

Supporting information

Impact of chemical pollution on threatened marine mammals: a systematic review

Iris Schaap¹, Larissa Buedenbender², Sarah Johann³, Henner Hollert^{3,4,5}, Gulsah Dogruer⁶

¹ Farm Technology, Department of Plant Sciences, Wageningen University, 6708PB Wageningen, The Netherlands

² Centro Interdisciplinar de Química e Bioloxía (CICA), Facultade de Ciencias, Universidade da Coruña, 15071 A Coruña, Spain

³ Department Evolutionary Ecology & Environmental Toxicology, Goethe University Frankfurt, 60438 Frankfurt am Main Germany

⁴ Department Environmental Media Related Ecotoxicology, Fraunhofer Institute for Molecular Biology and Applied Ecology IME, Auf dem Aberg 1 | 57392 Schmallenberg, Germany

⁵ LOEWE Centre for Translational Biodiversity Genomics (LOEWE-TBG), Senckenberganlage 25, 60325 Frankfurt am Main, Germany

⁶ Wageningen Marine Research, Wageningen Research, 1976CP IJmuiden, The Netherlands

Corresponding author

iris.schaap@wur.nl

Table S1
IUCN red listed marine mammal species included in present study

Conservation status	Scientific name	Common name	Present study
Critically endangered	<i>Balaenoptera ricei</i>	Rice's whale	no
	<i>Eubalaena glacialis</i>	Black Right Whale	yes
	<i>Lipotes vexillifer</i>	Yangtze River dolphin	no
	<i>Phocoena sinus</i>	Vaquita	no
	<i>Sousa teuszii</i>	Atlantic Humpback Dolphin	no
Endangered	<i>Arctocephalus galapagoensis</i>	Galapagos Islands Fur Seal	no
	<i>Balaenoptera borealis</i>	Sei whale	no
	<i>Balaenoptera musculus</i>	Blue whale	yes
	<i>Cephalorhynchus hectori</i>	Hector's dolphin	no
	<i>Enhydra lutris</i>	Sea Otter	yes
	<i>Eubalaena japonica</i>	North Pacific right whale	no
	<i>Inia geoffrensis</i>	Amazon River dolphin	no
	<i>Lontra felina</i>	Marine Otter	no
	<i>Mesoplodon perrini</i>	Perrin's beaked whale	no
	<i>Monachus monachus</i>	Mediterranean monk seal	no
	<i>Neomonachus schauinslandi</i>	Hawaiian Monk Seal	no
	<i>Neophoca cinerea</i>	Australian Sea Lion	no
	<i>Neophocaena asiaeorientalis</i>	Finless Porpoise	yes
	<i>Orcaella brevirostris</i>	Irrawaddy dolphin	no
	<i>Phocarctos hookeri</i>	Hooker's Sea Lion	no
	<i>Platanista gangetica</i>	Ganges river dolphin	no
	<i>Platanista minor</i>	Indus river dolphin	no
	<i>Sotalia fluviatilis</i>	Tucuxi	no
<i>Sousa plumbea</i>	Indian Ocean humpback dolphin	no	
<i>Zalophus wollebaeki</i>	Galapagos Sea Lion	no	
Vulnerable	<i>Balaenoptera physalus</i>	Fin Whale	yes
	<i>Callorhinus ursinus</i>	Northern Fur Seal	yes
	<i>Cystophora cristata</i>	Hooded Seal	yes
	<i>Dugong dugon</i>	Dugong	yes
	<i>Neophocaena phocaenoides</i>	Indo-Pacific Finless Porpoise	yes
	<i>Odobenus rosmarus</i>	Walrus	yes
	<i>Orcaella heinsohni</i>	Australian Snubfin Dolphin	no
	<i>Physeter macrocephalus</i>	Sperm Whale	yes

