

United States of America Trade in Ornamental Fish

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Abstract

Ornamental fish production is among the leading cash crops of the United States of America aquaculture economy, and retail value of the fish trade is worth approximately US\$1,000 million. However, few studies exist to document this trade. Using import and export documents we report trends in total values for the U.S. trade in ornamental fish. Also, we determined the number and value of the most commonly imported ornamental fish. In 1992, approximately 201 million fish valued at \$44.7 million were imported into the U.S. The port of Los Angeles handled 39% of all trade activity, Miami 22%, New York 16%, Tampa 6%, and Honolulu 6%. Freshwater fish accounted for approximately 96% of the total volume and 80% of the value of the imports. Most freshwater ornamental fish were farm-raised and imported from Southeast Asia. Most U.S. exports of ornamental fish were cultured in the state of Florida. Although saltwater fish had a high market value (20% of the declared value of the imports), the volume of these fish was only 4%. Most imported and exported saltwater ornamental fish were collected from the wild. Of the 1,539 species declared as ornamental fish, 32 species dominated the trade. These were all of freshwater origin. The guppy *Poecilia reticulata* and neon tetra *Paracheirodon innesi* were the most popular ornamental fish kept in U.S. households. The average prices paid for imported ornamental freshwater fish were 45 cents for egg layers and 22 cents for live bearers. The results of this study document the importance of the ornamental fish industry and identifies the most valuable species in the trade for potential domestic culture and protection in the wild.

Worldwide, the ornamental (or aquarium) fish hobby is a multi-million dollar industry, and the United States of America is considered the largest market for ornamental fish in the world (Conroy 1975; Hemley 1984; Andrews 1990). In 1994, 56% of U.S. households (estimated at 94.2 million in total) had pets, and 10.6% owned ornamental freshwater and saltwater fish; with an average of 8.8 fish per household (APPMA 1994). The U.S. pet industry in 1993 was estimated at US\$3.6 billion, and the retail value for the fish hobby was worth US\$0.91 billion (Pet Dealer 1993). Sales associated with the ornamental fish hobby included

aquarium accessories (57.7%), reef products (3.8%), freshwater livestock (30.8%), and saltwater livestock (7.7%).

Few studies exist to document the trade on ornamental fish (Conroy 1975; Hemley 1984; Ramsey 1985; Andrews 1990). Unlike the foodfish industry, where a relatively small number of species are cultured (approximately 95, Pillay 1990), the trade in ornamental fish is believed to number into the thousands of species, including their varieties (Conroy 1975; Hemley 1984; Ramsey 1985). In this article, trends in total import and export values for the U.S. trade of ornamental fish are reported. The number and value of the ornamental fish species most commonly imported into the United States of America are also examined.

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Data and Analysis

Data in this report were obtained from two major sources: 1) trade information on import and export data, compiled by the U.S. Department of Commerce, Bureau of Census, which is available in Microfiche and CD-ROM; and 2) the U.S. Fish and Wildlife Service (USFWS) "Declaration for Importation or Exportation of Fish or Wildlife" (Form 3-177). The declaration forms were obtained from the USFWS, Division of Law Enforcement, through a Freedom of Information Act request.

Microfiche and CD-ROM Files

Since 1982, the recording of U.S. import and export data has been the responsibility of the U.S. Bureau of the Census. These data are obtained from the declarations of shipments (Form 3-177) recorded with U.S. Custom's officials, as required by law for nearly all overseas transfers. Prior to 1989, however, no specific category was established to represent the imports and exports of ornamental fish. Ornamental fish data were grouped in the general category, "fish or shellfish-live-other than for human consumption." Included in this category were live trout, carps, eels, and other live fish. Only in 1989 did the Bureau employ a detailed coding system, with ornamental fish data being placed under the separate category, "fish-ornamental-live."

Based on data analyzed after 1989, when all live commodities were assigned to specific categories, it was ascertained that the number of imported or exported live fish or shellfish (other than for human consumption) was relatively small when compared to ornamental fish. Therefore, while we cannot be certain of the actual numbers for ornamental fish in the pre-1989 period, we assumed that imports and exports of ornamental fish accounted for the majority of the totals for the live fish/shellfish category. The year 1988 was one of code-transition for the Bureau, and ornamental fish data were placed on another broad category,

"live animals-NSPF." Because of the impossibility of obtaining an accurate measure of ornamental fish totals within this category, data for 1988 were not tabulated in the analysis.

