

Utilization of Small Pelagic Fish Species in Asia



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A summary report of a research project

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CONTENTS

	Page
Introduction	1
Principal Conclusions and Recommendations	2
Small Pelagic Fisheries	3
Current Status of Small Pelagics	8
Current Utilization	12
Global trade	12
Asian trade	13
Utilization Within Asia	15
Conclusions and Recommendations	22
Further Reading	24

INTRODUCTION

This study sets out to define the current status of the utilization of small pelagic fish—fast growing species usually reaching maturity within a year—in Asia, and to assess competing demands on the resource so that appropriate strategies for the future development of the fishery can be determined. Small pelagic fish are considered to be an under-utilized resource and the 1992 Study of International Fishery Research Summary Report identified the utilization of small pelagics as an important area for future research. This finding was reached against a background of:

- increasing pressure on the supply of marine resources and the effects of this trend on the poor in developing countries; with catches reaching their maximum sustainable limit and with increasing demand from rich industrialized nations, there would be an increasing diversion of resources from the poor—the traditional consumers of small pelagics
- 50% is used for the production of fishmeal rather than human consumption and the constant high demand for fishmeal for feed in livestock and aquaculture systems shows no signs of decreasing. There is also a loss of valuable fish as food due to spoilage and discard in fisheries, particularly small pelagics; it was thought that tolerance of such losses would diminish with population growth, especially in regions such as Asia, where fish is a major source of animal protein for poor consumers.

Small pelagics could be utilized more efficiently to improve protein consumption among poor consumers. Responses for improving utilization include increasing fishing intensity of under- or un-exploited stocks, reducing post-harvest losses, diverting small pelagics from use as fishmeal to human consumption and better management of stocks.

This study was funded by ODA's research programme on post-harvest fisheries and its focus on Asia reflects ODA's regional priority for work on small pelagic utilization. Within Asia the study concentrated on developing countries with a marine fishery—Bangladesh, Cambodia, China, India, Indonesia, Malaysia, Maldives, Myanmar, Pakistan, Philippines, Sri Lanka, Thailand and Vietnam. However, there were few data available on the small pelagic fisheries of Maldives, Vietnam, Myanmar and Cambodia. The full report (R6272) is available from NRI, and a summary of the report is published here.

Research was based on a desk study of data from FAO publications and statistical publications, various project reports, articles and papers, and interviews with key informants in the UK, at FAO in Rome and in Asia.

PRINCIPAL CONCLUSIONS AND RECOMMENDATIONS

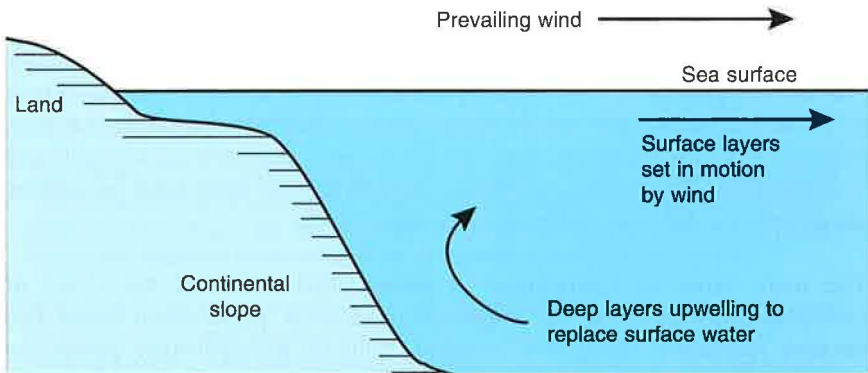
- Small pelagic fish are an important but variable component of the global and regional fish catch accounting for 36% of world fish landings in 1992 and 21% of Asian landings.
- Generally small pelagics are utilized efficiently in Asia although there is much variation between countries.
- Although many inland coastal resources are already heavily or over-exploited in Asia there are believed to be significant under-exploited off-shore small pelagic resources in some Asian countries. Their exploitation, however, is a complex issue.
- Post-harvest losses are generally less, both in quantity and value, than previously thought and traditional fisheries and markets appear to handle the catch efficiently. The only significant source of losses is at sea as by-catch and discards.
- Most domestic production in Asia is already directed towards human consumption and with growing populations and increasing demand for fish it is unlikely that there will be any significant diversion of fish from food use to feed.
- There is an increasing demand for high quality fishmeal in Asia which cannot be met from domestic resources. Asia imports about 10% of world fishmeal production.
- Given the increasing demand for fishmeal, it is recommended that research be carried out on investigating alternative sources.
- It is recommended that investigations be made into ways in which low-income groups can continue their involvement in production, processing and trade of small pelagics and not have these activities taken over by other groups as the catch becomes more valuable.
- Policy, such as trade barriers, subsidies and taxes, has affected utilization of small pelagics and it is recommended that the impact of policy be studied to identify the range of policies likely to affect utilization, consider the actual implementation and effects of such policies and identify options for the improvement of policy.

SMALL PELAGIC FISHERIES

Pelagic fish live in open waters feeding mainly on phytoplankton. The production of phytoplankton is dependent on an ample supply of nutrients and sunlight which is required for photosynthesis. Particularly rich areas of phytoplankton are found in zones of upwelling on the coasts of many of the continental land masses. The nutrient rich waters of these areas attract large numbers of pelagics and key commercial pelagic fisheries are found in these areas.

World-wide, the most important small pelagic species are sardines, herrings and pilchards (Clupeidae), anchovies (Engraulidae), jack mackerels (Carangidae) and mackerels (Scombridae). Small pelagics are characterized by high levels of oil in the flesh and their tendency to group in tight shoals, either as a protection against predators or as part of their breeding behaviour.

This shoaling behaviour is important to the fishing industry as shoals can be detected by a variety of methods ranging from low technology, such as watching the behaviour of sea birds, up to the highest technology, for example, sonar. The rapid increase in the development of purse seine fishing methods in the 1950s/1960s lead to a sharp increase in the world-wide catch of small pelagics. In 1992 small pelagic fish accounted for 36% of the total fish catch of 98 million tonnes.



Zones of upwelling are found in certain parts of the world where the deeper oceanic layers with their high levels of dissolved nutrients, such as nitrogen, phosphorus and iron, are brought to the surface by a combination of ocean currents and the presence of land masses. The nutrient-rich waters in the surface layers of the ocean are areas of high phytoplankton production which results in large numbers of small pelagic fish



Shoaling behaviour can also be induced by a number of methods including baiting. For any species there tends to be an optimum shoal size and this means that even when overall populations get very low the shoals are fewer but the shoal size remains the same but there are fewer of them. This has

important implications for the fishery and allows for potential over-fishing.

