



UnderWater World

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Impact Assessment on import of Silver Arawana into Australia

Prepared for the 'Department for the Environment and Heritage' for Amendment of the List of Specimens Suitable for Live import

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Purpose of Live Import

The purpose of this proposal to import live silver arawana (*Osteoglossum bicirrhosum*) is for public display and educational purposes only. Underwater World – Sunshine Coast currently includes over 700 species of fish and is one of the main attractions on the Sunshine Coast. Over 300 000 people visit the Aquarium each year and without doubt our interactive displays are one of the most effective methods for public education concerning aquatic animals and their associated environments.

Underwater World is currently interested in the construction of an Amazonian environment display. The main aim of this display is to show the public species of fish and plants from the Amazon River and its tributaries (neotropical species). This environment display would include a number of fish species, including the arawana species *Osteoglossum bicirrhosum* – the silver arawana. The enclosure will be designed to be more of an experience to the public than just a view into the tank. It is intended to have artificial vines, trees and rockwork spilling over to the public side giving a feeling of actually walking in the display. The acrylic viewing panels are intended to be 1.8m high.

As national (domestic) tourists make up over 78% of visitors to our Aquarium it would be an educational experience for those who have not seen an Amazon rainforest first hand. We have many native Australian aquatic animal displays, as do a number of other public aquaria in Australia. The Amazonian display would be unique in terms of Australian public aquariums, and would help to educate the viewing public on international aquatic environments.

There will also be scope to have signage to increase public awareness in relation to noxious fish species from this region and in relation to the protection of our indigenous fish life and affects introduced species can have.

Number of animals required and method of import, transport and housing.

The proposal is for the housing of eight silver arawana in a purpose built facility. It should be understood that imported fish or progeny of imported fish will not be permitted for release from this display facility in a viable (live) state. Any progeny produced from the holding of silver arawana will be at the discretion of AQIS for either termination or for the availability for transfer to other AQIS approved arawana display or holding facilities. Underwater World will comply with all requirements outlined by AQIS and Biosecurity Australia in terms of quarantine issues and bio-containment of the imported animals.

There are two options for importation and transport of silver arawana:

Option 1: Import through a current registered importer of exotic fish (already approved by AQIS to import fish). This will mean that the silver arawana will undergo quarantine at the wholesaler's premises as approved by AQIS, and then be moved to the aquarium facility following the initial quarantine period.

Option 2: Import directly from exporters overseas but requires our facilities to become an approved import facility. This is the preferred option as this will reduce the transfer risks involved in the operation, and give Underwater World a greater control on the level of bio-containment for the animals.

The quarantine facility must be approved in accordance with section 46A of the Quarantine Act 1908. A condition of registration as a post – arrival quarantine facility (PAQ) is that the facility will be subject to regular audits by AQIS.

As the Underwater World includes both exotic and native animals (not of quarantine concern), only the particular display will need to be approved as a PAQ.

Silver Arawana

Class:	Actinopterygii (ray-finned fishes)
Order:	<u>Osteoglossiformes</u>
Family:	<u>Osteoglossidae</u> (Bony tongues),
subfamily:	Osteoglossinae
Genus:	<u>Osteoglossum</u>
Species:	<u>bicirrhosum</u>
Common Name:	arawana, silver arawana, arowana, aruana
Taxonomic Reference:	Dr. Axelrod's Atlas of Freshwater Fishes. 3 rd Edition, 1989.

Status of Species in its Natural Range

Silver Arawana

Max. size:	120 cm TL (male/unsexed); max. weight: 4,600 g (Axelrod, Dr H.R. 1989).
Environment:	benthopelagic; freshwater , pH 6.7 (Axelrod, Dr H.R. 1989)
Climate:	tropical; 24 - 30°C (Axelrod, Dr H.R. 1989)
Importance:	fisheries: commercial; gamefish: yes; aquarium: commercial (Robins et. Al. 1991)
Distribution:	Northern South America: Guianas and most parts of the Amazon tributaries. (Robins et. Al. 1991)
Diagnosis:	Body covered with very big scales; dorsal and anal fins almost fused with the caudal fin; 2 barbels at the extremity of the lower jaw; adult silvery, juvenile with blue glints and a yellow-orange bar. (Goulding 1990)
Biology:	The superior position of the mouth allows it to capture its prey while swimming from below. Also jumps out of the water to feed on large insects. It is capable of adapting to environments with low oxygen levels. (Robins et. Al. 1991)
Reproduction:	Reach maturity at three years of age.
Maternity:	Sexually dimorphic. Females may pro 50-250 eggs per year. Males are mouth brooders and are retained for four to six weeks (until the yolk sac is absorbed).
Fucundity:	Life span from 5 to 15 years.(Robins et. Al. 1991)
Dangerous:	harmless (Robins et. Al. 1991)
Ecological role:	A higher level predator, in the wild is omnivorous, will prey on small fish and leap out of the water to prey on small frogs and insects. (Goulding 1990)
Main Refs:	Axelrod, Dr H.R. 1989. & Robins, C.R., R.M. Bailey, C.E. Bond, J.R. Brooker, E.A. Lachner, R.N. Lea and W.B. Scott. 1991. Goulding M. 1990
Red List Status:	Not in IUCN Red List (Baillie et al, 2004)

Status of Species in Australia

Currently there are no recorded cases of silver arowana being found in natural waterways within Australia (Biosecurity Aus. pers. comm.). However, there have been accounts of silver arowana imported to Australia illegally for the aquarium trade. The illegal smuggling of the fish has resulted in the confiscation of the animals by AQIS and the Australian Customs Service (Biosecurity Aus. pers. comm.).