	<i>Pontoporia blainvillei</i>	La Plata River Dolphin	no
	<i>Sousa chinensis</i>	Indo-Pacific Humpback Dolphin	yes
	<i>Sousa sahalensis</i>	Australian Humpback Dolphin	no
	<i>Trichechus manatus</i>	West Indian Manatee	no
	<i>Trichechus senegalensis</i>	West African Manatee	no
	<i>Ursus maritimus</i>	Polar bear	yes
Near threatened	<i>Balaenoptera bonaerensis</i>	Antarctic Minke Whale	no
	<i>Berardius minimus</i>	Black Baird's Beaked Whale	no
	<i>Cephalorhynchus eutropia</i>	Chilean Dolphin	no
	<i>Cephalorhynchus heavisidii</i>	Benguela Dolphin	no
	<i>Eumetopias jubatus</i>	Northern Sea Lion	no
	<i>Hyperoodon ampullatus</i>	Northern Bottlenose Whale	no
	<i>Mesoplodon stejnegeri</i>	Bering Sea Beaked Whale	no
	<i>Phocoena spinipinnis</i>	Burmeister's Porpoise	no
	<i>Pseudorca crassidens</i>	False Killer Whale	yes
	<i>Sotalia guianensis</i>	Guiana Dolphin	no
	<i>Tursiops aduncus</i>	Indo-Pacific Bottlenose Dolphin	yes
Data deficient	<i>Balaenoptera omurai</i>	Omura's Whale	no
	<i>Mesoplodon bowdoini</i>	Andrews' Beaked Whale	no
	<i>Mesoplodon carlhubbsi</i>	Hubbs's Beaked Whale	no
	<i>Mesoplodon ginkgodens</i>	Ginkgo-toothed Beaked Whale	no
	<i>Mesoplodon hectori</i>	Hector's Beaked Whale	no
	<i>Mesoplodon hotaula</i>	Deraniyagala's Beaked Whale	no
	<i>Mesoplodon traversii</i>	Traver's Beaked Whale	no
	<i>Orcinus orca</i>	Orca	yes
	<i>Tasmacetus shepherdi</i>	Tasman Beaked Whale	no

