ANALYSIS OF THE ORNAMENTAL FISH EXPORTS FROM THE AMAZON STATE, BRAZIL*

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ABSTRACT

The updated status of the ornamental fish trade from the Amazonas state was analyzed between the years of 2006-2015 (IBAMA database). The trade of ornamental fish from Amazonas State mainly consists of wild species. A total of 142,552,253 specimens were exported during the studied period. Sales plummeted since 2006 from 26,075,241 specimens exported to 2,729,846 specimens in 2015 (Jan-Jul). Between 2006 and 2015, a total of US$ 23.0 million in revenue was generated from fish exports destined to 35 countries. Germany, Taiwan, USA and Japan accounted for 75.5% of the volume and 76.7% of the value exported. During this time 375 species were exported, included Paracheirodon axelrodi, P. simulans, Hemigrammus bleheri, Otocinclus affinis and O. hoppei that together represented 84.5% of exports. Thirty of them are not on the list of Brazilian Institute of the Environment and Renewable Natural Resources - IBAMA species released for export, and six are currently on the list of endangered fauna of Brazil: Hopliancistrus josselmai, Parancistrus nudventris, Peckoltia compta, Scobinancistrus auratus and S. pariolispos. The collection of this information can help producers, managers and environmentalists in the elaboration of the political policies to establish regulations to govern the trade.

Keywords: aquarium fish; export; monitoring; sustainability; Amazon basin.

INTRODUCTION

Ornamental fish trade started during the 1950’s (Leite and Zuanon, 1991), becoming in 2014 a global industry of the US$ 10 billion, while the entire industry including plants, accessories, aquarium, feed, and drugs is estimated to be worth US$ 18-20 billion annually in 125 countries (Dey, 2016). In 2010, global exports of ornamental fish were estimated in 2 billion live ornamental fish that were moved annually worldwide (Monticini, 2010). That same year proximally 7.2 million homes in the United States
According to ornamental fishermen (piabeiros) the middle Brazilian customs contributed to this decline (Benzaken et al., 2015). In South America the majority of species traded are wild-caught fish from the Amazon (Moreau and Coomes, 2007; Anjos et al., 2009a). The middlemen is the communication channel between the piabeiros and the export companies that buy the fish and resell it with a 20% profit (Prang, 2001; 2007). This caused these fishermen to start working on sport fishing and commercial fisheries, which have larger negative impacts on fish stocks.

Most wild-caught fish were from the middle Negro River Region, supplying 90% of the exports and generating income to the municipalities of Barcelos, Santa Isabel do Rio Negro and São Gabriel do Rio Negro. Wild-caught fish was the main source of income for these municipalities (Anjos et al., 2009a) generating 10,000 indirect and direct jobs to around 1,600 families of the region (Prang, 1996; Chao et al., 2001; Prang and Thomé-Souza, 2003; Prang, 2007), although that number has declined in recent years (Inomata and Freitas, 2015; Ladislau et al., 2020). The market is organized in a way that the main players are the fisherman (“piabeiros”), usually older, who capture only what the export companies request via the middleman (patrones). The middleman is the communication channel between the piabeiros and the export companies that buy the fish and resell it with a 20% profit (Prang, 2001; 2007). The Paracheirodon axelrodi was the number one export, representing 70% of total exports. Other exported species include Hemigrammus bleheri, Otocinclus flexilis, Carnegiella strigata, Hynphemobrycon socolofi, O. affinis, Corydoras reticulatus, C. agassizii, C. schwartz, C. julii, Peckoltiaittate and Symphysodon discus (Anjos et al., 2009a).

According to data from the Department of External Commerce-SECEX, the number of commercialized fish declined drastically in 2008 caused by the 2008 economic crisis that hit Brazil (Benzaken et al., 2015). This sharp drop in sales resulted in the closure of the biggest Brazilian export company that was responsible for 51% of sales (Anjos et al., 2009a; Benzaken et al., 2015). In addition to the economic crisis, other factors such as freight prices, which are one of the highest in the world from Manaus to the export companies (piabeiros) the middleman (“intermediário”) was paying very little for the fish the caught (mainly the Paracheirodon axelrodi), the fisherman thought that the trade came to a halt because the middle men did not want to pay them (Anjos et al., 2009b). However, the true reason was that competition with neighboring countries (e.g. Peru and Colombia) with less bureaucratic systems, and fewer restrictions on which species can be exported, destroyed Brazilian Amazonian market (Moreau and Coomes, 2007; Anjos et al., 2009b). Additionally, international pressure to stop the commerce of wild-caught fish intensified.

This paper is a thorough evaluation of wild-caught ornamental fish trade from the Amazonas State between the years 2006 a 2015. The main objective was to evaluate the diversity of species exported, assess the value and quantity exported and identify receiving countries. This contributes to a better understanding of the market, serving to assist public policy and so that lawmakers can produce better lists of species allowed for export.

MATERIAL AND METHODS

The data was collected from the Brazilian Institute of the Environment and Renewable Natural Resources – IBAMA export control for ornamental fishes database (COREP/CGFAP/DBFLO/IBAMA). The authors were given authorization from this department to produce this article. The database included the scientific name, quantity of fish exported, state of origin, authorization number, price per fish and country of destiny. Data from 2006 until 2015 was analyzed and the total of fish exported per species and the amount collected (until July 2015) in US dollars were verified. The analysis was made on descriptive statistics producing tables and graphs. The species list presented herein follows the taxonomic classification of Betancur et al. (2017), with the orders arranged following the systematic/phylogenetic organization of the latter, whereas families, genera and species were presented in alphabetical order. Some scientific names had to be corrected and checked for duplicates (Reis et al., 2003; Buckup et al., 2007; Beltrão et al., 2019). Some species Loricariidae are described throughout the text with the codes “L” as they are known internationally (Schraml and Schäfer, 2004; 2020).

RESULTS

Aquarium fish exports

Between 2006 and July 2015, more 142,552,253 fishes from 375 species, 8 Order and 34 families were exported from the Amazonas State for ornamental trade. Characiformes and Siluriformes were the two orders most exported, representing...
82.6% (117,808,641) and 16.0% (22,914,367) of exports, respectively. The Cichliformes, represented 1.2% of total export. The order less exported the least was the such as Cyprinodontiformes, Myliobatiformes, Tetraodontiformes, Gymnotiformes and Pleuronectiformes corresponded to only 0.04% of total exports (Table 1).

