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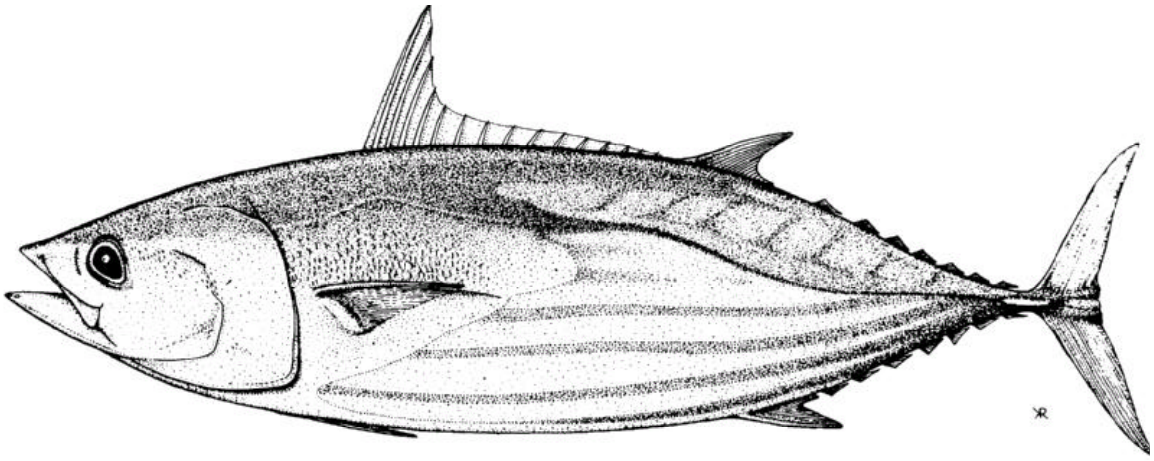
New Zealand Domestic Tuna Fisheries, 1990 – 2001



Talbot Murray[1], Lynda Griggs[1] and Paul Wallis[2]

[1]National Institute of Water and Atmospheric Research (NIWA)
Wellington

[2]Ministry of Fisheries
Wellington

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Talbot Murray, Lynda Griggs and Paul Wallis[1]
NIWA, Wellington & Ministry of Fisheries[1], Wellington

Introduction

Tuna in New Zealand waters represent important and valuable seasonal fisheries that are based on stocks that mostly occur outside of the 200 nautical mile Exclusive Economic Zone (EEZ). While no highly migratory species are currently included in the Quota Management System (QMS) most tunas and swordfish are being considered for potential inclusion in the QMS from October 2004. Only southern bluefin tuna (*Thunnus maccoyii*), managed by the Commission for the Conservation of Southern Bluefin Tuna (CCSBT), is subject to catch restrictions, with a 420 t competitive national catch limit. Commercially important tuna also include albacore (*T. alalunga*), bigeye (*T. obesus*), Pacific bluefin (*T. orientalis*), skipjack (*Katsuwonus pelamis*) and yellowfin tuna (*T. albacares*). While billfish are also regularly a non-target catch on tuna longlines, no billfish except swordfish (*Xiphias gladius*) can be kept (whether alive or dead) when caught. Targeting swordfish is prohibited, but incidental catches have become an important component of the domestic tuna longline fishery.

Albacore form the basis of a summer troll fishery, primarily on the west coasts of the North and South Island, with annual catches averaging 3472 tonnes since 1990 (maximum troll catch 5339 t in 1995). Albacore are also caught throughout the year by longline (averaging 981 t per year for the same period). Bigeye, are caught by longline around the northern half of the North Island throughout the year with longline catches averaging 188 t per year since 1990 (maximum longline catch 480 t in 2001). Skipjack, caught in small numbers by trolling (20 to 60 t), are primarily caught by purse seine in summer. Purse seine skipjack catches have averaged 4411 t per year since 1990 (maximum purse seine catch 9657 t in 2000). Southern bluefin tuna traditionally have been caught by handline and trolling during autumn and winter months off the west coast of the South Island from small vessels. These methods are still occasionally used. Longline vessels, however, catch most southern bluefin tuna. Southern bluefin tuna catches, restricted to a national competitive catch limit of 420 t since 1989, have usually been below this limit with landings averaging 326 t per year since 1990 (maximum landing 529 t in 1990). Pacific bluefin tuna, first recorded in the longline fishery in 1991 are a minor but increasing component of tuna longline catches (maximum landing 50 t in 2001).

Yellowfin tuna, caught in small numbers by trolling (16 t on average), are generally an incidental catch of longline sets targeting bigeye in summer. Longline catches of yellowfin tuna have averaged 76 t per year since 1990 (maximum catch 149 t in 1999). Swordfish are caught on longline sets targeting bigeye and southern bluefin tunas around both the North and South Islands. Longline catches of swordfish (averaging 372 t per year since 1990) have rapidly increased since 1996 with the maximum longline catch reaching 1029 t in 2001.

