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The Role of the Ornamental Fish Industry in Poverty Alleviation

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Glossary of names and acronyms

c.i.f.	Carriage, Insurance and Freight - the cost of a shipment landed, but excluding any taxes or import duty
CBD	1992 Convention on Biological Diversity
CITES	Convention on Trade in Endangered Species
f.o.b.	Free On Board - the cost of a shipment as it is put on a plane. Cost of fish + cost of box + local handling charges. Does not include airfreight charges.
FAO	Food and Agriculture Organisation of the United Nations
FIC	Forum Island Countries of the South Pacific
MAC	Marine Aquarium Council
OATA	Ornamental Aquatic Trades Association
OFI	Ornamental Fish International
SFLP	DFID West Africa Sustainable Fisheries Livelihoods Project
USCRTF	United States Coral Reef Task Force
WTO	World Trade Organisation

Executive summary

1. The world-wide trade in ornamental fishes is has an export value of about US$186 million, a substantial proportion of which is from developing countries. The total value of the retail trade generated by ornamental fishes, including hardware, accessories and feeds is estimated at US$7.2 billion. Considerable value is added to the ornamental fish in developed countries and only a small proportion of the value returns to collectors in poor communities. Notwithstanding this, there can be considerable benefits from the trade in alleviation of poverty.

2. The ornamental fish trade can provide poor communities with direct cash income or with traded goods. In addition, where the trade is sufficiently concentrated, revenue to local authorities may be sufficient to provide for facilities such as schools. In some remote communities, the ornamental fish trade may be one of the few opportunities for cash income.

3. Few studies have been found which deal with the role of ornamental fish in livelihoods. Most studies are concerned with conservation issues. There appears to be a lack of good information on how ornamental fish contribute to livelihoods and thus whether their contribution can be increased.

4. There are many threats to the livelihoods of those involved in the ornamental fish trade, notably to those who rely on collecting from well-managed natural environments such as coral reefs or rain forests. The threats are mainly from environmental degradation which reduces biodiversity and abundance of ornamental fishes and from competition from other sources. About 90% of all ornamental fishes are from farmed sources, and these are often not based in the countries of origin. Thus the benefits of biodiversity often accrue to businesses away from poor communities, sometime located in developed countries. Trade barriers related to legislation intended to limit the trade in biodiversity may contribute to this problem, further reducing the opportunities for communities to benefit from the biodiversity on their own doorsteps.

5. Such information as exists suggests that while the greatest price increase is added to ornamental fish once they have been loaded for export, the opportunities for feeding that added value back to producers in developing countries are limited as a substantial proportion is the added cost is in freight, handling, customs and overhead charges. Interventions to improve the benefits to the poor may be targeted better at the trade chain within developing countries. There are a number of measures which might improve livelihood outcomes. Better market information to raise awareness of prices and give sellers a better bargaining position could help producers to negotiate better prices with buyers. Better techniques for capture and handling of fish would enable a higher return for effort, promote sustainable collection and give a higher return from better quality fishes. The implementation of "fairtrade" measures would help to ensure the products are sourced sustainable and that prices and conditions of work are acceptable.

6. Work is needed to clarify the role of ornamental fishes in livelihoods and the opportunities for enhancement. A number of countries would be suitable for study, based on the potential for improving the contribution to livelihoods. These include Bolivia, Brazil, Nigeria and Congo DR for freshwater fish and Indonesia for marine fish. Work would include defining the role of ornamental fish in livelihood strategies, identifying possibilities for improving livelihood outcomes and the possibilities for improving working

conditions for those dependent on the trade. Specific work to be carried out is outlined below.

7. Bolivia. There is potential for export trade based in Trinidad, E Bolivia. This was previously recommended by an ODA mission to examine the fisheries potential of the region. Fieldwork would be needed to define the role of ornamental fish collecting in livelihood strategies of the local communities. This should include a study of sustainability and should examine the ability of the existing infrastructure to export greater number of fishes.

8. Brazil. Lessons may be transferred from Project Piaba to other areas where ornamental fish collecting takes place. Although opportunities are restricted in the varzea, there is some opportunity for the transfer of knowledge generated by Project Piaba to DFID projects in Brazil (Mamiraua and Varzea Projects). In addition, a detailed examination of the livelihood strategies of collectors involved in Project Piaba would provide a good model for the collecting industry as a whole and of the relationship between ornamental fish collection and sustainable forest exploitation.

9. Nigeria and Congo DR are both current exporters of ornamental freshwater fish. In Congo DR, the trade has declined significantly due to civil unrest. Both countries have the best potential in the SFLP area to develop their export trade and to generate rural incomes. Insufficient is know about either country and fieldwork would be needed to both assess the potential for future growth of the trade and to define its role in improving livelihood outcomes.

10. Tanzania has potential for increasing freshwater fish exports. It is currently the main source of fish from Lake Tanganyika. There may be potential for increasing this trade as some other riparian countries have ceased exports. Due to the nature of the trade on L Tanganyika, collecting is likely to create employment opportunities rather than direct involvement by local communities. Tanzania has good prospects for exploiting its coral reef fishes for the ornamental fish trade, but seems to not be doing so at the moment. The reasons for this would need to be investigated fully before further recommendations could be made.

11. Indonesia is a country with a substantial ornamental fish trade and a wide range of opportunities for intervention. Information indicates that it serves as an important source of income for some coastal communities, but that there are considerable threats to the collecting industry from over-collecting, destructive fishing practices (often for food fish), coral mining and unrestricted access to the resource. There are opportunities for promoting sustainable reef exploitation which could include ornamental fish collection. In addition, there are interventions which could be made to improve the survival and quality of fish sold to buyers and thus to improve returns to collectors.

Background

12. The world-wide trade in ornamental fishes is thought to have potential for the alleviation of poverty in DFID priority countries. The trade is widespread throughout the tropics in marine and freshwater environments. There is a lack of information on the trade and the role which it plays in livelihood strategies of the poor. The low entry costs and informal nature of collecting ornamental fish could make a useful contribution to livelihoods in any community with access to suitable natural resources. While the ornamental fish trade has the ability to contribute to the development of social capital, it can also contribute to other areas of livelihood capital. Reliable and detailed information on the role that ornamental fish collection or farming plays in livelihood strategies is limited. A number of anecdotal reports indicate that the ornamental fish trade can play an important role in sustaining livelihoods, but that role is very variable, depending on location.

13. This study was commissioned to inform DFID policy on the role that the ornamental fish trade plays in livelihoods and the scope for intervention. Particular attention has been paid to DFID priority countries and current DFID projects would favour intervention to improve the benefits from the ornamental fish trade to the poor. Countries chosen include:

the countries in the DFID West Africa Sustainable Livelihoods Fisheries Project

in East Africa - Tanzania

in South America - Bolivia

British Dependent Territories in the Caribbean

The term "ornamental fish" is here used to indicate any animal which might be in the aquarium trade, including reef organisms such as shrimps, anemones and corals.

14. Within the framework of the DFID sustainable livelihoods approach, the ornamental fish trade may be seen to contribute to capital development in the following areas:

- Human capital - No direct contribution, although in rare cases, such as in Barcelos, Brazil the existence of the trade can contribute to the establishment of some social facilities such as schools by contributing to the economy of the municipality.
- Social capital Despite the evidently ambiguous relationship between porducers and buyers of ornamental fishes, in some areas, the trade can make an important contribution to the development of social capital. Elements of this may appear to be based on patronage, but the interrelationship between producers and buyers can still bring significant benefits to producers and their families. In some areas, the relationship appears to be one-sided and probably only serves to reduce the social capital of producers. In such areas, one may also find that other benefits accruing to producers are considerably less than they should be.
- Physical capital. There is very little relationship between the ornamental fish trade and the development of physical capital, except indirectly through the conversion of natural capital (e.g. via cash or trading).
- Financial capital This is where the ornamental fish trade has the greatest opportunity to contribute to capital development. The trading of fish for cash or goods is the basis for

collectors and farmers of ornamental fish. It is clear that the equability of trading varies greatly from place to place. In some areas, the ornamental fish trade is probably one of the greatest sources of financial capital for poor families in remote communities. This financial capital can spin off into wider community development through increased spending or in revenues to local authorities.

- Natural capital The relationship between the users of natural resources and the resource itself can be complex. Collectors of ornamental fish from the wild rely on a pristine resource for abundant and diverse populations. Under such conditions, the resource can have high value to the local community, encouraging sound and sustainable management. The living from the renewable, natural resources of such areas can be sufficient to deter collectors from less sustainable harvesting or from the conversion of natural capital (e.g. by felling timber). This relationship can be used to develop a win-win situation where a well managed and well conserved resource will continue to provide a wide range of benefits for the communities which exploit it.

The trade in ornamental aquatic organisms

15. A more detailed description of the global trade and details of trade between developing countries and tbe EU are given in the consultant's report in Appendix 1. This section deals only with overall figures.

Global trade

16. Various figures have been given for the total value of the ornamental fish trade, but it is difficult to compare these values as the basis for their derivation is often not stated. Thus, it is difficult to know whether values are f.o.b., c.i.f., fish only or whether they include the total trade including aquaria, equipment and other dry goods. The retail value of the trade is considerable, but not a reliable indicator of the trade in ornamental fishes as it relies to a substantial extent on the sale of dry goods. Various values of global trade quoted are:

- US$ 900 million wholesale trade value of ornamental fishes, excluding freight and packing (Basleer, 1994)
- US$ 3 billion total retail value of aquarium fishes (Basleer, 1994)
- US$ 4 billion 1971 rising to US$ 7.2 billion in 1986 total retail sales of all ornamental fish hobby goods (Andrews, 1992)
- US$ 255 million total value of imports of ornamental fish (FAO Fishstat)
- US$ 186 million total value of exports of ornamental fish (FAO Fishstat)
- US$ 24-40 million c.i.f. import value to world trade in marine ornamental fish and invertebrates (Wood, 1985)

17. It is difficult to reconcile some of these figures. Expenditure on dry goods and non-fish items tends to be about 80% of total expenditure in the UK, so Andrew's figure of US$4 billion total retail sales does not seem compatible with Basleer's figure of US$3 billion for the retail value of fish. It is also difficult to reconcile Basleer's value of US$ 900 million for wholesale with the retail value of US$ 3 billion. Adding freight and packing charges which usually contribute in the order of 50% to landed costs (cleared of customs) would take the total to about US$ 1.8 billion, which seems more in proportion. FAO figures are complicated as not all countries report the values on the same basis. It is best therefore to treat all the figures as indicative of the value of world trade, not as being definitive.

18. Numbers of fishes in trade are even more difficult to determine as these are not recorded by most countries, either at export or at import. Most figures are derived from guesswork, based on an assumed number of fish per kg of freight, and an assumed average weight per box. These figures cannot be relied on. Estimates for the numbers of ornamental fishes in trade include:

- 150 million sold world-wide (Andrews, 1992)
- 15-18 million fishes exported from Amazonas annually (Chao and Prada-Pedreros, 1995)
- 350 million fishes involved in trade annually (Baquero, 2000)
- 10-15 million and 35 million , number of marine ornamental fish in trade, derived by different means (Baquero, 2000)

19. Whichever figures are taken, comparing export values with the total retail value of the trade shows that a relatively small proportion of the trade value is retained by exporting countries. The export value of fishes may be as little as 3% of the global retail value of all ornamental fish goods. Value to individual developing countries is difficult to assess, the only figures being available in most cases being the FAO trade statistics. FAO figures indicate that the value of exports from developing countries in 1998 was US$ 56 million, of which only US$ 2 million was from countries covered by the DFID West Africa Sustainable Fisheries Livelihoods Project (SFLP). These figures are provided in detail in Appendix 1. The value to the collector is much more difficult to ascertain. The commonly quoted figure of 20-25% of f.o.b. value being paid to the collector has not been confirmed by this study.

20. The trade in ornamental fishes is small when compared to the global value for exports of all fish and fish products. This was recorded as US$ 51.5 billion in 1997 (FAO Fishstat Plus). Nonetheless, while the global trade is small, and the value to most developing countries is small, the trade can provide benefits which reach down to poor, remote communities.

21. No overall figures are available for the employment provided by the ornamental fish trade in developing countries. However, it can be an important employer in some areas. Examples include:

Colombia

- Direct employment - 5,000 persons
- Indirect employment in support industries - 5,000 persons
- Number of persons directly or indirectly dependent on the industry 40,0000
- Total number of persons benefiting from the industry - 50,000

Sri Lanka

- Total employment in collection 500 persons (Wood 1985)
- Number of ornamental fish divers in:
  Dehiwala 200
  Weligama 100

Brazil

- Number of collectors based around Barcelos, Rio Negro 3,000
- Number of families in Barcelos dependant directly or indirectly on collecting - 1,000
- Number of collectors in Amazonas - 8,000 - 10,000

The trade chain

22. In developing and in developed countries, an appreciable contribution to the trade is made by farming. This is believed to account for about 90% of all ornamental fishes, although the proportion is much lower for marine fishes. Farming tends to be in intensive systems, often based on aquaria. It thus tends to demand appreciable capital inputs and attracts high running costs. The role in poverty alleviation is thus small. Secondary benefits to the poor from employment are often restricted as the enterprises tend to be family based. In addition, opportunities for employment of rural poor are small as such enterprises tend to cluster around points of export (often the capital city). The largest farming operations are in developed countries, notably in the US where the state of Florida produces a substantial amount of farmed ornamental fishes, both for the US market and for export.

23. Of greatest relevance to poverty alleviation is the collection-based trade. Detailed and verifiable information on this is limited, but there is a clear tendency for collection which requires trained and well-equipped divers to be more dependent on employed divers, and collection which does not require diving to be carried out by more or less freelance collectors. Employed dive teams will work for a single buyer, who may be an intermediary, or may be an exporter. The chain from remote communities with freelance collectors to the point of export tends to be longer, with more intermediaries along the way.

24. Intermediaries serve a number of functions. The main one is to aggregate small collections of ornamental fishes into lots of sufficient size to supply the needs of exporters. Aggregation serves to both increase the numbers available to exporters and to increase the range of species available. A lesser and apparently much less well developed role of the intermediaries is to provide a market link between the exporters and the collectors to enable both to target their collection in line with export requirements. Generally, this link does not act to inform collectors of current market prices paid by exporters and so does not allow collectors to assess the prices paid to them by intermediaries. A variable, but important role played by intermediaries is the transfer of goods and cash into remote communities. To some extent, collectors and intermediaries are co-dependent. In many remote communities, traders would not find it profitable to visit unless they could find something to buy and trade from those communities. Alternatively, the costs of visiting remote communities would be passed on to them in the form of higher cash prices for goods. They do, of course pay this higher cost in the form of low prices when trading ornamental fish, but part of it is absorbed in the intermediaries' margins when selling on. Thus, remote communities have access to goods which they might not otherwise get, and traders make a profitable business by buying more goods to trade on when they return. This relationship is

open to considerable abuse and it would not be correct to assume that the relationship is always mutually beneficial and equitable.

25. The trade to this point is almost entirely reliant on land and water-based transport. In areas such as Amazonas, the trade requires considerable effort in transport by water as there are generally no alternatives. In coastal areas, such as in the Philippines, road transport plays a greater role in aggregating ornamental fish for export. Good infrastructure connections are important to the development of the trade as they ensure that fish can be got to the next stage in the chain simply and quickly. This is a constraint to trade in East Africa, where the logistics of getting fish from the Rift Valley lakes to international airports can be considerable. As an example, the former collecting station at Kalemie in (then) Zaire relied on small aircraft to export the fish via Bujumbura as infrastructure links to (e.g.) Kinshasa were so bad.

26. Once the fish reach the exporters' premises, consolidation takes place. Exporters may trade fish with each other to make up orders. Export may be direct to the final destination, or fish may be transshipped. Fish are packed in polythene bags, with air or oxygen, depending on species and with the possible addition of buffers and/or bacteriostats. Packing density varies greatly with species. Some spiny or aggressive species must be packed individually. Transshipment may take two forms. In the simplest form, an importer may export part or all of a shipment to another country. This is common where an importer has the single source of supply or where there is an oligopoly. Thus fish may come from Lake Tanganyika to the UK and then be re-exported to Japan. More commonly, transshipment is a result of consolidation. This occurs in response to importers' preference for dealing with a single supplier to make up one, large shipment rather than dealing with several suppliers in a number of countries. Shipping and handling charges can be appreciable (typically $400 per shipment for handling and customs clearance into the EU), so it makes sense to bring in fewer but larger shipments. In addition, consolidation can serve to bring together a much wider range of fish from a wider geographical area, including wild-caught, farmed, marine and freshwater. The largest transshipment centres are Singapore and Hong Kong which serve to channels exports of ornamental fish from much of S and SE Asia to markets in the EU and the US. Shipments are often supplemented with farmed fish, especially in the case of Singapore.

27. On reaching the final destination, shipments take two routes to the retailer. Where a consolidated shipment has been imported (that is, an order is put together for a customer which may involve sourcing boxes of fish from different suppliers), it will go direct to the retailer on clearance from customs. Consolidation tends to be used by retailers as a means of savings costs, although they take the full risk of import. Consolidated shipments have a poor reputation with consumers as they tend not to be quarantined. The second route is for large shipments taken by importers. These will be transferred to a fish house for storage and quarantine prior to sale. Fish may be sold on to a wholesaler, or direct to the retailer. The latter is more common.

28. At each stage, a variable mark-up is applied depending on the species of fish (different mark-ups may be applied to males and females), its cost and the number sold. In addition to the direct mark-ups, additional costs will be incurred at each stage where fish are shipped by any means. The greatest additional costs are incurred by transshipment by air. Typically, the costs of shipping are about 50% of the landed cost, so each shipping stage can add substantially to the final retail price without necessarily adding value. From the

exporter to the retailer, a typical mark-up would be not less than 100% at each stage. Thus, the greatest value is added and retained once the fish reach markets in developed countries.

