Comparison between observer data and data reported by fishermen.
日本延縄漁業における科学オブザーバのデータと漁業者の報告データの比較

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要約

昨年度の SAG/SC において要請された、科学オブザーバデータを用いた追加的な分析を行った。我々は、まず、日本の派遣した科学オブザーバが観察した漁獲物の体長組成と、漁船から報告された漁獲物の体長組成を比較した。両データの体長組成には、特に、小型魚が放流されていた 1995・1996 年に明確な相違が見られた。我々は、更に、日本のオブザーバデータに、オーストラリア（以下、豪州）との合弁会社による操業（JV 船）と、ニュージーランド（以下、NZ）にチャーターされて行った操業でのオブザーバデータを加えて、カバー率および CPUE の分析を行った。日本船の操業が少なかった 5,6 海区については、NZ のオブザーバデータを加えたことで、カバー率は非常に高くなった。オブザーバ種類別の CPUE の比較では、明白で実質的な差はない。

Summary

Additional comparative analyses between the scientific observer data and reported by the fishermen were conducted, which was requested at SAG8/SC12. First, we compared the length of SBT captured between the two data sets: Japanese scientific observer data and Japanese RTMP data. Length frequency distributions of those two data sets indicated apparent differences especially in 1995 and 1996, due to the voluntary release of small individuals by fishermen. Then, using the catch and effort data combined including Japanese longline vessels, Australian joint venture (JV) vessels and the New Zealand's (NZ) chartered vessels with information on presence/absence of scientific observers, we analyzed the observer coverage and the difference in CPUE with presence or absence of observer on board. The coverage in areas 5 and 6 were low by Japanese fishery, but it was higher as a result of the addition of NZ data. There are no substantial differences evident in comparing CPUEs by observer type.

1. 背景　　　Introduction

日本延縄 CPUE に関する議論は 2006 年、2007 年の SAG/SC や第 2 回 CPUE モデリングワークショップ等で行われたが、最終的な結論には至らず、更なる分析が要求された(Anon.(CCSBT), 2007)。そこで我々は、CCSBT メンバーによる日本延縄データに対する理解を更に深めることを目的として、科学オブザーバの乗船効果に関する分析を実施した。

本文書では、我々は、まず１）漁業者から報告された延縄操業データ（RTMP）と、日本のオブザーバ観察データとで、漁獲体長組成を比較した。次いで、日本の操業データに、提供を受けた NZ チャーター船と豪州 JV のオブザーバ乗船の有無を含む操業データを加えて２）オブザーバカバー率の算出、３）オブザーバの種別での CPUE の比較を実施した。

There have been discussions on the Japanese longline CPUE data at the SAG/ESC in 2006 and 2007 as well as at the second CPUE modeling workshop. In these meetings, participants did not reach consensus to common interpretation on the Japanese CPUE data, and there was a need for further analyses to better understand it. In this document, we therefore further analyzed the observer data, which was requested at the SAG8/SC12 (Anon, 2007a).

We used not only the Japanese scientific observer data but also the observer data of Australia and New Zealand (NZ) in order to analyze the coverage rate and catch per unit effort (CPUE). The following analysis is contained in this document.

1) Comparison of the SBT length frequency between the Japanese scientific observer data and RTMP reported by fishermen.
2) Calculation of observer coverage using the data of Japan, Australia and NZ.
3) Comparison of CPUE among observer types (ex-fisherman observers VS other scientific observers).

2. 科学オブザーバ計画の概要 Outline of the observer programs

1) 日本の科学オブザーバ計画　Japanese scientific observer program

ミナミマグロ漁場で操業する日本延縄漁船には、1992 年以降、毎年 10～18 隻に科学オブザーバが乗船していた。日本のオブザーバは、水産庁により雇用され、派遣前に訓練を受けている。問題が見られたオブザーバは再雇用されていない。各年での観察操業数は約 400～900 であり、その大部分は CCSBT 統計海区 4・7・8・9 で行われたものであった（Fig. 1)。1992～1995 年には、漁期外の操業を行うことが許可された一部の RTMP 船にも豪州人を含むオブザーバが乗務していた（Fig. 2)。1996 年以降、豪州から RTMP 漁獲枠が提供されなくなり、オブザーバは全て日本人となった。また、得られる情報も漁期内に限定された（Fig. 3)。日本人オブザーバには延縄漁業の経験者が多く、長期の航海かつ過酷な天候下でオブザーバ活動を円滑に遂行している。科学オブザーバプログラム以外での活動においても、日本は度々オブザーバや調査員を延縄漁船に乗せていた。1998～2000 年の EFP では、のべ 123 隻の EFP 調査船のうち、50 隻に米国人を含むオブザーバを派遣した。また、2001 年以降、SRP の一環として毎年 1 隻の船に調査員を派遣していた。これらの調査員は科学オブザーバ活動に加えてアーカイバルタグ等の標識放流活動を行った。今回の分析ではこれら調査の操業もオブザーバ操業として扱っている。

Since 1992, the scientific observer has been sent to 10-18 vessels of Japanese longline fisheries every year. These observers were employed by the Fisheries Agency Japan. All of these observers received a training program before being sent to the longline vessels. Observers who had problems were not rehired. The total number of the operations observed was 400-900 sets in each year, and most of those were operated in the CCSBT statistical area 4, 7, 8 and 9 (Fig. 1). Between 1992 and 1995, the scientific observer program was conducted as part of collaborative Real Time Monitoring Program (RTMP) which was conducted under the cooperation among NZ, Australia and Japan. Under the RTMP framework, Australia provided some observers and national quota to the Japanese RTMP vessels, and some vessels with observer were allowed to operate after the seasonal closure of the Japanese SBT fishing management zones (Fig. 2). After 1996, Australia stopped the allocation of its quota for the RTMP, and the observed periods were reduced to the fishing season. Since then, observers were usually Japanese (Fig. 3). Most of observers in resent years were retired fishermen who had experience of SBT fisheries; thus they could smoothly implement observer activities in long voyages under inclement weather conditions. Japan also sent some observers and researchers to longline vessels as a part of other scientific activities in addition to the scientific observer program. In 1998-2000, Japan sent observers to 50 vessels out of 123 vessels under the Experimental Fishing Program (EFP). Some of these observers were American. In addition, Japan has sent a researcher to one fishing vessel every year since 2001. This researcher performed not only the scientific observation but also the tagging activity under the SRP. In this document, we included these scientific investigations into the Japanese observer activities.

2) 豪州・NZ による、日本延縄船での科学オブザーバ計画

The observer programs of Australia and NZ for the Japanese longline vessels

日本以外の CCSBT メンバーが日本延縄漁船にてオブザーバ活動を行ったケースとして、豪州 JV と NZ チャーターでの操業がある。日本漁船は、1991～1997 年に豪州 JV の枠組みにて、豪州の 200 海里内を含む 4･7･8 海区で操業を行っていた。これらの操業では、毎年 164～910 操業を豪州のオブザーバが観察していた（Polacheck et al., 2006）。また、日本漁船は 1989 年以降、NZ チャーターの枠組みにて、NZ の 200 海里内を含む 5･6 海区で操業を行っている。これらのチャーター船の多くにはオブザーバが乗務しており、近年のカバー率は 100％に近い（Anon., 2007b）。

There were two cases where non-Japanese observers were placed on the Japanese longline vessels: the observer activity on the Australian joint venture (JV) vessels and the NZ chartered vessels. Japanese longline vessels operated in areas 4, 7 and 8, including the Australian Fishing Zone (AFZ) under the Australian JV arrangements in 1991-1997. Australian observers covered 164-910 sets of these operations in each year (Polacheck et al., 2006). Also, Japanese longline vessels which were chartered by NZ have operated in areas 5 and 6, including the NZ exclusive economic zone (EEZ), since 1989. Most of these operations were observed by the NZ observers, and coverage in recent years has been almost 100% (Anon., 2007b).

3. 体長組成データの分析　Analysis of the SBT length frequency

1992～2007 年に漁獲されたミナミマグロの体長組成分布を、科学オブザーバの観察した漁獲と漁業者が報告した漁獲とで比較した（Fig. 4）。前述のように、この分析は日本のオブザーバデータと漁業データ（RTMP）のみで実施している。データの比較は、オブザーバの観察尾数が年・月・統計海区別に 100 尾以上ある場合に限定した（Table 1）。両データの体長組成分布には、特に 1995・1996 年の 8・9 海区で明確な相違が見られた。これは、両年にはオブザーバが乗船していない場合には、生きている 25Kg 以下の小型魚が漁獲されても放流していたが、オブザーバが乗船していた場合は全ての魚体を船に取り込んで体長測定を行っていたためである（Itoh 1996）。

Fig. 4 shows the comparison of the SBT length frequencies between the data reported by observers and fishermen. The observer data used in this analysis contained the Japanese observer data and Japanese SRP researcher's data (not included the Australia and NZ observer data). The data reported by fishermen is RTMP data. The comparison is limited to those spatio-temporal strata that have more than 100 SBT observed (Table 1). The distributions of length frequency from both data sets had apparent differences in the 1995 and 1996. During these two years, vigorous and small sized SBT (<25 kg) were released by Japanese longline vessels that did not carry observers on board (Itoh 1996).

4. オブザーバのカバー率　The coverage of observer

1990～2006 年のオブザーバカバー率を、日本、NZ チャーター、豪州 JV を併せたデータについて求めた。日本のデータは、1990～2004 年については漁獲成績報告書に、2005～2006 年については RTMP に基づく。1998～2000 年に行われた EFP では、操業位置の制限が無い商業的操業、操業海域の指定がある操業、および、操業位置が指定されたグリッド調査操業が行われた。今回の分析には、操業位置指定の無い商業的な操業に限り、EFP データも含めた。

カバー率は、努力量（Hook 数）に対して、および SBT 漁獲尾数に対して、統計海区、年、月別に示した（Table 2、Table 3）。カバー率の算出対象としたのは 1～12 月の 4～9 海区である。5・6 海区では、日本のオブザーバは 1992 年以外には観察を行っておらず、1993 年以降にみられる非常に高いカバー率は、全て NZ のオブザーバ活動による。いずれの海区でも、オブザーバのカバー率が極端に高い月と、極端に低い月が存在する。即ち、オブザーバは年間を通して一定のカバー率で操業を観察しているわけではなく、海区・年毎に、観察が行われた月に偏りがある。

Fig. 5 に 4～9 海区の 1～12 月でのオブザーバカバー率をオブザーバのタイプ別（元漁業者か否か）に示す。近年の日本の科学オブザーバは、ほとんどが元漁業者であり、元漁業者以外のオブザーバによるカバー率は高くない。

We calculated the observer coverage rates for the efforts and catches by the Japanese longline vessels in 1990-2006. The data used in this analysis were Japanese logbook data (1990-2004) and RTMP data (2005-2006), Japanese EFP data (1998-2000), Australia JV data (1991-1995) and NZ charter data (1990-2006). The EFP had three types of operation: Type I) area constrained fishing (stratified operation), Type II) unconstrained fishing (commercially directed operation), and Type III) grid survey (systematic operation). In this analysis, EFP data only for Type II operations (unconstrained fishing) were included.

Table 2 and Table 3 summarize the observer coverage for effort (number of hook used) and catch in number of all aged SBT captured, respectively. The coverage was calculated for January-December and areas 4-9. In areas 5 and 6, Japanese scientific observers did not cover except for in 1992, thus higher coverage in 1993-2006 in areas 5 and 6 was resulted mainly from the observer activity by NZ. Every area had the month with higher coverage as well as the month with lower coverage. In other words, the observer coverage was variable throughout the year.

Fig. 5 shows the coverage by observer type (ex-fishermen or others) in areas 4-9 between January and December. Most of the Japanese observers in resent years were ex-fishermen, thus the coverage by the non-ex-fisher observer was not high.

5. CPUE の比較　　Comparison of CPUE by observer type

オブザーバ乗船時・非乗船時、および乗船していたオブザーバの種類別に、漁業者の報告するCPUE を比較した。同様の分析は SAG7/SC11 や第 2 回 CPUE モデリングワークショップへの提出文書でも行ったが（Sakai et al., 2006; Sakai et al., 2007）、それらの分析では、日本のオブザーバのみを対象とし、オブザーバの種類の検討は行っていなかった。本文書では、日本のデータに加えて、NZ チャーター、豪州 JV のオブザーバデータも併せて分析を行った。オブザーバの影響を検討するため、データは 3 通りに区分した（オブザーバ無し、元漁業者のオブザーバが乗船、その他のオブザーバが乗船）。分析にあたり、毎年 CCSBT へ提出している緯度・経度 5x5 度セル毎の漁獲物体長組成を用いて、データを 4 歳以上のミナミマグロの CPUE に限定した。比較に供した時空間は、4～9 海区の 4～9 月である。

We examined the influence of the observer's presence or absence on board and observer type over the recorded CPUE which was reported by the Japanese longline vessels. Similar analyses were already attempted and submitted to the SAG7/SC11 and 2nd CPUE modeling workshop (Sakai et al., 2006; Sakai et al., 2007), though these previous analyses based only on the Japanese data. In these previous analyses, we examined only the influence of presence or absence of observers, which does not include the comparison between observer types. In this document, we used not only the Japanese data, but also the NZ charter vessel's data, and Australia JV vessel's data. Moreover, we divided the data into three categories: presence of ex-fisher observer, presence of non-ex-fisher observer, or absence of observer. CPUE were calculated as the number of age 4+ SBT caught per 1000 hooks. Catch number of age 4+ fish were estimated by the catch-at-length data of each 5x5 cell and month which had been submitted to the CCSBT. The month and area compared were April to September and areas 4-9.