Table 1. List of species, the total number of specimens and the percentage of total export volume between 2006 and 2015 from the Amazonas state, Brazil (2015* = database of Jan-Jul).

| ORDER/Family/Specie | 2006-2015* | %   | ORDER/Family/Specie | 2006-2015* | %   |
|---------------------|------------|-----|---------------------|------------|-----|
| **MYLIOBATIFORMES** |            |     | **SILURIFORMES** (Cont.) |           |     |
| Potamotrygonidae    |            |     | Doradidae           |            |     |
| Potamotrygon cf. henlei | 5         | <0.01 | Acanthodoras cataphractus | 241        | <0.01 |
| Potamotrygon cf. histrix | 6,399     | <0.01 | Acanthodoras spinosissimus | 6,565      | <0.01 |
| Potamotrygon leopoldi | 417       | <0.01 | Agamyxix pectinifrons | 100        | <0.01 |
| Potamotrygon motoro | 342        | <0.01 | Amblydoras affinis | 220        | <0.01 |
| Potamotrygon orbignyi | 32        | <0.01 | Amblydoras hancockii** | 5,314      | <0.01 |
| Potamotrygon shroedery | 21        | <0.01 | Hassar orestis | 115        | <0.01 |
| **CHARACIFORMES** |            |     | Hassar wilderi | 35         | <0.01 |
| Acestrorhynchidae   |            |     | Opisodoras ternetzi | 10         | <0.01 |
| Gnathocharax steindachneri | 220 | <0.01 | Platydoras armatulus | 57         | <0.01 |
| Hoplocharax goethei | 140        | <0.01 | Heptapteridae       |            |     |
| Anostomidae         |            |     | Pimelodella gracilis | 3,759      | <0.01 |
| Abramites hypselonotus | 466       | <0.01 | Loricaridae         |            |     |
| Anostomus anostomus | 4,398      | <0.01 | Acanthicus adonis | 447        | <0.01 |
| Anostomus ternetzi  | 8,671      | 0.01 | Acanthicus hystric | 33         | <0.01 |
| Leporinus agassizi  | 785        | <0.01 | Acestridium discus | 860        | <0.01 |
| Leporinus fasciatus | 16         | <0.01 | Ancistrus aquaobensis | 650       | <0.01 |
| Pseudanos gracilis | 46         | <0.01 | Ancistrus claro     | 15         | <0.01 |
| Pseudanos trimaculatus | 1,195     | <0.01 | Ancistrus dolichopterus | 45,836    | 0.03  |
| **Bryconidae**      |            |     | Ancistrus hoplogenys | 12,194     | 0.01  |
| Salminus maxillosus | 1,812      | <0.01 | Ancistrus multispinis | 150        | <0.01 |
| **Characidae**      |            |     | Ancistrus ranunculus | 16         | <0.01 |
| Aphyocharax anisitsi | 6,944      | <0.01 | Ancistrus sp. “L255” | 934        | <0.01 |
| Astyanax bimaculatus | 230       | <0.01 | Ancistrus spp.      | 242,987    | 0.17  |
| Astyanax fasciatus  | 890        | <0.01 | Baryancistrus chrysolomus | 12         | <0.01 |
| Brittanicthys axelrodi | 1,840     | <0.01 | Baryancistrus sp.   | 258,451    | 0.18  |
| Brittanicthys myersi | 8,198      | 0.01 | Baryancistrus sp. “L142” | 480        | <0.01 |
| Chalceus erythrurus  | 1,088      | <0.01 | Baryancistrus xanthellus | 900        | <0.01 |
| Charax condei       | 1,780      | <0.01 | Dekeyseria amazonica | 35         | <0.01 |
| Exodon paradoxus    | 20         | <0.01 | Dekeyseria brachyura | 563        | <0.01 |
| Gymnocorymbus ternetzi | 75        | <0.01 | Dekeyseria pulcher  | 1,103      | <0.01 |
| Hemigymnus belottii | 6,445      | <0.01 | Dekeyseria scaphirhyncha | 150        | <0.01 |
| Hemigymnus bleheri  | 7,178,906  | 5.04 | Farlowella amazona  | 768        | <0.01 |
| Hemigymnus elegans  | 320        | <0.01 | Farlowella nattereri | 80         | <0.01 |
| Hemigymnus marginatus | 59,690    | 0.04 | Farlowella sp.      | 6,503      | <0.01 |
| Hemigymnus occelifer | 7,701      | 0.01 | Hemiancistrus sabaji | 472        | <0.01 |
| Hemigymnus pulcher   | 3,320      | <0.01 | Hemiancistrus snethlageae | 120       | <0.01 |
| Hemigymnus rodwayi  | 14,948     | 0.01 | Hemiancistrus spilomma | 4          | <0.01 |
### Table 1. Continued...