In addition to tuna and swordfish, several other species are part of the non-target catch in the longline fishery. Francis *et al.* (1999 and 2000) give the species composition and estimates of non-target catch for the New Zealand longline fishery. This non-target catch has also focused attention on the potential for impacts on a range of other species, particularly those that are rare, have low fecundity or about which little is known. Similarly, for purse seine fishing in the EEZ a wide range of fish taxa (over 60

species) have been recorded as incidental catch in sets targeting skipjack tuna (Habib *et al*. 1982). Trolling and other tuna fishing methods do not appear to have an appreciable incidental catch in New Zealand waters.

The New Zealand Tuna Fleet

A wide range of vessel types fish for tuna in the EEZ. Of these, only those engaged in purse seining and some tuna longline vessels are purpose built tuna vessels with most New Zealand tuna vessels operating in non-tuna fisheries for part of the year. Trolling, purse seining and longlining are the main tuna fishing methods used in New Zealand with handline and pole-and-line only occasionally used. Figure 1 shows the number of New Zealand vessels (domestic and chartered) reporting tuna catches by gear type, size (GRT) and year. Although no foreign licensed tuna vessels have operated in the New Zealand EEZ since 1995–96, a few USA purse seiners have fished for skipjack under the US/Pacific States treaty in some years. USA vessels and their catches are not included in this report.

Most vessels that fish for tuna troll for albacore. These vessels are predominantly smaller than 50 GRT and while fleet size has been increasing over the last three years, the fleet (328 trollers fished in 2001) is well below its maximum size of 492 trollers in 1994. The number of vessels longlining has steadily increased since 1990 to 132 vessels in 2001, and most of these target bigeye tuna. Throughout the 1990s, six medium-sized purse seiners (< 400 GRT) caught most of the New Zealand skipjack catch. This fleet was virtually unchanged until 2000, when one super seiner entered the fishery. Three more super seiners entered the New Zealand fleet in 2001. These super seiners fish part of the year in New Zealand waters and for much of the year fish in the equatorial western Pacific Ocean. Although up to 15 boats report using pole-and-line as a fishing method, this method is only occasionally used (2 to 5 vessels report using this method since 1997) and is a minor contributor to tuna landings. For this reason the number of pole-and-line vessels are not shown in Figure 1.

Total Tuna and Swordfish Catches

We have extended the record of New Zealand tuna landings back to 1960 through published government reports. While the species were generally not distinguished in early reports, the area of operation and months fished strongly suggest that early landings were primarily albacore although some skipjack tuna were also caught. Since 1972 records have been kept on each species landed and these are included in Figures 2 and 3. The largest annual landings come from summer surface fisheries for albacore (troll fishery) and skipjack tuna (purse seine fishery). Figure 2 shows that skipjack landings increasing rapidly in the 1970s to about 3000 t. Throughout the 1980s and 1990s skipjack landings were quite variable, ranging from 1000 to over 9000 t. Albacore landings have also been variable ranging from 2000 to 6526 t (in 1998) but show a generally increasing trend.

The annual landings shown in Figure 3 are species primarily caught by longline. Prior to 1990 most tuna longlining was by 3-5 chartered Japanese vessels primarily targeting southern bluefin tuna, with catches of bigeye, yellowfin and swordfish mostly made at the end of the season. Landings of these species have increased recently due to the expansion of the domestic longline fishery starting in 1990. Bigeye catches prior to 1996 were typically less than 100 t, however, since 1997 landings increased to about 400 t. Yellowfin tuna landings are low and prior to 1994 were similar to those of bigeye (less than 100 t), but since 1994 yellowfin landings have ranged from 100 to 200 t. Southern bluefin tuna catches limited by a national competitive quota of 420 t since 1989, have usually been well below this level until recent years (although the quota was exceeded in 4 of the past 15 years). In cases where the quota has been exceeded, the domestic allocation has been reduced so that New Zealand catches do not exceed the quota on average. In recent years landings of Pacific bluefin tuna have increased to about 50 t, this increase in landings is due to the newly acquired ability to distinguish southern and

Pacific bluefin tunas. A striking feature of Figure 3 is the dramatic increase in swordfish landings. Prior to 1995 swordfish landings were typically less than 100 t, however, despite a prohibition on targeting billfish, swordfish landings have increased to over 1000 t (of the billfish, only swordfish may be retained by commercial fishers, a measure designed to protect recreational fisheries for the marlins).

Catch Estimates by Gear Type

The following tuna and swordfish catch estimates are compiled from Ministry of Fisheries Catch Effort Logbook Returns (CELR) and Tuna Longline Catch Effort Logbook Returns (TLCER) for calendar years 1990 to 2001. Data grooming procedures are similar to those described by Murray *et al*. (1999) but unlike that report have also been applied to TLCER data. Catch estimates have been compiled from records of daily catch by each vessel that fished and include both domestic owned and operated vessels and vessels operating under charter to New Zealand companies. The charter fleet catch has not been separately identified because of confidentiality provisos protecting information of potential commercial sensitivity.

Catch estimates were compiled from estimates of catch in weight on TLCER forms and from estimates of catch in number converted to weights based on estimates of average weight for CELR data for all gear types except purse seine and unclassified gear types where weight is provided. For species and gear types where catch was reported as processed weight, conversion factors were also applied so that all weight estimates are given in greenweight (tonnes). Catch estimates were then scaled to the total domestic landings data provided by Licensed Fish Receiver Reports (LFRR). LFRR data do not include the catches made by charter vessels in 1992. In this report, however, company records for this fleet have augmented the LFRR data for 1992.

