



GREENING CHINA'S FISH AND FISH PRODUCTS MARKET SUPPLY CHAINS



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CONTRIBUTORS

Arthur Hanson
He Cui
Linlin Zou
Shelley Clarke
Geoffrey Muldoon
Jason Potts
Huihui Zhang

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China Aquatic Products Processing and Marketing Alliance (CAPPMA) is a non-profit organization. It consists of seafood producers, processors, traders, distributors, suppliers, and institutions for fisheries research and education, as well as relevant social entities that provide various services for seafood processing and marketing. Its objectives are dedicated to improve the self-discipline mechanism among members in their business operation, to standardize and maintain order in the seafood market, to protect the members' legal rights, to coordinate relationships among domestic enterprises and international parties, to upgrade technology and management in China's seafood industry to enhance the awareness of credibility needs within the industry and to improve seafood quality security, to promote the prosperity and stability of markets, and to ensure sustainable fisheries development. Further information is available at www.cappma.org



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GREENING CHINA'S FISH AND FISH PRODUCTS MARKET SUPPLY CHAINS¹ SUMMARY REPORT

INTRODUCTION

Over the past two decades, China's involvement with world fisheries and trade in aquatic products has increased dramatically, making it the world's largest producer, consumer and exporter of seafood. China will play an increasingly important role in securing the long term sustainability of the sector. Its role in market supply chains is especially important. There is worldwide interest in greening of these supply chains, taking into account sustainability impacts on species, stocks and ecosystems within China and elsewhere in the supply chains. International certification processes such as those of the Marine Stewardship Council (MSC) and various seafood consumptions guides are examples of how this international interest is shifting production, processing, trade and consumption patterns globally.

China is linked into the complex oceanic exploitation and management systems in ways that


are not well understood, either within China or outside of the country². Some of the raw materials supplying China's massive processing industry are from aquaculture in China or elsewhere, some are catches from Chinese vessels operating within China's territorial seas and Exclusive Economic Zone (EEZ) or in other parts of the world, and some by fleets of other nations which then send the products to China for processing and then export to markets such as Japan, the EU and the U.S. or many other countries.

Seafood often moves great distances from point of capture or production before reaching final consumers. During that journey its origin, identity and

1 This is a summary of the full IISD and CAPPMA report Greening China's Fish and Fish Products Market Supply Chains (2011, 149 pps.) available at <http://www.iisd.org/publications/pub.aspx?id=1474>

2 The work of Shelley Clarke in studies undertaken via TRAFFIC provides the most coherent picture of Chinese fish trade linkages, along with statistical data bases published by FAO and the Chinese Fisheries Statistics Yearbook.





certainly the circumstances of production and processing may be lost or altered. Without good traceability it becomes difficult to assess whether the fish or other aquatic product was obtained and processed in a way that was sustainable. The criteria of sustainability also need to be reasonably defined, but generally will take into consideration social, economic and environmental factors.

Trade in aquatic products is undergoing considerable scrutiny since it is a key avenue for enhancing global efforts on sustainable development. A number of issues have been raised in the past decade. These include problems such as the import into China of Patagonian toothfish for processing and export to markets in North America and Europe. Much of the overfishing around the world for sharks and rays is for markets in Asia, with China being a prominent consumer. Chinese exports of aquacultured products are subject to considerable international scrutiny due to reports of contaminants including heavy metals, antibiotics and other medicines and bacteria. The potential exists for non-tariff trade barriers being imposed in the form of excessive health and sanitation requirements.

China has a large stake in attempting to make fisheries and aquaculture sustainable, and has taken a number of steps to address the activities of its own fisheries and processors, but there will be pressures for more action in relation to market supply chains. Already there is a strong effort on the part of Chinese producers to ensure health and food safety in aquatic products bound for international trade, for example through implementation of Hazard and Critical Control Points (HACCP) principles. In the years ahead, sustainability of market supply chains will become an important part of the mix—both internationally and domestically.

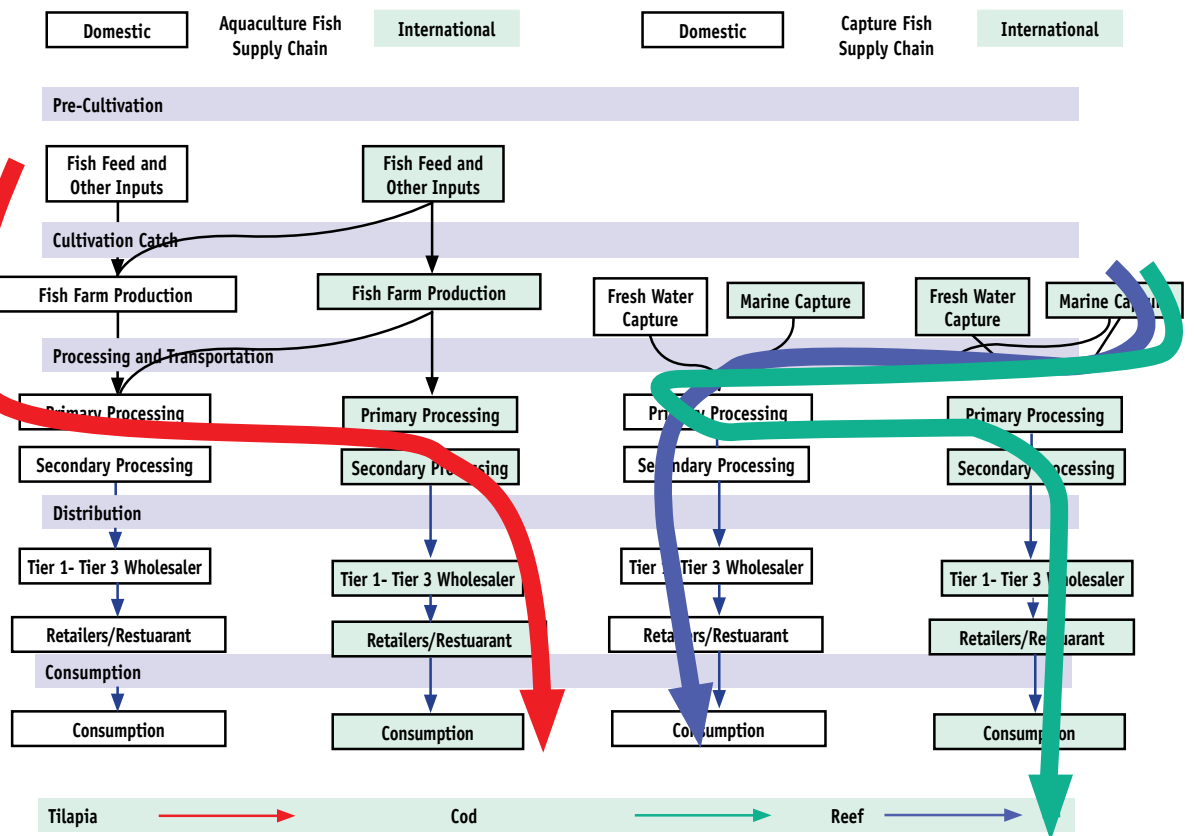
The International Institute for Sustainable Development (IISD) and the Chinese Ministry of Commerce (MOFCOM) have cooperated on analysis of sustainability of China's market supply chains in several major sectors³. In 2009, work was initiated on market supply chains related to China's fisheries and aquaculture, in cooperation with the China Aquatic Products Processing and Marketing Association (CAPPMA). Funding was provided by British Department for International Development (DFID), with supplemental funding from the Swiss State Secretariat for Economic Affairs (SECO). In addition to providing an overview of some key general concerns related to environmentally sustainable market supply chains and some of the important species in Chinese freshwater and saltwater fisheries, the project examined three fish

3 The "Sustainable Development: China and Global Markets" Project, initiated by IISD and MOFCOM in 2006, with financial support from the Swiss State Secretariat for Economic Affairs (SECO), examined the ecological impacts and shared responsibilities of China and its trading partners in several commodity supply chains. The overall goal of this on-going project is to integrate sustainable development concerns into trade/economic policies of the Chinese government as well as countries supplying raw materials to China and countries consuming Chinese products internationally. The market supply chains include forest, cotton, e-waste and copper. As well, IISD in cooperation with Development Research Center of the State Council (DRC) published a major report in November 2010 on Elements of a Sustainable Trade Strategy for China. Further information on these studies is available at <http://www.iisd.org/publications/pub.aspx?pno=1361>

supply chains in some detail. The methodology is based on an approach worked out by IISD in previous market supply chain analyses, and draws upon the knowledge and expertise available in CAPPMA and from several international experts knowledgeable about Chinese fish trade and sustainability concerns. Extensive use was made of existing studies of China's fish trade.

This summary report is based on the full report of the study which is available on IISD's website in both Chinese and English versions. The recommendations to the Government of China contained in this summary report are based on the full report, and have been submitted to MOFCOM for consideration in shaping future policies. Additional recommendations to the seafood industry in China are being carried forward by CAPPMA.

FIGURE 1: THREE MARKET SUPPLY CHAINS





Three types of market supply chains have been examined, as noted in the diagram. The red line is a within China aquaculture-based system designed to supply both domestic consumption and a major export product. The example used is the economically-outstanding rise of tilapia aquaculture and trade. China now leads the world in production and trade of this fish. The other two market supply chains are based on capture fisheries and involve movement of fish into China either for processing and re-export (green line), or for domestic consumption (blue line). The example of the processing and re-export is frozen cod. This is one of many white-fleshed species caught in waters in various parts of the world, sent to China, often via ports such as Rotterdam processed to finished or semi-finished in Chinese plants, and then distributed abroad either as a final product or to be finished into final products at seafood plants in other countries. The third market supply chain is the live reef food fish trade (LRFFT) mainly of grouper species from the Coral Reef Triangle in Southeast Asia to Hong Kong and Mainland China. This trade is mainly for consumption in Chinese restaurants as a luxury food item. The grouper fishery also includes a growing component of aquacultured fish from Taiwan and Mainland China.

The seven-chapter main report from which this summary is drawn covers the following topics, not all of which could be covered here: 1. Background and Purpose. 2. Trade, Sustainability and Engagement covering China's role in world fisheries and aquaculture trade, international and Chinese aquatic resources, the significance of this sector in WTO agreements and action; and various sustainability criteria for fisheries and aquaculture that may be used in the framework for analysis; plus results of other relevant studies by

international organizations interested in working with China on sustainable fisheries and aquaculture. 3. Overview of species for market supply chain analysis. Notes on nine specific fisheries and aquaculture supply chains of high interest. 4. Sustainability case study of tilapia supply chain. 5. Sustainability case study of China's cod supply chain. 6. Sustainability case study of live reef food fish (LRFF) supply chain. 7. Conclusions and recommendations.

This Summary Report covers material drawn mainly from Chapters 1, 4, 5, 6 and 7. Sources of quotations and more detailed information on the topics here can be found in the main report.

The study was completed in March 2011 at a time of unprecedented interest in environment and development within China, and the start of the 12th Five Year Plan (2011-2015). This is a transformative time when China is placing great emphasis on expanding its domestic consumption and is starting to expand its foreign direct investment as well as seeking to build new, sustainable avenues for bolstering trade. There is a growing realization that China will need to expand international cooperation, and to pay greater attention to ways in which China can shift its economic growth into less ecologically damaging activities. At the same time it is also recognized that job creation, food security and scientific development continue to be very important goals.

