

Throughout the region, capture and culture marine fisheries continue to play an important role in food security, poverty alleviation and national economies. Marine fisheries resources have now largely been overexploited, and as a result in some countries, development of coastal aquaculture has been encouraged to provide needed protein, income, employment, and export earnings. Such a policy trend implies, however, that sufficient food for this culture will be available. Inevitably, a dangerous spiral has evolved, in which the demand for low value fish, or 'trash fish', has supported increased fishing pressure on already degraded resources. This raises some important questions regarding the social, economic, ecological costs and benefits of this system, its sustainability and future trends.

Defining Low Value/Trash Fish

Once caught, fish are either retained or discarded. Those retained are used either as human food in a range of product forms and markets, or as feed for livestock or fish. In the latter, they are either fed directly or used indirectly by processing it into fish meal and the fish oil used to make pellets). Some of the retained fish might also be used for other purposes (such as fertilisers), though to a much lesser extent.

'*Low value/trash fish*' is a term loosely used to describe fish that are generally small in size (as well as some larger fish of low quality, and waste from other uses), are not highly favoured by consumers, and so have little or no direct commercial value. The term is not really appropriate in many cases, as these fish form the basis of human nutrition in many coastal areas in Asia-Pacific. Fish can be trash for one community but be preferred in another, making a precise definition difficult. In this article, we first define some of the characteristics of low value/trash fish, and compare their usage across a sample of countries.

The use of the terms 'low value' and 'trash fish' varies across the Asia-Pacific region (see Table 1) and can also change both seasonally and with location. However, in the six Asian countries studied, the definition above is generally true. They are usually taken as a by-catch,¹ in the sense that they are caught using non-selective fishing gear. A portion is often thrown away or discarded at sea, although this practice is uncommon in many Asian fisheries.





Prized Commodity:

Low Value / Trash Fish

from Marine Fisheries in the Asia-Pacific region

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| Country | Low value | Small size | Low consumer preference | Human consumption | Livestock / fish food | By-catch | Target | Discard |
|------------------|-----------|------------|-------------------------|-------------------|-----------------------|----------|--------|---------|
| Bangladesh | ⊗ | ⊗ | ⊗ | ⊗ | | ⊗ | | +++ |
| China PR | | | | | | | | |
| 'Trash fish' | ⊗ | ⊗ | ⊗ | | ⊗ | ⊗ | ⊗ | + |
| 'Low value fish' | ⊗ | ⊗ | ⊗ | ⊗ | | ⊗ | ⊗ | + |
| India | ⊗ | ⊗ | ⊗ | ⊗ | | ⊗ | | ++ |
| Philippines | ⊗ | ⊗ | ⊗ | ⊗ | ⊗ | ⊗ | | + |
| Thailand | ⊗ | ⊗ | ⊗ | | ⊗ | ⊗ | | + |
| 'Trash fish' | ⊗ | ⊗ | ⊗ | | ⊗ | ⊗ | ⊗ | + |
| 'Low value fish' | ⊗ | ⊗ | ⊗ | ⊗ | | ⊗ | ⊗ | + |
| Vietnam | ⊗ | ⊗ | ⊗ | ⊗ | ⊗ | ⊗ | | + |

Table 1: Some characteristics of low value/trash fish in six countries in Asia-Pacific

+++ = major discarding (confined largely to shrimp trawling), ++ = moderate discarding, + = minor discarding

The main difference in use of the terms depends on whether they include fish eaten by humans or whether they are restricted to fish used in animal feed. In the Philippines and Vietnam, the term 'trash fish' refers to fish that is both eaten by humans and used as feed for livestock or fish. In Thailand and China PR, 'trash fish' is more restricted, where it only includes the livestock and fish food component, while 'low value fish' is consumed by humans. In Bangladesh and India, less is converted into livestock or fish food, and 'low value/trash fish' is mainly directly used for human consumption. In China (and to a lesser degree in Vietnam), it includes a large amount of fish targeted for processing into fish meal or fish oil, such as Japanese anchovy and chub mackerel.

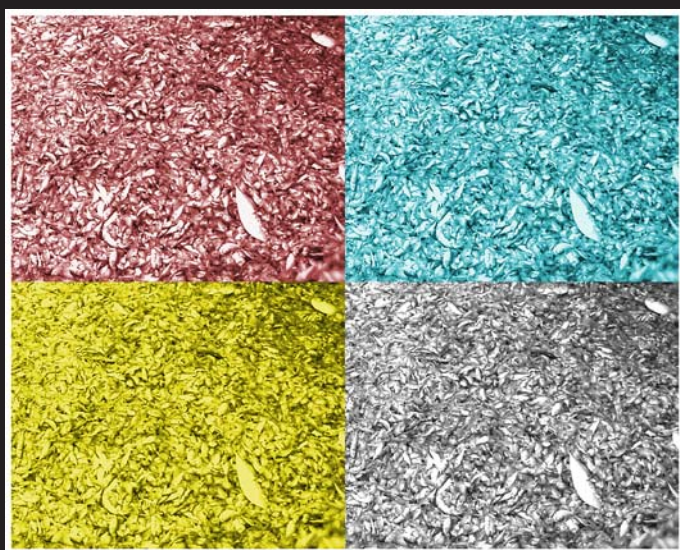
In view of these different uses of the terms in different countries, we refer to all of these as low value/trash fish.

