

SCOURGE OF THE SEAS

The impact of bottom trawling on Thailand's
marine ecosystems and recommendations
for sector reform





A trawler comes back into port in Ranong province.

Abbreviations:

AIS – Automatic Identification System
 AND – Andaman Sea
 CPUE – Catch per unit effort (measured in kg/hr)
 DOF – Department of Fisheries
 EJJ – Environmental Justice Foundation
 GOT – Gulf Of Thailand
 GT – Gross tonnage
 JTED – Juvenile and trash excluder device

MPA – Marine Protected Area
 MSY – Maximum Sustainable Yield
 RTG – Royal Thai Government
 SEAFDEC – Southeast Asian Fisheries Development Center
 TAC – Total Allowable Catch
 TAE – Total Allowable Effort
 VMS – Vessel monitoring system

The Environmental Justice Foundation (EJJ) exists to protect the natural world and defend our basic human right to a secure environment.

EJJ works internationally to inform policy and drive systemic, durable reforms to protect our environment and defend human rights. We investigate and expose abuses and support environmental defenders, Indigenous peoples, communities and independent journalists on the frontlines of environmental injustice. Our campaigns aim to secure peaceful, equitable and sustainable futures.

Our investigators, researchers, filmmakers and campaigners work with grassroots partners and environmental defenders across the globe.

Our work to secure environmental justice aims to protect our global climate, ocean, forests and wildlife and defend basic human rights.

EJJ is committed to combating illegal, unreported, and unregulated (IUU) fishing as well as associated human rights abuses in the fishing sector. EJJ has worked in Thailand on these issues since 2014, engaging in a combination of in-depth independent investigations into these potential crimes, high-level advocacy with Royal Thai Government ministries and frontline enforcement observations of Thailand's fisheries monitoring, control and surveillance mechanisms.



This report is funded by the Transform Bottom Trawling (TBT) Coalition. The TBT Coalition is a global movement of organisations working to tackle bottom trawling and restore our oceans. The coalition brings together small-scale fishers, seafood companies, conservationists, local tourism businesses, scientists, managers and fisheries policy experts that are devoted to inclusive, holistic and lasting change. Learn more at transformbottomtrawling.org.¹

Executive Summary

Trawlers are increasingly regarded both within Thailand and internationally as having a disproportionate environmental impact.² There are currently 3,187 bottom trawlers in Thailand, representing around a third of the total commercial fleet and responsible for over 40% of total marine landings in 2021.³ These vessels drag large nets on or near the seabed to harvest a multitude of species. Trawling nets often catch marine species indiscriminately, with catches comprising a high proportion of juveniles of commercially important species, such as mackerel and squid.⁴

The catching of juveniles of marine species is especially damaging as it prevents individual fish from reaching maturity and reproducing in order to replenish stocks. This can rapidly decimate fish populations, causing destruction to marine ecosystems and threatening livelihoods.⁵ Endangered species of shark and turtle, among others, are also caught and killed in these gears.

Often trawler catches are so badly bruised and mixed together that they are no longer classified as fit for human consumption. Instead, much of their catch is branded as ‘trash fish’ and is sent to factories to be made into fishmeal and subsequently livestock or aquaculture feeds.⁶ In 2020, 411,300 tonnes of trash fish were landed by Thailand’s commercial fleet, with trawlers responsible for 84% of this total.⁷

Trash fish is worth a fraction of the value of adult specimens of the main species that often make up trash fish. Trash fish fetched an average price of 6.6 baht/kg in 2021 according to Thai Department of Fisheries (DoF) statistics whereas one kilogram of Indo-Pacific mackerel, if left to mature, could be worth 220 baht/kg and squid worth up to 280 baht/kg.⁸

Pair trawlers – one subsection of the trawler fleet – have been found to have the greatest impact. Pair trawling involves two

vessels towing one net that stretches between them. By Thai law this net can stretch to as wide as 1km.⁹ Despite conducting less than 20% of trawler fleet fishing trips, pair trawlers are responsible for over 50% of the total trawler catch. Pair trawlers also contribute the greatest amount of trash fish with 63% of all trash fish landed in 2020 by the entire trawl sector coming from this sector.¹⁰

From 1990 until the present, half of pair trawler catches were made up of trash fish. Over 80% of this trash fish was made up of juveniles of commercially valuable fish species.^{11/12}

It is only a matter of time before such fishing practices leave vast areas of Thailand’s fishing grounds bare of any life or in such a degraded state as to have little to no economic value. In some provinces it is already too late, with trawlers having reduced marine biodiversity to such an extent that catches are a mere fraction of what they used to be even 20 years ago.¹³

The Royal Thai Government must urgently review the practice of bottom trawling in Thailand’s fisheries and consider taking drastic measures to ensure that the country’s precious seafood resources are not degraded even further.

EJF recommends that a carefully structured and planned decommissioning plan that targets the most impactful pair trawling vessels first is developed and implemented within three years. The DoF should also consider increasing inshore exclusion zones (IEZ) (coastal waters reserved for small-scale fishing operations) to provide larger buffer zones from the impact of commercial trawling activity, expand monitoring capacity to smaller commercial fishing vessels, and improve catch data collection systems so that the true environmental impacts of trawlers can be better understood.



Fishing piers in Samaesan in Chonburi province show a wide variety of fishing vessels moored alongside.

Introduction

Thailand's total fishing fleet is vast, with 60,686 total vessels split between 10,047 commercial vessels and 50,639 artisanal vessels.¹⁴ In 2022, there were 3,187 trawlers operating in Thailand, representing nearly a third of the commercial fleet.

Thailand divides its trawler fleet into three distinct sub-categories: otter board, pair and beam trawlers. Otter board trawlers, which represent 52.3% of the trawler fleet, use two boards to support and keep the mouth of the trawl net open. Pair trawlers, which represent 35.1% of the trawl fleet, operate in tandem, towing one net that stretches between them. Beam trawlers, which make up the remaining 12.6% of the trawl fleet, use a long beam to spread the net widely.¹⁵

The nets of these trawl vessels are dragged on or near the seafloor and may extend close to the sea surface.^{16/17/18/19} This enables the fleet to catch both demersal and pelagic species such as mackerel and anchovies. Despite representing just 5% of Thailand's total fishing fleet (of both commercial and artisanal vessels), trawlers were responsible for over 40% of total marine fishery landings in 2021.²⁰

Trawl gears in Thailand are classified by the Thai Department of Fisheries (DoF) as 'high-efficiency gears' alongside purse seine gears and light luring devices.²¹ Rather than having any relation to sustainable fishing practices, this classification means that they are extremely effective at catching marine animals.



A bottom trawler drags its net far out in the Gulf of Thailand.

Although the number of total commercial vessels has dropped in recent years, long-term trends show a significant increase in the average engine size per vessel across all three subcategories of trawlers since 2007.²² This has been accompanied by an increase in the average gross tonnage (GT) per vessel (see table below) as owners seek to increase catch capacity and fishing effort without having to acquire new licenses.²³ Larger vessels can pull larger nets, fish for longer and further from land, ultimately resulting in higher catches by fewer vessels. Larger vessels may also allow vessel operators to subscribe to the lucrative subsidised 'green oil' fuel scheme. More information about the green oil scheme is found on page 23.

Vessel gear	GT/vessel (2007)	GT/vessel (2021)	% change
Otter board trawler	34 GT	49 GT	+45%
Pair trawler	52 GT	79 GT	+53%
Beam trawler	16 GT	42 GT	+161%

Table 1: Thai Fishing Vessels Statistics from DoF show the average gross tonnage (measure of the size of a vessel) for different trawl gears for 2007 and 2021 showing significant increases in vessel size.²⁴

The Thai commercial fleet has shrunk in size from 13,456 vessels (recorded in May 2016) to 10,074 vessels in 2022, a decline of 25%.²⁵ The total trawler fleet has also declined during this time, falling from 3,796 vessels in 2016 to 3,187 vessels in 2022 (a 16% decrease).²⁶

It should be noted that this report has had to rely on historical studies on the impact of trawlers and specifically pair trawling gears on Thailand's fish populations. EJJ acknowledges the limitations of using such historical studies however also stresses that these studies are currently the best-known resources to be able to conduct such an assessment.

Global spotlight on bottom trawling



A bottom trawler off the coast of Songkhla prepares to bring its net in.