1) ノミナル CPUE　　Nominal CPUE

Fig. 6 に、操業毎（ショット-バイ-ショット）に算出したノミナル CPUE の平均値と標準偏差を海区別に示す。日本漁船の CPUE は、オブザーバ乗船時と非乗船時の操業で、必ずしも一致せず、

年・海区によっては極端に乖離した値をとる場合もあった。この CPUE の相違には、様々な要因が複合的に作用していると考えられる。

例えば、1992～1995 年には、一部のオブザーバ船は漁期終了後も操業を許されていた。漁船が密集し、個々の漁船の操業位置の自由度が低い漁期内に比べ、大半の漁船が漁場から離脱する漁期外には、効率的に漁場を利用し高い CPUE を得ることができたと考えられる。この一例は、1990 年代前半の 4 海区の CPUE にみられる。

また、豪州 JV や NZ チャーター船でのオブザーバ乗船操業には、200 海里内での操業が多く含まれ、公海域よりも高い CPUE が得られる場合があることを考慮すべきである。この影響は NZ チャーター船の操業が多い 5･6 海区で大きいだろう。

1995･1996 年の CPUE には、オブザーバ非乗船時の操業での小型魚放流の影響も考えられる。1995･1996 年のオブザーバ乗船時の操業では、他船では放流される大量の小型魚を取り込むため、相対的にその漁獲尾数が多い。今回の分析では、4 歳魚以上の魚の CPUE を計算するに当たり、オブザーバ乗船の有無に関わらず、全ての船の漁獲物の年齢組成データを一律に使用したため、両年のオブザーバ乗船時の 4 歳以上の漁獲が過大推定された。そのため、両年のオブザーバ乗船時の CPUE は高くなった。

なお、年・海区によっては、オブザーバのカバー率が低い/高いため、オブザーバ乗船時/非乗船時の CPUE に対する、個々の船の特性に起因した影響が大きいことを考慮すべきである。

ノミナル CPUE の年トレンドには、乗船したオブザーバが元漁業者か否かで、顕著な違いが認められなかった。この結果の解釈に当たっては、近年の日本のオブザーバの多くが元漁業者であること、豪州 JV、NZ チャーター船でのオブザーバが元漁業者以外のオブザーバに分類されていることを念頭に置くべきである。

Fig. 6 shows yearly average and standard deviation of nominal CPUEs by observer type, which was calculated by shot-by-shot data. CPUE did not always coincide between observer types, and did differ substantially depending on the certain year and area. These differences were caused by various factors.

For example, a part of observer vessels were allowed to operate after the end of fishing season in 1992-1995. It was considered that effective fishing operations was possible after the end of fishing season in the high CPUE areas where fewer boats operated and thus recorded high CPUE. The typical case of such occasion was observed in early 1990s in area 4.

The operations within the EEZ could also contribute to the better fishing than in the international waters. This type of influence would be strong in areas 5 and 6, in which most of the operations were covered by observers from NZ.

With respect to 1995 and 1996, it should be noted the release of small SBT from the Japanese boats. In this analysis, age composition by all vessels were pooled in order to calculate CPUE of age 4+ fish, therefore it includes not only the data from the boats that released small fish but also from the boats that did not release the fish. This resulted in the overestimation of the age 4+ CPUE when 1995-1996 observer data were used, because large catches of small fish were caught and the release of small fish was seldom released.

Because of these facts and different levels of observer coverage rates by year and area, it should be born in mind that CPUE with and without observer were quite variable depending on how the boat operated, i.e., performance of individual boats.

In this analysis, there was no appreciable differences in the year trend of nominal CPUE by the observer type (ex-fisherman or not). However, as mentioned above, it should be carefully interpreted that most of the Japanese observers in resent years were ex-fishermen whereas all of non-Japanese observer (i.e. observers for Australian JV and NZ chartered vessels) were categorized as the non-ex-fishermen.

2) 標準化 CPUE　　Standardized CPUE

CPUE に影響を与える要因の中からオブザーバの種類による効果を取り出すため、標準化を行った。使用したデータは、ノミナル CPUE の分析に使用したデータを 5x5 度・月毎に集計しなおしたものである。標準化には CPUE－Lognormal モデルを使用した。モデルに組み込んだ変数は「年」、「月」、「海区」、「緯度 5 度」、「オブザーバ種類」の主効果と、「月＊海区」、「年＊海区」、「年＊緯度 5 度」、「年＊オブザーバ種類」の交互作用である。初期段階のフルモデルを以下に示す。

$$log(CPUE+0.2) = Intercept + Year + Month + Area + Lat5 + Observer + (Month*Area) + (Year*Lat5) + (Year*Area) + (Year*Observer) + Error,$$

但し、 $Error \sim N(0, \sigma^2)$ とする。

CPUE に影響を与えている変数の取捨選択には、ステップワイズ検定を用いた。結果、除去される変数は無く、フルモデルが最終的なモデルとして選択された（Table 4）。オブザーバの種類で CPUE の年トレンドを比較するため、年とオブザーバの交互作用の効果の最小二乗平均値を推定した。計算には SAS の GLM procedure を用いた。

推定された年トレンドを Fig. 7 に、モデルからの残差のヒストグラムを Fig. 8 に示す。オブザーバ種類別の CPUE の比較では、明白で実施的な差はない。

In order to take out the effects of observer type, some explanatory variables that affect CPUE were removed through the CPUE standardization using Log-Nomral error structure model. The CPUE data used in this analysis were those data used in the nominal CPUE analyses aggregated by 5° x 5° square and month. Main effects and some two-way interactions of “Year”, “Month”, “Area”, “Latitude (5 degree)”, “Observer”, “Month*Area”, “Year*Latitude”, “Year*Area” and “Year*Observer” were initially included in the model. “Observer” was categorized into 3 classes (presence of ex-fisher observers, presence of non-ex-fisher observer, and absence of observers). The calculation was performed through GLM procedure of SAS package (SAS. Ver. 9.1.3). At first, we used the following formula as a full model:

$$log(CPUE+0.2) = Intercept + Year + Month + Area + Lat5 + Observer + (Month*Area) + (Year*Lat5) + (Year*Area) + (Year*Observer) + Error,$$

where $Error \sim N(0, \sigma 2)$

We performed the model selection based on the statistical stepwise F-test at one percent level of significance. No effect or interaction was removed from the full model, and finally it was selected as the final model (See Table 4). CPUE year trend by observer type was estimated as the Least Squared Means (LSMEANS) of (Year*Observer) effect in GLM output.

Fig. 7 shows the estimated trends of CPUEs by observer type, and Fig. 8 shows the total standardized residuals for the finally selected model. There are no substantial differences evident in comparing CPUEs by observer type.

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Table 1. Data used in Fig. 3. These months have the measurement of more than 100 fish recorded by the observer vessels.

	Area 4	Area 7	Area 8	Area 9
1992		May, Jun., Jul.	Aug., Sep., Oct., Nov.	Apr., May, Jun., Jul.
1993		May, Jun., Jul.	Aug., Sep.	May, Jun., Jul.
1994	Jun.	Jun., Jul.	Aug., Sep.	May, Jun., Jul.
1995	May, Jun., Jul.		Jul., Aug., Sep., Oct., Nov., Dec.	May, Jun., Jul.
1996	May, Jun.		Sep., Oct.	May, Jun., Jul.
1997	May, Jun.	May, Jun.	Oct., Nov., Dec.	May, Jun., Jul.
1998	Jun., Jul.		Sep., Oct., Nov.	Jun., Jul.
1999	Jun., Jul., Aug.	May,	Sep.,	May, Jun., Jul.
2000	May, Jun., Jul.	May, Jun.		May, Jun., Jul.
2001		Apr., Jun.,	Sep., Oct.	May, Jun., Jul., Nov.
2002	Jun.	May, Jun.	Oct.	May, Jun., Jul.
2003	May, Jun., Jul., Oct., Nov.	May, Jun.	Oct., Nov., Dec.	May, Jun., Jul.
2004	May, Jun.,	May	Nov., Dec.	May, Jun., Jul., Aug.
2005			Oct., Nov., Dec.	May, Jun., Jul., Aug.
2006			May, Aug., Sep., Oct.	May, Jun., Jul., Aug.
2007			Aug., Sep.	Jun., Jul., Aug., Sep., Oct.

Table 2-1. Total efforts (a), observed efforts (b), and observer coverage (c) of Japanese longline vessels in areas 4, 5, and 6. Empty cells and cells in italics in the coverage table indicate "no effort" and "<30000 hooks used" by all vessels, respectively.

a) Number of hooks used by All vessels — unit=1000hooks

Area	Year	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Total
4	1990	19	50	106	127	320	3451	3866	1047	6				8992
4	1991		28	135	438	1172	1460	2017	882	180				6311
4	1992	6		167	580	1431	1993	2547	763	194				7681
4	1993	6	161	581	2419	2227	2726	2665	1302	86	32		3	12208
4	1994	6	178	454	1640	3492	2737	1263	1009	118			3	10901
4	1995		56	382	1747	2292	2815	2213	1115	343	10			10973
4	1996		106	655	1822	3960	4031	2076	1173	350				14174
4	1997	57	170	537	2769	3746	3372	2088	708	82			24	13554
4	1998			236	1070	1752	4230	3679	987	38			36	12030
4	1999			185	666	693	1492	2805	648					6489
4	2000		81	195	562	1358	2063	1979	262	66	42			6607
4	2001			197	421	339	1627	1932	493	100	213	40	10	5372
4	2002	3	54	293	311	238	2751	3056	413	13				7130
4	2003		65	478	305	949	2890	3368	657	295	621	440	149	10216
4	2004	84	69	257	424	1108	2972	2959	1079	229	194			9375
4	2005			217	31	2073	3188	2033	3					7545
4	2006					1681	1482	368	9					3540
5	1990	24	14	9		2	460	2042	1074	9				3634
5	1991		63	11	114	62	1458	3024	623	231				5587
5	1992					242	1936	1498	221	48				3946
5	1993		3	3		9	240	411	3					668
5	1994						90							90
5	1995					6	36	43	15					101
5	1996				53	6	4	137						200
5	1997			11			68	83						162
5	1998		40	27			109	227	101					503
5	1999							69	603	168				840
5	2000						37	27	92	124	9			289
5	2001						10	148	204	143		24		528
5	2002	3		19			18	9	6	6				63
5	2003				4		3	103	154	140			6	409
5	2004			15				61	267	24				367
5	2005			6				158						164
5	2006							84	84					168
6	1990			550	1529	1490	1242	8						4819
6	1991			777	2752	3091	814	84						7517
6	1992			234	1582	1968	632	447						4862
6	1993			154	1038	987	370	73						2621
6	1994			23	176	488	208							896
6	1995				243	537	484	148						1413
6	1996													
6	1997			97	338	447	228							1110
6	1998				20	405	286							712
6	1999				180	378	432	107						1097
6	2000				127	362	263	52						804
6	2001			14	84	391	233	3						726
6	2002			16	142	337	240	3						738
6	2003				145	401	340							886
6	2004			3	250	416	399	65						1132
6	2005				142	207	180							529
6	2006				96	211	202	53						562

b) Number of hooks observed — unit=1000hooks

Area	Year	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Total
4	1990						3	72						75
4	1991							7	3					9
4	1992						6	24						30
4	1993							32						32
4	1994					9	93							102
4	1995						26	110	13					149
4	1996					88	72							160
4	1997				56	182	129							367
4	1998					5	80	80	22					187
4	1999					14	211	159	20					403
4	2000					63	184	92						340
4	2001						24	31						55
4	2002						96	25						121
4	2003				10	161	121	118			65	41		514
4	2004					57	61							118
4	2005					107	164							272
4	2006						33							33
5	1990													
5	1991							40	75					116
5	1992					14	79	28						122
5	1993							16						16
5	1994						30							30
5	1995							16	11					27
5	1996													
5	1997						50	74						124
5	1998						89	136	25					249
5	1999							45	43					88
5	2000						37	27						64
5	2001													
5	2002						12							12
5	2003						3	77						80
5	2004							52						52
5	2005							138						138
5	2006							50						50
6	1990				71	42								112
6	1991						43	43						86
6	1992				122	138	85	36						382
6	1993				123	96	96	9						325
6	1994			23	125	289	123							560
6	1995				72	138	149	95						454
6	1996													
6	1997			33	171	285	189							678
6	1998				17	366	271							654
6	1999				114	286	384	66						850
6	2000				109	344	263	28						744
6	2001				84	352	182							618
6	2002			16	136	328	232							711
6	2003				142	394	337							872
6	2004			3	250	414	396	62						1125
6	2005				142	207	180							529
6	2006				96	211	199	53						559

c) Coverage of hooks (%)

