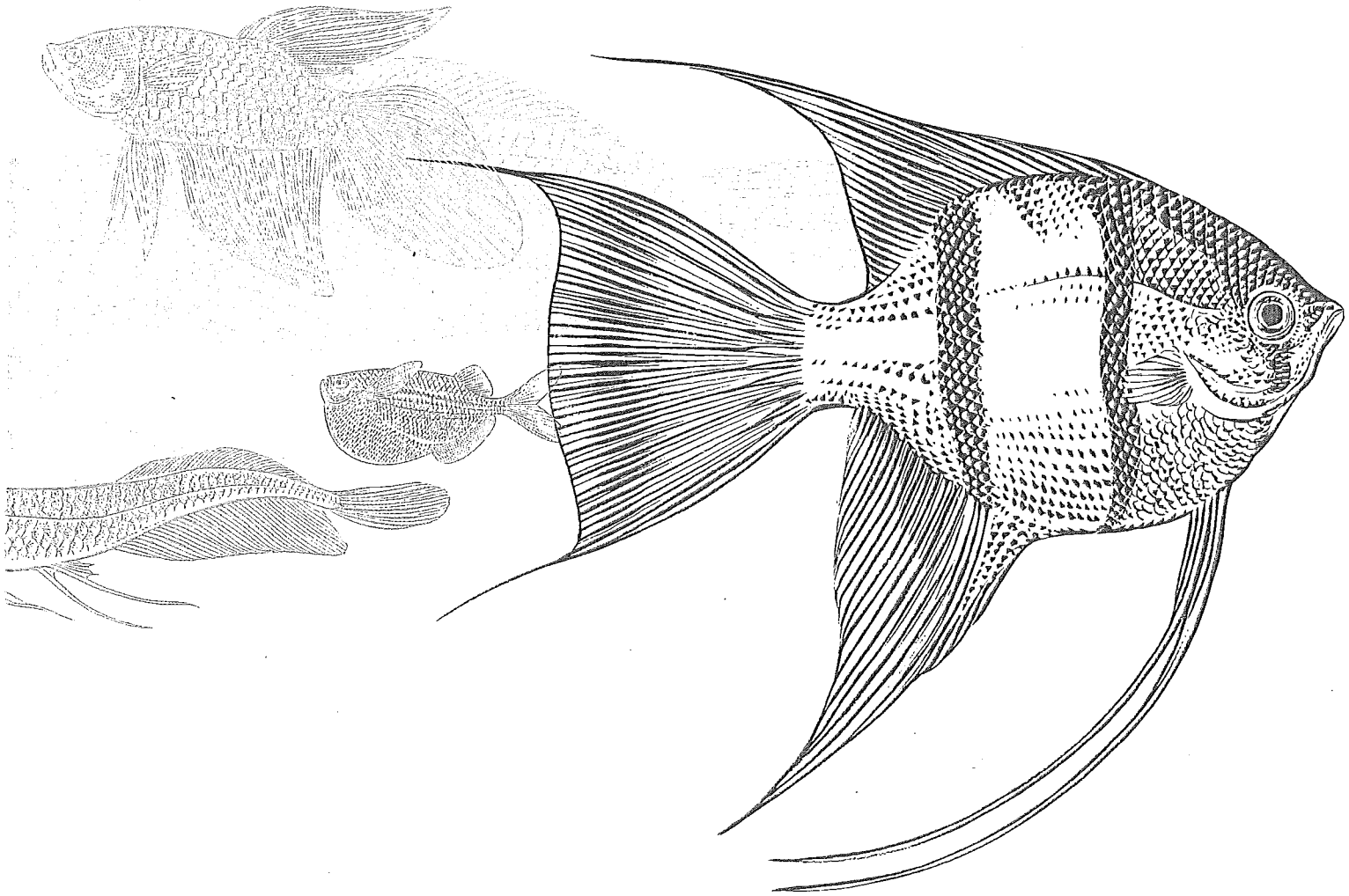
WWF

Wereld Natuur Fonds

TRAFFIC EUROPE

Ornamental fish trade in the Netherlands



Tonnie Woeltjes

WWF

Wereld Natuur Fonds

TRAFFIC EUROPE

Ornamental fish trade in the Netherlands

Tonnie Woeltjes

Acknowledgements

Preparation of this report would not have been possible without the assistance of many individuals, organizations and government agencies who responded to the request for information on trade in ornamental fish.
The complete report was reviewed by Arnold van Kreveld of WWF/TRAFFIC-Netherlands and Ger van Vliet of the CITES-Secretariat. Parts of the report were reviewed by Ruud Wildekamp of KFN, Cor van de Sanden of Poecilia Nederland and Willem Heins of NVC, providing comprehensive comments that were extremely useful in the preparation of the final text.
Mr. Paul Farrow kindly reviewed the English text.
Many people in the trade and hobbyists kindly cooperated, as well as the following aquarists societies: NCV (Dutch Cichlid Association), KFN (KilliFish Netherlands), Poecilia Nederland (Dutch Lifebearing Fish Association) and NBAT (Dutch Union of Aquarists Associations).
Several contributors are not mentioned here as it was felt more appropriate to keep their identity confidential. However, their help is gratefully acknowledged.
Martin Jenkins has greatly helped with the editing of this report, and for this I would like to thank him.
Finally, I wish to express my sincere gratitude to Arnold van Kreveld for his assistance during every phase of this project.
Completion of this report would not have been possible without the generous financial support of WWF-Netherlands.

Ornamental fish were already kept by ancient Chinese, Romans and Aztecs. Fish have been traded internationally in large numbers since the end of the 19th century. Throughout the 20th century large numbers of wild-caught fish have been supplied by African, Asian and South American countries, mainly to Europe and the US. Since the 1960s ornamental freshwater fish have been bred in increasing numbers in Southeast Asia. The reduction of shipping times since the 1960s by using air transport greatly increased the volume and species diversity of international trade.

Today's world market is estimated at about 350 million aquarium fish per year and is thought to be still growing (Fitzgerald, 1989). An estimated 90-95% of these are freshwater fish. Although Southeast Asian countries supply a large part of the market today with captive-bred specimens, a significant part of the trade still concerns wild-caught fish.
The Cardinal tetra, *Paracheirodon axelrodi*, is the most popular aquarium fish today. Official Brazilian records state that in the period 1977-1981 annually 12-17 million wild-caught specimens were exported from the Rio Negro basin only. Of the 20,000 known species of fish over 10% has been recorded in international trade in recent years. However, accurate trade volumes on a species level are unknown. There are indications that local populations are threatened by overexploitation for ornamental fish trade. Also, some of the methods used to catch marine fish are known to have major ecological impacts.

On the other hand, trade may have beneficial effects on the conservation of certain habitats by generating revenue for local people. However, only a few reliable surveys have been undertaken to estimate economic benefits from the trade in ornamental fish.

The Netherlands play an important role in the international trade in wildlife, including ornamental fish. In the country no licensing and monitoring system exists for species covered in this report. Traders are not required to supply information on traded numbers and species.

It is the aim of this study to document the trade in ornamental fish in the Netherlands. Information is presented on numbers, prices, trade-associated mortality, illegal trade, distribution of the economic benefits and effectiveness of current trade measures. This report gives some insight in the issue, but much still needs to be learned and documented.

A wide variety of sources was used: literature, price-lists and information on legislation as well as codes of conduct in Germany and the United Kingdom. Additional information was gathered in interviews with hobbyists, traders, authorities and conservationists.

Introduction

1 The history of fis

1.1 History of fish keeping worldwide

Fish keeping has a long history. The ancient Egyptians kept fish, almost certainly mainly for food but probably also for decoration. The Romans, around the time of Christ, kept fish in piscinae and vivaria, again mainly for consumption, but also for pleasure and study.

In the New World, the Spaniards came across fishponds in their conquest of Mexico: the Aztec king Montezuma is said to have had both freshwater and seawater ponds in his gardens to keep and breed fish and waterfowl.

However, it is the Chinese who were probably the first to keep and breed fish entirely for pleasure. The oldest description of breeding fish dates from 500 BC. Chinese sources mention an official in the province of Chekiang, who kept gold-shining and orange carp, as well as other species, in a garden pond. From the 10th century A.D. onwards keeping and breeding Goldfish *(Carassius auratus)* in large bowls decorated with a pair of dragons became very popular in China. These translucent porcelain dragon-bowls and their goldfish have been known in Europe since at least 1611 and were important objects of trade during the 17th century.
In 1572 the personal physician of the king of Brandenburg, Leonhart Thurneysser zum Thurn (1530-1596) had a spherical glass container made in which he kept fish swimming around a bird which was placed in the central compartment. In 1666 Leonhart Baldner, a fisherman from Strasbourg, discussed the possibility of keeping fish in glass containers to study them, and mentioned in particular the Weatherfish *(Misgurnus fossilis)* and its ability to predict the weather.

1.2 Modern aquaristics

J.M. Bechstein (Thüringen, Germany) is regarded as the founder of modern aquarium fish keeping. In 1797 he described the Weatherfish and Goldfish in detail, along with several newts and salamanders, in his book 'Naturgeschichte der Stubentiere'. In 1855 the Englishman Philip Henry Gosse, in his book 'A naturalist's rambles on the Devonshire coast', became the first writer to use the word 'aquarium' to describe water-filled containers with plants and fish in them.

After several minor publications such as 'Der See im Glase' (1856), Rossmäßler's influential book 'Das Süßwasseraquarium' was published in 1857. This drew wide popular attention to aquaria and fish keeping for the first time.

Between 1850 and 1890 many European zoos had aquarium displays, and in 1905 Scholze & Pötzschke set up in Berlin what was probably the first retail and wholesale business specializing in ornamental fish, amphibians and reptiles. This concern supplied many pet-shops in Germany and abroad. In 1911 a new large shop was opened, with a glass-house where fish were bred. Another pioneer was Karl Zeller in Magdeburg, Germany. Originally an amateur fish keeper, he established a firm for breeding ornamental fish in or just before 1908. Later he also imported ornamental fish from all over the world (Albrecht, 1993).
Specialized journals and books sprung up which disseminated information con-

sh keeping

cerning the rapidly improving techniques for keeping fish in aquaria. In Germany the weekly journal 'Isis' appeared from 1879 to 1889. This was followed in 1890 by 'Blätter für Aquarien- und Terrarienkunde', which continued after 1945 as 'DATZ'.

1.3 The introduction of tropical fish species

Originally, aquarists mainly kept and bred native fish but gradually tropical species increased in importance. In 1869 the Paradisefish, *Macropodus opercularis*, was brought from China to France on board a French warship. The Siamese fighting fish, *Betta splendens*, was imported from Asia to Europe for the first time in 1874, followed in 1892 by a North American Sunfish, a *Lepomis* species. Shortly afterwards several live-bearers entered the trade.
Other notable introductions were:

1903 *Barbus tetrazona*, the Tiger barb.
1905 *Brachydanio rerio*, the Zebrafish or Zebra danio.
1906 *Rasbora heteromorpha*, the Harlequin fish or Rasbora.
1908 *Corydoras paleatus*, the Peppered corydoras.
1910 *Hemigrammus ocellifer*, the Head-and-tail light.
1913 *Aphyosemion australe*, the Cap-Lopez.
1924 *Pristella riddlei*, a characid.
1925 *Pseudocrenilabrus multicolor*, a mouth-brooding cichlid.
1930 *Hyphessobrycon callistes*, the Jewel tetra.
1933 *Apistogramma agassizi*, the Agassiz dwarf cichlid.
1936 *Paracheirodon innesi* the Neon tetra.
1937 *Cichlasoma meeki*, the Fire-mouth cichlasoma.
1939 *Tanichthys albonubes*, the Chinese danio.
1948 *Microgeophagus ramirezi*, the Ramirez's dwarf cichlid.

In 1912 a German publication, the 'Taschenkalender' listed 180 species that had been imported up to that time. Arnold in 1950 knew of some 800 species in trade. Increasingly, as electricity for lighting and heating became widely available, the small and colourful tropical species displaced the few temperate species.

In the early days, breeding these species was considered a great challenge. For example, *Rasbora heteromorpha*, introduced in 1906, was not bred in Europe until 1932. Although breeding efforts gradually improved, few of the early introductions survived World War II in captivity. Examples of those that did are the Neon tetra, which was discovered in the middle Amazon basin in 1936, and was imported into Europe and the USA for prices ranging from Dfl 25.- to Dfl 30.- per specimen. In the 1950s this species was bred and the price dropped over tenfold, to approximately Dfl 2.- per specimen.

Tanichthys albonubes and *Aphyosemion australe* (the Cap-Lopez), also survived World War II in captivity. For years the natural habitat of the latter was unknown, until two Belgian aquarists rediscovered this fish in southwestern Congo in 1978. A few years later a French aquarist rediscovered this species in western Gabon, on Cap Lopez.

1.4 History of aquaristics in the Netherlands

In the Netherlands interest in aquatic animals was first roused by Heimans and Thijsse with the publication in 1895 of their book 'In sloot en plas'. C.J. den Hollander wrote the first book on aquaria and aquarium fish in the Netherlands, entitled 'Het Zoetwateraquarium' (1898). By 1902 it had already been reprinted five times. Pioneers of aquaculture in the Netherlands at that time included Butôt, Deutz, Gadiot, Groeneveld and Thiellier. The first Dutch aquarist societies

were founded in Amsterdam and Rotterdam, the cities where most fish were imported from Africa, Asia and America by sailormen.