Table 2
Overview of database search queries

Web of Science (2022-05-11) n=626
(TS=("Phocoena sinus") OR TS=("Sousa teuszii") OR TS=("Balaenoptera ricei") OR TS=("Eubalaena glacialis") OR TS=("Lipotes vexillifer") OR TS=("Balaenoptera omurai") OR TS=("Mesoplodon bowdoini") OR TS=("Mesoplodon carlhubbsi") OR TS=("Mesoplodon ginkgodens") OR TS=("Mesoplodon hectori") OR TS=("Mesoplodon hotaula") OR TS=("Mesoplodon traversii") OR TS=("Orcinus orca") OR TS=("Tasmacetus shepherdi") OR TS=("Arctocephalus galapagoensis") OR TS=("Cephalorhynchus hectori") OR TS=("Enhydra lutris") OR TS=("Monachus monachus") OR TS=("Neomonachus schauinslandi") OR TS=("Neophoca cinerea") OR TS=("Neophocaena asiaeorientalis") OR TS=("Orcaella brevirostris") OR TS=("Phocarcos hookeri") OR TS=("Sotalia fluviatilis") OR TS=("Balaenoptera borealis") OR TS=("Balaenoptera musculus") OR TS=("Eubalaena japonica") OR TS=("Inia geoffrensis") OR TS=("Lontra felina") OR TS=("Mesoplodon perrini") OR TS=("Platanista gangetica") OR TS=("Platanista minor") OR TS=("Sousa plumbea") OR TS=("Zalophus wollebaeki") OR TS=("Cephalorhynchus eutropia") OR TS=("Cephalorhynchus heavisidii") OR TS=("Phocoena spinipinnis") OR TS=("Sotalia guianensis") OR TS=("Balaenoptera bonaerensis") OR TS=("Berardius minimus") OR TS=("Eumetopias jubatus") OR TS=("Hyperoodon ampullatus") OR TS=("Mesoplodon stejnegeri") OR TS=("Pseudorca crassidens") OR TS=("Tursiops aduncus") OR TS=("Cystophora cristata") OR TS=("Dugong dugon") OR TS=("Neophocaena phocaenoides") OR TS=("Odobenus rosmarus") OR TS=("Orcaella heinsohni") OR TS=("Sousa chinensis") OR TS=("Trichechus manatus") OR TS=("Balaenoptera physalus") OR TS=("Callorhinus ursinus") OR TS=("Physeter macrocephalus") OR TS=("Pontoporia blainvillei") OR TS=("Sousa sahalensis") OR TS=("Trichechus senegalensis") OR TS=("Ursus maritimus")) AND (TS=(organics) OR TS=(persistent organic pollutant) OR TS=(contaminant) OR TS=(pollutant) OR TS=(metal) OR TS=(heavy metal) OR TS=(plastic) OR TS=(microplastic)) AND (TS=(toxic) OR TS=(toxicity) OR TS=(response) OR TS=(relationship) OR TS=(effect) OR TS=(disease)))
Scopus (2022-05-11) n=429
TITLE-ABS-KEY("Phocoena sinus" OR "Sousa teuszii" OR "Balaenoptera ricei" OR "Eubalaena glacialis" OR "Lipotes vexillifer" OR "Balaenoptera omurai" OR "Mesoplodon bowdoini" OR "Mesoplodon carlhubbsi" OR "Mesoplodon ginkgodens" OR "Mesoplodon hectori" OR "Mesoplodon hotaula" OR "Mesoplodon traversii" OR "Orcinus orca" OR "Tasmacetus shepherdi" OR "Arctocephalus galapagoensis" OR "Cephalorhynchus hectori" OR "Enhydra lutris" OR "Monachus monachus" OR "Neomonachus schauinslandi" OR "Neophoca cinerea" OR "Neophocaena asiaeorientalis" OR "Orcaella brevirostris" OR "Phocarcos hookeri" OR "Sotalia fluviatilis" OR "Balaenoptera borealis" OR "Balaenoptera musculus" OR "Eubalaena japonica" OR "Inia geoffrensis" OR "Lontra felina" OR "Mesoplodon perrini" OR "Platanista gangetica" OR "Platanista minor" OR "Sousa plumbea" OR "Zalophus wollebaeki" OR "Cephalorhynchus eutropia" OR "Cephalorhynchus heavisidii" OR "Phocoena spinipinnis" OR "Sotalia guianensis" OR "Balaenoptera bonaerensis" OR "Berardius minimus" OR "Eumetopias jubatus" OR "Hyperoodon ampullatus" OR "Mesoplodon stejnegeri" OR "Pseudorca crassidens" OR "Tursiops aduncus" OR "Cystophora cristata" OR "Dugong dugon" OR "Neophocaena phocaenoides" OR "Odobenus rosmarus" OR "Orcaella heinsohni" OR "Sousa chinensis" OR "Trichechus manatus" OR "Balaenoptera physalus" OR "Callorhinus ursinus" OR "Physeter macrocephalus" OR "Pontoporia blainvillei" OR "Sousa sahalensis" OR "Trichechus senegalensis" OR "Ursus maritimus") AND (organics OR persistent organic pollutant OR contaminant OR pollutant OR metal OR heavy metal OR plastic OR microplastic) AND (toxic OR toxicity OR response OR relationship OR effect OR disease)