Low Value/Trash Fish in the Context of Asia-Pacific Fisheries

The capture fisheries sector in the Asia-Pacific region can generally be divided into:

1. Large-scale industrial or commercial sub-sector, and
2. Small-scale artisanal sub-sector

Low value/trash fish: A broader definition



For the purpose of this article we define low value/trash fish as:

'Fish that have a low commercial value by virtue of their low quality, small size or low consumer preference. They are either used for human consumption (often processed or preserved) or used for livestock or fish food, either directly or through reduction to fish meal or fish oil.'

| Country | Low value/trash fish (tonnes) | % of total catch | Dominant gear | Year of estimation | Source |
|-------------|-------------------------------|------------------|-------------------------------|--------------------|--------------------------------|
| Bangladesh | 71,000 | 17% | Gill nets (48%) | 2001-2002 | Uddin et al, 2004 |
| China | 5,316,000 | 38% | Non-mechanised set bags (42%) | 2001 | Han and Xu, 2004 |
| India | 271,000 | 10-20% | Trawl | 2003 | Jayaraman, 2004 |
| Philippines | 78,000 | 4% | Trawl | 2003 | Ramiscal and Chiuco, 2004 |
| Thailand | 765,000 | 31% | Trawl (41%) | 1999 | Kaewnern and Wangvoralak, 2004 |
| Vietnam | 933,183 | 36% | Danish seine (22%) | 2001 | Edwards et al, 2004 |

Table 2: Estimations of annual low value/trash fish production in Asia-Pacific, based on country studies initiated by the Asia-Pacific Fisheries Commission (APFIC)

In 2003, world total fishery production was reported to be 136 million tonnes, representing an increase of some 30% since 1990 (Figure 2). According to FAO FishStat¹, marine capture fisheries production was 85.9 million tonnes in 2003. In 2003, capture fishery production from Asia-Pacific accounted for half of the world production, and the production from aquaculture in the region reached almost 90 percent of the global aquaculture production of fish and shellfish.

It is currently acknowledged, by both scientists and managers, that coastal resources are being 'fished down the food chain' and the percentage of low-grade low value/trash fish has risen considerably in recent years. To estimate this amount is difficult. However, while noting the widely divergent definitions of low value/trash fish across the region and the lack of sound statistics, recent estimates of low value/trash fish production obtained through our reviews are tabulated below for six countries (Table 2).

These countries account for over half of the marine capture fish production in the Asia-Pacific region. A weighted average of low value/trash fish across the six countries is 35% of the total marine catch. Noting that varying amounts are used for livestock and fish feed in the different countries (by definition, 100% in China and Thailand, and little in India and Bangladesh), a conservative estimate for the amount of fish used for livestock and fish feed Asia would be in the order of 25% of capture fisheries production. In a separate study, Malaysia estimates its catch of trash fish (i.e. fish not used for human consumption) in 2003 as 32% of the total marine capture landings.

Major Pathways for the Use of Fish in the Asia-Pacific Region

Using the statistics provided by FAO for capture and aquaculture production in the region, a very approximate 'back of the envelope' calculation can be developed to trace the flow of fish products through direct and indirect (mostly aquaculture) human use. For 2003, the recorded Asian capture fishery landings was about 39.3 million tonnes (for all carnivorous and omnivorous

fish, excluding molluscs and seaweeds) and the latest estimate for discarding is 1.8% (i.e. 720 000 tonnes), giving a total capture figure of 40.0 million tonnes. Applying the 25% factor to the landed catch gives a figure of 9.8 million tonnes being used for livestock and fish feed, and 29.5 million tonnes being used directly for human consumption. The total aquaculture production in Asia for all fish, excluding molluscs and seaweeds, is also estimated as 28.0 million tonnes.

From these figures (summarised in Figure 1) it is clear that the diversion of marine fish via aquaculture is providing a very significant proportion (approximately 50%) of the total fish provided to humans, both within Asia and exported. In addition, an increasing proportion of this is high-valued carnivorous species production is increasingly dependent on imported fish meal and fish oil.

Uses of Low Value/Trash Fish

Low value/trash fish are important food sources for poor people in various community groups in coastal areas. Small-scale fishermen generally keep low value/trash fish for home consumption, after selling other fish with high market demand. Some of the low value/trash fish are consumed fresh, while some are dried or processed into products such as fish sauce. The proportion of low value/trash fish for human consumption can be quite high. For example, in Bangladesh about 60 000 tonnes of the total 71 000 tonnes of low value/trash fish landed are

¹ The term 'by-catch' is a generic term referring to catch that is incidental to the target species. In many fisheries using non-selective gear such as fish trawls, the term is also used for the unwanted portion of the catch that is discarded, and sometimes to refer to the less desirable fish that are landed, i.e. low value/trash fish.

