THE IMPACTS OF INTRODUCED FRESHWATER FISHES IN THE PHILIPPINES (1905–2013): A REVIEW AND RECOMMENDATIONS

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INTRODUCTION

What are introduced freshwater fishes?

- Exotic, foreign, non-native or alien fishes thriving in freshwater environments (e.g., lakes, rivers, ponds)
- Transported by man from one country to another or from one body of freshwater to another intentionally or accidentally

What are invasive fishes?

- Fishes that cause harm to the environment, people and the economy

Why freshwater fishes are introduced:

(1) Economic reasons

- for food production through aquaculture (fish farming) or inland fisheries enhancement (*e.g.,* tilapia, carps, gouramis)

(2) Recreational purpose

- for ornamental/aquarium fish (*e.g.,* goldfish) or sport fishing (e.g., large mouth bass)

(3) Mosquito control

Ex. mosquito fishes, guppies

The Impacts of Introduced Freshwater Fishes

(1) Positive (Beneficial)

a. Economic and social benefits

– Increased fish production through aquaculture and inland fisheries enhancement

FAO DIAS : (a) most introductions were for aquaculture (b) "…more positive socio-economic benefits than negative ecological impacts"

b. Ecological benefits

– Introduced fishes have filled available niches in the ecosystem (Ex. planktivores and omnivores)

(2) Negative (Harmful)

a. Ecological loss of biodiversity

Ex. Introduction of white goby and eleotrid from Lake Mainit to Lake Lanao in Mindanao caused the loss of 15 endemic cyprinids.

b. Economic and social losses

Ex. "Knife fish" in Laguna de Bay

c. Environmental degradation

Ex. "Janitor fish" in Marikina River

d. Genetic pollution

Ex. "Uncontrolled hybridization and introgression" (Mooney and Cleland, 2001)

e. Harm to humans

Ex. Rice paddy eel in Isabela

METHODOLOGY

- Review of literature (published and unpublished)
- FishBase – including the FAO Database on Introductions of Aquatic Species (DIAS)
- Personal observations
- Visits to the BFAR for regulations
- Media – televised and printed reports
- Visits to commercial aquarium establishements

RESULTS AND OBSERVATIONS

- There were 60 fishes recorded to have been introduced in the country from 1905 to 2013.
- The fishes were evaluated according to whether they were beneficial (B), invasive (I) and potential invasive (Pi).
- Of the 60 fishes, 48 (80%) were beneficial, 8 (13%) were invasive and 4 (7%) were potential invasive.

Status and Impacts of Some Introduced Fishes

Species	Introduction Origin	Year	Status	Impact
Poecilia reticulata (Guppy)	USA	1905	Bc, En, W	B
Syptomus tetrazona (Sumatra barb)	*?*	*?*	*O, En*	*B*
Channa striata (Mudfish)	Malaysia	1908	C, En, W	I/B
Catla catla (Catla)	India	1967	C, N	B
Clarias gariepinus (African catfish)	Taiwan	1985	C, Ei	B
Micropterus salmoides (Largemouth bass)	*USA*	1985	R, N	B
Chitala chitala (Clown knifefish)	Thailand	?	O, En, W	I
Oreochromis hornorum (Wami tilapia)	*Singapore*	*1971*	C, N	B
Pygocentrus nattereri (Red-bellied piranha)	Amazon	?	O, En	Pi

- Introduced Fishes for Culture
  - Of 30 fishes introduced for aquaculture
    - 27 (90%) – beneficial
    - 3 (10%) – invasive

    - 19 (62%) – established (breeding naturally)
    - 8 (28%) – not established
    - 3 (10%) – artificially bred

Introduced Freshwater Fishes That Have Contributed Significantly to Fisheries Production

Striped catfish (*Pangasoinodon hyopthalamus*)

Nile tilapia (*Oreochromis niloticus*)

Common carp (*Cyprinus carpio*)

Bighead carp (*Aristichthys nobilis*)

Economic Contribution of Introduced Freshwater Fishes For Culture (BAS, 2013)

Species	Volume (MT)	Value (PhP 000)
Nile tilapia	268,507 (92%)	19,188,202 (95%)
Bighead carp	18,251 (6%)	611,900 (3%)
African catfish/ Pangasius	3,754 (2%)	358,735 (2%)
Total	290,512	20,158,837

