REPORT OF JAPAN'S SCIENTIFIC OBSERVER PROGRAM FOR TUNA LONGLINE FISHERY IN THE ATLANTIC OCEAN IN THE FISHING YEARS OF 2005 AND 2006

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SUMMARY

This document reports the outline of the Japanese scientific observer program for longline fishery in the Atlantic Ocean conducted from August 2005 to March 2007.It also summarizes the data collected by this program. In 2005 fishing year (FY, thereafter, fishing year starts from August to next July), 504 operations and 1,343,789 hooks were observed. In 2006 FY, 378 operations and 981,021 hooks were observed. Majority of observation was conducted in the North Atlantic in both years. Number of observed species and individual number were 43 and 7,175 in 2005 FY. In fiscal 2006, 46 species and 10,621 individuals were observed. In the central and eastern North Atlantic, albacore and blue shark were dominant, while bluefin tuna were dominant in western North Atlantic. In general, most species examined were alive when they were brought up on the deck except for longbill spearfish. Regional difference in sex ratio was observed for many species. Especially, marked difference was observed for sharks (blue shark, porbeagle and shortfin mako shark). Length -frequency distribution showed regional difference in their modes and the size range for bluefin tuna, bigeye tuna, yellowfin tuna, longbill spearfish, blue shark and porbeagle. In general, large individuals occurred in tropical region except for bluefin tuna and porbeagle, for which difference between east and west was rather prominent.

RÉSUMÉ

Le présent document esquisse les grandes lignes du programme japonais d'observateurs scientifiques au sein de la pêcherie palangrière de l'océan Atlantique qui a été mené entre août 2005 et mars 2007. Il récapitule également les données recueillies par ce programme. Au sein de l'année de pêche 2005 (désignée ci-après « FY », l'année de pêche s'étendant du mois d'août au mois de juillet suivant), 504 opérations et 1.343.789 hameçons ont été observés. Au cours de l'année de pêche 2006, 378 opérations et 981.021 hameçons ont été observés. La majorité des observations ont été réalisées dans l'Atlantique Nord au cours des deux années. Quarante-trois espèces et 7.175 spécimens ont été observés. Au cours de l'année fiscale 2006, 46 espèces et 10.621 spécimens ont été observés. Dans l'Atlantique Nord (centre et est), le germon et le requin peau bleue étaient les espèces dominantes, tandis que le thon rouge prédominait dans l'Atlantique nord-ouest. En général, la plupart des espèces examinées étaient vivantes lorsqu'elles étaient hissées sur le pont, à l'exception du makaire bécune. On a observé une différence régionale dans le sex-ratio pour de nombreuses espèces. On a notamment noté une différence marquée pour les requins (requin peau bleue, requin-taupe commun et requin taupe bleue). La distribution de fréquence des tailles a dégagé des différences régionales dans leurs modes et la gamme des tailles pour le thon rouge, le thon obèse, l'albacore, le makaire bécune, le requin peau bleue et le requin-taupe commun. En général, les gros individus se trouvent dans la région tropicale, sauf le thon rouge et le requin-taupe commun, pour lesquels la différence entre l'est et l'ouest était assez importante.

RESUMEN

Este documento resume el programa japonés de observadores científicos para la pesquería de palangre en el océano Atlántico llevado a cabo desde agosto de 2005 hasta marzo de 2007. Resume también los datos recopilados por este programa. En el año pesquero 2005 (FY, en lo sucesivo; el año pesquero empieza en agosto y termina el siguiente mes de julio), se observaron 504 operaciones y 1.343.789 anzuelos. En el año pesquero 2006 se observaron 378 operaciones y 981.021 anzuelos. La mayoría de las observaciones de ambos años se llevaron a cabo en el Atlántico norte. El número de especies observadas y el número de ejemplares fue de 43 y 7.175 en el año pesquero 2005. En el año fiscal 2006, se observaron 46 especies y 10.621 ejemplares. En el Atlántico norte central y oriental predominaba el atún blanco y la tintorera mientras que en el Atlántico norte occidental predominaba el atún rojo. En general la mayoría de las especies examinadas estaban vivas cuando fueron subidas a cubierta, excepto la aguja picuda. Se observó, para muchas especies, una diferencia regional en la sex ratio. En especial, se observó una diferencia marcada para los tiburones (tintorera, marrajo dientuso y marrajo sardinero). La distribución de frecuencias de tallas mostraba diferencia regional en sus modas y en el rango de tallas del atún rojo, patudo, rabil, aguja picuda, tintorera y marrajo sardinero. En general, en la región tropical había

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ejemplares grandes excepto para el atún rojo y el marrajo sardinero, para los que era más prominente la diferencia entre Este y Oeste.

KEYWORDS

Long lining, tuna fisheries, by-catch, catch composition, size composition, sex ratio

1. Introduction

Fisheries Research Agency of Japan has conducted its own national scientific observer programs for Atlantic tuna longline vessels since the late 1990s. Data collection includes vessel attributes, gear configuration, species identification, biological sampling and various measurements on catches. This observer program was conducted in response to the recommendation of ICCAT for tropical tuna in 1996. Two to nine cruises have been monitored annually since then. Previous results until 2004 cruise were reported to the SCRS meetings (Matsumoto, T. 2006). This document reports the outline and summary of Japan's national scientific observer program and collected data for cruises conducted from August 2005 to Mach 2007.

2. The outline of observer program

Nine and seven observers were trained and sent to commercial tuna longline vessels in 2005 FY and 2006 FY, respectively. All observers were trained through on-the-job training about species identification, recording protocols for information on fishing operation and catch, and protocols for taking measurements for catch. Fishing activity, oceanographic and weather condition, gear configuration, bait and observed hook number. Size measurements were conducted for all catch taken on the deck, which includes body length, whole weight and/or processed weight, clasper length, gonad weight. In addition, time when a catch was retrieved, the branch number the catch was hooked, the life status of catch (alive or not), sex, wound status and maturity index were recorded. Some biological sampling was conducted for whole body, otolith, vertebrae, stomach contents, muscle, and genital gland upon request. Archival pop-up tag was attached to five tunas (two for bluefin and three for bigeye) and one swordfish, and three tunas (for bigeye tuna) in 2005 FY and 2006 FY, respectively.

3.Species identification and measurements

i) Identification of species and related information

All catch taken on the deck was identified and recorded, and the catch that was not taken on the deck was recorded only when species was identified. According to the National Report of Japan to ICCAT (2006), this program conducted in 2005 FY covered about seven percent (6.9%) of the total number of fishing vessels operating in the entire Atlantic Ocean. Data for 2006 FY is now aggregating. Each catch was identified whether they were alive or dead immediately after they were hauled on the deck or when they were released at the deck side. The status "alive" was further separated into "vigorous", "sluggish" or "injured". The branch number and catch time were recorded for each catch when possible.

ii) Measurement of catch

Length was measured for all intact catches by 1cm (round up). As for length, the following measurements were applied for different fish groups; fork length for tunas, eye-fork length for billfishes, precaudal length for sharks, disk length for rays, total or fork length for other teleost. Length was measured with a caliper.

Whole body weight (to the nearest 100g in principal), processed weight (to the nearest 1 kg) and gonad weight (for tunas and billfishes; to the nearest 100g) were measured as much as possible. When there was substantial numbers of catch, priority was given to tunas and billfishes but the number of catch was counted for all catches by species. Clasper length was measured and recorded for sharks by 0.1 cm interval.

iii) Sex determination and status of maturity

Sex determination was conducted through the observation of genital gland for teleosts and with or without clasper for sharks and rays.

The status of maturity of ovaries for tunas and billfishes was identified on megascopic basis and divided into the following categories.

M1: Ovary is small and no grains of egg are visible.
M2: Ovary is larger than M1 and small grains of egg are visible. Arteries are developed on the surface of ovary.
M3: Each grain of egg is over 0.4-0.5mm and ovary is full of them. The color of the egg is light pink and no translucent egg is observed. Arteries are well developed.
M4: Ovary is very large and some translucent eggs are observed which are easy to come off.
M5: Many eggs are exfoliated in the ovary and are about to get out of.
M6: Ovary is comparatively large but it has a open cavity inside.

As for sharks, maturity was checked by the existence of sperm and embryos for males and females, respectively.

iv) Biological sampling

Otolith, stomach contents, muscle, genital gland and vertebra were collected mainly for tunas.

v) Archival pop-up tagging for bluefin tuna, bigeye tuna and swordfish

Archival pop-up tagging was conducted for bluefin tuna and bigeye tuna in 2005 FY and 2006 FY to investigate vertical and horizontal swimming behavior. The Pop-up Archival Tag (PAT: Microwave Telemetry Inc., PTT-100) was set to collect data of depth and water temperature every 15 minutes or 30 minutes, and programmed to be popped-off six months after release.

PAT was attached to fish by harpooning from the side of vessel with keeping the fish in the sea surface or on the scooper, trying to tag at the dorsal muscle under the first dorsal fin, and then released by cutting the line. Length and weight of the fish were estimated by the eye of observer or fishing master. In the attachment for bigeye tuna on the scooper, body length was measured with a caliper.

4. Summary of Information

i) Operation

Nine and Seven trips were made in 2005 FY and 2006 FY, respectively. **Table 1** shows the detail information for each trip by year. Three operations in AT200510 were made before the observer was transshipped to the pre-determined fishing vessel (AT200507). In this case, this observer was placed by the other commercial tuna longline vessel.