Given the evidence of smuggling of these species it is very likely that a number of silver arowana specimens are to be found in illegal private collections within Australia. Anecdotal evidence would also suggest that this is the case.

Likelihood of Release Establishment, Likelihood and Consequence

1. Pest History

Two specimens have been recorded from California, USA. The first was a single fish taken from Lake Berryessa, Napa County, by an angler in 1972 (Shapovalov et al. 1981; Courtenay et al. 1991); a second specimen was netted from Lake Merced, San Francisco County, by anglers in August 1994, a third specimen was collected from Adobe Creek in Petaluma in July 2000 (D. Logan, 2001). The species was unsuccessfully introduced at Forest Spring in Ash Meadows, Nye County, Nevada, during the early 1960's (Soltz and Naiman 1978; Deacon and Williams 1984).

There are no other recorded findings of Arawana release into the environment in other countries.

Means of Introduction: Probably aquarium releases in California (Shapovalova, Dill and Cordone 1997); introduced by an illegal ornamental fish farming operation in Nevada (Soltz and Naiman 1978).

Status: Reported in California and Nevada. (Shapovalova, Dill and Cordone 1997, Soltz and Naiman 1978).

Impact of Introduction: Unknown. (Shapovalova, Dill and Cordone 1997, Soltz and Naiman 1978).

2. Disease

Silver arawana would be expected to suffer from and potentially carry a number of the ubiquitous disease agents that effect ornamental fish around the world. In a preliminary literature search Biosecurity Australia was not able to identify any specific disease agent concerns associated with the importation of *Osteoglossum bicirrhosum* that could not be covered by the existing conditions for live freshwater ornamental fish importation (Biosecurity Aus. pers. comm.).

Further analysis on specific disease risks will be conducted once permission to import this species is granted by the Department of the Environment and Australia.

Arawana are not prone to disease and are quite hardy when acclimatised but they are sensitive to water changes and particularly to nitrite build up (Axelrod, H.R. 1985). Silver arawana are also tolerant to lower dissolved oxygen levels (Axelrod, H.R. 1985).

3. Breeding in Captivity

There has been minimal success with breeding of Osteoglossidae in captivity due to their sheer size. Spawning of silver arawana has been observed in the wild (Goulding, M. 1990).

Due to the value of arawana to the commercial aquarium trade many efforts have been made to successfully and commercially breed arawana species to supply this demand (Brown. D. 1991).

Breeding of silver arawana has occurred in aquaria and can be bred in pairs in larger aquarium tanks. Eggs are 1.6 cm in diameter, and are brooded by the male for a period of 50-60 days, after which 12 to 30, 8-10 cm fry are released (Brown. D. 1991).

In 1991 the University of Hawaii, Centre for Tropical and subtropical Aquaculture documented spawning and rearing methodologies of silver arawana in a captive environment (Brown. D. 1991).

4. Habitat Requirements

Arawana species are native to the South American Amazon tributaries. The silver arawana live in the Amazonian flood plain, entering the flooded forest during monsoonal high water periods. It is a common species in many Amazonian waters, often swimming close to the surface searching for small fish and insects. They move in a snake-like motion and are surprisingly agile. The Silver Arawana species move to shallow quiet backwaters, marginal lagoons and small tributaries in the dry low water season and are suited to areas of dense vegetation. During the dry low water season the Silver Arawana can tolerate lower dissolved oxygen levels. (Moreau & Coomes 2006). The Silver Arawana is a surface feeder and in the low water season can be observed around sunset jumping clear from the water to catch flying insects (Henderson, P. 2002). Silver arawana can reach more than a metre in length (Henderson, P. 2002). They prefer neutral to slightly acidic water with pH 6.7 (Axelrod et.al. 1985), a temperature range from 24- 30 degrees Celsius (Henderson, P. 2002)

a) Behavioural Characteristics

The arawana is an excellent jumper, capable of leaping 1.5 metres from the water. During the flood season, the silver arawana have been observed to use this ability to snatch young monkeys and sloths that are drinking from overhanging branches (Henderson, P. 2002).

They are an opportunistic feeder, leaping out of the water to take fruit from overhanging branches. They are an omnivore and can jump to feed also on birds and bats (Henderson, P. 2002).

Like all Osteoglossidae they possess a spiral shaped organ in the gills, which they use to filter plankton from the water. In nature this is one of the main food sources during the dry season (Goulding. 1990).

Captive behaviour: Silver arawana may be flighty if disturbed and will jump if given an opportunity. They are not an outwardly aggressive fish, however they may eat smaller fish exhibits housed with them. They have been kept successfully with Oscars, red bellied pacu, plecostomus and other lesser aggressive large fish (Goulding. 1990). Due to the jumping characteristics of the silver arawana, the display needs to incorporate barriers to stop the fish from jumping from the display.

b) Reproductive Characteristics

Arawana are sexually dimorphic, reaching sexual maturity at three years of age. The females can produce between 50 and 250 eggs per season. The silver arawana are mouth brooders with the males having slightly offset jaws to accommodate developing eggs and young and incubate their fry in their mouths. Young are retained in the buccal cavity for a period of four to six weeks or until the yolk sac is absorbed (Henderson, P. 2002). Male silver arawana have a longer anal fin while females are slightly larger and broader, especially during spawning season. Silver arawana have a lifespan of between five and fifteen years. (Henderson, P. 2002).

