

Illegal, Unreported and Unregulated Marine Fish Catches in the Indian Exclusive Economic Zone

FIELD REPORT



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EXECUTIVE SUMMARY

Taking advantage of previous local contacts, language and knowledge of the coastal areas of India, in a 7-month field visit in 2008/9, Ganapathiraju Pramod gathered information that may be used to make a complete estimate of fishery extractions, including illegal and unreported landings and discards (IUU). Nine of the ten coastal States of India were visited, including the Andaman Islands. Methods used were over 150 confidential interviews, gathering of grey literature reports and direct observations. The trip was sponsored partly by NSERC, by the UBC Cecil and Kathleen Morrow Scholarship for 2007, by DEFRA (UK Government, as part of global analysis of illegal fishing), and partly by MRAG (UK, as relating to a core area of interest). This report describes the fieldwork completed, together with some preliminary results that suggest an Indian IUU in excess of one million tonnes per year.

INTRODUCTION AND SCOPE

The purpose of the field trip was to get estimates of illegal and unreported catches from India's long and often inaccessible coastline to improve current estimates of total catch statistics from both mechanised and subsistence fishery sectors. The field work was carried out over a period of seven months (May - November 2008). As the 6 million fisherfolk (Ministry of Agriculture, 2006) are spread over a widely dispersed 8118 km coastline, the main foci of the interviews were to derive estimates for subsistence catches in the small-scale sector, while in the mechanized sector emphasis was given to discards, fish meal landings and take home catches of crew members. Illegal catches by foreign as well as domestic trawlers were also estimated through interviews with trawler crews in all maritime States and Government enforcement staff in some States. Unregulated fisheries catches were also derived by enquiring about the range of unregistered fishing crafts in all major fish landing centres. Preliminary estimates reveal that such crafts comprise anywhere between 5-9 % of the total fishing crafts operating along the India's maritime zone. There is no dearth of fisheries related regulations in each State (Marine Fisheries Regulation Acts), but implementation of these acts is virtually absent, except in the State of Orissa where serious attempts have been made in the last decade to implement fisheries and environmental laws in marine sanctuaries.

Literature was also collected from State fisheries departments, central Government agencies, fisheries journals and newspapers. Special emphasis was given to collecting grey literature as well as all the publications of IGOs like the Bay of Bengal Programme.

State	Name of places visited	Number of Interviews conducted	
		Small-scale	Mechanised
Gujarat	Porbandar, Veraval, Jamnagar, Kutch, Bhavnagar, Okha	10	12
Maharashtra	Mumbai, Thane, Ratnagiri, Raigad, Malvan	9	9
Karnataka	Malpe, Mangalore, Karwar	12	14
Kerala	Cochin, Kasargod, Kannur, Neendakhara, Munambam, Trivandrum, Kovalam	11	18
Tamil Nadu	Tuticorn, Chennai, Pulicat, Rameshwaram, Pamban, Mandapam, Nagapattinam, Cuddalore, Kanyakumari	11	14
Andhra Pradesh	Suluru, Nizampatnam, Kakinada, Machilipatnam, Visakhapatnam, Bheemunipatnam	18	12
Orissa	Paradeep, Chandipur, Chatrapur, Puri, Bhattarakanika	11	11
West Bengal	Calcutta, Roychowk, Digha, South Parganas	11	9
Andaman & Nicobar islands	Port Blair, Diglipur, Wandoor, Mayabundar	7	3
Total		100	102

MAIN ISSUES

Discards

Discards from Indian fisheries have generally been reported as very low in global analyses (Kelleher 2005). My study, however, is beginning to reveal that this situation is untrue and total discards may be in excess of 1,000,000 tonnes per annum.

Some recent studies (e.g., Bhathal 2005) have assumed that no discards exist for trawl fisheries in India presumably due to burgeoning trash fish demand in poultry and aquaculture feed sectors in the last two decades. No concrete sources are given for Kelleher's 2005 estimate; with the only two sources being cited as *pers.comm.* from Ministry in Delhi and MPEDA, Kochi. However, Davies *et al.* (2009) write that, "Bhathal (2005) estimates total landings in 2000 at 3,400,000 tonnes, so trawl catch would be just over half of the nominal total marine catch. However, Bhathal (2005) assumes virtually no discards in the trawl fishery, contrary to a number of other sources. If, as the data suggest, one-third of the 1,800,000 non-shrimp catch was discarded, the total discards would be about 600,000 tonnes. That figure is added to the total estimated nominal catch of 3,400,000 tonnes to get an estimated actual marine catch of 4,000,000 tonnes. The total estimated trawl catch of 2,250,000 tonnes, all of which is considered by-catch, thus represents 56.3 percent of the estimated total marine catch."

However, these previous studies have made these assumptions based on a few case studies from certain maritime States which have proved erroneous. Based on my fieldwork, several issues correct these misconceptions: A) a majority of the maritime States do not have estimates of discards from trawlers operating along their coastal jurisdictions; B) a majority of the trawlers operating along Indian coastline do not have a large hold capacity and deck space to store trash fish landed for each haul or for the whole trip; C) declining catches of target species in trawl gears in the past two decades has led to increase in duration of each fishing trip, with trips increasing from 2 days to 10 days to compensate for declining catches; D) although the duration of fishing trips has increased, operators continue to use trawlers of the same hull size, so a concurrent increase in hull capacity has not occurred in relation to increase in duration of fishing trips; E) single day trawlers are the only class of trawlers capable of landing bulk of trash fish caught in each jurisdiction, but they constitute only 15-25% of total trawlers operating along the Indian coastline (Pramod, *per.s obs.*, 2009¹).

¹ Pramod, G. (2010) *Estimation of Illegal, Unreported and Unregulated fish catches in India's marine capture fisheries, Field Trip to eight maritime states and 2 island territories in India, May to November 2008, India.*

Discards from marine fisheries sectors vary from one coastal State to another due to different levels of demand, availability of fish meal processing facilities, and variation in fishing days at sea (for mechanized trawlers in each State). Discards for the West coast have been poorly quantified in previous studies. So, the estimates drawn from the current trip are probably among the best drawn so far. On the East coast previous studies have only estimated discards from Central Bay of Bengal, with other maritime States having very poor or no estimates of discards. Malhotra and Sinha (2007) also state that there are no reliable estimates of discards in India's marine fisheries. Jayaraman (2004) based on a study in 2003 estimated trash fish to constitute 10-20% of total catches (271,000 tonnes) landed by trawlers operating along Indian coastline. Sathiadas *et al* (1994) estimate a discard rate of 5% for marine fisheries in India. FAO (2004) document estimated that Indian trawlers have a discard rate of 2%, discarding 57,917 tonnes per year, which is very low compared to my estimates.

During 1982-1983, 110 chartered or joint venture deep-sea trawlers operated in inshore waters along the SW coast, catching about 13 tonnes /day /vessel (Devaraj, 1987). These vessels reportedly discarded 8 tonnes of catch / vessel / day, as they were targeting shrimps and discarding the bulk of the other catch. Using the above figure, an estimated 202,400 tonnes of fish were discarded by these vessels every year (110 vessels x 230 days in operation x 8 tonnes discards /vessel) for the years 1982 & 1983. Once the depth limitation of fishing beyond 80 m depth was enforced in 1983, only 12 vessels remained. 120 Mexican trawlers (57¹) were operating along the NE coast during the same period, primarily engaging in shrimp trawling in inshore waters. These trawlers likely discarded similar quantities of discards in Bay of Bengal as they were targeting shrimps and lobsters for the export market.

Regulation 5, of the Maritime Zones of India Rules 1982, is probably the only regulatory source stating how discards would be managed in Indian marine fisheries "Crews may not discard substantial surplus catch, catch exceeding authorized quantities shall be retained onboard, recorded, and surrendered as required by authorized officers". However, since its inception mechanized vessels have never abided by this law, and no records exist on huge quantities of discards dumped by trawlers at sea. Moreover, since there is no effective mechanism to monitor fishing vessels at sea, over the last three decades fisheries discards have been assumed to be low.

Table I. DISCARD ESTIMATES FROM THE PRESENT STUDY

State	Average Discards at sea by mechanised trawlers tonnes	Range	
		Lower Limit tonnes	Upper Limit tonnes
West Bengal	4,440	1,268	7,612
Orissa	99,247	67,076	131,418
Andhra Pradesh	207,232	134,826	279,639
Tamil Nadu	212,969	179,274	246,665
Kerala	429,074	351,778	506,371
Karnataka	161,042	111,985	210,099
Maharashtra	90,037	68,807	111,268
Gujarat	690	360	1021
Andaman & Nicobar Islands	13,200	9,600	16,800
Total	1,217,931	924,974	1,510,893

In Maharashtra, trawlers operating from Mumbai landed 3-12 baskets (each basket is 25-40 kg) of trash fish in each trip with 10-35 baskets landed at Ferry wharf. Interviews revealed that during the monsoon season from May-June, prawn and commercial fish are given more importance for storage, with 80-90% of trash fish being discarded at sea during this period. Even for multiday trawlers, trash fish from the first 3 days is discarded at sea, and only 11-25 baskets of trash fish is landed at Sassoon dock for each trip. Single day trawlers landed more trash fish compared to multi-day trawlers during post-monsoon season, but discards from these trawlers were also substantially higher during May-June when prawns and bigger sized fish were given more preference for storage onboard. In Gujarat, discards were much less, due to high demand for trash fish in the dry fish industry and the presence of a large number of fish meal plants to process these catches. The high demand for fishmeal also meant that fishermen landing trash fish in Gujarat were paid more money to land these catches, which would otherwise be discarded at sea. None of the other maritime States in India have such an organized system of trash fish collection and processing as in Gujarat. In fact, overfishing by trawlers throughout the year in large numbers has led to drastic decline in catches of large commercial fish, but fishermen still manage to eke out a living by landing more quantities of trash fish, with trash fish compensating for decline in commercial fish species.