Bottom trawling is increasingly regarded as one of the most problematic types of fishing practice.²⁷ Globally, it is estimated to catch more than 30 million tonnes of seafood per year, more than any other fishing method.²⁸ 50% of all bottom trawled fish is caught in the Exclusive Economic Zones (EEZs) of Asian countries or by the foreign fleets of Asian countries.²⁹ Concerns have arisen due to the detrimental and long-lasting impact that such gears can have on fish populations, non-target species, endangered and charismatic species as well as the overall condition and health of the seafloor.³⁰ Research from across the globe has shown that such gears can leave large scars in the seabed, destroy coral reefs, disrupt sediments and silt, and negatively impact marine wildlife that rely on seabed ecosystems for shelter, feeding or reproduction.^{31/32}

Bottom trawling has also been estimated through scientific studies to contribute 600-1,500 million tonnes of carbon dioxide emissions per year.³³ Bottom trawling contributes to greenhouse gas emissions through the direct use of fuel to drive vessels, as well as through the disturbing of carbon-containing sediments on the seabed.



Trawlers illegally fishing in areas such as coral reefs can devastate these fragile ecosystems.

“ *Through your actions you are breaking your own rice pot. When all these corals are gone, then you will feel that what you have done cannot be undone... please help solve this problem before there is nothing left in the sea for your children.*

- Varawut Silpa-archa, Minister of Natural Resources and Environment, speaking about fisheries operators who conduct fishing activities in coral reef areas.³⁴

Spatial distribution of bottom trawlers in Thailand

Thailand's trawling fleet is concentrated primarily in the Gulf of Thailand with 2,614 trawlers (82% of all trawlers) registered there compared to 573 in the Andaman Sea.³⁵ Five major ports dominate trawler registrations with Nakhon Si Thammarat and Songkhla located in the lower Gulf of Thailand and Samut Songkhram and Samut Prakan located in the upper Gulf (Table 2).

Province	Region	Otter board trawls	Pair trawls	Beam trawls	Total	% of total
Nakhon Si Thammarat	Gulf of Thailand	506	54	44	604	19%
Samut Songkhram	Gulf of Thailand	72	386	3	461	15%
Samut Prakan	Gulf of Thailand	91	120	10	221	7%
Ranong	Gulf of Thailand	156	60	-	216	7%
Songkhla	Andaman Sea	186	18	2	206	7%
Top five provinces	-	1,011	638	59	1,708	54%
Total	-	1,666	1,120	401	3,187	-

Table 2: The top five ports for trawler registrations in Thailand. (Additional data on these gears is available upon request.)

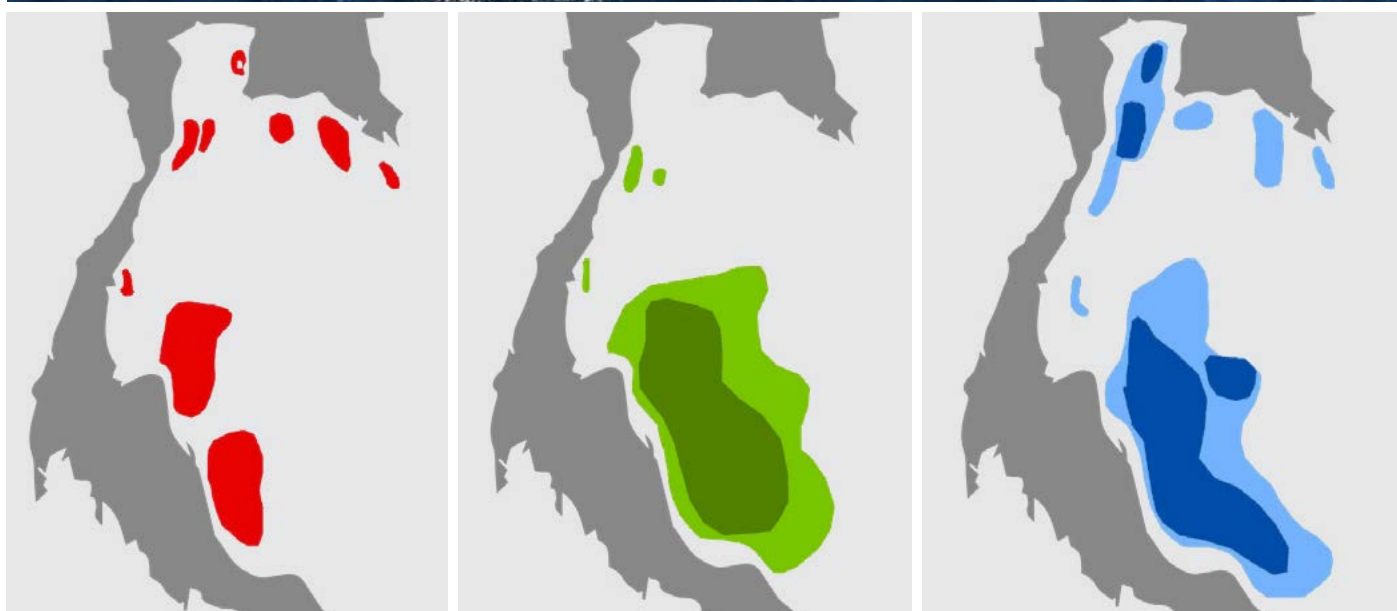


Figure 1: These maps depict fishing activity by small-sized otter board vessels (red), medium-sized otter board vessels (green) and pair trawling vessels (blue). It is important to note that this data is taken from a study conducted by the DoF in 2011.³⁶ Even so, these diagrams help to illustrate the primary fishing grounds of trawler vessels and demonstrate how the geographical focus around the southern provinces of Nakhon Si Thammarat and Songkhla is longstanding.

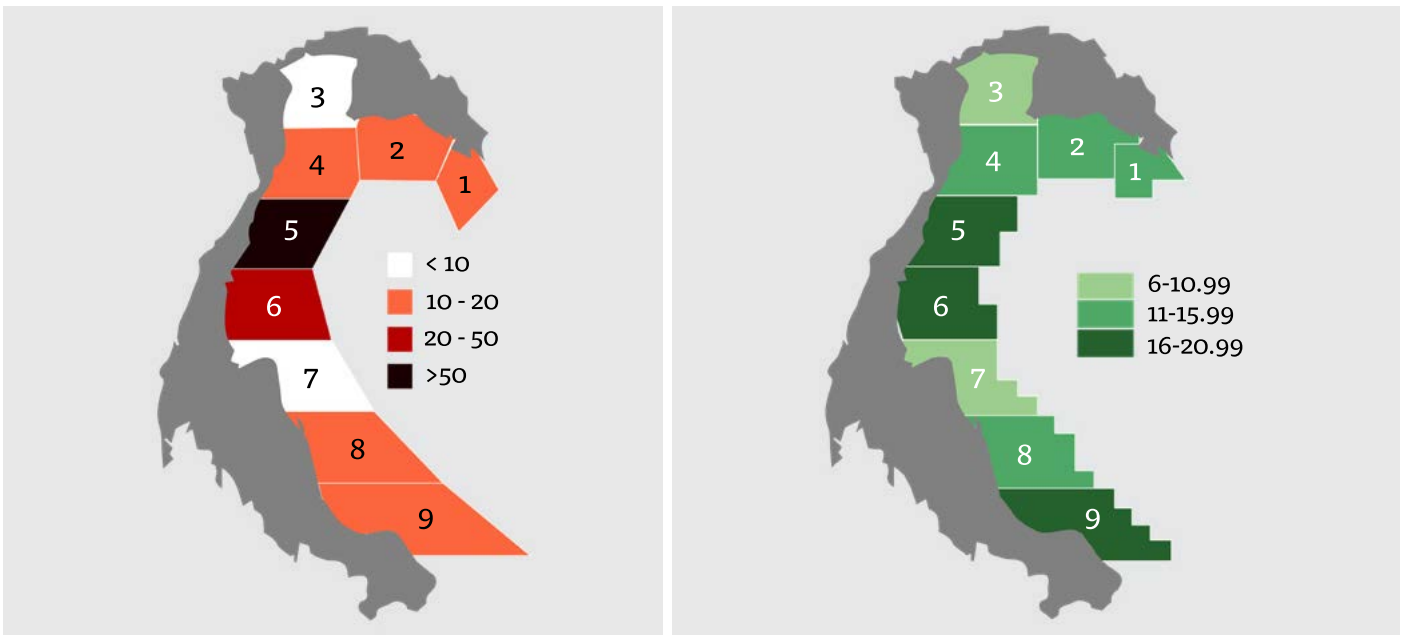


Figure 2: These maps show the recorded catch per unit effort (CPUE) statistics for different segments of the Gulf of Thailand (measured in kilograms of seafood caught per hour) for 2011 (left) and 2020 (right).³⁷

Catch per unit effort (CPUE) is a proxy measure of stock abundance and can be used to measure general trends over time. Three of the main ports for trawler registrations (Nakhon Si Thammarat, Samut Songkhram and Samut Prakan) are located in two of the Gulf's fishing areas (Regions 3 and 7) with the lowest CPUE figures in the country at 8.990 kg/hr and 9.480 kg/hr, respectively, in 2020 (Figure 2).³⁸



If bottom trawlers are not monitored effectively then they can conduct fishing operations in protected areas such as coral reefs. The dragging of trawler nets in these areas can cause significant damage to these sensitive ecosystems.