² www.fao.org/fi/statist/FISOFT/FISHPLUS.asp

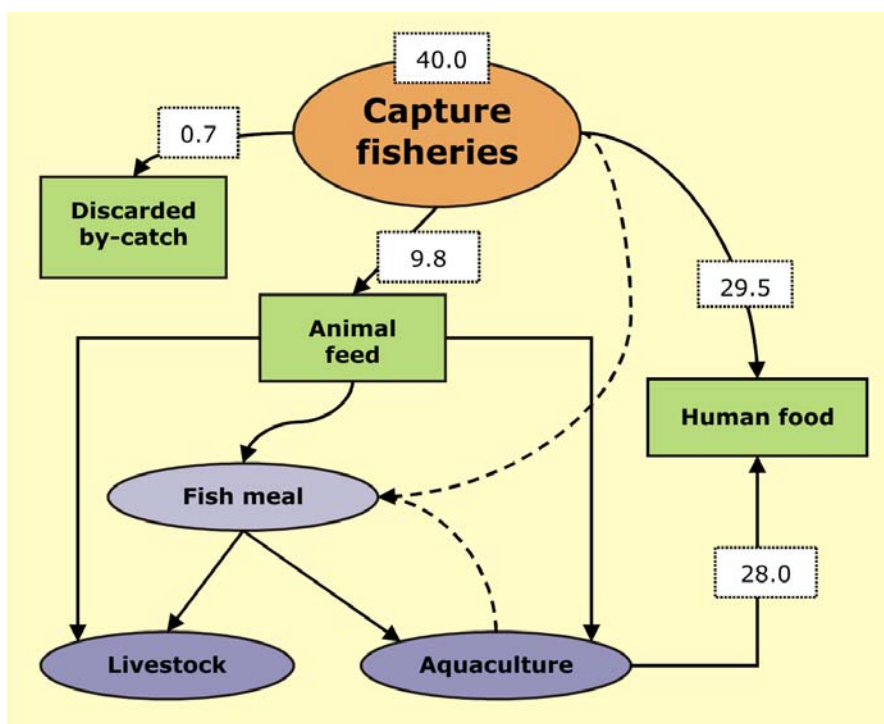


Figure 1: Production flows by major categories of fish in the Asia-Pacific region (amounts expressed in million tonnes)

consumed either directly or in dried forms. In China, low value/trash fish have traditionally been used as a main ingredient to supplement the daily diet with protein. A significant factor that determines how low value/trash fish are used is the location of the landings and the available infrastructure to deal with these landings.

In China, both fresh and frozen low value/trash fish are used directly to feed cultured animals, such as shrimp, crab or fish

species in small farms, especially when formulated feeds are not available or their prices are too high. The Philippines and Thailand use low value/trash fish as direct feeds for grouper and mud crab culture to enhance growth. In the Philippines, some portions are also given to tilapia, prawn and milkfish in grow-out ponds as supplement feeds provided by pond owners.

In Asia, utilisation of low value/trash fish for fish meal production varies between countries. The extent of fish meal production and use is sometimes difficult to estimate, and often, following Edwards et al (2004), the most reliable estimation method is to back calculate from aquaculture production statistics. Large-scale manufacturing of fish meal using low value/trash fish as raw materials is prominent in Thailand and the Philippines. Small-scale and household production is found in Bangladesh, where the poultry sector

dominates the utilisation of fish meal. Currently, there are 35 established poultry feed producing plants, producing about half of the poultry feed used in the country. The other half comes from smaller scale, household level producers located around the country. In India, production has declined due to the increased emphasis on export of high quality fish and fishery products. China, on the other hand, is developing this new industry to respond to the growing demand from aquaculture and poultry sectors.

There has been considerable innovation in recent years in an attempt to utilise previously unwanted by-catch, especially from

| Country | Human consumption | Direct animal feed | Fish meal | Fish oil | Other |
|-------------|---|--|---|-----------------------------------|--|
| Bangladesh | Direct consumption, often dried | No record | Poultry feed | Sporadic production for fish feed | - |
| China | Innovation in new products (e.g. fish meat filling), dietary protein supplement | Poultry, livestock, shrimp, crab and fish | Relatively new, but production has increased dramatically due to aquaculture demand | No record | Some use as fertiliser to enrich primary production in ponds |
| India | Increasing consumption levels, fresh or dried | Some used for fish and poultry | Poultry feed, production declining due to increase in direct consumption | Shrimp feed production | - |
| Philippines | Consumed directly, fresh or dried (as much as 50% of low value/trash fish) | Aqua farms (e.g. crab, grouper) | Demand as poultry and animal feed | No record | Fish sauce |
| Thailand | Some low value/trash fish are dried for human consumption | Chicken, duck and pig feed. Aquaculture (e.g. crab, grouper) | Dominant use of low value/trash fish (as much as 90%), especially poultry feed. Recent decrease due to use of surimi processing waste | No record | Fish sauce |
| Vietnam | Direct human food (e.g. sun dried) | Feed for pigs and coastal aquaculture | Fish powder, artisanal and industrial processing, mainly for pigs and poultry feed. Increasing demand due to aquaculture | Mostly imported | Fish sauce |