A total of 504 operations were observed in 10 cruises in 2005 FY (average: 56 per trip). In 2006 FY, 378 operations were observed in seven cruises (average: 54 per trip). Total observed hook number in 2005 FY and 2006 FY was 1,343,789 and 981,021 hooks, respectively. The average hook number per cruise for 2005 FY (148,410) was larger than that for 2006 FY (140,146).

The area of operation is shown in **Figure 1** by year. Fishing area was divided into six areas; Area1 (off Florida), Area2 (Grand bank), Area3 (Central North Atlantic: indicated as “CNA” thereafter), Area4 (off Ireland), Area5 (off Dakar), and Area6 (off Abidjan).

In 2005 FY, eight vessels operated in the area off Ireland, of which two vessels also operated in CNA. Another two vessels operated in the area off Florida and off Abidjan, respectively. In summary, most of the observations were conducted in the North Atlantic in 2005 FY. As for 2006 FY, four vessels operated in the area off Ireland, of which two vessels also operated in CNA and one of these two vessels even operated in the Grand Bank and the area off Florida. Another three vessels operated in Grand Bank, in the area off Florida and in the area off Dakar, respectively. As well as in 2005 FY, the operations monitored in the northern area were much larger than those observed in the tropical region.

ii) Catch by major species

The list of species caught was shown in **Table 2**. The species for which observed number was less than 5 individuals were aggregated. Total of 43 species (including 5 unidentified) with 7,175 individuals and 46 species (including 11 unidentified) with 10,621 individuals were recorded in 2005 FY and 2006 FY, respectively. Observed number of species and total catch number in 2006 FY were larger than that in 2005 FY. **Figure 2** shows catch composition of major species by area for 2005 FY and 2006 FY.

In area off Iceland, blue shark accounted for over 60% of total catch in 2005 FY and 2006 FY. Albacore and bluefin tuna followed after blue shark. The inter-annual difference was small.

In CNA, albacore and blue shark dominated in the catch both in 2005 FY and 2006 FY, while the inte-annual difference in percentage was observed between these two species. The percentage of albacore was larger than blue shark in 2005 FY, but this trend was reversed in 2006 FY.

In Grand Bank (only 2006 FY), tuna group (albacore, bluefin tuna, bigeye tuna and yellowfin tuna) accounted for 65% of all catch. Among tuna catch, bluefin tuna was most common (69 % of tuna catch, 44% of total catch) and bigeye tuna was common secondary (18 % of tuna catch). Except tuna group, blue shark accounted for 16% of total catch and was second common after bluefin tuna.

In area off Florida, tuna group accounted for almost 50% of all catch and albacore was most common among tuna group in 2005 FY and 2006 FY. Billfish accounted for 20 % and 34% of total catch in 2005 FY and 2006 FY, respectively. Almost half of billfish catch was swordfish and longbill spearfish in 2005 FY and 2006 FY, respectively. The percentage of shark was smaller than 10% both in 2005 FY and 2006 FY.

In tropical, bigeye tuna dominated of all catch (45%) and catch number of teleost fish except for tuna and billfish was second highest (30%) in area Off Abidjan (only 2005 FY). In area Off Dakar (only 2006 FY), bigeye tuna (73%) and yellowfin tuna (15%) accounted for 88% of total catch.

The number of fish measured and sampled was indicated for each item by year in **Table 3**.

iii) CPUE for major species

CPUE (catch number per 1000 hooks) for major species by area was calculated for 2005 FY and 2006 FY, separately (**Figure 3**). The observed hook number was used as effort for calculation.

Tuna

Albacore was most abundant in CNA in both year and CPUE declined in Grand Bank and area off Ireland. In area off Florida, the value of CPUE was intermediate. For bluefin tuna, CPUE was high only in Grand Bank. For bigeye tuna, CPUE was much higher in tropical region (off Abidjan and Dakar) than temperate region (Grand Bank and off Florida). On the other hand, CPUE for yellowfin tuna was higher in temperate region (off Florida) than tropical area.

Billfish

Swordfish was relatively abundant in western part of North Atlantic (Grand Bank and area off Florida). In the North Atlantic, CPUE was very low in area off Ireland in both years. In tropical, abundance was intermediate. Atlantic blue marlin and Atlantic sailfish was most abundant in tropical and temperate region (off Florida). Longbill spearfish and white marlin were most abundant in the area off Florida.

Shark

Blue shark was most abundant in northern region (CNA and off Ireland) and secondary abundant in Grand Bank. On the other hand, CPUE was low in tropical region. CPUE in CNA and area off Ireland in 2006 FY was much higher than that in fiscal 2005. Porbeagle was abundant only in Grand Bank. For shortfin mako shark, the trend of abundance by area was similar to that of blue shark except in area off Ireland. In both years, CPUE in area off Ireland was much smaller than CNA. In general, the lower the latitude, the lower its abundance.

iv) Life status of fish caught

The percentage of the species caught alive is shown in **Table 4**. The species for which the observed number was less than 5 individuals were excluded from calculation.

Tuna

For albacore, survival rate was higher than 50% in any area except area off Abidjan (42.9%) in 2005 FY, however, it was lower than 50% except area off Ireland (61.7%) in 2006 FY. For bluefin tuna, survival rate was higher than 50% in Grand Bank, CNA, and area off Ireland; however, it was lower than 50% in area off Florida in 2005 FY and 2006 FY. Survival rate in northern area tents to be higher than that in temperate area. For Bigeye tuna, survival rate was around 60 to 70% except area off Dakar (37%) for 2005 FY and 2006 FY. Survival rate in

Grand Bank and Florida (over 70%) was higher than that in C N A (60%), however, regional difference in survival rate seemed to be relatively small. For yellowfin tuna, survival rate in temperate region was much higher than that in tropical region.

Billfish

For swordfish, regional difference in survival rate was not observed in 2005 FY but observed in 2006 FY. In 2006 FY, survival rate was higher in area off Florida, Ireland and CNA (almost 50%) than that in Grand Bank and area off Dakar (lower than 20%). For Atlantic blue marlin, survival rate in area off Florida in 2005 FY and 2006 FY was 88% and 62%, respectively. In tropical region, survival rate (46%) was much lower than temperate region. For longbill spearfish, survival rate in area off Florida in 2005 FY and 2006 FY was 17 % and 11 %, respectively. In tropical, rate (28%) was higher than temperate region. This trend is the opposite to that of Atlantic blue marlin.

Shark

For blue shark, survival rate in northern regions (over 90%) was higher than temperate region (80%) and lowest in tropical area (74%) in 2005 FY. In 2006 FY, same trend was observed, while the rate for area off Florida was higher than that for Grand Bank. In tropical, rate in area off Dakar (34%) was much lower than that in area off Abidjan (74%) For porbeagle, the data was obtained only in Grand Bank (2006 FY) and area off Ireland (2005 FY). Survival rate for area off Ireland (56%) was higher than that for Grand Bank (39%). For shortfin mako shark, survival rate was almost above 70% in any area in both years. The rate in northern regions tends to be higher than that in temperate region.

v) Sex ratio

Sex ratio (number of male / number of male and female) was calculated (**Table 5**). The species which observed number was less than 5 individuals was excluded from calculation.

Tuna

For albacore, male was dominant in area off Ireland in both years, but female was dominant in CNA in 2006 FY. For bluefin tuna, sex ratio was almost even in CNA and area off Ireland in both years. In area off Florida and Grand Bank, the ratio of male was slightly higher than that of female. For bigeye tuna, female was dominant in area off Florida and Grand Bank. In CNA, the ratio was even in 2006 FY. For tropical region, ratio was even in area off Abidjan, but male was relatively dominant in area off Dakar. For yellowfin tuna, female was dominant in area off Florida and Abidjan in 2005 FY. In 2006 FY, the ratio was even in area off Florida and male was dominant in Grand Bank and area off Dakar.

Billfish

For swordfish, female was dominant in areas off Florida and Ireland in both years. Ratio was even in Grand Bank, CNA in both years. In tropical, ratio was even in area off Abidjan (2005 FY), while male was dominant in area off Dakar (2006 FY). For longbill spearfish, female was dominant in area off Florida in both years and male was dominant in area off Abidjan (2005 FY).

Shark

For blue shark, female was dominant in areas other than off Florida in both years. In area off Florida, male was generally dominant in both years. For porbeagle, male was dominant in CNA in 2005 FY, while female was dominant in area off Ireland in 2005 FY. Ratio in Grand Bank was even. For shortfin mako shark, male was dominant in all areas in both fishing years.

vi) Length of the fish caught

Length frequencies of major tuna, billfish and shark were shown in **Figure 4**.