Journals and associations concerned with fish keeping appeared, although most were short-lived. In 1930 the NBA -later NBAT- was founded by 8 associations with 275 members, and the monthly journal 'Het Aquarium' first appeared. In 1943 31 associations with 1357 members were affiliated with the NBAT. By 1946 this had grown to 62 associations with 6140 members and by 1955 to 232 associations with 16,112 members. In 1972 nearly 35,000 members were associated with NBAT although this had decreased to around 9000 by 1992. The latter figure probably represented something less than 10% of the total number of people in the Netherlands with one or more aquaria, who were believed to number between 100,000 and 150,000, this number having stayed fairly stable over the last few years.

According to a recent estimate (CBI, 1993), in the Netherlands as many as 220 fish-hobbyist associations exist, and, including people with a pond, an estimated 450,000 fish-hobbyists are found in the country.

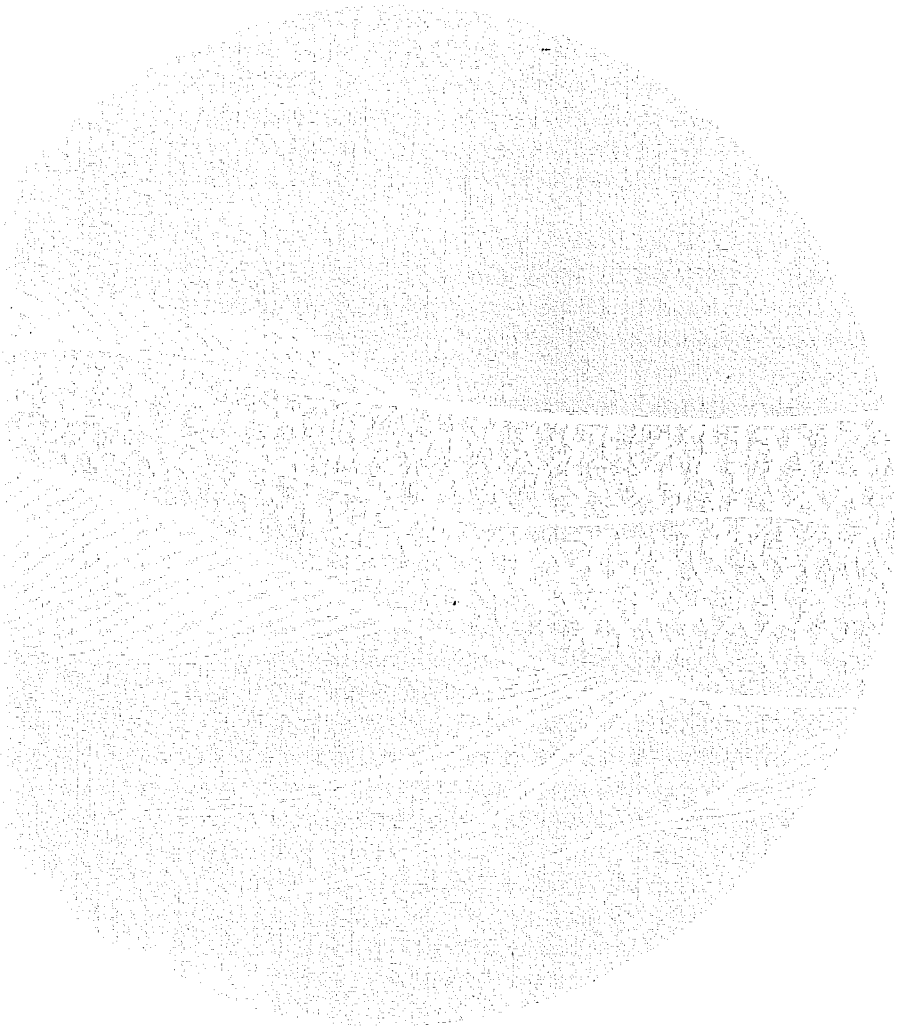
Over the years Dutch aquarists have developed their own particular form of aquarium, known througout the world as a 'Dutch aquarium'. This is a community aquarium in which the plants and decorative materials in particular, but also the fish, are designed to form an aesthetically pleasing whole, which complements the interior of the aquarist's home. Much attention is paid to the safety and technical performance of the technical equipment.

As the hobby developed in the Netherlands, competitive aspects became of increasing importance with local and national competitions arising in which the aquaria were judged in *situ*. Originally, fish only played a minor role in these aquaria, with aquatic plants being of major importance. However, as more and more specialist aquarist associations arose, themed aquaria, for example those for East African cichlids with rocky habitats, or marine aquaria, were also allowed to enter the competitions. Fish and other animals were of much greater importance in these more specialised aquaria. Nowadays the competition is further extended with the participation of riparia (i.e. shoreline aquaria) and aqua-terraria.

Among the specialised aquarist associations in the Netherlands are:

- NBZ, an organisation specializing in marine fish founded in 1950, with about 1500 members in 1992.
- KFN, a killifish-fanciers organization founded in 1972, with about 300 members in 1992.
- NVC, a cichlid-fanciers organization founded in 1975, with about 1600 members in 1992.
- Poecilia, a livebearer-fanciers association founded in 1984, with some 50 members in 1992.

International societies which have Dutch members include the 'Internationalen Gesellschaft für Regenbogenfische' (IRG) which was founded in June 1986 and is for those interested in Gouramis (Anabantidae). The 'Interessengemeinschaft Schmerlen', for specialists in the family Cobitidae, was founded in Germany in 1987, and resulted in the society 'Barben Salmler Schmerlen Welse' (BSSW) in 1989, with four groups, one for barbs (Cypriniformes), one for characins (Characiformes), one for loaches (Cobitoidea) and one for catfish (Siluriformes).



2 Ornamental fres

2.1 The world market

The world market in aquarium fish is estimated to number approximately 350 million specimens every year, and to be still growing (Fitzgerald, 1989). Between 90 and 95% of these are freshwater fish. The total value of the trade is estimated at over US$ 750 million annually. The USA is the world's largest market for ornamental fish, importing around 150 million specimens every year. Germany, Japan, the Netherlands and the United Kingdom also import large numbers. The trade of ornamental fish has become a huge industry, involving not only live fish but also aquarium plants, aquaria, aquarium-equipment, fish foods, medicines, books, journals etc.

2.2 Breeding of ornamental freshwater fish

Before 1940 the technical equipment available was fairly primitive, making it difficult to breed and keep tropical species successfully. It could, however, be a profitable business, as prices for fish were sometimes very high: the Neon tetra, *Paracheirodon innesi*, first imported in the mid 1930s could command prices at that time of Dfl 25.- to Dfl 30.- per specimen. Many aquarists tried to earn a living breeding fish, especially during the 1930s when unemployment was high in western Europe, but only a few succeeded.

With the widespread use after World War II of electricity for heating, lighting and later for filtering water, breeding results improved. A better understanding of water-chemistry led to further improvement. In western Europe a few professional breeders and many hobbyists successfully bred fish of many different species, some in large quantities.
Many aquarists in western Europe still breed ornamental fish, but almost all do so now as a hobby and not for commercial reasons. The majority of these breeders are members of specialist societies and the results of their efforts are published in hobbyist magazines.

Germany used to be the main source for captive-bred ornamental fish in Europe. However, the commercial breeding of tropical fish has become relatively uneconomical in western Europe in recent years, because of high labour and heating costs and despite the relatively high transport costs of importation from other parts of the world. Most commercial breeding has now moved to countries with cheap labour and a warm climate. Breeders in these countries have been able to benefit from the knowledge gained by amateur breeders, and from improvements in air-transport. Many of the countries supply both captive-bred and wild-caught specimens. Recently some commercial breeders have established themselves in the Mediterranean region, where the climate is warmer.

2.3 Origin of fish in the present-day trade

Since the 1970s, Asian countries such as Indonesia, the Philippines, Sri Lanka, Taiwan, Thailand and Singapore have been the largest suppliers of the international tropical fish trade, with Singapore the world's single largest producer, exporting approximately 150 million specimens annually. Outside Asia, Latin America is the principal supplier, particularly Brazil, Colombia and Venezuela.

hwater fish trade

A small proportion of the trade originates in the USA (mainly Florida), Europe and Africa, particularly Nigeria, Zaire, Burundi and Malawi.

Singapore

According to an editor's note in Aquarium Heute (1989), aquarium fish with a total value of U$ 47.3 million were exported from Singapore in 1986. The vast majority of the fish exported are captive-bred specimens. More than 500 different species originating in many parts of the world are offered, including many species of livebearing fish (families Poeciliidae and Goodeidae), many species of Latin American characins (Characidae), African and Latin American catfish (order Siluriformes), many species of Latin American and African cichlids (Cichlidae), Asian barbs and gouramis, and also cold-water species such as goldfish and gold-carp.

Ornamental fish breeding was established in Singapore by the Chinese. Tomey (1975) describes in detail how breeders used large Chinese pottery vessels as breeding containers. The juveniles are raised in large concrete or eternite tanks measuring 2 x 2 meters. The tanks and bowls are placed in the open-air under a loose roof of palm-leaves. A mean temperature of 28 C during daytime and some 25 C during nighttime makes this possible. Generally hatcheries are situated near a river or well to allow water to be changed regularly, particularly important for tanks holding juvenile fish.

Sometimes techniques developed for breeding fish for consumption have been used to improve breeding results. Poncin et al. (1988) report the successful artificial reproduction of *Labeo bicolor* and *Labeo frenatus* by using hypophysis extracts for stimulation of egg production and artificial insemination, a method originally developed to breed carp.

Other Asian countries

Fish exported from Hongkong, Taiwan and Israel are mostly captive-bred, while those exported from Indonesia, Thailand, Malaysia and Sri Lanka are a mixture of wild-caught and captive-bred. China and Japan mainly export 'cold-water species' such as goldfish and gold-carp.
Asian exporters transport their fish directly to the world's largest markets for ornamental freshwater fish: USA, western Europe and Japan.

USA

Martin (1987) reports that 95% of the captive-bred freshwater fish in the USA are produced in Florida, which has an ideal sub-tropical climate. There are about 300 licenced fish farms in Florida, mainly around Tampa. In total they have more than 20,000 culture ponds, usually 1.8 m deep and varying from 160 to 300 m2 in extent. Between 200 and 300 million fish of 100 different species are produced annually. Between 15,000 and 20,000 boxes leave Tampa weekly according to Hemley and Gaski (1986). Martin (1987) estimated their value to lie in the range US$ 15-150 million annually, while Hemley and Gaski (1986) quote estimated annual retail sales of over US$ 75 million. Figures of the Florida Tropical Fish Farmers Association (FTFFA) for 1989 give total combined sales of US$ 33.7 million for their 193 associated breeders.

The majority of the fish that are bred are sold on the local market in the USA, but some find their way to western Europe and elsewhere.

Latin America

Almost every aquarium fish from Latin America is wild-caught, although sometimes this is claimed to be untrue. At present Brazil is the main Latin American exporter. More than 80% of the aquarium fish exports from Brazil originate in the Rio Negro basin and are exported through Manaus, with most of the remainder exported through Rio de Janeiro.

Chao (1992 and 1993) estimates that between 30 and 40 million aquarium fish are extracted annually from this Rio Negro basin. Of these, only 10-20 million are actually exported from Manaus, because exporters lose about 30-35% of their stocks, and the collectors and intermediaries probably suffer similar or greater losses.
The Cardinal tetra or Red tetra, *Paracheirodon axelrodi*, is the most numerous species exported from Latin America. Official Brazilian records indicate that between 12 and 17 million Cardinal tetras were exported annually through Manaus during the early 1980s (Geisler, 1990). Smaller numbers are exported through Iquitos in Peru and through Colombia. Recent estimates by OFI (pers. comm.) suggest annual exports from South America (mainly Manaus, Brazil) may well number as high as 60-80 million Cardinal tetras. Extrapolating from Chao (1992 and 1993), annual extraction of Cardinal tetras may well be as high as 150 million.

The fish, especially the Cardinal tetra, provide major cash income to the rural communities of the region. The impact of collection on wild populations remains controversial. Geisler (1990) considered impact to be mimimal while Chao (1992 and 1993) stated that in recent years several traditional fishing grounds had been depleted of their commercial stocks of cardinals and that fishermen now had to travel to more distant tributaries for their catches.

In the Rio Negro basin ornamental fish are collected by 'caboclos' or river-people who live along the river margins and around temporary blackwater lakes and river margins, and make their living by gathering natural products from the rainforest, fishing, and hunting (Chao, 1992 and 1993).

The caboclos catch live fish in special dipnets called rapiches; the catch is stored in cages made from nylon mosquito netting awaiting the arrival of fish-traders in motorized boats who pass by periodically to buy the fish. Prices paid to the Rio Negro caboclos range from 0.5 to 1 US$ per 1000. This is confirmed by Wildekamp (pers. comm.), who visited the Rio Negro basin in February 1994.

Barcelos, some 385 km up the Rio Negro from Manaus, is the centre for the motorized fish-traders. Fish are stored in plastic shipping containers, called monoblocks, measuring 55 x 35 x 30 cm. One monoblock will hold 800 large or 1200 small Cardinal tetras or 200-600 specimens of other species. To prevent diseases oxytetracycline, a broad-spectrum antibiotic, is used. In Barcelos there are about 30 full-time fishing families and many more part-time fishermen. About 80% of the 6000 inhabitants of Barcelos have some economic tie to the ornamental fish trade.