SUSTAINABILITY ANALYSIS OF CHINA TILAPIA PRODUCTS SUPPLY CHAIN

Tilapia, a tropical freshwater fish from Africa, is now one of the most widely-farmed fish types—in more than 80 countries. Tilapia ranks third in the international trade of farmed aquatic products, behind salmon and shrimp. Total production reached 3.5 million tonnes (Mt) in 2008, out of which 2.8 Mt were farmed products. Tilapia has become popular globally among consumers for its tasty meat, free of intramuscular bones, so that the international demand from North America, Europe, Africa, Mid-East, Oceania and many other countries and regions has been continuously increasing. Tilapia will probably become one of the major sources of animal protein in the future, given the expanding demand being experienced in the global seafood market. China has become the world's leading producer and exporter of tilapia. A profile of the species, China's remarkable success in culturing tilapia, and some of the perceived sustainability issues are summarized in Table 1.

While international commentary about tilapia sustainability has been relatively positive, sourcing from Asia, including China, has been discouraged in a number of seafood watch guides issued by various NGOs. WWF has generally rated the fish as

“unsustainable because of issues related to harmful environmental effects, including chemical use, waste spilling into waterways, risks of disease and escapes and weak regulation of aquaculture in many producing areas.” Through the Aquaculture Stewardship Council, WWF has recently released a tilapia stewardship standard for certification. Tilapia in Indonesia and Honduras are currently being certified, but so far not many Chinese tilapia aquaculture businesses have started such a process.

China is the world's biggest tilapia exporter. The U.S. and Mexico were the traditional markets, with the U.S. taking 70 per cent in 2005. The Russian market share began to expand after 2005, becoming the third largest tilapia market for China. But Russia stopped importing for several months during the 2008–2009 financial crisis. Meanwhile, the EU market was growing steadily to become the fourth largest export market; it is expected to be the fastest growing market



TABLE 1: TILAPIA PRODUCTION AND TRENDS

TILAPIA (OREOCHROMIS NILOTICUS)

Global Production

Tilapia (all species) is the second most important group of farmed fish after carp, and the most widely cultured of any farmed fish. (Approximately 650,000 t per year of tilapia are also produced from capture fisheries but none of it from Chinese fisheries). Aquaculture production has grown rapidly since the early 1980s and now totals over 2.1 Mt per year based primarily on one species, Nile tilapia (*Oreochromis niloticus*). Since tilapia can accept feed with a higher percentage of plant proteins (or other agriculture by-products, e.g. manure) and are relatively resistant to poor water quality and disease, they can be cultured intensively and economically. Yield for a skinless fillet is 33 per cent.

China's Role

China's production in 2008 (1.11 Mt) far surpassed the other top producing countries of Egypt, Indonesia, Thailand, and the Philippines, each of which cultured no more than 300,000 t. China reports exporting only about 200,000 t in 2007 with a substantial proportion of production consumed in China..

China reported mostly processed exports in the categories of "prepared and preserved" and "frozen fillets" with 64 per cent to the U.S. and 31 per cent to Mexico. U.S. demand is attributed to China's low production costs. The trade figures, however, are shifting with Europe becoming more significant.

Current and Future Trends

Global production has grown at an exponential rate of approximately 14 per cent per year. The development of sex reversal techniques for female tilapia in the 1970s allowed for the introduction of male monoculture populations which grow twice as fast and produce uniformly-sized individuals for market. Current estimates suggest that tilapia culture produces more fish protein than it consumes but an ongoing trend toward higher quality products would be expected to lead to a greater use of fish meal and fish oil as feed for tilapia, thus reducing efficiency.

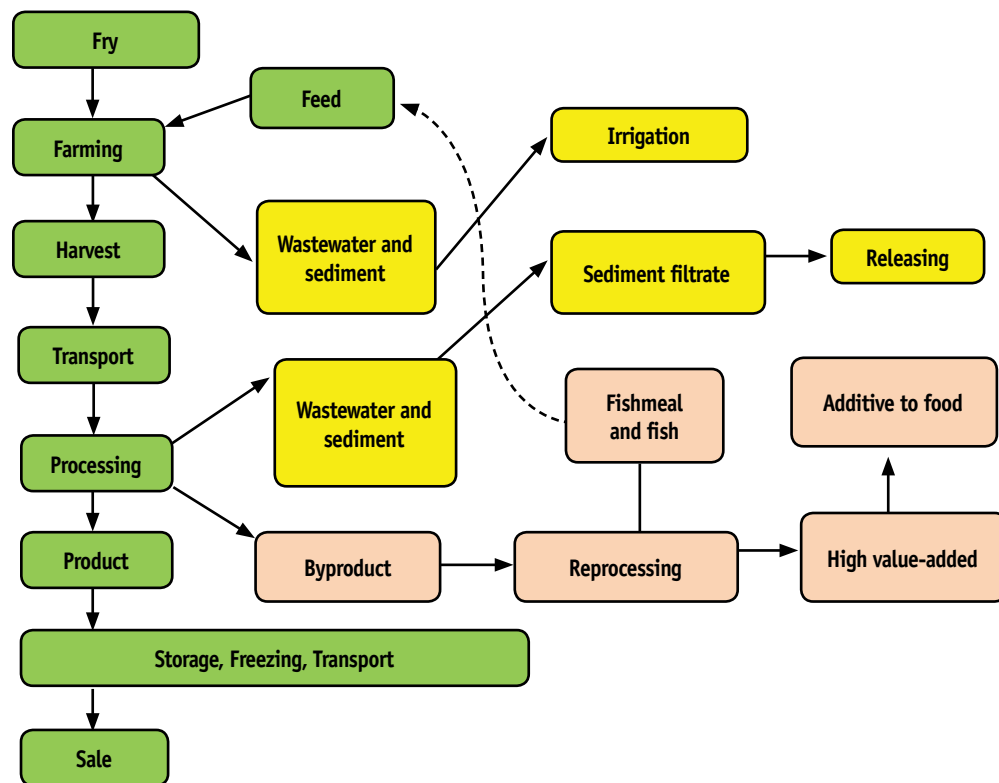
Key Drivers

Premium production for higher grade export markets may increase quality standards but decrease efficiency. Dependence on the U.S. market belies a sensitivity to U.S. demand and hence market perception. Some seafood sustainability guides advocate avoidance of Chinese-produced tilapia due to issues relating to operational waste management, antibiotic and pesticide residues, and treatment with carbon monoxide which can mask spoilage. There have been some recent efforts within China to certify tilapia production to various national and international organic, or other "green" standards.

in the future. In 2008 some 70 countries received tilapia cultured in China. Mostly the exported product is whole or filleted frozen fish. It is a remarkable success story for farmers and processors, drawing revenue and jobs into the countryside.

The diagram describes, in a simplified way, the market supply chain within China. From the environmental point of view the most critical aspects are within China, although there are some concerns about the impacts elsewhere, including fish food sourced from imported fish meal. And there is a good possibility that future growth may have to be mainly through ponds located outside of China due to the scarcity of suitable land and water supply within China. An important point is that preferences within China dictate that domestically consumed fish are often moved around the country as fresh fish, where some 70 per cent of the weight or volume transported is water, and only about 30 per cent fish.

FIGURE 2: THE TILAPIA SUPPLY CHAIN IN CHINA





Based on the extensive information gathered during this study, and including recent studies done under EU sponsorship on tilapia sustainability in southern China, CAPPMA has identified the following short and medium term priorities to ensure sustainable development:

- To improve the current domestic standards and to remove inappropriate criteria while adding new standards.
- To align the domestic criteria with international criteria.
- To establish a traceability system from pond to dining table.
- To research and develop vaccines for disease prevention.
- To implement an integrated tilapia technology export through international cooperation projects. The Chinese tilapia industry plays a leading role in technology for breeding, aquaculture and processing: These advanced, integrated technologies can be exported to other developing countries in order to support them in development of the aquaculture industry.

Over the longer term (i.e., the coming decade) CAPPMA proposes that Chinese producers, assisted by government and others, take the following actions, with a focus on globally significant improvements:

- To set up a global tilapia information sharing system that includes all information and criteria for farming, processing, marketing, trading and the latest progress.
- To develop a low carbon emissions industrial business model and explore the proper way to

reduce carbon emissions in the tilapia industry such as rational stocking density, proper feeding methods, healthy and ecological farming models, good operating specifications for transportation, refrigeration and processing.

- To set up a Tilapia Industry Development Fund with the support of international organizations, such as banks and foundations, to export or transfer technologies to other developing countries to help solve food shortage problems.
- To establish a unified supply chain platform which gives consideration to all benefits from both developing and developed countries, both producers and consumers, and set up standards in various stages of tilapia producing, processing, transportation and other sectors. It will help to promote the integration of the global tilapia industry.

IISD's perspective, based in part on its own observations of the Chinese situation, and also on efforts by various groups working internationally to make aquaculture more sustainable, is that there is a tremendous opportunity for China's tilapia industry to become a global model for sustainable aquaculture. It will be necessary to address challenging issues at all stages in the market supply chain. The model should be global in focus since the markets are widespread,

and because the species is so important in terms of its potential elsewhere in Asia, Latin America, and, of course, Africa.

The clearest effort to define the sustainable development of tilapia has come from the international efforts of the tilapia roundtable dialogue process established by WWF, including a recently released sustainability standard and certification process. The dialogue produced a set of eight principles that are listed below:

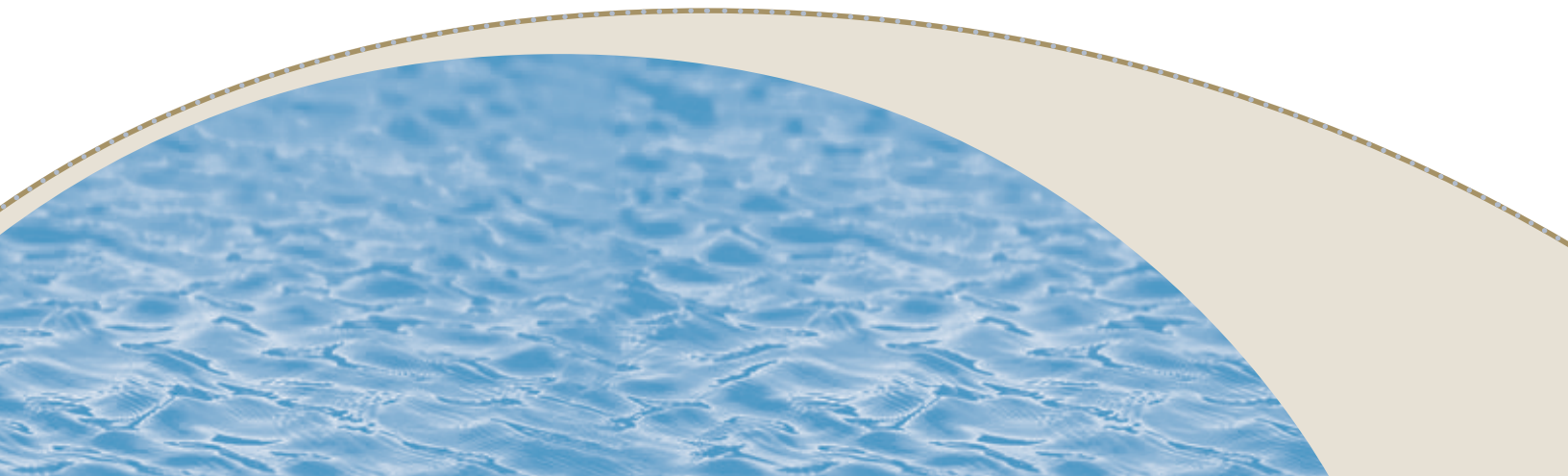
1. Obey the law and comply with all international, national and local regulations
2. Site and/or expand farms to conserve natural habitat and local biodiversity
3. Conserve water resources
4. Conserve fish species diversity and wild populations
5. Use resources efficiently
6. Manage disease and pests in an environmentally responsible manner
7. Ensure food safety and environmental health
8. Be socially responsible

