

CONSULTATION PAPER

FINAL DOCUMENT

Monitoring of International Trade in Ornamental Fish

Prepared for



**European Commission
Directorate General E - Environment
ENV.E.2. - Development and Environment**

Prepared by



UNEP WCMC

**United Nations Environment Programme
World Conservation Monitoring Centre**

ABOUT UNEP WORLD CONSERVATION MONITORING CENTRE

The UNEP World Conservation Monitoring Centre is the biodiversity assessment and policy implementation arm of the United Nations Environment Programme (UNEP), the world's foremost intergovernmental environmental organisation. UNEP-WCMC aims to help decision-makers recognise the value of biodiversity to people everywhere, and to apply this knowledge to all that they do. The Centre's challenge is to transform complex data into policy-relevant information, to build tools and systems for analysis and integration, and to support the needs of nations and the international community as they engage in joint programmes of action.

UNEP-WCMC provides objective, scientifically rigorous products and services that include ecosystem assessments, support for implementation of environmental agreements, regional and global biodiversity information, research on threats and impacts, and development of future scenarios for the living world.

The first draft of this document was produced with contributions from the Marine Aquarium Council (MAC), which drafted the section on MAC certification; and the IUCN Freshwater Biodiversity Assessment Unit. Both organisations provided a review and general input to the document.

Prepared for European Commission Directorate
General E – Environment ENV.E.2. – Development
and Environment

by

The United Nations Environment Programme -
World Conservation Monitoring Centre
219 Huntingdon Road, Cambridge CB3 0DL, UK

Tel: +44 (0) 1223 277314

Fax: +44 (0) 1223277136

Website: www.unep-wcmc.org



© Copyright: European Commission, 2008.

The contents of this report do not necessarily reflect the views or policies of UNEP, the European Commission, or contributory organisations. The designations employed and the presentations do not imply the expressions of any opinion whatsoever on the part of UNEP, the European Commission or contributory organisations concerning the legal status of any country, territory, city or area or its authority, or concerning the delimitation of its frontiers or boundaries.

Table of Contents

1.	Context	8
2.	Introduction.....	9
3.	Objective and scope.....	10
4.	Method	11
5.	International trade monitoring.....	12
5.1	Certification and Monitoring.....	12
5.2	Monitoring through Wildlife Trade Legislation	17
5.3	Customs legislation and monitoring	19
5.4	Veterinary legislation.....	22
6.	Discussion.....	23
6.1	Strengths and weaknesses of the governmental instruments available to monitor trade in aquatic ornamentals	23
6.2	Strengths and weaknesses of the non-governmental instruments available to monitor trade in aquatic ornamentals	26
6.3	Effectiveness of the various instruments as international trade monitoring mechanisms.....	31
6.4	Possible impacts on livelihoods from the monitoring of international trade	33
6.5	Possible impacts on livelihoods from NOT monitoring of international trade	35
7.	Concluding remarks from consultees.....	35
8.	Conclusions	41
9.	List of consultees.....	44
10.	Literature	45

EXECUTIVE SUMMARY

The consultation process on the Monitoring of International Trade in Ornamental Fish was initiated on 13 June 2008 and closed for comment on 19 October 2008. It has taken the form of a Consultation Paper, alongside a document providing background information. The aim of the process was to assess the ability of governmental and non-governmental mechanisms to provide information appropriate for the monitoring of this trade at the species level and to produce recommendations with regards to suitable methods. The document and the consultation process focused on the international trade in ornamental fish entering the European Union.

Three consecutive drafts of the Consultation Paper were circulated for feedback to 58 individuals and organisations, and all documents were made publicly available on the website¹ of the United Nations Environment Programme World Conservation Monitoring Centre (UNEP-WCMC). Responses were received from academic experts, the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) authorities, trade associations, conservation organisations, hobbyists, and the Directorate General for Health and Consumer Affairs (DG-SANCO). In total, 15 participants provided input, including five combined responses from organisations such as Ornamental Fish International, the European Pet Organisation, Ecocean and the Zoological Society of London.

Six monitoring mechanisms were considered in detail, namely statistics collected by: Customs and The Food and Agriculture Organization of the United Nations (FAO); European Community (EC) veterinary controls²; CITES listing; Annex D of the European Union Wildlife Trade Regulation³; The Global Marine Aquarium Database (GMAD); and certification. Table 1. shows the key characteristics of each of these mechanisms.

The debate arising from the Consultation indicated the following:

Some consultees felt that due to the threats currently facing coral reefs, increased monitoring is necessary and desirable. Others agreed that current data are insufficient.

Some consultees suggested that monitoring international trade was less effective than on-the-ground conservation because it does not consider mortality prior to export, collection methods, or domestic use, and it does not include stock and habitat assessments. Some consultees emphasised the importance that monitoring should be targeted to species of conservation concern.

Although it was not contested that Annex D was a relatively comprehensive monitoring tool for species imported into the EC, several concerns were raised with regards to Annex D listing. The concerns included that it is focused only on trade into the EU, and that it does not consider domestic use and post-capture mortality. Concerns from industry representatives included a perceived lack of justification for this monitoring measure, a lack of consultation with range States, a lack of confidence in the SRG process, the administrative burden, duplication of effort with veterinary controls and the inclusion of captive-bred specimens.

Industry representatives from Ornamental Fish International (OFI) and the European Pet Organisation (EPO) expressed support for trade monitoring via the data captured by veterinary controls. The forms used by EC veterinary controls⁴ request species-level information and are already completed as a matter of course by importers. The support for monitoring by this mechanism was in a large part because it would minimise any additional administrative burden for the industry. However, a number

¹ <http://www.unep-wcmc.org/species/OrnamentalFishTrade.aspx>

² Decision 2006/656/EC

³ Council Regulation 338/97

⁴ <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2006:271:0071:0080:EN:PDF>

of practical issues would need to be resolved before this option could monitor trade at the species level. At present, although species names are recorded on hard copy forms, they are not collected or managed electronically. Furthermore, captive-bred specimens are not distinguished from wild-caught specimens.

Some of the concerns raised about Annex D appear to be based on mistaken assumptions, for example: that it will lead to the closure of the European market and that permits are required. There was also a complaint about a lack of clarity about the criteria for inclusion of species in Annex D. One respondent commented that species were listed in Annex D solely because they are traded in significant numbers, to which another replied that species can be listed due to other criteria and that species traded in low numbers can also be assessed.

Certification received support in principle from a range of consultees, but the complexity of the issue was widely recognised. This included issues such as the sustainability of the business, whether consumers would pay a premium for certified fish, economic incentives and industry motivation. There was agreement that a successful certification scheme which is capable of monitoring international trade is a long way off. Several respondents pointed out examples of poor implementation in certification schemes, while one respondent highlighted the success of Project Piaba as a positive example of certification.

Several respondents were concerned about the impact of trade monitoring on wild populations and livelihoods in range states. However, there was disagreement over the expected effects that monitoring would have. There was concern from some respondents that the administrative costs associated with monitoring would be passed on to poor collectors; others felt that economic extinction from unmonitored and unrestricted collection was a greater threat to the livelihoods of collectors.

Various other suggestions concerning aspects of the trade which are outside the scope of the consultation were also debated. These included:

One respondent suggested that ornamental invertebrates should also be monitored; however, another felt that this would need to be justified.

One consultee suggested that breeding in Europe should be encouraged; however another suggested that this would ruin livelihoods in range states, e.g. in South America. Furthermore, other consultees pointed out that such a shift from local use can devalue the resource, and leave the habitat vulnerable to damaging alternative uses.

The important characteristics of each of the mechanisms are compared in Table 1 and presented as follows:

1. Whether monitoring is targeted at species of conservation concern.
2. Whether species name is collected, so that target species can be monitored.
3. Whether species-level data are collected and stored electronically.
4. Whether source of specimens is recorded to distinguish whether individuals are wild or captive bred.
5. Whether the mechanism is compulsory or voluntary.
6. Whether the mechanism is self-sustaining, so that the monitoring can continue in the long-term.
7. Global extent of coverage.
8. Permit fee.
9. Whether data are collected using an agreed list of accepted scientific names.
10. Consideration of mortality prior to export.

While each mechanism has its benefits, there are also limitations which rule out most of the mechanisms. Although they are very longstanding, Customs and FAO statistics have been found to be inconsistently reported in terms of units, and lack the species and source

information required to serve a useful conservation purpose. CITES has many desirable characteristics, and is generally an effective and targeted tool for monitoring trade in species that meet the CITES criteria for listing. However, the monitoring enabled by CITES requires the trader to obtain a permit for the transaction. Certification is the only mechanism which takes into account mortality prior to export; however, for the purpose of international trade monitoring they are expensive; they provide only partial coverage, limited to a selection of areas in some countries; some have a poor track record; and they depend upon consumer awareness to support the schemes. Data in GMAD were collected on a voluntary basis only, and it is not currently operational as it does not have a continued source of funding.

Annex D listing and EC veterinary controls fulfil most of the necessary criteria to effectively monitor EU imports of ornamental fish and appear to be the only practical options for monitoring international trade in ornamental fish; they collect species name, are enforceable and are self-sustaining. Both mechanisms focus on trade to the EU rather than globally. However, they do not currently require information on source of the specimens in trade. Furthermore, veterinary controls do not currently gather the species information electronically, although there are reported to be plans to do so in the future.

It is apparent that there is no ideal mechanism and that any decision made is likely to be subject to criticism from some sectors. Veterinary controls are favoured by the industry because the information which is already provided on veterinary certificates could be used to monitor the trade. The problems with collecting and managing species information electronically for veterinary controls and for recording the source of the specimens are practical issues which would need to be addressed.

The evidence presented in this report and the feedback received from consultees suggest that currently, the only instrument that can provide comprehensive, species-level data on international trade in species of conservation concern is Annex D of the Wildlife Trade Regulations. However, industry operators have expressed a willingness to work in partnership with the regulatory bodies and are keen for veterinary controls to be investigated further as a mechanism for monitoring international trade in ornamental fish.

TABLE 1. SUMMARY OF THE CHARACTERISTICS OF MECHANISMS FOR MONITORING INTERNATIONAL TRADE IN ORNAMENTAL FISH.

Mechanism	Customs and FAO statistics	CITES listing	GMAD	Certification	EC Veterinary controls	Annex D of the EC Wildlife Trade Regulation
Species name normally collected	No	Yes	Yes	Depends on scheme	Yes	Yes
Species-level data recorded electronically	Yes	Yes	Yes	Depends on scheme	No	Yes
Distinguishes wild and captive bred	No	3) a No	No	Yes	No	No
Enforceable	Yes	Yes	No	No	Yes	Yes
Species coverage	All	Listed species only	Marine	Depends on scheme	All	Listed species only
Self-sustaining	Yes	Yes	No	No	Yes	Yes
Geographic coverage	Global	Global	Potentially global	Where active	EU	EU
Permit fee	No	Yes	No	No	No	No
Agreed list of scientific names for use on permits	Not applicable	Yes	Yes	No	No	Yes
Considers mortality prior to export	No	No	No	Yes	No	No
Other comments	Has been collected for a long time, allowing detection of trends. Inconsistent reporting values Small shipments sometimes excluded.	Species need to meet CITES criteria for listing.	Not currently operational.	Requires an economic incentive.	No additional administrative burden for traders.	Possible duplication of effort with veterinary controls.

THE CONSULTATION IS NOW CLOSED.

1 CONTEXT

The trade in live aquatic ornamental animals for the aquarium trade is a global multi-million dollar industry, which can provide economic incentives for habitat conservation. However, little is known about the scale of the international trade in many species, and there are concerns that trade in some species might not be sustainable, given factors such as their biology, distribution, conservation status and ability to survive in captivity (see background information⁵).

In 2000, the Global Marine Aquarium Database (GMAD) was established by UNEP-WCMC, in collaboration with the Marine Aquarium Council (MAC) and with members of various aquarium trade associations. Many industry members (wholesale exporters and importers) provided data to enable monitoring of the trade in marine ornamentals, including information on the species in trade, volumes traded, and source and destination countries. While this initiative provided an important step for the monitoring of this trade, it has lacked an institutionalised, systematic reporting process and a regular source of funding to sustain it.

Following several discussions, the Scientific Review Group (SRG) of the EU Wildlife Trade Regulation recommended that a number of species should be listed in Annex D of Council Regulation 338/97. This recommendation has not yet come into effect⁶. Meanwhile, some traders have expressed concern about these potential listings, suggesting that the value of their voluntary monitoring efforts may have been overlooked, and that the Annex D listings would lead to increased administrative burden on the import of specimens into the EU.

In addition to GMAD, a number of mechanisms exist which aim to gather information concerning the trade in these organisms. These include customs and veterinary border controls, and sustainability-certification schemes. There has been, however, lack of clarity about how useful these sources of trade data can be for the monitoring of species-specific international trade.

Moreover, to date, certification and monitoring efforts have been focused on the marine component of the ornamental trade, with less emphasis on the freshwater sector. Although much of the freshwater trade involves captive-bred specimens (Andrews, 1990; Olivier, 2001; Tlustý, 2002), substantial volumes of wild-caught fish are also traded. Little is known about the scale and nature of much of this trade.

In order to clarify some of these issues, and to bring on board the various opinions of the different stakeholders, at its 38th meeting the SRG indicated its support for a consultation process to be conducted on monitoring of international trade in ornamental fish.

⁵<http://www.unep-wcmc.org/species/OrnamentalFishTrade.aspx>

⁶ Following CITES CoP14 *Pterapogon kauderni* was listed in Annex D on 3/8/2008

Contributions from consultees

[5:] Marine invertebrates could also be included, as trade in invertebrates is in some ways less known than fish but of significant importance.

[7:] As for fish species, the trade in marine ornamental invertebrates compared to the total resource and compared to the use made of it by other sectors is often *de minimus*.

[7:] Nowhere is there a clear rationale for how species subject to greater scrutiny might be selected – we must emphasize that “it might be nice to know” is not and never can be sufficient justification. Resources are limited and must be deployed to best conservation effect, not on a whim (I am not suggesting respondent 5 did this).

[11a:] Considering the title of the Paper, invertebrates are beyond the scope of this document.

[7:] Lines 17-19 do not reflect our concerns. I suggest “Meanwhile some traders have expressed concern “ be reworded as “Some sectors have a deep seated mistrust of the methodology and hence validity of the SRG as currently established”.

[7:] I think it is incorrect to say “little” is known about the scale or nature of the trade. Much is known but perhaps not as much or in as much detail as the SRG might like to see.

[7:] The voluntary nature of GMAD has been overlooked. There is a long-held fundamental lack of confidence in the decision making process of and the conclusions drawn by the SRG. A more transparent inclusive approach to decision making is required to enable the greatest conservation benefit for the least, or at least a proportionate, cost.

[5:] “There is a long-held fundamental lack of confidence in the decision making process of and the conclusions drawn by the SRG” seems to be a sweeping statement – is there evidence to back it?

[7:] During 2007, 3200 consignments (pers. com. Tristram Bradfield, Heathrow Border Inspection Post) of ornamental fish landed at Heathrow (LHR). LHR is responsible for 70% of UK imports (Customs data) by value, in turn the UK is responsible for 25% of EU imports (Eurostat). Therefore it is not unreasonable to assume there are in the region of 20,000 consignments of ornamental fish imported into the EU annually. It is probably a reasonable assumption that an average of 50 species is present in each consignment-thus over 1 million records would need to be created, recorded, collated filed and reported. Even if all this could be done electronically there is the potential for an enormous cost for both trade and administrators. {Editors’ note: This comment seems to refer to a scenario in which trade in all ornamental fish species were monitored}. [7:] Since the criteria for Annex D are neither clear nor precise we had to assume the worst case – that it might be “nice to know” about all species. Any eventual conclusion should carry a health warning that a RIA should be undertaken.

2 INTRODUCTION

This report is the final document of a Consultation Paper based on three drafts which have been circulated to major stakeholders in the international trade in aquatic ornamentals, including importers, exporters, trade regulators, NGOs *etc.* Summaries of comments were incorporated with the intention of reflecting as clearly as possible the views of all contributors.