Due to the value of the silver arawana and of the difficult nature of aquaculture for this species the male silver arawana is targeted by fishermen for the harvesting of the arawana fry. Unfortunately, most wild-caught juveniles are caught in a very brutal manner. Fishermen can recognize male Arawana with young in their mouth by their coloured cheek patches and swollen lower jaw bones. When such a male is spotted, fishermen attempt to sever its head. Severing the head prevents the male from killing the young by swallowing them, which is usually the reaction when the male is captured with a net. As the young flee the decapitated head, they are captured (Henderson, P. 2002).

There has been little success with breeding silver arawana in captivity due to their sheer size. Spawning has been observed in the wild around spring as floodwaters rise, the cheek spot of male Arawana turns bright pink. (Goulding 1990). Females are attracted to males with bright pink cheek spots, as this indicates that sperm is ripe. The female produces 50 to 250 eggs, which after fertilization, are taken into the protection of his mouth. The young hatch and remain in the mouth of the father. The yolk sac is used up in 2 or 3 weeks, after which, the male lets them out to feed on micro-organisms such as algae, tiny crustaceans, and insects. When danger approaches, the male's chin barbells are used to coax the young back into the safety of his mouth. After 4 to 6 weeks, the young are abandoned to fend for themselves (Henderson, P. 2002).

c) Physical Characteristics

These prehistoric-looking fish are covered with a layer of large, thick scales. The head is protected with bony plates, and the eyes are large. The mouth is hinge-like and faces toward the surface. The family Osteoglossidae emerged from the Jurassic age and appears to have changed little in the last 150 million years (Henderson, P. 2002). The species of this family have been used to support the continental drift theory since members from different areas closely resemble one another. It is believed that members of this family once existed in North America, Europe, and India (Henderson, P. 2002).

The pelvic fin of the silver arawana is a long, slender, sharp ray, while the pectoral fin is also very slender. These fins are white to silver in colour, but may darken with age. The mouth is hinge-like and can be opened widely. Two barbels, which range in colour from black to blue to green to red, are located on the lower jaw. The body colour ranges depending on the sex, age, and habitat of the individual. Usually the arawana is white with a silvery iridescence, but is often pink with rainbow iridescence (Henderson, P. 2002). The pinkish fish are often referred to as the Rainbow or Salmon Arawana. The arawana has two large black spots that fade with age. The first is located in front of the gill cover and can only be seen on young individuals. The second is located behind the gill cover and is dark black with a copper coloured mark located next to it. The eyes are large and dark. Silver arawana measuring 152 cm have been caught by fishermen in the Amazon Basin, although the arawana rarely exceeds 110 cm in captivity (Henderson, P. 2002). Arawana have an average body mass of 4600g, for specimens around the 110-120cm mark. (IGFA 2001).

Chapter
7

Similar Assessments Completed on the Species

There are no other similar assessments completed on these species of which the applicants are aware.

Chapter
8

Other Legislative Controls on the Species

Legislative controls

Section 89 of the Queensland Fisheries Act 1994 states

'A person must not unlawfully -

- a) Bring noxious fisheries resources, or cause noxious fisheries resources to be brought, into Queensland; or
- b) Possess, rear, sell or buy noxious fisheries resources; or
- c) Release noxious fisheries resources, or cause noxious fisheries resources to be placed or released, into Queensland waters.'

Section 25D of the Fisheries Regulation 1995 states

'The fish stated in schedule 5A, or a hybrid of the species with another species of the fish, are noxious fisheries resources.'

Section 81 of the Fisheries Regulation 1995 states

'A person may do the following things involving noxious fisheries resources only if the person holds an authority for the purpose -

- a) Bring them or cause them to be brought into Queensland;
- b) Possess, rear, sell or buy them;
- c) Release them, or cause them to be released, into Queensland waters.'

Schedule 5A of the Fisheries Regulations 1995 states the declared noxious fish in Queensland, which in the case of the red bellied piranha is in the category of 'fish of the family Serrasalminidae: subfamilies Myleinae and Serrasalminae or Family Characidae: subfamily Serrasalminae other than Metynnis spp and Myleus rubripinnis.'

In the case of the silver arawana the following legislation applies:

Section 90 of the Fisheries Act 1994 states:

'A person must not unlawfully -

- 1) a) bring nonindigenous fisheries resources, or cause nonindigenous fisheries resources to be brought, into Queensland; or

- 2) b) possess, rear, sell or buy nonindigenous fisheries resources; or
- c) Release nonindigenous fisheries resources, or cause nonindigenous fisheries resources to be placed or released, into Queensland waters.

2) Subsections (1)(a) and (b) do not apply to nonindigenous fisheries resources prescribed under a regulation or management plan.'

Section 80 of the Fisheries Regulation 1995 states:

'(1) A person may do the following things involving noxious fisheries resources only if the person holds an authority for the purpose -

- a) Bring them or cause them to be brought into Queensland;
- b) Possess, rear, sell or buy them;
- c) Release them, or cause them to be released, into Queensland waters.'

2) Subsections (1)(a) and (b) do not apply to nonindigenous fisheries resources mentioned in schedule 6 if the fisheries resources are released into waters other than waters on unallocated State land and are kept in a way preventing their escape into other waters.'

Schedule 6 of the Fisheries Regulation 1995 lists the fish that may be kept without an authority. Arawana is not in this schedule, therefore an authority is required.