Form 3-177

Specific fish species entries were obtained directly from the USFWS Form 3-177. This declaration form differentiates if the fish are imports or exports, the exporter and importer agents, and the ports of export and entry. The form also identifies the quantity, scientific name, common name, domestic value, and country of origin. Data declared in a given shipment were sometimes difficult to interpret. Sometimes it was impossible to match the scientific name to the fish being traded. Traditional common names (and their regional synonyms) became more useful to identify the particular fish species. Also, not all import declaration forms indicated if the species were cultured or collected from the wild. Last, the country of origin of the shipments was not always known since transshipments were common.

Included in the declaration forms were invertebrates such as shrimps, corals, sea urchins, crabs and live rock. The total number and monetary value of these invertebrates were significantly low (<1%) and not included in the analysis.

The species entry forms (3-177) analyzed included only those for the month of October 1992. Ramsey (1985) conducted a similar trade study of ornamental fish imported by the United States of America during October 1971. This month, therefore, provided a comparison period for detecting major shifts in the trade after a 20-yr period. Also, in terms of fish numbers and monetary values of the shipments, October represented an average season (Fig. 1). A particular month may underestimate the value of some species, especially those collected seasonally in the wild such as the clown loach *Botia macracantha*, and cardinal tetra *Paracheirodon axelrodi*.

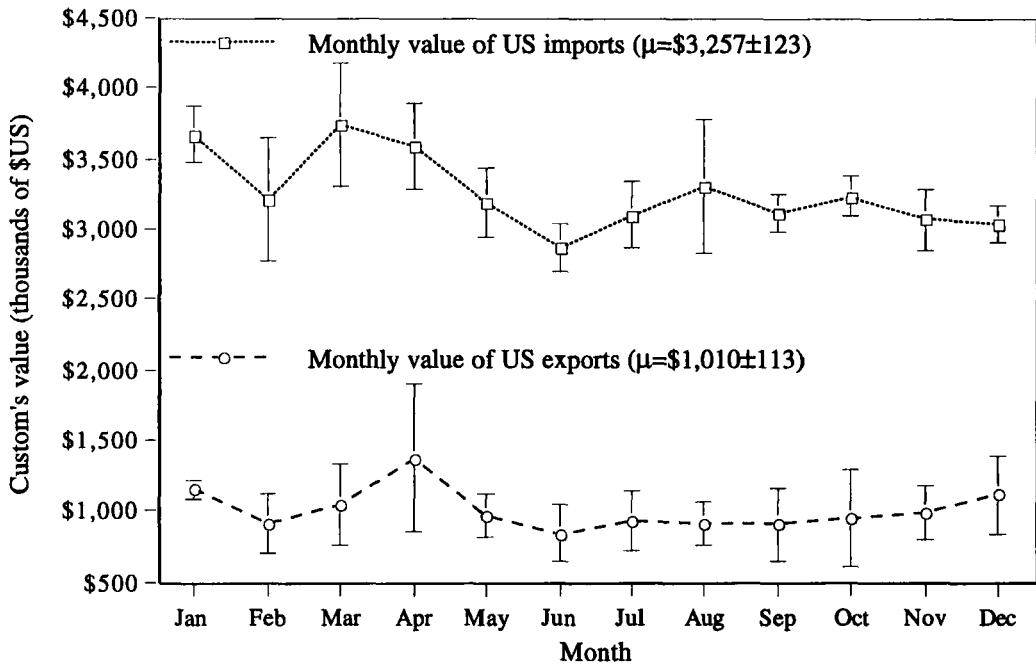


FIGURE 1. Value of U.S. monthly imports and exports of ornamental fish from 1982 to 1992.

After the data collection process had been completed, monthly totals for each country and fish species were computed. The data were grouped into ten geographical regions: United States of America (U.S.), Canada, Central America (including Caribbean Islands), South America, Europe (including Russia), Africa, Southeast Asia, Japan, Australia (and Pacific Islands), and other to determine areas active in ornamental fish trade. Prices for individual fish were derived from shipping invoices attached to each importation declaration (Form 3-177). Because of different shipment sizes (fish number and values), the declared price for a species was calculated using a weighted mean. Monetary values are represented in nominal U.S. dollars (\$).

