

# Endangered Fish Species and Seed Release Strategies in Vietnam

Thai Ngoc Chien, Nguyen Huu Khanh and Nguyen Xuan Truong

Research Institute for Aquaculture (RIA) No. 3

33 Dang Tat, Nha Trang, Khanh Hoa, Vietnam

## Introduction

World economic growth has led to considerable changes in the ecosystem in many places and has raised concerns on global resource management particularly aquatic animal resources and their living environment. In Vietnam, aquatic animal resources play an important role in the national economy and are one of the targets for economic development. However, under high population pressure, high demand for seafood has resulted in unfavorable living environment. Aquatic animal resource has been over-exploited and in some places reported to be declining, hence some species have become extinct or endangered.

This paper presents some endangered species, seed production and release strategies for resource conservation.

## Endangered Species

Based on the Red Book, various freshwater fish (Table 1) and marine animals (Table 2) have different levels of endangered status.

Reasons for the various species being endangered are as follows:

### a) Fishing

High fishing pressure and destructive fishing gears/methods such as trawls, seines, explosives, dynamite, etc., have been used in coastal and inland waters, which resulted in the destruction of habitats and death of animals.

### b) Destruction of ecosystem

Mangroves and wetland ecosystems have been converted into aquaculture ponds. Dam construction for irrigation and building of shipping harbors have also affected the ecosystem.

### c) Water pollution

Industrial, agricultural and domestic waste discharges reduced the biodiversity and spawning of animals.

## Aquatic Resource Management

Although the government of Vietnam has issued many regulations and legislation for environmental and resource management, guidelines and methods for effective implementation are still lacking. Legislation has not been updated.

In recent years, integrated coastal or community-based management programs have been undertaken in Vietnam. Some protected marine areas such as Hon Mun PMA (Nha Trang Bay), Trao Reef (Van Phong Bay), sea garden (Van Phong Bay) have been organized. Likewise, a long-term resource management strategy has been established.

Artificial propagation of many endangered species has not been successfully achieved. Seed production technology has been focused on high value species due to farmers' demands. For endangered freshwater fish, hatching the snakehead fish *Channa striata*, *C. micropeltes* and *C. maculata* has been successfully done. To date, seed production of *Cyprinus centralus*, *Labeo chrysophekadion*

Table 1. List of freshwater fish species that are endangered (E), very endangered (V), threatened (T) and at risk (R). Symbol + indicates the presence of the species in the specified locations.

Scientific name	Status	Location					
		North	Center	Central South	Highlands	Eastern South	Mekong Delta
<i>Scleropages formosus</i>	E					+	
<i>Anguilla japonica</i>	E	+	+				
<i>Procypris merus</i>	E	+					
<i>Cyprinus multitaeniata</i>	E	+					
<i>Tenualosa reevesii</i>	V						+
<i>Hilsa kelee</i>	V				+		+
<i>Hilsa toli</i>	V	+	+				
<i>Clupanodon thrissa</i>	V	+	+				
<i>Konosirus punctatus</i>	V	+					
<i>Laichowcypris day</i>	V	+	+	+			
<i>Onychostoma laticeps</i>	V	+	+				
<i>Semilabeo notabilis</i>	V	+	+	+			
<i>Bangana lemassoni</i>	V	+	+		+		
<i>Spinibarbus caldwelli</i>	V	+		+			
<i>Spinibarbus denticulatus</i>	V	+	+		+		
<i>Cyclocheilichthys enoplus</i>	V					+	+
<i>Tor tambroides</i>	V						
<i>Mylopharyngodon piceus</i>	V	+	+				
<i>Luciocyprinus langsoni</i>	V	+					
<i>Megalobrama terminalis</i>	V	+	+				
<i>Pangasius larnaudii</i>	V			+			+
<i>Hemibagrus elongatus</i>	V	+	+	+		+	
<i>Cranoglanis boudierius</i>	V	+	+	+			
<i>Bagarius bagarius</i>	V	+	+				+
<i>Trichogaster pectoralis</i>	V			+	+		
<i>Chanos chanos</i>	T		+				
<i>Chitala chitala</i>	T			+	+		+
<i>Cyprinus centralus</i>	T						
<i>Catlocarpio siamensis</i>	T			+			+
<i>Squaliobarbus curriculus</i>	T	+	+		+		
<i>Ochetobius elongatus</i>	T	+			+	+	
<i>Cirrhinus microlepis</i>	T						+
<i>Cosmochilus harmandi</i>	T						+
<i>Labeo chrysophekadion</i>	T				+		+
<i>Probarbus jullieni</i>	T					+	+
<i>Channa micropeltes</i>	T						+
<i>Channa striatus</i>	T		+	+		+	+
<i>Toxotes chatareus</i>	R	+					
<i>Anguilla marmorata</i>	R					+	
<i>Anguilla bicolor pacifica</i>	R						
<i>Gyrinocheilus aymonieri</i>	R			+			
<i>Sinogastromyzon tonkinensis</i>	R			+			+
<i>Pangasianodon gigas</i>	R	+	+			+	+

