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Review

International and national biosecurity strategies in aquatic animal health

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ABSTRACT

With a growing global human population and an increasing demand for food protein, aquatic animal protein has become an increasingly important resource. In several geographic areas, wild stocks have been severely overfished, increasing the demands on aquaculture. In response, aquaculture production has dramatically risen over the last 30 years. Movement of live aquatic animals, within and between countries, for aquaculture and the ornamental trade, is an important route of disease spread. Over the last decades, many aquatic animal diseases have emerged to have a substantial economic impact on aquaculture, sometimes with ecological consequences.

Effective biosecurity strategies provide protection to both farmed and wild aquatic animal populations by minimising the risk of introducing pathogens and minimising the consequences if the pathogen was introduced. We provide an overview of international, supranational and national biosecurity strategies for aquatic animal health. The role of the World Organisation for Animal Health (OIE) as the reference organisation for the development of standards relating to international trade in animals and animal products is described and an overview of the OIE standards provided; Europe and England and Wales are used as examples to illustrate how the international standards are implemented at supranational and national level other important elements of biosecurity not defined by international standards are described.

At the national level, the paper describes and discusses the role of the competent authority, instruments to prevent the introduction of exotic diseases and limit the impact of endemic diseases; it highlights the relevance of import risk assessments and the importance for awareness of international developments. At farm level, it summarises available standards and the role of farm biosecurity plans. Challenges to biosecurity strategies at the various levels are discussed.

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1. Introduction

Over recent years, aquaculture production worldwide has grown substantially (FAO Fisheries and Aquaculture Department, 2010), driven by rising demands from a growing world population at a time when harvests from capture fisheries are largely stagnating due to limited wild stock resources and overexploitation. This growth was accompanied by the introduction of new species for aquaculture, new aquaculture systems, an increase in international trade and the emergence of new diseases as well as the continued spread of known diseases. Some of the most important diseases to have emerged in recent years include koi herpesvirus disease (which affects mainly common carp, *Cyprinus carpio*), epizootic ulcerative syndrome (EUS, an infection with an Oomycete, that is known to affect a large range of species) and infectious salmon anaemia (ISA, a viral disease of Atlantic salmon). Economically significant viral diseases have also emerged in penaeid shrimp production, most notably white spot syndrome (WSS), yellow head disease (YHD) and Taura syndrome. Bivalve mollusc production has also been affected by diseases such as Bonamiasis caused by *Bonamia ostreae*, and more recently the emergence of oyster herpesvirus that has dramatically affected the culture of the Pacific oyster *Crassostrea gigas* in Europe. The spread of these diseases has adversely affected aquaculture industries, to the extent, in some cases, that social and economic disruptions occurred at a national level. Due to limited wild stocks the growth in aquaculture is likely to continue, and thus the culture of new species, expansion into new geographic areas and the development of new systems. Therefore, it must be assumed that diseases will continue to emerge as serious challenges to the aquaculture industry.

The development and implementation of biosecurity strategies are vital to minimise disease risks by reducing the likelihood of pathogen introduction and the potential consequences. Such strategies also aim to prevent the establishment of pathogens in the wild where they could have serious impacts on wild aquatic animal populations and act as a reservoir of infection for farmed animal populations.

The term biosecurity has been variously defined on numerous occasions depending on the context in which it is used (e.g. bioterrorism, agriculture). However, in general, biosecurity involves practices, procedures and policies that are used to prevent the introduction and spread of pathogens and invasive species (Gunn et al., 2008). Biosecurity strategies can be applied at farm, regional, country or international level.

The principal steps in the development of biosecurity strategies are hazard identification, followed by a risk assessment process. Based on this knowledge, risk mitigation (prevention of introduction), disease detection and control (in the event that introduction does take place) and eradication plans can be developed. These elements will vary depending on the level at which biosecurity strategies are applied.

The hazard identification step usually involves the identification of all pathogens considered to pose a threat, which will vary with the level at which the biosecurity strategy is applied (farm, country, international level). Routes via which the pathogen might be introduced are then identified. The principal pathways of pathogen introduction and spread are largely the same across all aquatic animal diseases: transport of live aquatic animals, and spread of pathogen via contaminated water, fomites, live vectors or aquatic animal products.

The consequences of pathogen introduction can be substantial. There is often water-connectivity between farmed and wild aquatic animal populations. This close interaction means that pathogens may spread between farmed and wild aquatic animal populations, which may result in wild populations becoming a permanent reservoir of infection. Once established, pathogen eradication may be impossible. Therefore, in the context of aquatic animal diseases, there is a clear need to focus on prevention. For this reason, biosecurity strategies in aquatic animals are in this sense of even higher relevance compared to terrestrial animals, for which wildlife reservoirs are generally less important.

This paper provides an overview of international biosecurity strategies and gives examples of supranational and national biosecurity frameworks. It explains the rationale underlying biosecurity frameworks and discusses limitations of and challenges for existing biosecurity frameworks.

2. International biosecurity frameworks

2.1. The Sanitary and Phytosanitary Measures Agreement

The Sanitary and Phytosanitary (SPS) Measures Agreement (WTO, 1995) is the highest level international agreement that sets out the basic rules on food safety and animal and plant health standards. It applies to all sanitary (relating to human and animal health) and phytosanitary (relating to plant health) measures that may have a direct or indirect impact on international trade.

According to the SPS agreement, sanitary or phytosanitary measures should include all relevant laws, decrees, regulations, requirements; testing, inspection, certification and approval procedures; quarantine treatments including relevant requirements associated with the transport of animals; relevant statistical methods, sampling procedures and methods of risk assessment; and packaging and labelling requirements directly related to food safety.

The purpose of the SPS agreement is to provide a framework of rules that aims to ensure that countries do not use the SPS measures to erect protectionist trade barriers. However, members may use more stringent measures if they can be scientifically demonstrated as necessary to protect human, animal or plant life or health (i.e. supported by a risk assessment). These measures must be consistently applied.

In circumstances, where insufficient scientific evidence is available, a member may provisionally adopt SPS measures on the basis of available information. However, members need to seek the additional information necessary for a more thorough assessment of risk and review the sanitary or phytosanitary measure accordingly within a reasonable period of time.