World Fish Supplies, Outlook and Food Security

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More people in the world to feed, rising wealth and a new focus on healthy foods are generating a rising tide of demand for fish. This rise in demand is happening just when the main sources of fish and other aquatic life are struggling to keep pace, and prices of many aquatic commodities are increasing. Fish is caught from natural or wild fisheries stocks, from enhanced and restored fisheries stocks and is cultured on farms. All sources of supply present economic opportunities but each faces major problems. Most natural fish stocks are heavily depleted already, and continue to be over-exploited because fisheries management is inadequate to counter the drive to exploit. Aquaculture has made great progress in some countries, largely driven by markets and specific innovations but ignoring externalities such as the environment, feeds and social equity. Stock restoration and stock enhancement show promise for some species and some environments but have received little development attention. Whether the poor will rise on or submerge under the tide of fish demand depends on how affordable fish remains, and what access they have to the means of fish production for income and livelihood. Policy, technical and business solutions are needed to help the poor meet the challenges. The solutions are location and country-specific, but advances should be sought on three fronts: (1) domesticating key species for aquaculture production systems and selecting good candidate species for restoring and enhancing stocks in the wild, (2) making fish trade, development assistance and fisheries cooperation strategies coherent to enhance developing country capacity to capture equitable benefits of fish trade, and (3) managing natural fisheries resources to restore them and make them sustainable.

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Introduction

For the world food outlook, one of the few points of strong consensus is that fish supplies are challenged. Most natural fish stocks are unable to sustain even their current productivity in the face of heavy fishing pressure and declining environment quality (Box 1). From these overstressed stocks we presently extract 70% of the fish and other aquatic resources we use directly for human food (about 70 of the 100 million metric tonnes (MMT) of fish eaten). The remainder of our fish come from aquaculture, a sector that is expanding rapidly but unevenly, and that also faces challenges.

The progress of aquaculture has been largely driven by markets and specific innovations, such as success in captive breeding of prawns, but ignoring externalities such as the environment, feed costs and sources, and social equity.

Most present forms of aquaculture are quite rudimentary when compared with fully developed agricultural practices.

Box 1. A sample of seminal papers from the last decade exposing the depleted state of world fisheries resource, the declining state of the aquatic environment and the links with aquaculture

- FAO fisheries status reports compiled for the 1992 Rio de Janeiro World Summit on Sustainable Development showed that only a third of major fish stocks were capable of sustaining greater harvests, about 40% were fully exploited and could not produce more without depleting the base stock and one-fourth were overexploited and would produce greater catches only if returned to a healthier state (FAO 1992a,b). The situation has not improved dramatically since 1992, as evidenced by detailed national fisheries status reports, e.g. Caton (2002).
- Pauly *et al.* (1998) reported that marine food webs, as well as those in the inland fisheries, have been altered so that now more of the fish are from lower on the food web. Myers and Worm (2003) gave further evidence of this by describing pervasive patterns of depletion of the large predator fish high on the food webs. Jackson *et al.* (2001) reviewed the history of whole-of-ecosystem changes, triggered by fishing over hundreds of years, to highlight the knock-on effects of fishing.
- Silvestre *et al.* (2003) demonstrated, with detailed data from eight Asian countries, that the coastal fisheries depletions are indeed widespread and deep.
- For the well-documented and collapsed cod stocks of the North Atlantic, a series of papers has shown in detail other features of these fisheries depletions. Before their collapse in 1992, the Canadian stocks began to mature at rapidly diminishing sizes and earlier ages (Olsen *et al.* 2004); in the North Sea, Beaugrand *et al.* (2003) found that rising sea temperatures since the 1980s had added to fishing stresses on cod and further reduced stocks by modifying the ecosystem of microscopic plankton on which the larval cod depended.
- Where data exist, marine and freshwater ecosystems are being shown to be more and more heavily impacted by greenhouse gases and land-based pollutants, e.g. a new hypoxic zone has just been identified off Oregon in the US (Grantham *et al.* 2004).
- On balance, aquaculture adds to world fish supplies but some aquaculture has negative impacts on fish supplies through its demands for fish in feed and through environmental modifications that destroy natural fish habitat and use wild fish seed (Naylor *et al.* 2000).

