Opportunities and Strategies for Conservation of Fish Genetic Resources in Côte d'Ivoire

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Cote d'Ivoire has a diverse ichthyological fauna. About 173 species of fish from 27 families and 67 genera are represented in the different rivers and lacustrine systems. Around 60 species are harvested by artisanal fishing. Less than 10 are used in aquaculture. Strategies need to be developed to preserve these diverse fish populations in both natural and artificial waterbodies.

Cote d'Ivoire is watered by four main rivers. These are, from west to east, Cavally (600 km), Sassandra (650 km), Bandama (1050 km) and Comoe (1 100 km). A group of small coastal rivers composed of San Pedro (112 km), Boubo (130 km), Me (140 km), Agnebi (250 km) and Bia (290 km), among others, loca ted in the forest zone, are distributed throughout the southern region. Tributaries of river systems from neighboring countries flow partly on the Ivorian territory, including those of Niger, coming from Mali (Bagoe, 230 km, and Baoule, 330 km); Black Volta, from Ghana (Koulda and Bineda); and Laleraba of Comoe system, a natural frontier with Burkina Faso. Over 400 dams have been constructed by the government of Cote d'Ivoire or by private investors in the last 30 years. Hydroelectric and hydroagricultural dams cover more than 180 542 km2, and agropastoral dams cover about I 562 km2.

Fisheries

The fishing sector has a very high economic importance (Nugent 1997). The total fishery potential is estimated at 26 000 t.year1, with an annual value of about 6 billion francs CFA. Fishers often mention the disappearance of species, e.g., from Lake Fae (Da Costa and Traore 1997). Entire species may not be disappearing, but populations within species are decreasing (Kouassi et al. 1998), e.g., those of *Distichodus rostratus, Citharinus eburneensis, Barbus sublineatus* and *B. waldroni.* According to the same authors, there is a tendency for some species to reappear after insecticide treatments against onchocerciasis have stopped.

Currently, most fish captured in inland fisheries come from the four main lakes created for hydroelectric dams (Ayame, Kossou, Taabo and Buyo). Fishing activities have been very intense since the creation of these lakes. There are very few data on the productivity of rivers and small watercourses, except for some sections of Bandama, Comoe and Sassandra Rivers, where marketing routes are known. Such fisheries are generally artisanal; i.e., practiced by a dispersed population of fishers and thus, very difficult to monitor. Given the incomplete and unreliable statistics, it is difficult to present the actual status

of fish resources in Cote d'Ivoire that are economically important to fisheries and aquaculture. However, *FAO* statistics showed a decline in total inland freshwater fish production during the period 1986-1996 from 25 200 to 11 300 t. During the same period, farmed tilapia production increased fivefold (30-170 t). In the long run, a situation could be reached where only few species will predominate in aquaculture and fisheries.

Aquaculture

Aquaculture is very recent in Cote d'Ivoire. It started in 1955 (Anon. 1975) and studies conducted at the fish research station in Bouake (created in 1956) were the basis for the development of aquaculture in the country. Only a few species have been used. The majority of aquaculture comprises subsistence activities, managed by a family or community and usually integrated into agricultural production systems with very low inputs. There are a few commercial enterprises, e.g., the societe Ivoirienne d' Aquaculture Lagunaire. In the earlier years of aquaculture development, state-owned and private hatcheries were established to produce fingerlings for fish farmers. At present, most fish farmers produce their own fingerlings, especially for tilapia.

The first freshwater species cultured on station were *Oreochromis macrochir, Tilapia rendalli* and T. *zillii.* These species were later abandoned due to their poor growth performance and small size. 0. *niloticus* and its various hybrids, particularly 0. *aureus,* 0. *mossambicus* and 0. *urolepis hornorum,* were then cultured (Lessent 1968; Lazard et al. 1991). The strain of 0. *niloticus* from the Bouake Fish Research Station currently dominates the distribution of farmed tilapia in Cote d'Ivoire. It has also been introduced into most artificial lakes (Nugent 1988).