Draft 1 of The Consultation Paper was produced by UNEP-WCMC with input from IUCN Freshwater Biodiversity Assessment Unit, the Marine Aquarium Council (MAC) and the Scientific Review Group of the EU Wildlife Trade Regulations (SRG). Drafts 2 and 3 incorporated feedback received from consultees. The current, final version incorporates all the comments which have been received and includes an Executive Summary outlining the major points made in the debate.

3 OBJECTIVE AND SCOPE

This consultation is conducted with three objectives, namely to:

- a) consider the existing governmental mechanisms that gather data concerning the international trade in ornamental fish, and assess their ability to provide information appropriate for the monitoring of this trade at the species level;
- b) consider the extent to which non-governmental mechanisms, such as certification schemes or voluntary databases provide a mechanism to monitor the international trade in aquatic ornamentals at a global scale;
- c) produce recommendations for the best method of monitoring international trade in ornamental fish.

The document and the consultation process are focused on the international trade in ornamental fish entering the EU. Trade in corals, which is already monitored through CITES, as well as trade in other invertebrates and plants, are not generally discussed.

[6&7:] The document seems to be based on the principle that it is desirable to improve and/or increase monitoring of the international trade in ornamental fish and yet there is no explicit case made for increased monitoring. The revised draft should state the objectives that increased or improved monitoring is meant to achieve. Without this, it is very difficult to assess the relevance or potential effectiveness of any proposed measures, let alone what the longer term objective might be (conservation, trade, livelihoods, etc).

[5:] Increased monitoring is desirable and necessary at a time when there is widespread concern about the rate at which coral reefs are being lost or degraded and the knock-on effect this has on availability of resources. Wilkinson (2004) concluded that 20% of reefs have been effectively destroyed and show no prospects of recovery. A further 24% are considered to be under imminent risk of collapse and 26% under longer-term threat. This leaves only 30% of reefs at low risk, and even these are not immune from the effects of global climate change. The main threats to coral reefs are from climate change, destructive fishing, declining water quality and degradation of coastal habitats. But whatever the cause of the loss of, or damage to, reefs, it means that reef resources will be increasingly scarce and vulnerable to over-harvesting. Thus there are strong arguments for monitoring collection of fish for the aquarium trade. The seriousness of the situation is illustrated by a recently published Red List analysis that placed one third of reef-building corals at elevated risk of extinction (Carpenter *et al.*, 2008).

[6:] The revised report still does not make an explicit case for increased monitoring of the ornamental fish trade. Any benefits are at best implicit and most are inferred rather than defined. It is by no means certain that monitoring will bring any conservation benefits and gathering of data without a clear idea of what that data represents or how it can be analysed and interpreted is bound to lead to the generation of information which is at best difficult to interpret. The intended conservation benefits should first be defined and then the data needed to achieve these benefits should be identified and a data collection and analysis system designed around this need. The world is littered with the remains of databases which collected a great deal of information without any clear idea how that data would be used. Consideration should be given to how much information could be extracted from data which is currently gathered before any move is made to extend data collection.

[6:] The justification for increased monitoring is still unclear. What is proposed has some elements of displacement activity about it; doing something easy but trivial to avoid addressing the more serious and difficult issues relating to the potential loss of coral reef biodiversity. It might make people feel as if they are doing something, but little concrete may result. At worst, monitoring may simply provide a better platform from which to observe the loss of coral reef biodiversity. I do not think that monitoring in isolation is really going to do much to conserve coral reefs.

4 METHOD

The consultation process consisted of three ‘consultative rounds’. The ‘first consultative round’ aimed to gather comments and contributions on the general content of, and on the list of issues and monitoring tools identified in the first draft (Draft 1) of the Consultation Paper.

The second draft (Draft 2) of the document sought to incorporate a summary of the feedback and data received from the first consultative round, as well as to provide a series of provisional conclusions on the topics discussed. Changes made since the first draft were in bold text to enable readers to identify them easily. The second draft was circulated for comments in a ‘second consultative round’, for which comments were to be on the bold text (i.e. changes made since the first draft).

The third draft (Draft 3) aimed to incorporate a summary of comments received from the second round. It was not the purpose of this draft to add any further substantive issues, which should have already been incorporated in the second draft. The third draft of the document was circulated on a ‘third consultative round’, to give stakeholders the opportunity to contribute any final feedback, particularly if there were any clarifications needed concerning the extent or the accuracy with which contributions and opinions were summarised and on the conclusions made.

At all stages in the drafting process, the drafting team endeavored to summarise all substantive contributions in a clear, succinct and representative manner. However, contributions were generally not transcribed verbatim.

The Discussion section aimed to identify the most relevant issues concerning the remit of this paper, and to present a set of ideas under each issue, about which contributors can provide further information.

Contributors were requested to read the entire document at least once before formulating their comments, as issues that may come to mind at one point in the text may have already been addressed further on. Providing pertinent and succinct feedback would enable the drafting team to capture and represent contributions accurately in subsequent versions of the document.

While a significant effort has been made to produce a well documented and well discussed paper, Draft 1 in particular did not claim to be exhaustive in the range and depth of issues it intended to cover. Instead, the document was expected to grow and evolve as feedback is received. Contributors were emphatically encouraged to provide literature references or data supporting their contributions whenever possible. Contributors were also requested to include the line number(s) relevant to each comment.

All dates for the consultation process are given in Table 4.1. The consultation process has now closed.

TABLE 4.1. TIMELINE FOR THE CONSULTATION PROCESS

Date	Action
13 June 2008	Draft 1 circulated to contributors
20 July 2008	Deadline for feedback on Draft 1
22 August 2008	Draft 2 completed and circulated
14 September 2008	Deadline for feedback on Draft 2
03 October 2008	Draft 3 completed and circulated
19 October 2008	Deadline for feedback on Draft 3
10 November 2008	Final document completed

5 INTERNATIONAL TRADE MONITORING

This section considers the various existing mechanisms that gather data concerning the international trade in ornamental fish. Particular attention is given to the way in which data are collected through certification processes and through legislative regulation, and whether information is collected in such a way that it can be used to monitor this trade at the species level.

5.1 CERTIFICATION AND MONITORING

Certification is a procedure to ensure that a product, process or service conforms to specified requirements. There are three principal ways in which certification can be developed and applied:

- First Party certification is based upon a self-declaration by the producer that it meets the requirements of a certain standard. There is no independent oversight agency for first party certification and therefore it is normally deemed to be of limited value.
- Second Party certification is based upon an assessment that the producer meets the requirements of a standard that was set by a group of consumers, by government or by a non-governmental organization. Unlike first-party certification, the producers do not define the standards nor do they assess their compliance themselves. However, the standards may be less than objective and comprehensive as they are often subject to the interests of the group that both sets them and assesses compliance.
- Third Party certification is based upon standards created by a multi-stakeholder process. Compliance with the standards is voluntary and is assessed by an accredited, independent third party that has no vested interest in the standards, certification, product or any particular stakeholder group. The International Organization for Standardization (ISO) defines third party certification as the highest order for proof of compliance.

5.1.1 MARINE CERTIFICATION

At the time of writing, only one global certification process for marine ornamentals was known – that established and implemented by the Marine Aquarium Council (MAC). The following section introduces MAC and the MAC Certification scheme. Most of the material in Sections 5.1.1 to 5.1.2.1 inclusive was provided by the Marine Aquarium Council, unless otherwise stated.

5.1.2 THE MARINE AQUARIUM COUNCIL AND CERTIFICATION

The Marine Aquarium Council (MAC), established in 1996, is an international, multi-stakeholder, not-for-profit organization that brings together conservation organizations, fishers, the aquarium industry, public aquaria, aquarists and government agencies to ensure the marine aquarium trade

is responsible and sustainable. MAC's mission is to conserve coral reefs and other marine ecosystems by creating standards and certification for those engaged in the collection and care of ornamental marine life from reef to aquarium.

In 2002, MAC launched a certification scheme following multi-stakeholder consultations which included participation in the standard-setting process. The multi-stakeholder Standards Advisory Group in the first developmental phase included about 80 members, with representation from Asia, the Pacific, North America and Europe. The different interests were represented by industry in supply and demand countries, consumers, conservation organizations, science, governmental agencies and trade associations.

MAC Certification is a third-party certification. It accredits independent third-party certification companies. These MAC Accredited certifiers assess companies for their initial compliance with the MAC Standards, and they conduct scheduled and unscheduled surveillance visits to monitor continued adherence to the Standards.

MAC Certification covers both practices (industry operators, facilities and collection areas) and products (aquarium organisms). Industry operators at any link of the chain of custody from reef to retail (collectors, culturists and breeders, exporters, importers, retailers) can seek to become MAC Certified by being evaluated for compliance with the appropriate MAC Standard.

Four Standards apply along the Certified Chain of Custody:

- The Ecosystem and Fishery Management (EFM) international Standard: ensures the collection area is managed as a responsible fishery and includes resource assessment and monitoring, a Collection Area Management Plan (CAMP) and organism replenishment/'no-take' areas.
- The Collection, Fishing and Holding (CFH) international Standard: makes sure that the harvesting of fish, coral and other coral reef organisms are conducted responsibly and maintain the health of the collection area (e.g. using no destructive fishing practices; ensuring that handling prior to export, holding, packaging and transport maintain optimal health of the harvested organisms).
- The Handling, Husbandry and Transport (HHT) international Standard: certifies that (i) the handling of marine life during export, import and retail maintain the organisms' optimal health; (ii) uncertified organisms are segregated; and (iii) MAC Certified organisms have passed exclusively from one MAC Certified industry operator to another.
- The Mariculture and Aquaculture Management (MAM) international Standard: launched in 2006, this Standard addresses the propagation, collection, and culturing of marine aquarium organisms, and specifies requirements for all stages from broodstock/post-larvae collection through to grow-out for market, packaging and transport of cultured marine ornamentals.

MAC Certified products must be harvested from a certified collection area or bred and cultured by a certified Mari- or Aquaculture facility and pass from one certified operation to another. Along this chain of custody certain quality criteria (e.g. mortality allowances) apply to products to maintain their certification.

MAC Certification and the corresponding MAC Certified Label enable the end consumer to identify those businesses that apply best practices in handling, husbandry and transport of organisms, operating in appropriate facilities and with trained staff. MAC Certified Organisms can be identified by the MAC Certified Label on their holding tank and boxes in which they are kept and shipped. Thus, when a fish is labelled as MAC-certified it means that it was collected in a MAC Certified Collection area (EFM Standard) by a MAC Certified Collector (CFH Standard) and then passed from one certified trader to another (HHT Standard). Another possibility is that the fish comes from a MAC Certified aquaculture/mariculture facility (MAM Standard) and is traded by MAC Certified operators (HHT Standard). The fish itself is not certified for compliance with any standard, but results as the product of implementing the standards throughout the different links of the chain of custody.

MAC defines “mariculture” as the cultivation of marine organisms by exploiting their natural environment, whereas “aquaculture” is the farming of aquatic organisms including fish, molluscs, crustaceans, corals and other invertebrates, and aquatic plants with some sort of intervention in the rearing process to enhance production, such as regular stocking, feeding, protection from predators, etc. Farming also implies individual or corporate ownership of the stock being cultivated.

Each of the four MAC standards has its own set of requirements, which need to be complied with by any industry operator seeking to be certified. MAC certification requires the industry to support the monitoring and documentation of the trade as well as the conservation and management of the reefs, through the way it does business.

As of mid-2007, 63 industry operators were MAC Certified, see Table 5.1.

TABLE 5.1. NUMBER OF MAC CERTIFIED OPERATORS, BY CATEGORY AND COUNTRY (2008)

Collection Areas	Collector's Groups	Exporters	Culturists/Breeders	Importers	Retailers
				Canada: 1	
Fiji: 5	Fiji: 5	Fiji: 1			
				France: 4	France: 2
				Germany: 1	
Indonesia: 3	Indonesia: 3	Indonesia: 6			
				Netherlands: 2	
Philippines: 9	Philippines: 8	Philippines: 10			Philippines: 1
		Singapore: 1		Singapore: 1	Singapore: 1
			UK: 1	UK: 3	UK: 1
			USA: 2	US: 4	USA: 4

The MAC Certification scheme has requirements, mechanisms and processes for collecting and analysing information on the status of marine ornamental resources, including the status of the ecosystem and the of impact of human activities. This information was not previously collected and is expected to ensure that the sustainability of marine ornamental operations to be assessed more objectively. MAC Core Standards provide the means to integrate this information into the requirements for industry operations, creating the possibility to improve continually the sustainability of the marine aquarium trade through adaptive management.

Contributions from consultees

[4:] The MAMTI standard has never been applied and no post-larvae experts have been consulted about it

[11:] MAC has gone through a major transformation in the last months and the text needs an update to the present situation. The basic idea of MAC still stands, but experience in the last decade has shown that the way forward needs a major adaptation toward more simplified mechanisms. For the moment the MAC system would absolutely not work in the majority of the freshwater businesses.

5.1.2.1 EVALUATION AND CAPACITY BUILDING

MAC developed a Monitoring & Evaluation (M&E) system and team for the impact and outcomes of MAC Certification. This team collected and reported relevant data at the species level, quantity, mortality rates, reject rates and price (see Organism Receipt Sheet (ORS) form in Figure 5.1). Data are recorded by collectors and traders, who the pass the data to their respective contacts in MAC (e.g. community organizer). This information was then collated into an internal MAC database. The Marine Aquarium Market Transformation Initiative (MAMTI) and M&E reports provided a project “score card” that tracks a number of project output and outcome indicators.

277 FIGURE 5.1. ORGANISM RECEIPT SHEET FORM USED BY MAC



ORGANISM RECEIPT SHEET & SHIPMENT EVALUATION (related to invoice no.):		Supplier:		Delivery Date:					
				Receipt Details					
Species (Common and/or Scientific Name)	MAC Certification Status	Size (S,M,L,XL)	Ordered	Received	Invoiced	DOA	In suboptimal condition + Reason(s)*	Misidentified (please correct ID)	Comments

278 The Marine Aquarium Market Transformation Initiative (MAMTI) was a joint project of MAC, the
 279 Conservation and Community Investment Forum (CCIF) and Reef Check in the Philippines and
 280 Indonesia, sponsored by the International Finance Corporation (IFC). The project has concentrated
 281 on the implementation of MAC Certification at the collection area and collector level. The main
 282 tasks were training programmes (collection, post-harvest handling, basic ecology, business skills)
 283 and reef surveys that can “pave the way” to certification for areas that have not yet certified. The
 284 project started in October 2004 and is funded until 2009. The main goal is the certification of a
 285 number of collection areas and certification of collectors that supply the marine aquarium industry.

286 In 2006, the MAMTI project of MAC covered 14 collection areas in seven provinces, in 10
 287 municipalities and districts encompassing 22,947 hectares of reef areas in the Philippines and
 288 Indonesia. The MAMTI project covered only Indonesia and the Philippines, but there were also
 289 certified collection areas in Fiji. The project monitored many more areas in the Philippines and
 290 Indonesia than were certified. These were the areas the project was working in, but where
 291 certification had not yet been achieved. Seven hundred and eighteen (718) collectors and traders
 292 (483 in the Philippines and 235 in Indonesia) have been trained in non-destructive collection
 293 methods and given assistance in preparing for a third party assessment for MAC Certification.

294 Discussion on the challenges relating to monitoring trade through certification, including the MAC
 295 scheme, are summarised in Section 6.2.

296 *Contributions from consultees*

297 [5:] If available, the MAC database could, in theory, be a useful source of data.

298 {Editors' note: MAC has offered to provide an update on their work. This was not received before circulation
 299 of this document. This information will be made available when received.}

300 5.1.2.2 THE GLOBAL MARINE AQUARIUM DATABASE (GMAD)

301 To support the certification process, UNEP-WCMC, MAC and members of various aquarium trade
 302 associations began collaboration in 2000, to address the need for better information on the
 303 international trade in marine aquarium species and created the Global Marine Aquarium Database
 304 (GMAD). Companies keep records, for their own files, of their sales, either on their own electronic
 305 databases or, more commonly, as paper copies of their invoices. Although the way in which
 306 companies register their trading records varies, all records show species name, quantity, date and
 307 usually origin and/or destination. Hence, company sales records can be an excellent source of data
 308 on marine aquarium species in trade, and the only source for species not recorded through any
 309 other process. A number of these companies provided UNEP-WCMC with access to their sales
 310 records. Trade data were obtained from wholesale exporters and importers of marine aquarium
 311 organisms, most often through copies of trade invoices; integrated and standardized into
 312 quantitative, species-specific information; and placed in the public domain. Fifty-eight companies,
 313 approximately one-fifth of the wholesalers in business, and four government management
 314 authorities provided data to GMAD between 2000-2003.