Table 3: Examples of low value/trash fish use in the Asia-Pacific region

shrimp trawl fisheries and from finfish trawlers. Many of these activities have been the result of by-catch utilisation programmes supported by governments, research institutes, or development agencies, while some have been driven primarily by the market.

Issues Associated With Low Value/Trash Fish

Overall drivers

The issues related to low value/trash fish landings from multi-species/multi-gear fisheries in the Asia-Pacific region are underpinned by the rapid development of the aquaculture industry and the increasing demand for fish by consumers (see Figure 2). These two pressures represent new challenges for sustainable fisheries management in the region.

Several issues concerning low value/trash fish need to be resolved in order to ensure that fisheries in the Asia-Pacific region contribute more to the region's sustainable development. These issues include the following:

- increasing demand as direct feed for aquaculture and fish meal and fish oil
- food for humans or animal feed
- sustainability of harvesting
- lack of incentives for improved post-harvest
- growth over fishing (catch of juveniles of important commercial species)

- discarding
- environmental impact of direct feeding to aquaculture
- social concerns over use of low value/trash as a major source of animal protein for poor people.

Increasing demand

Recognising the potential effects of declines in marine capture fisheries, many governments in the region have turned to aquaculture as a means to increase fish supply, provide employment and generate foreign income. On the one hand, aquaculture development can be seen as a viable option to utilise low value/trash fish. On the other hand, it contributes to increasing fishing pressure on the already overexploited fish stocks in the region.

Over the last decade, the price of low value/trash fish has risen considerably. It is predicted that it will keep rising over the next few years due to increased demand for fish meal and fish oil to meet market demands for aquaculture of carnivorous fish, while capture fisheries will remain stable. As fish meal is the preferred protein source in most aquaculture feeds, the natural limits of the supply of fish meal and oil will in the future restrict the development potential of global aquaculture, since the culture of many species relies on fish meal and oil for growth.

Some regard this to be only partly relevant in the shorter term, as aquaculture is only one competitor for global fish meal supplies. The demand for livestock is still greater than aquaculture, although this is gradually shifting. A second consideration is that the fish meal component of feeds could be replaced by vegetable protein (e.g. soya) or mono-cellular proteins. An impact in the longer term of such replacement will tend to be lower growth rates of cultured fish (fish-based feed contain higher quality proteins resulting in greater growth if compared to vegetable-based feed). Prices of fish meal and oil will also tend to rise as competition between the aquaculture and livestock sectors increases (it is perhaps worth noting that chicken, cattle and pigs do not naturally feed on fish and therefore the inclusion of fish meal in feeds for these animals is a nutritional/economic convenience rather than absolute necessity – the same cannot be said for carnivorous fish!)