| ORDER/Family/Specie | 2006-2015* | % | ORDER/Family/Specie | 2006-2015* | % |
|---------------------|------------|---|---------------------|------------|---|
| **CHARACIFORMES**   |            |   | **SILURIFORMES**    |            |   |
| (Cont.)             |            |   | (Cont.)             |            |   |
| Hemigrammus stictus| 20,249     | 0.01| Hopliancistrus tricornis| 4,115     | <0.01|
| Hemigrammus ulreyi  | 4,950      | <0.01| Hopliancistrus tricornis| 30        | <0.01|
| Hemigrammus unilineatus| 3,478    | <0.01| Hypancistrus inspector| 3,938     | <0.01|
| Hyphessobrycon aguilha| 320       | <0.01| Hypancistrus sp. “L004”| 2,267     | <0.01|
| Hyphessobrycon amandaе| 150       | <0.01| Hypancistrus sp. “L066”| 233       | <0.01|
| Hyphessobrycon bentosi| 90,295    | 0.06| Hypancistrus sp. “L136”| 1,825     | <0.01|
| Hyphessobrycon copelandi| 3,646    | <0.01| Hypancistrus sp. “L260”| 2,855     | <0.01|
| Hyphessobrycon erythrostigma| 100,153  | 0.07| Hypancistrus sp. “L262”| 26        | <0.01|
| Hyphessobrycon heterorhabdus| 1,620 | <0.01| Hypancistrus sp. “L333”| 377       | <0.01|
| Hyphessobrycon parvellus| 150       | <0.01| Hypostomus cochiliodon| 1,209     | <0.01|
| Hyphessobrycon pyrrhonotus| 6,750    | <0.01| Hypostomus soniae| 60        | <0.01|
| Hyphessobrycon socolofi| 200,469   | 0.14| Hypostomus sp.| 16,770 | 0.01|
| Hyphessobrycon sp.| 1,903,629 | 1.34| Leporacanthicus galaxias| 2,639     | <0.01|
| Hyphessobrycon takasei| 160       | <0.01| Leporacanthicus heterodon| 16        | <0.01|
| Inpaichthys kerri | 880        | <0.01| Leporacanthicus josalimai| 11,459    | 0.01|
| Moenkhausia affinis| 1,060      | <0.01| Loricaria lata| 169        | <0.01|
| Moenkhausia colletii| 13,005     | 0.01| Megalancistrus barrae| 109      | <0.01|
| Moenkhausia gracilima| 550       | <0.01| Megalancistrus parananus| 181       | <0.01|
| Moenkhausia hasemani| 200        | <0.01| Oligancistrus punctatissimus| 15,295   | 0.01|
| Moenkhausia intermedia| 3,022     | <0.01| Otocinclus affinis| 6,542,195 | 4.59|
| Moenkhausia lepidura| 4,506      | <0.01| Otocinclus flexilis| 12,615    | 0.01|
| Moenkhausia oligolepis| 164       | <0.01| Otocinclus hoppei| 4,011,196| 2.81|
| Moenkhausia sanctaeilmenae| 720      | <0.01| Otocinclus vittatus| 2,182,380| 1.53|
| Paracheirodon axelrodi| 92,050,816| 64.57| Panaque ambrustieri| 7,192  | 0.01|
| Paracheirodon simulans| 10,708,387| 7.51| Panaque sp. “L002”| 6,887  | <0.01|
| Petitella georgiae| 21,150     | 0.01| Panaque sp. “L271”| 3,498  | <0.01|
| Prionobrama filigera| 100        | <0.01| Panqolus sp. “L271”| 130    | <0.01|
| Roeboides descalvadensis| 19        | <0.01| Parancistrus aurantiacus| 6,111     | <0.01|
| Serrapinnus notomelas| 378        | <0.01| Parancistrus nudiventris| 130    | <0.01|
| Thayeria boehlkei| 50        | <0.01| Parotocinclus jumbo| 10,890 | 0.01|
| Tucanoicthys tucano| 59,707    | 0.04| Parotocinclus maculicauda| 58,476   | 0.04|

**Chilodontidae**

- Chilodus punctatus| 4,006 | <0.01|
- Peckoltia bachi| 3,167 | <0.01|

**Crenuchidae**

- Ammocryptocharax elegans| 2,600 | <0.01|
- Peckoltia brevis| 1,256 | <0.01|
- Characidium fasciatum| 7,020 | <0.01|
- Peckoltia spp.| 173,824 | 0.12|
- Crenuchus spilurus| 18,295 | 0.01|
- Peckoltia vittata| 8,235 | 0.01|
| ORDER/Family/Specie | 2006-2015* | %   | ORDER/Family/Specie | 2006-2015* | %   |
|---------------------|------------|-----|---------------------|------------|-----|
| **CHARACIFORMES**   |            |     | **SILURIFORMES**    |            |     |
| (Cont.)             |            |     | (Cont.)             |            |     |
| Odontocharacidium   | 20         | <0.01 | Pseudacanthiscus    | 222,448    | 0.16 |
| aphanes             |            |     | sp. leopards        |            |     |
| Poecilobarax        | 510,147    | 0.36 | Pseudacanthiscus    | 22         | <0.01 |
| weitzmani           |            |     | sp. “L024”          |            |     |
| **Curimatidae**     |            |     | Pseudacanthiscus    | 312        | <0.01 |
| Curimatia vittata   | 4          | <0.01 | sp. “L025”          |            |     |
|                      |            |     | Pseudacanthiscus    | 46         | <0.01 |
| Curimatopsis        | 90         | <0.01 | sp. “L097”          |            |     |
| macrolepis          |            |     | Pseudacanthiscus    | 23         | <0.01 |
| **Erythrinidae**    |            |     | sp. “L185”          |            |     |
| Erythrinus          | 48         | <0.01 | Pseudacanthiscus    | 235        | <0.01 |
| erythrinus          |            |     | sp. spinosus        | 711        | <0.01 |
| Hoplias            | 79         | <0.01 | Pseudancistrus      | 108        | <0.01 |
| malabaricus         |            |     | sp. “L067”          |            |     |
| **Gasteropelecidae**|            |     | Pseudancistrus      | 160        | <0.01 |
| Carnegiella         | 167,959    | 0.12 | sp. “L273”          |            |     |
| marthae             |            |     | Pseudorinelepis     | 10,413     | 0.01 |
| Carnegiella         | 2,698,586  | 1.89 | genibarbis          |            |     |
| strigata            |            |     | Pterygophlycthis    | 7          | <0.01 |
| Gasteropelecus      | 1,410      | <0.01 | gibbiceps           |            |     |
| sternicla           |            |     | Rineloricaria      | 25         | <0.01 |
| Thoracocharax       | 140        | <0.01 | castroi            |            |     |
| stellatus           |            |     | Rineloricaria       | 2,290      | <0.01 |
| **Hemiodontidae**   |            |     | fallax             |            |     |
| Hemiodus            | 14,892     | 0.01 | Rineloricaria      | 817        | <0.01 |
| gracilis            |            |     | formosa            |            |     |
| **Iguanodectidae**  |            |     | Rineloricaria       | 375        | <0.01 |
| Bryconops           | 4,565      | <0.01 | lanceolata         |            |     |
| caudomaculatus      |            |     | Rineloricaria       | 111        | <0.01 |
| Bryconops melanurus | 2,359      | <0.01 | parva              | 14,685     | 0.01 |
| Iguanodectes        | 320        | <0.01 | Pterygophlycthis    |            |     |
| adujai              |            |     | gibbiceps           | 7          | <0.01 |
| Iguanodectes        | 40         | <0.01 | Rineloricaria       | 25         | <0.01 |
| gracilis            |            |     | formosa             | 385        | <0.01 |
| **Lebiasinidae**    |            |     | Rineloricaria       | 140        | <0.01 |
| Copeina             | 71,542     | 0.05 | parvus             | 256        | <0.01 |
| guttata             |            |     | Spectracanthicus    |            |     |
| Copella             | 70,111     | 0.05 | murinus             | 25         | <0.01 |
| arnoldi             |            |     | Sturisoma          |            |     |
| Copella metae       | 350        | <0.01 | barbatum            |            |     |
| Copella nattereri   | 5,470      | <0.01 | **Pimelodidae**    |            |     |
| Nannostomus anduzei | 24,561     | 0.02 | Brachyplatystoma    | 28         | <0.01 |
| Nannostomus beckfordi| 2,000     | <0.01 | juruense           |            |     |
| Nannostomus         | 3,510      | <0.01 | Brachyplatystoma    | 266        | <0.01 |
| digrammus           |            |     | tigrinum           |            |     |
| Nannostomus eques   | 192,294    | 0.13 | Pimelodus          | 150        | <0.01 |
| Nannostomus         |            |     | maculatus          |            |     |
| marginatus          | 902,720    | 0.63 | Pimelodus pictus   | 20         | <0.01 |
| Nannostomus         |            |     | Pseudoplatystoma    | 24         | <0.01 |
| trifasciatus        | 410,739    | 0.29 | corrucans          |            |     |
| Nannostomus         | 157,955    | 0.11 | Pseudoplatystoma    | 230        | <0.01 |
| unifasciatus        |            |     | fasciatum          |            |     |
| Pyrrhulina brevis   | 75         | <0.01 | **Pseudopimelodidae**|          |     |
| Serrasalmidae       |            |     | Batrochoglanis     | 3,081      | <0.01 |
|                     |            |     | raninus            |            |     |
|                     |            |     | Batrochoglanis     | 80         | <0.01 |
|                     |            |     | villosus           |            |     |
|                     |            |     | Microglanis        | 140        | <0.01 |
|                     |            |     | poecilus           |            |     |
Table 1. Continued...

