



# Managing tropical fisheries - using trawl fisheries to look at issues and solutions

Simon Funge-Smith\* and Steven J. Kennelly<sup>1</sup>

Asia-Pacific Fishery Commission, FAO Regional Office for Asia and the Pacific, Bangkok, Thailand.

<sup>1</sup>ICIC Consulting, 15/1-7 Arthur Ave, Cronulla, 2230, Australia

\*Correspondence e-mail: [simon.fungesmith@fao.org](mailto:simon.fungesmith@fao.org)

Received: 14 Oct 2013, Accepted: 30 Jun 2014, Published: 15 Oct 2014

Original Article

## Abstract

Using tropical trawl fisheries as an example, the paper explores options to improve fishery management in Asia and develop regional guidelines by the Asia-Pacific Fishery Commission (APFIC). The paper provides a background description of the history of tropical trawling and its evolution to the present day. The ecosystem and fishery impacts are described under the headings of socio-economics, environment and ecosystem and governance. The management options are outlined for the various issues in tropical trawl fisheries, noting that management is context specific for each fishery. The APFIC guideline process to develop a management plan for a tropical trawl fishery is described.

**Keywords:** *Tropical trawling, guidelines, fishery management.*

## A short history of trawling in Asia

The earliest records of trawling in the Asian region relate to beam trawls towed behind sailboats in Manila Bay. Industrial trawling began in the early part of the 20<sup>th</sup> Century, with steamships and then diesel-powered vessels towing large nets. In the early 1970's the modification of otter board gear to suit small, low powered vessels allowed trawling to rapidly become a dominant form of fishing in tropical Asian waters. These fisheries underwent

a rapid expansion over a period of decades and led to massive increases in the total catches of shrimp and finfish.

## Types of trawling

The main gear used in Asia's tropical trawl fisheries is the Bottom otter trawl, which has two major variants (the shrimp trawl and fish trawl). There are also modifications to give high opening nets which can target a broader part of the water column. There are also pair trawls which are used in some countries (e.g. Thailand) but banned in others (e.g. Malaysia). These are operated either on the bottom or as mid-water or pelagic trawls. They are generally faster trawls and capable of catching pelagic and faster swimming species. Push nets are another form of active gear, and were widely used, but have been on the decline due to their high impact on resources and habitats.

Asian tropical trawl fisheries typically operate at depths ranging between 10 m and 150 m but are often restricted to a maximum depth of about 70 m. Trawling, therefore, remains a feature of coastal fisheries. This results in significant overlap and/or interaction with other gear type fisheries. There are now an estimated 83,000 trawl vessels currently operating in the tropical parts of the APFIC region (Funge-Smith *et al.*, 2012).

## Catch from trawling

Asia catches approximately 50 % of the world's wild fish (48.7 million tonnes) and five Asian countries are in the top ten global producers of capture fish. Trawl fishing is one of the chief methods responsible for placing the Asia-Pacific region as the world's largest producer of fish (Table 1). Overall, in regions where significant tropical trawl fisheries exist, they produce 25-52% of the total marine catch, making a total production of over 6.6 million tonnes. These trawl fisheries include not only high and low value fish but also high value products such as shrimp. China and four other Asian countries produce approximately 55 % of the global shrimp catch.

Table 1: Overview of trawl fishing in Asia

Number of trawl vessels	> 83,000 vessels
Trawl fisheries provide % of country marine catch	50 % PR China, South China Sea/Beibu, Hong Kong SAR
	52% Thailand (2009)
	48% Malaysia (2012)
	>50% India (2010)
	43% Vietnam (1997)
	~25% Indonesia (2008)
Approximate total trawl catch of southern PR China, India, Thailand, Malaysia, Vietnam, Indonesia	6.58 million tonnes

## Catch levels

The increases in capture fishery production that are being achieved in the Asian region in recent decades can be attributed to large increases in fishing effort and the expansion of the geographical range of fishing activities as a result of mechanization, technology and globalization. They are also driven by the retention of most animals caught (including shorter-lived, small, fast-recruiting species), with very little discarding. Tropical trawl fisheries have been a major driver of these trends in coastal areas.