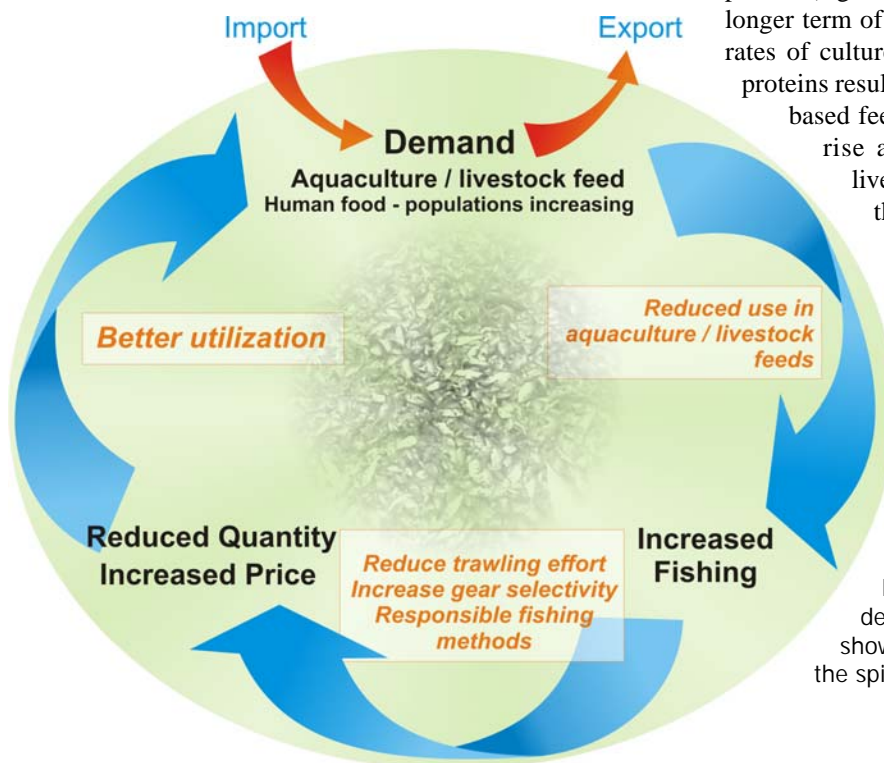


Figure 2: The low value/trash fish spiral. Increasing demand, increased fishing, degraded resources and increased price. Boxes show some actions that might help in escaping the spiralling effect.

Price of low value/trash fish

At the local level, prices of low value/trash fish vary depending on species, seasons and abundance of other fish and fishery products. Prices also fluctuate with the demand for fish meal for livestock and the aquaculture industry, and the availability of raw materials for fish meal production. At the low end, fresh low value/trash fish has been known to fetch as little as US\$ 0.04 per kg (e.g. Thailand), while the price can be as high as US\$ 1.50 per kg (e.g. India). Prices for low value/trash fish at landing places in Bangladesh range from US\$0.08 to US\$0.15 per kg. Fish meal producing industries, however, buy low value/trash fish at higher prices (US\$0.25 to US\$0.35 per kg), depending on protein concentrations of the low value/trash fish, including transportation cost as well as remunerations for fish traders.



FAO³ estimates that an annual global production increase of 3.3% until 2030 is feasible in the aquaculture sector. IFPRI⁴ gives an estimate of 2.8% until 2020. The production of high-value species will increase most, given the rising demand for these fish products. The biggest rise in production is expected to be in China.

Developing countries will continue to export high value products (e.g. brackish-water shrimp, marine finfish and pellet-fed tilapia) and import or domestically produce fish of lower value for consumption (e.g. carp and mussels). Coastal aquaculture, particularly farming of brackish-water shrimp and carp culture

in freshwater ponds, has been rapidly developed. In many areas, these culture practices have been transformed from extensive system to semi-intensive and intensive culture systems, where large amount of feeds are required.

However, if one accepts that supplies of low value/trash fish are declining and prices are increasing, Asia-Pacific countries may need to increase imports of fish meal from the global fish meal market for the aquaculture industry, or replace it with other feed materials, including plants and other protein supplement. The replacement of fish meal in aquaculture diets is hence a major international research priority.

“
For fish meal
or
human food?
”

For Fish Meal or for Human Food?

There is increasing conflict between the use of low value/trash fish for livestock and fish feed and for human consumption. It has been argued that it would be more efficient and ethical to divert more of the limited supply to human food, using value-added products. Proponents of this suggest that using low value/trash fish as food for poor domestic consumers is more appropriate than supplying fish meal plants for an export income-oriented aquaculture industry, producing high value commodities. On the other hand, food security can also be increased by improving the income generation abilities of poor people, and it can be argued

³ FAO (2002) 'The state of world fisheries and aquaculture 2002.' FAO, 2002.

⁴ IFPRI (2003) 'Fish to 2020 – Supply and demand in changing global markets.' International Food Policy Research Institute, Washington.

⁵ WorldFish Centre, Regional synthesis on the analysis of 'TrawlBase' data for low value/trash fish species and their utilization (in press)

that the large number of people employed in both fishing and aquaculture has this beneficial effect, via income generation, rather than direct food supply.

Without external interventions (such as incentives and subsidies), it will be the economics of the different uses of low value/trash fish in different localities that will divert the fish one way or the other. For example, in Vietnam, where the national demand for fish sauce is predicted to double over the next 10 years, there appears to be direct competition for mixed low value/trash fish between *Pangasius* feeds and production of low-cost fish sauce. By contrast, culture operations for high value marine finfish and lobsters can afford to pay more for anchovy than fish sauce manufacturers in central Vietnam.

Sustainability

As a result of the expansion of aquaculture and local livestock production, low value/trash fish has a ready market and can be sold easily in many localities. This can then be converted into higher-grade fish, crustacean and livestock feeds, some of which are sold at good prices. Hence, there seems to be little incentive to discourage the harvesting of low value/trash fish given their important contribution to aquaculture, overall employment and consequent export earnings. Also, the low value/trash fish catch is based on a large number of short-lived highly productive species for which, apart from targeted low value/trash fisheries in China, there is little evidence of current overexploitation leading to reduction in overall fish production. The demand for low value/trash fish has led to increased levels of low value/trash fishing by small-scale vessels in particular, and is now an important reason why many vessels can continue to be economically viable.