Results from the present study show that discards have increased for two main reasons. Firstly, the number of trawlers operating along the Indian coastline has increased over the past four decades. Secondly, the duration of fishing trips (10-12 day trips) has also increased all along the Indian coastline, with trawlers along the Kerala, Karnataka and Maharashtra coastlines increasingly targeting deep sea stocks at 150-350 metres during most of the year. Increasingly, longer fishing trips in deeper waters means that non-commercial species of fish and shrimps are encountered in larger numbers. Longer fishing trips also create problems for the operators of these trawlers as they cannot store trash fish from all the hauls during each trip. The expansion of fishing into deeper waters is a positive development in terms of exploiting new fishing grounds. But, crew members of these trawlers mentioned that they are increasingly coming in closer range of foreign chartered vessels operating under joint venture in Indian waters, which could lead to problems in future. In all coastal States, interviews with skippers and trawler boat owners revealed that fisheries department enumerators never collect data on discards at sea. Detailed estimates of discards from 8 maritime States and island territories are given in Table. I.

Small-scale fishers all along the mainland coast said that displacement of fishers has increased during the last decade due to industrial development, pollution, formation of new dead zones (where fishers could no longer catch fish largely due to dumping of sewage and industrial wastes near major cities). Small-scale fishermen cited that to compensate for decreasing catches they are increasingly using more nets, go further and stay for more days at sea. Another noticeable change according to small-scale fishermen was that more crew work on each vessel, so profit from each trip is reduced, as bulk of revenue from trip is paid to agent who funded the trip, fuel costs and fishing gear. Incomes have declined for fishermen in all coastal States, as fishers earn half the amount of money that they used to earn 10 years back. This decline is due to two reasons. The increase in the number of crew on each boat means the share per person is less; more time at sea means average income per day is less, and bulk of profit from trip is paid to lenders due to indebtedness. In the mechanised trawl sector, depletion of local fish stocks has led to migration of crew working on these vessels to work as crew in other coastal States where they face more risks. For example, during interviews with fishing crew working on trawlers in Gujarat and Maharashtra, it was revealed that most of the crew working on trawlers nowadays are from distant States like Andhra Pradesh and Orissa. This has contributed to decrease in wages for trawler crew in Gujarat, as crews from other States are employed on a daily wage basis. In the past most of local crew from Gujarat working on trawlers used to get a certain percentage of profit from each trip. So, increasingly local crew are reluctant to take the risks to work on trawlers, while trawler crew from Andhra Pradesh are ready to take the risks as they don't have alternate employment in their home State. So, overfishing in one State is fueling displacement and conflict with fishers from other State due to migration.

Unregulated catches

Interviews with fishers revealed that unreported catches from unregulated or unlicensed fishing boats in both artisanal and industrial sectors are not quantified or accounted for in the present reported Indian catch statistics. Previous studies have also thrown light on similar problems in estimates of fishing crafts taken from various State fisheries departments (Malhotra and Sinha 2007). Interviews have revealed that there are unregulated fishing vessels in most of the coastal States. Detailed estimates are currently being drawn up on the extent of these catches and will be published elsewhere.

Fish bartered at sea is substantially less now compared to earlier years. I undertook a similar survey of trawl fisheries on the northeast coast of Bay of Bengal in 2003-04, (Pramod 2005), when trawler crews used to barter approximately 10-20 kg of fish in each trip at sea in exchange for groceries and alcohol. Presently, only 2-5 kg is bartered for a 10 day trip. This decrease is mainly to compensate for the increase in fuel and trip costs in recent years.

Illegal catches

Illegal fish catches were very high in island territories, with most violators being foreign trawlers targeting sea cucumbers, shark fins and reef fish in the Andaman Islands, while shark fins were the target of poachers in Lakshadweep archipelago. Patrolling was found to be inadequate in proportion to the length of coastline throughout the Indian coast. Interviews with enforcement staff in State Fisheries Departments revealed that in some cases poaching foreign vessels possess far better monitoring radar equipment as revealed by equipment on confiscated trawlers.

The Government of India through State Governments of respective maritime States implements a fishing ban during the monsoon every year. The ban lasts for 45-60 days with each State using a different time period or criteria such as advancement of monsoon as an indicator. Absence of a uniform ban period throughout the coastline has led to fishing trawlers of several States using this legal technicality to fish where fishing ban exists and land in an adjacent State where there is no ban. During interviews, fishermen in Goa, Karnataka and Maharashtra (West coast), Orissa and West Bengal (East Coast) complained that the very essence of the fishing ban is flawed as vessels from neighbouring States continue to catch from one State and land in another, leading to low catches during the post ban period. With most of the coastal States having weak enforcement, due to huge gaps in allocated infrastructure, manpower and monetary resources, illegal fishing persists through domestic fishing vessels in inshore waters. Moreover, it also leads to problems in misreported catches where fish caught in one jurisdiction is reported as caught in another location.

Enforcement of mesh size regulations is dismal in all States, with Fisheries Departments in all maritime States being ill equipped to carry out surveillance or implementation of regulatory measures. To prevent overcapacity and misuse of trawlers from one State in another, trawlers from one state should not be allowed to operate in another state or use ports of neighbouring States during a fishing ban in their port of registration. In many cases it has been observed that a single trawler has been fishing in more than 3 states during different periods of the year. Trawler owners in most states said that trawlers often contravene the ban, by taking their vessels to neighbouring States during a ban in their port of registry, and returning after completion of the ban period to fish in their State waters. But, most trawler owners rarely realize that this action is leading to depletion of the very stocks that are sustaining profits for them, as the bulk of the pelagic and demersal stocks along the Indian coastline are transboundary in nature. In some coastal States in India, registration is required for trawlers from neighbouring States to operate and use port facilities, but vessel skippers often contravene the regulations through landings in small harbours. Since, a vessel monitoring system does not exist in Indian fisheries, it is almost impossible for Coast Guard to monitor all the Indian trawlers that operate within its EEZ.

The majority of the States, with the exception of Orissa, do not have patrol vessels to enforce a fishing ban. This fact assumes importance since the fisheries departments of each maritime State are the primary enforcement authority for fisheries management in territorial waters (0-12 nautical miles). The Coast Guard in its present role is providing supplementary support in some States during ban period, but it is impossible for Coast Guard with its present budgetary constraints to monitor the vast numbers of trawlers operating along the Indian coastline. Illegal fishing by domestic mechanized trawlers in the inshore artisanal zone has been reported in all coastal States of mainland India².

Perceptions of causes of decline in fish stocks

Five problems are cited as being responsible for decline in fish stocks; 1) Overcapacity in the mechanized and traditional sectors; 2) The State Fisheries Departments in each State do not take into account the catches from seasonal influx of trawlers from other States during monsoon season (doubling of fishing effort during these periods) leading to local depletion of stocks; 3) Fish stocks don't stand a chance of recovery as influx of trawlers into productive inshore waters of the coastline is increasing with decline of stocks in many coastal States; 4) Fishermen in Kerala, Karnataka, Orissa and West Bengal blame the seasonal migration of trawlers from other States as huge impediment to recovery of fish populations as these trawlers are coming in more numbers each year since 1996. This has led to declining catches for both traditional and mechanized vessels in the respective States. 5) Poor enforcement of mesh size and gear regulations in both mechanised and small-scale sectors has led to drastic declines in biomass of several commercial species.

Small-scale fishermen were of the opinion that unless the central and State Governments take concrete measures to reduce overcapacity in their own States and prevent influx of trawlers from neighbouring States, the fish stocks will continue to plummet. This issue has never been addressed by State Governments, and fishermen are of the opinion that "fishing ban" for 45 days every year during monsoon season is not working as fishermen put more effort prior to and after ban period catching indiscriminately by fishing in breeding areas of fish and shrimps in ever large numbers. Many fishermen were of the opinion that both number of fishing vessels and hours at sea should be restricted for fishing trawlers during the breeding season to prevent capture of juvenile fish and shrimps. Small-scale fishermen in Kerala also cited that the monsoon ban is not working along their coastline as there is more fishing through small-scale fishers during this period. So, the fishing effort from mechanised sector is transferred to small-scale sector every monsoon with more ring seines operating during this period, leading to recruitment overfishing of pelagic fish stocks.

Some recent reports suggest that increasingly trawler boat owners are investing in new high-speed engines to get higher catches along the Mangalore coast. The new trawlers with high speed engines engage in both bottom trawling and mid-water trawling to land higher fish catches. This has resulted in encroachment of trawlers into coastal fishing grounds traditionally targeted by purse seiners which traditionally target pelagic fish stocks (Anon 2010a).