All Thai commercial fishing vessels over 30 GT have been required to fit Vessel Monitoring Systems (VMS) since 2015. Out of a total 3,187 trawler vessels in 2022, around 20% are below 30 GT which means that they are not required to be fitted with VMS nor are they required to pass through regular so-called Port-in Port-Out (PIPO) vessel inspections whenever they leave or enter ports.³⁹ This means that around 700 vessels lack effective monitoring, control and surveillance, potentially allowing these vessels to drastically underreport their catches, further degrading fish populations.



Massive declines in marine biodiversity can result in vessels fishing down the food web until they are only able to catch 'trash fish' as shown here.

Analysis of trends in CPUE and the Thai bottom trawl sector

Although CPUE can be used to measure overall stock abundance, it is reliant on consistent and accurate data collection. In Thailand, CPUE is only available for broad taxonomic groups, namely pelagic species, demersal species, squid, shrimp, crab, clams, trash fish and others.* The lack of widespread adoption of single-species categories for measuring CPUE can make it difficult to arrive at robust population assessments.

Available CPUE measurements for Thailand began in the 1960s with measurements for the Gulf of Thailand (GOT) first available in 1961 and the Andaman Sea (AND) in 1966. Between 1960 and 1981, CPUE fell by 83% in the GOT and by 76.5% in the AND.⁴⁰ These dramatic declines coincided with sharp increases in the number of trawler vessels across Thailand, rising from just 99 registered vessels in 1961 to a peak of 13,111 registered vessels in 1989. The number of trawlers subsequently stabilised before gradually declining to the 3,187 trawlers that were registered in 2022.⁴¹

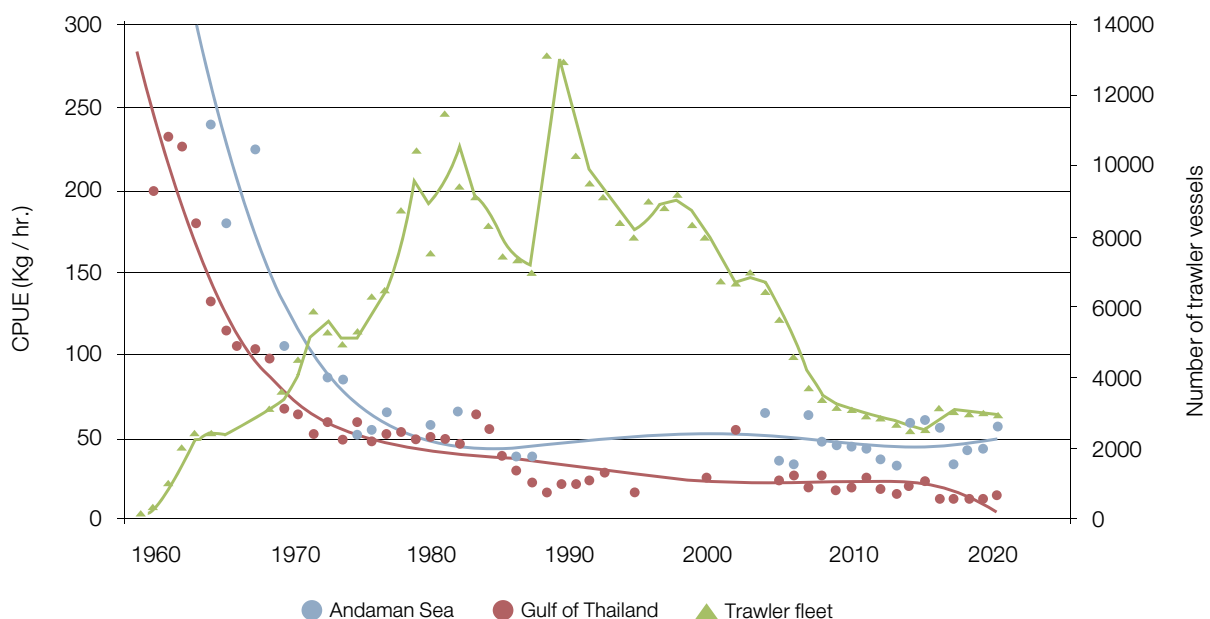


Figure 3 : CPUE (measured in kg/hr) data is shown alongside trawler fleet figures. It should be noted that the number of trawler vessels rises and falls dramatically during some periods (especially in 1989) due to fluctuating licence renewals and the introduction and revocation of a tenure system – freezing the total number of fishing licences given out each year.⁴²

* In many trawl fisheries, catch can become bruised and crushed by the nature of the dragging operation. Often this heavily degraded fish and other marine biota – a mixture of low economic value species – in the back of the net is not suitable for human consumption and is classified as 'trash fish'

Even as of 2021, several years after fisheries reforms were instigated in 2015, there are few signs of ecosystem recovery with CPUE figures for both the Andaman Sea and Gulf of Thailand still mere fractions of what they were 25 years ago. Available catch data for the bottom trawl fleet of 3,368 vessels for 2008 until 2019 also shows that the weight of landed product fell from 784,991 tonnes in 2008 to 637,213 tonnes in 2019, a drop of 19%.⁴³

Linkages between unsustainable fishing and labour abuses



As fish populations decline, vessels are forced to take longer fishing trips. These in turn drive up costs. The most likely way that operators can slash rising costs is by paying workers less, making labour exploitation more likely.

Vessels engaged in unsustainable fishing practices have also been found to engage in illegal, unreported and unregulated (IUU) fishing, labour exploitation and serious human rights abuses in the fishing industry. EJF has documented linkages between environmental degradation, illegal fishing and labour abuses in multiple geographies including Thailand and Ghana and in distant water fisheries across the globe.^{44/45} In the case of Thailand, decades of neglect in fisheries management and a lack of transparency in fishing operations have provided the primary catalysts for ecosystem declines and subsequent labour abuses.

Broadly speaking, as fish populations and CPUE decline, fishing effort must increase to maintain catches resulting in smaller profit margins. Labour costs can account for up to 60% of vessel operating costs and subsequently, the demand for cheap labour – often in the form of migrant workers – increases as does the likelihood of labour exploitation and IUU activity.^{46/47} EJF's previous investigations across Thailand have documented these linkages in great detail.^{48/49}

Thai fishing vessels have, in the past, been documented conducting fishing practices for months or even years at a time and fishing illegally in neighbouring countries. Long periods of time at sea can enable labour abuses as there is little chance for workers to escape and limited opportunity for scrutiny by enforcement agencies.

Vessels have also engaged in the practice of at-sea trans-shipment of catch. This is where fishing vessels meet with carrier vessels and transfer seafood so that they can remain fishing for longer.⁵⁰ This can help boost vessel profits by enabling vessels to minimise transit times and fuel burn.

The practice has however been linked to facilitating IUU fishing and a lack of transparency in fisheries.^{51/52} At-sea trans-shipments can take place hundreds of kilometres away from shore and any potential monitoring authorities, thus allowing illegitimately caught seafood to slip into markets undetected.

Previous EJF investigations have also found how at-sea trans-shipments have been tied to incidents of forced labour and slavery at sea.⁵³ Undocumented workers may be rotated amongst fishing vessels in order to prevent them from escaping or alerting the authorities on shore. Workers might not see shore for months or even years at a time.⁵⁴ Without effective monitoring of at-sea trans-shipment practices it can be difficult to achieve a truly sustainable, legal and ethical fishing industry.