Cost, price and profit

29. It cannot be denied that the greatest profit from the ornamental fish industry is made by the retailer. A part of that profit (possibly the major part in the UK) will come from non-fish goods such as aquaria, feeds, filters and so on. The entry price for aquarium keepers can be considerable. The entry cost for a simple marine fish system would be in the region of US$350-500, rising to US$1,000 - 2,000 for systems where coral reef invertebrates are kept. Retail prices vary considerably, but a typical cost range for marine fishes would be US$5 - 40, but with an appreciable number of fish being sold in the US$50-100 bracket. For tropical freshwater fishes, retail prices are much lower with cheap, mass-produced fishes such as neon tetras usually retailing at less that US$2 and with the majority of fish retailing in the US$2-10 bracket. Comparing these prices with the prices paid to collectors suggests a highly inequitable distribution of benefits. However, to approach pricing in this manner would be simplistic and misleading. The costs of getting fish from the country of origin to the retailer may be considerable in airfreight, handling, agents' and customs fees. These will all contribute to the landed price in the country of retail sale which will be marked up from importer to wholesaler to retailer.

30. The costs involved in the ornamental fish trade and the associated risk rise as fish move up the chain of supply. Thus a collector may expend very little cash on financing a collecting trip and the real cash cost may be low. For diver-based operations reliant on SCUBA equipment, the running costs and maintenance would obviously be appreciably higher. Risk to collectors will mainly be in the form of opportunity cost, which may or may not be in the form of cash. The first point in the chain at which cash is involved leads to a significant increase in risk. Thus a buyer may have substantial amounts of capital tied up in live fish and any losses represent a real cash loss in addition to any foregone income and profit. Chao and Prada Pedreros (1995) estimate that losses by exporters in Manaus are in the region of 30-35%. This risk rises sharply for the exporter who may have to risk hard currency for shipping and handling costs with no guarantee of payment. An importer may reject part or all of a shipment if there are numbers of dead fish on arrivals (normally referred to as DOA in the trade). DOA are generally a cost to the exporter, not to the importer. In addition, there is the risk of abandoned shipments where the importer refuses to accept delivery of a shipment which has been delayed for an unacceptable period of time, often at no fault to the exporter. In this case, the exporter would lose the entire value of the shipment and incur costs for boxes, handling charges and airfreight.

31. Any analysis of the costs, prices and profits retained at each level of the trade would need to take these factors into account. The capital risk may be greatest for the exporter, but that is not to say that the collector would not experience real hardship if a shipment was lost. Refusal to buy a collectors catch would result in an immediate increase in indebtedness under the *aviamento* system as goods are advanced against future deliveries of fish and in communities where cash income is restricted, the effects of the loss of that cash may be disproportionate to the actual sums.

32. The industry (K Davenport, *pers. comm*.) has suggested that Purchasing Power Parity (PPP) would be a more realistic way of looking at income to collectors than actual cash sums. PPP adjusts for cost of living differences by replacing exchange rates with rates

designed to reflect differences in the price of a standard basket of goods and services. It recognises that the purchasing power of a currency varies with where it is spent. Thus one dollar in New York would buy much less and have a lesser impact on quality of life than one dollar spent in Barcelos. This should not be used as an argument in support of continued low prices paid to collectors, rather it should be seen as support for increased cash income to collectors as this cash income will have a disproportionally higher benefit in remote communities in developing countries.

Trade related organisations

33. A number of organisations seek to promote and/or regulate the trade in ornamental fishes for the aquarium trade. These act at national and international level. Details of some of these organisations are given below.

34. ***Ornamental Fish International (OFI)*** OFI state that ***"Ornamental Fish International*** *is a worldwide non-profit making organisation representing the industry for the import and export of ornamental fish, water plants and aquatic equipment."*

The following is abstracted from the OFI website which can be found at:

http://www.ornamental-fish-int.org/

"*Our organisation was founded on 1 June 1980 at a meeting held in Rome by a dedicated group of people who were unhappy and concerned at the state of the international aquatic industry at the time. One of the main aims that arose out of that original meeting: to improve all-round standards, still remains a central part of our organisation today, as - despite the many major developments that have taken place over the years - there is always room for further improvement.*

Since its launch, OFI (which is a non- - profit - making organisation) has expanded steadily and we now have members in some 40 countries, stretching from Argentina to Zambia (you will find full details in the Members' Directory page). As such, we represent the international aquatic industry in all its aspects.
This all-encompassing brief is reflected in our membership, which includes consultants, manufacturers, publishers, wholesalers, collectors, breeders, retailers, importers, exporters, plant specialists, freight forwarders, airlines, exhibition companies - even a university department.

Some of our members are individuals, while others include some of the largest ornamental fish farms in the world, as well as leading manufacturers. What they all have in common, irrespective of their size or specialisation, is that they are directly or indirectly involved in one sector or other of the international ornamental aquatic industry."

Code of Ethics

35. "Members of OFI are committed to supplying their best services, livestock, plants and products, giving the welfare of livestock top priority at all times. They also agree to operate in a spirit of co-operation with each other and according to honourable standards of trading, both between each other and with non-members of the organisation. Members further agree to settle legitimate complaints promptly and satisfactorily."

36. OFI mainly acts to further the development of the ornamental fish trade and is mainly concerned with the conduct of the trade by its members. It seeks to represent the views of its members at meetings (predominantly relating to trade and conservation issues) and to lobby for the continuation of the trade in live ornamental fish.

37. ***Marine Aquarium Council (MAC)*** MAC is a body which deals only with the trade in marine ornamentals, predominantly those which originate from coral reefs. While it is essentially a trade organisation, MAC works closely with those with an interest in coral reef conservation (such as the US Coral Reef Task Force) and in the regulation of the trade in reef organisms.

The following is taken from the MAC website which can be found at:

http://www.aquariumcouncil.org/

"The Mission of the Marine Aquarium Council is to conserve coral reefs by creating standards and educating and certifying those engaged in the collection and care of ornamental marine life from reef to aquarium.

*The Marine Aquarium Council - **MAC - is implementing its Mission by:***
***Establishing independent certification** process for those in the industry that meet best practice standards.*
***Raising public awareness** of the role of the marine aquarium industry and hobby in conserving coral reefs.*
***Assembling and disseminating accurate data** relevant to the collection and care of ornamental marine life.*
***Promoting the sustainable use of coral reefs** though the responsible collection of ornamental marine life.*
***Ensuring the health and quality of marine life** during transport.*
***Encouraging responsible husbandry** by the industry and hobby through education and training."*

One of the main actions of MAC is to develop certification for the trade in ornamental reef organisms. The certification scheme currently aims to cover issues relating to sustainable and non-destructive harvesting and to welfare. Certification may extend in the future to cover issues such as the Convention on Biological Diversity (CBD) and fuller considerations of ethical trading.

38. ***Ornamental Aquatic Trade Association (OATA)*** OATA is the UK trade association (formerly called OFI(UK)). It represents the UK trade from importer to wholesaler. It seeks to represent the trade on matters relating to the operations of business in the UK (health and safety, legislation covering pet shops, etc) and to represent the industry at international level on matters such as the regulation of the trade in ornamental fish. The following is taken from the OATA website which can be found at:

http://www.ornamentalfish.org/

"The Ornamental Aquatic Trade Association is an organisation representing the interests of ornamental fish importers, breeders, wholesalers, retailers and manufacturers. OATA represents the industries' views and interests on a wide range of issues at local, national, and international levels. We try to keep the industry free of unnecessary legislation, and ensure the smooth flow of business.
We are a non-profit making organisation which was founded in 1992 to promote and protect the interests of all those engaged in, and dealing with, the UK ornamental aquatic trade.
OATA is composed of a Chief Executive and the Board of Directors, plus the members. A major role of the Executive is mediation on behalf of the UK Aquatic Trade with government departments and other official representatives worldwide"

OATA members are expected to conform to its Code of Practice which cover areas as diverse as the manufacture of aquaria, health and safety legislation and welfare of aquatic livestock. In addition, OATA offers a training scheme to those working in the industry designed to raise professional standards.

Key points for intervention

39. Some interventions would be unrealistic in a trade which is international and with so many potential interested parties. Interventions are needed which have the backing of all parties and which would not lead to a loss of benefits for the poor. On the basis of current knowledge, opportunities for intervention which would wholly or mainly benefit poor communities in developing countries are limited and the main opportunities are outlined below.

40. ***Territorial rights***. The ability of many communities to manage the ornamental fish resources in a sustainable manner is often reduced by open-access to the resource. This can lead to direct competition for the ornamental fish themselves, or degradation of the resource by harvesting of other organisms. The harvesting of fish for food is one example where destructive fishing practices (dynamite, cyanide, reef-breaking, etc) may destroy the resources on which ornamental fish collectors rely. In addition to environmental degradation, destructive practices may also reduce incentives for local communities to manage their resources sustainably. Strengthening, or better definition of the territorial rights of especially coastal communities may help to conserve the resource and assist in the development of mechanisms by which those communities can regulate access and harvesting.

41. ***The trade chain.*** It is probably unrealistic to propose interventions which interfere with the operation of the market. It may be expected that as the rules of the WTO are defined and brought into more general operation these will tend to determine the way in which the

international trade operates and that prices will continue to be determined by the market. Various suggestions have been put forward by conservation organisations that the trade should incorporate pricing into its codes of practice. This seeks to ensure that the trade in developed countries requires that exporters in developing countries pay their collectors or other primary suppliers as a fixed proportion of the f.o.b. value of the fish. Apart from being contrary to the interest of market-oriented trade, this proposal smacks of colonialism, with interested parties in developed countries seeking to impose their rules on trade in developing countries. It seems unlikely that such an intervention could succeed. It is likely that exporting countries would simply sell via consolidators in other countries to get around this.

42. Tackling the problem of getting more of the value of the trade back to the collectors would require a more concerted approach. Perhaps the best solution would be to develop ornamental fish as an ethically traded product. This would serve to consolidate the aims of conservation, workers' rights, equitable distributions of benefits and sustainable development under one umbrella and assist in the development of coherent and non-conflicting goals for each of these elements. Current initiatives by MAC and OFI are mainly trade and conservation orientated, but MAC at least has the question of rights and equitable distribution of benefits on its agenda for the future. The current OATA code of practice for importers states:

"6. Animals from the wild should have been collected using legal, ethical techniques which do not damage the ecosystem"

There is no direct reference to employment conditions, prices, or other matters relating to ethical trade.

For direct benefit to the poorest people in the trade chain, the main point at which interventions may be made would be directly at the level of the primary producer, whether they be farmer or collector. Several key points can be addressed which would provide direct benefit to the primary producers:

43. ***Market information.*** Both collectors and small-scale farmers of ornamental fish are severely disadvantaged by lack of access to market information. They are mostly unable to judge prices which can promote the interests of buyers unfairly and they are also unable to find out what the market demands at any moment. The remote location of many communities creates a barrier to obtaining market information that is both timely and accurate. Interventions to improve the access to and the flow of market information would help remote communities to judge better whether the prices they receive are fair or not. Regular trading and passage between communities can serve to transmit market information to the remotest communities. Such a system is being piloted through Project Piaba to help collectors to obtain better information about prices in Manaus (export or wholesale prices) and on the needs of visiting buyers. For such a system to be successful, it is desirable that the current oligopsony operating in many locations be broadened to allow greater competition.

44. ***Direct marketing.*** This may seem an attractive option, but there are limitations to its value. The system could work very well for small-scale farmers who could market their fish co-operatively. This can serve a number of purposes. Firstly, by acting co-operatively, farmers can manage production to avoid surplus supply onto the market which will tend to

depress prices or lead to fish remaining unsold. Secondly, if different farmers produce different fish species, they can effectively act as consolidators to meet the requirements of buyers for diversity of species. Thirdly, it may be that co-operative marketing would allow farmers to be in a stronger position when negotiating prices. For collectors, the benefits are less certain. In very remote areas, the opportunities for co-operative production and marketing may not exist for logistical reasons. It may simply be too difficult to organise. However, it could have benefits where fish are consolidated from over a large area. To some extent, the benefits from direct marketing would depend on whether buyers had a choice of alternative sources. Its role may be limited to in-country as the capital expenditure and working capital (in hard currency) required to participate in the export trade may be beyond the means of co-operative groups.

45. ***Improved handling.*** This may have much to offer in terms of improved sustainability of the collecting trade and in improved returns to collectors. At present, losses after collection tend to be high, varying from about 5% in the best run marine dive-based operations to 50% or even 90% in cyanide collection. Losses on the major Rio Negro fishery may be higher than 50%. Typically losses occur due to poor handling and failure to adapt fish to changing water conditions. Excess collecting will threaten the resource base and so undermine livelihood sustainability. Losses of fish by collectors will generally not involve substantial loss of money, as the capital needed to fund a collecting trip is small. The loss in terms of opportunity costs of labour will also be small as there are few alternative sources of wage labour. There would still be advantages to collectors as, if fewer fish needed to be collected in order to supply the same number to the buyers, it would free up time for other activities. Alternatively, if more fish could be got to market (assuming the market can absorb greater numbers), then collectors' incomes would increase. The added value of healthier fish may also feed back into securing livelihoods and improving incomes. At the very least, importers in developed countries would seek to source fish from those exporting countries which provide fish of the highest quality and with the highest survival post-import. It is uncertain as to whether this would simply secure markets, or whether it would be reflected in higher prices.

46. ***International legislation.*** Considerable benefits could come from the promotion of legislation which will support the sustainable development of the trade and promote equitable distribution of the benefits. Conversely, legislation which seeks to end or severely limit the trade may impact harshly on the poorest, tending to concentrate benefits in the hands of fewer, better financed farm-based producers. The potential benefits of the 1992 CBD have not yet been realised and many developing countries are not receiving the full benefit of the exploitation of their biodiversity. There remains much scope for the promotion of the rights of countries of origin to retain some of the benefit for exploitation of their biodiversity resources once they have been exported. Similarly, although the WTO may not always act in the best interests of developing countries, it could serve to break down non-tariff (e.g. unilateral, conservation-based) constraints to trade.

Special reference countries

SLFP countries (West Africa)

47. Based on the current level of exports of ornamental fish from these countries, the trade in ornamental fish plays a very small role in trade and so may be thought to have little

prospect for improving the livelihoods of poor collectors. However, wars and other disturbances in the region have caused considerable disruption, and it has been necessary to examine the trade in the past to assess what it might be on recovery of a stable democracy and stable economy. Information was sought from those involved in the trade, species lists for the countries and comparison with other countries to make an initial assessment of the prospects for growth in the trade. Much of the information cannot be verified and would need to be confirmed by in-country studies. It can be concluded that the poor diversity of marine fishes, related to the paucity of coral reef in the region, means that there is very little prospect for developing exports of marine fishes. Similarly, the market for brackish water fishes is very small and this too offers little prospect. The export of freshwater fishes has the greatest potential, but not for all countries. Some of the SLFP countries have a long history of supplying ornamental fishes, some providing a relatively small range of species, some offering a very diverse range.

48. Benin, Equatorial Guinea and Togo have little prospect for improving trade in ornamental fishes, mainly due to their lack of diversity in the fish fauna. Liberia and Gabon may have potential, but have a limited range of fishes, only the killifishes being particularly diverse. Senegal, Ghana and Guinea Bissau are intermittent exporters and may have some potential for developing a more consistent trade. Cameroon, Cote d'Ivoire, Congo Republic, Guinea and Sierra Leone appear to offer better prospects as they have all consistently exported a range of fishes, some of which have niche markets. Nigeria is the most consistent performer and has maintained a fairly steady trade for some years. It has a relatively diverse ichthyofauna and a reasonably well developed system of collectors and exporters. However, it does have a reputation for being unreliable. There may be good prospects for the development of the industry. Congo Democratic Republic has by far the greatest potential and has exported a wide range of fishes for many years. Exports have even been maintained through the recent civil war. In addition to having its own very diverse ichthyofauna with a number of species which are in high demand in the trade, Congo DR has access to a substantial part of Lake Tanganyika which also contains many valuable species. Once the political and economic situation in Congo DR has stabilised, it should offer good prospects for further development of the trade. The development of a substantial export trade would probably be dependent on attracting the expatriate exporters who were based there to return. It is assumed that something survives of their holding facilities.

Tanzania

49. Tanzania has access to a rich diversity of freshwater habitats and species of fish. It also has access to some relatively intact coral reef and a rich variety of coral reef fishes. In this respect, it is similar to Kenya. However, unlike Kenya, the marine ornamental fish trade seems to be very undeveloped and very few exports are recorded. It may be that exports are made informally via Kenya. If the marine resources are comparable to those in Kenya, it is reasonable to speculate that ornamental fishes might be exported annually with an approximate f.o.b. value of US$100,000 - 200,000. This would be dependent on the development of suitable handling and export facilities and exporters who are sufficiently well capitalised to develop the business. Tanzania already exports fishes from inland waters, notably from Lake Tanganyika, and to a lesser extent from Lakes Malawi and Victoria. Markets for fishes from these areas may be limited, although the temporary lack of exports from other countries around Lake Tanganyika may give Tanzanian exports a boost. Tanzania should afford good opportunities for expansion and diversification of the

export trade. More details of the current state of the trade in country and of the facilities available for export would be needed to give an accurate assessment of the potential for development and of the likely benefits to poor communities.

British Dependent Territories

50. Little information was available from these countries. It appears that the export trade in coral reef fishes is not well developed. Faunal lists suggest that there are many species available from the islands which would be in demand by the trade. Given their proximity to the important US market, prospects ought to be good. However, if prospects were so good, it has to be questioned why the trade is not more developed. The answer may lie partly in the state of the coral reef resources. Open access coral reefs tend to be highly degraded and over-fished. Only those which are in closely preserved areas with no commercial harvesting offer the wide range of species necessary to sustain an export trade. The potential for the Dependent Territories may not be realised unless the problems of degraded reefs and uncontrolled fishing can be addressed.

Bolivia

51. Bolivia has good prospects for developing its export trade but must satisfy a number of conditions. It is assumed that it can compete on price with neighbouring countries offering similar species, especially Peru and Brazil, both of which have a more developed ornamental fish trade. The development of the trade would also be dependent on good airline connections, at least to the US and ideally to a major EU hub as well. Airline freight charges would need to be comparable with those of neighbouring countries in order to be competitive. Bolivia has a good range of species suitable for export, ranging form the "bread and butter" species to those which would appeal more to the specialist. There used to be an export trade based in Trinidad (E Bolivia), but it is not known if this still operates. The peak time for collecting is believed to be in June/July when flood waters recede to leave standing pools. Before these dry up and/or the fish are eaten by birds and caiman, there are opportunities for harvesting the fish for the ornamental trade. Given that these fish would mostly die anyway, the impact on populations may be negligible. From comparison with other areas, it is assumed that collecting could continue in other seasons, except at high water. Bolivia appears to be a good candidate for developing the ornamental fish trade in poor and/or remote communities, but the scope for this and the means by which it could be achieved need to be verified.