Results

World Sources of U.S. Imported Ornamental Fish

From 1989 to 1992, almost 79% of all U.S. ornamental fish imports arrived from Southeast Asia and Japan (Table 1). Singa-

pore, Thailand, the Philippines, Hong Kong, and Indonesia were the top five exporting nations. South America was the second largest exporting region accounting for 14% of the total annual value. Colombia, Brazil and Peru were the major suppliers. The remaining 7% of ornamental fish imports came from other regions of the world. Prominent exporting countries included Costa Rica, Trinidad, and Haiti in Central America and in Africa, Nigeria and Zaire. A few imports arrived from Australia and other Pacific Islands (primarily the Marshall and Fiji Islands). Europe plays only a minor trade role.

The USFWS, Division of Law Enforcement has designated 11 ports of entry for live ornamental fish (Federal Register 1992). Shipments originating in Canada and Mexico may enter other specified ports. Patterns of import and export trade activities indicated that Los Angeles (39%), Miami (22%), New York (16%), Tampa (6%), and Honolulu (6%) were the major ports for entry of ornamental fish in the United States of America during 1992 (Table 2).

TABLE 1. *World suppliers and destinations of U.S. ornamental fish imports and exports from 1989 to 1992. Source: U.S. Bureau of Census.*

Suppliers		Destinations	
Region	Total imports (%)	Region	Total exports (%)
Southeast Asia	74.5	Canada	29.0
South America	14.0	Southeast Asia	25.3
Japan	3.7	Europe	20.3
Africa	2.1	Japan	17.6
Australia	2.1	Central America	6.4
Central America	2.7	South America	1.0
Europe	0.5	Other	0.4
Other	0.4		

Value of Ornamental Fish Imports

Ornamental fish imports into the United States of America are growing (Fig. 2). The value of ornamental fish imports increased by approximately 34% from the 1982–1983 to the 1984–1987 period. During the latter time period the annual value of imports remained relatively stable, ranging from

\$26.5 million to a high of \$29.2 million. Annual imports over 1989–1992 rose from \$38.2 million in 1989 to \$41.1 million in 1992 although falling in 1991 to \$36.1. The relatively large increase during 1989–1992 compared to 1984–1987 could be due to changes in import document codes implemented in 1988. The reason for the decline in import values in 1991 is not known.

TABLE 2. *U.S. ports of major trade activity for ornamental fish (1992).*

Trade ports	Shipments	Imports		Exports	
		Total number of fish	Declared value (\$)	Total number of fish	Declared value of fish (\$)
Los Angeles, CA ^a	7,892	118,626,139	24,552,930	15,051,348	6,909,433
Miami, FL ^a	4,390	25,669,279	5,511,538	9,181,411	3,837,952
New York, NY ^a	3,159	40,013,014	8,312,753	1,451,046	487,754
Tampa, FL	1,206	2,793,321	789,734	3,236,883	1,043,118
Honolulu, HI ^a	1,156	1,405,306	1,024,117	102,467	708,863
San Francisco, CA ^a	746	5,563,527	1,427,901	566,631	254,692
Chicago, IL ^a	640	4,792,237	1,538,814	449,134	120,881
Detroit, MI	302	622,426	960,016	19,563	16,093
Newark, NJ	177	199,610	67,675	51,680	20,334
Dallas/Fort Worth, TX ^a	122	295,556	146,395	8,954	9,822
Seattle, WA ^a	111	986,741	261,290	44,902	26,916
Buffalo, NY	107	4,492	8,678	7,618	5,659
Portland, OR ^a	75	37,060	26,539	4,175	5,383
Minneapolis/St. Paul, MN	65	23,678	15,238	111,538	13,475
Port Huron, MI	52	28,583	11,712	200	90
Agana, GUAM	26	108,273	25,285	n.e. ^c	n.e.
Blaine, WA	6	9	54	62,928	8,756
Atlanta, GA	6	3,452	1,714	n.e.	n.e.
Baltimore, MD ^a	3	1,030	2,651	5,135	510
New Orleans, LA ^a	2	645	400	100	191
Champlain, NY	2	20	n.d. ^b	n.e.	n.d.
Total	20,245	201,174,398	\$44,730,434	30,355,714	\$13,469,922

^a USFWS designated ornamental live fish point of entry. Only Canada and Mexico can ship to other ports.