The concern, to both fisheries and aquaculture, is that there is no way of knowing how sustainable this system is. The WorldFish Centre⁵ has carried out analyses of low value/trash fish trends in several countries based on past scientific trawl surveys that has shown that many families containing both low value/trash fish and commercial species have suffered severe declines in abundance, whereas families just containing low value/trash fish species have been less impacted. Reduced fishing capacity may, in fact, result in increased catches for a smaller number of vessels, although it will be difficult to reconcile who would be refused access to the resources.

From a socio-economic perspective, the benefit of catching low value/trash fish is obvious. The low value/trash fish are important food source for many people, especially the poor, as well as an important source of income. The range of utilisation of these low value/trash fish for human consumption suggests that very little waste is associated with them. However, serious conflicts over use are common. Trawlers in the region tend to operate close to shore and use very small mesh sizes. They thus cause conflicts with small-scale fishers, and destroy fisheries stock and ecosystem services. Government measures have attempted to eliminate and resolve these conflicts through banning trawling in some areas. The western half of Indonesia is now forbidden to trawlers. There are heavy restrictions in some areas of the Philippines and Malaysia, and a prohibition for trawlers from

within 3 km from shore in Thailand, and within 40 m depth in Bangladesh. Such regulations are unfortunately difficult to enforce and success has been rather limited, unless supported by local communities and administrations. Increasingly, small-scale fishermen are the main champions of responsible fishing practices, through community-based and co-management programmes, often with strong support from local government.

Overall knowledge of the dynamics of these low value/trash fisheries must be enhanced. Serious efforts to improve statistical records, and to identify and quantify where and how these fish are used, are urgently needed. The composition of landings must be identified and probably categorised in the national catch statistical system (certainly for major species), such that groups, like 'other fishes', 'miscellaneous', 'low value/trash fish', disappear. Local communities can assist in recording amounts of catches of these fish at small landing sites. Knowledge about who uses the fish and who benefits from their use, are also fundamental. This will certainly require supplemental information gathering beyond catch records that utilises local knowledge to support conventional statistical approaches.



Another aspect of the sustainability issue is that the low value of these fish does not reflect their high ecological value. These small fish serve a niche in the marine ecosystem and are certainly food to other fish and marine animals. Removing them in large quantities from the environment creates a void in the food chain, and could eventually lead also to the reduction or loss of larger fish species, not just of its own species. Fishing with demersal gears that destroy habitats adds to the overall ecological impact.

Improving post-harvest

Because less money and effort is needed for handling, and because there is a market that can accommodate the catch, some larger fish caught are included as low value/trash fish for fish meal and fish oil. Indeed, it is clear that with high demand and good economic gains from low value/trash fish in the fish meal production sector, many fishers have decided that careful handling and chilling is not essential. According to some reports in Vietnam, 20-30% and even 50-60% of high value fish on some offshore trawlers becomes low value/trash fish because of poor storage.

Even if it was theoretically possible to improve the product, the limiting factor of small-scale and artisanal vessels is the lack of chilling equipment and on-shore infrastructure to access high value urban or export markets. Hence it may be difficult for these vessels to land a high quality product for the human consumption market, without incremental increases in infrastructure and costs. With proper handling, landing and supply of high quality fish to local markets should still be possible, in cases where fishing grounds are close to port. Of greater interest are perhaps the industrial vessels, which with the proper equipment and skills, should be better at ensuring a high quality catch. The underlying incentive for this to materialise, however, is that the economic gains of doing so outweigh the gains of landing fish on the low value/trash fish market. Here it is fundamental that the national authorities establish appropriate policies to help structure the sector, especially in relation to the national goals of food supply to the population and income generation. Indeed, as long the low value/trash fish market is vibrant, fishermen will have few incentives to improve the overall quality of their landed catch.

The quality of low value/trash fish destined for feed-mill factories is also a major concern. Even though it has a high protein content and quality when caught, the quality declines rapidly, as only ice or chilled water is used to preserve it on board ship, especially when boats may be at sea for 1–4 weeks. The resulting quality of the fish meal is often poor by the time it reaches the fish meal plant, limiting its use to lower product-value aquaculture operations.

Harvesting juveniles of commercial species

Another related issue of low value/trash fisheries is the capture of juvenile fish of potentially important commercial species (so-called growth over fishing). Between 18% and 32% of low value/trash fish in the Gulf of Thailand are juveniles of commercially important fish species. Given a chance to grow to a larger size, these high-value species could be harvested much more effectively, both in terms of total catch of these species, but more importantly, in terms of value. However, to increase the catch of these species, a dramatic reduction in overall fishing effort would be required, and the overall lower quantity of catch would then have knock on effects to markets and aquaculture. As with the current system of using low value/trash fish for aquaculture, this higher value catch would still supply the wealthier parts of the population. Social costs in terms of reduction in employment and livelihoods would be large, and the actual economic benefits (and distribution of benefits) need to be studied in greater detail.

