

References				
Reference no.	Year	Reference	Reliability	Comment
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Ecotox study summaries																												
Study reference	Information on Test species								Information on the test design											Results and comments			Reliability score					
	Marine or freshwater	Acute or chronic	Taxa	Test species common name	Test species name	Source of the test organisms	Holding conditions prior to test	Life stage of the test species used	Methodology used (e.g. test guideline followed where relevant)	Form of the test substance	Source of the test substance	Type and source of the exposure medium (e.g. tapwater, groundwater, artificial media)	Type of test solution used (e.g. solution, water accommodated fraction)	Length of test	Range of test concentrations used	Number of replicate vessels used per test concentration	Number of organisms used in each replicate test vessel	Nature of the test system (static, semi-static or flow-through, duration, feeding or no feeding)	Measurement of exposure concentrations in the study (i.e. analytical confirmation)	Measurement of water quality parameters in the study (e.g. pH, temperature, dissolved oxygen)	Test validity criteria in the guideline satisfied (if relevant)	Water quality criteria in the guideline (e.g. pH, temperature, dissolved oxygen) satisfied (if relevant)	Study conducted to GLP (Yes/No)	Toxicity test result(s) : L(E)C ₅₀ /NOEC/LOEC value(s)	Any other comments on the conduct of the study	Reliability of the study	Relevance of the study	Klimisch Code assigned (1, 2, 3 or 4)
Hernando <i>et al.</i> (2007)	Freshwater	Acute	Bacteria	<i>Vibrio fischeri</i>	Bacteria	BioFix Lumi from Macherey-Nagel, Duren, Germany	-20 °C	Not reported	ISO 11348-2 (1994) guidelines	Emamectin benzoate (81%)	Dr Ehrenstorfer (Ausburg, Germany)	Artificial	Seawater		10 and 50 ng/l	Not reported	Not reported	Static	Not reported	Not reported	Not reported	Not reported	Not reported	EC50 (5 min, 15 min and 30 min) = >6300 µg/l	Inhibition of luminescence test. No toxic effect up to the maximum water solubility.	Reliable with restriction (not GLP but well documented)	Relevant	2
Volz (2006) cited by EFSA (2009)	Freshwater	Acute	Crustacean	<i>Daphnia magna</i>	Water flea	Not reported	Not reported	<24 hours old	OECD 202: EU comm. Dir. 92/69/EEC, C.2: US EPA OPPTS 850, 1010	Solid	8a-OH MAB (NOA438306), batch CDX-XVII: 48-1, purity 96.9%	Reconstituted test water	Solution		6 concentrations (nominal concentrations 0.32, 1.0, 3.2, 10, 32 and 100 mg/l)	4	5	Static	HPLC	Temperature: 21°C; pH: 7.8-7.9; no aeration; no feeding; 18.8 hrs light (470-640 lux)	Not reported	Not reported	Yes	48 hour EC50 of 11µg/l		Reliable without restrictions	Relevant	1
Blankinship <i>et al.</i> (2002) cited by EFSA (2009)	Freshwater	Acute	Crustacean	<i>Daphnia magna</i>	Water flea	Not reported	Not reported	<24 hours old	OECD 202: EU comm. Dir. 92/69/EEC, C.2: US EPA OPPTS 850, 1010	Granular solid	A10324A, 5% SG formulation (as Emamectin benzoate), batch no. GA 908002, purity 4.75%	Filtered well water	Solution		5 concentrations (nominal: 0.43, 0.94, 2.1, 4.6 and 10 µg/l)	2	10	Flow-through	HPLC	Temperature: 19.6 - 19.7°C; pH: 8.0 - 8.2; no aeration; no feeding; 18.8 hrs light (470-640 lux)	Not reported	Not reported	Yes	48 hour EC50 of 3.5 µg/l	Mean measured result	Reliable without restrictions	Relevant	1
Environment Canada (2005) cited ECOTOX (2016)	Freshwater	Acute	Crustacean	<i>Daphnia magna</i>	Water flea	Not reported	Not reported	Not reported	Not reported	Emamectin benzoate	Not reported	Not reported	Not reported	Not reported	Not reported	Not reported	Static	Not reported	Not reported	Not reported	Not reported	Not reported	48 hr EC50 (immobilisation) = >728 µg/l		Reliable with restriction (no experimental details but reliable source)	Relevant	2	
Environment Canada (2005) cited ECOTOX (2016)	Freshwater	Acute	Crustacean	<i>Daphnia magna</i>	Water flea	Not reported	Not reported	Not reported	Not reported	Emamectin benzoate	Not reported	Not reported	Not reported	Not reported	Not reported	Not reported	Flow-through	Measured	Not reported	Not reported	Not reported	Not reported	48 hr EC50 (immobilisation) = 1.0 µg/l (0.84 - 1.2)		Reliable with restriction (no experimental details but reliable source)	Relevant	2	
EFSA (2012)	Freshwater	Acute	Crustacean	<i>Daphnia magna</i>	Water flea	Not reported	Not reported	Not reported	Not reported	Emamectin benzoate - minimum purity 950 g/kg as emamectin benzoate anhydrous	Not reported	Not reported	Not reported	Not reported	Not reported	Not reported	Flow-through	Measured	Not reported	Not reported	Not reported	Not reported	48 hr EC50 (mortality) = 1.0 µg/l (mean measured)		Reliable with restriction (no experimental details but reliable source)	Relevant	2	
