denoël M, Schmidt B, Tarkhnishvili D, Ananjeva N, Orlov N, Nyström P, Ogrodowczyk A, Ogielska M, Bosch J, Miaud C, Tejedo M, Lizana M, Martínez-Solano I, 2009. Epidalea calamita. In: IUCN 2012. IUCN Red List of Threatened Species. Version 2012.1. <www.iucnredlist.org>. Downloaded on 19 June 2012.

Bosch J, Andreone F, Tejedo M, Donaire-Barroso D, Lizana M, Martínez-Solano I, Salvador A, García-París M, Gil ER, Slimani T, El Hassan El Mouden, Ulrich Joger, Geniez P, Corti C, 2009. Discoglossus pictus. In: IUCN 2012. IUCN Red List of Threatened Species. Version 2012.1. <www.iucnredlist.org>. Downloaded on 19 June 2012.

Bosch J, Beja P, Tejedo M, Lizana M, Martínez-Solano I, Salvador A, García-París M, Gil ER, Diaz Paniagua C, Pérez-Mellado V, Marquez R, 2009. Discoglossus galganoi. In: IUCN 2012. IUCN

Red List of Threatened Species. Version 2012.1. <www.iucnredlist.org>. Downloaded on 19 June 2012.

Bosch J, Tejedo M, Beja P, Martínez-Solano I, Salvador A, García-París M, Gil ER, Beebee T, 2009. Pelophylax perezi. In: IUCN 2012. IUCN Red List of Threatened Species. Version 2012.1. <www.iucnredlist.org>. Downloaded on 19 June 2012.

Bosch J, Tejedo M, Miaud C, Martínez-Solano I, Salvador A, García-París M, Gil ER, Marquez R, Diaz Paniagua C, Geniez P, 2009. Rana pyrenaica. In: IUCN 2012. IUCN Red List of Threatened Species. Version 2012.1. <www.iucnredlist.org>. Downloaded on 19 June 2012.

Bosch J, Tejedo M, Lizana M, Beja P, Martínez-Solano I, Salvador A, García-París M, Gil ER, Marquez R, Diaz Paniagua C, Pérez-Mellado V, 2009. Pelodytes ibericus. In: IUCN 2012. IUCN Red List of Threatened Species. Version 2012.1. <www.iucnredlist.org>. Downloaded on 19 June 2012.

Bosch J, Tejedo M, Lizana M, Martínez-Solano I, Salvador A, García-París M, Gil ER, Diaz Paniagua C, Pérez-Mellado V, Marquez R, 2009. Discoglossus jeanneae. In: IUCN 2012. IUCN Red List of Threatened Species. Version 2012.1. <www.iucnredlist.org>. Downloaded on 19 June 2012.

Bosch J, Tejedo M, Lizana M, Martínez-Solano I, Salvador A, García-París M, Gil ER, Arntzen JW, Marquez R, Diaz Paniagua C, Podloucky R, 2009. Alytes dickhilleni. In: IUCN 2012. IUCN Red List of Threatened Species. Version 2012.1. <www.iucnredlist.org>. Downloaded on 19 June 2012.

Bosch J, Beebee T, Schmidt B, Tejedo M, Martínez-Solano I, Salvador A, García-París M, Gil ER, Arntzen JW, Diaz Paniagua C, Marquez R, 2009. Alytes obstetricans. In: IUCN 2012. IUCN Red List of Threatened Species. Version 2012.1. <www.iucnredlist.org>. Downloaded on 19 June 2012.

Bosch J, Tejedo, M., Lecis, R., Miaud, C., Lizana M, Edgar P, Martínez-Solano I, Salvador A, García-París M, Recuero Gil E, Marquez R, Geniez P, 2009. Calotriton asper. In: IUCN 2012. IUCN Red List of Threatened Species. Version 2012.1. <www.iucnredlist.org>. Downloaded on 19 June 2012.

Denoël M, Beja P, Andreone F, Bosch J, Miaud C, Tejedo M, Lizana M, Martínez-Solano I, Salvador A, García-París M, Gil ER, Marquez R, Cheylan M, Diaz Paniagua C, Pérez-Mellado V, 2009. Pelodytes punctatus. In: IUCN 2012. IUCN Red List of Threatened Species. Version 2012.1. <www.iucnredlist.org>. Downloaded on 19 June 2012.