Tuna

For albacore, no marked difference in length frequency was observed. The average ranged from 93cm to 100cm and mode ranged from 95 to 105 cm. Slight inter-annual difference was observed in area off Florida. Average and mode for 2005 FY were 93cm and 95cm, respectively and those for 2006 FY were 100cm. This shows that individual in 2005 FY was smaller than that in 2006 FY in this area. Bimodal length frequency was observed

only in Grand Bank. Each mode lied in around 85cm and 105cm. In the other areas, the shape was unimodal. For bluefin tuna, average (123cm) and mode (104cm) in Grand Bank was smallest among four areas. In CNA and area off Ireland, the proportion of larger individuals increased with average ranging from 189 to 196cm. In the area off Florida, average (218cm) and mode (227cm) was largest among four areas. For bigeye tuna, the mode in area off Florida was smallest among four areas. Inter-annual difference was observed in this area and average in 2005 FY (90cm) was smaller than that in 2006 FY (102cm). The length frequency in Grand Bank and area off Ireland was similar with average of 131cm and 134cm, respectively. Individuals in these areas are larger than that in area off Florida. In tropical, the average in area off Abidjan in 2005 FY (150cm) was larger than that off Dakar in 2006 FY (135cm). Size of bigeye tuna caught in area off Abidjan was largest in all areas. For yellowfin tuna, the average and mode in area off Florida was 106-107cm and 100cm, respectively. The length frequency in Grand Bank shows bimodal shape and modes lies in around 100cm and 115cm, respectively. In tropical, the mode was largest of all areas (138cm for Abidjan and 141cm for Dakar) and most individual was adult.

Billfish

For swordfish, average length in area off Florida is 123cm (2005 FY) and 129cm (2006 FY), which was smallest among area. As latitude becomes higher, the average becomes slightly higher. In Grand Bank, average was 133cm. In CNA, average for each year was 135cm and 141cm, respectively. In area off Ireland, small and large individual were observed ranging from 60 to 250cm, while the individuals between 90cm and 160cm were not observed for both years. In tropical, length frequency for area off Dakar showed bimodal shape with two modes around 100cm and 150cm. For longbill spearfish, marked difference was observed between temperate and tropical region. In tropical, average for area off Dakar was 156cm, which was larger than that for area off Florida. In area off Florida, inte-annual difference in average was observed and average for 2006 FY (127cm) was larger than that for 2005 FY (117cm).

Shark

For blue shark, average for area off Ireland was 130 cm (2005 FY) and 125cm (2006 FY), which was smallest of all areas. This suggests juvenile dominates in this area. In CNA and Grand Bank, average ranged from 143cm to 158cm, which was larger than that in area off Ireland. In tropical, averages for two areas were 173cm (off Abidjan) and 199cm (off Dakar). In area off Florida, average is above 200cm and inter-annual difference was slight. As latitude becomes lower, mature individual increased. For porbeagle, marked difference was observed between Grand Bank and CNA. Larger individual occurred in CNA rather than Grand Bank. In Grand Bank, average and mode were 100cm and 88cm, respectively. In CNA, average and mode were 173cm and 180cm, respectively. In area off Ireland, individuals ranging from 120cm to 175cm were observed. For shortfin mako shark, no marked difference among areas was observed. In Grand Bank, trimordal distribution was observed with wide range from 83cm to 240cm. Average between CNA and area off Ireland was similar both in 2005 FY and 2006 FY.

vii) Pop-up archival tagging for bluefin tuna, bigeye tuna and swordfish

Information of the fish with pop-up archival tag attached is shown in **Table 6**. In 2005 FY, tags were attached to three bluefin tuna, two bigeye tuna and one swordfish. In 2006 FY, tags were attached to three bigeye tunas. So far, pop off of five tags (two bluefin and three bigeye in 2005 FY) were confirmed. For three bigeye released in 2006 FY, no pop off has been confirmed.

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References

MATSUMOTO, T. 2006. Report of observer program for Japanese tuna longline fishery in the Atlantic Ocean from August 2004 to January 2005. Collect. Vol. Sci. Pap. ICCAT, 59(2): 663-681.

NATIONAL RESEARCH INSTITUTE OF FAR SEAS FISHERIES. 2006. National Report of Japan. *In* Report for Biennial Period, 2006-2007, Part I (2006), Vol. 1-Commission.

Table 1. Information on the trip by year.

2005

Cruise ID	AT200501	AT200502	AT200503	AT200504	AT200505	AT200506	AT200507	AT200508	AT200509	AT200510	Total
Area	off Ireland C N A	off Ireland	off Ireland	off Ireland	off Ireland C N A	off Ireland	off Ireland C N A	off Florida	off Abidjan	off Ireland	
	46.5-53.9 N 14.1-39.4 W	30.5-56.7 N 13.9-24.4 W	51-62.4 N 16-22.2 W	50.0-57.1 N 16.1-29.9 W	47.6-56.2 N 16.2-42.3 W	48.8-55.3 N 15.0-32.8 W	44.8-56.6 N 16.1-43.9 W	27.8-30.8 N 70.1-75.8 W	4.5-12.5 S 0.1-6.4 W	49.5-54.3 N 15.8-17.1 W	
Start date of operation	2005/8/19	2005/9/6	2005/9/8	2005/9/19	2005/9/21	2005/9/29	2005/10/5	2005/11/25	2005/12/17	2005/10/1	
End date of operation	2005/12/9	2005/10/24	2005/11/21	2005/11/20	2005/12/24	2005/12/3	2005/12/25	2005/12/30	2006/1/31	2005/10/4	
Number of operation	91	41	58	46	67	55	64	34	45	3	504
Number of hooks observed	249,481	110,472	144,885	115,950	177,474	143,352	177,456	105,192	111,427	8,100	1,343,789

2006

Cruise ID	AT200601	AT200602	AT200603	AT200604	AT200605	AT200606	AT200507	Total
Area	off Florida	Grand bank	off Ireland C N A off Florida Grand bank	off Dakar	off Ireland C N A	off Ireland	off Ireland	
	29.9-41.9 N 54-75.5 W	39.6-45.5 N 45.8-66W	28.3-51.7N 10.2-72.9 W	7.2-24.4 N 19.4-31.9 W	45.9-53.4 N 11.1-44.8 W	40.5-52.7 N 10.2 29.9 W	49.0-53.9 N 14.5-23.9 W	
Start date of operation	2006/12/12	2006/12/14	2006/10/22	2007/1/25	2006/9/20	2006/10/9	2006/10/3	
End date of operation	2007/2/11	2007/3/1	2007/1/3	2007/3/17	2006/12/12	2007/1/6	2006/11/14	
Number of operation	54	60	50	47	69	60	38	378
Number of hooks observed	136,520	143,504	125,870	134,239	147,540	179,221	114,127	981,021

Table 2. List of catches by fish species (2005FY)[1].

2005

Common name	Scieintific name	off Florida	C N A	off Ireland	off Abidjan	**Total**
Albacore	*Thunnus alalunga*	148	939	475	8	**1570**
Bluefin tuna	*Thunnus thynnus*	21	213	533	-	**767**
Yellowfin tuna	*Thunnus albacares*	26	-	-	64	**90**
Bigeye tuna	*Thunnus obesus*	33	1	-	512	**546**
Atlantic blue marlin	*Makaira nigricans*	8	-	-	11	**19**
White marlin	*Tetrapturus albidus*	11	-	-	2	**13**
Swordfish	*Xiphias gladius*	46	25	38	14	**123**
Atlantic sailfish	*Istiophorus albicans*	1	-	-	4	**5**
Longbill spearfish	*Tetrapturus pfluegeri*	71	-	-	68	**139**
Atlantic pomfret	*Brama brama*	-	-	26	-	**26**
Pomfrets	Bramidae	-	16	-	-	**16**
Dolphin	*Coryphaena hippurus*	12	-	-	10	**22**
Pompano dolphin	*Coryphaena equisetis*	-	-	-	15	**15**
Ocean sunfish	*Mola mola*	1	2	27	10	**40**
Opah	*Lampris guttatus*	-	3	2	7	**12**
Wahoo	*Acanthocybium solandri*	13	-	-	14	**27**
Snake mackerel	*Gempylus serpens*	-	-	-	15	**15**
Escoler	*Lepidocybium flavobrunneum*	13	28	13	39	**93**
Oilfish	*Ruvettus pretiosus*	7	29	-	1	**37**
Longnose lancetfish	*Alepisaurus ferox*	-	83	26	-	**109**
Lancetfishes	*Alepisaurus spp.*	-	31	64	225	**320**
Unidentified anglerfish	Lophiiformes	-	1	6	-	**7**
Ribbonfishes	Trachipteridae	-	-	5	-	**5**
Other teleost		-	2	3	5	**10**
Blue shark	*Prionace glauca*	27	564	2378	88	**3057**
Porbeagle	*Lamna nasus*	-	7	9	-	**16**
Shortfin mako	*Isurus oxyrinchus*	8	14	9	2	**33**
Unidentified thresher shark	Alopiidae	4	2	3	-	**9**
Tiger shark	*Galeocerdo cuvieri*	6	-	-	-	**6**
Other shark		2	1	1	2	**6**
Crocodile shark	*Pseudocarcharias kamoharai*	-	-	-	9	**9**
Sting ray	*Dasyatis violacea*	3	3	-	4	**10**
Other ray		1	-	2	-	**3**
Total		462	1964	3620	1129	**7175**

[1] The species which observed number is less than 5 individuals were excluded.

Table 2. List of catches by fish species (2006FY)[2].