Wallace (2001b) cited by EFSA (2009)	Freshwater	Acute	Fish	<i>Cyprinus carpio</i>	Carp	Commercially obtained	Acclimated 7 days prior to the test.	Length: 32 - 38 mm; weight 0.77 - 1.52 g	OECD 203: 1992; US EPA 540/9-85-006, EC L 683 A, Part C.1	White tan granules	A10324A, 5% SG formulation (as Emamectin benzoate), batch no. GA 908002, purity 4.75%	Dechlorinated tap water	Solution		5 concentrations (nominal: 3.2, 5.6, 10, 18 and 32 mg/l)	0	10 fish per concentration vessel	Static, no feeding, aeration	HPLC-UV	Temperature: 21.6 - 22.4 °C; pH: 7.4 - 7.6	Not reported	Not reported	Yes	96 hour LC50 of 567 µg/l	Initial concentrations were 92 - 100% of nominal and at 96 hours concentrations were 80 - 100% of nominal. Mean measured were 87 - 100% of nominal.	Reliable without restrictions	Relevant	1
Maynard (2003b) cited by EFSA (2009)	Freshwater	Acute	Fish	<i>Cyprinus carpio</i>	Carp	Commercially obtained	Acclimatised 7 days prior to test	Length: 45 - 52 mm; weight: 2.43 - 3.86	OECD 203: 1992; JMAF 12 no. 8147, 2000	White powder	Technical MK-244 (Emamectin benzoate) batch SSH2F004, purity 97.3%	Dechlorinated tap water	Solution		5 concentrations (nominal: 0.056, 0.10, 0.18, 0.32, 0.56 mg/l)	1	10	Flow-through	HPLC	Temperature: 22 ± 1 °C; pH: 7.5 - 7.7, aeration	Not reported	Not reported	Yes	96 hour LC50: 200 µg/l	Initial concentrations were 5 - 50% of nominal and at 96 hours were undetectable to 36% of nominal. Deemed not acceptable by EFSA.	Not Reliable	Not Relevant	3
EFSA (2012), US EPA (2009), Environment Canada (2005)	Freshwater	Acute	Fish	<i>Oncorhynchus mykiss</i>	Rainbow trout	Not reported	Not reported	Not reported	Not reported	Emamectin benzoate - minimum purity 950 g/kg as emamectin benzoate anhydrous	Not reported	Not reported	Not reported	Not reported	Not reported	Not reported	Flow-through	Measured	Not reported	Not reported	Not reported	Not reported	96 hr EC50 (mortality) = 174 µg/l (mean measured)		Reliable with restriction (no experimental details but reliable source)	Relevant	2	
Environment Canada (2005) cited ECOTOX, EFSA (2008)	Freshwater	Acute	Fish	<i>Lepomis macrochirus</i>	Bluegill sunfish	Not reported	Not reported	Not reported	Not reported	Emamectin benzoate	Not reported	Not reported	Not reported	Not reported	Not reported	Not reported	Flow-through	Nominal	Not reported	Not reported	Not reported	Not reported	96 hr LC50 = 180 µg/l (40 - 240 µg/l)		Reliable without restrictions	Relevant	1	
Environment Canada (2005) cited ECOTOX (2016)	Freshwater	Acute	Fish	<i>Pimephales promelas</i>	Fathead minnow	Not reported	Not reported	Not reported	Not reported	Emamectin benzoate	Not reported	Not reported	Not reported	Not reported	Not reported	Not reported	Flow-through	Measured	Not reported	Not reported	Not reported	Not reported	96 hr LC50 = 194 µg/l (160 - 260 µg/l)		Reliable with restrictions	Relevant	2	
Environment Canada (2005) cited ECOTOX (2016)	Freshwater	Acute	Fish	<i>Oncorhynchus mykiss</i>	Rainbow trout	Not reported	Not reported	Not reported	Not reported	Emamectin benzoate	Not reported	Not reported	Not reported	Not reported	Not reported	Not reported	Flow-through	Not reported	Not reported	Not reported	Not reported	Not reported	96 hr NOEC (mortality) = 49 µg/l		Reliable with restriction (no experimental details but reliable source)	Relevant	2	
Environment Canada (2005) cited ECOTOX	Freshwater	Acute	Fish	<i>Pimephales promelas</i>	Fathead minnow	Not reported	Not reported	Not reported	Not reported	Emamectin benzoate	Not reported	Not reported	Not reported	Not reported	Not reported	Not reported	Flow-through	Measured	Not reported	Not reported	Not reported	Not reported	96 hr NOEC = 160 µg/l		Reliable with restrictions (no experimental details but reliable source)	Relevant	2	
Environment Canada (2005) cited ECOTOX	Freshwater	Acute	Fish	<i>Lepomis macrochirus</i>	Bluegill sunfish	Not reported	Not reported	Not reported	Not reported	Emamectin benzoate	Not reported	Not reported	Not reported	Not reported	Not reported	Not reported	Flow-through	Not reported	Not reported	Not reported	Not reported	Not reported	96 hr NOEC = 90 µg/l		Reliable without restrictions	Relevant	1	
Khan <i>et al.</i> (2011)	Freshwater	Acute	Insect	<i>Aedes albopictus</i>	Dengue mosquito	Natural population from upper Punjab, Pakistan	Larvae and pupae were colonised under laboratory conditions at 27 ± 1 °C, fed on fish food. Adults were kept in cages and fed blood of white rats 3 times a week.	Larvae and adults	Not reported	Emamectin benzoate	Proclaim 1.9 EC, Syngenta, UK	Distilled water	One millilitre of insecticide solution dispensed with a pipette above the water surface.		7 - 8 concentrations	At least 4 times	10	Static, 24 hours, photoperiod of 14L:10D hours	Not reported	Temperature 27 ± 1 °C	Not reported	Not reported	Not reported	LC50 (averages range from 90 - 2450 µg/l) 90 µg/l (40 - 140 µg/l) 1390 - 2450 µg/l 1350 - 2000 µg/l 1140 - 1700 µg/l	Natural population areas (Lahore, Faisalabad and Sargodha)	Not Reliable	Not Relevant	3