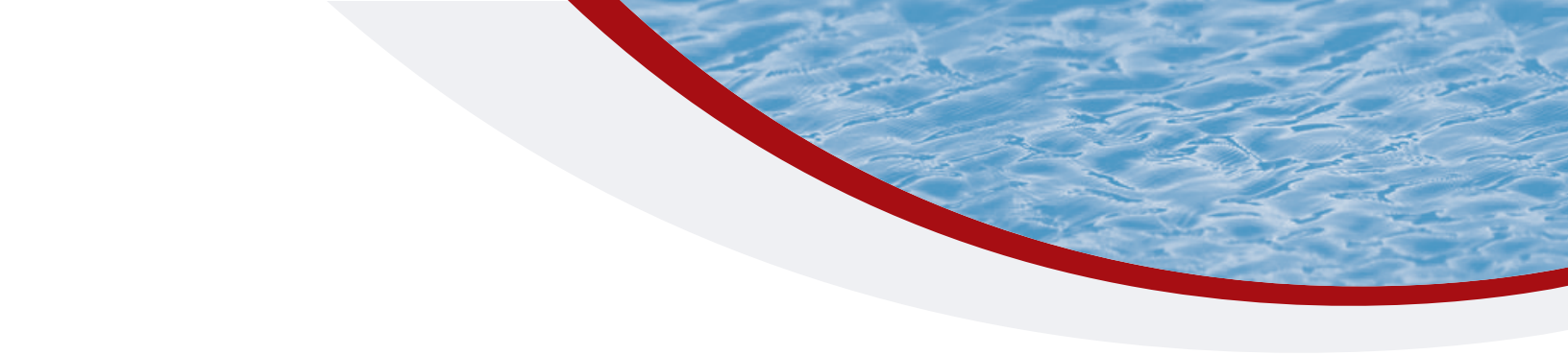
Extensive effort has been put into developing relevant laws and regulations within China to address these health, safety and environmental management matters. It is also clear that there has been a concerted effort, especial on the socio-economic side, to provide considerable rural employment through the tilapia market supply chain. Thus it may be reasonable to consider that tilapia aquaculture, even on the massive scale currently being carried out in

China, has the potential to be sustainably conducted. It could eventually be an important contributor to China's new green economy.

Other observers, for example, have documented sites in south China where tilapia cultivation appears to be undertaken with adequate environmental safeguards. The EU-China Trade Project examined sustainable aquaculture potential at a number of sites in both Hainan and Guangdong Provinces in the autumn of 2008. The EU study team reported the following findings based on visits to leading companies operating in southern China:

The management of environmental sustainability was impressively demonstrated at the site visits: all facilities well situated without any visible signs of unfavourable environmental impacts on the surrounding areas; water resources were well used with farms and hatcheries minimizing on-site water exchange and most waste water receiving basic treatment before discharge for use as irrigation water or back into the surrounding water; all sites demonstrated good management, which lead to a low incidence of disease and the regulations on the use of aquaculture medicines was well communicated and understood; all hatcheries used farmed broodstock





with strict quarantine procedures on all imported broodstock. All farms and hatcheries exclusively used formulated, pelleted feed, which the feed factories produced from good quality raw materials and without using any waste products, medicinal or hormone additives or binding agents.

The EU–China team concluded that “with the current trend in the EU’s major retail and food companies towards implementing purchasing programs for the supply of environmentally sustainable aquaculture products, the need to adopt an international environmental sustainability scheme will significantly improve China’s supply opportunities.” That is indeed a worthwhile observation and one that is timely, given that as a result of the WWF-initiated Tilapia Aquaculture Dialogue there now is not only a set of standards formulated around the eight principles noted above, but also robust indicators that can be used for certification. It is anticipated that the certification process will operate via a new body, the Aquaculture Stewardship Council. However, it is not clear at this stage whether most large Chinese enterprises will participate, at least in these early days of such certification.

Clearly, however, there is interest, especially on the part of companies with direct ties to the U.S. and perhaps also from other countries with considerable experience and pressures for certification and traceability. An example is HQ

Sustainable Maritime Industries Ltd., with tilapia aquaculture operations in Hainan. The company takes certification seriously as noted below:

The Company holds HACCP and GMP certification from the U.S. FDA and the EU Code Assignment of Quality, permitting its products to be sold in these international markets. It has also achieved the ISO 9001 quality management system standards certification and the ISO 22000 certification for quality in food safety. The Aquaculture Certification Council, Inc. certified that HQS tilapia farming and processing standards met Best Aquaculture Practices and Moody International Certification Ltd. The Company’s certified co-op farming and processing are in conformity with the new Global G.A.P., the Global Partnership for Good Agriculture Practice, standards for Tilapia. The Chinese government gave organic certification to the Company’s tilapia processing, production, labeling, marketing and management system.

The HQ company experience is at the high end of what may be required of major aquaculture companies operating in China in the future, certainly over the 10 year time frame of further development laid out by CAPPMA. But what of the many smaller companies and individual farmers that have contributed to the growth of this industry? And what of at least some of the larger businesses that are probably operating somewhere well below the high sustainability performance level by comparison to the ideals of existing regulations and certification? Or companies that are selling into markets that are less demanding on sustainability concerns than the U.S. or the EU countries?

These three questions reflect the concerns of how to bring an entire sector first of all into the dialogue on sustainable development, and then into full compliance and, when appropriate, certification of their efforts. At least for some of the international

markets this has already been done by Chinese enterprises with respect to HACCP (Hazard Analysis and Critical Control Points) which is a self-analysis necessary for exporting seafood products into the U.S. If the obligation is there (whether by regulation or market imperatives), or if there is a sufficient market opportunity opened up by embracing tilapia certification then it will almost certainly happen within China. But it may take considerable time.

The U.S.-based Sustainable Fisheries Partnership, which has a sustainable tilapia program in China under its Aquaculture Improvement Partnership (AIP is “an alliance of buyers, suppliers and producers”), sees a great need for capacity building, including mechanisms to improve the livelihoods of small-scale producers. The objectives of the partnership are to:

- Convene producers to reduce potential risks associated with tilapia farms in the natural environment and to prevent their introduction in pristine water bodies.
- Improve tilapia aquaculture management and compliance with eco-label standards.
- Create an environment where different stakeholders (producers, processors, exporters, etc.) can discuss and work together towards the sustainability of tilapia.
- Assist buyers in developing procurement policies.
- Improve small farmer capacity to achieve sustainable farming.

This initiative is being undertaken first in Hainan, with work already underway. A number of lessons learned are useful to consider. These include: importance of involving key stakeholders; collaborating with local institutions; taking into account regional or other characteristics; recognizing the value of demonstration farms; and taking into account fac-

tors such as extreme weather like the severe storm that impacted south China tilapia operations in 2008. Hopefully the AIP effort will be helpful to linking smallholders into the broader picture of sustainable aquaculture. Many more such efforts will be required, given the number of farms and processors in local areas of south China. This will require the involvement of local governments and the relevant national agencies including the Ministry of Environmental Protection, the Ministry of Agriculture and others.

For the larger operations, especially those involved with export operations, the role of CAPPMA to promote sustainable aquaculture should be helpful, but a more concerted and visible effort on the part of individual companies is needed, especially vertically integrated operations that include several components of the market supply chain. The major companies should consider taking an active role on introducing the new tilapia certification standard within China. This could be useful in ensuring “branding” of Chinese tilapia aquaculture as sustainable in the seafood markets of the world. And it could help to align the industry with the government’s goals of seeking green economic growth. WWF-China could be a helpful partner.

Also important is creating awareness on the part of Chinese consumers of the desirability of purchasing eco-certified aquaculture products. Tilapia is not by any means among the most favoured fish within China, and there is a desire on the part of industry to stimulate demand, especially for frozen fillets. If tilapia is perceived as a product that is cultivated in an environmentally sustainable fashion it might help to stimulate domestic sales.



This consumer awareness-raising should be left mainly in the hands of the aquaculture industry, if possible, but it will require leadership, by companies and by associations such as CAPPMA.

The third question, pertaining to Chinese aquaculture products being sold in poorer countries, and very likely also pertaining to the conditions for investment in tilapia aquaculture ventures in Africa, Latin America, and other parts of Asia, should be addressed through national-level policies. Obviously it would not be in China's interests to sell really low-grade food products to anyone. However, it may be difficult to differentiate between products that have a large environmental impact and those that have been produced sustainably unless there is adequate traceability and other safeguards associated with certification or other reliable market mechanisms. In the case of tilapia products it would be ideal if there could be a simple standard set that would provide for basic product quality and some recognition of basic environmental conditions being met in the production and processing stages. This approach would not be as comprehensive on sustainability matters as the WWF standard.

That China will need to look abroad for siting some of its future aquaculture growth is almost a given. There are not enough suitable land and water resources to accommodate the likely future growth of freshwater aquaculture. Growth of tilapia farming will be affected unless there are opportunities to invest in pond development elsewhere in the tropical world. Such expansion should be done in an ecologically-sound way if China is to build a

reputation as a country seeking sustainable development. Thus China should be prepared to draw upon its best environmental management experience and best aquaculture practices in tilapia ventures undertaken in other countries. Such an approach will require guidance from government, understanding and diligent review on the part of the financial sector in China providing loans, lines of credit, and development assistance for foreign investment.

Overall, China's tilapia aquaculture is now one of the highest profile fishery activities in the world today. It has achieved a level of economic success that now must be safeguarded by creating a sustainable development approach that reaches both smallholders and large operators. The regulatory framework within China to address this challenge is quite extensive, and the means to provide assurance via international standards and indicators is also at hand. Thus considerable progress towards sustainable tilapia aquaculture should be possible over the coming period of the 12th Five Year Plan (2011-2015). Without such progress it is likely that some markets will weaken, especially in North America and Europe where sustainability questions about Chinese tilapia products are likely to be raised, as they have been in the past.

COD MARKET SUPPLY CHAIN ANALYSIS

Cod (*Gadus morhua* in the Atlantic, and *Gadus macrocephalus* in the Pacific) has long been one of the most heavily utilized whitefish in western seafood markets. Cod's long-standing top rank in the EU's whitefish supply was usurped by [Alaska] pollock (*Theragra chalcogramma*) only in 2008 when 906,000 t of pollock and 849,000 t of cod were imported. Nevertheless, cod remains the highest value whitefish species by a substantial margin (generally double the price of pollock). China is the largest supplier of frozen wild-caught whitefish fillets to the EU market contributing 36 per cent of the total supply. However, due to recent, strong growth in the market for *Pangasius* (a species of farmed catfish), Vietnam surpassed China as the leading supplier of whitefish to the EU in 2008. Although these statistics indicate that cod, pollock and *Pangasius* are all important species to China's fish processing trade, the depleted status of several cod stocks suggest that this species is of greatest concern from an ecological perspective. China's supply of cod for processing derives from stocks in four major fishing grounds (northeast Pacific, northwest Pacific, northeast Atlantic and northwest Atlantic). The status of these stocks range from severely overfished to resilient. A highly summarized profile of the global cod situation and China's role is shown in Table 2.

