Anti-sea lice drugs may pose hazard to non-target crustaceans

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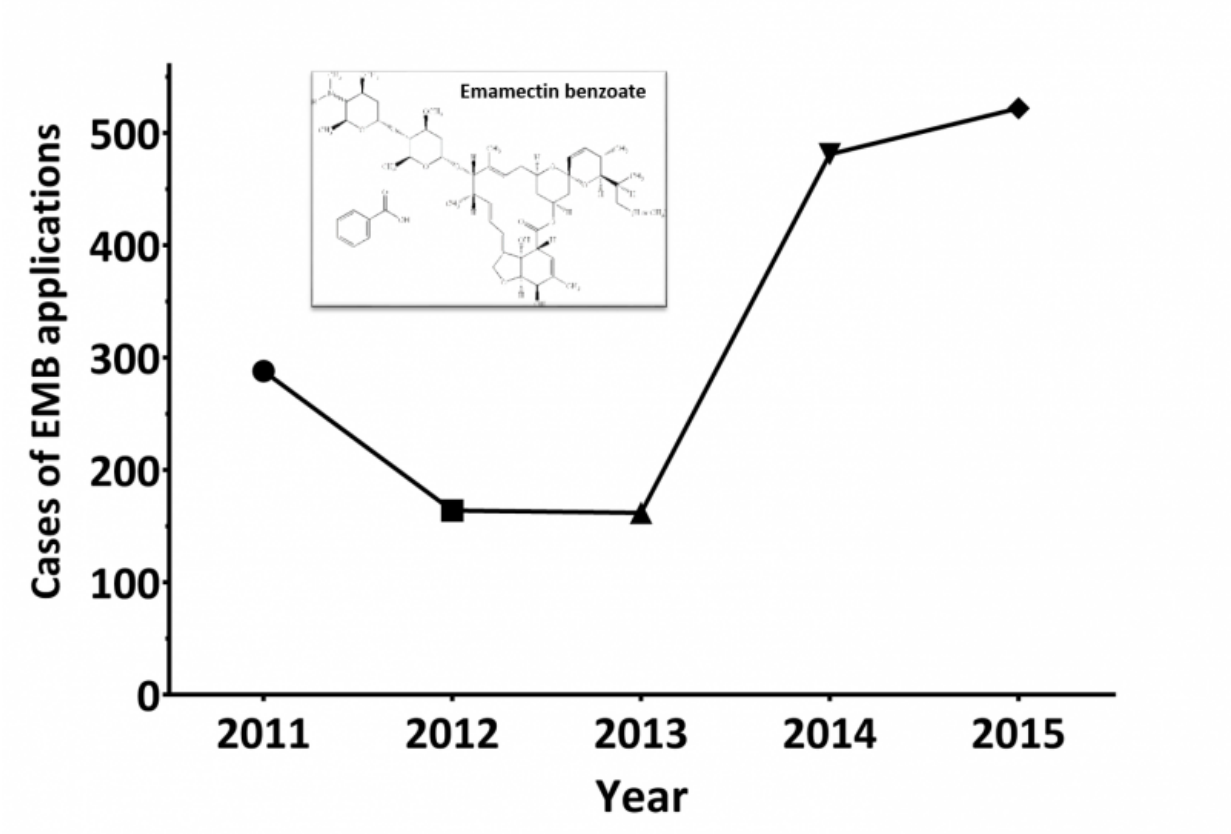


Chemical structure of emamectin benzoate (EMB) and annual applications of EMB against sea lice by the Norwegian fish farms in the past five years. Credit: Data from Fish Health report 2016, Norwegian Veterinary Institute