Area	Year	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Total
4	1990	*0.0*	*0.0*	*0.0*	*0.0*	**0.0**	**0.1**	**1.9**	**0.0**	**0.0**				*0.8*
4	1991		*0.0*	*0.0*	*0.0*	*0.0*	**0.0**	**0.3**	**0.3**	**0.0**				*0.1*
4	1992	*0.0*		*0.0*	*0.0*	*0.0*	**0.3**	**1.0**	**0.0**	**0.0**				*0.4*
4	1993	*0.0*	*0.0*	*0.0*	*0.0*	**0.0**	**0.0**	**1.2**	**0.0**	**0.0**	**0.0**		**0.0**	**0.3**
4	1994	*0.0*	*0.0*	*0.0*	*0.0*	**0.3**	**3.4**	**0.0**	**0.0**	**0.0**			**0.0**	*0.9*
4	1995		*0.0*	*0.0*	*0.0*	**0.0**	**0.9**	**5.0**	**1.1**	**0.0**	**0.0**			*1.4*
4	1996		*0.0*	*0.0*	*0.0*	**2.2**	**1.8**	**0.0**	**0.0**	**0.0**				*1.1*
4	1997	**0.0**	*0.0*	*0.0*	**2.0**	**4.9**	**3.8**	**0.0**	**0.0**	**0.0**			**0.0**	*2.7*
4	1998			*0.0*	*0.0*	*0.3*	**1.9**	**2.2**	**2.3**	**0.0**			**0.0**	*1.6*
4	1999			*0.0*	*0.0*	*2.0*	**14.1**	**5.7**	**3.0**					*6.2*
4	2000		*0.0*	*0.0*	*0.0*	**4.7**	**8.9**	**4.7**	**0.0**	**0.0**	**0.0**			**5.1**
4	2001			*0.0*	*0.0*	*0.0*	**1.5**	**1.6**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**1.0**
4	2002	*0.0*	*0.0*	*0.0*	*0.0*	**0.0**	**3.5**	**0.8**	**0.0**	**0.0**				*1.7*
4	2003		*0.0*	*0.0*	*3.1*	**16.9**	**4.2**	**3.5**	**0.0**	**0.0**	**10.4**	**9.2**	**0.0**	**5.0**
4	2004	**0.0**	*0.0*	*0.0*	**0.0**	**5.2**	**2.1**	**0.0**	**0.0**	**0.0**	**0.0**			**1.3**
4	2005			*0.0*	*0.0*	*5.2*	**5.2**	**0.0**	**0.0**					*3.6*
4	2006					*0.0*	*2.2*	*0.0*	**0.0**					*0.9*
5	1990	*0.0*	*0.0*	*0.0*		*0.0*	*0.0*	*0.0*	*0.0*	**0.0**				*0.0*
5	1991		*0.0*	*0.0*	*0.0*	**0.0**	*0.0*	**1.3**	**12.1**	**0.0**				*2.1*
5	1992					*6.0*	*4.1*	*1.9*	**0.0**	**0.0**				*3.1*
5	1993		*0.0*	*0.0*		*0.0*	*0.0*	*3.8*	*0.0*					*2.4*
5	1994						*33.8*							*33.8*
5	1995					*0.0*	*0.0*	*37.4*	*71.7*					*26.8*
5	1996				*0.0*	*0.0*	*0.0*	**0.0**						*0.0*
5	1997			*0.0*			*73.5*	*89.3*						*76.5*
5	1998		*0.0*	*0.0*			*81.9*	*59.8*	*24.8*					*49.6*
5	1999							*65.0*	*7.1*	*0.0*				*10.4*
5	2000						*100.0*	*100.0*	*0.0*	**0.0**	*0.0*			*22.0*
5	2001						*0.0*	*0.0*	*0.0*	*0.0*		**0.0**		*0.0*
5	2002	*0.0*		*0.0*			*66.7*	*0.0*	*0.0*	*0.0*				*19.2*
5	2003				*0.0*		*100.0*	*74.9*	*0.0*	*0.0*			**0.0**	*19.6*
5	2004			*0.0*				*85.1*	*0.0*	*0.0*				*14.0*
5	2005			*0.0*				*87.2*						*84.0*
5	2006							*58.7*	*0.0*					*29.4*
6	1990			*0.0*	*4.6*	*2.8*	**0.0**	**0.0**						*2.3*
6	1991			*0.0*	*0.0*	*0.0*	**5.2**	**51.9**						*1.1*
6	1992			*0.0*	*7.7*	*7.0*	**13.5**	**8.2**						*7.9*
6	1993			*0.0*	*11.9*	*9.8*	**25.9**	**13.0**						*12.4*
6	1994			*100.0*	*71.1*	*59.1*	*59.3*							*62.5*
6	1995				*29.4*	*25.8*	*30.7*	**64.3**						*32.1*
6	1996													
6	1997			*33.7*	*50.4*	*63.8*	**83.1**							*61.1*
6	1998				*84.5*	*90.3*	*94.6*							*91.9*
6	1999				*63.3*	*75.5*	*88.9*	**62.4**						*77.5*
6	2000				*85.7*	*95.1*	*100.0*	**52.9**						*92.5*
6	2001			*0.0*	*100.0*	*90.0*	*78.0*	**0.0**						*85.1*
6	2002			*100.0*	*95.7*	*97.2*	*96.6*	**0.0**						*96.4*
6	2003				*97.9*	*98.3*	*99.0*							*98.5*
6	2004			*100.0*	*100.0*	*99.4*	*99.4*	**95.4**						*99.3*
6	2005				*100.0*	*100.0*	*100.0*							*100.0*
6	2006				*100.0*	*100.0*	*98.4*	**100.0**						*99.4*

Table 2-2. Total efforts (a), observed efforts (b), and observer coverage (c) of Japanese longline vessels in areas 7, 8, and 9. Empty cells and cells in italics in the coverage table indicate "no effort" and "<30000 hooks used" by all vessels, respectively.

a) Number of hooks used by All vessels — unit=1000hooks

Area	Year	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Total
7	1990			50	4120	6093	2884	114	26					13288
7	1991					2297	4116	1747	17	80	120	158	698	9234
7	1992	155	77	26	128	2422	3996	1113	23	39	435	2028	1665	12106
7	1993	299				3279	3700	616	10		487	2054	1898	12341
7	1994	223		3			4121	2042	3		579	1554	955	9480
7	1995	6	41	131	117	1525	2211	545		3	550			5130
7	1996					950	1102	358	197	86	38			2732
7	1997				569	3117	1751	164			279	15	6	5901
7	1998				1331	3685	1180	33		6	236			6471
7	1999				2209	4789	1723	271		364	1368	1129		11853
7	2000				1943	2811	1699	37		63	801	638	1123	9115
7	2001				2693	5081	3085	429		195	247	21		11750
7	2002				2298	4608	1538	101			1087	471		10103
7	2003				1918	3120	764			140	3			5944
7	2004				1361	1631	6							2997
7	2005				1738	1127	10							2874
7	2006					578	214	147		17				955
8	1990	9		3			21	2666	2359	143	102	79	112	5493
8	1991	11					15	91	2440	3798	602	844	538	8339
8	1992	15	14	36	25			66	1639	2730	1313	1041	82	6960
8	1993	62	194	86	100	24	31	45	644	1320	712	534	281	4033
8	1994	171	34	37			18	67	833	3807	1143	206	172	6488
8	1995		3				33	245	726	4479	3391	1769	661	11307
8	1996	171				7	19	3		4549	4382	5488	1452	16072
8	1997									4370	3550	4418	1899	14236
8	1998					14		1251	2741	3513	3893	4346	750	16510
8	1999						10	1401	2618	3328	2069	2271		11697
8	2000									4340	3988	4629	2793	15751
8	2001								38	3974	4065	3849		11926
8	2002							3	86	3637	2022	905		6653
8	2003									2802	2407	2357	917	8483
8	2004					1173	312			1338	1672	2503	1669	8668
8	2005					1887	38			1610	1993	2363	1420	9310
8	2006					39		249	1281	862	1133	1737	882	6182
9	1990	32	52	380	4540	5506	6200	6007	1677	29		5		24429
9	1991	10	63	299	3954	6396	6596	6173	997	519	25	29		25060
9	1992		47	274	3458	5860	7391	6731	3058	1140	142			28101
9	1993		45	468	3376	6549	7779	5191	2352	577	219		3	26558
9	1994	20	91	608	1063	4391	6545	3854	1603	861	944	361	180	20520
9	1995	2	140	875	1417	7768	6692	1623	888	396	284	124	12	20221
9	1996	5	253	323	581	7860	6840	5515	911	637	541	37	5	23508
9	1997		78	355	598	7429	6899	5950	1882	1338	568	77	2	25176
9	1998	9	133	412	440	6429	6467	5062	2205	1443	511	71		23182
9	1999	39	172	423	257	6221	6246	4267	1423	264	286	84	89	19770
9	2000	157	166	19	33	5007	4883	4744	1629	302	618	81	27	17666
9	2001		20	29	54	6596	6945	5499	892	347	816	128	42	21367
9	2002	17		2		5681	5886	824			15	41	33	12499
9	2003					7341	7795	1720					11	16866
9	2004				48	6219	7564	7539	1520	14	150	14	6	23074
9	2005					5492	7275	7737	3493					23998
9	2006					2806	3657	4714	5187	3124	828	78		20393

b) Number of hooks observed — unit=1000hooks

Area	Year	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Total
7	1990						35							35
7	1991					124	308	176				23	75	706
7	1992	14		21		252	431	168			57	159	166	1267
7	1993	45				592	348	246			58	350	214	1854
7	1994	3					816	224			76	147	111	1377
7	1995	3												3
7	1996					3								3
7	1997					31	37							68
7	1998													
7	1999					120	445			48	21			634
7	2000				53	196	100							350
7	2001				105	25	100	3		17	26			276
7	2002				22	185	133				69			410
7	2003				69	69	28			5				171
7	2004				19	84								104
7	2005													
7	2006													
8	1990													
8	1991													
8	1992			17					98	230	276	323		945
8	1993		8	42	85	19			238	234	53			679
8	1994	11						3	331	431	34	17	7	833
8	1995							27	313	412	259	160	88	1258
8	1996	34								548	206			788
8	1997									6	474	355	144	979
8	1998							295	600	265	266	93		1520
8	1999							276	714	194	64			1248
8	2000										12	79	60	151
8	2001									140	255	74		468
8	2002									30	144	24		198
8	2003									62	205	185	58	510
8	2004											165	144	309
8	2005										5	206	152	363
8	2006					39			124	97	52			312
9	1990													
9	1991													
9	1992				138	262	340	102	12					854
9	1993				28	161	297	176						662
9	1994					114	284	170						568
9	1995					181	286	188						655
9	1996					199	271	157						628
9	1997					138	260	223						622
9	1998					33	220	103	11					367
9	1999					101	286	134						521
9	2000					254	244	204	14					716
9	2001					187	495	414	32					1128
9	2002					39	505	62						605
9	2003					158	364	78						599
9	2004					111	424	436	80					1051
9	2005					268	369	536	208					1381
9	2006					441	572	647	294	6				1960

c) Coverage of hooks (%)

Area	Year	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Total
7	1990			*0.0*	*0.0*	*0.0*	**1.2**	**0.0**	**0.0**					*0.3*
7	1991					*5.4*	*7.5*	*10.1*	**0.0**	**0.0**	**0.0**	*14.7*	**10.7**	**7.7**
7	1992	**9.1**	*0.0*	*78.6*	**0.0**	**10.4**	*10.8*	**15.1**	**0.0**	**0.0**	**13.2**	*7.8*	**10.0**	**10.5**
7	1993	**14.9**				*18.0*	*9.4*	*39.9*	**0.0**		**12.0**	*17.1*	*11.3*	**15.0**
7	1994	**1.3**		*0.0*			*19.8*	*11.0*	*0.0*		**13.2**	*9.5*	*11.6*	**14.5**
7	1995	*52.9*	*0.0*	*0.0*	*0.0*	**0.0**	**0.0**	**0.0**		**0.0**	**0.0**			**0.1**
7	1996					*0.3*	*0.0*	*0.0*	**0.0**	**0.0**	**0.0**			**0.1**
7	1997				*0.0*	*1.0*	*2.1*	**0.0**			**0.0**	*0.0*	*0.0*	**1.2**
7	1998				*0.0*	*0.0*	*0.0*	**0.0**		**0.0**	**0.0**			**0.0**
7	1999				*0.0*	*2.5*	*25.8*	**0.0**		**13.1**	**1.5**	*0.0*		**5.4**
7	2000				*2.7*	*7.0*	*5.9*	**0.0**		**0.0**	**0.0**	*0.0*	**0.0**	**3.8**
7	2001				*3.9*	*0.5*	*3.2*	**0.8**		**8.9**	**10.6**	*0.0*		**2.4**
7	2002				*1.0*	*4.0*	*8.7*	**0.0**			**6.3**	*0.0*		**4.1**
7	2003				*3.6*	*2.2*	*3.7*			**3.9**	*0.0*			*2.9*
7	2004				*1.4*	*5.2*	*0.0*							*3.5*
7	2005				*0.0*	*0.0*	*0.0*							*0.0*
7	2006					*0.0*	*0.0*	*0.0*		**0.0**				*0.0*
8	1990	*0.0*		*0.0*			*0.0*	*0.0*	*0.0*	*0.0*	**0.0**	**0.0**	**0.0**	**0.0**
8	1991	*0.0*					*0.0*	*0.0*	*0.0*	*0.0*	**0.0**	**0.0**	**0.0**	**0.0**
8	1992	*0.0*	*0.0*	*48.1*	*0.0*			*0.0*	*6.0*	*8.4*	**21.0**	**31.1**	**0.0**	**13.6**
8	1993	**0.0**	*4.3*	*49.2*	**85.5**	**76.9**	**0.0**	**0.0**	*36.9*	**17.7**	**7.4**	**0.0**	**0.0**	**16.8**
8	1994	**6.7**	*0.0*	*0.0*			**0.0**	*4.6*	*39.7*	*11.3*	**2.9**	**8.1**	**3.9**	**12.8**
8	1995		*0.0*				*0.0*	*10.8*	*43.1*	**9.2**	**7.6**	**9.0**	**13.2**	**11.1**
8	1996	**19.9**				*0.0*	*0.0*	*0.0*		*12.0*	*4.7*	*0.0*	**0.0**	**4.9**
8	1997									*0.1*	*13.3*	*8.0*	**7.6**	**6.9**
8	1998					*0.0*		*23.6*	*21.9*	*7.5*	**6.8**	**2.1**	**0.0**	**9.2**
8	1999						*0.0*	*19.7*	*27.3*	*5.8*	**3.1**	**0.0**		**10.7**
8	2000									*0.0*	*0.3*	*1.7*	**2.1**	**1.0**
8	2001								*0.0*	*3.5*	*6.3*	**1.9**		**3.9**
8	2002							*0.0*	*0.0*	*0.8*	*7.1*	**2.7**		**3.0**
8	2003									*2.2*	*8.5*	*7.8*	**6.4**	**6.0**
8	2004					*0.0*	*0.0*			**0.0**	*0.0*	*6.6*	**8.7**	**3.6**
8	2005					*0.0*	*0.0*			**0.0**	*0.3*	*8.7*	**10.7**	**3.9**
8	2006					*100.0*		*0.0*	**9.7**	*11.2*	**4.6**	**0.0**	**0.0**	**5.0**
9	1990	**0.0**	*0.0*	*0.0*	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**		**0.0**		*0.0*
9	1991	*0.0*	*0.0*	*0.0*	*0.0*	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**		*0.0*
9	1992		*0.0*	*0.0*	*4.0*	**4.5**	**4.6**	**1.5**	**0.4**	**0.0**	**0.0**			**3.0**
9	1993		*0.0*	*0.0*	*0.8*	**2.5**	**3.8**	**3.4**	**0.0**	**0.0**	**0.0**		**0.0**	**2.5**
9	1994	*0.0*	*0.0*	*0.0*	*0.0*	**2.6**	**4.3**	**4.4**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**2.8**
9	1995	*0.0*	*0.0*	*0.0*	*0.0*	**2.3**	**4.3**	**11.6**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**3.2**
9	1996	*0.0*	*0.0*	*0.0*	*0.0*	**2.5**	**4.0**	**2.9**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**2.7**
9	1997		*0.0*	*0.0*	*0.0*	**1.9**	**3.8**	**3.8**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**2.5**
9	1998	*0.0*	*0.0*	*0.0*	*0.0*	**0.5**	**3.4**	**2.0**	**0.5**	**0.0**	**0.0**	**0.0**		**1.6**
9	1999	**0.0**	*0.0*	*0.0*	**0.0**	**1.6**	**4.6**	**3.1**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**2.6**
9	2000	**0.0**	*0.0*	*0.0*	**0.0**	**5.1**	*5.0*	**4.3**	**0.9**	**0.0**	**0.0**	**0.0**	**0.0**	**4.1**
9	2001		*0.0*	*0.0*	*0.0*	*2.8*	*7.1*	**7.5**	**3.6**	**0.0**	**0.0**	**0.0**	**0.0**	**5.3**
9	2002	*0.0*		*0.0*		*0.7*	*8.6*	*7.6*			**0.0**	*0.0*	*0.0*	*4.8*
9	2003					*2.2*	*4.7*	*4.5*					*0.0*	*3.6*
9	2004				*0.0*	*1.8*	*5.6*	**5.8**	**5.3**	**0.0**	**0.0**	**0.0**	*0.0*	**4.6**
9	2005					*4.9*	*5.1*	*6.9*	**5.9**					*5.8*
9	2006					*15.7*	*15.6*	*13.7*	**5.7**	**0.2**	**0.0**	**0.0**		**9.6**