The fishery for small pelagics is often highly seasonal. Small pelagic fish can complete their entire life cycle in one year and breeding is frequently linked to part of the seasonal cycle. Therefore the fishery may be tied to the cycle of breeding behaviour, for example, and occur during the period when breeding shoals form. In many of the fisheries there is also a seasonal cycle of fish condition related to the breeding cycle and/or feeding cycle. This may be due to factors such as lipid : water ratios of the tissue and/or texture. These factors can affect both the storage and handling characteristics of the fish as well as the value to the consumer. These changes in fish condition and therefore their marketability tend to be predictable and are well known to fisherfolk. An important management consideration in the exploitation of small pelagics is therefore how to concentrate fishing effort in only part of the year.

Production of small pelagics in any one location can be variable, particularly for those stocks associated with zones of upwelling. Failure of the fishery in a particular year can be followed by rapid recovery due to the high fecundity of the remaining stock. So the potential for over-fishing is not acute although over-fishing has been recorded, as well as failure of recruitment into the next generation due to insufficient breeding stock. This may be a particular problem in years when adult populations are already low due to a combination of natural causes.

The main cause of fluctuations in pelagic fish stocks is the effect of environmental factors on the important recruitment phase when larval fish develop into adult stock. For example, reduced phytoplankton production resulting from a reduction of the intensity of an upwelling would result in a poor year for any particular pelagic stock. Variation in environmental parameters may also affect not only the overall production but the location of productive areas and this also has important effects on the fishery. Location of the productive areas where fish will congregate or spawn will help reduce fishing effort and is,

therefore, necessary for efficient management where wasted fishing effort could easily render a fishery unviable.

Monitoring of environmental parameters together with detailed examination of the fishery and precaution against over-fishing are priorities in the management of pelagic fish stocks. The regular provision of this type of information could potentially lead to increased efficiency in the fishing of small pelagics. Optimization of fishing effort would lead to greater overall yields by preventing over-fishing, particularly in low recruitment years, and by exploiting increased stocks in high recruitment years.

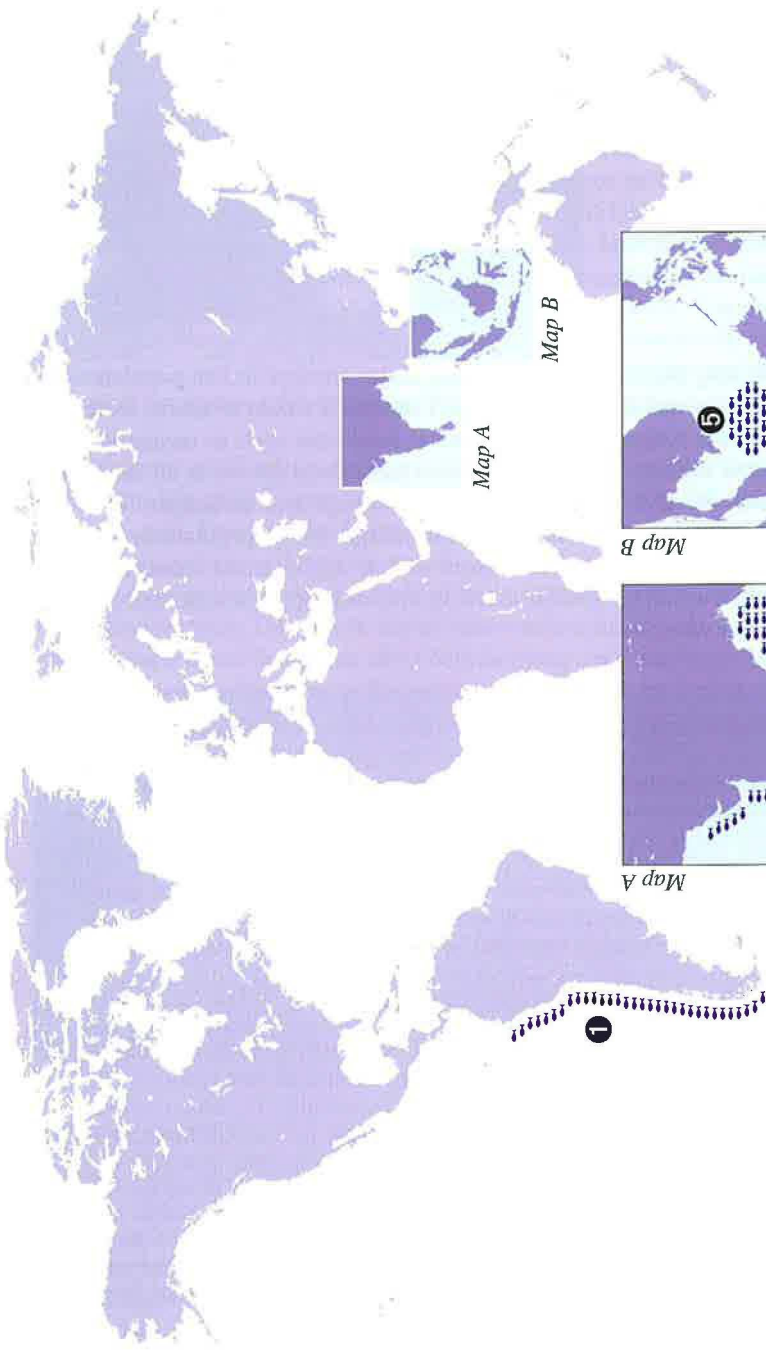
As well as locating populations, anticipating major changes in fish populations is also a priority in the management of pelagic fisheries. It would be useful, therefore, to be able to relate measurable environmental conditions such as meteorological, oceanographic or primary production data to a particular fishery as all these are a major influence on fish stocks. The normal management techniques used for demersal fish may not be applicable for small pelagic fish as populations fluctuate so rapidly. Methods to estimate recruitment such as egg or larval counts are more appropriate and it would be sensible to incorporate this approach with measurement of environmental variables.

BIOLOGY OF SMALL PELAGICS

Small pelagic fish are fast-growing and can usually reach sexual maturity in less than a year. Therefore overall production and egg production are strongly related to the conditions which exist within a one-year period or one full seasonal cycle. Egg production is usually high within the group. The rapid growth and high fecundity of small pelagic fish suggest that they are typically r-selected, that is they are adapted to respond quickly (in terms of growth and reproduction) to a favourable environment and the populations of an r-selected species are inherently highly variable.