Based on the IISD Global Market Supply Chain analysis, a diagram has been prepared for China's import, processing and re-export of cod. It is a complex set of supply chains, in fact, with points where there are already some Marine Stewardship Council certified fish being delivered and processed in China. But

there also are some raw materials shipped to China that are likely taken from IUU fisheries. There are many problems of traceability and practical difficulties for downstream final processors in countries abroad being able to make accurate statements about the sustainability of supply for the semi-processed products coming from China. It is clear that improvements are needed and these will require international cooperation within the seafood industry, and by government.

Chinese laws and regulations relevant to the supply chain for cod include customs regulations applied by the China Customs Administration. These regulations specify the requirements for import documentation and clearance, i.e., the certificate of origin, and regulations and procedures for auditing product yields for the purposes of duty assessment. China classifies all processed fish products as being "products of China" if the value added during processing increases by ≥ 40 per cent or the four-digit tariff code heading changes, e.g., from 0303 for frozen fish to 0304 for frozen fillets. While this policy has attracted some criticism on the basis that it could serve to conceal the true origin of IUU-derived fish products, it has been advocated by many countries as appropriate. The extent to which China's fish processing industry would benefit



TABLE 2: COD PRODUCTION AND TRENDS

COD (GADUS MORHUA AND GADUS MACROCEPHALUS)

Global Production

Two species of cod comprise the majority of global production: Atlantic cod (*Gadus morhua*) and Pacific cod (*Gadus macrocephalus*). Both species are temperate, pelagic whitefish caught primarily by midwater trawl. Currently catches of Atlantic cod are roughly 775,000 t per year with the major fisheries conducted by Norway, Russia and Iceland. Pacific cod catches currently total approximately 332,000 t primarily by U.S. fleets with considerably smaller catches by Russia and Japan. Yield ratios for fillets are slightly less than 50 per cent. A portion of the U.S. Pacific cod fishery (116,000 t) and a small segment of the Norwegian Atlantic cod fishery (5,000 t), both of which are longline fisheries, are certified under the Marine Stewardship Council (MSC) Ecolabel.

China's Role

China processes 110,000 t of cod products for the European Community and U.S. markets. This amount equates to approximately 15–20 per cent of the global catch. Although cod are primarily imported to China for processing and re-export, a small amount of product likely remains in China for consumption. Although cod is undoubtedly a major processing trade species, the reliability of China's trade statistics for cod may be compromised by mixing of cod and pollock under the same commodity code. There is a small cod fishery in China's Yellow Sea (21,000 t per year). These fish are consumed domestically.

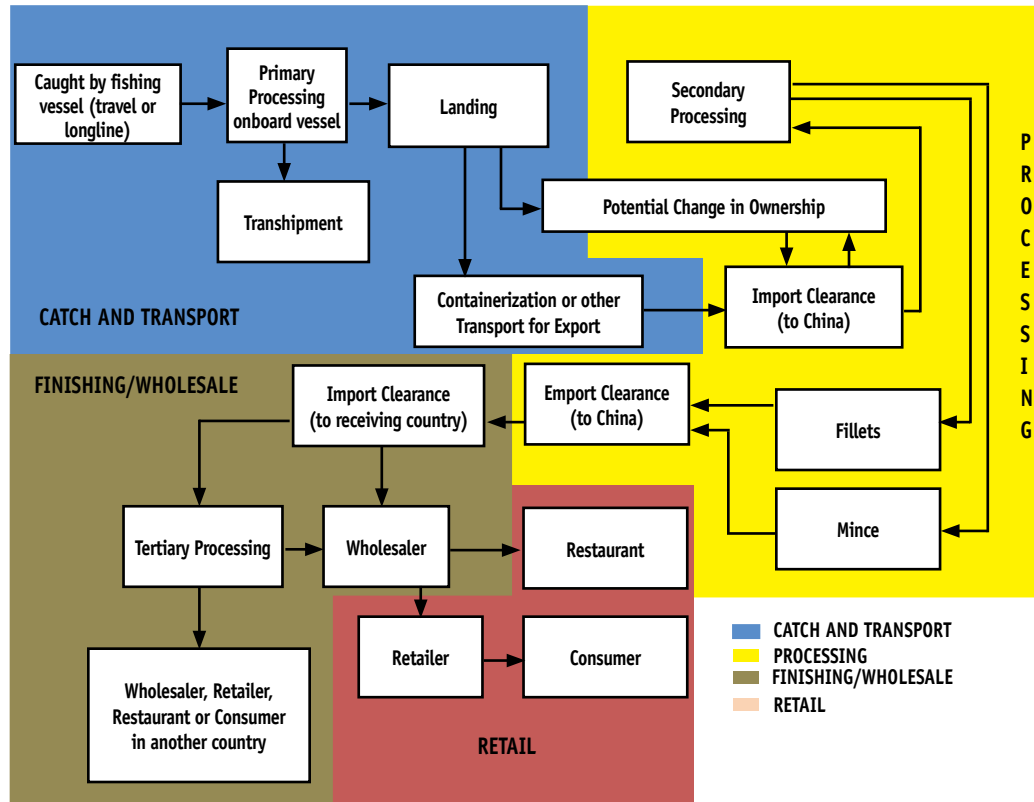
Current and Future Trends

Atlantic cod catches peaked in the late 1960s at nearly 4 Mt but have collapsed to roughly 20 per cent of that level. Pacific cod catches have declined slightly from levels of over 400,000 t in the late 1980 and early 1990s. Pacific cod is considered to be resilient to fishing pressure. Small quantities of Atlantic cod (≤ 14 t) have been farmed in recent years but several major producers are struggling or have closed down.

Key Drivers

NGOs' consumer campaigns may have dampened demand for cod by highlighting problems with IUU fishing and stock declines. A few Atlantic cod fisheries appear to be rebuilding and have applied for MSC assessment. IUU fishing for cod in the Barents Sea has been successfully combatted by NEAFC port State controls. Limited incidents of circumvention of these port State controls by landing in China have been reported.

FIGURE 3: CHINESE IMPORTATION AND PROCESSING OF COD



from, or be disadvantaged by, a change in World Trade Organization (WTO) rules of origin which might force China to modify this current practice remains to be assessed.

Regarding sanitary issues, the China Administration of Quality Supervision Inspection and Quarantine (CIQ) and its regional China Inspection and Quarantine Bureaus are responsible for sanitary checks of imported materials for processing and outgoing finished products (exports). CIQ is also responsible for day-to-day auditing of processing facilities. CIQ's traceability systems and tools are developing rapidly and already represent a solid foundation for documenting the origin of processed fish materials back to the original imported shipment. However, their primary focus is food safety, and a recent decision to create a new system in response to the EU's IUU fishing regulation to be managed by the China Bureau of Fisheries.

The responsibility for maintaining documentation of the origin of China's fish raw materials back to the Chinese fishing vessel, as required under the EU IUU fishing regulation and under catch documentation schemes, has been assigned to the China Bureau of Fisheries (BOF). The BOF is responsible for validating the catch and trade documents accompanying imports of these species to China. BOF is also the lead agency for ensuring that catch certificates are provided with all fish shipments imported to China for processing, and for ensuring that these certificates remain linked to the product up until the point at which they are exported from China. It appears that BOF, through its non-governmental coordinating body CAPPMA, is in the process of implement-

ing a tracking system similar to that currently employed by the China Customs Administration for tracking product yields. Since the system was fully implemented on January 1, 2010, it reduced the IUU fishing products going into China for re-export processing effectively.

There are no multilateral treaties specifically relevant to the trade of cod into China for processing. Management of cod stocks is the responsibility of RFMOs such as the North Atlantic Fisheries Organization (NAFO) in the northwest Atlantic; the International Council for the Exploration of the Sea (ICES) and Northeast Atlantic Fisheries Commission (NEAFC) in the northeast Atlantic; or of national authorities (e.g. in the North Pacific where the governments of Russia, the U.S., and other countries manage cod stocks in their respective EEZs). There are two voluntary initiatives by industry to combat IUU fishing for cod in the Barents Sea and in the Baltic Sea. Much work remains before the majority of the world's cod stocks could be certified as sustainable.

The Marine Stewardship Council's (MSC) sustainability certification program requires strict chain of custody standards to be upheld, and there have been some incidents of facilities in China having their certificates withdrawn due to non-compliance. However, in principle, since CIQ's traceability system requires the same basic principles as the MSC, there should be no fundamental problem for Chinese processors in complying with the MSC's eco-label chain-of-custody requirements. Some China-based fish processing operations are accredited to the British Retail Consortium's (BRC) food safety standard. While this is an important step toward ensuring quality, this standard does relate directly to sustainability issues.



There are a number of important conclusions from the case study, starting with traceability needs. China's role is a mid-chain one, since in most cases it is neither harvesting the fish nor consuming it. The key sustainability issue for China therefore seems to be the extent to which China's handling of the fish allows full traceability between the fishery and the consumer. Establishing such traceability allows for market preferences for sustainable products to be transmitted through the supply chain to encourage sustainable harvesting practices. The lack of such traceability breaks the linkage between markets and fisheries, and negates the value of any sustainability policies put in place "downstream" from the point of extraction/catch.

At the moment there are two separate traceability systems operating in China: the sanitary system managed by CIQ and the new EU catch certificate scheme managed by Bureau of Fisheries (BOF) delegated to CAPPMA. These systems do not appear to be closely linked. The sanitary system is covered in detail in a 2009 TRAFFIC report. The new EU catch certificate scheme is well understood from the perspective of the EU requirements, but, because it has only been in operation for a relatively short period, the procedures used by China to comply with the EU requirements may require adjustment. This will require thinking that goes beyond merely satisfying the requirements of the EU catch certificate scheme.

There are many sustainability issues which are not necessarily covered by this scheme since it is aimed only at establishing legal provenance based on confirming that the fishing vessel was properly licensed. In addition, there are many imported fish raw materials which are not subject to the EU catch certificate scheme. By focusing only on the EC requirements, China leaves itself open to a range of accusations of "laundering" illegal or unsustainable fish, as was the international criticism several years ago concerning Patagonian toothfish processed in China from fish taken in Antarctic waters.

Beyond the EU catch certificate scheme, China needs to consider traceability requirements arising from Regional Fisheries Management Organizations (RFMOs) catch documentation schemes (tuna and toothfish), potentially CITES listed species (e.g., concerning the on-going debate about the status of Atlantic bluefin) and schemes developed by countries other than the EU, especially with regard to the U.S. China should also consider how to maintain traceability for certified sustainable fish which do not fall under any of the above regulatory systems. In all cases, the key point is to link documentation attached to the shipment at import to documentation attached to the shipment at export. While the provision and use of the information is not China's responsibility, this linkage clearly is. However, at present, the responsibility is split (or perhaps even duplicated) between different government agencies and it appears that some important information is being lost because of the lack of a coherent system to hold it.

Options for China to respond to current and future pressures for traceability of fish supply beyond documentation of legal provenance (e.g., exact species identification, more precise location of catch data, and fishery information such as gear type, etc.,) need to be explored. Recommendations should be made in a more fine-grained way, for example, related to fisheries from particular regions, particular fleets, and with greater identification of species. It will be necessary to improve statistical data gathering, and to work closely with the seafood processing industry and retailers who increasingly are concerned about traceability. As the CEO of one major North American fish processor mentioned during the latest global seafood conference held in Vancouver in February 2011, the coming five years will be a shift away from past practices and will place emphasis on the practices of the entire market supply chain.