Major factors influencing the vulnerability context of collectors and farmers of ornamental fishes

52. A number of factors may be seen to influence the vulnerability of those whose livelihoods depend on the ornamental fish trade. Most of the factors are external to the trade and in many cases take place on a far larger scale, both geographically and economically. As such, it may be difficult to influence such factors directly and other problems may need to be addressed before the livelihoods of poor people dependent on the ornamental fish trade can be secured.

Negative factors

53. These factors may arise from the trade and indeed may be a direct consequence of this, or they may arise from activities which have no connection with the trade. Some of the factors increase competition to the detriment of developing countries; others threaten the livelihood base itself. The factors may be biotic or abiotic, the result of human activity, or the result of natural changes to the environment. Some of the most important factors are reviewed.

54. ***Aquaculture*** While aquaculture of ornamental aquatic organisms may have some benefits in reducing poverty (see below), there are substantial negative effects. The most important of these is the relocation of the benefits of the exploitation of biodiversity away from the area of origin. The most extreme case of this would be Singapore which derives much of its business in exporting ornamental fishes which are not even native to the region, let alone to Singapore. For example, the great majority of Malawi cichlids are now supplied from Florida and Singapore, and the neon tetra, originally from the Amazon basin, is now often referred to as the Hong Kong tetra in trade as Hong Kong has been the country of supply for so long. In both these cases, the countries of origin derive no income from the trade in these farmed fishes. Even on a local scale, production may be shifted away from remote communities which depend on collecting, to urban communities where production on intensive farms will tend to be concentrated in the hands of those who have the necessary capital for investment. The number of jobs displaced from collecting to farming is likely to be significantly less, resulting in an overall reduction in employment.

55. Relocation of production is dependent on a number of factors; the most important of which is price. Initially, all Malawi cichlids were wild caught and prices were high. Then supplies began to be supplemented by production from aquarists, but prices remained high and wild caught fish were still in demand. This was possibly due to the number of species new to the hobby which continued to sustain demand. However, as production from the Far East increased, prices fell and now the trade is based on small, cheap, farmed cichlids, with very few wild adults and juveniles being sold due to their relatively high price. Efficient production techniques and competitive airfreight rates from the Far East have meant that over 90% of all ornamental fishes are now supplied from farming. The technology for production has now been expanded to cover several hundred species, some of which are specially bred varieties. The benefits of this trade accrue to a relatively small number of businesses and not to poor people. As far as is known, new species are continually entering farmed production with no benefit to the country of origin.

56. The generally high price of marine ornamental organisms has led to increased interest in their farming, largely as a spin-off from commercial marine aquaculture for food production. Already, some common and cheap marine species such as clownfish (*Amphiprion* spp) are farmed widely. Some gobies and angelfishes are also in farmed production. Now attempts are being made to produce high value crustaceans such as cleaner shrimp (*Lysmata amboinensis*) which has just been successfully produced in the UK. This too threatens to relocate production of ornamental fishes away from developing countries and into capital intensive businesses in developed countries.

57. The relocation of production from developing to developed countries is already the subject of discussion (e.g. through the auspices of MAC), but there appears no immediate prospect of resolution. In theory, the 1992 Convention on Biological Diversity should ensure that some benefit does accrue to the country of origin, but this would not necessarily

accrue to those originally involved in collection and thus may have no direct effect on poverty alleviation. However, most developing countries do not appear able to or have the desire to enforce this treaty for ornamental fishes and it is in any case very difficult to prove that a fish was not already in trade before 1992. Thus farmed stocks could already have pre-existed and so would be except from the provisions of the CBD.

58. Overall, aquaculture may present a substantial threat to the livelihoods of those dependant on collection of ornamental fishes. Collectors also perceive this threat (rightly or wrongly). In Sri Lanka, 75% of collectors in the marine sector said they would not support aquaculture projects for the breeding of ornamental species, viewing this as a threat to their livelihoods (Arjan Rajasuriya, pers. comm.). In the worst case, they may wholly lose their income from the trade if exports collapse due to competition from aquaculture in other countries. This will impact most severely on the poorest, most remote communities. Urban communities or those with good infrastructure connections for export may be able to respond by also turning to aquaculture if they can compete on the basis of lower cost. However, particularly for marine organisms, this is likely to concentrate the trade in the hands of those who have the necessary capital to invest and the education and training to take part in a high technology business. The benefits to the poor are likely to be few and would mainly exist in opportunities for unskilled labour.

59. While prices for reef organisms in particular remain high, their culture will remain an attractive commercial proposition. Already companies are committing expenditure to the development of techniques for closed system culture of reef organisms. As culture techniques are developed and refined, more species will be capable of being grown in intensive units in developed countries. It is entirely possible that these organisms could follow the same pattern as farmed fishes; that is initial high prices attract investors. At some point, excess supply is produced and prices start to fall leading producers look for efficiency gains to reduce costs and maintain profit margins, and this usually involves increased volume of production. This can in turn lead to further depression of prices. In the case of ornamental reef organisms, the great diversity may reduce the impact of such cycles, and prices may hold up for longer. However, in the long term, widespread and high volume production of reef organisms in developed countries could depress prices to the detriment of collectors in developing countries.

60. ***Environmental degradation*** This is probably the most widespread threat to the livelihoods of those dependent on the harvesting of organisms from the wild. In some cases the collection of ornamental fishes causes directly degradation of the environment, but in many cases, the causes are external to and beyond the control of collectors and may be specific to the environment being exploited. The most common examples include:

61. *Loss of reef habitat.* Coral mining, industrial fishing and some destructive artisanal fishing methods (e.g. blast fishing, cyanide fishing) cause degradation or even complete loss of the reef habitat. Hard coral are vulnerable to physical destruction and are slow to recover from damage. Damaged reefs support fewer species of fish, reducing opportunities for collectors both in terms of the range of species which are available and in their abundance. Some 27% of the world's coral reef are classed as being at high risk (Bryant et.al. 1998). Loss of these habitats would impact directly on the poorest members of the community who would have fewer opportunities for alternative employment. In addition, loss of reef value tends to lead to lower incentives to maintain the reef and may further accelerate the rate of degradation. Harvesting of ornamental fishes has contributed to reef

degradation. Fishes may be pried from gaps in the coral with hammers, resulting in widespread damage. Cyanide fishing is especially destructive as it kills corals. They may be replaced by the same species, but often are out-competed by more aggressive colonisers. It may take many years for such damage to be recovered. Threats to reef structure and biodiversity from external activities include smothering with sediments from soil erosion, pollution (especially sewage, petrochemicals) and global climate change. All of these factors threaten a partial or total loss of livelihoods.

62. *Loss of forest habitat.* There is an inextricable link between tropical forest and fisheries. Many plant species rely on fishes for translocation of their seeds. Many species of fish rely on autochthonous inputs of food in the form of forest fruits and insects. The destruction of forest can impact directly on fish populations by removal of food inputs, or indirectly by opening up the forest canopy allowing greater light levels which will shift the ecological balance. It can also impact indirectly by increasing the threat of soil erosion, or by altering seasonality. Loss of fishes and of forest can lead to a vicious circle developing. If communities cannot make a living from harvesting forest products (including ornamental fish), the forest loses value to them and they may seek to recover that value in other ways. This has included increasing rates of timber harvesting or clear felling for agriculture. This loss of forest habitat may further cause loss of the ornamental fish populations which in turn will lead to more destructive exploitation of the forest. The ability of local communities to make livelihoods from the forest is one of the factors influencing forest conservation. Thus any intervention to improve livelihood outcomes from collectors in such areas will need to consider the role of collection in maintenance of forest cover.

63. *Grazing.* Habitat degradation may occur where heavy grazing takes place. Trampling of riverbanks by cattle causes direct destruction of bankside habitats and increases the rate of erosion, leading to increased siltation in rivers. A greater threat comes from the grazing of cattle on aquatic vegetation. In the Amazon basin in particular, cattle grazing has caused damage to or even loss of floating aquatic macrophytes and floating meadows. The damage is considerable where water buffalo have been introduced. Loss of these floating refuges is a threat to the survival of fry and juvenile fishes, and the floating meadows in particular are key habitats for a wide range of species and are responsible for maintaining a surprisingly high fish biomass.

64. *Pollution.* Pollution from various sources can threaten the livelihoods of collectors. Gross pollution has led to the total loss of some habitats as a source of ornamental fishes (e.g. the development of a new port at Pucallpa, Peru). Chronic pollution can lead to the loss of susceptible species and this loss in biodiversity may make the ornamental trade inviable. Chronic pollution from excess nutrients leading to coral reef destruction would be one example of this. Pollution from mining has been shown to adversely affect fish populations by physical effects, such as smothering and by toxic effects, such as from mercury. Parts of the Amazon basin are badly affected by mining pollution. Although this is primarily considered from the viewpoint of health hazards from eating fish contaminated with mercury, reduction in fish populations and in biodiversity will also have a negative impact on livelihoods.

65. ***International legislation*** There appears not to be any international legislation aimed at preventing the trade in ornamental fishes *per se*. However, such legislation may still

restrict or prevent trade to the detriment of those involved in collection. The impact on livelihoods is probably small at the moment, but expansion of the coverage of some legislation on animals in trade could restrict the trade to the point at which collectors find their livelihoods severely compromised.

66. *CITES.* At present, CITES restricts the trade in very few fishes and of these, only one is of major interest to the ornamental trade (*Scleropages formosa*), and this is now only available from farmed sources. Trade in many reef invertabrates is much more restricted, although this would largely affect the gathering of certain shells for the curio trade rather than for the aquarium trade. The prohibition of trade in most hard corals is a restriction to trade and removes a possible source of livelihood earning for collectors. 2,000 species of hard and soft corals are on Appendix II of CITES. No data are available, but it is believed that the impact of CITES is small.

67. *EU legislation.* This does not currently represent a direct threat to the trade by restriction for purposes of conservation. Attempts have been made in some EU countries via the European parliament to introduce a "positive list" for imports of exotic animals for the aquarium trade. Fishes would only be placed on the positive list if it could be proven that their harvesting was sustainable and did not affect wild populations. Given the large number of species in trade and the lack of knowledge of either their populations or their biology, this would effectively end the import of fishes from the wild. Production would be limited to farmed fish. Introduction of such legislation would effectively remove the harvesting of ornamental fishes as a livelihood option. Such legislation that does exist (e.g. Council Regulation 338 of 1997 and Commission Regulation 939 of 1997and amendments) relies on negative lists to restrict the trade in wild fauna. For fishes, the impact on livelihoods of collectors of ornamental fish will be insignificant as only the trade in seahorses and pipefishes (Syngnathidae) is in any way restricted. EU legislation on the control of fish diseases is very unlikely to affect the trade in wild fishes for the aquarium and is therefore unlikely to have an impact on livelihoods of collectors.

68. *Certification*. Although certification as such is not legislation, it does arise from the pressures of international legislation and from concerned groups with an interest in regulating the trade. In some respects, certification of aquarium fish exports would be good for the trade, encouraging sustainable and responsible trade. However, current initiatives concentrate on matters of environmental interest, and these may conflict with the interests of the poor, or may disadvantage them in comparison to the better off. Certification attracts a cost and the poor may be singularly ill-prepared to absorb such costs. It may simply eat into their income and provide no direct benefit in return. As currently proposed, the benefits of certification appear to fall more to those in developed countries, and to a lesser extent to those in developing countries.

69. The leading certification scheme under development is that led be MAC and this will apply only to reef organisms. The Canadian government and the US government are supporting the development of certification under the Forum Fisheries Agency and in the Philippines and Indonesia. This implies that the costs of introducing the scheme are substantial. Countries which are not able to attract donor funding may find that they cannot introduce and maintain a certification scheme and so may be denied access to some markets, especially the US (which is the largest single market).

70. The development of certification by MAC has involved participation by importers, exporters, collectors and governments. Submissions have been made to the US government via the US Coral Reef Task Force (CRTF). Despite this, and despite a minority support for increased restriction of trade, the CRTF seems to be heading towards a unilateral ban on the trade in all CITES listed species, and to extend this ban to non-CITES species if seen fit. This move is not supported by MAC. Certification may not, under such circumstances assure the trade for poor collectors in developing countries. It may adversely impact on them and they (and their regulating agencies) may be the least equipped to cope with the impact of such restrictions on trade. It could serve to concentrate the industry in the hands of breeders and commercial farmers in developed countries.

To quote MAC, loss of the aquarium trade would:

"Eliminate the stewardship incentive and open these reef areas to more destructive uses Eliminate the community's high value-added aquarium fishery, thereby contributing to the poverty and poverty-driven use of destructive fishing practices for food by the community Eliminate economic options where there are few, and contribute to the out-migration from rural coastal areas to over-populated urban areas"

It should be noted that the imposition of a unilateral ban by the US might well be challenged under the WTO as a non-tariff barrier to trade.

71. ***Markets*** While the global market for ornamental fish has shown an increase over the last 20 years, much of this has been in farmed fish. It is difficult to assess the growth of the retail market as figures include equipment and other dry goods, and it is likely that sales of these have grown much faster than sales of fish. There are a number of threats to the livelihoods of collectors from potential market trends. The main threat is price competition from farmed fish. This could lead to more and more species being substituted either by other species or by cheaper individuals. If for example, the Far East were to mass-produce cheap cardinal tetras, the impact on collectors in the Rio Negro area would be enormous, as this fish alone accounts for 80% of all fish sold. Markets tend to be fickle and what is in fashion one year may become out of fashion the next, leading to a substantial fall in demand for expensive, wild-caught fish. In some cases (such as Lake Victoria haplochromine cichlids), the market may be very short lived. No definitive market studies have been carried out in the UK. The trade reports that demand for many species is relatively inelastic, and therefore may not respond to price changes to any great extent.

72. No detailed studies are available on the UK markets for ornamental fishes. At best, one partial survey has been carried out. Market reports have tended to concentrate on the total market for the aquarium trade (including dry goods) and so are not useful for informing on the state of the market for the fishes themselves, or of the characteristics of the consumers. Informal feedback from the industry suggests that UK ornamental fish prices have stagnated in real terms. There is no evidence to say whether this has fed back into producer countries to depress their prices or to encourage cost cutting through efficiency gains. With so little evidence available, the impact on poverty can only be speculated. Given that collectors are the least able in the chain of supply to bargain against price cuts, pressure from the retail end to reduce exporter prices may impact more severely on poor, disadvantaged groups than on others.

73. It is much more difficult to assess the impact of local market changes on livelihoods. In Sri Lanka, the farming of ornamental fish can provide significant income to growers in less favoured areas (such as the Mahaweli dry zone). However, growers complain that it is very difficult to predict whether their fish will be sold and at what price. There appeared to be little attempt at co-ordinating production to meet the needs of exporters. Even where growers were acting under contract to agents or exporters, buyers would often refuse to buy the fish or pay a low price, citing lack of demand or over-supply as the cause. This may simply be a cynical attempt by the buyers to pay below market price and exploit the growers. For this reason, it can be difficult to link local market supply to market demand at the retail end. A similar situation applies in the Rio Negro where collectors often bring fish to find that there are no buyers. The contrast between the Rio Negro and Sri Lanka is that the former is largely limited by poor communication to remote communities, and market information reaching collectors (if any), will usually be weeks out of date.

74. Failure to sell will affect collectors and farmers in different ways. A collector based on the Rio Negro markets in Barcelos would have invested relatively little cash in the collection of fishes, but would have expended considerable time. The opportunity cost of labour in the area would be low, as there are realistically no alternative forms of wage labour. Thus the loss would be mainly in lost income, not in outgoings and capital expenditure. This contrasts with fish farmers who would have had to make substantial capital and labour investment in pond construction and (depending on the terms of the growers' contracts) sums of money on stocks, feed, fertiliser and treatments. Loss of farmed fish would represent a real cash loss. Failure to sell the crop would be a substantial loss, probably resulting in a considerable increase in indebtedness. Local market failure appears to be one of the greatest and most immediate threats to livelihoods.

Positive factors

75. In contrast to the negative factors which may affect livelihoods, positive factors may be under substantial local influence. This would open them up to local initiatives to take advantage of opportunities to secure or improve livelihood outcomes. It may provide more opportunities for interventions to increase benefits for poor communities than by addressing some of the negative factors.

76. ***Aquaculture*** While noting that aquaculture can be a negative influence on livelihoods, there are opportunities which will improve livelihoods, either by improving existing outcomes, or by creating new opportunities for diversifying livelihoods. It should be noted that benefits to one community may decrease or even remove livelihood opportunities for another. However, if aquaculture initiatives are focussed on species which are only or mainly supplied from aquaculture at the moment, or whose collection from the wild is likely to be curtailed or cease in the future, such negative impacts will be minimised. The problem of the relocation of the benefits of biodiversity still applies, but this may be resolved through international legislation (see para 67 below).

77. Culture of freshwater ornamental fishes has a number of advantages, although the relatively high capital cost will restrict entry to some production systems for the poor. It has fast turnover, so recovery of capital and operating costs tends to be rapid, leading to reduced reliance on credit (although contract growing may still lock farmers into debt dependence). There are also opportunities for linking production closely to markets, ensuring fish can be sold and at a more or less predictable price. This should lessen risk to

farmers. Some systems (especially aquarium-based systems) can be labour intensive and so create employment opportunities. Once sufficient concentration of aquaculture takes place, this may create further opportunities in support industries, although this may simply be a case of substituting for previous demand from collection-based production.

78. Aquaculture may also have advantages for collectors, especially where some fishes are vulnerable to over-exploitation. Where such species can be farmed successfully, aquaculture may be a means of securing supplies without adversely affecting the resource base. It may also have advantages where species are difficult to catch, or highly dispersed. The proposed farming of dwarf cichlids (*Apistogramma* spp.) by Project Piaba in Barcelos would meet both of these criteria.