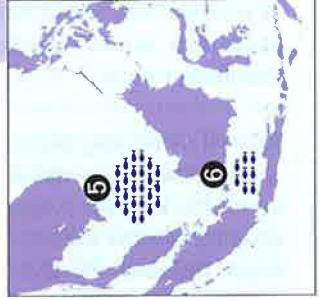
Most of the fish that are defined as small pelagic fish cannot, in fact, be considered 100% pelagic as their breeding is often tied to shallow waters where they lay their eggs on the sea floor. They are therefore almost exclusively limited (at least in any substantial numbers) to the shallow zones close to continental land masses.

Frequently in areas where pelagic fish are common there are more than one species present and the dominance may switch between species. This may simply be a result of natural conditions favouring one species over the other or in some cases it could be due to fishing pressure on the most commercially favoured species, giving advantage to the other. In many of the upwelling zones of the world, there are two species of small pelagic fish present in large numbers and the biology of the competition between these species may be important to the management of the fishery.

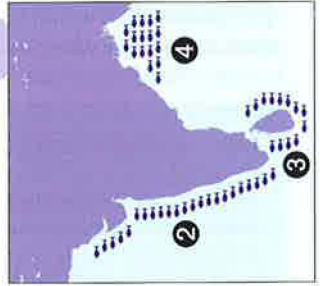


Map A

Map B



Map B



Map A

*Pelagic fisheries discussed
in this report*

① West Coast of South America

The largest fishery for pelagic fish in the world concentrated off Peru, Chile and Southern Ecuador. Main fishery for the Peruvian anchoveta (*Engraulis ringens*) until early 1970s, peaked at 13.8 million tonnes in 1970. Catch rates dropped dramatically to 2 million tonnes in 1973. (This crash was linked to the failure of the Peruvian upwelling, which occurs with some frequency during what are known as *El Niño* events.) Decline was partly compensated for by increase in landings of the South American pilchard (*Sardinops sagax*) and Chilean jack mackerel (*Trachurus murphyi*). By 1990s overall catches were returning to 1970s levels with some recovery of the anchoveta.

② West Coast of India

Landings of 1.57 million tonnes amounted to 70% of total Indian landings in 1993, half of the total catch for the West Coast was small pelagic fish. Productivity of fishery is related to currents and offshore winds of north-east monsoon producing upwelling in the region. Catches are related to environmental conditions as evidenced by variable landings of Indian mackerel (*Rastrelliger kanagurta*). Indian oil sardine (*Sardinella longiceps*) is also an important pelagic landed in this area.

③ Sri Lanka

Narrow continental shelf and lack of large-scale upwellings limit marine resources, but there is an important fishery for small pelagics. Maximum sustain-

able yields of these fish estimated at about 95,000 tonnes per annum, a figure that was approached in 1981 with a total catch of 76,000 tonnes. Since then there has been a decline in pelagic catches.

④ Bay of Bengal

Data on fishery not available. Not thought to be highly productive but possibility of expanding fisheries further offshore is being investigated.

⑤ South China Sea and Malaysia

Statistics show that landings of small pelagic fish have exceeded estimates of maximum sustainable yield. As an uncertain amount of fish not landed in Malaysia itself is not included in the statistics estimates of yield seem to be

underestimates. Areas of Sarawak and Sabah appear to be fished at levels much below the estimated yield of small pelagics which suggest potential for fisheries expansion.

⑥ The Java Sea

Large purse seine fishery for small pelagics. Catches are very mixed. Main species caught are scads (*Decapterus* spp.), Indian mackerels (*Rastrelliger* spp.) and sardinella sardines (*Sardinella* spp.). In 1987 landings of small pelagics totalled some 0.40 million tonnes, 77% of the estimated maximum sustainable yield of small pelagics from the area. 'Open access' nature of fishery may in future result in over-fishing and reduction in small pelagic populations.

CURRENT STATUS OF SMALL PELAGICS

Global landings of small pelagics increased between 1985 and 1989 but by 1992 had fallen again. A similar pattern was observed in both Asian and non-Asian waters but the pattern is different for the selected group of Asian countries. Not only did the absolute landings increase between 1985 and 1992 but the group's share in Asian and world catches also increased. For example, the group's share of Asian small pelagic landings increased from 32% in 1985 to 49% in 1992 (Table 1).

The most important small pelagics (by volume of landings) for all marine areas in 1985, 1989 and 1992 are shown on pages 10 and 11 where those species with landings of over 600,000 tonnes per annum are illustrated. A striking feature is the re-emergence of the Peruvian anchoveta as the most important small pelagic globally. In 1985, landings were 1 million tonnes but these increased to just under 5.5 million tonnes by 1992. Other important species, with landings above 2.5 million tonnes in 1992, are Chilean jack mackerel, South American pilchard and Japanese pilchard and these four species accounted for about 40% of small pelagic landings in 1992.

The graphs also illustrate the most important small pelagics in selected Asian waters with landings in excess of 100,000 tonnes. Since 1985 scads are the most important small pelagic and landings increased from 540,000 tonnes in 1985 to 920,000 tonnes in 1992. Other important species are the Largehead hairtail, Sardinella and Indian mackerels.

When considered against data for total marine fish landings globally, the proportion made up by small pelagics varied between 42% and 45% for the years 1985, 1989 and 1992. In Asian waters, however, the percentage as a proportion of all marine fish caught declined from 37% in 1985, to 34% in 1989 and 28% in 1992 (Table 2). For the selected group of Asian countries a similar trend can be seen—27% in 1985, 24% in 1989 and 23% in 1992.

Small pelagics are less important for the group of selected countries than they are for the Asian region in general although there is some variation within the group. Five countries—Bangladesh, Cambodia, the Maldives, Myanmar and Vietnam—have no recorded landings of small pelagics but it is known that these countries have significant pelagic resources. It is estimated that Myanmar has a resource of 975,000 tonnes consisting mainly of sardine, anchovies, mackerel and horse mackerel. Cambodian and Vietnamese stocks are also heavily exploited by Thai vessels either without licenses or by joint access agreements.

Table 1. Estimated small pelagic landings (million tonnes) 1985, 1989 and 1992

Year	World	Asian Waters ¹	Non-Asian Waters	Selected Countries in Asia	Selected Countries as % of Landings in Asian Waters	Selected Countries as % of Landings in all Marine Areas
1985	32.9	11.3	21.5	3.6	32.12	11.10
1989	38.7	11.9	26.6	4.2	35.76	11.16
1992	34.8	10.0	24.8	4.9	49.06	14.23

¹ Areas covered include: Indian Ocean Western; Indian Ocean Eastern; Pacific Northwest; and Pacific West Central.