Donaire-Barroso D, Beebee T, Beja P, Andreone F, Bosch J, Tejedo M, Lizana M, Martínez-Solano I, Salvador A, García-París M, Gil ER, Slimani T , El Hassan El Mouden, Marquez R, 2009. Hyla meridionalis. In: IUCN 2012. IUCN Red List of Threatened Species. Version 2012.1. <www.iucnredlist.org>. Downloaded on 19 June 2012.

Kaya U, Agasyan A, Aziz Avisi, Tuniyev B, Isailovic JC, Lymberakis P, Andrén C, Cogalniceanu D, Wilkinson J, Ananjeva N, Üzüm N, Orlov N, Podloucky R, Tuniyev S, Kaya U, 2009. Hyla arborea. In: IUCN 2012. IUCN Red List of Threatened Species. Version 2012.1. <www.iucnredlist.org>. Downloaded on 19 June 2012.

Kaya U, Kuzmin S, Sparreboom M, Ugurtas IH, Tarkhnishvili D, Anderson S, Andreone F, Corti C, Nyström P, Schmidt B, Anthony B, Ogrodowczyk A, Ogielska M, Bosch J, Tejedo M, 2009. Rana dalmatina. In: IUCN 2012. IUCN Red List of Threatened Species. Version 2012.1. <www.iucnredlist.org>. Downloaded on 19 June 2012.

Kaya U, Tuniyev B, Tuniyev S, Kuzmin S, Tarkhnishvili D, Tuniyev B, Papenfuss T, Sparreboom M, Ugurtas I, Anderson S, Güven Eken, Tuba Kiliç, Engin Gem, 2009. Pelodytes caucasicus. In:

IUCN 2012. IUCN Red List of Threatened Species. Version 2012.1. <www.iucnredlist.org>. Downloaded on 19 June 2012.

Kuzmin S, Tarkhnishvili D, Ishchenko V, Ananjeva N, Orlov N, Tuniyev B, Sparreboom M, Ugurtas I, Rastegar-Pouyani N, Papenfuss T, Anderson S, Güven Eken, Tuba Kiliç, Engin Gem, Kaya U, 2009. Rana macrocnemis. In: IUCN 2012. IUCN Red List of Threatened Species. Version 2012.1. <www.iucnredlist.org>. Downloaded on 19 June 2012.

Kuzmin S, Tarkhnishvili D, Ishchenko V, Dujsebayeva T, Tuniyev B, Papenfuss T, Beebee T, Ugurtas IH, Sparreboom M, Rastegar-Pouyani N, Disi AMM, Anderson S, Denoël M, Andreone F, 2009. Pelophylax ridibundus. In: IUCN 2012. IUCN Red List of Threatened Species. Version 2012.1. <www.iucnredlist.org>. Downloaded on 19 June 2012.

Kuzmin S, Tarkhnishvili D, Ishchenko V, Tuniyev B, Beebee T, Anthony B, Schmidt B, Ogrodowczyk A, Ogielska M, Babik W, Vogrin M, Loman J, Cogalniceanu D, Kovács T, Kiss I, 2009. Rana arvalis. In: IUCN 2012. IUCN Red List of Threatened Species. Version 2012.1. <www.iucnredlist.org>. Downloaded on 19 June 2012.

Kuzmin S, Denoël M, Anthony B, Andreone F, Schmidt B, Ogrodowczyk A, Ogielska M, Vogrin M, Cogalniceanu D, Kovács T, Kiss I, Puky M, Vörös J, Tarkhnishvili D, Ananjeva N, 2009. Bombina variegata. In: IUCN 2012. IUCN Red List of Threatened Species. Version 2012.1. <www.iucnredlist.org>. Downloaded on 19 June 2012.

Kuzmin S, Papenfuss T, Sparreboom M, Ugurtas IH, Anderson S, Beebee T, Denoël M, Andreone F, Anthony B, Schmidt B, Ogrodowczyk A, Ogielska M, Bosch J, Tarkhnishvili D, Ishchenko V, 2009. Salamandra salamandra. In: IUCN 2012. IUCN Red List of Threatened Species. Version 2012.1. <www.iucnredlist.org>. Downloaded on 19 June 2012.

