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Thai Tuna Longline Fishing in the Indian Ocean from 2000 to 2006

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ABSTRACT

Thai tuna longliners were operating in the Indian Ocean from 2000 to 2006; data from their logbooks displayed important information of their fishing operation. Total annual catches during the period were: 384.90, 390.93, 93.57, 252.48, 272.41, 280.12 and 414.44 tonnes, with a value of 2, 1.84, 0.46, 1.16, 1.58, 0.98 and 2.42 million USD, respectively. Fishing grounds were in four zones namely: the Bay of Bengal, the west coast of Indonesia, Somalia and the Seychelles, and the southern part of the Indian Ocean.

The highest catch rate was found in Somalia and the Seychelles (1.3 fish/100 hooks), followed by the west coast of Indonesia (1.2 fish/100 hooks) and the southern part of the Indian Ocean (1.0 fish/100 hooks). The lowest catch rate was reported in the Bay of Bengal (0.7 fish/100 hooks), which compared to other fishing grounds. The major catch species were bigeye tuna (*Thunnus obesus*), yellowfin tuna (*T. albacares*), albacore tuna (*T. alalunga*), and swordfish and other large pelagic species comprising 36.64, 35.77, 20.28 and 7.31% of the total seven-year catch, respectively. Bigeye tuna were caught in all fishing grounds, with the highest catch in the southern part of the Indian Ocean. Yellowfin tuna occurred in all fishing grounds. However, the highest abundance was found in Somalia and the Seychelles, while the lowest numbers were found in the Bay of Bengal. Albacore tuna were dominant in the southern part of the Indian Ocean. Other large pelagic species recorded included: swordfish (*Xiphias gladius*), sharks, blue marlin (*Makaira mazara*), black marlin (*M. indica*), striped marlin (*Tetrapturus audax*) and sailfish (*Istiophorus* spp). Thai tuna longliners fished north of equator during 2000 to 2002 and moved south of the equator during 2003 to 2006. Analysis of catch data by the PRIMER program showed changes in target species from yellowfin tuna, bigeye tuna, swordfish and other species during 2000 to 2002 to albacore tuna, bigeye tuna, yellowfin tuna, swordfish and other species during 2003 to 2006.

Key words: Thai tuna longline, Indian ocean

INTRODUCTION

Tuna fishing in the Indian Ocean commenced in 1973 with tuna longline, tuna purse seine and pole-and-line vessels operated by the French, Russian, Japanese and Taiwanese (IOTC, 1998). Catches from tuna longline fishing contributed 16% to total tuna production in the Indian Ocean (1.67 million tonnes) in 2006. The main nations involved in commercial longline

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fishing in the Indian Ocean are Taiwan, Japan, Indonesia, Korea and China, with their total catches contributing more than 83% of total production from longline fisheries (IOTC, 2008a), while Thai tuna longliners contributed 0.23%. Since 2000, two Thai tuna longliners (Mook Andaman 028 and Mook Andaman 018) have been operating in the Indian Ocean. Their catches have been landed at the Seychelles and Mauritius.

Thailand is well known as one of the leading producers of canned tuna and has a record of exporting it for more than 10 years. Total tuna production exported in 2007 was 553,620 tonnes, with a value of USD 1,000 million. The major markets were the USA, Canada, Australia and Japan. Tuna products consisted of tuna cans (451,410 tonnes) and frozen tuna loin (16,550 tonnes), whereas more than 80% of the raw materials were imported from the various tuna-fishing countries (INFOFISH, 2004; FAO, 2006). It is a concern that foreign countries were relied upon to supply the majority of tuna raw materials in Thailand. In addition, trade barriers have been implemented using many approaches, including taxation increases (rule of origin, certificate of origin), standards of food safety and combating illegal, unregulated and unreported fishing vessels. Such activities will affect the sustainable capacity of Thailand's tuna industry with regards to the world market.

However, the oceanic tuna fisheries in Thailand have been only slowly developed. This has been due to a major problem of lack of knowledge to undertake a proper cost-benefit analysis. Since 2000, the Thai private sector has established a longline industrial fleet for oceanic tuna fishing in the Indian Ocean.

Consequently, updating and evaluating the Thai tuna longline data is considered to be an important source of technical information to support Thai tuna longline fishing in the Indian Ocean.