2006

Common name	Scieintific name	off Florida	Grand bank	C N A	off Ireland	off Dakar	**Total**
Albacore	*Thunnus alalunga*	179	138	266	374	-	**957**
Bluefin tuna	*Thunnus thynnus*	43	1998	72	250	-	**2363**
Bigeye tuna	*Thunnus obesus*	72	522	22	-	936	**1552**
Yellowfin tuna	*Thunnus albacares*	218	250	1	-	202	**671**
Skipjack tuna	*Katsuwonus pelamis*	7	1	-	-	-	**8**
Atlantic blue marlin	*Makaira nigricans*	13	1	-	-	7	**21**
White marlin	*Tetrapturus albidus*	17	2	-	-	-	**19**
Swordfish	*Xiphias gladius*	55	88	20	9	37	**209**
Atlantic sailfish	*Istiophorus albicans*	8	-	-	-	9	**17**
Longbill spearfish	*Tetrapturus pfluegeri*	198	1	-	-	7	**206**
Atlantic pomfret	*Brama brama*	6	-	15	6	-	**27**
Dolphin	*Coryphaena hippurus*	12	3	-	-	3	**18**
Ocean sunfish	*Mola mola*	5	-	2	14	6	**27**
Opah	*Lampris guttatus*	-	41	1	1	-	**43**
Wahoo	*Acanthocybium solandri*	5	3	-	1	7	**16**
Japanese Spanish mackerel	*Scomberomorus niphonius*	7	3	-	-	1	**11**
Escoler	*Lepidocybium flavobrunneum*	21	23	20	21	7	**92**
Oilfish	*Ruvettus pretiosus*	2	-	63	-	-	**65**
Lancetfishes	*Alepisaurus spp.*	43	282	14	49	-	**388**
Other teleost		3	8	1	3	1	**16**
Ribbonfishes	Trachipteridae	-	-	-	10	-	**10**
Blue shark	*Prionace glauca*	44	716	432	2085	47	**3324**
Porbeagle	*Lamna nasus*	-	266	1	1	-	**268**
Shortfin mako	*Isurus oxyrinchus*	7	43	23	15	6	**94**
Bigeye thresher	*Alopias superciliosus*	3	1	-	1	-	**5**
Thresher shark	*Alopias vulpinus*	2	2	3	1	-	**8**
Oceanic whitetip shark	*Carcharhinus longimanus*	1	23	-	1	-	**25**
Tiger shark	*Galeocerdo cuvieri*	9	-	-	-	-	**9**
Other shark		7	1	1	0	6	**15**
Sting ray	*Dasyatis violacea*	42	86	-	7	-	**135**
Other ray		1	1	-	-	-	**2**
Total		1030	4503	957	2849	1282	**10621**

[2] The species which observed number is less than 5 individuals were excluded.

Table 3. Number of fish measured and sampled by year[3].

2005

Species	Number of fish observed/measured									Biological sampling						
	Length	Product weight	whole weight	Sex	Branch line number	Alive or not	Gonad weight	Maturity	Clasper length	Whole body	Otolith	Stomach contents	Muscle	Gonad	Vertebrae	Anal fin
Albacore	1513	1080	638	252	715	1555	2						1		83	
Bluefin tuna	739	743	274	709	301	759	351	251				1	10	5	9	2
Bigeye tuna	500	496	32	387	485	531	171	171			15	22	4	59	8	
Yellowfin tuna	83	81	24	59	61	88	24	28				1		1	5	
Atlantic blue marlin	16	16	8	13	7	19		3								
White marlin	13	13	11	7		13		4								
Swordfish	116	108	57	85	29	122	22	49						3		
Atlantic sailfish	5	5	1	5		5		1								
Longbill spearfish	137	137	71	84	5	137	2	18						1		
Other telepst	307	184	149	133	195	663	2	4				1				
Blue shark	2675	1076	5	2590	759	2958	6	1135	255							
Porbeagle	12	9		13	1	16		6	4							
Shortfin mako	32	30	8	26	6	33	1	22	13							
Crocodile shark	9			8		9										
Othe shark	8	3		4	1	21		4	2							
Sting ray	6		5	4		10										
Other ray	1					2										
Total	6172	3981	1283	4379	2565	6941	581	1696	274		15	25	15	69	105	2

2006

Species	Number of fish observed/measured									Biological sampling						
	Length	Product weight	whole weight	Sex	Branch line number	Alive or not	Gonad weight	Maturity	Clasper length	Whole body	Otolith	Stomach contents	Muscle	Gonad	Vertebrae	Anal fin
Albacore	583	816	108	36	493	944	2	8					44			
Bluefin tuna	1026	1929	541	915	611	2340	67	125				18	200	22		
Bigeye tuna	1289	1366	930	1157	83	1529	41	317				2	109	5		
Yellowfin tuna	488	589	214	422	143	659		59					37	2		
Skipjack tuna	6		5		7	6										
Atlantic blue marlin	20	20	6	13	6	20		6					7	1		
White marlin	18	17		12	6	19		1					1	1		
Swordfish	179	148	36	75	67	205	4	20				4	40	2		
Atlantic sailfish	9	11	5	5	3	11							1			
Longbill spearfish	190	201	7	145	166	204		1					6	1		
Others*	157	124	44	42	319	692		6		2			3			
Blue shark	2664	1860	177	2616	1571	3308	123	1442	188				33		1	
Porbeagle	125	183	2	167	100	266		11	8				5	1		
Shortfin mako	73	80	6	74	19	94	4	31	42				19			
Oceanic whitetip shark	17	18		15	3	25			4				1			
Thresher shark	7	8		6		8		4	3							
Tiger shark	6	4		7	4	9		2	3				3			
Other shark	15	10		9	7	19							1			
Sting ray	18		5	4	88	129										
Other ray					1	2										
Total	6906	7387	2093	5723	3713	10541	242	2035	254	4		24	511	35	1	

[3] The species which observed number is less than 5 individuals were excluded.

Table 4. Life status of fish caught (2005 FY).

2005		Alive				Dead	Unknown	Total	Total number alive	**Percentage alive**
		No details	Vigorous	Sluggish	Injured					
off Florida	Albacore	1	76			70		147	77	**52.4**
	Bluefin tuna		6			14		20	6	**30**
	Bigeye tuna	1	20			12		33	21	**63.6**
	Yellowfin tuna	1	16			8		25	17	**68**
	Swordfish	2	23			21		46	25	**54.3**
	Atlantic blue marlin	1	6			1		8	7	**87.5**
	Longbill spearfish	3	9			59		71	12	**16.9**
	White marlin	1	4			6		11	5	**45.5**
	Blue shark		21			5		26	21	**80.8**
	Shortfin mako		6			2		8	6	**75**
	Other sharks		11			1		12	11	**91.7**
C N A	Albacore		410	201		320		931	611	**65.6**
	Bluefin tuna		84	23		106		213	107	**50.2**
	Swordfish		8	4		12	1	25	12	**48**
	Blue shark		386	128		45	1	560	514	**91.8**
	Shortfin mako		7	2		5		14	9	**64.3**
off Ireland	Albacore	1	273	20		176		470	294	**62.6**
	Bluefin tuna	1	345	31		149		526	377	**71.7**
	Swordfish		13	8		16		37	21	**56.8**
	Blue shark	9	1731	376		159	10	2285	2116	**92.6**
	Porbeagle		5			4		9	5	**55.6**
	Shortfin mako		8			1		9	8	**88.9**
off Abidjan	Albacore		2	1		4		7	3	**42.9**
	Bigeye tuna		264	49		184		497	313	**63.0**
	Yellowfin tuna		18	2		43		63	20	**31.7**
	Atlantic blue marlin		4	1		6		11	5	**45.5**
	Swordfish		3	4		7		14	7	**50**
	Longbill spearfish		12	6		48		65	18	**27.7**
	Blue shark		45	20		23		88	65	**73.9**
	Other sharks		8		2	1		11	10	**90.9**

Table 4. Life status of fish caught (2006FY).

2006		Alive				Dead	Unknown	Total	Total number alive	Percentage alive
		No details	Vigorous	Sluggish	Injured					
off Florida	Albacore		41	6		128		175	47	**26.9**
	Bluefin tuna		19	1		22		42	20	**47.6**
	Bigeye tuna		45	7		20		72	52	**72.2**
	Yellowfin tuna	2	110	17		80		209	129	**61.7**
	Atlantic blue marlin		6	2		5		13	8	**61.5**
	Swordfish		18	14		20	1	53	32	**60.4**
	Longbill spearfish		11	10		175		196	21	**10.7**
	White marlin		4	2		11		17	6	**35.3**
	Blue shark		40	3		1		44	43	**97.7**
	Shortfin mako		4	1		2		7	5	**71.4**
	Other sharks		15	3		3		21	18	**85.7**
off Grandbank	Albacore		24	19		94		137	43	**31.4**
	Bluefin tuna		627	827		533		1987	1454	**73.2**
	Bigeye tuna		229	149		140		518	378	**73.0**
	Yellowfin tuna	2	130	21		94		247	153	**61.9**
	Swordfish		10	3		75		88	13	**14.8**
	Blue shark		391	222		93		706	613	**86.8**
	Porbeagle		47	55		161	1	264	102	**38.6**
	Shortfin mako		22	8		13		43	30	**69.8**
	Other sharks		3	8		16		27	11	**40.7**
C N A	Albacore		106	1		157		264	107	**40.5**
	Bluefin tuna		39			25		64	39	**60.9**
	Bigeye tuna		9	4		9		22	13	**59.1**
	Swordfish		12			8		20	12	**60**
	Blue shark		326	65		41		432	391	**90.5**
	Shortfin mako		18			5		23	18	**78.3**
off Ireland	Albacore		226	1		141		368	227	**61.7**
	Bluefin tuna	1	189	7		50		247	197	**79.8**
	Swordfish		5			4		9	5	**55.6**
	Blue shark	6	1879	62	3	129		2079	1950	**93.8**
	Shortfin mako		14	1				15	15	**100**
off Dakar	Bigeye tuna		339			578		917	339	**37.0**
	Yellowfin tuna		40			162		202	40	**19.8**
	Atlantic blue marlin					6		6	0	**0**
	Swordfish		4			31		35	4	**11.4**
	Longbill spearfish					7		7	0	**0**
	Blue shark		16			31		47	16	**34.0**
	Shortfin mako		2			4		6	2	**33.3**
	Other sharks		1			5		6	1	**16.7**

Table 5. Sex ratio for major species by area and year (2005 FY).