They often rely on unimproved breeds, seed collected from the wild or from newly captive broodstock, and are still experimenting with sustainable farming systems.

The 'third way' to potentially increase fish production is through artificial reseeding to the wild. The technology to do this needs considerable development for most species, although it is already very successful for some situations, such as freshwater fish in inland open water bodies in Bangladesh, many species of shellfish in Japan and scallops in New Zealand. Bell *et al.* (in press) recently reviewed the prospects for shellfish and concluded that few marine fish resources would likely grow through from the release of cultured juveniles, but that reseeding of shellfish holds considerable promise. At the same time, world fish demand is like a rising tide, creating real opportunities for fish producers and marketers, and often incentives for quick and unsustainable gains. The tide of demand is driven by a growing world population, greater purchasing power in many developing countries and mounting evidence and promotion of the nutritional benefits of fish (Choo and Williams 2003). Delgado *et al.* (2003) modelled the rising world demand for fish to 2020, using mainly population and income parameters. The healthy lifestyle drivers may push the demands even higher, e.g. in the United States, consumers ate a record amount of seafood in 2003, climbing from 15.6 pounds per person in 2002 to 16.3 pounds in 2003 (NOAA, National Oceanic and Atmospheric Administration 2004). Delgardo *et al.* (2003) documented the trend over the last three decades for developing countries to consume and produce more fish, and projected that this trend would continue out to 2020, by when developing countries are expected to produce 80% and consume three-quarters of world fish.

A further characteristic of fish supply is the major redistribution of fish by trade. By value, about 40% of the world fish supply is traded internationally, compared to 10% for meat. The value of international fish trade was US$60 billion in 2000. In several fish-exporting Asian countries, foreign exchange from fish exports balances import bills for other foods. In the late 1990s, developing countries became net fish exporters, but Delgado *et al.* (2003) predict that rising domestic demand will lower the level of net developing country exports out to 2020. Average fish prices are also projected to rise.

Fish is already the subject of trade wars (e.g. disputes over Vietnamese catfish exports to US; US tariffs on shrimp imports and EU bans on shrimp containing antibiotic residues), causing some economic instability for the exporting countries. Fishing subsidies have been the focus of a recent campaign by the environment organisation WWF (Schorr 2004). In addition to market controversies over fish trade, concerns have also been raised over the environment and trade, e.g. in the live fish trade, over-exploitation of Galapagos sea cucumbers for export, and export-driven shrimp farming's impact on the environment, and food security and trade, e.g. coastal shrimp farming in India and Tanzania.

Despite the bad press, Kurien (in press) found that international trade has created national economic benefits for many developing countries, large numbers of jobs, especially for women, in the processing sector and helped improve the standard of the product. On the other hand, there is also evidence that trade has taken some control out of the hands of local fishers, pushing them to the limits of their personal safety, and that the employment created for trade has little job security, offers few worker benefits and is precarious as the trade shifts.

Trade practice and policy — global and bilateral — therefore will be critical determinants for fish supply and the economy in developing countries.

Thirty-five million people are directly employed in the fisheries sector (80% in fishing and 20% in aquaculture) (FAO 2003), but the sector supports several times this figure through their households and the ancillary support sectors. The vast majority of this employment is in developing countries —mostly in Asia-Pacific. Employment in fisheries is declining in developed countries, but tends to be stable or increasing in many developing countries.

Many involved in the fish sector are poor, and work under conditions that are recognised by the ILO as the most dangerous of all occupations. Fatality rates may be higher than police and firefighters, and few are covered by any international safety regulations (ILO 2004). Yet work in the sector can offer real solutions to development — employment in new occupations in fish farming, in export processing factories and in community empowerment through new management regimes.