MATERIALS AND METHODS

Data was collected from logsheets and provided to the Department of Fisheries, Thailand. The data included information related to fishing trips and operations. The trip data was composed of dates and ports of vessel departure and return, number and weight of catch and effort (such as the number of hooks used, hooks per basket) by species. The fishing operation included data on the time of the operation, location (latitude and longitude), the retained catch of target species and other information related to the operation. The data were provided by the Siam Tuna Fishery Company. Logsheets were used to estimate annual catches of the longline fleet, while the prices of tuna and tuna-like species were downloaded from http://www.sydneyfish- market.com.

Catch, value, catch by species and effort were analyzed and illustrated using Excel, Access (Serial no: WO 015400/001-031606) and ArcView software (free download from internet). The distribution of the catch was plotted in the Arabian Sea (zone 1), Somalia and the Seychelles (zone 2), the Mozambique Channel (zone 3), the southern part of the Indian Ocean (zone 4), the west coast of Indonesia (zone 5), the Bay of Bengal (zone 91) and west of South Africa (zone 93) as shown in Figure 1 (IOTC, 2008b).

Cluster analysis and non-metric multi-dimensional scaling ordination (MDS) (Kruskal and Wish, 1978) were used based on a Bray-Curtis similarity matrix with square-root transformation of yearly tuna and tuna-like catch data (total catch by species, tonnes). Analysis of similarities (ANOSIM) and similarity percentages (SIMPER) were used to identify tuna and tuna-like species catch similarities and species ranking of average dissimilarity between assemblages, respectively. All the above were carried out by PRIMER (Serial no: AP5200-1853-4580893) (Carr, 1997).

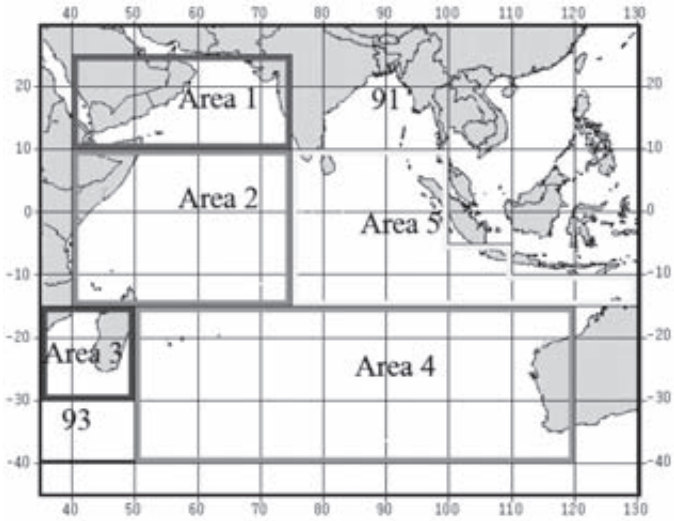

Figure 1 Indian Ocean fishing zones (IOTC, 2008b).

RESULTS AND DISCUSSION

Pattern of tuna catch and value

The total catch and value from tuna longline fishing were estimated to be 384.90 tonnes and USD 2.00 million in 2000 and decreased to a low of 93.57 tonnes (USD 0.46 million) in 2002 because one fishing vessel ceased operations. Since then, the catch and value have increased from 252.48 tonnes, (USD 1.16 million) in 2003 to 414.44 tonnes (USD 2.42 million) in 2006 (Table 1). In 2006, Thai tuna longliners contributed 0.23% of the tuna longline catch in the Indian Ocean. All captured fish were exported to Japan after landing at the Seychelles and Mauritius.

Species composition and distribution

The major species caught during seven years (2000-2006) were: bigeye tuna (*Thunnus obesus*), yellowfin tuna (*T. albacares*), albacore tuna (*T. alalunga*), and swordfish (*Xiphias gladius*) and other large pelagic fish comprising 36.64, 35.77, 20.28, and 7.31% of the total catch. All

Table 1 Total catch (tonnes) and value (USD million) from Thai tuna longline fishing from 2000 to 2006.

