Changes in Fishing Gear- Impact on Tropical Tuna Landing

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Abstract

Simultaneous long line survey conducted in Arabian sea and Bay of Bengal of Indian EEZ for the period from 2005 – 07 using different fishing gears are analyzed. The monofilament, a recently evolved longline fishing gear could land more yellowfin tuna 66% in Arabian Sea and 55% in Bay of Bengal. Whereas multifilament conventional long liner yielded 20 and 62 % of shark by-catch in Arabian sea and Bay of Bengal. Monofilament longline could reduce the shark by 12 and 13 % respectively. The negligible quantity of loss due to depredation of tuna (3.94%) and bill fishes (6.94%) could be reduced by installation of modern techniques .

Introduction:

The estimated annual fishery potential in Indian EEZ is estimated as 3.9 million tons of which the production has reached upto 3.2 million tons. Additional harvestable yield available for exploitation is o.7 million tons. The estimated annual oceanic fishery potential in Indian EEZ was 0.24 million tons (Suderson 1990), it is the fact still India could not reach this level for the past two decades since it started it's exploitation. Perfect understanding on impact of nature & human induced changes on ecosystem is imperative in the present scenario of oceanic fishing industry. Capture fisheries impact on the environment have been abundantly reviewed (Agady, 2000; Kaithor et al 2003 and Gisason 2003) and revealed that it reduced the abundance and spawning potential of the target species as well as by-catch species and it's ecology at large scale. In the Indian ocean for the recent past installation of FAD caused alternation of course of migration, habitat and even spawning behavior of the Tuna and other non target species of oceanic concern.

There is no large scale exploitation of tuna from Indian waters as it fetches low value in the local market. However about 34 larger vessels are exclusively operating for tuna for export. Around Lakshadweep sea, there exist pole & line fishing for skipjack tuna and lands around 12000 tons. Tuna landings in the recent past encouraged the fishing industry to convert the shrimp trawlers in to monofilament long line fishing. The Fishery survey of India implemented monofilament long line fishing by inducting two vessels in Bay of Bengal and Arabian sea during 2005. Simultaneous operation of multifilament and monofilament long line fishing conducted in the same area are analysed and furnished in this paper which could demonstrate the impact of changes in fishing gear on tuna lading and also in by-catch.

Materials and methods

The monofilament long line fishing inducted by Fishery Survey of India during 2004 in the Indian EEZ by two imported vessels viz. MFV Matsya Vrushti in Arabian sea and MFV Matsya Drushti in Bay of Bengal. The details of gear are furnished in table.1. the Systematic Statistical Sampling is followed by exploring 1° X 1° Lat. – Long. Squares. Data collected from the two different parts of Indian EEZ during 2005 – 07 of monofilament longline survey and multifilament long line survey conducted simultaneously were considered for analyses. The catch rate is expressed a CPUE i.e the catch in kgs / 1000 hooks and Hooking rate as percentage of fish caught in 100 hooks also worked out.

Table.1. ***Specification of multifilament and monofilament Long line gears***

Particulars	Multifilament	Monofilament
Float	300mm	360mm
Float line	22m (6.7mm tetron)	22m (3.6mm HDPE)
Main line	Continue (6.7mm tetron)	Continue (3.6 mm HDPE)
Branch line	12 m (4.5mm tetron) 5 Nos / Basket	20 m (2.0mm HDPE) 7 Nos / Basket
Sekiyama	Steel wire (6m)	NA
Leader wire	Steel wire (2m)	NA
Hook	3.6 sun	16/0 Hiliner tuna Circle Hook

Results and Discussions:

Survey results on catch rate of Yellow fin Tuna.

