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EDITED AND REVIEWED BY
Laura Airoldi,
University of Padova Chioggia Hydrobiological Station, Italy

*CORRESPONDENCE
Stephanie A. Norman
stephanie@marine-med.com

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Editorial: Aquatic one health — the intersection of marine wildlife health, public health, and our oceans

Stephanie A. Norman[1]*, Dušan Palić[2], Ayanna Carla N. Phillips Savage[3], Stephanie Plön[4], Samantha Shields[5] and Claudia Venegas[6]

[1]Marine-Med: Marine Research, Epidemiology, and Veterinary Medicine, Bothell, WA, United States, [2]Faculty of Veterinary Medicine, Ludwig-Maximilians-Universität München, München, Germany, [3]Department of Population Medicine, Virginia-Maryland College of Veterinary Medicine, Virginia Tech, Blacksburg, VA, United States, [4]Department of Pathology, Stellenbosch University and Bayworld Centre for Research and Education (BCRE), Port Elizabeth, South Africa, [5]School of Veterinary Medicine, St. Matthew's University, Grand Cayman, Cayman Islands, [6]Veterinærmedisinsk Oppdragssenter Chile (VESO), Puerto Varas, Chile

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Editorial on the Research Topic
Aquatic one health—the intersection of marine wildlife health, public health, and our oceans

Plastics, disease pathogens, overfishing, and climate change are major threats to marine animal health. The scientific, public health, and veterinary medical communities are crucial in addressing these threats. A One Health approach, in which various disciplines are integrated together to promote the protection and preservation of human, animal, and environmental health, represents an ideal model to address marine health issues. One Health initiatives are becoming more popular globally (Delesalle et al., 2022); however, most focus on human health, and less on animal health, with very few addressing environmental health. Although the oceans and their ecosystems cover most of the planet, playing a pivotal role in the health and welfare of humans and animals, relatively little research has been published on One Health within aquatic ecosystems (Selbach et al., 2022). This Research Topic highlights how the health of humans, marine wildlife, and the ocean environment are holistically integrated through a One Health framework. The articles cover multiple marine ecosystem components such as fish, marine mammals, and invertebrates.

Pathogens potentially impacting marine wildlife, as well as the environment and humans, such as *Escherichia coli*, *Mucor* spp., and *Toxoplasma gondii*, are represented in the Research Topic. Anthropogenic sources of *E. coli* appear in terrestrial and freshwater ecosystems, but relatively less is known about *E. coli* diversity in marine ecosystems. In the article by Grunwald et al., a large diversity of sequence types (STs), associated with animals,

were found in an area of the Salish Sea, (Washington, USA) near to where farm animals are raised. Many of the STs identified have been associated with virulence in humans, while for others, no reference sequences could be identified.

Diversity of bacterial pathogens in gill microbiome of eastern Mediterranean wild fish was investigated by Itay et al.. Using a next generation sequencing approach on 16S amplicons collected from 89 individual fish, 177 unique values (*i.e.*, bacteria species) were identified. A total of 41 bacteria were known to have pathogenic potential to humans and/or marine animals. Even more interesting, is that a total of 36 bacteria had varying human clinical relevance or zoonotic potential. Finally, the literature also revealed that from 41 potentially pathogenic species, 14 bacteria were known marine animal pathogens, suggesting that some of those bacteria which are potentially pathogenic to humans, may also cause disease in marine wildlife.

Reports of disease due to the fungi *Mucor* spp., are increasing globally, and are considered a One Health concern in humans and animals. In humans, infections can occur in individuals who are immunocompromised, have elevated circulating serum iron, or uncontrolled diabetes; however, predisposing factors are less known in marine mammals. A qualitative risk assessment performed on a series of cases in harbor porpoises (*Phocoena phocoena*) in the inland waters of Washington State, USA, revealed elevated liver iron as a risk factor (Norman et al.). Another mycotic disease of growing One Health concern, lobomycosis-like disease (LLD), due to *Lacazia loboi*, causes a chronic and progressive dermatitis in humans and cetaceans, and is transmissible between the two (Reif et al., 2013). Endemic to central and south America, little is known about the epidemiology, pathology, and current expansion of LLD in the southwestern Gulf of Mexico (SWGM). An investigation of LLD in coastal SWGM bottlenose dolphins (*Tursiops truncatus*) revealed disease prevalence is relatively low, but habitat quality, and demographic and social characteristics of the dolphins may be influencing its geographical expansion into SWGM (Gálvez et al.). Furthermore, global and local climate variability may influence the epidemiology of LLD which could impact coastal human and dolphin health in the SWGM.

An atypical and rare genotype of the parasitic protozoan, *Toxoplasma gondii*, first isolated in Canadian cougars (*Puma concolor*), was detected for the first time in California sea otters (*Enhydra lutris nereis*). The resulting infection caused a new and intense lesion pattern of severe steatitis in otters. (Miller et al.). This parasite may be a One Health concern due to its high zoonotic potential and risk of infection from marine food sources shared by humans and otters.

Marine mammals have long been recognised as sentinels of marine ecosystem health, and Hart et al. adapted this approach to investigate the ubiquity of microplastic pollution risk for coastal communities that rely on seafood. Investigating gastric samples of common bottlenose dolphins (*Tursiops truncatus*) from Sarasota Bay, FL (USA), they highlighted the animals' likely exposure to microplastics *via* contaminated prey, augmenting recent findings that concentrations of prevalent phthalate exposure in these dolphins was exceeding those of human reference populations. Monitoring the health status of marine mammals through systematic investigations of stranded animals in a One Health context is a strategy developed in metropolitan France (Wund et al.). The authors propose a common regional European strategy concerning analyses carried out together with other European Union Member States under the Marine Strategy Framework Directive of the European Union, using an integrated vision of public, animal and environmental health.

The Deepwater Horizon (DWH) oil spill of 2010 resulted in a high occurrence of chronic, moderate to severe, pulmonary disease in bottlenose dolphins living in Barataria Bay, Louisiana, USA, one of the most heavily-oiled estuaries. Aspiration of oil is the most likely exposure route, with alveolar interstitial syndrome being the most significant factor in the lung disease seen in these dolphins. Although physiologically adapted for swimming and diving, dolphin lungs are also susceptible to harmful effects of inhaled pollutants. They are air breathing mammals that live and feed along the coastline and thus should be considered sentinel species. The chronic and progressive lung disease found in dolphins inhabiting areas most affected by the DWH arguably provides insight into the long-term effects of contaminants, such as oil spills, on other animals (including humans) and the environment (Smith et al.).

Cultivated animals are globally traded, facilitating the spread of serious infectious diseases. Several trans-boundary aquatic animal diseases have swept through regions over the past 30 years, causing massive economic and social losses, through introduction, establishment, and spread of pathogens into new geographic areas. *Perkinsus* sp. dinoflagellates, internationally reportable pathogens of concern, are extremely virulent for clams and oysters. Perkinsosis, an important disease reported worldwide in bivalves and gastropods, can be responsible for large mortality events due to their extensive invasiveness and virulence. The first known report of *Perkinsus* sp. in Mediterranean mussels, *M. galloprovincialis*, is described in a mussel farm from the Campania region of Italy (Carella et al.).

The complex threats marine ecosystems face was revealed in the studies reported in this Research Topic. The studies highlighted threats to marine health that demand international cooperation and cross-disciplinary knowledge. A One Health framework provides an appropriate approach to handling the addressed marine threats in this Research Topic that require cross-disciplinary skills.

Author contributions

All authors listed have made a substantial, direct, and intellectual contribution to the work and approved it for publication.

Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Publisher's note

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