Fish bycatch in New Zealand's Southern Bluefin Tuna Longline Fisheries, 2002–03 to 2003-04

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Wellington, N.Z.

Abstract

This report summarises fish catches taken in tuna longline sets that either targeted or caught southern bluefin tuna. Most of the effort was attributed to the New Zealand domestic fleet, but it was noted that effort from this fleet decreased considerably from 2002-03 to 2003-04. Observer coverage rates were good for all fleets, but the coverage in the domestic fishery was not representative leading to problems estimating catches of less commonly reported bycatch species.

For the Japanese charter fleet, Ray's bream and blue shark were the most commonly caught species followed by southern bluefin tuna, while for the domestic fleet and the Philippine charter fleet albacore was the most commonly caught species.

Ray's bream, blue shark, and dealfish were the most discarded fish species by number while most of lancetfish, deepwater dogfish, rudderfish, and dealfish caught were subsequently discarded. There were some differences between the domestic and Japanese charter fleet, with the domestic fleet far more likely to discard sharks. Most discards were alive, and the most commonly discarded species had relatively low rates of dead discards, e.g. Ray's bream and the pelagic sharks. The relatively high discard rates of pelagic sharks in the domestic fishery, in particular live discards, indicates a general practice across this fleet which should act to reduce the impact of the fishery on sharks.

1. Introduction

This report summarizes fish bycatch taken in New Zealand's southern bluefin tuna (SBT) longline fishery during the 2002-03 and 2003-04 fishing seasons (1 October-30 September; though due to the timing of our fishery the analysis is almost identical to an analysis of 2003 and 2004 calendar years). Information recorded by both MFish observers and commercial fishers were included in the analysis, with a particular focus on information from longline sets where SBT was either the target species or was taken as bycatch. We have not included information from our summer longline fishery targeted predominantly at bigeye tuna (unless SBT was taken as bycatch in a set).

This report will consider the following: levels of fishing effort and observer coverage, estimated (from observer data) and reported catches of fish, observed discards of fish (including SBT), and the fate of discarded fish. This analysis represents an update of previous analyses presented at ERSWG-5 in Wellington in 2004 and ERSWG-4 in 2001.

A list of the common and scientific names of the fish species described in this report are provided in Table 1.

2. Methods

2.1 Data sources

New Zealand tuna longline fishery data are available for 2002–03 and 2003–04 from two sources: observed fishing data and commercial fishing data. The most reliable fish bycatch data are collected by the Ministry of Fisheries Scientific Observers and stored in the scientific observer database (*l_line*)

managed by NIWA for the Ministry of Fisheries. These observed data represent a proportion of the total fishing effort data. The commercial effort data are from the Tuna Longlining Catch Effort Returns (TLCER) and Catch Effort Landing Returns (CELR) that longline fishers are required to submit to the Ministry. These data are stored in a database (*tuna*), which is also maintained by NIWA.

While previous summaries have been based on data for all tuna longlining effort in New Zealand, the summaries in the current report are restricted to fishing effort that was either targeted at, or caught SBT (referred to as 'SBT effort').

2.2 Data treatment

For the purposes of these analyses, the tuna longline fleet operating in New Zealand waters has been separated into the domestic owner-operator vessels that fish primarily in waters north of about 40º S (NZD), the chartered Japanese vessels that fish mainly in more southern waters during the southern bluefin tuna season (JC), and the Philippine flagged vessels that were chartered during the 2002-03 season to target albacore in northern waters (PHI).

One important assumption in our analyses is the criteria for "observed hooks", e.g. if during the haul an observer takes a break, the hooks hauled in his/her absence are considered non-observed. This assumption should reduce bias in estimates of catch rates and total catches of bycatch species. The number of hooks observed in each set is estimated from the proportion of the haul observed (based on the haul duration and time recorded as unobserved in the observer events logs) multiplied by the number of hooks set. The total catches and average catch rates (number of fish per 1000 hooks) are now estimated more accurately by the inclusion of this information.

2.3 Catch per unit effort analysis

Catch per unit effort (CPUE) was defined as the number of fish caught per 1000 hooks set. The basic unit of sampling was an individual set; a set *i* has information on the number of fish caught (c_i) and the amount of effort expended (where u_i the number of hooks). As mentioned above, all hooks on a set may not be observed. In the calculation of CPUE we use the estimated number of observed hooks.