The fish-traders in Barcelos in turn sell their fish to buyers who come to Barcelos on the weekly passenger boat. Chao (1993) quotes a price of less than US$ 2 for 1,000 medium-sized cardinals (0.2 cents a piece) and US$ 3 per thousand for other species. In contrast, Krause (1987) stated that about DM 15 was paid for 1,000 Cardinal tetras by a wholesaler in Manaus, which is equivalent to 1 cent (US$) a piece. This difference could reflect inflation between 1987 and 1992 or one or other may be in error; the later figures are probably the more reliable.

Roughly, per Cardinal tetra, collectors get US$ 0.001-0.002, exporters in Manaus pay US$ 0.002-0.01 and sell for US$ 0.04-0.08. Dutch importers receive US$ 0.25-0.60 and the retail price is US$ 1-2.

An individual fish-trader may sell 800,000 to 1.2 million fish to exporters every year. During the peak fishing season from September to February, some exporters

make the boat trip to Barcelos every week. Chao (1992) counted at least 1,200 monoblocks on a single trip, equivalent to around 800,000 fish. In Manaus they are stored in the aquaria of the exporters.

Brazil's Institute for the Environment and Renewable Resources, IBAMA (Instituto Brasileiro do Meio Ambiente e dos Recursos Naturais Renovaveis) has introduced some regulations to control the trade. Initially, only exports were permitted of 86 listed species. In addition, the capture of Cardinal tetras was prohibited from May to July, the peak of the spawning season. Recently, IBAMA changed the regulations by replacing this list of permitted species with a list of prohibited species, consisting essentially of all food fish in the region; thus all non-food fish can now be exported.

In 1990 the organization of the fourteen Brazilian exporters of ornamental fish, all based in and around Manaus, decided to stop the export of all aquarium fish during May, June and July. They also proposed to the Brazilian government that all collecting in the Rios Téia, Jufari, Aiuana and Quares be banned for a period of two years. A ban was also proposed on new companies for the whole Amazon basin.

Other important exporting countries in Latin America are Colombia, Peru, Venezuela and Guyana. Smaller numbers are exported from Paraguay, Argentina, Bolivia and Panama.

The majority of the Latin-American ornamental freshwater fish are sold in the USA. Hemley (1984) stated that in 1980 at least 20 million specimens were imported into the USA from Latin America.

Ornamental freshwater fish from Latin America destined for Europe are sometimes stored temporarily and/or repacked in Florida, USA. Transport from Latin America to Southeast Asia and Japan generally takes too long and nowadays Asian importers mostly buy Latin American species on the European and North American market.

Africa

Far smaller numbers of ornamental freshwater fish are exported from Africa than from Asia or Latin America. Zaire, Nigeria, Burundi and Malawi are the most important exporting countries. Smaller quantities are exported from Guinea, Zambia, Cameroon and Kenya. Most exports are to Europe.

Almost all fish exported from Africa are wild-caught. Some captive-breeding apparently takes place in Burundi. Fish from Burundi and Malawi come from lakes Tanganyika and Malawi respectively. The majority of these are cichlids (family Cichlidae).

Western Europe

Western Europe re-exports large quantities of ornamental freshwater fish, usually imported from Africa and Latin America, and sold to Southeast Asia and Japan.

2.4 Transport of ornamental freshwater fish

Originally freshwater fish were transported by ship in large heavy metal transport-cans, wrapped in insulating material. Because of the long duration of the journey mortality was high.

Between 1930 and 1940 Dutch importers furnished tanks with air supply on board ships of Dutch shipping-companies such as the 'Rotterdamsche Lloyd' and the 'Stoomvaartmaatschappij Nederland', so that fish could be imported from the

Dutch colonies in eastern Asia. The Harlequin fish, *Rasbora heteromorpha*, in particular was imported in large quantities into the Netherlands. Since the end of World War II, transport of ornamental tropical fish has increasingly taken place by air, this being the fastest and most efficient way of transporting perishable goods such as living animals. Nowadays virtually all transport is by air. The metal transport-cans used before World War II have been replaced, first by KLM, by plastic bags, which are far lighter.

Bags are 30% filled with clean water and fish, and then filled with oxygen, a mixture of oxygen and air or compressed air (for gouramis and catfish). The use of oxygen rather than air allows more fish to be packed per bag. Bags are placed in a box which usually measures 50 x 40 x 40 cm. Depending on the size of the animals boxes can contain anything from one large fish (e.g. an adult *Acanthicus hystrix*) to 1,200 small fish (e.g. juvenile Cardinal tetras).

To reduce the ammonia level in the water, fish are starved before they are packed. Fish are also usually transported in the coolest water they will tolerate, as this decreases the production of waste products and also keeps oxygen pressure higher. Drugs such as MS 222 (nembutal) and 2-phenoxyethanol are used to reduce the metabolism of the animals and thereby decrease oxygen consumption. All these factors allow more fish to be packed per unit volume of water and thereby reduce freight-costs.
A growing number of countries, including the Netherlands, have formally adopted the provisions of the IATA (International Air Transport Association) Live Animals Regulations. On 16 April 1990 the IATA had 157 active members, 32 associated members and 66 airlines were participating in the IATA Multilateral Interline Traffic Agreement - Cargo. This means that the majority of the airlines in the world will only accept live animals for transportation when they are packed according to IATA regulations.

These regulations are accepted by the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) and have been used by the Council of Europe as a basis for its code of conduct for the transport of animals.

The IATA Live Animals Regulations (17th Edition effective on 1 July 1990) describe the basic general behaviour patterns of animals which must be recognized by all parties concerned when planning a journey, the common handling precautions, considerations and carrier acceptance requirements which apply to any animal shipment. Furthermore it explains the general container requirements and the specific container and handling requirements for the advance preparation, emergency feeding, care and loading of the animals in question.

2.5 Import of ornamental freshwater fish into the Netherlands

No special licence is required to import ornamental fish and other aquatic animals into the Netherlands. Estimating the number of ornamental freshwater fish imported annually is very difficult for reasons discussed below, but is believed to be somewhere between 15 and 30 million. Imports are carried out by large wholesalers as well as by retailers and trans-shippers/consolidators. Only one of these is known to use the services of a professional veterinarian. Importers should keep newly arrived stock in quarantine for at least several days, and preferably for two weeks.

By far the largest importer of ornamental freshwater fish in the Netherlands, and one of the largest in the world, is based in Montfoort. This firm annually imports and exports millions of fish from and to all parts of the world. Every year about three million Cardinal tetras are flown in directly from Manaus in Brazil; these

represent about 15% of their imports. Other important countries which supply imports are Singapore (14%), the USA (22%) which mainly tranships Latin American stock, Germany (8%), Hongkong (3%), Zaire (4%), Nigeria (3%), Denmark (3%) and ex-Czechoslovakia (3.5%). Smaller quantities come from Burundi, Ghana, Guinea, Indonesia, Thailand, Sri Lanka and Belgium.

Only 15% of the fish imported are sold in the Netherlands. The remainder are re-exported mostly within Europe, with France accounting for 23%, Germany 16%, Belgium 8%, Italy 6%, and smaller quantities to the United Kingdom, Austria, Denmark, Spain and Switzerland. Many are shipped to Asia, with Japan accounting for 19%, Taiwan 7% and Hongkong 4% of exports.

The figures are certainly not representative of the other Dutch importers. Only two or three other firms have similar foreign connections while the smaller wholesalers and retailers import mainly for the local market.

An annotated list of freshwater fish regularly found in trade is presently in preparation (Woeltjes, in prep.)

Figures for imports and exports of ornamental freshwater fish from CBS (Centraal Bureau voor de Statistiek, Central Bureau of Statistics) over the years 1988, 1989 and 1990 are presented in Table A and B in the appendix of this report. The imports and exports are represented in kilograms and in ECUs. These figures provide little useful information regarding the numbers of fish in trade. The practice of reporting the volume of exports and imports in terms of weight alone is unsuitable as a basis of records, as the figures include the total weight of the water and packaging used in shipment as well as of the fish. Wood (1985 and 1992) made an attempt to calculate numbers of fish from weight of shipments based on suggestions by traders, but these figures did not correspond well with (more accurate) official figures based on declarations to customs. Neither does the value of a shipment provide a reliable measure of the number of animals involved, since prices for fish differ widely according to species and country of export.
Based on samples taken for this report, for 1992 a percentage was calculated from real imports at Schiphol airport, but only for two short periods. These figures too, are presented in Table A and B in the appendix of this report.

The risks when trying to calculate numbers of fish from the weights of shipments are clear when looking at recent CBI-data (1993). According to CBI 342,870 fish were imported from Brazil to the Netherlands. The actual number of Cardinal tetras alone for the same year to just one importer already is around 3 million.When adding other species and other Dutch importers the number of fish imported from Brazil directly to the Netherlands of course greatly exceeds 3 million. The number of 342,870 is therefore not even close to the actual number of fish imported.

The majority of ornamental freshwater fish are imported from outside the EU. Singapore is the largest single source of imports at present, although supplies from Indonesia are increasing rapidly. Figures for imports from the USA and South American countries are difficult to interpret, because a significant percentage of fish from South America is flown in through Miami (Florida, USA). Imports from Zaire virtually ceased in 1990 because of the difficult political and social situation in the country.

Many of the ornamental freshwater fish imported into the Netherlands are re-exported, mainly to other European countries, especially those in the EU, but also to several countries in East and Southeast Asia.

2.6 CITES

Trade in wildlife between countries is regulated by the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), which entered into force on 1 July 1975. CITES regulates trade in animals and plants listed in its appendices.
CITES prohibits commercial trade in threatened species which are listed in Appendix I. Trade in specimens of Appendix I-species may be authorized only in exceptional circumstances, provided the import is not primarily for commercial purposes. All international shipments must be covered by an export or re-export permit, as well as an import permit from the country of destination. Appendix II lists species which are vulnerable to exploitation but not yet at risk of extinction. Trade in these species is permitted in a regulated manner. For trade in specimens of Appendix II-species, an export or re-export permit is required, but not an import permit. An export permit may be issued only if the export is not detrimental to the species.

The freshwater or anadromous fish listed on CITES are:

Ceratodiformes : Ceratodidae		
Neoceratodus forsteri	Australian lungfish	II
Acipenseriformes : Acipenseridae		
Acipenser brevirostrum	Shortnose sturgeon	I
Acipenser sturio	Common sturgeon	I
Acipenser oxyrhynchus	Atlantic sturgeon	II
Polyodontidae		
Polyodon spatula	Paddlefish (since 1992)	II
Osteoglossiformes : Osteoglossidae		
Arapaima gigas	Arapaima	II
Scleropagus formosus	Asian arowana	I/II
Cypriniformes : Cyprinidae		
Caecobarbus geertsi	African blind barb	II
Probarbus jullieni	Ikan temoleh	I
Catostomidae		
Chasmistes cujus	Cui-ui	I
Siluriformes : Schilbeidae		
Pangasianodon gigas	Giant catfish	I

Formerly the killifish *Cynolebias constanciae, C. marmoratus (=Leptolebias marmoratus), C. minimus (=Leptolebias minimus), C. opalescens (=Leptolebias fluminensis)* and *C. splendens (=Leptolebias sandrii)* (Cyprinodontiformes : Rivulidae) were listed in Appendix II of CITES; they were removed from the appendices in 1992.

3 Marine fish trad

The trade in marine ornamental fish and invertebrates differs in many aspects from that in freshwater species. Most importantly, while the majority of the latter are now captive-bred, marine animals are almost all taken from the wild. The only marine fish regularly bred in captivity are a few species of clownfish. Most species in trade come from coral reefs as the great majority of pelagic species are unsuited to life in small or medium sized aquaria.

3.1 Collectors and collecting

Although some live fish are caught as a sideline by commercial food fishermen using gillnets (a technique resulting in a high injury rate to the animals), the majority of live fish and other animals are collected by divers. Many of them are inexpert, and apparently little interested in the welfare of the animals they collect. Most are paid small amounts for the animals they collect and therefore are forced to collect large numbers to make a reasonable living.

Typically, chemicals are used to immobilize the animals temporarily for collection. Quinaldine and rotenone are most suitable for this, but they are very expensive and difficult to obtain. Many divers therefore use sodium cyanide or sodium hypochlorite which are cheaper and easier to obtain. These are often supplied to the divers by the fish exporters who buy the fish collected. The cyanide is diluted in sea water and squirted into the hiding places between the corals. Although this usually kills some of the target species (as well as non-target animals), others become immobilized and drift to the surface where they are collected.

The use of cyanide has major ecological impacts, causing mortality of many species on the reef, particularly sessile animals such as the corals themselves (Robinson 1985). In the Philippines for instance, shallow water areas close to shore have been so affected by collecting practices for ornamental trade that collectors have been forced to move out into deeper waters. Although the use of sodium cyanide and other destructive fishing methods, such as dynamiting reefs, is illegal in the Philippines, they continued at least until recently. As became evident when some shipments from the Philippines, showing clear signs of being affected by these fishing methods, arrived in the Netherlands at the end of 1992 (pers. observation).

Fish collected with cyanide suffer heavy mortality both during transport and after they have reached their country of destination; deaths particularly occur after the fish have been fed for the first time. Such mortality has given a poor name to Philippine exporters as suppliers of life marine fish.

Officials in the Philippines have claimed that they lack manpower to control the collectors, although it has been alleged that lack of will rather than of resources is the principal impediment to reform Robinson (1985).
In 1986 training began of some ornamental fish collectors in the use of handheld nets and barrier nets. These techniques are well developed in other countries which supply the marine aquarium trade. This was followed up by training in fish holding and shipping techniques (Wood, 1992).