79. Aquaculture-dependent production may also be of benefit to collectors. Examples of this would include the ranching of various conch species (*Trochus* spp.) for the aquarium trade by planting out hatchery produced juveniles onto suitable reefs. Similarly, attempts are now being made to culture corals and "living rock" by planting out artificial substrates on reefs which are either already seeded with the desired organisms, or have the required characteristics to attract colonisation. Such schemes have additional advantages. They do not require anything to be removed from the natural reef when harvested, thus preserving its integrity. They are also more attractive to the retailer as the organisms are already habituated to their substrates which increases the chances of survival in the aquarium. Ranching of reef invertebrates in this manner may offer real, new livelihood opportunities to collectors, but they are to some extent dependent on technology for production of seeding organisms, and this requires more capital than would be available to DFID priority groups.

80. ***International legislation*** In theory, the 1992 Convention on Biological Diversity (CBD) should provide protection of rights and benefits for communities dependent on the ornamental fish trade. These arise from:

Art. 4 Subject to the rights of other States, and except as otherwise expressly provided in this Convention, the provisions of this Convention apply, in relation to each Contracting party:

(b) "In the case of processes and activities, regardless of where their effects occur, carried out under its juristification or control, within the area of its natural jurisdiction, or beyond the limits of national jurisdiction."

Art. 8. Each Contracting Party shall, as far as possible and as appropriate:

(j) "Subject to its national legislation, respect, preserve and maintain knowledge, innovations and practices of indigenous and local communities embodying traditional lifestyles relevant for the conservation and sustainable use of biodiversity and promote their wider knowledge, innovations and practices and encourage the equitable sharing of the benefits arising from the utilisation of such knowledge, innovations and practices."

These Articles appear to promote the rights of local communities to the benefits of the production of ornamental fish whether by harvesting from the wild, or by the subsequent breeding of these fishes outside the country of origin.

81. In addition Articles 15, 16 and 19 appear to give countries of origin rights to share in the benefits arising from research into or exploitation of their genetic resources, including biodiversity, such as ornamental fish. In practice, the situation is unclear, and it is not certain what, if any, protection is provided to local communities to ensure that they can benefit from the exploitation of their local biodiversity or from the exploitation of biodiversity derived from their locality outside the country of origin. It is understood that attempts are being made to resolve this issue at international level. Brazil is taking a strong position on the farming of its native fishes for the ornamental trade by other countries. It is argued that they are only exported for the purpose of keeping in aquaria and that breeding them without agreement of both Contracting Parties is in breach of the CBD.

82. The CBD is weakened by the fact that the biggest market for ornamental fishes, the USA, has not ratified the Convention and may thus be assumed not to be a Contracting Party. The Marine Aquarium Council is currently attempting to reconcile differences between countries which produce marine ornamentals (mainly from collection from the wild) and producers in the US who are now starting to farm a wide range of organisms for the aquarium trade. The US Lacey Act should provide some protection for countries of origin as it makes it an offence to import or trade in wildlife where that is in breach of the laws of the country of origin. It is unlikely that this will be resolved soon, and any resolution is unlikely to arise from the ornamental fish trade given the far greater commercial implications of other biodiversity and genetic resources currently under dispute (e.g. plant materials for the production of pharmaceuticals). Thus, while CBD offers some protection and guarantee of benefits for local communities which exploit ornamental fish, the extent of this benefits remains to be determined either to those communities or to the country of origins.

83. Protection to local communities under the CBD relies on proving that the species in trade was not in trade prior to 1992. This means that many ornamental fishes may not be covered as the trade was considerable prior to that year. In addition, the occurrence of some species in more than one country of origin may weaken protection. This effectively opens up the process of licensing production outside the countries of origin to bidding. For highly desirable biodiversity and genetic resources, this might drive up the price, but for ornamental fishes, it is most likely that the country of origin making the cheapest offer of licence would dominate, eroding the ability of other countries to receive the benefits of exploitation by other countries. The only situation where the country of origin would have a clear case would be where an ornamental fish has a very restricted range, wholly within the boundaries of that country of origin.

84. ***Trade initiatives*** A number of initiatives are being undertaken by the trade which could increase the benefits to producers. The Marine Aquarium Council (MAC) is working on an initiative to ensure that more of the benefits of the trade accrue to the country of origin. This goes further than simply price. It is planned to extend to cover issues of sustainability and conditions of employment or conditions for collectors paid by the piece. In the UK OATA is working to produce a Code of Conduct which will eventually extend to some form of eco-labelling. As with the MAC scheme, this would also cover issues such as fair payment to producers. Both these initiatives are seen as medium term measures and may be expected to come in some time in the next five to ten years.

85. If such initiative could be brought in and be made binding on the trade, the benefits of the schemes should extend to poor collectors and farmers in the form of a more equitable

distribution of income and (for employees) in better terms and condition of employment. Ornamental fish may become an ethically traded product. No work has been carried out in the UK to determine whether this would carry a consumer premium or not.

Case studies

Barcelos on the Rio Negro, Amazonas, Brazil

Information in this case study is taken from Prang (2000) and Chao (1992) and Chao and Prang (1997).

86. *Background.* The lower and middle Rio Negro was the area which really launched the ornamental fish trade from Brazil. This followed the discovery and subsequent commercialisation of the cardinal tetra in the 1950s. The cardinal tetra still dominates the export trade from the area. The trade in ornamental fishes contributes about 65% to the economy of Barcelos and at least 1,000 families in the municipality are directly involved in the trade. The number supported in remote communities is not stated. The trade is the main source of income in cash and traded goods for many of the families in Barcelos. Collecting is restricted by water height mainly to the months of November and January to April. The trade is more or less static, the area exporting about 20 million fishes (of which at least 80% are cardinal tetras) worth about US$ 3 million at export.

87. Alternative livelihoods have traditionally been dependant on extractive forest products. These have included various gums and rubber-like compounds for international trade as well as fruits for local trade. A palm plantation has been established by Sharp Electronics to supply a palm heart processing factory. Apart from that, there is little industrial employment. Pissaba palm fibre was important in colonial days, but is much less in demand now, although still contributing about 20% of municipal income. There is little agriculture apart from family plots. Both the state and municipal governments are offering incentives for the development of palm and sugar cane plantations. There is a small, seasonal business offering sport fishing to tourists.

88. Barcelos is heavily dependent on the trade in extractive products and opportunities for diversification are limited. Recent dry years in which ornamental fish collecting has been restricted or impossible have led to an increase in slash and burn agriculture and in timber extraction in order to maintain incomes. Neither of these appears to be sustainable, and may in the long-term lead to the degradation of the ecosystem on which the extractive industries are based. One response to the loss of income from extraction has been the migration of families to Manaus, where they are forced to live in extreme poverty.

89. *The aviamento system* The *aviamento* (literally, to supply) system derives form colonial days when it was used mainly as a means to ensure a supply of labour to provide the raw materials demanded by international commodity markets. It was based initially on the trade in raw rubber and other gums. The *aviamento* system ensured the supply of labour by keeping the rubber dealers in debt, and they in turn kept the rubber tappers in debt. The *aviador* (trading house) himself would have been in debt to the exporter. The system deliberately set out to prevent the development of a cash-based economy and ensured the labourers were in debt from the first transaction.

90. This system has evolved to meet the need of the ornamental fish trade and differs significantly from the system which existed in the rubber boom days. The current system tends towards interdependence between collectors (*piabeiro*s) and the *aviador*s. There has also tended to be a shift away from a system which relied wholly on traded goods to one in which cash plays a more or less important part. The *aviador* is now firmly linked to the piabeiro society and *aviador*s often become part of the family life through (for example) becoming godparents or through other forms of elective kinship. It is now more difficult to say who is dependent upon whom. That said, the *aviador* system may still exploit piabeiros through the trade in over-priced or sub-standard goods. However, there is no reason to suppose that any other form of trade would not treat the piabeiros in similar fashion.

91. The *aviamento* system is essential in supplying Barcelos with traded goods, ranging from basic foodstuffs to tools and consumers goods. Given the remoteness of many of the communities around Barcelos, or which use Barcelos as a trading centre, the *aviador* still plays a vital role. It is doubtful that many would make the journey from Manaus to Barcelos unless they had products to collect there to sell on their return to Manaus.

92. As in most trading systems of this kind, the *aviador* acts as a source of credit. Less commonly, money is advanced. More usually, credit is advanced in the form of pre-ordered goods (usually consumer goods) which are paid for by future deliveries of fish. No firm evidence is available on the cost of such credit to the piabeiro, but the claimed mark up of 40% (profit and the cost of credit) from one *aviador* does not seem excessive when compared with the cost of credit through banks. *Aviador*s claim to make little profit on traded goods.

93. Piabeiros themselves may elect to stay with a goods-based system of trade rather than a money-based system. Neither system appears to constrain the ability of piabeiros to move their trading relationship from one *aviador* to another. Indeed, those which have a wholly cash-based trade often sell to the *aviador* with the highest prices. Others prefer to stay with one *aviador*, often due to (formal or informal) kinship links. Some collectors only take part when they are short of cash, or need credit to buy some specific item not available locally. The largest exporter based in Barcelos (there is no note of how many *aviador*s he employs) has over 600 *piabeiro*s delivering to him though *aviador*s. How this figure translates into those who are further dependent on collecting is unknown. Opinion appears to be equally divided as to whether the form of merchant capitalism practised under the *aviamento* system is essentially conservative (that is it maintains the *status quo*) or whether it is dynamic (that is it facilitates the change to a money-based economy).

94. There are seven exporters in Barcelos, not all of who are part of the *aviamento* system. Each tends to have their own buyers and sometimes collectors. Exporters do not generally extend credit, unlike *aviador*s. Their areas of operation may overlap, but the piabeiros tend to have a well-defined collecting territory and local agreements usually mean that their collecting rights in these areas are respected. Informal and part-time collectors therefore tend to be restricted to less favourable areas for collecting. The piabeiros have a complicated system by which they may swap species of fish in order to help each other meet the demands of their respective *aviador*s. The basis for this system is not well understood.

95. *Incomes and prices* The following is based on an interview with a single piabeiro, but it is believed to be typical of the income for a full-time (August-November and January-April) collector. From August to October, the collector can gather an average of 20,000 cardinal tetras per week, giving a total of 240,000 for the period. In November and January-April (fishing rarely takes place in December), the collector can gather 7,500 cardinal tetras per week, giving 120,000 for the period. This gives 360,000 for the collecting season. The piabeiro is paid US$5 per 1,000 fish, equivalent to US$1,800 for the season. This equates to an average of US$257 per month or US$150 per month over the whole year. This compares favourably with the average Brazilian salary of US$100 per month. Typically, after deduction of traded goods from the *aviador*, the *piabeiro* would be left with US$90 per month. Given the few opportunities for employment locally, this may be considered to be a good wage.

96. The prices increase rapidly through the trading system and are presented in Table 1 below modified from Prang (2000).

Table 1: Price of cardinal tetras from collection to retail, March 1999

Point in distribution chain	**Price per each sold US$**	**Markup% of price paid to collector**	**Markup% from previous stage**	**Main expenses.**
Piabeiro	0.005			Canoe, knife, machete, nylon mosquito netting
Buyer	0.01	100%	100%	Boat, fuel and oil, repairs, non-payment of advances, mortality of fish
Exporter	0.10	2,000%	1,000%	Transport of fish (Barcelos-Manaus), mortality, water, utilities, installation, labour, food and medical treatment of fish, customs, taxes, packaging and marketing
Importer	0.26	5,200%	260%	[1]Transport (Manaus-Miami), mortality, water, utilities, installation, labour, food and medical treatment of fish, customs, taxes, packaging and marketing.
Wholesaler	0.65	13,000%	250%	Transport (Miami-Detroit), mortality, water, utilities, installation, labour, food and medical treatment for fish, customs, taxes, packaging
Retailer	2.00	40,000%	300%	Mortality, water, utilities, installation, labour, food and medical treatment of fish, customs, taxes, packaging, buying in small lots, selling on small scale

1 Note: shipping costs typically account for 40-50% of the landed price of a shipment.

Against expectation, the buyer is not taking the highest margin. The exporter takes this, but it should be remembered that 40-50% of the selling price will be made up of freight and handling charges. Thus it might be more realistic to estimate the real mark-up by the exporter to be 500-600% from the buyer's price. These mark-ups may be taken as representative for any cheap fish sold in volume. Mark-ups may differ for less common, expensive fishes.

97. *Sustainability* It is acknowledged that the lower and middle Rio Negro have been overfished at times for cardinal tetras. However, the exports have remained at about 20 million individuals per year for some time, suggesting that the resource is more or less stable. While over-collecting can depress populations, for many of the fishes, population recovery is rapid. Cardinal tetras are effectively annual fishes and are capable of repopulating areas in a single season. Unless a great increase in demand for cardinal tetras occurs (unlikely), the main threats to sustainability and hence livelihoods of collectors will come from other actions.

98. Cattle and water buffalo grazing have been shown to destroy some Amazonian habitats by removing grass cover and floating vegetation. However, cardinal tetra numbers have actually increased in some areas after cattle grazing was introduced, possible as a result of increased nutrient inputs (Michael Goulding, pers comm). Removal of vegetation by cattle and especially water buffalo is likely to impact more on other fish species. It is believed to have contributed to the decline in discus fish in some areas, although overcollecting was probably the main cause.

99. There is an intricate link between the ornamental fishes and the forest. Without the forest, many of the fish species would disappear or decline in number, either due to direct dependence on the forest (e.g. for food) or due to secondary factors such as increased light levels, soil erosion, etc. Conversely, without the income from the harvesting of ornamental fishes, the forest loses value to the inhabitants, and they seek to obtain income by other means. Around Barcelos, this has included slash and burn agriculture and timber harvesting. Both of these will degrade the forest environment, placing the ornamental fish collecting trade at risk.

100. The remoteness of much of the Rio Negro serves to protect it to some extent against overexploitation. Traditional use rights also tend to protect areas by limiting who can exploit them. However, some fishes are very vulnerable to overcollecting. The discus, due to its high value (it makes up only 0.7% by numbers but 22% by value of exports from Amazonas, Crampton (1999)) is highly sought after by collectors and has been fished out in many areas to the extent that it is commercially extinct. With prices remaining high, it will become worthwhile for collectors to go further afield in search of new sources of supply, probably resulting in further areas being fished to the point of commercial extinction.

101. Overall, the combination of the limits imposed by the collectors and their *aviador*s with export restrictions imposed by the Brazilian government (although these are not very effective) should ensure that the collection trade around Barcelos is sustainable for some time to come. Further work is being done with the local communities to strengthen their involvement in the management of the resource and to encourage sustainable developments through Project Piaba.

102. *Project Piaba* Project Piaba was founded in 1989 and seeks to promote an economically viable (ornamental) fishery for the riverine communities of the middle Rio Negro. It is community-based and seeks to involve local communities in all aspects of the management of the ornamental fish trade. The Project works closely with Universidade do Amazonas, Instituto Nacional de Pesquisas Amazonicas (INPA) and IBAMA, the Brazilian environment protection agency. Funding is partly from external (mainly private) sources

and from the Brazilian government. The project relies heavily on volunteers for its research programmes.

103. The Project seeks to improve the economic benefit from the collection of ornamental fishes in a number of ways. An education centre has been built to provide education material for local schools and for the wider local community to inform them of the benefits of the trade and how it is dependent on the forest environment. The centre also serves to educate those involved in the collecting trade on best practice for harvesting, handling and shipping of fishes in order to maintain quality and reduce mortality.

104. The Project also carries out scientific studies on the ornamental fish resources in order to understand better the ecology of ornamental fishes, the socio-economic and cultural aspects of the collectors and how these factors may affect management decisions for the fishery. One specific aim of the research is to find ways of retaining more of the value of the trade in the area rather than at present, in points further down the chain of supply. The project is also developing methods for the culture of some higher value species.

Malawi

Information is mainly derived from Bull-Turnøe (1992) and Grant (1996).

105. *Background* Lake Malawi was one of the newer sources of ornamental fishes from Africa when it opened up in the 1970s. The trade is unusual in being based almost entirely on the export of cichlids, predominantly the rock-dwelling mbuna. In the 1970s and 80s, these fish were in high demand and commanded high prices. Subsequently, the demand for wild fish fell as a result of strong competition from cheap, farmed fish from the Far East and Florida. Hobby breeding may also have had a significant effect, before farming even began, but it is difficult to quantify. The costs of the trade have increase significantly since it began and the bureaucracy at both point of export and in the EU has increased, leading to higher costs in agents' fees and higher time-related costs. In addition, airlines will no longer accept home made boxes for shipping necessitating the use of imported styrofoam boxes at US$25 each (many times the UK cost). Originally three exporters operated from the lake, falling to two in the mid-1980s and then to a single exporter, Stuart Grant, based in Malawi. A second company, MalTaVi is believed to be operating from the Tanzanian shore. African Diving also export some fish from Tanzania to Sweden, but they are faced with high costs due to the distance from the Lake to the international airport. In the early 1970s, some shipments were made from Mozambique.

106. Lake Malawi has a very diverse cichlid fauna, with possibly as many as 700 species of which about 100 regularly appear on export lists. The trade differs significantly from that in Barcelos in that no single species dominates. The trade, being based on a relatively small market segment, is small in comparison to Amazonas, only amounting to about US$250-300,000 per year at its peak. The trade is now down to about US$100,000 per year. A significant source of supply to the hobbyists and to the retailer are cichlid keepers who breed the fishes at home. The Malawi cichlids are relatively easy to breed and can be produced in large numbers. This provides further competition for wild-caught fishes. In

addition, the market is subject to swings in fashion, and the demand for Malawi cichlids and hence the number of people prepared to pay the premium for wild-caught fish has fallen since the 1980s, further reducing demand for fish from the lake.

Stuart Grant, export and breeding station, Kambiri Point

107. The original catching and exporting station was set up in 1973, but has been much added to and changed over the years. In 1992, the station employed 101 workers directly, including boatmen, divers, fish house staff and support staff. No breakdown of wages is available, but the average wage for all staff in 1992 was MKw4 per day, approximately equivalent to US$1.54. This compares with the national average wage at that time of MKw 1.8 per day. Current wages are from US$25 per month (unskilled labour) to US$40 per month (dive team leader). All staff are salaried and are not paid on the basis of fish caught. All staff are provided with free housing and other benefits.