Table II. ANNUAL CLOSED FISHING PERIOD IN INDIAN FISHERIES

State	Monsoon Fishing Ban Period
Gujarat	None
Maharashtra	June 10 to Aug 15
Goa	June 10 to July 31
Karnataka	June 15 to July 29
Kerala	June 15 to July 29
Tamil Nadu	May 1 to June 15
Andhra Pradesh	April 15 to May 29

² The Area up to 5 nautical miles from shore is reserved for artisanal fishermen (Non-motorised fishing craft) in most coastal states of mainland India under the Marine Fishing Regulation Acts (MFRA).

Orissa	April 15 to May 29
West Bengal	April 15 to May 29

For example, artisanal fishermen in Kerala were of the opinion that every year a narrow stretch of waters between Alleppey and Neendakhara constitutes the breeding ground for the bulk of shrimps caught in the State. But the State has not protected even one quarter of this area from trawlers. Subsistence fishermen in this section of the coast state that they are not left with any other avenue except using smaller sized gillnets to catch juveniles, while younger fish are more dominant in the gillnet catches in recent years. Traditional fishermen in Kerala are also to blame for the decline of fish catches as they have allowed operation of smaller meshed ring seines which catch 0 and 1 size classes of sardines and mackerels in more numbers every year.

Discrepancies of Foreign Joint Venture Chartered vessels

Under the Maritime Zones of India Act, of 1981 the Indian Coast Guard is the nodal agency responsible for monitoring chartered vessels operating under joint venture with Indian companies. Up to the year 1995, 800 of these vessels were licensed to operate in Indian EEZ (Kurien, 1995).

In recent years as many as 110 chartered joint venture vessels have been operating in Indian waters. The joint venture vessels originally came from Taiwan, and operate under an Indian flag while fishing in Indian EEZ, while retaining their original vessel registration in Taiwan. The names of the original vessels are changed while fishing in Indian waters; they have no IMO number and essentially engage in ‘flag hopping’. The Association of Indian Fishery Industry has asked various Government agencies to take action on the companies and vessels involved (Patnaik, 2008) with little impact as these vessels continue to fish in Indian EEZ. Violations include dual registration³, under-reporting, illegal transfer of catches, failure to file shipping bills to Indian Customs listing the quantity of catch being taken out while exiting Indian EEZ, and violations of the Maritime Zones of India Act⁴ (Patnaik 2008).

The modus operandi is explained below. The Government of India acquires the deep sea fishing vessels on “deferred payment” under External Commercial Borrowing / Suppliers Credit. The original tuna vessel owner from Taiwan, registers the vessels to a management company, and this company signs an agreement with the Indian company. The tuna vessel is then shown as vessel sold to Indian company on deferred payment. 10% of the down payment is made at the time of issue of the Letter of Permission (LoP) and the balance has to be paid in five equal instalments. The conditions for the Indian company is that they should have a paid up capital of Rs. Twenty Lakhs only (US\$ 43,478) where as the amount of 10% payment works out to Rs. two Crores (US\$ 434,782). To overcome this shortfall the seller of the vessel advances the money by the way of advance for tuna catch. This rotation of funds is only to get the necessary clearance to operate the vessels in Indian EEZ. In fact, these vessels are presumably operating through buyer and seller agreement on a commission basis, which violates the regulatory process itself (Anon pers comm., 2008). Interestingly, many of the personal sources were very willing and keen to share their knowledge and information with us, but have expressed a clear preference for not being named, i.e. wanting to remain anonymous, usually out of concern about their perceived scientific standing, or concerns about their job security. Throughout this report, we treat such concerns seriously, and cite ‘anonymous source’ for such material. We also endeavour to use such information in a manner so as not to make the original source apparent.

³ Section 435 of the Marine Shipping Act states that for a vessel to fly an Indian flag it should be registered under ownership of an Indian.

⁴ As per MZI Act, 1981 an Indian vessel means “ (I) a vessel owned by a Central Act or by a corporation established by a Central Act, or (II) a vessel (i) Which is owned wholly by persons to each of whom any of the following description applies: (1) A citizen of India; (2) a company in which not less than sixty percent, of the share capital is held by citizens of India; (ii) Which is registered under the Merchant Shipping Act, 1958, or under any other Central Act or any provincial or State Act”.

According to the Association of Indian Fishery Industries, they have taken up these issues with the concerned investigating agencies and they expect the Government to take action on Indian companies shortly. Furthermore, these joint venture companies do not declare catch details of yellowfin and bigeye tunas according to crew members working on the vessels. The vessels essentially engage in flag hopping as, they operate under an Indian flag in Indian waters, and use the Taiwanese flag in international waters, where they tranship the tuna catch caught in Indian EEZ. The tuna is eventually sold as tuna caught by Taiwanese vessels into Japanese markets. Recently, some of these chartered vessels have changed to Indian flag, as reflected by a sudden increase in Indian flagged vessels in the Indian Ocean Tuna Commission (IOTC) authorized vessel list. However, several inconsistencies still exist with illegal transshipments and vessel licensing of Taiwanese tuna vessels operating in Indian EEZ.

Some of the steps that can be taken to tackle this problem include implementation of observer schemes and vessel monitoring systems (VMS) as part of license requirements for all foreign chartered and joint-venture vessels operating within Indian EEZ. The VMS can provide the much needed information for Coast Guard to check discrepancies in IUU fish catches, while observers onboard the tuna vessels can help to counter check the transshipments at sea. This is essential as bulk of the chartered tuna vessels operating in Indian waters do not land their catches in Indian ports. IOTC also has an independent observer programme onboard all the legitimate reefer vessels operating in the Indian Ocean, and the Indian government can take steps in this direction to begin a positive change in management of its valuable tuna stocks.

Table III. FOREIGN CHARTERED FISHING VESSELS OPERATING IN THE INDIAN EEZ

Year	Number of vessels licensed	Source
1990	83	Shajahan (1996)
1993	39	Shajahan (1996)
1994	122	Shajahan (1996)
1997	120	Miglani (1997)
2008	110	Present Study, 2008

Troubled waters

Interviews with fishermen in Tamil Nadu on the Indo-Sri Lanka maritime border revealed that, previously, illegal fishing was undertaken for profit, mainly targeting shrimp, while in recent times accidental incursions into Sri Lankan waters is for survival due to declining catches in Indian waters, overcapacity and inability of smaller trawlers from Palk bay to fish in neighbouring coastal States of mainland India.

Unlimited fishing trawlers in limited fishing grounds

Indian fishers in Palk Bay and Mandapam stated that accidental incursions of fishing vessels from both countries occur on a regular basis into each others' waters. Based on interviews in the present study, the problem of illegal fishing in Palk bay and Mandapam are likely due to three reasons. Firstly, the Government of India has tried to solve the problem of incursions through increased patrolling along the international maritime boundary, instead of controlling the huge overcapacity of Indian trawlers operating along Palk Bay and Mandapam. The trawling grounds along the Palk Bay and Mandapam can hardly sustain fishing pressure from one third of the existing fleet. Fishermen from Palk Bay were of the opinion that since there is a narrow border separating India and Sri Lanka, accidental intrusions should be treated with utmost sensitivity through warnings, with crew and vessels being promptly released for such cases.

A common understanding seems to exist between India and Sri Lanka, with illegal tuna vessels from Sri Lanka and illegal Indian shrimp trawlers operating in each others' jurisdiction being arrested and handed over to each others' Coastguards on a regular basis. Information from Appendix V, shows that the number of illegal Sri Lankan tuna vessels operating in Indian waters has increased drastically, putting Indian tuna vessels at disadvantage. A recent media report suggests that almost all the multi-day tuna vessels that were caught illegally fishing for tuna in Indian EEZ during 2009 were handed over to Sri Lankan authorities (Anon 2010b). A press release from Government of India revealed that 116 Sri Lankan fishing vessels were arrested in 2009 (Anon 2010c). Majority of the arrested vessels were multi-day tuna longliners. Data from GIFI database reveals that more than 100 of these apprehended Sri Lankan vessels in 2009 are tuna longliners. So, the Indian Government has lost (each multi-day Lankan tuna vessel has a current market price of US\$ 57,631 per vessel) US\$ 5,763,100 from 100 vessels which were handed over to Sri Lankan authorities after arrests⁵. Return of illegal fishing vessels on both sides does not stand in good stead as majority of these illegal multiday tuna vessels in Sri Lanka and illegal fishing trawlers from India are owned by commercial interests and are seldom owned by fishermen. Handing over of the apprehended crew on both sides is a good move to improving bilateral relations, but Governments on both sides should confiscate fishing vessels implicated in illegal fishing.

Interviews were also conducted with Indian fishermen operating along the Indo-Pakistan and Indo-Bangladesh maritime boundary to understand the reasons for frequent arrests of fisherfolk on both sides of the border. Declaration of 5-10 km, no fishing zones on both sides of border along Indo-Pakistan & Indo-Sri Lanka regions can help in preventing accidental intrusion of small-scale fishers into each others' jurisdiction. Indian fishermen in Gujarat stated that marker buoys with flags can help in preventing accidental intrusions into Pakistan and vice versa.