Troll

Table 1 summarise catches by trolling and shows that most of the catch by this gear type is of albacore with small catches of bigeye, southern bluefin, skipjack and yellowfin tunas. Albacore catches by trolling have averaged 3472 t since 1990 with peak catches in the mid-1990s (5339 t in 1995). The albacore troll fishery operates along the west coast of the South Island and off both coasts of the North Island from January to April. New Zealand troll vessels have also fished in high seas areas along the Subtropical Convergence Zone east of New Zealand, while these catches are not reported here in detail, landings in various South Pacific ports and to carrier vessels during the period 1989 to 1997 were substantial (in excess of 700 t in some years). Trolling is also regularly undertaken for skipjack and yellowfin tunas on a small scale in the Bay of Plenty and off the northeast coast of the North Island. Since 1990, skipjack tuna troll catches have averaged 24 t (maximum = 61 t in 2001) while yellowfin catches have averaged 16 t (maximum = 46 t in 1996). Target trolling in winter months off the west coast of the South Island has regular but small catches of southern bluefin tuna (average = 8 t since 1990). The accuracy of the peak catch recorded in 1990 (49 t) is uncertain.

Purse seine

Tuna purse seining in the EEZ is conducted during summer with sets primarily in the Bay of Plenty and to a lesser extent off the east and west coasts of the North Island. Purse seine catches, shown in Table 2, are almost exclusively of skipjack regardless of target. EEZ skipjack catches have averaged 4411 t since 1990 with the peak catch of 9657 t in 2000. While other tunas, primarily albacore and yellowfin tuna are a purse seine non-target catch in New Zealand waters (Bailey *et al.* 1996) only yellowfin tuna have been reported as a commercial catch component since 1990 (5 t in 1996). Catches by New Zealand flagged vessels fishing outside the EEZ in 2000 and 2001 are not shown in Table 2.

New Zealand distant water purse seine catches reported from outside the EEZ were 3101 t of skipjack in 2000 and 4679 t in 2001 while yellowfin catches were 876 t and 667 t in 2000 and 2001 respectively.

Longline

Longline fishing for tuna targets bigeye and southern bluefin tunas and to a lesser extent albacore. Longlining has expanded dramatically since 1990 (13 vessels) with 132 vessels fishing in 2001. This fishery operates year round throughout New Zealand waters and adjacent high seas areas. Tuna and swordfish catches by longline are summarised in Table 3. Catches since 1990 have averaged 981 t for albacore (maximum of 2103 t in 1999), 188 t for bigeye tuna (maximum of 480 t in 2001), 13 t for Pacific bluefin tuna (maximum of 50 t in 2001), 303 t for southern bluefin tuna (maximum of 457 t in 1999), 2 t for skipjack tuna (maximum of 8 t in 2001), 76 t for yellowfin tuna (maximum of 149 t in 1999), and 372 t for swordfish (maximum of 1029 t in 2001).

Catches of tuna (except southern bluefin tuna) and swordfish have all increased as more boats have entered the fishery (see Figure 1) and catches since 1996 are generally 4–6 times higher than they were in the preceding six years. Southern bluefin tuna catches have not increased because New Zealand catches have been subject to a national catch allocation from the CCSBT since 1989. Pacific bluefin tuna catches appear to have increased because fishers can now readily distinguish this species from southern bluefin tuna. Swordfish catches have increased proportionately more than have tuna catches (by 9 times as opposed to 4–6 times) suggesting that some targeting of swordfish is probably occurring in New Zealand waters.

Pole-and-line and Unclassified

Pole-and-line and other gear types are seldom used to catch tuna in New Zealand waters. These catches are summarised for pole-and-line in Table 4 and for all other gear types in Table 5. Catches of all species range from less than a tonne to a few hundred tonnes (albacore in 1990 and 1995; skipjack in 1990 and 1996; southern bluefin in 1990). These gear types form an insignificant portion of the total catch. In the case of southern bluefin, the handline fishery was a major gear type used in the 1980s when this fishery started, however, during the 1990s handline fishing, like trolling, has only occasionally been used.

Data from Observer and Port Sampling Programs

New Zealand has conducted an observer programme on tuna longliners targeting bigeye and southern bluefin tunas since 1987. Typically, coverage of the domestic longline fleet has been low (generally < 10% of sets) and has focused primarily on Japanese flagged vessels fishing for southern bluefin tuna during winter months (up to 100% of sets covered). Never-the-less, considerable information has been collected on catch composition, as well as sex ratios, size composition and discard practices on these vessels. Catch composition is reported in Francis *et al.* (1999 and 2000). Summaries of the non-target catch in the tuna longline fishery based on observer data are given in Appendix 1 for fish species and in Appendix 2 for non-fish species over the past two years compared with the preceding decade.