108. Due to the nature of the lake and the habitat in which the mbuna are found, catching them is labour intensive and five dive teams are maintained to catch fish in different areas. Each team can collect about 250-500 cichlids over a typical collecting trip of 2-4 days, but much of this time may be spent in travelling and in decompressing fish caught at depth. Collecting the fish once on site can be a relatively quick process. Occasional trips are made to more distant locations for collecting special orders. The cichlids are caught buy dive teams using a "hookah" system. Fish are caught by hand after driving them into fine mesh seine nets. Where fish are caught in deep water, they may be placed into barrels which are then brought to the surface over a period of days. Giving the fish time to adjust to the change in pressure. Collecting is a time-consuming affair which demands highly trained and skilled staff. A major cost in travelling on the lake is fuel which attracts 63.5% import duty (as do most imported goods). With a few exceptions, most of the materials needed to support the collection trade need to be imported, imposing high additional costs. For this reason, it is unlikely that it will be ever be cheap to collect fish, and this may continue to constrain demand.

109. There are no permanent agreements with other countries, but occasional, licensed trips were made to Mozambique for collection of special order cichlids. These fish were exported through Malawi, not Mozambique. Trips to Mozambique are now restricted to ecotourism due to high costs imposed by Mozambique to collection licences. Collecting within Malawian waters is now restricted due to the creation of an underwater park in which collecting is prohibited.

110. The main market for exports from Malawi was Germany, although a substantial proportion was transhipped within Europe. Turnøe-Bull's original data on the destination of exports do not reflect the current situation, but he recorded that 39 % of cichlids by value went to Germany in 1990. Exports to the UK were only 9% of the total and are currently zero. The main market is now France, taking 40% of exports.

111. In addition to catching wild fish, Stuart Grant has invested in breeding in order to ensure supply of rare cichlids and those whose collection necessitates a long journey. However, this has not proved to be a success as customers did not pay the premium for wild fish, and they were not competitive with cheap farm bred fish from the Far East and Florida. This facility is believed to be no longer in use and is mainly used as a holding facility. Very few fish are now bred and reared on site.

112. In addition to employing 101 workers directly, the collecting station supports 461 people through families and dependants. There are very few alternatives for income generation in the area, and the operation provides additional benefits in the form of purchase of food and materials and the employment of casual workers (builders, carpenters, etc). Direct benefits to government of Malawi include tax on profit at 50%. Further benefits come from reimbursable airfreight and handling charges.

113. The demand for wild caught Malawi cichlids seems to be still falling and Stuart Grant now mainly catches and exports to order. Originally responding to a demand from aquarists to dive in the lake and see the cichlids in their natural habitat, a visitor centre has been constructed, accommodating up to 20 guests. In addition to being based at the station, excursions to other parts of the lake may be arranged. This new business means that many of the existing staff have changed roles to support an ecotourism industry. This seems set to continue developing and unlike the fish export business, looks as if it will attract significant tourist income to the area. The implications of this for employment, local traders and other support services are not known. Staff receive a bonus for ecotourism work.

114. *Incomes and prices* As stated above, the workers at the collecting station earned an average of MKw4 per day in 1992. Current earnings are in the region of US$25-40 per month. Prices for Malawi cichlids are difficult to compare, given the wide range of species and colour morphs in trade. Costs have risen, but prices have been more or less static.

115. *Sustainability* The greatest threat to sustainability appears to be the fickle markets in developed countries. It may be that wild caught Malawi cichlids will come back into fashion, and that demand will pick up, but this seems unlikely in the short term. It is possible that supply could be wholly supplanted by farm bred fish. If this were to happen, an important source of employment and cash to the economy of the area around collecting stations would be lost. This would have a serious impact on the livelihoods of local communities. The development of ecotourism may fill the gap, but the distribution of benefits may change, so some people will lose and some will gain. It is not possible to quantify or detail such changes without further study. Ecotourism development would be expected to benefit Malawi in general by bringing hard currency spenders into the country. In this respect, the total benefit to Malawi may be considerably greater than that from the export of ornamental fish.

116. The low level of trade implies that collecting *per se* is not a threat to the biodiversity of the region. While some (probably temporary) local depletion has been seen, this has been highly localised and recovery is usually quick once the immediate demand for that fish has declined. Some of the non-mbuna species are threatened by the development of beach-seining for increased food-fishing, and with no controls imposed this is thought to be endangering some forms, especially in the SE part of the Lake. Severe depletion around some beach areas has been noticed. Even depletion of mbuna has been observed around some very heavily fished islands. This does not usually affect species in the aquarium trade. At the peak, only about 250,000 cichlids were exported annually. The current

number is considerably less (c. 100,000). The numbers are insignificant compared to the harvest of fish for food from Lake Malawi. Such low numbers are unlikely to impact on populations overall, although some species with very restricted distributions and some rare colour morphs of species have been overcollected at times in some areas. Generally, scarce and/or remote forms are not viable to collect due to long journey times and the greater diving effort needed. Some transplantation of species or colour morphs has occurred. In a few cases this was accidental due to barrels used for storing or decompressing fishes sinking, but to some extent, it has been deliberate. Such transplantation may be a threat to the genetic integrity of the lake, but is not likely to threaten livelihoods. It may actually improve livelihood options by increasing the range of fish available in any area. In practice, most translations fail to establish in the long term, and none has been observed to affect the natural populations adversely.

117. Collecting mainly takes place from September to May and there is an annual closedown in July/August. This is caused by the unfavourable weather which causes the water temperature to drop and the water to become cloudy. The very strong winds which tend to spring up (mwera) pose a considerable risk to collecting in this period, and travel on the Lake is generally avoided. Some, but not all cichlids therefore have a period in which they can reproduce without interference. In addition, some cichlids are only available seasonally as they only enter waters in which they are easily taken for relatively short periods. Fish are caught mainly to order and unwanted fish are not taken from the nets are freed at the point of capture.

118. It is understood that airfreight charges from Malawi are high, which may make the country uncompetitive as a source of fish. However, as the sole supplier, the impact of such charges may be less than if there were strong competition from other riparian countries. There is competition from MalTaVi, though some of the species /forms are different, which partially counters this. High airfreight charges will continue to lessen the competitiveness of Malawi fish against farm bred fish

Canada - trade routes, transshipment and costs

119. This section is derived from a study obtained via the MAC website (Baquero, 2000). The study was of the trade in marine ornamentals from the Pacific Islands with special emphasis on Canada. It was prepared jointly by the Forum Fisheries Agency and MAC. The Forum Island Countries (FIC) are a major supplier of marine ornamental fishes, especially to the US. Canada is not a large market for ornamental fishes (approx. US$ 5.2 million per annum) and very few fish are exported from FIC to Canada directly. The majority are transshipped through the US, notably through California. Fishes are also transshipped from California to other parts of the US and to other countries.

120. Some 85% of the marine fishes imported to the US are from Indonesia and the Philippines. Imports from Indonesia are valued at about US$ 32 million per annum. The remaining 15% comes from a number of other sources, of which FIC contributors about 200,000-250,000 pieces per annum, with a value of about US$1-1.5 million. The trade is well established and has existed for some years. Live fish, corals, living rock and other invertebrates are included in the trade between US and FIC.

121. *The trade chain* Most collectors in FIC are on a piece rate basis, rather than employed. Collecting is often controlled by territorial rights which restrict access. The livestock is then collected by various agents until it reaches the exporter. The shipments are then exported, with California being the main destination. Only US$18,000 worth of ornamentals were exported directly to Canada between 1993-1997; a very small amount when compared to the annual total of all ornamental fish imports (US$5.2 million in 1998). Airfreight to the US (Los Angeles) was US$2.10 per kg (1999 first quarter, based on 100kg shipment) or up to US$4.46 direct to Canada (Toronto, Ottawa, Montreal).

122. Fishes may then be shipped on directly from California to Canada, or held in exporters' premises, possibly to be combined with fishes from other sources to make up a re-export shipment. Freight costs vary considerably from Los Angeles to Canada, from US$0.74 per kg (cheapest rate to Vancouver) to US$2.62 per kg (highest rate to Montreal). In addition to the extra cost of freight, transshipment will add other costs in handling. On a 100 kg shipment from Fiji to Toronto, transshipment via Los Angeles could add as much as US$460 to the shipping and handling costs.

123. Further distribution costs will be incurred on entering Canada. These will be highly variable due to the large variation in lot size and the wide variety of forms of shipping used (collection, trucking, airfreight).

124. All of this adds to cost and hence to price, but does not necessarily add value. It is tempting to compare the retail price of fish with the price paid to the collector and conclude that very high mark-ups occur at all stages. Table 2 below shows the typical changes in price of fishes exported from FIC to Canada. These prices can be compared to those for cardinal tetras exported from Barcelos shown in Table 1. In both cases, freight and handling charges add substantially to the cost of fish.

Table 2: Marine ornamentals from FIC, 1998. Prices are given in Canadian $ (C$1=US$0.65)

Common name	FIC C$ each[1]	Canada wholesale $ each	% change in price[2]	Canada retail $ each	% change in price[2]
Clown tang	2.80-3.50	24-31	873%	49-69	214%
Picasso trigger	2.70	14	518%	39+	278%
Auriga butterfly	2.70	10.50	389%	29	276%
Cleaner wrasse	3.50	7	200%	19	271%
Percula clownfish	3.50	10	286%	20	200%
Fiji blue devil	1.70	4.10	241%	14	341%
Flame angel	10	24	240%	59	246%
Emperor angelfish	35	84	240%	170	202%

Assumed to be f.o.b.

[2.] Increase compared to previous stage in the chain. % based on median prices.

125. Price changes at the wholesale to retail level are more consistent than changes from FIC to wholesale. It is assumed that part of this difference will relate to the different shipping requirements of fishes (e.g. tangs would need to be packed individually).

Sri Lanka ornamental marine fishes

126. Information is taken from Roy (1996), Madhu (1996) and Arjan Rajasuriya (pers. com,). Sri Lanka is a leading exporter of marine ornamental fishes for the aquarium trade. Exports of 963,997 individuals valued at RS 472 million (US$ 8 million) were made in 1997 (NARA, 1999). Approximately 75% of the fish (and a greater proportion of value) are marine. These are supplied entirely from the wild at present, although there are attempts under way to introduce farming of some species of fish and ornamental shrimp. The marine fish are caught by divers, some directly employed by exporters, the majority self-employed and selling on a price per piece basis. Each dive team may employ support staff to tend compressors or to work as "tube pushers", keeping the floating tubes into which the catch is placed in the proximity of the divers.

127. Fish are caught by a variety of methods, the most common of which is to drive the fish into a net from which they are removed with small hand nets, or by the use of "moxy" nets which are used for fish which hide in coral cervices. While the diving used to be in depths of less than 15m, over-exploitation of inshore resources has meant that divers now have to go further offshore and dive deeper. Some divers are well educated, others simply highly skilled by learning the trade from (e.g.) their parents.

128. It is not cheap to get into the diving business. SCUBA apparatus, a compressor, boat and engine are needed in most areas. About 40% of divers use SCUBA at least part of the time, with the remainder using snorkel only. The high cost of SCUBA equipment effectively rules out participation by the poorest members of communities (c.f. shallow waters areas in Indonesia which can be free-dived with only goggles). The investment

required is a risk in itself and that risk may be made greater if a loan or credit is taken for its purchase. Divers used to migrate from the west to the east coasts of Sri Lanka according to season, but this has now become very risky due to Tamil separatist activity. Madhu (1996) reports one dive team being captured by Tamil Tigers and losing much of their equipment. To put the costs into perspective, Madhu (1996) reported that the cost of a compressor was Rs 65,000, compared with prices paid to divers of Rs40 for more common fish and Rs350 for rare fish. In addition, increased security restrictions now mean that many areas are out of bounds to divers.

129. While most (90%) of the divers consider themselves as full-time, a variable part of the year may be spent harvesting valuable food organisms such as spiny lobster. Competition and conflict have been noted between divers and fishing communities which rely on the same resources, but exploit them by other means.

130. The risk of travelling to the east coast now means that diving is effectively only possible for six months of the year. Diving is intensive and this, probably in addition to poor training and operating standards leads to many accidents. Mild decompression sickness (bends) are commonly experienced and there are no facilities for dealing with this. The impact of recurrent or chronic bends can be severe and increases with the depth, duration and frequency of diving. Divers complained about the lack of any facilities to deal with medical emergencies. In addition to the risks directly related to diving, there are always risks from encounters with venomous marine animals.

131. Information from other countries suggests that this Sri Lanka situation is by no means unusual and it appears that divers generally are working under conditions which would not be regarded as satisfactory. Issues of health and safety are of particular concern. In addition, the high capital risk which is carried by independent divers may lock them into a debt burden, reducing or removing any opportunities to seek better prices through a competitive and open market from buyers.

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APPENDIX I

CONSULTANT'S REPORT ON THE INTERNATIONAL TRADE IN ORNAMENTAL AQUATIC ORGANISMS.

REPORT

ON THE INTERNATIONAL TRADE IN ORNAMENTAL AQUATIC ORGANISMS

With special reference to the British Dependant Territories and countries covered by the DfID SLFP project

Contents

1.0 Objectives

- To determine the countries involved in the trade in ornamental fishes and invertebrates (freshwater and marine) and the benefits accrued from the export trade

- To identify major trans-shipment points and trace exports from such points back to the country of origin
- British Dependant Territories
  - Determine the value of the trade in ornamental aquatic organisms to each country
  - Determine the current nature of the trade: collected or farmed, fish and/or invertebrates, freshwater or marine
- West Africa
  - Determine the value of the trade in ornamental aquatic organisms to each country
  - Determine the current nature of the trade: collected or farmed, fish and/or invertebrates, freshwater or marine
  - Identify the main species traded

2.0 Sources of information

The following data were provided by NRI:

- Fish lists for relevant West African countries + Tanzania & Bolivia from Fishbase (printed sheets)
  - Aquarium Trade Fishes (Freshwater and Marine)
  - Native Freshwater Fishes
  - Native Marine/Brackish Fishes
  - Native Reef Fishes
- Fish Lists for British Dependant Territories from Fishbase (printed sheets)
  - Aquarium Trade Fishes (Freshwater and Marine)
  - Native Reef Fishes
- FAO export statistics 1996-1998 (FISHDAB, 11.02.2000) (spreadsheet computer file)

The following data were obtained from OATA:

- UK ornamental fish imports (freshwater, marine) 1989-99 (Abacus Data Services (UK) Ltd) (photocopies of computer print-outs)
- Eurostat EU ornamental fish imports (freshwater, marine) 1992-98 (Ditto) (photocopies of computer print-outs)

No data were available on non-fish importations, and it has thus not been possible to investigate this aspect of the import/export trade. It is possible that the term "fish" may in fact include marine invertebrates.

A certain amount of additional information was obtained from contacts in the ornamental fish industry by means of emailed and faxed requests. It was considered inappropriate to pressure, and thus possibly antagonise, busy people whose present and future cooperation might thereby be compromised. As a result only limited information has been obtained from these sources within the limited time frame allowed for this study, but it is hoped that additional data may be subsequently forthcoming. Any such data will be transmitted immediately to NRI.

A list of books used in evaluating the species lists will be found in the bibliography,

2.1 Evaluation of data

2.1.1 Species lists

- **Aquarium fish lists**

An attempt has been made, using personal knowledge and the reference works cited above, to annotate the lists to indicate the plausibility of the listed species as aquarium fish exports, as well as their suitability (actual or potential). The lists should now give some indication of what is credible as aquarium trade exportation, and what is potentially viable.

The highlighting in yellow of a species *name* indicates that it is a known aquarium fish. Such highlighting is not exclusive, ie species not thus highlighted may nevertheless be aquarium fishes, but this could not be ascertained from the reference material available. Insufficient time was allotted for detailed investigation of every species included in the lists.

The highlighting in yellow of a species *number* (but not its name) indicates that the genus is known as an aquarium fish from one or more representatives. This has been taken as indicating that the species thus highlighted might be an actual or potential aquarium fish.

The highlighting in green of a species *number* indicates that no information on this genus could be discovered in the time allotted, but it was thought possible it might have aquarium potential.

The highlighting in orange of a species *name* indicates known unsuitability as an aquarium fish, eg sharks, mackerel, moray eels, manta rays, barracudas, and tarpon. Introduced food fishes such as the carp (*Cyprinus carpio*) have also been thus marked, there being no known breeding of ornamental carp in the countries concerned. The same has been applied to introduced fishes that are known as aquarium fishes, eg the guppy (*Poecilia reticulata*) as these have probably been introduced for mosquito control and are not actually likely to be of aquarium value.

The highlighting in orange of a species *number* indicates that although it is, or may be, an aquarium fish, it is of doubtful value as such on account of its size, coloration, or habits. Again, this highlighting is not exclusive, and other fishes, highlighted in yellow, may be equally unsuitable. The fact that a fish has been kept in the aquarium does not always mean it is ideal for aquarium culture, or suitable at all; by the same token some genera include species that are suitable for aquarium culture and others that are not. Again, insufficient time was available to check the size/colour/habits of every species included on the lists.

The pencilled annotation "M/B" (often with groups of fishes bracketed together) indicates marine or brackish-water species and hence definitely or most probably of no aquarium interest. Generally speaking it is only reef fishes that are of aquarium interest, and these "M/B" species are not reef fishes. However, within this category a very small number of species are highlighted in yellow as they (may well) have been exported for the aquarium trade - seahorses (*Hippocampus* spp) and mudskippers (*Periophthalmus barbarus*).

This leaves unmarked a few species from the freshwater fish fauna: these are genera where no information could be discovered on the genus, and which may or may not prove to be suitable for aquarium culture and thus plausible exports..

Freshwater species lists

Species are annotated as above, except that some species which may not have an aquarium history at present, but which are most probably suitable (eg killifishes) have been highlighted. Thus a name highlighted in yellow indicates a known aquarium species and/or one thought probably worth exploitation. Species which are well-known species in the aquarium hobby, but which do not figure on the corresponding aquarium fish list, have their yellow highlighting extended into the left-hand margin to indicate the omission.