INTERVIEW METHODOLOGY

A semi-structured questionnaire was used to determine the amount of illegal and unreported fish caught and landed by artisanal fishers (hook and line, gill nets, traditional gears) and mechanized trawlers in India. The illegal catches looked at infringement of trawlers into the 5-12 mile fishing zone, which is reserved for this sector by the Government of India's Fisheries Laws. Interviews through the questionnaire helped to determine the total percentage of illegal and unreported catch in India's marine fisheries sector. For example, any fish caught by a mechanized trawler within 5 nautical miles from the shore is illegal as this zone is reserved for artisanal fishers. So, interviews with artisanal fishers regarding activity by trawlers in their 5 mile zone helped in determining illegal catches from the industrial sector (See Table II & III for results of this analysis). For the artisanal sector, interviews with fishermen on take home catches (any fish catch not sold and retained for consumption at home after fishing trip), recreational catch by part-time fishermen and catches from remote fish landing centres which are presently poorly monitored by Government officials were used in determining unreported catches. These latter are not illegal, but are rarely reported correctly. The work forms part of a world-wide UN initiative to improve the estimates of fish landings.

A snowball approach was used in contacting fishers. Since most of the fish landing centres are in remote locations. We went to the main fish landing centres in each village and asked people engaged in fishing randomly whether they would be willing to participate in this survey. If they agreed, we informed them the purpose of our study through oral consent as most of the fishers are illiterate. If they gave us permission, we then asked them the questions in the questionnaire.

⁵ Chapter IV of Maritime Zones of India (Regulation of Fishing by Foreign Vessels) Act, 1981 states that "13. (1) Where any person is convicted of an offence under section 10 or section 11 or section 12, the foreign vessel used in or in connection with the commission of the said offence, together with its fishing gear equipment, stores and cargo and any fish on board such ship or the proceeds of the sale of any fish ordered to section (4) of section 9 shall also be liable to confiscation"

Each maritime State has designated fish landing sites for small-scale fisheries and fishing harbours for large mechanized trawlers operating beyond 5-12 nautical miles. For small-scale fisheries in each State there are numerous landing centres at district level. Interviews with small-scale fishers were conducted in at least 10 per cent of landing centres in each district. The landing centres were chosen randomly along the coastline to give a broader picture of fishing activity in each district. For example, if there are 16 designated small-scale landing centres numbered 1 to 16 from South to North. Landing centres numbered 1, 5, 10, 15 were chosen for the study to uniformly cover required number of interviews throughout the coastline. Some of the constraints in choosing landing centres include access by road, and ability to get there at least on a two wheeler. Each participant was interviewed for approximately 30-60 minutes once during the survey.

BRIEF REPORTS ON STUDY AREAS

A preliminary State-wise report of the IUU estimation is given below.

West Coast (Arabian Sea): 52 interviews were done with trawler crew and 42 interviews were done with small-scale fishermen in the coastal States of Gujarat, Maharashtra, Karnataka, Kerala, and Lakshadweep islands. The interviews were undertaken by primary author (Prمود) and field assistants hired and trained by him for this purpose. A total of 14 field assistants were hired for this period. In the small-scale sector, interviews were conducted with fishermen operating gillnets, hook and line, trammel gill nets, and cast nets. In the mechanized sector interviews were conducted with skippers and crew of demersal trawlers, longliners, and gillnetters.

Gujarat

Gujarat has a 1600 km coastline with 1,64,183 km² continental shelf supporting 18,369 mechanized vessels and 11,784 non-mechanized vessels. The State has 263 marine fishing villages, with 59,889 fisherfolk operating along its coastline. Trawlers, gillnetters and dol-netters are the main fishing craft in the mechanized sector while plank-built boats and canoes figure more prominently in the artisanal sector (CMFRI 2005a). Trawlers target sciaenids, ribbonfish, lobsters, shrimps, etc., and contribute 71% of the total catch, while gillnetters target pomfret, seerfish, tuna and sharks; and dol-netters land 19%, with the remaining 10% are landed by dugout boats and canoes with outboard motors and non-mechanized boats using gillnets (Zyundheen *et al.*, 2004). A good account of marine fisheries in Gujarat is given in Shiyani (2002); Johnson (2001); Praveen *et al.*, (1998) and Devaraj *et al.*, (1998).

Gujarat ranks second among the top three marine fish producing States in India. The bulk of the catch is exported due to low local demand in the State. This allowed an interesting opportunity to look at any discrepancies between fishmeal exports from the State and the actual landings based on interviews with fishers. Discards from the trawl fishery were the least in Gujarat among all the coastal States enumerated. The probable reason for the low discards is the high demand for trash fish in the local fishmeal industry.

Discards estimated from trawlers suggest that only 0.3% of catch is discarded, mostly during the monsoon season (the bulk of it coming from trawlers operating in Northern Gujarat), which probably represents the lowest estimate of discards among trawlers operating in India's maritime States. Bostock (1986) made a similar note on trawlers operating along the Gujarat coast. This study showed that trash fish comprises 62% of the catch with none of it being discarded. Estimates from the current field trip suggest that trash fish comprised 81% of the total catch landed suggesting an increase in landings of lower value species. Gujarat sets a good example by landing bulk of the trash fish as both trawler owners and fish meal plants have ensured a higher price for trash fish landed in this State compared to other coastal States in India.

The Gujarat Fisheries Act, 2003 is the primary legislative act responsible for protection, conservation and development of fisheries in territorial waters of the State. Section 4(a) of the Act prohibits use of fishing gear

with less than 40 mm mesh size at the cod end portion. However, interviews with fishers revealed that almost all trawlers (95%) use one of the smallest mesh sizes in the cod end of trawl net (8-12 mm) essentially resulting in recruitment overfishing. Estimates of illegal catches by trawlers in the 5 nautical mile artisanal zone give an estimate of 740 to 1,130 tonnes for Gujarat. Intrusions by trawlers into artisanal zone were reported in Kutch, Jamnagar, Bhavnagar, Bharuch and Valsad districts. Several hundred tonnes of fish meal is brought by merchants in Maharashtra for domestic and export markets. This fish meal is largely accounted for in the present catch statistics for Gujarat. See Appendix I for details on number of Indian fishing boats arrested in Sindh Waters (Pakistan EEZ). Appendix II provides details on number of Pakistani fishing boats detained for illegal fishing in Gujarat waters (Indian EEZ).

Unreported catches from small-scale fisheries and fishmeal landings are under evaluation and will be presented later through other publications.

Maharashtra

Maharashtra has a 720 km coastline with a continental shelf of 1,11,512 km² supporting 23,508 fishing crafts of which 13,053 are mechanized craft, 3382 were motorized and 7073 non-motorised craft. The State has 406 marine fishing villages with 65,313 fisherfolk operating along its coastline. Trawlers, gillnetters and dol-netters are the main fishing crafts in the mechanized sector (CMFRI 2005b).

Interviews with trawler skippers reveal that discards range between 8-15% of total catches landed by trawlers for each trip in Maharashtra. The quantity of discards varies from season to season with substantially higher discards during pre-monsoon and post-monsoon periods when juveniles of fishes and shrimps constitute higher percentage of the catch. No discards have been reported for trawlers operating along Mumbai coast in previous studies (Chakraborty *et al*, 1983).

Substantial high discards have also been reported along the Raigad coastline due to presence of plastic waste in trawl catches. Trawler skippers said that the problem is now so acute that they avoid some parts of coastline due to plastic wastes constituting as much as 30-45% of the total catch in every haul. This creates immense problems during sorting as it increases the time afforded for sorting between each haul. Trawler skippers blame disposal of plastic waste into sea in Mumbai district for this serious problem.

Illegal incursions by multi-day trawlers into dol-net fishing grounds have been reported by small-scale fishermen in Thane and Mumbai districts. Fishermen reported that such illegal incursions have resulted in declining catches of pomfrets, shrimps and Bombay duck in recent years. Estimates drawn from interviews with fishermen reveal that illegal catches by trawler intrusions into inshore traditional grounds amount to loss of 1100 to 1800 tonnes each year for the artisanal sector.

Maharashtra notification Section 4 of the Maharashtra Marine Fishing Regulation Act, 1981 dated October 13, 1999 states that purse seine gear should not be operated by any mechanized vessel within 12 nautical miles from shore. However, fishermen reported that compliance with this notification is lacklustre due to absence of enforcement by State Government agencies. Moreover, Maharashtra Notification dated 12th December 1997 affirms that no trawl gear should have less than 35 mm mesh size for trawlers operating in territorial waters of Thane, Mumbai, Raigad and Sindhudurg district. However, it was reported during interviews that most of the vessels operate trawl gear with mesh size between 15–25 mm, which is far less than the regulatory requirements.

Karnataka

Karnataka has a 300 km coastline with continental shelf of 27,000 km² supporting 15,655 fishing crafts of which 7577 were traditional non-motorized craft, 3705 were motorized and 4373 mechanized vessels (2515

trawlers; 1254 gillnetters) CMFRI (2005c). Trawlers, gillnetters and purse seiners are the main fishing vessels in the mechanized sector while plank built boats and canoes are the main fishing craft in the artisanal sector.

Discards estimated from interviews with trawler skippers and crew revealed that discards constitute 10-15% of total catches landed in fishing harbours. No previous estimates were available for comparison with the above estimates hence estimates from the current IUU trip are the best available estimates for discards in Karnataka.