In August 2003 the dataset contained 102,928 trade records concerning 7.7 million imported and 9.4 million exported animals, covering a total of 2,393 species of fish, corals and invertebrates, and spanning the years 1988 to 2003⁷. These data have permitted the most accurate quantitative estimates to date of the size of the global trade in marine ornamental fish and corals, and the production of the first ever estimates for invertebrates other than corals - a previously overlooked section of the industry. However, the data were only collected for those countries/regions in which MAC is active. Moreover, no data have been entered into GMAD since 2003.

Discussion on the opportunities and constraints relating to GMAD are summarised in Section 6.2.

Contributions from consultees

[5:] GMAD represented only a small percentage of the total trade.

5.1.3 FRESHWATER CERTIFICATION

There is no body or process equivalent to MAC in the freshwater sector. However, a number of local and national initiatives have been developed with the aim of certifying the trade in freshwater ornamentals or establishing mechanisms to promote a sustainable trade e.g. in Brazil, Cameroon and Guyana.

The Zoological Society of London is working with Sociedade Civil Mamirauá, to develop a pilot project in the Mamirauá and Amaná Sustainable Development Reserves (MSDR) in Brazil, which aims to establish best practice guidelines that can potentially be adopted for a certification system within this and other Amazonian regions, providing a mechanism for improved control of the trade in ornamental fish and a sustainable ornamental fish trade. It is hoped that the introduction of such a trade will result in direct economic benefits to the rural community, which along with the establishment of a sustainable system is intended to ensure the long-term protection of fish diversity within the reserve.

In Guyana, an organisation called Iwokrama was formed in partnership with the North Rupununi District Development Board (NRDDDB) to create a sustainable, community-based aquarium fisheries business in the Rupununi wetlands. The project was designed to generate revenue for indigenous communities from the area's extraordinarily high fish diversity. Management protocols to ensure local ecological and social sustainability were implemented. On a regional level, Iwokrama hoped to influence South America's aquarium trade by introducing a certified 'green equity' trade, resulting in regulation of the presently unregulated industry. The project has since ended (see the first comment by [6], below).

In Brazil, an initiative called Project Piaba was established which aimed to promote an economically viable fishery for the riverine communities of the middle Rio Negro, and an ecologically sustainable resource for a 'green' aquarium industry (Chao & Prang, 1997). This project is conducting research on the diversity, abundance and distribution of ornamental species with a view to: establishing fishery management strategies; identifying ways in which fish husbandry techniques and captive breeding could be improved; providing environmental education; creating community-based fisheries management strategies; and liaising with the regulatory bodies in Brazil to provide advice on monitoring and inspection of stocks, fisheries management and export policy (Chao & Prang, 1997).

Ornamental Fish International (OFI) is involved in plans to develop a labelling system for South American fish in cooperation with The United Nations Conference on Trade and Development (UNCTAD), TRAFFIC South America and Organización del Tratado de Cooperación Amazónica (OTCA).

[12:] In Cameroon, the WorldFish Center is working with fishing communities and exporters provide training in proper capture, handling and holding (resulting in a net change in survival during shipping from <20% to >90%), which has contributed importantly to the profitability and sustainability of the trade. Studies of the abundance and distribution of ornamental species and the

⁷ Import and export data cannot be pooled as some of the contributing exporters traded with some of the contributing exporters. Therefore import and export data should be treated separately.

costs and practices associated with various stages of the local value chain, enabled by having a good relationship with the main stakeholders, facilitated the generation of sustainable business plans, although financial assets to implement these are currently available only to wealthier investors.

Contributions from consultees

[6:] Having worked on the Iwokrama/NRDDDB project I can provide some information, although this is not a statement on behalf of either organisation. The aim was to produce “green” ecolabelled ornamental fishes from the Rupununi River. Most of the effort went into establishing monitoring of populations and catch/effort and insufficient went into creating a stable and sustainable business. When the project ended in March 2005, the collectors in N Rupununi were ill-equipped to handle the business and, coupled with a very unstable business environment in Guyana and high waters in the Rupununi, very little collecting or exporting took place in the next two years. A few shipments have taken place subsequently, but these have not relied on the “green” label and were made by NRDDDB directly to the exporters, not through Iwokrama. One of the important lessons to come out of this (and some other ornamental fish projects) is that it is not possible to create sustainable ornamental fish trade without a sustainable business at the core.

[11:] Certification is an interesting idea that has much support from within the industry, but examples like this show that it is not a straightforward task.

[6:] The report correctly points out that first party certification is of limited value. First party certification was what Iwokrama originally proposed; the idea was to promote “green” fish from Guyana on the basis of the work done in NRDDDB. The data collection records from the collectors would have been available to an external auditor should second party certification have been required. Unfortunately, as the project concentrated on measuring offtake and catch per unit effort and did not engage with the trade until the very end of the project, the idea did not take off. If the setting of standards by Iwokrama were to be considered an external influence, there may be grounds for considering this to be second party certification after project completion.

[11:] The OFI Code of Conduct was adopted at the annual meeting of May 2008 and will be formally implemented in the coming year. *{Editors’ note: the OFI code of conduct covers animal welfare, biosafety and fair trade}.*

[7:] OATA also has a Code of Conduct.

[14:] Freshwater fish are more vulnerable due to the number of endemics being traded and small population sizes of some wild caught species. As the wild-caught marine trade is bigger globally it seems to get more management attention. Freshwater species can often be more important in domestic trade in developing countries where management of domestic trade is poor or non-existent.

5.2 MONITORING THROUGH WILDLIFE TRADE LEGISLATION

5.2.1 INTERNATIONAL

The Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) is a legally binding international agreement between national governments. It acts as a regulatory instrument which aims to ensure that international trade in specimens of wild animals and plants does not threaten their survival. As of May 2008, 173 countries were party to the Convention. The species covered by CITES are listed in three Appendices depending on the level of regulation needed to ensure international trade does not threaten them. Appendix I includes species threatened with extinction. Appendix II includes species not necessarily threatened with extinction, but in which trade must be controlled to avoid utilization incompatible with their survival. Appendix III contains species for which at least one country has asked other CITES Parties for assistance in controlling the trade.

The trade in CITES-listed species is regulated so that all imports, exports and re-exports of CITES-listed species must be authorized through a licensing system. Each Party to the Convention must

designate one or more Management Authorities in charge of administering that licensing system and one or more Scientific Authorities to advise them on the effects of trade on the status of the species. Before a permit may be granted, the Scientific Authority must make a “non-detriment finding” or a conclusion that the export of specimens of a particular species will not impact negatively on the survival of that species in the wild. In this way, it is intended that trade will only be permitted if there is evidence that it is sustainable.

International trade in any species listed in the Appendices to CITES, involving parties to the Convention must be accompanied by a CITES permit or certificate of origin issued by a national CITES Management Authority. Parties to CITES are then obliged to produce annual reports specifying the quantity of trade that has taken place in each listed species, the country of export/origin/destination, source of the specimens and purpose of trade. These data are compiled in the CITES trade database which is managed by UNEP-WCMC on behalf of the CITES Secretariat.

Annual reports should be submitted in accordance to agreed standards (<http://www.cites.org/eng/notif/2006/E030wAnnex.pdf>). Additionally taxonomic references have been adopted by CITES to ensure that the same nomenclature is applied by all countries in their annual reports and permits.

To date very few ornamental fish species have been listed on CITES.

Marine ornamental fish species listed in CITES Appendix II include the seahorses *Hippocampus* spp., listed in Appendix II in 2004 *Pristis microdon* was listed in Appendix II (for the exclusive purpose of allowing international trade in live animals to appropriate and acceptable aquaria for primarily conservation purposes) at the 14th meeting of the Conference of the Parties to CITES (CoP 14) in June 2007 (Anon, 2007a). A proposal to list the Banggai Cardinal fish (*Pterapogon kauderni*) in CITES Appendix II was discussed at CITES CoP 14 (Anon, 2007b) but was withdrawn.

Few species of freshwater fish have been listed in the Appendices to CITES to date, and even fewer freshwater ornamental species. Hence species-level trade data on a global scale are not generally available for this group. Ornamental freshwater fish species which have been listed include the Asian Arowana *Scleropages formosus*, the Cui-ui *Chasmistes cujus*, Seven-line Barb or Giant River Carp *Probarbus jullieni* and the Pangasid catfish *Pangasianodon gigas* which are listed in CITES Appendix I. Although only representing a small part of the ornamentals trade, other CITES-listed marine and freshwater species that are kept in public aquariums include (Koldewey & Jones, 2008; CITES Appendix in parentheses): Whale shark (*Rhincodon typus*; II); Great white shark (*Carcharodon carcharias*; II); Sawfish (*Pristidae* spp.; I) except *Pristis microdon* (II); Acipenseriformes spp. (II) except Shortnose sturgeon (*Acipenser brevirostrum*; I) and Sturgeon (*Acipenser sturio*; I); Arapaima (*Arapaima gigas*; II); Congo blind barb (*Caecobarbus geertsii*; II); European eel (*Anguilla anguilla*; II); Seahorses (*Hippocampus* spp.; II); Humphead wrasse (*Cheilinus undulatus*; II); Totoaba (*Totoaba macdonaldi*; I) and Australian lungfish (*Neoceratodus forsteri*; II).

The opportunities and constraints of the use of CITES for monitoring the aquatic ornamental trade are summarised in Sections 6.1 and 6.3.

Contributions from consultees

[7:] The proposal to list Banggai Cardinal fish on Appendix II was subject to criticism concerning various aspects of the research and was withdrawn due to a lack of support from the range State. The proposal to list the species on Annex D in spite of these criticisms has increased industry reservations concerning the SRG.

5.2.2 REGIONAL

5.2.2.1 EUROPEAN UNION

The European Single Market and the absence of systematic border controls within the European Union (EU) mean that the provisions of CITES have to be implemented in a uniform way in all 27 EU Member States. This has been achieved through the European Wildlife Trade Regulations, in particular Council Regulation 338/97 and Council Regulation 865/2006, which together implement

CITES and go beyond it. Council Regulation 338/97 lists species in four annexes: Annexes A, B, and C which broadly correspond with CITES Appendices I, II and III respectively but also contain some non-CITES species, and Annex D for species that are imported into the European Union at such levels as to warrant monitoring. An import permit is required for species listed in Annexes A and B, differing from CITES which only requires an import permit to be issued for Appendix I specimens. The European Union can establish import suspensions where the Scientific Authority is concerned that the trade might have a negative impact on the status of the species in the wild.

Annex D of Council Regulation 338/97 is intended to be a tool which allows for the monitoring of non-CITES species that are imported into the European Union in relatively high numbers. An import notification (rather than an import permit as required for Annexes A and B) is required for imports of species listed in Annex D upon entry to the EU. Criteria for listing species in Annex D agreed by the SRG read as follows:

- a) there is evidence of demand for it in the EU market and
- b) it might be threatened by trade due its unfavourable or unknown conservation status, distributional, ecological or reproductive potential and
- c) reliable trade data are not available from any other source.

Discussion on the opportunities and constraints relating to the use of Annex D of the EU Wildlife Regulation for monitoring trade are summarised in Section 6.1.

Contributions from consultees

[7:] There is concern that closing the EU market will reduce the value of fish and reduce returns from the harvest, rather than ensure a sustainable harvest.

5.2.3 NATIONAL

The vast majority of the 173 Parties to CITES have national legislation that implements the Convention and/or that specifies the conditions for trading in wildlife according to national priorities (e.g. commercial exploitation of threatened native species may be prohibited). Many countries, including the Bahamas, Brazil, and certain states in the US limit the number of fish or the number of species that can be taken from the wild (Tlustý, 2002).

Legislation regulating the trade in ornamental species can pertain to various ministries including environment, trade, fisheries, water etc. Some countries may collect information at the species level in taxa that are not listed in CITES. However, many countries do not. A comprehensive review of national legislation was beyond the scope of this paper.

5.3 CUSTOMS LEGISLATION AND MONITORING

5.3.1 INTERNATIONAL

The World Customs Organization (WCO) is an intergovernmental organisation with competency regarding the development of global Customs Standards, the simplification and harmonization of Customs procedures, the security and facilitation of the trade supply chain, trade facilitation, and Sustainable Customs capacity-building initiatives. It currently represents 173 Customs administrations on all continents. Currently, WCO Members are responsible for processing more than 98% of all international trade⁸.

The Harmonized Commodity Description and Coding System provides a common basis for the classification of goods and the collection of Customs duties. It comprises about 5,000 commodity groups, each identified by a six digit code, arranged in a legal and logical structure and is supported by well-defined rules to achieve uniform classification. The coding system includes code “0301.10 - Ornamental fish”. While countries can further develop this code to distinguish between

⁸ http://www.wcoomd.org/home_about_us_our_profile.htm

categories of ornamental fish, many countries do not (particularly when they charge the same excise duty on all ornamental fish), so data is commonly collected only at this level.

Thus, all WCO member countries involved in importing and exporting ornamental species record trade through Customs data.

5.3.2 REGIONAL

Customs procedures are often applied consistently in particular regions through trade agreements and common tariff systems. Some of the main agreements are summarised below. Others include the Central American Customs System and the Common Customs Law of the Cooperation Council for the Arab States of the Gulf.

5.3.2.1 EUROPEAN UNION

The Customs codes that are applied by the 27 Member States of the European Union for ornamental fish are listed in Part two, Section I, Chapter 3 of Commission Regulation 1214/2007 which amended Annex I to Council Regulation 2658/87 on the tariff and statistical nomenclature and on the Common Customs Tariff⁹. These are: “0301.10 is the code for Ornamental fish”, which is further broken down into 0301.10.10 the code for Ornamental fish – freshwater, and 0301.10.90, which is the code for Ornamental fish – saltwater¹⁰.

5.3.2.2 SOUTH AMERICA

The Southern Common Market (Mercosur), a Regional Trade Agreement (RTA) between Brazil, Argentina, Uruguay and Paraguay, applies the codes: “0301.10 - Ornamental fish”; “0301.10.10 - Arawana *Osteoglossum bicirrhosum*”; and “0301.10.90 - Ornamental fish - other”.

The member Countries of the Cartagena Agreement, namely Bolivia, Colombia, Ecuador, Peru, and Venezuela (Decision 580, effective 4 May 2004) do not distinguish between marine and freshwater species of ornamental fish (see International Customs Tariffs Bureau). However, the tariff code specifies that Member Countries may include national subheadings for the classification of goods in more detail than that laid down in this nomenclature.

5.3.2.3 AFRICA

Countries which are part of the West African Economic and Monetary Union (WAEMU) involving the countries Benin, Burkina Faso, Côte d’Ivoire, Guinea Bissau, Mali, Niger, Senegal and Togo do not distinguish between marine and freshwater species of ornamental fish.

5.3.3 NATIONAL

Many countries use the higher level tariff code “0301.10 - Ornamental fish”, some have additional sub-codes for particular species or groups. However, while many countries may record marine and freshwater trade separately, most countries do not collect data on aquatic ornamentals at a species level with the exception of species of particular national interest and species listed in the CITES Appendices.

Countries using the higher level tariff code “0301.10 - Ornamental fish” which do not distinguish between marine and freshwater species of ornamental fish (see International Customs Tariffs Bureau) include: Algeria, Australia, Bolivia, Canada, Democratic Republic of the Congo, China, Chile, Colombia, Costa Rica, Cuba, Egypt, Guatemala, Iceland, India, Japan, Lebanon, Madagascar, Malta (prior accession to the EU), Mauritius, Mexico, New Zealand, Nicaragua, Norway, Pakistan, the Philippines, Saudi Arabia, Switzerland, the United States of America, South Africa.