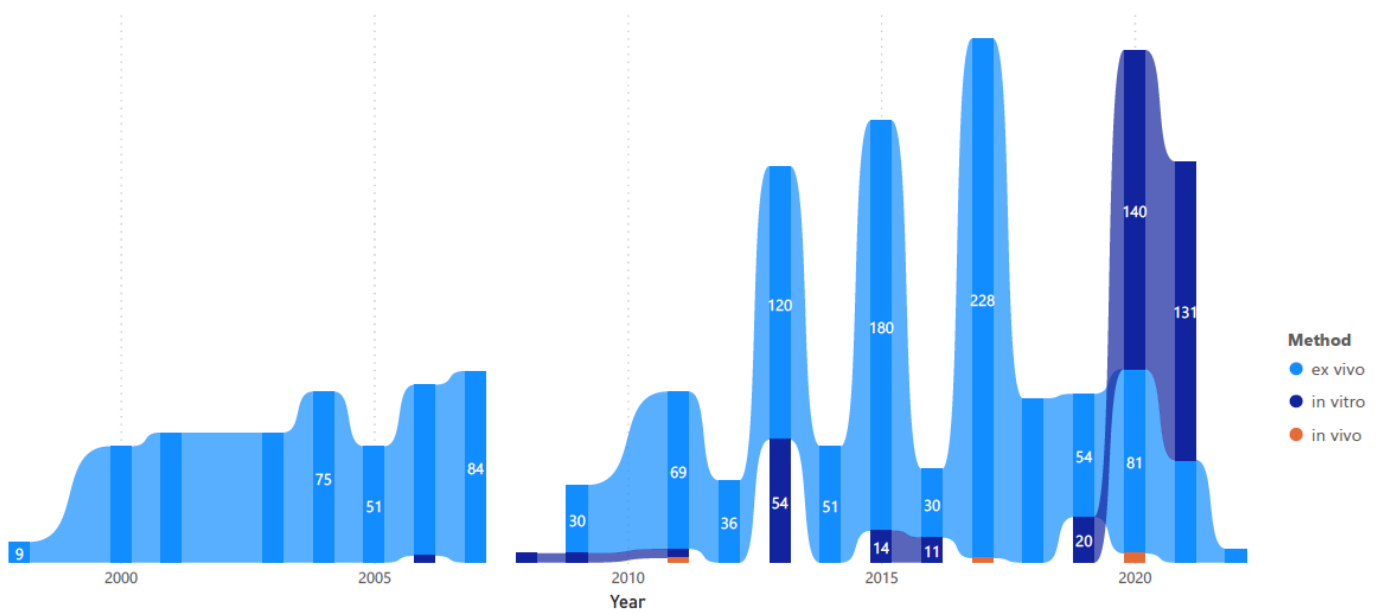


Fig. S1. Timeline of number of ex vivo, in vitro, and in vivo studies performed per year on pollutant-effect relationships in IUCN red listed marine mammal species.