It is hoped that the resulting lists may prove a sensible guide to the freshwater fish fauna potential for the aquarium trade, and a more realistic listing than the existing aquarium fish lists which include so many fishes patently not aquarium fishes at all.

- **Reef fish lists**

These have been highlighted as for the freshwater lists.

- **Marine/brackish fish lists**

A few species, known/thought to be of potential interest, have been yellow-highlighted (using the usual system of highlighted name for known aquarium species, highlighted number for possibles), if they have not already been thus marked on the corresponding reef fish list.

It must be stressed that some aspects of these lists, in particular the "aquarium fish" lists cast considerable doubt on their credibility. Many of the fishes, particularly marine fishes, cannot by any stretch of the imagination be classed as aquarium fishes: for example sharks, tunnies, mackerel, Nile perch, tarpon, and so forth. The author is unaware of any *Tylochromis* species in the aquarium hobby, yet these figure as aquarium exports on several West African lists. It is more credible that some of the freshwater species listed may have been privately exported by visiting aquarists or as scientific specimens by ichthyologists - for example, a revision of the genus *Tylochromis* about 10 years ago. At the same time there are a number of notable errors of omission, in particular the absence of *Pelvicachromis pulcher* and *P.taeniatus* from the Nigeria export list. Both are popular aquarium fishes known to have been exported from Nigeria during the past decade.

Turning to the lists of resident species for each country, these appear in general more credible, although the presence of endemic Angolan cichlids on the freshwater (and export) list for the Democratic Republic of the Congo is clearly suspect.

The lists are thus probably better regarded as an indication of potential rather than actual ornamental fish exports, ie of species that could perhaps be exploited for the aquarium hobby.

Numerical data

FAO export statistics for 1996-98 were provided by NRI in spreadsheet form. The countries involved have subsequently been coded: *SLFP* (Sustainable Livelihoods Fisheries Project), *DT* (Dependant Territory), *DC* (Developing Country), and *Dev* (Developed) and sorted into sublists by these codes, with sub-totals of the annualised figures for quantity (tonnes) and value (US$). The *DC* and *Dev* codings are to some extent subjective - many countries are borderline cases. The resulting revised spreadsheet, *Exports of Fish for Ornamental Purposes, 1996-1998* is appended. It has been assumed that these data include both freshwater and marine fishes - this was not in fact stated in the information supplied.

The UK importation data obtained from OATA have been processed into comparable spreadsheet form, showing those countries recorded as importation sources for the UK, coded according to the system outlined above and sorted into groups. For each year the annualised figures for quantity (tonnes) and value (£ & US$) have been tabulated and sub-totalled by group.

Freshwater and Marine fishes have been processed separately and are appended as two spreadsheets, *UK Extra-EU Freshwater Fish Imports 1988-89* and *UK Extra-EU Saltwater Fish Imports 1988-89*. It should be noted that the freshwater data include ornamental carp (Koi). Although separate data for ornamental carp were provided, these were patently incomplete as they typically showed only small (if any) importations from Japan and Israel; while at the same the freshwater data clearly included coldwater (Koi, goldfish) as well as tropical ornamentals for these countries, with huge quantities recorded even though neither country is noted as a source of tropical ornamentals.

Unfortunately these data do not differentiate in any way between farmed and collected fishes (although it may be reasonably assumed that the bulk of marine fishes are collected), and in all probability also include trans-shipped fishes and/or errors. For example, Dubai, Yemen, Fiji, St Helena, and Australian Oceania seem unlikely sources of freshwater ornamentals, and by the same token Japan, Hong Kong, and Malawi (land-locked!) are not noted sources of locally collected (or even farmed) marines.

Although the original data included imports from EU countries, OATA advised that these figures were based on VAT data rather than actual quantities and values, and were therefore unreliable. They have therefore not been included.

The Eurostat EU import data obtained from OATA have been processed to spreadsheet form along the same lines as the UK data. Although the original data include separate annual import totals (quantity and value) for each EU country, only the total figure for the EU (for each exporting country) has been tabulated. However, the EU countries have been included in the list of exporting countries as the volume of intra-EU trading

(presumably trans-shipment) is interesting. They have been coded *EU* and grouped together as for the other exporting countries. Again both freshwater and marine spreadsheets have been prepared: *Eurostat Total EU Imports, Freshwater, 1992-98* and *Eurostat Total EU Imports, Saltwater, 1992-98*.

Unfortunately there is once again reason to suspect that some of the data are suspect. Iceland, Greenland, and Mongolia are unlikely sources of ornamental fishes of any type (collected/ farmed, freshwater/marine), and do not appear to be regular centres of trans-shipment (on the basis of the quantities/values supposedly exported), and hence would almost certainly not have the specialised facilities required for such activities. Malawi is again shown (twice) as exporting marine fishes. Moreover, if we examine the intra-Europe trading (refer to the photocopied data) then we find that some countries are apparent net exporters of ornamentals, including marines. Meanwhile it is difficult to credit such a noted fish-keeping country as Germany importing only a few tonnes of fishes per annum. There is also reason to believe the data for France include exports from former colonies. Interpretation of import/export data for the EU needs to be treated with caution. The figures do not compare like with like. Import figures are generally quoted as CIF whereas export figures are generally quoted as FOB. Thus apparent value can double (at least) when fish are re-exported. In addition, packing practices in the EU tend to be to a higher standard than in some original exporting countries and so the total freight weight for a given number of fishes may increase.

Overall, in view of the obvious anomalies and errors outlined above, the impossibility of differentiating between farmed and collected fishes (OATA advise that this information is not available), and the likelihood that the figures for imports from some countries (EU, USA, Japan, Singapore, Hong Kong, and possibly others) include a large element of trans-shipment, it is felt
that the available numerical data do not provide an adequate basis for any in-depth quantitative study (ie of the quantity and value) of the trade in ornamental fishes worldwide. The obvious inaccuracy of the Fishbase aquarium fish export lists likewise precludes any qualitative evaluation. Nevertheless it has been possible to deduce a certain amount of potentially useful information, as detailed below.

3.0 Countries involved in the ornamental fish industry

Table 1 provides an indication of which countries are involved in the collecting, farming, and trans-shipment of freshwater and marine ornamental fishes. In order to produce this table the Eurostat data were analysed to identify those trading countries that were credible original sources
of wild or farmed fishes, and those which were unlikely to be source countries but whose trading activities were regular and/or large-scale, such that it might reasonably be assumed they were involved in trans-shipment. Small-scale or irregular activities by unlikely countries (eg ornamentals from Iceland and marines from Malawi) were discounted and not included in the table. Personal knowledge and information from the ornamental fish industry was also used.

Nevertheless it was not possible to arrive at any definite conclusions regarding some of the possible activities for a number of countries which have been trading on a significant basis. Unfortunately although the FAO statistical data supplied for exporting countries was useful as a cross-check regarding the involvement of particular countries, the absence of any corresponding
import data for non-EU countries meant these data could not be used to confirm the fact or degree of involvement in trans-shipment. Subsequent additional data from industry sources may help elucidate some of these problem areas.

Table 1. Countries involved in the aquarium fish trade, 1992-8

Key: ***X*** **=** *known or probable activity;* **?** *= possible activity; blank = probably no involvement*

		Freshwater			**Marine**		
Code	**Country**	***collected***	***farmed***	***Transshi p***	***collected***	***farmed***	***transship***
EU	Belgium/Lux.			**X**			**X**
EU	Denmark			**X**			**X**
EU	France			**X**			**X**
EU	Germany		**X**	**X**			**X**
EU	Greece						**X**
EU	Italy			**X**			**X**
EU	Netherlands			**X**			**X**
EU	Portugal						**X**
EU	Sweden						**X**
EU	UK		**X**	**X**		**X**	**X**
DC	Belize	**X**			**X**		
DC	Bolivia	**X**					
DC	Brazil	**X**			**X**		
DC	Brunei	**X**					
DC	Burundi	**X**	**X**	**X**			
DC	Centr.Afr.Rep.	**X**					
DC	Colombia	**X**			**X**		
DC	Costa Rica	**X**			**X**		
DC	Djibouti	**X**			**X**		
DC	Dominican Rep				**X**		
DC	Ecuador	**X**					
DC	Eritrea				**X**		
DC	Ethiopia				**X**		
DC	Fiji				**X**		
DC	Fr. Guiana	**X**					

/Table 1 continued

		Freshwater			Marine		
Code	**Country**	***collected***	***farmed***	***transship***	***collected***	***farmed***	***transship***
DC	Guadeloupe				**X**		
DC	Guyana	**X**					
DC	Haiti				**X**		
DC	India	**X**	**X**				
DC	Indonesia	**X**	**?**		**X**		
DC	Kenya	**X**			**X**		
DC	Laos	**X**					
DC	Madagascar				**X**		
DC	Malawi	**X**	**X**				
DC	Maldives				**X**		
DC	Mali	**X**					
DC	Martinique				**X**		
DC	Mauretania	**X**					
DC	Mauritius				**X**		
DC	Mayotte				**X**		
DC	Mexico	**X**					
DC	Neth. Antilles			**?**	**X**		
DC	Nicaragua	**X**					
DC	Niger	**X**					
DC	NZ Oceania				**X**		
DC	Palau				**X**		
DC	Paraguay	**X**					
DC	Peru	**X**	**X**	**X**			
DC	Philippines		**X**	**X**	**X**	**?**	
DC	Solomon Is				**X**		
DC	South Korea		**?**	**?**			
DC	Sri Lanka	**X**	**X**	**?**	**X**	**?**	
DC	Surinam	**X**					
DC	Tanzania	**X**					
DC	Thailand	**X**	**X**	**?**	**?**		
DC	Trinidad/Tobago	**X**					
DC	Uganda	**X**					
DC	Uruguay	**X**					
DC	US Oceania				**X**		
DC	Vanuatu				**X**		
DC	Venezuela	**X**					
DC	Vietnam	**X**			**?**		
DC	Yemen				**X**		
DC	Zambia	**X**					
DC	Zimbabwe	**X**					
Dev	Argentina	**X**					
Dev	Australia	**X**			**X**		
Dev	Bahrain			**?**	**X**		
Dev	Bulgaria		**?**				
Dev	Canada			**?**			

/Table 1 continued

		Freshwater			Marine		
Code	**Country**	***collected***	***farmed***	***transship***	***collected***	***farmed***	***transship***
Dev	Canary Islands			**?**			
Dev	Ceuta/Mellilla						**X**
Dev	China	**?**	**X**	**?**			
Dev	Cuba	**X**			**X**		
Dev	Cyprus		**X**				?
Dev	Czech.Rep.		**X**	**X**			
Dev	Egypt	**?**	**?**	**?**	**X**		
Dev	Hong Kong		**X**	**X**			**X**
Dev	Hungary		**X**				
Dev	Iran		**?**	**?**	**X**		
Dev	Israel		**X**		**X**		**X**
Dev	Japan		**X**	**X**			?
Dev	Libya	**?**	**?**	**?**			
Dev	Malaysia	**X**	**X**		**X**		
Dev	Poland		**X**				
Dev	Quatar		**?**	**?**			
Dev	Oman				**X**		
Dev	Romania						
Dev	Russia		**X**				
Dev	Saudi Arabia		**?**	**?**	**X**		
Dev	Singapore		**X**	**X**			**X**
Dev	Slovakia		**X**	**?**			?
Dev	Slovenia		**X**				
Dev	South Africa	**X**	**X**	**?**	?		?
Dev	Switzerland			**X**			**X**
Dev	Taiwan		**X**				
Dev	Tunisia						
Dev	Turkey		**?**	**?**			
Dev	UAE				**X**		
Dev	Ukraine		**X**				
Dev	USA	**X**	**X**	**X**	**X**	**X**	**X**
SLFP	Cameroon	**X**	**X**				
SLFP	Congo D.R.	**X**			?		
SLFP	Congo.Rep.	**X**					
SLFP	Eq.Guinea	**X**					
SLFP	Gabon	**X**					
SLFP	Ghana	**X**					
SLFP	Guinea	**X**					
SLFP	Guinea Bissau	**X**					
SLFP	Ivory Coast	**X**					
SLFP	Nigeria	**X**			?		
SLFP	Senegal	**X**			?		
SLFP	Sierra Leone	**X**			?		
SLFP	Togo	**X**					

4.0 British Dependant Territories

Of the seven countries involved - Anguilla, Antigua/Barbuda, Bermuda, Cayman Islands, Montserrat, Turks & Caicos, and Virgin Islands - only one (Antigua/Barbuda) figures in the statistical data available (FAOstat exports, UK imports, Eurostat imports), in the form of a single export value of US$ 6,000 in 1997 (see spreadsheet *Exports of Fish for Ornamental Purposes, 1996-1998*). The absence of any corresponding quantity figure begs the question whether even this datum is reliable. There were apparently no imports at all from any of the Dependant Territories to the UK or other EU countries during the periods covered by the data, although this does not preclude exports to the USA or other non-EU countries for which no import data were available.

As already discussed under 2.1.1 the aquarium fish lists appear unreliable. There is no correlation whatsoever between known aquarium fishes from the general Caribbean/western Atlantic region and species shown in the export lists, which are largely sharks, food fishes, and other pelagic species rather than reef fishes. In fact the aquarium fish and reef fish lists are largely mutually exclusive. Yet the latter do in fact include a number of relatively or very popular species kept in marine aquaria. A selection of such species vis-a-vis the countries is shown in Table 2.

Table 2. Some marine aquarium fishes found around the British Dependant Territories

Species	Anguilla	Ant/Bar	Bermuda	Cayman	Monts't	Tks&C	Virgin Is
Abudefduf saxatilis (sergeant major)			*	*			
Acanthurus coeruleus (blue tang)	*	*	*	*	*	*	*
Apogon maculatus (flamefish)			*	*			
Balistes vetula (queen triggerfish)	*	*	*	*	*	*	*
Bodianus pulchellus (Cuban hogfish)		*	*				
Bodianus rufus (Spanish hogfish)		*	*	*			
Centropyge argi (pygmy angel)	*	*	*	*	*		*
Chaetodon striatus (banded butterflyfish)			*				*
Holacanthus ciliaris (queen angel)	*	*		*			
Holocentrus rufus (white-tip squirrelfish)			*	*			*
Pomacanthus paru (French angel)		*		*			

As far as quantifying the value of the aquarium fish export trade to the countries is concerned, on the basis of available data it appears there is no such trade at present. At the same time it would appear that there are reasonable numbers of reef fish species, both known to be and potentially suitable for the aquarium (see highlighted reef fish lists) present, with some countries somewhat better endowed than others. It may thus be possible to exploit this resource to the benefit of some or all of the countries. In view of the varying degrees of aquarium-suitable biodiversity and the expense of creating an exportation facility for worldwide trade, it might perhaps be appropriate to consider a centralised and shared holding and exportation facility in one of the countries, with the other countries transhipping via this facility. As the reef faunas of the various countries include a number of apparently localised species, a centralised trans-shipment facility would also permit

optimum exploitation of the combined biodiversity of the entire group of countries by offering the maximum possible choice of species to potential customers.

5.0 West African countries covered by the DFID SLFP project

5.1 General Considerations

5.1.1 Existing Trade

Once again the aquarium export lists are clearly unreliable. A large percentage of the fishes listed for each country are marine/brackish species of no known aquarium interest, and some are patently ridiculous (sharks, tunnies, manta and other large rays, tarpons, etc).

By contrast, the small number of aquarium-suitable (or possibly so) species on the reef fish lists do not figure on the corresponding export lists at all.

However, the freshwater fishes listed are more credible, though again questionable in some respects. For example, the list of haplochromine cichlids supposedly exported by the Democratic Republic of the Congo, appears to include every haplochromine cichlid found in that country, while only a very small number of these species are known as aquarium fishes. Likewise several countries list *Tylochromis* (Cichlidae*),* which are not known as aquarium fishes. As discussed in 2.1.1 above, these exports could represent scientific collections rather than aquarium trade exports. It is not known how far this may apply to other plausible exports, ie although the fishes concerned are plausible as aquarium fishes, this does not necessarily mean they have actually been exported as such.

Given the political instability of some of the countries concerned, these lists are, presumably, of some antiquity in at least some cases. Enquiries made in the ornamental fish industry indicate that regular exportations to Europe of freshwater species are currently taking place from the Democratic Republic of the Congo (formerly Zaire), Guinea, Nigeria, and Cameroon. Particularly cited are rheophilic cichlids from the River Congo (*Lamprologus*, *Teleogramma*, and *Steatocranus* spp.), *Synodontis* catfishes, *Erpetoichthys calabaricus*, various barbs and characiforms, and the freshwater butterflyfish *Pantodon buchholzi*. Interestingly the last of these, a long-established and ever-popular aquarium fish that is not being captive-bred, is conspicuous by its absence from the aquarium export lists of those countries to which it is native.

The numerical data discussed in 2.1.2 above indicate that all of the countries except for Benin have exported freshwater fishes during the 1990s, although Liberia does not figure in the available data later than 1991, presumably because of political unrest. Apropos of which it is, perhaps, noteworthy, that despite the sporadic upheavals in the Democratic Republic of the Congo (formerly Zaire), exports of freshwater fishes appear to have been maintained, although sometimes on a reduced basis.

The Eurostat data used as the basis for Table 1 (qv) indicate limited exports of marine fishes during the same period from just four countries - Congo D.R., Nigeria, Senegal, and Sierra Leone. Given the unsuitablility of the marine species listed on the export lists, the numerical data must be regarded with some suspicion, although it is perhaps credible that small numbers of species unsuitable for domestic aquaria may have been supplied to large public aquaria (e.g. sharks, rays). Equally, if we assume, as seems likely, that food fish and/or scientific exportations have been included on the export lists, then it is equally possible that this type of export may have figured in the numerical data as well.

It is certainly questionable whether some of the countries have ever (or at least in recent years) sustained a permanent aquarium fish export trade of any description. At least some of the fishes listed are known to have been collected by European aquarists and specialist collectors/importers during expeditions mounted specially for the purpose, rather than being exported commercially by persons or businesses based in the countries concerned.

The appended spreadsheets provide figures which may or may not, given the reservations regarding the accuracy of the data, provide the required indication of the value of the ornamental fish trade to the countries concerned.