The calculation of the mean catch rate used is a ratio of means estimator (1):

$$(1)\quad CPUE = = (\Sigma c_i / n) / (\Sigma u_i / n) = \Sigma c_i / \Sigma u_i$$

where n is the number of observed sets. For these calculations the data was stratified by fleet and fishing year. Variances and confidence intervals are calculated by bootstrap. Improved 'model-based' methods for the estimation of catch rates and total catches are being developed and will be used in future analyses.

The CPUE was then used to scale observed catches to total estimated catches using total reported effort. These estimates are referred to as "scaled catches" (see Section 3.2).

3. Results and discussion

3.1 Fishing effort and observer coverage

The majority of SBT effort in the New Zealand fishery is from the New Zealand domestic fleet (Table 2). SBT effort in this fishery peaked in the 2002-03 season with at 25% reduction in both the number of sets made and hooks fished in 2003-04. Effort from the Japanese charter fleet increased by about 25% to a peak in 2003-04. Total effort for the Philippine vessels that fished in 2002-03 was low

compared to the other fleets. Due to non-reporting of SBT in the commercial data, the estimates of observed SBT effort are more reliable than the reported effort (see note on Table 2).

All sets from the Japanese Charter fleet were observed, though only about 93% of hooks were observed during the hauling phase due to observers taking breaks during the long hauling period on these vessels. In spite of reductions in effort for the domestic fleet, total observed effort increased for this fleet to 14% of total effort in 2003-04. It should be noted that because of the full observer coverage of the one large domestic vessel in the New Zealand fleet that fished in the southern fishery, the domestic observer coverage was not fully representative of the fleet (Figure 1). This absence (2002-03) and very low (2003-04) observer coverage in the north has lead to problems in accurately estimating catch level from observer data for this fleet (see Section 3.2).

The Japanese charter fleet focussed its effort in the southern fishery during this period, while the Philippine fleet fished in the northern area with observers carried on all trips (Figure 2).

3.2 Species composition of catches

We have two estimates of total fish bycatch for the SBT longline fishery: (1) catches reported on commercial catch effort returns, and (2) scaled estimates from observer data. These two estimates, plus the actual number of fish reported by observers, are provided in Table 3. We note that the observer data include fish that were “caught”, but later discarded. For the bycatch species of commercial value (e.g. swordfish and albacore), the commercial returns likely provide the best estimates, while observer data provide better estimates for more of the less valuable bycatch species (e.g. deepwater dogfish and dealfish). A comparison of these estimates provides information of the level of reporting (and retention) by commercial fishers of bycatch species and information on how representative the observer coverage is likely to have been.

For the Japanese charter fleet, Ray’s bream and blue shark were the most commonly caught species followed by southern bluefin tuna (Table 3). The higher reported catches of Ray’s bream may be in part due top miss-identification with bigscale pomfret. For species that are less likely to be retained (see Section 3.3) such as dealfish and deepwater dogfish, reported catches are lower than observed catches (which include discards).

The catches from the domestic fleet are quite different to those of the Japanese charter fleet, in particular the predominance of albacore in the catches from the domestic fishery (Table 3). While, like the charter fleet, catches of blue shark and Ray’s bream are common in the domestic fishery, catches of oilfish, swordfish, and moonfish are far more common in the domestic catches. The dominance of albacore in the catch can be attributed to the area of fishing effort with all Japanese effort occurring in the south while most of the domestic effort occurred in the north. As noted previously, almost all observer coverage of the domestic fleet was of effort in the south and this is certainly not representative of the effort of this fleet. This is clearly shown by the comparison of scaled and reported estimates for several species that are likely to be well reported in commercial returns, e.g. albacore, swordfish, and Ray’s bream. Therefore the observer data are not appropriate for estimating catches from the domestic fleet and the issue of representative coverage in the fleet must be addressed to allow estimation of catch rates of the more poorly reported species.

The catches from the Philippine fleet are dominated by its target species, albacore. It is not possible to compare the reported and observed estimates due to reporting issues (see Table 2).

3.3 Discarding

Observers reported information on both fish that were caught and subsequently discarded, and fish that were lost before they could be brought aboard the vessel. For over 96% of the discarded fish, their status (alive or dead) was also reported.