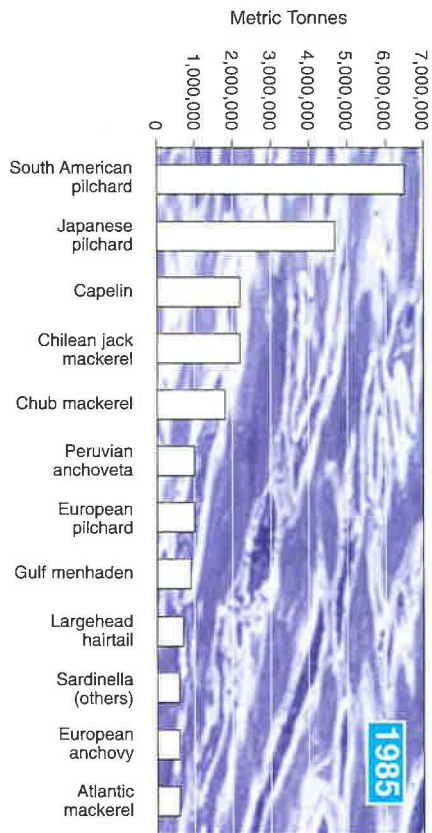
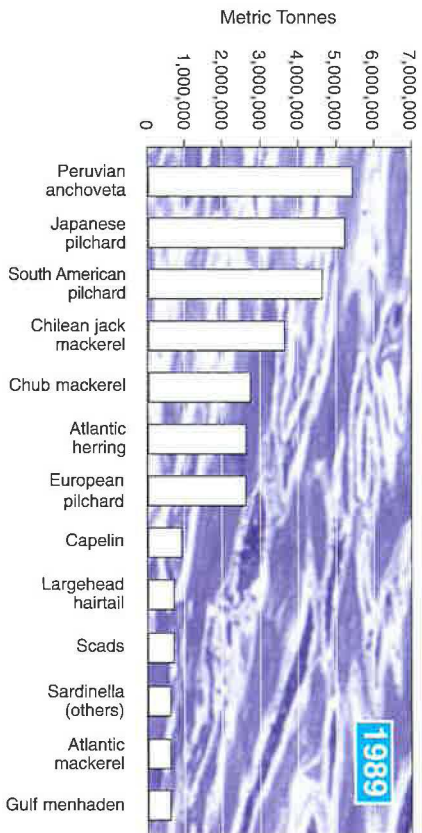
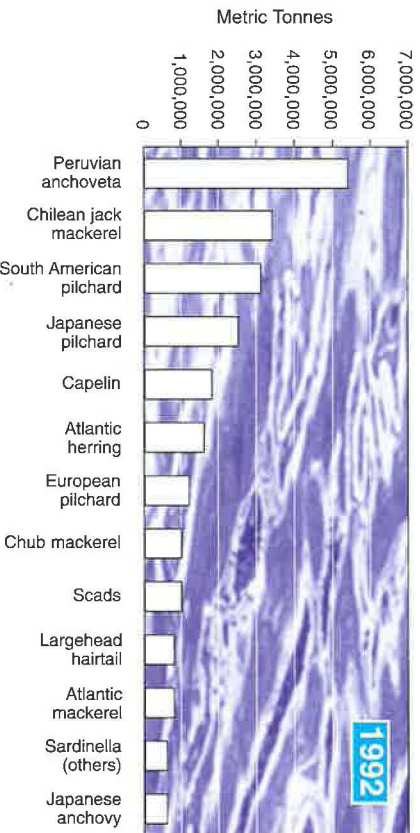
Table 2. All fish and small pelagic landings (million tonnes) world and Asian water totals 1985, 1989 and 1992

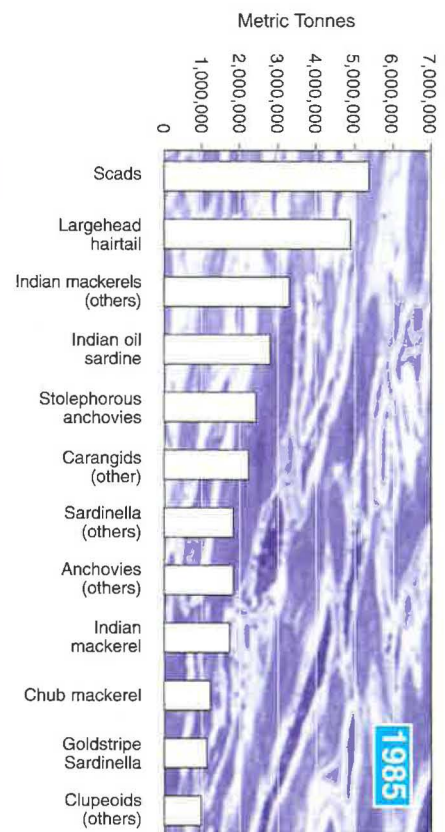
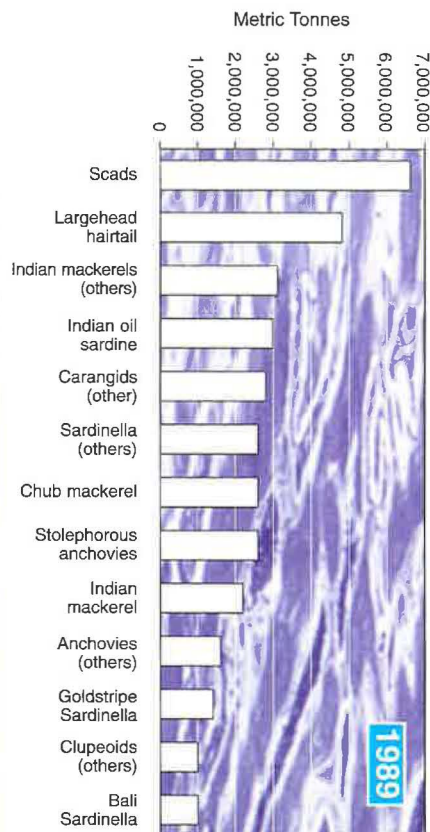
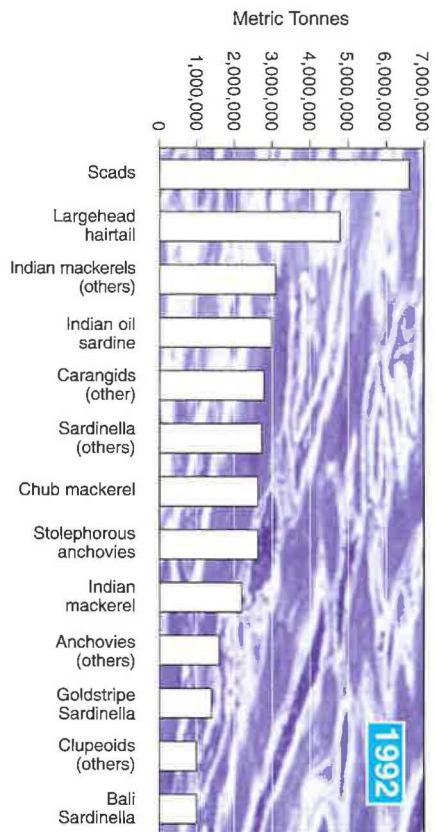
		1985	1989	1992
World	All fish ¹	86.3	100.3	98.1
	Marine fish ²	75.7	86.4	82.5
	Small pelagics	32.9	38.7	35.8
	SP as a % of all fish	38%	39%	36%
	SP as a % of marine fish	43%	45%	42%
Asian Waters	All fish ¹	37.7	45.0	47.8
	Marine fish ²	30.7	35.4	36.1
	Small pelagics	11.3	11.9	10.0
	SP as a % of all fish	30%	27%	21%
	SP as a % of marine fish	37%	34%	28%
Selected Asian Countries	All fish ¹	19.6	26.5	32.1
	Marine fish ²	13.2	17.5	21.1
	Small pelagics	3.6	4.2	4.9
	SP as a % of all fish	18%	16%	15%
	SP as a % of marine fish	27%	24%	23%