Table 3-1. Total catches (a), observed catches (b), and observer coverage (c) of Japanese longline vessels in areas 4, 5, and 6. Empty cells and cells in italics in the coverage table indicate “no catch” and “<100 fishes captured” by all vessels, respectively.

a) Number of SBT caught by All vessels

Area	Year	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Total
4	1990	0	0	0	0	0	5,801	9,948	915	0	0	0	0	16,664
4	1991	0	0	0	0	583	6,341	9,790	1,614	102	0	0	0	18,430
4	1992	0	0	0	0	764	2,901	17,757	3,675	3	0	0	0	25,100
4	1993	0	0	0	1	5,121	31,558	10,989	3,307	153	0	0	0	51,129
4	1994	0	0	0	0	10,369	16,325	1,968	1,275	1	0	0	0	29,938
4	1995	0	0	0	0	5,121	8,471	1,543	829	226	0	0	0	16,190
4	1996	0	0	0	0	5,800	8,874	400	1,097	13	0	0	0	16,184
4	1997	0	0	0	485	4,016	6,239	2,572	129	13	0	0	0	13,454
4	1998	0	0	0	31	1,417	8,619	4,152	35	0	0	0	0	14,254
4	1999	0	0	0	4	1,074	3,615	7,772	827	0	0	0	0	13,292
4	2000	0	0	0	43	2,035	5,394	5,666	10	0	0	0	0	13,148
4	2001	0	0	0	0	519	4,846	6,247	89	0	0	0	0	11,701
4	2002	0	0	0	0	463	7,326	11,041	0	0	0	0	0	18,830
4	2003	0	0	0	65	1,472	7,305	9,864	77	36	1,247	1,635	581	22,282
4	2004	0	0	0	42	1,667	6,038	5,914	135	178	139	0	0	14,113
4	2005	0	0	0	2	2,425	5,488	4,439	0	0	0	0	0	12,354
4	2006	0	0	0	0	2,573	3,262	1,146	0	0	0	0	0	6,981
5	1990	0	0	0	0	0	475	4,287	335	0	0	0	0	5,097
5	1991	0	47	6	0	0	1,247	3,642	108	10	0	0	0	5,060
5	1992	0	0	0	0	54	1,103	1,422	27	0	0	0	0	2,606
5	1993	0	0	0	0	1	228	598	2	0	0	0	0	829
5	1994	0	0	0	0	0	17	0	0	0	0	0	0	17
5	1995	0	0	0	0	0	2	16	2	0	0	0	0	20
5	1996	0	0	0	0	0	0	0	0	0	0	0	0	0
5	1997	0	0	0	0	0	118	609	0	0	0	0	0	727
5	1998	0	0	0	0	0	35	1,304	43	0	0	0	0	1,382
5	1999	0	0	0	0	0	0	127	15	3	0	0	0	145
5	2000	0	0	0	0	0	31	0	3	0	0	0	0	34
5	2001	0	0	0	0	0	0	0	0	0	0	0	0	0
5	2002	0	0	0	0	0	0	0	0	0	0	0	0	0
5	2003	0	0	0	0	0	0	0	3	6	0	0	0	9
5	2004	0	0	0	0	0	0	0	3	0	0	0	0	3
5	2005	0	0	0	0	0	0	710	0	0	0	0	0	710
5	2006	0	0	0	0	0	0	115	18	0	0	0	0	133
6	1990	0	0	417	2,186	3,462	2,285	6	0	0	0	0	0	8,356
6	1991	0	0	437	1,932	4,367	1,535	143	0	0	0	0	0	8,414
6	1992	0	0	141	2,546	3,439	1,883	1,408	0	0	0	0	0	9,417
6	1993	0	0	100	680	1,313	1,108	158	0	0	0	0	0	3,359
6	1994	0	0	49	342	2,675	949	0	0	0	0	0	0	4,015
6	1995	0	0	0	499	1,407	1,472	374	0	0	0	0	0	3,752
6	1996	0	0	0	0	0	0	0	0	0	0	0	0	0
6	1997	0	0	169	550	1,293	452	0	0	0	0	0	0	2,464
6	1998	0	0	0	64	1,228	567	0	0	0	0	0	0	1,859
6	1999	0	0	0	306	1,076	1,140	209	0	0	0	0	0	2,731
6	2000	0	0	0	134	701	1,190	96	0	0	0	0	0	2,121
6	2001	0	0	0	140	1,079	1,328	8	0	0	0	0	0	2,555
6	2002	0	0	5	218	1,382	829	3	0	0	0	0	0	2,437
6	2003	0	0	0	360	568	276	0	0	0	0	0	0	1,204
6	2004	0	0	0	286	666	511	79	0	0	0	0	0	1,542
6	2005	0	0	0	161	379	51	0	0	0	0	0	0	591
6	2006	0	0	0	201	491	347	51	0	0	0	0	0	1,090

b) Number of SBT observed

Area	Year	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Total
4	1990	0	0	0	0	0	21	726	0	0	0	0	0	747
4	1991	0	0	0	0	0	0	175	53	0	0	0	0	228
4	1992	0	0	0	0	0	25	242	0	0	0	0	0	267
4	1993	0	0	0	0	0	0	92	0	0	0	0	0	92
4	1994	0	0	0	0	0	1,230	0	0	0	0	0	0	1,230
4	1995	0	0	0	0	0	191	692	77	0	0	0	0	960
4	1996	0	0	0	0	207	113	0	0	0	0	0	0	320
4	1997	0	0	0	48	302	358	0	0	0	0	0	0	708
4	1998	0	0	0	0	8	158	62	0	0	0	0	0	228
4	1999	0	0	0	0	25	600	903	150	0	0	0	0	1,678
4	2000	0	0	0	0	137	619	334	0	0	0	0	0	1,090
4	2001	0	0	0	0	0	83	131	0	0	0	0	0	214
4	2002	0	0	0	0	0	269	82	0	0	0	0	0	351
4	2003	0	0	0	1	237	271	367	0	0	348	169	0	1,393
4	2004	0	0	0	0	68	157	0	0	0	0	0	0	225
4	2005	0	0	0	0	59	85	0	0	0	0	0	0	144
4	2006	0	0	0	0	0	94	0	0	0	0	0	0	94
5	1990	0	0	0	0	0	0	0	0	0	0	0	0	0
5	1991	0	0	0	0	0	0	39	47	0	0	0	0	86
5	1992	0	0	0	0	1	34	9	0	0	0	0	0	44
5	1993	0	0	0	0	0	0	59	0	0	0	0	0	59
5	1994	0	0	0	0	0	0	0	0	0	0	0	0	0
5	1995	0	0	0	0	0	0	14	2	0	0	0	0	16
5	1996	0	0	0	0	0	0	0	0	0	0	0	0	0
5	1997	0	0	0	0	0	94	522	0	0	0	0	0	616
5	1998	0	0	0	0	0	26	1,127	43	0	0	0	0	1,196
5	1999	0	0	0	0	0	0	124	3	0	0	0	0	127
5	2000	0	0	0	0	0	31	0	0	0	0	0	0	31
5	2001	0	0	0	0	0	0	0	0	0	0	0	0	0
5	2002	0	0	0	0	0	0	0	0	0	0	0	0	0
5	2003	0	0	0	0	0	0	0	0	0	0	0	0	0
5	2004	0	0	0	0	0	0	0	0	0	0	0	0	0
5	2005	0	0	0	0	0	0	365	0	0	0	0	0	365
5	2006	0	0	0	0	0	0	114	0	0	0	0	0	114
6	1990	0	0	0	131	126	0	0	0	0	0	0	0	257
6	1991	0	0	0	0	0	124	74	0	0	0	0	0	198
6	1992	0	0	0	209	281	290	126	0	0	0	0	0	906
6	1993	0	0	0	67	157	304	54	0	0	0	0	0	582
6	1994	0	0	49	261	1,521	685	0	0	0	0	0	0	2,516
6	1995	0	0	0	137	493	389	232	0	0	0	0	0	1,251
6	1996	0	0	0	0	0	0	0	0	0	0	0	0	0
6	1997	0	0	82	336	877	416	0	0	0	0	0	0	1,711
6	1998	0	0	0	58	1,138	559	0	0	0	0	0	0	1,755
6	1999	0	0	0	223	922	1,069	142	0	0	0	0	0	2,356
6	2000	0	0	0	134	666	1,190	74	0	0	0	0	0	2,064
6	2001	0	0	0	140	1,011	1,175	0	0	0	0	0	0	2,326
6	2002	0	0	5	207	1,347	805	0	0	0	0	0	0	2,364
6	2003	0	0	0	331	563	274	0	0	0	0	0	0	1,168
6	2004	0	0	0	286	663	511	69	0	0	0	0	0	1,529
6	2005	0	0	0	161	379	51	0	0	0	0	0	0	591
6	2006	0	0	0	201	491	346	51	0	0	0	0	0	1,089

c) Coverage of catches (%)