Several types of biological data are also routinely collected. Sex ratios of tuna and swordfish based on longline observer data are summarised in Table 6. Males and females are nearly equally represented in the longline catch for tuna but in the case of swordfish, females predominate in the catch (3.4 times as common as males). Observer data have also been used to determine the status of fish on landing in order to estimate the additional mortality due to discards and loss of fish during landing. This information is summarised in Table 7 and clearly shows that loss and discard rates are low in this

fishery, as is the additional mortality due to these factors (0.4 to 4.6%). The main reason observers record for discarding of fish is shark damage. The parameters of linear regressions of ln(length) against ln(greenweight) for longline caught tuna and swordfish are given in Table 8. Size composition is one of the key tasks for observers on longliners and composite size frequencies (1987 to 2001) are given in Figures 4 (albacore), 5 (bigeye tuna), 6 (southern bluefin tuna), 7 (yellowfin tuna), and 8 (swordfish). Where fish are processed on deck the size composition is shown by sex (all species except albacore). In most cases (including for the limited data available on albacore) size composition of males and females are similar. In the case of swordfish, however, not only are females more commonly caught, they are also substantially larger than the males that are caught. The trends in mean size together with the coefficient of variation are given for these species in Table 9. There is no significant trend in fish size for any of these species except for southern bluefin tuna which shows a marked declining trend in mean size since 1987 when observer coverage was begun.

In addition, port sampling has been conducted to monitor size composition in New Zealand's albacore troll fishery. Albacore port sampling results are reported separately. There has been no observer coverage on troll or purse seine vessels since the 1980s.

Markets

The main markets for tuna are for canned skipjack and albacore with canning done outside New Zealand where labour costs are lower. Spain and the United States of America are important markets for albacore while Indonesia and Thailand are important for skipjack. Some skipjack is re-imported to New Zealand under various labels. Fresh and frozen bigeye, southern bluefin, northern bluefin and yellowfin tunas and swordfish are exported, primarily to the Japan, Australia and the United States of America. Domestic consumption of tuna is small relative to domestic production.

Onshore Developments

The infrastructure supporting the New Zealand tuna fishery includes many excellent harbours with easy access to fuel, ice and freezer facilities as well as vessel repair facilities. Air links to markets in Asia, the United States of America are excellent. There are no tuna canneries but many licensed export fish processors ship fresh and frozen product tuna regularly.

Future Prospects

Although the seasonal nature of New Zealand's tuna fisheries has limited the scope for development inside the exclusive economic zone, these fisheries remain an important component of the seafood industry. These fisheries are especially important for the small inshore fleet operating in the summer. The value of New Zealand tuna fisheries is now around $NZ 45 million (export value). Increases in the value of the longline fishery are likely to flow from reform of management instruments in the next 2-3 years.

Recent Developments

Of note in New Zealand tuna fisheries is the increase in the number of domestic longliners targeting southern bluefin and bigeye tunas. Several longliners are also operating further north; on the high seas and in other countries' waters. There has also been an expansion in the purse seine fleet. In addition to the domestic fleet of smaller purse seiners, several companies are now operating super-seiners that operate in the summer skipjack fishery in New Zealand waters, but range further north during the rest of the year.

Acknowledgments

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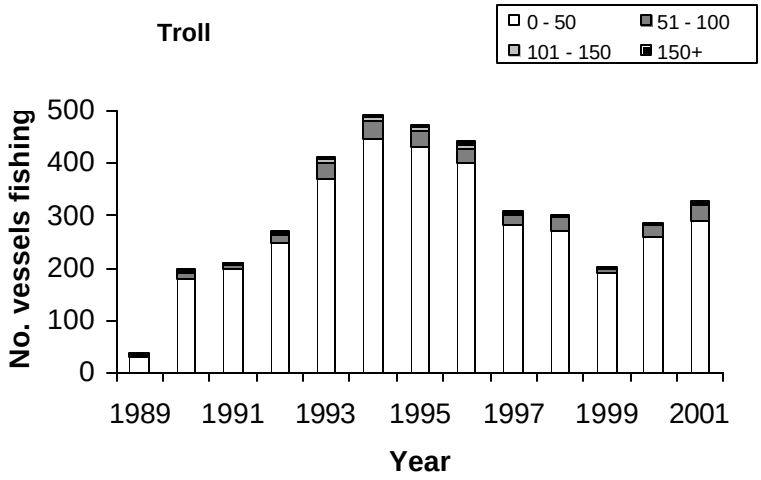
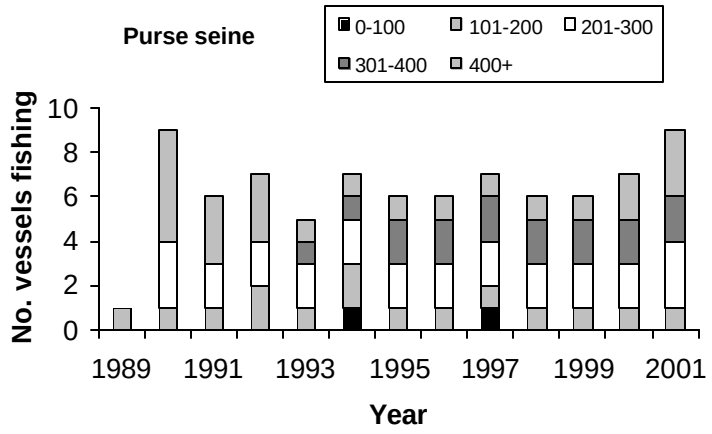