In total 3,89,169 hooks were operated in Indian EEZ by monofilament and multifilament long liners of which 1,69,055 hooks were operated in Arabian sea and 2,20,114 hooks in Bay of Bengal. Total 2,10,688 hooks were operated by monofilament long liners yielded the CPUE of 4563 kgs/1000 hooks and 1,78,481 hooks by multifilament long liners yielded CPUE of 3913 kgs / 1000 hooks. The Yellow fin tuna landed by monofilament longliner was 2734 kgs /1000 hooks and there is no significant difference in the annual landing between Bay of Bengal and Arabian sea in the survey results (table -2). The multifilament long liner landed more YFT catch in Bay of Bengal (706 kg/ 1000hooks) than Arabian sea (422 kgs/ 1000 hooks). However the monofilament long line technique offered comparatively higher CPUE of Yellow fin Tuna (table 2). Though the multifilament long liner landed a catch (3913 kg /1000hooks) the by-catch was dominant (Fig. 2)

Area wise seasonal variation

In general the highest catch rate was registered during the period from October to April irrespective of area and gear. This trend in catch rate was almost similar for Yellow fin tuna, other tunas like fishes and even by-catches. However the catch rate of yellow fin tuna was always in higher side in monofilament long line fishing irrespective of area surveyed (Fig. 3 & 4). As the monofilament yielded almost equal catch rate in Bay of

Bengal and Arabian sea during the period of simultaneous survey conducted. Based on this it is predicted that the yellow fin tuna of highly migratory nature are almost equally distributed in Indian EEZ and could vary only by season.

In Indian seas especially Bay of Bengal by virtue of privileged shark abundance and species richness (John and Neelakandan, 2003) leads overexploitation and diminish the shark population is clear in the past decade (John *et al* 2007). Generally sharks are dominant in the by-catches of multifilament long line fishing, considering it's slow growth and low fecundity there is an urgent need to take conservation and management retrieve the stock.

Impact of changes in fishing gears on by-catch

Despite the Indian Long liner started fishing in oceanic water using multifilament long line a conventional fishing technology since 1986 for aiming yellow fin tuna (Bonfil, 1994) and sharks but only meager reports are available on species wise by-catch (Taniachi, 1990). In the present observation the multifilament long line fishing method resulted more by catch (fig. 1 & 2) especially in Bay of Bengal (Fig. 2b) exhibit more diversity and species richness of shark captured. The highest catch rate (356 kgs/100hooks) for yellow fin tuna was recorded during the month of April from Bay of Bengal (Fig. 4a) area whereas the simultaneous operation multifilament resulted 57.5 kgs/1000hooks of YFT (Fig. 3a). It is not quietly uncommon that the operation of two different gears offered indifferent result in catch rates (Bonfil, 1994 and Somvanshi *et al* 2008). However quantify of by-catch in the tuna long line is vital in conservation of oceanic resources (Bonfil 1994). James and Pillai 1987 reported the shark by catch in log line fishing of India was around 39.8%, where as James and Jayprakash (1988) reported 3.3 – 14%. In Western Australian waters the by-catch of shark alone was estimated to be 3.3 -8.3% of the total catch (Stevans, 1992). The pilot study exhibits the multifilament long line fishing resulted 20 – 62% of sharks occurred as by-catch from Arabian sea and Bay of Bengal respectively, whereas the simultaneous monofilament operation in these area resulted 12 – 13 % shark by catch. There are 17 species of sharks reported during this observation period in multifilament long line operated in Indian EEZ, whereas only less numbers of sharks species were reported in monofilament long line survey (table-2). It is worth to mention here that this report is based on simultaneous operation of Mono/multi filament long line in the same area, the former reduced the shark catches may be due escapement of sharks to circle by virtue of hook used in the monofilament long line. The shark by catch discard is estimated world wide was 22,108 tons (Japon) 9089 tons (Korea) and 34044 tons in Thailan (Romon Bonfil, 1994). How ever the escapism and survival during hooked / discard would be varied amoung species, where as Carcharhinid sharks has higher survival rate (70 – 80%) when discarded, hammer head and Mako shark usually sensitive and usually die on the line (Sivasubramanian, 1964). Hence it is imperative to approximate the amount of shark by-catch in detail (species wise) and escape rate during discord in soupfin shark fishery if any, would enable to construct the conservative measures.