Area	Year	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Total
4	1990						*0.4*	*7.3*	*0.0*					*4.5*
4	1991					*0.0*	*0.0*	*1.8*	**3.3**	**0.0**				*1.2*
4	1992					*0.0*	*0.9*	*1.4*	**0.0**	**0.0**				*1.1*
4	1993				*0.0*	*0.0*	*0.0*	*0.8*	**0.0**	**0.0**				*0.2*
4	1994					*0.0*	*7.5*	*0.0*	**0.0**	**0.0**				*4.1*
4	1995					*0.0*	*2.3*	*44.8*	**9.3**	**0.0**				*5.9*
4	1996					*3.6*	*1.3*	*0.0*	**0.0**	**0.0**				*2.0*
4	1997				*9.9*	*7.5*	*5.7*	**0.0**	**0.0**	**0.0**				*5.3*
4	1998				*0.0*	*0.6*	*1.8*	*1.5*	**0.0**					*1.6*
4	1999				*0.0*	*2.3*	*16.6*	*11.6*	**18.1**					*12.6*
4	2000				*0.0*	*6.7*	*11.5*	*5.9*	**0.0**					*8.3*
4	2001					*0.0*	*1.7*	*2.1*	**0.0**					*1.8*
4	2002					*0.0*	*3.7*	*0.7*						*1.9*
4	2003				*1.5*	*16.1*	*3.7*	*3.7*	**0.0**	**0.0**	**27.9**	*10.3*	*0.0*	**6.3**
4	2004				*0.0*	*4.1*	*2.6*	*0.0*	**0.0**	**0.0**	**0.0**			**1.6**
4	2005				*0.0*	*2.4*	*1.5*	*0.0*						*1.2*
4	2006					*0.0*	*2.9*	*0.0*						*1.3*
5	1990						*0.0*	*0.0*	*0.0*					*0.0*
5	1991		*0.0*	**0.0**			*0.0*	*1.1*	*43.5*	**0.0**				*1.7*
5	1992					*1.9*	*3.1*	*0.6*	*0.0*					*1.7*
5	1993					*0.0*	*0.0*	*9.9*	*0.0*					*7.1*
5	1994						*0.0*							*0.0*
5	1995						*0.0*	*87.5*	*100.0*					*80.0*
5	1996													
5	1997						*79.7*	*85.7*						*84.7*
5	1998						*74.3*	*86.4*	*100.0*					*86.5*
5	1999							*97.6*	*20.0*	*0.0*				*87.6*
5	2000						*100.0*		*0.0*					*91.2*
5	2001													
5	2002													
5	2003								*0.0*	*0.0*				*0.0*
5	2004								*0.0*					*0.0*
5	2005							*51.4*						*51.4*
5	2006							*99.1*	*0.0*					*85.7*
6	1990			**0.0**	*6.0*	*3.6*	**0.0**	**0.0**						*3.1*
6	1991			**0.0**	*0.0*	*0.0*	**8.1**	**51.7**						*2.4*
6	1992			**0.0**	*8.2*	*8.2*	**15.4**	**8.9**						*9.6*
6	1993			**0.0**	*9.9*	*12.0*	**27.4**	**34.2**						*17.3*
6	1994			**100.0**	*76.3*	*56.9*	*72.2*							*62.7*
6	1995				*27.5*	*35.0*	*26.4*	**62.0**						*33.3*
6	1996													
6	1997			**48.5**	*61.1*	*67.8*	**92.0**							*69.4*
6	1998				*90.6*	*92.7*	*98.6*							*94.4*
6	1999				*72.9*	*85.7*	*93.8*	**67.9**						*86.3*
6	2000				*100.0*	*95.0*	*100.0*	**77.1**						*97.3*
6	2001				*100.0*	*93.7*	*88.5*	**0.0**						*91.0*
6	2002			**100.0**	*95.0*	*97.5*	*97.1*	**0.0**						*97.0*
6	2003				*91.9*	*99.1*	*99.3*							*97.0*
6	2004				*100.0*	*99.5*	*100.0*	**87.3**						*99.2*
6	2005				*100.0*	*100.0*	*100.0*							*100.0*
6	2006				*100.0*	*100.0*	*99.7*	**100.0**						*99.9*

Table 3-2. Total catches (a), observed catches (b), and observer coverage (c) of Japanese longline vessels in areas 7, 8, and 9. Empty cells and cells in italics in the coverage table indicate "no catch" and "<100 fishes captured" by all vessels, respectively.

a) Number of SBT caught by All vessels

Area	Year	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Total
7	1990	0	0	109	14,420	24,107	9,838	292	32	0	0	0	0	48,798
7	1991	0	0	0	0	14,938	23,418	7,368	55	394	208	594	2,083	49,058
7	1992	5,042	4,097	878	5,101	19,679	27,120	5,336	82	94	771	5,392	4,435	78,027
7	1993	1,181	0	0	0	28,779	33,416	3,506	143	0	1,333	4,294	3,775	76,427
7	1994	462	0	0	0	0	23,630	12,667	13	0	2,113	3,202	1,977	44,064
7	1995	4	287	1,222	1,466	9,467	12,902	2,928	0	7	1,385	0	0	29,668
7	1996	0	0	0	0	3,100	5,258	1,905	371	154	21	0	0	10,809
7	1997	0	0	0	1,544	9,441	5,804	520	0	0	615	12	6	17,942
7	1998	0	0	0	2,255	5,651	2,115	106	0	10	616	0	0	10,753
7	1999	0	0	0	4,762	12,053	7,521	1,217	0	628	1,861	2,055	0	30,097
7	2000	0	0	0	3,346	6,023	5,939	113	0	146	1,438	847	1,445	19,297
7	2001	0	0	0	5,177	12,510	9,522	1,711	0	342	404	24	0	29,690
7	2002	0	0	0	4,376	9,923	5,060	174	0	0	964	332	0	20,829
7	2003	0	0	0	3,056	6,883	1,759	0	0	53	1	0	0	11,752
7	2004	0	0	0	1,744	2,359	6	0	0	0	0	0	0	4,109
7	2005	0	0	0	1,698	1,321	10	0	0	0	0	0	0	3,029
7	2006	0	0	0	0	1,098	1,692	1,409	0	6	0	0	0	4,205
8	1990	5	0	0	0	0	57	14,538	16,731	484	195	155	261	32,426
8	1991	14	0	0	0	0	44	407	12,435	7,685	882	1,363	967	23,797
8	1992	6	0	0	0	0	0	123	5,499	6,062	3,613	1,870	86	17,259
8	1993	1	6	11	2	11	60	71	2,737	3,963	5,458	3,082	1,019	16,421
8	1994	225	4	0	0	0	0	556	6,867	19,955	9,967	996	520	39,090
8	1995	0	11	0	0	0	218	1,901	5,639	15,163	11,751	3,022	1,572	39,277
8	1996	366	0	0	0	0	0	0	0	12,164	9,393	10,537	2,516	34,976
8	1997	0	0	0	0	0	0	0	0	7,576	5,937	4,237	2,739	20,489
8	1998	0	0	0	0	17	0	3,425	18,363	11,610	7,762	9,937	1,693	52,807
8	1999	0	0	0	0	0	0	8,953	16,717	7,651	3,052	4,282	0	40,655
8	2000	0	0	0	0	0	0	0	0	13,356	7,522	6,096	4,303	31,277
8	2001	0	0	0	0	0	0	0	0	9,662	7,872	6,337	0	23,871
8	2002	0	0	0	0	0	0	3	435	5,380	1,232	641	0	7,691
8	2003	0	0	0	0	0	0	0	0	4,850	3,840	4,715	1,723	15,128
8	2004	0	0	0	0	2,415	580	0	0	3,459	3,957	9,247	4,913	24,571
8	2005	0	0	0	0	3,968	42	0	0	5,399	5,056	5,578	11,003	31,046
8	2006	0	0	0	0	132	0	937	4,049	2,383	1,609	2,138	1,003	12,251
9	1990	0	0	0	12,648	9,596	9,099	11,262	3,151	0	0	0	0	45,756
9	1991	0	0	53	14,477	15,924	14,503	25,598	863	827	0	0	0	72,245
9	1992	0	0	425	10,069	14,470	16,550	29,018	3,263	780	60	0	0	74,635
9	1993	0	0	0	15,049	26,971	35,766	13,533	927	0	0	0	0	92,246
9	1994	0	50	604	975	20,248	31,490	2,873	1	0	0	0	0	56,241
9	1995	0	0	322	917	23,761	17,845	1,239	136	0	0	0	0	44,220
9	1996	0	0	0	0	16,691	12,260	19,753	591	712	61	3	0	50,071
9	1997	0	0	0	8	17,376	17,616	23,221	453	320	175	0	0	59,169
9	1998	0	0	0	0	12,214	17,174	21,344	5,315	511	2	0	0	56,560
9	1999	0	0	0	117	17,499	18,189	12,213	1,708	100	0	0	0	49,826
9	2000	0	0	0	15	12,663	10,908	17,488	990	0	14	0	0	42,078
9	2001	0	0	0	69	18,232	16,466	23,753	1,016	0	394	32	75	60,037
9	2002	2	0	0	0	25,561	25,329	4,281	0	0	6	48	75	55,302
9	2003	0	0	0	0	23,106	21,202	6,850	0	0	0	0	0	51,158
9	2004	0	0	0	0	12,777	14,876	20,039	6,086	0	39	0	0	53,817
9	2005	0	0	0	0	11,330	15,273	19,108	9,995	0	0	0	0	55,706
9	2006	0	0	0	0	4,732	4,197	9,808	16,525	6,762	1,954	183	0	44,161

b) Number of SBT observed

Area	Year	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Total
7	1990	0	0	0	0	0	180	0	0	0	0	0	0	180
7	1991	0	0	0	0	1,366	2,333	1,251	0	0	0	77	241	5,268
7	1992	548	0	869	0	1,811	3,443	870	0	0	101	492	450	8,584
7	1993	207	0	0	0	6,095	3,668	1,347	0	0	118	694	447	12,576
7	1994	1	0	0	0	0	4,965	1,040	0	0	297	327	258	6,888
7	1995	3	0	0	0	0	0	0	0	0	0	0	0	3
7	1996	0	0	0	0	1	0	0	0	0	0	0	0	1
7	1997	0	0	0	0	150	40	0	0	0	0	0	0	190
7	1998	0	0	0	0	0	0	0	0	0	0	0	0	0
7	1999	0	0	0	0	460	1,835	0	0	79	14	0	0	2,388
7	2000	0	0	0	118	358	399	0	0	0	0	0	0	875
7	2001	0	0	0	202	71	410	14	0	36	39	0	0	772
7	2002	0	0	0	59	485	383	0	0	0	34	0	0	961
7	2003	0	0	0	104	140	69	0	0	1	0	0	0	314
7	2004	0	0	0	33	119	0	0	0	0	0	0	0	152
7	2005	0	0	0	0	0	0	0	0	0	0	0	0	0
7	2006	0	0	0	0	0	0	0	0	0	0	0	0	0
8	1990	0	0	0	0	0	0	0	0	0	0	0	0	0
8	1991	0	0	0	0	0	0	0	0	0	0	0	0	0
8	1992	0	0	0	0	0	0	0	245	554	685	545	0	2,029
8	1993	0	0	1	2	2	0	0	912	554	596	0	0	2,067
8	1994	0	0	0	0	0	0	39	2,869	2,473	99	58	15	5,553
8	1995	0	0	0	0	0	0	305	2,496	2,823	850	226	170	6,870
8	1996	103	0	0	0	0	0	0	0	3,093	506	0	0	3,702
8	1997	0	0	0	0	0	0	0	0	22	826	429	258	1,535
8	1998	0	0	0	0	0	0	808	3,859	1,081	546	309	0	6,603
8	1999	0	0	0	0	0	0	1,780	4,541	744	205	0	0	7,270
8	2000	0	0	0	0	0	0	0	0	0	4	75	61	140
8	2001	0	0	0	0	0	0	0	0	180	404	129	0	713
8	2002	0	0	0	0	0	0	0	0	41	93	10	0	144
8	2003	0	0	0	0	0	0	0	0	89	405	454	165	1,113
8	2004	0	0	0	0	0	0	0	0	0	0	739	546	1,285
8	2005	0	0	0	0	0	0	0	0	0	12	577	505	1,094
8	2006	0	0	0	0	132	0	0	311	195	69	0	0	707
9	1990	0	0	0	0	0	0	0	0	0	0	0	0	0
9	1991	0	0	0	0	0	0	0	0	0	0	0	0	0
9	1992	0	0	0	241	684	691	484	54	0	0	0	0	2,154
9	1993	0	0	0	137	527	1,189	1,305	0	0	0	0	0	3,158
9	1994	0	0	0	0	438	817	524	0	0	0	0	0	1,779
9	1995	0	0	0	0	647	794	1,071	0	0	0	0	0	2,512
9	1996	0	0	0	0	493	631	693	0	0	0	0	0	1,817
9	1997	0	0	0	0	206	787	944	0	0	0	0	0	1,937
9	1998	0	0	0	0	65	1,044	447	32	0	0	0	0	1,588
9	1999	0	0	0	0	294	657	336	0	0	0	0	0	1,287
9	2000	0	0	0	0	568	575	736	0	0	0	0	0	1,879
9	2001	0	0	0	0	453	1,192	1,751	43	0	0	0	0	3,439
9	2002	0	0	0	0	190	1,374	147	0	0	0	0	0	1,711
9	2003	0	0	0	0	366	758	305	0	0	0	0	0	1,429
9	2004	0	0	0	0	212	673	1,299	392	0	0	0	0	2,576
9	2005	0	0	0	0	365	623	1,197	554	0	0	0	0	2,739
9	2006	0	0	0	0	496	675	1,277	1,018	6	0	0	0	3,472

c) Coverage of catches (%)