Ray's bream, blue shark, and dealfish were the most frequently discarded fish species (Table 4). A comparison of the observed catches and discards provides estimates of the percentage of the catch of a species which is discarded. Most of lancetfish, deepwater dogfish, rudderfish, and dealfish caught were subsequently discarded (ranging from 76% to 100% across species and fleets). Ray's bream were discarded less than half the time and the tunas and swordfish were seldom discarded. There were some differences between the domestic and Japanese charter fleet, with the domestic fleet far more likely to discard sharks.

Most discards were alive, and the most discarded species by number had relatively low rates of dead discards, e.g. Ray's bream and the pelagic sharks (Table 4). Tunas were generally discarded when they were dead (and typically damaged). Dealfish were typically discarded dead, and this combined with the relatively high rate of discarding for this species suggests that it is considered of little value to the longline fleet. The relatively high discard rates of pelagic sharks in the domestic fishery, in particular live discards, indicates a general practice across this fleet which should act to reduce the impact of the fishery on sharks.

4. Acknowledgements

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Table 1: Common and scientific names of fish species included in this report

Species common name	Scientific name
Blue shark	*Prionace glauca*
Albacore	*Thunnus alalunga*
Ray's bream	*Brama brama*
Southern bluefin tuna	*Thunnus maccoyii*
Porbeagle shark	*Lamna nasus*
Dealfish	*Trachipterus trachypterus*
Lancetfish	*Alepisaurus ferox* & *A. brevirostris*
Moonfish	*Lampris guttatus*
Oilfish	*Ruvettus pretiosus*
Deepwater dogfish*	Squaliformes
Swordfish	*Xiphias gladius*
Butterfly tuna	*Gasterochisma melampus*
Mako shark	*Isurus oxyrinchus*
Rudderfish	*Centrolophus niger*
School shark	*Galeorhinus galeus*
Bigeye tuna	*Thunnus obesus*
Yellowfin tuna	*Thunnus albacares*
Striped marlin	*Tetrapturus audax*
Bigscale pomfret	*Taractichthys longipinnis*
Hoki	*Macruronus novaezelandiae*
Thresher shark	*Alopias vulpinus*

*Deepwater dogfish includes: Owston's dogfish (*Centroscymnus owstoni*), Portuguese dogfish (*Centroscymnus coelolepis*), longnose velvet dogfish (*Centroscymnus crepidater*), leafscale gulper shark (*Centrophorus squamosus*), Plunket's shark (*Centroscymnus plunketi*), seal shark (*Dalatias licha*), velvet dogfish (*Zameus squamulosus*), spiny dogfish (*Squalus acanthias*), shovelnose dogfish (*Deania calcea*), Baxter's lantern dogfish (*Etmopterus baxteri*) and Lucifer dogfish (*Etmopterus lucifer*). Owston's dogfish is the most abundant of these (87% of the observed deepwater dogfish).

Table 2: Reported and observed sets and hooks, and percentage observer coverage, for the 2002–03 and 2003–04 fishing years for all sets where southern bluefin tuna was targeted or caught.

Number of sets and hooks reported:

		Fleet			
Fishing year		JC	NZD	PHI	all
2002-03	No of sets	264	2383	12	2658
	No of hooks	862,380	3,008,960	51,200	3,922,540
2003-04	No of sets	334	1779		2113
	No of hooks	1,118,493	2,276,738		3,395,231

Number of sets and hooks observed:

		Fleet			
Fishing year		JC	NZD	PHI	all
2002-03	No of sets	264	84	21	369
	No of hooks observed	810,031	241,779	74,832	1,126,642
2003-04	No of sets	334	135		469
	No of hooks observed	1,029,690	318,174		1,347,864

Percentage hooks observed:

		Hooks		
Fishing year	Fleet	Reported	Observed	% observed
2002-03	Japanese charter	862,380	810,031	93.9
	New Zealand domestic	3,008,960	241,779	8
	Philippine charter	51,200	74,832	146.2*
2003-04	Japanese charter	1,118,493	1,029,690	92.1
	New Zealand domestic	2,276,738	318,174	14.0

*Note that the higher number of observed sets and hooks for the Philippine fleet (as compared with the reported data) is due to these vessels not reporting captures of southern bluefin tuna. All of these sets were targeting albacore, observers recorded captures of 26 STN over 21 sets, while the vessels reported capture of 15 STN over 12 sets. These vessels were not permitted to retain southern bluefin tuna.