The Karnataka Marine Fisheries Regulation act requires all mechanized trawlers operating along the coast to use a cod end mesh size of at least 30 mm. However, most of the trawlers were using 10-15 mm cod end mesh size resulting in indiscriminate capture of juveniles of fish and shrimps. This has also contributed to substantial discards during the monsoon season. Illegal fish catches by trawlers in the inshore traditional zone result in annual loss of 1200 - 1950 tonnes (based on interviews with small-scale fishermen along Karnataka coast).

Kerala

Kerala has 590 km coastline with continental shelf of 36,000 km² supporting 29,177 fishing crafts of which 5504 vessels were mechanized, 14,151 motorized and 9522 non-motorized fishing crafts. Of the vessels operating along Kerala coast, trawlers comprised (72%), ring seiners (8%) and gillnetters (7.8%) in the mechanized sector (CMFRI 2005d).

Discards were estimated from interviews with trawler skippers and crew revealed that discards constitute 15-25 % of total catches landed by trawlers for each trip in Kerala. Reduction in ring seine mesh size has led to glut in catches of juvenile sardines during some periods of the year, when oil sardines frequent coastal waters. Decline in prices during such periods has led to low market demand resulting in substantial fish discards as excess fish which cannot be dried is dumped in back-waters (van der Heijden, 2007). Interviews with fishermen operating in backwaters reveals the figure for ring seine discards during glut period is only 1.8 – 3 tonnes oil sardines per year.

Since the early eighties overfishing in coastal waters has been responsible due to activities of both motorized and mechanized sectors (Kurien 2005). In backwaters and inshore fishing grounds this unsustainable exploitation is pushing both subsistence and motorised fishermen towards destructive fishing practices (Kurien and Achari, 1990; Hari kumar and Rajendran 2007).

Under Notification No. 448, dated February 18, 1986 of the Kerala Marine Fishing Regulation Act, 1980 the use of mid-water trawl and bottom trawl gear with less than 35 mm stretched mesh is prohibited while fishing in territorial waters of the State (Kerala Govt, 1986). Kerala Gazette No.10, dated March 11, 1986 also prohibits use of bottom trawl gear from sunset to sunrise in specific areas of the coast. Kalwar *et al.*, (1985) reported that random inspection of mesh size from trawlers operating in Shaktikulangara revealed that most trawls were operating 20 mm mesh size in the cod end. A recent study by Kurup and Radhika (2004) found that 80% of trawlers engaged in shrimp trawling use cod end mesh size of 18 mm, while the remaining 20% used mesh size varying from 20-25 mm.

During the fieldwork for this study it was found that shrimp trawlers use a mesh size of 10-18 mm, which indicates a further decline in cod end mesh size to target even smaller sized juveniles of shrimps and fish. Violations by trawlers into waters less than 20 m depth (reserved for traditional fishermen since 1980) have been reported since the inception of inshore artisanal zone (Kalwar *et al.*, 1985). In the late eighties, mini trawlers were using a cod end mesh size of 10-12 mm, against the required mesh size of 20 mm (Vijayan *et al.*, 1990). In this fieldwork, enquiries with crew of mini-trawlers revealed that they are now using cod end

mesh size of 8-10 mm, which indicates a further decline in mesh size for the 4000 mini trawlers operating along the Kerala coast. Stake nets are using mesh size of 10-12 mm and ring seines use 7-9 mm, which further illustrates a drastic decline in mesh size, resulting in recruitment overfishing of both fish and shrimps. Estimates of illegal catches by trawlers in the 5 nautical mile artisanal zone give an estimate of 2100 - 3320 tonnes for Kerala. Intrusions by trawlers into artisanal zone were reported in all the coastal districts with higher frequency of violations in Allepey, Ernakulam, Kozhikode, Kollam and Kasargod districts.

A ban on purse seining was initiated in the eighties to prevent loss of livelihood for traditional fishers, and an improvised gear called “ring seine” was developed from a traditional seine gear. The new net is 450 to 1000m long and employs up to 50 crew. This also led to development of larger plank built boats (“Kettu Vallam”), which were fitted with up to 3 outboard motors of 40 HP (40x3 =120 HP). Although these boats are far larger than the specifications for a traditional motorized fishing boat as per KMFRA 1980, they continue to operate ring seines during the monsoon ban, under the traditional motorized sector. Blatant violation of mesh size regulations is evident in both mechanized and traditional sectors, with purse-seiners, ring seine (Statutory requirement 20 mm), and bottom trawlers (Statutory requirement 35 mm) having a mesh size of 8-15 mm, which is far less than the statutory requirements under the Kerala Marine Fishing Regulation Act, 1980. Of the 1727 stake nets operating in Cochin backwaters, there are 794 licensed stake nets and 933 illegal stake nets in operation (Thomson and Berkes 2006). Reliable estimates of unlicensed nets are hard to determine as several reports in the past also indicate that unlicensed nets are up to three times the number of licensed nets operating in Cochin backwaters (Kalawar *et al.*, 1985; Anon 2007).

Using estimates from this fieldwork, it was found that if we take the legal statutory requirements of the Kerala Government, almost 90 % of the 1727 stake nets are engaged in illegal fishing⁶, as majority of these nets do not follow the distance and mesh size⁷ requirements as well as illegal operation of nets during high tide⁸. Removal of illegal stake and Chinese dip nets by the Fisheries Department has been met with stiff resistance by fishers in backwaters, so in recent years no action has been taken on illegal nets in operation. According to Thomson (2003) there are more illegal nets (stake and Chinese dip nets) than the licensed nets. Using catch information of average stake net catches/year, it is estimated that around 1119 to 3732 tonnes of illegal shrimps and fish are landed by these (assuming 933 illegal nets are in operation) stake nets within Cochin backwaters. This figure of illegal catch can range from 1864 to 6216 tonnes if we assume that 90% of nets are operating illegally in Cochin backwaters (adding illegal catches from mesh size, distance and operational requirements defaulters calculated for 1554 illegal stake nets in operation).

According to Vijayan *et al.*, (2000) there are 17,724 stake nets in the State of Kerala and 90% of the stake nets have cod mesh size of less than 13 mm (George *et al.*, 1998) against statutory requirement of 20 mm. Assuming that 54% of stake nets operating in Kerala are illegal and unlicensed from the above figure (Thomas and Berkes 2006), this would give an estimated illegal catch figure of 11,484 to 38,280 tonnes per year for 9570 illegal stake nets in the State. The State Fisheries Department is responsible for monitoring and enforcement of fisheries regulations in backwaters, but is neither equipped with the appropriate infrastructure or manpower for these tasks. According to stake net fishermen, Fisheries Department officials never inspect or enforce any rules within backwaters. The history of non-compliance with fisheries regulations in backwaters goes back to several decades, with as many as 3131 unlicensed nets operating against 1692 licensed nets in the year 1989 (Pauly, 1991; Srinivasan 2006). Fishers in many sections of the backwaters stated during interviews that they do comply with informal rules governed by Sanghams (Fisheries Society),

⁶ Section 19 of Government water rules 1974 regarding fishing in Government waters stipulates that the distance between two stake nets in a stake line shall not exceed four meters and distance between two stake line shall not be less than 50 meters.

⁷ As per Travancore- Cochin Fisheries Act (1950) allowed mesh size of stake nets is 20 mm.

⁸ Section 22 of the Government Water Rules 1974 “ruled that stake nets should not operate during flow tide (high tide)”.

which prevent them from using stake nets at high tides. However, Thomson (2003) states that most of nets located near bar mouth, Thevara and Aroor operate even during high tides.

Previous studies also indicate that there are several gaps in collection of landings data. “There is no organized system of collecting landings and effort data, and the available estimates seem so very crude. The present scale of unregulated fishery in the backwaters could be gauged from the quantity of young shrimps being caught at various points by the filtration fishery (Chemmeen kottu)” (Kalawar *et al.*, 1985). The exact number of vessels being inducted into the fishery in the mechanised and motorised sectors remains uncertain as large numbers of these vessels are being constructed without permission from the authorities (Harikumar and Rajendran 2007).

East Coast (Bay of Bengal) 61 interviews were conducted with trawler crew and 51 interviews were done with small-scale fishers in the coastal States of Tamil Nadu, Andhra Pradesh, Orissa, West Bengal and the island territories of Andaman Islands. A total of 16 field assistants were hired for conducting interviews during this period. In the small-scale sector, interviews were conducted with fishermen operating gillnets, hook and line, trammel gill nets, and cast nets. In the mechanized sector interviews were conducted with skippers and crew of demersal trawlers, longliners, and gillnetters.

Tamil Nadu

Tamil Nadu has a 1076 km coastline with continental shelf of 41,000 km² supporting 54,420 fishing crafts of which 24,448 were traditional non-motorized craft, 22,312 were motorized and 7618 mechanized vessels (5256 trawlers; 2361 gillnetters, purse seiners, liners, dol-netters) CMFRI (2005f). Catamarans (63%), plank built boats (34%) and dugout canoes (3%) are the main fishing craft in the artisanal sector.

With the exception of mesh size violations in the mechanised sector and inter-sectoral conflicts between trawlers and artisanal craft, majority of other fishery regulations are enforced well for fishing vessels operating in Tamil Nadu waters. Similar observations were made by Bavinck *et al.*, (2008) state that the closed season is implemented well in Tamil Nadu due to close co-ordination between mechanised boat owners association and the Fisheries Department.