Though depredation is not uncommon in conventional (multifilament) long line fishing (Sivasubramanian, 1964) and estimated depredation rate in Indian EEZ was 3.94% for Tuna and 6.26% for Bill fishes, which was comparatively lesser extent in monofilament long line fishing (Varghese *et al* 2008) may be due to lesser immersion / exposure time of line which enhanced by rapidity in hauling procedure. However more information and evidence are required by observing the bite marks to confirm the cetacean / shark related depredation. It is significant to keep in mind the mitigation measures such as using acoustic devices (Pingers) and protective nets or protective curtains may condense the depredation loss.

Table 2 CPUE (kgs / 1000 hooks) of Oceanic Resources During 2005-07

	Monofilament			Multifilament			
	Bay of Bengal	Arabian sea	Total	Bay of Bengal	Arabian sea	Total	Grand total
Effort (hr)	107843	102845	210688	112271	66210	178481	389169
YFT	1304.7	1430.2	2734.9	706.89	422	1128.89	3863.79
BET	4.9	0	4.9	89.13	0	89.13	94.03
SKJ	49.5	22.2	71.7	3.52	34.13	37.65	109.35
SWD	5.9	1	6.9	123.39	4.28	127.67	134.57
SAIL	528.8	37.3	566.1	120.68	281.81	402.49	968.59
Marlin	106.2	318.5	424.7	2.65	22.54	25.19	449.89
Shark	280.6	269.3	549.9	1784.7	203.6	1988.3	2538.2
DOL	56.2	34.4	90.6	5.77	14.43	20.2	110.8
OTH	83.2	30.8	114	73.31	21.04	94.35	208.35
Total	2420	2143.7	4563.7	2910.04	1003.83	3913.87	8477.57

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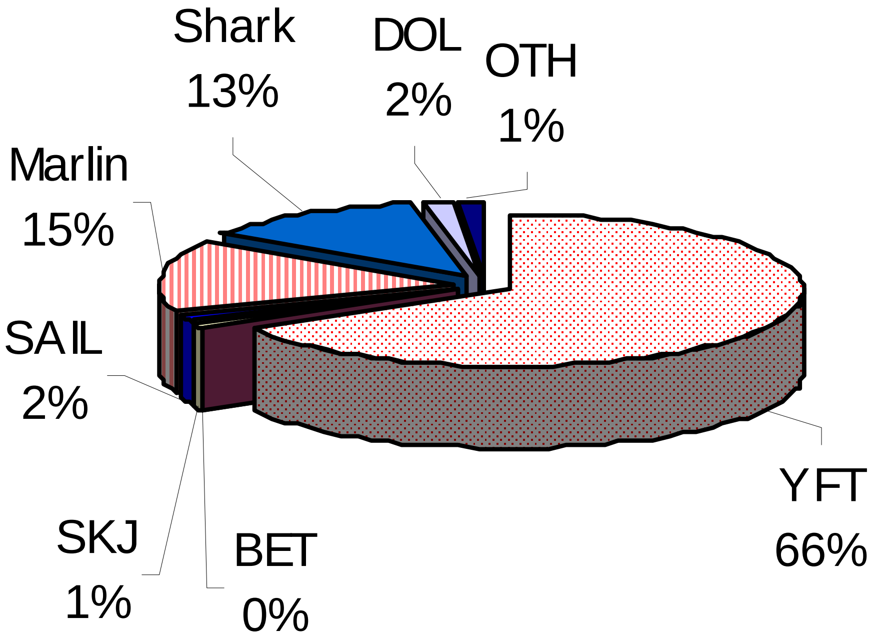