Economic Contribution of Introduced Freshwater Fishes to Inland Fisheries (BAS,2013)

Species	Volume (MT)	Value (PhP 000)
Nile tilapia	48,937 (55%)	2,804,344 (52%)
Common carp	15,371 (17%)	916,401 (17%)
Mudfish	10,864 (12%)	905,084 (17%)
Gouramis	6,839 (8%)	275,336 (5%)
Asiatic catfish	6,201 (7%)	489,451 (9%)
Total	88,216	5,390,617

- **Introduced Fishes for Ornamental Purpose**

  Of 22 fishes introduced:

  12 (55%) – beneficial

  6 (27%) – invasive ("escapees")

  4 (18%) – potential invasive

Mudfish (*Channa striata*)

Black-chin tilapia (Sarotherodon melanotheron)

"Black mask" (*Channa micropeltes*)

Clown knifefish (*Chitala chitala*)

Thai catfish (*Clarias batrachus*)

Rice paddy eel (*Monopterus albus*)

Jaguar guapote (*Parachromis managuensis*)

Introduced Freshwater Fishes Considered to be "Potential Invasive" Species

Clown featherback (*Chitala ornata*)

Arapaima (*Arapaima gigas*)

Red-belly piranha (*Pygocentrus nattereri*)

Butterfly peacock bass (*Cichla occularis*)

Negative Impacts of Invasive Fishes

Species	Impacts
"Janitor fish"	Damage to banks of Marikina River Reduced catch of fisherfolk in Laguna de Bay (Chavez *et al.,* 2006) and Agusan Marsh (Hubilla *et al*., 2007)
"Jaguar guapote"	Predation and competition with native fishes in Lake Taal (Rosana *et al*., 2006)
"Clown knife fish"	Predation of cultured milkfish, tilapia and native fishes in Laguna de Bay; reduced catch of fisherfolk (Palma, 2013)
"Giant snakehead"	Predation of tilapia in Pantabangan Reservoir, Nueva Ecija (Anon., 2013)
"Black-chinned tilapia"	A pest in brackishwater ponds in Bulacan, Bataan and Pampanga (Chavez, 2013; Cervantes, 2013)

Potential Invasive Fishes

Species	Remarks
"Araipama"	With authority from BFAR; confined in commercial aquaria; predaceous and can breed in the wild; reported to be invasive in Bolivia (Miranda-Chumacero *et al*., 2012)
"Peacock bass"	No authority from BFAR; being bred in a commercial establishment; predaceous and can breed in the wild; reported to be invasive in Panama (Pelicice and Agostinho, 2008) and Brazil (Latini and Petrere, 2004)
"Red-bellied piranha"	No authority from BFAR; being bred in a commercial establishment; predaceous and can breed in the wild; reported to be invasive in the US (Fuller *et al.,* 1999)
"Clown Featherback "	With authority from BFAR; confined in commercial aquaria; predaceous and can breed in the wild; similar to the "Clown knife fish" in Laguna de Bay

- **Fishes Introduced for Recreational Fishing**

  Of four fishes introduced:

  - Only one has become established in Lake Caliraya (Laguna) with no reported negative impact.

- **Fishes Introduced for Mosquito Control**

  All four introduced fishes have become established and are widely found in estuaries and ponds.

  - Help in reducing mosquito larvae in open waters
  - Used for feeding carnivorous fishes such as the "arowana"

CONCLUSION ON FISH INTRODUCTIONS

- The socio-economic benefits of the fish introductions particularly for aquaculture and inland fisheries enhancement far outweigh the negative impacts of invasive fishes.
- Most of the invasive fishes have emanated from fishes introduced for the ornamental fish industry that have escaped or intentionally introduced into the wild and have become established.
- The list of 60 fishes reported in this study is by no means complete. The list of "Live Aquarium Fishes Allowed for Importation" of the BFAR includes 91 fishes not officially reported to be present in the country and need to be verified.

REVIEW OF POLICIES ON FISH INTRODUCTIONS

- Philippine Fisheries Code of 1998 (R.A. 8550)

Section 10: Introduction of Foreign Aquatic Species

"No foreign finfish, mollusk, crustacean or aquatic plants shall be introduced in Philippine waters without a sound ecological, biological and environmental justification based on scientific studies subject to the bio-safety standards as provided for by existing laws."