To treat sea lice infections in aquaculture, veterinary medicines are

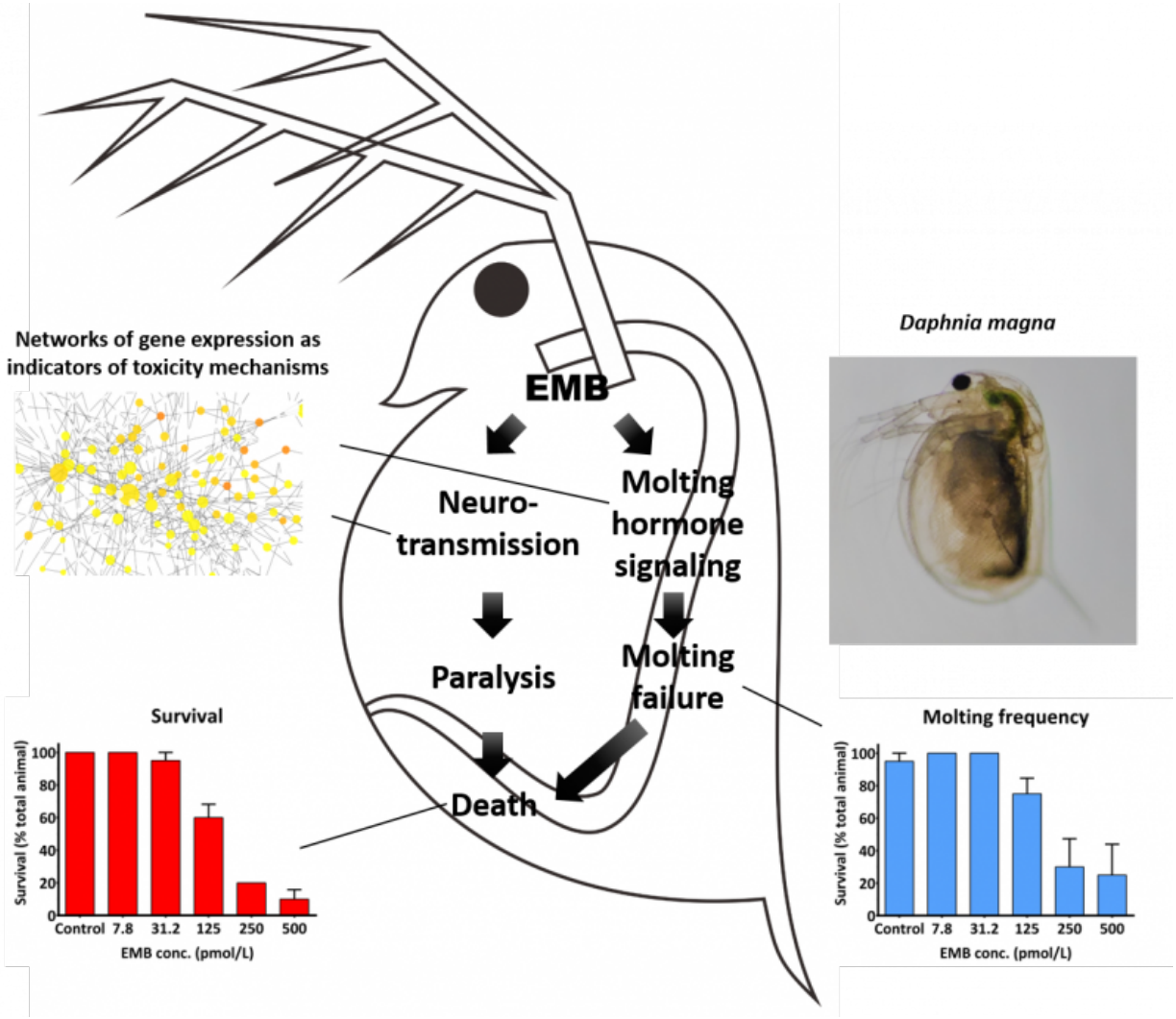
widely used. However, these medicines may cause collateral damage.

Sea lice are a group of marine copepods living as parasites and severely affecting the fitness of the host fish, especially farmed fish, such as salmonids. Emamectin benozoate (EMB), an efficient insecticide in terrestrial pest control, is used to kill sea lice and combat sea lice infections in high-intensity salmonid aquaculture. Although beneficial for ensuring healthy fish and maintaining cost-effective production of salmonids, the use of EMB has become controversial due to reported adverse effects on non-target species that are considered key for maintaining a healthy environment.

Increased use

Although the use of emamectin decreased in 2012-2013, its use increased again from 2014 in countries such as Norway due to development of resistance to alternative treatments. Emamectin, which interferes with normal nerve signaling mediated by glutamate- and/or GABA-gated chloride channels, display high neurotoxicity to insects and copepods such as sea lice and may ultimately lead to death by paralysis. This potent insecticide is also highly toxic to crustaceans such as the American lobsters, thus raising concern for adverse impact on economically valuable non-target species.

With this concern, researchers at the Norwegian Institute for Water Research (NIVA) conducted a series of studies to characterize the toxicity of EMB in non-target crustaceans. The study was published in *Environmental Science & Technology* and was presented at the 6th Norwegian Environmental Toxicology Symposium (NETS), 25-27 Oct, 2016 in Oslo, Norway.



Emamectin benzoate (EMB) caused mortality in the aquatic crustacean Daphnia magna mainly by affecting neurotransmission and molting signaling, revealed by microarray gene expression analysis and functional bioassays. Credit: NIVA

"The freshwater crustacean and standard OECD toxicity testing species, Daphnia magna, was used as a reference model," explains You Song, Post Doc at NIVA.

"By combining standardized acute toxicity testing with advanced

molecular- and cellular techniques, EMB was demonstrated to both affect neurotransmission in D. magna, but also interfere with normal molting due to disrupting endocrine signaling," Song says.

These potential mechanisms may be the main driving forces leading to high mortality of the animals as observed in this study.

Restricted use?

The study concluded that treatment of sea lice with EMB may potentially pose hazard to non-target crustaceans in waters near the fish farms.

"Assessment to scale the size of the problem and determine whether special use restrictions are needed should be considered to ensure sustainable use of veterinary medicines in aquaculture," says senior researcher and project manager Knut Erik Tollefsen at NIVA.

More information: You Song et al. Whole-Organism Transcriptomic Analysis Provides Mechanistic Insight into the Acute Toxicity of Emamectin Benzoate in, *Environmental Science & Technology* (2016). DOI: 10.1021/acs.est.6b03456

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