Troll
0 - 50
51 - 100
101 - 150
150+
No. vessels fishing
500
400
300
200
100
0
1989
1991
1993
1995
1997
1999
2001
Year


Purse seine
0-100
101-200
201-300
301-400
400+
No. vessels fishing
10
8
6
4
2
0
1989
1991
1993
1995
1997
1999
2001
Year

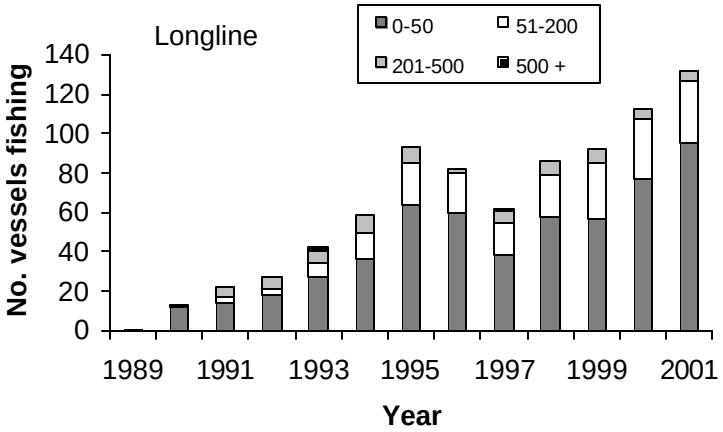

Longline
0-50
51-200
201-500
500 +
No. vessels fishing
140
120
100
80
60
40
20
0
1989
1991
1993
1995
1997
1999
2001
Year

Figure 1. Changes in vessel size (GRT) in New Zealand's primary domestic tuna fleets, 1989–2001

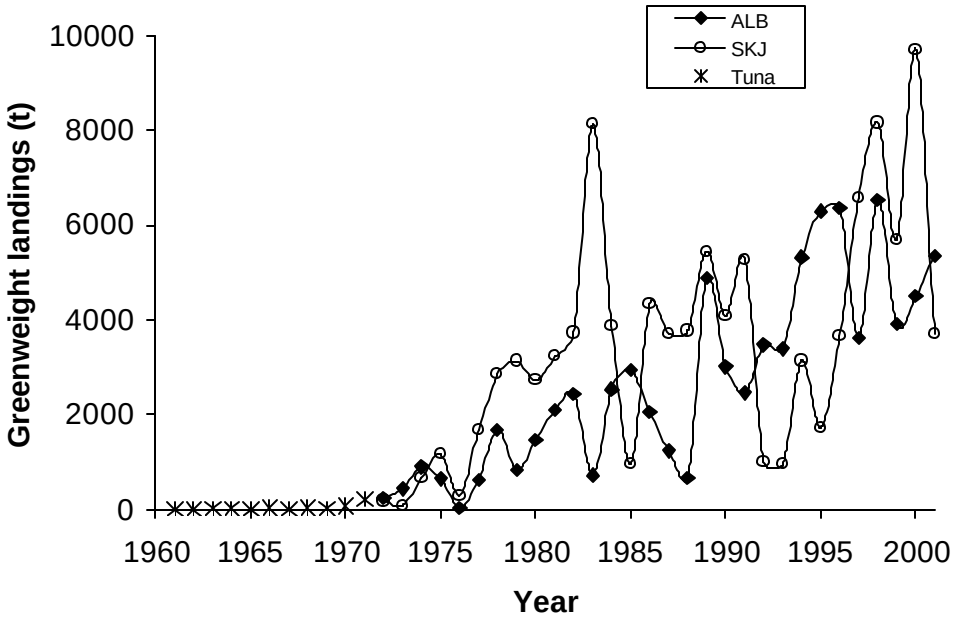


Figure 2. Domestic landings (tonnes, greenweight) of albacore and skipjack tuna by year

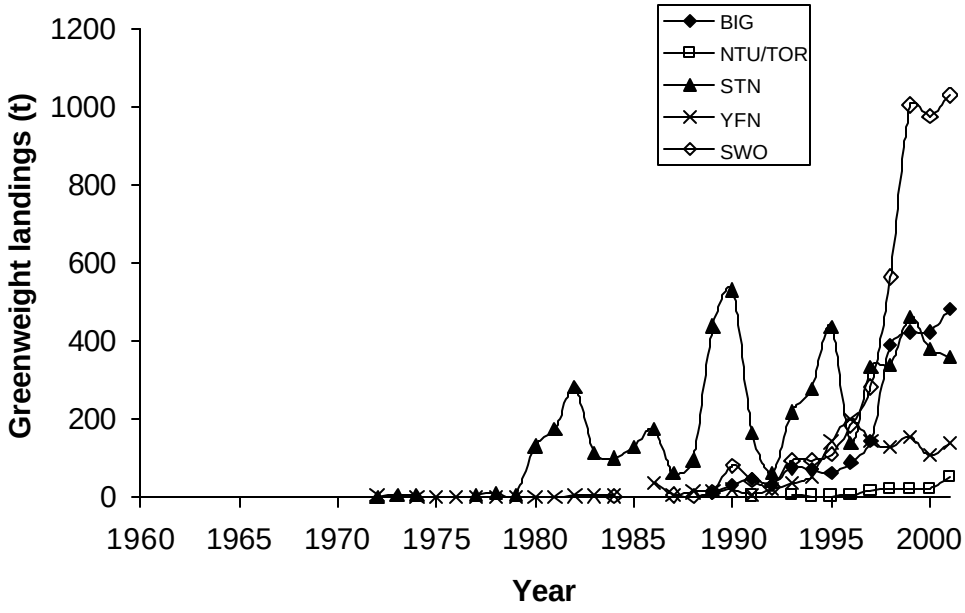


Figure 3. Domestic landings (tonnes, greenweight) of bigeye, northern bluefin, southern bluefin, and yellowfin tunas and swordfish by year