¹ includes inland and marine landings

² includes only marine landings

Small pelagic landings - the most important species (all waters)





Small pelagic landings - the most important species for the selected Asian countries

For countries with recorded landings, small pelagics increased as a proportion of all species of fish in Pakistan and the Philippines, but the share fell in China, India, Malaysia and Thailand. The fall in share occurred despite absolute increases in small pelagic catches in China and India. In Indonesia and Sri Lanka the small pelagic share remained roughly constant.

CURRENT UTILIZATION

Despite their importance in consumption, data on the utilization of small pelagics are generally poor. Data on the commercial species such as demersals, large pelagics and crustaceans are easier to locate because of their importance in international trade. By contrast small pelagics are largely consumed in the country of origin, by low income consumers, and often served by informal market systems. Therefore existing data are likely to under-estimate the importance of small pelagics.

Global trade

World trade in small pelagics has declined from 20% of the volume and 9% of the value of total fresh and frozen fish traded in 1980 to 15% of the volume and 5% of the value in 1989. The low price fetched by small pelagics means that they are less important in value than in volume. As world landings show no discernible decrease the trade figures suggest that a greater proportion of small pelagic catch is being consumed domestically thereby reducing the supply available for trade. This would confirm the predictions of fisheries trade specialists over the last twenty years that domestic consumption will increase while supplies remain static.

North American countries, Europe (including the former Soviet Union) and Japan are major processors of small pelagics. Most of this production is utilized within the regions with the exception of Japan which still exports significant, if declining quantities. South American and southern and western African countries are also large producers of selected species. Most of this catch is exported either as fishmeal or in cans. World-wide South America is the most important producer, especially Peru and Chile. Fishmeal dominates world trade in small pelagic products. It is used in the production of animal feeds for poultry and aquaculture—particularly salmon, trout and shrimp.

Most international trade for human consumption is in canned fish, such as sardines and pilchards. The other major type of trade is in preserved products, either pickled, smoked or salted. There is also a large trade in frozen pelagics,

particularly mackerels. Eastern Europe and Asia are major importers of these fish, much of which is caught in the north and eastern Atlantic, and in Asian waters fished by East Asian fleets.

Asian trade

Imports

Imports are relatively insignificant. Annual imports of small pelagics (excluding fishmeal) by the selected group of Asian countries are over five times the level of exports. The Philippines is the most important importer in the group accounting for 58% of the group's imports. The major species imported are frozen sardines and mackerel, and preserved sprats, together representing 85% of imports.

Table 3. Annual small pelagic trade (tonnes) for selected countries (excluding fishmeal)

Country	Exports	Imports
Malaysia	5844	26,440
Pakistan	0	11,716
India	11,892	0
Thailand	449	17,814
Indonesia	8909	3041
Sri Lanka	2	15,108
Philippines	5606	104,442
Total	32,702	178,561

Table 4. Annual small pelagic trade (tonnes) for selected countries including fishmeal

Country	Exports	Imports
Malaysia	12,251	37,949
Pakistan	1071	11,716
India	12,213	0
Thailand	18,689	84,725
Indonesia	9919	65,489
Sri Lanka	2	21,667
Philippines	5851	177,647
Total	59,996	399,193

The selected Asian countries import small pelagic products (excluding fishmeal) mostly from northern Europe and other Asian countries. These products are mainly used by the canning industry. There is also a significant intra-regional trade with Thailand, and to a lesser extent with Malaysia and Indonesia. Hong Kong and Singapore are important entrepots for much Asian trade.

If fishmeal is included in the figures then the volume of imports is about 7 times greater than exports. Annual small pelagic imports by the selected group totalled about 400,000 tonnes in the early 1990s, of which 220,000 tonnes were fishmeal, mostly from South America. China imported 75% of this volume. Fishmeal consumption in Asia increased from 904,000 tonnes in 1988 to 1,295,000 tonnes in 1992. Increased consumption in China and Thailand

accounted for 90% of the overall net increase. The only country where consumption declined was Malaysia.

Currently Asian imports of fishmeal stand at about 10% of global production and 20% of world exports and Asian demand for fishmeal is still increasing. Supply forecasts are problematic as future levels of catches are difficult to predict but it is likely that strong demand for fishmeal will push up prices from their currently low levels.

Exports

Exports from the selected Asian countries are also dominated by fishmeal (45% of small pelagic export volume), but other important exports include frozen or canned sardines (10% of exports), salted or dried anchovies (17% of exports). Thailand is the only major exporter, while the others mostly supply domestic markets. Sri Lanka and Malaysia are important importers of anchovy products produced within the region. Thailand, Indonesia, Malaysia and the Philippines have large canning industries. Raw material for canning derives from national fisheries during fishing seasons or is imported from world markets (European frozen mackerel and Japanese frozen sardines) to make up for any shortfall in supply. Thailand has an important pet food industry which uses small pelagics as raw material.