Klausewitz (1987) described how marine fish were collected in Kenya for many years in an ecological responsible manner by taking only juveniles. Commercial collectors however also started collecting the more immediately profitable adult specimens, thereby disrupting populations on the reef and putting their own busi-

ness in jeopardy in the long term.
Wood (1985) noted a further problem with collection of fish from deep waters. These must be brought to the surface very gradually to allow the fish' swim-bladders to re-adjust to the decreased presure. In Sri Lanka she observed many collectors bringing fish to the surface without allowing decompression time. The inflated swim-bladders were then pierced with a pin; this resulted in heavy subsequent mortality, either during transport or later in the country of destination.

3.2 Export from the countries of origin

Exporters usually pay very little money for the fish they buy from collectors; few exporters work with their own divers.

Invertebrates, sea-weeds and large amounts of 'live rock' are exported from several countries. 'Live rock' is generally old dead coral, stuck together with silt, calcareous algae and bryozoans and rich in animal and plant species.

Many exporters lack professional knowledge of the handling and specialist care of the marine species they export. The majority of them are principally exporters of freshwater fish and export marine animals as a sideline. Only a few specialize in marine animals. These specialists usually offer the highest quality of animals as they handle their livestock with more care and knowledge and have better equipment. Their prices are therefore usually higher than those of other exporters.

Derr (1992) describes how collectors carried off between 500 and 600 tons of live rock from the Florida Reef Tract in a period of just two years. Confronted with a similar situation in 1990, Hawaii banned the taking and selling of stony coral, and in 1991 of any rock with marine life attached. Guam and Puerto Rico have introduced similar regulations but the trade continues in many other countries, with most of the 'live rock' imported into the Netherlands and Europe today coming from Singapore.

3.3 Exporters and exporting countries

Table C in the appendix presents the main exporters of marine ornamental fish to the Netherlands for the years 1988-1992.

Until the mid-1980s the Philippines were the major exporter of marine animals to western Europe and the USA, supplying around 70% of the world market. However, because of the poor quality of exports and consequent declining reputation of the Philippines as a supplier, the trade has shifted largely to Singapore, Indonesia and Sri Lanka.
The Philippine exporters concentrate on fish, and export few invertebrates. Although their quality is generally low, these exports are cheaper than those from elsewhere and some trade therefore still persists.

Singapore largely exports marine invertebrates in a wide variety and in large numbers. There are some specialist exporters, and the quality in general is very good.

Indonesia offers a large assortment of fish and invertebrates of very variable quality.

Sri Lanka exports fish and invertebrates of a limited number of species. The quality is reasonable.

There are occasional exports of fish or fish and invertebrates from the Red Sea area. Variety and quality are in general very good, but because of the political situation in the area supply is irregular.
There is some export of fish and invertebrates from eastern Africa, mainly Kenya. Prices are high but this is not always reflected in the quality of the animals.

The Caribbean area supplies a wide range of small fish species, exports are generally of good quality. Shipments for Europe usually go through Florida.

Hawaiian exporters offer many species of fish but relatively few invertebrates. Prices are rather high and the quality is good. Consignments for Europe are usually transshipped via the mainland USA.

Other areas which export marine animals are Australia (the Great Barrier Reef), the Lord Howe Islands, the Marshall Islands, the Cook Islands, the Christmas Islands and the Tuamotu Archipelo in French Polynesia.

3.4 Transport of marine ornamental fish

Marine animals are generally transported by air. They cannot be packed as densely as freshwater animals, so transport costs are much higher. Ideally, they should be packed individually in separate plastic bags, but this is not always done. Exporters keep the amount of water each animal is packed in to a minimum to reduce transport costs. For fish extra oxygen is needed to survive the journey in good condition. The plastic bags are packed in styropore boxes or sometimes in boxes lined with styropore and paper.

Mortality during shipping depends on the physical condition of the animals following capture, decompression and treatment, handling technique and time taken for transportation. Most airline companies nowadays have special freight capacity for live animals, where temperature and pressure are kept constant. Under optimum conditions, mortality rates as low as 2-3% can be achieved, and 100% mortality of shipments, as used to be observed, is now very rare. Some species however are more sensitive to transport than others.

The total time for packing and transportation can exceed 36 hours, and any delay to the flight can be fatal for the animals.

3.5 Import of marine ornamental fish into the Netherlands

Table D in the appendix presents the main importers of marine ornamental fish exported from the Netherlands for the years 1988-1992.

According to CBS statistics, the total import of marine ornamental fish into the Netherlands in 1990 was valued at some 1.23 million ECU (ca 2.7 million Dutch guilders). These imports originated in a wide range of countries.

As elsewhere, the Philippines were originally the major supplier but have now ceased to be so. Figures from CBS show that the Philippines supplied 15% of the marine fish in 1988, 5% in 1989, 3% in 1990 and an estimated 1% in 1992. As of 1991, Indonesia was the biggest supplier of the Dutch market, accounting for approximately 35% of imports. Singapore has rapidly risen in importance and was expected to overtake Indonesia in 1992. Its share of the market rose from 4.5% in 1988 to 13% in 1990 and a projected 40-50% in 1992. Other notable suppliers are the USA (10-12%), Sri Lanka (5%), and the Maldives (5%). Small amounts originate elsewhere, for example the Netherlands Antilles, Kenya, Egypt, Costa Rica and Australia.

About 10% of imports are recorded as coming from other European countries, mainly Belgium. This is because some importers bring in their shipments through Zaventem airport near Brussels, this being closer to them than Schiphol airport (Amsterdam). It is also averred that controls at Zaventem may be less strictly enforced than those at Schiphol.

No special licence is required to import marine animals into the Netherlands. The Netherlands market is dominated by one large importer, accounting for over 50% of all imports. Retail shops buy their fish from wholesale importers, or import their fish by way of a transshipper.
Importing marine animals requires a high level of professional knowledge, particularly with regard to water chemistry and the individual needs of each species. Facilities must also be available to keep the animals in quarantine for at least several days, preferably for one or two weeks. Several importers and retailers lack the knowledge and the skill to deal with wild-caught and newly imported marine fish, but still continue.

One of the most critical stages in acclimatising newly imported species is the first feeding. Animals that are not in good condition, and whose digestive system is not functioning well will often die at this point.

3.6 Public and home aquaria

Self-evidently, only healthy animals should be bought, although it is not always easy to determine the state of the animals. Often cheap animals are bought, even when it is generally known that they tend to come from countries which supply poor quality animals.

Although not common practice, it is important for the buyers of marine animals to keep any new stock in quarantine for a period of at least several weeks, and preferably three months. Too often newly acquired animals are placed immediately in a community tank, leading to outbreaks of disease. Treatment in a community tank is always much more difficult, because many species may be sensitive to the medicines used for treatment.

Often inexperienced aquarists will place incompatible animals together in a community aquarium.

Wood (1985) in a study of the Sri Lankan fish trade estimated a total mortality rate of 64% from the time of capture until the animals had been kept at their final destination for a period of six months. Since then, knowledge of the capture, handling and feeding of marine fish has improved, and it is likely that mortality rates have decreased somewhat.

In 1950 a Dutch confederacy of marine aquarist associations was founded: the NBZ ('Nederlandse Bond van Zee-aquarium verenigingen'). Their journal 'Het Zee-Aquarium' is published monthly, in full colour, with informative articles written by and for their members. The NBZ produces another high quality publication, 'Gids en Handboek', a loose-leaf publication, published in parts since 1985, with valuable information on all aspects of marine aquaria in the home.

The NBZ participates in all the consulting structures with other hobbyist organizations, with the responsible Ministry ('Landbouw, Natuurbeheer en Visserij', i.e. agriculture, nature management and fisheries) and the importers of ornamental fish.

It considers that the number of species imported should be limited, with no import at all of very vulnerable species such as many of the sponges, and would also like to see imports halted from areas which supply poor quality stock. Their criterion is that all marine animals not banned from trade, that can be demonstrated, totally or in part, to be bred in captivity, should be allowed to be kept.

In the opinion of the NBZ all tropical marine fish can be kept, excluding all species of the order Lophiiformes, the families Mullidae, Zanclidae, Dactylopteridae

and Pegasidae, the genera *Microlabrichthys, Chaetodon, Pomacanthus, Pygoplites, Anampses* and *Oxymonacanthus,* and several species of *Acanthurus,* namely *A. leucosternon, A. achilles, A. triostegus, A. glaucopterus* and *A. japonicus.* They also consider that all invertebrates can be kept except: in the Phylum Cnidaria all species in the orders Antipatharia, Coenothecalia, Gorgonacea without zooxanthellae, and Pennatulacea; amongst molluscs all species of the Nautiloidei; of the Echinodermata all the species of the order Isocrinida (NBZ, December 14, 1993).

3.7 Marine species under CITES

As of July 1993 only five species of partially or wholly marine fish were listed under CITES: three species of anadromous sturgeons *(Acipenser brevirostrum, A.sturio and A.oxyrhynchus)*, the Coelacanth *(Latimeria chalumnae)*, transferred from Appendix II to Appendix I in January 1990, and the Totoaba or MacDonald weakfish *(Cynoscion macdonaldi),* a large game fish found only in the Mexican waters of the Gulf of California.

A significant number of animals imported for marine aquaria are invertebrates of which more species are found on CITES.

In 1985 the following corals were listed in Appendix II of CITES:
Black corals (Antipatharia)
Stony corals (Scleractinia)
Fire corals (species of the family Milleporidae)
Lace corals (species of the family Stylasteridae)
Blue corals (Coenothecalia spp.)
Organpipe corals (of the family Tubiporidae)

Giant clams of the family Tridacnidae (Mollusca : Veneroida) are also listed on Appendix II of CITES.

In the Netherlands CITES is implemented under the 'BUD'-law (i.e Bedreigde Uitheemse Diersoorten=Endangered Exotic Animal Species Act) and the 'In- en Uitvoerwet' (Import and Export Decree for Endangered Exotic Animals and Plants).

In July 1993 the following species were listed on the BUD-law: 21 species of Pearl mussels (Unionoida : Mollusca) and the Agate snails of the genus *Achatinella* (Stylommatophora) next to *Acipenser brevirostrum*, the Shortnose sturgeon.

On Appendix 2A (Import and Export Decree, with restrictive licence policy) are listed five more species of Pearl mussels, next to *Acipenser sturio*, the Common sturgeon. On Appendix 2B of the Import and Export Decree (with less restrictive licence policy) are listed, besides the Coelacanth and the Atlantic sturgeon, another six more species of Pearl mussels (Unionoida), all species of Black corals (order Antipatharia), all species of the genera *Acropora* (the Branch corals), *Euphyllia* (the Brain trumpet corals), *Favia* (the Brain corals), *Fungia* (the Mushroom corals), *Halomitra* (the Bowl corals), *Lobophyllia* (the Brain root corals), *Merulina* (the Merulina corals), *Pavona* (the Cactus corals), *Pectinia* (the Lettuce corals), *Platygyra* (the Brain corals), *Pocillopora* (the Brown stem cluster corals), *Polyphyllia* (the Feather corals), *Seriatopora* (the Bird nest corals) and of the genus *Stylophora* (the Cauliflower corals) all the Stony corals (Scleractinia). And also all the Fire corals of the genus *Mellipora* (Hydrozoa) and the Soft corals (Alcyonaria) of the genera *Heliopora* (the Blue corals) and *Tubipora* (the Organpipe corals).

4 The specialized

4.1 Killifish

The killifish, or egg-laying tooth-carps, are a very variable group of fish included in several families in the order Cyprinodontiformes. Many of the species, especially those from tropical regions, are very colourful and have long been popular aquarium fish. Much of the knowledge of the biology, distribution and systematics of the killifish has been and continues to be contributed by aquarists and amateur scientists. Of particular interest are the so-called annual species.

The American Killifish Association (AKA) was founded in 1962, followed in 1965 by the British Killifish Association (BKA), in 1968 by the German 'Deutsche Killifisch Gemeinschaft' and in 1972 by the Dutch 'Killi Fish Nederland' (KFN). Since then associations have been formed in Belgium (separate French and a Flemish speaking associations), France, the Scandinavian countries, Canada, Japan, Spain, Uruguay and Brazil. All these associations have a species maintenance programme to encourage members to set up breeding teams and/or programmes for species to maintain healthy populations in captivity.

Species are exchanged on an international basis, by air-freighting fish or by sending their eggs by air mail. This is possible because the eggs, packed in damp peat in plastic bags or jars, can survive from two weeks for the non-annual species, to several months for the annual species.

Killifish are of little importance in the regular fish trade. The majority of the species are difficult to collect without specialist knowledge of their habits. In addition, many are very good jumpers and tend to escape from the open containers of those collecting them in the wild or from the tanks of exporters and importers. Because of the high level of exchange and trade in killifish by amateurs, prices are mostly low, reducing the incentive to import wild-caught animals for commercial purposes.
Of the hundreds of species and populations available in the killifish associations, only about thirty species are found in the regular ornamental fish trade; the majority of these are represented by captive-bred specimens supplied by killifish fanciers.

The Dutch association of killifish fanciers, KFN, publishes annually an inventory of the species and populations kept and bred by their members. According to the 1993 inventory (Van de Berg, 1993), members of the KFN keep and breed 597 different populations and/or subspecies of between 235 and 280 different species. Forty-five populations belong to unknown species.

The majority of these captive populations and species originate in animals collected in the wild by members of the killifish associations at collecting expeditions. In general only small numbers of each species are collected, and information is also gathered on the habitat and ecology of the species. The fish are packed in polythene bags singly or in small groups. As long as the water is changed regularly they can be kept alive up to three weeks.
The collectors then attempt to breed these species in captivity. Offspring are distributed to the other members of their association and to members of the other

aquarists societies

associations, often through exhibitions and shows. Information on the collecting trips and subsequent breeding efforts are passed on through lectures at shows and in articles in the specialist journals.