EFSA (2012), US EPA (2009), ECOTOX (2016)	Freshwater	Chronic	Algae	<i>Pseudokirchneriella subcapitata</i>	Algae	Not reported	Not reported	Not reported	Not reported	Not reported	Not reported	Not reported	Solution	Not reported	Not reported	Not reported	Static	Measured	Not reported	Not reported	Not reported	Yes	5 day EC50 (population abundance/growth inhibition) of >3.9 µg/l	Reported acceptable study	Reliable without restrictions	Relevant	1	
US EPA (2009), ECOTOX (2016)	Freshwater	Chronic	Algae	<i>Pseudokirchneriella subcapitata</i>	Algae	Not reported	Not reported	Not reported	Not reported	Not reported	Not reported	Not reported	Solution	Not reported	Not reported	Not reported	Static	Not reported	Not reported	Not reported	Not reported	Yes	5 day NOEC (population abundance) of <3.9 µg/l	Reported acceptable study	Reliable without restrictions	Relevant	1	
EFSA (2012)	Freshwater	Chronic	Algae	<i>Pseudokirchneriella subcapitata</i>	Green algae	Not reported	Not reported	Not reported	Not reported	Emamectin benzoate - minimum purity 950 g/kg as emamectin benzoate anhydrous	Not reported	Not reported	Not reported	Not reported	Not reported	Not reported	static	Measured	Not reported	Not reported	Not reported	Not reported	96 hr EC50 (growth rate) = 7.2 µg/l (mean measured)		Reliable with restriction (no experimental details but reliable source)	Relevant	2	

Wallace (2001) cited by EFSA (2009)	Freshwater	Chronic	Algae	<i>Pseudokirchneriella subcapitata</i>	Green algae	Not reported	Not reported	Not reported	US EPA OPPTS 850.5400; OECD 201	White/tan granules	A10324A5% WSC formulation (Emamectin benzoate), batch no GA908002, chemical purity 4.75%	Broth	solution	8 concentrations (3.5, 5.6, 10, 18, 32, 56, 100, 180 mg/l)	3	1 x 10 ⁴ cells/ml	static	HPLC	pH 7.5 – 10.0, temperature 24 ±1°C	Not reported	Not reported	Yes	96 hr EC50 = 8170 µg/l	Not acceptable – actual concentrations were 63-95% of nominal, biomass significantly reduced after 48 hr.	Not Reliable	Not Relevant	3	
Environment Canada (2005) cited ECOTOX (2016)	Freshwater	Chronic	Crustacean	<i>Daphnia magna</i>	Water flea	Not reported	Not reported	Not reported	Not reported	Emamectin benzoate	Not reported	Not reported	Not reported	Not reported	Not reported	Not reported	Static	Not reported	Not reported	Not reported	Not reported	Not reported	21 day LOEC (reproduction) = 0.16 µg/l, 21 day NOEC (reproduction) = 0.088 µg/l	Reliable with restriction (no experimental details but reliable source)	Relevant	2		
US EPA (2009)	Freshwater	Chronic	Crustacean	<i>Daphnia magna</i>	Water flea	Not reported	Not reported	Not reported	Not reported	Emamectin benzoate	Not reported	Not reported	Not reported	Not reported	Not reported	Not reported	Flow-through	Not reported	Not reported	Not reported	Not reported	Not reported	Chronic NOAEC (effect not stated) = 0.088 µg/l	Reported acceptable study	Reliable with restriction (no experimental details but reliable source)	Relevant	2	
EFSA (2012), ECOTOX (2016)	Freshwater	Chronic	Fish	<i>Pimephales promelas</i>	Fathead minnow	Not reported	Not reported	Not reported	Not reported	Emamectin benzoate - minimum purity 950 g/kg as emamectin benzoate anhydrous	Not reported	Not reported	Not reported	32 days	Not reported	Not reported	Not reported	Flow-through	Measured	Not reported	Not reported	Not reported	32 day NOEC (mortality) = 12 µg/l (mean measured)	Reliable with restriction (no experimental details but reliable source)	Relevant	2		
US EPA (2009) cited ECOTOX (2016)	Freshwater	Chronic	Fish	<i>Pimephales promelas</i>	Fathead minnow	Not reported	Not reported	Early life stage	Not reported	Emamectin benzoate	Not reported	Not reported	Not reported	32 days	Not reported	Not reported	Not reported	Not reported	Not reported	Not reported	Not reported	Not reported	32 day NOEC = 6.5 µg/l	Reliable with restrictions (limited experimental details but reliable source)	Relevant	2		
EFSA (2012)	Freshwater	Chronic	Higher plant	<i>Lemna gibba</i>	Duckweed	Not reported	Not reported	Not reported	Not reported	Emamectin benzoate - minimum purity 950 g/kg as emamectin benzoate anhydrous	Not reported	Not reported	Not reported	Not reported	Not reported	Not reported	static	Measured	Not reported	Not reported	Not reported	Not reported	14 day EC50 (fronds) = > 94 µg/l (mean measured)	Reliable with restriction (no experimental details but reliable source)	Relevant	2		