5.1.2 Future Potential

- **Marine species**

Although a small number of actual and potential aquarium reef fish species, plus up to three seahorse species, are found offshore of each of the countries studied, it is thought unlikely that the number of species involved would justify the establishment of the specialised fishery and holding/export facilities necessary to exploit this resource, at least by any single country. And even with a shared export facility - probably unlikely to be successful given the turbulent politics of the region - there is very little variation in reef fish species along the entire coastline, such that the overall biodiversity would probably be insufficient to support a viable export trade.

- **Brackish-water species**

Two resident species, *Monodactylus sebae* and *Periophthalmus barbarae*, are occasionally kept in brackish-water aquaria. However, brackish-water aquaria are very much a minority interest, within which neither species is notably popular. Hence the brackish-water fish fauna is probably of no economic value although it could possibly be exploited as a limited side-venture by any freshwater operations in the vicinity of tidal waters.

- **Freshwater species**

As can be seen from the highlighted and annotated lists, it is in this area that there is real potential for the aquarium fish trade, especially considering that many of the countries are at present apparently not trading in ornamental fishes at all.

Groups thought to be of interest are: killifishes, barbs, characiforms, cichlids, mormyrids, and catfishes. These include many species probably so far unexploited and others which have been exported in the past but are no longer available readily, if at all, in fish-keeping countries (previous imports failed to become established as tank-breds, at all or adequately to supply demand). Those which have become established may, of course, be of little export value if self-sustaining farmed or hobbyist-bred populations already exist in captivity.

A problem that may have to be taken into consideration, is the resistance of some elements in the aquarium trade in some countries (particularly at the retail level) to investment in species other

than known "best-sellers", i.e. they are reluctant to stock anything new or unusual unless they are sure it will sell. Species that are immediately and obviously highly attractive in appearance, relatively small as regards eventual size, relatively undemanding in their environmental requirements, and unaggressive and/or otherwise inoffensive in their habits, are the best potential for the mass trade.

It might be thought that killifishes (Cyprinodontidae, e.g. *Aphyosemion*, *Aplocheilichthys*, and *Epiplatys* species, *inter alia*) would fit the mass market bill; but unfortunately, because many are annual or otherwise relatively short-lived, fishes, there is again considerable resistance in the retail trade (apparently because of the fear that they may not survive long enough to be sold, as well as because of their undeserved reputation as "specialist-only" species) even though such fishes generally sell well on the rare occasions that they are actually offered to aquarists. Moreover such fishes are often limited in their distribution, and, of course, not - at least in the case of annual species - available year-round. The conservation aspect would also need to be considered - some species and/or forms may be extremely vulnerable to over-fishing. Thus killifishes may prove to be a small-volume commodity for all these reasons.

"Best-sellers" are perhaps more likely to be found among the barbs (Cyprinidae), characiforms, and smaller catfish species (such as at least some *Amphilius* spp.). With this regard it should be noted that the dwarf barb *Barbus jae*, eminently satisfied all the criteria required for a top-selling aquarium fish, and is not - according to the species lists - being exploited by all of the countries to which it is native. The species apparently has a fairly broad range and could thus probably sustain a sensible fishery.

There should also be a market for smaller - but still significant - numbers of species more favoured by more experienced and/or specialist aquarists, e.g. cichlids, mormyrids, medium-sized to moderately large catfishes, plus killifishes and "oddballs" such as lungfishes, *Erpetoichthys* and other species of bizarre appearance and/or habits. With this regard it is worth noting that, according to one European importer/trans-shipper,

Polypterus, mormyrid, and *Synodontis* catfish species are, apparently, very popular in Japan (to which they are trans-shipped).

In view of the already-mentioned retailer resistance to exotic species, it would be advisable to try to enlist the assistance of aquarium periodicals to publicise interesting species and, hopefully, stimulate public (i.e. aquarist) interest, such that enquiries by aquarists to retailers might stimulate the latter to stock the new fish(es). One major import/export/wholesale company in Germany actually publishes its own, internationally available, bi-monthly "newspaper" in which it publicises new imports, presumably to stimulate demand.

5.2 The individual countries

What has been said above in general applies to all of the countries concerned. The following summaries provide a little more detail for each country.

5.2.1 Benin

There is no evidence of any recent exports from this small country, nor does the available information suggest that it has ever had any significance as an exporter of ornamental fishes of any type. Although its freshwater icthyofauna includes a number of species of potential interest, none is known to be endemic. This, coupled with the limited nature of the ichthyofauna, suggests that opportunities for exploitation may be equally limited.

5.2.2 Cameroon

Freshwater aquarium fishes were first exported from Cameroon at least as long ago as the 1970s, after which period of some years of political instability led to a total cessation of trace of this type. Exports resumed during the mid 1980s and have continued fairly regularly since. At one time a UK importer/wholesaler of tropical freshwater ornamentals maintained a permanent export (and possibly breeding) station in the country, fairly close to the border with Nigeria, across which a certain amount of illicit importation of (at least) *Pelvicachromis* species/forms (notably *P.taeniatus*) took place. The British owner of the business is now resident in the Czech Republic, and it is not known whether or not he still maintains the station in Cameroon.

Freshwater fishes are currently being imported by at least one German importer/wholesaler, specifically numerous localised forms of *P.taeniatus*, plus *Arnoldichthys* and *Erpetoichthys.*

During the past few years a Belgian-based importer/wholesaler has been exporting from a base in Cameroon to, probably *inter alia*, the UK, France, Germany, and the USA. This exporter is known to be exporting some of the endemic cichlids of Barombi mbu, a small crater lake in a remote part of the country which has recently been made accessible for the first time by the building of a new road. Although the Barombi fishes have not proved particularly marketable, the building of the road indicates that improvements are being made to the infrastructure, which may in turn facilitate further exploitation of the freshwater ichthyofauna.

Because Cameroon is a large country with a number of freshwater biotopes of very different types, it has a large and varied ichthyofauna. It is home to a number of cichlids (e.g. *Chromidotilapia*, *Parananochromis*) which *are* of aquarium interest, as well as un- or under- exploited populations of killifishes, mormyrids, catfishes, barbs, characiforms, and a number of "oddities".

5.2.3 Congo Democratic Republic (Zaire)

The largest of the countries, and that with the greatest potential because it not only includes much of the Congo drainage but also borders on a number of the Rift Valley lakes. Lake Tanganyika cichlids in particular are popular aquarium fishes, but as far as is known none are at present being exported from the Democratic Republic of the Congo (hereinafter DRC), although there was formerly an export station at Kalemie exporting via Bujumbura in Burundi, and a degree of southerly exportation via Zambia (by interests based in that country). It is possible that a certain amount of probably illicit exportation is taking place across the DRC/Burundi border and thereafter from Bujumbura to Europe and America. There are some notable omissions on the aquarium fish list, i.e. species present in the DRC but not listed as exports.

A German importer/wholesaler has reported current regular importation from the DRC, largely rheophile cichlids and catfishes (*Synodontis*), as well as some characiforms, mormyrids (*Gnathonemus*) in large numbers, cichlids (*Nanochromis*), *Ctenopoma*, and "naturally" *Pantodon*. (Yet *Pantodon bucholtzi* does not figure on the aquarium fish list!). Historically most rheophiles have been captured in Malebo Pool (near Kinshasa), probably because of accessibility and convenience as regards capture and exportation, respectively. It is perhaps this proximity to an international airport that accounts for the continuation of the exportation of rheophilic Congo fishes practically throughout the recent turbulent years.

There remains no doubt that the freshwater fish fauna remains largely unexploited. This must in part be attributed not just to political unrest, but to the almost total disappearance of the former infrastructure following independence from Belgium. The former export station at Kalemie had no telephone contact with the outside world, only short-wave radio with which to communicate with Bujumbura. There was no practicable transport between the town and the capital Kinshasa, and the export of fishes via Burundi involved the use of a private light aircraft. The business was regularly “held hostage” (literally on at least one occasion) by the local military, whose activities were unsupervised and uncontrolled by the government because of the overland or telephonic communication problem. The station was abandoned when the disturbances in Rwanda looked likely to spill over into the DRC, and an already difficult and dangerous situation became intolerably perilous. Yet its lakeshore situation makes Kalemie relatively accessible to the outside world (e.g. via the lake steamer) compared with many parts of the country.

It thus seems likely that a more stable political climate and a vast improvement in the infrastructure will be necessary before the undoubted potential of the ichthyofauna can be exploited to any degree.

Some of the species included on the aquarium fish and freshwater lists are dubious. For example, I have been unable to find any record of *Lamprologus lethops* being exported (apart from the single - dead - type specimen) and its habitat and presumed habits make its live capture unlikely (Keith Banister, pers.comm.). Both lists also include fishes endemic to Lake Fwa in Angola. Some of the latter have been exported in small quantities by Heiko Bleher, a private collector and explorer, and subsequently bred in captivity. These may well have been exported via the DCR. This, however, might in turn suggest that the freshwater species list may have been based at least in part on the export list, and itself thus be unreliable.

5.2.4 Congo Republic

Although the Congo Republic is much smaller than the DRC, and does not extend as far east as the Rift Valley lakes, it might be thought that it would at least be able to exploit the River Congo fishes in the same way as its larger neighbour. However, the border between the two countries is not, as might be expected, the Congo itself, but its northern bank. The river thus lies geographically in the DRC, and this is reflected in the absence of mainstream Congo fishes from the Congo Republic freshwater list. And although doubtless the riparian people on both banks do in fact utilise the river as a water supply and to fish for food, it seems probable that the exploitation by the Congo Republic of its neighbour’s property for export profit would not be a viable proposition. Nevertheless it is interesting to note that during one recent bout of unrest in the DRC, with a concomitant decrease in export figures, exports from the Congo Republic simultaneously soared, which would appear to indicate that fishes were either collected from the Congo in the Congo Republic, or trans-shipped from the DRC via that country.

There does not, however, seem to be any significant regular trade, at least with Europe. Fishes of possible interest include killifishes, catfishes, characiforms, barbs, and mormyrids. The freshwater list includes a *Lepomis* species, a coldwater genus from North America.

5.2.5 Cote d'Ivoire

The Eurostat data indicate a relatively large export trade from this former French colony, almost exclusively with France. Whether or not this precludes exports to other countries, or whether exports are in fact taking place to non-European countries, is not known. Likewise it has not yet proved possible to determine whether the importations by France are being trans-shipped elsewhere, though this seems possible, even probable. As the country is in fact independent, one may surmise that the exportations are being made by French interests in the country, which might therefore welcome an opportunity for trade perhaps more profitable to itself. Fishes of possible interest include killifishes, catfishes, characiforms, barbs, and mormyrids.

5.2.6 Equatorial Guinea

The fish export list for this country comprises mostly non-aquarium marine fishes, and this reflects a relative paucity of freshwater species. There are a good number of killifishes and a few interesting cichlids (*Chromidotilapia*, *Nanochromis*, *Parananochromis*), but there is probably not enough diversity to support a meaningful export trade. The numeric data indicate some exportation over the period covered, but it has not been possible to establish whether this is organised trading or small-scale exporting by visiting collectors.

5.2.7 Gabon

Like Equatorial Guinea, Gabon is another small country with no significant history of exportation of ornamental fishes. It harbours a quite extraordinary diversity of killifish species and one or two other potentially interesting species, but, especially given the limited market for killifishes, it is doubtful whether it could ever sustain a viable independent export trade.

5.2.8 Ghana

The Ghanaian freshwater fish fauna has been sporadically exploited in the past, but apparently largely in the form of occasional collections rather than regular organised trade. It has a number of endemic species, most notably two cichlids, *Steatocranus irvinei* (an interesting but rather large - to 17 cm total length - species known only from the Volta rapids and possibly extinct as the result of hydro-electric activity) and *Limbochromis robertsi*, an extremely attractive dwarf species which, however, is difficult in its behaviour and extremely limited in its known range so as to be possibly extremely vulnerable to collecting pressures. Farming the latter species might present possibilities, as this would prevent overfishing and might help curtail the natural aggressive territoriality inherent in wild males.

There is a comparatively small (for the region overall) selection of killifishes which have not been hitherto exploited if the export list is to be believed. Also of potential interest is the fairly extensive selection of *Synodontis* catfish species - this genus is generally quite popular amongst aquarists; some of the other catfishes may be also of interest to specialists in the group, though some are too large to be of widespread or even any interest. The large number of *Barbus* species may include some with aquarium potential, and there may be some additional possibilities among the mormyrids, characiforms, and "oddities" such as *Parachanna*, *Gymnarchus*, and *Polypterus*.

It is not known, however, whether the Volta hydroelectric activity has had any effect, deleterious or otherwise, on these elements of the freshwater ichthyofauna.

Cooperation with neighbouring or nearby countries could perhaps lead to benefits to all concerned. As discussed under 5.2.5, Cote d'Ivoire appears currently to be under a French near-monopoly, and Togo (5.2.15) and Benin (5.2.1) are largely unexploited and possibly too small to sustain their own export industries.

5.2.9 Guinea

Guinea is the third of the four countries known to be exporting regularly to Germany, with particular emphasis on various *Polypterus*, mormyrid, and *Synodontis* species which are, apparently, very popular in Japan (to which they are trans-shipped), as well as small characiforms such as *Lepidarchus*, plus *Roloffia* (a killifish genus, which does not, in fact, figure on the freshwater species list for the country) and the dwarf barb recommended earlier, *Barbus jae* (which likewise does not figure on the freshwater list).

The freshwater ichthyofauna also includes a large number of other *Barbus* species, some of which may be suitable for the aquarium trade, as well as a small selection of killifishes including the rarely seen and much coveted (at least among killifish enthusiasts) clown killie, *Epiplatys annulatus*.

5.2.10 Guinea Bissau

This is a small country with a correspondingly limited freshwater ichthyofauna which includes a number of potentially interesting killifishes, characiforms, mormyrids, catfishes, and "oddities", but is nevertheless probably not diverse enough to sustain an independent fishery. Guinea-Bissau is recorded as having exported freshwater species, but irregularly and not in significant quantity. Possible options could include collaboration with neighbouring Senegal, which also has a limited and relatively unexploited freshwater ichthyofauna, or exportations via the existing infrastructure in neighbouring Guinea.

5.2.11 Liberia

Political instability has precluded exports of ornamental fishes from Liberia for the best part of a decade. In fact, although the country has a large selection of killifishes from a number of genera, the freshwater fauna is relatively limited (especially given the size of the country). There are a few potentially exportable characiforms, mormyrids, barbs, and cichlids, but probably not sufficient diversity to support a significant trade, especially as some of the saleable species are available from other, more stable, countries with an existing export trade.

5.2.12 Nigeria

Nigeria has a long history of aquarium exports dating back at least to the early 1960s, which has, however, had its ups and downs due to sporadic instability. Some aspects of its freshwater ichthyofauna parallel those of its neighbour, Cameroon. It is at present a regular exporter, with, as for Cameroon, the main species being geographical variants of *Pelvicachromis taeniatus*. Interestingly this species is not included on the aquarium fish list, nor is its close relative the krib, *P.pulcher*, perhaps the best known Nigerian species in captivity. Although self-sustaining hobbyist-bred populations of this extremely popular species, in practically every aquarium-hobby country, mean that demand for fresh wild imports is not large, "wild-caught" kribs are regularly seen in the UK and presumably also elsewhere.

The freshwater species list suggests plenty of scope for additional exploitation, as this large country has a correspondingly large and diverse ichthyofauna. Killifishes, barbs, mormyrids, catfishes, characiforms, and "oddballs" are all potential areas for expansion of the existing trade.

Whether or not the current religious unrest will have any adverse effect on the export trade remains to be seen.

5.2.13 Senegal

Senegal has exported ornamental freshwater fishes sporadically over the past decade, but the trade does not appear to have been conducted on any permanent basis. As for the West Africa region in general, the groups of fishes of particular interest are killifishes, catfishes, mormyrids, and barbs, but the ichthyofauna is relatively depauperate in species terms, and it is thus doubtful whether it could sustain any significant level of trade. Limited exports via the (presumed) existing trade infrastructure in neighbouring Guinea might be the best option, or perhaps collaboration with another neighbour, Guinea-Bissau, which also has a limited and unexploited ichthyofauna..

5.2.14 Sierra Leone

Sierra Leone, like many other countries in the group, has a history of sporadic rather low-volume exports. Its freshwater ichthyofauna includes a very high percentage of mormyrids, which are, however, not particularly popular in the general aquarium hobby as they are not normally colourful, albeit interesting in form and habits. There are a reasonable number of killifishes, including the desirable clown killie, *Epiplatys annulatus*, as well as a few barbs, characiforms, catfishes (remarkably few), and "oddities". As for Senegal, above, limited exports of "prime" species via the existing trade infrastructure in neighbouring Guinea might be the most viable option.

5.2.15 Togo

Perhaps because of its small size and rather limited fish fauna, Togo appears never to have had any serious involvement in the ornamental fish industry. Its ichthyofauna is rather similar to that of its neighbour Benin

(5.2.1), and, as in the case of that country, is probably not adequately diverse to support a "free-standing" export industry.

6.0 Other countries of special interest

6.1 Tanzania

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Tanzania is arguably the ichthyologically most diverse country in Africa. It borders on the two largest Rift Valley lakes (Malawi and Tanganyika), encloses a third, smaller, one (Rukwa); and also has a Lake Victoria shoreline. Although often thought of as a land of open dry plains, it in fact has a number of rivers offering a variety of biotopes, as well as marshy areas and small streams that are home to small fishes. Offshore there are coral reefs with an abundance of species. Yet although there has been some exploitation for the ornamental fish industry over the years, there is no doubt that there is huge scope for development in some areas.

The country is large and includes a number of quite separate (geographically and ichthyologically) aquatic biotopes and fish faunas which would require separate investigation and exploitation, and which are therefore summarised individually below.

Because Tanzania did not form part of the original terms of reference of this project, the information given is based largely on the data provided and existing personal knowledge. Requests for additional information have, however, now been made to a number of possible sources, and any information thus obtained will be passed on to NRI as and when it becomes available.