Overall, fish production and supply are local and global matters, as is food security. By nature of its economic value, fish usually helps food security more through providing livelihood and income than through direct consumption. Thus, whether the poor rise on or submerge under the rising tide of fish demand depends on what access they have to the means of fish production, and fishing-related labour for income and livelihood, as well as the affordability of fish. The many contributions of fish are well illustrated, for example, by how fish appear in the Australian aid program as means of livelihood to help landmine victims in Cambodia, as small business enterprises for women in Indonesia, as post-disaster construction resources after cyclone Linda in Vietnam, and as new enterprises after water project construction and salvinia water weed control in Vietnam and Sri Lanka, respectively.

Supportive policy, technical and business solutions are needed to help the poor meet the challenges. Like the diversity of fish and fisheries, the solutions are location and country specific. I propose seeking solutions along three broad fronts, namely (1) a serious commitment to domesticating key species for aquaculture and selecting good candidate species and locations for reseeding, (2) helping developing country fish workers capture equitable benefits from fish production and trade by making fish trade, development assistance and fisheries cooperation coherent, and (3) helping developing countries urgently address national and local management of natural fisheries resources to restore them to sustainability.

Domesticating key species for aquaculture and reseeding

Although I remain hopeful that more effective methods of fisheries management can be found in time to restore natural resources, I accept that aquaculture is very important for the future supply and affordability of fish and other aquatic products. Therefore, we will have to seriously develop aquaculture. Becoming serious means domesticating more species for aquaculture and, since there is a large cost to domestication, carefully choosing the species. Domestication[1] is at the heart of mak-

[1]' Domestication — the evolution of plants or animals either naturally or through artificial selection, to forms more useful to

ing aquaculture more productive and fish more affordable, for three reasons: domestication allows us to develop improved breeds, and this usually contributes about one-third of the long-term productivity improvement in aquaculture — farm management and better feeds are the other contributors; species choice and domestication co-evolve with farming practices and therefore tend to drive farm and feed improvements to get the best out of the breeds; and domestication, coupled with the conservation of the diversity of genetic resources, provides the long-term safety net for weathering production crises such as devastation from fish diseases and the impacts of climate change. Despite the great desirability of domestication, many farmed species are far from being domesticated, illustrating the rudimentary state of much aquaculture.

Choosing species to culture and domesticate

Too little attention is given to this step in aquaculture development, and species choices are typically made on the basis of a few, albeit important, criteria — usually market value and/or growth rate. In the long term, farmers and consumers need to be able to breed varieties of the farmed species with characteristics suitable for a range of farm conditions and markets. The breeding must be backed up by *in situ* and *ex situ* genebanks to provide the raw material for further breeding. A wide range of economic, biological and environmental criteria should be considered in the choice of species (Table 1).

Choice of species by the fish farmer is a dynamic process influenced by factors at different scales. At the farmers' level, determinants include the farmer's own know-how, local practices, markets, likely profitability and access to the support infrastructure for aquaculture such as availability of seed, feed and technical support. Indeed, most of the small-scale fish farmers in the developing world will start with growing the species that their

Table 1. A menu of criteria and sub-criteria for species selection for aquaculture (adapted from Williams and Choo in prep.)

Criteria	Sub-criteria
Economics	Location
	Production system
	Scale of operation
	Price structure
	Traditions and food preference
	Size of market
	Organoleptic characteristics (colour, appearance, texture, taste)
	Suitability for and ease of processing
Biology	Indigenous/exotic species
	Adaptability
	Reproductive cycle
	Egg, larval development and availability of fry
	Feed and nutritional requirements and feed conversion efficiency
	Growth rate
	Tolerance ranges for environmental conditions
	Disease tolerance
	Animal behaviour
Environmental maintenance	Habitat use
	Gene pool contamination
	Escape of exotics
	Unsustainable use of chemicals and drugs in culture practices

government research agencies are studying and those for which the development assistance organisations offer project technical help. In some cases, such as the Malaysia cockle farming industry, the fishers themselves pioneered the farming system which is based on spat collection and grow-out. Research agencies and development assistance agencies have a responsibility to do their own careful planning in choosing aquaculture species for research and dissemination — because not only are their research programs dependent on making sensible choices, but their choices have a large bearing on the farmer's choices of species.