Source: Fisheries Ministry of Vietnam (1996)

Table 2. List of endangered marine animals that are endangered (E), very endangered (V), threatened (T) and at risk (R).

Scientific name	Status	Location
<i>Nematolosa nasus</i>	E	Vietnam sea except for Ca Mau
<i>Anodontostoma chacunda</i>	E	Tonkin Gulf; Thailand Gulf
<i>Crocodylus porosus</i>	E	Eastern; southwest
<i>Crocodylus siamensis</i>	E	High lands; south
<i>Sepia tigris</i>	E	Tonkin Gulf; central south
<i>Trochus niloticus</i>	E	Central south; southeast
<i>Trochus pyramis</i>	E	Central south; southeast
<i>Turbo marmoratus</i>	E	Khanh Hoa province
<i>Anomalocardia squamosa</i>	E	Khanh Hoa province
<i>Gafrarium tumidum</i>	E	Khanh Hoa province
<i>Nautilus pompilius</i>	E	Khanh Hoa and Vung Tau provinces
<i>Loligo formosana</i>	E	Tonkin Gulf; southern center
<i>Chelonia mydas</i>	E	Vietnam Sea
<i>Eretmochelys imbricate</i>	E	Tonkin Gulf; southern center
<i>Dermochelys coriacea</i>	E	Hai Phong, Khanh Hoa and Kien Giang provinces
<i>Microthele nobilis</i>	E	Khanh Hoa province
<i>Thelenota ananas</i>	E	Khanh Hoa province
<i>Bostrichthys sinensis</i>	V	Tonkin Gulf; southwest
<i>Hippocampus trimaculatus</i>	V	Tonkin Gulf
<i>Hippocampus kelloggi</i>	V	Tonkin Gulf
<i>Hippocampus histrix</i>	V	Tonkin Gulf
<i>Hippocampus kuda</i>	V	Tonkin Gulf
<i>Panulirus longipes</i>	V	Center
<i>Panulirus ornatus</i>	V	Tonkin Gulf; center; southeast
<i>Panulirus versicolor</i>	V	Center
<i>Panulirus homarus</i>	V	Center
<i>Sepioteuthis lessoniana</i>	V	Khanh Hoa province
<i>Strombus luhuanus</i>	V	Southern center; southwest
<i>Charonia tritonis</i>	V	Southern center
<i>Haliotis asinina</i>	V	Tonkin Gulf and southern center
<i>Haliotis ovina</i>	V	Tonkin Gulf
<i>Heterocentrotus mammillatus</i>	V	Khanh Hoa province
<i>Actinopyga echinites</i>	V	Khanh Hoa province
<i>Actinopyga mauritiana</i>	V	Khanh Hoa province
<i>Caretta caretta</i>	V	Vietnam Sea
<i>Lepidochelys olivacea</i>	V	Vietnam Sea
<i>Masturus lanceolatus</i>	T	Tonkin Gulf
<i>Rhina ancylostoma</i>	T	Tonkin Gulf
<i>Tachypleus tridentatus</i>	T	Vietnam sea except for southwest
<i>Cypraea testudinaria</i>	T	Khanh Hoa and Quang Ngai provinces
<i>Pocillopora damicornis</i>	T	Southern center; southwest
<i>Pocillopora verrucosa</i>	T	Southern center; central south
<i>Acropora florida</i>	T	Southern center; central south
<i>Elops</i> spp.	R	Nam Ha province
<i>Albula vulpes</i>	R	Nam Ha, southern center
<i>Cyttopsis cypho</i>	R	Tonkin Gulf; southern center
<i>Trachyrhamphus serratus</i>	R	Vietnam Sea
<i>Syngnathus acus</i>	R	Vietnam Sea
<i>Solegnathus hardwickii</i>	R	Center
<i>Ateleopus japonicus</i>	R	Vietnam Sea
<i>Solenostomus paradoxus</i>	R	Nha Trang
<i>Schindleria praematura</i>	R	Tonkin Gulf
<i>Sathyrichthys rieffeli</i>	R	Quy Nhon