^b n.d. = no value was declared.

^c n.e. = no export activity. Data source: US Bureau of Census.

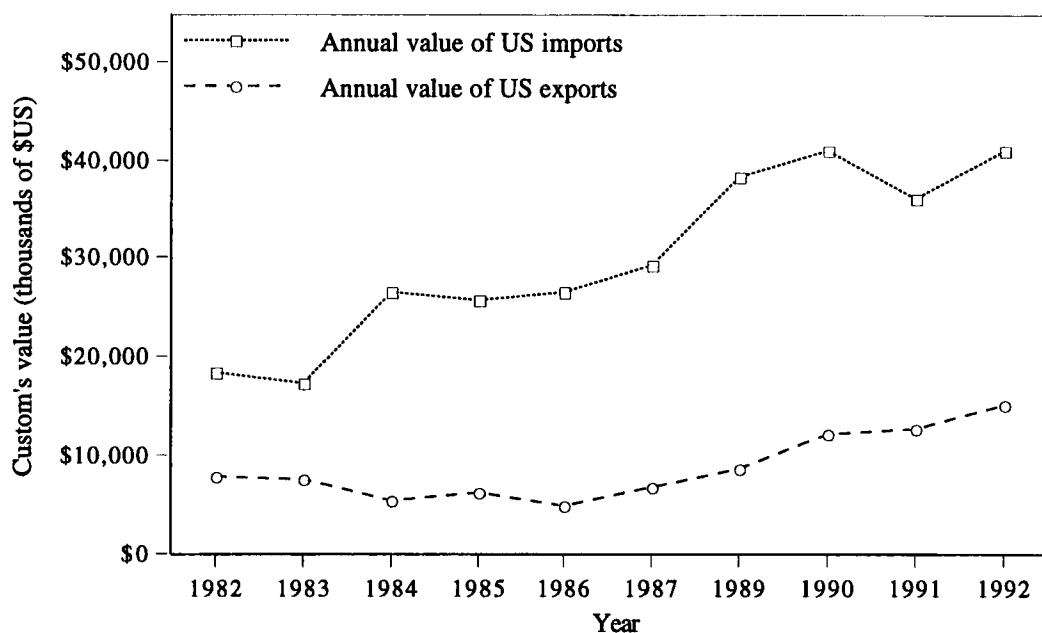


FIGURE 2. Value of U.S. annual imports and exports of ornamental fish from 1982 to 1992.

Over the period of analysis, monthly imports peaked in January and March and reached a low in June (Fig. 1). February, March and August showed the most variability. June, September, October, and December, by comparison, were relatively constant. The average value of U.S. monthly imports was \$3.2 million for 1992.

Number and Species of Ornamental Fish Imported into the United States of America

Approximately 201 million fish worth \$44.7 million were imported into the United States of America in 1992 (Table 2). Of these, approximately 15.4 million ornamental fish valued at \$3.1 million arrived in October 1992 (Table 3). The number of declared freshwater and saltwater ornamental fish imported into the United States of America in October 1992 totaled 1,539 species. A total of 730 species were of freshwater origin and 809 from saltwater. The freshwater fish accounted for approximately 96% of the total volume and 80% of the total import

value. Saltwater fish made up only 4% of the total import, but their dollar value amounted to 20% for October. Of the total of all trade, only 32 species had import values of more than \$10,000. These top species are all of freshwater origin and accounted for approximately 58% or \$1.82 million of the total imported value of fish. The remaining \$1.34 million, 42% of the value, was accounted for by 1,507 species divided into 698 freshwater species (\$0.7 million or 22%) and 809 saltwater species (\$0.64 million or 20%). Any species, freshwater or saltwater, not included in Table 3, contributed less than 1% to the total declared import number and value of ornamental fish.

The two most popular ornamental fish species imported into the U.S. were the live bearer, guppy *Poecilia reticulata*, and the egg layer, neon tetra *Paracheirodon innesi*. These two species accounted for 37% of the total number of fish imported and were valued at approximately half a million dollars. These species with four others, the platy *Xiphophorus maculatus*, betta *Betta splen-*

TABLE 3. Number and value of ornamental fish imported into the United States of America in October 1992.