Effective reforms to fisheries management efforts and implementation of transparency mechanisms in fisheries can allow authorities to resolve opaque aspects of both fishing and labour practices on vessels. Improved registration of fishing vessels, for example, can help verify vessel and owner identities, restricting the ability for vessels to operate without a license. Addressing unsustainable fishing practices can also make fisheries more productive and profitable, thus reducing the necessity for suppressed worker wages.

“Nowadays, the Phuket artisanal fishers can fish only within the 1.5 nautical mile zone. There are very limited resources and it’s really hard to find fish. If we go further out than this, the commercial trawlers will drag all of their equipment with their big boats.

– Mr. Somsak, head of Phuket artisanal fisher group, interviewed in December 2021.⁵⁵

At the same time, total vessel gross tonnage across the bottom trawl fleet has increased significantly from 154,972 tonnes in 2008 to 201,426 tonnes in 2019 (an increase of 30%). These trends are indicative of overfishing as an increase in overall fishing capacity should translate into higher catches (assuming all other conditions, such as the number of fishing days and gear types remain consistent).⁵⁶ However, this has not been the case in practice (see Figure 4).

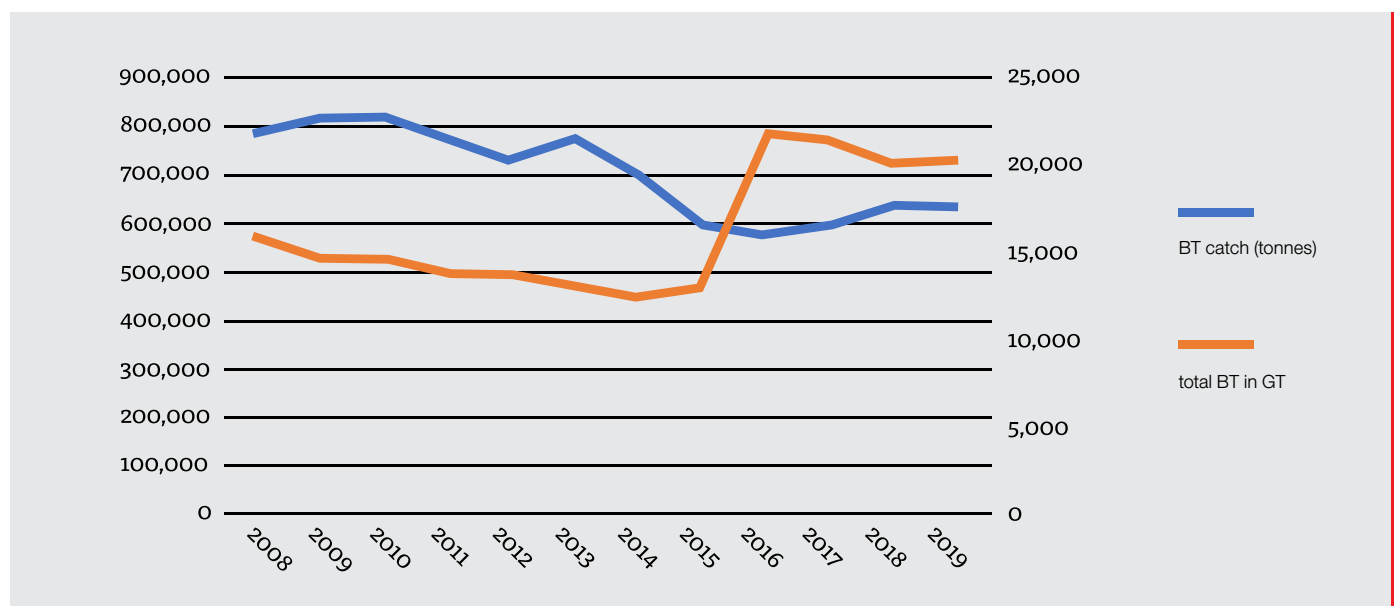


Figure 4: Total catch by bottom trawlers (measured in tonnes) alongside bottom trawl fleet gross tonnage from 2008 until 2019.⁵⁷ The sudden increase in gross tonnage between 2015 and 2016 was due to renewed vessel registration efforts initiated by the DoF.

“Usually, a single trip takes 30 days. It can use ten thousand litres [of fuel]. We keep dragging all day and night. If the fuel is gone, we will ask the tanker boat to fill it up in the middle of the sea. When the fish is fully loaded, then we return. Nowadays, we can catch only a small number of fish, which is not worth the trip. Fishing grounds are far away. Workers are hard to find. Nothing to do but keep dragging back and forth.

– Trawler boat owner at Phuket Port, interviewed in December 2021.⁵⁸

An assessment of CPUE of otter board operations in the GOT between 2016 and 2020 recorded abundance declines for commercially important pelagic species, squid and crab, while CPUE for trash fish increased by 24% (Table 3).⁵⁹ The increase in trash fish caught indicates that the average size of fish in Thai catches has decreased, which is one of the indicators that aquatic resources are declining.⁶⁰ These trends indicate a worrying decline in the ecosystem health and economic productivity for the Gulf of Thailand.

A more specific example that assesses otter board operations in the Gulf of Thailand since 2016 recorded declines for pelagic species, squid and crab catches – all economically important species. Trash fish and demersal proportions have increased. It should be noted that comparable analysis is not available for earlier years nor for beam trawlers or pair trawlers, exemplifying a chronic lack of reliable, consistent data collection across Thai fisheries. Without such data it is difficult to accurately determine or compare the true environmental impacts of these destructive fishing gears. These trends indicate a worrying decline in the ecosystem health and economic productivity for the Gulf of Thailand.



Thailand is renowned for the wide variety of fish and seafood species that are on offer in its seafood markets. Continued depletion of economically important species puts this at risk.

CPUE trends for the Gulf of Thailand (KG/hour) by otter board vessels

Species Group	2016	2017	2018	2019	2020	% Change
Pelagic	0.74	0.690	0.924	0.862	0.459	-38%
Demersal	4.735	4.260	4.669	5.324	5.723	21%
Squid	3.055	3.177	2.511	2.176	2.359	-23%
Shrimp	0.017	0.029	0.017	0.034	0.016	-6%
Crab	0.277	0.135	0.125	0.132	0.191	-31%
Clam	0.354	0.426	0.342	0.307	0.532	50%
Others	0.077	0.049	0.069	0.053	0.068	-12%
Trash/forage fish	3.356	2.232	3.078	3.719	4.176	24%

Table 3: Catch declines over the past five years for pelagic species, squid and crab - some of the most important economic species in Thailand - are juxtaposed by increases in Trash/forage fish catches.



Trash fish is heaped onto the back of a waiting truck to be taken for processing.

Data gaps in measuring the health of Thailand's fisheries

“Despite Thailand having most elements of a developed fisheries governance system, negligible progress has been made towards restoring fish stocks to sustainable levels. Nearly all of Thailand's catch comes from unassessed stocks, with unknown sustainability status.

- Global Fishing Index, Minderoo Foundation (2021).⁶¹

The inaugural Global Fishing Index first released by the Minderoo Foundation in 2021 conducted a global assessment of countries' efforts to assess their fish populations. This assessment covered 142 countries and analysed countries on their fish population data availability, number of populations assessed and population sustainability among other indicators.⁶² Thailand received a final grade of E (out of A to F) with its progress towards improving population assessments and sustainability only ranking 7.9 out of 100. According to the study, 88% of Thailand's catch is currently unassessed, 11% is assessed and 1% is covered by Regional Fisheries Management Organisation (RFMO) assessments.⁶³

The DoF does provide statistics in the form of an annual report and data on fleet composition and size. However, publicly accessible data on catch statistics, catch composition and fish population assessments for economically important species have been limited in recent years. This is due to both restricted access to data as well as growing research gaps.

Data gaps in estimating maximum sustainable yield (MSY), total allowable catch (TAC) and CPUE for Thailand's many fisheries hinder the effective management of the country's marine resources. MSY in Thailand is currently only measured for the broad categories of demersal species, pelagic species and at species level for anchovies (due to the large number of fishing gears that target exclusively anchovies). To provide a more accurate picture of the status of fish populations in Thailand's waters, there is an urgent need to expand the number of taxa for which stock assessment data is collected at the species level, with a priority focus on commercially important species.

Lack of access to data also prevents the effective study of current fishing effort to assess whether fishing practices are truly in line with sustainable levels. Crucial data on vessel metrics, historical fishing effort and fleet capacity are difficult to source and in some cases are not accessible to the public.