Table 5. Estimates of small pelagics availability

Country	Small pelagic fish as food (tonnes)	All fish per capita (kg)	Per capita supply of small pelagics available as food (kg)	Small pelagics as % of fish as food supply
Bangladesh	n.a.	7.20	n.a.	n.a.
Cambodia	n.a.	n.a.	n.a.	n.a.
China	896,360	9.40	0.80	8.54
India	623,668	3.70	0.75	20.31
Indonesia	897,650	14.70	4.96	33.74
Malaysia	90,116	27.50	5.30	19.28
Maldives	n.a.	n.a.	n.a.	n.a.
Myanmar	n.a.	15.40	n.a.	n.a.
Pakistan	41,465	1.90	0.36	18.98
Philippines	1,598,944	34.70	26.21	75.54
Sri Lanka	68,255	14.60	4.02	27.5
Thailand	163,534	20.40	3.03	14.85
Vietnam	n.a.	12.40	n.a.	n.a.

Per capita food supply are for a three-year average (1988–90)

Human consumption

Among the selected countries small pelagic fish as food are most important in the Philippines where availability stands at about 26 kg per capita (35 kg for all fish). The Philippines is the country most dependent on small pelagics as part of the total fish as food supply. The country least dependent on small pelagics as food is Pakistan where availability is less than 0.5 kg per capita and fish availability overall stands at only 2 kg per capita (Table 5).

UTILIZATION WITHIN ASIA

The study focused principally on **India** and **Thailand** and case studies on the utilization of small pelagics within these countries are presented in the boxes on pages 16–19.

Sri Lanka is a major producer, importer and consumer of small pelagic fish. Small pelagics are an important part of the national diet and are consumed in large quantities, fresh, dried as well as in other traditional processed forms. The supply of fish as food was 14.6 kg per capita in 1989 with small pelagics providing 4 kg. The proportion of small pelagics of the fish as food supply is the fourth highest in the selected countries.

Maximum sustainable yield estimates for this fishery are estimated at around 95,000 tonnes per annum. Catch statistics from 1981 showed that this figure was approached with a total catch of 76,000 tonnes. Since then there has been a decline in reported catches but this may be more a result of civil disturbances in the north and west of the country.

Imports of small pelagics have been increasing and the gap between imports and exports has been widening reflecting the overall trend in the fisheries sector. Imports in 1991 were 21,700 tonnes which included 15,100 tonnes of preserved sprats and 6550 tonnes of fishmeal. The preserved sprats are mostly imported from Thailand with 12,400 tonnes being supplied in 1991. The import duty for all small pelagic products is at a base rate of 66% which will be reduced to 50% after the implementation of the Uruguay Round proposals. There is no duty on the import of fishmeal.

The shortfall in fishmeal requirements is expected to continue and in the near future will have to be met with increased imports. Annual demand is estimated at 10,000 tonnes and is likely to increase with the growing poultry and aquaculture industries. Currently domestic production is estimated at 1000 tonnes with the major supply of raw material coming from artisanally beach

CASE STUDY: INDIA

There is some suggestion, although this is debated, that the small pelagic fisheries are showing signs of over-exploitation and falling yields. It is, however, difficult to draw firm conclusions given the volatility of the small pelagic catch size and possible changes in data collection. There are thought to be substantial offshore pelagic resources still unexploited.

Three species, Indian oil sardine, anchovy and Indian mackerel, dominate the small pelagic catch. Together they accounted for 71% of the total small pelagic catch in 1985, 68% (1989) and 54% (1990). The total catch for the three years ranged from 610,000 tonnes to 730,000 tonnes. Small pelagics accounted for 27–35% of total marine catch in the same years.

The intense demand for fish as food means that the domestic market easily dominates the market overall, although the export market is economically important for the country. Home demand is shifting increasingly towards fresh iced fish and away from the traditional processed products. For example, 10–15 years ago a significant proportion of the Indian oil sardine catch would have been salted and dried for distribution to more distant domestic markets. Nowadays, it is mostly consumed fresh, generally on the day of landing, with ice widely used from landing onwards. Losses are allegedly minimal (less than 2% of volume). Most of the catch can now find a market in places 8–10 hours distance from the landing centre.

Like sardines the Indian mackerel is now consumed as iced fresh fish, generally within 48 hours of landing and has acquired the status of a prized table fish. Anchovy is the only one of the three main pelagics which is still processed on any significant scale. Most other small pelagics, pompanos, threadfish, butterfish, jacks and crevalles, now find ready markets as fresh fish. These markets are pre-

dried production. Processing technology has been developed to suit this cottage scale production which should be economically feasible but is not in common use.

Small pelagic utilization appears to be insignificant in Bangladesh. The only reported trade was 20 tonnes of sprats imported from India. Informal estimates, however, indicate a virtually unexploited stock of 264,000–373,000 tonnes within the continental shelf. The insignificance of the small pelagic catch is probably related to the lack of a suitable fishing fleet to exploit these off-shore resources; it is estimated that 94% of the marine fleet is artisanal in nature. New joint venture fishing agreements to exploit the pelagic stocks have been reported recently. The duty on small pelagics and related fish products has been set at 200% under the recent GATT treaty and therefore imports are unlikely to

dominantly in the traditional fish-consuming coastal communities, where demand from growing populations now outstrips supply, pushing up prices.

The export market has seen a dramatic expansion and is increasingly important in terms of volume as well as value (in the late 1980s it absorbed about 4% of marine catch by volume). Exports of high value products, such as prawns and cuttlefish or squid, account for much of the expansion, but increasing volumes of other fish species are exported to markets in the Gulf, Far East, Europe and USA. Until recently, dried ribbon fish was food for the less well-off but has now found a large market in China. In 1992, ribbonfish was the sixth most important small pelagic (by volume) in India.

The expansion in poultry farming and aquaculture has led to increased demand for fishmeal. Indian fishmeal production was approximately 110,000 tonnes in 1987, but declining availability of raw material suggests that output would have since fallen. Small pelagics traditionally used for fishmeal production are now used for human consumption. This has resulted in a chronic shortage of domestic raw material and fishmeal now has to be imported.

Given the fact that most small pelagics in India are already being used for human consumption, there is limited scope for increasing the availability of protein for the poor by diverting small pelagics from fishmeal production to fish for human consumption.

In general, small pelagic stocks are utilized efficiently in India and studies are starting to show that losses may not be as high as previously believed, and traditional and informal marketing systems appear to handle the catch efficiently and are apparently responsive to changes in demand.

increase. There is no reported duty on fishmeal. Demand from the feed industry is likely to increase pressure on the supply of fishmeal.

Like Bangladesh, Pakistan has large unexploited small pelagic stocks and so could become a major exporter of small pelagics and fishmeal to other countries in the Asian region. At present though the only recorded export is 1070 tonnes of fishmeal. There are no recorded imports and no reported duties for imports.