Area	Year	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Total
7	1990			0.0	0.0	0.0	1.8	0.0	0.0					0.4
7	1991					9.1	10.0	17.0	0.0	0.0	0.0	13.0	11.6	10.7
7	1992	10.9	0.0	99.0	0.0	9.2	12.7	16.3	0.0	0.0	13.1	9.1	10.1	11.0
7	1993	17.5				21.2	11.0	38.4	0.0		8.9	16.2	11.8	16.5
7	1994	0.2					21.0	8.2	0.0		14.1	10.2	13.1	15.6
7	1995	75.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0			0.0
7	1996					0.0	0.0	0.0	0.0	0.0	0.0			0.0
7	1997				0.0	1.6	0.7	0.0			0.0	0.0	0.0	1.1
7	1998				0.0	0.0	0.0	0.0		0.0	0.0			0.0
7	1999				0.0	3.8	24.4	0.0		12.6	0.8	0.0		7.9
7	2000				3.5	5.9	6.7	0.0		0.0	0.0	0.0	0.0	4.5
7	2001				3.9	0.6	4.3	0.8		10.5	9.7	0.0		2.6
7	2002				1.3	4.9	7.6	0.0			3.5	0.0		4.6
7	2003				3.4	2.0	3.9			1.9	0.0			2.7
7	2004				1.9	5.0	0.0							3.7
7	2005				0.0	0.0	0.0							0.0
7	2006					0.0	0.0	0.0		0.0				0.0
8	1990	0.0					0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
8	1991	0.0					0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
8	1992	0.0						0.0	4.5	9.1	19.0	29.1	0.0	11.8
8	1993	0.0	0.0	9.1	100.0	18.2	0.0	0.0	33.3	14.0	10.9	0.0	0.0	12.6
8	1994	0.0	0.0					7.0	41.8	12.4	1.0	5.8	2.9	14.2
8	1995		0.0				0.0	16.0	44.3	18.6	7.2	7.5	10.8	17.5
8	1996	28.1								25.4	5.4	0.0	0.0	10.6
8	1997									0.3	13.9	10.1	9.4	7.5
8	1998					0.0		23.6	21.0	9.3	7.0	3.1	0.0	12.5
8	1999							19.9	27.2	9.7	6.7	0.0		17.9
8	2000									0.0	0.1	1.2	1.4	0.4
8	2001									1.9	5.1	2.0		3.0
8	2002							0.0	0.0	0.8	7.5	1.6		1.9
8	2003									1.8	10.5	9.6	9.6	7.4
8	2004					0.0	0.0			0.0	0.0	8.0	11.1	5.2
8	2005					0.0	0.0			0.0	0.2	10.3	4.6	3.5
8	2006					100.0		0.0	7.7	8.2	4.3	0.0	0.0	5.8
9	1990				0.0	0.0	0.0	0.0	0.0					0.0
9	1991			0.0	0.0	0.0	0.0	0.0	0.0	0.0				0.0
9	1992			0.0	2.4	4.7	4.2	1.7	1.7	0.0	0.0			2.9
9	1993				0.9	2.0	3.3	9.6	0.0					3.4
9	1994		0.0	0.0	0.0	2.2	2.6	18.2	0.0					3.2
9	1995			0.0	0.0	2.7	4.4	86.4	0.0					5.7
9	1996					3.0	5.1	3.5	0.0	0.0	0.0	0.0		3.6
9	1997				0.0	1.2	4.5	4.1	0.0	0.0	0.0			3.3
9	1998					0.5	6.1	2.1	0.6	0.0	0.0			2.8
9	1999				0.0	1.7	3.6	2.8	0.0	0.0				2.6
9	2000				0.0	4.5	5.3	4.2	0.0		0.0			4.5
9	2001				0.0	2.5	7.2	7.4	4.2		0.0	0.0	0.0	5.7
9	2002	0.0				0.7	5.4	3.4			0.0	0.0	0.0	3.1
9	2003					1.6	3.6	4.5						2.8
9	2004					1.7	4.5	6.5	6.4		0.0			4.8
9	2005					3.2	4.1	6.3	5.5					4.9
9	2006					10.5	16.1	13.0	6.2	0.1	0.0	0.0		7.9

Table 4 Results of ANOVA for the GLM final model.

Source	DF	SS	Mean Square	F value	Pr > F
Model	190	2167.16	11.41	17.99	<.0001
Error	3386	2146.27	0.63	_	_
Corrected Total	3576	4313.43	_	_	_

Source	DF	SS	Mean Square	F value	Pr > F
Year	16	30.36	1.90	2.99	<.0001
Month	5	72.16	14.43	22.77	<.0001
Area	4	12.16	3.04	4.8	0.0007
Lat.(5 degree)	3	416.93	138.98	219.25	<.0001
Observer	2	16.01	8.01	12.63	<.0001
Month*Area	20	174.61	8.73	13.77	<.0001
Year*Area	64	162.74	2.54	4.01	<.0001
Year*Lat.(5 degree)	48	110.82	2.31	3.64	<.0001
Year*Observer	28	50.24	1.79	2.83	<.0001

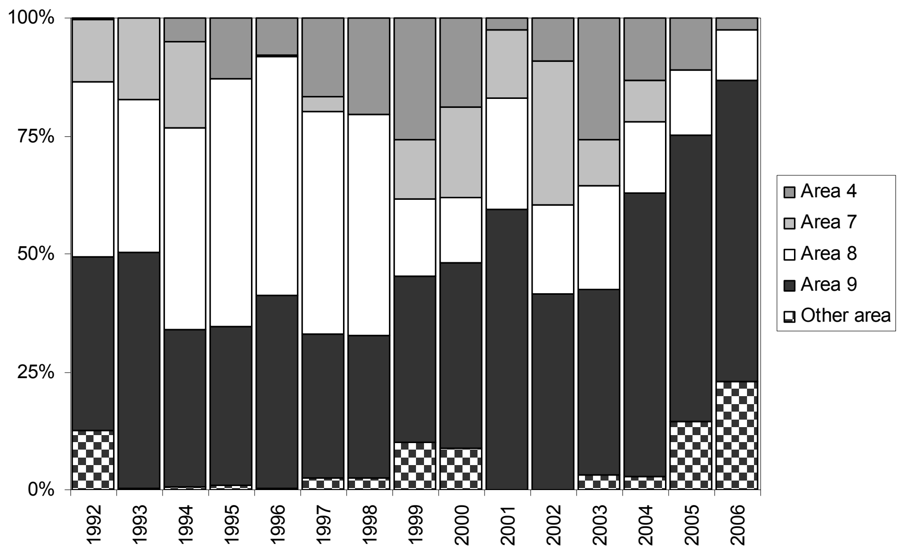


Fig. 1 Percentage of the observed operation by area.
This figure is based on the data from the Japanese scientific observer program (not include the EFP, SRP and other country's observer programs).

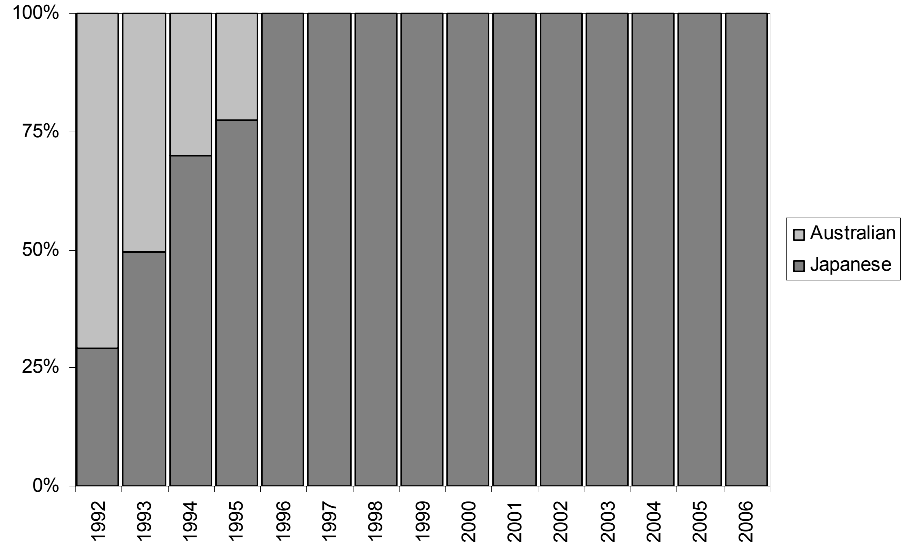


Fig. 2 Percentage of the observed operation by observer nationality.
This figure is based on the data from the Japanese scientific observer program (not include the EFP, SRP and other country's observer programs).

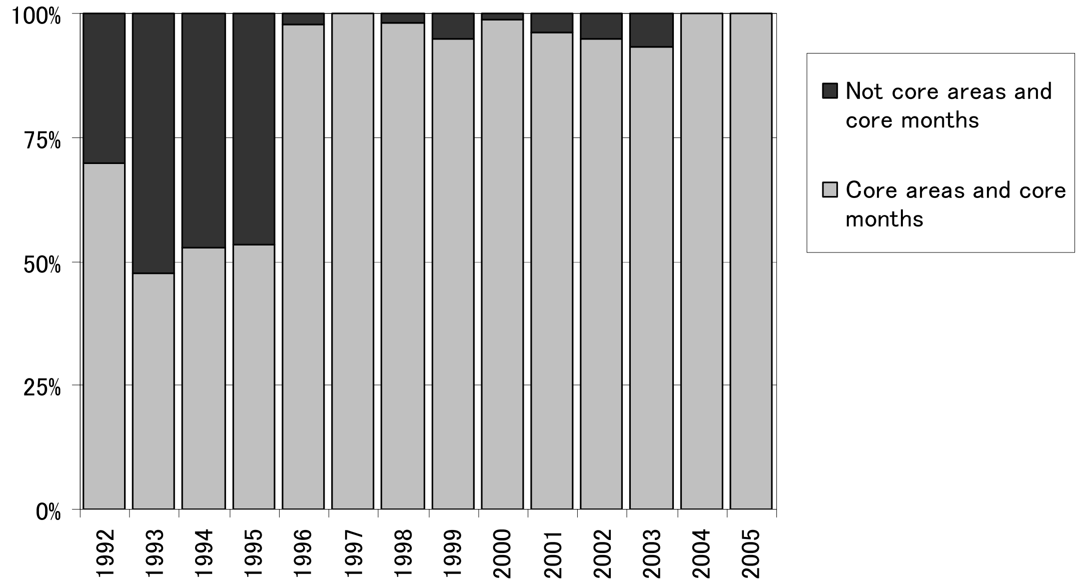


Fig. 3 Percentage of the observed operations within core areas (CCSBT Statistical area 4, 7, 8, 9) and core months (fishing seasons). Japanese SBT fishing management zones overlapped with the CCSBT area 4, 7, 8, 9, but they were not identical each other.

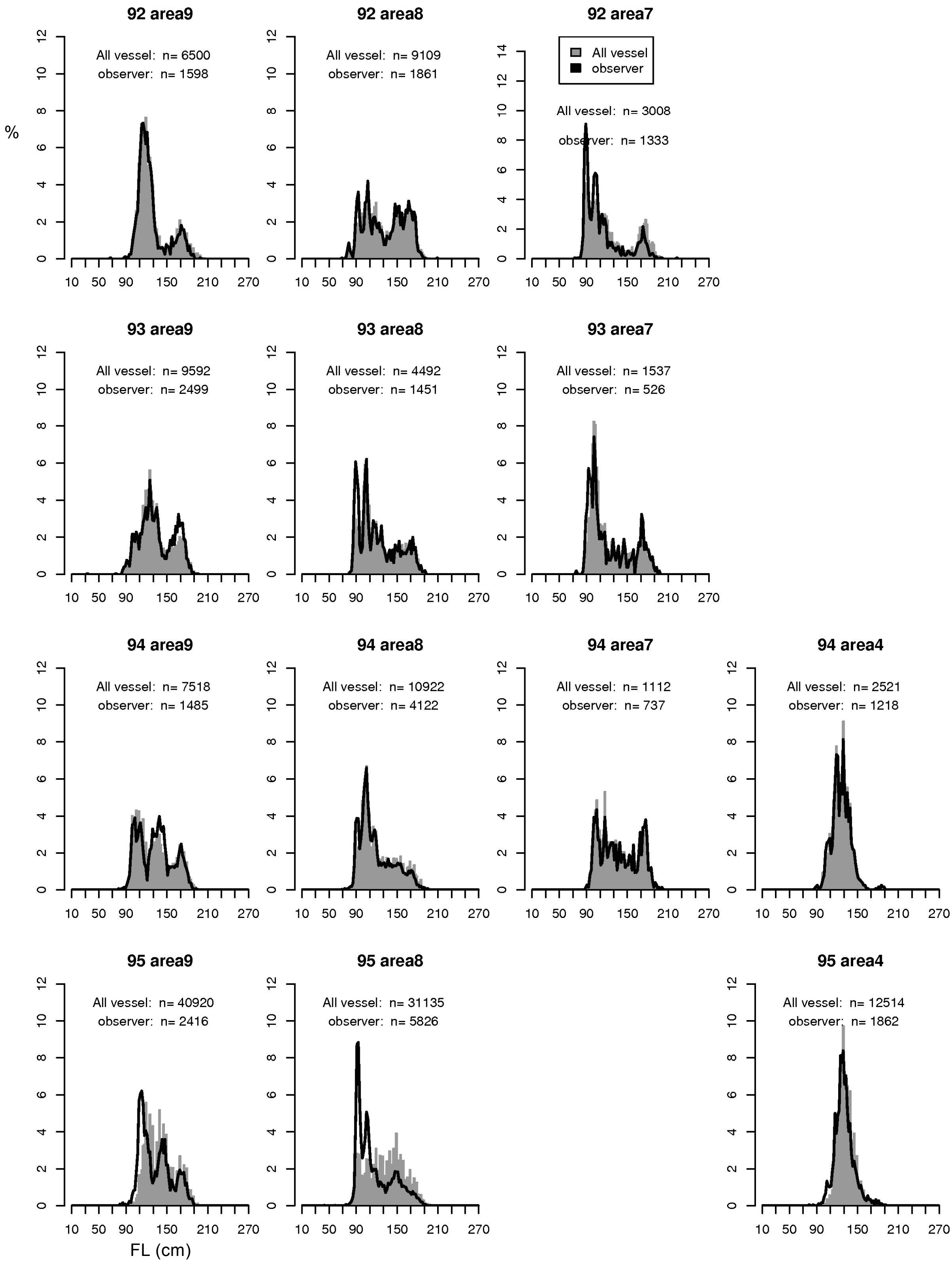


Fig. 4-1 Length frequency distributions of SBT by year and area of 1992-1995.

These figures are based on the data from the Japanese scientific observer program and Japanese SRP (not include the EFP and other country's observer programs). Lines are from observer data. Bars are from RTMP data in all vessels. The data period of each graph is summarized in Table 3. Sample numbers in the each graph are number of fish measured.

