

6. Conclusions and recommendations

Most of the fish examined during the Task Force mission appeared normal. Ten of the 23 fish specimens subjected to detailed analysis showed lesions, red spots and haemorrhages many of which can be attributed to handling.

Oomycete infection was confirmed in two clinically diseased fish. Fungal-like hyphae invaded the epidermis, dermis and through to the musculature causing necrotizing dermatitis with degeneration of the muscle. Some hyphae appeared in the muscle next to the vertebral column. The oomycete fungi elicited a strong inflammatory response and mycotic granulomas formed around the penetrating hyphae, a typical characteristic of EUS.

The preliminary outcomes of laboratory analysis in early June 2007 revealed that the two diseased fish samples were infected with EUS based on histopathology. Further work enabled the successful isolation and sporulation of the putative fungal pathogen *Aphanomyces invadans*.

Because of the urgency of this fish disease situation, a preliminary report (dated 13 June 2007 or referred to as June 2007 report in this document) was submitted to the Government of Botswana and other relevant governments and organizations to inform the preliminary findings of the Task Force investigation.

The June 2007 report indicated that with the EUS pathogen now found in the upper reaches of the Chobe-Zambezi River system, downstream spread seems inevitable, particularly during the rainy season. Flow reversal along tributaries during the rainy season will also likely lead to the spread of the pathogen through floodplain watersheds. Salinity and water temperatures strongly influence spore production of the fungus. EUS outbreaks may not occur wherever salinity is ≥ 2 ppt and water temperatures remain above 30 °C. Within the Chobe-Zambezi River system, this disease condition could become pandemic, damaging both aquaculture and capture fisheries and aquatic biodiversity.

The report also emphasized that a short-term (urgent) control, prevention and preparedness programme is essential and could help to reduce social and economic impacts of the fish disease on people involved in fisheries in the Chobe-Zambezi River system, as well as aquaculture farmers.

Among the key short-term measures recommended by the mission in the June 2007 report include:

- urgent notification to the World Organisation for Animal Health (*Office internationale des épizooties* or OIE), of the presence of EUS in the Chobe River in Botswana by the veterinary authority of Botswana. Similarly, the Namibia

veterinary authority was also encouraged to make the same notification of the occurrence of the disease in the Caprivi region in Namibia;

- initiation of a public awareness and extension programme to raise understanding of the disease and impact reduction measures;
- conducting short-term training and awareness raising on EUS for key government officers and other key stakeholders (e.g. NGOs working on fisheries or with fishing communities) to raise awareness and implement an extension and monitoring programme;
- establishment of surveillance and monitoring programmes along the Chobe-Zambezi River system to monitor spread pattern of the disease outbreak;
- more detailed epidemiological investigation of the present EUS distribution, analysis of risks to the fisheries (people and biodiversity) in all major tributaries and lakes in the Chobe-Zambezi River system, and development of appropriate risk management responses.
- Initial dialogue among the countries sharing the Chobe-Zambezi River system, to establish a subregional disease surveillance, monitoring, preparedness and response programme and a practical action plan as early as possible.

FAO was also encouraged to ensure that the information on EUS is shared among countries in the Chobe-Zambezi River system and neighbouring watersheds to create awareness on EUS and to provide early warning of wider spread of the disease.

The EUS outbreak had exposed serious biosecurity weaknesses in the southern African region. Thus, the mission also recommended actions through a medium- to long-term programme to strengthen capacity for fish disease diagnosis and control, quarantine, responsible movement of live aquatic animals, development of appropriate policy and regulatory frameworks, and implementation of better aquatic animal health management programmes in the region.

As there is insufficient capacity to control EUS within existing facilities and human resources in Botswana and neighboring countries, the mission recommended that an immediate programme of technical assistance be established:

- to assist government authorities take immediate preventative and control measures, particularly through training of key staff and establishment of an effective surveillance, monitoring and public awareness campaign, before the possible start of the next EUS season in 2007/2008;
- to consider a longer-term programme to identify the source of EUS and take measures to reduce the spread of the disease to other parts of the region.

The June 2007 report emphasized that the disease (fish mortalities) experienced in the Chobe-Zambezi River system over the past few months was not entirely due to environmental and water quality problems but a disease outbreak caused by EUS. The causative agent of EUS does not pose any human health implications. Except for the fish exhibiting deep ulcerations and tissue decay, which could harbour secondary pathogens which may have human health implications, the fish infected with EUS do not pose human health hazards for consumers. This fact needs to be conveyed to affected communities urgently.

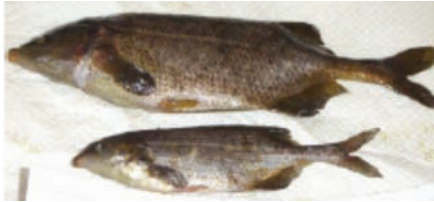
The potential negative impact to biodiversity cannot be ignored. The Zambezi River is home to more than two hundred fish species, some of which are endemic to the river. Important species include cichlids which are fished heavily for food, as well as catfish, tigerfish, yellowfish and other large species (Plate 9). An estimate of about 32 million people inhabit the Zambezi River valley; 80 percent of the population are dependent on agriculture. River communities fish extensively for food; recreational fishing is also a significant activity in some parts of the river for tourists.

There had been a number of developments since the submission of the preliminary report of the Task Force findings in June 2007. These are briefly described in the following sections.

PLATE 9

Examples of diversity of fish species in the Chobe-Zambezi River, Kasane, Botswana

(All photographs courtesy of M.B. Reantaso)



Bulldog
Marcusenius macrolepidotus



Squeaker
Synodontis spp.



Tigerfish
Hydrocynus vittatus



African catfish
Clarias gariepinus



Silver catfish
Schilbe intermedius



Churchill
Petrocephalus catostoma



Banded tilapia
Tilapia sparrmanii



Brownspot largemouth
Serranochromis thumbergi