| ORDER/Family/Specie | 2006-2015* | %  | ORDER/Family/Specie | 2006-2015* | %  |
|---------------------|------------|----|---------------------|------------|----|
| **CHARACIFORMES**   |            |    | **SILURIFORMES**    |            |    |
| (Cont.)             |            |    | (Cont.)             |            |    |
| Catoprion mento     | 573        | <0.01 | Trichomycteridae  |            |    |
| Metynnis fasciatus  | 587        | <0.01 | Trichomycterus davisi | 1,514 | <0.01 |
| Metynnis hypsauchen | 120        | <0.01 | GYMNOTIFORMES     |            |    |
| Metynnis mola       | 12         | <0.01 | Apteronotidae      |            |    |
| Myloplus rubripinnis| 6,929      | <0.01 | Apterodonus albifrons | 2,745 | <0.01 |
| Pristobrycon calmoni| 557        | <0.01 | Sternopygida       |            |    |
| Pygocentrus nattereri| 11,284    | 0.01 | Eigenmannia sp.    | 441        | <0.01 |
| Pygopristis denticulata | 15       | <0.01 | Hypopomidae       |            |    |
| Serrasalmus eigenmanni | 44       | <0.01 | Seatotogenys duidae | 20     | <0.01 |
| Serrasalmus hollandi | 1,851      | <0.01 | CYPRINODONTIFORMES  |            |    |
| Serrasalmus rhombeus | 190        | <0.01 | Poeciliidae       |            |    |
| Serrasalmus spilopleura | 694    | <0.01 | Fluviphylax pygmaeus | 200    | <0.01 |
| **Triportheidae**   |            |    | Rivulidae         |            |    |
| Triportheus angulatus| 1,000      | <0.01 | Pterolebias longipinnis | 188    | <0.01 |
| **SILURIFORMES**    |            |    | Rivulus punctatus | 7,150     | 0.01 |
| **Aspredinidae**    |            |    | Rivulus urophthalmus | 8       | <0.01 |
| Bunocephalus aamurals | 3,918      | <0.01 | PLEURONECTIFORMES  |            |    |
| Bunocephalus coracoideus | 37,319 | 0.03 | Achiridae         |            |    |
| Bunocephalus verrucosus | 20        | <0.01 | Hypoclinemus mentalis | 34     | <0.01 |
| Platystacus coteylephorus | 30       | <0.01 | CICHLIFORMES      |            |    |
| **Auchenipteridae** |            |    | Cichlidae         |            |    |
| Ageneiosus marmoratus | 234        | <0.01 | Acarichthys heckeli | 15,902 | 0.01 |
| Asterophysus batrachus | 5         | <0.01 | Aequidens diadema | 100       | <0.01 |
| Liosomadoras oncinus | 17,980    | 0.01 | Aequidens pallidus | 280       | <0.01 |
| Tatia aulopygia     | 11,538     | 0.01 | Aequidens tetramerus | 294   | <0.01 |
| Tatia brunea        | 4,380      | <0.01 | Apistogramma agassizii | 274,914 | 0.19 |
| Tatia intermedia    | 2,945      | <0.01 | Apistogramma bitaeniata | 8,819 | 0.01 |
| Trachelyopterichthys| 812        | <0.01 | Apistogramma borellii | 23,187 | 0.02 |
| taeniatus           |            |    | Apistogramma cacatuoides | 430   | <0.01 |
| **Callichthyidae**  |            |    | Apistogramma commbrae | 210   | <0.01 |
| Aspidoras pauciradiatus | 42,200    | 0.03 | Apistogramma diplotena | 7,229 | 0.01 |
| Aspidoras poecilus  | 58,324     | 0.04 | Apistogramma elizabethae | 17,423 | 0.01 |
| Brochis britskii    | 14,368     | 0.01 | Apistogramma geisleri | 280   | <0.01 |
| Brochis splendens   | 46,297     | 0.03 | Apistogramma gephyra | 3,962   | <0.01 |
| Callichthys callichthys | 759       | <0.01 | Apistogramma gibbiceps | 1,040 | <0.01 |
| Corydoras acrencias | 390        | <0.01 | Apistogramma hippolytae | 170  | <0.01 |
| Corydoras acutus    | 6,979      | <0.01 | Apistogramma meinkeni | 500   | <0.01 |
| Corydoras adolfii   | 613,556    | 0.43 | Apistogramma mendezi | 10,103  | 0.01 |
| Corydoras aeneus    | 31,732     | 0.02 | Apistogramma paucisquamis | 7,035 | <0.01 |
| Corydoras agassizii | 872,174    | 0.61 | Apistogramma personata | 60    | <0.01 |
| Corydoras amandajanea | 1,060    | <0.01 | Apistogramma pertensis | 26,499 | 0.02 |
| Corydoras ambiacus  | 3,402      | <0.01 | Apistogramma pulchra | 2,098    | <0.01 |
| Corydoras araguaiaensis | 101      | <0.01 |                |            |    |
| Corydoras arcuatus  | 44,870     | 0.03 |                |            |    |
### Table 1. Continued...