Species group	2019	2020
Gulf of Thailand MSY (tonnes)		
Demersal species	790,985	775,548
Anchovies	202,077	200,092
Pelagic species	251,547	247,880
Andaman Sea MSY (tonnes)		
Demersal species	230,115	228,348
Anchovies	33,007	32,090
Pelagic species	118,344	117,514

Table 4: Estimated MSY divided between the Gulf of Thailand and Andaman sea sides.^{64/65}

Maximum sustainable yield as a measure of healthy seas

Maximum Sustainable Yield (MSY) is often used as a reference point for measuring the sustainability of a fishery. Other biological data such as age at first maturity and sex composition are also valuable for improving the accuracy of management regimes.

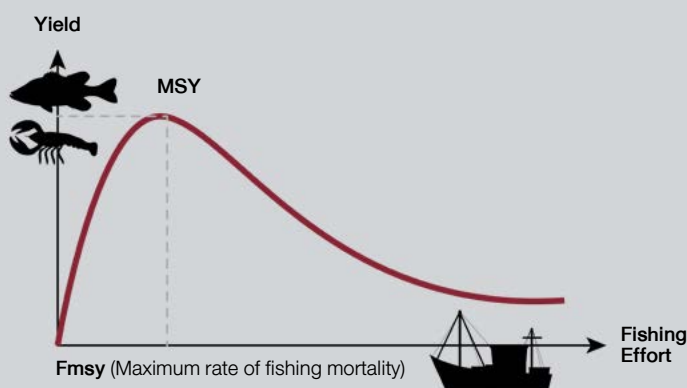


Figure 5: The relationship between fisheries yields and fishing effort and where MSY usually lies.⁶⁶

After the MSY of a target stock is calculated, a total allowable catch quota (TAC) or total allowable effort (TAE) can be assigned to each commercial fishing vessel as a way to prevent overfishing. For Thailand, the DoF uses a “fishing day” allocation per trawler subcategory as a means of distributing TAC across the Gulf of Thailand and Andaman Sea.⁶⁷

A more accurate method of calculating fishing effort could be to calculate it by vessel engine power measured in kilowatt day units.^{68/69} This is because engine power can have a stronger impact on the total catch for each fishing gear than simply measuring fishing days which does not take into consideration vessel size, engine power or other vessel characteristics. Other techniques such as managing fisheries by maximum nutrition yield are also worth consideration.⁷⁰

Misreporting and a failure to enforce fishing quotas

Although much effort has been made to reform Thailand’s catch monitoring and verification systems since 2015, such as introducing electronic catch logging and documentation systems, the current catch reporting system affords all commercial fishers significant leeway if they misreport catches. The system allows total vessel catch to be up to 20% under or over the declared amount in the vessel’s logbook, from a more conservative limit of 10% set in 2016.⁷¹

There is currently no system of sanctions for vessel operators who consistently exceed the 20% threshold, meaning there are no disincentives to non-compliance. TAC quotas are not implemented or enforced, meaning that vessels which consistently exceed the 20% threshold are not required to reduce their catch on subsequent trips. The issues are exacerbated by the fact that the TAC for vessels is set at 95% of estimated MSY – giving little margin for error.

A precautionary approach should be implemented to prevent TAC quotas and associated MSY limits from being breached. If the DoF wishes to continue using TAC as a means of restricting fishing effort, then fishing quotas should be enforced to prevent overfishing. This would be in the interests of preserving Thailand’s fragile fish populations and would be an appropriate response in the face of mounting evidence from recent years of fishery declines.⁷²

Trash fish: a threat to sustainable fisheries and marine biodiversity



Trash fish is heaped into the back of a truck in Chonburi.

“What the authorities should do is stop environmentally destructive fishing altogether. It should not be allowed near the coast, nor out in the open seas.

– Jaroen Toh-eetae, community leader at Tambon Tha Sala, Nakhon Si Thammarat (2014).⁷³

In many trawl fisheries, catch can become bruised and crushed by the nature of the dragging operation, degrading it to the classification of trash fish. Catch data for 2019 indicates that out of 637,213 tonnes of fish caught by the trawling fleet, 46% of this was classified as trash fish.⁷⁴ In 2020, 411,300 tonnes of trash fish were landed by Thailand's commercial fleet, with trawlers responsible for 84% of this total.

Recent data shows, however, that a relatively small segment of Thailand's trawl fleet is responsible for the major proportion of trash fish catches in the country. According to DoF data for 2022, out of the 3,187 trawlers operating in Thailand,⁷⁵ just 358 vessels accounted for over 60% of all trawler fishing trips in 2022 and caught more than half of the total catch.⁷⁶

The proportion of catch that can be defined as 'true trash fish' – that is, trash fish that is purely of low to no economic value species – can sometimes be difficult to determine. This is because heavily degraded specimens or juveniles of economically valuable species may be mixed in. This subcategory can be classified as 'fake' trash fish as they will not be consumed anyway.

Analysis conducted by both the DoF in 2003 and the Southeast Asian Fisheries Development Center (SEAFDEC) in 2013 and 2014 of the catches of otter board trawlers and pair trawlers found that 'true' trash fish accounted for just 14-15% of total catch whereas 'fake' trash fish accounted for 27-50% of the total catch (Table 5).^{77/78} Juveniles of economically valuable species accounted for 64-78% of the trash fish caught. Consistent with these findings, a 2017 study found that 81% of trash fish was made up of juveniles of these species.⁷⁹ Such a high proportion of juveniles in catches raises serious concerns regarding the true impact of trawl fisheries on Thailand's marine resources as they are catching these juveniles before they have had the chance to reproduce and replenish stocks.

	Otter board 1	Otter board 2	Pair trawl
Food fish	% of total catch	% of total catch	% of total catch
Pelagic fish	1	1	21
Demersal fish	27	36	16
Cephalopods	3	9	8
Shrimps and prawns	4	5	0.5
Other invertebrates	1	7	0.5
Commercially important species (total)	36	58	46
Trash fish	-	-	-
Undersized pelagic fish	2	2	23
Undersized demersal fish	40	20	13
Undersized cephalopods	1	1	3
Undersized shrimps and prawns	0	1	1
Undersized other invertebrates	7	3	0
<i>Juveniles of commercially important species (total)</i>	<i>50</i>	<i>27</i>	<i>40</i>
True trash fish	14	15	14
Trash fish (total)	64	42	54

Table 5: Catch composition analysis (2013) for a small-sized otter board trawler based in Prachuap Khiri Khan (OT1), a medium-sized otter board trawler based in Chumphon (OT2), and pair trawlers (PT) operating in both areas.

The average income for a pair trawler in the SEAFDEC study was 205,965.51 baht per trip with the bulk of the income coming from squid (representing 68.3% of total revenue but only 15.0% of weight).⁸⁰ Pelagic and demersal fish species each contributed 5% of revenue, and 5.4% and 5.2%, respectively, by weight. The remainder of the catch – trash fish – made up 74.2% of total catch weight but accounted for only 18.8% of total revenue.⁸¹



Trash fish comprises both low value species as well as the juveniles of economically important species.

The vast majority of juveniles caught by trash fish trawlers are from species such as Indo-Pacific mackerel, anchovies and squid, that if left to mature over a period of 3-6 months would be worth many times more in value. They would have also had the opportunity to reproduce, thus replenishing the population. Fishing these juveniles before their first maturity – a measure of whether an individual has had the opportunity to reproduce and therefore replenish the population – has a negative impact on marine biodiversity, disrupts the recovery of fish populations and threatens incomes of both commercial and artisanal fishers.

The SEAFDEC study conducted in 2013 analysed the length of specimens caught by otter board and pair trawlers to assess whether or not they had reached their size of first maturity.* The average length of all species identified as trash fish were smaller than this and almost 100% of specimens of short mackerel, one of the most important economic species in Thai fisheries, caught by pair trawlers were smaller than this crucial reproductive size.⁸²

* Size at first maturity is the length in centimetres of the female at first reproductive maturity for the species.

81% of the trash fish is made up of juveniles of economically valuable fish species.⁸³

The market price for one kilogram of trash fish is significantly lower than that of adult specimens of the main species that are found in trash fish.⁸⁴ The average price of one kilogram of trash fish in October 2020 as stated by the Thai Fishmeal Producers Association was 5.87 baht/kg - having dropped by 32% since 2018.⁸⁵ In comparison one kilogram of short mackerel can be worth 100 baht/kg whilst squid can be worth up to 280 baht/kg (as of 2022).⁸⁶ Such a low proportion of total revenue originating from trash fish begs the question of how such a damaging and wasteful practice can be allowed to continue in Thailand's fisheries.