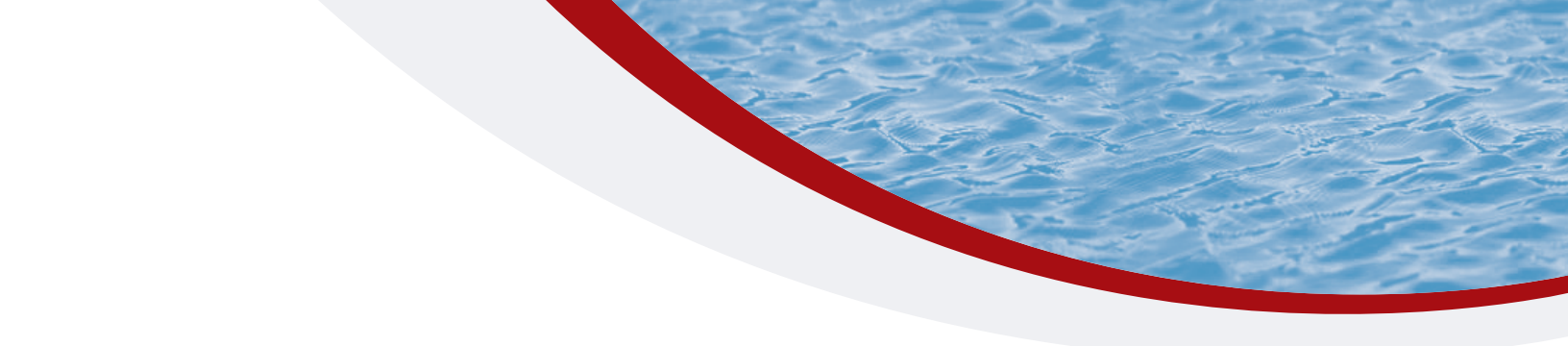
Chinese processor participation in sustainability certification needs to be increased. One of the areas for attention is increasing the percentage of MSC certified reprocessed fish handled by Chinese seafood companies. This is particularly a concern for sources from countries such as Russia. It is good that Barents Sea cod and haddock being caught by Russian ships for the Ocean Trawlers Group

have been MSC certified since late 2010. Chinese reprocessors could accelerate the demand for certification by setting goals for increases in amount of MSC certified fish, and also by expanding the range of processed fish types.

Improvements are quite urgently needed in the fish statistical data system. At the moment, many problems exist in the Chinese data gathering system, including misidentification of species, problems with accuracy concerning the amount of fish recorded (and the actual origin) and other aspects related to traceability. These are not problems that China can solve on its own, but because the percentage of the world's fish catch moving through China is so high, it is a strategically important country in terms of addressing these issues. It is important to do so for a number of reasons. First, it is essential in order to control IUU. Second, it is the fundamental way to address traceability and, ultimately, contribute to sustainable fisheries management. Third, better statistics will lead to greater confidence and credibility with partners in the market supply chains, especially as they face increasing scrutiny on issues of sustainable, responsible fisheries.

The improvements within China need to be done in a perhaps more coordinated fashion among different agencies, and in a way that not only meets immediate needs and demands from outside countries and bodies such as the EU, but also in a way that genuinely builds a capacity within China to extract the maximum value out of its information base. This should be considered part of the trend towards scientific development in China.





Statistical data gathering in international fisheries and in the movement of raw product, semi-finished, and fully-processed product requires a lot more co-operation among the international bodies responsible for such monitoring, and the actors directly involved in the supply chains. With modern data management tools, it should be possible to be much more precise about these transfers and the process should be much more open and transparent. China should consider a more proactive role because it is involved at such a large scale, and also because it is now developing skills and personnel probably beyond the level of many other countries. The question is, why bother? The answer is the same as for any other natural resource commodity. Knowledge of sources and accurate trading information can translate into security of supply and competitive advantage in export product marketing.

The social and economic benefits of fish processing for re-export need to be optimized. The remarkable transformation of the world's fish processing brought about by the efficient and inexpensive Chinese seafood processing industry has also brought employment to a substantial number of Chinese workers, even though the actual numbers are difficult to accurately determine. It is likely that the story is far from over. Indeed, it would be unfortunate for the industry if it should remain at the current level of sophistication and approach.

There should be considerable potential to move into arrangements where more complete processing takes place in China, with a broader range of value-added projects. This is in line with national priorities. It might also be possible to integrate the domestic market needs with

those of international trade, creating even greater scale than now exists. The advantage of doing so would not only relate to the financial bottom line, but could help to expand certification and other sustainability best practices to the domestic marketplace.

Another important matter is working conditions, pay scales and other socially-significant matters pertaining to large fish processing operations. These have not been receiving the same level of external scrutiny as some other sectors such as the electronic assembly plants and some other export-oriented industries. This could change at any time, but even without external drivers, workers will be demanding more in the years ahead—not only in income, but also improvements in health and safety, and amenities important for quality of life including those in the immediate environment of the work place. Making progress on such issues is necessary for the reprocessing industry to thrive.

Fortunately China has learned to turn what others might consider waste into revenue streams as products. Inedible fish parts are rather fully utilized, including skin, bones, oil, etc. This is a way to meet rising demand for fish meal, and for higher value products such as cosmetics, nutraceuticals, and chemical ingredients. It is a means to reduce pollution in the vicinity of fish plants.

But there is still room for improvements, including building pollution prevention rather than pollution control strategies, reduction in water use, better energy efficiency and consideration of how to implement low carbon practices. In line with priorities of the 12th Five Year Plan, fish processing plant operators should consider how their operations could meet environmental objectives that will help to meet targets for reduction of harmful nitrogen compounds, greenhouse gases, and other pollutants.

It is encouraging that Chinese large-scale fish processing, as exemplified by cod reprocessing has reached a stage where genuine environment and sustainable development progress is possible. It is a different industry today compared to a decade ago, and it is fortunate that despite much of the dismal international news about the state of ocean fisheries, there is evidence of the new models such as certification and traceability beginning to take hold, and of modern facilities in tune with the need of demanding markets such as some in the EU. This decade offers the opportunity to make a transition where processing of fish in China will expand and support the global effort for sustainable fisheries.

LIVE REEF FOOD FISH TRADE (LRFFT) CASE STUDY

The LRFFT supply chain study is quite different in nature from those described in the previous two chapters, involving the import of “live” coral reef fish species, especially grouper (family Serranidae) and snapper (family Lutjanidae), drawn from the Indo-west Pacific and certain parts of the Indian Ocean, but principally from the Coral Triangle (CT) countries adjacent to the South China Sea. One of the most important species is the leopard coral trout, which is extensively distributed and heavily fished. In some ways it is a proxy for many other species in the analysis. A summary of information about this species is provided in Table 3.

While LRFF are widely consumed in East Asian countries, they are most well known as a high value food for consumption in the restaurant trade, where demand has historically been concentrated in Hong Kong and southern China. Most LRFF enter Mainland China as re-exports from Hong Kong, but there is a growing trade directly from the producing countries to Mainland China. Moreover, the distribution of these fish within China is expanding northward rapidly and there are now burgeoning markets for LRFF in Shanghai and Beijing as well as a number of second-tier cities such as Chengdu. In addition, there is now a substantial aquaculture trade for some species, including fish cultured in Taiwan and exported to Mainland China. The Live Reef Food Fish Trade (LRFFT), while a comparatively small fishery in terms of volume, is a highly valuable fishery estimated to have a retail value of up to a billion dollars annually, according to WWF.

There has been considerable concern expressed about the sustainability of this trade. Much of

the concern emanates from the issue of destructive fishing practices such as the use of cyanide to capture fish, which cause collateral damage upon reefs and other non-target species. However it is the more common issue of overfishing, and particularly the capture and retention of juvenile or undersize fish, that poses the greatest threat to the sustainability of this trade.

The value added within the market supply chain in Hong Kong and Mainland China is at the retail level, since the consumption of these fish is extremely popular at higher-priced seafood restaurants, especially in Southern China and Hong Kong. The fish are consumed at wedding banquets and on festive occasions such as the Spring Festival. During periods of high demand, the wholesale price may rise to over 1400 RMB (about US\$200) per kilogram.

Historically, most LRFF have come from wild-capture, but with rapid improvements in breeding and farming technology there is an increasing volume of grouper and snapper species coming to markets from full-cycle aquaculture (FCA) production. While many of these culture operations are based in the CT countries, mainly Indonesia and Malaysia, Mainland China has started to culture reef fish (especially groupers), with an estimated

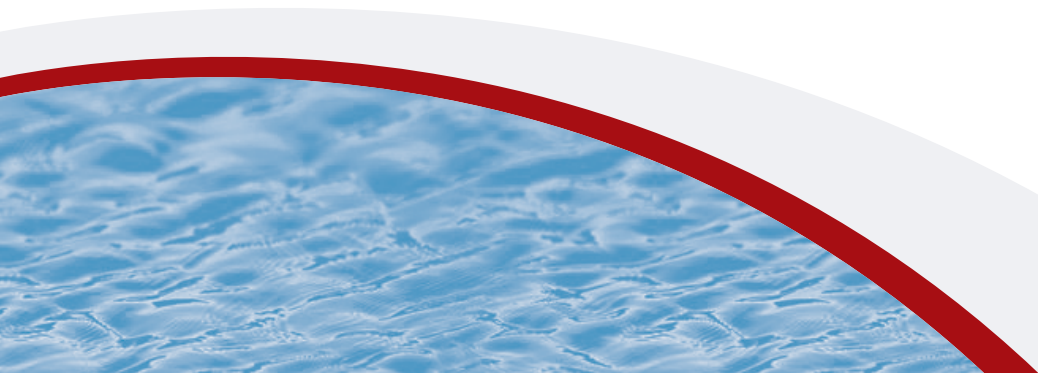




TABLE 3: LEOPARD CORAL TROUT: PRODUCTION AND TRENDS

LEOPARD CORAL TROUT (PLECTROPOMUS LEOPARDUS)

Global Production

This species (known by the common names coral trout, leopard coral trout, and leopard coral grouper) is found in reef habitats throughout southeast Asia and northern Australia. The only catch reported to FAO of leopard coral trout was 6000 t by Indonesia in 2000. However, as many of these fish are likely to be caught by small-scale, artisanal fishers in developing countries, reported catches are likely to be underestimates. The supply chains are characterized as long, complex, and with high transport costs controlled by dealers in Hong Kong.

China's Role

Commodity codes for Mainland China do not distinguish this species. However, it is estimated that about 60 per cent of the international trade in live reef fish transits Hong Kong, with about 50 per cent of this destined for Mainland China. The annual quantity and value of the trade through Hong Kong is estimated at 13,000-14,000 t and US\$400 million. Leopard coral trout comprised about half of the live fish reef traded during a Hong Kong survey in 1999-2003 with a wholesale price of US\$36 per kg (mid-to-high range among live reef fish).

Current and Future Trends

Leopard coral trout imports to Hong Kong increased steadily from 2000-2007 to over 3000 t per year primarily from Australia and the Philippines. Live reef fish fisheries in southeast Asia are considered to far exceed sustainable levels. With the exception of Australia, most fisheries lack appropriate control structures suggesting that sustainability is unlikely to be achievable in the short term.

Key Drivers

The International Union for Conservation of Nature (IUCN) Red List notes concerns for *P. leopardus* associated with declining catch rates and targeting of juveniles for "grow-out" operations, thus reducing spawning populations, as reasons for listing this species as "near threatened." Other concerns include destructive fishing techniques, vulnerable life history characteristics, and potentially increasing demand by Chinese consumers. There have been some experiments with this species involving use of coded wire tags to facilitate traceability.

50 per cent or more of domestic demand being met from cultured fish.