Fig.1 a Catch composition of Monofilament long line fishing in **Arabian sea**

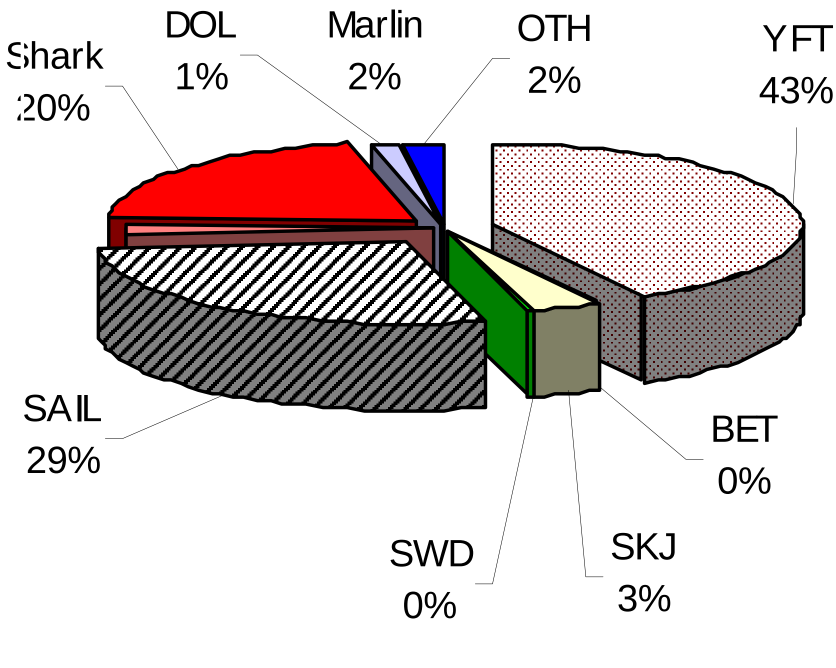

Fig 1 b Catch composition of multifilament long line fishing in **Arabian sea**

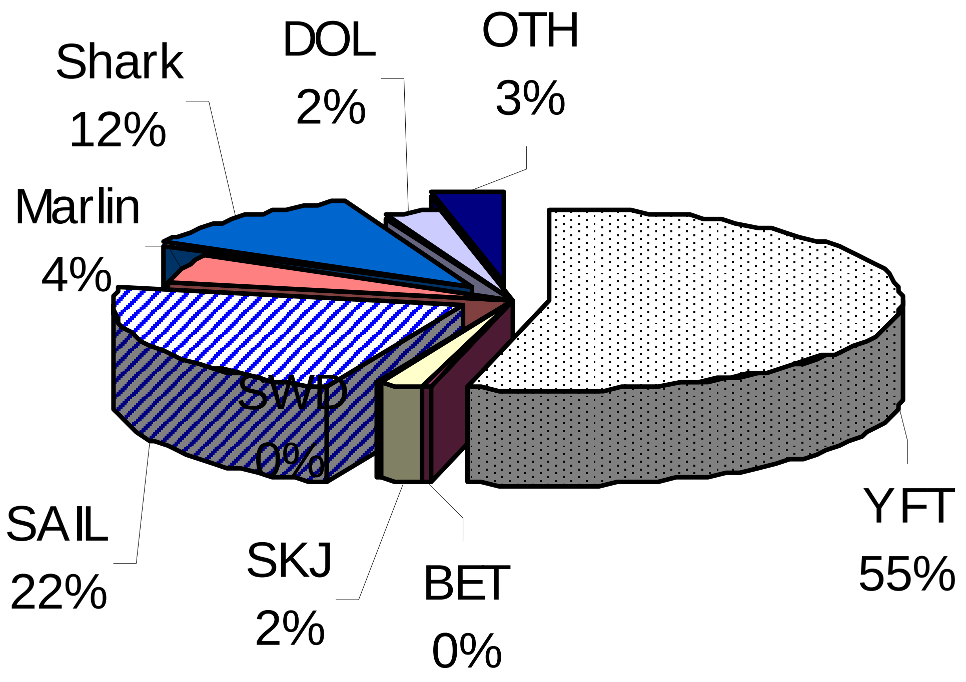

Fig 2 a Catch composition of Monoifilament long line fishing in **Bay of Bengal**