The advantage of this system is that in general only small numbers of fish are taken from the wild. Some species such as *Tomeurus gracilis*, an oviparous toothcarp with internal fertilization from northern South America and some lampeyes of the African genus *Hypsopanchax*, are very difficult to keep alive during transport and never reach hobbyists' aquaria.

When species are difficult to keep and/or to breed, they are generally only distributed to more experienced breeders. If breeding efforts fail, as in the case of *Aphyosemion joergenscheeli*, they disappear from captivity. If the technique of breeding them in reasonable numbers is discovered, they are distributed to hobbyists both within and outside the associations. Offspring are then often sold to retail shops and/or dealers in the regular ornamental fish trade. *Aphyosemion australe, A. (=Fundulopanchax) gardneri* and *Nothobranchius rachovi* are examples of species which have entered the regular fish trade by this route.

There are a few hobbyists who carry out collecting expeditions solely for financial gain, collecting as many animals as possible to sell to fellow hobbyists. However, it is felt that these collectors do not pose a serious threat to wild populations.

The Dutch Killifish association holds a meeting every two months, normally attended by 100-125 members and a few hobbyists from Belgium and Germany. There is a lecture and the opportunity to buy or exchange fish. Usually 100-150 pairs of fish change hands at these meetings for a price of US$ 2-3 a pair, or US$ 6 a pair for rarities.

Like other killifish associations, the KFN organizes an annual exhibition, where between 400 and 500 pairs of fish are shown, with entries from all over the world. Fish are judged. The fish that are sent in, are donated to the organizing association and sold in an auction. This is one of the ways in which species are exchanged between members of the different killifish associations.

Up to 1992 five species of *Cynolebias* were listed on CITES Appendix II: *C. constanciae, C. marmoratus, C. minimus, C. opalescens* and *C. splendens.* In the Netherlands these species were listed on Appendix B of the 'Import and Export Decree for Endangered Exotic Animals and Plants' (see chapter 5).

The 'KFN' is a member of the 'Federatie Welzijn Koudbloedigen' (FWK, Federation for Welfare of Cold-blooded animals), a coalition of hobbyist organizations concerned with the welfare of ornamental fish, amphibians and reptiles. Welfare of these animal is regulated in the Netherlands by the Law on Welfare of Companion-animals, introduced in 1992.

Currently the following species are included in the 'IUCN Red List of Threatened Animals' (see table on next page).

Tabel I **List of killifish found on CITES (Appendix II) and Appendix B of the 'Import and Export Decree for Endangered Exotic Animals and Plants' (first column), 'Red Data Book' of 1969 (second column), 'Red Data Book' of 1971 (third column), 'Red Data Book' of 1979 (fourth column) and the '1990 IUCN Red List of Threatened Animals' (fifth column).**

X = Listed
Ex = Extinct
E = Endangered
V = Vulnerable
R = Rare
I = Indeterminate
U = Unknown

Species	CITES	1969	1971	1979	1990
Aplocheilidae					
Nothobranchius spec. Caprivi					E
Rivulidae					
Campellolebias brucei				X	E
Cynolebias boitonei			I	X	R
Cynolebias constanciae	X	U	U	X	V
Cynolebias marmoratus	X	E/Ex	E/Ex	X	E
Cynolebias minimus	X	U	U	X	I
Cynolebias opalescens	X	E/Ex	E/Ex	X	E
Cynolebias splendens	X	E/Ex	E/Ex	X	E
Rivulus marmoratus					R
Rivulus robustus					R
Profundulidae					
Profundulus hildebrandi				X	
Fundulidae					
Fundulus albolineatus				X	Ex
Fundulus julisia					R
Fundulus lima					V
Fundulus waccamensis					V
Lucania interioris				X	E
Valenciidae					
Valencia hispanica					E
Aplocheilichthyidae					
Micropanchax (=Aplocheilichthys) schoelleri		Ex?	Ex?	X	I
Goodeidae					
Crenichthys baileyi					V
Empetrichthys latos latos		E	E	X	E
Empetrichthys latos concavus		E	E	X	Ex
Empetrichthys latos pahrump		E	E	X	Ex
Empetrichthys merriami				X	Ex
Cyprinodontidae					
Cualac tessellatus					E
Cyprinodon alvarezi					E
Cyprinodon atrorus					R
Cyprinodon beltrani					V
Cyprinodon bifasciatus					R
Cyprinodon bovinus				X	E
Cyprinodon diabolis		E	E	X	V
Cyprinodon elegans		E	E	X	E
Cyprinodon eximius					V
Cyprinodon fontinalis					E
Cyprinodon labiosus					V
Cyprinodon latifasciatus					Ex
Cyprinodon macrolepis					V
Cyprinodon macularius				X	E
Cyprinodon maya					V
Cyprinodon meeki					E
Cyprinodon nazas					V
Cyprinodon nevadensis					V
Cyprinodon nevadensis calidae		E	E	X	(V)
Cyprinodon nevadensis mionectes		R	R	X	(V)
Cyprinodon nevadensis pectoralis		E	E	X	(V)
Cyprinodon pachycephalus					E
Cyprinodon pecosensis					V
Cyprinodon radiosus		E	E	X	E
Cyprinodon salinus milleri					R
Cyprinodon salinus salinus					R
Cyprinodon simus					V
Cyprinodon spec. Perrito de Sandia					Ex
Cyprinodon tularosa				X	R
Cyprinodon verecundus					V
Kosswigichthys (=Aphanius) asquamatus	E	E	X	V	
Megupsilon aporus				X	E
Orestias cuvieri		Ex?	Ex?	X	E

Cynolebias splendens is a synonym for *Leptolebias sandrii*, and *Cynolebias opalescens* a synonym for *Leptolebias fluminensis*.

C. minimus and *C. constanciae* have been bred in captivity in the Netherlands since 1980, when they were introduced from the USA. *C. constanciae* in particular has been bred in large numbers and been offered for sale in many retail shops during the past ten years. *C. minimus* is usually traded under its synonym *Cynolebias ladigesi*, or as *Cynolebias* spec. NSC-2. *Cynolebias marmoratus*, now *Leptolebias marmoratus*, has not been kept in the past few years.

Aphanius apodus (Cyprinodontidae) is not included in the IUCN Red List of Threatened Species, although concern was expressed about its conservation as early as the 1960s (Villowck, 1969). Nothing was known of the fate of the species until a member of the KFN rediscovered it in the wild in 1990, in a single small ditch in the highlands of the Atlas Mountains in Algeria. This ditch was threatened by the planned construction of a new road, the withdrawal of water for irrigation and the use of pesticides in the surrounding agricultural fields. The discoverer of the population therefore collected fifty specimens which were distributed between specialized members of the killifish associations in the Netherlands and Germany and the Artis-aquarium in Amsterdam. After some initial problems, the species is now bred in reasonable numbers, and appears relatively secure in captivity. Because of political problems it is difficult to establish the current status of *A. apodus* in the wild or to pursue recommendations that a protected area be established to preserve its habitat.

The KFN and Artis-aquarium have founded an 'Aphanius Conservation Group' to focus attention on the critical situation in the wild of several *Aphanius* and *Valencia* species in southern Europe, northern Africa and Minor Asia. It is planned to establish captive-bred populations for these species as is done for the severely threatened fish fauna of the North American deserts (Pister, 1981). It is hoped that these may serve as a potential source for future reintroductions.

4.2 Livebearing ornamental fish

By live-bearers, aquarists usually mean species of the Latin American families Poeciliidae (Live-bearing toothcarps), Goodeidae (Highland toothcarps) and Anablepidae (Four-eyed fish) in the order Cyprinodontiformes, and species of the south-east Asian family Hemirhamphidae (Halfbeaks) in the order Beloniformes. Many other fish not usually found in home aquaria are live-bearers.

Livebearers have been very popular aquarium fish since the inception of the hobby. *Xiphophorus helleri* (the Swordtail), *Poecilia sphenops* (the Molly) and *Poecilia reticulata* (the Guppy) were some of the first species to be imported and bred. Several species of livebearing fish can be found regularly in the ornamental fish trade. The most common are the Guppy, the Platy, *Xiphophorus maculatus*, and the Swordtail.

There are specialist aquarist associations concerned with the keeping of livebearers in several countries. The Dutch association, named Poecilia Nederland, has about 70 members and is one of the smallest of the specialized aquarist societies in the Netherlands. Some members are primarily interested in the Guppy and all its breeding forms, but the majority are interested in a wider range of species.

Every two months 'Poecilia Nederland' organizes a meeting with lectures on various aspects of collecting, keeping and breeding of livebearing fish, and an opportunity for members to exchange fish. The organisation also publishes a bi-monthly journal.

There are extensive contacts with organizations in neighbouring countries, especially during shows, where fish are shown and judged. The guppy breeders have a

European competition with a championship which was held for the fifteenth time in 1993.

According to the 1993 inventory carried out by the society, a total of 102 different strains, populations or species are kept by the members of 'Poecilia Nederland'. The society co-operates with the Artis Aquarium in Amsterdam to maintain livebearing fish species in captivity. Information on protected and/or threatened species is exchanged with similar organizations in other countries (DGLZ in Germany and Viviparous in England). Of the livebearing fish that are vulnerable or endangered according to the 1990-update IUCN Red List of Threatened Animals *Ameca splendens, Characodon lateralis* and *Skiffia francesae* are kept by members of 'Poecilia Nederland'.

'Poecilia Nederland' is also a member of the 'FWK' (Federatie Welzijn Koudbloedigen = Federation of Welfare of Cold-blooded Animals). The society has annotated a list of live-bearers, classifying them into those which are easy to keep, those which should be kept only by experienced aquarists and those which should not be kept at all. This list was appended to the Act of Welfare of Companion Animals at the end of 1993.

Tabel II **List of livebearing fish found in the 'Red Data Book' of 1969 (first column), 'Red Data Book' of 1971 (second column), 'Red Data Book' of 1979 (third column) and the '1990 IUCN Red List of Threatened Animals' (fourth column).**

X = Listed
Ex = Extinct
E = Endangered
V = Vulnerable
R = Rare
I = Indeterminate
U = Unknown

Species	1969	1971	1979	IUCN'90
Poeciliidae				
Gambusia alvarezi				V
Gambusia amistadensis			X	Ex
Gambusia eurystoma				R
Gambusia gaigei	E	E	X	E
Gambusia georgei (= spec. San Marcos)	E	E	X	Ex
Gambusia heterochir	E	E	X	V
Gambusia hurtadoi				V
Gambusia longispinus			X	V
Gambusia nobilis	E	E	X	V
Gambusia senilis				R
Poecilia latipunctata				V
Poecilia sulphuraria				V
Poeciliopsis occidentalis	E	E	X	R
Priapella bonita				Ex
Xiphophorus clemenciae				R
Xiphophorus couchianus	R	R	X	E
Xiphophorus gordoni			X	E
Xiphophorus meyeri				E
Goodeidae				
Allotoca maculata				E
Ameca splendens				E
Ataeniobius toweri				E
Characodon audax				V
Characodon garmani				Ex
Characodon lateralis				E
Girardinichthys multiradiatus				E
Girardinichthys viviparus				E
Goodea gracilis				V
Hubbsina turneri				E
Skiffia francesae				E
Xenophorus captivus				E
Hemirhamphidae				
Dermogenys megarramphus				V
Dermogenys weberi				V
Nomoramphus celebensis				R

4.3 Cichlids

Cichlids (family Cichlidae) are another very popular group of aquarium fish, mainly because of their interesting breeding behaviour in which many species show elaborate parental care. Most cichlid fish are generally adaptable in their water and feeding requirements and are relatively easy to keep and breed in captivity.

Dutch cichlid-keepers formed a society, the 'Nederlandse Vereniging van Cichliden-liefhebbers'(NVC) in 1975. It organizes bimonthly meetings with lectures and a fish-exchange, and puts out a bulletin every two months. Several hundred fish, almost all captive-bred, change hands at the meetings. Every year a large market is organized which is now one of the biggest of its kind in Europe. Many cichlid fish, and some non-cichlids, are sold here, as well as aquarium equipment.

Initially members of the NVC mainly kept and bred cichlids from lakes Tanganyika and Malawi in eastern Africa. These lakes have a remarkable diversity of often colourful cichlid species, many of which were exported by firms in Malawi (Stuart Grant) and Burundi (Pierre Brichard). Over the years, these firms have supplied the European market with many new populations and species. A large percentage of these have subsequently been bred in captivity in sufficient numbers to satisfy demand within Europe from captive-bred individuals.

In the early years of cichlid-keeping, a characteristic cichlid aquarium was very popular. This was preferably a large aquarium with rocks and stones, generally without plants, populated with several pairs of cichlid fish. This type of aquarium is still often seen, but over the years many cichlid fanciers have increasingly turned their attention to other groups of cichlid fish, particularly those from Latin America. At present cichlids from all over the world and from a wide range of habitats are kept and bred by members of the NVC.

The NVC organises bi-monthly meetings, usually attended by several hundred people. Offspring of cichlid species new to captivity are often offered here for the first time, before they appear in retail shops. Prices are usually about half of those charged in retail shops.

The NVC is a member of the FWK and of the Fish Commission of the 'Foundation for Welfare of Companion Animals'. The society has made proposals to define and elaborate on the term 'welfare' for fish in captivity, particularly cichlids, and has suggested criteria for keeping fish, involving volume of the aquarium, water chemistry, number of species and individuals, etc.

