

Fleet-operational, Economic, and Cultural Determinants of Bycatch Uses in Southeast Asia

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A brief history of demersal trawling in Southeast Asia (here: Philippines, Thailand Malaysia, and Indonesia) is given. It is argued that this fishery, through its overwhelming emphasis on penaeid shrimps, imported the concept of "trash fish," which had been previously alien in this region, and which still generates considerable unease.

In the long term, and for reasons not necessarily related to bycatch issues, the competition between small-scale fishers (who do not generate bycatch) and trawl operators (who do) for access to nearshore demersal resources may well be won by the former. This would lead to a resolution of the bycatch problem that would not only reduce social conflicts, but would also be culturally more acceptable than the current bycatch discarding practices of the trawling industry.

The bycatch of marine fisheries is a global issue (Alverson et al. 1994), though it may manifest itself differently, and consequently have different solutions in different parts of the world.

This brief contribution discusses the origins of, and a possible long-term solution to, the bycatch problem in Southeast Asian demersal trawl fisheries, adding to the diversity of mainly North American views presented in this volume. Diversity of views is part of the crane that lifts us to new insights (Bennet 1995).

HISTORY OF DEMERSAL TRAWLING IN SOUTHEAST ASIA

Prior to World War II, several attempts were made to introduce demersal trawling to Southeast Asia, notably by the Dutch in Indonesia, the French in Indochina, and the British in Malaysia. All attempts failed, however, because the gear tested was inappropriate, as were the economic and social conditions. Other attempts by Japanese vessels were more successful, but were never in-

tended and did not lead to the development of local trawl fisheries (Shindo 1973, Pauly and Chua 1988).

The development of indigenous Southeast Asian trawl fisheries started just after WW II in the Philippines, and was largely, and literally, driven by landing crafts and other gear and motors left by U.S. forces. By the late 1950s, Manila Bay exhibited all the symptoms of what would later be called ecosystem overfishing, and fishing effort began to spill over into other areas of the country.

More important is that the Manila Bay trawl fishery was then being studied by a German FAO expert (Dr. K. Tiews), who subsequently went to Thailand on behalf of a German bilateral development agency. Having seen a Southeast Asian demersal fishery in full swing, it was easy for him to convince the Thai Department of Fisheries to follow suit. An appropriate light, high opening trawl net was designed, resource surveys were conducted (the first in 1961), and the Asian Development Bank provided massive, subsidized credit to would-be investors. A boom occurred that has now become a fisheries classic, along

with the bust that followed (Pauly and Chua 1988, Pauly 1988 [Fig 13.2.]).

In the 1970s, Thai trawlers, which had made a clean sweep of the Gulf of Thailand demersal resources, were operating in other Southeast Asian countries such as Burma and Indonesia—sometimes illegally, sometimes not—and once even reaching as far as the coast of Oman on the Arabian Peninsula.

More important than these Thai incursions was the adoption of the Thai model of fisheries development by neighboring countries, notably Malaysia and Indonesia. Here, as previously in Thailand, the introduction of demersal trawling led to serious conflicts between trawl operators and small-scale fishers.

TRAWLERS AND THEIR BYCATCH

Southeast Asian trawlers must operate close inshore, for two interrelated reasons: (1) on tropical shelves, demersal fish biomass declines rapidly with depth, far more so than in temperate or boreal shelf ecosystems (Longhurst and Pauly 1987, Pauly and Chua 1988 [Fig. 3]), and (2) penaeid shrimps, the real target of the demersal trawlers, occur only in shallow waters.

For centuries, Southeast Asian inshore waters have provided a livelihood to thousands of small-scale fishers using a variety of (mainly) stationary gear. Thus, demersal trawlers operating close inshore not only compete for the same resource as the small-scale fishers, but also often destroy their passive gears.

Further, Southeast Asian trawlers use material to line their codend which has extremely small meshes, usually of 2 cm when stretched (less than one inch from knot to knot). They sometimes cover that with even smaller mosquito netting when aiming for small shrimps or anchovies. Recent efforts have been made in several countries to increase codend mesh sizes, but their success has been limited, not only because it is inherently difficult to enforce such regulation, but because of the nature of Southeast Asian demersal resources and the size of penaeid shrimps. This tropical region is the world center of marine biodiversity; therefore, these resources consist of an extremely large number of small, "r-selected," fish species. The bulk of the biomass is contributed by species not exceeding 15 cm (Sinoda et al. 1979, Azhar 1980). Thus, most fish are as small as the penaeid shrimps which, because of their high value relative to the fish (around 10:1), are targeted by the trawlers. Given that shrimps con-

tribute about one-tenth of the catch weight, most of that will consist of bycatch (the small species mentioned above, and to a lesser extent the juveniles of large, "K-selected," species including snappers, groupers, etc.).