Year	Catch by species				Total	
	Albacore	Yellowfin	Bigeye	Swordfish & other species	Catch	Value
2000	2.66	178.52	171.63	32.09	384.90	2.00
2001	6.44	247.07	99.3	38.12	390.93	1.84
2002		69.49	18.42	5.66	93.57	0.46
2003	64.25	67.21	97.07	23.95	252.48	1.16
2004	77.24	103.14	55.56	36.47	272.41	1.58
2005	142.61	19.72	104.38	13.41	280.12	0.98
2006	130.43	61.98	218.95	3.08	414.44	2.42
Total	423.63	747.13	765.31	152.78	2,088.85	10.45

oceanic tuna and marlin fish were target species, while other large pelagic fish, such as sharks were by-catch. Table 2 shows the catch composition by species and zones. Bigeye and yellowfin tuna were caught in all fishing grounds, with the highest catch in zone 2 (289.40 and 473.50 tonnes, respectively), while the lowest catch was in zone 91 (1.60 and 17.30 tonnes, respectively). Albacore tuna (*T. alalunga*) dominated the catch in zones 2 (149.30 tonnes) and 4 (121.70 tonnes), while catches in zone 5 were very rare with none in zone 91. Other swordfish and pelagic species were composed of: swordfish (*Xiphias gladius*), sharks, blue marlin (*Makaira mazara*), black marlin (*M. indica*), striped marlin (*Tetrapturus audax*) and sailfish (*Istiophorus* spp.). Swordfish and marlin were found in all fishing grounds with the highest catch being in zone 2 (Table 2). The main target species for the Thai tuna longliners were similar to those of the Chinese and Taiwanese tuna longliners (IOTC, 2008a).

Figures 2.1 to 2.3 show the annual catch distribution of Thai tuna longliners from 2000 to 2006, separated into two periods, 2000 to 2002 and 2003 to 2006, by fishing zone and target species. During the first period from 2000 to 2002, catch distribution was aggregated in the northern fishing zone (latitude 15^0 N to 15^0 S). The main target species were yellowfin and bigeye tuna. Catch distribution was the widest in the western and eastern Indian Ocean in 2001. During the second period (2003-2006) catch distribution was from latitude 0^0 to 30^0 S in zones 2 and 4, with the main target species being bigeye and albacore tunas. The highest catch, in 2006, was bigeye tuna off the west coast of Madagascar.

Catch and year structure

Ordination analysis categorized tuna catches into two assemblages composed of group

Table 2 Catch (tonnes) of major species from Thai tuna longline fishing by fishing zone from 2000 to 2006.

Zone	Bigeye	Yellowfin	Albacore	Swordfish	Blue marlin	Black marlin	Indo-Pacific sailfish	Striped marlin	Shark
2	289.40	473.50	149.30	41.90	31.77	15.14	0.90	0.91	8.41
4	114.03	34.24	121.70	0.15	1.75	1.81	0.00	0.00	0.00
5	65.12	44.96	3.84	2.04	3.37	5.04	0.53	0.00	3.36
91	1.60	17.30	0.00	0.33	0.20	1.46	0.21	0.00	0.38

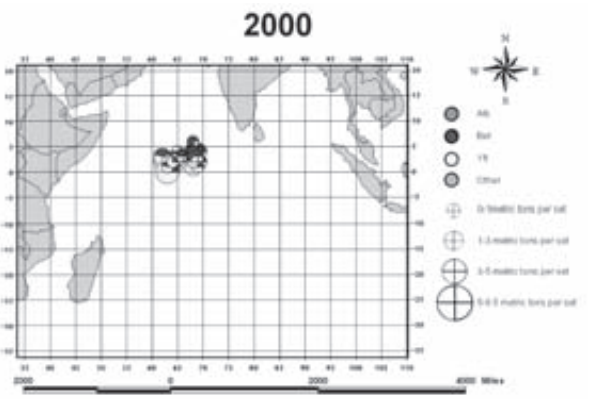

Figure 2.1 Catch of major species from Thai tuna longline fishing by fishing zone in 2000.
Note: BET = bigeye tuna, YFT = yellowfin tuna, ALB = albacore, Other = large pelagic species.

1; catch by species groups from 2000 to 2002 and group 2; catch by species groups from 2003 to 2006 (Figure 3). ANOSIM showed significant differences between the groups (R=0.87). Table 3 shows the species list and catch based on a breakdown of average similarity for each assemblage. For group 1, the dominant average catch was yellowfin tuna, followed by bigeye tuna, swordfish and other large pelagic species, whereas, group 2 was dominated by bigeye tuna followed by albacore and yellowfin tuna. The results from species composition and distribution from the previous paragraph are supported by the changes in the average catch and year structure. Thai tuna