Efforts to reform and transform this trade have been underway for a number of years through various international bodies such as the World Wildlife Fund (WWF), The Nature Conservancy (TNC), Conservation International (CI) and national non-government organizations; enabling agencies such as the Asian Development Bank, Worldfish, Australian Centre for International Agricultural Research (ACIAR) and the Secretariat of the Pacific (SPC).

Despite ongoing efforts to reduce resource and environmental impacts, success has been limited and the LRFFT continues to pose major challenges to future sustainable use of this marine resource. There remains a need for a whole chain-of-custody approach that would support responsible fisheries capture and aquaculture through trade mechanisms and market-based initiatives. Various meetings, most recently an Asia-Pacific Economic Cooperation (APEC) sponsored gathering held in Bali in March 2011, have attempted to find solutions involving producers, traders and the LRFFT demand side. Several years ago a voluntary sustainability certification concept was proposed, but uptake to date has been nil. There are concerns that some species such as the humphead wrasse will become very scarce to the point of being listed as endangered


under CITES. At present, the grouper fisheries appear to be highly damaging to coral reef ecosystems, so that short-term income gains by fishers, traders and others may lead to longer-term decline and loss of livelihood.

STRUCTURE OF THE GROUPER SUPPLY CHAIN

To understand grouper supply chains, production must be examined from both wild-capture and aquaculture sources. Wild-caught grouper tend to be mainly harvested by non-Chinese national fishermen, but may be transhipped in whole or in part by Chinese vessels. For cultured groupers, China is the world's largest producer of "low-value" grouper species, almost all of which would be for domestic consumption but some aquacultured grouper species sold in China are imported.

The grouper supply chain for wild-caught species and for non-mainland China cultured product consumed in mainland China can be considered in two distinct stages. The first stage, which is well documented, is from the fishing grounds in source countries to the point of arrival in Hong Kong, which itself is a major consumer of LRFF. The next stage of the





supply chain from the point of entry into Hong Kong, via air or sea shipment, into restaurants in Hong Kong or for re-export into and distribution throughout mainland China is less well understood. The diagram provides a schematic overview of the various market supply chains. In the diagram, Coordinator describes the first collector of LRFF from the fisher and who usually operates at or near the fishing grounds, particularly when remote from major transit hubs, while Collector describes the second buyer who is responsible for transshipping fish to the point of export, and Exporter refers to the agent responsible for transporting LRFF to consumer markets.

Because many fishing grounds for LRFF are remote and distant from major markets, and supply chains are complex, custody of the fish will pass through many different agents before reaching their final destination, mainly restaurants. The market chain can be shorter in some countries than in others. The supply chain originates with fishers who catch fish using preferably hook-and-line but also other means including poisoning with cyanide and use of explosives. They sell their catch to coordinators and collectors who consolidate catches near the fishing grounds in holding pens (ranging from floating sea cages to land-based tanks).

Fish too small for market are kept in floating cages and “grown-out” until they reach marketable size (500–600 grams) while “good” size fish are transferred to hubs for export to demand markets, either by sea or air, with the mode of transport dictated by the opportunity to access air transport and the value of the fish. Based on available data, more than 70 per cent of all LRFF imported into Hong Kong are transported by air, although this is higher in some countries (e.g. Australia, Philippines) where nearly all LRFF exports are delivered by air. Proportions also differ by species, with more than 95 per cent of leopard coral grouper transshipped to Hong Kong by air as compared with around 50–60 per cent for lower value species such as Green and Tiger grouper. The reliability of these estimates is questionable, due largely to there being no requirement for Hong Kong registered live transport vessels to declare their imports. Despite the AFCD having a voluntary declaration system in place, it is regarded that estimates of LRFF imports into Hong Kong via fishing vessels capture only 30 per cent to 40 per cent of all sea shipments.

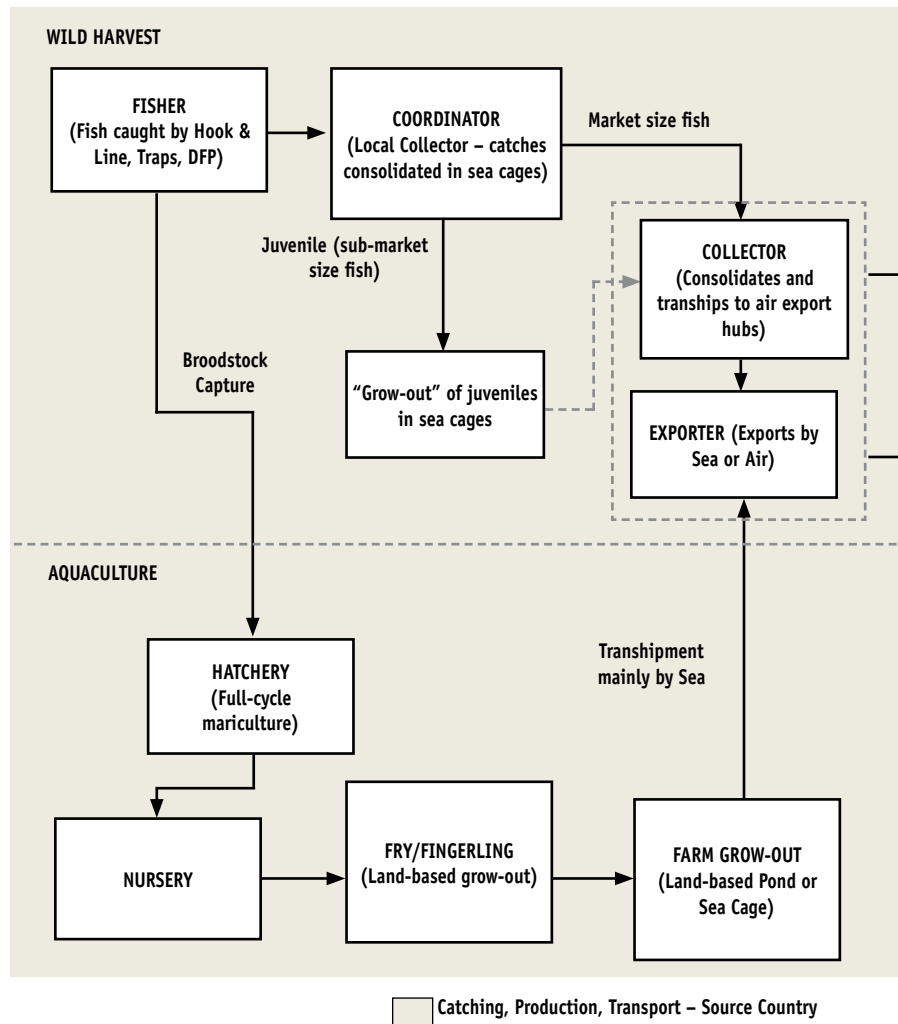
Those LRFF remaining in Hong Kong are reconditioned for further short periods before being passed onto wholesalers and retailers (e.g., restaurants) for purchase and consumption by a consumer at home or display in tanks before being purchased by the consumer. Those LRFF being re-exported to mainland China may be transshipped by air, by road or by sea, although sea transport is widely seen as the most widespread means of transportation.

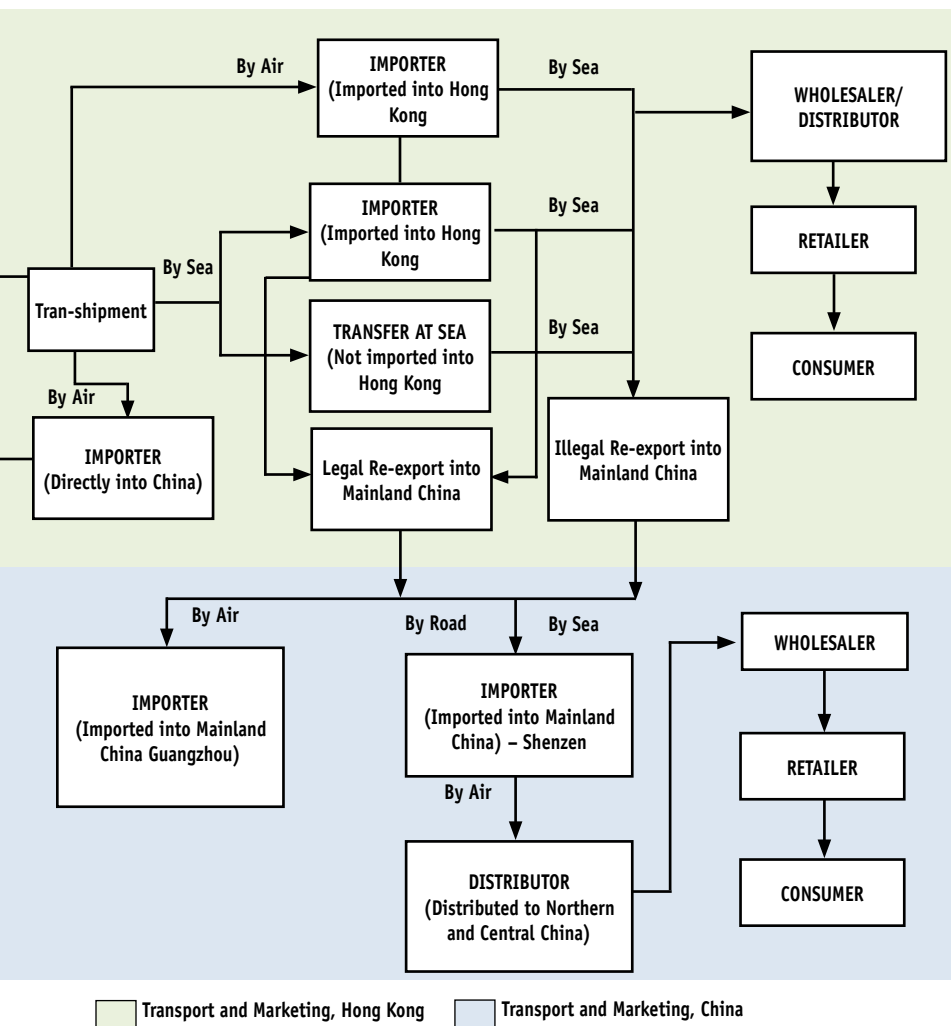
RE-EXPORT OF LRFF TO MAINLAND CHINA

The only known records of re-exports of LRFF to mainland China are retained by the Hong Kong Agriculture, Fishery and Conservation Department (AFCD). However these are considered to be unreliable estimates. Compounding the unreliability of these data is the route by which most LRFF are thought to enter mainland China. For those LRFF imported into Hong Kong, most are re-exported to mainland China using widely acknowledged informal or unofficial trading routes—transported by sea across the border to Yantian and then by road to Shenzhen before distribution throughout China (historically mainly to Guangzhou but increasingly to Beijing and Shanghai). Furthermore, there is an unknown quantity of LRFF shipped from source countries which are transferred at sea, just before entering Hong Kong waters, to vessels bound for mainland China.

According to the AFCD, official re-exports of LRFF to mainland China account for only 4 per cent of all re-exports, with the main destination ports being Macao and Chinese Taipei. However, market interviews conducted by WWF Hong Kong in Shenzhen suggest a somewhat different breakdown. Based on recorded imports into Hong Kong of roughly 3,600 t of leopard coral grouper in 2009, ap-

FIGURE 4: SUPPLY CHAIN COMPONENT LINKAGES FOR AQUACULTURED AND WILD-CAUGHT LIVE REEF FOOD FISH FROM SOURCE COUNTRIES TO HONG KONG AND MAINLAND CHINA





proximately 20 per cent of these can be accounted for from an estimate of trading volumes given by a small sample of traders in Shenzhen; suggesting that the estimate of 50–60 per cent of Hong Kong imports being re-exported to mainland China may be reasonable.