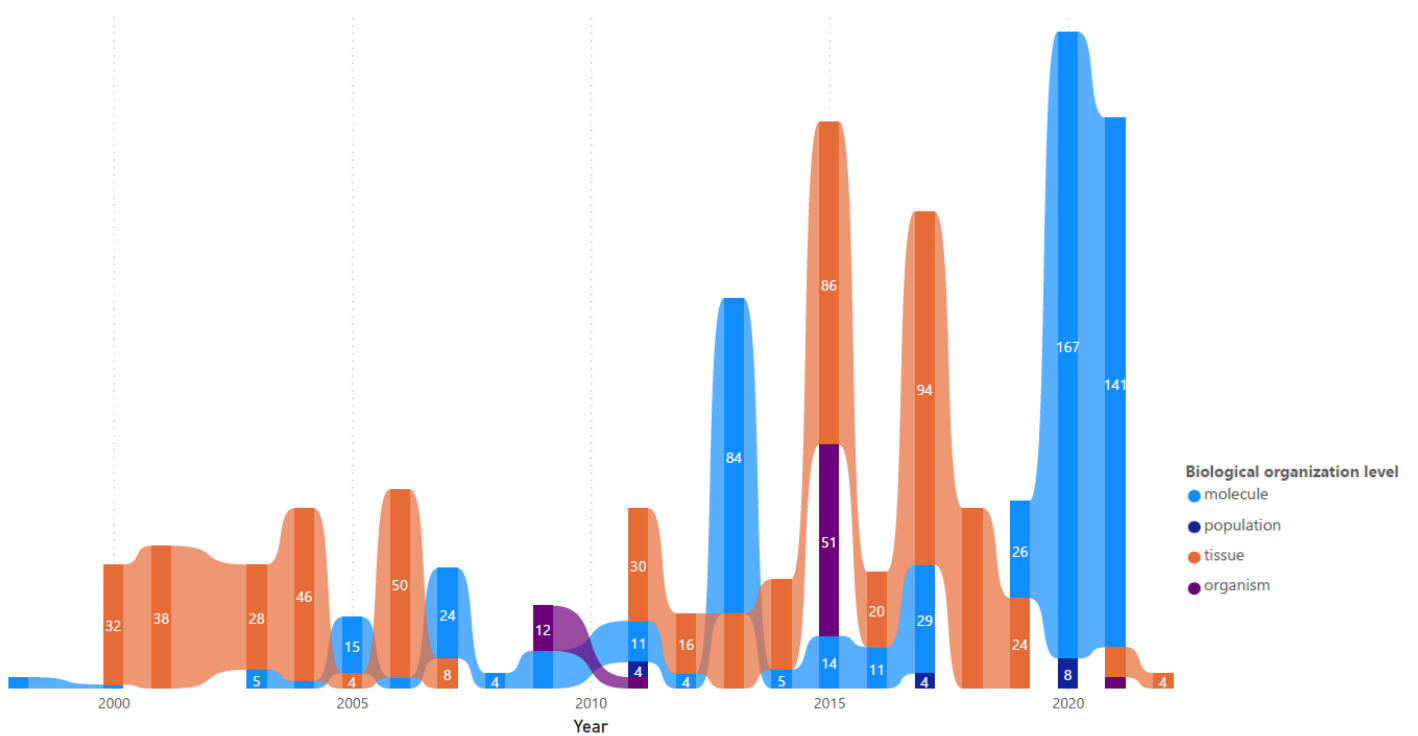


Fig. S2. Timeline of number of pollutant-effect relationships reported on different biological organization level per year in IUCN red listed marine mammal species.

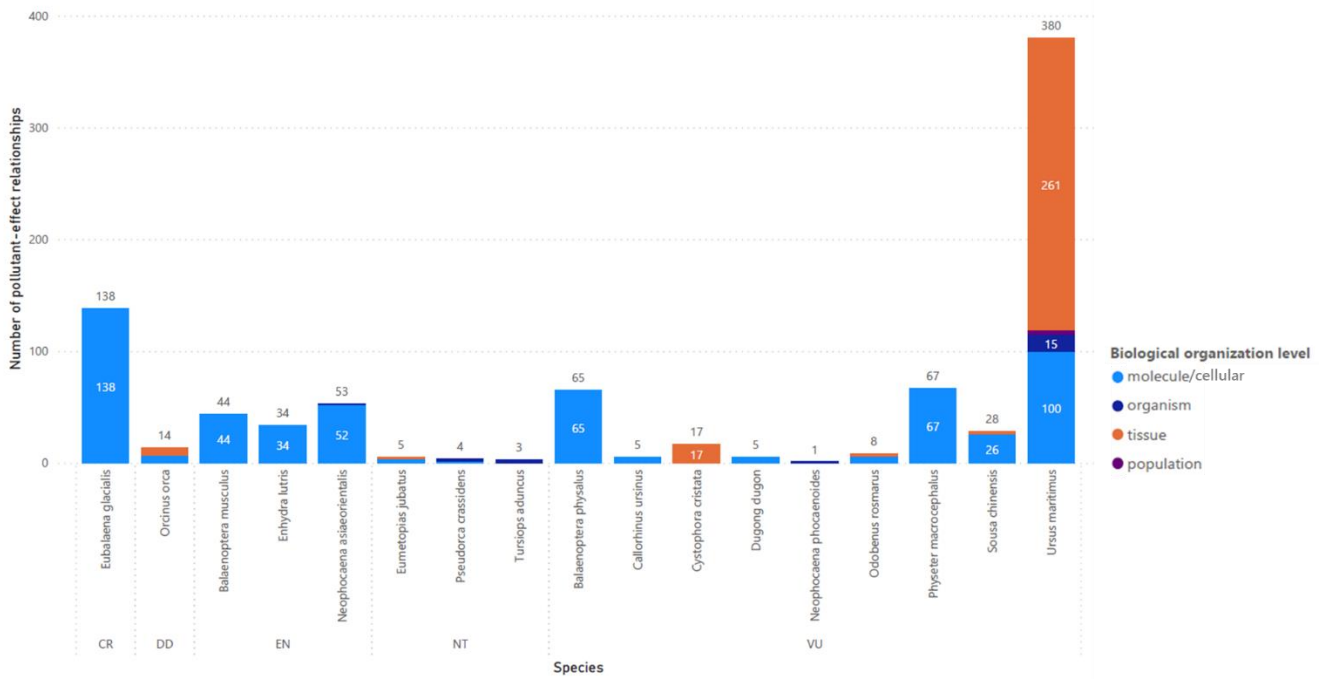


Fig. S3. Number of pollutant-effect relationships per biological organisation level in distinct species. IUCN red list categories: **CR** - critically endangered, **DD** - data deficient, **EN** - endangered, **NT** - near threatened, **VU** - vulnerable