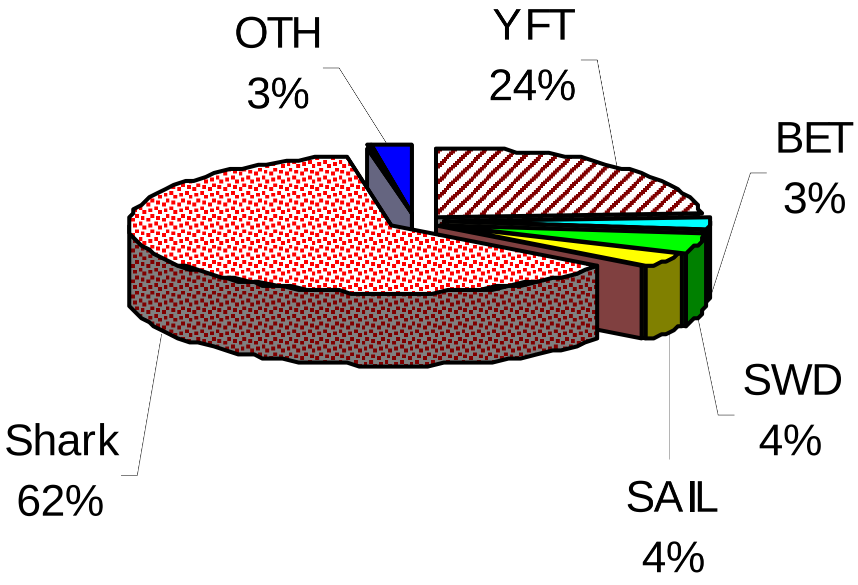

Fig 2 b Catch composition of multifilament long line fishing in **Bay of Bengal**