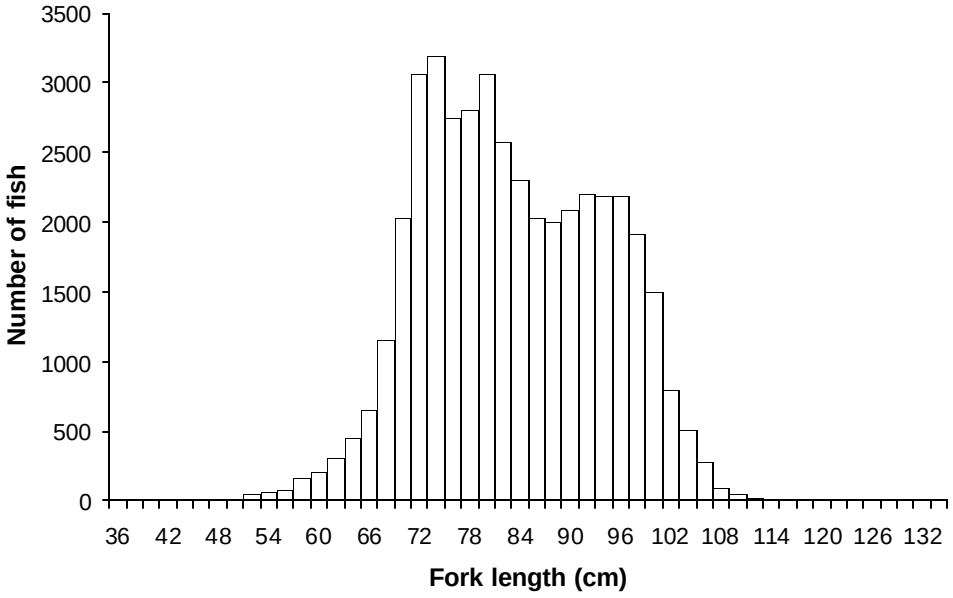


Figure 4. Length frequency distribution of longline caught albacore (1987 to 2001) based on observer data (n = 39 654 fish)

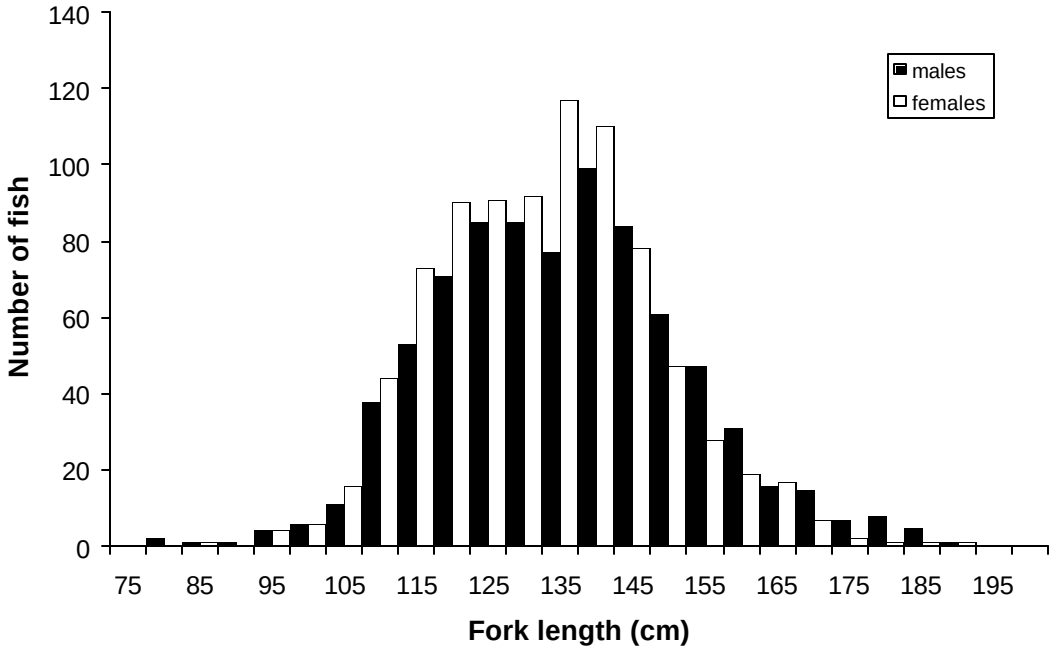


Figure 5. Length frequency distribution of longline caught bigeye tuna (1987 to 2001) by sex (n = 808 males, 845 females) based on observer data

