EMERGING FISH INFECTIONS: LESSONS LEARNED AND MANAGEMENT IMPLICATIONS

MOHAMED FAISAL

Professor of Aquatic Animal Medicine
The College of Veterinary Medicine
Michigan State University
East Lansing, Michigan, 4882, USA
Email: faisal@msu.edu

Abstract

As the globalization era progresses, societies and world economies have been transformed dramatically. Advances in technology, major biotechnological innovations, and greater international movements of people and commodities have created a system that metaphorically unites the world into one global village; goods and services produced in one part of the world can easily be transported and made available in all parts of the globe. Parallel to the emergence of the globalization era, mass mortalities have been observed over a wide range of farmed and wild aquatic animals, including fish, mollusks, crustaceans, coral reefs, urchins, turtles, frogs, and marine mammals. In addition to these mortalities, many aquatic animals are at the brink of extinction, and many more cannot reproduce, thereby causing their fisheries to collapse. Dramatic increases in demand for fish consumption, increased urbanization and industrialization, invasion by non-indigenous species, catastrophic climatic events, and continuous influxes of toxic chemicals into water bodies have been incriminated for the observed fisheries decline worldwide.

Concomitant with the eruption of the globalization era, expansion in tilapia aquaculture have reached untoward proportions to the extent that the Nile tilapia (Oreochromis niloticus) became global in distribution; being raised in almost every country in the world. Parallel to tilapia movements, symbionts, parasites, and pathogenic microorganisms have invaded new geographic ranges. As a result, in facilities where tilapia is raised in high densities, devastating infections emerged and there are concerns of the spread of emerging pathogens into wild tilapia stocks. To protect tilapia aquaculture and ensure the sustainability of tilapia fisheries, an effective health plan to minimize the risks of pathogen introductions into tilapia farming facilities and potential leaks into regions where tilapia species are native, needs to be developed at the national, regional, and international world levels.

In order to develop a comprehensive health plan for tilapia species, a number of difficulties have first to be overcome. The first of such impediments is the weakness of the aquatic animal health infrastructure in most countries where tilapia species are native or extensively farmed. There are a limited number of laboratories that can accurately diagnose tilapia diseases, and there is a huge shortage in aquatic animal health professionals. This problem is particularly evident in the Asia-Pacific region, a

major contributor to the world production of tilapia, yet it is equipped with very few professional health services. As a result, baseline health data for the presence of pathogens and diseases of tilapia is lacking and disease databases are either non-existent or relatively primitive. It appears that, the expansion in tilapia aquaculture was not matched with an expansion of the supporting aquatic animal health infrastructure. The problem is compounded with the current knowledge gaps on the life cycle, range, and ecology of the most serious tilapia pathogens and parasites, a matter that compromises the accuracy of disease surveillance programs and the reliability of risk analysis and control measures, and hinders the selection of disease management options.

The second important constraints in developing effective disease control strategy is the lack of diagnostic tools to enhance pathogen detection capabilities, particularly in cases of subclinical and carrier infections. For example, cell-lines routinely used to isolate intracellular pathogens of vertebrates are currently lacking for tilapia. As a result, there is a significant constraint to the detection and understanding of the epidemiology of viral and other intracellular microbial infections affecting tilapia species. Therefore, there is an urgent need not only to develop the enhanced diagnostic tools, but also to develop standardized protocols that lead to diagnosis of tilapia diseases with precision.

The last of impediments is the limited knowledge on tilapia susceptibility to disease, host defense mechanisms, and disease ecology. In general, tilapia is a term applied to a heterogeneous group of cichlids with major taxonomic diversities. This diversity is often associated with different anatomical features and physiological functions, many of which impinges upon disease transmission modes and the disease process. For example, diseases are transmitted from parents to offspring easier in mouth-brooders tilapia species compared to substrate spawners. Moreover, most wild tilapia stocks have a relatively narrow home range; therefore, rates of infection transmission of pathogens are higher due to the ease of pathogen transmission among adjacent susceptible hosts.

The current situation mandates that fishery organizations involved in tilapia aquaculture and management join forces to achieve the following:

- developing, harmonizing, and enforcing appropriate and effective national, regional, and inter-regional policies and regulatory frameworks on introduction and movement of live tilapia and products to reduce the risks of introduction, establishment, and spread of tilapia pathogens;
- developing and implementing effective national disease reporting systems, databases, and other mechanisms for collecting and analyzing tilapia disease information;

- improving technology through research to develop, standardize, and validate accurate and sensitive diagnostic methods, safe therapeutants, and effective disease control methodologies; and
- Promoting a holistic system approach to tilapia health management, emphasizing preventative measures and maintaining a healthy ecosystem.

Guided by these principles, a number of health plans have been developed for other fish species such as the Diseases of Fish Act issued in 1937 in Great Britain that is considered the longest-standing example of national legislation specifically devised to control fish diseases. The Act prohibited the importation of live salmonids, and made it illegal to import salmonid ova and all live freshwater fish species without a license. Moreover, the Act enabled any disease to be designated as 'notifiable', meaning that even the suspicion of its presence in any waters must be reported to the official services. While these principles remain the core of most national policies, other countries/regions amended and expanded their policies as needed to face emerging challenges such as the regional health plans were developed for the European Union and for states and provinces sharing the Great Lakes basin. This regional approach has significantly extended the scope of aquatic animal health legislation to include recommendation directives and decisions to ensure effective control of fish diseases under farming conditions, protecting native fish species, ensure the movement of live fish and their products, while guaranteeing a high level of animal health. Both national and regional plans agreed on the need to establish accurate disease surveillance system, create a system of certification, establish disease-free zones, start assessment of disease risks, and quarantine for introduced species before permitting access into the importing

In the case of tilapia, scientific and managerial efforts are needed to narrow knowledge gaps, find innovative ways to implement health control measures, and to be prepared in case an emerging disease erupts. These efforts include the establishment of comprehensive databases on pathogens and diseases and related issues essential for the understanding of national disease status, for use in risk assessment studies, and to serve as a decision support system for managerial and regulatory agencies.