In their project 'Traffic-light' the NVC has developed a methodology for dividing cichlids into those that can be kept by all interested hobbyists (the 'green' species), those that can only be taken care of by experienced hobbyists (the 'orange' species) and those which for various reasons should not be kept in home aquaria under normal circumstances (the 'red' species). This categorisation is evidently to some degree subjective.

This lead has been followed by the other societies in the 'Federation of Welfare of Cold-blooded animals'. These lists could form the basis for the species lists which will be attached to the Act of Welfare of Companion Animals.
No cichlid species are listed in CITES. Miller (1979) lists eleven species in the 'Red Data Book'. In the '1990 IUCN Red List of Threatened Animals' about 275 species are listed. These are found in the following table.

Tabel III **Cichlids listed in the 'Red Data Book' (1979) and the '1990 IUCN Red List of Threatened Animals'.**

X	= Listed
Ex	= Extinct
E	= Endangered
V	= Vulnerable
R	= Rare
I	= Indeterminate
U	= Unknown

Species	1979	1990
Cichlidae		
Astatotilapia brevis		R
Cichlasoma bartoni		E
Cichlasoma labridens		E
Cichlasoma minckleyi		E
Cichlasoma pantostictum		R
Cichlasoma spec. Media de Luna		E
Cichlasoma steindachneri		R
Cichlasoma urophthalmus ericymba		E
Konia dikume	X	V
Konia eisentrauti	X	V
Myaka myaka	X	V
Oreochromis alcalicus grahami		R
Pungu maclareni	X	V
Sarotherodon caroli	X	V
Sarotherodon linellii	X	V
Sarotherodon lohbergeri	X	V
Sarotherodon steinbachi	X	V
Serranochromis meridianus		R
Stomatepia mariae	X	V
Stomatepia mongo	X	V
Stomatepia pindu	X	V
Tilapia guinasana		E
Haplochromine cichlids Lake Victoria (250)		E
Tilapine cichlids from Lake Victoria (2)		E

5 Legislation with

The Netherlands acceded to CITES on 18 July 1984. Since then, CITES regulations in the Netherlands have been implemented through the 'Wet Bedreigde Uitheemse Diersoorten' (Endangered Exotic Animal Species Act), better known as 'Wet BUD', and the 'In- en Uitvoerbesluit Bedreigde Uitheemse Dier- en Plantesoorten' (Import and Export Decree for Endangered Exotic Animals and Plants).
Both Act and Decree have now been combined in a new law: the 'Wet Bedreigde uitheemse dier- en plantesoorten (Endangered Exotic Animal and Plant Species Act), better known as 'Wet Budep', which is thought to come into effect mid-1995.

The Dutch legislation follows CITES and the CITES-Regulations of the European Union. The European CITES-legislation is stricter than CITES. For example, some species listed on Appendix II of CITES are listed on Annex C1 of the European CITES-Regulation and are therefore considered as listed under Appendix I.

Another relevant difference is that for import of Appendix II and III species into the European Union not only an export or re-export permit is needed, but also an import permit.

For fish the level of protection under the new and the old Dutch legislation is basically the same. Species listed on Appendix I (see 2.7 and 3.7) are generally banned from national and cross-border trade in the Netherlands. However, under exceptional circumstances trade in specimens of Appendix I-species may be authorized, provided it is not for primarily commercial purposes.
Species listed on Appendix II and III (see 2.6 and 3.7) are permitted in trade if and when the proper permits have been issued.

To find out the precise requirements for trade in CITES-listed species within the Netherlands it is best to contact the CITES Management-Authority of the Ministry of Agriculture, Nature Management and Fisheries.

Although listed on Appendix I of CITES, there is considerable commercial trade in Asian bonytongues in a number of countries. For instance on the weekend market in Bangkok the Asian bonytongue, *Scleropagus formosus*, is offered in large numbers. Size varies from 10 cm up to specimens from one meter length (Latka, 1988).
Also in the Netherlands Asian bonytongues are offered from time to time.
The Indonesian populations of *Scleropagus formosus* were removed from Appendix I of CITES to Appendix II in 1992.

The Nature Conservation Act protects endemic species in the Netherlands in need of protection, prohibiting killing, possession and disturbance of listed species. The following species are listed: *Lampreta fluviatilis* (River lamprey) and *L. planeri* (Broak lamprey), *Alburnoides bipunctatus* (Spirlin), *Phoxinus phoxinus*

in the Netherlands

(Minnow), *Rhodeus sericeus* (Bitterling), *Cobitis taenia* (Spined loach), *Misgurnus fossilis* (Weatherfish), *Noemacheilus barbatulus* (Stone loach), *Silurus glanis* (Catfish) and *Cottus gobio* (Bullhead).
There is some trade in the Netherlands in the legally-protected Bitterling, *Rhodeus sericeus*, particularly in the southern part of the country where the species is still found in the wild.

On 24 September 1992 the Netherlands 'Act on Health and Welfare of Companion Animals' entered into force. This law regulates amongst other how species should be kept, hygienic conditions, use of medicins and methods of transport.
The requirements of course greatly differ per group and for ornamental fish the aquarist societies formulated criteria to determine the suitability of species to be kept in aquaria.
Fish will be divided into three groups: 'green', 'orange' and 'red' species (traffic light).
'Green' species are relatively easy to keep, because their needs (food, physical conditions, social behaviour and such) are not too difficult to fulfil. To keep 'orange' species specialized knowledge and conditions are required. These species should only be kept by experienced aquarists.
'Red' species can not even be kept by specialists, because their requirements are too difficult to fulfil, e.g. species very sensitive to stress or specialized feeders such as fin and/or scale feeders.
At this moment all relevant fish species are being listed following these criteria and subsequently will be listed as such under the Act on Health and Welfare of Companian Animals.

6 Problems assoc
with the ornam

6.1 Introduction of foreign species

There are several instances of non-native ornamental fish being released into the wild, both intentionally and accidentally. Introduced tropical and subtropical species rarely survive the winter in temperate regions, although some may occasionally persist over mild winters in artificially warmed environments, such as power station outflows.

Where climatic conditions are suitable, however, introduced species may become serious pests. Examples are some North American Sunfish in the genera *Lepomis* and *Micropterus* (family Centrarchidae) which have established viable populations in many parts of Europe. Probably the best known example is the introduction of the Mosquito fish, *Gambusia affinis*, originally from the southern USA, all around the world to fight malaria. *G. affinis* is a very competitive species and populations of rare Mediterranean *Aphnius* and *Valencia* species seem to have suffered severe declines after the introduction of the Mosquito fish.

Hardy and aggressive species such as the Walking catfish, *Clarias batrachus*, originally from Southeast Asia, and several neotropical cichlids have successfully established breeding populations in parts of Florida, where they compete with native species. This has prompted a ban on the import of *Clarias batrachus* into the USA.

Restrictions were similarly imposed on the import of ornamental fish into the Republic of South Africa, after several river systems proved to be heavily infested with swordtails, a *Rivulus* species (probably *R. urophthalmus*) and many other accidentally and/or intentionally released ornamental species. They threatened local populations of small barbs and small cyprinodonts. Eradicating introduced species is usually very expensive and has in some cases proved impossible.
In Surinam in 1972 several species of fish escaped from a fish nursery into the Cola creek near Zanderij airport. Today Cardinal tetras, *Paracheirodon axelrodi*, originally from the Rio Negro basin, an Angelfish, *Pterophyllum scalare*, originally from the Demarara river in Guyana, and *Mesonauta festivum* can be found here.

6.2 Artificial manipulation of ornamental fish species

Glassfish *(Chanda ranga)* are imported from eastern Asia, mainly Singapore and Thailand, with fluorescent colors in their normally completely transparent bodies: red, rosa, yellow or purple. These fish are injected with pigments used in the food industry. These pigments disappear within a few weeks.

ıted
ıtal fish trade

6.3 Diseases and the use of medicines

Wherever fish are kept in large numbers (hatcheries, export and import firms, and retail shops) they can serve as a source of disease and parasites. These can spread particularly easily when tanks are linked by a common water circulation system. In addition, newly captured or recently transported fish are generally stressed and particularly susceptible to disease.

For this reason it is important that hygenic work practices are adopted when dealing with large concentrations of live fish. Dead fish should be removed as soon as possible and equipment should be sterilized before it is used in a different tank. Unfortunately this is not routine procedure in many countries.

As a precaution, the majority of the exporters use large quantities of tetracyclines, broad-spectrum antibiotics, without the assistance of a veterinarian. Grondel demonstrated that tetracyclines considerably reduce the resistance of all kinds of animals, including fish. Under anaerobic conditions tetracyclines are decomposed only very slowly. Because of the extensive use of tetracyclines, resistant bacteria can be found nowadays in many biotopes, even when this medicine was not used there, like for instance in the Dutch Shallows, where resistant bacteria were isolated from the mud (Zwart, pers. comm. 1992).

Ornamental fish enter the aquaria of the retail shops and/or the hobbyists almost sterile, with reduced resistance, stressed and underfed and are an easy prey for parasites and diseases.

As already mentioned before, of the Dutch importers, only one is assisted by a veterinarian on a regular basis. This firm claims an average mortality rate of 3%, which can be considered as very low. The other importers are thought to have (sometimes much) higher mortality rates. For some Dutch importers a strong smell of dead fish in their building is rather common.

6.4 Mortality during trade

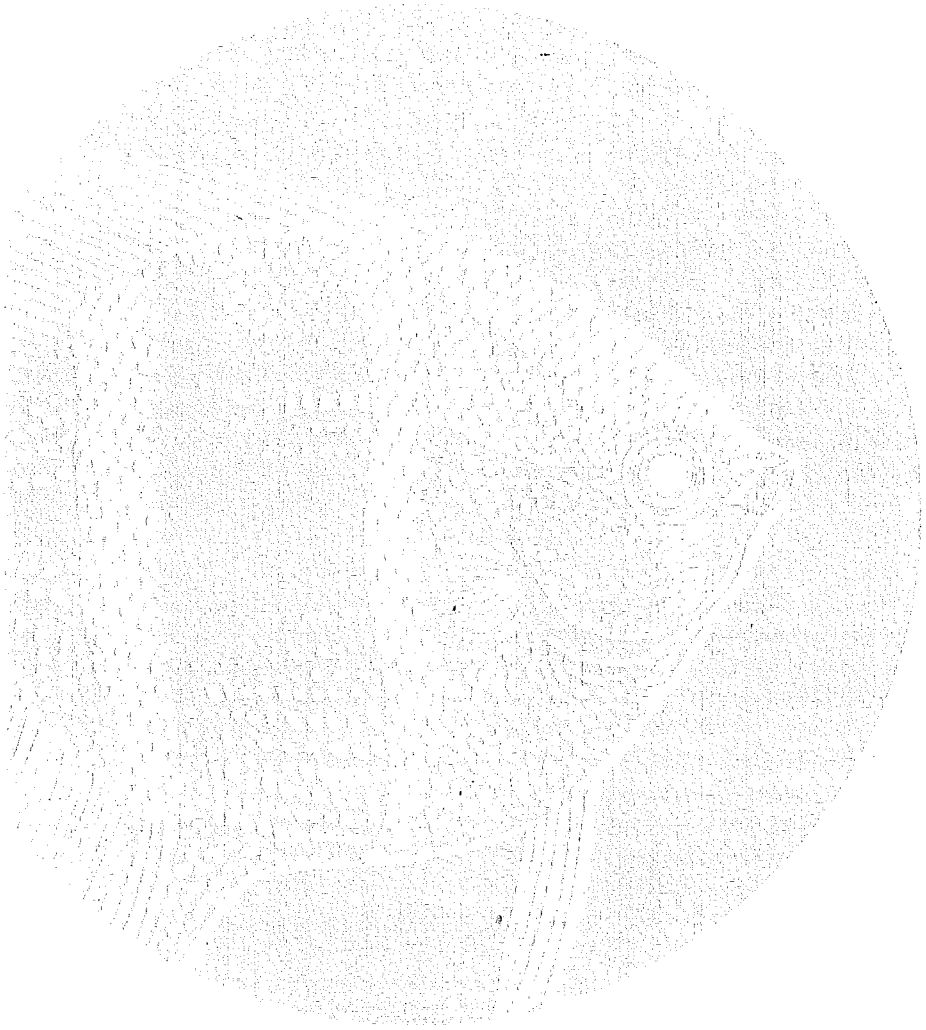
Fish losses during capture in natural habitats, and while stocked by export and import firms are still alarmingly high. Rough handling during capture and transport is responsible for much of this. Overstocking, lack of care and knowledge, and the inadequate and incorrect use of medicines also lead to high mortality rates.

Dense packing during air transport, combined with delays in handling in airports is another cause of heavy losses. Mortality rates on arrival of up to 30% are regularly claimed by importers but exporters persist in packing at high densities for air transport, because of the relatively high costs involved.

Mortality rates during shipment of captive-bred specimens from Southeast Asia, Florida, Israel and South-Africa are generally much lower than those for wild-caught shipments from many other parts of the world. Low mortality rates during transport of wild-caught animals can certainly be achieved as is shown by by exporters (mainly of cichlids) from Burundi and Malawi.

6.5 Illegal trade

Illegal trade in ornamental fish, corals and other species kept in aquaria is documented in 2.6, 3.7 and chapter 5. In volume, corals probably account for most illegal trade. This is not surprising, as many corals are listed on CITES and only few species of fish. Little illegal trade therefore does not imply that no conservation problems exist.