2005

Area	Species	Male	Female	Indeterminate	Unknown	Total	**Sex ratio**
off Florida	Bigeye tuna		7			7	**0**
	Yellowfin tuna	1	7			8	**0.13**
	Swordfish	2	23			25	**0.08**
	Longbill spearfish	3	15			18	**0.17**
	Blue shark	11	1			12	**0.92**
C N A	Albacore	60	87	4		151	**0.40**
	Bluefin tuna	103	98			201	**0.51**
	Swordfish	11	12			23	**0.48**
	Blue shark	80	408			488	**0.16**
	Porbeagle	6	1			7	**0.86**
	Shortfin mako	11	1			12	**0.92**
off Ireland	Albacore	78	21	2		101	**0.77228**
	Bluefin tuna	291	213			504	**0.57738**
	Swordfish	7	17	1		25	**0.28**
	Blue shark	539	1476		1	2016	**0.27**
	Porbeagle	2	4			6	**0.33**
	Shortfin mako	6	3			9	**0.67**
off Abidjan	Bigeye tuna	189	190			379	**0.50**
	Yellowfin tuna	19	32			51	**0.37**
	Atlantic blue marlin	5	3			8	**0.625**
	Swordfish	6	6			12	**0.5**
	Longbill spearfish	41	25			66	**0.62**
	Blue shark	30	44			74	**0.41**

Table 5. Sex ratio for major species by area and year (2006 FY).

2006

Area	Species	Male	Female	Indeterminate	Unknown	Total	Sex ratio
off Florida	Bluefin tuna	26	16			42	**0.62**
	Bigeye tuna	23	33	2		58	**0.40**
	Yellowfin tuna	83	74	1		158	**0.53**
	Atlantic blue marlin	1	12			13	**0.08**
	Swordfish	9	29	1		39	**0.23**
	White marlin		12			12	**0**
	Longbill spearfish	12	133			145	**0.08**
	Blue shark	23	15			38	**0.61**
Grand bank	Bluefin tuna	345	218	1		564	**0.61**
	Bigeye tuna	68	163	2		233	**0.29**
	Yellowfin tuna	54	27	1		82	**0.66**
	Swordfish	7	7			14	**0.5**
	Blue shark	142	290	1		433	**0.33**
	Porbeagle	76	89			165	**0.46**
	Shortfin mako	26	7			33	**0.79**
C N A	Bluefin tuna	38	33			71	**0.54**
	Bigeye tuna	6	6			12	**0.5**
	Swordfish	5	4			9	**0.56**
	Blue shark	97	264			361	**0.27**
	Shortfin mako	22	1			23	**0.96**
off Ireland	Albacore	24	10			34	**0.71**
	Bluefin tuna	133	105			238	**0.56**
	Swordfish	1	6			7	**0.14**
	Blue shark	381	1402		1	1784	**0.21**
	Shortfin mako	11	2			13	**0.85**
off Dakar	Bigeye tuna	570	284			854	**0.67**
	Yellowfin tuna	127	54	1		182	**0.70**
	Swordfish	5	1			6	**0.83**

Table 6. Information on pop-up tagging[4].

	PAT information						Release						Pop-off
	Cruise ID	Species attached	Serial ID	Argos ID	Programmed pop-off period (month)	Scheduled pop-off date	Date	Time(JST)	Lat	Lon	Body length (estimated)	Product weight (estimated)	status
2005	AT 200501	Bluefin tuna	8206	44862	6	2006/5/19	2005/11/19	10:34	53-34 N	19-27 W	160	75	pop-off
	AT 200501	Bluefin tuna	8207	44863	6	2006/2/29	2005/8/29	8:05	52-25 N	17-47 W	230	190	pop-off
	AT 200509	Swordfish	03P0145	16574	6	2006/7/5	2006/1/5	20:20	05-59 S	00-22 W	150	60	unconfirmed
	AT 200509	Bigeye tuna	8379	58945	6	2006/7/10	2006/1/10	21:24	06-57 S	05-09 W	160	80	pop-off
	AT 200509	Bigeye tuna	8380	58945	6	2006/7/22	2006/1/22	17:55	09-30 S	05-59 W	164	85	pop-off
	AT 200509	Bigeye tuna	8381	46252	6	2006/7/4	2006/1/4	17:55	05-07 S	01-13 W	167	95	pop-off
2006	AT200604	Bigeye tuna	9565	67683	6	2007/8/8	2007/2/8	6:40	07-23N	29-23 W	142*	54	not pop-off
	AT200604	Bigeye tuna	9566	67684	6	2007/8/27	2007/2/27	10:15	10-29 N	31-51 W	155*	75	not pop-off
	AT200604	Bigeye tuna	9567	67685	6	2007/9/14	2007/3/14	5:30	08-54 N	24-05 W	134*	48	not pop-off

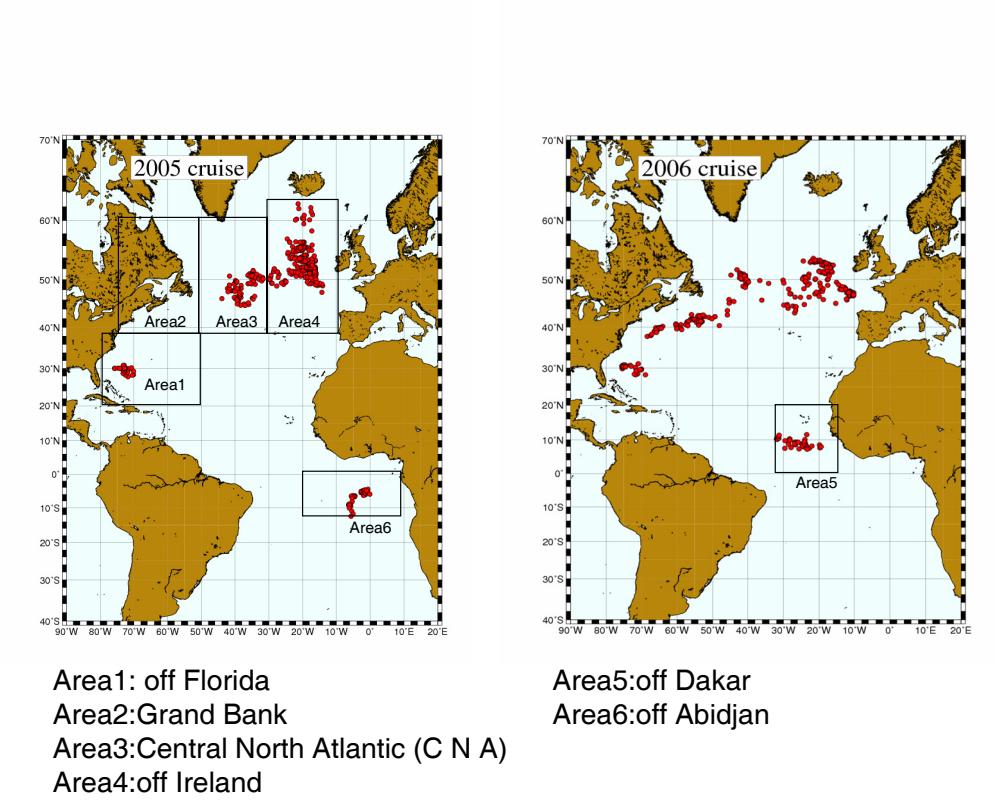
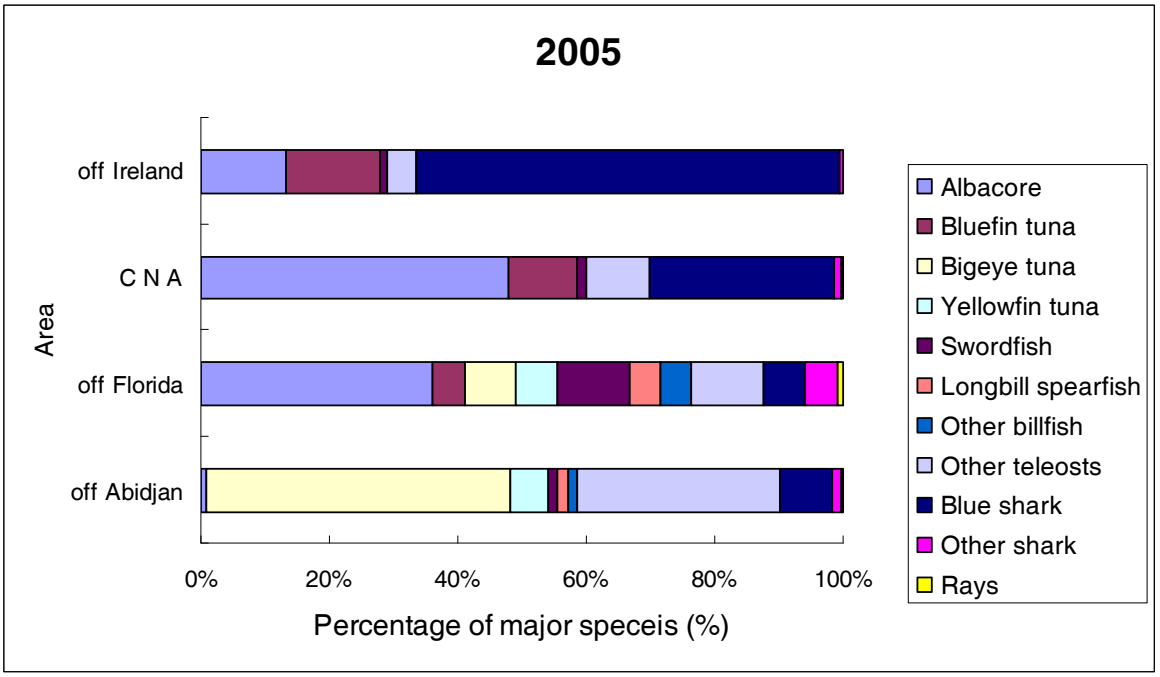