## What is being caught in tropical trawl fisheries?

Tropical trawl fisheries in Asia catch approximately 800 species; including sharks, fish, crustaceans, cephalopods, shellfish, echinoderms and other benthos. Approximately 300 species contribute to the fishery and the vast majority of species are all utilized in some form. Discarding is therefore relatively uncommon and at low levels, except in targeted shrimp trawl fisheries.

## Problems due to the rapid expansion of trawling

The rapid expansion of geographical range and effort expended on trawl fishing since the 1970's has meant that regulatory and management systems have either not been put in place or have been unable to keep pace with development. The result is that many tropical trawl fisheries are poorly managed, giving rise to social and economic problems and increasing concerns on their effect on fish populations and coastal ecosystems.

### *Social & economic issues*

- **Conflicts with other segments:** There are significant conflicts with other fleet segments (esp. artisanal fishers) as they often target the same species, as well as encroachment in reserved areas.
- **Overcapacity:** More than 83,000 trawlers operate in tropical Asia. There are probably too many vessels for the size/value of the catch.
- **Low profit margins:** Rising fuel prices and labour costs, coupled with too many fishing vessels and stable or declining catches means that many trawl fisheries operate at marginal profitability. This drives subsidies and a tendency for state support to the sector.
- **Linkages to dependent industries:** Onshore fish processing, surimi, fishmeal, and aquaculture operations have arisen because of the availability of trawl products. This demand means that curtailing the landings of the trawl fishery may have negative impacts on the supply of raw materials. Strong economic and social interests will tend to influence management measures and decision making.

### *Ecological and environmental issues*

- **Overfishing:** Trawling is a highly efficient and relatively non-selective method for catching large quantities of fish. The large scale trawling in Asia's tropics contributes to overfishing of stocks to unsustainable levels. Trawling in fishing areas and at times where juveniles of commercial species occur prevents them from contributing to the next generation. When larger mature spawning animals are caught, it may lead to recruitment overfishing. Both effects lead to long-term declines in stocks
- **By-catch:** By-catch is a common feature of any trawl fishery, but becomes a particular problem when at-risk species and juveniles are caught.

- **Catch of low-value fish:** Catch and landing of low-value fish is a feature of many tropical trawl fisheries in Asia. The loss of larger fish and resulting development of production and market demand for aquaculture and agriculture feeds and fish surimi products (see social and economic issues) can drive growth overfishing and often reduces economic returns from fisheries.
- **Habitat Impacts:** Trawls are mobile gear and damage benthic habitats and disrupt ecosystem function. Longterm intensive trawling can permanently change the benthic ecosystem, however, in some tropical benthic habitats recovery after trawling can be very quick. This gives good prospects for managing tropical trawl fisheries to reduce impacts on benthic ecosystems.
- **Effects on ecosystem function:** Impacts on benthic habitats and removal of large numbers of aquatic organisms, will impact the functioning of marine ecosystems. Ghost fishing and other unidentified mortalities: considered a relatively minor issue, this is mortality of animals caught in lost gear or after escaping the trawl.

### *Policy & governance dimensions*

- **IUU fishing:** Most trawl fisheries are subject to some management measures (e.g. closed areas, seasons or other zones, mesh sizes, gear restrictions). However, there is often poor compliance (over-capacity or weak fishery controls). Some vessels operate illegally or operate in an unregulated way. In many cases there is weak reporting of catches. This constrains management of the fishery, and the illegal or encroaching element often leads to significant conflicts.
- **Increased investment and subsidies:** In many countries, governments try to promote the fishing industry to produce more fish for food security and job creation. At the same time it attempts to stabilize the industry by acting as a buffer against fluctuating prices and changing market demands. Typical support actions are access to low cost fuel, development of port infrastructure and port services, low-cost loans, direct payments and other types of subsidies. These subsidies offset the real production costs and often make fishing appear profitable well beyond the point that it is actually economically viable. This has the tendency to encourage increased fishing effort or investment in the fishery and its downstream industries and thus contribute to further overfishing. This support may also undermine safety at sea, as vessels have to fish longer and further, but fail to invest in upkeep. A major principle should be that any subsidy provided should be used only as a temporary

measure, and always be linked to mechanisms for improved fisheries management.