Trade agreements between Hong Kong and mainland PRC have meant lower tariffs on LRFF entering mainland China through Hong Kong than on those entering China directly. While China has now joined the World Trade Organization (WTO) and is entering into bilateral and multilateral Free Trade Agreements (FTAs), which will significantly reduce tariffs, these have yet to take effect, making Hong Kong still the most attractive option for trade with mainland China. Despite this, and with LRFF entering mainland China continuing to attract a tariff of 12 per cent, there remains a strong incentive to avoid this charge. At present, there is limited capacity to record and monitor such imports or trade between Hong Kong, China and mainland PRC,

and given the relative insignificance of the LRFFT compared with other traded seafood commodities (e.g., cod, pollock, tilapia, and shrimp), more needs to be done by Chinese authorities to eliminate these loopholes. At present, the traceability of product within China is difficult, especially in the rigorous fashion required for any type of sustainability certification.

The live reef food fish supply chain presents major challenges for shifting from the current practices to more sustainable approaches. The key unsustainable elements that need to be addressed are the following:

- Overexploitation of a number of species, often with fishing practices that have collateral ecological damage to coral reefs and to non-targeted species.
- Extensive IUU (Illegal, Unregulated and Unreported) fisheries throughout much of the vast Coral Triangle area.
- High demand and expanding trade of threatened species such as the humphead wrasse without adequate regulatory safeguards required under CITES.
- Substantial mortality as a consequence of some transportation methods between capture and the final marketplace.
- Capture of juvenile fish before they have a chance to reproduce, and the grow-out of these fish by feeding them other fish to fatten them to market size.
- High consumption of fish protein by aquacultured LRFF and other issues regarding sustainability of farmed groupers within China, while demand continues to rise in many parts of China.

Coupled with these sustainable development concerns is a set of difficult management, administrative and institutional matters for urgent attention. The three most important are:

- Significant gaps in statistical data and scientific information needed to fully understand the dynamics of reef fish stocks under various pressures and to accurately determine the magnitude of trade flows into the main markets, especially into China. These problems need to be tackled by producer countries and the importing countries, especially Hong Kong and China. Regional and global fisheries and environmental organizations, especially FAO, regional trade agreements such as those between ASEAN and China, China and Taiwan, and global trade bodies such as the secretariat of CITES could be helpful in setting out protocols for data gathering, and acceptable practices. The issues associated with IUU are critically important.





- Inability to implement sustainable development initiatives at the most strategically important points along the market supply chain and to secure cooperation from all the important players, including producers, traders, wholesale and retail operators. Entrenched approaches by the important players at all levels (production, trade and consumption) reward continuation of unsustainable practices for wild reef fish exploitation. Generally the players fail to engage on these issues in the broader context of either sustainable fisheries or sustainable trading arrangements. Awareness on the part of consumers in China and Hong Kong appears to be limited, so that pressures for sustainable seafood choices are markedly less than in western Europe or North America, for example.

This is where the proposed LRFF certification system that so far has not gained much support on the part of producers and traders could be extremely valuable. It would provide a basis initially for dialogue among the important members of the market supply chain, and eventually could serve as the basis for agreement on what constitutes a sustainable approach. It is likely that the impetus for a shift will have to come from non-governmental organizations, but it is necessary for both industry and government to participate.

- The optimal arrangements between the rapidly expanding aquaculture of reef species, including their food sources, and the existing reef fisheries need to be worked out in a fashion that is more sustainable

for both. There are major opportunities if a long-term sustainable aquaculture vision can be developed. This vision will include considerable science and technology investment, consideration of aquaculture expansion within China and also in some of the Coral Triangle countries, improved traceability of products, and mechanisms to ensure harvest of young fish and other resource management associated with reef fish aquaculture is kept within sustainable limits.

In the coming years the international dialogue about sustainable live reef food fish trade is likely to become much more intense. Certainly it will involve major international organizations, both intergovernmental and non-governmental, the Coral Triangle countries, and, of course, the governments of reef fish consuming countries in Southeast and East Asia. Much of the focus will be on the links in the supply chain, especially those between primary producers and entry into Hong Kong and China. These elements of the trading system do not appear to be well-prepared for a transition.

Thus the steps required for the move towards sustainability of reef fisheries and aquaculture should start with awareness-raising and action in the marketplaces where demand is greatest: Hong Kong and mainland China's coastal large cities and ports. The governments of Hong Kong and mainland China could move quickly to improve the statistical data systems to help close trading loopholes in ports of entry such as the limited reporting from ship landings. It is also possible to develop traceability and chain of custody systems for some of the most threatened species such as the humphead wrasse, as quantities are fairly limited, and mostly move by air. This will require cooperation from airlines so that they do not move shipments without adequate documentation of species, and eventually, of certification so that IUU products are eliminated. The good aspects of the Hong Kong statistical reporting system could be quickly adopted in mainland China, and improved communications between the two systems could reduce discrepancies of data that currently exist.

Already some chefs in international hotels such as the Marriott in Hong Kong are working towards assurances that their fish supplies are drawn from sustainable sources. This effort needs to be encouraged via trade associations such as the Chamber of Commerce in Hong Kong. But the effort will have to be extended on a much broader scale, and especially needs the cooperation and involvement of major seafood restaurant chains in mainland China.

Additional outreach to the Chinese public is needed. The objective should be to make consumers understand the relationship of catching and consuming LRFF with protecting coral reef, fish resources and biodiversity. Ultimately, the purpose should be to reduce growth in the consumption of wild captured LRFF. Reinforcing the publicity of LRFF resources protection can be done through print and broadcast media.

A globally-shared scientific and economic information platform of LRFF knowledge is urgently required. It should contain up-to-date information on catching, farming, supply chains and all other aspects of this sector. As the largest consuming nation of reef fish, China should be both an important contributor to and user of this knowledge. It would be useful for a future meeting of key scientists, NGOs and others concerned about these fisheries to take place in mainland China.

The trade agreements China has put in place bilaterally and multilaterally (e.g., ASEAN-China) are opening freer trade on many items, including fisheries. It is important to bring in concrete measures for sustainable resource use and traceability for both food safety and ecological sustainability either within the agreements or in parallel with them. So far this has

not happened for reef fish trade. Certainly a robust LRFF trade certification arrangement worked out by stakeholders would provide a good basis, even if it operates on a voluntary basis. The number of traders and wholesalers is quite limited, even though there are thousands of individual producers. The existing effort on trade certification is stalled and needs to be restarted. It was based on the model that has proven useful in other settings, including the Marine Stewardship Council, the Marine Aquarium Council, and others such as the Roundtable on Sustainable Palm Oil certification.

It would be strategically valuable to initiate a roundtable process, endorsed by the Government of China and by national governments of the Coral Triangle countries in order to develop certification for living reef food fish trade (LRFFT). Simultaneously, it is possible to consider possible action in trade forums such as the Committee of Parties for CITES, and in regional trade discussions. So far there has not been full agreement within CITES to accelerate the pace of action for protecting humphead wrasse, as requested by Indonesia. This deserves further attention from both consuming and producing countries.

The opportunity to develop a sustainable, healthy farming mode of LRFF should not be lost. By rationalizing the farming density, improving feeding mechanisms so they are less dependent on harvest



of small fish, and standardizing transport operations that minimize losses, reef aquaculture can progress to a more sustainable basis. It is important to strengthen research efforts such as seeking further breakthroughs of artificial propagation and for developing vaccines to prevent fish diseases. Perhaps it would be possible to develop a domestic certification system that would emphasize higher quality of aquaculture products, and thereby reduce the price differential between farmed and wild fish. If so, this might take some pressure off wild stocks. Certainly a good approach to protect LRFF resources is to have high-standard aquaculture models of LRFF. Encouraging Chinese investment in overseas reef fish aquaculture in the Coral Triangle countries is likely to be worthwhile in the future.

The steps outlined above all need to be initiated over the coming three to five years, but action should be started as soon as possible since consumption growth is likely to continue over the coming decade, even if wild supplies are unsustainable. It will be a difficult undertaking because the supply of wild fish is so dispersed. But the market supply chains are quite limited in terms of the number of actual traders, ports of entry and final destinations of products. It is thus possible to transform this system into one that is far more sustainable than at present.

CONCLUSIONS

China's fishery and aquaculture sector leads the world. Whatever the directions of China's future expansion of production, import and export, and domestic consumption, it will affect the potential of global aquatic resources to become sustainable in their use and regeneration. The great range of products, the success with aquaculture (which now exceeds fisheries in scale) and the ability to create a great variety of market supply chains in an adaptive fashion are positive signals of a dynamic development capacity in China's aquatic resource exploitation. The economic result has been important, since

millions of livelihoods have been maintained or added in the last two decades of expansion into aquaculture and fish processing and reprocessing for export. China has been able to add value to its fish products, with high utilization rates of caught fish ("there is no such thing as trash fish in China"), and by extracting novel products such as ingredients for cosmetics and medicines from aquacultured species. The fundamental question is whether the exponential growth can continue. China is already experiencing limits as to what it might expect to harvest from the sea, lakes and rivers, and from the flooded lands and other areas where aquaculture takes place.

The answer to this question lies not only in ecological limits, including land, clean water and ocean space that is environmentally suitable and available for aquaculture, but also in the issues associated with the market supply chain, including trade and investment practices, and pressures arising from those seeking environmentally sound practices in resource use, or seeking limits for a variety of other reasons. We could not explore all of the important factors likely to affect sustainability of China's aquatic resource systems and market demands such as, for example, the growing demand for fish meal and bait-sized fish for aquaculture, or a workable path towards reduction in shark fin consumption in order to halt the alarming decline in global shark populations. However, clearly there are lessons to be taken from the analysis of the three market supply chains.

In the main report we identified 17 sustainability criteria that might be used to provide some guidance as to whether activities in the living aquatic

resource sector were following a sustainable path. It is doubtful that any country could claim success in fully meeting these criteria at the present time. The health of the oceans is believed to be under growing threat, and there are no real boundaries to this threat. Nor are there boundaries to the transfer of aquatic resource products. No matter how remote the fisheries, there may be a good chance that its products will end up in China on the way to a final consumer destination. This movement can be an impediment to sustainability, especially when, as so often happens, the catch is from an illegal, unregulated or unreported source. In aquaculture there may be greater hope for accurate traceability, but the rapid growth of this sector strains ability to manage many of the issues of intensive cultivation. Furthermore, international development of appropriate standards and certification is still at a relatively early stage, and where they are available, as now is the case of tilapia, uptake by producers and traders has not been great.

The formal international trade rules affecting aquatic resources, while providing quite good safeguards for health and safety, especially for export products sent to some rich parts of the world such as the EU, U.S. and Japan, are still lacking when it comes to addressing environmental and ecological sustainability. The issue of fisheries subsidies, which are highly damaging in terms of overfishing, is still unresolved at the level of the WTO. There has been limited ability to resolve matters such as overexploitation of threatened or endangered high economic value

species (e.g., the coral reef groupers examined in this study) by turning to the Convention on Trade in Endangered Species (CITES) for support. And regional fisheries management organizations have had difficulty limiting unsustainable levels of fishing for bluefin tuna and other luxury food items from the sea.

These examples are cited to give a sense of how widespread and serious the problems of sustainable market supply chains have become, and of how solutions are needed that involve the most significant components in the supply chain if there is to be real progress. It is for this reason that China is now perceived to be the most important link in the chain. Not only is the country so involved, but it has the means and, very likely, the will to create positive changes.