Figure 1. Operation area for 2005 and 2006 cruise.

[4]These lengths were measured with caliper..



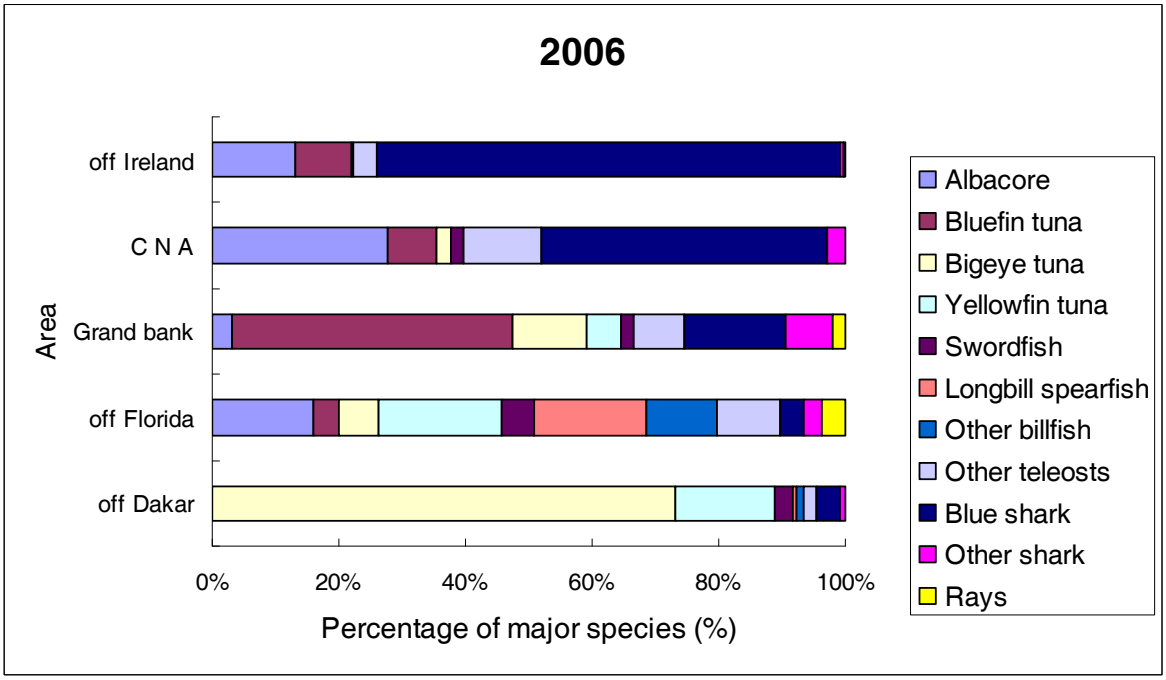


Figure 2. Catch composition by area and year.

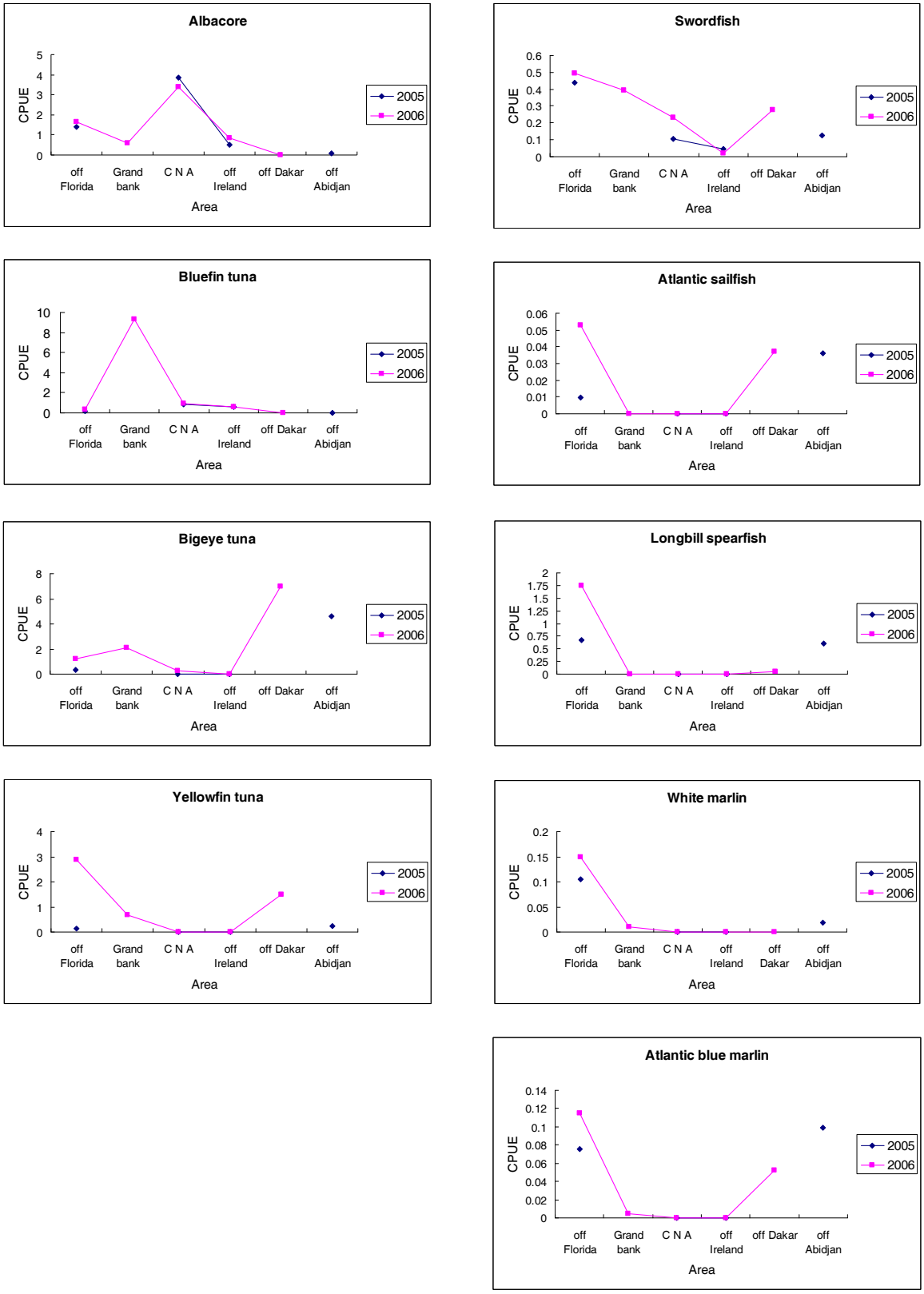
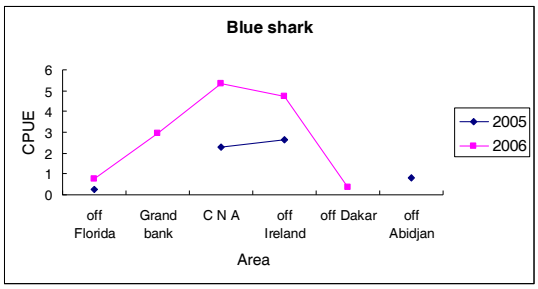
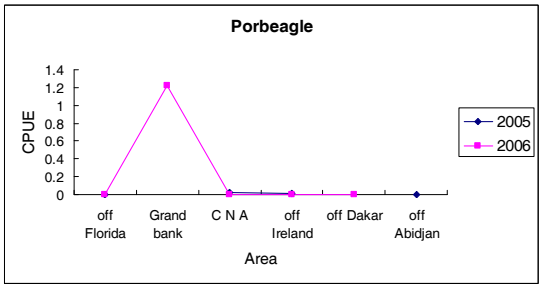


Figure 3. CPUE[5] for major species.