| ORDER/Family/Specie | 2006-2015* | %  |
|---------------------|------------|----|
| **SILURIFORMES**    |            |    |
| Corydoras blochi    | 1,740      | <0.01 |
| Corydoras burgessi  | 57,855     | 0.04 |
| Corydoras caudimaculatus | 64,163  | 0.05 |
| Corydoras cervinus  | 721        | <0.01 |
| Corydoras cochui    | 172        | <0.01 |
| Corydoras crypticus | 1,888      | <0.01 |
| Corydoras davidsandisi | 5,989   | <0.01 |
| Corydoras duplicareus | 12,550   | 0.01 |
| Corydoras elegans   | 468,260    | 0.33 |
| Corydoras ellisae   | 250        | <0.01 |
| Corydoras ephippifer| 2,382      | <0.01 |
| Corydoras eques     | 33,330     | 0.02 |
| Corydoras evelynae  | 14         | <0.01 |
| Corydoras gossei    | 4,700      | <0.01 |
| Corydoras gracilis  | 246        | <0.01 |
| Corydoras griseus   | 12,472     | 0.01 |
| Corydoras haraldschulzi | 47,958  | 0.03 |
| Corydoras hastatus  | 752,285    | 0.53 |
| Corydoras imitador  | 5,964      | <0.01 |
| Corydoras imitator  | 3,135      | <0.01 |
| Corydoras incolicana| 210        | <0.01 |
| Corydoras julii     | 679,601    | 0.48 |
| Corydoras kanei     | 38,688     | 0.03 |
| Corydoras leucomelas| 68         | <0.01 |
| Corydoras maculifer | 1,150      | <0.01 |
| Corydoras melini    | 143,125    | 0.10 |
| Corydoras narcissus | 7,180      | 0.01 |
| Corydoras nattereri | 15,792     | 0.01 |
| Corydoras nijseni   | 5,006      | <0.01 |
| Corydoras ornatus   | 4,897      | <0.01 |
| Corydoras ourastigma| 820        | <0.01 |
| Corydoras paletus   | 2,589      | <0.01 |
| Corydoras parallelus| 1,461      | <0.01 |
| Corydoras pinheiroi | 160        | <0.01 |
| Corydoras polystictus | 6,268    | <0.01 |
| Corydoras pulcher   | 28,852     | 0.02 |
| Corydoras punctatus | 722,199    | 0.51 |
| Corydoras pygmaeus  | 128,228    | 0.09 |
| Corydoras rabauti   | 8,010      | 0.01 |
| Corydoras reticulatus | 245,541  | 0.17 |
| Corydoras robinae   | 125,844    | 0.09 |
| Corydoras robustus  | 18,498     | 0.01 |
| Corydoras sarareensis | 1,800    | <0.01 |
| Corydoras schwartzi | 3,165,797  | 2.22 |

| ORDER/Family/Specie | 2006-2015* | %  |
|---------------------|------------|----|
| **CICHLIFORMES**    |            |    |
| Apistogramma regani | 542        | <0.01 |
| Apistogramma taeniata| 80         | <0.01 |
| Apistogramma trifasciata | 434   | <0.01 |
| Apistogramma uaupesi | 1,490      | <0.01 |
| Apistogramma ortomanni| 50        | <0.01 |
| Astronotus crassipinnis| 4        | <0.01 |
| Astronotus ocellatus | 275        | <0.01 |
| Biotodoma cupido    | 4,551      | <0.01 |
| Biotodoma wavrini   | 96         | <0.01 |
| Biotoeus opercularis| 5,284      | <0.01 |
| Bujurquina mariae   | 383        | <0.01 |
| Caquetaia spectabilis| 8        | <0.01 |
| Cichlasoma bimaculatum| 5      | <0.01 |
| Cichlasoma portalegrense| 533    | <0.01 |
| Crenicara punctulatum| 93,080    | 0.07 |
| Crenicichla alia    | 8,256      | 0.01 |
| Crenicichla johanna | 123        | <0.01 |
| Crenicichla lenticulata| 1       | <0.01 |
| Crenicichla lepidota | 7         | <0.01 |
| Crenicichla lugubris| 291        | <0.01 |
| Crenicichla marmorata| 11       | <0.01 |
| Crenicichla notophthalmus| 14,508 | 0.01 |
| Crenicichla regani  | 14,531     | 0.01 |
| Dicrossus filamentosus| 199,146  | 0.14 |
| Dicrossus maculatus | 568,783    | 0.40 |
| Geophagus altifrons | 4,183      | <0.01 |
| Geophagus megasema  | 121        | <0.01 |
| Geophagus proximus  | 1,130      | <0.01 |
| Guarania caracara   | 70         | <0.01 |
| Heros eurystomus    | 112        | <0.01 |
| Heros severus       | 418        | <0.01 |
| Hoplarchus psittacus| 2          | <0.01 |
| Hypseleca marginata| 40         | <0.01 |
| Hypseleca temporalis| 44         | <0.01 |
| Laetacara curviceps | 4,825      | <0.01 |
| Laetacara dorigera  | 80         | <0.01 |
| Mesonauta festivus  | 4,916      | <0.01 |
| Mesonauta insignis  | 90         | <0.01 |
| Nannacara adoketa   | 7,805      | 0.01 |
| Pterophyllum leopoldi| 2,690     | <0.01 |
| Pterophyllum scalare| 58,657     | 0.04 |
| Retroculus lapidifer| 26         | <0.01 |
| Satanoperca jurupari| 1,823      | <0.01 |
| Satanoperca lilith  | 1,069      | <0.01 |
Table 1. Continued...

| ORDER/Family/Specie | 2006-2015* | % | ORDER/Family/Specie | 2006-2015* | % |
|---------------------|------------|---|---------------------|------------|---|
| SILURIFORMES (Cont.) |            |   | CICHLIFORMES (Cont.) |            |   |
| Corydoras serratus  | 3,129      | <0.01 | Symphysodon aequifasciatus | 225,139 | 0.16 |
| Corydoras seussi    | 4,902      | <0.01 | Symphysodon discus    | 133,664 | 0.09 |
| Corydoras similis   | 8,154      | 0.01 | Taeniacara candidi    | 2,410    | <0.01 |
| Corydoras sodalist  | 22,515     | 0.02 | Teleoichilus prionogenys | 90      | <0.01 |
| Corydoras sterbai   | 86,254     | 0.06 | Uaru amphicanthoides   | 3,898    | <0.01 |
| Corydoras tukan     | 5,520      | <0.01 | Gobiidae              |          |    |
| Corydoras xinguensis| 800        | <0.01 | Awaous flavus         | 25       | <0.01 |
| Dianema longibarbis | 7,828      | 0.01 | Tetraodontiformes     |          |    |
| Dianema urostriatum | 140,128    | 0.10 | Tetraodontidae        |          |    |
| Hoplosternum littorale | 24w    | <0.01 | Colomesus asellus     | 4,085    | <0.01 |
| Scleromystax barbatus | 3,976    | <0.01 | Colomesus psittacus   | 450      | <0.01 |
| Cetopsidae          |            |   | Total                | 142,552,253 | 100 |
| Helogenes marmoratus| 480        | <0.01 |                        |          |    |
| **375 species**     |            |   | **Total**            | 142,552,253 | 100 |