7 Recommendatio

Monitoring and research

More research needs to be done on the ecological effects of the collection of live fish and other aquatic animals for the aquarium trade. This is particularly true of marine species, as the majority are still wild-collected and are associated with vulnerable, species-rich habitats such as coral reefs. Trade based upon such studies could provide income to local peoples and could thereby work as an incentive to protect rivers, lakes and coral reefs.

Destruction of biotopes

The destruction of natural habitats through the use of poisons for the collecting of animals and dynamite for the collecting of live rock as observed in the Philippines (Robinson, 1985) should be stopped immediately. Hobbyists, importers and lawmakers in importing countries can all put pressure on the countries where these practices are still allowed or sanctioned. Complete cessation of imports of live animals and plants from such countries is justified

Use of antibiotics

The indiscriminate use of medicines in the trade, especially antibiotics such as tetracyclines, should be stopped. Grondel demonstrated that tetracyclines considerably reduce the resistance of all kinds of animals, including fish. Under anaerobic conditions tetracyclines decompose very slowly. Their widespread use has led to the development of resistant bacteria which can now be found widely (Zwart, pers. comm. 1992).

Density of packing

Regulations on the density of packing should be included in the 'Live Animals Regulations' of the IATA.

Breeding programs

Aquarist societies and others keeping ornamental fish should set up breeding programmes. These programmes should focus on species known to be vulnerable, in demand and not bred in large numbers elsewhere.

CITES

Species with restricted distribution known to be in trade should be placed on Appendix II of CITES.

ons

8 | Literature

a

Albrecht, E.
1993 Pioniere der Aquaristik: Karl Zeller.
DATZ 47(1994),1: 60-61.

Amir, A.P. & H. Compaan (eds.)
1985-1992 Gids en handboek voor de zeeaquariumliefhebber en amateur zeebioloog.
Vroomshoop, Nederlandse Bond van Zeeaquariumverenigingen. Loose-leaf.

Andrews, C.
1990 The ornamental fish trade and fish conservation.
Journ. Fish Biol., 37,A: 53-59.

Anonymus
1986 Philippines approves new fish collecting program.
Traffic (USA) Bulletin, 7,2/3: 26.

Anonymus
1988 Toelichting op de wettelijke maatregelen ter uitvoering van de conventie van Washington (CITES) in Nederland.
Ministerie van Landbouw en Visserij, Directie Natuur, Milieu en Faunabeheer, Den Haag. 153 p. 4th ed.

Axelrod, H.R.
1991 The world's largest aquarium fish wholesaler ... Germany's aquarium Glaser.
TFH, 39,9(#423): 92-98.

Axelrod, H.R. & L.P. Schultz
1955 Handbook of tropical aquarium fishes.
McGraw-Hill Book Company, Inc., New York, Toronto, London. 718 pp.

b

Baensch, H.A., K. Paffrath & L. Seegers
1992 Gartenteich Atlas.
Mergus Verlag, Melle. 1023 pp.

Baensch, H.A. & R. Riehl
1985 Aquarien Atlas 2.
Mergus Verlag, Melle. 1212 pp.

Berg, L. van de
1992 Visregistratie 1992.
Supplement Killi Nieuws 22,4: 28 p.

Berg, L. van de
1993 Visregistratie 1993.
Supplement Killi Nieuws, 23,2: 41 p.

c

CBI
1993 Ornamental fish and aquatic plants; a survey of the Netherlands and other major markets in the European Union.
Centre for the promotion of imports from developing countries: 53 p.

Chao, N.L.
1992 Diversity and conservation of ornamental fishes - the gems from flooded forest, Amazonia.
Canadian Biodiversity: 8 pp.

Chao, N.L.
1992 Into the flooded forest.
TFH 41,2(#440): 94-110.

Chao, N.L.
1992 Ornamental fishes and fisheries of the Rio Negro.
T.F.H., aug. 1992: 84-102.

Chao, N.L.
1993 Conservation of Rio Negro ornamental fishes.
T.F.H., 41,5(#443): 99-114.

Conroy, D.A.
1975 An evaluation of the present state of world trade in ornamental fish.
FAO, Rome. 128 pp.

Crouse, D., M. Donnelly, M. Bean, M. Sutton & H. Upton
1992 CITES and marine fishes.
IUCN feb.1992: 11 pp.

d

Dawes, J.
1990 Amazonian exporters act to conserve fish stocks.
Pets Europe, 1990,7 (July): 34-35.

Dawes, J.
1990 Cites and Dragon fish breeders.
Pets Europe, 1990,5 (May): 13-15.

Derr, M.
1992 Raiders of the reef.
Audubon 1992, March/April: 48-56.

Deutz, H.
1980 Een stukje aquariumgeschiedenis (1).
Het Aquarium 50 (1979/80),15: 476-477;
ibid. (2), 50,16: 489-490;
ibid. (3), 50,17: 525-526.

Deutz, H.
1982 Een stukje aquariumgeschiedenis (4).
Het Aquarium, 52,6: 158-159;
ibid. (5), 52,7: 194-195;
ibid. (6), 52,8: 223-224;
ibid. (7), 52,9: 242;
ibid. (8), 52,10: 279-280;
ibid. (9), 52,12: 338-339.

Deutz, H.
1983 Een stukje aquariumgeschiedenis (10).
Het Aquarium 53,2: 47-48;
ibid. (11), 53,3: 75;
ibid. (12), 53,5: 125-126;
ibid. (13), 53,6: 167-168;
ibid. (14), 53,7/8: 186-187;
ibid. (15 en slot), 53,9: 210-211.

f

Fitzgerald, S.
1989 Whose business is it? Ch.25: ornamental fish.
World Wildlife Fund, Baltimore. pp. 259-265.

Frey, H.
Het aquarium van A tot Z.
Zutphen, Thieme. 2nd ed. 632 p.

g

Geisler, R.
1990 "Sonderangebot: Rote-Neon - Wildfänge!" Ist das noch zeit-gemäß?
DATZ, 43,10: 582-583.

Geisler, R.
1991 Speciale aanbieding wildvang - kardinaaltetra's.
Aquariumwereld, BBAT, 44,1: 3-8.

Goulding, M.
1980 The fishes and the forest. Explorations in amazonian natural history.
Univ. Calif. Press, Berkeley. 280 pp.

Goulding, M., M.L. Carvalho & E.G. Ferreira
1988 Rio Negro, rich life in poor water. Amazonian diversity and foodchain ecology as seen through fish communities.
SPB Acad. Publ., The Hague. 200 pp.

h

Heijns, W.P.C.
1992 Het welzijn van cichliden.
Cichlidae (NVC), 18,1: Welzijn 1-4.

Heijns, W.P.C.
1992 Welzijnswetgeving in Nederland.
Cichlidae (NVC), 18,2: Welzijn 5-6.

Heijns, W.P.C.
1992 Welzijn in de natuur.
Cichlidae (NVC), 18,3: Welzijn 7-8.

Heijns, W.P.C.
1992 Het project stoplicht.
Cichlidae (NVC), 18,4: Welzijn 9-10.

Heijns, W.P.C.
1992 Welzijnswerk in de Nederlandse aquaristiek.
Cichlidae (NVC), 18,5: Welzijn 11-14.

Hemley, G.
1984 U.S. imports millions of ornamental fish annually.
TRAFFIC (U.S.A.), 5,4: 1, 18.

Hogendoorn, W.
1970 Een blik terug.
Het Aquarium 41 (1970/71),1: 15-19.

j

Jager, J.H., S.D. Koning, K. Telman, W.A. Tomey & M.J.W. Veldhuis
1992 Keuringswijzer.
NBAT, Hilversum. 1e herziening voorjaar 1992. 50 pp.

Joseph, J., D. Evans & S. Broad
1986 International trade in Asian bony-tongues.
Traffic Bull., 7,5: 73-76.

k

Kemley, G. & A.L. Gaski
1986, unpubl. Travelling tropicals. Study op the U.S.-international ornamental fish trade.
TRAFFIC (U.S.A.), Washington, D.C.

Klausewitz, W.
1987 Berechtigter oder unbegründeter Artenschutz für Korallenfische?
DATZ, 40,8: 360-362.

Krause, H.-J.
1987 Mit dem Hausboot in Amazonien.
DATZ, 40,6: 258-260.

Krohn, G.
1986 Die Cichlidenexportstation in Salima.
DATZ, 39,7: 306.

Kruijf, H.A.M. de
1978 Report on the export of fishes and invertebrates for the aquarium trade from Curaçao 1972-1977.
STINAPA Documentation Series No.1. 24 p

l

Lachner, E.A., C.R. Robins & W.R. Courtenay, Jr.
1970 Exotic fishes and other aquatic organisms introduced into North America.
Smithsonian Contributions to Zoology 59: 1-29.

Ladiges, W.
1973 Schwimmendes Gold vom Rio Ukayali. Die abenteuerliche Entdeckung des Neonfisches.
Engelbert Pfriem Verlag, Wuppertal. 85 pp.

Latka, R.
1988 Ein Markt voller Fische: vom Weekend Market in Bangkok.
DATZ, 41,9: 379.

m

Martin, G.
1987 Zierfischzucht in Florida. (I) & (II)
DATZ, 40,10: 452-455.
DATZ, 40,11: 489-491.

McGrath, D.G.
1986 The animal products trade in the brasilian Amazon.
Report to WWF-US, November 10th 1986.

Mekenkamp, B.
1985 Kweek van de Driebandanemoon-vis Amphiphrion percula.
Het Aquarium 55,9: 200-202.

Meyer, M.K., L. Wischnath & W. Foerster
1985 Lebendgebärende Zierfische. Arten der Welt.
Melle, Mergus Verlag. 496 p.

Miller, R.R.
1969 Red Data Book vol.4 - Pisces. Freshwater fishes.
Morges, IUCN.

Myers, G.S.
1942 Studies on South American freshwater fishes. I.
Stanford Ichthyological Bulletin 2,4: 89-114.

Myers, G.S.
1952 Annual fishes.
Aquarium Journal 23,7: 125-141.

n

Nieuwenhuizen, A. van den
1972 Een kroon op onze liefhebberij.
Het Aquarium 42 (1971/72),8: 174-181.

o

Onderwater, B.
1980 De hedendaagse aquariumliefhebberij.
Het Aquarium 50 (1979/80),12: 318-321.

p

Poncin, P., M. Libois & J.-C. Philippart
1988 Reproduction artificielle réussie de Labeo bicolor et de Labeo frenatus.
Rev. fr. Aquariol., 15,2: 39-42.

r

Reck, K.
1993 Sri Lanka. Ein Paradies erholt sich vom Raubbau.
Das Aquarium 27(287): 38-39.

Riehl, R. & H.A. Baensch
1985 Aquarien Atlas 1.
Mergus Verlag, Melle. 992 pp. 5th ed.

Riehl, R. & H.A. Baensch
1989 Aquarien Atlas 3.
Mergus Verlag, Melle. 1104 pp.

Robinson, S.
1985 Fishing with poison.
Traffic (USA) Bulletin, 6,3: 10-11.

s

Sterba, G.
1981 Encyclopedie van de aquaristiek en ichthyologie.
H.J.W. Becht, Amsterdam. 600 pp.

Tomey, W.A.
1975 De viskwekerijen van Singapore.
Het Aquarium 46 (1975/76),4: 93-96.

Turner, B.J.
1984 Evolutionary genetics of artificial refugium populations of an endangered species, the Desert pupfish.
Copeia 1984,2: 364-369.

V

Vierke, J.
1991 Gouramis and snakeheads from Bangkok.
TFH, 39,8(#422): 82-90.

Voorwalt, F.H.
1977 De aquariumliefhebberij in Nederland voor de Tweede Wereldoorlog en nu.
Het Aquarium 47 (1976/77),7: 172-176.

W

Wells, S.M. & J.G. Barzdo
1991 International trade in marine species: is CITES a useful control mechanism?
Coastal Management, 19: 135-154.

Wezeman, B.
1988 Aquariumhouden in de vorige eeuw.
Het Aquarium, 58,7/8: 195-196.

Wijnstekers, W.
1992 The evolution of CITES.
A reference to the Convention on International Trade in Endangered Species of Wild Fauna and Flora.
Third, revised edition.

Woeltjes, T.
1981 Valencia hispanica letourneuxi van Corfu en Griekenland.
Killi Nieuws, KFN, 11,6: 107-115.

Wood, É.
1985 Exploitation of coral reef fishes for the aquarium trade.
Marine Conservation Society, Herfordshire, Great Britain.

Wood, E.
1992 Trade in tropical marine fish and invertebrates for aquaria. Proposed guidelines and labelling scheme.
A report for the Marine Conservation Society. 36 pp.

World Conservation Monitoring Centre
1990 1990 IUCN red list of threatened animals.
Cambridge, IUCN - the World Conservation Union.

Z

Zee, J.R.
1993 Nieuwsbrief Aphanius conservation group
Nr.1 Maart 1993: 9 p.

Zee, J.R. & R. Vonk
1991 Fischexpeditionen in den Magreb; 1. Verschollenen Zahnkarpfen wiedergefunden.
DATZ 44,4: 255-257.

9 Appendix

Tabel A Imports of ornamental freshwater fish into the Netherlands during the years 1988-1992 based on CBS statistics.