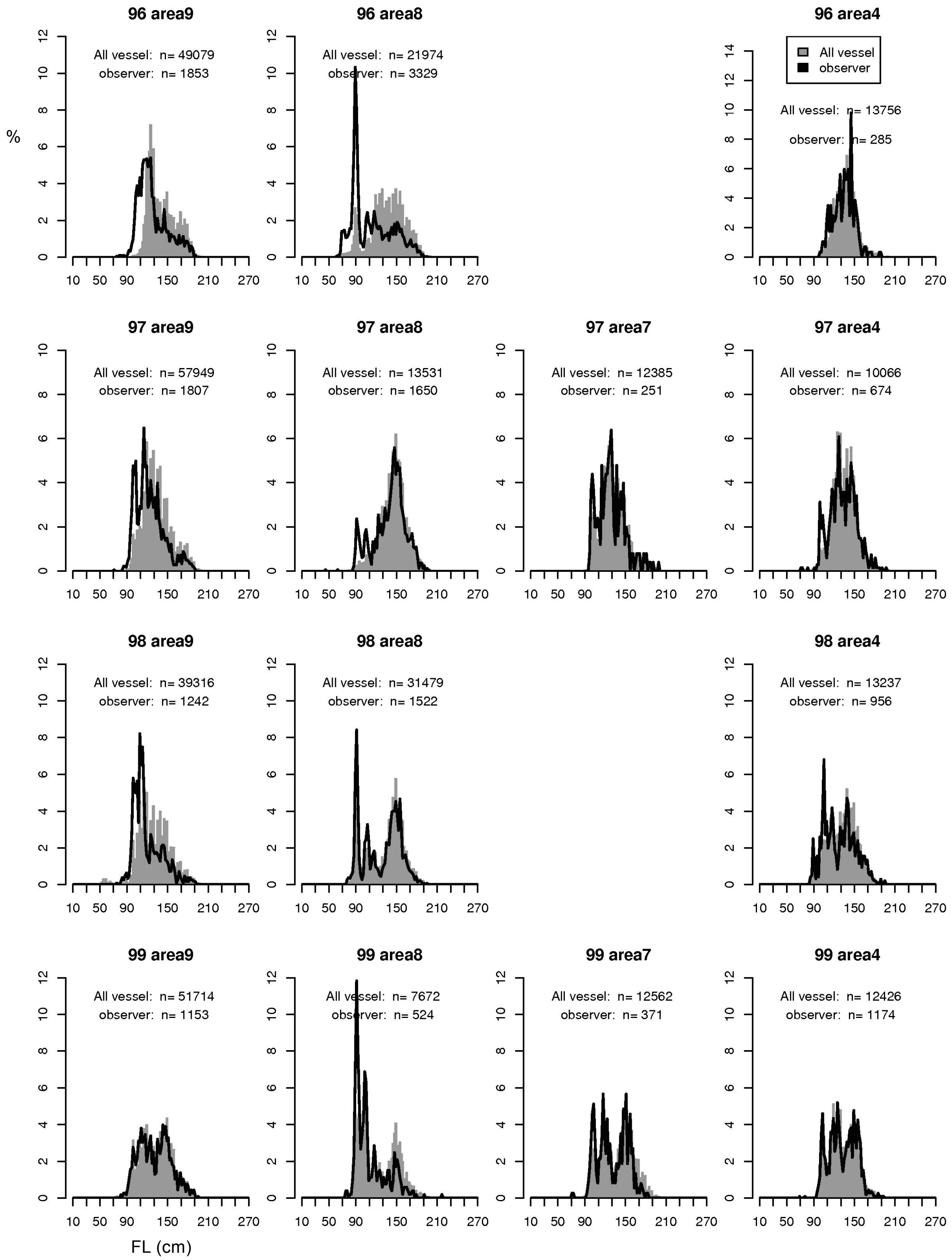


Fig. 4-2 Length frequency distributions of SBT by year and area of 1996-1999.

These figures are based on the data from the Japanese scientific observer program and Japanese SRP (not include the EFP and other country's observer programs). Lines are from observer data. Bars are from RTMP data in all vessels. The data period of each graph is summarized in Table 3. Sample numbers in the each graph are number of fish measured.

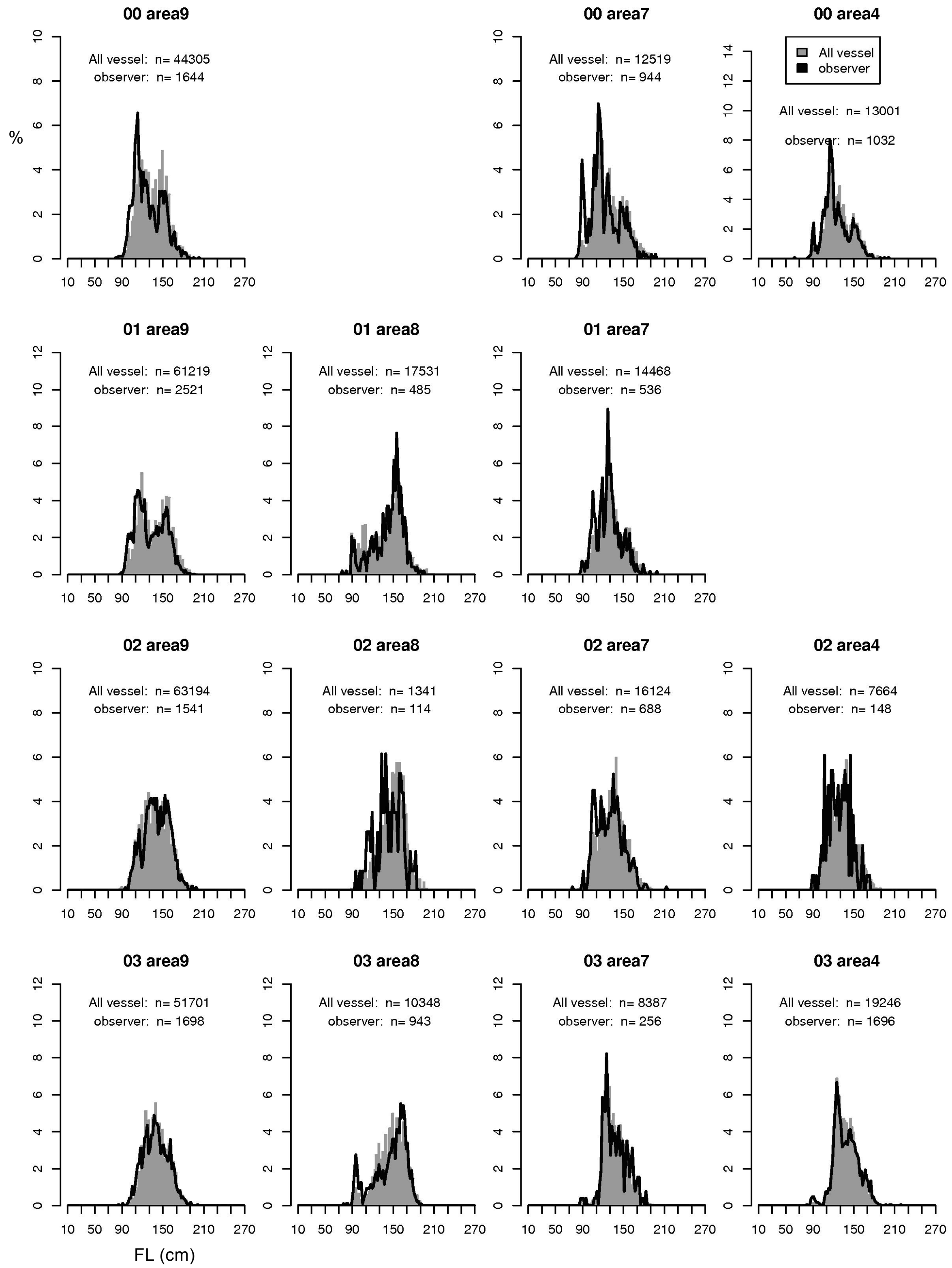


Fig. 4-3 Length frequency distributions of SBT by year and area of 2000-2003.

These figures are based on the data from the Japanese scientific observer program and Japanese SRP (not include the EFP and other country's observer programs). Lines are from observer data. Bars are from RTMP data in all vessels. The data period of each graph is summarized in Table 3. Sample numbers in the each graph are number of fish measured.

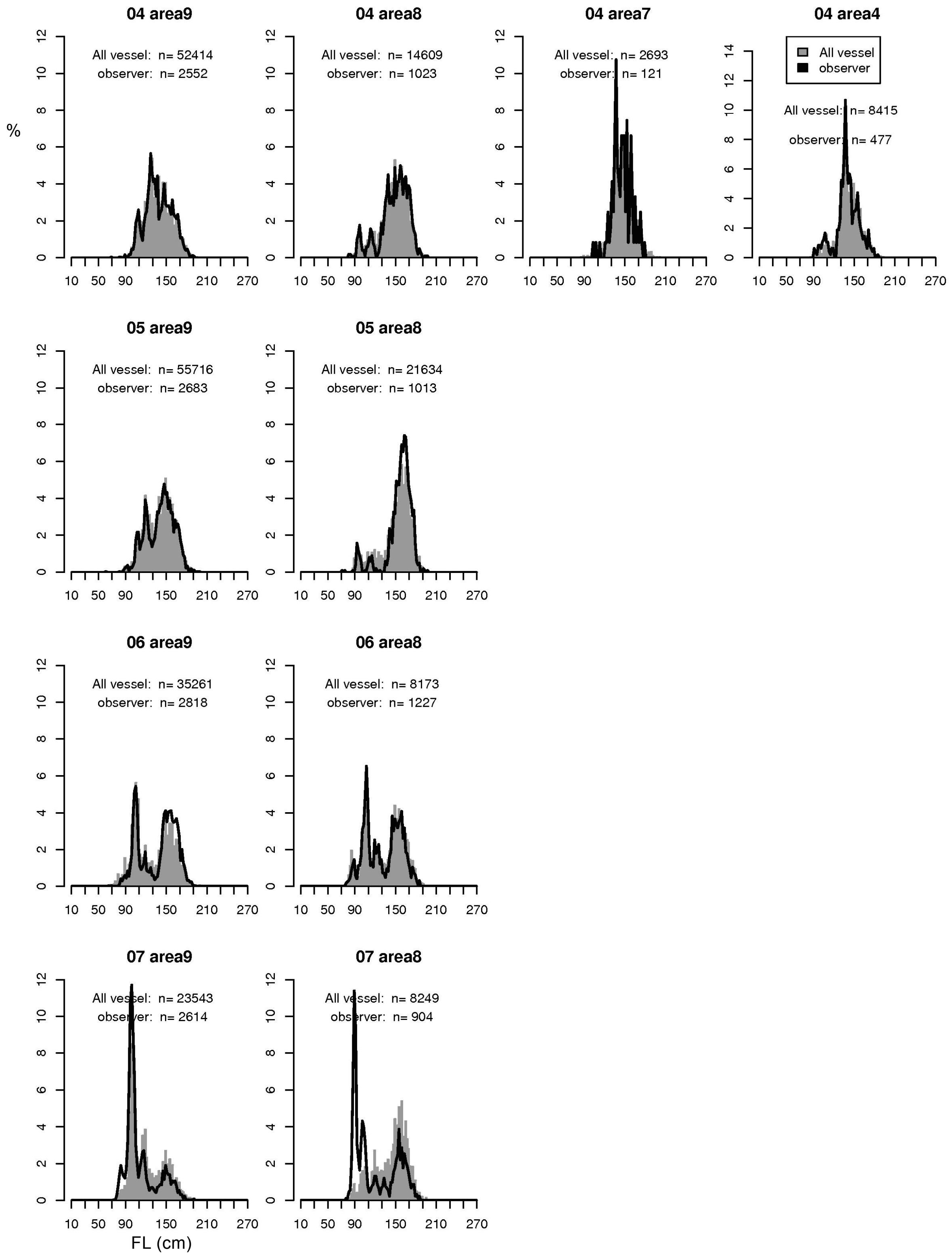
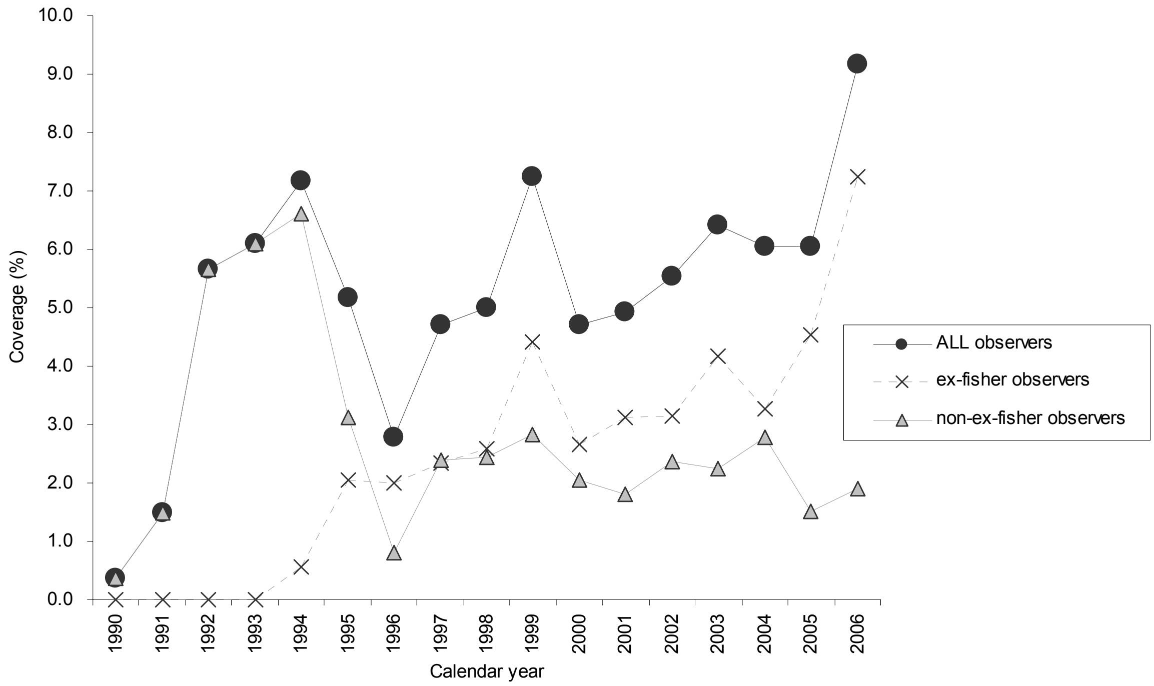


Fig. 4-4 Length frequency distributions of SBT by year and area of 2004-2007.