### **The varying status of different trawl fisheries means that there will be differing objectives for management**

Well managed trawl fisheries are those which have addressed issues relating to impacts and sustainability of the trawl operations. They typically operate profitably and within sustainable limits.

Trawl fisheries that have not been closely managed tend to be increasingly fished to the point where the quality of resources is declining. They have often lost top-end predators and have fewer long lived demersal species. These fisheries still have a reasonable chance of being restored to provide MEY/higher trophic index with the introduction of a management plan. They could be better-managed to improve or sustain existing services & profitability.

Those trawl fisheries which are heavily overfished and have modified ecosystems have incurred significant changes to composition of the stocks. These fisheries often operate at marginal profitability, or are even subsidized. There is very little that can be achieved in these fisheries without major reforms of the fishery, its dependent industries and the supporting policies.

### **Moving towards more effective management of the trawl sector**

The contribution of trawl fisheries to fish production, occupation and income generation must be counterbalanced by concerns about the sustainability of catches and ecosystem impacts. To support a transition of trawl fisheries to more sustainable practices, they, more than any other in the region, require careful management underpinned by sound information and backed up by solid enforcement.

A particular challenge is that with no more new fishing areas for trawlers to exploit there is a strong need to bring illegal fishing under control and develop and implement strategies that will limit the region's trawling effort to levels which will ensure long-term, sustainable demersal resources for all fleet segments.

### **The need for guidelines on tropical trawl fisheries**

The Asia-Pacific Fishery Commission, at its 32<sup>nd</sup> Session, recognized the importance of the trawl sector and its impacts

on aquatic resources and benthic habitats and requested practical advice on trawl management. In response, the Commission has developed regional guidelines which are responsive to local management measures and the capabilities of the relevant management authorities. They will be simple, pragmatic and practical, applicable to fisheries that lack high levels of science, assessment and surveillance.

As catch rates and profits have declined, ecosystems have been altered, and conflict between trawl fishers and other

users of the resources, especially small scale artisanal fishers, are a common occurrence. These issues have resulted in Asian countries introducing various management reactions such as:

- complete bans on trawling (mostly at sub-national level)
- introduction of fishery zones and trawl exclusion areas (many countries in the region)
- efforts to improve post harvest utilization of low value by-catch (e.g. surimi)

Table 2: Management of trawl fisheries in Asia

Issue	Actions or management measures to resolve the issue
Conflict	<ul style="list-style-type: none"> <li>● Reserve special, artisanal-only fishing zones, such as near shore closures, that exclude trawling</li> <li>● Installation of obstructions to deter illegal trawling</li> <li>● Day/Night closures to trawling to avoid other fisheries</li> <li>● Facilitate meetings between sectors experiencing conflict</li> <li>● Flow of benefits back to the community from trawl fishery e.g. employment on trawl boats, product going to communities</li> <li>● Awareness programs regarding the existing regulations.</li> </ul>
Over-capacity	<ul style="list-style-type: none"> <li>● Too many trawlers for the size of available fisheries resources</li> <li>○ Limit and freeze the number of licences</li> <li>○ Government / Industry buy-backs - Compensation for loss of income through negotiated exit of vessels</li> <li>○ Conversion of existing trawlers to other fishing gears/practices</li> <li>● Excess fishing effort</li> <li>○ Limit the number of licences</li> <li>○ Subsidies for fuel and other capacity-enhancing subsidies such as: free port facilities, ice, tax exemptions etc. only available for compliant vessels</li> <li>○ Government subsidies (incentives) that reward good practices – i.e. to not fish during certain periods and to comply with other measures and as an incentive to reduce effort</li> <li>○ Spatial zoning</li> <li>○ Seasonal closures to limit effort</li> <li>○ Total Allowable Catches and Individual Transferable Quotas</li> <li>○ Limits to days allowed to fish (Boat days)</li> <li>○ Limited entry for new participants, 2 for 1 entry schemes</li> <li>○ Fishing on rotational basis</li> </ul>
Unprofitable trawl sector	<ul style="list-style-type: none"> <li>● Operating costs are too high compared to the value of the catch</li> <li>○ Government subsidies that reward good practices – i.e., to not fish during certain periods and to comply with other measures and as an incentive to reduce effort</li> <li>○ Increase value of the catch through better marketing, eco-labelling, acceptance of the fishery and its products (e.g., for fish meal) as responsible</li> <li>○ Fishing practices and gear modifications including boat hull and engine that reduce operating costs (e.g. labour costs and fuel consumption)</li> <li>○ Increase the value of the catch by improving its quality through gear modifications (e.g., increased mesh size leading to reduced damage in cod-ends) and on-deck handling practices</li> <li>○ Long-term recovery of fishery leads to increased CPUE, improved productivity and profitability</li> </ul>
IUU fishing	<ul style="list-style-type: none"> <li>● Promote legal trawling</li> <li>○ Establish and enforce fishing zones for trawling</li> <li>○ Electronic Monitoring (including VMS)</li> </ul>