US EPA (2009), ECOTOX (2016)	Freshwater	Chronic	Higher plant	<i>Lemna gibba</i>	Duckweed	Not reported	Not reported	Not reported	Not reported	Emamectin benzoate	Not reported	Not reported	Not reported	Not reported	Not reported	Not reported	static	Measured	Not reported	Not reported	Not reported	Not reported	NOEC (population abundance) = 94 µg/l	Reported acceptable study	Reliable with restriction (no experimental details but reliable source)	Relevant	2	
EFSA (2012)	Freshwater	Chronic	Insect	<i>Chironomus riparius</i>	Midge	Not reported	Not reported	Not reported	Not reported	Emamectin benzoate	Not reported	Not reported	Not reported	Not reported	Not reported	Not reported	Static	Nominal	Not reported	Not reported	Not reported	Not reported	28 day NOEC 1.25 µg/kg dwt sediment	Reliable with restrictions	Relevant	2		
Maynard (2003a) cited by EFSA (2009)	Freshwater		Algae	<i>Pseudokirchneriella subcapitata</i>	Green algae	Not reported	Not reported	Not reported	US EPA OPPTS 850.5400; OECD 201	White powder	MK-244 (Emamectin benzoate) batch SSH2F004, purity 97.3%	Culture medium	Solution	8 concentrations (0.0031, 0.0063, 0.013, 0.025, 0.050, 0.10, 0.20, 0.40 mg/l)	3	0.96 x 10 ⁴ cells/ml	static	HPLC	pH 7.3 – 9.7, temperature 23.9 – 24.1°C	Not reported	Not reported	Yes	EC50 12.1 (growth inhibition)	Reliable without restrictions	Relevant	1		
Schering-Plough Animal Health (2000) cited by Telfer et al (2006)	Marine	Acute	Annelid	<i>Capitella capitata</i>	Polychaete worm	Not reported	Not reported	Not reported	Not reported	Not reported	Not reported	Microcosm study	Not reported	Not reported	Not reported	Not reported	21 day	Not reported	Not reported	Not reported	Not reported	Not reported	NOEC: 460 µg/kg (effect not stated)	Not assignable	Not Relevant	4		
Willis and Ling (2003)	Marine	Acute	Crustacean	<i>Oithona similis</i>	Marine copepod	Collected from sea lochs on the south west coast of Scotland (Oban)	Culture vessels (salinity 32 ± 2‰, aerated, 14° dim light, photoperiod 14 hrs light and 10hrs dark, fed)	Nauplii, copepodites and adult stages	Not reported	Emamectin benzoate – 99.7% pure	PESTANAL, Riedel-de Haen	Sea water	Seawater	48 hours exposure with additional 48 hours recovery	5 concentrations	3	10	Static but toxicant solutions renewed once every 24 hours, fed	Nominal	Salinity 32 ± 2‰, aerated, 14°, dim light, photoperiod 14 hrs light and 10hrs dark, fed	Not reported	Not reported	No	Exposed period (initial 48 hours): nauplii EC50 (immobilisation): > 15.8 µg/l (0.07 – 0.29); Stage 1 EC50 (immobilisation): 15.86 µg/l (7.36 – 34.19) adults EC50 (immobilisation): 232 µg/l (64.5 – 13586) Recovery period: nauplii EC50 (immobilisation): > 15.8 µg/l stage 1 EC50 (immobilisation): 14.75 µg/l (7.63 – 28.54) adults EC50 (immobilisation): 113 (37.6 – 760) µg/l	Only adult stage show recovery	Reliable with restriction (not GLP but well documented)	Relevant	2
Willis and Ling (2003)	Marine	Acute	Crustacean	<i>Pseudocalanus elongatus</i>	Marine copepod	Collected from sea lochs on the south west coast of Scotland (Oban)	Culture vessels (salinity 32 ± 2‰, aerated, 14° dim light, photoperiod 14 hrs light and 10hrs dark, fed)	Nauplii, copepodites and adult stages	Not reported	Emamectin benzoate – 99.7% pure	PESTANAL, Riedel-de Haen	Sea water	Seawater	48 hours exposure with additional 48 hours recovery	5 concentrations	3	10	Static but toxicant solutions renewed once every 24 hours, fed	Nominal	Salinity 32 ± 2‰, aerated, 14°, dim light, photoperiod 14 hrs light and 10hrs dark, fed	Not reported	Not reported	No	Exposed period (initial 48 hours): nauplii EC50 (immobilisation): 0.12 µg/l (0.07 – 0.29); Stage 1 EC50 (immobilisation): 0.14 µg/l (0.05 – 0.44); Adults EC50 (immobilisation): 0.45 µg/l (0.22 – 0.9) Recovery period: Stage 1 EC50 (immobilisation): 0.17 µg/l (0.07 – 0.43); Adults EC50 (immobilisation): 10.89 µg/l for adults.	Only adult stage show recovery	Reliable with restriction (not GLP but well documented)	Relevant	2
Willis and Ling (2003)	Marine	Acute	Crustacean	<i>Temora longicornis</i>	Marine copepod	Collected from sea lochs on the south west coast of Scotland (Oban)	Culture vessels (salinity 32 ± 2‰, aerated, 14° dim light, photoperiod 14 hrs light and 10hrs dark, fed)	Nauplii, copepodites and adult stages	Not reported	Emamectin benzoate – 99.7% pure	PESTANAL, Riedel-de Haen	Sea water	Seawater	48 hours exposure with additional 48 hours recovery	5 concentrations	3	10	Static but toxicant solutions renewed once every 24 hours, fed	Nominal	Salinity 32 ± 2‰, aerated, 14°, dim light, photoperiod 14 hrs light and 10hrs dark, fed	Not reported	Not reported	No	Exposed results (initial 48 hours): nauplii EC50 (immobilisation): 0.23 µg/l (0.12 – 0.46) for nauplii; stage 1 EC50 (immobilisation) of 0.41 µg/l (0.25 – 0.67); Adults EC50 (immobilisation): 2.81 µg/l (1.89 – 4.16).	Only adult stage show recovery	Reliable with restriction (not GLP but well documented)	Relevant	2