Juvenile/trash fish excluder devices (JTEDs) have been trialled in trawl needs in several Southeast Asian countries. However, given the many conflicting uses for low value/trash fish, it is difficult to envisage a management system that optimises the supply of low value/trash fish for both human and livestock and fish feed uses, and at the same time excludes juvenile fish. Socio-economic studies are required to assess the costs and benefits of different management interventions such as juvenile fish excluder devices in nets.

Discarding unwanted fish

Discarding practices are seen by many as a waste of fish and fish protein, but the impact on the species taken is the same whether they are landed or not. In fact, the discarding practice will benefit some species in the ecosystem, such as scavengers, if carried out in large volumes. Obviously the degree of discarding varies according to the market available to the fishermen and can vary considerably by gear type and location. It is nevertheless clear that discarding at sea will decline if unwanted catches can be landed for economic gain.

International instruments, including UN resolutions, the Kyoto declaration, and the Code of Conduct for Responsible Fisheries, have highlighted the need to reduce, or minimise discards. There are two major approaches to addressing the discard problems, namely reducing by-catch and increasing its utilisation. These two harvest strategies may be complementary and in any given fishery, an appropriate balance between by-catch reduction and utilisation is required. Again there is a need for analyses of the trade-offs between promoting by-catch reduction and utilisation. In particular, the balance between highly selective fishing which targets one trophic level (or species) only, and less selective fishing which is likely to impact upon several trophic levels (or species groups), requires further attention so that the best scientific advice can be made available. Examples of by-catch utilisation legislation in Asia-Pacific countries are given in Table 4.

For the Asia-Pacific region, the greater utilisation of low value/trash fish has been of particular importance. Indeed, with some exceptions, discards in most fisheries in China and Southeast Asia are now considered to be negligible. There has been a change in perception of what constitutes a target species. Given the expansion of markets for low-value fish, almost all catches can now be regarded as targeted, meaning that there are no by-catch or discards. Of course, exceptions occur. In Brunei, unlike in other Southeast Asian countries, no low value/trash fish fishing is allowed (for aquaculture or local consumption), and hence a discarding estimate of some 70% is still being quoted.

FAO⁶ estimates that trawl fisheries for shrimp and demersal finfish account for over 50% of total discards, while representing only 22% of total landings. Trawl fisheries and tropical shrimp fisheries⁷ account for over 55% and 27% of the total estimated discards, respectively. In general, small-scale fisheries account for at least 8.5 million tonnes (11%) of discards. In the analysis, most small-scale fisheries in the Asia-Pacific region were assigned very low or zero discard rates, given the supporting expert evidence summarised in Table 5.

Fisheries with high discard rates include the Bangladeshi industrial finfish and shrimp trawl, which has an estimated discard rate of some 80%. Discarding in the Indonesian shrimp trawl fishery in the Arafura Sea is estimated to be over 80%, based on 1998 figures; discards there have remained high, despite the introduction of by-catch exclusion devices, largely due to poor enforcement and the lack of local markets for by-catch.

| Country | Legislation or Code | Key strategy |
|------------|--|--|
| Bangladesh | Marine Fisheries Ordinance | Shrimp trawlers must have at least 30% of their total catch as fish |
| India | Maritime Zones of India Rules 1982 (amended April 1985), Regulation 5 | Crews may not discard substantial surplus catch, catch exceeding authorised quantities shall be retained onboard, recorded, and surrendered as required by authorised officers |
| Indonesia | Decree No. 561 of the Ministry of Agriculture on the utilisation of the by-products of fisheries | All entities fishing prawns are bound to utilise as foodstuff for the population the fish resulting as a by-product from their fishing activities |
| | Presidential Decree No. 85 of 1982 | All fish by-catch to be handed over to the State owned company |

Table 4: Examples of by-catch utilisation legislation in the Asia-Pacific region

A number of national by-catch reduction initiatives have also been implemented. Despite the best intentions, problems with enforcement and user conflicts have been observed.

Action Plan

Current dilemma

Considering the increasing conflict between the use of low value/trash fish for livestock and fish feed and for human consumption, one obvious but important conclusion is that, given the strong interdependency between capture fisheries and aquaculture in the Asia-Pacific region, management of these two sub-sectors can no longer be carried out independently of each other. This interdependency raises many important questions. For example:

- Has the system evolved into a sustainable system, whereby over fishing of more traditional fishery resources has allowed an increased supply of low value/trash fish to meet increased demands?
- What is the impact of harvesting the juveniles of potentially commercial species on the total supply of high-quality fish for human consumption both in the region, and globally?
- From where will the food for the growing aquaculture sector in the region be sourced in the future?
- What will be the implications of an increasing gap between supply and demand – and the resulting increase in the price of fish – for food security and poverty alleviation in the region?
- Will substitute feeds for livestock and fish (if developed) result in a collapse of the existing low value/trash fish markets and impact the livelihoods of Asia-Pacific fishing communities?
- Will current fishery policies that advocate reduction in fishing capacity and rights-based fisheries

management actually improve the overall situation? and

- Who are the beneficiaries and the losers in the current system, and how would that change through management interventions?