- Fisheries Administrative Order No. 221 (Series of 2003) of the Department of Agriculture

  Subject: Regulating the importation of live fish and fishery/aquatic products

  Section 3: Categories based on risk

  . . . the legality of importation of live fish shall be determined based on the CITES categories of:

  Low risk species – species with no ecological, genetic and disease/threats to native Philippine species and to aquaculture

  Medium risk species – species considered BFAR to pose potential environmental impact

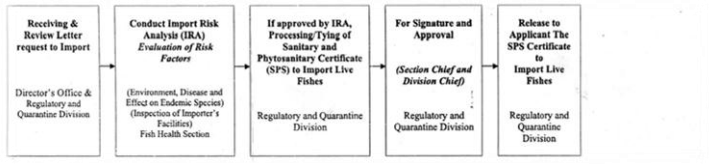
  High risk species – exotic species that may most likely pose adverse environmental impact

  Prohibited or banned species – exotic species the importation of which is prohibited due to their known adverse effect on local fauna, human health and the environment.

Section 4: Prohibition

It shall be unlawful to import live fish . . . without a valid license or permit issued by the Director of BFAR.

Section 5: Filing of application to import with BFAR- RQD



- Section 6. Review

  All importation of live fish shall be subject to review by the Import Risk Analysis (IRA) Panel created by the BFAR Director.

  Chair: Fish Health Officer

  Permanent Members:

  a. A member of the Philippine Bar
  b. Fish Health Officer
  c. A regulatory fisheries quarantine officer
  d. A member of the NFARMC
  e. A fishery biologist (on call)

- Section 7. Importation requirements

  c. For high risk species. –

  5) Quarantine and inspection until the first generation (F1) offspring for high risk species (to be imposed after the release of the shipment from the airport to the BFAR's quarantine facilities, with costs to be borne by the importer).

- Section 10. Transitory provision

  High risk and prohibited species which have already entered the country without any valid import permit prior to the promulgation of this order shall be monitored and evaluated by the IRA Panel and those that are found to be causing any adverse effect on the local fauna, human health and environment shall be confiscated.

- Section 11. Penalty

  Violation shall subject the offender to the penalty of eight (8) years imprisonment and a fine of Eighty Thousand Pesos (PhP 80,000) including the destruction of the live fish.

FINDINGS OF POLICY REVIEW

Upon verification with the BFAR'S RQD:

(1) There is no permanent IRA Panel as stipulated in FAO No. 221. The IRA for fish introductions is done by the BFAR's Fish Health Section which is staffed by veterinarians who are more qualified for Pathogen Risk Analysis.

(2) The BFAR used to have a quarantine facility for "High Risk Species" at the Manila airport. Presently, quarantine is done at the importer's facility subject to inspection by the Fish Health Section.

(3) While permits have been granted by the BFAR for the *Pterygoplicthys pardalis/dysjunctivus, Araipama gigas, Chitala chitala and C. ornata*, no permits have given for the *Pygocentrus nattereri*, *Channa micropeltes, Parachromis managuensis*, *Cichla ocularis*, *Monopterus albus and* Sarotherodon melanotheron.

(4) No monitoring of "High Risk" and "Prohibited " fishes which have already entered the country without any valid import permit by the IRA Panel is done.

(5) In the BFAR RQD's list of "Live Aquarium Fishes Allowed for Importation", there are 91 fishes that are not mentioned in any of the sources reviewed. The RQD has no official list of "Prohibited Fishes for Importation."

RECOMMENDATIONS

(1) Full implementation of FAO No. 221 should be done, particularly with respect to the quarantine facility of the BFAR, formation of a permanent IRA Panel and monitoring of "high risk/prohibited" fishes.

(2) Commercial aquarium fish establishments or private aquarists illegally keeping "high risk/prohibited" fishes should be dealt with according to the law or held responsible/liable for possible deliberate or accidental escapees. A Surety Bond for such purpose may be imposed.

(3) The capability of the BFAR's RQD should be strengthened in terms of manpower and facilities to carry out its functions more effectively.

(4) The BFAR in coordination with the other stakeholders (*i.e.* LGUs, LLDA, FARMC, etc.) should conduct ecological impact studies and research on mitigation measures for the control and/or preventive spread of invasive fishes.

(5) A massive "Information, Education and Communication" Campaign should be launched by the BFAR to make people aware of the negative impacts of invasive fishes and drum up the need for responsible aquarium pet care and environmental protection.