Willis and Ling (2003)	Marine	Acute	Crustacean	<i>Acartia clausi</i>	Marine copepod	Collected from sea lochs on the south west coast of Scotland (Oban)	Culture vessels (salinity 32 ± 2‰, aerated, 14° dim light, photoperiod 14 hrs light and 10hrs dark, fed)	Nauplii, copepodites and adult stages	Not reported	Emamectin benzoate – 99.7% pure	PESTANAL, Riedel-de Haen	Sea water	Seawater	48 hours exposure with additional 48 hours recovery	5 concentrations	3	10	Static but toxicant solutions renewed once every 24 hours, fed	Nominal	Salinity 32 ± 2‰, aerated, 14°, dim light, photoperiod 14 hrs light and 10hrs dark, fed	Not reported	Not reported	No	Exposed results: (initial 48 hours) Nauplii EC50 (immobilisation): 0.57 µg/l (0.04 – 3.99); Stage 1 EC50 (immobilisation) of 0.28 µg/l (0.1 – 0.69); Adults EC50 (immobilisation): 0.29 µg/l (0.08 – 1.1); Recovery period: Nauplii EC50 (immobilisation): 0.487 µg/l (0.001 – 6.64) for nauplii; Stage 1 EC50 (immobilisation): 0.13 µg/l (0.03 – 0.16); Adults EC50 (immobilisation): 5.27 µg/l for adults	Only adult stage showed recovery	Reliable with restriction (not GLP but well documented)	Relevant	2
Willis and Ling (2003)	Marine	Chronic	Crustacean	<i>Acartia clausi</i>	Marine copepod	Collected from sea lochs on the south west coast of Scotland (Oban)	Culture vessels (salinity 32 ± 2‰, aerated, 14° dim light, photoperiod 14 hrs light and 10hrs dark, fed)	Adult females	Not reported	Emamectin benzoate – 99.7% pure	PESTANAL, Riedel-de Haen	Sea water	Seawater	8 days	3 concentrations plus control and solvent control	3	10	Static but toxicant solutions renewed once every 24 hours, fed	Nominal	Salinity 32 ± 2‰, aerated, 14°, dim light, photoperiod 14 hrs light and 10hrs dark, fed	Not reported	Not reported	No	NOEC (fecundity, egg production): 0.05 µg/l	Reliable with restriction (not GLP but well documented)	Relevant	2	
Burridge et al (2004)	Marine	Acute	Crustacean	<i>Homarus americanus</i>	American lobster	Bay of Fundy, NB, Canada and raised from larvae and adults from commercial fishery	Temperature 0-15°C, varying day lengths	Juvenile (stage V and VI) and adult		Emamectin benzoate coated salmon feed pellets	Enviro-Test Laboratories / Xenos Division	Salmon feed pellets	Seawater (Salinity 30 g/l)	0, 1.17, 2.48, 4.76, 9.90, 18.9, 36.6, 63.7, 121, 293, 589 µg g ⁻¹	One control group	30 (control) and 20 (different concentrations)	Flow-through	Measured	Salinity 30 g/l, temperature 11.2 ± 0.3 °C (juveniles) and 13.3 ± 1.4 °C	Not reported	Not reported	No	7 day LC50 = 644 µg g ⁻¹ (adults) and >589 µg g ⁻¹ (juveniles)	Reliable with restriction (not GLP but well documented)	Relevant	2		
Vekthoen et al (2012)	Marine	Acute	Crustacean	<i>Pandalus platyceros</i>	Spot prawn	Ocean waters near Sidney, British Columbia (2008)	Held in 500L tank, fed, flowing seawater from Burrard Inlet, Canada, acclimated for 10 days at 8±1 °C.	Adult (mean weight 20.39 g) and did not carry eggs – developmental stage	Analytical: LC/MS/MS with electrospray ionization	Commercial SLICE	Not reported	Seawater	Solution/sediment preparation	0.1, 0.4, 0.8, 1.2, 4.8 mg/kg sediment	5	10	Fed on day 4, study length 8 days.	Yes	Water quality parameters measured at 0, 4 and 8 days: pH 7.8 ± 0.1, dissolved oxygen 9.5 ± 0.3 mg/l, temperature 8 ± 0.7°C	Not reported	Not reported	Not reported	8 day % Mortality (15% at 0.1 mg/kg sediment, 20% at 0.4 and 0.8 mg/kg sediment, 2% at 1.2 and 4.8 mg/kg sediment)	No effect on weight, molting and alters mRNA abundance patterns in muscle tissue.	Reliable with restriction (not GLP but well documented)	Relevant	2	

Helgesen and Horsberg (2013), ECOTOX (2016)	Marine	Acute	Crustacean	<i>Lepocephtherus salmonis</i>	Sea lice	Four location in the Norwegian regions Finnmark, Nord and Sor-Trondelag in 2009, 2010 and 2011.	Continuous culture using Atlantic salmon or Rainbow trout in sea water	3 weeks before preadult II stage	Westcott et al (2008) with some modifications	EMB, analytical standard	Schering-Plough	Sea water	Solution		Six concentrations 0 – 250 µg/l	One	Not reported but 120 parasites in total	Static, treated fish fed EMB and then fed throughout.	none	12 °C	Not reported	Not reported	No	EC50 – parasites on fish were measured/immobilisation and mortality after exposure period. 243 µg/l (127 – 409 µg/l) 51.4 µg/l 21.5 µg/l (18.2 – 23.7 µg/l) 167 µg/l (138 – 199 µg/l) 302 µg/l	No	Reliable with restriction (not GLP but well documented)	Relevant	2