2. Victorian Fisheries Act 1995

Act No. 92/1995

Division 2-Noxious Aquatic Species

75. Declaration of noxious aquatic species

(1) The Governor in Council may, by Order in Council, declare any aquatic species to be noxious. (2) A declaration cannot be made under sub-section

(2) A declaration cannot be made under sub-section (1) in respect of –

- (a) protected aquatic biota; or
- (b) protected wildlife, notable wildlife or endangered wildlife under the Wildlife Act 1975; or
- (c) protected flora or part of a taxon or community listed under the Flora and Fauna

Guarantee Act 1988.

- (3) A declaration under sub-section {1}
 - (a) may apply to any species of aquatic flora or fauna (whether alive or dead) specified in the declaration, other than mammals, reptiles, amphibians or birds;
 - (b) may apply to all, or a specified part, of Victoria;
 - (c) comes into operation on the date the Order in Council is published in the Government Gazette or any later date specified in the declaration as the date of commencement.
- (4) A declaration is a subordinate instrument for the purposes of the Interpretation of Legislation Act 1984.
- (5) The Governor in Council may at any time, by Order in Council, amend or revoke any Order made under sub-section (1).

76. Offences concerning prohibited noxious aquatic species

Unless authorised under this Act, a person must not bring into Victoria or take, hatch, keep, possess, sell, transport, put into any container or release into protected waters any aquatic species that is declared to be noxious under section 75.

Penalty: First offence: 100 penalty points
 Second offence: 200 penalty points

81. Noxious aquatic species permits

- (1) The Secretary may issue a noxious aquatic species permit to a person authorising the person to do anything that is prohibited by section 76.
- (2) In considering whether to issue a permit, the Secretary must have regard to the welfare of any relevant fishery or aquatic ecosystem.
- (3) The Secretary
 - (a) must not issue a permit if the Secretary considers that
 - (i) the applicant does not satisfy the relevant eligibility criteria; or
 - (ii) the issue of the permit would be inconsistent with the relevant management plan or if there is no relevant management plan, would be harmful to the welfare of any relevant fishery or aquatic ecosystem;
 - (iii) the permit is sought for a purpose other than a scientific, research, fisheries management, aquaculture or other purpose specified by the regulations;

(b) may refuse to issue a permit if the applicant has been convicted of an offence under this Act, the Fisheries Act 1968, the Catchment and Land Protection Act 1994, the Vermin and Noxious Weeds Act 1958, the Wildlife Act 1975 or the Flora and Fauna Guarantee Act 1988 or a law of the Commonwealth or of another State or of a Territory that corresponds to any of those Acts.

- (4) If a person kept a noxious aquatic species immediately before the commencement of this section, the person may continue to keep it
- (a) if the person does not apply for a permit within 90 days after that commencement, until the end of that period of 90 days; or
 - (b) if the person applies for that permit during that period, until the application is determined.
- (5) A permit
- (a) unless revoked, continues in force for a period not exceeding 3 years as is specified in the permit by the Secretary; and
 - (b) applies to the category of noxious aquatic species specified in the permit; and
 - (c) is not transferable.
- (6) A permit is not renewable, but the Secretary may issue another permit to a person whose permit is about to expire or who has previously held a permit.

82. Revocation of permit

- (1) The Secretary may revoke a noxious aquatic species permit at any time by serving notice of the revocation on the holder of the permit.
- (2). Before revoking a permit, the Secretary must
- (a) give notice of the proposed revocation to the permit holder, specifying
 - (i) the grounds for the proposed revocation; and
 - (ii) that the person may make written or oral submissions about the matter within 28 days after the date of service of the notice;
 - (b) consider any submissions made in accordance with paragraph (a).

83. Authorisation

- (1) The Governor in Council may by Order in Council authorise the transporting, putting into containers or releasing into protected waters of a noxious aquatic species.
- (2) An authorisation under sub-section (1)
- (a) may apply to a specified taxon;
 - (b) may apply to a specified activity;

- (c) may apply to a specified class of person;
- (d) may apply to all protected waters or to specified waters or areas;
- (e) may apply for such period as is specified;
- (f) is subject to such conditions as are specified.

84. Notice to be given of location of noxious aquatic species

Any person who knowingly comes into possession of, or is in any way concerned in the ownership of, any noxious aquatic species must forthwith in writing give or cause to be given to the Secretary information as to the existence and location of that noxious aquatic species.

Penalty: 40 penalty units.

85. Seizure and removal of noxious aquatic species

- (1) An authorised officer may at any time and at any place in Victoria seize and remove any noxious aquatic species from any protected waters.
- (2) An authorised officer may by written notice served on any person require that person to take specified measures to destroy any noxious aquatic species in the possession of that person and to produce evidence of that destruction within a specified period.
- (3) If a person fails to comply with a notice served on that person under sub-section (1), the Secretary may recover any costs or expenses reasonably incurred by an authorised officer in carrying out the measures specified in the notice as a debt due to the Secretary in any court of competent jurisdiction.
- (4) If the Secretary is satisfied that
 - (a) a noxious aquatic species exists in any protected waters; and
 - (b) it is not practicable for that species to be seized and removedthe Secretary may order in writing that the species be destroyed even though other fish or aquatic species may also be destroyed.
- (5) An order under sub-section (4) may
 - (a) specify the method, equipment, chemicals or poison to be used in the destruction of the noxious aquatic species; and
 - (b) specify any person authorised to carry out the destruction.

86. Prevention of spread of aquatic noxious species

- If the Secretary is satisfied that
- (a) a noxious aquatic species has become established in any protected waters; and
 - (b) there is no practical means of killing or removing the noxious aquatic species

the Secretary may take any action necessary to delay or prevent the spread of the noxious aquatic species from the waters in which it is established to other waters.