One major challenge for species choice is to balance the investment in domesticating and improving breeds of known desirable species with that of bringing new species into culture. Research information and more formal decision support and priority-setting tools can help decision-makers and stakeholders set objectives and multiple criteria

man .... characteristics of domestication are frequently absent in *wild-types* of the organisms and may constitute a negative genetic load for survival in the wild state' (IBPGR 1991. *Elsevier's Dictionary of Plant Genetic Resources*. Compiled by the International Board for Plant Genetic Resources. Elsevier Science Publishers, Amsterdam.).

(such as those selected from Table 1), and weigh quantitative and qualitative factors, for several potential aquaculture species. The species choice process, if rigorous, also provides good information on gaps in knowledge that need to be filled if culture of the chosen species is to succeed.

Food security objectives can readily be used to guide species choice in aquaculture. The poor can benefit from choice of appropriate species as consumers and/or producers: if more low-value fish are farmed, then fish will be more affordable; and if more species of fish are able to be farmed with little capital input, then more of the poor can become fish farmers. In designing its aquaculture research programs, WorldFish Center placed emphasis on species choice (ICLARM 2000), and developed a program that covered species from pearl oysters to tilapia, depending on the conditions in which aquaculture was practiced.

Environmental and feed requirements — e.g. habitat needs, carnivorous vs herbivorous species — can also be defined to guide decisions on those species for which aquaculture is more likely to be sustainable in the long term.

The list of candidate aquatic organisms appears large, e.g. FishBase (www.fishbase.org) lists nearly 30 000 finfish species alone. However, only 130 finfish are farmed in such quantities that they receive a mention by name in the official FAO global statistics, and of these, only 30 species of carps, tilapias and salmonids produce most of the world's cultured finfish. Few new species, however, will become major global producers because the exploratory development of aquaculture to date has picked the 'easy' species and already brought them into culture. Indeed, many of the recent attempts to domesticate fish have chosen high-value and over-fished marine species such as the northern cod (*Gadus morhaus)* and Asia-Pacific groupers in desperate attempts to fill gaps in market demand. None of these species are 'easy'; this could have been predicted advance by taking a well-considered approach to their choice. But ease of culture may still not deter attempts at domestication if the species is special enough. Even so, the more considered approach to species selection will be valuable, as it will enable the proponents to identify the bottle-necks and pay special attention to these (e.g. see Williams and Primavera 2001).

With a more considered approach to species choice, more species can become important national and local culture species, even if few go on to become globally prominent. For example, the culture of the Australian silver perch (*Bidyanus bidyanus)* is an excellent example of careful and well-planned species selection using a native species (Rowland *et al.* 1998). In Bangladesh, small native freshwater species are being chosen for culture along with the large carps, catfish and tilapia that have dominated the early days of aquaculture. The price of the small, locally-preferred species is now high, and some are found to have very high vitamin A content (Thilsted and Roos 1999).

Domestication through selective breeding

Following choice of species for culture, domestication of a species starts with closing its life cycle, i.e. breeding the species and growing it to breed again in captivity. At the present early stage of aquaculture development, many farmed species still have open life cycles (Table 2), including many of the species of fish and other aquatic organism that produce the bulk of the world aquaculture harvest (Table 3).

Freshwater fish, such as carps and tilapias, and some fish that migrate between salt and freshwater, such as salmons and trouts, have proven the easiest to breed in captivity and are now also the most advanced in domestication. All fish species for which the life cycle is closed are domesticated to some extent, since they are amenable to growth in captivity and therefore could be classified as forms 'more useful to man'. An advance of the last 30 y in aquaculture is artificial selection that is directed to create strains more suitable for widespread and intense human use.