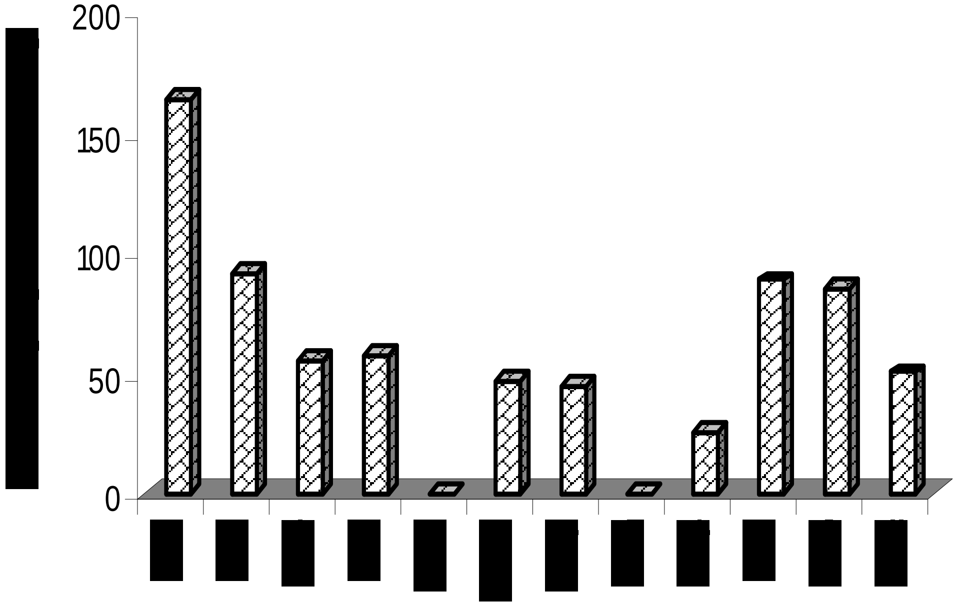

Fig 3 a CPUE of YFT multifilament long line fishing in **Bay of Bengal**

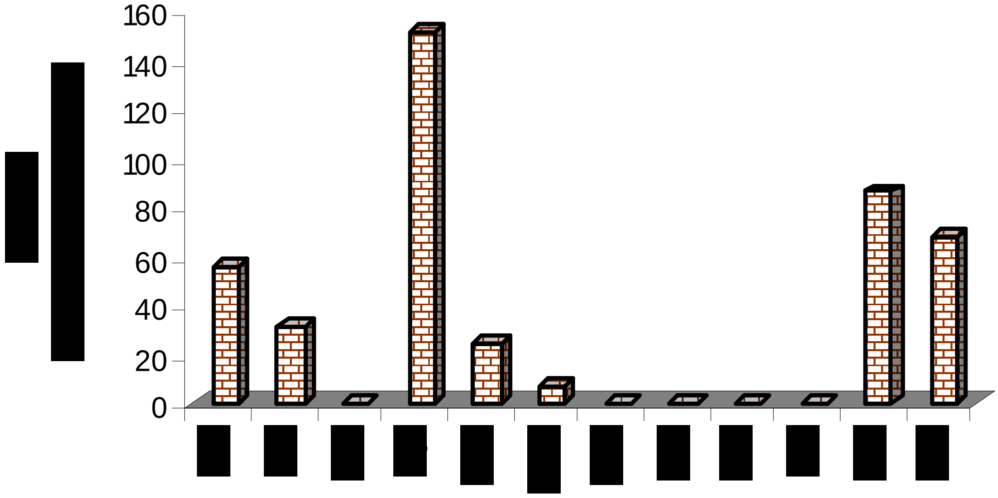

Fig 3 b CPUE of YFT multifilament long line fishing in **Arabean sea**

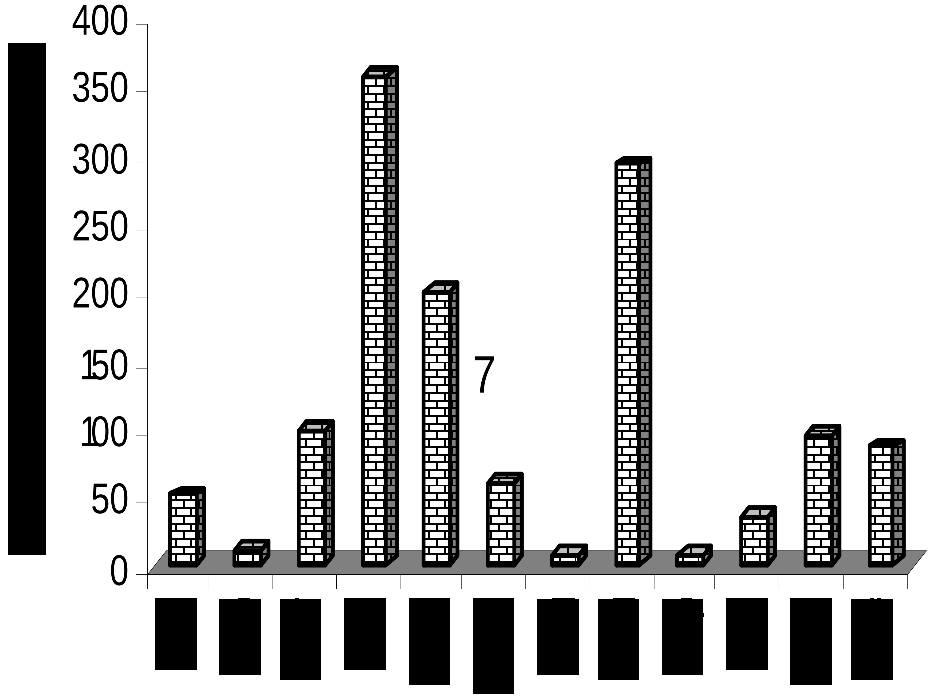

Fig 4 a CPUE of YFT Monofilament long line fishing in **Bay of Bengal**

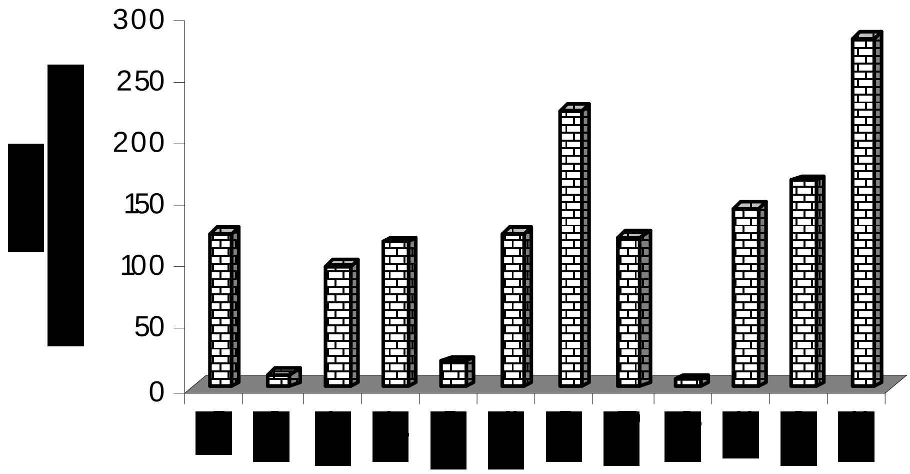

Fig 4 b CPUE of YFT Monofilament long line fishing in **Arabian sea**

Table. 3 Species composition (CPUE) of Mono / multi filament long line survey during 2005-‘07

Group	Name of species	Multi Bengal	Mono Bengal	Multi Arabeansea	Mono Arabena sea
	Thunnas albacares	32.8	32.49	35.34	31.97
Tuna	*Katsuwanus pelamis*	3.9	4.03	4.93	4.74
	Thunnus obesus	33.27	0	0	0
	Xiphias gladius	23.68	18.85	21	6
	Istiophorus platypterus	25.7	24.37	22.61	25.74
Bill fishes	*Makaira mazara*	71.3	48	39	38.8
	Makaira indica		29.64	0	58.17