Sarotherodon melanotheron and *Chrysichthys nigrodigitatus* have been cultured in brackishwater lagoons (Oteme 1993; Ouattara et' al. 1993). Initial research studies on fish culture in brackishwater included S. *melanotheron.. T. guineensis* and 0. *niloticus.* 0. *niloticus* was not adopted for brackishwater culture because of its high mortality in saline water (Adou 1988). S. *melanotheron* and T. *guineensis,* both well adapted to the lagoon environment, were also considered as poor candidates for aquaculture in brackishwater because of their low growth and poor feed conversion efficiency (Adou 1988). C. *walkeri* was initially cultured but was also abandoned due its to slow growth (Lazard et al. 1991). C. *nigrodigitatus* is presently cultured; *Heterobranchus longifilis* (Agnese et al. 1995) and *H. isopterus* (Da Costa et al. 1996) are also being considered for aquaculture, Among the Clariidae, *Clarias gariepinus* (par- ticularly in the western region; Konan 1988) and C. *anguillaris* are being used in aquaculture (Da Costa 1998).

Threats

Unless living aquatic resources are used and managed carefully, natural production faces the risk of collapse. The situation in Cote d'Ivoire is, as observed by Pullin (1998), that genetic resources for aquaculture are poorly documented and their ownership and access are poorly defined. The economic importance of fish has led very often to their excessive exploitation, with strong pressure on commercial species, by very selective fishing, use of destructive and prohibited fishing methods and a lack of respect for legislation. Hence, the stocks in the inland watersheds are threatened and are being depleted.

Pollution poses another type of risk-industrial wastes, such as those of the sugar factory at Borotou on the Sassandra River, have caused massive fish mortalities and the disappearance of shrimps upstream, with an overall decrease in landings of about two- thirds.

Another indirect cause of fish depletion is the lack of adequate institutions to monitor fishing activities. It is therefore difficult to follow the evolution of fisheries and the changes in the aquatic environment. It has become almost impossible to control fishing effort (number of active fishers) and fishing

methods (number and quality of fishing gears used and their output) and to ensure respect for fishing legislation. (Da Costa and Traore 1997; Nugent 1997; G. Gourene, pers. comm.).

Towards conservation

Documentation and characterization are the first steps towards conservation. The current status of fish resources used in capture fisheries and aquaculture should be determined to predict future trends. An inventory of available resources is the basis for management and development that will lead to improvement and sustainable use. Accurate and up-to-date information on available fish resources is therefore essential. Research stations should playa major role in implementing long-term improvement programs through conventional selective breeding and in providing technical assistance, particularly on the conservation and management of broodstocks of fish populations under threat. Sustained scientific research activities will be required in the inventory of resources available in different waterbodies, and in the determination of appropriate location of protected areas (Da Costa and Traore 1997).

Conservation efforts should be undertaken for the aquatic fauna of large hydroelectric dams where fishing pressure is great as well as for river systems. The priority is to preserve natural aquatic resources and to rationalize and sustain the exploitation of all watersheds through the installation of a reliable system for evaluation of fishing statistics in different ecosystems, updating and enforcement of fishing legislation, creation of natural reserves and periodic restocking of populations.

Insufficient institutional and legal support or unavailability of appropriate information can hinder conservation efforts. A national fishing plan for inland waters is underway (Nugent 1997). This should allow, in the near future, for a more rational management of aquatic natural resources, and the conservation of inland aquatic genetic re- sources for their sustainable use. All concerned actors (policymakers, rural communities, fishers, fish farmers and scientists) should take an active part in the decision- making process and the implementation of strategies for the conservation of aquatic re- sources.

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Discussion

Dr: Teugels: Where did you get your data on the number of dams in the northern part of Cote d'Ivoire?

Dr. Kouassi: The data came from a survey conducted by a special government institute in 1990 and were published in 1992.

Dr. Teugels: I do not doubt the validity of the data but the survey from where you got the data was conducted a long time ago. Thus, the data may be outdated now and we counted more dams quite recently.

Dr: Gnaore: You may be right since there is a possibility of new constructions, etc. but it also depends on your definition of a dam.

Dr: Teugels: I think your species list of Lake Ayame is incomplete. For example, there is no S. *melanotheron* in your list.

Dr: Gnaore: It is certainly not an extensive list.

We just laid emphasis on the species captured by the fishers in Lake Ayame.

Dr: Laleye: I want to know the reason for the variation in species in your data, and why do you consider the use of bamboo dangerous in fishing?

Dr. Kouassi: The variation in species could be due to environmental factors or chemical treatments in connection with the Onchocerciasis Control Programme, or to a combination of factors. The use of bamboo is prohibited because most of the fish caught are females of *Chrysichthys* looking for a place to spawn.