Estimates from this fieldwork on illegal catches by trawlers in the 3 nm artisanal zone give an estimate of 460 to 1220 tonnes for Tamil Nadu. Intrusions by trawlers into artisanal zone were reported in Nagapattinam, Rameshwaram and Tuticorn districts. Fishermen often complained that compensation for damages of artisanal gear is very minimal or none in many cases. Small-scale fishermen complained that the mechanised boat owners associations do not compensate them unless they provide some evidence such as vessel name, registration number and area of incident. Often the compensation paid does not even pay for the travel expenses from their fishing village to fishing harbour, hence in many cases fishermen do not complain to the authorities, except the village councils. Overall analysis for all the districts in TN reveals that compensation is available for only 20-35% of the reported incidents, and the compensation is far less in compared to actual damage to the gear and boats.

Andhra Pradesh

Andhra Pradesh has a 974 km coastline with continental shelf of 33,000 km² supporting 41,039 fishing crafts of which 24,386 were traditional non-motorized craft, 14,112 were motorized and 2541 mechanized vessels (1802 trawlers) CMFRI (2005g). Trawlers and gillnetters are the main fishing vessels in the mechanized sector while catamarans (64%), and plank built (34%) are the main fishing craft in the artisanal sector.

Dwivedi (1987) reports that during the mid eighties for every kilo of shrimp caught, trawlers operating from Visakhapatnam, discarded three kilos. He estimated that fishing vessels operating from Visakhapatnam alone

discard between 864 to 960 tonnes of fish every year. Further, a total of 60 tonnes of bycatch was discarded every year at Visakhapatnam fishing harbour alone during the same period (Dehadrai 1987). Salagrama (1998) estimated that trawlers on the east coast discard 26,000 to 50,000 tonnes each year.

Illegal catches within State waters is difficult to analyze as fishermen are apprehensive about the use of information given to scientists. Estimates from this fieldwork on illegal catches by trawlers in the 8 km artisanal zone give an estimate of 1,300 to 2,600 tonnes for Andhra Pradesh. The exact number of unregistered mechanised vessels operating in State waters is uncertain, but interviews with fishermen revealed that around 40-60 mechanised trawlers operate in State waters. The State Fisheries Department has arrested some unregistered vessels in recent years (Anon 2008).

Orissa

Orissa has a 480 km coastline with continental shelf of 26,000 km² supporting 23,740 fishing craft of which 15,444 were traditional non-motorized craft, 4719 were motorized and 3577 mechanized vessels (1340 trawlers) CMFRI (2005h). Previous studies have not given any estimates on discards in Orissa's marine fisheries. Hence, estimates of discards from the current trip are the best available estimates for this State.

Illegal fishing violations ranged from mesh size violations, inter-sectoral conflicts between motorised fishing vessels and trawlers due to incursions into inshore artisanal zone. Estimates from this fieldwork on illegal catches by trawlers in the 5 km artisanal zone give an estimate of 2,100 to 4,100 tonnes for Orissa. However, the State Fisheries Department, Forest Department and the Indian Coast Guard have co-ordinated one of the best patrolling efforts along Indian coastline to patrol and enforce fishing and marine regulations within marine protected areas here. The Coast Guard has also provided one patrol ship and aerial surveillance during the turtle breeding season to help the Forest department in apprehending illegal fishing vessels. It is also perhaps the only State where mechanised trawlers are arrested every year for fishing in inshore artisanal zone and Marine Sanctuaries. Some of the type of violations and arrests of trawlers are given in Table V.

West Bengal

West Bengal has a 158 km coastline with continental shelf of 17,000 km² supporting 18,646 fishing crafts of which 15,444 were traditional non-motorized craft, 1776 were motorized and 6829 mechanized vessels (610 trawlers) CMFRI (2005e). Gillnets, fixed bagnetts, and shore seines are the main fishing craft in the artisanal sector.

There is a growing problem due to illegal incursion of Bangladeshi fishing trawlers to fish in the West Bengal's rich estuarine waters. Illegal fish catches by trawlers in the inshore traditional zone result in annual loss of 802 to 1,920 tonnes (based on interviews with small-scale fishermen along West Bengal coast). Fishermen reported that due to intense patrolling by the Coast Guard, in recent years these vessels have been observed moving towards Orissa's territorial waters. Many such Bangladesh trawlers have been arrested by both the Forest Department and the Coast Guard along the Orissa Coastline in recent years. See Appendix III for more information on number of Bangladeshi trawlers arrested in Indian EEZ.

Under-reporting was found to be a major problem for domestic IUU catches within West Bengal's Territorial waters. Detailed estimates are currently being drawn up on the extent of these catches and will be published elsewhere.

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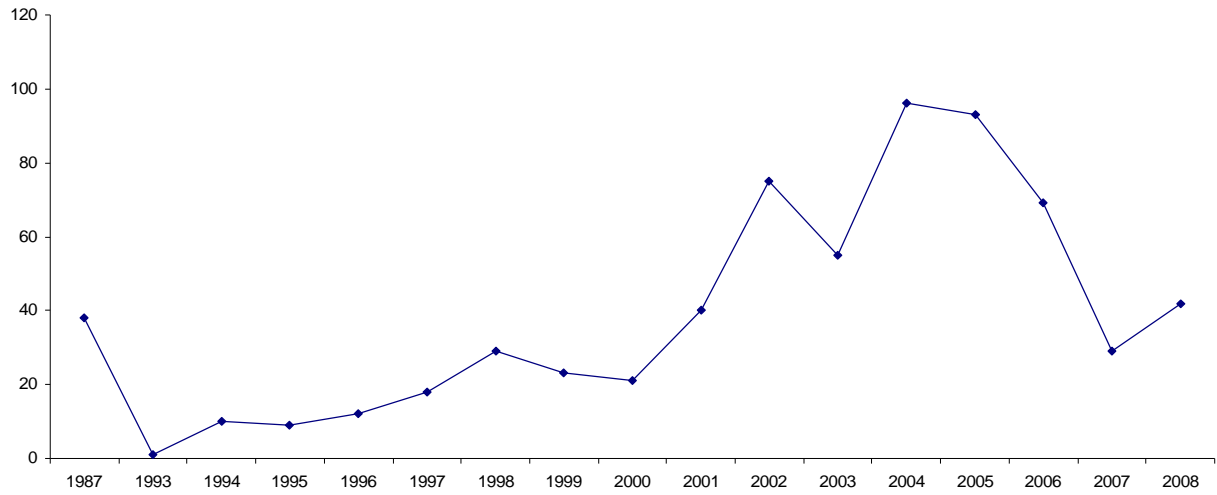
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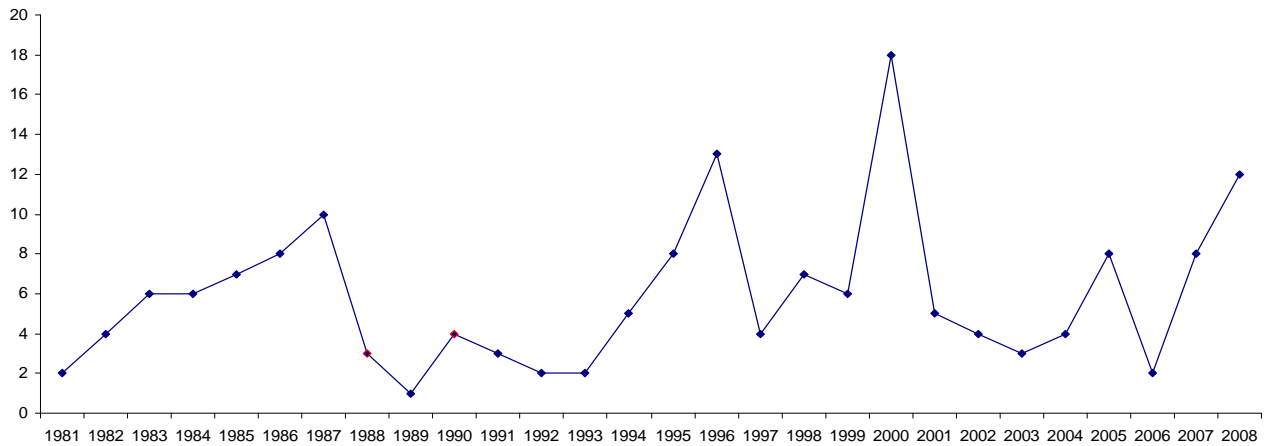
Appendix I

Number of Indian fishing boats arrested in Sindh (Pakistan) for Illegal Fishing (1987-2008), Source: GIF Database © Ganapathiraju Pramod



Appendix II

Number of Pakistani fishing boats arrested in Gujarat (India) for Illegal Fishing (1981-2008), Source: GIF Database © Ganapathiraju Pramod