Some countries record more detailed levels of ornamental fish trade. Morocco uses “0301.10 for Ornamental fish”, which is further broken down into 0301.10.10, the code for Ornamental fish -

⁹ <http://www.bitd.org/Search.aspx>

¹⁰ COMMISSION REGULATION (EC) No 1214/2007

http://eur-lex.europa.eu/LexUriServ/site/en/oj/2007/L_286/L_28620071031en00010894.pdf

freshwater and 0301.10.90, the code for Ornamental fish – saltwater. Rwanda applies the codes: “0301.10.10 Ornamental fish – Breeding animals; and “0301.10.90 - Ornamental fish - other”. Fish are not excisable according to legislation in Singapore according to the Customs Tariff of 09/06/2004¹¹. In Singapore, different customs codes are used for recording freshwater and marine ornamental fish species. For freshwater species the code is: “Fish, freshwater, live, ornamental, 03011030” and although the same code is used fish may be recorded as barb, angel or betta within this category. For marine species the code is “Fish, marine live, ornamental- 03011020” which may also be recorded as butterfly, clown or damsel within this category¹².

Indonesia and Viet Nam use the codes: “0301.10 - Ornamental fish”; “0301.10.10 - Ornamental fish – Fish Fry”, “0301.10.20 - Ornamental fish – Other, marine fish”, “0301.10.30 - Ornamental fish – Other, freshwater fish”.

The U.S. Fish and Wildlife Service (USFWS) compile data on the international trade of live, ornamental aquatic species through their Law Enforcement Management Information System (LEMIS). These data are taken from Customs shipment declaration forms (Form 3-177), which are completed for each shipment that arrives or exits a given U.S. port of entry. Information about ornamental species is recorded on these forms through three general “species groups”: (1) non-CITES invertebrates (designated as NONV), (2) other live invertebrates contained in tropical fish and other shipments (designated as OLIN), and (3) all live tropical fish including goldfish (designated as TROP) (Adams *et al.*, 2001).

According to Adams *et al.* (2001), individual species names in each shipment are not databased by USFWS, although they do appear on the Form 3-177, resulting in difficulties in distinguishing between marine and freshwater species through the existing datasets. As from the 15th of May 2004, all importers and exporters must separate marine tropical fish from freshwater tropical fish on different lines of the declaration form (Form 3-177). Declarations that combine freshwater and marine tropical fish as one line item will be rejected for correction¹³.

5.3.4 CUSTOMS TRADE DATABASES

There are a number of statistical databases which provide information on trade in ornamental fish based on the Customs codes described above or on the associated tariffs.

These include:

- The United Nations Commodity Trade Statistics Database (COMTRADE) which contains detailed imports and exports statistics reported by statistical authorities of close to 200 countries or areas. It concerns annual trade data from 1962 to the most recent year and is thought to be the most comprehensive trade database available. As of September 2007, it contained more than one billion records.
- The United Nations Conference on Trade and Development (UNCTAD) Trade Analysis Information System (TRAINS) that contains information on Imports, Tariffs, Para-Tariffs and Non-Tariff Measures for 119 countries. The data are available at the most detailed commodity level of the national tariffs (i.e., at the tariff line level) and are recorded according to three internationally recognized trade and tariff classifications.
- The World Trade Organization (WTO) Integrated Data Base (IDB) that contain Imports by Commodity and Partner Country and MFN Applied Tariffs for over 80 countries at the most detailed commodity level of the national tariffs; and, the Consolidated Tariff Schedule Database (CTS) that contains WTO Bound Tariffs, Initial Negotiating Rights (INR) and other indicators. The CTS is the official source for Bound Tariffs, which are the concessions made by countries during a negotiation (e.g., the Uruguay Round of Multilateral Trade Negotiations). The data are recorded according to two internationally recognized trade and tariff classifications.

¹¹ <http://www.bitd.org/Download.aspx?ID=292>

¹² Singapore Customs <http://www.customs.gov.sg/NR/rdonlyres/9DD35ABD-7D3D-44F1-8350-A06F5D39710C/0/AZ.pdf>

¹³ <http://www.fws.gov/le/PubBulletins/PBSeahorsesTropicalFish.htm>

- FISHSTAT Plus¹⁴ is a web-downloadable software for fishery statistical time series at global level. It provides time series data on aquaculture production, total capture production, trade and production of fishery products.
- EU Export Helpdesk statistics¹⁵ is an online service, provided by the European Commission, to facilitate market access for developing countries to the European Union. It provides trade data (exports and imports) for the EU and its individual Member States, both collectively and individually as well as intra-EU trade. Data are available for the years 2000-2006. The data are recorded using the TARIC (Integrated Tariff of the European Communities) code system.
- National statistics are available for a number of countries, some of which can be accessed online.

A discussion of the opportunities and constraints of using the available trade statistics mentioned above for monitoring the aquatic ornamental trade are summarised in Section 6.1.

5.4 VETERINARY LEGISLATION

In addition to Customs regulations, veterinary and health regulations apply in most countries with regards the import of all live animals. Veterinary requirements can provide a method of monitoring the trade although the purpose is usually solely the control of exotic diseases and species introductions in importing countries.

Most countries now have national legislation relating to veterinary requirements that must be met in order to import live animals. In all but six of 20 countries and regions¹⁶ surveyed by Whittington & Chong (2007), a health certificate was required to import freshwater fish. A fish inspection was required in 14, but fish were quarantined in only eight. Veterinary and health regulations can involve physical checks of shipments, health certificates or permits, prior notification of arrival (Olivier, 2001).

5.4.1 REGIONAL

In September 2006, the European Commission published a Decision 'laying down the animal health conditions and certification requirements for imports of fish for ornamental purpose' (2006/656/EC). The aim of the decision was to prevent any potential introduction of disease which could have a significant impact on farmed and wild fish stocks in Community waters. The Decision has been enforced from the 1st April 2007 by Member States.

In Decision 2006/656/EC, cold water ornamental fish are defined as any ornamental fish which are susceptible to one or more of the following diseases: epizootic haematopoietic necrosis (EHN), infectious salmon anaemia (ISA), viral haemorrhagic septicaemia (VHS), infectious haematopoietic necrosis (IHN), spring viraemia of carp (SVC), bacterial kidney disease (BKD), infectious pancreatic necrosis (IPN), Koi herpes virus (KHV) and infection with *Gyrodactylus salaris*. Tropical ornamental fish are defined in the Decision as all those not included under the 'cold water' definition. The distinction between the two categories is related to the susceptibility of an ornamental fish to diseases as listed by the relevant Community legislation in accordance with the list of the World Organisation for Animal Health (OIE). Therefore, any ornamental fish which is not listed as susceptible to any disease can be treated as a 'tropical ornamental fish' (independently of whether it originates from a 'tropical' region) and it may be exported to the Community provided it is sourced from a country which is a member of the World Organisation for Animal Health (OIE).

The certificates for imports of cold-water and tropical ornamental fish into the European Community required through Decision 2006/656/EC require the data concerning the country of origin and destination, the scientific name of the species, and the quantity of specimens imported.

¹⁴ <http://www.fao.org/fishery/topic/16073>

¹⁵ <http://exporthelp.europa.eu/> Accessed on 09/08/2007

¹⁶ Requiring a health certificate: Australia, Brazil, Bahrain, Europe (some members), China (People's Republic; Taiwan), Iceland, Indonesia, Mauritius, Malaysia, New Zealand, Philippines, Poland, Singapore. Not requiring a health certificate: Canada, China (Hong Kong), Japan, Mexico, Thailand, United States of America.

Data collected in this way between 01/05/2007 and 23/07/2007 has been made available electronically. However, the electronic dataset did not include species-level information, even though data on the origin and destination country and the number of fish imported were recorded.

Further discussion on the opportunities and constraints of monitoring the aquatic ornamental trade through veterinary legislation are summarised in Section 6.1.

Contributions from consultees

[13:] In the future, species-level data will be captured, as species will be sorted in categories in accordance with their susceptibility to diseases of Community concern. These certificates will be repealed and replaced by the end of 2008. The main amendments to the current certificates will be in scope, as they will cover ornamental mollusc and ornamental crustaceans and with regard to ornamental fish, new animal health requirements related to Epizootic Ulcerative Syndrome (EUS).

6 DISCUSSION

The ornamental marine and freshwater industries are different in many respects, ranging from the habitats from which specimens are extracted, to the costs and level of specialisation required by hobbyists for maintaining each type of aquarium. However, the measures that may be put in place to ensure their sustainability, and some of the mechanisms already in place to regulate and monitor this trade (such as veterinary controls and customs reporting practice) are, in many respects, common to both sectors. For this reason, both sectors are considered in tandem in this discussion, highlighting issues pertaining exclusively to one or to the other only when this is appropriate.

6.1 STRENGTHS AND WEAKNESSES OF THE GOVERNMENTAL INSTRUMENTS AVAILABLE TO MONITOR TRADE IN AQUATIC ORNAMENTALS

i) Customs and FAO statistics

In countries where most or all of the ornamental species collected are for export, customs export data could provide an indication of catch. At present, however, there are many issues associated with trade data collection, including differences in reporting values, reporting by weight of boxes (including water) rather than number of fish, misclassification in the food-fish category, and exclusion of small shipments, for instance. International trade in the sector is frequently underreported and estimations using available data may include a large degree of uncertainty containing incorrect statistics with different unit values (Olivier, 2001).

Moreover, when trade is recorded in volume or weight, many countries include in this the water and packaging the fish are transported in, and frequently do not distinguish between marine and freshwater species (Wilhelmsson *et al.*, 2002).

Customs data on international trade usually do not include information at the species level. Moreover, where species level information is collected other problems present themselves; for example fish are often only known by common names, and where scientific names are used they can be out of date or mistaken (Moreau & Coomes, 2007). There are however, occasional exceptions, such as data collection for *Osteoglossum bicirrhosum* through the tariff system of the Southern Common Market (Mercosur).

One advantage of Customs statistics is that they have been collected over a relatively long time period, and will presumably be collected for some time to come. This allows better detection of trends and patterns of trade. However, FAO international trade statistics rely on data reports submitted by member countries (Olivier, 2001). In many cases, trade may not be reported or may be underreported. Moreau & Coomes (2007) observed that approximately 41% of trade from Peru to the US was undeclared at export. They remarked that as shipments of ornamental fish in Peru are not routinely checked, exporters admitted to mis-declaring with the purpose of exporting restricted

species, and to under-declaring with the purpose of tax evasion. Monteiro-Neto *et al.* (2003) also noted that intentional under-reporting of the trade can take place with the purpose of reducing tax duties or to remain below allowed quotas.

Contributions from consultees

[14:] Calculations based at the point of export will be underestimates as they do not consider mortality during collections, holding and transfer to the point of export. [5:] A very valid point. Monitoring needs to be done as close to the point of collection as possible in order to provide reasonably accurate data on numbers of specimens/species extracted.

[2:] Comparison of customs import data from the United States with CITES import data for five key taxa showed widely divergent values among the two databases for similar products (Blundell & Mascia, 2005). The authors conclude that these discrepancies indicate high uncertainty in the reporting of wildlife data. Problems included the observation that some CITES import records did not specify the units and CITES did not report trade in derivatives of products (i.e. powder from ginseng) (Blundell & Mascia, 2005). A similar comparison of EU customs data and CITES data would be beneficial to see if the problems are limited to the US or are more widespread.

ii) Veterinary controls

As noted above, in 2006 the European Commission published Decision (2006/656/EC) laying down the animal health conditions and certification requirements for imports of fish for ornamental purpose. Member States should therefore only authorise imports of ornamental fish complying with the animal health conditions set out in the above mentioned Decision.

The certificates required for imports of cold-water and tropical ornamental fish into the European Community should record the country of origin and destination, the scientific name of the species and the quantity. However, data captured electronically so far (between 01/05/2007 and 23/07/2007) did not include information on the name of the species traded. It is not clear whether a standard list of accepted names will be used in the future to ensure data consistency, and whether such information will be databased and maintained. The data are submitted using paper forms which need to be entered into a computer manually if they are to be used for analysis. Moreover, unlike those for CITES, the reporting forms do not distinguish between specimens extracted from the wild and those originating from captive-breeding operations. It should also be noted that the Decision does not cover so far the import of ornamental invertebrates. *{Editors' note: SANCO has indicated that in the future, species-level data will be captured, and ornamental molluscs and ornamental crustaceans will be included. See Section 5.4.1}.*

Contributions from consultees

[11:] The present health certificates have separate documents for tropical fish and coldwater fish. In both certificates, the animals imported are usually listed in the separate packing list or in the invoice. Shrimps and mollusks imported in the same shipment are usually listed in one of these certificates and are thus included in the total number of specimens. Indeed the Certificate is originally for fishes, but Border Inspection Posts in most countries accept it. Per 1 August new certificates will be implemented in which all fish, mollusks and crustaceans for ornamental purpose will be covered by a single certificate. The legislation does not distinguish captive bred and wild specimens.

[11:] Currently there is no standard list of accepted names. OFI has proposed to the European Commission (Traces) to work out such a list and will bring this up once more.

[15:] One of the objectives of the World Organisation for Animal Health (OIE) is to safeguard world trade by publishing health standards for international trade in animals and animal products. The normative publications of the OIE relevant to aquatic animals are the *Aquatic Animal Health Code* and the *Manual of Diagnostic Tests for Aquatic Animals*. These standards provide for Member Countries and Territories to protect against the introduction of diseases and pathogens, without setting up unjustified sanitary barriers. OIE standards are recognized by the World Trade Organization as reference international sanitary rules.

[15:] The OIE *Aquatic Animal Health Code* provides standards for safe international trade in aquatic animals (fish, molluscs, crustaceans and amphibians) and their products. These safeguards take the form of health measures to be used by the veterinary services or other competent authorities of importing and exporting countries in establishing health regulation for the safe importation of animals and animal products including ornamental fish. It is very important for any country wishing to be part of international ornamental fish markets to be a Member of the OIE.

iii) CITES listing

CITES, with 173 signatory Parties, is the foremost intergovernmental mechanism for the regulation and monitoring of trade in species that are threatened by international trade. While species of hard coral have been listed in the CITES Appendices since the 1980s, the Convention's involvement in the trade in ornamental fish is fairly recent, and a number of marine taxa traded by the ornamental industry, such as seahorses, have recently been included in the CITES Appendices. The Convention has had a much more limited involvement to date on the trade in freshwater ornamentals, with only a small number of these species listed in its Appendices.

Data are collected through CITES only for those species listed in the Appendices of the Convention. Exports from the 173 CITES Parties are reported at the species level annually, forming the basis of a comprehensive dataset in listed species. However, as only a limited number of aquatic ornamental species are listed in the Appendices, data coverage in terms of species is limited.

It has been argued that trade restrictions such as listing of a species in CITES Appendix I can shift the trade to look-alike or substitute species, thus transferring the pressure to other taxa, and displacing market opportunities of local traders (see Section 6.4 for further discussion on impacts on livelihoods). The listing of the Asian Arowana (*Scleropages formosus*) in CITES Appendix I, for instance, was followed by an increase in trade in Silver Arowana (*Osteoglossum bicirrhosum*), a South-American species (Tello & Cánepa, 1991 cited in Moreau & Coomes, 2006).

Contributions from consultees

[2:] It has been argued that CITES “uplisting” of species from one Appendix to the next can lead to an increase in commercial value and thus increase their collections from the wild, during the time between uplisting and the final ban in trade (Rivalan *et al.*, 2007). Listing species in Appendix I may also lead to illegal trading (Rivalan *et al.*, 2007). If the listing process is impeded for whatever reason, it can have grave impacts on the populations of the species. This issue should be addressed or at least considered before wholesale listings of marine/freshwater species are proposed. [11a:] Considering the very few ornamental fish species listed by CITES and the very low volume of trade in these species, this is hardly an issue.

iv) Annex D of the EU Wildlife Trade Regulation

Annex D of Commission Regulation (EC) No. 338/97 serves as a trade monitoring tool that allows early detection of levels of trade into the European Union of possible conservation concern. Species are listed in Annex D if they are imported into the Community in such numbers as to warrant monitoring.

Species listed on Annex D require an import notification, to be completed by the importer upon entry into the European Union. The import notification form is found in Commission Regulation 865/2006. It requires that data is collected on the species name, quantity, country of origin, exporter (where different from the country of origin) and importer. While it does not specifically require information on whether the specimens were extracted from the wild or originated in captive-breeding operations, in practice this information is often reported in the annual reports of EU Member States. Failure to provide a notification is one of the criminal offences which Member States are required to create under Council Regulation 338/97. However, the awareness of customs officials and the degree of enforcement on Annex D requirements by all Member States is unclear.