Small pelagics are landed in large quantities as by-catch particularly of the shrimp industry. They are consumed fresh and unprocessed as processed fish is neither available nor preferred. Over 50% of the marine catch is used for fishmeal. Fishmeal production is estimated at 36,000 tonnes per annum and domestic consumption has gradually increased from 33,000 tonnes per annum to

CASE STUDY: THAILAND

Thailand is the third largest marine fishing country in Asia, after Japan and China, and is a major producer of small pelagics landing 506,000 tonnes in 1992, about 18% of the total marine catch (28% in peak year of 1977). The major species caught are *Sardinella*, anchovies and Indian mackerel and these three together accounted for 13% of the total marine catch in 1992. The major coastal and off-shore fisheries are heavily exploited. The Gulf of Thailand is thought to be over-exploited but the Andaman Sea fishery may be under-exploited. It is reported that the maximum sustainable yield of pelagic fish in the Gulf of Thailand stood at 400,000 tonnes but landings in 1990 were 719,000 tonnes. Thailand now fishes in neighbouring areas belonging to Bangladesh, Indonesia, Cambodia and Myanmar.

In the last twenty years there appears to have been a notable decline in artisanal/small scale fishing, as well as a decrease in the share of small pelagics that these fishermen catch. The importance of the commercial sector has grown significantly. The gears used by the small scale sector have changed from those for small pelagics, to those for shrimps and high value demersals.

The majority of small pelagics landed in Thailand now appear to be landed by medium and large purse seiners fishing in the Gulf of Thailand or in waters of neighbouring countries. Since the early 1970s there has been heavy investment in new gears and boats especially large purse seines. The exploitation of offshore small pelagics is mainly undertaken by commercial purse-seiners.

The catch from the Gulf of Thailand is reported to suffer quality problems due to the length of fishing trips compared to ports on the Andaman Sea. There appears to be a trade-off between losses and catch size: one source suggests that coastal purse seiners undertaking one-day cruises report no losses whereas offshore vessels undertaking ten-day cruises have 50% of the catch suffering a decline in landed value of up to 33%.

Within Thailand there is a large regional variation in food preferences and there is a large market for fresh fish as well as traditional preserved products. During 1971–90 there was a decline in per capita supply of fish and fishery products from 25.4 kg per annum to 19.5 kg. At the same time there was a small increase in the supply of other

39,000 tonnes during the years 1988 to 1993. Also there are 175,000 tonnes of pelagics (1990) that are not generally consumed locally, although a good proportion of these are sardines which could be processed for local consumption or export. In view of this, serious attempts are being made to develop technologies that will better utilize these fish.

Indonesia is a major consumer of fish particularly in the densely populated Java island. Fish availability as food is estimated to be 14.7 kg per capita per annum and of this small pelagics are about 5 kg per capita or 33% of total fish

animal proteins from 5.1 kg to 5.5 kg per capita per year. This indicates a shift, with rising incomes, from fish to other animal proteins.

Small pelagics are considered to be a poor man's food and large amounts are consumed in rural inland areas. Some 98% is consumed steamed and 2% is eaten fresh. The major species used are Indo-pacific mackerel, Indian mackerel, trevallies, hardtail scad and scads. About 85% of the fish is transported frozen from southern ports to cold storage plants in the provincial towns of the north east.

The availability of small pelagics as food and as a percentage of fish available is estimated to be very low at 1.09 kg and 5.3% respectively. These figures are unlikely to increase due to the limits of the Thai small pelagic resources. It is therefore possible that prices for preferred species for human consumption, such as mackerels, will continue to increase in real terms, unless cheap imports maintain supplies at acceptable prices.

Thailand's imports are the second highest in the countries studied, amounting to 84,700 tonnes in 1992. Almost all of this was fishmeal with 66,900 tonnes imported in 1992. Many of the Thai fishmeal plants do not have a sufficiently high standard of processing and there is a shortage of high quality raw material. The industry also has substantial over capacity. This lack of supply which is not expected to improve, the poor quality of fish supplied, as well as the poor quality of the processing, means that the feed industry can be expected to rely increasingly on imported fishmeal to meet demand in the increasingly intensive aquaculture and livestock industries. The figures for 1988–92 reflect the demand for imported fishmeal. Although production remained fairly constant at around 260,000 tonnes per annum, exports decreased from 72,000 tonnes in 1988 to only 8000 tonnes in 1992. In the same period imports increased from 3000 tonnes to 72,000 tonnes. The domestic consumption of fishmeal has therefore increased from 167,900 tonnes in 1988 to 341,400 tonnes in 1992.

The main non-fishmeal imports are frozen mackerel and sardines, the latter used in the canning industry. Thailand has a base duty rate of 60% for all small pelagic products which will decline to 5% after implementation of the Uruguay Round proposals. In the short-term this should increase imports of fishmeal and frozen small pelagics. Most of this supply will derive from Latin America, Japan and northern Europe. The major export is fishmeal and this mostly goes to Sri Lanka.

as food supply. In 1992, Indonesia exported 9900 tonnes of small pelagics and related products, including 1000 tonnes of fishmeal. Over 6000 tonnes of these exports were salted and dried anchovies. Imports were much higher at 65,500 tonnes, just over a third of which comes from Chile and Peru; 62,400 is accounted for by fishmeal. Domestic fishmeal production is still relatively low but growing. Production increased from 1200 tonnes in 1989 to 17,300 tonnes in 1992. Imports have also grown during this period from 24,100 tonnes in 1988 to 57,000 in 1993. In the same period exports have decreased from 24,100 tonnes to 1000 tonnes. There are no import duties on small

pelagics or related products and therefore imports are likely to increase in the medium term.

Although Indonesia has rich pelagic resources it appears that in the near future there is a severe danger of the area being overfished and the small pelagic stock reduced.

Within the selected countries, Malaysia has the second largest fish as food supply at 27.5 kg per capita per annum. Small pelagics make up a significant proportion of this at about 5 kg per capita which is 19% of the total food fish supply. Landings of small pelagics have actually exceeded estimates of maximum sustainable yield, although such estimates may be based on out-dated data. Data for the areas of Sarawak and Sabah, however, suggest that these areas are fished at levels much below the estimated maximum sustainable yield of small pelagics suggesting an area of possible fisheries expansion.

The country is a major importer of small pelagics and related products with imports of 38,000 tonnes in 1992. The major imports were frozen (from Japan) and canned sardines, dried anchovies (from Thailand) and frozen mackerel. Fishmeal imports were 11,500 tonnes. Exports were 12,250 tonnes with the major commodities being the re-export of frozen and canned sardines as well as 6400 tonnes of fishmeal.