	Tetrapterus audax	48	0	0	0
	Alopias pelagicus	37.3	0	25.11	0
	Alopias superciliosus	48	36.880	0	33.67
	Alopias vulpinus	40.1	0	0	0
Shark	*Carcharhinus albimariginatus*	20	17	6.5	0
	Carcharhinus dussumieri	0	0	15	16.1
	Carcharhinus limbatus	24.68	13.79	21.33	9.42
	Carcharhinus longimanus	35	0	0	
	Carcharhinus macloti		*0*	14.25	
	Carcharhinus melanopterus	40	*12.53*		10.15
	Carcharhinus obscurus	62.5			0
	Carcharhinus sorrah	26			0
	Carcharhinus falciformis	0			4.6
	Galeocerdo cuvier	119.5		115	36
	Isurus oxyrinchus	*48.5*			10
	Sphyrna zygaena	*52*	15		66.5
	Sphyrna lweini		36.5		0
	Sphyrna mokarran	*150*			0
	Acanthocybium solandri	*7*			
	Coryphaena hippurus	*4.27*	4.11	3.18	6.95
	Coryphaena equiselis			6.33	6.75
Teleosts	*Sphyraena barracuda*	*9.62*	4		3.2
	Rachycentron canadum		0.5		3.67
	Mola mola		54	87	
	Lancet fish	2.53	3.92	2.74	2.74
	Elagatis bipinnulata				2.05