87. No penalty if noxious aquatic species specimen is killed immediately

Despite anything to the contrary in this Division, if a person who takes any thing that is declared to be a noxious aquatic species immediately kills it, the person is not liable to any penalty under this Division.

List of Declared Noxious Aquatic Species in Victoria as Declared under the Fisheries Act 1995 (last ammendment 28/12/2000)

Scientific Names	Common Name
Acestorhynchus microlepis	Pike Salmon (Hervey, Hems)
Alfaro amazonus	Amazon Livebearer
Alfaro cultratus	Knifetail Livebearer
Anabas ansorgi	Poss. syn. Ctenopoma ansorgi
Anabas oxyrhynchus	Poss. syn. Ctenopoma oxyrhynchus
Apeites quadracus	Four spined stickleback
Asterias amurensis	Northern Pacific seastar
Callichrous bimaculatus	
Channa fasciata	Snakehead
Cherax quadricarinatus	Red claw crayfish
Cherax tenuimanus	Marron
Chrosomus erythrogaster	Red-bellied Dace
Cichlasoma tetracanthus	Cuban Cichild
Cichlasoma urophthalmus	
Clarias batrachus	Walking catfish
Clarias Lazera	Clara
Colossoma nigripinnis	
Cretochanes affinis	
Cretochanes	

melanurus surinamensis	
Crenicichla dorsocellata	
Crenicichla lepidota	Pike Cichlid
Crenicichla	
notophthalmus	
Crenicichla saxatilis	Ring-tailed Pike Cichlid
Ctenopharyneodon idellus	Grass Carp
Ctenopoma ansorgi	
Ctenopoma argentoventer	Silver-bellied Climbing Perch
Ctenopoma congieum	
Ctenopoma fasciolatus	Striped Climbing Perch
Ctenopoma nanum	Dwarf Climbing Perch
Ctenopoma ocellata	
Ctenopoma oxyrhynchus	
Cyprinus carpio (Linnaeus)	Common Carp
Dianema longibarbus	
Dorichthys fluviatilis	
Elassoma evergladei	Pigmy Sunfish
Elassoma zonata	
Eleotris lebretonis	
Enneacanthus gloriosus	
Esox lucius	Pike
Eucalia inconstans	Brook Stickleback
Eutropius niloticus	
Fundulus chrysotus	Golden-ear
Gambusia affinis holbrooki	Common Gambusia. Mosquito fish
Gambusia affinis holbrooki	Black Gambusia
Gambusia domincensis	San Domingo Gambusia
Gambusia manni	Nassau Gambusia
Gambusia nicaraguensis	Nicaraguan Gambusia
Gambusia patruelis	Silver Gambusia
Gambusia punctata	Blue or Spotted Gambusia
Gasterosteus aculeatus	Three-spined

Hemichromis fasciatus	Stickleback
Herichthys	Banded Jewelfish
cyanoguttatus	Texas Cichlid
Heteropneustes fossils	
Hollandichthys	
multifasciatus	
Hydrocynus goliath	African Tiger Fish
Hydrocynus maculatus	
Irvineia voltoe	
Knodus savannensis	
Lamprologus leleupi	
Lates nilotica	Nile Perch
Lebiasina bimaculata	
Lepomis auritus	
Lepomis gibbosus	
Lepomis macrochirus	Bluegill
Lepomis megalotis	
Leptolebias	
aureoguttatus	
Leptolebias marmoratus	
Leptolebias minimus	
Leptolebias opalescens	
Leptolebias splendens	
Malapterurus electricus	Electric Catfish
Micropterus dolomieu	Small-mouthed Bass
Micropterus punctulatus	Spotted Bass
Micropterus salmoides	Large-mouthed Bass
Misgurnus	Weather loach
anguillicaudatus	
Ompok bimaculatus	
Ophiocephalus	
obscurus	
Ophiocephalus	
senegalensis	
Osteoglossum	South American
bicirrhosum	Arowana
Oxyeiotris marmorata	
Parauchenoglanis	
macrostoma	
Phago maculatus	Pike Characin (Sterba)
Pimelodus clarias	
Polypterus enlicheri	

<i>Polypterus retropinnis</i>	
<i>Pomoxis</i> spp.	Crappie
<i>Protopterus annectens</i>	
<i>Pseudoziphophorus bimaculatus</i>	
<i>Pungasinodon gigas</i>	Mekong River Giant Catfish
<i>Pungitius pungitius</i>	Nine-spined Stickleback
<i>Puntius setevimensis</i>	Algerian Barb
<i>Schilbe mystus</i>	
<i>Sabella spallanzanii</i>	Sabella worm (European fan worm)
<i>Serrasalmus</i> spp.	Piranhas
<i>Serrasalmus nattereri</i>	Piranha
<i>Serrasalmus rhombous</i>	Spotted Piranha
<i>Sorubim lima</i>	Spatula Loach
<i>Spartina anglica</i>	Rice grass
<i>Spartina xtasmanica</i>	Rice grass
<i>Tilapia busumana</i>	
<i>Tilapia dolloi</i>	Congo Mouthbreeder
<i>Tilapia heudeloti</i>	Senegal Mouthbreeder
<i>Tilapia mactocephala</i>	Black-chinned Mouthbreeder
<i>Tilapia melanopleura</i>	
<i>Tilapia mossambica</i>	Mozambique Mouthbreeder
<i>Tilapia natalensis</i>	Natal Mouthbreeder
<i>Tilapia nilotica</i>	Nile Mouthbreeder
<i>Tilapia ovalis</i>	
<i>Tilapia sparrmanni</i>	Sparrman's Mouthbreeder
<i>Tilapia zilli</i>	Zill's Mouthbreeder
<i>Tomerurus gracilis</i>	
Trichomycteridae family	Parasitic catfishes
<i>Valencia hispanica</i>	Spanish Fundulus
<i>Xiphophorus pygmaeus</i>	

QUARANTINE LEGISLATION

- Quarantine Act 1908
- Quarantine Proclamation 1998

Live fish will only be brought in under permit issued by the director of Australian quarantine. A permit will only be made available if the importation of this species is allowed under environmental legislation. Underwater World will comply fully with the requirements set out by AQIS if an import permit is granted.