Table 3: Numbers of fish caught reported on commercial catch effort returns (Reported), observed, and estimated from observer reports and total fishing effort (Scaled) for fish species caught on longline sets where southern bluefin tuna was either targeted or caught during the 2002–03 and 2003–04 fishing years. *Note that Scaled estimates could not be obtained for the Philippine fleet (see Table 1 note), and this fleet only fished during the 2002-03 season,

2002–03 fishing year	Japanese Charter			New Zealand Domestic			Philippines		
	Reported	Observed	Scaled	Reported	Observed	Scaled	Reported	Observed	Scaled
Ray's bream	3,241	2,300	2,448	7,883	3,962	49,307	0	5	-NA-
Blue shark	3,725	3,587	3,819	18,238	2,289	28,487	5	90	-NA-
Albacore	632	639	680	80,460	115	1,431	1,846	2,907	-NA-
Southern bluefin tuna	1,168	1,186	1,263	3,782	488	6,073	15	26	-NA-
Dealfish	937	1,385	1,475	515	513	6,384	0	0	-NA-
Bigscale pomfret	283	666	709	406	321	3,995	0	6	-NA-
Deepwater dogfish	61	473	504	1	42	523	0	0	-NA-
Rudderfish	66	231	246	953	175	2,178	0	2	-NA-
Porbeagle shark	230	291	310	794	100	1,245	0	4	-NA-
Hoki	114	132	141	85	84	1,045	0	0	-NA-
School shark	77	81	86	86	31	386	0	0	-NA-
Moonfish	100	81	86	2,422	14	174	0	82	-NA-
Mako shark	53	49	52	1,605	22	274	14	38	-NA-
Thresher shark	92	94	100	195	40	498	0	4	-NA-
Swordfish	47	45	48	2,778	23	286	1	7	-NA-
Butterfly tuna	74	74	78	359	35	436	0	0	-NA-
Lancetfish	0	2	2	303	0	0	17	40	-NA-
Oilfish	2	2	2	3,003	1	12	0	8	-NA-
Yellowfin tuna	0	0	0	12	0	0	4	26	-NA-
Bigeye tuna	0	0	0	162	0	0	0	8	-NA-
Striped marlin	0	0	0	11	0	0	0	0	-NA-

Table 3: continued.

2003–04 fishing year	Japanese Charter			New Zealand Domestic		
	Reported	Observed	Scaled	Reported	Observed	Scaled
Ray's bream	7,754	7,455	8,098	16,433	4,346	31,098
Blue shark	5,503	5,291	5,747	29,440	4,222	30,211
Albacore	275	280	304	28,885	1,457	10,426
Southern bluefin tuna	1,529	1,525	1,657	3,114	538	3,850
Dealfish	467	553	601	353	354	2,533
Bigscale pomfret	783	976	1,060	203	96	687
Deepwater dogfish	714	881	957	141	168	1,202
Rudderfish	211	311	338	1,048	309	2,211
Porbeagle shark	330	335	364	1,252	239	1,710
Hoki	127	205	223	38	34	243
School shark	193	188	204	231	69	494
Moonfish	54	54	59	1,696	93	665
Mako shark	75	71	77	1,756	94	673
Thresher shark	75	85	92	135	16	114
Swordfish	22	22	24	2,116	97	694
Butterfly tuna	67	69	75	177	10	72
Lancetfish	0	8	9	108	53	379
Oilfish	0	0	0	1,742	35	250
Yellowfin tuna	0	0	0	7	0	0
Bigeye tuna	0	0	0	227	1	7
Striped marlin	0	1	1	10	2	14

Table 4: Number of fish discarded, by fleet and species, for the 2002–03 and 2003–04 fishing years, on observed vessels, for longline sets where southern bluefin tuna was either targeted or caught (JC=Japanese charter vessels, NZD=New Zealand domestic vessels, PHI=Philippine charter vessels).