[5]CPUE denotes catch number per 1,000 hooks.





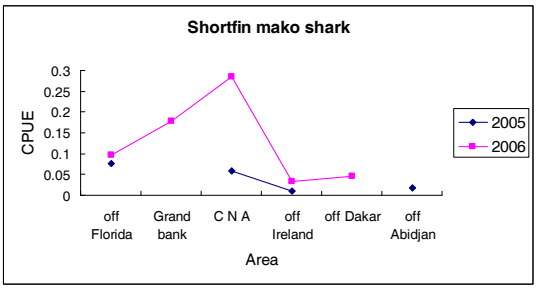


Figure 3 (Continued).

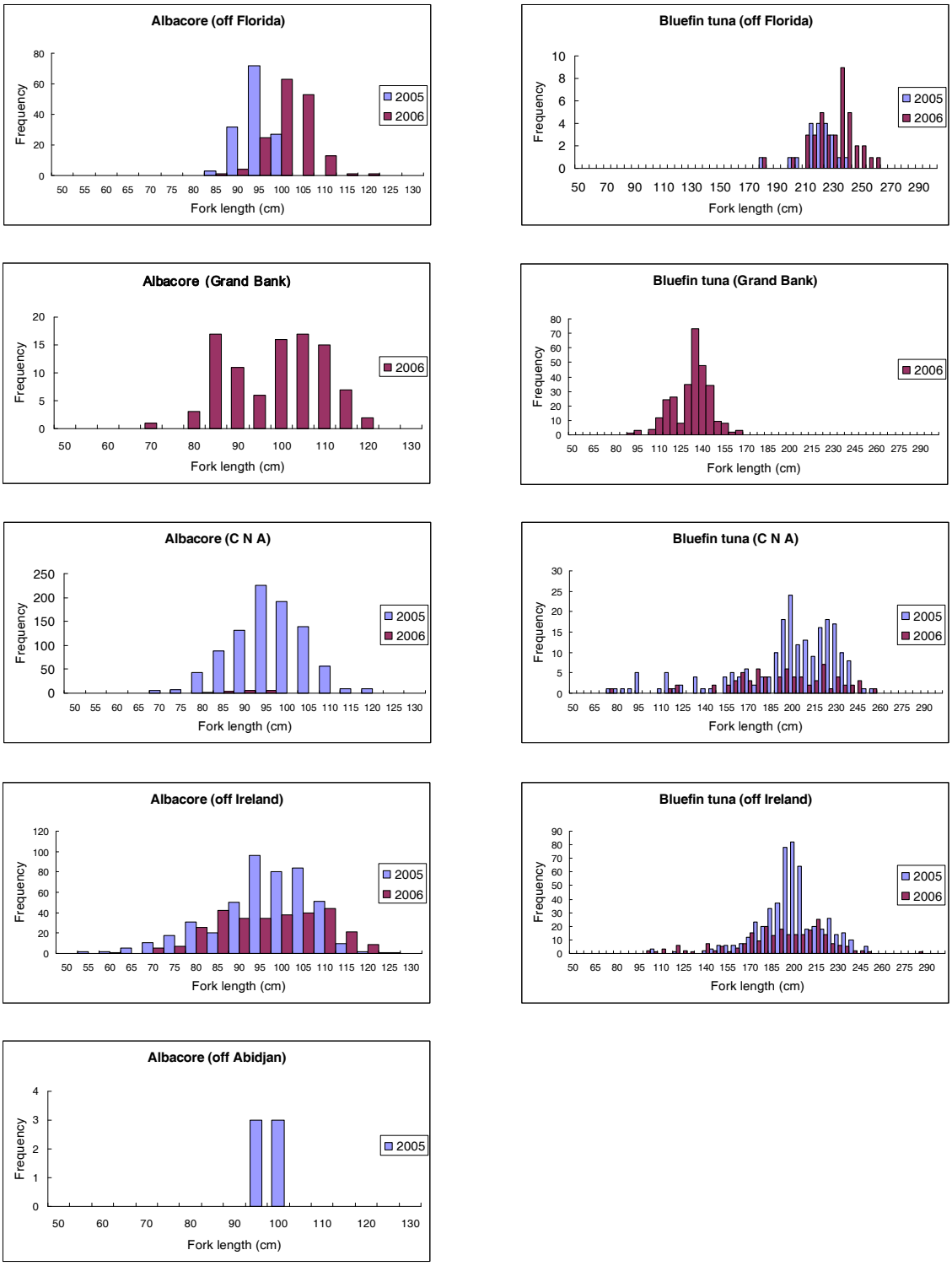
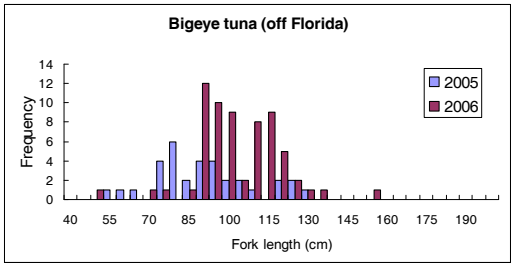
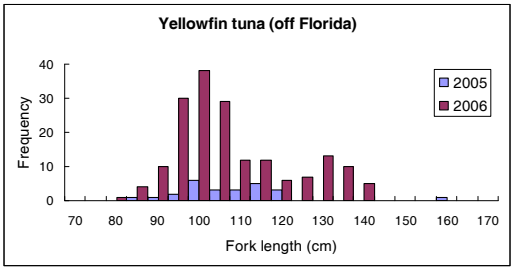
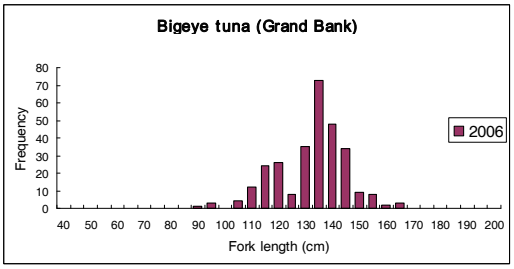
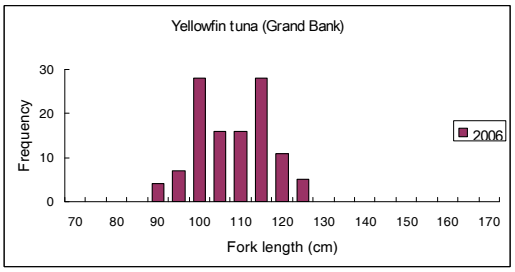


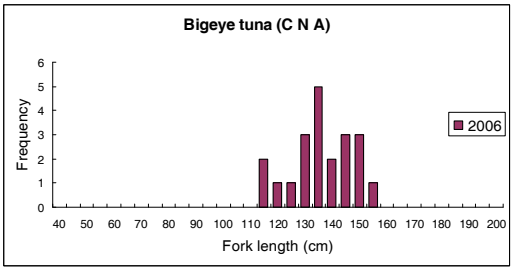
Figure 4. Length frequencies for major species.