Malaysia has a base rate of import duty of 50% on whole smoked and canned small pelagics a 15% duty on salted small pelagics, and no duty on frozen small pelagics or fishmeal. These rates are set to fall under GATT to 5% on whole small pelagics, 40% on smoked and 19% on canned small pelagics. Previously it appears that Malaysia wanted to encourage raw materials for its canning and feed sector and to discourage competition for its small pelagic processing industry, both commercial and artisanal. The decrease in duty on canned products together with planned expansion within the canning industry will increase imports of raw small pelagics.

The Philippines has the highest per capita supply of fish as food for the selected countries at 34 kg per capita per annum and small pelagics make up the largest proportion of this at 26 kg, about 75% of the total fish as food supply. The Philippines is by far the largest importer of small pelagics among the selected countries with imports of 177,600 tonnes in 1991. Most of this was made up by 91,300 of frozen sardines, 12,350 frozen mackerel and 73,200 of fishmeal. The majority of these frozen products came from Japan and the former Soviet Union. Exports were negligible at 5850 tonnes comprising sardines, mackerel and round scad.

No fishmeal production was reported for 1988–92 indicating that the high human demand may mean there is little available for use in the feed sector. The



Philippines appears to be almost totally dependent on imports for its fishmeal requirements. Over 84% of fishmeal comes from Chile and Peru and it is unlikely that this figure will decrease in the near future. The dependence of the country on imports is reflected in the absence of any existing or planned import duties.

There is, therefore, no scope for diverting domestically produced small pelagics from use as fishmeal to use for human consumption.

The supply of fish as food in China is 9.4 kg per capita per annum but small pelagics only account for 0.8 kg or 8.5%. Large amounts of small pelagics are utilized for fishmeal. During 1988–92 fishmeal production decreased from 95,000 tonnes to 82,000 tonnes, whereas imports increased from 454,000 tonnes to 637,000 tonnes, falling back again in 1993 to 434,000 tonnes. In comparison to this exports are negligible and stood at 2000 tonnes in 1992. Over 94% of this supply came from Chile and Peru and it appears unlikely that reliance on this source will decrease in future. Domestic production of fishmeal is often inadequate for the production of high grade animal feed and therefore much of the raw material is used as unprocessed fertilizer. It is produced by traditional methods of sun drying and the fish is usually in an advanced state of spoilage.

There are few data available for Cambodia, Maldives, Vietnam and Myanmar but these countries are known to have abundant stocks of small pelagics.

CONCLUSIONS AND RECOMMENDATIONS

This study examines small pelagic resources and their utilization in Asia. Generally small pelagic stocks are utilized efficiently in Asia although there is much variation between countries with some countries, such as Bangladesh and Pakistan, recording little or no utilization of this resource.

Although small pelagics are considered to be an under-exploited resource this is not the case for all countries. The situation is complex with many inland coastal resources in Asia already heavily or over-exploited. The highly variable nature of the landings makes it difficult to assess resources accurately, but in Malaysia landings of small pelagics are estimated to have exceeded estimates of maximum sustainable yield, and in the Gulf of Thailand, the maximum sustainable yield of pelagic fish stood at 400,000 tonnes whereas landings were 719,000 tonnes in 1990.

There are believed to be significant under-exploited offshore small pelagic stocks in some countries, such as Bangladesh, Pakistan, Cambodia, Maldives and Myanmar. In Bangladesh it is estimated that there is a virtually un-exploited stock of 264,000–373,000 tonnes. These resources may prove difficult to exploit, however, since their value rarely justifies the capital-intensive gear, fleet and storage or processing facilities required, as is the case in Pakistan and Bangladesh. The development of deep sea purse seiner fleets might be feasible, however.

Contrary to previous suggestions, post-harvest losses are generally not high, and the level of post-harvest losses has been exaggerated with the only significant source of absolute losses being by-catch and discards at sea. Losses in value terms also appear to be less significant than previously stated with low prices and use in feed often driven by market preferences rather than poor handling. Furthermore, in many Asian countries, for example, India, traditional fisheries and marketing systems appear to handle the catch efficiently, and are apparently responsive to changes in demand.

There is little scope for diverting small pelagics from use as fishmeal to use for human consumption and so improve protein consumption among low-income consumers in Asia, because most domestic production is already directed towards human consumption, while most of the fishmeal consumed in the region is imported from South America particularly from Chile and Peru. In the selected countries only Pakistan produced sufficient fishmeal to meet demand.

The domestic market for fish as food in Asia significantly dominates the small pelagic market in terms of volume of fish absorbed. No fishmeal production was reported in the Philippines for 1988–92 because the high human demand for fish means there is little available for use in the feed sector. However, the importance of small pelagics in the food system varies significantly both between and within countries, with annual per capita consumption ranging from less than 1 kg in India and China to more than 26 kg in the Philippines.



Even Thailand, which currently exports the highest amount of fishmeal of the selected Asian countries, is likely to increasingly rely on imported rather than domestically produced fishmeal to meet demand from the aquaculture and livestock industries which are becoming more intensive. This does not, however, appear to be a result of pressure from domestic demand for small pelagics as food, since there was shown to be low use of these species for food, mainly because of consumer resistance.

In all countries the gap between imports and exports is increasing, as supply, mostly as fishmeal, is generally failing to meet demand. The demand for high quality fishmeal in Asia for use as feed is increasing as population increases, and currently cannot be met from domestic production. Increasing efficiency in animal production systems may reduce the demand for fishmeal, or lead to the use of cheaper substitutes. For example, the USA poultry feed industry decreased its use of fishmeal from 600,000 tons in 1972 to 150,000 tons in 1992. Further research is needed in this area since access to alternative low cost feeds is of paramount importance in the development of intensive livestock systems and aquaculture.

The India case study highlighted the increase in domestic demand and real value of small pelagics, together with a shift away from traditional preserved products to higher value fresh products and exports. This trend affects low-income groups as fish becomes more costly and less likely to be consumed by the poor. Fishing communities traditionally dependent on small scale fish trade and processing may

find themselves unable to pay the higher prices for fish at landing, and unable to meet the investment costs associated with supplying large urban markets. Consequently, although fisherfolk benefit from higher prices for landed fish, the local economy based around the processing and marketing of small pelagics is adversely affected.

More detailed investigation needs to be carried out on ways in which low-income groups can continue to engage in production, processing and trade of small pelagics and identify possibilities for improvements in low cost technology that would enable low-income groups to benefit from changes in pattern of demand.

It is suggested that further research also be carried out to look at the impact of policy, such as trade barriers, subsidies or taxes. By identifying the range of policies likely to affect utilization, it should consider actual implementation and effect of such policies for selected countries, and identify options for the improvement of policy relating to small pelagics.

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