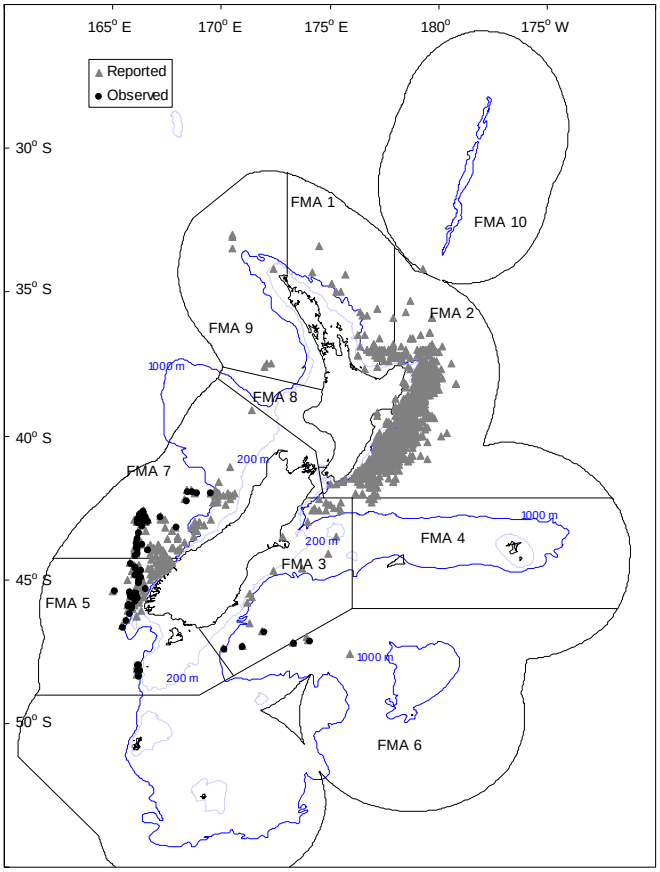
	2002–03 fishing year Fleet				2003–04 fishing year Fleet		
Species	**JC**	**NZD**	**PHI**	**all**	**JC**	**NZD**	**all**
Ray's bream	779	2,294	4	3,077	2,351	1,086	3,437
Blue shark	217	1,659	4	1,880	145	1,365	1,510
Albacore	1	6	21	28	2	48	50
Southern bluefin tuna	2	0	0	2	2	2	4
Dealfish	1,028	354	0	1,382	354	185	539
Bigscale pomfret	404	240	6	650	406	65	471
Deepwater dogfish	436	41	0	477	866	129	995
Rudderfish	208	137	1	346	268	231	499
Porbeagle shark	15	87	0	102	51	184	235
Hoki	80	61	0	141	9	28	37
School shark	4	2	0	6	0	6	6
Moonfish	1	10	76	87	0	14	14
Mako shark	0	4	7	11	0	34	34
Thresher shark	34	34	0	68	30	13	43
Swordfish	0	1	0	1	0	7	7
Butterfly tuna	2	32	0	34	1	6	7
Lancetfish	2	0	37	39	8	52	60
Oilfish	1	1	6	8	0	5	5
Yellowfin tuna	0	0	0	0	0	0	0
Bigeye tuna	0	0	0	0	0	0	0
Striped marlin	0	0	0	0	0	2	1

Table 5: Summary of the state of discarded fish as reported by observers, for 2002-03 and 2003-04 combined, by fleet and species, on observed vessels, for longline sets where southern bluefin tuna was either targeted or caught.

	Japanese charter vessels			New Zealand Domestic vessels		
Species	**No. alive**	**No. dead**	**% dead**	**No. alive**	**No. dead**	**% dead**
Ray's bream	2,535	526	17	2,602	773	23
Blue shark	309	42	12	2,872	151	5
Albacore	0	3	100	14	40	74
Southern bluefin tuna	0	4	100	0	2	100
Dealfish	17	1,167	99	136	113	45
Bigscale pomfret	616	190	24	203	101	33
Deepwater dogfish	1,241	47	4	153	17	10
Rudderfish	414	45	10	357	11	3
Porbeagle shark	55	11	17	165	103	38
Hoki	5	83	94	27	62	70
School shark	4	0	0	6	2	25
Moonfish	1	0	0	21	3	13
Mako shark	0	0	NA	31	7	18
Thresher shark	55	4	7	42	4	9
Swordfish	0	0	NA	5	3	38
Butterfly tuna	1	2	67	19	19	50
Lancetfish	5	5	50	19	33	63
Oilfish	1	0	0	5	1	17
Striped marlin	0	0	NA	1	1	50