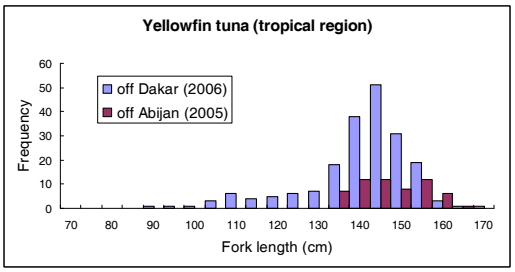


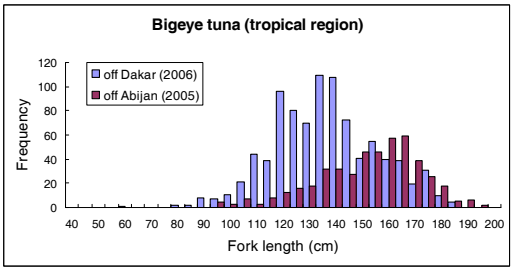












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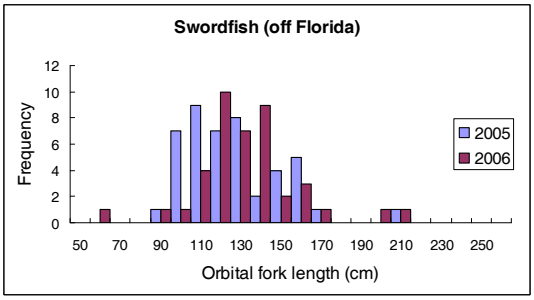
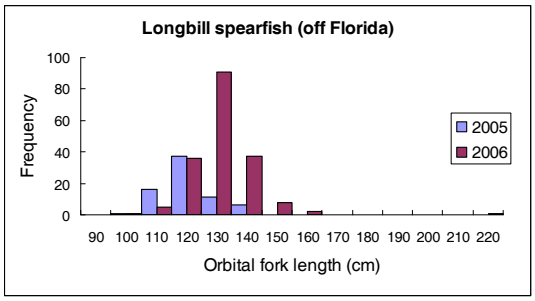
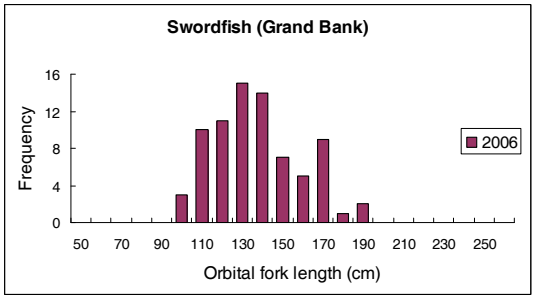
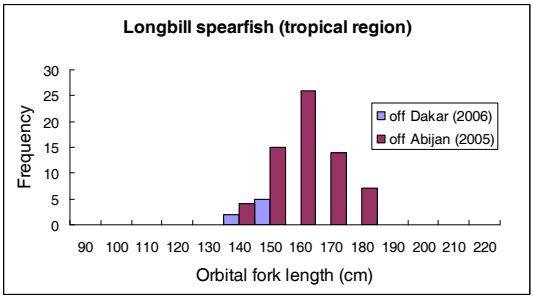
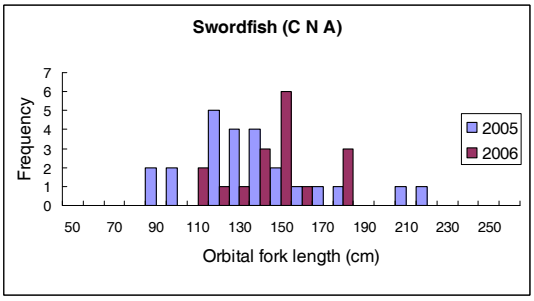
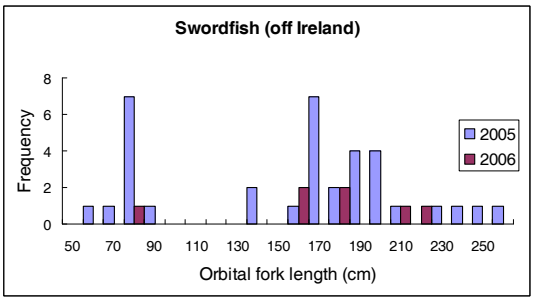












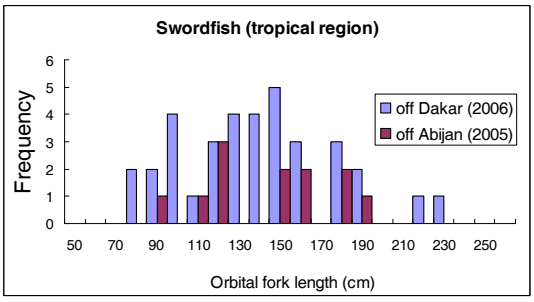
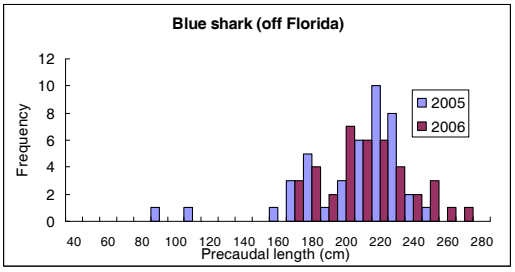
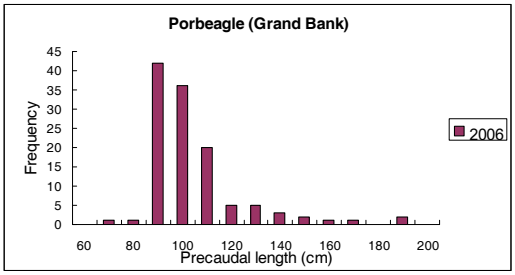
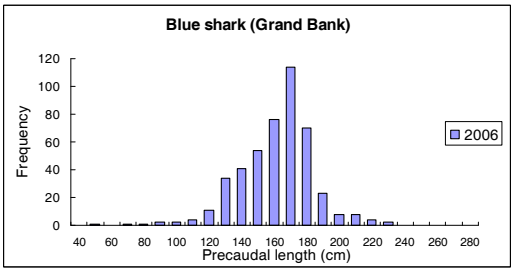
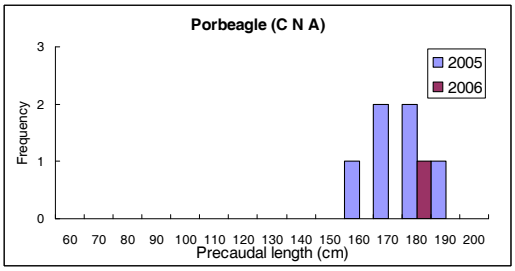


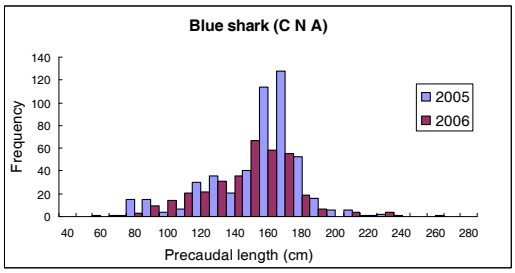
Figure 4 (Continued).

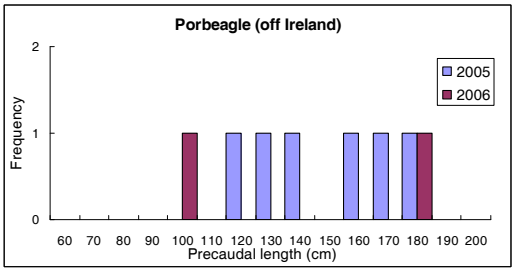


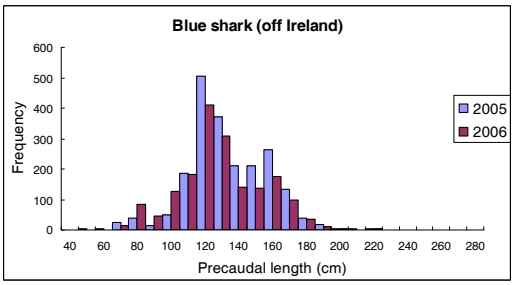












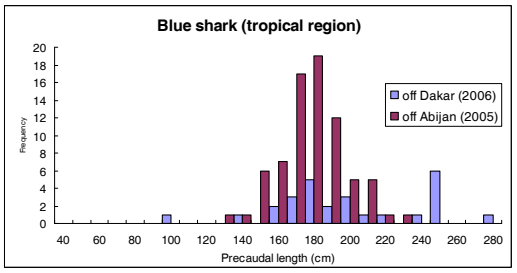
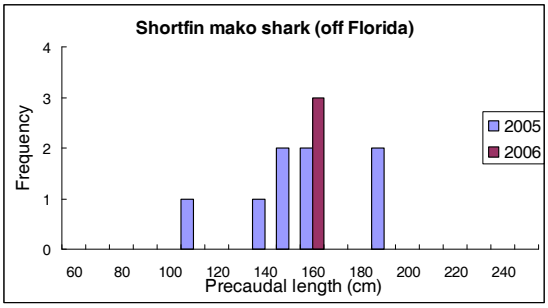
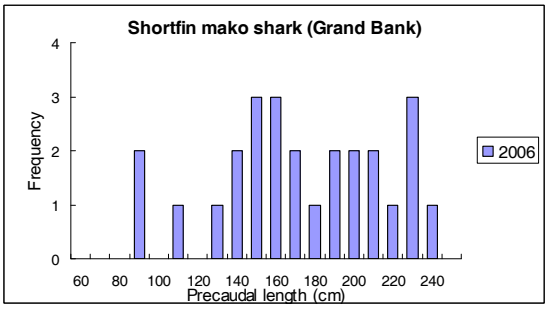
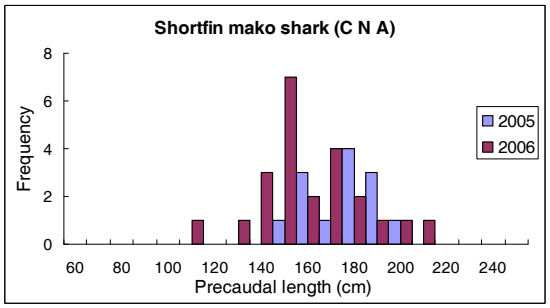
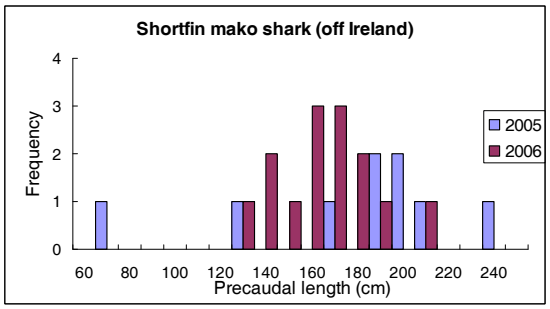


Figure 4 (Continued).









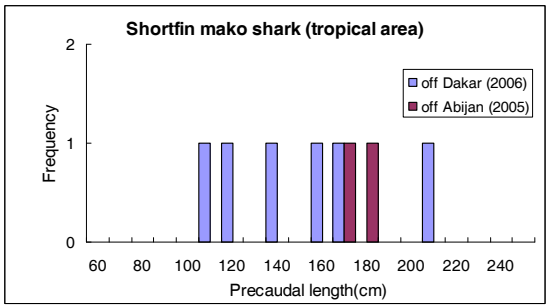


Figure 4 (Continued).