There is an urgent need to understand the system better. This report has given some insights into how fisheries are evolving in the Asia-Pacific region, but big questions such as those above remain unanswered. We now have an initial understanding and enough quantitative data to start addressing them, and urge the research community to take up the challenge.

Future prospects

Estimated future demand is expected to rise given the continued growth in the aquaculture sector. The competition between the use of low value/trash fish for livestock and aquaculture production and human consumption will also likely continue to increase.

Reducing the Dependence on Low Value/Trash Fish

Fisheries interventions

1. Reduce trawling and push net effort (and clearly monitor the effect of capacity reduction)
2. Introduce improved selectivity of fishing gears and fishing practices

⁶ FAO (2004) 'International plan of action for the management of fishing capacity: Review of progress in Southeast Asia'. TC IUU-CAP/2004/, Rome, May 2004.

⁷ China, India and Thailand, all with low or negligible discard rates, account for over half of the penaeid shrimp catch.

| Country | Landings | Discards | Discard rate |
|-------------------------------|-------------------|----------------|--------------|
| Bangladesh | 314,966 | 64,578 | 17.0% |
| Brunei | 1,214 | 3,579 | 74.7% |
| Cambodia | 49,343 | 0 | 0.0% |
| China | 14,777,934 | 74,261 | 0.5% |
| India | 2,849,066 | 57,917 | 2.0% |
| Indonesia | 3,104,788 | 270,412 | 8% |
| Malaysia | 1,027,276 | 10,377 | 1.0% |
| Myanmar | 880,594 | 27,371 | 3.0% |
| Philippines | 744,583 | 7,521 | 1.0% |
| Thailand | 2,752,878 | 27,807 | 1.0% |
| Vietnam | 3,547,346 | 17,826 | 0.5% |
| Total | 30,049,988 | 651,649 | 1.83% |
| FAO statistical area | | | |
| Eastern Indian Ocean (57)* | 2,931,174 | 205,428 | 6.5% |
| Western Central Pacific (71)* | 9,366,816 | 407,826 | 4.2% |

Table 5: Landings, discards and weighted discard rate in the Asia-Pacific region (t) Source: FAO (2004a), Note: *excluding tunas

3. Facilitate reduction in 'race for fish', through rights-based fisheries and co-management
4. Protect juvenile nursery areas (refugia/closed areas and seasonal closures), and
5. Provide alternative social support measures (including employment).

Improved utilization

1. Improve post-harvest fish handling, and
2. Develop new fish products through processing.

Improve feeds for aquaculture

1. Change from direct feeding to pellet feeding
2. Reduce fish meal content by substitution of other suitable ingredients in pellets
3. Invest in feed research for inland and marine species, and
4. Promote adoption and change to pellet feeds.



“ Has the system evolved into a sustainable system, whereby **over fishing** of more traditional fishery resources has allowed an increased supply of low value/trash fish to meet increased demands? ”



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What is the impact of harvesting the juveniles of potentially commercial species on the total supply of **high-quality fish** for human consumption both in the region, and globally?

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Notes

The article draws on a range of documents and data sources from the United Nation Food and Agriculture Organization (FAO) to provide insights into current issues surrounding low value/trash fish production in the region.

Readings

A number of comprehensive country studies were initiated by the Asia-Pacific Fisheries Commission (APFIC) and have provided the majority of the information discussed, and include:

Chuenpagdee, R. and K. Juntarashote (2004) 'Regional overview of status and trend of 'trash fish' from marine fisheries and their utilization, with special reference to aquaculture'. April 2004.

Han, J. and H. Xu (2004) 'Overview of status and trend of 'trash fish' from marine fisheries and their utilization, with special reference to aquaculture: China'.

Jayaraman, R. (2004) 'Overview of status and trend of 'trash fish' from marine fisheries and their utilization, with special reference to aquaculture: India'.

Kaewnern, M. and S. Wangvoralak (2004) 'Overview of status and trend of 'trash fish' from marine fisheries and their utilization, with special reference to aquaculture: Thailand'.

Ramiscal, R.V. and M.B. Chiuco (2004) 'Overview of status and trend of 'trash fish' from marine fisheries and their utilization, with special reference to aquaculture: Philippines'.

Uddin, A.M.K., M.S. Iftekhhar, M.J. Abedin and M.S. Islam (2004) 'Overview of status and trend of 'trash fish' from marine fisheries and their utilization, with special reference to aquaculture: Bangladesh'.

Widodo, J. (2004) 'Overview of status and trend of 'trash fish' from marine fisheries and their utilization, with special reference to aquaculture: Indonesia'.

A recent review carried out under the auspices of the Australian Centre for International Agriculture Research (ACIAR) was also used:

Edwards, P., L.A. Tuan and G.L. Allan (2004) 'A survey of marine low trash fish and fish meal as aquaculture feed ingredients in Vietnam'. ACIAR Working Paper No. 57, 2004.



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