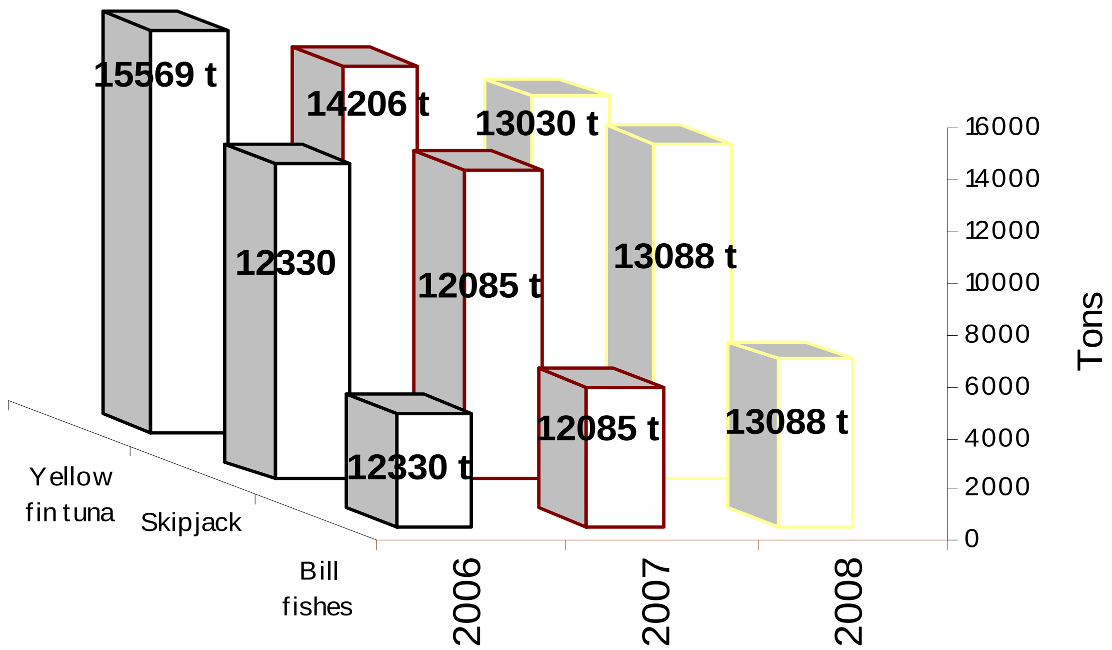

Fig 5.a Commercial tuna landings during 2006 – ’08

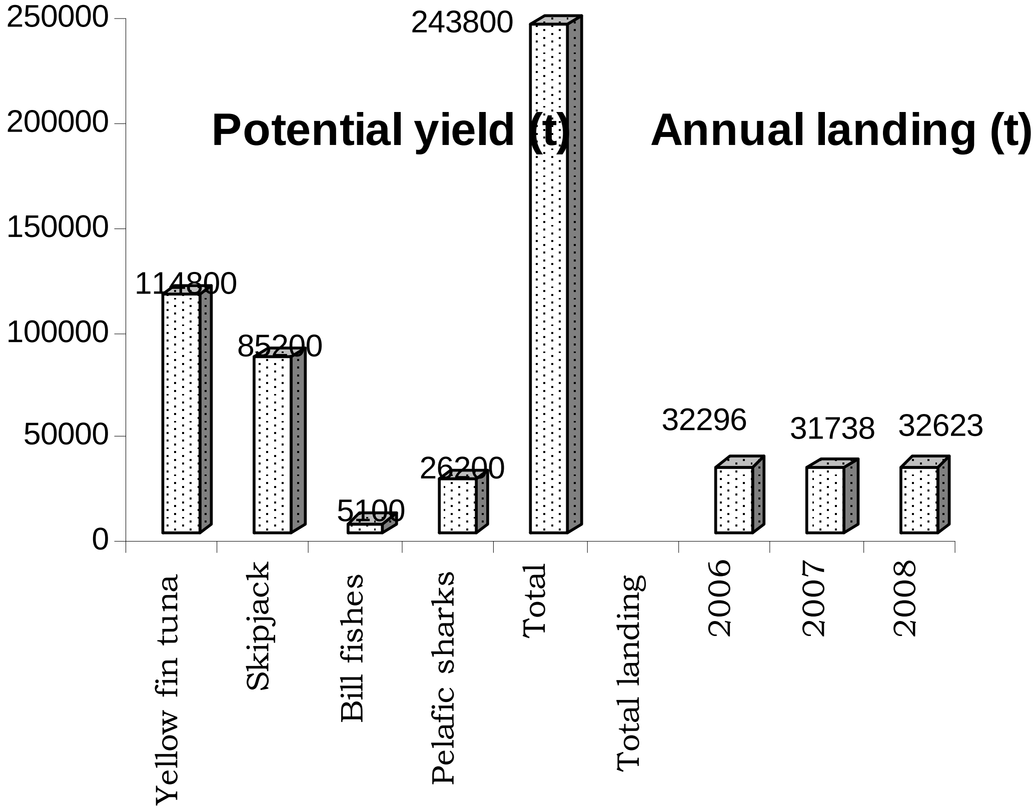

Fig 5.b.Estimated annual potential and actual landings of Oceanic resources during 2006 – '08