ENVIRONMENTAL LEGISLATION

- The Environment Protection and Biodiversity Conservation Act 1999
- The Environment Protection And Biodiversity Conservation Amendment (Wildlife Protection) Act 2001

The purpose of this report is to have the specie *Osteoglossum bicirrhosum* added to the Environment Protection and Biodiversity Conservation Act 1999 – “List of Specimens Taken to be Suitable for Live Import”. It is proposed that a special permit be issued for Underwater World to keep this species for the purposes of public display, in a bio-secure facility, which must meet the requirements set out by AQIS and Biosecurity Australia.

All requirements as laid out by Biosecurity and AQIS will have to be met for the importation of Silver Arawana. Only high security facilities such as Underwater World would be expected to be granted permission to import silver arawana for the sole purpose of public display.

Criteria for the design of the display facility will need to take the following key points into consideration.

1. Animal requirements.

- Physiological requirements.
- Psychological requirements.
- Reproductive requirements.
- Group behavioural requirements.

2. Husbandry management requirements.

- Access for feeding and cleaning by approved staff members of the biosecure facility.
- Access for observation by staff and veterinary input.
- Provision of space for animal management.
- Off exhibit space for veterinary and husbandry activities.
- Off exhibit space for managing breeding program.
- Ability to isolate individuals or entire group in a bio-secure manner.

3. Visitor Interaction.

- Ability to observe the animals in a non-threatening manner.
- Ability to listen to keeper presentations – gain an understanding of the role these animals play in the environments, threats to the environment, gain an appreciation for the effort that goes into caring for and managing these animals zoos and aquaria worldwide.

Key Points of Design.

- Imported fish are not for general distribution throughout Australia.
- Imported fish and their progeny are kept in an indoor enclosure for the period of their natural lives.
- Imported fish are not permitted contact with “Australian wildlife”.
- Water leaving the exhibit will be treated as per AQIS requirements.
- Facilities approved by AQIS/ Biosecurity Australia will be instructed to follow basic quarantine and containment practices, clothing changes and footbaths, entry to the facility via an ante room as deemed necessary by AQIS and Biosecurity Australia.
- The level of bio-containment achieved in design of the display facility will be negotiated between AQIS / Biosecurity Australia and the approved facility.

Overall Analysis of Impact

As all appropriate efforts will be made to reduce any possibility of these animals being released from this facility to Australian waterways the risk of establishment will be very low. These efforts include high security and Biosecurity arrangements at the holding facility as set out by Biosecurity Australia and AQIS.

A further factor to consider is that this species already exists in Australia and has done so for many years in private collections; they have not been recorded in wild waterways as this species is of value to collectors.

If this species got into the wild and establish itself in Australian Waterways the potential environmental damage of the Arawana species may include but is not limited to:

- Out competing local fish species for food requirements
- Predating on local fish species
- Out competing local fish species for habitat requirements.
- Upsetting and placing pressure on natural food chain events.
- The potential to harbour and or transfer fish bourn disease.

Due to the poor record of introduced exotic pests to Australia and of the financial burden it has placed on Australia to rid these pests, Underwater World would be seen in very poor light and would be detrimental to financial operations of this organisation. Underwater World is also committed to public education, and that release of a noxious species from our facility would provide very negative public image, and would not be in our interest. In fact our interest would be to work with 'Department for the Environment and Heritage', AQIS, Biosecurity Australia and the State Government of Queensland in educating the general public of our Marine and Aquatic ecosystems and the dangers of noxious species in our country.

1. Likelihood of release

- All appropriate efforts will be made to reduce the possibility of these animals being released from a designated approved facility to Australian waterways, including maintaining a secure facility by specialist staff trained in exotic fish husbandry.
- Security arrangements as approved by AQIS at the facility would have to be implemented to reduce the risk of the removal of fish from a designated approved facility.
- The black market dollar value of these animals would make it unlikely that if someone was to remove an animal from an approved facility that it would be released into the aquatic environment. It would most likely be kept in a closed environment (aquarium or private collection) for the duration of its life.
- The presumption of release to a natural waterway would be deemed more likely from a private collection of illegally obtained Arawana and not from a secure facility approved by Biosecurity Australia.
- Silver Arawana are currently held in private aquariums within Australia, but despite this, they have not been recorded in natural waterways (Biosecurity Aus. pers. comm.).

2. Likelihood of establishment

Scenario 1 – Fish removed and maintained in a private aquarium (closed system)

- Arawana are difficult to breed in captivity due to their sheer size, requiring substantial aquarium / aquaculture facilities (Goulding, M.1990).
- The aquarium systems to house silver Arawana will be secured and operated in accordance with AQIS imported noxious species protocol. The Arawana species approved for import to approved Biosecurity facilities in Australia would see out their existence within this closed system.
- The financial value of the silver Arawana on the black market would reduce the likelihood of the fish being released to natural waterways.