	<ul style="list-style-type: none"> <li>○ Communication between agencies responsible for issuing boat licences, skipper licences and gear registration</li> <li>○ Communication and collaboration between neighbouring countries</li> </ul>
	<ul style="list-style-type: none"> <li>● Regular and accurate reporting of trawl activity</li> </ul>
	<ul style="list-style-type: none"> <li>○ Onboard logbooks</li> </ul>
	<ul style="list-style-type: none"> <li>○ Education program on importance of regular and accurate reporting</li> </ul>
	<ul style="list-style-type: none"> <li>○ Observer programs</li> </ul>
	<ul style="list-style-type: none"> <li>○ Improved compliance &amp; enforcement of regulations</li> </ul>
	<ul style="list-style-type: none"> <li>○ At sea surveillance by Officers</li> </ul>
	<ul style="list-style-type: none"> <li>○ Dockside monitoring</li> </ul>
	<ul style="list-style-type: none"> <li>○ Reduction of transboundary IUU fishing</li> </ul>
Impacts on dependent industries	<ul style="list-style-type: none"> <li>● A critical dimension of the drivers that push trawl fisheries</li> <li>● Dependent industries may suffer if trawl catches and overall sector is reduced and may undermine management efforts - demanding fish to stay in business</li> <li>● Management changes to trawl sector are implemented gradually, allowing support industries to adjust</li> </ul>
Overfishing	<ul style="list-style-type: none"> <li>● Excessive trawl effort leads to depletion of stocks</li> <li>○ Capacity reduction measures</li> <li>○ Space/time closures to protect vulnerable stocks</li> <li>○ Permanent closures to trawling in critical areas for vulnerable stocks</li> <li>○ Trawling taking too many individuals (spawners and juveniles) of vulnerable small species</li> <li>○ Space/time closures to protect vulnerable small species</li> <li>○ Permanent closures to trawling in critical areas for vulnerable small species</li> <li>○ Gear modifications (mesh size, panels, grids) to exclude vulnerable small species</li> <li>○ Space and/or time closures to reduce trawling where sub-optimal sized and low-value fish occur</li> <li>○ Appropriate mesh sizes / gear changes where sub-optimal sized and low-value fish occur</li> </ul>
By-catch of juvenile fish	<ul style="list-style-type: none"> <li>● Two types of impact: <ul style="list-style-type: none"> <li>○ Juveniles caught before spawning</li> <li>○ Species harvested at a sub-optimal size for maximum value (growth overfishing)</li> </ul> </li> <li>● Measures <ul style="list-style-type: none"> <li>○ Space/time closures to protect juveniles; to reduce trawling where/when juveniles occur</li> <li>○ Permanent closures to trawling in nearshore nursery areas</li> <li>○ Minimum Legal Lengths (MLLs) set at size of sexual maturity</li> <li>○ Minimum Legal Lengths (MLLs) set at a size close to the optimal</li> <li>○ Gear modifications (mesh size, panels, grids) to exclude undersize fish</li> <li>○ Reduce mortality of juvenile fish through introduction of Bycatch Reduction Devices (BRDs) in nets</li> </ul> </li> </ul>
Catch of Endangered, Threatened or Protected (ETP) species	<ul style="list-style-type: none"> <li>● Space and/or time closures to reduce trawling where/when ETPs occur</li> <li>● Reduce mortality through introduction of Bycatch Reduction Devices in nets</li> <li>● Reduce mortality through better on-deck discarding practices <ul style="list-style-type: none"> <li>○ e.g. recovering techniques for turtles, sharks</li> </ul> </li> </ul>
Habitat impacts	<ul style="list-style-type: none"> <li>● Spatial closures to remove trawling from sensitive areas (e.g. key habitats)</li> <li>● Obstructions to deter illegal trawling</li> <li>● Modified trawl gear that minimizes benthic impacts</li> </ul>
Effects on ecosystem function	<ul style="list-style-type: none"> <li>● Excessive and uncontrolled trawling disrupts normal ecosystem function and food webs <ul style="list-style-type: none"> <li>○ Spatial closures to protect entire sensitive ecosystems containing representative habitat types and resources</li> <li>○ Obstructions to deter illegal trawling</li> <li>○ Trawl modifications to reduce impacts on ecosystem components</li> <li>○ Balanced harvesting throughout the ecosystem</li> </ul> </li> </ul>

