Landings of small fresh tuna longline vessels to ports in the eastern Indian Ocean during the year 1999

Miguel Herrera[1]

Praulai Nootmorn[2]

Mahyam Mhd. Isa[3]

Sampan Panjarat[2]

ABSTRACT

The present paper reviews the data retrieved from two shipping agencies dealing with longliners targeting tuna for the fresh *sashimi* market. The information includes the individual weight, name of the species and destination of all specimens unloaded per boat and landing throughout the year 1999.

About 36,000 specimens weighing more than 1,300 tonnes were monitored accounting the bigeye and the yellowfin tunas for more than the 80% of the total landings both in number and in weight. Other species recorded in the landing sheets are the swordfish, Indo-Pacific blue marlin, striped marlin, black marlin, Indo-Pacific Sailfish and albacore tuna.

Catches per species, month, boat, landing and destination of the fish in the landing are presented as well as the mean weights and size distributions of the species in the catch.

AKNOWLEDGMENTS

The basic data used to write this document were fully provided by the representatives of two shipping agencies[4], in Phuket and Pinang. They also provided very interesting information on the general characteristics of the fleet and their operation and facilitated the sampling teams to conduct the first samplings in their plants.

It is evident that the programs would not operate if no cooperation from the companies were provided.

1 Indian Ocean Tuna Commission, PO Box 1011, Victoria, Mahe; Seychelles (e-mail: herrera@seychelles.net)

2 Andaman Sea Fisheries Development Centre, 77 Sukdidaj rd. Muang District, Phuket; 83000 Thailand (e-mail: afdec@phuket.ksc.co.th)

3 Fisheries Research Institute, 11960 Batu Maung, Pulau Pinang, Malaysia (e-mail: mahyam@rocketmail.com)

INTRODUCTION

At the last Commission meeting, held in Kyoto (Japan), the implementation of sampling programmes in different ports of the Indian Ocean was strongly recommended, the primary objective being to monitor the activities of IUU (illegal, unregulated and unreported) longliners operating in the Indian Ocean. Nine Indian Ocean ports were selected as primary targets for the implementation of sampling programmes, namely Benoa, Cilacap and Jakarta (Indonesia), Cape Town and Durban (South Africa), Pinang (Malaysia), Phuket (Thailand), Port Louis (Mauritius) and Singapore.

Missions were scheduled to the ports selected in order to assess the possibilities and objectives of implementation. Trips to Phuket and Pinang resulted in agreements with the research institutions for the implementation of joint sampling programs. The representatives of the shipping agencies dealing with longliners in those ports were also met in order to inform them on the objectives of the program and facilitate the sampling in the processing plants, a third objective being to assess whether data on the landings were gathered and under which conditions the IOTC would be provided with this information.

Three representatives engaged to cooperate with the IOTC providing information on all landings of longliners to their processing plants.

The present paper deals with the first data provided regarding 245 landings occurred throughout 1999 both in Phuket and Pinang. More data will be made available in the next future. A brief description of the fishery is provided in the first section.

The characteristics of the data retrieved in each port, as their completeness, the number of landings monitored per month, number of specimens and corresponding weights are dealt in the second section.

In the third section the species composition in the landings is reviewed. Species breakdowns are shown relying upon the port, month, boat and flag for all landings monitored. Mean landings are also dealt in this section.

The fourth section is about the destination of the fish in the landings which is also reviewed per month, species, boat and flag.

To finish, the last section includes information on the trends of the mean weights of the species in the landings and the size distributions for these species throughout 1999.

GENERAL CHARACTERISTICS OF THE FLEET

1. History

An unknown number of fresh tuna longliners have been operating in the Indian Ocean since the mid eighties. The increasing demand from Japan for fresh tuna, which was declared main product for the 'sashimi' market in 1986 (information from the Indonesian Company Perikanan Samodra Besar), and the higher and higher prices it fetched in relation to frozen tuna products led to a dramatic increase in the number of small tuna longliners in only a few years. Some 1,200 of these boats, mainly Taiwanese, were spread all over the Indian Ocean, but especially in the eastern side, by 1993.

While the bulk of this fleet was made up by Taiwanese boats for a long period this situation has been gradually reversed re-flagging more and more vessels to the flag of their hosting countries. Countries as Oman, Pakistan and Indonesia have seen their fleets increasing as a direct consequence of the implementation of new regulations primarily leading to the 'nationalization' of the foreign vessels exploiting each country resources.

Besides this re-flagging is the building of new longliners to operate under flags of these or other coastal countries in the Indian Ocean being the relative low investing and operating costs and the high profitability the main reasons for local owners to venture in such activities.

The aftermath are the current 1,500 or more small fresh tuna longliners fully or seasonally operating in the Indian Ocean.

2. Boats

Two different types of boats are operating from ports in the eastern Indian Ocean:

Taiwanese built longliners: These boats, usually built at Kaoshioung, have a fibreglass-hull, 20 to 30 meters LOA, 20 to 80 MT GRT, 200 to 300 HP engines and 250 to about 400 pieces (7 to 16 tons) of carrying capacity. Target species are usually stored in ice in a hold located fore ship being all other fish stored in a second hold aft ship. Some boats, especially the newest, have also refrigerated sea water tanks where fish is kept at about 0^{O}C.

Chinese built longliners: These boats, built for trawling and afterwards rigged as longliners, have a steel and concrete hull, 30 to 35 meters LOA, about 100 MT GRT, 200 to 300 HP engine and 150 to 250 pieces (4 to 8 tons) of carrying capacity. Fish are all kept in ice in a single hold.

All vessels have GPS but it seems that any of them has radar neither eco-sounder nor sonar.

3. Gear

Chinese and Taiwanese boats use surface monofilament longlines bearing between 800 and 1,600 hooks, with 4 to 10 (usually 6) hooks between buoy lines (per basket). Longlines are set over the stern without using line setters and hauled forward using a standard line hauler.

Radio-buoys are set from time to time in order to keep track of the line. From six to ten radio buoys are usually stored on board with this purpose.

Wire leaders and light sticks are never or almost never used which implies that neither billfish nor shark species are targeted.

Milkfish (Chanos chanos) are sometimes used as live bait. Other species used (frozen) are the Argentina squid (Illex spp.) and some scads species (Decapterus spp.).

4. Operation

Boats usually operate from ports in the eastern Indian Ocean, as Thai (Phuket), Malay (Pinang) and Indonesian ports (Bali, Jakarta, Cilacap, Sabang, etc.).

Landings occur to processing plants in these ports where all specimens going through are graded, cleaned, individually weighed and if sashimi graded packed and air freighted to Japan. The remaining specimens are also weighed and put aside in the processing plant to be sold to local buyers (for canning or direct consumption). Bigeye and yellowfin tunas make up the bulk of the export with a lesser amount of swordfish and some billfish species also being exported. These same species make up the reject.

Individual weights of all specimens going through the processing plants are recorded, along with the name of the species and the destination. Fish graded as sashimi are labelled as Export being the remaining specimens referred to as Reject.

These weights correspond to specimens which were processed on board in a different way relying upon the species group:

- Tuna: All specimens of Yellowfin and Bigeye tuna are bled, gilled and gutted on board.. Fish are kept in ice or in refrigerated sea water. Albacore and Skipjack are seldom caught no undergoing any processing.
- Billfish: All specimens are headed and tailed on board and stored in ice.
- Shark: Either trunks or fins (dorsal and/or pectoral fins) of some species are usually kept the first put in ice and the second dried and stored in sacs.

A part of the catch, including sharks, other tuna and billfish species and other fish, does not go through the processing plant but the specimens put aside on the dock and directly sold to local buyers. This specimens are not recorded in the landing sheets and therefore need to be dealt separately.

Trips does not usually last longer than 30 to 40 days the main reason being the spoiling of the flesh of the specimens in the catch. Yellowfin tuna specimens are more subject to short term spoiling than bigeye tuna specimens do. Specimen of yellowfin tuna kept on board for more than 25 days are less likely to be sashimi graded lasting around five more days the bigeye specimens.

The activity is different relying upon the season:

Northwest Monsoon season (October-March): The most of the activity occurs during this monsoon with the whole fleet operating in the Indian Ocean and primarily exploiting the area located between Sri Lanka and Indonesia and from the Equator northwards. The trips to the fishing grounds vary depending upon the port the boat is based. Boats based in ports as Phuket and Pinang usually spend four days to arrive to the fishing area.

Southeast Monsoon season (April-September): The bulk of the fleet shift into the Pacific Ocean staying in the Indian Ocean the remaining boats which usually fish more to the south between the equator and the 5^{O}S. Trip lengths are a day longer as a consequence of this.

Both yellowfin and bigeye tunas can be considered as target species for they account for

more than the 80% of the exported catch. Although the yellowfin tuna is a species more likely caught by surface longlines this seems not to be the case with this fishery which either the two species are caught in similar proportions or more catches of bigeye tuna occur.

This more successful catches of bigeye tuna seem very much related to the fact of this species being caught by surface longlines during full moon. More and more skippers have been taking advantage of this higher catchability of bigeye by always fishing during full moon.

LONGLINE LANDINGS MONITORED DURING 1999

Two Shipping Agencies' representatives provided the landing sheets which data are presented in this document. Similar data are recorded in both cases even though a single sheet is used to record all specimens in the landing in Phuket and more than one in Penang. The name of the vessel (usually in Chinese) and the date of landing are recorded in all sheets irrespective of the port of landing. The landing sheets include the following data:

1-. Phuket: All fish going through the processing plant are recorded in a single sheet. The specimens are recorded in different places on the sheet depending upon the species and the destination:

a-. Individual weights of all bigeye tuna specimens graded as Export.

b-. Individual weights of all yellowfin tuna specimens graded as Export.

c-. Individual weights of all swordfish specimens graded as Export.

d-. Individual weights of all marlins specimens graded as Export.

Every export fish, which are those complying with "sashimi" quality standards, is cleaned (after grading), its fins cut off, weighed, packed and air-freighted to Japan (seldom to United States). Yellowfin and bigeye tunas are always gilled and gutted on-board. Only the gonads of gravid females are not removed at sea but during the cleaning at the processing plant. Swordfish and marlins also undergo on-board processing for they are headed and tailed (the peduncle usually kept). Therefore, the weights recorded on the landing sheets are processed weights, gilled, gutted and finned or headed, tailed and finned depending upon the species concerned.

The specimens of Indo-Pacific blue marlin (*Makaira mazara*), black marlin (*Makaira indica*), striped marlin (*Tetrapturus audax*), Indo-Pacific sailfish (*Istiophorus platypterus*) and short-billed spearfish (*Tetrapturus angustirostris*) are all recorded as marlins, not being classified to the species level. Nevertheless, only specimens of the first three species quoted are likely to be exported.

e-. Individual weights of all bigeye tuna specimens graded as Reject.

f-. Individual weights of all yellowfin tuna specimens graded as Reject.

g-. Individual weights of all swordfish specimens over 30 kg weight graded as Reject.

h-. Individual weights of all swordfish specimens up to 30 kg weight graded as Reject.

i-. Individual weights of all marlins specimens graded as Reject.

All reject fish are processed on the same way than the Export although they are not packed and air-freighted but sold to the local market (either to canning factories or for direct consumption).

A component of the catch, make up especially by sharks (e.g. thresher sharks, whitetip oceanic shark, etc., including shark-fins), small and/or non-sashimi tuna species and marlins (skipjack, albacore, short-billed spearfish, sailfish, etc.) and other fishes (wahoo, barracuda, etc.) does not go through the processing plant but it is put aside on the dock and directly sold to local buyers. The data presented do not include these catches for the specimens are not recorded on the landing sheets. Samplings are currently conducted in Phuket to monitor this part of the catch which is not recorded.

2-. Pinang: Only a form is used but the specimens are recorded in different sheets de-

pending upon the species and the destination:

a-. Yellowfin tuna specimens graded as Export.

b-. Bigeye tuna and billfish specimens graded as Export.

Tuna specimens are recorded as Export-A or Export-B depending upon their quality. The former fetch higher prices in the Japanese "sashimi" auctions. Billfish specimens are identified to the species level and all classified simply as Export, being the species concerned the swordfish (*Xiphias gladius*), Indo-Pacific blue marlin (*Makaira mazara*), black marlin (*Makaira indica*) and striped marlin (*Tetrapturus audax*). Considering the processing the specimens undergo, the same than in Phuket, it is possible that some billfish specimens (apart from the swordfish which is easy to identify) be mistakenly classified.

c-. Reject specimens: All Reject specimens are recorded in a new sheet where the name of the species and its individual weight are written down. The species concerned are the yellowfin tuna, bigeye tuna, albacore tuna, swordfish, black, blue and striped marlins and Indo-Pacific sailfish (*Istiophorus platypterus*) which possibly is an aggregate of this species and the short-billed spearfish (*Tetrapturus angustirostris*). All other species are labelled as "Miscellaneous" and weighed either individually or in groups depending on their size. The following species are recorded under this category: moro shark (*Alopias spp*.), barracuda (*Sphyraena spp*.), wahoo (*Acantocybium solandri*), skipjack (*Katsuwonus pelamis*), etc.

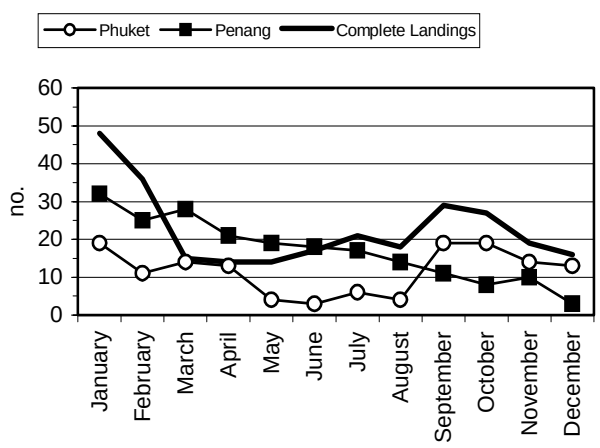


Chart 1: Total number of landings per month and port which landing sheets were retrieved versus the number of complete landings during 1999 (which all landing sheets were present).

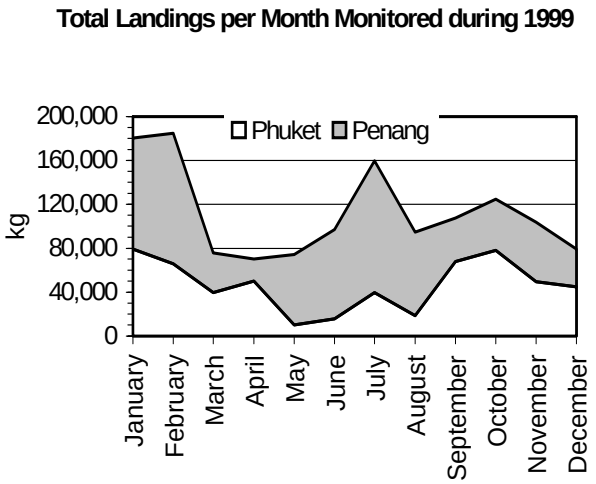


Chart 2: Total landings per month per port monitored during 1999.

The number of landings monitored per month in Phuket and Pinang during 1999 is shown in the Chart 1. The Chart 2 shows the total catch landed which was monitored in Phuket and Pinang throughout 1999. These data are thoroughly reviewed in the following sections.

1. Phuket (Thailand)

The Table 1 shows the number of vessels operating, the number of landings monitored, the total number of specimens which weight was recorded in the landing sheets and the total

Month	Number of Vessels Operating	Number of Landings monitored	Total number of specimens measured	Total Catch monitored (kg)
January	14	19	1,881	79,225
February	11	11	1,547	65,715
March	14	14	881	39,525
April	13	13	1,250	50,184
May	4	4	287	10,082
June	3	3	395	15,770
July	4	6	1,000	39,597
August	4	4	497	18,515
September	13	19	1,854	67,976
October	14	19	1,933	78,016
November	14	14	1,139	49,440
December	12	13	966	44,867
Total 1999	14	139	13,630	558,912

Table 1: Number of vessels and number of landings which landing sheets were retrieved, total number of specimens weighed and total weight (processed weight) recorded per month during 1999 in Phuket (Thailand).

weight (processed weight) of those specimens.

139 landing sheets were retrieved out of the 14 vessels monitored in Phuket throughout 1999. These sheets recorded individual weights for a total of 13,630 tuna and tuna-like specimens, amounting the total weight of the specimens to 558,912 kg (processed weight). All longliners monitored in Phuket were flying the Chinese flag.

The total number of specimens and catch monitored in Phuket is shown in the Chart 3. The number of landing sheets retrieved as higher from January to April and from September to December (i.e. during the North-West Monsoon season). This is in accordance with the seasonal way the bulk of this fleet operates, fishing within the eastern Indian Ocean from September-October to March-April and shifting to the Pacific during the South-East Monsoon.

The days the longliners unloaded the catches during 1999 are shown in the Figure 1. The days of full moon are highlighted in grey in the calendar. It is clear that landings did not occur randomly throughout the year but especially after the full moon.

The Table 2 shows the number of landings recorded within the weeks before and after full moon during the year 1999. These values are represented in the Chart 4. Only 10 (3.06%) out of the 327 landings recorded occurred in weeks just before the full moon (this included) while the remaining landings (96.94%) occurred in other weeks. The highest number of landings was recorded within the two weeks after full moon (32.72% and 41.90%, respectively), the first in Phuket (65.65% of the total landings in Phuket) and

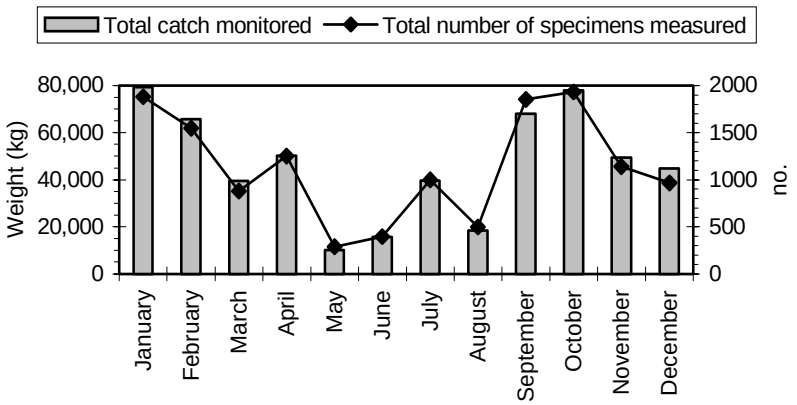


Chart 3: Total number of specimens measured and total weight monitored in Phuket during 1999.

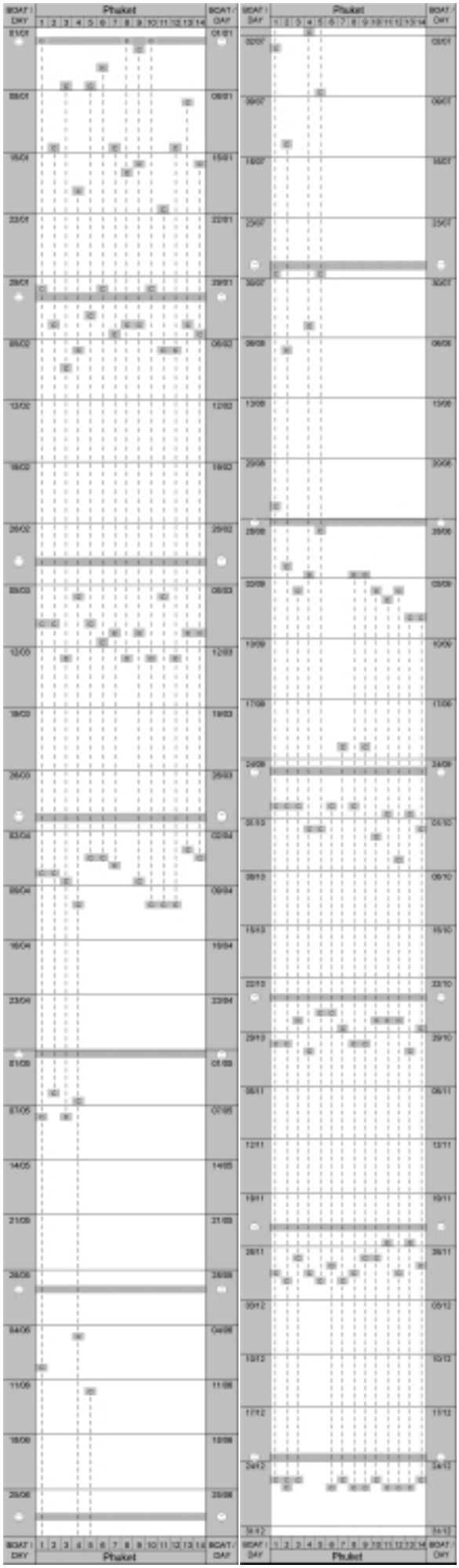


Figure 1 (left)**:** Calendar of landings for the 14 longliners consigned by the Shipping Agency providing the data in Phuket.

Legend: ☺ Full moon

C Day of landing (C: Chinese longliner)

Broken lines are drawn when no landings in between of the two joined were supposed to occur (consecutive landing dates separated no more than 45 days one another).

the second in Pinang (52.04% of the total landings in Pinang).

As it was mentioned before it seems that the bigeye tuna is more caught during the full moon by surface longlines in equatorial waters. The fact that the most of the fleet is at sea before the full moon and the higher catches of bigeye tuna both in Phuket and Pinang seem to confirm this.

Apart from the fact that part of the fleet leaves the Indian Ocean during the Southeast Monsoon season, which is confirmed by the distribution of the landings throughout the year 1999 (see the calendar of landings on the right), it sounds as if the most of the vessels were always consigned by the same Shipping Agency (as it is also the case in Pinang). The broken lines in the Figure 1 on the right were drawn to join two landings defining a single trip (i.e. the vessel was thought not to call to a different port in-between of both landings). A maximum trip length of 45 days was estimated on the basis of the below criteria:

1-. According to the Representative of the Shipping Agency providing the information a longliner uses to stay for two or three days in port, one for the unloading and the other or others for filling the water and fuel tanks, loading the ice and the bait and other operations.

2-. The trip to the fishing grounds use to last four or five days. This relies upon the season for longer trips are usual during the Southeast Monsoon (the longliners operate more to the South).

3-. Trips should not last more than 25 days since the first yellowfin tuna is caught for its flesh usually starts spoiling after that time (being the bigeye tuna more resistant to spoiling).

Therefore, taking into account that only the landing dates are represented in the Figure 1, the trips shown are larger than the real trips which will be reduced of at least 10 to 13 days if the days in port and days of route were removed.

Indeed, after arriving to the fishing grounds one, two or more days could be used in searching operations. The length of the searching will rely upon different factors as the season, the weather, the skills of the skipper, etc.

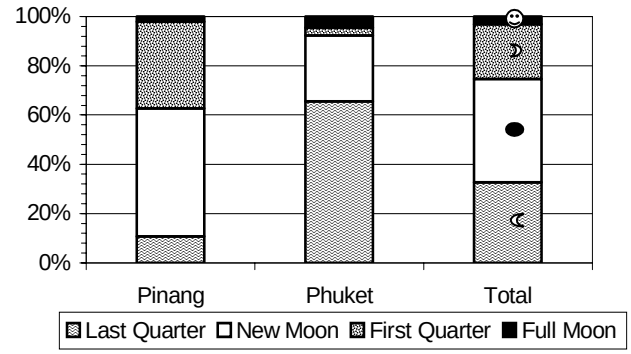


Chart 4: Number of landings by longliners in Phuket and Pinang recorded during 1999 relying upon the moon phase.

	Number			Percentage		
	Pinang	Phuket	Total	Pinang	Phuket	Total
Landings from full moon to last quarter	21	86	107	10.71	65.65	32.72
Landings from last quarter to new moon	102	35	137	52.04	26.72	41.90
Landings from new moon to first quarter	69	4	73	35.20	3.05	22.32
Landings from first quarter to full moon	4	6	10	2.04	4.58	3.06
Total landings	196	131	327	100.00	100.00	100.00

Table 2: Number (and percentage) of landings recorded within the last quarter, new moon, first quarter and full moon weeks during 1999 for the longliners landing to the processing plants in Phuket and Pinang.

The fourteen vessels consigned by the Shipping Agency in Phuket were all using this port while they were in the Indian Ocean being also all consigned by that Agency throughout such period.

Only four vessels out of the fourteen kept using this port during the Southeast Monsoon season.

2. Pinang (Malaysia)

The Table 3 shows the number of vessels operating, the number of landings monitored, the total number of specimens which weight was recorded in the landing sheets and the total weight (processed weight) of those specimens in the landing sheets provided by the representative of the Shipping Agency in Pinang.

As it was mentioned before three or more sheets were completed in each landing, two recording the Export (one for the yellowfin tuna and the other for the bigeye tuna and billfish specimens) and the third the Reject (all species combined). The three last columns to the right of the Table show the number of landings which all sheets were retrieved, the number of specimens recorded and the total weight (processed) of those specimens.

All landings which the three sheets were not present were considered as incomplete. Therefore, 71 out of the 206 landings lacked of one or more sheets. It is possible that some landings considered as incomplete were in fat complete (i.e. landings which all specimens were graded as reject), but this is not thought to have happened many times.

Month	Number of Vessels Operating	Number of Landings monitored	Total number of specimens measured	Total catch monitored (kg)	Complete Landings	Number of specimens in complete Landings	Catch in complete Landings (kg)
January	22	32	2,541	101,056	29	2,322	93,064
February	19	25	2,962	118,749	25	2,962	118,749
March	22	28	1,008	35,972	1	52	1,908
April	20	21	653	19,955	1	10	296
May	19	19	1,744	64,048	10	1,316	48,221
June	18	18	2,069	81,339	14	1,747	68,708
July	16	17	3,101	120,101	15	2,889	112,508
August	14	14	2,101	76,083	14	2,101	76,083
September	11	11	1,222	39,603	10	1,183	38,627
October	8	8	1,285	46,771	8	1,285	46,771
November	10	10	1,379	54,162	5	1,217	47,721
December	3	3	815	34,203	3	815	34,203
Total 1999	27	206	20,880	792,042	135	17,899	686,859

Table 3: Number of vessels and number of landings which one or more landing sheets were retrieved (Number of landings monitored) versus the number of landings which the landing sheets were fully retrieved (Complete landings) during 1999 in Pulau Pinang and total number of specimens weighed and total weight (processed weight) recorded per month versus the number of specimens weighed and total weight monitored in the Complete landings. An estimate of the mean number of fishing days per month and trip is also shown in the right column.

Also worth of mention is the low number of complete landings during March and April which only the Reject sheets were retrieved for the most of the landings. The total number of landings recorded from October to December is also low if compared with the January to March values (months where the activity is usually high). This is probably due to a lack of landing sheets for some vessels during those months.

All this lacking information will be partially or totally retrieved on next visits to Pinang.

206 (135 complete) landing sheets were retrieved out of the 27 vessels monitored in Pinang throughout 1999. These sheets recorded individual weights for a total of 20,880 (17,899) tuna and tuna-like specimens, amounting the total weight of the specimens to 792,042 kg

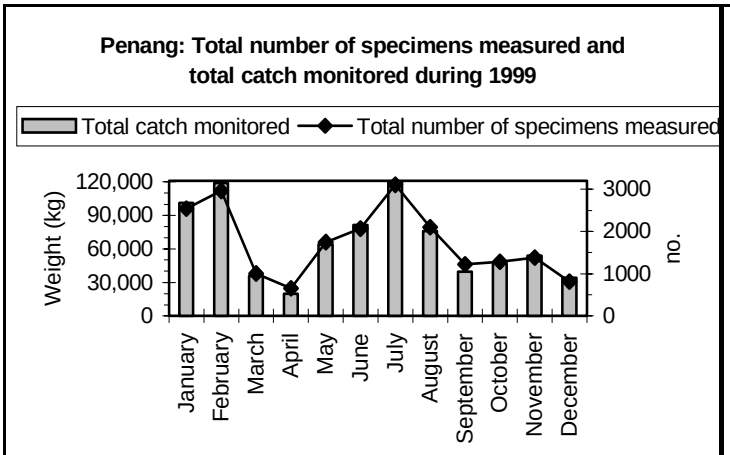


Chart 5: Total number of specimens measured and total weight monitored in Pinang during 1999.

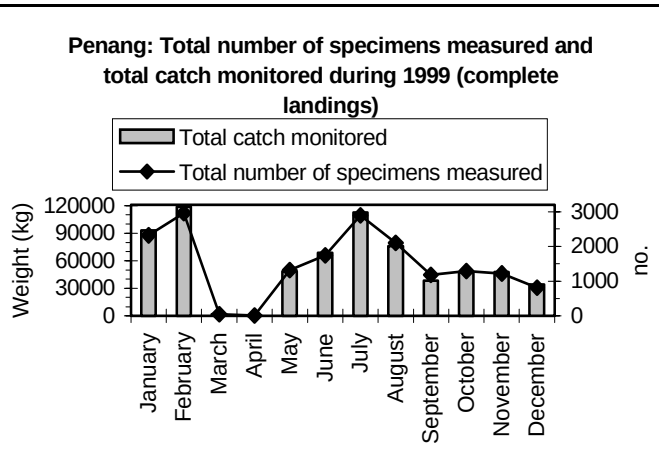


Chart 6: Number of specimens measured and weight monitored in Pinang during 1999 in landings which the three landing sheets were retrieved (complete landings).

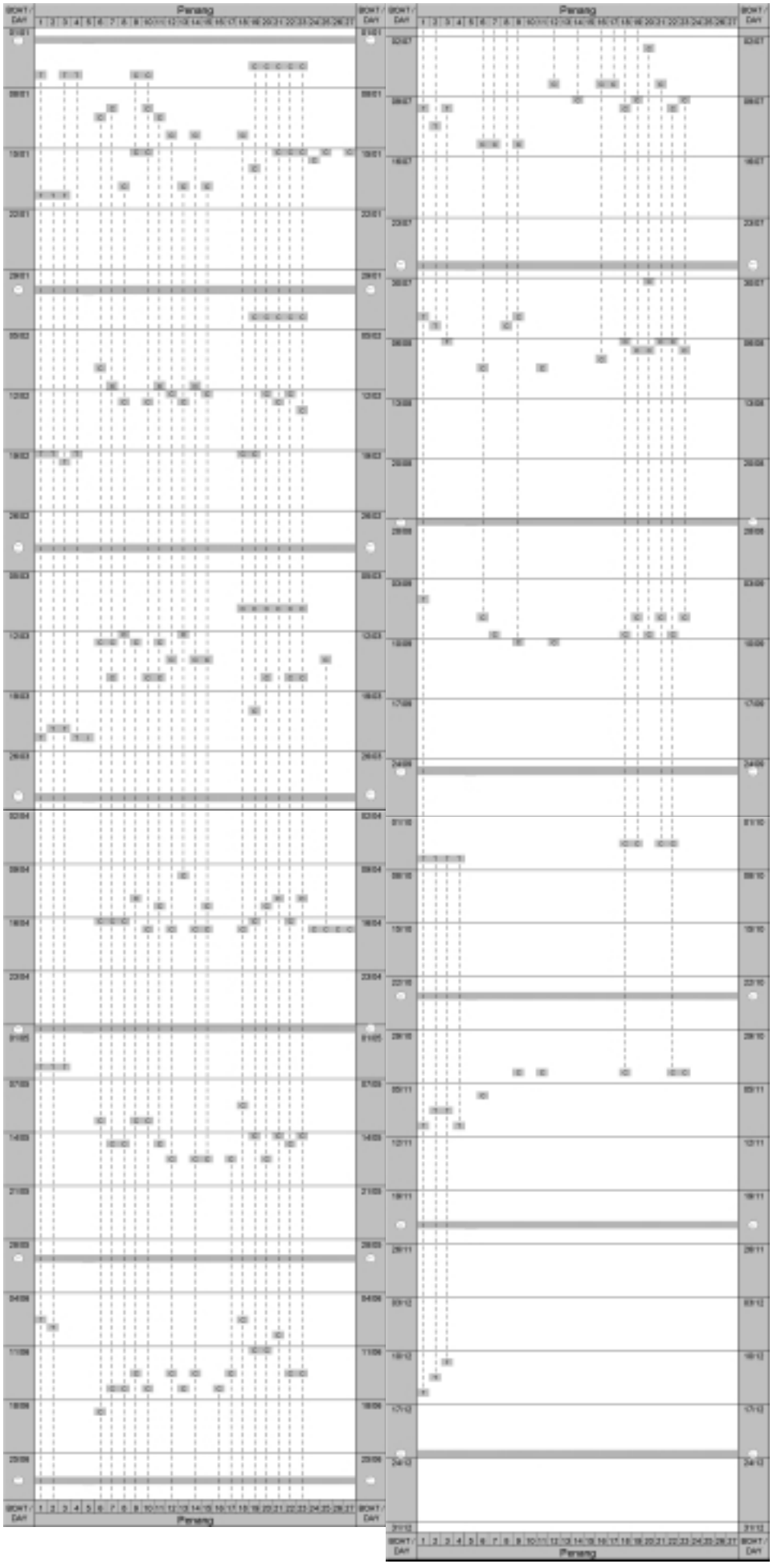


Figure 2 (left)**:** Calendar of landings for the 27 longliners consigned by the Shipping Agency providing the data in Pinang.

Legend:

 Full moon

C Landing of Chinese longliner

T Landing of Taiwanese longliner

I Landing of Indonesian longliner

Broken lines are drawn when no landings in between of the two joined were supposed to occur (consecutive landing dates separated no more than 45 days one another).

(processed weight; 686,859 in complete landings). The vessels dealt by the company were 4 Taiwanese, 22 Chinese and 1 Indonesian.

The total number of specimens and catch monitored in Pinang during 1999 is shown in the Charts 5 (total) and 6 (complete).

The decreasing trend in the number of landings monitored in Pinang from January to December 1999 was due to the lack of landing sheets for some vessels unloading during the last three months of the year, not to a lesser activity.

The Figure 2 is equivalent to the Figure 1, recording the landing dates for the 27 longliners dealt by the Shipping Agency in Pinang

during 1999. More landings were recorded in Pinang than in Phuket during the Southeast Monsoon which could be a consequence of more vessels staying in the Indian Ocean during those months or to a vessels operating half the year in the Indian Ocean and half in the Pacific ocean but always using Pinang as port of landing. Although the second is less likely to have happened (according to the representative of the Shipping Agency all catches landed were from the Indian Ocean) the reason why the fleets unloading to Phuket and Pinang operate differently is not known.

As regards the landing pattern (see the Table 2 and the Chart 4) the longliners based in Pinang operate in the same way than those in Phuket with the most of the landings occurring in weeks other than the week between the first quarter and the full moon (which only the 2% of the landings were recorded in that week).

In spite of the lack of landings for the second semester of the year it can be said that, as in Phuket, the most of the vessels used to be consigned by the same Company. No landings of longliners based in Pinang were found to occur in Phuket and *vice versa*.

SPECIES BREAKDOWN

A/ Breakdown by Species Per Month

The charts 7 and 8 below show the total landings per species and month monitored in Phuket and Pinang during the year 1999. Only the landings which all sheets were retrieved were used in case of Pinang. These data are also displayed in the tables 4 and 5.

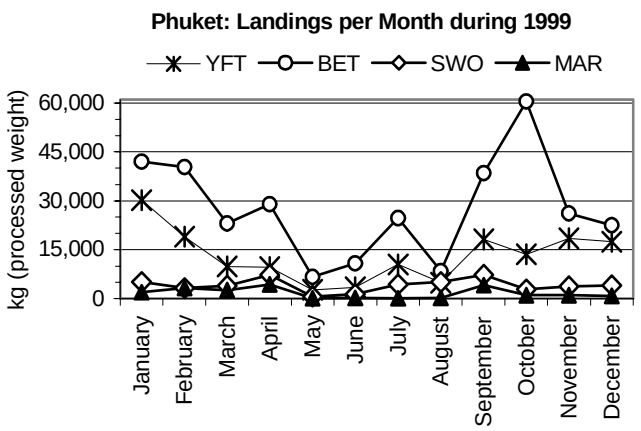


Chart 7: Total landings per species per month monitored in Phuket during 1999.

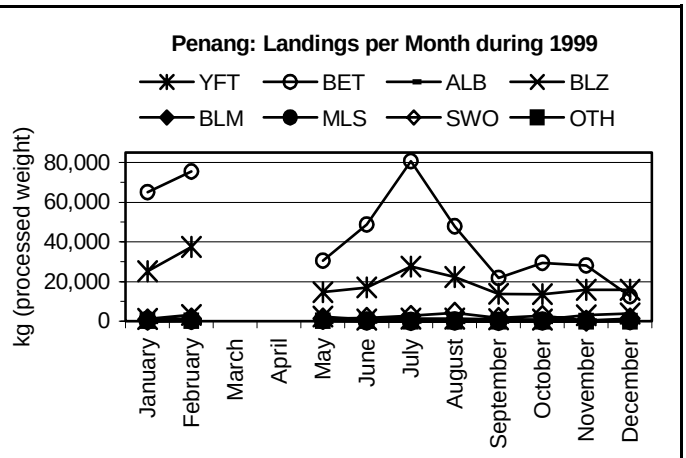


Chart 8: Total landings per species per month monitored in Pinang during 1999 (complete landings only).

The amount of bigeye tuna landed to the shipping agencies which data were monitored were higher both in Phuket and Pinang for the whole period. 332,531 kg (59.5%) out of the 558,859 kg monitored in Phuket and 440,361 kg (64.1%) out of the 686,563 kg monitored in Pinang were of bigeye tuna As regards the yellowfin tuna the landings were of 157,665 kg (28.2%) and 203,280 kg (29.6%) in Phuket and Pinang, respectively.

These results are quite in contradiction with those coming from the four following sources:

1-. Reports by the Andaman Sea Fisheries Development Centre of Phuket (AFDEC) and the Fisheries Research Institute of Pinang (FRI) refer to the yellowfin as the species most landed.

2-. Data reported by the CSIRO regarding the sampling program which this institution monitor in Benoa-Bali showed landings of yellowfin tuna slightly over those of bigeye tuna during the year 1998 (42% of yellowfin tuna versus the 32% of bigeye tuna). It is worth mention that the landings of bigeye tuna have been increasing over the time (e.g. the 26% of the weight in the landings monitored in 1993 were made up by bigeye tuna versus the 62% of yellowfin tuna).

3-. The data officially reported by the Chinese IOTC Liaison Officer regarding the catches by longliners flying the Chinese flag in the Indian Ocean during 1999 show almost equal values for the yellowfin (37.5%) and the bigeye tunas (36.0%). These proportions have been changing over the time since 1995, the first year which the catches were reported. The highest catch of yellowfin tuna was reported in 1998 amounting to the 71.2% of the total (making up the bigeye the 13.2%).

The reason or reasons why these discrepancies occur are not fully understood. However,

1,999	no LAND	YFT	BET	SWO	MAR	TOTAL
January	19	30,153	42,039	5,041	1,992	79,225
February	11	18,936	40,342	3,201	3,236	65,715
March	14	9,870	23,061	3,973	2,621	39,525
April	13	9,649	28,916	7,258	4,361	50,184
May	4	2,646	6,643	649	144	10,082
June	3	3,452	10,777	1,359	182	15,770
July	6	10,471	24,667	4,380	79	39,597
August	4	4,832	8,408	5,073	202	18,515
September	19	18,149	38,461	7,254	4,112	67,976
October	19	13,587	60,493	2,848	1,088	78,016
November	14	18,462	26,186	3,740	999	49,387
December	13	17,458	22,538	4,040	831	44,867
Total	139	157,665	332,531	48,816	19,847	558,859

Table 4: Total landings per month and species monitored in Phuket during the year 1999..

considering that all landings monitored were from only two processing plants it is possible that the species composition in the landings by longliners operating through other agencies were different. This will be assessed once more data be available from the sampling programs.

Other species less important in the landings were the swordfish and other billfish species. The landings of swordfish made up the 8.7% and the 2.7% of the total landings in Phuket and Pinang, respectively. Finally, the marlins made up the 3,6% (Phuket) and 3.4% (Pinang) of the total landings. Therefore, while the marlins share similar values in both ports this is not the case with the swordfish which much higher landings were recorded in Phuket. Regarding the catches of marlins (Pinang) it is the Indo-Pacific blue marlin the species most caught being the striped marlin and the black marlin much less important.

Other species recorded in the sheets (Pinang) as the albacore tuna and others do not appear to be relevant. Nevertheless, it is important to point out that these species (and also the billfish) could be overlooked for they are never or almost never exported. Furthermore, the specimens which do not go through the processing plants are usually not recorded in the landing sheets. This group is made up by several shark species (which either the fins or the carcasses are landed), other tuna or tuna-like species and other fishes.

The proportion of bigeye tuna in the landings varied relying upon the month attaining its highest in October (77.5%) and its lowest in August (45.4%) in Phuket. As regards Pinang the

1,999	no LAND	YFT	BET	ALB	BLZ	BLM	MLS	SWO	OTH	TOTAL
January	29	25,144	65,122	0	1,145	123	494	918	118	93,064
February	25	37,532	75,434	0	3,297	335	595	1,441	115	118,749
March										0
April										0
May	11	14,654	30,517	69	2,465	296	646	1,387	95	50,129
June	14	16,975	48,642	110	933	0	213	1,728	107	68,708
July	15	27,543	80,783	137	1,282	0	70	2,679	14	112,508
August	14	22,362	47,805	68	1,389	0	155	4,304	0	76,083
September	10	13,821	21,826	208	958	0	80	1,689	45	38,627
October	8	13,664	29,488	0	810	0	91	2,685	33	46,771
November	5	15,779	28,183	0	3,010	0	308	360	81	47,721
December	3	15,806	12,561		3,987	169	309	1,310	61	34,203
Total	134	203,280	440,361	592	19,276	923	2,961	18,501	669	686,563

Table 5: Total landings per month and species monitored in Pinang during the year 1999..

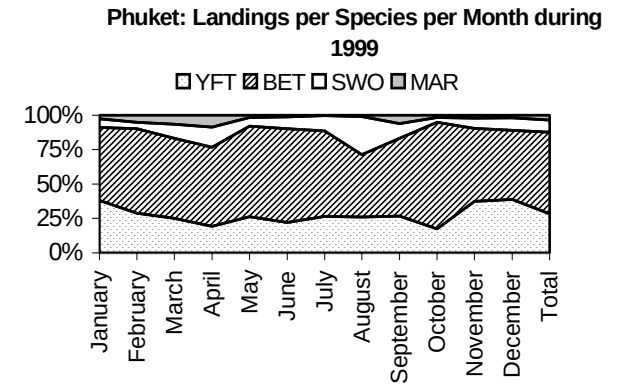


Chart 9: Breakdown by species per month in the landings monitored in Phuket during 1999.

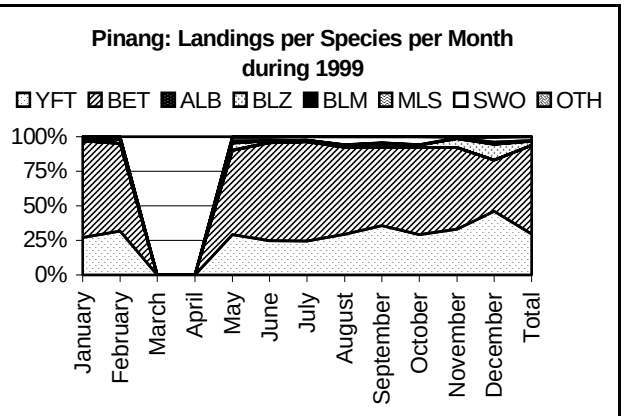


Chart 10: Breakdown by species per month in the landings monitored in Pinang during 1999.

landings of bigeye were highest in July (71.8%) and lowest in December (36.7%). The proportion of yellowfin tuna in the landings was also changing throughout the year with maximum values in December (38.9% in Phuket and 46.2% in Pinang) and minimum in October (Phuket: 17.4%) and July (Pinang: 24.5%).

All other species are also more or less numerous in the landings depending upon the month considered.

Nevertheless, it is important to note that owing to the limited carrying capacity of the boats (usually between 5 t and 15 t) the more the target species (considering as target species the bigeye tuna and the yellowfin tuna) are harvested the more all other species are discarded. This must have a clear effect in the landings of incidental catches over the months. The interviews to skippers currently conducted in some of the ports used by these longliners will possibly help in assessing this issue.

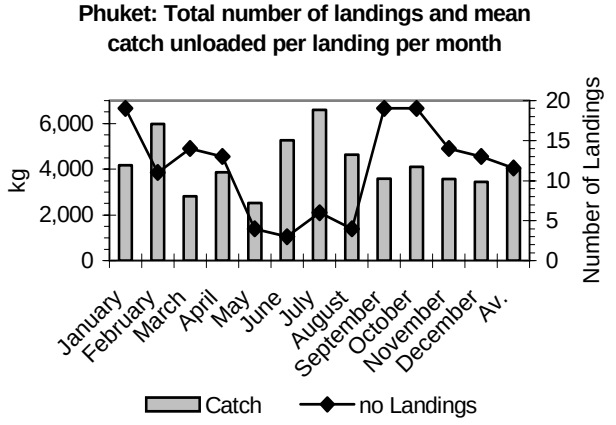


Chart 11: Total number of landings and mean catches unloaded per month in the landings by Chinese longliners monitored in Phuket during 1999.

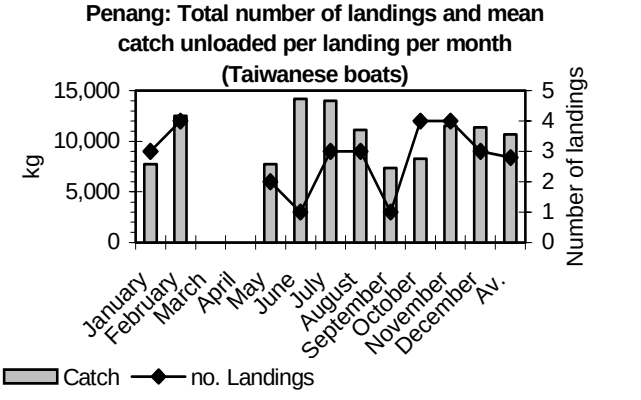


Chart 12: Total number of landings and mean catches unloaded per month in the landings by Taiwanese longliners monitored in Pinang during 1999.

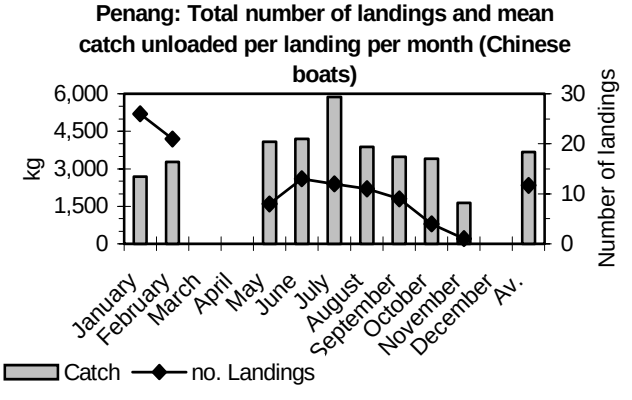


Chart 13: Total number of landings and mean catches unloaded per month in the landings by Chinese longliners monitored in Pinang during 1999.

The charts 11 to 13 show the total number of landings and mean catches unloaded per landing per month during 1999 in Phuket (Chinese longliners) and Pinang (Taiwanese and Chinese longliners). Chinese and Taiwanese longliners were dealt separately owing to the very different values obtained. Thus, while the mean catches unloaded per month by Chinese boats were between the 1.6 t (Pinang, November) and the 6.6 t (Phuket, July), those regarding the Taiwanese vessels were much higher ranging from 7.4 t in September to 14.1 t in June. The mean catches unloaded per boat per landing for the whole period amounted to some 4 t as regards the Chinese boats and 10 t the Taiwanese.

One of the reasons for this difference between the two fleets is the lower carrying capacity of the Chinese boats which only between 100 and 150 specimens can be stored onboard (versus the 400 to 450 pieces stored on Taiwanese longliners).

Nevertheless, and according to the figures 1 and 2 it seems as if the length of the trips by Chinese and Taiwanese longliners were quite similar. Therefore, much better catch rates per trip are attributable to Taiwanese skippers.

The fact that the Chinese skippers have been fishing in the Indian Ocean only since 1995 and that most of them first used a longline in those waters are enough reasons for these very different mean catches per trip.

B/ Breakdown by Species Per Boat

The tables 6 and 7 show the number of landings and catches per species for the longliners which landings were monitored in Phuket and Pinang, respectively. The percentage of the total catch each species made up in the total landings monitored of each longliner is shown in the charts 14 and 15.

The percentage of yellowfin tuna in the landings varied depending upon the boat ranging between the 18.9% and the 42.5% of the total landings in Phuket and between the 15.9% and the 34.5% in Pinang (excluding the boats which only three or less landings were available). As regards the bigeye tuna the figures recorded were ranging from the 47.2% to the 66.2% of the total landings in Phuket and from 58.3% to 80.1% in Pinang.

The four Taiwanese longliners monitored in Pinang shared similar percentages regarding these two species ranging the yellowfin tuna between the 27.1% and the 32.6% of the total catches and the bigeye tuna between the 58.3% and 62.6%.

Nevertheless, taking into account that all boats did not operate in the same way (see figures 1 and 2) not keeping using the same port for landing throughout the year but in three or four cases, these results could be much affected by the seasonality. However, when only the landings of vessels operating during given periods are considered, the results obtained are not really different:

1-. Landings of longliners in Phuket from January to March and from September to November (14 boats): the values ranged between the 18.3% and the 51.2% for the yellowfin tuna and between the 37.2% and the 68.7% for the bigeye tuna.

2-. Landings of Chinese longliners in Pinang from January to February and from May to September (6 boats, no. 18 to 23 in figure 2): the yellowfin tuna made up between the 31.1% and the 34.7% while the bigeye ranged from the 63.0% and the 67.3% of the total landings for the six boats considered.

Therefore, although the bigeye tuna was in all cases (vessels landing four or more times during the year) the species most caught, its proportion in the landings varied relying upon the boat considered. It is important to note that this variability among the boats seems not to rely upon the shipping agency they belong to.

The number of landings monitored and the mean landings recorded per boat during the year 1999 in Phuket and Pinang is displayed in the charts 16 and 17, respectively.

The mean landing obtained for the whole Chinese longliners monitored in Phuket was 4,024 tonnes. This value varied among the vessels ranging from 3,051 to 5,141 tonnes.

As regards the longliners monitored in Pinang it is important to note the clear difference in the mean landings of Taiwanese and Chinese vessels. While the Chinese longliners averaged out at 3,638 tonnes per landing, the mean landing obtained for the Taiwanese boats was much higher, amounting to 10,681 tonnes (see also the charts 12 and 13).

LL FLAG	no LAND	YFT	BET	SWO	MAR	TOTAL
1 CHN	13	17,043	36,647	6,342	693	60,725
2 CHN	13	14,274	25,513	6,962	755	47,504
3 CHN	10	11,005	18,219	2,436	1,267	32,927
4 CHN	12	10,263	29,271	3,739	940	44,213
5 CHN	11	13,737	31,655	4,151	1,506	51,049
6 CHN	8	9,160	26,636	2,970	2,362	41,128
7 CHN	8	10,261	18,552	3,439	825	33,077
8 CHN	9	9,522	15,838	1,549	553	27,462
9 CHN	10	13,818	15,351	2,090	1,275	32,534
10 CHN	9	12,616	19,844	4,432	2,556	39,448
11 CHN	9	9,321	25,105	2,546	1,601	38,573
12 CHN	9	7,366	25,567	3,530	2,502	38,965
13 CHN	9	8,330	23,814	2,282	1,739	36,165
14 CHN	9	10,949	21,051	2,348	1,273	35,621
TOTAL	139	157,665	332,531	48,816	19,847	558,859

Table 6: Total number of landings and total weights landed per species and total for the 14 longliners monitored in Phuket during the year 1999.

It has to be noted also that the mean catches recorded reflect only the fish that went through the processing plants their weights being recorded in the landing sheets completed by the shipping agencies' staff. Although this is the way the most of the catch is unloaded, some specimens of sharks and other species (wahoo, short-billed spearfish, Indo-Pacific sailfish, etc.) could have been overlooked for they being sold by the crewmembers out of the plants. The importance of these species in the landings would be as-

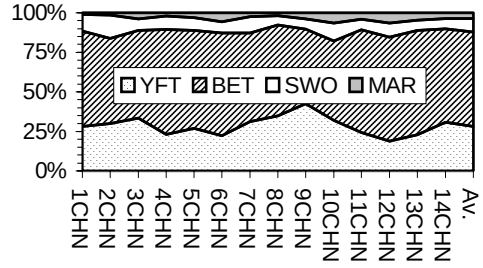


Chart 14: Breakdown by species per boat in the landings monitored in Phuket during 1999.

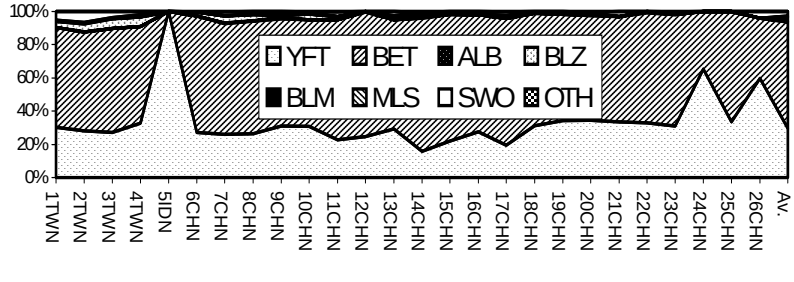


Chart 15: Breakdown by species per boat in the landings monitored in Pinang during 1999.

sessed once more data from the field (sampling programs) be available.

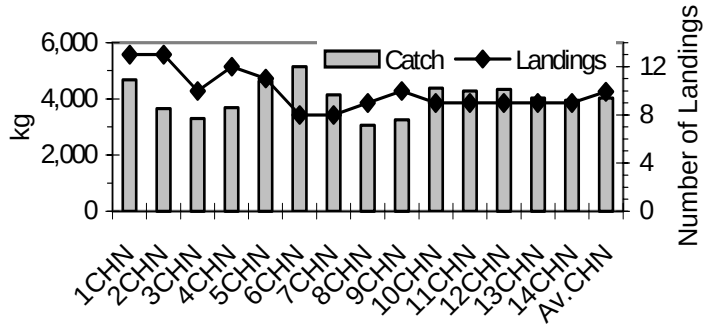


Chart 16: Total number of landings and mean catches unloaded per boat in the landings monitored in Phuket during 1999.

LL FLAG	no LAND	YFT	BET	ALB	BLZ	BLM	MLS	SWO	OTH	TOTAL
1 TWN	10	35,373	70,180		4,129	274	763	6,024	122	116,865
2 TWN	7	18,243	38,389		3,173	270	398	4,135	35	64,643
3 TWN	7	21,456	49,578		4,507	194	534	2,875	26	79,170
4 TWN	4	12,526	22,397		2,233		463	768		38,387
5 IDN	1	1,908								1,908
6 CHN	7	8,422	21,595		744		90		53	30,904
7 CHN	5	6,094	15,742	20	1,025		82	499	66	23,528
8 CHN	5	5,224	13,475	21	703	65		356		19,844
9 CHN	7	8,693	18,055	232	386		235	394	10	28,005
10 CHN	6	5,967	12,445		665		147	108	37	19,369
11 CHN	4	2,985	9,520		271			367	33	13,176
12 CHN	3	2,628	7,998	46						10,672
13 CHN	3	2,772	6,285		182		36	251		9,526
14 CHN	4	2,266	11,427	45	316	48	48	44	71	14,265
15 CHN	2	1,044	3,662					80		4,786
16 CHN	3	3,655	9,425				40	215		13,335
17 CHN	2	1,712	6,691		112		48	195	20	8,778
18 CHN	9	12,164	26,235	51	327			70	23	38,870
19 CHN	8	8,524	15,829		159			283	9	24,804
20 CHN	6	7,091	12,930	68	97	72		187	82	20,527
21 CHN	10	13,268	25,068		45			1,156		39,537
22 CHN	9	8,931	17,943	64	101				33	27,072
23 CHN	9	11,420	24,632	45	101		77	450	49	36,774
24 CHN	1	49	26							75
25 CHN	1	226	448							674
26 CHN	1	639	386					44		1,069
TOTAL	134	203,280	440,361	592	19,276	923	2,961	18,501	669	686,563

Table 7: Total number of landings and total weights landed per species and total for the 26 longliners monitored in Pinang during the year 1999.

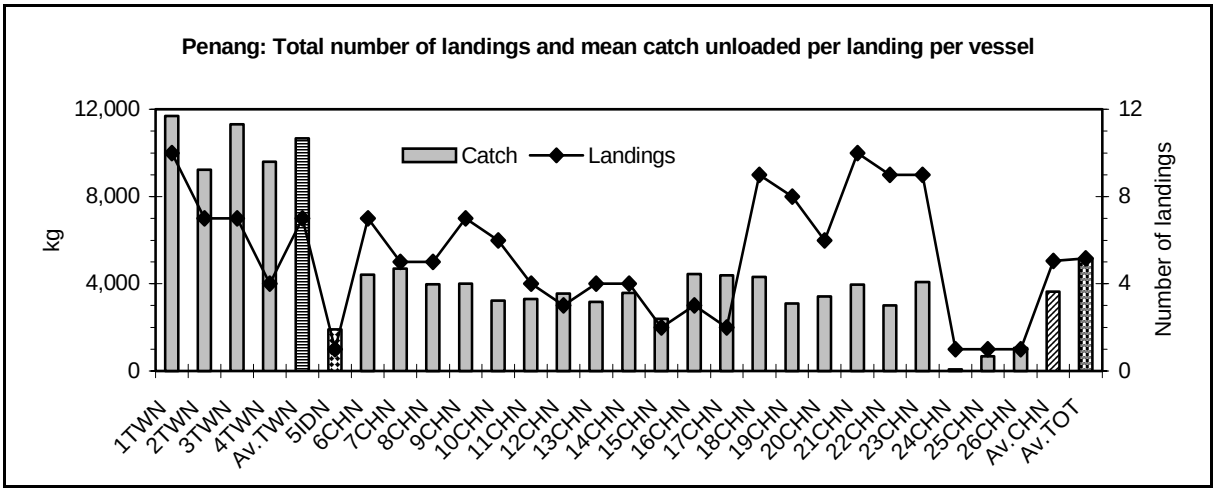


Chart 17: Total number of landings and mean catches unloaded per boat in the landings monitored in Pinang during 1999.

C/ Breakdown by Species Per Landing

The charts 18 to 20 show the breakdown by species per individual landing obtained from the landing sheets of Chinese (charts 18 and 19) and Taiwanese (chart 20) longliners monitored during 1999. A high variability inter landings was observed. This variability seems not to be related with a particular season or month, for the landings in the charts were sorted chronologically, but to happen in a really short term.

Although the Taiwanese vessels showed less variability a similar pattern can be assumed from the chart.

The more or less catchability of the bigeye tuna relying upon the phase of the moon could partially, if not fully, explain why these changes in the species composition of the catch among landings happening in so short time span.

However, as no individual information on the trips is available yet and taking into account that this changes could be also related to other factors as the gear (e.g. the use of more or less hooks per basket) and fishing grounds exploited, this variability cannot be assessed

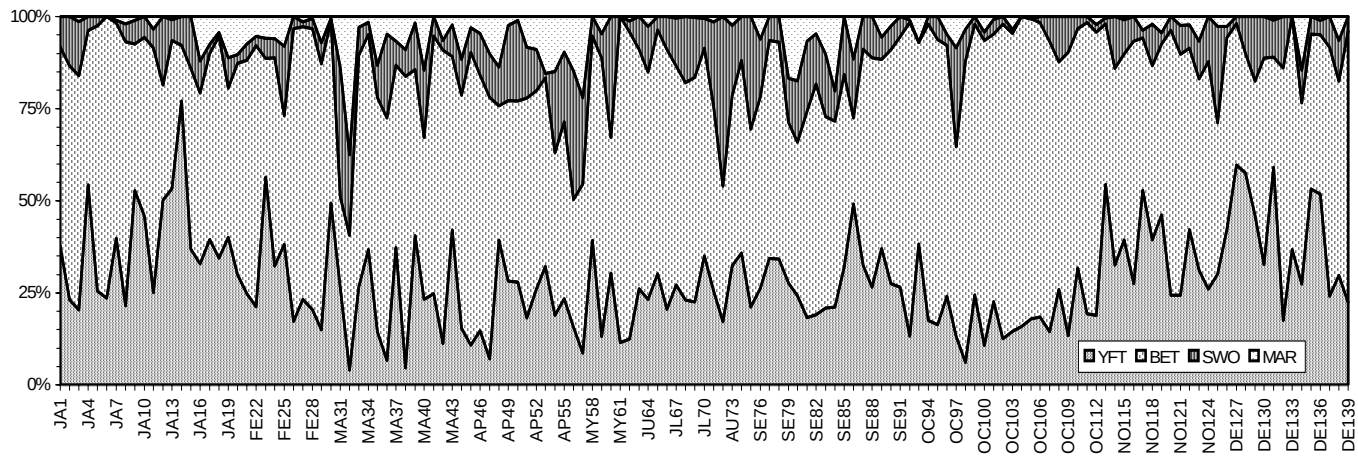


Chart 18: Breakdown by species per individual landing for the Chinese longliners monitored in Phuket during 1999.

JA1: Landing 1, January; JA2: Landing 2, January; JU61: Landing 61, June, etc.)

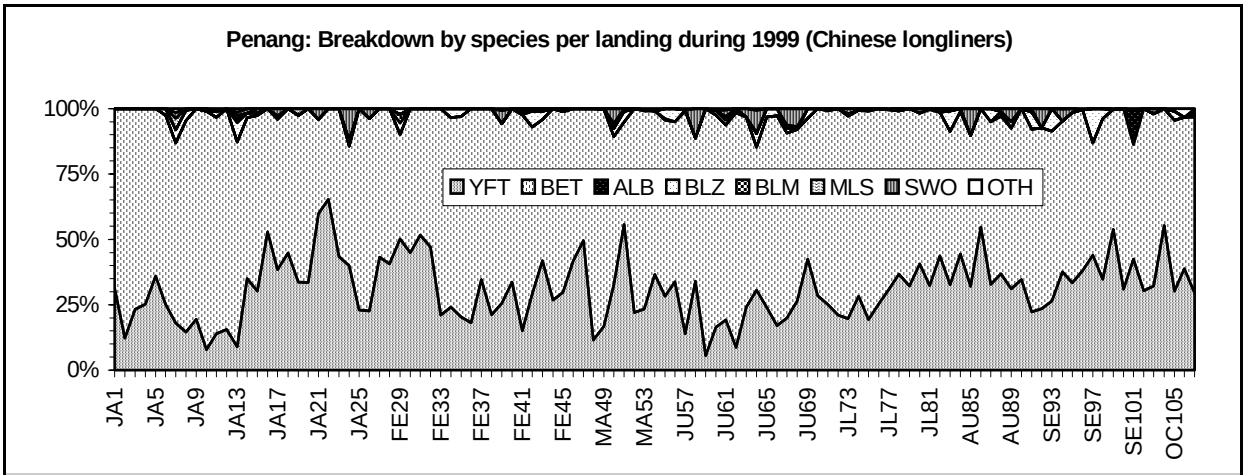


Chart 19: Breakdown by species per individual landing for the Chinese longliners monitored in Pinang during 1999.

JA1: Landing 1, January; JA2: Landing 2, January; JU61: Landing 61, June, etc.)

since more interviews to the fishing masters be conducted in the ports of landing of these boats.

It is also worth mention the higher proportion of Swordfish in the catches of Chinese longliners unloading in Phuket in relation to those unloading in Pinang (irrespective of the flag). The harvesting of this and other related species (billfish) could rely upon the shipping agency which the boat is dealing with and/or with the port of landing since these species are usually rejected and not easily marketed everywhere.

The charts 21 and 22 show the total weights unloaded in each of the landings which landing sheets were retrieved in Phuket and Pinang, respectively.

The difference between Taiwanese and Chinese longliners is clear. While the landings of Taiwanese longliners were in almost all cases over the 5 tonnes, those of Chinese longliners were seldom over that value both in Phuket and Pinang.

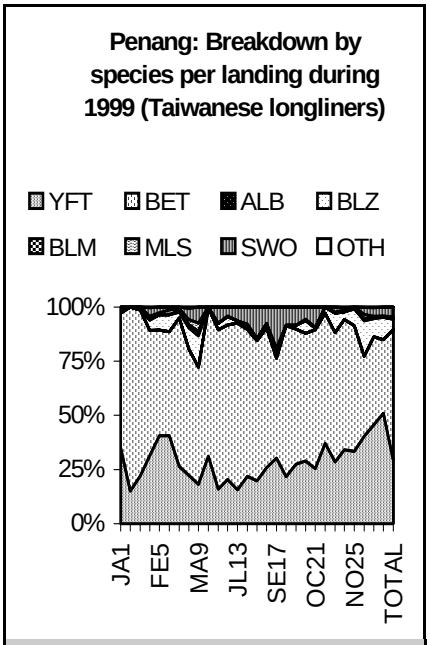


Chart 20: Breakdown by species per individual landing for the Taiwanese longliners monitored in Pinang during 1999.

JA1: Landing 1, January; JU61: Landing 61, June, etc.)

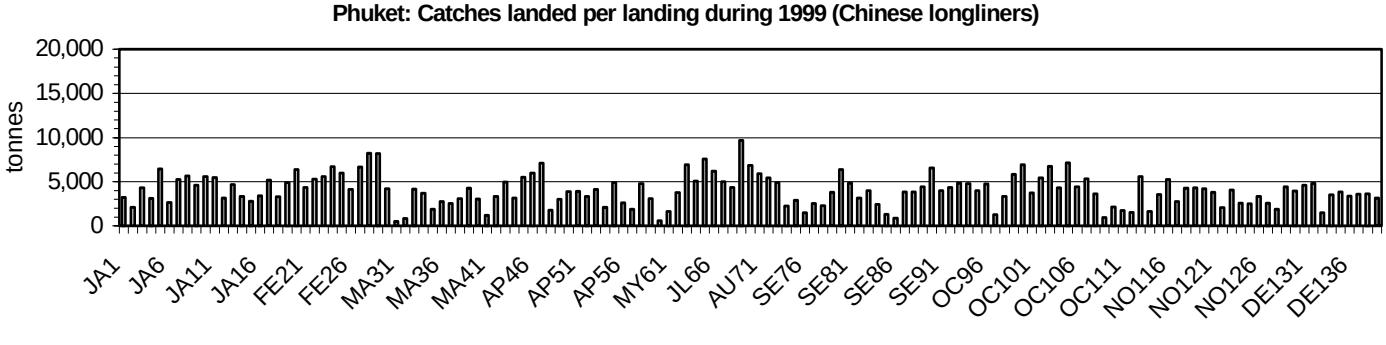


Chart 21: Weights unloaded per landing during 1999 for the Chinese longliners monitored in Phuket.

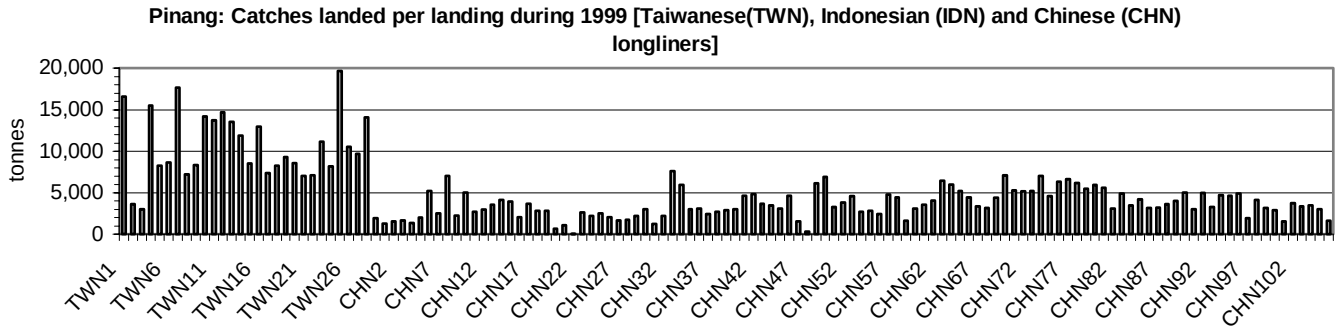


Chart 22: Weights unloaded per landing during 1999 for the Taiwanese (TWN1 to TWN28), Indonesian (IDN1) and Chinese (CHN1 to CHN106) longliners monitored in Pinang.

DESTINATION

All fish going through the processing plants are graded and either packed and air freighted to Japan (seldom to USA) or sold to local buyers. Those tunas, swordfish and marlins sashimi graded are exported (Export) while those rejected as sashimi (Reject) are put aside to be sold locally.

This Export and Reject categories does not usually include all other specimens in the catch, which are not graded, as some tuna and billfish species (skipjack, Indo-Pacific Sailfish and short-billed spearfish), sharks (either fins or trunks of some species, especially thresher sharks, hammer sharks, silky shark, oceanic whitetip shark and other Lamnidae and Carcharhinidae) and other fishes (wahoo, barracuda, etc.).

As only the fish which are thought potentially good for the sashimi market go through the processing plants, most of them are finally exported. The charts 23 to 25 show the percentage of the weight exported and rejected per month for the landings monitored in Phuket (Chinese longliners) and Pinang (Chinese and Taiwanese longliners) during 1999.

Around the 75% of the fish undergoing grading was exported both in Phuket and Pinang. This percentage did not vary a lot among the fleets or within the year being slightly above or below that value depending upon the month considered. September was the only month recording more rejects than exports in Pinang regarding the landings of Chinese longliners.

The amounts exported and rejected were different relying upon the species considered. The charts 26 to 37 show the percentage of the weight which is exported versus that rejected for the species more important in the catch, namely the yellowfin and bigeye tunas, swordfish and marlins (including Indo-Pacific blue marlin, striped marlin and black marlin).

Exports of yellowfin tuna amounted to some 70 to 75% of the total weight unloaded for this species while the bigeye tuna were al-

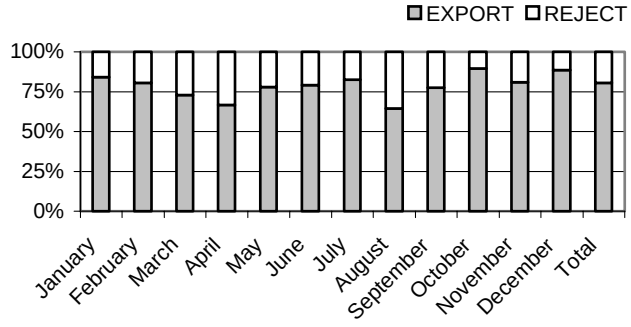


Chart 23: Destination of the fish unloaded per month for the landings monitored in Phuket during 1999 (all species combined).

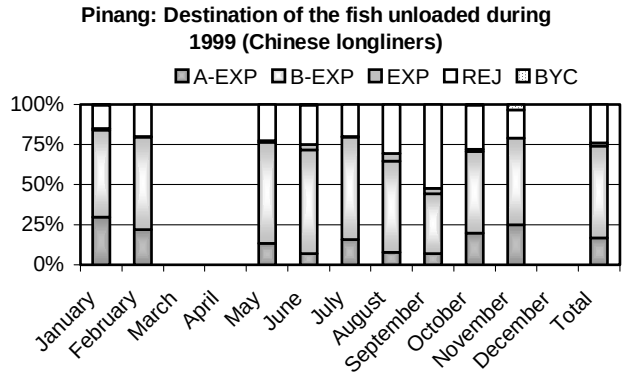


Chart 24: Destination of the fish unloaded per month for the landings of Chinese longliners monitored in Pinang during 1999 (all species combined).

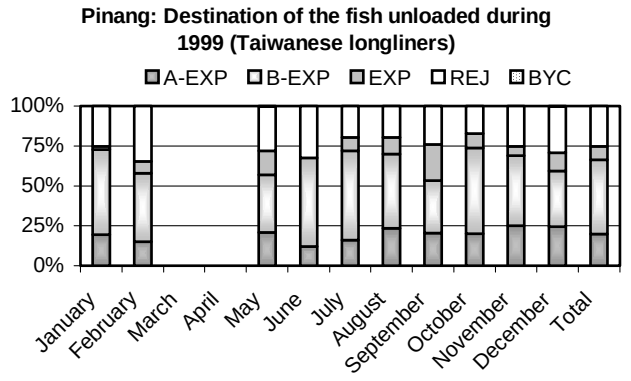


Chart 25: Destination of the fish unloaded per month for the landings of Taiwanese longliners monitored in Pinang during 1999 (all species combined).

most fully exported, accounting for 80 to 90% of the total weight.

The amounts exported in Phuket for these two species were slightly over those in Pinang.

Swordfish and marlins showed really different values in Phuket and Pinang. While these species were almost fully rejected in Phuket, which less than the 5% of the total landings were exported, this was not the case in Pinang where more than the 60% were exported.

The reason for this difference is not fully understood although it could be related with the market in Japan each agency uses to deal with.

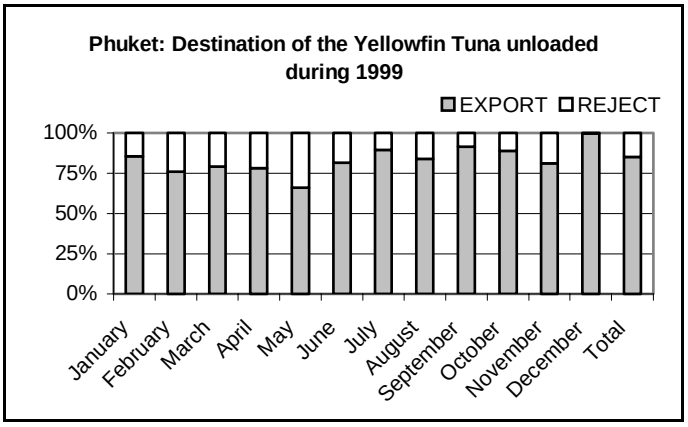
It is also possible that part of the export of swordfish and marlins in Pinang remain in Singapore for the fish go usually through the airport in this country.

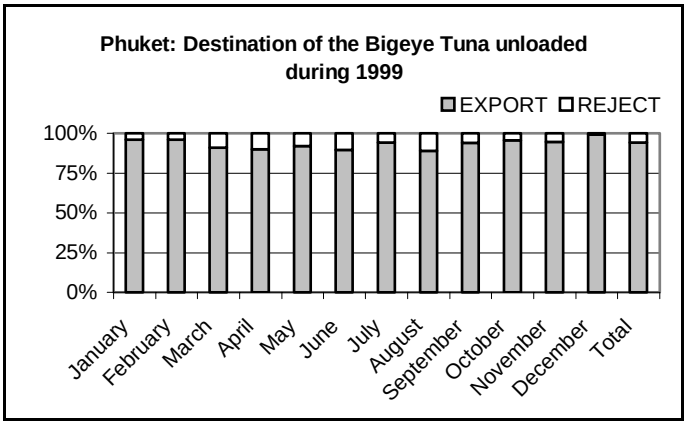
Whatever be the reason for this difference what is clear is the changing amounts of swordfish and marlins exported and rejected relying upon the months. It seems as if the market for these species were much less stable than that dealing with yellowfin and bigeye tunas.

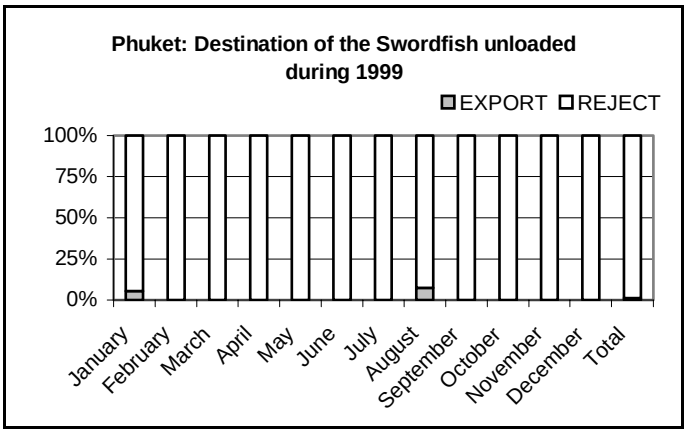
The charts 38 to 40 show the percentage the weight of each species makes up relying upon the total weight exported, rejected and total.

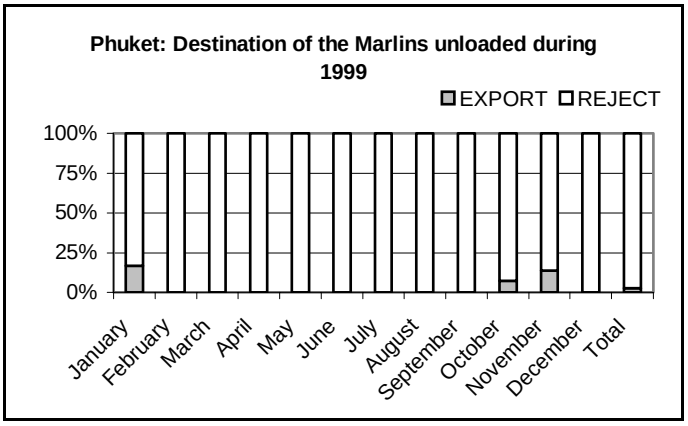
The share of the export each tuna species made up was similar in Phuket and Pinang (both fleets). Yellowfin and bigeye tunas accounted for the 30% and the 70% of the export, respectively.

Other species exported as swordfish and marlins accounted for only a small proportion of the exports, especially in Phuket, where almost all specimens were rejected. The highest

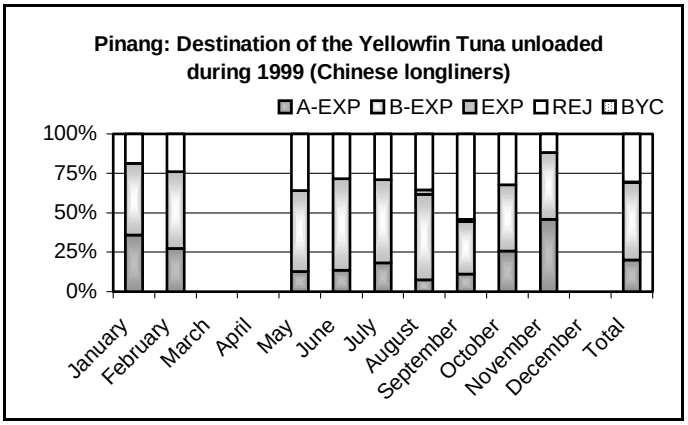


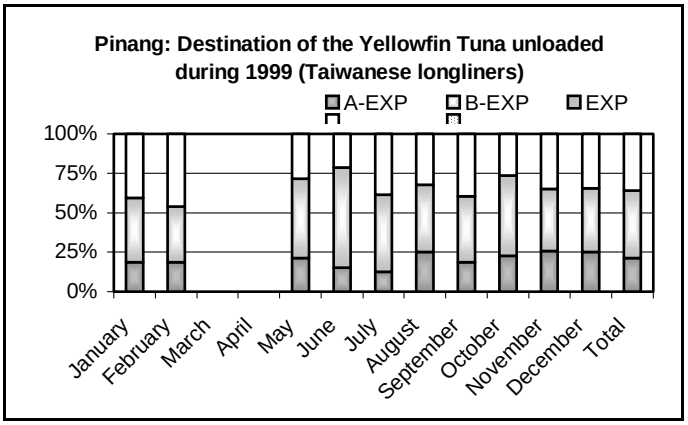


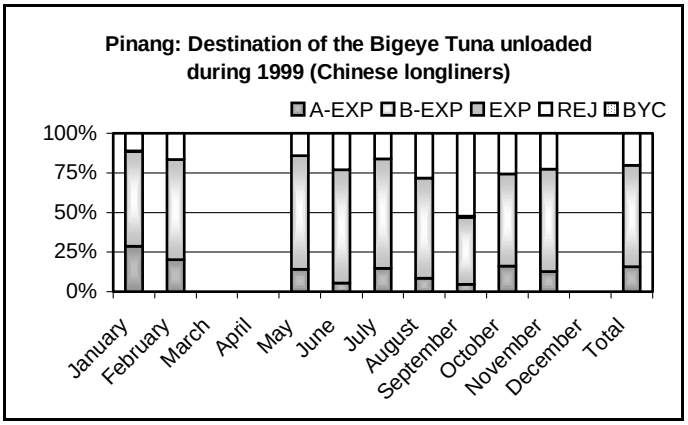


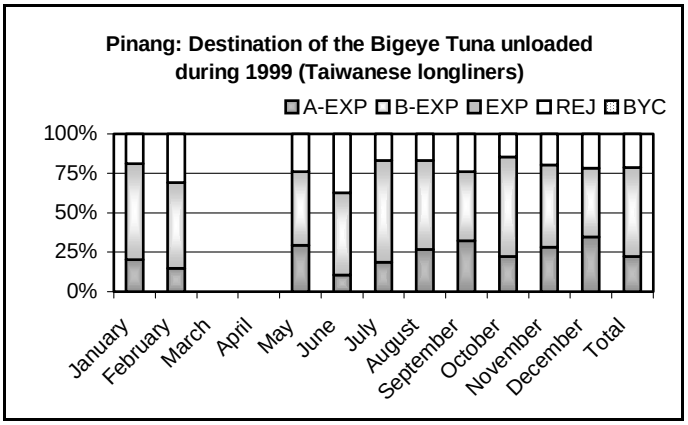


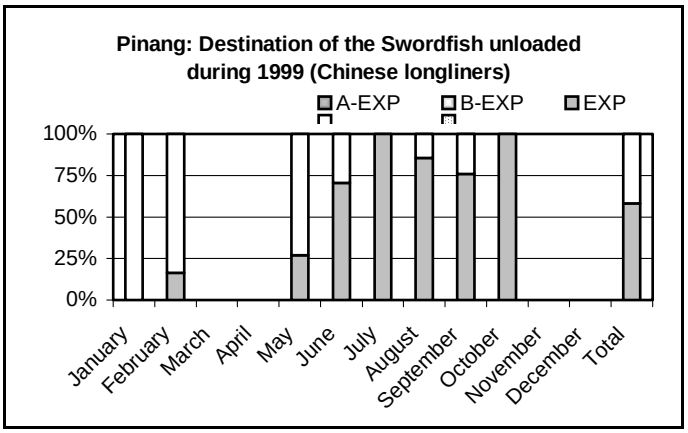
Charts 26-29: Destination of the tuna (yellowfin and bigeye tunas), swordfish and marlins unloaded per month for the landings monitored in Phuket during 1999.

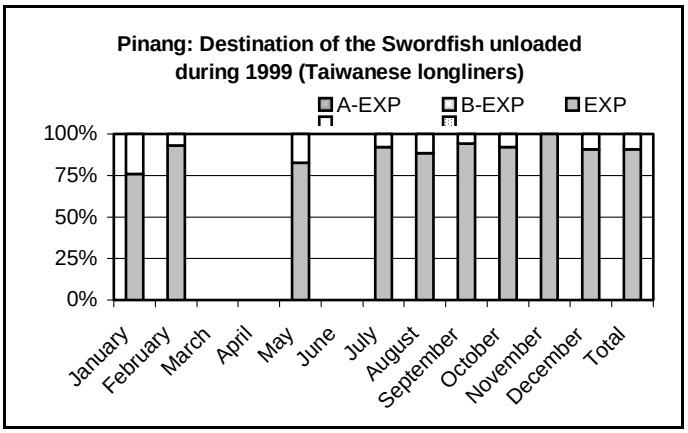


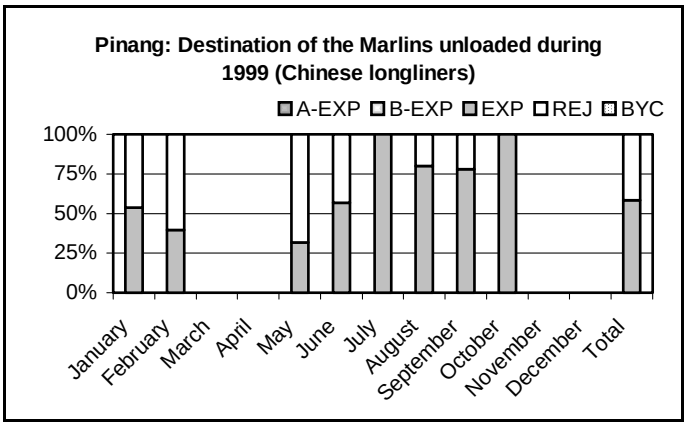


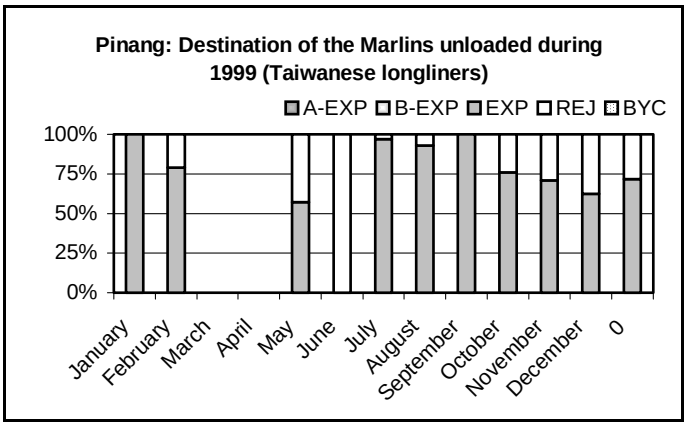












Charts 30-33: Destination of the tuna (yellowfin and bigeye tunas), swordfish and marlins unloaded per month for the landings of Chinese longliners monitored in Pinang during 1999.

Charts 34-37: Destination of the tuna (yellowfin and bigeye tunas), swordfish and marlins unloaded per month for the landings of Taiwanese longliners monitored in Pinang during 1999.

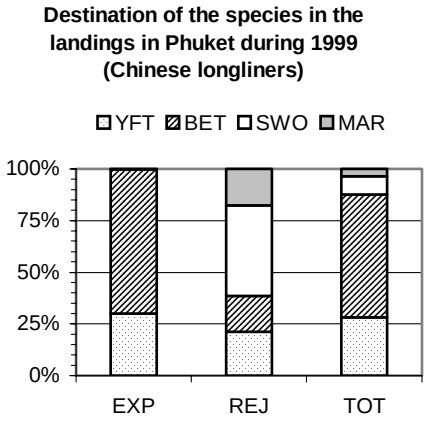


Chart 38: Breakdown .by species according to the destination of the fish for the landings monitored in Phuket during 1999.

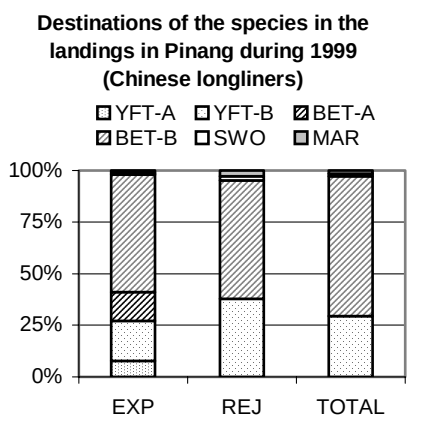


Chart 39: Breakdown .by species according to the destination of the fish for the landings of Taiwanese longliners monitored in Pinang during 1999.

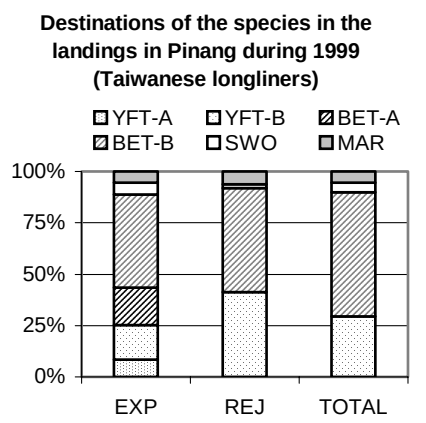


Chart 40: Breakdown .by species according to the destination of the fish for the landings of Chinese longliners monitored in Pinang during 1999.

export of swordfish and marlins occurred in Pinang (Taiwanese longliners) where these species accounted for some 10% of the total exports.

Regarding the rejects, Swordfish and marlins accounted for more than half the weight in Phuket attaining only the 10% in Pinang. The higher landings of swordfish and marlins in Phuket than in Pinang, the fact that these species were almost fully rejected in Phuket and the lesser amount of tunas rejected in Phuket are the reasons for this difference.

The charts 41 and 42 show the percentage of the weight exported versus that rejected per longliner in the landings monitored in Phuket and Pinang, respectively. Besides the Indonesian longliner unloading in Pinang, which a single landing was monitored, the amounts exported and rejected for all other boats are not considerably different ranging the export from 70 to 80% of the total landings.

These same percentages are shown in the charts 43 (Phuket) and 44 (Pinang) where each landing is displayed individually.

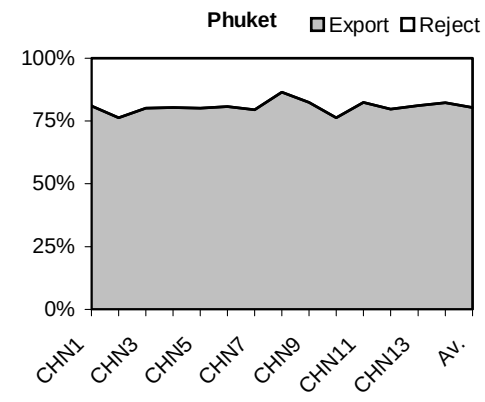


Chart 41: Percentage of the weight which the exports and the rejects made up in the landings of longline boats monitored in Phuket during 1999.

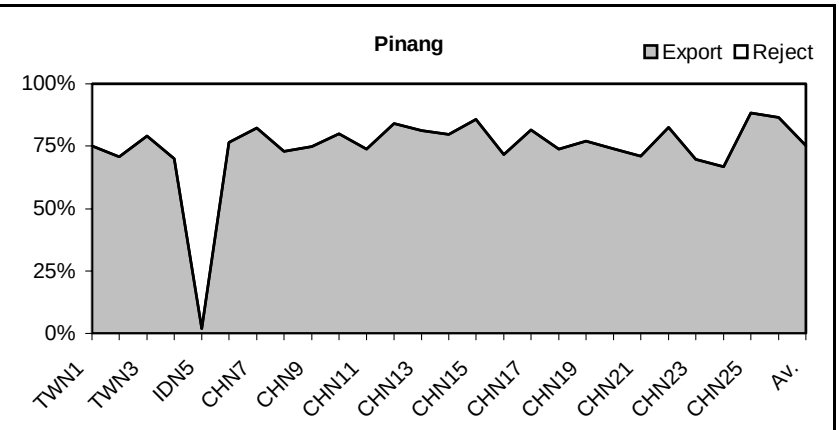


Chart 42: Percentage of the weight which the exports and the rejects made up in the landings of longline boats monitored in Pinang during 1999.

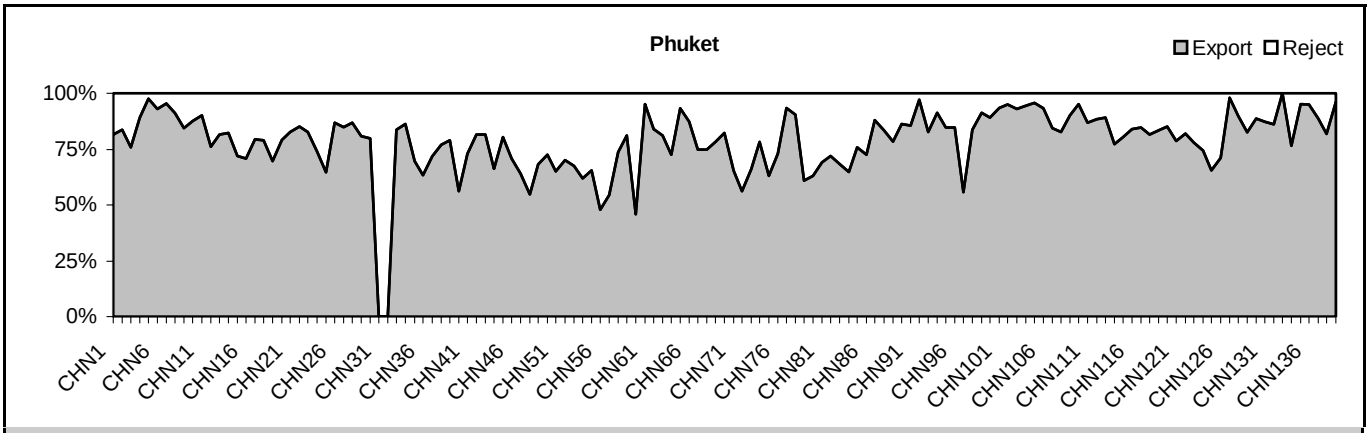


Chart 43: Percentage of the weight which the exports and the rejects made up in each landing monitored in Phuket during 1999.

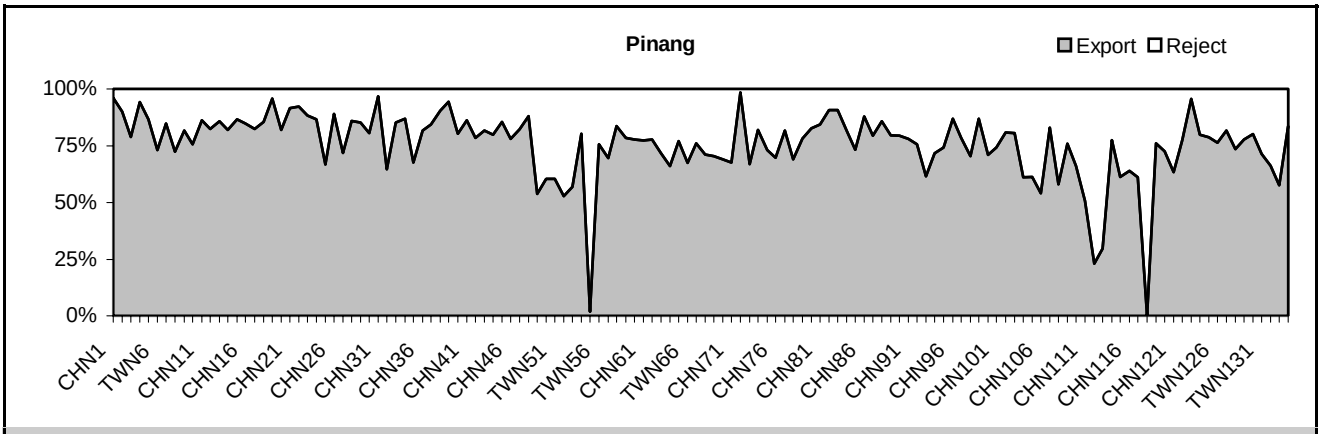


Chart 44: Percentage of the weight which the exports and the rejects made up in each landing monitored in Pinang during 1999.

MEAN WEIGHTS AND SIZE DISTRIBUTION OF THE SPECIES IN THE LANDINGS

The total number of specimens recorded on the landing sheets and the weights corresponding to these specimens per species and month for the landings monitored in Phuket and Pinang are shown in the Table 8.

The charts 45 to 54 show the trends of the mean weights for the species in the table 8 along 1999 according to the destination of the specimens and all together.

It is important to note that the weights of yellowfin and bigeye tunas represented correspond to processed weights from specimens gilled and gutted on the contrary of those concerning the albacore tuna which the round weights are displayed. Swordfish and mar-

PHUKET	Yellowfin tuna		Bigeye tuna				Swordfish		Marlins					
	no.	kg	no.	kg			no.	kg	no.	kg				
January	748	30,153	992	42,039			105	5,041	36	1,992				
February	469	18,936	942	40,342			71	3,201	65	3,236				
March	238	9,870	493	23,061			104	3,973	46	2,621				
April	241	9,649	756	28,916			148	7,258	105	4,361				
May	86	2,646	178	6,643			20	649	3	144				
June	90	3,452	259	10,777			39	1,359	6	182				
July	282	10,471	623	24,667			92	4,380	3	79				
August	145	4,832	237	8,408			109	5,073	6	202				
September	501	18,149	1,100	38,461			181	7,254	72	4,112				
October	359	13,587	1,489	60,493			62	2,848	23	1,088				
November	448	18,462	593	26,186			76	3,740	21	999				
December	450	17,458	421	22,538			79	4,040	16	831				
Total	4,057	157,665	8,083	332,531			1,086	48,816	402	19,847				
PINANG	Yellowfin tuna		Bigeye tuna		Albacore tuna		Swordfish		IP blue marlin		Black marlin		Striped marlin	
	no.	kg	no.	kg	no.	kg	no.	kg	no.	kg	no.	kg	no.	kg
January	643	25,144	1,627	65,122			16	918	21	1,145	2	123	10	494
February	956	37,532	1,904	75,434			22	1,441	58	3,297	5	335	13	595
March	52	1,908												
April														
May	414	12,746	798	30,517	3	69	28	1,387	49	2,465	4	296	17	646
June	486	16,975	1,191	48,642	5	110	36	1,728	19	933			5	213
July	778	27,543	2,035	80,783	6	137	47	2,679	20	1,282			2	70
August	650	22,362	1,340	47,805	3	68	80	4,304	24	1,389			4	155
September	445	13,821	677	21,826	11	208	28	1,689	16	958			2	80
October	391	13,664	829	29,488			50	2,685	12	810			2	91
November	404	15,779	753	28,183			4	360	47	3,010			7	308
December	411	15,806	313	12,561			21	1,310	59	3,987	2	169	7	309
Total	5,630	203,280	11,467	440,361	28	592	332	18,501	325	19,276	13	923	69	2,961

Table 8: Total number of specimens measured and corresponding weights for the species in the landings monitored in Phuket and Pinang during 1999.

NOTE: Weights of yellowfin and bigeye tunas correspond to processed weights (specimens gilled and gutted) as the swordfish and marlins do (specimens headed and tailed). Weights of albacore tuna correspond to round weights.

lin species, on the other hand, are weighed once headed and tailed and therefore the weights represented correspond also to processed weights.

Average weights for the specimens of yellowfin tuna varied between 32 and 42 kg and between the 30 and the 40 kg relying upon the month in Phuket and Pinang, respectively. Mean weights over the 40 kg were recorded in Phuket from January to April and in November. January, February November and December were the months which the highest mean weights were obtained in Pinang (above 38 kg).

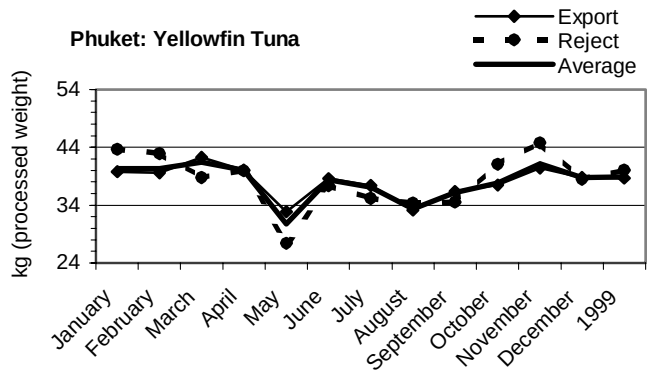


Chart 45: Mean weights (specimens gilled and gutted) for the **specimens** of yellowfin tuna monitored in Phuket during 1999 according to the month of landing and average for the whole year.

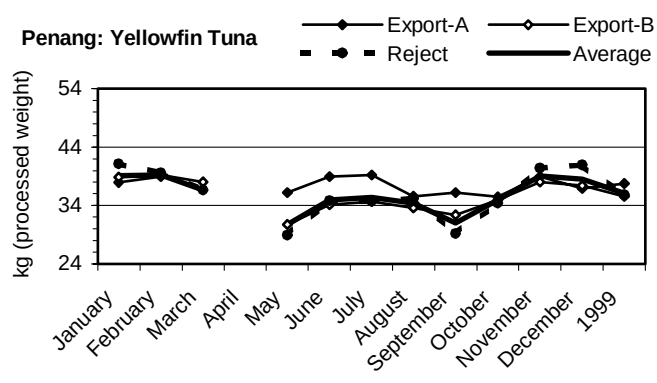


Chart 46: Mean weights (specimens gilled and gutted) for the specimens of yellowfin tuna monitored in Pinang during 1999 according to the month of landing and average for the whole year.

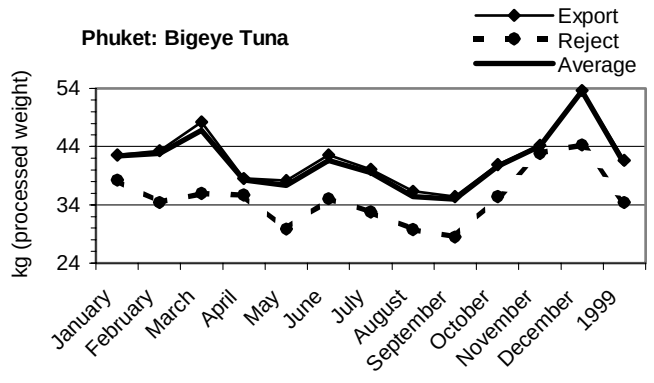


Chart 47: Mean weights (specimens gilled and gutted) for the specimens of bigeye tuna monitored in Phuket during 1999 according to the month of landing and average for the whole year.

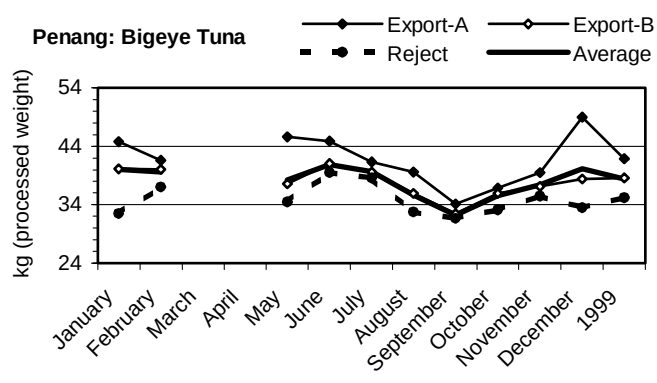


Chart 48: Mean weights (specimens gilled and gutted) for the specimens of bigeye tuna monitored in Pinang during 1999 according to the month of landing and average for the whole year.

As regards the mean weights for the specimens of bigeye tuna monitored the months which the highest weights were recorded were the same than with the yellowfin tuna. Mean weights ranged from 36 to 54 kg in Phuket and from 32 to 40 kg in Pinang. Mean weights were above 42 kg from January to March and in November and December in Phuket. The largest specimens were landed in March (46 kg) and especially in December (54 kg). The trend in Pinang was similar although the mean weights were

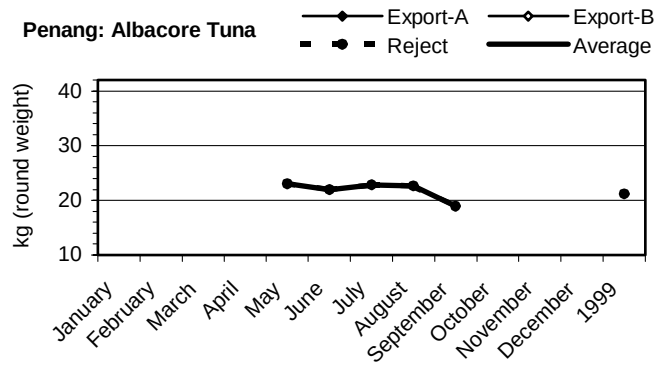


Chart 49: Mean weights (round) for the specimens of albacore tuna monitored in Pinang during 1999 according to the month of landing and average for the whole year.

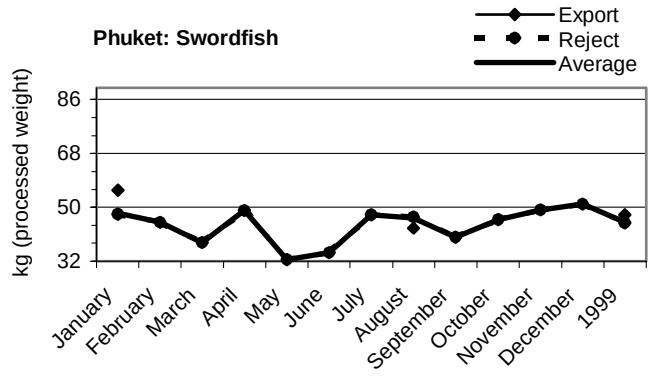


Chart 50: Mean weights (specimens headed and tailed) for the **specimens** of swordfish monitored in Phuket during 1999 according to the month of landing and average for the whole year.

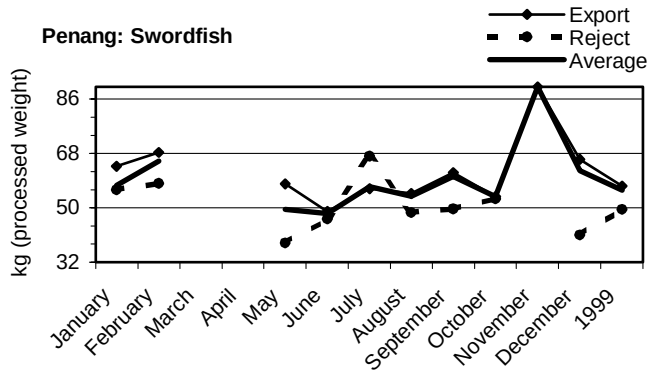


Chart 51: Mean weights (specimens headed and tailed) for the specimens of swordfish monitored in Pinang during 1999 according to the month of landing and average for the whole year.

lower and less changing than in Phuket.

Mean weights of tuna use to be higher during the northwest Monsoon than during the southwest Monsoon. This could be related to the different areas exploited depending on the monsoon north the equator during the northwest Monsoon (the period of highest activity) and south the equator during the southwest monsoon. Mean weights for the tunas in the catch would be therefore lower south the equator (information from the representa-

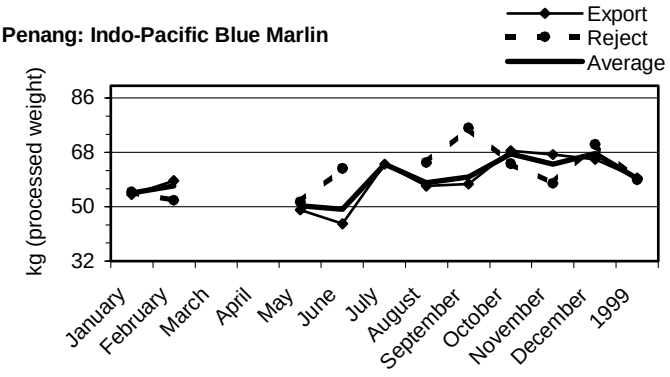


Chart 52: Mean weights (specimens headed and tailed) for the specimens of Indo-Pacific blue marlin monitored in Pinang during 1999 according to the month of landing and average for the whole year.

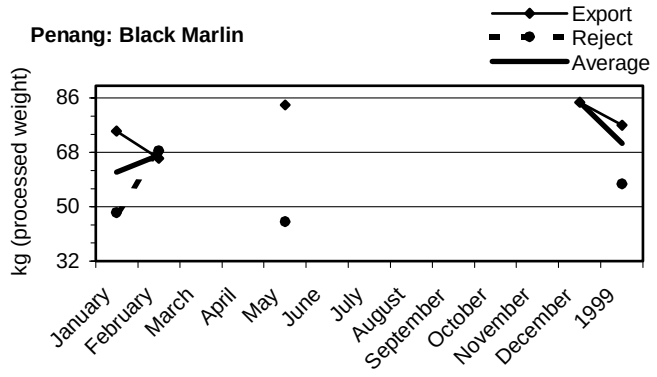


Chart 53: Mean weights (specimens headed and tailed) for the specimens of black marlin monitored in Pinang during 1999 according to the month of landing and average for the whole year.

tives of the shipping agencies interviewed in Phuket and Pinang).

Regarding the weights of the specimens according to the destination it is worth mention the difference between both species for the size seems to be less important in case of the yellowfin tuna than in case of the bigeye tuna concerning the exports. Therefore, the mean weights of the specimens of yellowfin exported were similar than those of the specimens rejected in both landing ports.

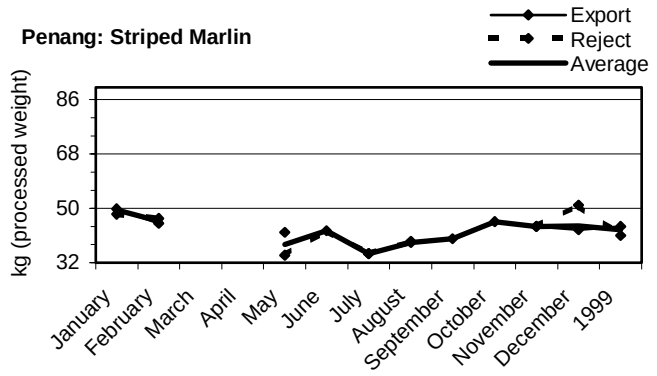


Chart 54: Mean weights (specimens headed and tailed) for the specimens of striped marlin monitored in Pinang during 1999 according to the month of landing and average for the whole year.

The bigeye tuna specimens exported, on the contrary, had weights ranging from 2 to 8 kg above those of the specimens rejected in Phuket. Furthermore, the difference in Pinang was also between the specimens graded as export-A and those graded as export-B which the first weighing 2 or more kg than the second and the same between the export-B and the reject. Nevertheless, it seems as if the size of the specimen (besides the specimens below 20 kg which are almost never exported) did not imply it being chosen as export or not, this relying more on whether the weight of that specimen is above or below the mean weight for all specimens in the landing. That is to say, the probability of a specimen of bigeye tuna of 44 kg being exported would be higher in a landing (month) were the mean weight for that species be lower (e.g. February in Phuket) than in a landing (month) which this weight were below the mean (e.g. December in Phuket).

Catches of albacore tuna were only recorded in Pinang from May to October (southeast Monsoon). Mean weights for the specimens in the catch were fairly stable, ranging from 20 to 24 kg (round weight).

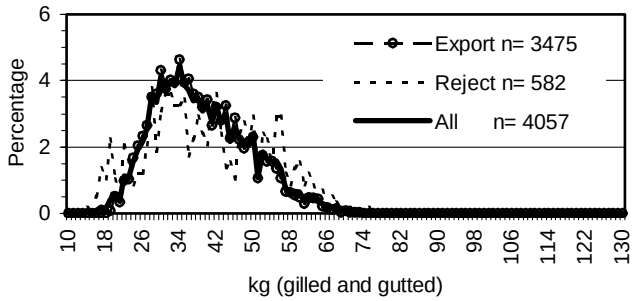
Regarding the swordfish, the specimens unloaded in Pinang (mean weights from 50 to 90 kg) were larger than those in Phuket (mean weights from 32 to 50 kg). Taking into account the much higher number of swordfish unloaded in Phuket it is possible that this difference be owed to more swordfish being discarded at sea by longliners operating from Pinang. As it was mentioned formerly swordfish and marlins are not target species of this fleet and therefore their harvesting rely upon many factors as the capacity of the holds, the market, etc.

Mean weights of other marlins are showed in the charts 52 to 54. Only the data recorded in Pinang could be used for these three species were not individually recorded in Phuket but all labelled as marlins. Mean weights for the specimens of Indo Pacific blue marlin ranged from 50 to 68 kg being higher in the last three months of the year. The specimens of striped marlin ranged from 35 to 50 kg of mean weight being the largest specimens recorded in January, February and from October to December.

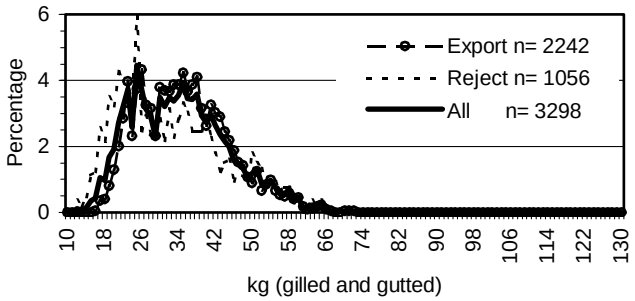
Therefore, it could be said that the fish caught during the northwest Monsoon season are larger than those caught during the other monsoon.

The size distributions for the species, monsoon season and flag of the longliner in the landings monitored in Phuket and Pinang during 1999 are displayed in the charts 55 to 79.

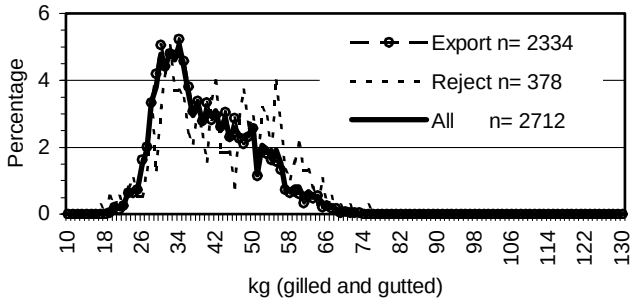
Phuket (1999): Yellowfin Tuna



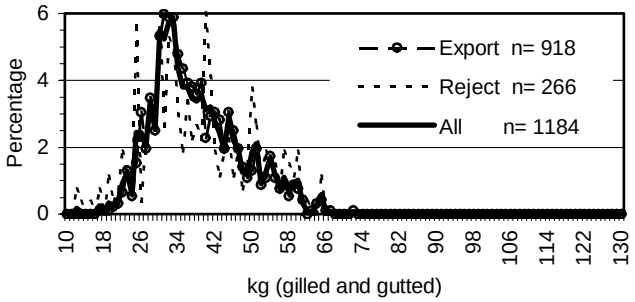
Pinang (1999): Yellowfin Tuna (CHN)



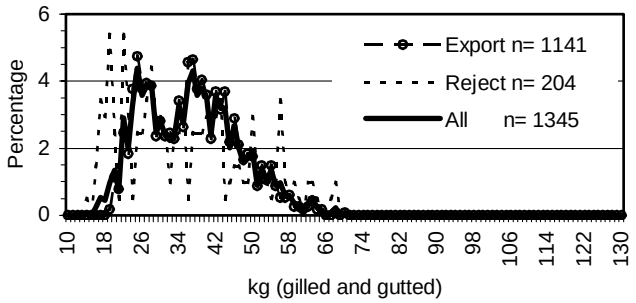
Phuket (October-March 1999): Yellowfin Tuna



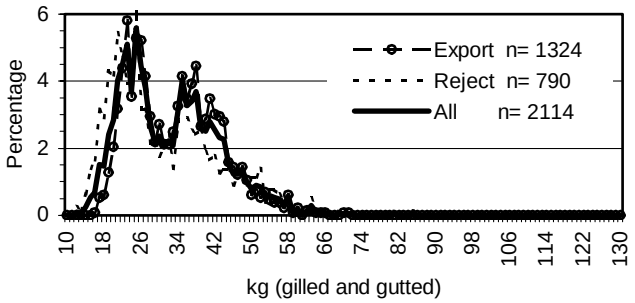
Pinang (October-March): YFT (CHN)



Phuket (April-September 1999): Yellowfin Tuna

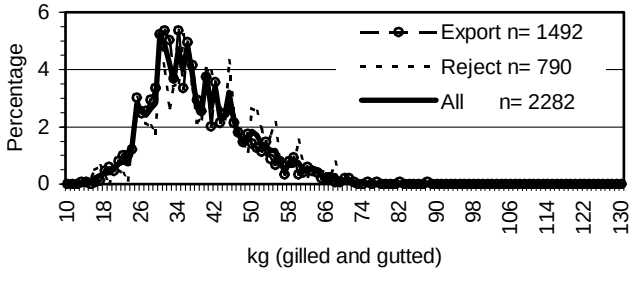


Pinang (April-September): YFT (CHN)

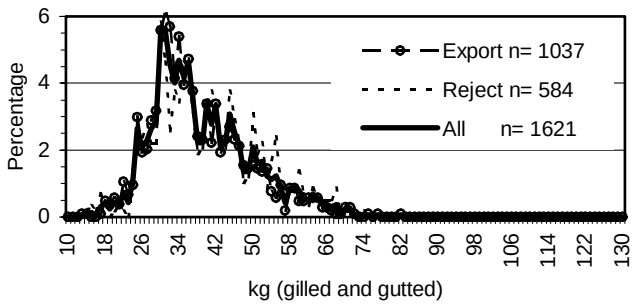


Charts 55-63: Size distribution of the specimens of yellowfin tuna landed in Phuket (above left column; Chinese longliners) and Pinang (right column and below; Chinese and Taiwanese longliners) corresponding to the landings occurred during the northwest monsoon and southeast monsoon seasons and totals for the year 1999.

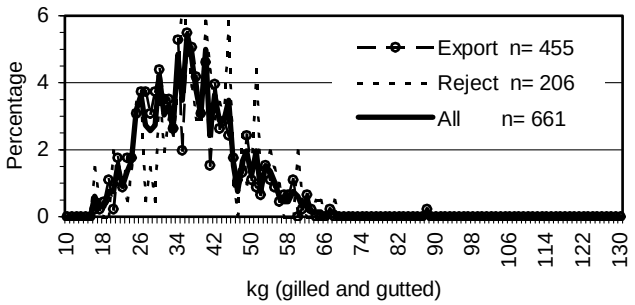
Pinang (1999): Yellowfin Tuna (TWN)



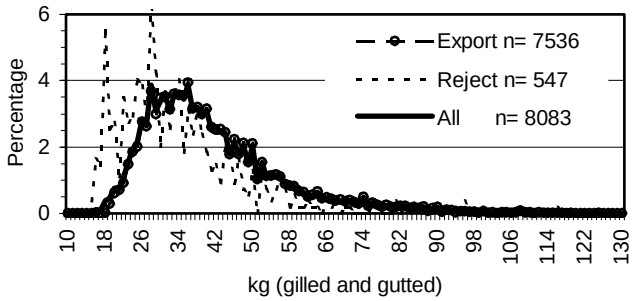
Pinang (October-March): YFT (TWN)



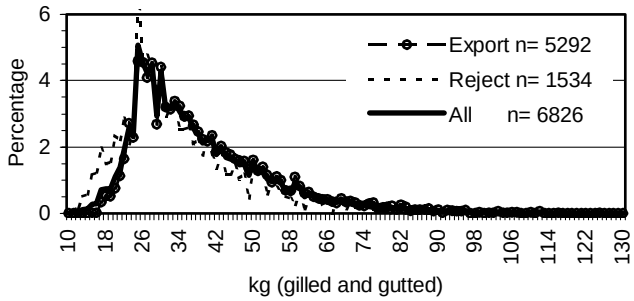
Pinang (April-September): YFT (TWN)



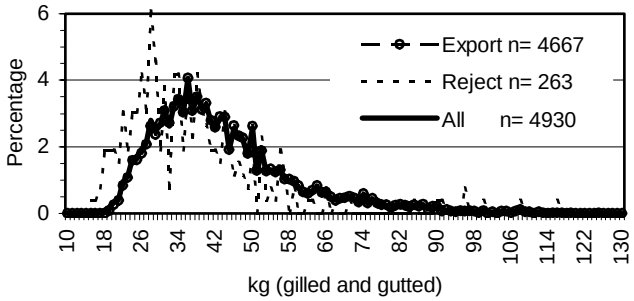
Phuket (1999): Bigeye Tuna



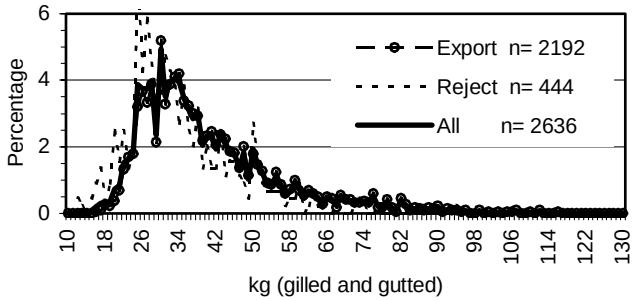
Pinang (1999): Bigeye Tuna (CHN)



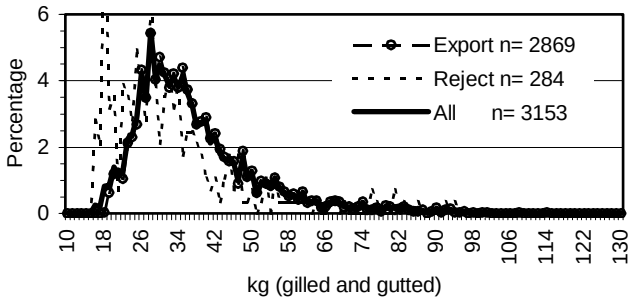
Phuket (October-March 1999): Bigeye Tuna



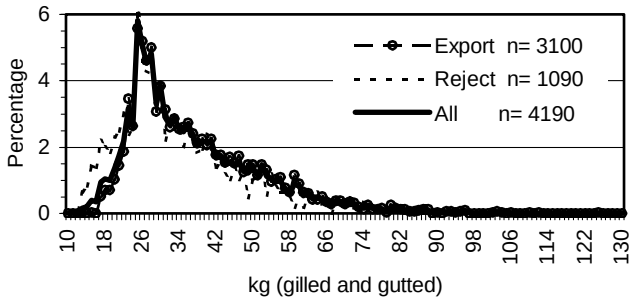
Pinang (October-March): BET (CHN)



Phuket (April-September 1999): Bigeye Tuna

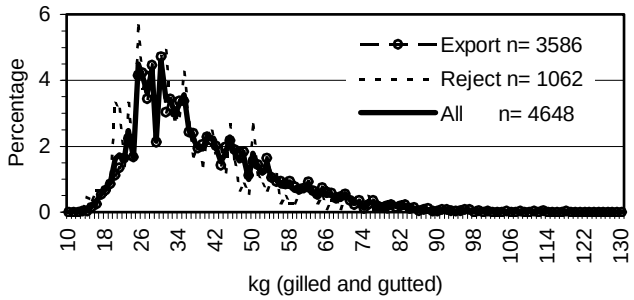


Pinang (April-September): BET (CHN)

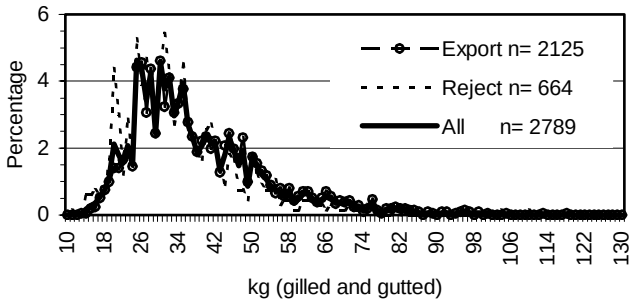


Charts 64-72: Size distribution of the specimens of bigeye tuna landed in Phuket (above left column; Chinese longliners) and Pinang (right column and below; Chinese and Taiwanese longliners) corresponding to the landings occurred during the northwest monsoon and southeast monsoon seasons and totals for the year 1999.

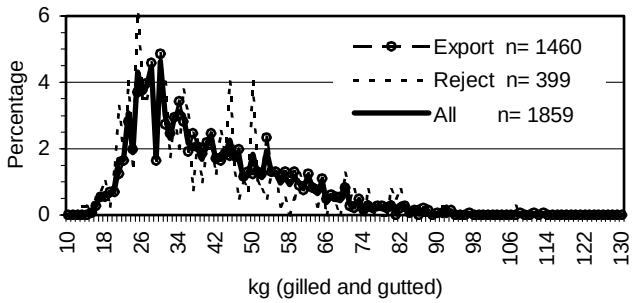
Pinang (1999): Bigeye Tuna (TWN)



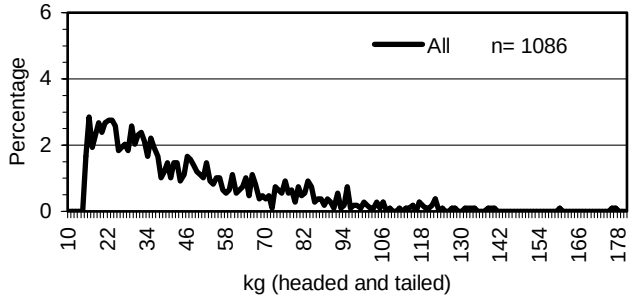
Pinang (October-March): BET (TWN)



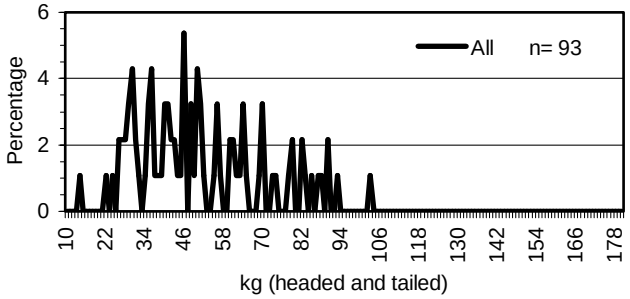
Pinang (April-September): BET (TWN)



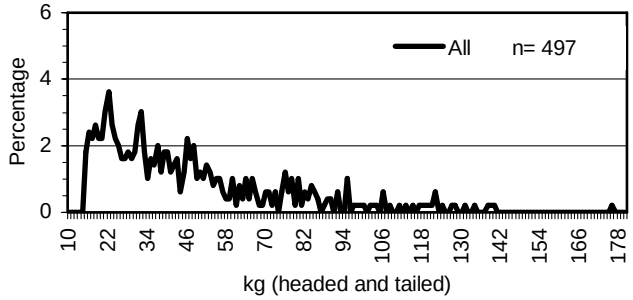
Phuket (1999): Swordfish



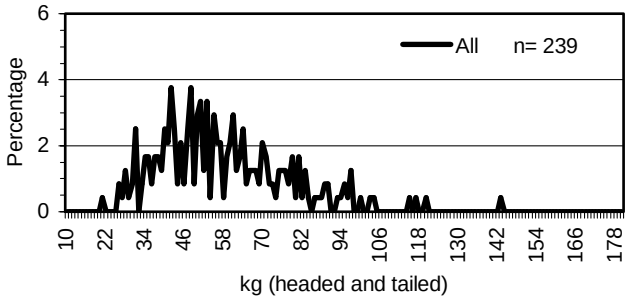
Pinang (1999): Swordfish (CHN)



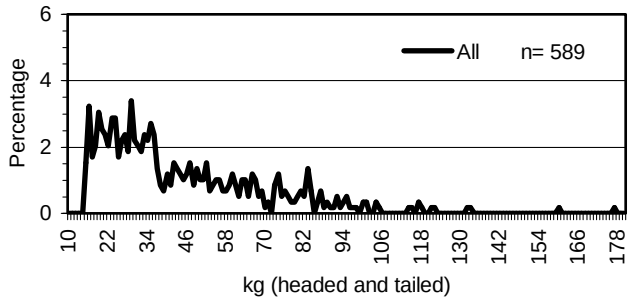
Phuket (October-March 1999): Swordfish



Pinang (1999): Swordfish (TWN)

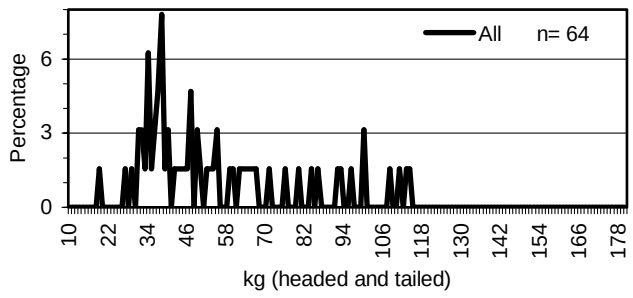


Phuket (April-September 1999): Swordfish

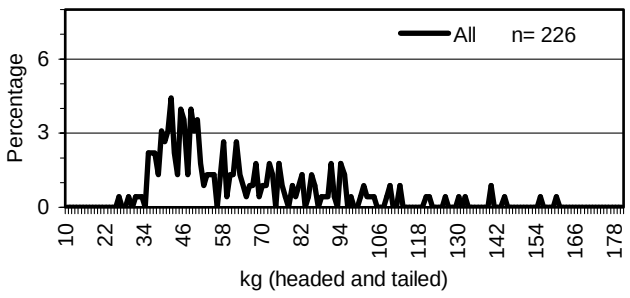


Charts 73-77: Size distribution of the specimens of swordfish landed in Phuket (left column; Chinese longliners) and Pinang (above; Chinese and Taiwanese longliners) corresponding to the landings occurred during the northwest monsoon and southeast monsoon seasons and totals for the year 1999.

Pinang (1999): Indo Pacific Blue marlin (CHN)



Pinang (1999): Indo Pacific Blue marlin (TWN)



Charts 78-79: Size distribution of the specimens of Indo Pacific blue marlin landed in Pinang (Chinese (above left) and Taiwanese (above right) longliners) corresponding to the total landings occurred during 1999.