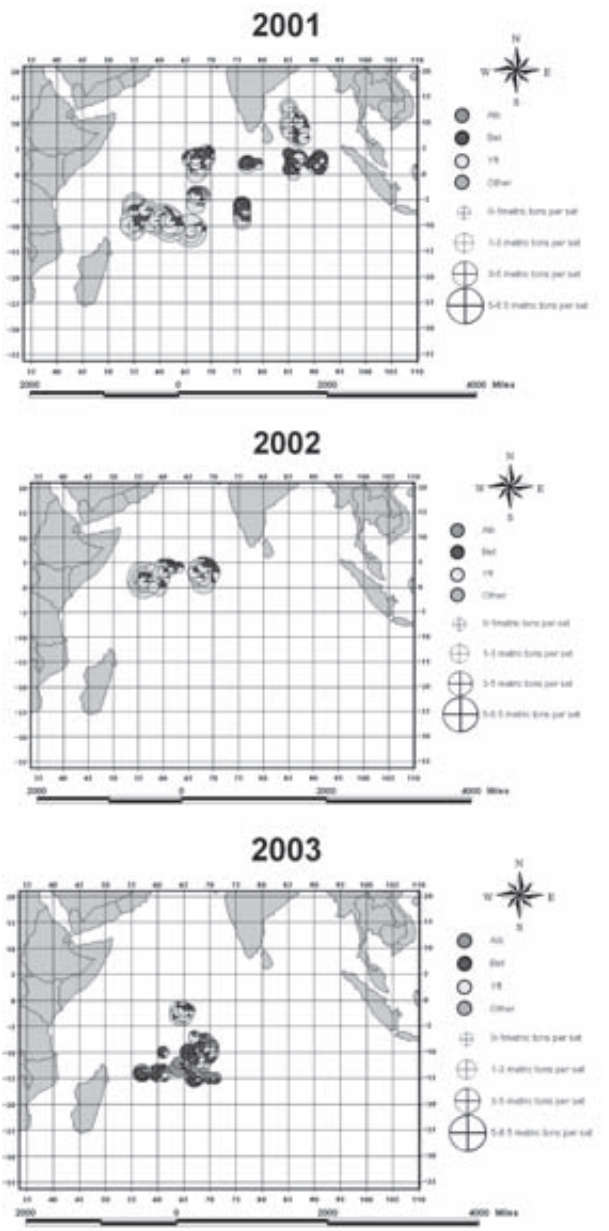

Figure 2.2 Catch of major species from Thai tuna longline fishing by fishing zone from 2001 to 2003. Note: BET = bigeye tuna, YFT = yellowfin tuna, ALB = albacore, Other = large pelagic species.

longliners changed fishing grounds from the northern fishing zone during 2000 to 2002 to the southern fishing zone during 2003 to 2006. In addition, the main target species (bigeye and albacore tuna) were more concentrated in the second period.

Fishing effort and catch rate

Fishing effort, catch and catch rate of Thai tuna longliners from 2000 to 2006 are shown