Species name	Number	(%)	Value (\$)	(%)	Weighted mean price \pm SD
<i>Poecilia reticulata</i>	3,986,675	25.8%	\$ 341,483	10.8%	\$0.14 \pm 0.11
<i>Paracheirodon innesi</i>	1,748,435	11.3%	\$ 174,768	5.53%	\$0.14 \pm 0.07
<i>Carassius auratus</i>	362,390	2.4%	\$ 171,206	5.41%	\$1.06 \pm 5.78
<i>Betta splendens</i>	423,234	2.7%	\$ 108,030	3.42%	\$0.32 \pm 0.84
<i>Xiphophorus maculatus</i>	837,016	5.4%	\$ 105,543	3.34%	\$0.16 \pm 0.25
<i>Botia macracantha</i>	94,764	0.6%	\$ 93,300	2.95%	\$1.29 \pm 0.64
<i>Astronotus ocellatus</i>	185,515	1.2%	\$ 90,676	2.87%	\$0.82 \pm 2.31
<i>Pterophyllum scalare</i>	127,534	0.8%	\$ 72,411	2.29%	\$0.67 \pm 0.52
<i>Symphysodon discus</i>	12,948	0.1%	\$ 52,213	1.65%	\$4.42 \pm 2.23
<i>Apistogramma ramirezi</i>	101,380	0.7%	\$ 48,245	1.53%	\$0.51 \pm 0.31
<i>Xiphophorus helleri</i>	150,053	1.0%	\$ 44,442	1.41%	\$0.33 \pm 0.48
<i>Colisa lalia</i>	100,842	0.7%	\$ 41,199	1.30%	\$0.50 \pm 0.64
<i>Poecilia velifera</i>	167,255	1.1%	\$ 39,217	1.24%	\$0.32 \pm 0.31
<i>Poecilia sphenops</i>	314,900	2.0%	\$ 38,124	1.21%	\$0.16 \pm 0.10
<i>Barbus tetrazona</i>	202,222	1.3%	\$ 35,708	1.13%	\$0.22 \pm 0.21
<i>Balatiocheilus melanopterus</i>	146,017	1.0%	\$ 34,538	1.09%	\$0.36 \pm 0.30
<i>Hypostomus plecostomus</i>	135,683	0.9%	\$ 33,289	1.05%	\$0.42 \pm 1.28
<i>Kryptopterus bicirrhus</i>	58,676	0.4%	\$ 30,711	0.97%	\$0.52 \pm 0.13
<i>Pimelodus pictus</i>	103,430	0.7%	\$ 30,224	0.96%	\$0.30 \pm 0.14
<i>Osteoglossum bicirrhosum</i>	16,368	0.1%	\$ 23,130	0.73%	\$7.23 \pm 4.79
<i>Labeo bicolor</i>	153,242	1.0%	\$ 22,323	0.71%	\$0.23 \pm 0.29
<i>Poecilia latipinna</i>	78,503	0.5%	\$ 22,223	0.70%	\$0.37 \pm 0.48
<i>Chanda lala</i>	224,437	1.5%	\$ 21,700	0.69%	\$0.11 \pm 0.05
<i>Pelmatochromis kribensis</i>	42,272	0.3%	\$ 20,043	0.63%	\$0.49 \pm 0.43
<i>Acanthopthalmus kuhlii</i>	147,215	1.0%	\$ 19,483	0.62%	\$0.14 \pm 0.01
<i>Pangasius sutchi</i>	136,011	0.9%	\$ 18,712	0.59%	\$0.20 \pm 0.23
<i>Labeo erythrurus</i>	121,825	0.8%	\$ 18,050	0.57%	\$0.22 \pm 0.21
<i>Rasbora heteromorpha</i>	133,910	0.9%	\$ 17,758	0.56%	\$0.14 \pm 0.08
<i>Telmatherina ladigesii</i>	22,544	0.2%	\$ 15,488	0.49%	\$1.04 \pm 4.31
<i>Gyrinocheilus aymonieri</i>	363,355	2.4%	\$ 14,758	0.47%	\$0.06 \pm 0.05
<i>Paracheirodon axelrodi</i>	225,495	1.5%	\$ 12,220	0.39%	\$0.16 \pm 0.24
<i>Brachygnathus xanthozoon</i>	108,930	0.7%	\$ 10,256	0.32%	\$0.11 \pm 0.06
Other (698) freshwater species	3,757,651	23.9%	\$ 703,171	22.18%	
Saltwater (809) species	650,487	4.2%	\$ 637,754	20.20%	
Total	15,441,214	100.0%	\$3,162,396	100.0%	