The leading examples are Atlantic salmon in Norway (begun in the 1970s), Nile tilapia (begun by WorldFish Center and partners, including Norway and Philippines — see review in Acosta and Williams 2001), and Chinese carps. Other species are now in the early stages of rigorous selective breeding but it is still relatively rare to have a properly conducted selection program for major aquaculture species. At the same time, investments are also in train to produce genetically modified fish in an effort to leapfrog the more standard approaches to genetic improvement through selective breeding.

Table 2. Sources of seed in different aquaculture operations. Shaded rows are those for which the life cycle is closed. (Source: adapted from Williams and Choo in prep.)

Source of seed/fry/fingerlings	Examples
Self-recruiting: natural or semi-controlled seeding from natural sources	Shrimp larvae and post larvae in coastal extensive farm ponds in tropical Asia; numerous small native fish, shrimps, crabs and molluscs in rice fields in Asia
Grow-out: juveniles from wild	Southern bluefin tuna (*Thunnus maccoyi*), Australia; grouper (*Epinephelus* spp.), Asia
Wild seed/fry collection: deliberate collection of seed from wild	Milkfish (*Chanos chanos*) in the Philippines; giant tiger shrimp (*Penaeus monodon*) in Asia, Pacific
Hatchery reared: raising of seed/fry of wild-caught adults in hatchery prior to release into culture operation	Giant tiger shrimp (*Penaeus monodon*) in Asia Pacific, grouper (*Epinepheleus* spp.), sea bass (*Lates calacrifer*) in Asia
Closed life cycle: as above but from parents also raised in hatchery	Tilapia, carps (many species)
Domesticated: all seed/fry developed to forms targeted to aquaculture needs	Atlantic salmon (*Salmo salar*), Nile tilapia (*Oreochromis nilotica*), some strains of shrimp (e.g. *Penaeus stylioristris* in new Caledonia, French Polynesia)

These developments are of interest but I do not believe they will have an immediate impact on aquaculture for food security.

Most current aquaculture production is from the domesticated species, and for many of these species the price of fish is much reduced as a result of the more efficient production and marketing.

A global example of the declining price of fish is the Atlantic salmon, which was once a luxury food item and is now widely available around the world at reasonable cost. Between 1989 and 1994, the average world price of salmon and trout declined by 21%, from US$3500 per tonne to $2750 per tonne (in current dollars). This decline in price occurred despite a major challenge from a viral disease that affected the Atlantic salmon in the period but which breeding helped overcome. During this period, prices of most other seafood

Table 3. Summary information on aquaculture species with closed life cycles and for which some attempts have been made and some success achieved towards domestication (Source: Williams 1999)

FAO: 233 named species used in annual detailed aquaculture statistics
Freshwater fish:
Carps: 19 of 24 named species
Tilapias and other cichlids: 8 of 11 named species
Miscellaneous FW fishes: 22 of 38 named species
Diadromous fish (fish that migrate between fresh and salt water):
Salmons, trouts, smelts: 9 of 10 named species
Sturgeons: 3 of 4 named species
Eels: 0 of 4 named species
Miscellaneous diadromous fish: 2 of 3 named spp.
Marine and brackishwater fish:
Unknown number of 37 species
Crustaceans:
Four of 60 farmed species are in early stages of domestication (Pullin *et al.* 1998)

remained stable or increased (FAO statistics quoted in Delgado and Courbois 1997). Species choice and domestication cannot occur without strong research backing and strong international sharing of experience. Many of the species, exotic and endemic, are shared across national borders, and most of the biological, engineering, economic and social research developments benefit from science as a global public good. In the case of fish domestication, aquaculture science has another deep additional pool of knowledge and experience on which to draw, namely that from terrestrial animal and plant domestication which are much more advanced compared to fish.