Value of seafood species at market in baht/kilogram

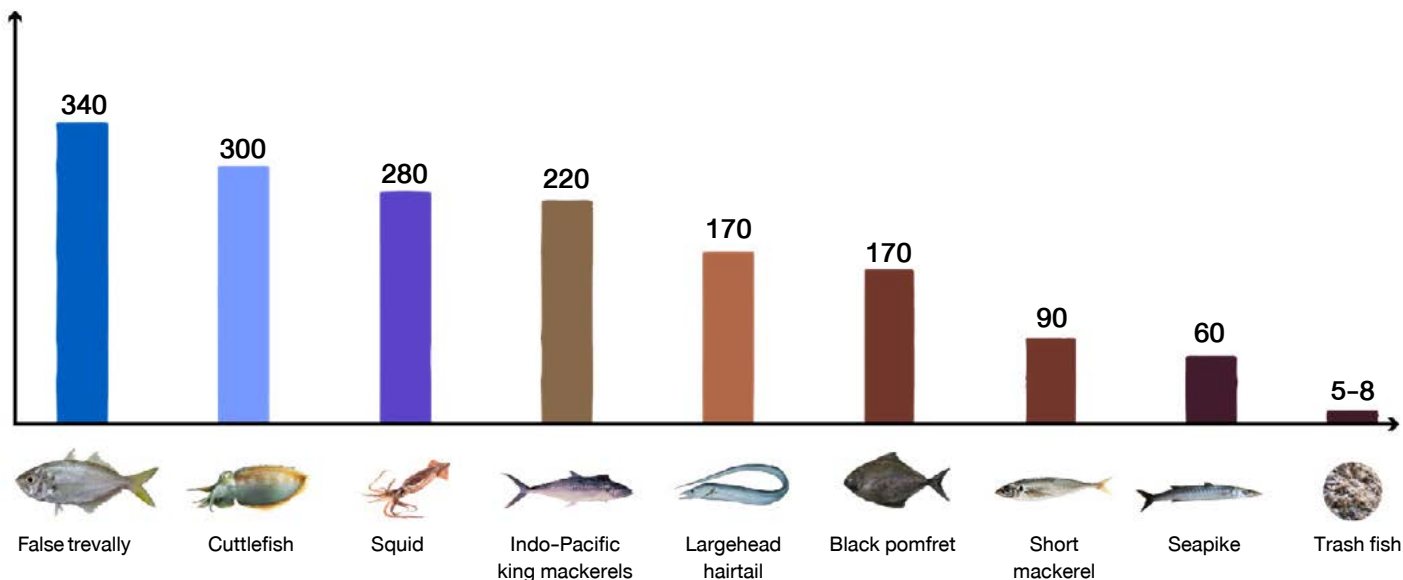


Figure 6: A range of different seafood products are ranked by their price (baht) per kilogram. Trash fish has the lowest price at only 5.87 baht/kg - a mere fraction of the average price of 217.5 baht/kg for many economically important species if left to mature.

Fish caught using trawling nets may also fetch a lower price compared to the same species caught by purse seine vessels because of quality degradation such as bruising and squashing in the back of trawling nets.⁸⁷ Trash fish originating from purse seine vessels for example fetches on average 7.78 baht/kg at market.⁸⁸



Vessels targeting economically important species will ultimately suffer if juveniles do not have the opportunity to reproduce.

According to one study, 40% of pair trawler catches are made up of juveniles of economically important species which are caught before they've had the opportunity to reproduce.⁸⁹

A pregnant whale shark is hauled onto a pair trawler in Phuket province. On discovery of the whale shark, the vessel captains were fined a record three million baht and their fishing licences were revoked. Such punishments are necessary to act as an effective deterrent against such wildlife crimes in the future and must be preserved.⁹⁰



Pair trawling's disproportionate impact on marine resources

The nature of pair trawling – dragging a large net between two boats – means that it is highly effective at catching an extremely large number of marine animals during trawling operations. Pair trawler net openings can stretch almost 100m, far wider than the average openings of beam trawlers (7.5m) or otter board trawlers (60m).^{91/92} These nets may stretch from the seabed to near the sea surface,⁹³ allowing these vessels to target both demersal and pelagic species at the same time.

The 2013 SEAFDEC study found that 44% of pair trawler catches were made up of pelagic species with over half of this amount made up of juveniles.⁹⁴ In addition, out of almost 330,000 tonnes of trash fish landed across Thailand in 2019 by all 21 commercial fishing gears, pair trawlers contributed 55% of the amount.⁹⁵ Trash fish represented 50% of pair trawler catches in 2019, compared to 42% of otter board trawler catches and 5% of beam trawler catches. These factors point to pair trawling being one of the most destructive and least well managed fishing methods practised in Thai waters.

Trawling gear	Total catch by trawl fleet in 2020 (tonnes)	Trash/forage fish caught in 2020 (tonnes)	Trash fish proportion of catch (%)
Beam trawler	12,657	489	4%
Otter board trawler	263,407	125,282	48%
Pair trawler	380,763	218,641	57%
Grand Total	656,827	344,412	

Table 6: Total catches and trash fish catches for the three different types of trawlers.
Pair trawlers are responsible for the majority of trash fish catches.⁹⁶

A DoF study conducted in 2017 demonstrates just how much more effective pair trawlers can be compared to other trawl gears.⁹⁷ Despite conducting less than 20% of trawler fleet fishing trips for the year, pair trawlers were responsible for catching 56% of the total trawler catch (Table 7). Pair trawler CPUE for 2017 was three times higher than the CPUE for otter board and beam trawl gears combined.

Gear	Number of trips		Operating days		Catches (tonnes)		CPUE (kg/day)
	Amount	%	Amount	%	Amount	%	
Pair trawl	14,921	19.48	138,616	21.97	328,533	56.40	2,370.09
Otter board	44,362	57.91	408,313	64.72	238,134	40.88	583.21
Beam trawl	17,316	22.61	83,949	13.31	15,856	2.72	188.88
Total	76,599	100	630,878	100	582,523	100	-

Table 7: Comparing catch rate (CPUE) and effort between bottom trawling gears in Thailand (2017).⁹⁸

In terms of total catch, pair trawler catches have steadily increased since 2003 (264,814 tonnes) peaking in 2019 (366,724 tonnes) – a rise of 38%.⁹⁹ The amount of trash fish caught by pair trawlers has also increased, almost doubling in recent years, from just under 110,000 tonnes in 2015 to around 220,000 tonnes in 2020.¹⁰⁰

These trends have been observed despite a 2015 DoF decree that aimed to make nets more selective and reduce the indiscriminate accumulation of trash fish, by enlarging the cod-end (catching portion) of the net to ensure a net mesh size of at least 4 cm.^{101/102} As both the proportion of catch classified as trash fish and total pair trawler catches have increased, this would indicate that this has not been successful. EJF field investigations conducted in 2022 have also found pair trawlers continuing to use net mesh sizes that are smaller than 4 cm.



Figure 18: (Clockwise from top left) A legal net used by pair trawlers shows how the body of the net has a significantly finer mesh size than the cod-end of the net. (Top right) Cleaned net ready for installation. (Bottom right & left) Clean nets obscure finer mesh nets underneath.

‘The fishing day quota transfer’ campaign, proposed by the DoF in 2021, risks further destabilising the situation. This scheme allowed vessel owners to scrap older vessels and transfer licences along with fishing quotas to other vessels they own using similar gears.¹⁰³ Since these quotas may be transferred to higher efficiency gears – for example, from otterboard or beam trawlers to pair trawlers – this could result in a dramatic increase in fishing effort even though the total number of vessels remains the same.¹⁰⁴ Previous studies conducted by DoF have revealed that with the same amount of fishing days, pair trawlers are able to catch four times the amount of seafood that otter board trawlers catch (Table 7).¹⁰⁵

How green oil keeps the trawling sector afloat

Commercial fishing vessels received fuel subsidies worth 3.98 billion THB (US \$ 115 million) in 2021.¹⁰⁶

Many pair trawler vessels can only maintain consistent profitability due to the use of lucrative fuel subsidies known as 'green oil'¹⁰⁷. Green oil is a specially dyed diesel fuel that is sold to Thai fishing boats at a subsidised tax-free price of around 23.5 baht per litre – around 21.5% less than typical diesel used on land as of February 2022.^{108/109} Green oil is unique in that it can only be sold beyond 12 nautical miles of shore, requiring vessels to travel out to sea to collect it.¹¹⁰ This requirement makes registering for the subsidy beneficial to large business owners who own larger, more capable seaworthy vessels. This indirectly incentivises the building or buying of larger vessels to accrue these benefits. Green oil is just one type of capacity-enhancing fisheries subsidy which has increasingly been regarded as 'harmful' to sustainable fishing practices.¹¹¹

Year	Green Oil usage (million litres)	Subsidy amount/year (million baht)	Fuel discount rate (THB/litre) *
2016	639.43	3,293.23	5.15
2017	615.13	3,587.32	5.83
2018	597.08	3,613.01	6.05
2019	599.48	3,860.65	6.44
2020	610.07	3,928.88	6.44
2021	618.58	3,983.65	6.44

Table 8: Green oil usage and total value of fuel subsidies paid out per year.