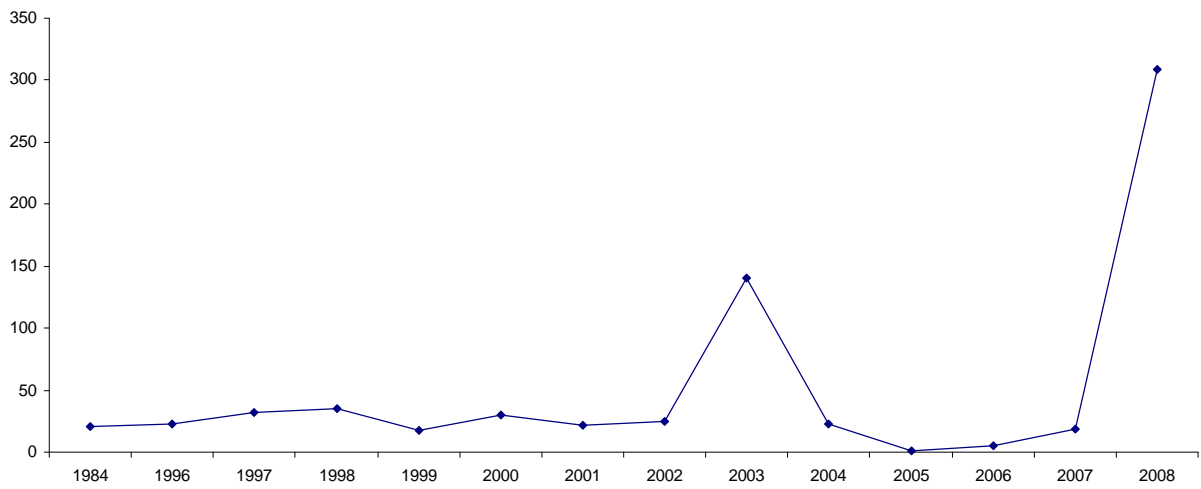
Appendix III

Number of Bangladeshi fishing vessels arrested in Indian EEZ (1981-2008), No data is available for the years 1988-1999, Source: GIF Database © Ganapathiraju Pramod



Appendix IV

Number of fishing vessels from Tamil Nadu (India) arrested in Sri Lankan EEZ (1984-2008), Source: GIF Database © Ganapathiraju Pramod



Appendix V

Number of fishing vessels from Sri Lanka arrested in Indian EEZ (1981-2008), Source: GIFD Database © Ganapathiraju Pramod

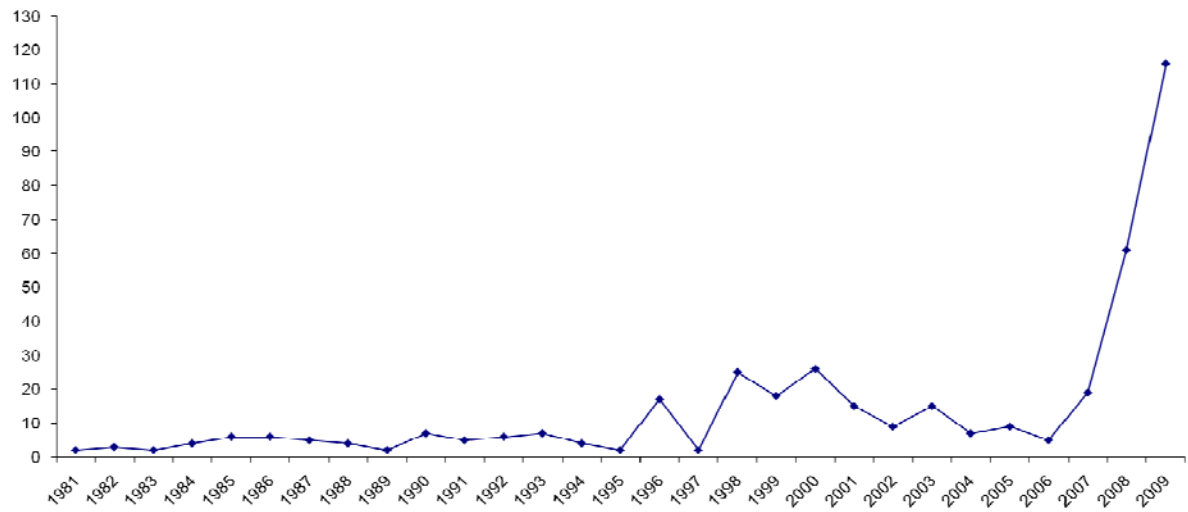


Table IV. Violations of marine fishing regulations in Indian Marine Fisheries

State	MFRA	Mesh size regulations violation rate		Illegal intrusions of Indian trawlers into 5 nm artisanal zone	Violations of foreign vessels into Indian EEZ
		Small-scale	Mechanised trawlers		
Gujarat	-	85%	95%	M	6-24 vessels / year
Maharashtra	Yes	80%	90%	H	1-2 vessels / year
Karnataka	Yes	90%	100%	M	1-3 vessels / year
Kerala	Yes	100%	100%	H	1-4 vessels / year
Tamil Nadu	Yes	80%	95%	M	8-16 vessels / year
Andhra Pradesh	Yes	85%	95%	H	1-5 vessels / year
Orissa	Yes	80%	85%	H	1-2 vessels / year
West Bengal	Yes	95%	90%	L	12-16 vessels / year
Andaman & Nicobar Islands	No	65%	50%	L	10-24 vessels / year
Lakshadweep Islands	No	NA	NA	NA	2-5 vessels / year

	91-100% violations
	80-89 % violations
	Less than 79% violations
H	High (Intrusions observed 76- 100% of fishing days in an year)
M	Medium (Intrusions observed 50-75% of fishing days in an year)
L	Low (Intrusions observed less than 50% of the fishing days in an year)

Table V. State-wise allocation of areas for non-motorised fishing craft in India

State	Zone allocated exclusively for Artisanal fishermen ⁹	Relevant State Legislations
Gujarat	5 nm from shore (9 km from the coast horizontally)	¹⁰ Gujarat Marine Fishing Rules, 2003
Maharashtra		
Goa	5 km from the shore	Goa, Daman and Diu Marine Regulations Act
Karnataka		
Kerala	Area from the shore upto the 25 fathom line in the sea, along the coast line of the State from Kollengode to Paravoor Pozhikkara for a length of 78 kilometers; and the area upto 18 fathom line in the sea, along the coast line from Paravoor, Pozhikkara to Kovilthottam for a length of 26 kilometers; and the area up to 12 fathom line in the sea, along the coast line from Kovilthottam to Manjeswaram for a length of 486 Kilometers	Kerala Marine Fishing Regulation Ordinance, 1980 ^{11,12}
Tamil Nadu	3 nm from the shore ; No deep sea fishing vessels shall operate at depths of 25 fathoms or below.	Tamil Nadu Marine Fishing Regulation Rules, 1983 ^{13,14}
Andhra Pradesh	8 km from the shore (Contravention may lead to fine of Rs. 2,500 /-	A.P. Marine Fishing Rules, 1995 ¹⁵
Orissa	Waters upto 5 km from shore allocated only for non-mechanised traditional crafts; Mechanised fishing vessels upto 15 m OAL beyond 5 km from the coast ; Mechanised fishing vessels above 15 m beyond 10 km from shore	Orissa Marine Fishing Regulation Rules, 1983 ¹⁶
West Bengal	Non-mechanised vessels upto 9 metres in length upto 8 km from shore (Zone A) ; Non - mechanised vessels above 9 metres in length can only operate upto 20 km but not below 8 km from shore (Zone B) Mechanised vessels upto 15 m length are allowed to operate within 20 to 50 km from shore (Zone C) ; Vessels above 15 m length have to operate beyond 50 km from shore (Zone D)	West Bengal Marine Fishing Rules, 1995 ¹⁷

⁹ Trawling by mechanised fishing vessels (trawlers) is prohibited within this zone

¹⁰ Gujarat Fisheries Rules, 2003, Gujarat Government Gazette Ex., 15-8-2003, Registered No.G/GNR/2, Vol. XLIV.

¹¹ Government of Kerala Notification dated December 29, 1980, G.O.(P) 156/80/F&PD.

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¹³ Tamil Nadu Marine Fishing Rules 1983, Directorate of Fisheries, G.O. Ms. No. 993, Forests and Fisheries Department dated August 17, 1983.

¹⁴ Tamil Nadu Notification for Regulating Deep-sea Fishing Vessels, G.O. Ms. No. 166 dated 22.8.95.