Figure 1: Positions of reported longline sets versus observed sets, New Zealand domestic vessels, for sets where southern bluefin tuna was targeted or caught, 2002–03 and 2003–04 fishing years

2002–03 fishing year:



2003–04 fishing year:

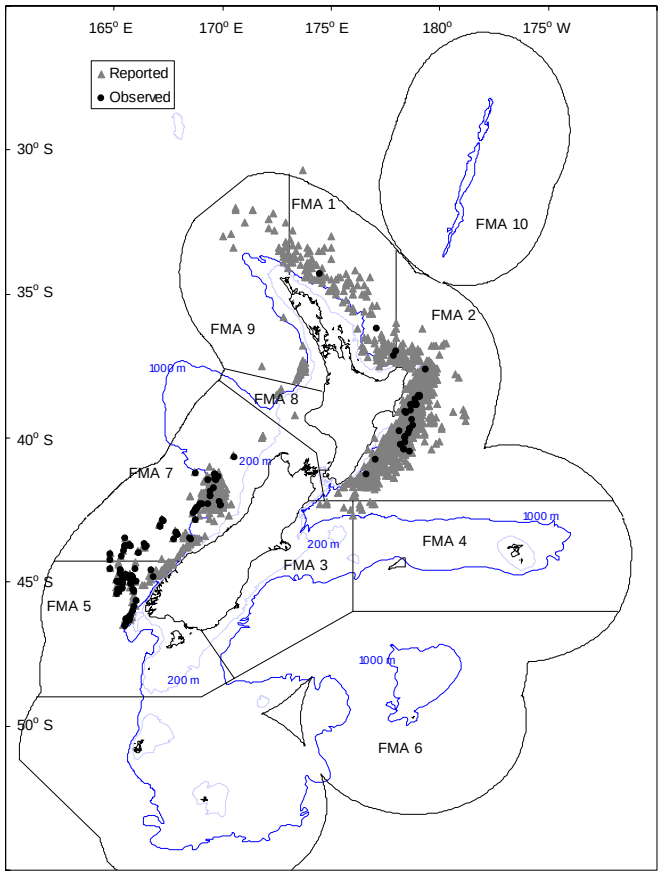
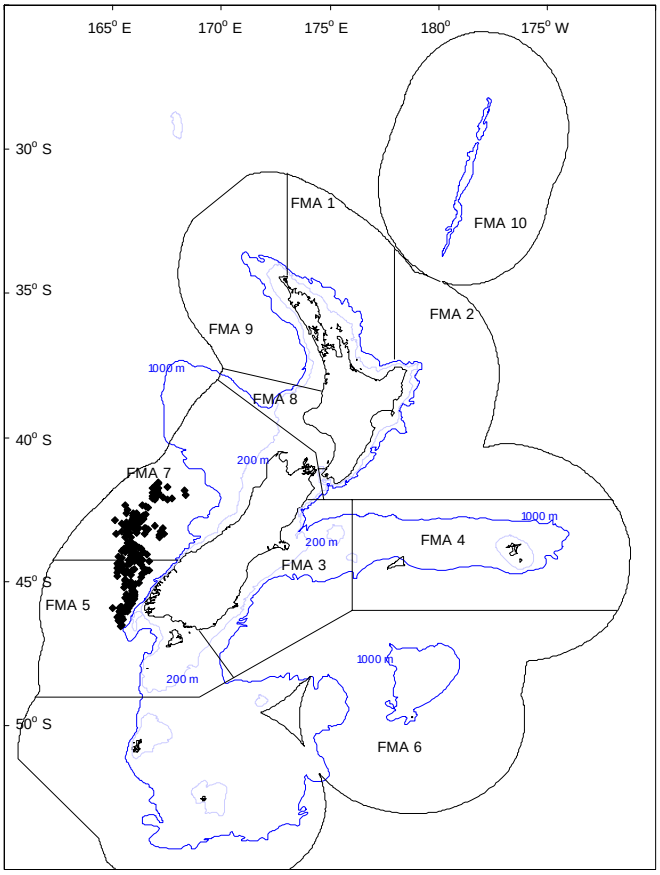


Figure 2: Positions of observed sets, Japanese charter vessels (above) and Philippine vessels (below), for sets where southern bluefin tuna was targeted or caught, 2002–03 and 2003–04 fishing years

2002–03 fishing year:



2003–04 fishing year: