Systematic of Data Collection and Status of Thai Industrial Tuna Purse Seine in the Indian Ocean

Praulai Nootmorn[1], Saran Petchpirom[2]* and Kanokwan Maeroh[3]

ABSTRACT

Six Thai industrial tuna purse seiners have operated in the Indian Ocean from 2005-2006. The fishery information and logistic were gathered from log book, port sampling and interview for created the diagram and systematic of data collection and processing. The result will be support and implement for responsible fisheries under the resolution of Indian Ocean Tuna Commission.

Total catch was reported 12,216 mts in 2005 and 23,161 mts in 2006, where the main fishing ground off Somalia and main fishing practice was associated schools. The high catches, CPUE and number of set were taken during February – April and September - November in 2006. Monthly catch, CPUE and number of sets ranged from 383-4539 mts, 15 to 61 mts/set, 15 to 144 set, respectively. Skipjack tuna was the main target, followed by bigeye tuna, yellowfin tuna and bonito. Skipjack tuna was high proportion during March to September, while bigeye and yellowfin tunas were high proportion from September to December and January to February in 2006.

Size range of skipjack, yellowfin and bigeye tunas varied from 39-75 cm, 33-152 cm, and 45-133 cm, whist length at 50% of capture were 60 cm, 81 cm and 66 cm, respectively. Most of yellowfin and bigeye tunas were juvenile.

The status of bigeye tuna from tuna purse seine was noticed to be stable in term of catch and CPUE.

INTRODUCTION

Thailand is well-known on top of the leading countries of canned tuna production and export more than 10 years. Total canned tuna production exported 497,173.54 mts and value was 49,604.32 million Baht in 2007, the major market was USA, Canada, Australia and Japan. In

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sprite of, the raw material for canned tuna was 725,632.74 mts and was imported more than 80 % from the varied tuna catch countries (INFOFISH, 2004). For this concern, the majority of tuna raw material in Thailand will be relied on foreign country. In addition, the situation of trade barrier have implement by many approaches such as taxation increase (rule of origin, certificated of origin), standard of food safety and combat the Illegal Unregulated Unreported fishing vessel. It will be impact on the sustainable capacity of Thai canned tuna industry in the world market.

However, the development of oceanic tuna fishery in Thailand has been going on very sluggish. This is due to the major problems those are lacks of knowledge, experience and reliability in the outcomes/cost-benefit. It was just recently in late of 2005 that the industrial tuna purse seine fleets of Thailand for oceanic tuna fishing was established by private sector and currently operating in the Indian Ocean.

As well as, tuna resources have became very important for the marine capture fisheries due to increasing demand of canneries in the country that mention in the previous. It was an imperative to undertake comprehensive studies on tuna at that time there were only few studies on the topic. Particular attention had been assigned for the study on basic tuna biology, fisheries and other data collection to assess the state of exploitation of tuna stocks in the western coast of Thailand and the Indian Ocean. The Department of Fisheries (DOF) focused on designing proper sampling scheme to collect the catch/effort, size composition, biological and other relevant data for the evaluation of tuna stocks.

Bigeye tuna (*Thunnus obesus*) is mainly caught by industrial fisheries and appears only occasionally in the catches of artisanal fisheries. Total annual catches have increased steadily since the start of the fishery, reaching the 100,000 mts level in 1993 and peaking at 150,000 mts in 1999. Total annual catches averaged 123,000 mts over the period 2001 to 2005. Bigeye tunas have been caught by industrial longline fleets since the early 1950's, but before 1970 they only represented an incidental catch. After 1970, the introduction of fishing practices that improved the access to the bigeye resource and the emergence of a sashimi market made bigeye tuna a target species for the main industrial longline fleets. Since the early 1990s bigeye tunas have been caught by purse seine vessels fishing on tunas aggregated on floating objects. Total catch of bigeye by purse seiners in the Indian Ocean reached 40,700 mts in 1999, but the average annual catch for the period from 2002 to 2006 was 26,000 mts. Forty to sixty boats have operated in this fishery since 1984. (IOTC, 2007).

The proposes of the present study were to create the systematic of data collection of Thai tuna industrial purse seine and status of the fleet in the Indian Ocean, in particular bigeye tuna caught from them. The result from this study should be conduct for support and implement an approach of sustainable Thai tuna industrial purse seine in the Indian Ocean.

MATERIALS AND METHODS

The data collections on fishery and activity information of the Thai Industrial tuna purse seine were interviewed from officers of Department of Fisheries and Indian Ocean Tuna Commission, and Manager from Procurement Department, Thai Union Manufacturing CO., Ltd. In addition, the data and information were reported in the logbook. The logbook data have been established and developed since 1999 from Andaman Sea Fisheries Research and Development Center. All information was gathered and used to creation the systematic of data collection.

The data of port-sampling survey and logbook used together to estimate annual catches by the purse seiner from October in 2005 to December 2006. Nominal catch (mts), CPUE (mts/set) and effort (number of set) were analyzed and illustrated by Excel, Access and ArchView software.

RESULT AND DISCUSSION

Fleet operation

The operation of industrial Thai purse seiners is summarized in Figure 1 below.

A/ Purse seiner in port : The Thai purse seine fleet usually put in to port twice a year:

- December-January: Thai purse seiners call to Victoria (Seychelles) to change its crew.

They spend between one and two weeks in port.

- June-July: Thai purse seiners call to Singapore/Phuket, Thailand to unload or/and change crew or/and for repairs; they may stay between one and two months in port.

No catches are unloaded in Singapore port; the Thai vessels seldom call to port during the year other than the two calls referred two above.

B/ Purse seiner fishing: The Thai purse seiners spend most of the time of the year searching for fish or fishing. They fish on two different types of tuna schools:

- Unassociated schools: free swimming tuna, tuna feeding on baitfish or other. Schools are usually mono-specific although more than one species are sometimes caught. The specimens making up the school are usually of similar size.
- Associated schools: tuna associated to natural (log, floating grass or other floating objects) or artificial (human-made) objects or associated with living or dead animals (whale, whale-shark, etc.). Schools are usually pluri-specific, containing specimens of different sizes with a higher proportion of small specimens.

C/ At sea transfer of catches between two purse seiners: In some circumstances a purse seiner might collect catches from another purse seiner or transfer its catches to it on the high seas. This operation does not usually take more than one day. The vessels usually resume fishing after this event.

D/ At sea transshipment of catches from a purse seiner to a cargo freezing vessel: The Thai purse seiners transship its catches on the high seas to cargo freezers. The totality or part of the catches might be transshipped. At sea transshipments usually last between one and four days, depending on the amount of catch to be transshipped. A cargo vessel might take catches from one or more purse seiners. The catches from different purse seiners are usually stored in different hold so as they can be identified at unloading. The purse seiner usually resumes fishing after the transshipment although in some cases it might sail to port (**A**).

E/ Cargo freezer in port for unloading: All catches collected on the high seas from Thai purse seiners are unloaded in Bangkok. The cargo freezers unload all catches to the canning factory Thai Union. The unloading can take several days depending on the amount of catches due for unloading.

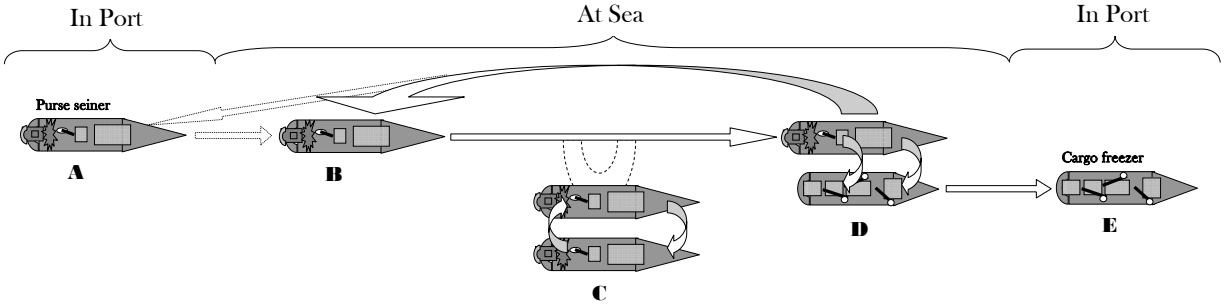


Figure 1. Operation of Thai industrial tuna purse seiners: main events.

Type of data collected on industrial tuna purse seiners from Thailand

The types of data sources and information were generated in each case concerning the activities of Thailand's industrial purse seine fleet. First, the data of vessel record have reported and described the ship identification, ownership, vessel dimensions and other vessel and gear attributes as recorded in the vessel documents, fishing license or other official documents. The second, vessel activity/ship operator was collected from fishing logbook and the information on the activity of industrial Thai purse seiners including:

- Details regarding vessel identification, vessel owner, fishing license and duration of the fishing trip (from one transhipment to next);
- the position (latitude-longitude) of each fishing set or a position per day for non fishing days (normally at noon);

- the catches retained per species and/or size class per set
- the catches discarded per type of fish (tuna or other) per set;
- catches transhipped per species, name of the cargo-freezer collecting the catches and amount of days transhipping catches;
- details on the catches collected/transferred from/to other vessels, if any

Second, the vessel activity and fishing master were collected from logbook containing the same type of information. The data entry must be complete/verify the information recorded in the fishing logbook before. Third, unloading catches and cargo-freezer, captain will be collected from vessel plan (amounts stored on each vessel hold), the record is details on the purse seiner from which the catches come from and total amount stored or amount stored per species and size category**.** Fourth, unloading catches at canning factory is collected from amounts unloaded from the cargo-freezer per species and size category**.** Fifth, length (weight) frequency of tuna specimens is taken in port sampling during the unloading of purse seine catches from cargo-freezers, including vessel hold. Species, fork length and individual weight will be recorded.

Data tables and database relationships

Figure 2 is an example of database design, containing some data tables and the relationship among them. This flowchart will be useful to develop a database (Access or SQL) for the industrial tuna purse seine fishery of Thailand and create a Microsoft Access user's interface including forms for the computerization of the data collected from tuna purse seiners and different types of reports, such as the estimation of catches, distribution of catch by species by position and catches-at-size. This program will be assisting the DOF of Thailand in the implementation of the database.

Status of Thai industrial tuna purse seine in the Indian Ocean

Six tuna purse seiners were operated under Thai flag in the Indian Ocean. These vessels have Length Over All (LOA) and Gross Registered Tonnage (GRT) range from 72.5-85 m and 1,413-2,660 mts. They were authorized for tuna fishing in the IOTC areas since September 2005 to 2006. The operating areas range from $10^0$58.5'N-$8^0$22.4'S and $42^0$28'E-$85^0$36.3'E (Figure 3), the main fishing ground in the western Indian Ocean same area with the Spanish and French fleets (IOTC, 2008), whist the Japanese fleet have main fishing ground in the eastern Indian Ocean (Nootmorn, *et. al*, 2007). The activities of these fleets were classified to be fishing success, searching, no fishing (bad weather, fishing breakdown, net repairing and bunkering), visit in port (at Victoria, Seychelles; Phuket, Thailand; Singapore), transit (at Victoria, Seychelles; Phuket, Thailand; Singapore), load to other fleets or carrier, load from other fleets and repairing at shipyard. The fourth quarter in 2005, the main activities were unload to other vessels at sea (71.7%), followed by fishing and searching (10.3 and 7.5%), transit (4.2%), and no fishing(1.5 %). In 2006, the main activities in the first and second quarters similar with the previous year: first quarter found the activities such as unload to other vessels at sea (56.2%), transit (26.4%), searching and fishing (9.5 and 4.1%) and no fishing (0.9%); second quarter was unload to other vessels at sea (80.2%), fishing and searching (7.4 and 4.6%), transit (4.0%), and no fishing (3.8%). Despite of the fishing activities in the third and fourth quarters were concern more the fishing (100 and 96.9 %) and a less was no fishing in the fourth quarter (3.1%). Most of fishing practice was associated schools (99.71%) and unassociated schools was operated very rare (0.29%) similar with ex-Thai and Japanese vessels (Nootmorn *et al*., 2001; Nootmorn *et. al*, 2007). In spite of the EU purse seine fleets were operated more unassociated school than associated school in the western Indian Ocean (Dorizo *et al*., 2008). Nootmorn *et al*. (2001) reported the activity of the ex-Thai tuna purse seine during 1998 to 2000, main activities were fishing (65%) and searching (13%), followed by sailing (8%), fishing equipments and net prepare (6%) and no fishing (5%).

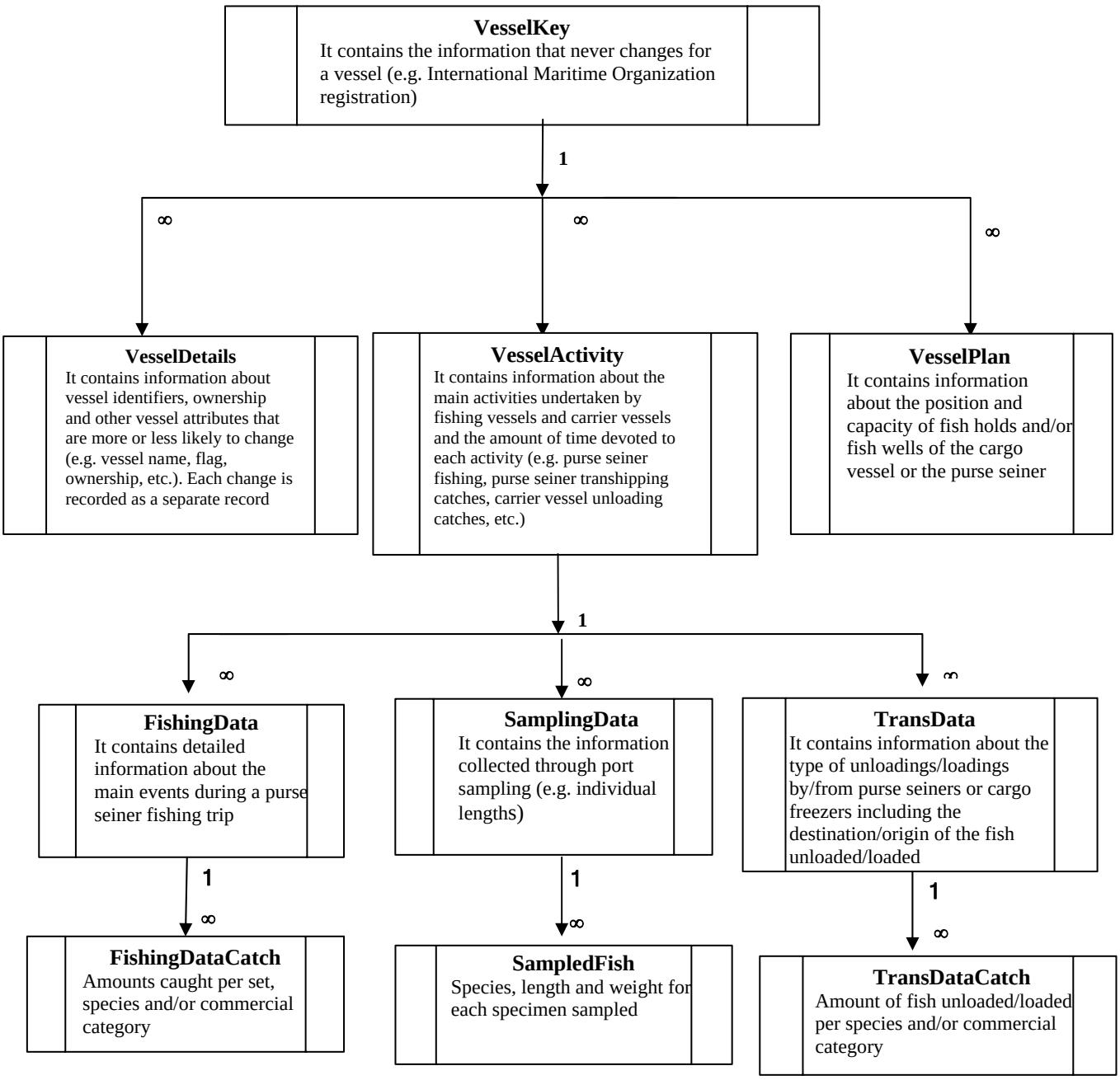


Figure 2. Main data tables and types of data gathered.

Tunas caught by this fleet are taken back to Thailand for raw material of tuna canning. Before the commencement of the current fleet in 2005 the total annual catches of Thai tuna purse seine were less than 2,000 mts (Sujittosakul, 2007). After the entry of the six tuna purse seiners, production rose sharply to 12,216 mts in 2005 and increased almost double fold in 2006 (23,161 mts). The high catches, CPUE and number of set were taken during February – April and September - November in 2006 (Figure 4). Monthly catch, CPUE and number of sets ranged from 383-4539 mts, 15 to 61 mts/set, 15 to 144 set, respectively. Skipjack tuna made up 70.65% of the total catch during 2005 to 2006, followed by bigeye tuna 15.27%, yellowfin tuna 13.57% and the bonito 0.51%. Monthly catch composition of skipjack tuna was high from March to September, while bigeye and yellowfin tunas were high from September to December and January to February in 2006. Furthermore, the proportion of yellowfin tuna during September to December in 2005 was higher than in 2006 cause from the catch composition of bigeye tuna decreasing in this period (Figure 5).

The present result showed average CPUE 32.81 mts/set or 33.35 mts/day were similar with the Spanish and Japanese tuna purse seiners (31.03 and 36.78 mts/day) (IEO, 2007; NRIFSF, 2007). Skipjack tuna was the main composition of tuna purse seine fleets that caught associated school, followed by yellowfin and bigeye tunas. Whist, yellowfin tuna was the target species of tuna purse seine fleets that caught unassimilated school, followed by skipjack and bigeye tunas (Dorizo *et al*., 2008).

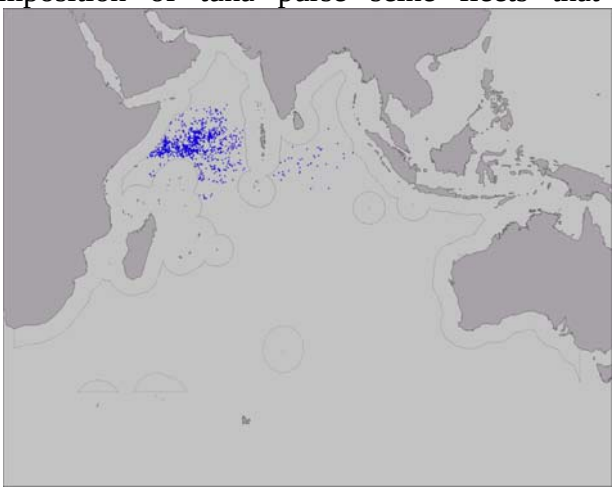


Figure 3. Fishing location of Thai tuna purse seiners in Indian Ocean during 2005 to 2006.

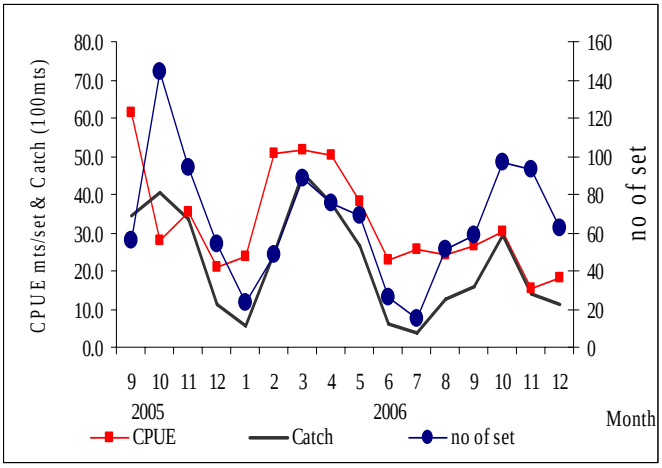


Figure 4. Monthly change of total catches, CPUE and fishing effort in 2006.

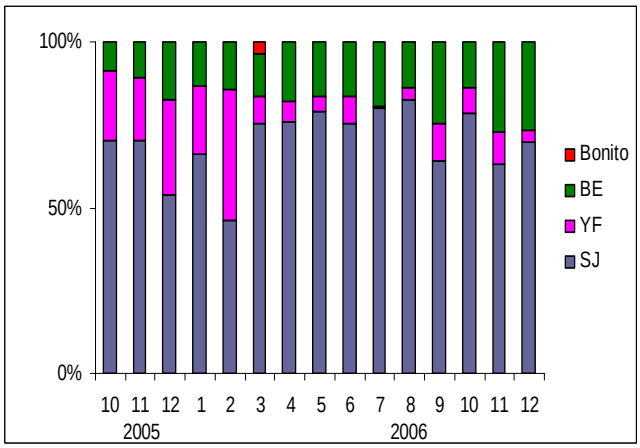


Figure 5. Monthly change of catch composition by species in 2006.

Spatial and temporal of catch rate distribution

Thai purse seiners spend most of the time of the year searching for fish or fishing. They fish on two different types of tuna schools, associated and unassociated schools. Associated schools were usual fishing practice, while unassociated schools were very rare for Thai tuna purse seine.

Figure 6 showed the quarterly catch distribution from associated school of Thai tuna purse seine during 2005 to 2006. The main fishing ground was the western Indian Ocean. In 2005, the fishing vessels only caught off the western coast of Somalia during quarter 3 (Figure 6a), whereas the wide fishing group, dense in the western and rare the eastern of Indian Ocean (Figure 6b) where presented during quarter 4. The high abundance of skipjack, yellowfin and bigeye tunas found in the western coast of Somalia. Fonteneau (2008) reported Somalia upwelling was the most powerful in the term of biological productivity. Seasonality and location of tuna fisheries are directly with this upwelling: small tunas off Somalia such as yellowfin, skipjack and bigeye

tunas, were seasonally feeding upon the Somalia upwelling productivity. In 2006 during quarters 1 and 2 show the catch distribution and main fishing ground (Figures 6c and d) similar quarters 4 in 2005. Whereas, the catch distribution during quarters 3 and 4 show the fishing ground dense in the western coast of Somalia and southeast Seychelles (Figures 6 f and g). Figures 7a, b and c showed the quarterly catch distribution from unassociated school of Thai tuna purse seine. The catch distribution from this practice was very rear, which found only 1 set during quarters 1, 2 and 4 in 2006. IOTC (2008) have reported the main fishing ground of tuna purse seine in the western Indian Ocean same as the Thai tuna purse seine, only Japanese tuna purse seine was operated in the eastern Indian Ocean during 2005-2006 (Nootmorn *et al*., 2007).

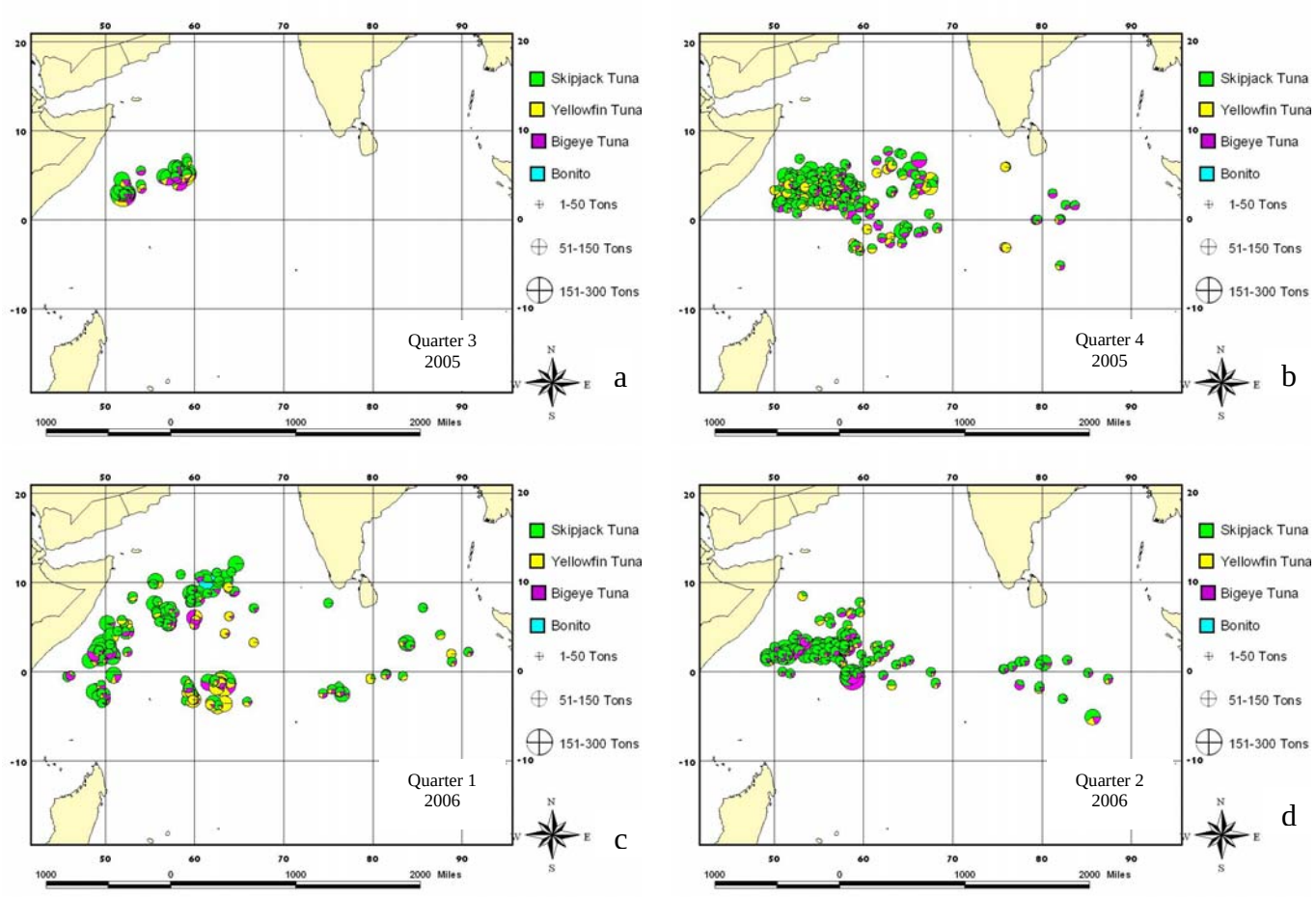
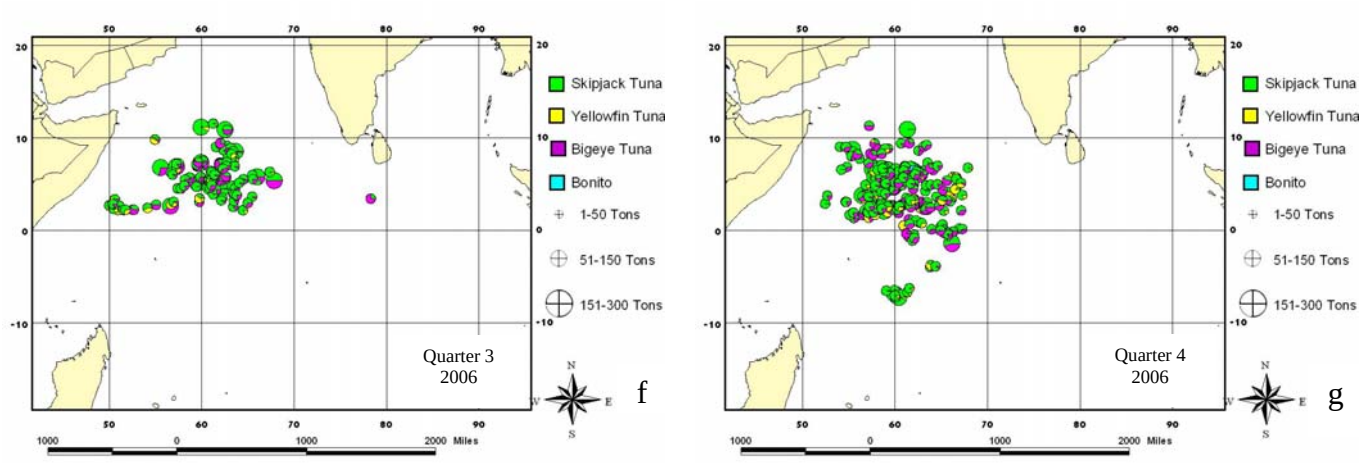


Figure 6. Catch by associated school of major species distributed of Thai tuna purse seines during 2005-2006.



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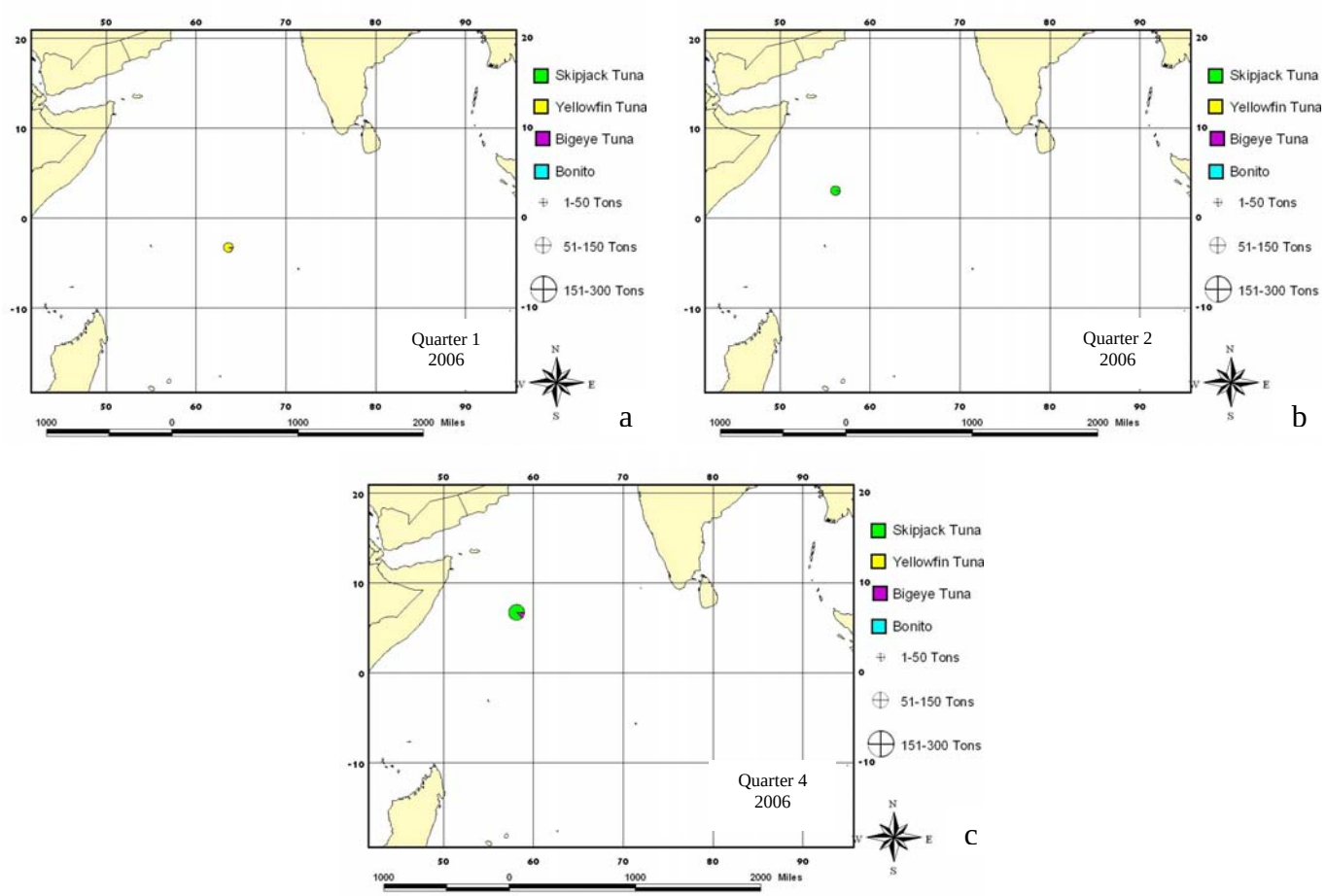

Figure 7. Catch by unassociated school of major species distributed of Thai tuna purse seines in 2006.

Size distribution of tunas

Figure 8 show the size distribution of folk length of skipjack, yellowfin and bigeye tunas.

Skipjack tuna have the size ranged from 39-75 cm, while a mode of size and Lc_{50} were 60-66 cm and 60 cm (Figure 6a). Range (30-63 cm) and mode (39-42 and 45-51 cm) of size frequency distribution from Japanese purse seine that caught in the eastern Indian Ocean was less than this study (Nootmorn *et al*., 2008). The size at first mature of this species was reported 41-42 cm (Stequert and Ramchrrun, 1995), while Nootmorn *et al*. (2001) reported the size at first

mature of skipjack female and male was 43.80 and 47.60 cm, respectively. That mean 99 % of skipjack tuna caught from Thai purse seine was bigger than the size at first mature. It was consistent with IOTC's recommendation on the increasing trend of skipjack tuna catch in the Indian Ocean (IOTC, 2007) whereas size of fish was bigger than 40 cm. This situation shows the healthy status of skipjack tuna population structure in this area.

Yellowfin tuna showed the size distribution from 33-152 cm, three modes were 61-63 cm, 75-87 cm, and 105-117 cm, while Lc_{50} was 81 cm (Figure 6b). Range and mode of size frequency distribution from Japanese purse seine (30-114 cm and 39 and 51-57 cm, respective) was less than the present study (Nootmorn *et al*., 2008). Nootmorn *et al*. (2001) reported the size at first mature of yellowfin tuna female and male was 109.69 and 104.95 cm, respectively. Yellowfin tuna caught from Thai tuna purse seine was mainly smaller (78 % of size distribution) less than the size at first mature. IOTC have reported the status of this species, which have over fishing (IOTC, 2007) and the increasing of fishing practice that using purse seine with fish aggregating devices should be the negative impact with the yellowfin tuna population cause of this practice caught more juvenile of yellowfin tuna (IOTC, 2008).

Size range of bigeye tuna varied from 45-133 cm, the modes of size found 57-65 cm, 83-93 cm and 108-120 cm, while Lc_{50} was 66 cm (Figure 6c). Range (30-87 cm) and mode (39-45, 48-63 and 72-75cm) of size frequency distribution from Japanese purse seine was less than this study (Nootmorn *et al*., 2008). The size at first mature of this species was reported the female and male was 88.1 and 86.9 cm, respectively (Nootmorn and Pethpiroon, 2006). Meanwhile, 80% of bigeye tuna caught from Thai purse seine was mainly smaller than the size at first mature, similar with the yellowfin tuna. IOTC have reported the status of this species, which have over fishing (IOTC, 2007) and the increasing of fishing practice that using purse seine with fish aggregating devices should be the negative impact with the bigeye tuna population cause of this practice caught more juvenile of bigeye tuna (IOTC, 2008).

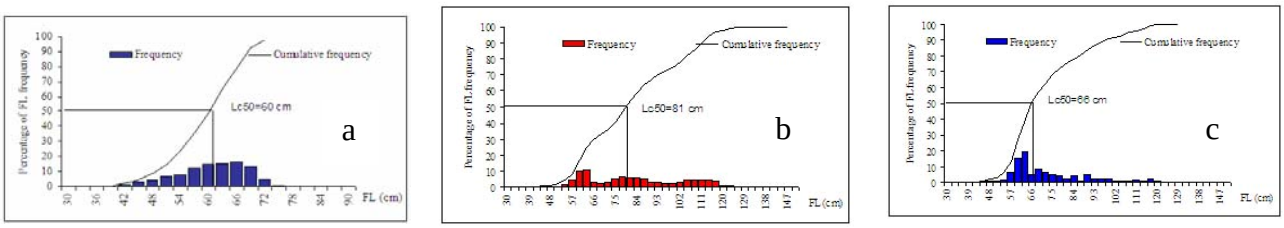

Figure 8. Length frequency distribution of skipjack (a), yellowfin (b) and bigeye (c) tunas caught from Thai tuna purse seine in Indian Ocean.

<u>Bigeye tuna caught from Thai tuna purse seine</u>

Bigeye tuna are one component of Thai tuna purse seine (15.27 % of total catch), which was the main fishing ground in the western Indian Ocean. The proportion of catch show 2 peaks during January to February and September to December (Figure 5). The spatial distribution of bigeye tuna was off coast of Somalia and western Indian Ocean. IOTC (2007) reported annual catches of bigeye tuna by longline and purse seine vessels were high abundance in the western Indian Ocean during 2000-2006. Thai vessel caught by purse seine with FADs for associated schools. Then, juvenile of this species was caught more than 80 %, even through this gear are aim to catch skipjack tuna for raw material of tuna can factory. But the nature of juvenile of bigeye and yellowfin tuna are same associated school with skipjack tuna swim under

log, floating grass, other floating object or human-made object. Purse seiners mainly take small juvenile bigeye (averaging around 5 kg) whereas longliners much larger and heavier fish; and while purse seiners take much lower tonnages of bigeye tuna compared to longliners, they take larger numbers of individual fish (IOTC, 2007). In addition, Ardill (1984) reported a characteristic of the tunas is the limited development of their swim bladders. Skipjack tuna have no swim bladder, while in the bigeye and yellowfin tunas, only the older individuals develop one; concurrently with an increase in body fat which reduces density.

Dorizo *et al*. (2008) report bigeye tuna catches and CPUEs from EU tuna purse seiners in the western Indian Ocean tend to be stable during 1983 to 2008, but the relatively high catches of bigeye tuna taken on unassociated schools (and the lower bigeye catches taken on associated schools) are rather surprising and they would deserve an in depth study taking into consideration the sizes of bigeye tuna caught and fish strata.

CONCLUSION

Six Thai purse seiners have operated in the Indian Ocean during 2005 to 2006. The information was gathering from the port sampling, log book and interview, which was aggregated to create the systematic and data base program for data collection and progressing of Thai tuna purse seine.

The activity of this fleet was categorized to be 8 activities such as fishing success, searching, no fishing, visiting in port, transit, load to other fleets or carrier, load from other fleets and repairing at shipyard. The main activities during fourth quarter in 2005 to second quarter in 2006 were unload to other vessels at sea, followed by fishing and searching, transit, and no fishing. Whereas, the fishing activities in the third and fourth quarters were concern more the fishing. Most of fishing practice was caught associated schools

Total catch of Thai tuna purse seiners, was 12,216 mts in 2005 and increased almost double fold in 2006 (23,161 mts). The high catches, CPUE and number of set were taken during February – April and September - November in 2006. Monthly catch, CPUE and number of sets ranged from 383-4539 mts, 15 to 61 mts/set, 15 to 144 set, respectively. Skipjack tuna was the main target, followed by bigeye tuna, yellowfin tuna and bonito. Skipjack tuna was high proportion during March to September, while bigeye and yellowfin tunas were high proportion from September to December and January to February in 2006.

Spatial and temporal of CPUE showed the quarterly catch distribution from associated school of Thai tuna purse seine during 2005 to 2006. The main fishing ground was off Somalia, where was the productive area and high abundance of skipjack, yellowfin and bigeye tunas.

Skipjack tuna have the size ranged from 39-75 cm, while a mode of size and Lc_{50} were 60-66 cm and 60 cm, respectively. Ninety nine percent of skipjack tuna was bigger than the size at first mature, which caught from Thai tuna purse seine. Range size of yellowfin varied from 33-152 cm, while the three modes were 61-63 cm, 75-87 cm, and 105-117 cm, and Lc_{50} was 81 cm. Seventy eight percent of yellowfin tuna was smaller than the size at first mature. Size range of bigeye tuna varied from 45-133 cm, the modes of size found 57-65 cm, 83-93 cm and 108-120 cm, while Lc_{50} was 66 cm. In particulaly 80% of bigeye tuna was smaller than the size at first mature, similar with the yellowfin tuna.

Bigeye tuna was the second composition, the most of them was juvenile, from Thai tuna purse seine. Their caught mainly practice with associated schools off Somalia, when the peak of catch showed during January to February and September to December. The situation of this species from tuna purse seine found stable in term of catch and CPUE.

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