* Fuel discount rate is based on estimated values.

The total value of green oil subsidies distributed to the commercial fleet has steadily increased since 2016, rising by 21% by 2022 despite usage declining by 3.3%. Previous studies have shown that pair trawler fuel costs were on average 168,389 THB/month in 1995.¹¹² In 2021, even accounting for inflation, the same amount of fuel would cost 138,762.68 THB/month due largely to the support of the green oil subsidy.

As of May 2022, EJF has learnt of plans to pursue the mandatory installation of Automatic Identification Systems (AIS) on all fishing vessels that are signed up to the green oil scheme.¹¹³ This would cover approximately 4,865 vessels.¹¹⁴ If these plans go ahead it could represent a great victory in terms of transparency in Thai fisheries as it would ensure that even vessels below 30GT that partake in the scheme are now monitored for their fisheries compliance.



Impact of banning pair trawling

The damaging impacts of pair trawling on Thai marine ecosystems have been well recognised for many years. The fact that almost three quarters of pair trawler catches are non-target species with low economic value – according to SEAFDEC studies – should signify a catastrophic warning that such practices should be heavily curtailed if not banned entirely.¹¹⁵ A study conducted in 2003 found that a ban on pair trawling would lower excess fishing effort by 22%.¹¹⁶

Any ban on pair trawling would have significant implications for employment and livelihoods. In 2022, pair trawlers represented around a third of the total trawl fleet with 1,120 registered vessels. The majority (80%) of these vessels were between 50 and 110.99GT, with just 9.2% between 10 and 49.99GT.¹¹⁷ The average number of workers on pair trawlers was thirteen people.¹¹⁸ This means around 14,600 workers across the sector would be directly affected by implementing a pair trawling ban.

With such a large number of vessels and workers active in the sector, any potential ban on pair trawling warrants a carefully considered approach. EJF recommends that a carefully structured and phased approach is deployed which targets the largest and most powerful pair trawling vessels first. Such an approach would have to consider:

- Undertaking further fish population assessments across Thailand's fisheries to understand how the fishing effort of banned vessels could be reallocated fairly amongst the remaining fishing fleet.
- Studying alternative fishery-related activities for vessel operators and workers to engage in if affected by such bans.
- Providing financial incentives and assistance for fishers who want to change to non-destructive fishing gears/practices such as gillnets¹¹⁹, as well as for those who are willing to change livelihoods completely. Financing could originate from the reallocation of green oil subsidies.
- Providing a voluntary scrapping or buy back scheme for pair trawler fishers who wish to leave the sector regardless of vessel size or engine power.
- Ensuring that a sincere participatory approach is employed for any consultation to include affected fishers, local communities, small-scale fishers and civil society organisations.

One additional solution to addressing the disproportionate impacts of pair trawling on marine ecosystems would be the trialling and rollout of Juvenile and Trash Excluder Devices (JTEDs). These could be used to minimise the pair trawling fleet's impact on juveniles of economically important species. Such a device has already been promoted by the SEAFDEC Training Department in the interests of making regional trawl fisheries more selective in what they catch.¹²⁰

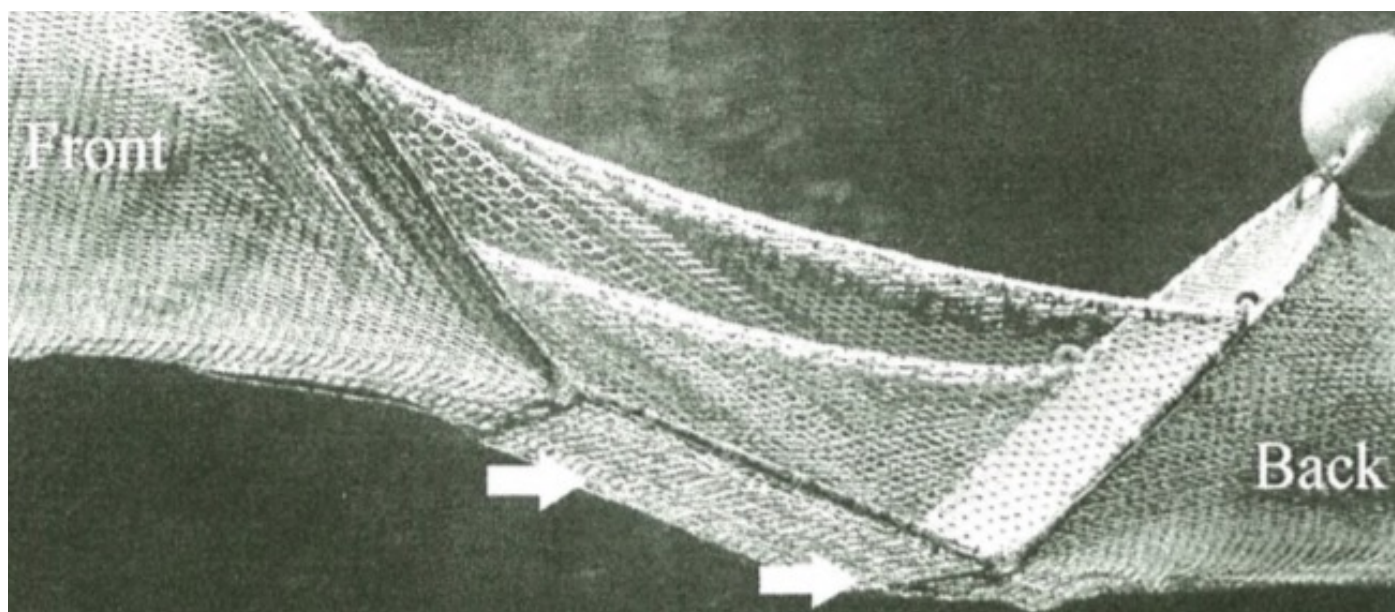


Figure 7: An example of a JTED device with arrows indicating a window within the net that can be opened and closed to release non-target species.

Recommendations

“For the majority of fishers, policies to manage fisheries resources do not exist because they apply to commercial fisheries which only make up 15-18 percent. The rest of the fishermen in 22 provinces are indigenous fishers. The sea is our resource foundation. The destruction of this resource will create poverty and inequality.

– Banjong Nasae, senior activist and consultant of the Thai Sea Watch Association.



The Transform Bottom Trawling Coalition sees bottom trawling as an urgent global issue that affects coastal states around the world. The Coalition calls on all coastal states to tackle this problem and wants to see evidence of a globally reduced footprint by 2030. To help achieve this goal, the Coalition is calling for States, in consultation with fishworker organisations and other stakeholders, to:¹²¹

- Establish, expand and strengthen national inshore exclusion zones (IEZs) for small-scale fishers in which bottom trawling is prohibited.
- Prohibit bottom trawling in all marine protected areas (outside IEZs) to ensure vulnerable habitats and ecosystems are effectively protected and recovered.
- End subsidised bottom trawling and allocate financial and technical resources to support a fair transition for fleets.
- Prohibit the expansion of bottom trawling to new, untrawled areas, unless and until it can be proven that there are no significant adverse impacts.

EJF has produced the following recommendations in line with the Coalition's global ambitions on tackling bottom trawling. They are designed to address the specific, identified capacity gaps in the regulation, monitoring and enforcement of bans of particularly destructive fishing gears in Thailand's fishing industry. It is important to note that these recommendations are not exhaustive.