Kuzmin S, Beebee T, Andreone F, Anthony B, Schmidt B, Ogrodowczyk A, Ishchenko V, Ananjeva N, Orlov N, Tuniyev B, Ogielska M, Miaud C, Loman J, Cogalniceanu D, Kovács T, 2009. Pelophylax esculentus. In: IUCN 2012. IUCN Red List of Threatened Species. Version 2012.1. <www.iucnredlist.org>. Downloaded on 19 June 2012.

Kuzmin S, Beebee T, Andreone F, Nyström P, Anthony B, Schmidt B, Ogrodowczyk A, Ogielska M, Cogalniceanu D, Kovács T, Kiss I, Puky M, Vörös J, 2009. Pelophylax lessonae. In: IUCN 2012. IUCN Red List of Threatened Species. Version 2012.1. <www.iucnredlist.org>. Downloaded on 19 June 2012.

Kuzmin S, Ishchenko V, Masafumi Matsui, Zhao Wenge, Yoshio Kaneko 2004. Salamandrella keyserlingii. In: IUCN 2012. IUCN Red List of Threatened Species. Version 2012.1. <www.iucnredlist.org>. Downloaded on 19 June 2012.

Kuzmin S, Ishchenko V, Tuniyev B, Beebee T, Andreone F, Nyström P, Anthony B, Schmidt B, Ogrodowczyk A, Ogielska M, Bosch J, Miaud C, Loman J, Cogalniceanu D, Kovács T, Kiss I, 2009. Rana temporaria. In: IUCN 2012. IUCN Red List of Threatened Species. Version 2012.1. <www.iucnredlist.org>. Downloaded on 19 June 2012.

Lecis R, Andreone F, Edgar P, Corti C, Sindaco R, Romano A, 2009. Speleomantes flavus. In: IUCN 2012. IUCN Red List of Threatened Species. Version 2012.1. <www.iucnredlist.org>. Downloaded on 19 June 2012.

Lymberakis P, Isailovic JC, Ajtic R, Vogrin M, Haxhiu I, 2009. Rana graeca. In: IUCN 2012. IUCN Red List of Threatened Species. Version 2012.1. <www.iucnredlist.org>. Downloaded on 19 June 2012.

Lymberakis P, Kaska Y, Kumlutaş Y, Avci A, Üzüm N, Yeniyurt C, Akarsu F, Tok V, Ugurtas IH, Sevinç M, Crochet P-A, Papenfuss T, Sparreboom M, Kuzmin S, Anderson S, Denoël M, 2009.

Lyciasalamandra luschani. In: IUCN 2012. IUCN Red List of Threatened Species. Version 2012.1. <www.iucnredlist.org>. Downloaded on 19 June 2012.

Miaud C, Lecis R, Edgar P, Cheylan M, Romano A, Sindaco R, 2009. Euproctus montanus. In: IUCN 2012. IUCN Red List of Threatened Species. Version 2012.1. <www.iucnredlist.org>. Downloaded on 19 June 2012.

Miaud C, Cheylan M, Sindaco R, 2009. Discoglossus montalentii. In: IUCN 2012. IUCN Red List of Threatened Species. Version 2012.1. <www.iucnredlist.org>. Downloaded on 19 June 2012.

Miaud C, Cheylan M, Sindaco R, Romano A, 2009. Salamandra corsica. In: IUCN 2012. IUCN Red List of Threatened Species. Version 2012.1. <www.iucnredlist.org>. Downloaded on 19 June 2012.

Olgun K, Arntzen JW, Papenfuss T, Degani G, Ugurtas I, Disi A, Sparreboom M, Anderson S, Sadek R, Hraoui-Bloquet S, Gasith A, Elron E, Gafny S, Werner Y, Avci A, Üzüm N, 2009. Ommatotriton vittatus. In: IUCN 2012. IUCN Red List of Threatened Species. Version 2012.1. <www.iucnredlist.org>. Downloaded on 19 June 2012.