The Government of China has clearly stated its aspirations to accelerate action that will support an improved environment and development relationship in order to achieve an environmentally friendly society. It wishes to tackle ocean environmental issues, to make fisheries sustainable, and to protect biodiversity. The Government is well aware of the pollution problems in lakes, rivers, and coastal areas, including the implications for aquaculture. It is also aware of





the issues associated with destruction of wetlands and other natural aquatic habitats by land reclamation. Thus there will be ongoing pressure to reduce pollution from fish ponds and fish plants and to protect important ecological habitat. These measures should help to restore and safeguard aquatic habitats, which are often among the most threatened ecosystems. As well, there appears to be an extensive body of laws and regulations that, if well applied, could support sustainable development for fisheries and aquaculture.

When it comes down to how well the environmental protection system is working for securing the environmental security of aquatic resources, the picture is not very clear. Certainly there are excellent models of aquaculture, with integrated environmental management capacity; and also seafood processing facilities capable of handling certification demands of many types, especially in the reprocessing sector. Yet these are not the norm. Monitoring for compliance with the many aquaculture regulations certainly occurs, but the need is great, and capacity likely quite limited at the level of small farms. There is limited transparency in the statistical system for fish processing, and significant problems with

accurate documentation of species and other necessary information for traceability to be possible for many of the most significant types of supply chains, including the two oceanic supply chain studies examined (cod and live reef food fisheries).

China needs time now for ecological stewardship to catch up after the frenetic economic growth of the past two decades. Not only is this essential for creating better sustainability in its aquatic resource supply chains, but also for building better communication on sustainability issues with consumers and within the aquatic products sector. Fish and other forms of aquatic products form a basic, relatively low cost component for food security in China, but also increasingly are part of the luxury trade in food—high end products for which demand rises with scarcity and cost. In between, domestically and in the market places of the world where Chinese-processed aquatic production ends up, are many opportunities for increasing value-added, sustainably certified products.

In the effort required to make the transition to sustainable fisheries and aquaculture two important points should never be overlooked: (1) the effort can be staged over a period of time that allows for learning and pilot efforts, starting with simpler or more urgent needs; and (2) the effort should be profitable if accompanied by good communications concerning benefits to consumers (health, safety and quality) and to the environment.

RECOMMENDATIONS

The primary audiences for the recommendations from this study are policy-makers in the Government of China concerned about sustainability aspects of trade and investment, especially on topics related to fisheries and aquaculture, plus those directly involved in the industry, whether as producers, processors, traders, financiers or industrial associations. In addition, the various stakeholders in China and internationally such as non-governmental organizations, and international bodies and research organizations may find the recommendations helpful in guiding their interests and work.

The recommendations are oriented towards policy needs, and in the interests of keeping a focus on a select group of high priority, practical and implementable suggestions, their number has been kept reasonably small.

1. The Government of China should set in place a robust long-term sustainable fisheries and aquaculture trade policy governing both domestic aquatic production for export, and imported seafood intended for domestic consumption or for reprocessing for export.

China's success in expanding its fish and aquaculture production and processing carries with it new levels of responsibility for ensuring sustainability of products whether for domestic or export markets. This includes consideration of internationally-defined objectives such as reduction in illegal, unregulated and unreported (IUU) sources of aquatic products; addressing pollution from processing facilities, aquaculture and other sources; and harm to marine and aquatic ecosystems and species as a consequence of harvesting or other activities.

Sustainable trade policy should address these and other problems at critical points in the market supply chain using a combination of regulatory and market-based approaches. These approaches may include improved enforcement of national and international conservation and environmental measures, economic instruments to limit participation and catches, and compulsory or voluntary certification systems such as those now in use for cod and other species through the Marine Stewardship Council and the proposed standard for tilapia cultivation. The sustainability trade policy should also take into account stepped-up action for conserving threatened or endangered species via the Convention on International Trade in Endangered Species (CITES), including some shark species and coral reef fish intended for live reef trade.

Greater attention needs to be paid to sustainability concerns for trade in fishmeal, fish oil and other products in feed for aquaculture. These concerns include overfishing of small pelagic fish species, excessive amounts of bycatch taken in order to meet demands for aquaculture feed, and harvest of juvenile fish as fish food for high value aquacultured fish such as groupers. It is important to note that further promotion of efficient omnivorous feeders such as tilapia into world markets is a means of reducing pressure on fish protein sources could be part of a Chinese sustainable fisheries and aquaculture trade policy.





An aquatic trade policy for China should address five significant elements:

- (1) Promotion and stronger support for sustainable fisheries and aquaculture initiatives within international trade agreements such as the WTO, via regional fisheries agreements from wherever China catches or sources aquatic products, and through the FAO initiatives for responsible fisheries and aquaculture.
- (2) Improvement of quality and sharing of information regarding the presence and impacts of unsustainable practices and policies within market supply chains.
- (3) Formulation of a strategy for branding China as a source of safe, healthy and environmentally responsibly aquatic products. For this branding effort to be successful, policy (e.g., for incentives) will be needed to stimulate aquatic products industries into greater participation in strategy implementation of the strategy.
- (4) Link aquatic product sustainability trade objectives with 12th Five Year Plan objectives for environmental improvement, for example, with those for improving freshwater and marine habitat protection, for sustainable aquaculture and for fisheries conservation, and for fish processing pollution reduction. More generally, this link should be made for low carbon economy, energy intensity reduction and greenhouse gas reduction as well.
- (5) Improve sustainability guidelines and, as necessary, regulations that cover Chinese trade and investment abroad for fisheries and for aquaculture.

2. Work collaboratively to set in place enabling policies for fisheries and aquaculture sustainability certification covering a range of aquatic products starting with products entering export markets and eventually covering domestic consumption as well.

The move towards sustainably harvested, produced and processed aquatic products is gaining world-wide momentum, and China will benefit from being proactive. To do so will require consideration of accreditation arrangements that are compatible with Chinese interests and needs but also meet international standards. Some Chinese fish processors are already taking Marine Stewardship Council-certified products for export-oriented reprocessing, but in general the level of participation needs to be accelerated and additional species such as tilapia added.

The enabling policies could include a clear statement by the Government of China concerning the need for and desirability of Chinese aquatic products industries to participate in reputable certification schemes; establishment of incentives for early acceptors of certification; an accreditation and auditing policy to ensure that certification systems used within China are credible; and promotion of certification as part of the branding of Chinese export products as sustainable.

While sustainability certification initially could be oriented mainly towards products exported from China, eventually certification should also be considered for key products consumed domestically. It would be desirable to establish seafood certification pilot projects, for example in some coastal cities, or for certain types of fisheries such as the live reef food fish trade (e.g., groupers sold for the restaurant trade).

It should be emphasized that good certification demands accurate identification of the product and its origin, good traceability, and sustainability criteria that can be monitored. These points are covered in the next recommendation.

3. Develop a national sustainable fisheries and aquaculture traceability system for seafood and other aquatic products imported, produced or processed in China.

Good traceability and chain of custody arrangements are essential for credible market-based sustainability certification. The market-oriented systems now in place have been developed through roundtable mechanisms that bring together the stakeholders, industry representatives, governmental bodies and scientists. The elements of the specific certification systems are detailed and auditable at the level of individual stocks as well as market supply chains.

In the Chinese situation where the potential number of sustainable certification systems eventually could become quite large, the following become very important: to build more complete data systems with better information on individual species and stocks; better information on catches of Chinese distant water fleets; closer cooperation with international bodies to ensure accuracy and compatibility of data; and efforts to close loopholes through which aquatic products enter the country with inadequate identification.

Thus, as part of developing the national traceability system, consideration should be given to a thorough overhaul of the national statistical data gathering for fisheries and aquaculture in order to provide more accurate information and to make it more relevant to trade and sustainability considerations.


Another important part of traceability is constructing good channels for information flow and communication regarding topics such as IUU-sourced materials, accurate naming of products being imported or exported, and verification of chain of custody. These appear to be matters of pressing concern for some supply chains, including some white-fleshed commodity fisheries, and for some of the boat-shipped live food fish supply chains, for example. It is a reason for the strong interest expressed by groups outside of China for greater engagement with China on fish and aquaculture market supply chains.

Traceability is, of course, an essential part of quality assurance systems for health and safety considerations of aquatic products. It will be useful to link policies for environmental and sustainability traceability with these other considerations in order to avoid unnecessary duplication of effort, and to reduce costs.

4. Create a sustainable aquaculture policy at the national level with considerable capacity development for regulating and managing future growth. Such a policy would help to safeguard the reputation and quality of products exported from China as well as Chinese aquaculture investments elsewhere in the world.

The great success of aquaculture in terms of its current rapid growth in quantity and range of products also raises expectations concerning its future role in rural development, food security, and the national economy. China now has more experience with aquaculture than probably any other country in the world. Sharing that experience with others for example in other parts of Asia and Africa is likely and will require policies that optimize benefits for both China and other countries hosting Chinese investments in aquaculture abroad. Domestically, there





is a need to consider how much consolidation is needed to optimize production systems for efficiency and use of inputs, to improve environment, and to maximize social benefits locally. This is an important topic for trade products such as tilapia, since limits will otherwise be reached on the ability to increase exports of this commodity trade.

The trade and investment implications of a sustainable aquaculture policy are quite considerable. They include matters such as the possible roles of genetically modified organisms (GMO) in Chinese aquaculture; science and technology advances required for reliable sources of young animals, disease control with minimal use of medications, food conversion, improving water quality, control of invasive species; and maintaining markets and the competitiveness of Chinese products.

Capacity development is essential and in line with policies for scientific development and for a science-based economy.

5. Set in place policies for containment of growth, substitution of existing products, and other means to avoid further ecological and conservation damage arising from luxury imported fish products from species believed to be in decline in areas outside of China.

Extremely high value imported seafood such as shark fin, some live reef fish used on festive occasions or in very high priced restaurant meals, some tuna species, and rare crustaceans are examples of products that are threatened—but where demand is still rising in the Chinese marketplace. Such products will become even more valuable as they decline in abundance, and therefore require special attention in trade policies. If trade continues to grow in such circumstances, it likely will be at the expense of China's sustainable development reputation.

To change the situation will require policies and actions for awareness-raising that may take years to be fully effective. This is a task that cannot be done by government alone but requires participation by individuals well known within China to take a personal stand on such products and who are prepared to campaign with peers as well as the general public.

The Government of China is in a position to address the subject of unsustainable luxury seafood consumption in a variety of policy ways. One is to work closely with producer countries to reduce or eliminate IUU fishing of threatened species (an example is the humphead wrasse). Another is to shift effort away from fish and shellfish stocks that are in decline and substitute species that are more abundant or develop aquaculture of the threatened species. While this happens at present for some scarce types of seafood, it is not totally successful, and other methods are needed as well. Generally the situation will be aided by policies that promote stronger international cooperation and improvements to transparency, monitoring and reporting.

6. Ensure that trade and competitive advantages associated with sustainable development of marine and freshwater Chinese products are identified and realized through effective working relationships of government and industry.

China's overall approach of seeking a low carbon economy, promoting resource efficiency, and generally building a stronger environment and economy relationship provides a macro-policy framework that should provide future competitive advantage of value to sustainable aquatic resource development and trade. The concrete ways, however, should be carefully assessed and reinforced for each major product. This will require on-going research and development that is best done through joint efforts involving individual enterprises, industry associations and government bodies including MOFCOM, the Ministry of Agriculture, and perhaps others.