- subsidies to sustain production, despite declining catches and profitability

Some of these have been effective and some have failed or even been counter-productive. Table 2 summarizes the sorts of measures that can be effective in addressing the range of issues that require management in a tropical trawl fishery.

### First step to improvement

The APFIC expert workshop on management of tropical trawl fisheries developed a series of general recommendations which could be applied to all trawl fisheries in the region. They provide a general rule of thumb for management based on the minimum standards which are found throughout the trawl fisheries of the region. Of course, the measures could be more stringent and these should be viewed as a first step to getting a tropical trawl fishery under more effective and responsible management.

### Initiate a process for managing trawl fisheries

- Countries with a significant trawl sector to:
  - Establish a Steering Committee to implement these guidelines
  - Initiate the development of a draft fisheries management plan for an important trawl fishery as a vehicle for capacity building
  - Establish consultative processes that engage with fishers, the fishing industry and other stakeholders for ALL steps in the above processes

### Reduce the impact of trawls through spatial, habitat and temporal measures

- Minimum 3nm trawl exclusion zone (noting that some countries currently have up to 8-10nm)
- No trawling in critical habitats (e.g. on seagrass, corals), nursery grounds or in waters shallower than 10 m
- All trawl fisheries to have an annual seasonal closure of at least 1-3 months to coincide with peak spawning and nursery times

### Reduce the impact of trawl gear

- Regulate trawl specifications for lighter gear (e.g. net material, footropes, bobbins) to reduce the environmental impact of trawling
- Regulations to have an effective minimum of 40 mm mesh size in the cod end, recognising that larger mesh sizes than this are preferable

- Promote gear designs that ensure correct selectivity in the cod end
- Develop and implement device designs with industry (BRDs, JTEDs, TEDs, etc) that reduce impacts on at-risk and ETP species
- Promote reduced duration of trawl tow to 2 hours to improve fish quality

### Strengthen Monitoring, Control & Surveillance

- Clear, individual markings for all trawlers that are visible from a distance
- Get effective MCS working (i.e. Satellite-based VMS on all larger vessels)
- Promote a fishers' volunteer watch/reporting scheme, and integrate into existing MCS arrangements

### Manage fishing effort and fishing vessel over-capacity

- Get vessel registration and licensing system working effectively
- Cap trawler numbers at existing levels
- In fisheries with overcapacity, reduce vessel numbers by 30% by 2025
- Limit effort shift into other areas and other fishery types
- Maintain horsepower and head rope length at current levels to prevent effort creep (and even reduce in cases of overcapacity)
- Stop or reform the use of subsidies (especially fuel subsidies) for trawl fisheries
- Ensure all financial incentives in trawl fisheries reward sustainable fishing practices

### A final thought

This paper has focused on trawl fishing by-catch and the need to manage trawl fisheries. The need for management is not confined to the trawl sector; gears such as purse seine, gillnet and FAD associated fisheries also need management. The issues are also not entirely confined to the impacts of industrial fishing as small-scale fishing can have equivalent impacts due to the large numbers of fishers involved. There is a strong need to manage most fisheries more effectively throughout the Asian region and this look at trawl fishing gives an idea where to start. Most of what is presented here can be equally applied to other fisheries.

### Reference

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