Papenfuss T, Kuzmin S, Disi AMM, Degani G, Ugurtas IH, Sparreboom M, Anderson S, Sadek R, Hraoui-Bloquet S, Gasith A, Elron E, Gafny S, Lymberakis P, Böhme W, Sherif Baha El Din, 2009. Pelophylax bedriagae. In: IUCN 2012. IUCN Red List of Threatened Species. Version 2012.1. <www.iucnredlist.org>. Downloaded on 19 June 2012.

Romano A, Arntzen JW, Denoël M, Jehle R, Andreone F, Anthony B, Schmidt B, Babik W, Schabetsberger R, Vogrin M, Puky M, Lymberakis P, Isailovic JC, Ajtic R, Corti C, 2009. Triturus carnifex. In: IUCN 2012. IUCN Red List of Threatened Species. Version 2012.1. <www.iucnredlist.org>. Downloaded on 19 June 2012.

Romano A, Sindaco R, Andreone F, Lecis R, Edgar P, Schmidt B, Corti C, 2009. Euproctus platycephalus. In: IUCN 2012. IUCN Red List of Threatened Species. Version 2012.1. <www.iucnredlist.org>. Downloaded on 19 June 2012.

Santos-Barrera G, Hammerson G, Hedges B, Joglar R, Inchaustegui S, Lue Kuangyang, Chou Wenhao, Gu Huiqing, Shi Haitao, Diesmos A, Iskandar D, van Dijk PP, Masafumi Matsui, Schmidt B, Miaud C, Martínez-Solano I, 2009. Lithobates catesbeianus. In: IUCN 2012. IUCN Red List of Threatened Species. Version 2012.1. <www.iucnredlist.org>. Downloaded on 19 June 2012.

Serra JM, Richard Griffiths, Bosch J, Beebee T, Schmidt B, Tejedo M, Lizana M, Martínez-Solano I, Salvador A, García-París M, Gil ER, Arntzen JW, 2009. Alytes muletensis. In: IUCN 2012. IUCN Red List of Threatened Species. Version 2012.1. <www.iucnredlist.org>. Downloaded on 19 June 2012.

Sindaco R, Romano A, Andreone F, Miaud C, Cheylan M, Corti C, Geniez P, 2009. Salamandra lanzai. In: IUCN 2012. IUCN Red List of Threatened Species. Version 2012.1. <www.iucnredlist.org>. Downloaded on 19 June 2012.

Sindaco R, Romano A, Andreone F, Garner T, Schmidt B, Corti C, Vogrin M, 2009. Rana latastei. In: IUCN 2012. IUCN Red List of Threatened Species. Version 2012.1. <www.iucnredlist.org>. Downloaded on 19 June 2012.

Sindaco R, Romano A, Mattoccia M, Sbordoni V, Andreone F, Corti C, 2009. Salamandrina terdigitata. In: IUCN 2012. IUCN Red List of Threatened Species. Version 2012.1. <www.iucnredlist.org>. Downloaded on 19 June 2012.

Tejedo M, Bosch J, Martínez-Solano I, Salvador A, García-París M, Gil ER, 2009. Rana iberica. In: IUCN 2012. IUCN Red List of Threatened Species. Version 2012.1. <www.iucnredlist.org>. Downloaded on 19 June 2012.

Tejedo M, Martínez-Solano I, Salvador A, García-París M, Gil ER, Crochet P-A, 2009. Pelophylax grafi. In: IUCN 2012. IUCN Red List of Threatened Species. Version 2012.1. <www.iucnredlist.org>. Downloaded on 19 June 2012.

Uzzell T, Andreone F, Lymberakis P, Vogrin M, Haxhiu I, Isailovic JC, Sindaco R, Romano A, 2009. Pelophylax kurtmuelleri. In: IUCN 2012. IUCN Red List of Threatened Species. Version 2012.1. <www.iucnredlist.org>. Downloaded on 19 June 2012.

Uzzell T, Isailovic JC, 2009. Pelophylax shqipericus. In: IUCN 2012. IUCN Red List of Threatened Species. Version 2012.1. <www.iucnredlist.org>. Downloaded on 19 June 2012.

Uzzell T, Lymberakis P, Haxhiu I, 2009. Pelophylax epeiroticus. In: IUCN 2012. IUCN Red List of Threatened Species. Version 2012.1. <www.iucnredlist.org>. Downloaded on 19 June 2012.