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Table. VI. Estimates of illegal catches by trawlers in the artisanal zone (<5 km from shore)

State	Illegal catches in tonnes / year
Gujarat	740 to 1,130 tonnes
Maharashtra	1,100 to 1,800 tonnes
Karnataka	1,200 - 1,950 tonnes
Kerala	2,100 - 3,320 tonnes
Tamil Nadu	460 to 1,220 tonnes
Andhra Pradesh	1,300 - 2,600 tonnes
Orissa	2,100 - 4,100 tonnes
West Bengal	820 - 1,920 tonnes
Total	9,820 - 17,840 tonnes / year
Please refer Table.II. for details on area allocated to artisanal fishermen in each State	

Table VII. Chartered vessels arrested for IUU violations within Indian EEZ

Date / Year of the incident	Flag	Vessel type	Number of vessels	Type of violation	Source
July 19, 1984	Taiwan / India ?	Pair trawlers	8	Four pair of chartered fishing vessels with 120 crew were apprehended by Coast Guard while engaged in fishing in less than 40 fathoms off Quilon, Kerala Coast. Vessels were detained in Bombay harbour for 12 months	Rao (2009)
May 29, 1988	Taiwan / India ?	Fishing trawlers	2	The two foreign fishing trawlers 'Shang Fuh Nos. 11 and 12' arrived at the Marmugoa port, Goa, India from high seas with a catch of marine products for a final call for declaring the cargo for export and departure to a foreign port. "They were chartered by M/s. Ocean Products & Shipping Ltd., Visakhapatnam. They appointed the appellant M/s. Choughule Brothers, Mormugoa as their local agents. On arrival of Trawlers agents filed the import manifest on behalf of the principal. In the general manifest of the Trawlers No. 11, 4615 boxes of assessed fish catch were declared as source bottom cargo, and in the general manifest of Trawler No. 12, 4601 boxes of assessed fish catches were declared as source bottom cargo without mentioning any weight. Entry inwards to both the Trawlers were granted on 30-5-1988. On 24-6-1988 both these trawlers around 11.00 p.m. left Marmugoa port surreptitiously by switching off the lights in the incessant weather without port clearance, without filing shipping bills, without paying cess on their catch. Efforts were made through Coast Guards/Naval Authorities to locate the fishing trawlers and intercept them, but the vessels escaped. The catch of fish on board of fishing Trawlers Shang Fuh Nos. 11 and 12 were 284.55 tonnes and 269.675 tonnes respectively. In the subject case the charters have orally declared the catch as worth Rs.1.5 crores. M/s. Ocean Products & Shipping Ltd. secured the log books of both the fishing Trawlers on their arrival and did not produce the same to Fisheries Survey of India for verifying the catch, nor was it produced to the customs authorities for inspection. Those log books were removed from the fishing Trawlers and taken to Visakhapatnam and reported lost by M/s. Ocean Products & Shipping Ltd." The Commissioner of Customs filed a case against the Indian company.	Anon (1998)

Table VIII. Marine Fishing Violations in Orissa's Territorial waters & Marine Sanctuaries

Date / Year	Target IUU Species	Type of IUU	Number of Illegal vessels	Action taken
1997 - 1998	Shrimps	Illegal	78	During the period 13.12.1997 to 26.1.1998, 55 trawlers and 23 gill netters were apprehended from Gahirmatha sanctuary (Anon 2003a).
January 30, 1998	Shrimps & Finfishes	Illegal	9	6 trawlers and 3 gill netters were apprehended from the core area of the Garhirmatha (Marine) Wildlife Sanctuary (Anon 2003a).
January 19, 2000	Shrimps & Finfishes	Illegal	5	Orissa Forest Department in collaboration with the Coast Guard arrested 15 people and seized 5 trawlers for illegal fishing inside the Gahirmatha Marine sanctuary (Anon 2000).
2000	Shrimps & Finfishes	Illegal	64	64 trawlers and gill netters were seized for illegal fishing by the Forest Department (Shankar and Wright 2000).
2002	Shrimps & Finfishes	Illegal	44	Up to 44 fishing boats have been seized here by the Orissa Forest Dept officials; 12 fishing trawlers were found near mouth of Devi river within a prohibited zone of 5 km from the coast on December 31; none of the trawlers had turtle excluder devices, which are mandatory on all trawlers operating along this coast (Das 2003)
February 8, 2003	Finfishes	Illegal	2	3 forest guards were abducted by the crewmembers of two gill-netters that were seized for illegal fishing inside the Gahirmatha Marine Sanctuary (Anon 2003b).
December 27, 2003	Finfishes	Illegal	11	Crews of 11 mechanised trawlers were fined Rs. 85,000 for illegal fishing within the Gahirmatha marine sanctuary. The catch was auctioned for Rs. 17,000. Boats were to be released after paying fine (Anon 2004a)
2004	Shrimps & Finfishes	Illegal	10	Orissa Forest Department registered cases of illegal fishing in prohibited water bodies against 24 fishermen and confiscated 10 vessels for fishing in the Bhitarkanika wildlife sanctuary; fishing gear and other implements used in illegal acts were seized (Anon 2004b)
February 2, 2006	Finfishes	Illegal	5	Bhitarkanika forest officials have arrested six persons and seized five trawlers from them near Chinchiri river mouth under Gahirmatha Marine Sanctuary on charge of illegal entry and catching fish in MPA (Anon 2006a).
December 23, 2005	Shrimps & Finfishes	Illegal	7	A Trawler with 4 crew members was arrested for fishing illegally along the Dhamra coast within Gahirmatha sanctuary. Fish catch worth more than Rs 1.5 lakh, fishing implements, fishing nets and VHF set were also impounded by the patrolling squad of the forest department. Earlier 6 trawlers with 16 crew were taken into custody for similar charges (Anon 2005a)
2005	Shrimps & Finfishes	Illegal	7	Seven fishing trawlers and 24 crew were arrested for illegally fishing along the Dharma coast during the turtle breeding season; fish catch, fishing implements, fishing nets and VHF set were also impounded by patrolling personnel of the forest department (Anon 2005b)
January 2, 2006	Shrimps & Finfishes	Illegal	1	The Forest Department officials with the help of local police intercepted the trawler for illegally fishing inside the prohibited zone of Gahirmatha Marine Sanctuary. The fishermen allegedly attacked the patrolling party, leading to killing of one fisherman. Later 14 fishermen were arrested and trawler seized. They were in jail for 2 ½ years, before being released by a judge (Anon 2008a).
2006	Shrimps & Finfishes	Illegal	>50	Trawlers fishing illegally caught 1800 endangered Olive Ridley Turtles in the Rushikulya estuary, in a marine sanctuary in Orissa state, fishing 200–300 m within the sanctuary; Fishing is prohibited in these waters during the breeding season of turtles. (Anon 2007c; Anon 2006b)
2007	Shrimps	Illegal	25	The Bhitarkanika forest department officials arrested 11 fishermen

	& Finfishes			and seized five trawlers and their fish catch for illegal fishing. In this season the Forest dept officials seized 25 trawlers and arrested 70 fishermen with 10 sets of fishing nets and fish worth Rs. 50,000 from them (Anon 2007a).
March 20, 2007	Shrimps & Finfishes	Illegal	9	Seven deep sea trawlers were intercepted by a joint forest-police patrol near Habelikhathi off Gahirmatha marine sanctuary coast. In another mid-sea crackdown 12 marine fishermen along with their boats were apprehended by the turtle surveillance squad (Anon 2007d).
November 27, 2007	Shrimps & Finfishes	Illegal	4	17 fishermen were intercepted along with 4 deep sea trawlers for fishing illegally inside the Gahirmatha Marine Sanctuary. The turtle surveillance squad spotted the vessels near Satabhaya-Chinciri Island off Gahirmatha coast (Anon 2007c).
2008	Shrimps & Finfishes	Illegal	12	Between November 2007 and January 2008, 72 persons were arrested and 12 fishing boats including nine trawlers and one gill-netter were seized by enforcement wing of Orissa Forest Department (Anon 2008b)
January 13, 2008	Shrimps & Finfishes	Illegal	2	Two deep sea trawlers were spotted by the turtle surveillance squad near Babuballi Island off Gahirmatha coast. The Forest Department seized the two trawlers and took the crew into custody. Fish catch worth nearly two lakh rupees besides fishing nets and equipment were also seized from the trawlers (Anon 2008c).
December 2, 2008	Shrimps & Finfishes	Illegal	2	The 2 mechanised trawlers were seized by the turtle surveillance squad spotted after spotting them near Satabhaya and Chinchiri off Gahirmatha coast. Catch worth Rs. 1 lakh besides fishing nets and implement were also seized (Anon 2008g).
December 4, 2008	Shrimps & Finfishes	Illegal	3	Three fishing trawlers from Andhra Pradesh with 20 crew members were apprehended by the Coast Guard ship 'Sarojini Naidu' while they were fishing illegally off Ganjam coast & also within the Rushikulya sanctuary (Anon 2008e).
December 13, 2008	Shrimps & Finfishes	Illegal	3	18 fishermen along with three trawlers were seized at Chinchiri mouth for fishing illegally inside the Gahirmatha sanctuary (Anon 2008f).
December 19, 2008	Shrimps & Finfishes	Illegal	4	Four deep sea trawlers with 21 crew were seized by turtle surveillance patrols while fishing near Satabhaya-Chinciri Island off Gahirmatha coast. This has increased the number of trawlers apprehended since November 1, to 15 vessels and 50 fishermen (Anon 2008d).
January 17, 2009	Shrimps & Finfishes	Illegal	1	The Joint Forest-Police patrol apprehended one deep sea trawler with 6 crew members for illegally fishing near Satabhaya off Gahirmatha marine sanctuary (Anon 2009a).
February 10, 2009	Shrimps & Finfishes	Illegal	20	In a joint operation, Bhitarkanika forest officials and Indian Coast Guard personnel seized 4 fishing trawlers along with 24 fishermen for fishing illegally within Gahirmatha Marine Sanctuary. State Forest Department had imposed ban on fishing around 20 Km off the shore from November 1 to May 31 every year to protect Olive ridley breeding sites (Anon 2009b).
March 3, 2009	Shrimps & Finfishes	Illegal	60	60 fishing vessels and 180 marine fishermen were arrested by turtle surveillance patrols of the Coast Guard, Forest Dept, Police and Fisheries Department (Anon 2009c).

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