**Amblydoras hancockii = Platydoras hancockii**

The top eight exported species represented 90.1% of the total trade. These species were the *P. axelrodi* (64.6% of the total), followed by *P. simulans* (7.5%), *H. bleheri* (5.0%), *O. affinis* (4.6%), *O. hoppei* (2.8%), *C. schwartzi* (2.2%), *C. strigata* (1.9%) and *O. viitatus* (1.5%). The other 367 species represented 9.8% of the total exported (Table 1). Most species came from the Rio Negro (278 spp.) and were captured close to Barcelos and Santa Isabel do Rio Negro. Figure 1 shows some of the most exported fish.

The family Loricariidae was the family with most species exported (85 species and 1,396,457 specimens), followed by Cichlidae (71 species and 1,766,310 samples), Callichthyidae (69 species and 8,847,300 specimens) and Characidae (47 species and 112,433,421 specimens). The genera with the biggest abundance of species were Corydoras, with 60 species and 8,533,396 (6.0%) specimens, followed by *Apistogramma*, with 22 species and 386,555 specimens (0.2%), *Hyphessobrycon*, with 11 species and 2,307,342 specimens (1.6%) and *Hemigrammus*, with 10 species and 7,300,007 specimens (5.1%). Some genera had few species exported, like *Paracheirodon*, with two species and 102,759,203 specimens, *Otocinclus*, with 4 species and 12,748,386 specimens, *Carnegiella*, with two species and 2,866,545 specimens and *Nannostomus*, with 7 species and 1,693,779 specimens (Table 1).

The number of species exported jumped from 169 among 2002-2005 (Anjos et al., 2009a) to 375 species between 2006 and 2015. The majority of species exported (345 spp.) are listed in the list of allowed species to be commercialized (Brasil, 2012). However, 30 species exported were not on the list being declared just by the genera (8 species, Ancistrus spp., Baryancistrus spp., Eigenmannia sp., Farlowella sp., Hyphessobrycon sp., Hypostomus sp., Peckoltia spp. and Scobiancistrus sp.). These species together represented 2,635,430 fish. Another three species were commercialized as edible fish due to their size: *B. tigrinum, P. corruscans* and *P. fasciatum* they represented 520 specimens. There were another 19 species that could not have been exported since they are not in the list of allowed export fishes. These were: *A. adonis, A. hystrix, A. hancockii, A. ortmanni, B. amaurus, C. metae, C. punctatus, G. sterniela, G. dacrya, M. parananus, M. affinis, O. flexilis, P. jumbo, P. maculicuda, P. longipinnis, R. lima, R. punctatus, R. urophthalimus, S. maxillosus and T. autolygia* (Table 1).

The species *P. reticulata* found on the export list has natural occurrence in Venezuela and the Caribbean, however, this species is highly spread in the aquaculture circles with easy reproduction in captivity.

Six species of freshwater stingray were exported (Myliobatiformes). These species were: *P. cf. henlei, P. cf. histrix, P. leopoldi, P. motoro, P. orbignyi, P. schoeroederi*. These species are found in the CITES appendix III as species with a population status of protected species (www.cites.org).

There were 18 species that were possibly new species. They were members of the Loricariidae Family described with an “L” code as known internationally (Schraml and Schäfer, 2004; 2020), and exported according to list number 001 from 2012 (Brasil, 2012). Some of these species are *Ancistrus sp. “L255”, Baryancistrus sp. “L42”, Hypancistrus sp. “L004”, Hypancistrus sp. “L066”, Hypancistrus sp. “L136”, Hypancistrus sp. “L260”, Hypancistrus sp. “L262”, Hypancistrus sp. “L333”, Panaque sp. “L002”, Panaque sp. “L271”, Pseudancistrus sp. “L024”, Pseudacanthicus sp. “L025”, Pseudacanthicus sp. “L097”, Pseudacanthicus sp. “L185” Pseudacanthicus sp. “L273, Pseudancistrus sp. “L067”, Pseudancistrus sp. “L259” and Scobiancistrus “L048” (Table 1).
Figure 1. Rio Negro fishing grounds, flooded forests ("igapó") (A), interfluvial swamps (B), fisherman community at Rio Jufari with fishing utensils (C), fisherman “piabeiro” family selecting fish for sale (D), Paracheirodon axelrodi (E), P. simulans (F), Hemigrammus bleheri (G), Hypheosobrycon erythrostigma (H), Carnegiella strigata (I) and Peckoltia spp. (J). (Photos credits: B, F, G, H and I - Project Piaba/Ning Labbish Chao; E – Douglas Bastos). bar = 1 cm
Finally, six Loricariidae species exported out of Amazonas State are listed in the red list of species in danger of extinction (ICMBIO, 2016). Among them H. tricoloris (30 specimens), L. joselimal (11,459 specimens), P. nudiventris (130 specimens), P. compta (2,415 specimens), S. auratus (267 specimens) and S. pariolispos (140 specimens) (Table 1).

Export rate and commercial values

A total of 142.5 million ornamental fish were sold between January 2006 and July 2015, generating a total of US$ 23,001,366 (Table 2). On average, 14.2 million fish were exported per year with an average annual revenue of US$ 2.3 million (Table 2). However, after analyses a sharp market decline is observed in recent years (Table 2; Figure 2A). During 2006, 26 million specimens generating US$ 3 million were exported. In 2014, there was a 75% drop in revenue from ornamental fish exports (Table 2; Figure 2A). The numbers continue to plummet and during 2015 fishing season (January to July) it was seen an even sharper drop (Figure 2B). The main specie exported, P. axelrodi, also saw a drop in sales. In 2006, 17.9 million of specimens were exported, and in 2014 only four million specimens were exported (Table 2). However, this is the main species exported out of Amazon state representing 61% (± 5.8) of the total (Table 2).

In 2006 to 2008, even with a decrease in exports, the revenue received for the trade increased 21.7% in 2006 and 28.3% in 2008. After 2008 sales dropped more than 50% when compared with the numbers of 2006 (Table 2; Figure 2A).