These figures are based on the data from the Japanese scientific observer program and Japanese SRP (not include the EFP and other country's observer programs). Lines are from observer data. Bars are from RTMP data in all vessels. The data period of each graph is summarized in Table 3. Sample numbers in the each graph are number of fish measured.

a) Coverage of efforts



b) Coverage of catches

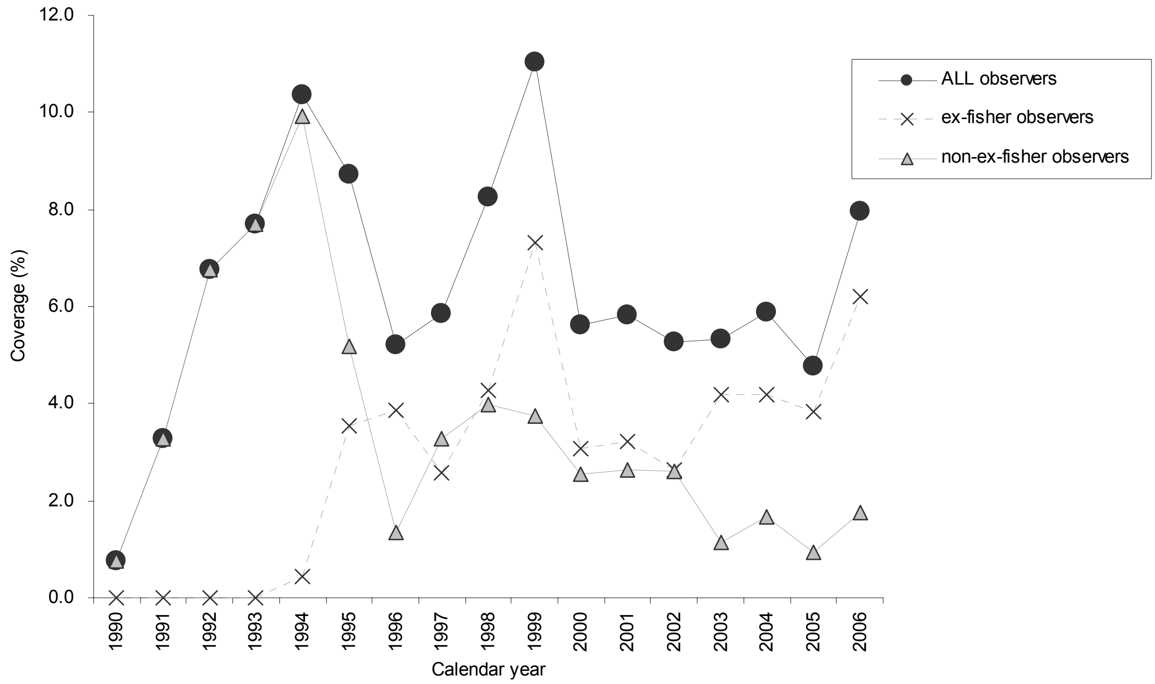


Fig. 5 Observer coverage in terms of the number of hooks (a) top) and number of SBT (b) bottom). The data period and area are between January and December and in area 4-9. These figures are based on the Japanese scientific observer program's data, Japanese EFP data, Australia JV vessel's data and NZ charter vessel's data (not include the SRP data of Japan). Coverage are calculated by the observer type: all observer (black circle), ex-fisherman (cross) and non-ex-fisherman (gray triangle).

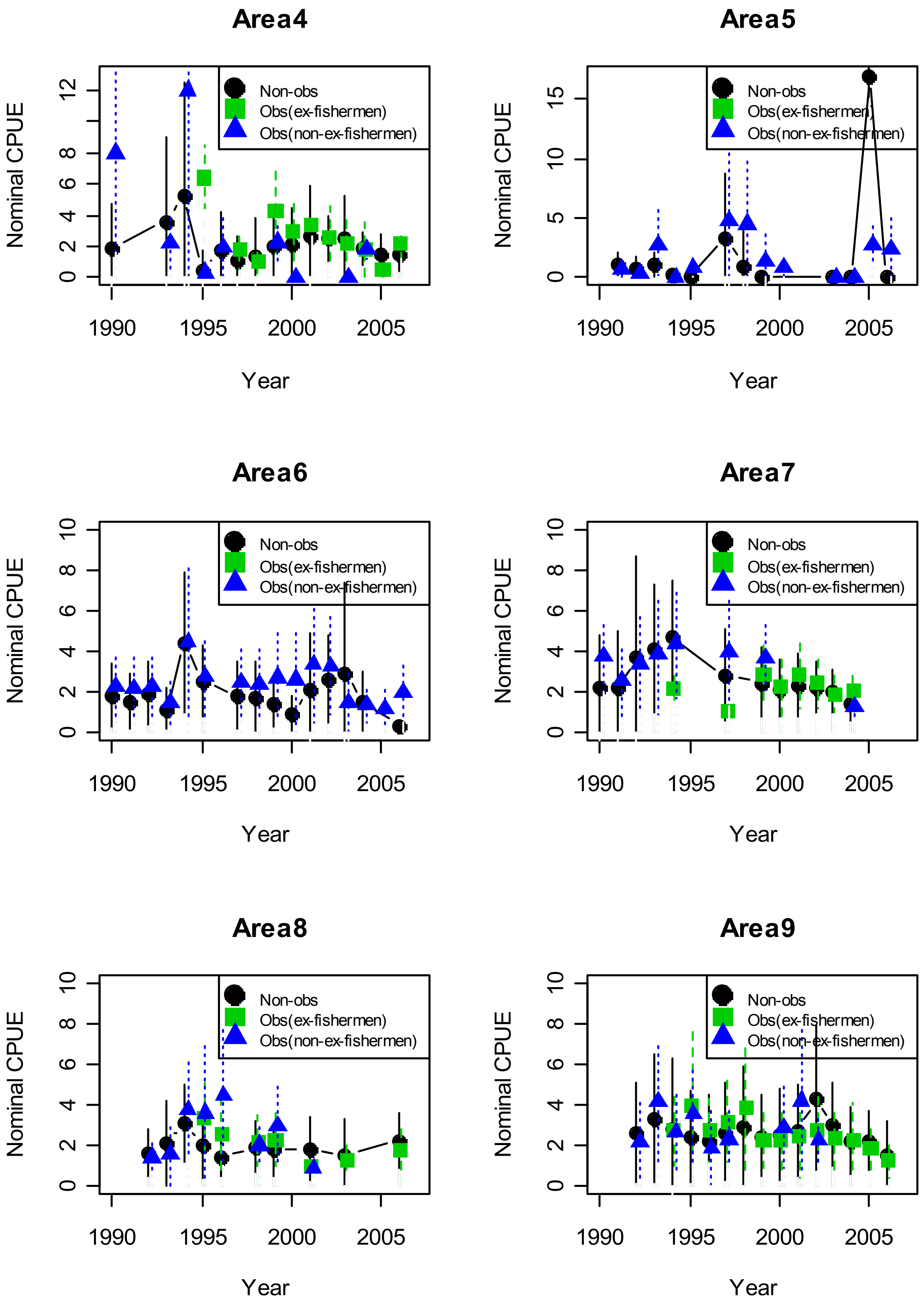


Fig. 6 Mean nominal CPUE (±1 S.D.) in areas 4 (top left), 5 (top right), 6 (middle left), 7 (middle right), 8 (bottom left), and 9 (bottom right) by observer type: without observer (circle), ex-fisher observer (square), and non-ex-fisher observer (triangle). Data period is between April and September in every area. These CPUEs include the data from Australia JV and NZ charter.

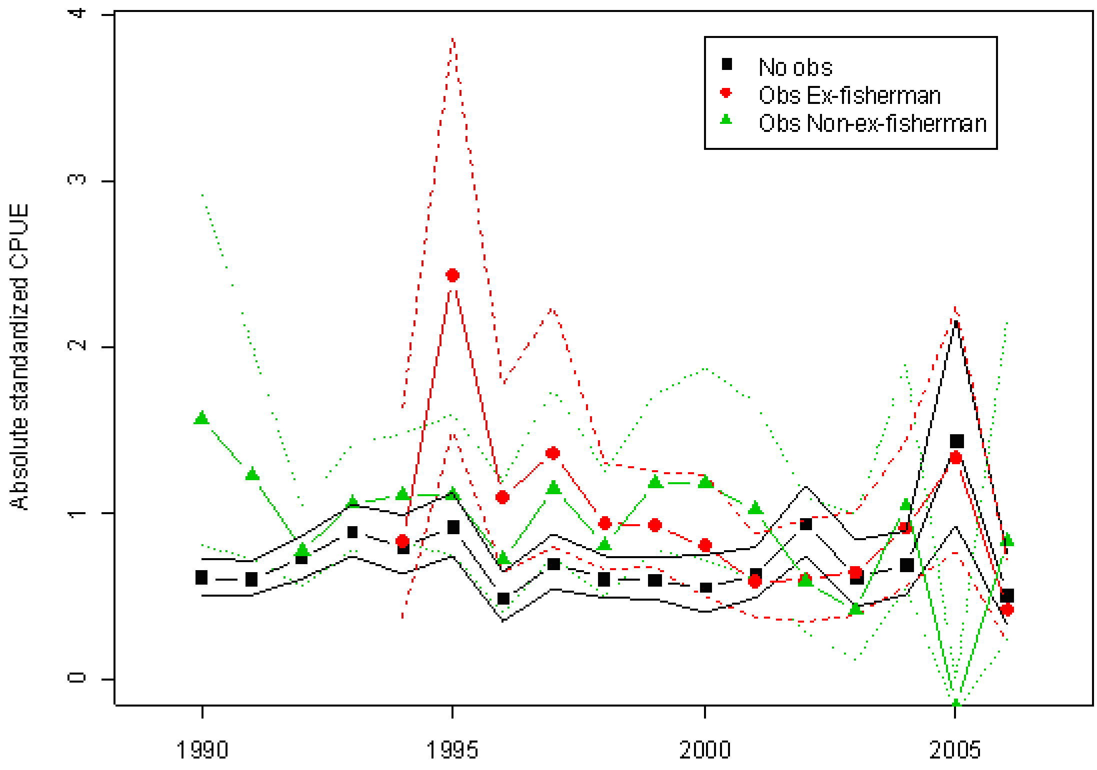


Fig. 7 Point estimates and the 95% confidence intervals of year trends of standardized CPUE by the observer types: without observer (square), with ex-fisher observer (circle), and with non-ex-fisher observer (triangle).

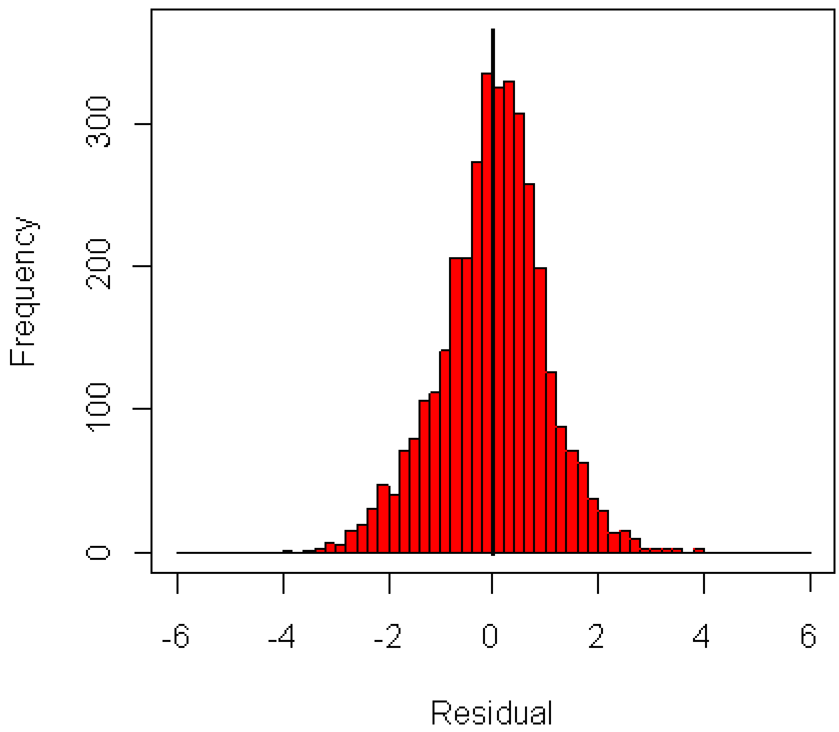


Fig. 8 Histogram of standardized residuals for the finally selected GLM model.