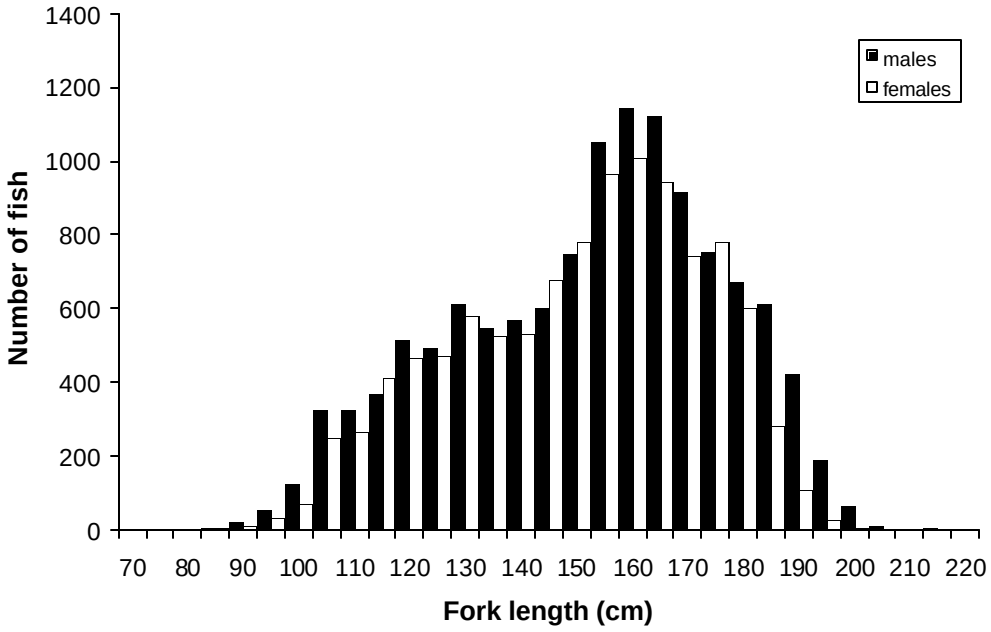


Figure 6. Length frequency distribution of longline caught southern bluefin tuna (1987 to 2001) by sex (n = 12 275 males, 10 535 females) based on observer data

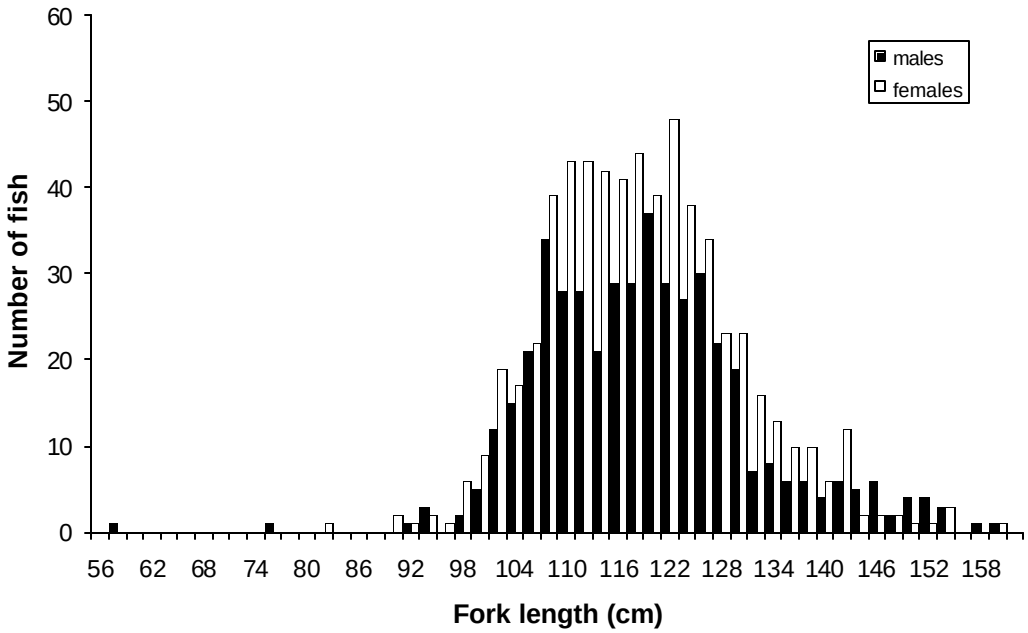


Figure 7. Length frequency distribution of longline caught yellowfin tuna (1987 to 2001) by sex (n = 457 males, 616 females) based on observer data