The months between August and December were when exporters received the largest number of orders (Figure 2B). Sales started to drop in January and strongly decreased by July. The revenue received followed similar patterns, with November being the strongest month. From April to September we had the lowest values received (Figure 2C).

Import countries

Between the years of 2006 and July 2015, a total of 35 countries imported fish from the Amazonas State (Table 3). Europe was the continent that imported the most, with 20 receiving countries, a total of 62,172,860 fish imported and total revenue of US$ 6,494,510 (Table 3). Asia was the second largest importer, with 10 receiving countries, 53,622,229 fish bought generating US$ 12,704,138 in revenue. North America followed Asia as an importer, with two receiving countries, 24,320,417 fish bought generating US$ 3,462,163. South America had two receiving countries (Argentina and Chile), buying 1,881,931 fish and generating US$ 207,623 in revenue. Africa had one buying country, 554,266 fish exported generated US$ 106,132 (Table 3).

Germany was the country that imported the largest fish quantities (38.9 million fish), followed by Taipei (27.2 million), USA (23.8 million) and Japan (17.6 million). These four countries imported 75.5% of all the fish that left the Amazonas state. However, revenue wise, Taipei presented the most value (US$ 5.99 million), followed by Japan (US$ 4.64 million), Germany (US$ 3.68 million), USA (US$ 3.34 million) and Hong Kong (US$ 1.26 million). These five countries accounted for 82.3% of all sales during these ten years reported here (US$ 18.9 million), except 2015 with data from January to July (Table 3).

DISCUSSION

This study has shown that the Amazonas State contributes with the selling species traded as ornamental fish for many countries, including mainly European Union, Southeast Asia and North America. The species of the Amazon commercialized out of the region are also bred in captivity (Chapman, 2000; Livengood and Chapman, 2020). Among fifty the species with the highest demand worldwide, five are native from the Amazon, most come of the Southeast Asian farms: P. innesi (Characidae), A. ocellatus, S. auratus, P. axelrodi, and P. compta.
ANALYSIS OF THE ORNAMENTAL FISH EXPORTS...

Figure 2. (A) Total exported and revenue received annually, and % of the increased or decreased is relation the 2006; (B) Monthly variation of amount exported yearly (C) average and standard deviation of revenue received monthly between 2006 and July 2015. Data from IBAMA (2006 to 2015* = database of Jan-Jul).

Table 3. Import countries and amounts exported and monetary value received since 2006 to 2015*. (2015* = database of Jan-Jul).

| Country     | Quantity | %    | Total value (US$) |
|-------------|----------|------|-------------------|
| Germany     | 38,891,521 | 27.28 | 3,682,973.15     |
| Taipei      | 27,279,318 | 19.14 | 5,991,318.51     |
| United States | 23,868,660 | 16.74 | 3,342,063.34     |
| Japan       | 17,674,694 | 12.40 | 4,643,677.44     |
| Hong Kong   | 4,994,653  | 3.50  | 1,266,474.86     |
| UK          | 4,238,862  | 2.97  | 582,243.90       |
| Denmark     | 4,227,542  | 2.97  | 296,885.55       |
| France      | 3,490,663  | 2.45  | 446,575.14       |
| Netherlands | 3,487,503  | 2.45  | 370,459.41       |
| Sweden      | 2,092,831  | 1.47  | 188,112.12       |
| Belgium     | 1,994,824  | 1.40  | 293,591.63       |
| Argentina   | 1,716,857  | 1.20  | 187,059.40       |
| South Korea | 1,309,535  | 0.92  | 187,975.72       |
| Singapore   | 1,137,688  | 0.80  | 152,336.78       |
| Spain       | 905,899    | 0.64  | 101,025.18       |
| China       | 887,754    | 0.62  | 388,519.84       |
| Poland      | 722,387    | 0.51  | 188,805.69       |
| Portugal    | 627,839    | 0.44  | 67,234.66        |
| South Africa| 554,266    | 0.39  | 106,132.00       |
| Switzerland | 456,048    | 0.32  | 56,969.21        |
| Canada      | 451,757    | 0.32  | 120,100.00       |
| Israel      | 266,881    | 0.19  | 42,964.48        |
| Italy       | 232,467    | 0.16  | 41,485.18        |
| Norway      | 205,490    | 0.14  | 63,629.55        |
| Chile       | 165,074    | 0.12  | 20,563.86        |
| Austria     | 163,375    | 0.11  | 26,845.55        |
| Finland     | 161,574    | 0.11  | 41,288.41        |
| Czech       | 159,693    | 0.11  | 25,652.69        |
| Republic    | 92,358     | 0.06  | 7,110.13         |
| Greece      | 53,888     | 0.04  | 25,045.95        |
| Thailand    | 17,518     | 0.01  | 3,832.00         |
| Malaysia    | 12,112     | 0.01  | 3,645.70         |
| Estonia     | 6,492      | <0.01 | 10,874.00        |
| Hungry      | 3,380      | <0.01 | 200.50           |
| Bulgaria    | 300        | <0.01 | 1,992.00         |
| N. Korea    | 550        | <0.01 | 26,800.45        |
| Total       | 142,552,253| 100.0 | 23,001,366.98    |

It was seen during the study that even with the decrease in sales, the number of species exported increased to 375 species between 2006 to 2015. Anjos et al. (2009a) reported that 169 species were exported between 2002 to 2005. This demonstrates that the market wanted different fish species, even with the decrease in exports. Even with the decrease between 2006 and 2015, *P. scalare*, *S. aequifasciatus* and *Symphysodon discus* (Cichlidae) (Chapman, 2000; Monticini, 2010). It is believed that the number of species sold as ornamental fish is greater than the 375 species reported due to many are exported only by the genera: Ancistrus spp., Baryancistrus sp., Eigenmannia sp., Farlowella sp., Hypessobrycon sp., Hyphostomus sp., Peckolita spp. and Scobiancistrus sp. most of these species belong to the Loricariidae Family and they have complex taxonomical classification. Studies carried revealed that exporters in Peru reported exports of 248 species, and in reality this number was 704 species (Moreau and Coomes, 2007).

P. scalare, *S. aequifasciatus* and *Symphysodon discus* (Cichlidae) (Chapman, 2000; Monticini, 2010). Currently the number of fish capture from nature is very small capture with the numbers sold out at the Southeast Asia (Anjos et al., 2009a).