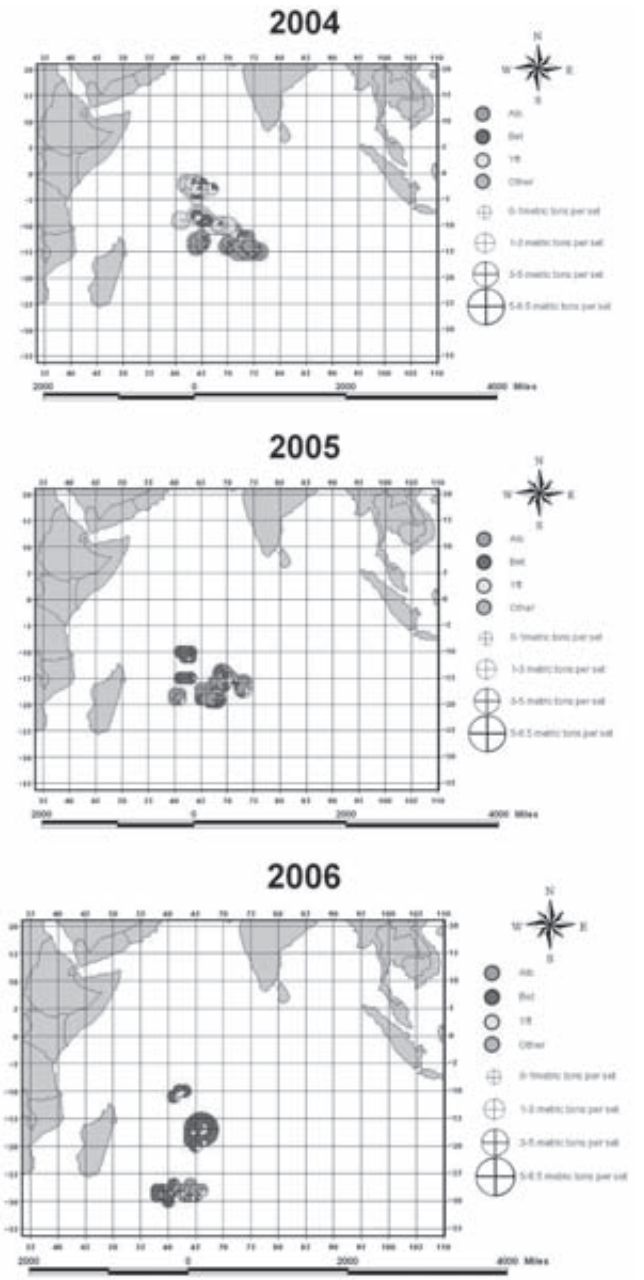

Figure 2.3 Catch of major species from Thai tuna longline fishing by fishing zone from 2004 to 2006. Note: BET = bigeye tuna, YFT = yellowfin tuna, ALB = albacore, Other = large pelagic species.

in Table 4. In 2000, a high fishing effort (322 sets and 967,978 hooks) and catch (384.90 tonnes) were reported, but the catch rates in number and weight were lower (1.2 fish/100 hooks and 0.04 tonnes/100 hooks) than in 2001 (1.5 fish/100 hooks and 0.05 tonnes/100 hooks) and 2002 (1.7 fish/100 hooks and 0.05 tonnes/100 hooks). In 2002, one of the longliners ceased operations. From 2003 to 2006, the catch and fishing effort increased from 252.48 tonnes and 604,000 hooks in 2003 to 414.44 tonnes and 1,287,000 hooks in 2006 due to one Thai tuna longliner returning to fishing in 2003. However, the catch rates in numbers of fish and weight decreased from 1.6 fish/100 hooks and 0.04 tonnes/100 hooks to 1.1 fish/100 hooks and 0.03 tonnes/100 hooks in 2006.

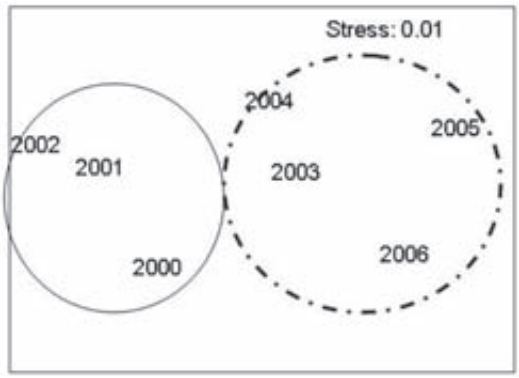

Figure 3 MDS ordination plot showing average catch from 2000 to 2002 (thick line) and 2003 to 2006 (dashed line).

Table 5 shows the catch rate in each fishing zone (zones 2, 4, 5 and 91). Zone 2 had the highest catch rate by number of fish (1.3 fish/100 hooks), while zone 91 had the lowest catch rate by number of fish (0.7 fish/100 hooks). This could be explained by the fleet concentrating on fishing in zone 2, followed by zones 4, 5 and 91. Fonteneau (2008) reported that zone 2 was the largest in terms of its biological productivity from the Somalian upwelling. The seasonality and location of tuna fishing are directly linked with

Table 3 Breakdown of average similarity between group 1 and 2 into contribution from the species list from Thai tuna longliners.

Group 1		Group 2	
Species	Average catch/year (tonnes)	Species	Average catch/year (tonnes)
Yellowfin tuna	165.03	Bigeye tuna	118.99
Bigeye tuna	96.45	Albacore tuna	103.63
Sword fish and other lage pelagic species	25.29	Yellowfin tuna	63.01

Table 4 Fishing effort and annual catch rate of Thai tuna longliners.