dens, Chinese algae-eater *Gyrinocheilus aymonieri*, and goldfish *Carassius auratus*, account for half the total number of ornamental fish imports. In addition, the top five species of these ornamental fish (except for the algae-eater) were valued at above \$100,000 for each species.

With the exception of a few fish that had significant price ranges, (e.g., arowana, discus, goldfish, Celebes rainbowfish, and oscar), the average price declared for an imported fish was between 26 and 28 cents. The average prices paid for imported egg layer and live bearer fish were 45 and 22 cents, respectively. The most commonly im-

ported fish, the guppy (a live bearer) and neon tetra (an egg layer) were, however, valued similarly at about 14 cents. The neon tetra had less price variability. The most highly priced ornamental freshwater fish were all egg layers and included the goldfish, discus, arowana, clown loach, black ghost knifefish, and Celebes rainbowfish. The least expensive (commonly) imported freshwater fish was also an egg layer, the Chinese algae-eater *Gyrinocheilus aymonieri* with an estimated value between 5 and 7 cents.

The imported saltwater fish number approximately 809 species belonging to a va-

riety of families. Saltwater ornamental fish species with high monetary value were imported from the Philippines (44.1%), Indonesia (25.5%), the Marshall Islands (6.2%), Nigeria (3.7%), Costa Rica (3.6%), Sri Lanka (3.2%), and Australia (2.6%). Average prices for saltwater fish were not estimated due to the great variability in individual prices.

A review of the taxonomic descent of the commonly imported freshwater species indicated they are primarily of South American and Indonesian origin. However, most species were exported from Singapore, Hong Kong, and Thailand, not their native geographical region (Table 4). It seems reasonable to conclude that most of the imported freshwater species are either transhipped or farm-raised in Southeast Asia.

Value of Domestic Exports and Species Traded

The more prominent exported ornamental fish included guppies, mollies, swordtails, platies, gouramies, barbs, tetras, armored catfish, and a variety of cichlid species. Ornamental saltwater fish originated primarily from the coastal waters of Florida and Hawaii. Only a handful of saltwater fish species were cultured and only those of the genus *Amphiprion* were exported in consistent numbers.

From 1989 to 1992 the total annual value of U.S. exports grew at an average annual rate of 16% (Fig. 2). In 1986 total export value was approximately \$4.8 million and in 1992 export value had more than tripled to \$15.1 million. The data analyzed cannot be used to separate the export source from either domestic production or transshipment trade.

The largest volume of annual exports went to Canada (29.0%), followed by Southeast Asia (25.3%), Europe (20.3%, primarily to England, The Netherlands, and Germany), Japan (17.6%), Central America (6.4%), and South America (1.0%) (Table 1). Annual exports to the Middle East, Africa, and Pacific Islands combined were less than 1% of the total export value.

Average monthly export values showed considerable variability; however, with the exception of four months (January, March, April, and December), exports were between \$0.8 to \$1.0 million (Fig. 1). Monthly exports peaked in April with a secondary peak in January. February and June were low points.

Discussion

Households in North America, Europe and Japan buy the bulk of ornamental fish traded in the world. Although a variety of ornamental fish species are available from fish wholesalers, only a few species are preferred by American aquarists. Comparison of our data to Ramsey (1985) indicates that, with a few exceptions, the species of ornamental freshwater fish imported into the U.S. are similar. Of the top 20 species by volume traded in 1971 (Ramsey 1985), 18 remained in the top (Table 5). Likewise, the trade volume of saltwater fish (4%) appears similar to that from a decade ago (approximately 4% reported by Hemley 1984). In 1971, saltwater fish made up approximately 1% of the total number of fish imported (Ramsey 1985).