Making fish trade, development assistance and fisheries cooperation strategies coherent

Fish trade is pivotal to fish supplies and the distribution of benefits from fish, including to the poor. Over the last decade, shifts in balances of fish trade have been rapid. For example, at the start of the 1990s, the United States was the biggest fish exporter in the world, but at the end of the 1990s Thailand held this position and the United States was running a fish trade deficit. Despite world shifts, Australia has maintained a fish trade surplus, now at about A$0.3 million (ABARE 2003). Kurien (in press) identified the paucity of information on the question of how rapid development in fish trade has affected food security and people.

In countries in the Asia-Pacific where fish trade is buoyant, Australian development assistance could help make that trade as stable as possible, using the experience of our own export-oriented agricultural sector.

In the face of the rapid developments and accompanying lack of information of their effects, I recommend policy, economic and social research to examine the linkages between trade, food security and fish production in key fish-producing countries. From an Australian perspective, this research should be directed to key questions for fish trade, development assistance and fisheries cooperation in partner countries. These questions could look at domestic production, trade and environment links, technologies, industry structures and employment affected by trade changes, and the sorts of entitlements questions raised by Kurien (in press). The research should also seek to strengthen the growing cadre of fisheries policy analysts in developing Asian countries, such as those involved in the nine-country study led by WorldFish Center on the supply and demand for fish and the technologies that will affect this in each country.

Kurien (in press) addressed trade and food security through examining four types of entitlements — production, trade, labour and transfer-based entitlements — and 11 case studies, including Fiji, the Philippines, Thailand and Sri Lanka from Asia Pacific. He found that the trade and food security links are complex and multi-layered, and on balance had brought many benefits as described above. Although there was no evidence of fish exports lessening the fish available for local food, 'the shark's share of the benefits from international fish trade accrue somewhere between the rich-country consumer and the poor-country producer'. Kurien suggested the need for 'guided outcomes' to address the food security dimensions of international fish trade. These would include better understanding of the 'chain of custody' of fish in trade to enable participation by poorer segments of society, and trade infrastructure that enhances domestic product and coastal communities at the same time as international product quality.

Managing natural fisheries resources to restore them and make them sustainable

Despite the global consensus on the problems of world fisheries, too little of the urgency at the global level is able to be translated into effective action in fisheries management on the ground and in the water. What is sorely needed is the capacity to act in fisheries management, and this ultimately has to come from national and local efforts, often supported by development assistance — not from papers on the global situation in the journals *Science* and *Nature*, although these have helped bring the fisheries situation to the attention of development assistance agencies such as the World Bank and stimulated a new World Bank fisheries *Approach Paper*.

The capacity to act on fisheries management does not come easily anywhere in the world. Fisheries are not considered politically important even in those countries with large fisheries and many fishery-dependent people. Many politicians and even some senior ministry officials do not understand the basics of managing the fishery resource. They do not see that more fishing leads ultimately to fewer fish when the removals of fish by fishing become so high that the remaining fish cannot reproduce fast enough to replace them. And even where there is a basic understanding of the need for restraint in fisheries exploitation for the sake of the long-term productivity of the resource, restraint is difficult to achieve.

New ways of handling fisheries issues are being sought and found through three increasingly-proven approaches: new fisheries governance regimes with the capacity to reduce fishing effort; connecting fisheries policies more strongly to those for the rest of the economy and the environment; and finding other ways of producing fish such as through aquaculture and re-seeding.

Fisheries governance changes over the last decade have been quite profound in many tropical developing countries. Governments have begun to share management roles and responsibilities, and provide greater empowerment of the fishers and other stakeholders in fisheries governance. In countries such as Bangladesh, the Philippines and Western Samoa, this process has proceeded quite a long way and unleashed thousands of innovative local fishery management schemes, many of which are starting to yield positive results on local fisheries.

Local capacity to understand the technical, legal and economic options has to be built. Often this capacity is helped through aid projects and involvement of local non-government organisations. WorldFish Center has studied the changes first hand through its co-management project (Vishwanathan *et al.* 2003) and shown the challenges and successes of the approach.