US EPA (2009), EFSA (2009), Environment Canada (2005) cited ECOTOX (2000)	Marine	Acute	Crustacean	<i>Americamysis bahia</i>	Mysid shrimp	Not reported	Not reported	Not reported	Not reported	Emamectin benzoate	Not reported	Not reported	Not reported	Not reported	Not reported	Not reported	Not reported	Flow-through	Not reported	Not reported	Not reported	Not reported	Not reported	LC50 = 0.04 µg/l (410 – 590 µg/l)	Reported acceptable study	Reliable with restrictions	Relevant	2
US EPA (2009), EFSA (2009), Environment Canada (2005) cited ECOTOX (2000)	Marine	Acute	Fish	<i>Cyprinodon variegatus</i>	Sheepshead minnow	Not reported	Not reported	Not reported	Not reported	Emamectin benzoate	Not reported	Not reported	Not reported	Not reported	Not reported	Not reported	Not reported	Flow-through	Measured	Not reported	Not reported	Not reported	Not reported	96 hour LC50 1430 µg/l (1259 – 1670 µg)		Reliable without restrictions	Relevant	1
US EPA (2009), EFSA (2009), Environment Canada (2005) cited ECOTOX (2000)	Marine	Acute	Fish	<i>Cyprinodon variegatus</i>	Sheepshead minnow	Not reported	Not reported	Not reported	Not reported	Emamectin benzoate	Not reported	Not reported	Not reported	Not reported	Not reported	Not reported	Not reported	Flow-through	Not reported	Not reported	Not reported	Not reported	Not reported	96 hour NOEC 860 µg/l		Reliable without restrictions	Relevant	1
US EPA (2009), EFSA (2009), Environment Canada (2005) cited ECOTOX (2000)	Marine	Acute	Fish	<i>Cyprinodon variegatus</i>	Sheepshead minnow	Not reported	Not reported	Not reported	Not reported	Emamectin benzoate	Not reported	Not reported	Not reported	Not reported	Not reported	Not reported	Not reported	Flow-through	Not reported	Not reported	Not reported	Not reported	Not reported	96 hour NOEC 860 µg/l	Reported acceptable study	Reliable with restrictions	Relevant	2
Environment Canada (2005) cited ECOTOX (2000)	Marine	Acute	Mollusc	<i>Crassostrea virginica</i>	Eastern/Virginia oyster	Not reported	Not reported	Not reported	Not reported	Emamectin benzoate	Not reported	Not reported	Not reported	Not reported	Not reported	Not reported	Not reported	Not reported	Not reported	Not reported	Not reported	Not reported	Not reported	96 hr LC50 = 670 µg/l (410 – 590 µg/l)		Reliable with restrictions	Relevant	2
Environment Canada (2005) cited ECOTOX (2000)	Marine	Acute	Mollusc	<i>Crassostrea virginica</i>	Eastern/Virginia oyster	Not reported	Not reported	Not reported	Not reported	Emamectin benzoate	Not reported	Not reported	Not reported	Not reported	Not reported	Not reported	Not reported	Not reported	Not reported	Not reported	Not reported	Not reported	Not reported	96 hr NOEC = 260 µg/l		Reliable with restrictions	Relevant	2
Environment Canada (2005) cited ECOTOX (2000)	Marine	Acute	Mollusc	<i>Crassostrea virginica</i>	Eastern/Virginia oyster	Not reported	Not reported	Not reported	Not reported	Emamectin benzoate	Not reported	Not reported	Not reported	Not reported	Not reported	Not reported	Not reported	Flow-through	Not reported	Not reported	Not reported	Not reported	Not reported	EC50 (Immobilisation) = 490 µg/l (410 – 590 µg/l)		Reliable with restrictions	Relevant	2
US EPA (2009), EFSA (2009), Environment Canada (2005) cited ECOTOX (2000)	Marine	Chronic	Crustacean	<i>Americamysis bahia</i>	Mysid shrimp	Not reported	Not reported	Not reported	Not reported	Emamectin benzoate	Not reported	Not reported	Not reported	Not reported	Not reported	Not reported	Not reported	Flow-through	Not reported	Not reported	Not reported	Not reported	Not reported	28 day NOAEC = 0.018 µg/l, NOAEC = 0.0087 µg/l	Reported acceptable study but only used as a supplementary study. Nominal values with potential for significant absorption to sediment and therefore potential for actual exposure concentration to be much lower is high.	Reliable with restrictions	Relevant	2
Waddy et al. (2002)	Marine	Chronic	Crustacean	<i>Homarus americanus</i>	American lobster	Purchased from commercial fishery in the south Gulf of St. Lawrence, Canada	Communal tanks in local seawater, fed	Female adult – preovigerous, in anecyclosis (moult stage 4) expected to spawn	Not reported	Emamectin benzoate	Merck technical grade	Slurry feed	Seawater		Nominal dose 1 µg/g body weight	1	8 – 10	Feeding	HPLC	Not reported	Not reported	Not reported	No	EC44 (prematurely moulting) = 1 µg/g body weight		Reliable with restriction (not GLP but well documented)	Relevant	2
US EPA (2009)	Marine	Chronic	Mollusc	<i>Crassostrea virginica</i>	Eastern/Virginia oyster	Not reported	Not reported	Not reported	Not reported	Emamectin benzoate	Not reported	Not reported	Not reported	Not reported	Not reported	Not reported	Not reported	Flow-through	Not reported	Not reported	Not reported	Not reported	Not reported	EC50 (Shell deposition or embryo larvae) = 490 µg/l (time not specified)	Reported acceptable study	Reliable with restrictions	Relevant	2
