

DOMESTICATION OF INDIGENOUS SPECIES TO INCREASE FOOD SECURITY AND ALLEVIATE POVERTY IN DEVELOPING COUNTRIES

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Introduction

The Aquaculture & Fisheries Collaborative Research Support Program (AquaFish CRSP), based at Oregon State University, develops and nurtures strong partnerships between US and host country institutions to engage in aquaculture and fisheries research, training, and outreach activities. The AquaFish CRSP currently collaborates with 17 US and 31 host country institutions in Africa, Asia, and Latin America to address the goals of poverty alleviation and food security in an environmentally sound way. As part of the program's broader development portfolio, AquaFish CRSP researchers are studying the domestication of indigenous species that can contribute to the development of local economies while addressing concerns about environmental threats that might otherwise be posed by the introduction and production of exotic species. Smallholder producers may benefit from culturing indigenous species because of their fitness with respect to local growing environments, product acceptance by local consumers, and the possibility of creating new markets. At the same time, domestication of native species for aquaculture must be approached in a responsible manner that diminishes the chances of negative environmental, technical, or social impacts. This poster highlights AquaFish CRSP investigations that address the domestication of suitable indigenous species for aquaculture production in Asia (Cambodia and Vietnam), Africa (Ghana, Kenya, and Uganda) and Latin America (Mexico and Nicaragua), with emphasis on seed production, larval rearing/hatchery management, and selective breeding.



AquaFish CRSP sites 2006-2012

Air Breathing Fishes

While most fish rely on dissolved oxygen in the water to survive, air-breathing fishes are capable of utilizing atmospheric oxygen. This characteristic allows them to cope with a variety of environmental conditions, making them more resilient to environmental change. As aquatic habitats become degraded and climate change shifts global temperatures, the value of these fish will become apparent due to their ability to survive poor water quality conditions and in some cases even extended drought. The domestication of species resilient to climate change may be pivotal for diversifying sustainable solutions in aquaculture. CRSP work focuses on seven groups, including both obligate and facultative air breathers: Gar (*Lepisosteus* spp.), pirarucu (*Arapaima gigas*), lungfish (*Protopterus* spp.), Pacific fat sleeper or chame (*Dormitator latifrons*), and snakehead (*Channa* spp.).

- **Prospects and potential of the African Lungfish (*Protopterus* Spp): An alternative source of fishing and fish farming livelihoods in Uganda.** Auburn University (USA), Aquaculture Research and Development Center of the National Fisheries Resources Research Institute (Uganda)
- **Effects of environmental conditions on gills and gas bladder development in bimodal-breathers, gar (*Lepisosteus* spp.), pirarucu (*Arapaima gigas*) and bowfin (*Amia calva*).** University of Hawaii (USA), Ohio State University (USA), Sao Paulo State University (Brazil), and Jagiellonian University, Krakow (Poland)
- **Sustainable feed and improved stocking densities for gar (*Atractosteus* spp.) culture.** University of Michigan (USA), Universidad Juarez Autonoma de Tabasco (Mexico)
- **Improvements in Spawning Control, Larval Growth, and Survival of Pacific Fat Sleeper (*Dormitator latifrons*).** University of Hawaii (USA), Ohio State University (USA), Universidad Autonoma de Sinaloa (Mexico), Sao Paulo State University (Brazil)
- **Sustainable snakehead aquaculture development in the Lower Mekong River Basin of Cambodia and Vietnam.** University of Connecticut-Avery Point, Inland Fisheries Research and Development Institute (Cambodia), Cantho University (Vietnam)



Harvesting cultured snakehead for market in Cambodia. Photo by Prum Somany



Pacific fat sleeper or "chame" (*Dormitator latifrons*). Photo courtesy of Maria Haws.



150 cm, 25 kg alligator gar (*Atractosteus spatula*). Photo courtesy of Solomon David.

Species Diversification in Ghana

Diversification of aquaculture species and systems in Sub-Saharan Africa, including expansion of the production of high-demand indigenous species for niche markets, provides a safety net and access to new markets for investors. CRSP researchers in Ghana are working to domesticate indigenous species, including Claroteid catfish (*Chrysichthys nigrodigitatus*), African bony-tongue (*Heterotis niloticus*), and African snakehead (*Parachanna obscura*), by determining dietary requirements and conducting marketing surveys. Researchers expect these results to contribute to species diversification and rapid acceleration of aquaculture development in Ghana and the region.

- **Development and Diversification of Species for Aquaculture in Ghana.** Virginia Polytechnic Institute & State University (USA), Kwame Nkrumah University of Science & Technology (Ghana)



Claroteid catfish (*Chrysichthys nigrodigitatus*)



African bony-tongue (*Heterotis niloticus*)



African snakehead (*Parachanna obscura*)

Oysters

Although most of the total world aquaculture production in 2010 (79.0 million tonnes) was achieved from freshwater finfish species such as carp, tilapia, and catfish (33.7 million tonnes), a large fraction was from molluscan shellfish (14.2 million tonnes) according to the FAO. With over 90% of the total world aquaculture production occurring in least-developed and developing countries, shellfish play an important role in food security and income generation for the neediest smallholder farmers in impoverished coastal communities. AquaFish CRSP investigators are working to develop and improve indigenous shellfish production systems and best management practices.

- **Spat collection, growth rates and survival of the native oyster species, *Crassostrea corteziensis* at Santa Maria Bay, Mexico.** University of Hawaii-Hilo (USA), Universidad Autonoma de Sinaloa (Mexico)
- **Developing hatchery methods for the mangrove oyster, *Crassostrea corteziensis* for the Pacific Coast of Mexico.** University of Hawaii-Hilo (USA), Universidad Autonoma de Sinaloa (Mexico)



Native oyster, *Crassostrea corteziensis* in Boca de Camichin, Narayit, Mexico. Photo courtesy of Maria Haws.



Working with native oysters in Boca de Camichin, Narayit, Mexico. Photo courtesy of Maria Haws.



Freshly harvested oysters in Boca de Camichin, Mexico. Photo by Tiffany Woods.

Snooks and Cichlids in Mexico

In Southeastern Mexico, a growing number of fish producers are requesting the development of alternative culture systems utilizing native species that are considered important from an economic and a conservation standpoint. Native snooks are among the most valuable fishery species in southeastern Mexico. In Tabasco and Chiapas, several species of native cichlids have been proposed for aquacultural purposes. Among these, the domestication of *Petenia splendida* and *Cichlasoma urophthalmus* is of special interest because of local demand and cultural value.

- **Development of snook (*Centropomus* spp.) seed production technology for application in aquaculture and restocking of over-fished populations.** Texas Tech University (USA), Universidad Juárez Autónoma de Tabasco (Mexico)
- **Incorporation of the Native Cichlids, tenhuayaca, *Petenia splendida* and Castarrica, *Cichlasoma urophthalmus* into Sustainable Aquaculture in Central America: Improvement of Seedstock and Substitution of Fish Meal Use in Diets.** University of Arizona (USA), Universidad Juárez Autónoma de Tabasco (Mexico)
- **Consolidation of Native Species Aquaculture in Southeastern Mexico: Continuation of a Selective Breeding Program for Native Cichlids and Snook Aquaculture.** University of Arizona (USA), Texas Tech University (USA), Universidad Juárez Autónoma de Tabasco (Mexico)



Snook fishing in southeastern Mexico. Photo by Tiffany Woods



Fishmonger Candelario Jimenez Hernandez holds up a small Mayan cichlid at a market in Villahermosa, Mexico. Photo By Tiffany Woods



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