It is believed that the number of species sold as ornamental fish is greater than the 375 species reported due to many are exported only by the genera: Ancistrus spp., Baryancistrus sp., Eigenmannia sp., Farlowella sp., Hypessobrycon sp., Hyphostomus sp., Peckolita spp. and Scobiancistrus sp. most of these species belong to the Loricariidae Family and they have complex taxonomical classification. Studies carried revealed that exporters in Peru reported exports of 248 species, and in reality this number was 704 species (Moreau and Coomes, 2007).
Continued to be the most exported species in all these years. *Paracheirodon axelrodi* apparently it is difficult to induce its reproduction in captivity (Anjos and Anjos, 2006) - compared with the *Paracheirodon innesi* (neon tetra) that is easily reproduced (Chapman et al., 1997, 1998; Sanage et al., 2008; Kucharczyk et al., 2010), this difficult breeding in captivity, probably helps to keep exports of this species in high demand. The total value received by the exported fish increased from 2006, when the price of cardinal tetra was US$ 0.11, to 2014, when the price was US$ 0.25, representing an increase of 120.0%. The period of lower activity is during the European summer when many families travel and do not buy pets. This period coincides with the wet season when it is hard to catch ornamental fish and they reproduce in large part of the Amazon. During the wet season, the exporters themselves proposed in 1992 that IBAMA create a law prohibiting fishing to allow species to reproduce (IBAMA, 1992).

From the 375 species exported, 28 not on the list of allowed species for commercialization (Brasil, 2012). Three did not occur in Brazil, *Apistogramma ornatrix* (Essequibo River/Guiana), *Corydoras punctatus* (Suriname) and *Copella metae* (Meta River – Orinoco). Another five species are from other regions in Brazil. These were: *Megalancistrus paranus* (Paraná/Paraguay basin), *Otocinclus flexilis* (Rio Grande do Sul), *Parotocinclus jumbo* (small rivers in Ceará, Paraiba and Alagoas states), *Parotocinclus maculicauda* (small creeks in Espirito Santo and Santa Catarina) and *Acanthicus adonis* (Tocantins river). These species may have arrived at the export companies for increased demand from importer countries.

Among stingray species (Myliobatiformes), although on the CITES list (as endangered) are exported out of Amazonas and Pará states every year based on a quota established by the IBAMA authorities (IBAMA, 2013).

Six Loricariidae species exported out of Amazonas State are listed in the red list of species in danger of extinction (ICMBIO, 2016). Among them *Hopliancistrus tricornis*, *Leporacanthicus joselima*, *Parancistrus nudiventris*, *Peckoltia compta*, *Scobinancistrus auratus* and *Scobinancistrus pariolispos*. Brazilian authorities should remove these species from the list of allowed species to be exported based on the 2016 red list published by the same institution (Brasil, 2012; ICMBIO, 2016).

The fall of exports of ornamental fishes

During 2008 there was an abrupt drop in sales of ornamental fish worldwide (Monticini, 2010) and the Amazonas State sales were also affected. Benzaken et al. (2015) explained this drop in sales as a consequence of the 2008 international economic crisis where the world economy collapsed, with steep drops of stock markets worldwide, devaluation of housing assets and economic recession.

Another factor that contributed to this decrease in sales was the closure of the biggest fish export company in the Amazonas State that represented 51% of the market (Anjos et al., 2009a). The 2008 economic crisis made the market non-viable for a big company with high costs (Benzaken et al., 2015). The closure of this company was followed by other smaller companies that could not keep up with the loss in revenues (H. Beltrão, personal observation). Benzaken et al. (2015) also points out the unfavorable exchange rate before 2008 - at R$ 1.5 to the dollar - high prices of freight (from Manaus to other locations in the world), customs bureaucracy, a small list of species allowed to be exported and competition with Southeast Asia producers as main factors leading to the drop in sales. Piabeiros (fishermen) were discontent with the price received mainly for cardinal sold. A large part of the fishermen gave up the profession because of the remuneration (Anjos et al., 2009b). Another reason for the down fall of the trade consists that our neighboring countries (Peru and Colombia) also export a significant number of ornamental species from the Amazon biome, without bureaucratic problems and without restriction list of exported species (Moreau and Coomes, 2007; Mancera-Rodriguez and Álvarez-León, 2008). On top of that they have a much lower air freight cost.

Fortunately, recently published legislation No. 10 of April 2020 (Brasil, 2020) releases a larger number of species for ornamental purposes, except those on the list of endangered species in Brazil (ICMBIO, 2016) and species that are on the CITES list.

The current market for ornamental fish from the Amazonas State

There is a historical tradition in Brazil and more exclusively in the Amazonas State to export ornamental fishes to Europe and North America (Falabela, 1985; Leite and Zuanon, 1991; Chao et al., 2001; Anjos et al., 2009a; Benzaken et al., 2015). Europe continues to be the biggest buyer representing 43.6% of the total fish exported (2010-2015), but they represented 58% between 2002 and 2005 (Anjos et al., 2009a) and 52.3% in 1983 (Falabela, 1985). The Asian continent has been buying increasingly more. In 1983 Asia represented 0.9% of the exports of Amazonas State (Falabela, 1985), 20 years latter (2002-2005), the continent was the destination for 26% of exports (Anjos et al., 2009a). Currently, Asia represents 37.6% of the exports (2006-2015). These increases show that Asia substituted Europe in the pet trade with the rise of the Chinese economy. Germany is still the biggest importer followed by Taipei, USA and Japan. Prang (2007) and Andrews (1990) reported that Europe bought 40% of the exports from the Amazon Region, indicating that this reduction was due to stronger competition from fish bred in Asia (Taipei, Thailand, Indonesia and Hong Kong) which also export many species from the Negro River.

**CONCLUSION**

In conclusion, the quantity of the ornamental fish exported from the State of Amazonas have decreased in the last ten years (2006-2015) and should be monitored more carefully. The monitoring ornamental fish exports over the years can help redefining public policies that focused on “piabeiros” and protect stocks of commercially exploited ornamental species by updating threatened species lists. In this sense, we believe that the export number of ornamental fish out of the Amazonas State will continue low and will concentrate on species that are not reproduced in big quantities in captivity (for example, *Paracheirodon axelrodi, P. simulans* and *Hemigrammus bleheri*) in order to improve the genetics of the stock reproduced in captivity. New described...
species can also help maintain export numbers. Finally, we do not see the ornamental fish export of the Amazonas State going back to the glamorous years during the 70s, 80s, and 90s. We believe that these exports remaining with low quantity to the sole purpose of genetic improvement of stocks in other regions of the planet, since many native ornamental fish species of the Amazon are already reproduced largely in captivity mainly in Southeast Asia, European Union and USA.

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