Table 2 (continued from p. 141)

Scientific name	Status	Location
<i>Anacanthus barbatus</i>	R	Tonkin Gulf
<i>Oxymonocanthus longirostris</i>	R	Truong Sea
<i>Mola mola</i>	R	Tonkin Gulf
<i>Antennarius striatus</i>	R	Khanh Hoa
<i>Etmopterus Lucifer</i>	R	Tonkin Gulf
<i>Anoxypristis cuspidata</i>	R	Tonkin Gulf
<i>Pristis microdon</i>	R	Tonkin Gulf
<i>Cypraea argus</i>	R	Khanh Hoa province
<i>Cypraea histrio</i>	R	Khanh Hoa province
<i>Cypraea mappa</i>	R	Southern Center
<i>Cypraea spadicea</i>	R	Khanh Hoa province
<i>Cypraea scurra</i>	R	Khanh Hoa province
<i>Ovula costellata</i>	R	Khanh Hoa province
<i>Calpurnus lacteus</i>	R	Center
<i>Calpurnus verrucosus</i>	R	Southern Center
<i>Lambis crocata</i>	R	Khanh Hoa province and Con Dao
<i>Cymatium lotorium</i>	R	Khanh Hoa province
<i>Epitonium scalare</i>	R	Khanh Hoa province and Con Dao

Source: Fisheries Ministry of Vietnam (1996)

and *Cirrhinus microlepis* is being studied. The seedstock of some endangered brackish and marine water species, such as green mussel *Perna viridis*, abalone *Haliotis asinina*, top shell *Trochus niloticus*, have been successfully produced. However, the biology of some important species such as *Panulirus ornatus* and *Actinopyga echinites* are currently being undertaken.

Through the support of the Ministry of Fisheries and many international organizations, such as Support to Freshwater Aquaculture (SUFA), Support to Brackish Water and Marine Aquaculture (SUMA), Danish International Development Agency (DANIDA), World Fish Centre (formerly ICLARM), Southeast Asian Fisheries Development Center (SEAFDEC), Australian Centre for International Agriculture Research (ACIAR), and the Norwegian Centre for International Cooperation in Higher Education (SIU), etc., there have been many projects on seed production and resource conservation in recent years.

In Vietnam, aquaculture is one of the major activities; hence, advanced technology has been of high priority. In 2000-2004,

the Ministry of Fisheries carried out over 70 projects on seed production. For freshwater fish, success in the seed production of bighead carp *Aristichthys nobilis*, silver carp *Hypophthalmichthys molitrix*, grass carp *Ctenopharyngodon idella*, common carp *Cyprinus carpio*, etc. was achieved. In recent years, we have given more attention to broodstock improvement. In addition, research projects on some endangered species were initiated and promising results have been achieved for *Hemibagrus elongatus*, *Mystus wolffii*, *Silurus asotus*, *Cyclocheilichthys enoplus* and *Cyprinus centralus*. Seed production of tiger shrimp *Penaeus monodon*, mud crab *Scylla serrata*, and swimming crab *Portunus pelagicus* was likewise successful (Research Institute for Aquaculture No. 3, 2004).