- There would be a very low risk of establishment within Australian waterways due to the specific water quality parameters required of the Arawana species (Henderson, P. 2002) (see Ch5&6 sect.4).

Scenario 2 – Fish released into an open waterway (river, lake)

- Currently there are no recorded cases of silver Arawana being found in natural waterways within Australia (Biosecurity Aus. pers. comm.).
- The survival success of Arawana released into an open waterway would require the release of more than one animal and of opposite gender to undergo courtship and mating.
- The appropriate water quality parameters would have to be present to induce mating behaviour and courtship.
- The most likely way for fish to become established would be for larger number of animals to be released, in the appropriate climatic area.
- Feral introductions of Arawana species in the United States of America have had an unknown impact as single fish introductions have only occurred on two separate occasions in the past 30 years (see pest history).
- The silver Arawana is tolerant to low dissolved oxygen levels, allowing the species to tolerate aquatic environments low in dissolved oxygen (Axelrod, H.R. 1985).
- The silver Arawana is omnivorous, which may allow introductions of silver Arawana to accommodate more successfully to open waterway introductions. The silver Arawana may establish as a predacious species of native fish and invertebrates if introduced to natural waterways.

3. Consequence of release and establishment

Scenario 1 – negligible consequences

- From the experiences of single fish introductions in the United States of America, the impacts to aquatic flora and fauna of that region were unknown but presumed to be negligible due to the inability of the animal to reproduce (US ESA 2003).
- A single animal release to the Australian waterways would be presumed to have minimal impacts on the surrounding aquatic biota.

Scenario 2 – consequences would be more severe.

- A severe consequence would be the survivorship and reproductive capacity of the Arawana species in Australian waterways. The fish would be limited to certain water parameter tolerances (see Ch 5&6 sect. 4); however the adaptability of the Arawana species to these tolerances is unexplored.
- Arawana can jump from water to eat insects, birds and even bats from low branches (Goulding, 1990). This suggests a possible threat not only to aquatic but terrestrial species.

Australia would be predominately unsuitable for establishment of Silver Arawana due to the temperature intolerances, it would be extremely unlikely that arawana could survive, let alone breed successfully in the surrounding environment. However there are certain climatic areas in Northern Queensland, Northern territory and Northern Western Australia where Silver Arawana could inhabit, therefore it is acknowledged there is potential for establishment. Further investigation suggests that environmental triggers that induce breeding are not relevant to Australia's northern regions, such as rising spring tides. (See Ch 5&6 4b), suggesting the chances of long term survival of this species to be rare. Another confounding point is that the areas in northern Australia where climate is most suitable, there is sparse population of people thus the risk of release into the environment is minimal.

Attachments

Submissions to the Department of the Environment and Australia regarding the amendment of the List of specimens for live import.

- 1 P Finglas, General Manager, Department of Primary Industries. 21/8/02.
- 2 Dr. Leon Loftus, westbusiness.com.au. 13/8/02

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Queensland
Government

Department of
Primary Industries

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21 August 2002

Director
Wildlife Science and Management
Environment Australia
GPO Box 787
CANBERRA ACT 2601

① Jane

② Melissa

26.8.02

Dear Director

Draft Terms of Reference for a report assessing the impact of importing live Red-bellied piranha (*Pygocentrus nattereri*), Arapaima (*Arapaima gigas*), Arawana (*Osteoglossum bicirrhosum*), Black Arawana (*Osteoglossum ferreirai*), and Ocellate River Stingrays (*Potamotrygon motoro*).

Thank you for the opportunity to comment on the draft Terms of Reference [ToRs]. The Queensland Fisheries Service (QFS) has concerns with some aspects of these terms of reference and these are outlined below:

1. Determining invasion success and the consequences of establishment of non-native fish are notoriously difficult. Therefore, the ToRs should be more specific in terms of the criteria and possible processes used to assess these fish. There is a need for consistency between this and future assessments and for that reason the criteria and process should be similar in each instance. I have attached a copy of the proposed process developed by QFS to assess the status of fish species for addition to the Queensland noxious fish list.
2. The proposal indicates that if the application is successful the fish will be kept in Queensland. Therefore it is important that the specific climatic conditions present in Queensland and their implications are acknowledged and referred to when assessing the likelihood of the species becoming established.
3. There does not seem to be a specific approach or timetable set out for consultation or even completion of the report. QFS have a number of grave concerns about the proposal and therefore requests input into the final decision about the suitability of these species for import.
4. ToR nine should refer specifically to security and disposal arrangements.

Queensland Fisheries Service

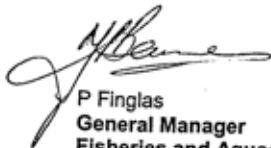
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a/v_bo/f_fa/m/mackenzie/noxious fish/noxious list committee/response to piranha proposal/jb.doc

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RecFind 02/11513 (RMA5)
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For Queensland waters and the native fish communities, the risks of escape and establishment are very high. These risks outweigh any benefits, educational, scientific or economic, that importing of some of the proposed species may bring.

Yours sincerely



P Finglas
General Manager
Fisheries and Aquaculture Development
Department of Primary Industries
celebrating 2002 Year of the Outback

Att: (1)

PROCESS FOR ASSESSING POSSIBLE NOXIOUS FISH

The noxious fish list is being moved from the *Fisheries (Freshwater) Management Plan 1999* to the *Fisheries Regulations 1995*. This will mean that the legislation will apply to fish listed as noxious regardless of whether they are found in freshwater or within the tidal zone. The noxious list has also been amended to reflect current taxonomy and the references have been updated. These changes were considered in consultation with key stakeholder groups.