In principle, all imports of Annex D species should be recorded, but in practice it appears likely that some gaps in the data may occur. For instance, a comparison of the data gathered for *Hippocampus* spp. by the GMAD and by Annex D up to 2003 showed that there have been some data gaps in the data collected for the Annex. However, while both datasets presented similar

overall trends in trade, Annex D was shown to be a relatively comprehensive monitoring tool which provided significantly higher number of specimens in trade than GMAD. As noted above, however, GMAD is designed to provide global coverage of all species, and as such, it continues to be a unique resource concerning the assessment of the volumes and trends of trade in ornamental taxa.

In 2004, the Scientific Review Group for wildlife trade (SRG) recommended the inclusion of 14 marine ornamental species in Annex D of Council Regulation 338/97¹⁷. Trade data used for the assessment of those species by the SRG was obtained from GMAD.

Some traders disagreed with the SRG recommendation on the basis that voluntary efforts were already being made to monitor the trade and it has further been suggested that the administrative burden placed on traders by listing species on Annex D could act as a disincentive to voluntary contribution of trade data to GMAD. It has also been argued that the data required from traders for compliance with Annex D listings of ornamental fish is also required by veterinary authorities, which may lead to duplication of the reporting effort by traders.

The EU Wildlife Trade Regulation is limited to EU trade, the market on which this consultation process is focussed.

Contributions from consultees

[4:] We agree with the fact that Annex D “could act as a disincentive to voluntary contribution of trade data” and “that the data required from traders for compliance with Annex D listings of ornamental fish is also required by veterinary authorities, which may lead to duplication of the reporting effort by traders”. The more traders have to fill different papers the harder it will be to gather data from them.

[11:] Low awareness among customs officials may be a result of over-complexity of regulations.

[11:] One of the main problems with the proposed Annex D listing is that the sole argument put forward is the significant number of the fish imported, which was extracted from the GMAD. Not only is this the strongest disincentive for voluntary D-listing you can imagine, but also it should be clear that there is no direct link with quantities in trade and a threatened conservation status. If there was a link, it would be likely to be the opposite one: threatened fish are not available in big quantities. Several of the proposed species are available in large parts of the world in big quantities. A few ten-thousands of specimens may be high for CITES authorities in Europe, but for most reefs it is an extremely small portion of the population of this fish. {Editors’ note: Annex D criteria are included in Section 5.2.2.1}.

[5:] It is not true that the sole argument put forward for the proposed Annex D listing is the significant number of fish imported. A species can be listed on Annex D if it might be threatened by trade due to its ‘unfavourable or unknown conservation status, distributional, ecological or reproductive potential’. All species would be assessed and listing would NOT necessarily follow just because the species was traded in high numbers – other criteria are equally important, and species traded in low numbers can also be assessed

6.2 STRENGTHS AND WEAKNESSES OF THE NON-GOVERNMENTAL INSTRUMENTS AVAILABLE TO MONITOR TRADE IN AQUATIC ORNAMENTALS

i) The Global Marine Aquarium Database

In April 2000, MAC and UNEP-WCMC commenced collaboration with members of marine ornamental trade associations to establish the Global Marine Aquarium Database (GMAD). The database was designed to gather, integrate, standardise and mobilise information on the trade of individual species. To this end, UNEP-WCMC liaised with wholesale import and export companies

¹⁷ http://ec.europa.eu/environment/cites/pdf/srg/31_summary_srg.pdf

from around the world. As these companies link the supply and retail ends of the business, they proved to be key in the collection of quantitative data about the aquarium trade.

GMAD was the first, and to date the only, global database on this trade at the species level. Its creation enabled the production of the first global and the first EU-wide assessments of levels and trends of this trade. Information was provided by the traders on a voluntary basis, as there is no institutional process in place that obligates reporting, nor a standard reporting method for GMAD. Thus, data gathering, collation, standardisation and integration proved to be a labour-intensive exercise, which required visits to wholesale companies to collect and process data mostly from invoices. Additionally, data was entered into GMAD mainly for those countries in which MAC was running their certification scheme, and so many exporting and importing countries were excluded.

Comparison of data collected for *Hippocampus* spp. through Annex D (of EU wildlife trade regulations) and in GMAD shows that, overall, Annex D captured significantly greater volumes of trade than GMAD, although for a small number of countries, GMAD captured greater volumes of trade than Annex D.

Funding for GMAD ended in 2004, and since then it has not been possible to continue maintaining this resource. Its continuation would require regular funding and the establishment of an obligatory reporting process that sought to ensure comprehensiveness and accuracy of the data, and to make the process of data collation effective and efficient.

No equivalent system has been established to monitor the trade in freshwater ornamentals.

Contributions from consultees

[11:] GMAD is based on information from only a very limited number of operators. Then, of course, it is very logical that any conclusions drawn from these data are not very trustworthy.

[14:] GMAD under-reports numbers collected as the reporting is at point of export and does not consider mortality prior to export.

[14:] In spite of the limitations, GMAD has been a very valuable tool and its re-establishment would be an excellent contribution to monitoring the trade. Inclusion of freshwater species would also be useful. Incorporating GMAD into an existing organisation or framework is needed so that it does not depend upon continued project funding.

ii) Monitoring through a certification scheme.

There is currently no international monitoring nor certification scheme for the trade in freshwater ornamental species comparable to that established by the Marine Aquarium Council (MAC) for the certification of the marine aquarium trade. Experience in this regard, therefore, emerges principally from the certification efforts put in place by MAC.

To date, there has commonly been a lack of information concerning the industry, as recognized at the World Conference on Ornamental Fish in 1999, with regard to the status of natural populations harvested for the industry, ornamental aquaculture production, and the number and species exported (Bartley, 2000). Catch and effort need to be monitored regularly and species under exploitation assessed on a country-by-country basis and reef-by-reef basis (Wood, 2001a; Wood, 2001b).

Monitoring at source is often difficult in key countries of origin such as Indonesia or the Philippines where there are thousands of collectors operating over large areas, and where hundreds of exporting companies and middlemen exist particularly due to lack of organization and resources (Wood, 2001a).

Under a certification scheme, sustainability of extraction may often be more effectively monitored by assessing the condition of the habitat and of the stock from which specimens are extracted, rather than by counting the number of specimens extracted. Monitoring number of specimens extracted at source can often be impractical as collection is conducted by often illiterate collectors, with limited resources to record catch and trade data on a species level.

Moreover, species in trade are given a variety of local names and although training in proper species identification using Latin names is part of the training provided by MAC, experience so far indicates that the chance of backsliding as soon as MAC leaves the field is very high. It is not only at the collection level that MAC faces these difficulties. Many misunderstandings also occur in the communication between exporters and importers. With the existing diversity of vernacular names for species in trade, it is always necessary that somebody ‘translates’ the names reported before data can be entered into a database in a standard way. This person has to be paid and there will usually be no funds available in developing countries.

MAC faces a significant challenge in its work in countries in which the specimens traded originate, as implementation of the MAC Certification Scheme and compliance with MAC Standards requires a change of behaviour. MAC performs awareness-raising regarding environmental issues as well as training and capacity building. The main Monitoring and Evaluation (M&E) challenge for MAC involves ensuring that local resource managers and certified traders appreciate the importance of documenting catch and shipment records. Local resource managers are not accustomed to keeping records or overseeing this process, as this is generally done by traders who do not share these data. The process of overseeing record keeping therefore has so far remained largely dependent on community organizers and the outreach officers in the supply and market countries, working with the Certified Industry Group. Moreover, when available, data are often only in hard copy form and need to be collected and then computerized by MAC community organizers.

A significant challenge in Indonesia, for instance, is the unwillingness of exporters to share information which is considered commercially sensitive. Moreover, some exporters do not consistently provide information on number of animals dead on arrival (DOA) and fish reject rates, nor on reasons for rejects, and those that do often do not follow the format that can be used by MAC’s M&E system.

Even when an internal quality feedback system (between exporter and collectors) is in place, many of the exporters do not seem to recognise the importance of data collection and information aggregation at the regional and national level. Actions such as the collection and provision of trade data, while not in themselves ensuring sustainability, can be used to inform choices to manage resources and the trade appropriately.

MAC intends to make further improvements in the M&E database by incorporating shipment data at the importer level. The M&E database program has already been updated to incorporate these data, but no data have yet been provided voluntarily by MAC-Certified importers who receive MAC-Certified supply. Again, only education on the value of monitoring and evaluation may overcome resistance in this respect.

“Leakage” (the selling of MAC-Certified fish to exporters that are not MAC-Certified) is also a problem. All four MAC-Certified collection areas in the Philippines and Indonesia recorded higher catch numbers compared to the number traded, these unrecorded traded organisms may have been sold to exporters that are not MAC-Certified. This is often mostly due to limited absorbing capacity of the MAC-Certified buyers for the limited species variety deriving from one collection area. To be economically viable in their business and to sustain their livelihoods, collectors then need to sell the excess of available organisms to non-certified buyers.

Currently, MAC works mainly in the Philippines, Indonesia and Fiji as these are the main exporters and in the first two countries a number of issues (cyanide fishing, etc.) were apparent. The main impediment to progress in other countries is lack of funding, hence the focus of MAC activities on these three countries.

Considerable time and funding would be required for each exporting country to market a national certification and labelling program. Without intensive outreach work, awareness of and interest in the MAC Certification scheme is limited. Additionally, certification of collection areas and of collectors is harder to achieve than in developed countries where management plans and regulations are already in place and enforced, and where collectors have access to education and knowledge.

Contributions from consultees

[7:] Exchange of information among participants in the scheme will allow exporters to fully materialise their role in enhancing the sustainability of the marine aquarium trade.

[1:] Unwillingness to share commercially sensitive information is also a problem in Hawaii. Working closer with state/provincial fisheries agencies and garnering greater legislative support from national governments to pass laws requiring exporters to disclose their records would help tremendously. This draconian approach may not be welcomed in many countries, but nearshore fishery resources in the US are considered a “public good” managed by the states for the people, so that could be used to justify the reason why exporters must concede their records. [7:] Since this is a report for the EU are comments on what the exporting countries might do relevant?

[11:] The importance of data collection is there only for scientists, anti-trade NGO’s and perhaps governments. What is the incentive for companies to document all data? Due to the economical situation of most collectors and exporters, their interest is only short term and only few look to the long term. For these few, however, there is hardly any incentive as it does cost more money, but they cannot get a better price. [5:] This is an introspective and short-term view. The incentive for companies to assist with documentation is that it is essential if they are to be sure of a long-term, sustainable trade. A comparison can be made with food fisheries, where the companies concerned were saying the same thing 10 years ago, but are now embracing the notion that they are accountable and have a responsibility to ensure that their trade is sustainable.

[6:] In the UK, much of the fishery product is sourced from non-certified fisheries which are nonetheless sustainable (e.g. the Icelandic cod fishery). Supermarkets do this by using their own resources to review fishery data and ensure that the product is sustainable. In addition, they may apply extra conditions such as low-impact fishing methods to reduce by-catch and/or environmental impact. It is difficult to define this as first, second or third party certification and the process is largely internal to those involved in the supply chain, rather than being open to external inspection or verification. What supermarkets are really after is assuring fishery product supplies in the long term (generally a 10-15 year horizon) and while they are quite happy to take certified products, this is not an absolute requirement. They do seek to address the conservation concerns relating to wild fisheries, but these too do not necessarily rely on certification. It should not be assumed that all markets will react the same way to issues of sustainability and certification. For example, the UK supermarkets will not touch trawled, tropical shrimp/prawn due to issues of by-catch and habitat destruction and instead use farmed, tropical shrimp/prawn. By contrast, Norwegian supermarkets will not touch farmed shrimp/prawn due to issues relating to mangrove destruction and prefer to buy trawled product. It is also worth making the point that sustainability is only one issue taken into consideration and that other issues relating to corporate social responsibility (e.g. carbon footprint, workers’ rights, workers’ pay, etc) may be given higher weighting.

[1:] The discrepancies between catch and traded numbers could also be from fishers taking larger or blemished fish that are recorded as catch but are either returned to the ocean or discarded by exporters. These “returned to ocean” and/or discarded fish should also be monitored.

[1:] A solid reporting system doesn’t preclude the need for concurrently undertaking stock and habitat assessments, but the latter shouldn’t be used as a surrogate for the former.

[5:] Leakage may also be the due to fish which have died.

[7:] It is not appropriate for MAC to dictate who may sell what to whom.

[1:] It would seem there needs to be a direct benefit for everyone in the supply chain for a certification scheme to work successfully. The hypothesis that people will replace the destructive activity with a non-destructive alternative assumes that the returns are at least as high as for the original activity. Aquarium certification schemes will continue to be challenged by economics, not behaviour change.

[12:] It is true that the common names are often confused, but my experience with ornamental fishing communities is that they know very well what they are catching and with some guidance

could attach correct Latin names to their harvest. However, there are no real incentives to do this; as with most of the private sector, compliance with status monitoring and/or regulating trade will depend upon incentives, whether endangered species or ecosystems are involved or not.

[7:] The trade in marine ornamentals compared to the total resource and compared to the use made of it by other sectors is often minimal. The ecosystem is chaotic and there is very little data on the natural variability in populations, especially fecund pelagic spawners.

[2:] Other experience may be gained by examining the ecolabeling schemes by the Marine Stewardship Council (MSC) for marine food fishes, which primarily indicates that consumers must have some concern for sustainability of the species before they will choose to buy an ecolabeled product, and that some financial benefit must flow to the producers of the product (Kaiser & Edwards-Jones, 2006). The authors also note that many of the successful MSC certified fisheries have co-operative management, and they suggest a tiered ranking for certification standard (Kaiser & Edwards-Jones, 2006). Currently, a limited number of fisheries have the ability to participate and thus, their conservation benefit is limited.

[6:] The following is not a statement on behalf of MSC. The conclusions of Kaiser and Edwards-Jones (2006) are broadly correct although MSC has now moved on to adapt their certification to be able to cope with data-deficient fisheries in developing countries. Lessons from this may (in a few years) provide some useful lessons for ecolabelling of ornamental fishes. It is worth noting that MSC arose out of a dialogue between WWF and Unilever, rather than as a response to consumer demands expressed through multiple retailers. Even now, evidence for the demand for MSC-certified fish being driven by consumer demand is weak. For multiple retailers, the incentives are to ensure supplies into the long term by securing product from sustainable fisheries and some retailers are now shifting to 100% ecolabelled (although not necessarily 100% MSC-certified) seafood. Partly due to food safety concerns, but also due to the need for securing supplies from sustainable sources, multiple retailers have also shortened supply chains and may now deal directly with catchers. How this could apply to the ornamental fish trade is not clear, although a greater connection between producers and markets is very desirable if for no other reason than to encourage collect to order rather than speculative collecting.

[6:] There is little evidence of economic incentives for producers to become involved in supplying ecolabelled products. Unless consumers can be shown to actually pay (as opposed to expressing willingness to pay) more for certified products, producers may avoid such schemes which would otherwise raise costs for no benefit. Even if producers were to receive higher prices initially, there is no indication that a “green” bonus would continue to accrue. As Kaiser and Edwards-Jones (2006) point out, while ecolabelled product may get a price premium initially, increasing supply tends to force prices down while the costs of ecolabelling remain the same, thus reducing profitability for producers. Unless this trap can be avoided, the logical move by producers would be to not become involved in ecolabelling. Examination of the literature on the economics of ecolabelling suggests that additional returns to producers are at best uncertain, and in some cases, non-existent.

[1:] It would make sense to evaluate the impacts of the freshwater fish farms and look into their practices to ensure sustainability. For the remaining fish collected from freshwater, commissioning a thorough environmental threats and socioeconomic analysis to determine the impacts and economic benefits should be considered. Aggressively investing in a freshwater certification scheme might not be the best use of resources.

[14:] To validate trade figures, monitoring should occur at as many trade levels as possible, e.g. collectors, buyers, exporters and importers. [7:] At what cost? We have seen the cost of stricter domestic measures in EU. If that idea is expanded down the supply chain will the fish be saleable at the higher price in the market? No trade no benefits for anyone! Any suggestion along these lines should be costed and determined proportionate to identified conservation gains.

[1:] Altruism is not going to encourage people to participate in a certification scheme, especially in the developing world where people are barely making ends meet but also in developed countries. If the certification makes economic sense, every fisher and their associates will partake. Intensive outreach and education programmes are expensive and their impacts are fleeting.