At the heart of these governance changes is the explicit or implicit definition of individual or collective fishing rights. Just as agrarian land reform and creating secure title to land and other assets is vital to the conduct of all business on the land (de Soto 2000), so the definition and assignment of fishing rights is critical to the success of fisheries governance (Hannesson *et al.* 2000). The transition costs to rights-based systems will often be daunting, but the costs of not making the transition may be even higher in the long run. The East Asia Seas Congress and Ministerial Meeting 2003 concluded that new socially-just and rights-based fisheries systems were urgently needed in the region.

Fisheries have been marginal activities in many countries, carried out by people in remote communities with few links to the mainstream and little served by mainstream services such as health and education. The growing prominence of fisheries issues and the spread of national economic activity are drawing fisheries more into the mainstream. For example, countries now recognise that many of the solutions to fisheries problems lie outside the sector itself. The problem of too many fishers will need to be solved by alternative livelihoods outside fisheries. Some of the problems of declining fisheries resources need to be solved by cleaning up pollution in the aquatic environment and zoning the coasts to accommodate different uses. Protected areas are an important tool for protecting fisheries and link well with new devolved and right-based governance mechanisms (EAS 2003). Important intellectual developments are occurring in the elaboration of the concept of ecosystem-based fisheries management approaches (Garcia *et al.* 2003; Browman and Stergiou 2004; Pikitch *et al.* 2004).

Even as new governance mechanisms and greater connectivity with the sector is starting to occur, the countries still need ways to produce more fish to meet growing demands. Aquaculture is usually given prominence as the main solution. However, re-seeding of some stocks should also be given serious attention, especially some coastal shellfish and inland finfish. Bell *et al.* (in press) point to the successes to date in stock enhancement, but warn that careful research needs to be done to ask the right questions before embarking on stock enhancement programs. The questions would include the spatial scale of the re-seeding, how many seed would be needed and at what cost, the likely impacts on the existing stock (if any), the trade-offs with different alternatives such as better fisheries management leading to natural regeneration, and the questions of the genetic diversity of the reseeded stock. These questions are being systematically explored with sea-cucumber re-seeding research in the Pacific by WorldFish Center, supported by ACIAR, and early results are promising.

Therefore, despite the bleak picture painted by crisis reports from fisheries, hope does exist for paths forward. The governance, economic integration and new production methods together offer promise. Many of the countries of the Asia Pacific region are already embracing these methods, often with the help of Australian aid, fisheries cooperation and international agricultural research programs.

I would like to suggest that Australia has a chance to take these important but often dispersed fish-related activities further by developing a fisheries thematic strategy such as it did with water last year (AusAID 2003). This strategy could add value to the existing activities by defining the fisheries challenges, examining options and resources available for their solution — including Australian organisations and their expertise — and creating focus on the most promising strategies.

Conclusion

Fish play an important but under-recognised role in sustaining food security in many developing countries. The importance of fish is coming more to the fore, however, as the state of world fish stocks is revealed to be parlous, and as the tide of fish demand keeps rising.

The challenges of meeting future world fish supply needs and improving food security are indeed daunting, and the complex and multi-layered nature of fish supply and food security issues adds to the challenges but also gives many avenues for positive actions. I have proposed the need to tackle the challenges along three fronts — becoming serious about aquaculture development by taking a domestication approach; making coherent the actions on fish trade, development assistance and fisheries cooperation; and tackling the challenges of managing fisheries to restore them and make them sustainable.

I would like to point out a common underlying theme for each of these fronts — namely their dependence on international, cooperative and mutually beneficial research. All three approaches — domestication, coherent trade support and better fisheries management — cannot proceed without being informed by insights and knowledge gained from research. Australia can help by applying its own research capacity, but it can make that capacity go much further by reaching out and building the capacity on the ground in our regional partner countries. So I will leave you with the thought that science, including fisheries science, is one of the most powerful political bridges between countries.

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