Year	Total number of sets	Total number of hooks	Total number of fish	Total catch (tonnes)	Catch rate tonnes/set	Catch rate fish/100hooks	Catch rate tonnes/ 100hooks
2000	322	967,978	11,793	384.90	1.2	1.2	0.04
2001	364	819,800	12,235	390.90	1.1	1.5	0.05
2002	54	172,800	2,979	93.57	1.7	1.7	0.05
2003	300	604,000	9,515	252.48	0.8	1.6	0.04
2004	231	639,000	7,573	272.41	1.2	1.2	0.04
2005	465	1,395,000	10,471	280.12	0.6	0.8	0.02
2006	429	1,287,000	13,706	414.44	1.0	1.1	0.03

Table 5 Fishing effort and catch rate of Thai tuna longliners in each fishing ground.

Zones	Total number of sets	Total number of hooks	Total number of fish	Total catch (tonnes)	Catch rate tonnes/set	Catch rate fish/100hooks	Catch rate tonnes/ 100hooks
2	1,321	3,331,178	42,083	1,350.10	1.0	1.3	0.04
4	711	2,133,000	21,450	588.96	0.8	1.0	0.03
5	111	346,600	4,332	128.24	1.2	1.2	0.04
91	22	74,800	530	21.52	1.0	0.7	0.03

this upwelling: small tuna (yellowfin, skipjack and bigeye tuna) move seasonally to the waters off Somalia, to feed on the abundant food sources in the Somalian upwelling. Typically, a rich, seasonal, feeding area is supplemented by tuna migration/ concentration as well.

The catch rate results (1.1-1.7 fish/100 hooks and 0.02-0.05 tonnes/100 hooks) were similar to other tuna longliners: Japan (0.03-0.04 tonnes/100 hooks), China (0.03-0.05 tonnes/100 hooks) and Korea (0.47-1.49 fish/100 hooks). Nevertheless, the fishing grounds for these countries were more widely distributed than those of the Thailand tuna longliners (NRIFSF *et al*., 2007; Liuxiong *et al*., 2007; Kim *et al*., 2007).

CONCLUSION

Two Thai longliners operated in the Indian Ocean from 2000 to 2006. Their total annual catch and value was higher during 2000 to 2002 than from 2003 to 2005, while the highest catch was found in 2006. The fishing grounds were in four zones namely: Somalia and the Seychelles, the southern part of the Indian Ocean, the west coast of Indonesia, and the Bay of Bengal. The main fishing ground for the Thai tuna longliners was Somalia and the Seychelles.

The highest catch rate was found in Somalia and the Seychelles, followed by the west coast of Indonesia and the southern part of the Indian Ocean. The lowest catch rate was reported in the Bay of Bengal. The major species caught during the seven years were: bigeye tuna, yellowfin tuna, albacore tuna, swordfish and other Large pelagic species. Bigeye tuna was caught in all fishing grounds with the highest catch in the southern part of the Indian Ocean. Yellowfin tuna were present in all fishing grounds. However, the highest abundance was found in Somalia and the Seychelles, whereas the lowest numbers were in the Bay of Bengal. Albacore tuna dominated in the southern part of the Indian Ocean and was absent in the Bay of Bengal. The composition of swordfish and other species were swordfish and sharks, while billfish comprised blue marlin, black marlin, striped marlin and sailfish.

Changes in the structure of the tuna catch by year were reflected in two assemblages composed of a catch by species group during 2000 to 2002 and the second during 2003 to 2006. The change in the catch by the Thai tuna longliners was caused by a change in target species and fishing ground. The fishermen caught more yellowfin and bigeye tuna fishing north of the equator in the Indian Ocean during 2000 to 2002, while albacore, yellowfin and bigeye tuna were the main target species from the southern part of the Indian Ocean during 2003 to 2006.

Fishing effort, catch and catch rate of Thai tuna longliners during 2000-2006 varied from 172,800-1,395,000 hooks, 93.57-414.44 tonnes and 0.8-1.7 fish/100 hooks, 0.02-0.05 tonnes/100 hooks, respectively. The highest catch rate was found off Somalia and the Seychelles followed by the west coast of Indonesia, and the southern part of the Indian Ocean (1.3, 1.2, and 1.0 fish/100 hooks, respectively). The lowest catch rate was

reported in the Bay of Bengal (0.7 fish/100 hooks). The main fishing ground for this fleet was off Somalia and the Seychelles, especially during 2003 and 2004. The southern part of the Indian Ocean was the main fishing ground during 2005 and 2006. The catch rate of Thai tuna longliners was similar to that from longliners from Japan, China and Korea.

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