[14:] Unless we have a thorough and practical system in place, spending lots of money on certification may be an inappropriate use of resources. We certainly need to learn from attempts to certify in both marine and freshwater elements of the aquarium trade. Undoubtedly, they are challenging to implement but the increasing movement towards this being effective and economically viable e.g. Forestry Stewardship Council, Marine Stewardship Council should provide valuable lessons on how this can be achieved in the aquarium trade. In spite of its problems, MAC has made progress in a number of areas and rather than reinventing the wheel with a new scheme, it seems more appropriate that stakeholders work with MAC to address previous issues and develop a scheme that works.

[1:] Although things in developed countries are better, they are not perfect. For example, Hawaii does not have a management plan in place for its aquarium fishery, and it's the State's most lucrative nearshore fishery. The Big Island of Hawaii closed 33% of its coastline to prevent complete exploitation of aquarium fish in 1999, and is in the process for shifting the fishery to a limited entry plan and developing a no-take list for certain species, but there is no comprehensive management plan in place – it's still managed on an ad hoc basis. There are many inefficiencies leading to mortality and waste associated with the exporter side of the industry in Hawaii. There is no reason why a certification process wouldn't work there if it made economical sense or was required by the state (a top-down approach is going to be more effective in the US).

{Suggested new heading} [1:]

iii) [1:] Industry Self-Monitoring.

[1:] There are a number of self monitoring schemes already in place and it would be great to assess their efficacy and transferability, and utilize them. One idea is to empower industry stakeholders (including aquarists) to enforce their own industry by developing an anonymous text messaging system using mobile phone technology to report illegal or questionable practices. Mobile phones are widely used in the Philippines, Indonesia and Hawaii. A bottom-up, self-monitoring mechanism linked to a third party organization will greatly increase the monitoring bandwidth.

6.3 EFFECTIVENESS OF THE VARIOUS INSTRUMENTS AS INTERNATIONAL TRADE MONITORING MECHANISMS

The focus of this consultation process is to consider whether the various existing mechanisms that gather data concerning the international trade in ornamental fish can adequately provide information appropriate for the monitoring of this trade at the species level. Thus, important considerations in this regard include the units reported (e.g. whether the trade is reported by weight or by number of specimens), the taxonomic level at which the data are collected, the geographic coverage provided by the data, the taxonomic coverage (i.e. whether data are collected for all species or just listed species), sectors monitored (i.e. marine and/or fresh water); and implementation regime (i.e. voluntary or compulsory). A summary of the characteristics of the data collected through those instruments concerned with international trade in aquatic ornamentals is provided in Table 6.1.

i) The Global Marine Aquarium Database

Data have been collected at the species level in GMAD for all species traded by participating companies. However, although coverage is global, it is limited to those countries in which MAC is active (and indeed to those companies participating in the certification scheme) and hence major geographic gaps in the data are apparent. As well as the implementation challenges experienced by MAC (Section 6.2), a significant limitation to the success of monitoring through certification is the need to secure long-term reliable funding. This has proved to be a key obstacle in the past. It should also be remarked that MAC is concerned with trade in marine ornamentals, and the scope of GMAD has therefore also been limited to that group of species. To date, there is no equivalent system in place in the freshwater sector.

Contributions from consultees

[3:] Being voluntary, it will never gather all trade. The high standards of excellence to meet the standards mean that by definition, it excludes the totality. The GMAD database depends on external funds and there is no obligation to anyone to maintain it. This is highly risky, as has been proved by the lack of operation since 2003.

ii) Customs and FAO statistics

Data collected through the Customs reporting process is undertaken at a global scale, with data usually submitted by both importers and exporters. However, data are collected at a very general level such as 'ornamental fish' or 'ornamental fish – marine' and trade is often reported by weight or by value. Hence data collected in this way fails to provide a mechanism to monitor the species and number of specimens in the ornamental aquatic trade.

Contributions from consultees

[1:] FAO statistics are based on the information provided by national statistical bureaus. Not all importers are required to provide their import figures. Ploeg (2007) noted that, in the Netherlands, errors are made in the data provided, and imports travelling via surrounding countries are often not registered. Additionally, import values are sometimes reported including freight, and sometimes excluding freight. This situation is likely to be the case in other countries.

iii) Veterinary controls

Many countries collect data on the imports and exports of live animals for veterinary purposes. As noted earlier (Section 5.4), a Decision has recently come into force in the EU concerning imports of fish for ornamental purposes. Although data made available in electronic form so far have been at a very general level (i.e. freshwater ornamentals and marine ornamental fish), the data reporting form (paper) specifies that, among other information, data should be collected at the species level, and information on the number of specimens in trade should be recorded. For this reason, it seems that this instrument potentially provides a mechanism for the monitoring of trade in ornamental fish, equivalent to the monitoring facility provided by Annex D of Commission Regulation (EC) No. 338/97. However, a number of issues should first need to be resolved in particular with regards to how data will be collected at the species level, and how this information will be standardised; and whether it will be databased.

Contributions from consultees

[2:] Gerson *et al.* (2008) have suggested the use of taxonomic serial numbers (TSN) that could be added to compliment the traditional Customs Harmonized System (HS) reporting. The TSN is attributed to each kingdom + scientific name + authority + rank, and is persistent. Currently the TSN is used in the Integrated Taxonomic Information System (ITIS), an online database for taxonomic information in the United States, Canada, Mexico and worldwide coverage for CITES-listed species (Gerson *et al.*, 2008). The collection of detailed species information using this method could help reconcile customs data with CITES and other wildlife trade databases; however, it would require extensive training for both traders and customs officers.

iv) CITES listing

Data on CITES-listed species are reported by both exporting and importing countries. As CITES is legally binding and has a global reach, it provides the most comprehensive and detailed data set available. Reporting is limited to species listed in the CITES Appendices.

Contributions from consultees

[14:] Even for species that are listed in CITES Appendices, there are limitations in the data and variations in quality of data according to reporting country.

v) Annex D of the EU Wildlife Trade Regulation

Annex D is legally binding and provides a comprehensive dataset of trade in listed species entering the EU. It does not confer any restrictions on trade and incurs minimal administrative burden

relative to CITES listing, as import and export permits are not required. As with CITES listing, the data collected are for species of conservation concern.

Contributions from consultees

[7:] The cost of preparing the declaration is small but measurable. The consequences of even an innocent mistake have in the past been confiscation. For Annex D to be used a full and clear public explanation of the scientific information and reasoning should be required. To add a species to a list which creates a criminal offence should not be taken lightly nor be on the basis of an opinion that is not readily open to public scrutiny.

TABLE 6.1 SUMMARY OF CHARACTERISTICS OF DATA COLLECTED THROUGH FIVE INSTRUMENTS REGARDING TRADE IN AQUATIC ORNAMENTALS

	Taxonomic level reported	Unit reported	Taxonomic Coverage	Geographic Coverage – importers	Geographic Coverage- Exporters	Sector	Implementation regime
GMAD	Species	Number of specimens	All species	Global – though limited to a few countries	Global – though limited to a few countries	Marine	Voluntary
Customs data	None/mixed	Mixed: weight, volume, number of items, etc.	All ornamental fish	Global	Global	Marine and Freshwater	Normally compulsory through national legislation
EC veterinary data	Possibly species?	Number of specimens	All ornamental fish	EU	Global	Marine and Freshwater	Compulsory
CITES	Species	Number of specimens	Listed species only	Global	Global	Marine and Freshwater - listed species only	Compulsory for listed species
Annex D	Species	Number of specimens	Listed species only	EU	Global	Marine and Freshwater - listed species only	Compulsory for listed species

6.4 POSSIBLE IMPACTS ON LIVELIHOODS FROM THE MONITORING OF INTERNATIONAL TRADE

It is widely believed that the trade in wild-caught freshwater and marine aquarium species, if managed sustainably, can present a valuable opportunity for income generation and support to livelihoods, while at the same time providing an alternative to environmentally destructive activities (Junk, 1984; Chao & Prang, 1997; Ng & Tan, 1997; Brummet, 2005; Calado, 2006; Moreau & Coomes, 2007).

CITES Resolution Conf. 8.3 (Rev. 13) recognises that that commercial trade may be beneficial to the conservation of species and ecosystems and/or to the development of local people when carried out at levels that are not detrimental to the survival of the species in question; and recognises also that implementation of CITES-listing decisions should take into account potential impacts on the livelihoods of the poor.

Dawes (2007) commented that the aquarium industry is not necessarily against regulation of trade in ornamental species particularly when a species survival is threatened in the wild and there is evidence to show that this is the case. However, there appears to be concern in the trading sector that listing species in CITES Appendix II may result in trade suspensions, particularly into the European Community using the EU Wildlife Trade Regulation, which could affect negatively the livelihood of traders. In turn, trade restrictions may force traders to shift efforts to alternative, less threatened taxa. Watson & Moreau (2006) suggested that international regulations may have negative effects and highlighted that the impact of CITES-listings on the livelihoods of collectors is

unknown. For CITES Appendix I and II species, frequently there are fees charged to traders for the issuance of export and import permits and associated administration.

Contributions from consultees

[1:] The shifting pattern resulting from trade restrictions is quite common in conservation and is the reason why rigorous monitoring programs should be implemented in conjunction with adaptive management strategies to adjust to for any possible shifts in catch composition and community structure.

[1:] Dulvy *et al.* (2003), argued that a species will become economically extinct prior to going biologically extinct due to the low profitability of harvesting from low-density populations. Therefore, it is in the best interest of the aquarium industry to embrace trade regulations.

[7:] The industry welcomes proportionate regulation, provided that it is enforced against those who deliberately break the law rather than make administrative errors.

[7:] The costs of permits vary around the EU. However in the UK we have a clear view of the real costs of stricter domestic measures. In total the cost to government is almost £1 million pa with a cost to industry of the same amount (ie on top of the permit charges etc)-in total this cost is equivalent to almost 80% of the CITES Secretariat budget (based on documents from Animal Health) {*Editors' note: This seems to refer to the cost of issuing CITES permits in the UK for all CITES-listed species*}. Can commensurate “on the ground” conservation benefits be identified? Or do such costs just divert trade to other major markets-by providing more specimens to a smaller market is there a risk of lower prices and hence lower returns to the collector or producer and hence a livelihood issue? Are we likely to set up a monitoring scheme the outcome of which is to skew markets such that foreseeable perverse impacts are the outcome?

[6:] The Convention on Biological Diversity (CBD) makes explicit reference to the rights of indigenous peoples to utilise the biodiversity around them. Any moves relating to monitoring or certification should be compatible with CBD and should ensure the continued ability of people in range states to benefit from income from ornamental fish diversity.

[6:] While the income from ornamental fish harvesting may appear low, it is of great local importance for the collectors who live in remote areas, being one of the very few opportunities for cash income. Collectors are also the group least able to cope with any decrease in income or increase in costs. Trade intermediaries may pass on the costs of increased monitoring or certification to the collectors, most likely through discounting prices paid for fish. It may be argued that this could be compensated to some extent by higher prices for certified fish, but there is little evidence that this happens; indeed, there is limited evidence that consumers are willing to pay more for any certified products. There is some limited evidence that MAC-certified fish may fetch higher prices due to their better health, but this may simply be absorbed by the increased costs of chain of custody.

[12:] European consumers care most about conservation of the resource and have the financial flexibility to act on their concern.

[7:] Keeping of ornamental fish is an optional pastime; the price the market is prepared to pay is not elastic. Before any monitoring is undertaken the impacts in terms of the market (and industries) reactions to additional costs must be considered. Ill advised or unwarranted monitoring will increase costs and distort markets with very real possibilities of perverse impacts eg tipping the economic balance between sustainable wild collection and ex situ production. Information about the potential for these predictable outcomes must be considered and when they occur the responsibility overtly acknowledged by those who take the decisions.

[7:] Tlustý (2002) reported that there a few key cases where a switch to aquacultural production should be made with great caution, or avoided altogether. This is the case for Cardinal tetra (*Paracheirodon axelrodi*), where the economic benefit of the wild harvest prevents agricultural development which would otherwise destroy the flooded forest ecosystem. An increase in ex situ production therefore poses a risk to wild populations of the species.

[6:] Any initiative which restricts the trade in wild-caught ornamental fishes from developing countries will impact on those least able to develop alternative livelihoods. The knock-on effects of this need to be considered. Evidence from the cardinal tetra fishery on the Rio Negro suggests that when the fishery is restricted (as happened during a severe drought which meant the fishery could not be accessed) the collectors turn to alternative forms of income which are far less sustainable and which have a far greater impact on the relatively intact rainforest. In the worst case scenario, restricting or making the trade in wild-caught ornamental fishes non-viable could simply divert the trade to the Far East where most freshwater ornamentals are produced. This would result in income being diverted from poor people in remote areas of low-income countries to businessmen in middle-income countries. It would also lead to economic loss as there is currently no effective mechanism for ensuring that range states can get benefit from ornamental fishes farmed in other countries.

{Suggested new section [9:]}

6.5 POSSIBLE IMPACTS ON LIVELIHOODS FROM NOT MONITORING OF INTERNATIONAL TRADE

[9:] It is widely known that the worlds coral reefs are now under serious threat. ICRAN reported¹⁸ that "Over a decade ago scientists reported that some 10% of coral reefs had already been destroyed or degraded beyond likelihood of recovery." and "Monitoring results from around the world in 1998 and 1999 indicated that less than 30% of coral reefs have completely healthy communities of corals, fish and other species".

[9:] The global marine aquarium trade are collecting their products from an ever declining source. CITES are adding an increasing number of marine species to the protected list, preventing further trade in these animals and reducing the opportunity of income generation for both developing and developed countries. By introducing regulation that independently monitors the collection of marine animals, not only could the trade ensure its future but it could also become the protector and maintainer of coral reefs. With the current pace of destruction of the worlds reefs and the increase in marine animals under threat, there is great risk of governments restricting access to coral reefs, making it impossible for the trade to survive.

[7:] The ornamental fish sector is tiny compared to almost every other user group.

[11a:] Only some marine species were listed on CITES appendices in the last few years. {Editors' note: see Section 5.2.1 for details of species.}

7 CONCLUDING REMARKS FROM CONSULTEES

Contributions from consultees

i) General

[14:] Establishing a comprehensive system for monitoring the trade in both marine and freshwater species is highly desirable, but will require extensive modification of existing systems. The method of recording (paper/electronic) and subsequent availability of data to stakeholders are important considerations. A system that has a degree of accuracy is particularly important, considering current issues of only reporting at one point in the chain and the variation across systems, organisations and countries.

[11:] In general this document described very well the concerns of the industry itself. We have hardly any reliable sources of statistical information on our industry that it is digitally available. On the other hand it also exemplifies the huge fear of our industry that more and more different bodies want to have information about this industry. For veterinary issues we need to provide information

¹⁸ <http://www.icran.org/peoplereefs-tenquestions.html>

in imports of susceptible species, for CITES we need to declare imports, or in the EU respectively A, B, C and D listed species, for customs we need to declare import values, statistical bureaus demand information, Traces in now introduces in the community. How do we ensure that proper information is made available in such a way that it can be utilized by all who need it without giving the industry a heavy administrative burden?

[6:] Before this proposal is taken much further, a wider consultation with the trade at all levels is required, which should include government and trade bodies in exporting countries. It is quite possible that existing market mechanisms could bring about major improvements in sustainable harvest of ornamental fishes and bring a higher level of benefits to collectors in remote areas.

[6:] The consultation document provides little evidence of consultation with the governments of range States, notably those which supply important quantities of wild-caught, ornamental fishes. A top-down system imposed by developed countries has little chance of gathering support from the main exporting countries, most of which are already tied up with increased costs of compliance with other issues such as EU fish health legislation and the OIE. Any requirement for more detailed reporting or compulsory certification may impose costs and duties on developing country governments which they may find impossible to comply with due to lack of resources and/or trained personnel.

[5:] Consultation with range States is certainly needed. It may be that countries already have some mechanisms for recording collection of ornamental species that they could enhance. An advantage of working directly with the export countries is that they will generate data of direct use for resource management.