The situation is different with small-scale fishers; they tend to catch larger fish and land all of their catch. They are bound to be wary of trawlers, especially when they operate close inshore.

There is much in the literature dealing with the ensuing conflicts, but this cannot be reviewed here. Suffice to say that these conflicts, as they turned violent, became destabilizing enough for demersal trawling to be banned in the heavily populated western half of Indonesia (Sarjono 1980), and in some areas of the Philippines; and strictly regulated in Malaysia.

SOUTHEAST ASIAN FISHERIES PRODUCTS

The catch of small-scale fishers, in Southeast Asia, tends to be marketed in one of three basic forms:

- a. fresh or live, as high-quality product (e.g. grouper);
- b. salted and sun-dried, as medium to low quality product that can be moved across large distances, and which supported (in the nineteenth century) a vast international trade (Butcher In press);
- c. salted and fermented, leading to various "fish sauces" which are added to rice.

I will deal briefly with items (b) and (c) because the existence of these traditional products largely shaped perceptions in Southeast Asia concerning the bycatch discard practice of the trawlers.

The product in (b) is one of the major sources of animal protein in the rural parts of Southeast Asia—even inland. It is a highly nutritious product, beneficial not only for the protein it contains, but also as a source of iodine, and of calcium because the bones are also eaten. This product is affordable in a way larger fish, which tend to be sold whole, are not. Further, many groups in Southeast Asia, e.g. the Javanese, simply like small fish (Leiognathidae), and hence do not perceive them as trash fish, even if trawl operators do.

Several of the products in (c) are poorly described as "sauce." The most important of these products is hard to imagine when one has not seen, smelled, or tasted it. It has the fluidity, and sometimes the color, of olive oil (and is often lighter, hence its name "fish water" in Thai and Vietnamese). It smells "fishy," and has a taste that is mostly salty. It consists of whole fish liquefied by a fermentation process driven by the fishes' own enzymes (Mizutani et al. 1987).

(The Ancient Romans consumed enormous quantities of a similar product, called *garum*, that was traded throughout the Mediterranean in amphorae—not all were used for wine!—and which seems to have been produced, at least in Spain, until the Middle Ages.)

The key advantage of this product, called *nam pla* in Thailand, *nuoc mam* in Vietnam, *petis* in Indonesia, *patis* in the Philippines, is that it can turn large quantities of tiny, and sometimes partly decomposed, fish into a highly esteemed and stable product (a bit like smelly cheese in France). This allows for continuous use of the seasonal raw material that otherwise would be lost, especially when refrigeration was not available (Ruddle 1986).

The products in (b) and (c) may be considered Southeast Asian "pre-adaptation" to the emergence of the trawl fisheries, and the "trash fish" they trawlers create. Trawlers have become the major suppliers of raw material for such products. Efforts are also being made to develop new products (Table 1). These efforts have been quite successful in some parts of Southeast Asia, but discarding continues elsewhere (Alverson et al. 1994).

The creation of "trash fish" by the trawl industry occurred at two levels: (1) *conceptually*—before the emergence of the trawl fisheries, the concept itself did not exist, as all fish that were caught were also consumed; and (2) *actually*—by reducing the fraction of large fish in the non-penaeid catch, and increasing the fraction contributed by their juveniles (one kind of trash fish), and of various, smaller fish (the other major kind of trash fish).

Item (1) was discussed above; item (2) is due to the combination of growth overfishing (which removed most older representative of large species, leaving only the juveniles) and of ecosystem overfishing (which saw large K-selected species replaced by smaller r-selected species) that characterized trawling in Southeast Asia (Pauly 1988).

Table 1. Some Southeast Asian fish products based on bycatch.

Product	Remarks and Source
Fish "sauces"	A common food item throughout Southeast Asia (Mizutani et al. 1987)
"Duckfish"	Feeding small fish to ducks is mostly done in Thailand
Fish meal	Often of variable quality (Ismail and Abdullah 1983)
Fish balls	Based on minced fish (Snell 1978; Suwanrangsi 1986, 1988)
Surimi	Some production exported to Japan (Suwanrangsi 1988)
Fish satay	Both for local (Thai) and export markets (Suwanrangsi 1986, 1988)
Fish cakes	Experimental in mid-1970s (Snell 1978); does not appear successful

A FUTURE

Marine fisheries resource conflicts in Southeast Asia, particularly conflicts between small-scale fishers and trawl operators, will tend to abate if economic growth continues and population growth does not. There are already indications of trends in several countries toward returning the exploitation and management of inshore resources to the small-scale fishers, and protecting the fishing grounds from trawlers (by spiking shallow water areas with artificial reefs). Because of the selective nature of their gear, and of the type of products marketed by small-scale fishers, this would markedly reduce the bycatch problem in Southeast Asia.

This scenario might also be a future for other parts of the world.

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