EFSA (2009)	Marine	Chronic	Mollusc	<i>Crassostrea virginica</i>	Eastern/Virginia oyster	Not reported	Not reported	Not reported	Not reported	Emamectin benzoate	Not reported	Not reported	Not reported	Not reported	Not reported	Not reported	Not reported	Flow-through	Nominal	Not reported	Not reported	Not reported	Not reported	EC50 (Shell deposition or embryo larvae) = 530 µg/l		Reliable without restrictions	Relevant	1

Physicochemical properties					
Property	Value	Method of analysis	Reliability code	Comment	Reference
Chemical name	4'-epimethymino-4-deoxyivermectin B1a benzoate (≥90%)	-	1		Environment Canada (2005)
Chemical name	4'-epimethymino-4-deoxyivermectin B1b benzoate (≥10%)		1		Environment Canada (2005)
Molecular formula	B1a: C56H81NO15 (C49H75NO13.C7H6O2)	-	1		EFSA (2012), EC (2011b)
Molecular formula	B1b: C55H79NO15 (C48H73NO13.C7H6O2)		1		EFSA (2012), EC (2011b)
Molecular weight	B1a: 1008.26 g/mol	-	1		Environment Canada (2005)
Molecular weight	B1b: 994.24 g/mol		1		Environment Canada (2005)
pH	6.0 at 25°C	CIPAC MT 75.3 – equivalent OECD 122 (published in 2013)	1	Well documented and peer reviewed by the Rapporteur Member State and the the EC	EFSA (2012), EC (2011b)
Vapour pressure	Emamectin benzoate hydrate: 4 x 10 ⁻⁶ Pa at 21°C (97.8% purity, 21.1°C)	OECD 104 - gas saturation method.	1	Well documented and peer reviewed by the Rapporteur Member State and the the EC	EFSA (2012), EC (2011b)
Vapour pressure		Used hydrate form as anhydrous form expected to have a lower vapour pressure.	1	Well documented and peer reviewed by the Rapporteur Member State and the the EC	EFSA (2012), EC (2011b)
Henry's Law constant	1.3 x 10 ⁻⁵ Pa x m ³ x mol ⁻¹ at pH 5 and 21°	Values calculated use of vapour pressure, molecular weight and water solubility. Deemed acceptable by the Rapporteur Member State.	1	Well documented and peer reviewed by the Rapporteur Member State and the the EC	EFSA (2012), EC (2011b)
Henry's Law constant	1.3 x 10 ⁻⁵ Pa x m ³ x mol ⁻¹ at pH 7 and 21°	Values calculated use of vapour pressure, molecular weight and water solubility. Deemed acceptable by the Rapporteur Member State.	1	Well documented and peer reviewed by the Rapporteur Member State and the the EC	EFSA (2012), EC (2011b)
Henry's Law constant	1.3 x 10 ⁻⁵ Pa x m ³ x mol ⁻¹ at pH 9 and 21°	Values calculated use of vapour pressure, molecular weight and water solubility. Deemed acceptable by the Rapporteur Member State.	1	Well documented and peer reviewed by the Rapporteur Member State and the the EC	EFSA (2012), EC (2011b)
Solubility in water	pH 5: 320 mg/l at 25°C (97.8% purity)	EEC A6;	1	Well documented and peer reviewed by the Rapporteur Member State and the the EC	EFSA (2012), EC (2011b), Environment Canada (2005)
Solubility in water	pH 7: 24 mg/l at 25°C (97.8% purity)	OECD 105 – flask method.	1	Well documented and peer reviewed by the Rapporteur Member State and the the EC	EFSA (2012), EC (2011b), Environment Canada (2005)
Solubility in water	pH 9: 0.1 mg/l at 25°C (97.8% purity)	OECD 105 – flask method.	1	Well documented and peer reviewed by the Rapporteur Member State and the the EC	EFSA (2012), EC (2011b), Environment Canada (2005)
Solubility in water	Salt water: 5.5 mg/l (maximum)	OECD 105 – flask method.	1	Well documented and peer reviewed by the Rapporteur Member State and the the EC	EFSA (2012), EC (2011b), Environment Canada (2005)
Octanol-water partition coefficient	pH 5.07: 3.0 at 23°C	EEC A8;	1	Well documented and peer reviewed by the Rapporteur Member State and the the EC	US EPA (2009); Environment Canada (2005)
(log Kow)	pH 7.00: 5.0 at 23°C	OECD 107 – shake flask method – water/solvent system.	1	Well documented and peer reviewed by the Rapporteur Member State and the the EC	US EPA (2009); Environment Canada (2005)
(log Kow)	pH 9.04: 5.9 at 23°C	It was questioned whether the surface active properties of emamectin benzoate would lead to poor repeatability of this method. However, in this case, good repeatability and high recoveries proved that the surface activity of emamectin benzoate did not influence the outcome of these tests.	1	Well documented and peer reviewed by the Rapporteur Member State and the the EC	US EPA (2009); Environment Canada (2005)

Soil Organic Carbon-Water Partitioning Coefficient (Koc)	Sandy loam: 278,983	US EPA 163-1 – leaching and adsorption/desorption studies.	1	Well documented and peer reviewed by the Rapporteur Member State and the the EC	EFSA (2012), EC (2011b), USEPA (2009)
Soil Organic Carbon-Water Partitioning Coefficient (Koc)	Sand: 728,918	US EPA 163-1 – leaching and adsorption/desorption studies.	1	Well documented and peer reviewed by the Rapporteur Member State and the the EC	EFSA (2012), EC (2011b), USEPA (2009)