The Royal Thai Government should:

- Seek to phase out the most destructive pair trawling fishing gears that are devastating Thai marine ecosystems and disproportionately contributing to declines in economically important fish populations in Thailand's waters. Such a phase out should be conducted according to a carefully planned, staggered approach that focuses attention on the largest pair trawling vessels first and should aim to be completed within three years.
 - Improve the effectiveness of monitoring, control, surveillance and enforcement mechanisms to deter and prevent bottom trawling activities within the IEZ and other protected marine areas within two years. Efforts should also be made to improve detection, investigation and prosecution mechanisms to maximise compliance.
 - Accelerate the adoption of the 10 principles of the Global Charter for Fisheries Transparency outlined by the Coalition for Fisheries Transparency which has been established by EJF and NGO partners including Oceana and Global Fishing Watch.¹²²
- Particular focus should be paid to addressing vessel monitoring gaps across the Thai commercial fleet as well as improving enforcement and prosecution of illegal fishing vessels. EJF strongly recommends that in order to address significant gaps across the trawler fleet special attention be paid to adopting the following principles:



► Policy principle 2: Publish punishments handed out for fisheries crimes.

► Policy principle 6: Enforce and maintain a ban on at-sea trans-shipment of catch.

► Policy principle 9: Ensure public and equitable access to fisheries data and participation in fisheries management and decision-making.¹²³

- Publicly endorse the Coalition for Fisheries Transparency's Global Charter for Fisheries Transparency and promote its implementation across Southeast Asia. Only through regional and international adoption and implementation of the principles within the Charter can Thailand and its neighbours hope to effectively end IUU fishing and associated overfishing issues.

- Restrict the use of capacity-enhancing subsidies such as the 'green oil' fuel subsidy that are provided to many trawler vessels. The use of such subsidies does little for sustainable fisheries development and is increasingly making commercial vessels dependent on such subsidies in the face of dwindling profits from catching low-value seafood products such as trash fish.

- Reintroduce an IEZ of at least 5 NM in the Gulf of Thailand and Andaman Sea to prevent overfishing and damaging trawling activity from impacting sensitive marine ecosystems and nearshore marine protected areas.

- Trial and implement alternative vessel monitoring technologies (such as Automatic Identification Systems) as appropriate in conjunction with transparency and monitoring efforts proposed by the Ministry of Finance and its Excise Department. EJF is encouraged to hear that such plans are already in discussion as of the time of writing.

The Department of Fisheries should:

- Scale up existing VMS trials for fishing vessels under 30GT as a matter of urgency with particular focus given to pair trawler vessels and otter board trawlers which have been found to be particularly destructive.

- Ensure that the Fisheries Monitoring Centre is effectively monitoring and investigating VMS outages by fishing vessels to determine whether or not any wrongdoing has taken place.

- Facilitate the use of VMS data for research purposes including stock assessments, spatial planning and worker safety.

- Tailor bottom trawl fleet management strategies according to vessel size, with vessels over 30GT, 60GT and 100GT receiving increasingly stringent regulations on their operations.

- Trial and implement gear modifications such as Juvenile and Trash Excluder Device (JTED) with particular focus given to pair trawler vessels and otter board trawlers.

- Re-evaluate current minimum net mesh sizes due to the high proportion of juvenile catches in nets. Enlarge the net mesh of the body portion of pair trawler nets to help limit the catching of juveniles.

- Introduce more accurate catch monitoring and verification methodologies so that the true impacts of trawling fishing gears on marine ecosystems can be better evaluated. Again, pair trawler catch verification should be prioritised.

- Adopt a precautionary approach towards the design and implementation of MSY, TAC, future catch and fishing effort limits for fisheries or fish populations where there is a lack of information or where the authorities are reliant on incomplete datasets.

- Enforce TAC quotas to prevent overfishing and keep fishing effort at consistent and sustainable levels in accordance with MSY levels.

- Trial and implement single-species CPUE assessments for important economic species such as squid and short mackerel across all trawling gears and other destructive gears as a proxy for population abundance. Similar CPUE assessments as those conducted for otter board trawlers should be conducted for beam trawlers and pair trawlers as a priority.

- The Marine Fisheries Research and Development Division should reconsider fishing effort quota for the trawling fleet and especially pair trawlers. Current fishing day quotas are allocated based on multi-species assessments, which are not sufficiently accurate to ensure that overfishing does not occur.

- Enforce existing regulations on the prohibition of catching juveniles by trawler vessels, decrease limits on the allowable bycatch of juveniles and decrease the current 20% allowable catch misreporting limit back to 10% of catch.



A DoF officer checks the VMS of a fishing vessel.

Conclusion

EJF's investigations and collated research from the last 20 years reveal a number of critical deficiencies in the management, regulation and enforcement of Thai trawl fisheries. A lack of substantive scrutiny of these vessel activities has led to unsustainable growth across the sector, trawler vessels growing in size and little to no measurable improvement in the overall health of fish populations in either the Gulf of Thailand or Andaman Sea.

Of most concern is the highly damaging pair trawling fleet.¹²⁴ These vessels have been shown consistently since as early as the 1990s and early 2000s to be the most damaging subcategory of trawlers in the Thai fishing fleet. Pair trawlers are responsible for a fraction of trawler fishing effort and yet were responsible for nearly 60% of Thailand's total trash fish landings in 2020.¹²⁵

Thai fisheries are sacrificing millions of baht in lost revenues through allowing these damaging pair trawlers to continue to operate, catching juvenile mackerel, squid and other species well before they are fully grown or have had the chance to reproduce and replenish the population.

It is EJF's recommendation that the Royal Thai Government and Department of Fisheries considers the carefully staged phase-out of these damaging vessels with a particular focus on the largest, and most destructive pair trawlers of over 60 GT first. Only through taking substantive steps to limit the impacts of these vessels now can Thailand hope to reverse the devastating impacts of these trawlers.

The situation is compounded by a lack of recent government supported studies on stock assessments, catch composition, ecological impacts of trawlers or the profitability of the trawling sector as a whole. Trawler operators are currently not punished for misreporting their catches, with only superficial warnings given out even if their figures are incorrect by over 20%. A chronic absence of such information or inaccurate reporting of catch data to government agencies such as the DoF make it difficult to regulate these fisheries accurately and fairly.

MSY and TAC are also still only being calculated for three broad species groups rather than the diverse number of marine species which are harvested in Thailand's waters. This is despite commercial fishing vessels adapting their technologies and fishing techniques to highly efficient, non-selective gears which can harvest an ever-growing number of marine species. EJF strongly advises that such data gaps should warrant a strict precautionary approach to future fish population management plans.

The situation is aggravated by the widespread use and exploitation of 'green oil' fuel subsidies, allowing vessels to operate for longer

periods of time than would otherwise be profitable. Without subsidies, many of these operations would not be economically viable given their reliance on catching seafood of low economic value or trash fish. Some trawler vessels may only accrue 5% of their total revenue from three quarters of their entire catch.¹²⁶

The concept of transparency in fishing is crucial for all relevant stakeholders to manage, monitor and enforce fisheries compliance accurately and confidently. Through improved and expanded data collection from trawl fisheries, rollout of vessel monitoring systems to smaller commercial vessels and better public access to relevant data, the Royal Thai Government can begin to rectify the situation.

The Coalition for Fisheries Transparency's 10 policy principles are designed to address these challenges through the implementation of cost effective and realistically achievable transparency mechanisms. These include the robust enforcement of IUU fishing violations as well as the online publication of successful prosecutions to act as an effective deterrent against future IUU violations, helping to bolster overall compliance. The banning and enforcement of unmonitored at sea trans-shipments within domestic waters can also help to prevent the laundering of illegally caught seafood amongst legitimate product.

Thailand has shown over the last six years that it has the resources and capability to reform large segments of the fishing industry for the better. In order to institutionalise these changes and ensure the continued recovery of Thailand's fisheries, the Royal Thai Government must show resolve in addressing critical issues across the trawling fleet. At the same time, any approach must be rooted in elevating transparency whilst ensuring the sincere participation of all relevant stakeholders in any future reform discussion.



The Royal Thai Government must take substantive measures to better regulate the activities of destructive bottom trawlers.

Endnotes

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“Pair trawlers shouldn’t exist in this country. It shouldn’t even exist on the planet at all because it’s a very destructive fishing practice. From seabed to water surface, it catches everything. It is impossible for aquatic animals to escape, whether small or large. It is a fishery that takes advantage of people all over the world.

– Wichoksak Ronnarongpairee, Thai Sea Watch Association President

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