Most of the commonly imported freshwater fish species are of South American, Asian, and African taxonomic origin. Most ornamental fish traded, however, are farm-raised freshwater species from Southeast Asia. In South America, little attention has been given to raising ornamental freshwater fish in captivity. It is presumed, therefore, that the South American export trade of ornamental fish is based on the collection of fish from the wild (Conroy 1975). Southeastern Asian countries, on the other hand, have long been famed for the culture of ornamental freshwater fish. Singapore and Hong Kong have become worldwide centers for the purchase and transshipment of ornamental fish. In contrast to freshwater fish, little is known on the culture of saltwater ornamental fish and to our knowledge most of them are collected from the wild. The Philippines and Indonesia are the main

TABLE 4. Regional sources of commonly imported ornamental fish into the United States of America. The volume of fish imported is expressed in percent of the total number for each species. Country abbreviations: Thailand (TH), Malaysia (MY), Singapore (SG), Indonesia (ID), Peru (PE), Hong Kong (HK), Colombia (CO), Trinidad & Tobago (TT), Venezuela (VE), South Africa (ZA), India (IN), China (CN), Japan (JP), Korea (KR), Jamaica (JM), Brazil (BR), Guyana (GY), Nigeria (NE), Sri Lanka (LK).

Species/Country	TH	MY	SG	ID	PE	HK	CO	TT	VE	ZA	IN	CN	JP	KR	JM	BR	GY	NE	LK
<i>A. kuhlii</i>	48	28	15	9															
<i>A. ramirezi</i>			69	25	4	1	1												
<i>A. ocellatus</i>	89		4	3		1	1	1	1										
<i>B. melanopterus</i>	80	18	1			1													
<i>B. tetrazona</i>	2	5	57	25		9		1		1									
<i>B. splendens</i>	75	1	10	13		1													
<i>B. macracantha</i>	1	11	10	76		1					1								
<i>B. xanthozoan</i>	13	3	11	73															
<i>C. auratus</i>	3	3	10	1	1	37						27	17	1					
<i>C. lalia</i>	5	28	63	2		1					1								
<i>C. lala</i>	91	1	1	5		1					1								
<i>G. aymonieri</i>	96		2	1		1													
<i>H. plecostomus</i>	13	1	11	1	1	1	3	34							34	1			
<i>K. bicirrhys</i>	83	5	3	9															
<i>L. bicolor</i>	76	22	1	1															
<i>L. erythrurus</i>	72	25	1	1		1													
<i>O. bicirrhosum</i>					95	1	3									1	1		
<i>P. sutchi</i>	86	10	1	1		1					1								
<i>P. axelrodi</i>			1			1	16									82			
<i>P. innesi</i>			7	3		86	4												
<i>P. kribensis</i>		2	83	10		2	1											2	
<i>P. pictus</i>					2		98												
<i>P. latipinna</i>		2	90	1		4				3									
<i>P. reticulata</i>	1	2	54	1		1		38		1					2				
<i>P. sphenops</i>		1	88	6		1									4				
<i>P. velifera</i>		17	72	9		1									1				
<i>P. scalare</i>	17	2	56	2	1	2	3	11	1						1	1	1		2
<i>R. heteromorpha</i>	7	20	64	4		4				1									
<i>S. discus</i>	79		2			1										18			
<i>T. ladigesii</i>		11	15	72		2													
<i>X. helleri</i>		2	93	1		2				1	1								
<i>X. maculatus</i>		17	75	6		1				1									

exporters of saltwater ornamentals. In the U.S. saltwater ornamental fish are collected primarily from coastal Florida and Hawaii. Although data analyzed is not conclusive, in-country visitations, conversations with government officials, fish collectors, and owners of fish wholesale houses confirm these conclusions.

The demand for ornamental fish appears to be seasonal. The pattern of ornamental fish imports and exports (Fig. 1) indicate a rise during March and April. This rise is most likely associated with a temporary increase in demand for fish during this time. Unfortunately, the reason for this purchas-

ing habit is unknown and should be investigated further. Also in early spring, U.S. domestic supply of ornamental fish is low due to delayed production during cold winter months. Broker-wholesalers and domestic farmers import fish to supply the demand until domestic production increases. There are indications that only the commonly imported species are being traded in great numbers at this time. For example, in Florida, indoor production of angelfish and tiger barbs remains the same, but imports rise during the early spring to meet the increased demand for these fish. A comparison between the monthly pattern of orna-