Success in seed production has also been achieved for abalone *Haliotis asinina*, oyster *Crassostrea* sp., hard clam *Meretrix lyrata*, blood cockle *Anadara granosa*, babylonia snail *Babylonia areolata*, cobia *Rachycentron canadum*, sea bass *Psammoperca waigiensis* and *Lates calcarifer*, sea cucumber *Holothuria scabra*, sea urchin *Tripneustes gratilla*, and some ornamental fish (Research Institute for

Table 3. Freshwater fish species stocked in Ea Soup reservoir, Daklak province.

Species	2001 (kg)	2002 (kg)	2003 (kg)	2004 (kg)	2005 (kg)	Price (VND)/kg	Total (VND)
Grass carp	90	30	75	52	-	48,000	11,856,000
Silver carp	85	60		120	60	48,000	12,720,000
Rohu	21	39	40	52	105	48,000	7,296,000
Indian mrigal	52	-	-	-	-	48,000	2,496,000
Tilapia	20	-	-	-	-	48,000	960,000
Hybrid carp	-	-	100	6	164	48,000	4,800,000
Total	268	129	215	230	165	-	40,416,000

Source: Database from Project of reservoir and river fisheries management in Mekong Delta basin/DANIDA (2004).

Aquaculture No. 3, 2004). These achievements will diversify the culture of species as well as increase the farmers' income.

### Stock Enhancement Program

#### Stock releasing campaign

The population size of some species has been decreasing and becoming extinct such as Giant barb *Catlocarpio siamensis*, which inhabits the Mekong Delta basin (Research Institute for Aquaculture No. 2, 2002). Seed release of declining aquatic animals has

been considered to increase the resources. Restocking of fish in reservoirs and lakes has been implemented but in small-scale. Table 3 shows the freshwater fish species stocked in Ea Soup Reservoir from 2001 to 2005. Likewise, seeds of indigenous fish species such as black sharkminnow, bagrid catfish and mud barb were released in the same reservoir in 2003 (Table 4). In Lak Lake 45 kg of Me hoi were released (DANIDA 2004) in 2003. The marine species released in sea garden in 2005 were top shell, abalone and sand fish (Table 5).

Table 4. Indigenous fish released in Ea Soup Reservoir in 2003.

Species		2003		2004	
English name	Scientific name	Quantity	kg	Quantity	kg
Black sharkminnow	<i>Labeo chrysophekadion</i>	61,965	79	3,900	6.5
Bagrid catfishes	<i>Mystus wolffii</i>	2,000	2		
Mud barb	<i>Leptobarbus hoevenii</i>			2,800	14
Total		63,965	81	6,700	20.5

Source: Database from Project of reservoir and river fisheries management in Mekong Delta basin/DANIDA (2004).

Table 5. Marine animals released in sea garden supported by SUMA –DANIDA in 2005.

Species	Quantity (no. of animals)	Price (VND)/ animal
Top shell	3,000	1,000
Abalone	5,000	1,000
Sand fish	10,000	1,000

### Future research on seed production and resource restoration

The following lists of animals (top-down priority) are the priority for future stock enhancement programs in Vietnam.

#### Marine animals

1. Red lobster *Panulirus longipes*
2. Spiny lobster *Panulirus versicolor*
3. Sea urchin *Heterocentrotus mammillatus*
4. Horseshoe crab *Tachypleus tridentatus*
5. Trumpet triton *Charonia tritonis*
6. Green turban *Turbo marmoratus*

#### Freshwater fishes

1. Giant barb *Catlocarpio siamensis*
2. Mekong giant catfish *Pangasianodon gigas*
3. Spot pangasius *Pangasius larnaudii*
4. Snakeskin gourami *Trichogaster pectoralis*
5. Japanese eel *Anguilla japonica*
6. Black sharkminnow *Labeo chrysophekadion*
7. Asian catfish *Clarias macrocephalus*

8. Carp *Paraspinibarbus macracanthus*
9. Four-banded tigerfish *Coius quadrifasciatus*

### Conclusion

Aware of declining aquatic resources, some endangered species have been highly considered for stock enhancement. Although this program is very new, some activities have been carried out such as reproduction, stock releasing campaigns, and restricting illegal fishing gears. But we lack experience in terms of stock assessment and understanding fish population dynamics, therefore we would like to cooperate with other countries to build up this knowledge.

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