Soil Organic Carbon-Water Partitioning Coefficient (Koc)	Clay loam: 25,363	US EPA 163-1 – leaching and adsorption/desorption studies.	1	Well documented and peer reviewed by the Rapporteur Member State and the the EC	EFSA (2012), EC (2011b), USEPA (2009)
Soil Organic Carbon-Water Partitioning Coefficient (Koc)	Silt loam: 28,325	US EPA 163-1 – leaching and adsorption/desorption studies.	1	Well documented and peer reviewed by the Rapporteur Member State and the the EC	EFSA (2012), EC (2011b), USEPA (2009)
Soil Organic Carbon-Water Partitioning Coefficient (Koc)	Reported average: 265,687 (average)	US EPA 163-1 – leaching and adsorption/desorption studies.	1	Well documented and peer reviewed by the Rapporteur Member State and the the EC	EFSA (2012), EC (2011b), USEPA (2009)
Dissociation constant (pK _b)	pK _b : 9.8 (benzoate) at 20°C	OECD 112 – potentiometric titration.	1	Well documented and peer reviewed by the Rapporteur Member State and the the EC	EFSA, 2012, EC (2011b)
Dissociation constant (pK _a)	pK _a : 4.2 (benzoic acid) at 20°C	OECD 112 – potentiometric titration.	1	Well documented and peer reviewed by the Rapporteur Member State and the the EC	EFSA, 2012, EC (2011b)
Dissociation constant (pK _a)	pK _a : 7.7 (epi-methyl-NH-2+) at 20°C	OECD 112 – potentiometric titration.	1	Well documented and peer reviewed by the Rapporteur Member State and the the EC	EFSA, 2012, EC (2011b)

Environmental fate data					
Property	Value	Method of analysis	Reliability code	Comment	Reference
Hydrolytic stability (DT50)	Stable at pH 5.2-8.0	OECD 111 – and GLP. Samples added to sterile buffers at pH 5, 6, 7, 8 and 9 for 6 weeks and sampled at regular intervals. Hydrolysis rate determined by linear regression.	1	Well documented and peer reviewed by the Rapporteur Member State and the the EC	EFSA, 2012, Environment Canada, 2005
Hydrolytic stability (DT50)	DegT50 at pH 9 and 25°C: 19.2 weeks	OECD 111 – and GLP. Samples added to sterile buffers at pH 5, 6, 7, 8 and 9 for 6 weeks and sampled at regular intervals. Hydrolysis rate determined by linear regression.	1	Well documented and peer reviewed by the Rapporteur Member State and the the EC	EFSA, 2012, Environment Canada, 2006
Photostability DegT50 (aqueous, sunlight, state pH)	Natural autumn light. Phosphate buffer pH 7: 22.4 days	US EPA Subdivision N, 161-2. Tests included sterile buffer at pH 7 and natural pond water with a pH of 7.4-8.9. Samples exposed to natural autumn light.	1	Well documented and peer reviewed by the Rapporteur Member State and the the EC	EFSA, 2012
Photostability DegT50 (aqueous, sunlight, state pH)	Phosphate buffer with acetone sensitiser: 1.4 days	US EPA Subdivision N, 161-2. Tests included sterile buffer at pH 7 and natural pond water with a pH of 7.4-8.9. Samples exposed to natural autumn light.	1	Well documented and peer reviewed by the Rapporteur Member State and the the EC	EFSA, 2012
Photostability DegT50 (aqueous, sunlight, state pH)	Natural pond water: 6.9 days	US EPA Subdivision N, 161-2. Tests included sterile buffer at pH 7 and natural pond water with a pH of 7.4-8.9. Samples exposed to natural autumn light.	1	Well documented and peer reviewed by the Rapporteur Member State and the the EC	EFSA, 2012
Biodegradation	Not readily biodegradable	OECD 301 F; 92/69/EEC, L383A, C4-D and GLP.	1	Well documented and peer reviewed by the Rapporteur Member State and the the EC	EFSA, 2012
Degradation in water/sediment systems	DT50 water: 8.7 days.	OECD 308 – and GLP. Two water sediment systems, silt loam and sand taken from UK freshwater lakes.	1	Well documented and peer reviewed by the Rapporteur Member State and the the EC	EFSA, 2012
Degradation in water/sediment systems	DegT50 sediment: could not be calculated as there was no degradation in the sediment.	OECD 308 – and GLP. Two water sediment systems, silt loam and sand taken from UK freshwater lakes.	1	Well documented and peer reviewed by the Rapporteur Member State and the the EC	EFSA, 2012
Degradation in water/sediment systems	DegT50 whole system: >120 days.	OECD 308 – and GLP. Two water sediment systems, silt loam and sand taken from UK freshwater lakes.	1	Well documented and peer reviewed by the Rapporteur Member State and the the EC	EFSA, 2012
Distribution in water/sediment systems (active substance)	Water: 0.3% of the applied dose at day 100.	OECD 308 – and GLP Two water sediment systems, silt loam and sand taken from UK freshwater lakes.	1	Well documented and peer reviewed by the Rapporteur Member State and the the EC	EFSA, 2012
Distribution in water/sediment systems (active substance)	Sediment: 33.6-24.2% of applied dose at day 1.	OECD 308 – and GLP Two water sediment systems, silt loam and sand taken from UK freshwater lakes.	1	Well documented and peer reviewed by the Rapporteur Member State and the the EC	EFSA, 2012