TABLE 5. *Principal ornamental freshwater fishes imported into the United States of America. Data for 1971 from Ramsey (1985).*

Common name	Species	Percentage of total fish imported	
		1992	1971
Guppy	<i>Poecilia reticulata</i>	25.8%	4.3%
Neon tetra	<i>Paracheirodon innesi</i>	11.3%	14.8%
Platy	<i>Xiphophorus maculatus</i>	5.4%	0.9%
Siamese fighting fish	<i>Betta splendens</i>	2.7%	2.1%
Goldfish	<i>Carassius auratus</i>	2.4%	0.5%
Chinese algae-eater	<i>Gyrinocheilus aymonieri</i>	2.4%	5.0%
Shortfinned molly	<i>Poecilia sphenops</i>	2.0%	1.2%
Cardinal tetra	<i>Paracheirodon axelrodi</i>	1.5%	8.4%
Glassfish	<i>Chanda lala</i>	1.5%	n.a.
Tiger barb	<i>Barbus tetrazona</i>	1.3%	1.7%
Red oscar	<i>Astronotus ocellatus</i>	1.2%	0.9%
Yucatan molly	<i>Poecilia velifera</i>	1.1%	n.a.
Redtail black shark	<i>Labeo biocolor</i>	1.0%	1.1%
Coolie loach	<i>Acanthopthalmus kuhlii</i>	1.0%	1.5%
Sucker catfish	<i>Hypostomus plecostomus</i>	0.9%	3.2%
Harlequin rasbora	<i>Rasbora heteromorpha</i>	0.9%	1.5%
Angelfish	<i>Pterophyllum scalare</i>	0.8%	5.2%
White-cloud	<i>Tanichthys albonubes</i>	0.5%	0.5%
Green corydoras	<i>Corydoras aeneus</i>	0.2%	1.6%
Leopard corydoras	<i>Corydoras julii</i>	0.1%	1.3%
Marbled hatchetfish	<i>Gasteropelecus strigatus</i>	n.a.	2.0%
Common hatchetfish	<i>Gasteropelecus sternicia</i>	n.a.	1.5%
Total		64.0%	59.2%

n.a. = no data available.

mental fish import and export value also indicates that U.S. trade flows may include a substantial amount of transshipments. For example, the largest volume of ornamental fish imports in terms of value occurred in March, but the export values peaked in April. Thus, a portion of the value of U.S. exports is produced domestically while the remaining product is imported or exported, for example, from/to Singapore, repackaged and exported to other parts of the world.

Although there are numerous import and export business houses, Los Angeles, Miami, New York, and Tampa have the broker-wholesale enterprises that trade most of the ornamental fish shipments. Ramsey (1985) suggested these broker-wholesale houses serve single retail pet stores at nearby population centers and pet warehouses at other major cities. The other less used ports (Chicago, New Orleans, San Francisco, etc.) may serve directly to pet dealers and whole-

salers in the immediate vicinity of their respective city.

Trade figures on the U.S. ornamental fish imports and exports indicate that the industry is expanding. As import and export numbers and value of ornamental fish increase, the U.S. net trade deficit also continues to rise. Imports of ornamental fish into the U.S. totalled \$45.2 million in 1993, a 10% increase from 1992 (USDA 1994). Exports of ornamental fish totalled \$17.3 million (5% higher than the previous year) for a net trade deficit of \$27.9 million. This latter value is a 13.9% increase in trade deficit from 1992.

The ornamental live fish industry has become the fastest growing segment of the U.S. aquaculture industry (USDA 1994). Domestic production of freshwater ornamental fish is predominately practiced in the state of Florida (USDA 1994). Most of the ornamental fish in Florida are of fresh-

water origin and raised in outdoor ponds. Newly released figures indicate that Florida ornamental fish sales totaled \$52.5 million in 1995, produced by some 205 farmers in approximately 580 ha of water surface area (FASS 1996). The survey showed that egg layers contributed \$35.2 million and live-bearers \$17.3 million.

The popularity and high value of the fish have placed ornamental fish production among the leading cash crops in the aquaculture economy. Currently few species are cultured domestically, the U.S. trade is based on foreign-cultured and wild caught species. The results of this study document the importance of the ornamental fish industry and identifies the most valuable species in the trade for potential domestic culture and protection in the wild.

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