There has not been adequate time to check the freshwater lists in detail against reference material for known ichthyofaunas within Tanzania (e.g. for each lake), but the Lake Malawi cichlid species catalogued on the freshwater list appear on cursory examination not to represent a full list of the described taxa present in the Tanzanian part of the lake. It should also be borne in mind that the ichthyofaunas of all three of the large lakes, all of which exhibit a very high degree of endemism, and possibly Lake Rukwa in addition, include many undescribed species and/or geographical forms which are not listed at all, many of which are known as aquarium fishes or suited to that purpose. The diversity of the exploitable Tanzanian freshwater ichthyofauna is thus rather greater than indicated by the already extensive freshwater species list.

- **Reef fishes**

The Indian Ocean is a fertile source of reef fishes for the ornamental fish industry, and the lists indicate that Tanzania is endowed with an extensive coralfish fauna which includes species known to be of interest to the aquarium trade, and others potentially so. This coralfish fauna is presumably very similar to that of neighbouring Kenya (for which lists were not supplied). Yet the available numeric (Eurostat) data show exportation of marines fishes in only a single year (1998), and then only one tonne, while neighbouring Kenya has been exporting 18-25 tonnes per annum on a regular basis throughout the 1990s. The collection and exportation of these rather delicate organisms requires specialised skills and facilities; because comparative data for 1999 are not yet available it is not possible to adjudge whether the single Tanzanian exportation documented represents an incipient new industry or collection and trans-shipment via existing facilities in Kenya.

The capital of Tanzania, Dar es Salaam with the main international airport, is sited on the Indian Ocean coast, and international air freight services are thus available "on-the-spot", a fact that should greatly facilitate any exploitation of the marine ichthyofauna (c.f. the continuing exports of freshwater fishes from Malebo Pool in the River Congo, via Kinshasa, DCR, despite that country's problems - discussed above under 5.2.3).

It is perhaps worth noting that Kenya also maintains a thriving tourist industry which includes SCUBA and snorkelling exploration of coral reefs and observation of their inhabitants. The Tanzanian island of Zanzibar is also a noted site for this type of activity, but there may be room for expansion, perhaps in conjunction with any future collecting operation. A freshwater ornamental fish exporter based in Malawi has long since successfully incorporated a degree of "underwater ecotourism" into his collecting activities on Lake Malawi, utilising the same equipment (boats) and the local knowledge/expertise of his fishermen employees, and is currently expanding this side of his business, and there is known to be similar interest in the touristic enjoyment of coral reefs and fishes.

- **Lake Tanganyika**

Along with the coral fishes, the cichlids of Lake Tanganyika probably represent the most valuable and least exploited ornamental fish resources in Tanzania.

Lake Tanganyika is thought to be one of the most biodiverse freshwaters on Earth, with most of its biodiversity comprising a large cichlid species flock, which, unlike those of Lakes Victoria and Malawi, may include a number of separate lineages, and is noted for its immense variety of form, size, and habits, the last of these particularly interesting to aquarists as well as scientists. Not all of these species are suitable for aquarium culture - *Boulengerochromis microlepis* can attain 100 cm total length - although such is the enthusiasm for Lake Tanganyika cichlids among specialists that practically any species exported (including *B.microlepis*) is virtually guaranteed at least limited sales on a regular basis. The lake also harbours a very popular small catfish, *Synodontis multipunctatus*, and an interesting non-annual killifish, *Lamprichthys tanganicus*, for both of which demand apparently currently exceeds the very limited supply.

Unlike Malawi cichlids (see below), many Lake Tanganyika species are suitable - in terms of size and behaviour - for maintenance in small aquaria and/or "general communities" of small compatible fishes of various types, provided their rather stringent water chemistry and quality requirements are met. Although few are attractive by virtue of bright coloration, many have a subtle rather than gaudy beauty which many aquarists, not only cichlid enthusiasts, find extremely attractive. Most are relatively or even extremely difficult to breed, hence there is no significant competition from captive-bred stocks (farmed or aquarist-bred). The demand for a number of species - notably *Cyphotilapia frontosa*, *Tropheus* and *Julidochromis* spp., *Neolamprologus leleupi*, and various small shell-dwelling lamprologines as a rule greatly outstrips the available supply, such that small aquarium-bred *C.frontosa* and *T.duboisi* sometimes command prices almost as high as those for wild adults.

The interest in and demand for these fishes, which has been increasing steadily, sometimes exponentially, since the late 1960s, has probably never been adequately paralleled by the supply, and in recent years the interest and demand has continued to increase while the

supply has diminished. This is due in large part to political unrest. The lake is bordered by four countries: the Democratic Republic of the Congo (DCR) (formerly Zaire), Burundi, Zambia, and, of course, Tanzania. As already mentioned (5.2.3), a UK-financed collecting operation in the DCR had to be terminated for the safety of its staff when the troubles in Rwanda spread southwards into the then Zaire. The main long-term (since the early 1970s), Belgian-owned, collecting operation on the lake, based in Burundi, has had its activities seriously curtailed by the same unrest and its side-effects. One of the two collecting operations in Zambia, with a collecting station close to the Tanzanian border, is rumoured to be closing down (it is hoped to provide more information on this later; infrastructure problems - a very long (mainly dirt) road journey to the nearest international airport in the capital, Lusaka, and difficulties obtaining fuel for boats - are possible causes). Nothing is known of the other Zambian operation, based at Mpulungu at the southern tip of the lake.

Historically Tanzania seems never to have been the base for any serious collection of its Lake Tanganyika fishes. Apparently some collections are made by a diving company (perhaps involved in tourism) in Dar es Salaam, and on an *ad hoc* basis by the Asian Vaitha family, who, *inter alia*, operate a hotel and SCUBA business at Kigoma, one of the few significant settlements on the Tanzanian shoreline and the base for UN-funded studies of the lacustrine biodiversity. Collections are known to have been made (and are probably still being made) by the Burundi- and Zambia-based exporters, and probably account for the bulk of the reported exportations of Tanzanian fishes from this lake.

The reasons for this lack of exploitation are probably largely based on the poor infrastructure of the country, particularly as regards transportation. As the crow flies, the distance from Kigoma to Dar es Salaam (and international airfreight services) is in the region of 800 km, and there are no proper roads. Other points on the lakeshore are a little closer to the capital but equally inaccessible. There is an air service between Kigoma and Dar es Salaam, but (at least until 1997) this was operated by a single ancient and very unreliable light plane (Keith Banister, pers.comm.). There is also a train service, reputedly vulnerable to "hold-ups" by bands of armed brigands (*idem*). Finally there is the lake steamer, which appears to be fairly reliable but erratic in its timetabling (*idem*); but in view of the lack of transport between any point on the Tanzanian shoreline and the capital, exports made using this mode of transportation would be viable only via another country, most sensibly Burundi where there is an international airport close to the lake, at Bujumbura.

The transportation difficulties also create problems with the provision of the boats, fuel, and other equipment required for a collecting operation of any significance.

There are also local difficulties to be taken into account. The lawless elements already mentioned also exist along the lake shore, such that small boats are sometimes fired on with automatic rifles while travelling close to the shore, and it can be dangerous to land because of the danger of armed robbery and possible murder (Ad Konings, pers.comm.). Because the shoreline is relatively uninhabited it still harbours a very large population of crocodiles (*Crocodilus niloticus*) which represent a very serious danger to anyone involved in "in-water" activities of any kind (*idem*). Hippopotamuses may also represent a danger to small boats, although larger ones are unlikely to be attacked.

Nevertheless the fact that successful fisheries have nevertheless been maintained for many years in neighbouring countries suggests that the difficulties are worth surmounting, and some (crocodiles, hippos) presumably have been surmounted in those other countries.

Kigoma might seem an obvious base, although because it lies in the extreme north of the coastline overall, a more central location such as Kipili or Kibwesa might be more appropriate. Kigoma, which lies close to the border with Burundi, may also be vulnerable to overspill of problems in that country - a massacre unreported in the media is known to have taken place close the border, possibly actually in Tanzania, in 1997 (Keith Banister, pers.comm.). The northern fish populations have already been exploited to some extent both from within Tanzania and more extensively from Burundi. Moreover it is thought that southern Tanzanian fishes have been exported to some degree from Zambia. Those in the central zone remain relatively unknown in the aquarium hobby, and thus have the all-important "novelty value" important to a new enterprise.

The benefits to the selected community (or communities) of a thriving ornamental fishery on the lakeshore should not be underestimated. A Malawi-based exporter of ornamental fishes from Lake Malawi is known to employ approximately a hundred persons directly in that country, with "knock-on" benefits to local service industries (telephone, electricity, vehicle repairers, airport services). Farming of selected species (as already conducted in Burundi and possibly Zambia) and "aquatic ecotourism" may also have economic potential. The improvements to the transportation infrastructure probably necessary - and certainly desirable - to service any of these industries would themselves provide additional work for local people, not to mention other benefits accruing from improved contact with other parts of the country. Furthermore, in the event that collecting rights could be negotiated for the currently unexploited central DRC shore the value of the trade could be increased further, with resulting benefits to both countries. Likewise, in the event of a separate collecting operation being re-established within the DRC, a country with even worse communication/transportation problems between the lake and its capital (and international airport), then trans-shipment via a facility on the Tanzanian shore could prove lucrative. But even if exportation has to be effected via one or more other countries, the opportunity to exploit this natural resource should not be neglected.

- **Lake Malawi**

Lake Malawi cichlids have been popular aquarium fishes since the beginning of the 1970s. Their attraction is somewhat limited, however, as for successful maintenance they require specialised culture in a large biotope aquarium devoted to this type of fish, while the most popular type of fishkeeping is the low-maintenance "general community" of small, attractive, peaceful fishes of mixed types and species.

The relatively short stretch of the Lake Malawi shoreline in Tanzania appears to be less biodiverse than some parts of the lake (but has not been as extensively researched by ichthyologists), but has for some years supported a thriving, and presumably profitable, ornamental fishery, almost entirely in cichlids, operated by European interests. The results of this fishery in all probability account for a significant part, if not the bulk, of the freshwater exportations catalogued in the ornamental fish industry statistics.

As far as is known this fishery is restricted to the Tanzanian part of the lake, as the location of the lacustrine border with Malawi is in dispute (Malawi and Tanzania both claim

ownership of the inshore waters - the area richest in aquarium-suitable fishes). This means that Malawi-based aquarium trade interests are not at present permitted to collect along the Tanzanian shoreline, or vice versa. There is apparently likewise no collecting from Tanzania along the Mozambique shoreline to the south. The reasons for this are unknown, but may be linked with the friendly relations and regular general trade between northern Mozambique and the Malawian islands of Likoma and Chizumulu, which lie only a few kilometres from the Mozambique shore and in Mozambique territorial waters. In addition a Malawi-based ornamental fish exporter has, following the cessation of the civil war in Mozambique, established friendly relations with that country and historically (but not currently) been permitted to collect at various points on the Mozambique shoreline, including the northernmost part adjoining Tanzania.

At present no information is available on how collected fishes are transported the long distance to (presumably) Dar es Salaam for exportation to Europe and the USA.

The demand for wild Malawi cichlids is significant, but limited largely to specialist enthusiasts. Some of the more popular and long-established species are now being farmed in the Far East and Florida, USA, and some species are also regularly supplied to the retail trade by amateur (aquarist) breeders. This is known to have had an adverse effect on the export trade from Malawi. It is thus questionable whether the existing Tanzanian trade in Malawi cichlids can be expanded, unless new species can be caught along the Mozambique coast (the northern Malawian coast is already well exploited from Malawi, right up to the border with Tanzania). As in Malawi, and with coral fishes, opportunities for organised fish-oriented "ecotourism" may exist , and there is some suggestion that a limited amount of such tourism already exists in the form of parties of aquarists visiting the export station.

- **Lake Victoria**

The ecological catastrophe that has taken place in Lake Victoria, as the result of the introduction of the Nile perch (*Lates niloticus*), is well known and well documented. The current status of many of the members of its once vast and diverse cichlid species flock remains unclear.

Lake Victoria cichlids have been available, in limited numbers and variety, in captivity for many years. A few were imported to the UK in the late 1960s as a private venture by an enterprising BOAC pilot, and retailed by an aquarium shop close to Heathrow Airport. Although these (or their captive-bred descendants) excited the imagination of a number of cichlid enthusiasts during the East African cichlid "boom" of the 1970s, this seems to have been largely fuelled by "rarity value" (i.e. limited availability - by then Uganda was in turmoil and the other shorelines of the lake were geographically (rather than politically) inaccessible to collectors) rather than inherent desirability. Although the fishes were known to be of considerable scientific interest, their appearance and behaviour proved to be relatively uninteresting and they bred prolifically and precociously, producing large quantities of young for which there was a strictly limited market.

Additional interest was stimulated, particularly among ecologically-minded aquarists, when the existence and extent of the *Lates* catastrophe became known, again fuelled by the "rarity value" factor, as by now the only captive specimens were in institutions in the UK, USA, and Netherlands, where captive breeding programmes had been instituted. Eventually the prolific breeding by these institutions of a number of species led to some juveniles from these programmes being released to responsible and committed aquarists, and the next generation percolated into the general aquarium trade. But the interest proved very limited, perhaps because none of the species concerned was particularly attractive visually and/or behaviourally.

Limited commercial exportations subsequently took place from the lake during the late 1980s and early 90s, and one or two exceptionally colourful species have obtained and retained a foothold, as "tank-breds" in the "permanent" trade. But is questionable whether even the original biodiversity of the lake could have supported a viable export trade.

- **Lake Rukwa**

Lake Rukwa is home to a small number of endemic and non-endemic species which are at present probably totally unexploited for the ornamental fish trade. Some of these might be of aquarium interest, but the ichthyofauna is not sufficiently diverse or potentially saleable to support a separate collecting facility on the lake. Any exploitation would probably be best effected via facilities on one or both of the two larger Rift Valley lakes (Malawi and Tanganyika).

- **Rivers, streams, and other small waters**

The ichthyofauna of these waters is little known in the aquarium hobby but contains a number of species definitely of interest, for example a wide selection of mormyrids and barbs; the rheophilic *Orthochromis* (Cichlidae) species and other fluviatile members of that family; killifishes (notably *Aplocheilichthys* and *Nothobranchius*, plus *Pachypanchax playfairii*, a non-annual killie and long-time aquarium fish which is unfortunately rarely available today); catfishes; and a few "oddities". Unfortunately the lack of infrastructure

(viable transport and communications) in large parts of the country would necessarily limit collectability (at least for the time being) to relatively accessible areas, e.g. those in the vicinity of collecting/export stations on waters with an extensive aquarium fish potential.

6.2 Bolivia

The ichthyofauna of Bolivia was not researched as part of this project. The country is known to have exported freshwater ornamental species in the past, and such exportations are shown, from 1993-97, in the Eurostat data. Earlier exportations must have taken place as well, as at least one Bolivian species, the "Bolivian Ram", *Microgeophagus altispinosus*, has been a popular aquarium fish since the 1980s.

Although no exportations are recorded after 1997 (and no importations to Europe since 1996), one source has suggested that limited numbers of Bolivian fishes are being exported via Peru, which is known to be trans-shipping species to Europe (and perhaps other countries) from at least two other South American countries, as well as farming a number of species. The two countries share a border remote from centres of civilisation, hence unrecorded exportation is a possible explanation of the anomaly. The success of Peru as an exporter of tropical freshwater ornamentals, despite its tropical waters being remote from its main centres of civilisation, is perhaps a good indication of the possibilities for the relatively untapped potential of Bolivia.

More information may be available when a contact who regularly visits Peru (and possibly Bolivia) as a private collector, returns to Europe from Central America at the end of March and is again contactable.

Notes added by Ian Watson. Export statistics supplied by the Bolivian National Institute for Statistics indicate exports up to 1997. Exports averaged US$ 56,000 from 1992-97, with the main destinations being US and Germany. Exports to Peru were very small over this period, but it may be that unofficial transhipment takes place. The range of freshwater fishes in Bolivia covers many species known in the aquarium trade, and some species which would be new to the trade (or are seen very rarely). The species present have market potential, and there appears to be scope for the expansion of the export trade from Bolivia. Exports are at a surprisingly low level when compared to other countries in the region (e.g. Peru).

7.0 Summary

The ornamental fish industry, freshwater and marine, is demonstrably of considerable benefit to a number of developing countries, while others have to date failed to exploit this valuable resource to its full potential, despite the possession of a suitably diverse and aquarium-suitable ichthyofauna. In some cases this may be due to political unrest, which is known to have interrupted or terminated collecting and exporting activities in a number of countries; in others inaccessibility and the lack of a suitable infrastructure - transport, communications - may limit or have precluded such exploitation. It must also be borne in mind that many fish-producing countries are not fish-keeping countries, the aquarium hobby being largely restricted to industrialised countries; hence local people may be unaware that small fishes - too small to be of obvious value locally, as food - are a potential source of overseas income and employment opportunities. Or that some of their food fishes could be worth considerably more than their immediate local value if exported for the aquarium hobby. Lack of the necessary specialised knowledge - and finance - to exploit such resources may be a further limiting factor.

The farming of food fishes is a well-documented assisted activity in developing countries (and undoubtedly accounts for some of the non-native fishes - carp and a number of "tilapias" - on the freshwater lists of some of the SLFP countries). A number of far eastern countries, together with the state of Florida, USA, have created a vast and profitable industry from the farming of ornamental tropical fishes, their warm climates precluding the need for water-heating and thus minimising costs. A number of eastern European countries are likewise profitably involved in this area of the ornamental fish industry, despite what must be fairly considerable heating costs.

There would appear to be no reason why, given the necessary encouragement, education, and initial financial assistance, developing countries in the tropics should not likewise develop thriving and profitable tropical freshwater fish farming businesses, breeding not only their own native species but also - and perhaps mainly - established "best sellers". Low labour costs - in international terms - would allow the "product" to be competitively priced even allowing for probably higher freight costs (at least initially) due to the relative lack of competition between airlines servicing developing countries. Ultimately demand for freight services might stimulate greater airline interest, more competition, and reduced freight charges. Limited-scale farming of tropicals is known to be taking place already in Peru, and has been conducted in Malawi and Burundi (it is not known whether this type of activity in Burundi has been curtailed by the civil unrest in recent years).

Activities of this kind could enable even those countries lacking the species diversity required for the establishment of a viable export trade in collected fishes, or whose current lack of infrastructure renders large-scale and diverse collecting impracticable, to benefit from the very real possibilities for profit available in the ornamental fish industry as a whole.

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