Stakeholders have indicated that the current list does not sufficiently reflect the number of fish with features that may cause environmental, social and economic damage to Queensland and its fisheries resources. Therefore it was requested that the Queensland Fisheries Service (QFS), in consultation with stakeholders, develop a process to expand the noxious fish list. Stakeholders also indicated that the current list of non-indigenous fisheries resources is unenforceable in its current state and therefore the noxious list has to be more comprehensive.

The process was developed in conjunction with the following representatives of key stakeholder groups:

- Ross Patrick – The Pet Industry Joint Association, the peak representative body of the aquarium industry.
- Jeff Johnson – Curator of Ichthyology, Queensland Museum.
- Bruce Hansen – President of the Australian and New Guinea Native Fishes Association, representing aquarium hobbyists.
- Robyn Stevenson – Australian Quarantine Inspection Service (AQIS).

The following QFS officers were also involved in developing the process:

- Debbie Muller, Queensland Boating and Fisheries Patrol.
- Kerrod Beattie, Aquaculture, QFS.
- Rachel Mackenzie, Freshwater, QFS.

This group is now known as the Noxious Fish List Assessment Committee (the committee) and represents a balance between the aquarium trade, the hobby, environmental/scientific interests, AQIS and QFS.

THE PROCESS

1. Members of the committee consult with their stakeholders and develop a list of fish to be assessed.
2. These lists are sent to QFS and duplicates removed.
3. Lists are sent back to the groups who nominated them, who then answer the questions set out in the live fish assessment protocol for each nominated species or species groups. The live fish assessment protocol is based on a similar protocol used by Environment Australia (see attachment). This protocol identifies the key aspects of a fish's behaviour, life cycle, diet, disease status, habitat preferences and morphology

Action Officer Peter Jackson Our Ref: PJD/K Facsimile 3224 2805 RecFind 02/10772 Page 1
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which could result in it causing environmental, social and economic damage to Queensland and its fisheries resources.

4. Filled in protocols are returned to QFS for distribution to other committee members for fact checking.
5. The committee will meet and discuss each filled in protocol and determine if a fish has sufficient potential for impact to be listed as noxious. If there is dissension, a vote can be taken. Rachel Mackenzie and Debbie Muller are non-voting members of the committee.
6. A list of fish considered by the committee to be "noxious" will be compiled and distributed to relevant stakeholder groups, placed on Fishweb and advertised in the local media to ensure that all member of the community have an opportunity to comment and provide additional information. This list will also outline the rationale for the listing. Members of the public will also have the opportunity to nominate fish to be included on the list by filling in the protocol. Fish listed as legal imports under the *Environmental Protection of Biodiversity Conservation Act 1999* will only be assessed if it can be proved that they will cause specific harm to Queensland as they have already been assessed for their suitability for importing into Australia.
7. Public comments will be received and assessed by the committee.
8. The revised list will be submitted to the QFS legal unit to determine if any of the proposed listings will require a Regulatory Impact Statement and the appropriate legal process will be followed.

The assessment process is ultimately subjective as there is insufficient information about the potential impacts of fish or their likelihood of invasion to develop a quantitative risk assessment approach. It is a combination of characteristics that will determine if a fish has the potential to be noxious and, based on the precautionary principle, lack of scientific certainty about the likelihood of risk should not preclude a fish being included on the noxious fish list. According to an independent report commissioned by AQIS in 1999, any fish that can form a self-maintaining population should be considered a serious threat to native aquatic ecosystems. For the purposes of this process, both the likelihood of invasion success and potential impacts if invasion does occur will be considered. However, in some cases the fish may be considered to:

- (a) have a high likelihood of establishing but be relatively benign; or
- (b) be unlikely to establish but have very significant impacts if released into the wild.

The committee considers that both these situations would warrant a fish being listed as noxious.

The committee considers that all fisheries resources in both marine and freshwater should be eligible for inclusion on the list.



Melissa Giese - Re: New fish species nominated for inclusion on EPBC Act liveimport list

From: "Dr Leon Loftus" <lloftus@westbusiness.com.au>
To: "Melissa Giese" <Melissa.Giese@ea.gov.au>
Date: 13/08/2002 5:01 PM
Subject: Re: New fish species nominated for inclusion on EPBC Act liveimport list

Ms Giese,
I believe that the importation of these fish is desirable.
However, I would place conditions upon the importation.

The fish are all endangered species. Each is becoming rare in its native habitat. It appears that each can be bred in captivity. Published data from Hawaii suggests that this is quite simple for at least some of the species. I would support the importation subject to the requirements that the importer obtains a sufficient number of each to be able to breed each species. In addition I would make it a requirement that the fish be bred, and their young protected. Seaworld has the resources and staff to be able to fulfil these 3 conditions.

A further concern is that these fish are each highly territorial predators. Given this is correct, I am concerned that keeping them together in one tank may not be feasible when they wish to breed. Three species are mouth brooders. These fish may be extensively stressed and fail as parents if placed in close physical proximity to others. I notice that Arrowanas need a large area, if breeding is to be successful. The fish to be imported can grow very large, and therefore they may need to be kept separate.

The conditions that they be bred might be best met by requiring that the fish be kept in a display area as discussed in the application, plus it be required that some of each species be kept in separate breeding facilities to ensure against total losses, and to facilitate breeding and survival of the young.

If you have any questions please contact me.

LEON....