[7:] If it is accepted, for the sake of this process only, that some additional monitoring is justified then it must be targeted. If the purpose is conservation then what benefit is achieved by incurring costs (both in industry and in government) by knowing how many fancy goldfish are imported to the EU from China, koi carp from Japan or captive-reared zebra danios from Singapore? If none can be clearly and publicly identified and justified then additional monitoring should not be considered. “It would be nice to know” is not a sufficient justification. Additional monitoring should only be undertaken to the extent necessary to address identifiable conservation concerns.

[4:] We suggest the implementation of only one form (plus CITES one if needed) mentioning all data required for customs, veterinary legislation, GMAD... This form could be based on the health certificate annex IV decision 2006/656/EC specifying freshwater/saltwater and cultured/non cultured ornamental fish through the tariff codes and secondly all the individuals by species traded with this code. Veterinary certification would be done as required on current annex IV. This certificate could be filled and transmitted online so that all the data (fish species and number of individuals) would be electronically available for customs, trade monitoring organisations and traders themselves.

[1:] Nothing can substitute actual catch numbers. Furthermore, the capacity to undertake rigorous and systematic habitat and stock assessments in the developing world is lacking, so the data generated from those endeavors may not accurately represent the standing stock or habitat integrity. Developing a standardized catch reporting system completed when the fish are sold to the exporter would prove more beneficial, and it would resolve the species nomenclature issue. A simple yet effective electronic system for reporting fish similar to how commercially harvested fish in Alaska are reported could be developed for aquarium species. Of course, someone would have to absorb the initial costs for such a system but it is quite effective and doesn't require high literacy rates.

[5:] “Nothing can substitute actual catch numbers” is an extremely important and relevant point. The remit of the paper is to find mechanisms for monitoring international trade, but this disregards domestic use and loss of fish due to post-capture mortality. In terms of conservation and sustainability it is vital to understand the whole picture – thus the importance of gathering range State fishery data.

[11a:] We also feel that it would be great to have actual catch numbers, however, at what cost? We are not dealing with large scale operations but very often with individual collectors or small

collectives. A large part of the discussion in this draft is on marine fish, but marine fish in actual numbers are only a very small percentage of the total number of fish collected from the wild. Most of the collectors are active in remote areas in the Amazon, Africa or Indonesia, far away from the coasts or cities. Furthermore, these fishermen also collect the same fish species for food, and often at the same time in one collection trip. I do not see that these people will ever keep records during the collection trips on what they actually catch and I do not see a governmental agency in these countries gather and check such data. Would we be able to do so ourselves in Europe, on species level and quantity level? The large errors in the import value data from our own statistical agencies already show that we are not able to do it properly in Europe ourselves.

[6:] Even in the best regulated fisheries, offtake is only estimated from catch reports. Similarly, stock assessment is only based on estimates. Good data on catch and stock do not guarantee sustainable fisheries as the case of the EU Common Fisheries Policy and N Sea cod fisheries illustrate only too well. In most developing country fisheries, even the commercial fisheries have to rely on limited stock and catch data for management purposes. The vast majority of fisheries in developing countries are data deficient which poses all manner of management limitations. To try to make an accurate estimation of offtake from highly dispersed ornamental fisheries would require a huge effort, beyond anything which most governments could afford, let alone have the resources to carry out. At best, proxy measures such as the numbers of fishes delivered to exporters or first buyers may be the best that can be achieved although such information needs to be treated with great caution due to improvements in handling. For example, Project Piaba has brought about considerable improvements in handling of the cardinal tetra fishery, reducing mortality to only about 2-3% compared to over 50% when the fishery opened up in the 1960s.

[10:] Systems to monitor and control the trade in ornamental fish may come directly from the government or through trade and amateur organisations, supervised by the government. The latter would be preferable, since more parties would be involved. [11a:] We do not agree with respect to amateur organisations. They lack the knowledge, not the capacity.

[10:] There are several weaknesses in monitoring the fish trade: a lack of experts to identify species and subspecies; animal welfare and transport, which has already improved greatly; diseases; willingness of exporting countries; finding an compromise between the varied interested parties; exhaustion at the point of origin.

[10:] Breeding of fish in the EU should be encouraged and breeding firms in SE Asia and South America should be better controlled, with more involvement from the local governments. And a support system to amateurs and “attestation of ability” for amateurs and pet shops such as the scheme run by BBAT in Belgium.

[11a:] There is hardly any export of captive bred fish from South America. Breeding in Europe would ruin the livelihoods of many thousands of fishermen and middlemen in many countries.[2:] Captive breeding in the EU may also eliminate incentive for the preservation of habitats in which ornamental species are found.

[7:] Encouraging ex situ over in situ production takes no account of Access to Genetic Resources and Benefit Sharing (ABS) discussions. Pet shops already are licenced in the UK and required to implement training. The key issue in the UK is patchy implementation by local authorities not the legal basis.

[6:] In situ captive breeding may help to conserve resources, but this is not guaranteed. Activities such as coral ranching can maintain access to the resource for local communities and may even improve incomes. However, what tends to happen is that production will shift away from areas where the biodiversity exists and to areas nearest to the point of export. Concurrently, there tends to be a shift away from relatively poor, rural collectors to urban, relatively wealthy enterprises which can afford the infrastructure necessary to breed a wide range of ornamental fishes. This in turn leads to a relocation of benefits and thus a devaluing of the resource which can have a strong, negative impact on how the resource is used. Worse still is relocation to capital-intensive, high-tech producers in developed countries where none of the benefits will accrue to developing countries. If this were to be coupled with a restriction in trade which reduced or prevented the trade in wild-

caught organisms from developing countries, it would be viewed as a highly retrograde measure. Such a move would not be compatible with EU objectives on development and would do nothing at all towards achieving the Millennium Development Goals.

[14:] It is also important to monitor freshwater trade. For example, freshwater species are imported and traded heavily in Sri Lanka as many species are cheaper and easier to maintain than marine species (and may be the same in other developing countries). Monitoring of domestic trade is therefore more important for freshwater species. Marine species are almost exclusively for use in developed countries.

[12:] A key difference between freshwater and marine species is the level of endemism, with a greater percentage of freshwater species being found in only a single locality. Some of our most important export species, members of the genus *Aphyosemion*, exhibit particularly high levels of endemism and technically qualify for endangered species status by the IUCN Species Survival Commission because of limited and/or highly fragmented distribution. By far the greatest threats to these species come from expanding agriculture, deforestation, dam construction and mining. With no value as foodfish, the only people who care about these species are the fishers who catch them for the ornamental trade and it would be extremely counter-productive to put these people out of business. MAC's EFM standard is the key to resolving this conundrum and the current practice of engaging local NGOs and concerned citizens is a reasonable means of enforcing the EFM. Providing support at this level, closer to the problem, will work much better than additional top-down mechanisms operated by governments and international agencies. [11a:] Fish of the genus *Aphyosemion* originate largely from captive breeding in Europe, not from the wild.

[1:] Trust funds that mature over time and provide an annual return are increasingly popular to supplement fundraising needs for conservation projects. This model should be explored for NGOs requiring long term financial support to cover operating expenses.

ii) The Global Marine Aquarium Database

[6:] International trade statistics are unreliable and examination of any set of stats reveals inconsistencies and inaccuracies. Given the limited ability of many government agencies to monitor trade, it is difficult to be optimistic about any significant improvement in the short term. The difficulty of improving statistical data is well illustrated by GMAD which proved to be difficult to operate in practice, notably in dealing with large numbers of paper records, and in the fact that it ceased as soon as funding was withdrawn. Major improvements in developing country statistics will require substantial funding and it is questionable as to whether this spending represents good value for money. It may be better to restrict monitoring to species where a risk from trade has already been identified, such as those placed on the various CITES appendices.

iii) Customs/FAO

[4:] Customs legislation can provide a good method of monitoring the trade. Firstly, eight digit tariff codes should have the same meaning in all countries, for example 0301.10.10 for freshwater ornamental fish and 0301.10.90 for saltwater ornamental fish.

New codes to further distinguish cultured and non-cultured fish as for example:

- 0301.10.10 for wild freshwater ornamental fish
- 0301.10.11 for cultured freshwater ornamental fish
- 0301.10.90 for wild saltwater ornamental fish
- 0301.10.91 for cultured saltwater ornamental fish.

[7:] From discussions I have witnessed in other fora is this suggestion practical? It seems Customs coders are in lumping not a splitting mode.

[4:] The meaning of "cultured" would follow Mariculture and Aquaculture Management (MAM) international MAC Standard, that is "from broodstock / post-larvae collection through to grow-out" with a scientific definition of post-larvae such as the last pelagic larval stage of marine coastal fishes.

[4:] Furthermore, a "cultured fish" certification should be implemented and different from the existing MAC focused on the wild capture. Producers would have to be certified to be allowed to declare their fish as "cultured fish" with the appropriate tariff code. Customs must ask the exporter ID.

[4:] Then, different import taxes between cultured and non cultured fish codes can be apply with smallest taxes for cultured which will be good incentive for people to develop aquaculture/mariculture. [7:] Don't agree.

iv) Veterinary controls

[11:] The EU health certification system, in combination with a workable Traces connection, could be a possibility to obtain all needed information in a digital way. OFI is in discussion with DG SANCO to develop Traces in such a way that species and quantities can be entered more easily, in batches. A uniform application of names in a must in this respect and OFI is open for direct cooperation to establish and maintain such a list. Photos for identification purpose are present in our membership and also the ichthyological knowledge (there are several graduated ichthyologists among the membership of OFI).

[8:] Maybe there is a possibility in following the import of ornamental fish in the EU on a species level via the TRACES-system. At the moment we have a harmonised sanitary document (2006/656/EU) which mentions the species and the number of imported fish. Until now this certification has been done on paper, and it is not yet practical to gather this information in a database. However in the future electronic certification should be introduced in the EU, and this could then be coupled to a TRACES report. If this form of certification would become a general procedure (or be made obligatory), everything that would enter the EU legally would be known on a species level.

[12:] The relative successes and costs of implementation favour the use of structures associated with the EU's Annex D or the national veterinary services in importing countries to monitor trade at the species level. Assuming that there is a desire to avoid duplication of effort, I would further suggest that of these two, the veterinary services would be the most easily upgraded to identify fish to species level (vets being biologists) and that their widely accepted role in policing the transfer of invasive alien species and disease transfer mean that their operations will be relatively immune to administrative restructuring and budget de-allocation. They are also well placed at receiving points, and their role is well understood both by exporters and importers. The vet at Charles de Gaul airport contacted me to see if I could do something about the terrible condition in which fish from Cameroon were arriving in France, which initiated the program of work by the WorldFish Center in Cameroon.

v) CITES listing

[14:] CITES is often weak on implementation, especially in documenting and managing wild collection (numbers, mortality, methods, etc.). There is some control at the export end but loopholes exist which differ among countries. Also, trends in trade may not represent population fluctuation at the local level. Where exported numbers remain the same, wild populations may have decreased, but supply is maintained by increased collection effort. An individual record represents a shipment and may refer to many individuals. Data may contain duplication if individual countries did not record their data in the same manner (UNEP-WCMC, 2004) and many of the species names used are inaccurate, with species recorded as wild-caught far from their known distribution (Green & Hendry, 1999). However, CITES can be useful for monitoring trends in the trade for listed species.

vi) Annex D of the EU Wildlife Trade Regulation

[11:] Annex D listing is not supported by the industry. All information is already provided in the attachment of the health certificate and thus should be available to the SRG. It would be good if it were possible to discuss arguments for Annex D listing with the SRG. Present mechanisms of decision taking prevent this.

[7:] Any proposals concerning monitoring from the SRG should be:

- made public (including the information upon which decisions were based);
- subject to stakeholder review;
- subject to scrutiny concerning proportionality and targeting by management authorities;
- assessed for costs and intended conservation benefits and that these conservation benefits are identified, justified and reported to stakeholders annually; and
- the least restrictive to trade necessary to meet the stated objectives.

[6:] Working with developing country governments, the most common complaint I get is about EU regulations. These are perceived as being imposed by the EC without consultation and are often seen as not being driven by genuine trade, health or safety concerns but as nothing more than non-tariff barriers to trade designed to protect EU producers. Regardless of the whether these perceptions are correct or not, an important issue needs to be considered. Why is the EC seeking to impose new trade conditions on developing countries in a top-down manner? There is little evidence of consultation with developing country stakeholders in this process apart from any which may come through OFI. Why should the EC seek to impose conditions on Third Countries for the (presumed) benefit of conserving their biodiversity without involving them in the process from the outset? It feels as if the underlying principle is that conservation is something that needs to be imposed by developed country “experts” on developing countries. Much could be learned by comparison with the Convention on Biological Diversity and what is perceived as a top-down approach to the implementation of Protected Areas without adequate consultation with indigenous peoples (see for example article in Samudra March 2008 reporting the CBD meeting in Rome, February 2008

http://www.icsf.net/icsf2006/uploads/publications/samudra/pdf/english/issue_49/art03.pdf).

An alternative and more sceptical interpretation might be that this process is being driven by a desire to end the trade in exotic animals and that conservation monitoring is simply one way to achieve this. It might well be that the money which would have to be spent on increased monitoring would be better spent on the ground in encouraging protection of the resource and sustainable harvest.

[6:] The money spent on increased monitoring would be better spent on the ground in addressing the urgent issues relating to widespread loss of coral reefs and their biodiversity (e.g. deforestation and run-off, coral mining, climate change, coastal development). A better way to assure the long term, sustainable use of coral reef biodiversity for the benefit of coastal communities in range states would be to encourage measures to improve stewardship of reef resources and sustainable livelihoods. A people-centred approach rather than a top-down, biodiversity-centred approach may well serve conservation concerns far better in the long term by empowering and enabling people who derive livelihoods from coral reefs to develop a truly sustainable approach to resource management and use.

vii) Monitoring through a certification scheme

[11:] The role of MAC is important as a basic idea, however, the percentage of fish entering Europe from a certified chain of custody is extremely limited, almost negligible. The current MAC system cannot be used for the even the entire Marine industry, and certainly not entire industry.

[6:] Second party certification may have some benefits for developing countries and could be developed either by trade organisations, government agencies or NGOs. It may be the least cost method for developing credible certification, a consideration which would be very important in most countries exporting wild-caught ornamental fishes.

[6:] Third party certification is expensive and there is little evidence that the costs can be recovered either by the trade or by the certifying body through higher prices paid by consumers or by licensing. Taking the Marine Stewardship Council as an example, income from licensing is not predicted to reach even 40% of income for a number of years meaning additional funds are essential to maintain MSC operations. It is not possible to get equivalent data from the MAC website, but from what limited information is available, it is clear that MAC relies very heavily on donor funds, even for its base operations. The financial information from the MAMTI project

indicates that substantial donor inputs are required to enable the project to take place. There are some examples of lower cost, third party certification (e.g. Friends of the Sea), but these have limited credibility and may not be much better than second party certification. It is reasonable to conclude that no certification scheme is financial viable in its early years and even long-term viability is questionable.

[6:] Regardless of how certification is carried out, there is very little evidence that there is significant consumer demand for certified ornamental fish. Even in Germany which may be regarded as having a high “green” awareness, MAC has had to carry out awareness-raising seminars for aquarists and there is not one MAC-certified retailer in Germany according to Table 5.1. The push for certification in the ornamental fish trade appears to be supply-driven, rather than demand-driven. There have been a number of ecolabelling initiatives for freshwater fishes in the past few years, most of which have gone nowhere, simply because they were developed on the assumption that certification was a “good thing” per se, rather than assessing market demand and developing a system to meet that demand. The arguments for certification seem very weak at the moment. It is worth stressing that any certification system would involve costs for the industry at all levels and that prolonged consultation would be needed to develop a system which would have even regional, let alone global support from the industry.

8 CONCLUSIONS

This section has been prepared by the editorial team.

This consultation exercise has been conducted with the purpose of considering the various mechanisms available to monitor the international trade in aquatic ornamentals fish and to provide recommendations about the best available mechanism(s) for monitoring the trade at species level. Six have been identified and discussed here, namely: the monitoring activities put in place by certification schemes (e.g. MAC), GMAD, the statistics generated by Customs and FAO, CITES, veterinary controls, and Annex D of the EU Wildlife Trade Regulations.