	1988			1989			1990			1991		1992	
	1000 kg	1000 Dfl.	%	1000 kg	1000 Dfl.	%	1000 kg	1000 Dfl.	%	1000 Dfl.	%	1000 Dfl.	%
Total	96	8768	100	91	10576	100	67	9867	100	11713	100	11613	100
EEC	16	1398	16	20	2106	20	10	1825	19	2016	17	2014	17
Outside EEC	80	7370	84	72	8470	80	57	8042	81	9697	83	9599	83
Germany	7	788	9	8	1414	13	5	1194	12	1325	11	1137	10
Belgium/Luxemburg		364	4	10	449	4	3	287	3	462	4	621	5
France		77	1		5			4		62	0,5	1	
Italy				1	113	1		124	1	-		65	0,5
Denmark		122	1,5		100	1		185	2	167	1,5	171	1,5
United Kingdom					11			31		-		19	
Ireland					14			-		-		-	
Czechoslovakia		61	0,5		68	0,5	1	118	1	272	2	267	2
USSR					-			3		10		8	
Hungary					6			5		-		8	
Poland					-			-		-		4	
Turkey					-			2		-		-	
Israel	7	533	6	6	513	4,5	1	582	6	941	8	899	8
Singapore	27	1895	22	26	2384	23	17	2444	25	2632	22	3006	25
Thailand		340	4		326	3	2	266	2,5	290	2,5	297	2,5
Indonesia		172	2		170	1,5	2	237	2,5	203	2	287	2,5
Hongkong	2	369	4	1	290	2,5	2	341	3,5	566	4	489	4
Taiwan					-			16		35		23	
Malaysia	-	-	-	-	4	-	-	31	0,5	41		22	
India					37			37	0,5	21		22	
Sri Lanka					37			66	0,5	78	0,5	116	1
China		64	1		53	0,5		65	0,5	75	0,5	111	1
Japan	-	-	-	-	56	0,5	-	36	0,5	141	1	174	1,5
Maldiven					-			-		39		-	
Philippines					10			2		2		-	
Brunei					1			-		-		-	
USA	17	1744	20	16	2026	19	17	2186	22	2518	21	2323	20
Neth. Antilles					4			3		-		-	
Trinidad					2			4		-		-	
Brazil	12	494	5,5	8	680	6,5	5	704	7	719	6	807	7
Venezuela					38			-		29		28	
Colombia		88	1		79	1	2	131	1,5	110	1	122	1
Peru		91	1		87	1		66	0,5	81	0,5	43	
Paraguay					8			-		8		7	
Zaïre		884	10	2	1018	9,5	-	110	1	85	0,5	40	
Nigeria		204	2		220	2	3	228	2,5	161	1	217	2
Malawi		94	1		120	1		109	1	117	1	37	
Burundi		51	0,5		97	1		63	0,5	60	0,5	32	
Ruanda					-			9		-		-	
Zambia		73	1		13			130		95	0,5	38	
Ghana					23			5		6		8	
Liberia					20			11		-		-	
Guinee					8			6		163	1	138	1
Guinee-Bissao					3			5		-		-	
Tanzania					-			13		-		2	
Kenya					-			-		2		-	
RSA					-			-		-		2	

Tabel 8 Exports of ornamental freshwater fish from the Netherlands during the years 1988-1992 based on CBS statistics.

	1988			1989			1990			1991		1992	
	1000 kg	1000 Dfl.	%	1000 kg	1000 Dfl.	%	1000 kg	1000 Dfl.	%	1000 Dfl.	%	1000 Dfl.	%
Total	162	12144	100	119	15229	100	91	15067	100	14698	100	13282	100
EEC	154	7524	62	110	8491	56	83	10067	67	10504	71	9364	70
Outside EEC	8	4620	38	8	6738	44	8	5000	33	4194	29	3918	30
France	48	1896	16	21	2099	14	19	2748	18	2756	19	2218	17
Germany	59	3325	27	36	3501	23	30	3670	24	3526	24	2962	22
Belgium/Luxemburg		1424	12	25	1726	11	20	2259	15	2486	17	2545	19
Italy		139	1		151	1,5		340	3	678	4,5	727	5
United Kingdom		589	5	12	751	5	10	800	4,5	728	5	561	4
Ireland					81	0,5		23		8		13	
Denmark		119	1	2	102	0,5		111	0,5	152	1	173	1
Spain					78	0,5	1	103	0,5	168	1	162	1
Portugal					-			13		2		3	
Greece					2			-		-		-	
Iceland					33			64		50		54	
Norway					26			25		9		21	
Sweden					31			27		76	0,5	61	0,5
Finland					12			5		-		34	
Switzerland		215	2	1	371	2,5	1	414	2,5	415	3	331	2,5
Austria		178	1,5		190	1		331	2	336	2	204	1,5
Gibraltar					-			-		3		-	
Hungary					-			7		-		-	
Czechoslovakia					-			-		-		5	
Rumania					3			-		-		-	
USSR					-			-		2		-	
Turkey					9			-		7		-	
Israel					4			9		8		-	
Japan	1	1039	9	2	1418	9	2	1451	10	1934	13	2177	16
Taiwan	2	2529	21	3	3773	25	2	1944	13	766	5	590	4,5
Hongkong		420	3,5	1	731	5		553	3,5	485	3	368	
Singapore		91	1		57			43		18		30	
Thailand					-			-		-		2	
USA					54			4		26		11	
Canada					2			10		-		-	
Neth. Antilles					-			3		3		-	
Venezuela					-			-		-		4	
Surinam					-			-		-		4	
Kenya					10			17		26		8	
South Africa					6			7		15		7	
Algeria					3			-		-		-	
Swaziland					-			4		-		-	

Tabel C Imports of marine ornamental fish into the Netherlands during the years 1988-1992 based on CBS statistics.

	1988			1989			1990			1991		1992	
	1000 kg	1000 Dfl.	%	1000 kg	1000 Dfl.	%	1000 kg	1000 Dfl.	%	1000 Dfl.	%	1000 Dfl.	%
Total	74	1196	100	31	2162	100	27	3108	100	2810	100	3295	100
EEC	40	204	17	4	259	12	2	267	9	99	3,5	339	10
Outside EEC	34	992	83	27	1803	88	25	2841	91	2711	96	2956	90
Belgium/Luxemburg	39	172	14		75	3,5		125	4	59	2	210	6
France					26	1		119	4	2		26	0,5
Germany					128	6		3		-		-	
Italy					11			3		-		-	
Denmark					19	1		17	0,5	17	0,5	98	3
United Kingdom					-			-		21	0,5	5	
Indonesia	15	254	21	10	781	36	10	1106	36	732	26	828	25
Singapore	2	54	4,5	1	110	5	5	405	13	592	21	741	22
Sri Lanka	2	120	10	1	97	4,5	1	166	5	233	8	334	10
Philippines	3	176	15	1	106	5	1	97	3	121	4	187	6
Maldiven					115	5	-	150	5	63	2	192	6
India					-			8		-		-	
Bahrein					-			35	1	23	1	-	
Saudi Arabia					28	1		-		-		19	0,5
Syria					-			4		-		-	
Australia					22	1		53	2	71	2,5	39	1
New Zealand					7			11		-		-	
USA	4	119	10	5	216	10		366	12	514	18	314	10
Canada					10	0,5	3	-		-		-	
Costa Rica					33	1		46	1,5	54	2	42	1
Neth. Antilles	5	94	8		116	5		116	4	52	2	78	2
Colombia					2			3		-		-	
Venezuela					14	0,5		2		-		-	
Brazil					-			23	1	11	0,5	43	1
Egypt					211	10		163	5	63	2	62	2
Kenya					26	1	-	63	2	154	5	57	2
Malawi					5			-		-		-	
Mauritius					4			25	1	11	0,5	18	0,5
Cap. Verd.					-			-		-		3	

Tabel D Exports of marine ornamental fish from the Netherlands during the years 1988-1992 based on CBS statistics.

	1988			1989			1990			1991		1992	
	1000 kg	1000 Dfl.	%	1000 kg	1000 Dfl.	%	1000 kg	1000 Dfl.	%	1000 Dfl.	%	1000 Dfl.	%
Total	42	1061	100		2091	100	53	3242	100	3954	100	3743	100
Total EEC	42	1033	97	26	1905	93	41	3016	93	3782	96	3640	97
Outside EEC	-	28	3	6	186	7	12	226	7	172	4	103	3
France		61	6		143	7		221	7	297	8	343	9
Belgium/Luxemburg		804	76		931	45	13	1253	39	1379	35	1529	41
Germany		52	5		635	30	9	1168	36	1821	46	1686	45
Italy					155	7		302	9	205	5	56	1,5
United Kingdom					31	1,5		31	1	42	1	1	
Greece					6			3		-		-	
Spain					4			27	1	36	1	20	0,5
Portugal					-			4		2		4	
Denmark		56	5		-			7		-		1	
Norway					10	0,5		15	0,5	-		-	
Sweden					19	1		20	0,5	22	0,5	7	
Switzerland					46	2		107	3	4		8	
Austria					12	0,5		16	0,5	47	1	17	0,5
Yugoslavia					-			2		15		8	
Hungary					-			-		-		4	
Israel					19	1		-		-		-	
Saudi Arabia					2			2		-		-	
Indonesia					-			13	0,5	12		44	1
South Korea					-			-		-		2	
Hongkong					-			-		8		10	
Japan					-			4		-		-	
Marocco					-			-		1			
USA					70	3		14	0,5	44	1	2	
Canada					6			2		8			

Colophon

Published by
WWF-Netherlands/Traffic Europe (1995)

Written by
Tonnie Woeltjes

Edited by
Martin Jenkins, Arnold van Kreveld

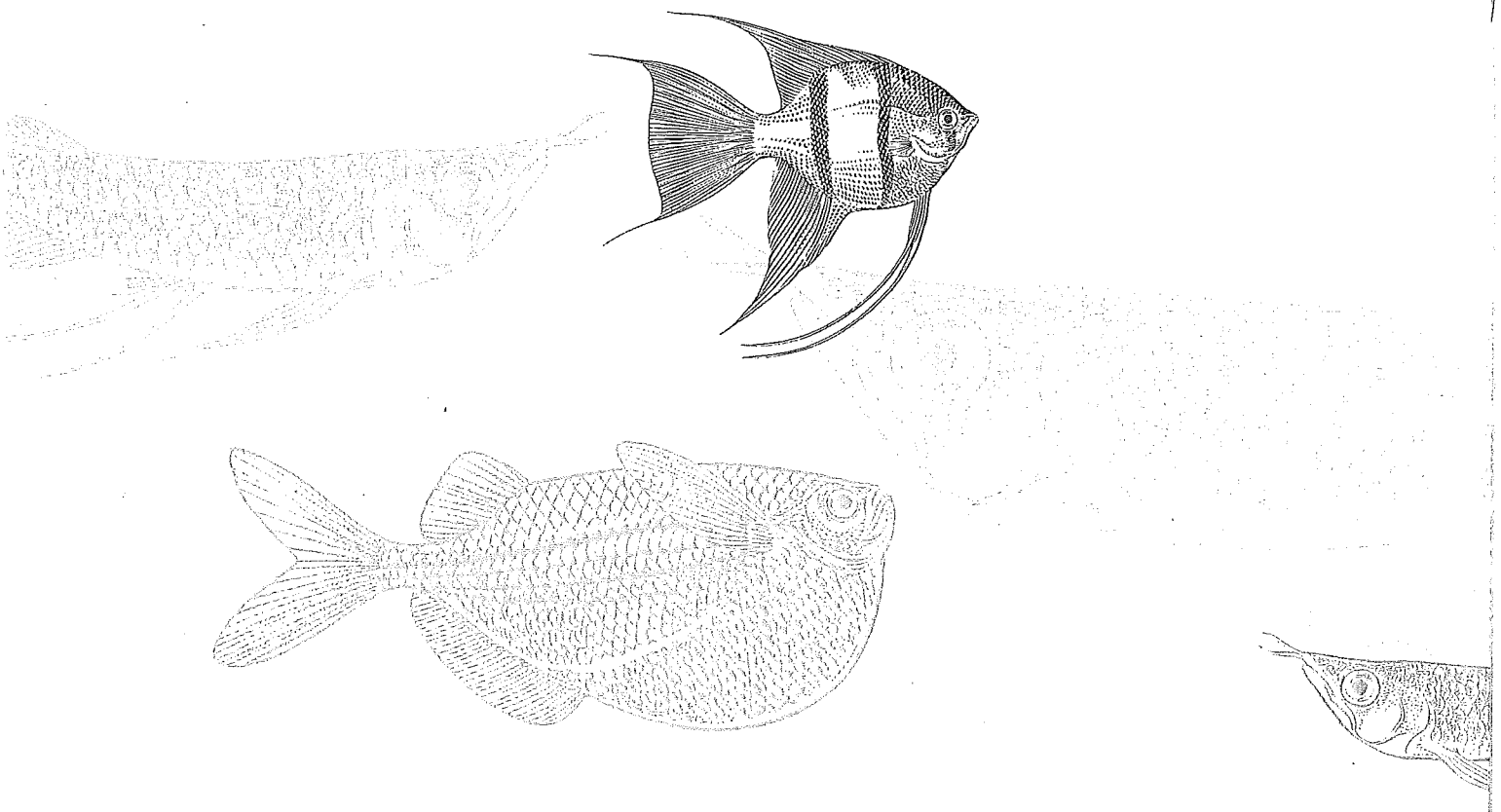
Produced by
Willem Vermeulen

Designed by
Samenwerkende Ontwerpers, Amsterdam

Illustrated by
Ari Stolk

Printed by
Grafische Bedrijven Bosch & Keuning, Baarn

Printed on
100% recycled paper



WWF

Wereld Natuur Fonds

WWF-Netherlands/Traffic Europe
Netherlands Office

Boulevard 12, 3707 BM Zeist
P.O. Box 7, 3700 AA Zeist
Telephone 31 (0)3404-37333
Telefax 31 (0)3404-12064