Examination of non-governmental instruments indicates that while certification schemes are recognised as a desirable ideal, for the purpose of international trade monitoring they are expensive; they provide only partial coverage, limited to a selection of areas in some countries; some have a poor track record; and there is little evidence of consumer awareness to support the schemes. GMAD, which was initiated by the private sector and MAC, in the context of certification, ran successfully for a number of years. However, it is reliant on continuing funding, which it does not currently receive. Moreover, being voluntary, it is not comprehensive enough for monitoring trade for conservation purposes.

Concerning the governmental mechanisms examined, the data generated by Customs and FAO have been found to be inconsistently reported in terms of units, and lack the species information required to serve a useful conservation purpose. CITES is generally an effective and targeted tool for monitoring trade of species that meet the CITES criteria for listing. However, the monitoring enabled by CITES requires the trader to obtain a permit for the transaction and there is often a monetary cost to the trader for the issuance of the necessary permits. Furthermore, CITES-listing can restrict trade.

Although EC veterinary regulations are not targeted to species of conservation concern, the forms used by EC veterinary controls request species-level information and are already completed as a matter of course by importers. In practice, however, species names are not captured or aggregated in a standardised and accessible manner. If, in the future, species information were to be captured in this manner, veterinary controls may offer a viable trade monitoring method for conservation purposes.

Annex D appears to be an effective tool for trade monitoring for conservation purposes. Notably, Annex D allows monitoring to be targeted to species of conservation concern. Trade in species listed in Annex D is not restricted, and as the Annex does not require the issuance of a

permit, it avoids the associated monetary costs. The consultation process has confirmed that there is concern among the trading sector about the administrative costs of reporting, the potential duplication of effort with reporting for veterinary controls, and the compulsory nature of the Annex.

The evidence presented in this report and the feedback received from consultees suggest that currently, the only instrument that can provide comprehensive, species-level data on international trade in species of conservation concern is Annex D of the Wildlife Trade Regulations. However, industry operators have expressed a willingness to work in partnership with the regulatory bodies and are keen for EC veterinary controls to be investigated further as a mechanism for monitoring international trade in ornamental fish.

Contributions from consultees

[5:] The conclusions reached by the editorial team are valid. An additional point about Certification schemes is that they are not in any case necessarily dedicated to collecting detailed data on numbers/species traded. Certainly at the moment they don't seem to have provided any that is publicly available.

[14:] The whole point of CITES is to ensure a sustainable trade. For a species to be listed under CITES in the first place requires sufficient evidence that there is a need for this level of management internationally and that the international trade is having a negative effect. It is, therefore, inevitable, that CITES listing will restrict trade in some cases. This should be for the benefit of listed species.

[5:] CITES listing is an impractical suggestion because there is no way that any/all of the species on the trade list would meet the criteria for listing in CITES.

[7:] Your conclusion on the effectiveness of Annex D is I believe incorrect. To be truly effective its use must be targeted and proportionate. The suggestions made for Annex D listings of marine ornamentals at SRG 31 (http://ec.europa.eu/environment/cites/pdf/srg/31_summary_srg.pdf) were based on consideration of a UNEP WCMC document "Review of ornamental species -December 2004". We are at a loss to see how given the evidence provided species identified as pan-oceanic, common, with a rapid doubling time and hardy in aquaria could be deemed in need of additional monitoring.

[5:] Annex D does provide a mechanism for recording international trade but in terms of conservation (which is what the monitoring is needed for) will not necessarily provide the information required. It is a step in the right direction, but is focused only on trade into the EU and also gives a incomplete picture because the data collected will not take into account domestic use and post-capture mortalities (which can be substantial). It would be more productive and useful to work with range states to develop mechanisms for monitoring catch. [2:] This is a valid point. Any approach limited to monitoring only through EU mechanisms, such as Annex D or Veterinary data may serve useful for monitoring EU trade. However, it will provide incomplete data on the conservation status of ornamental species in the wild, which should be the purpose of monitoring. If EU trade numbers go up or down for a particular species, will it mean anything? A decline in imports into the EU could be supplanted by an increase in imports into other countries, for a particular species. Without catch or stock monitoring within the country of origin, the overall effect on the conservation status of a species will be nil.

[11a:] As all the requested information is already present in the health certificates, we would prefer this sources of information above the Annex D-listing, which is a huge administrative burden for importers.

[14:] Two references that may be useful are:
Alencastro, L.A. 2004. Hobbyists pereferences for marine ornamental fish: a discrete choice analysis of source, price, guarantee and ecolabeling attributes. MSc Thesis, University of Florida, Gainesville. 100pp.

1611 Alencastro, L.A. Degner, R.L., Larkin, S.L. 2005. Hobbyists preferences for marine ornamental
1612 fish: a discrete choice analysis of ecolabeling and selected product attributes. *SPC Live Reef Fish*
1613 *Information Bulletin* 15: 19-22.

1614

9 LIST OF CONSULTEES

Identifier code

- [1:] Brian Tissot & Todd Stevenson, Washington State University, Vancouver, Canada.
- [2:] Cynthia Gerstner, Columbia College, Chicago, USA.
- [3:] Carlos Ibero, ATECMA Environmental Consultants, Madrid, Spain.
- [4:] A combined response from Ecocean, St Clément de Rivière, France.
- [5:] Elizabeth Wood, the Marine Conservation Society, Eversley, UK.
- [6:] Ian Watson, Watson Fish Consulting, Chatham, UK.
- [7:] Keith Davenport, Ornamental Aquatic Trade Association, Westbury, UK.
- [8:] Mr Graus, Federal Food Agency of Belgium.
- [9:] Mark Taber, Reefs UK
- [10:] Marc Thellissen, Belgische Bond Voor Aquarium-en Terrariumhouders, Neeroeteren, Belgium.
- [11:] A combined response from Ornamental Fish International, Maarssen, The Netherlands.
- [11a:] A combined response from Ornamental Fish International, Maarssen, The Netherlands and the European Pet Organization (EPO).
- [12:] Randall Brummett, WorldFish, Humid Forest Centre, Yaounde, Cameroon.
- [13:] A combined response from DG SANCO, Directorate General for Health and Consumer Affairs of the European Union.
- [14:] A combined response from the Zoological Society of London, London, UK and Project Seahorse.
- [15:] Bernard Vallat, the World Organisation for Animal Health (OIE), Paris, France.

10 LITERATURE

- Adams, C.M., Larkin, S.L., Degner, R.L., Lee, D.J. & Milon, J.W. 2001. *International Trade in Live Ornamental "Fish" in the U.S. and Florida*. University of Florida, Florida, USA.
- Andrews, C. 1990. The ornamental fish trade and fish conservation. *Journal of Fish Biology*, 37: 53-59.
- Anon, 2007a Notification No. 2007/022. Amendments to appendices I and II of the Convention adopted by the Conference of the Parties at its 14th meeting, The Hague (Netherlands), 3-15 June 2007.
- Anon. 2007b. CoP14 Prop. 19 Proposal to list Banggai cardinalfish (*Pterapogon kauderni*) on Appendix II. Fourteenth meeting of the Conference of the Parties of CITES, The Hague (Netherlands), 3-15 June 2007. Accessed in March 2007. URL: <http://www.cites.org/eng/cop/14/prop/E14-P19.pdf>
- Bartley, D. 2000. Responsible Ornamental Fisheries. *FAO Aquaculture Newsletter* 24:10.
- Basleer, G. 1994. The international trade in aquarium/ornamental fish. *Infofish International*, 5(94): 15-17. Cited by Wood, 2001a.
- Blundell, A.G. & Mascia, M.B. 2005. Discrepancies in reported levels of international wildlife trade. *Conservation Biology* 19(6): 2020-2025.
- Brummet, R.E. 2005. Ornamental fishes: a sustainable livelihoods option for rainforest communities. *FAO Aquaculture Newsletter* 33: 29-34.
- Calado, R. 2006. Marine ornamental species from European waters: A valuable overlooked resource or a future threat for the conservation of marine ecosystems? *Scientia Marina* 70(3): 389-398.
- Carpenter, K.E., Abrar, M., Aeby, G., Aronson, R.B., Banks, S., Bruckner, A., Chiriboga, A., Cortés, J., Delbeek, J.C., DeVantier, L., Edgar, G.J., Edwards, A.J., Fenner, D., Guzmán, H.M., Hoeksema, B.W., Hodgson, G., Johan, O., Licuanan, W.Y., Livingstone, S.R., Lovell, E.R., Moore, J.A., Obura, D.O., Ochavillo, D., Polidoro, B.A., Precht, W.F., Quibilan, M.C., Reboton, C., Richards, Z.T., Rogers, A.D., Sanciangco, J., Sheppard, A., Sheppard, C., Smith, J., Stuart, S., Turak, E., Veron, J.E.C., Wallace, C., Weil, E. & Wood, E. 2008. One-Third of Reef-Building Corals Face Elevated Extinction Risk from Climate Change and Local Impacts. *Science* 321: 560 – 563.
- Chao, N.L. & Prang, G. 1997. Project Piaba - towards a sustainable ornamental fishery in the Amazon. *Aquarium Sciences and Conservation* 1: 105-111.
- Chillaud T. 1996. The World Trade Organisation agreement on the application of sanitary and phytosanitary measures. *Revue Scientifique et Technique de l'Office International des Epizooties* 15(2): 733-741.
- Chong, R. & Whittington, R. 2005. A Review of Australian Ornamental Fish Import Risk Management for the Period 1999 – 2004. Department of Primary Industries and Fisheries, Yeerongpilly and University of Sydney, Sydney.
- Dawes, J. 2007. Column John Dawes : CITES and the Banggai Cardinal. *OFI Journal* 54:7-9.
- Doyle, K.A., Beers, P.T. & Wilson, D.W. 1996. Quarantine of aquatic animals in Australia. *Revue Scientifique et Technique de l'Office International des Epizooties* 15(2): 659-673.
- Dulvy, N.K., Sadovy, Y. & Reynolds, J.D. (2003). Extinction vulnerability in marine populations. *Fish and Fisheries* 4:25-64.
- Gerson, H., Cudmore, B., Mandrak, N.E., Coote, L.D., Farr, K. & Baillargeon, G. 2008. Monitoring international wildlife trade with coded species data. *Conservation Biology* 22(1): 4-7.
- Gerstner, C.L., Ortega, H., Sanchez, H. & Graham, D.L. 2006. Effects of the freshwater aquarium trade on wild fish populations in differentially fished areas of the Peruvian Amazon. *Journal of Fish Biology* 68(3): 862-875.
- Green, E.P. & Hendry, H. 1999. Is CITES an effective tool for monitoring trade in corals? *Coral Reefs* 18: 403-407.
- Haenen, O.L.M. 2005. The OIE, the world organization on animal diseases and its relation with ornamental fish. *OFI Journal* 48:106 -109.
- Hastein, 1996. Preparation and applications of the International Aquatic Animal Health Code and Diagnostic Manual for Aquatic Animal Diseases of the Office International des Epizooties, *Revue Scientifique et Technique* 15(2):723-31.

- 1689 Hedrick, R.P. 1996. Movement of pathogens with the international trade of live fish: problems and
 1690 solutions. *Revue Scientifique et Technique de l'Office International des Epizooties* 15(2): 523-531.
- 1691 Junk, W.J. 1984. Ecology, fisheries and fish culture in Amazonia. In: H. Sioli (ed.) *The Amazon:*
 1692 *Limnology and Landscape Ecology of a Mighty Tropical River and its Basin*. Dr W. Junk Publishers,
 1693 Dordrecht, The Netherlands. Pp. 443-476.
- 1694 Kaiser, M.J. & Edwards-Jones, G. 2006. The role of ecolabeling in fisheries management and
 1695 conservation. *Conservation Biology* 20(2): 392-398.
- 1696 Koldewey, H. & Jones, R. 2008. The impact of CITES on the management of species in aquariums.
 1697 *EAZA News* 6: 12-13.
- 1698 Monteiro-Neto, C., de Andrade Cunha, F.E., Carvalho Nottingham, M., Araújo, M.E., Lucena Rosa, I.
 1699 & Leite Barros, G.M. 2003. Analysis of the marine ornamental fish trade at Ceara State, northeast
 1700 Brazil. *Biodiversity and Conservation* 12(6): 1287-1295.
- 1701 Moreau, M.-A. & Coomes, O.T. 2006. Potential threat of the international aquarium fish trade to silver
 1702 arawana *Osteoglossum bicirrhosum* in the Peruvian Amazon. *Oryx* 40: 152-160.
- 1703 Moreau, M.-A. & Coomes, O.T. 2007. Aquarium fish exploitation in western Amazonia: conservation
 1704 issues in Peru. *Environmental Conservation* 34(1): 12-22.
- 1705 Ng, P.K.L. & Tan, H.H. 1997. Freshwater fishes of Southeast Asia: potential for the aquarium fish
 1706 trade and conservation issues. *Aquarium Sciences and Conservation* 1: 79-90.
- 1707 Olivier, K. 2001. *The ornamental fish market*. FAO/Globefish Research Programme, Vol. 67. United Nations
 1708 Food and Agriculture Organisation, Rome.
- 1709 Ploeg, A. 2007. The volume of the ornamental fish trade. In: S. Fosså, G.M.O. Bassleer, L.L. Chuan
 1710 and A. Ploeg (Eds.) *International transport of live fish in the ornamental aquatic industry*. OFI
 1711 Educational publication 2. OFI, Maarssen, The Netherlands. Pp 48-64.
- 1712 Rivalan, P., Delmas, V., Angulo, E., Bull, L.S., Hall, R.J., Courchamp, F., Rosser, A.M. & Leader-
 1713 Williams, N. 2007. Can bans stimulate wildlife trade? *Nature* 447: 529-530.
- 1714 Smith, K.G. & Darwall, W.R.T. 2007. *The status and distribution of freshwater fishes in the aquarium trade*
 1715 *from the Mediterranean basin and eastern, western and southern Africa*. Unpublished report submitted to
 1716 UNEP-WCMC.
- 1717 Tello, S.M. & Cánepa, J.R.S. 1991. Estado actual de la explotación de los principales peces
 1718 ornamentales de la Amazonía Peruana. *Folia Amazonica* 3: 109-128. Cited by Moreau & Coomes,
 1719 2006.
- 1720 Tlustý, M. 2002. The benefits and risks of aquacultural production for the aquarium trade.
 1721 *Aquaculture* 205:203-219.
- 1722 UNEP-WCMC, 2004. *A guide to interpreting outputs from the CITES Trade Database v 6.0*. UNEP-
 1723 WCMC, Cambridge, UK. 21pp.
- 1724 Watson, I. & Moreau, M. 2006. The ornamental fish trade in support of livelihoods. *OFI Journal* 50: 20-
 1725 23.
- 1726 Weigle, S., Smith, L., Carlton, J. & Pederson, J. 2005. Assessing the risk of introducing exotic species
 1727 via the live marine species trade. *Conservation Biology* 19(1): 213-223.
- 1728 Whittington, R.J.J. & Chong, R. 2007. Global trade in ornamental fish from an Australian perspective:
 1729 The case for revised import risk analysis and management strategies. *Preventive Veterinary Medicine*,
 1730 81: 92-116.
- 1731 Wijesekara, R.G.S. & Yakupitiyage, A. 2001. Ornamental Fish Industry in Sri Lanka: Present Status
 1732 and Future Trends. *Aquarium Sciences and Conservation* 3(4): 241-252.
- 1733 Wilhelmsson, D. Haputhanthri, S.S.K., Rajasuriya, A. & Vidanage, S.P. 2002. Monitoring the Trends of
 1734 Marine Ornamental Fish Collection in Sri Lanka. In: Linden O, Souter D, Wilhelmsson D, Obura D
 1735 (eds) *Coral Reef Degradation in the Indian Ocean: Status Report 2002*. CORDIO, Department of
 1736 Biology and Environmental Science, University of Kalmar, Sweden.
- 1737 Wilkinson, C (Ed) 2004. *Status of coral reefs of the world: 2004. Volume 1*. Australian Institute of Marine
 1738 Science, Queensland, Australia. 301 pp.
- 1739 Wood, E. 2001a. *Collection of coral reef fish for aquaria: global trade, conservation issues and management*
 1740 *strategies*. Marine Conservation Society, Ross-on-Wye, UK.
- 1741 Wood, E. 2001b. Global Advances in Conservation and Management of Marine Ornamental
 1742 Resources. *Aquarium Sciences and Conservation* 3(1): 65-77.