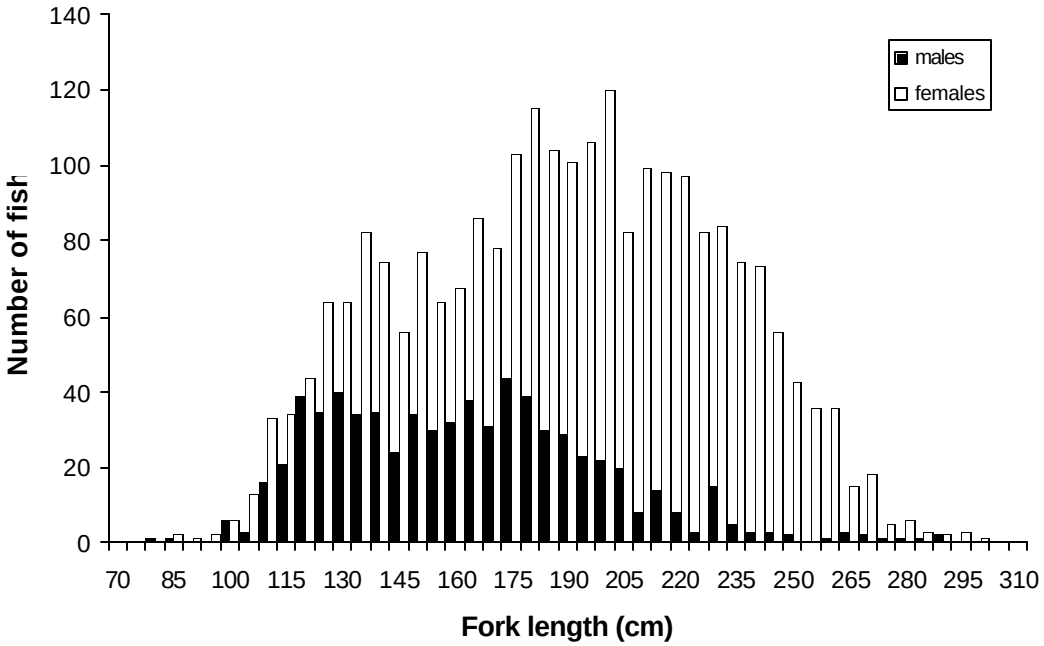


Figure 8. Length frequency distribution of longline caught swordfish (1987 to 2001) by sex (n = 699 males, 2410 females) based on observer data

Table 1. Catch estimates (tonnes, greenweight) in the New Zealand troll fishery by species for the period 1990 to 2001 (ALB = albacore; BIG = bigeye tuna; NTU/TOR = Pacific bluefin tuna; STN = southern bluefin tuna; SKJ = skipjack tuna; YFN = yellowfin tuna; SWO = swordfish). Zero entries are catches < 100 kg

Year	ALB	BIG	NTU/TOR	STN	SKJ	YFN	SWO
1990	2 554.9			49.3	2.5	13.6	
1991	2 349.7	0.0		8.6	3.0	0.5	3.9
1992	3 264.8	0.0		9.5	3.1	6.8	
1993	2 971.0	0.4			7.4	17.7	
1994	4 608.7	1.6		0.4	42.0	20.0	
1995	5 338.8	0.2		4.2	40.9	35.5	
1996	5 214.6	2.3	0.0	2.0	42.5	46.1	4.7
1997	2 767.1	2.0		2.2[1]	8.9	19.8	
1998	4 463.1	0.0		6.8	32.1	11.1	9.5
1999	1 798.5	1.2		2.2	19.9	4.1	
2000	3 084.0	0.3		0.7	28.5	9.1	1.3
2001	3 254.1	0.2		0.2	61.2	7.0	

[1] catch estimated from regression of all other years data due to CELR error from one vessel

Table 2. Catch estimates (tonnes, greenweight) in the New Zealand purse seine fishery by species for the period 1990 to 2001 (SKJ = skipjack tuna; YFN = yellowfin tuna)

Year	SKJ	YFN
1990	3 959.4	
1991	5 256.3	
1992	985.3	
1993	937.2	
1994	3 088.1	
1995	1 654.1	
1996	3 491.6	5.3
1997	6 510.4	
1998	8 118.5	
1999	5 656.4	
2000	9 657.6	
2001	3 621.4	

Table 3. Catch estimates (tonnes, greenweight) in the New Zealand longline fishery by species for the period 1990 to 2001 (ALB = albacore; BIG = bigeye tuna; NTU/TOR = Pacific bluefin tuna; STN = southern bluefin tuna; SKJ = skipjack tuna; YFN = yellowfin tuna; SWO = swordfish). Zero entries are catches < 100 kg

Year	ALB	BIG	NTU/TOR	STN	SKJ	YFN	SWO
1990	170.4	29.5		314.7	0.3	3.9	79.6
1991	84.7	44.2	1.5	149.7	0.0	5.8	37.9
1992	209.2	39.4	0.3	261.3		13.0	29.0
1993	344.8	73.5	5.6	215.0	0.2	13.9	92.6
1994	634.6	69.1	1.9	276.1	0.3	32.1	93.8
1995	810.3	59.5	1.8	429.6	2.1	93.9	108.0
1996	1 078.7	86.4	4.1	136.8	2.6	140.9	177.7
1997	846.9	139.8	14.3	329.6[1]	0.5	121.4	281.8
1998	2 056.6	387.5	20.4	328.7	3.3	115.9	554.1
1999	2 103.0	420.2	21.2	456.8	1.0	148.6	1 003.6
2000	1 343.6	421.4	20.9	379.6	1.5	97.8	973.2
2001	2 093.1	479.9	49.8	358.3	8.4	130.4	1 028.7

[1] see footnote to Table 1

Table 4. Catch estimates (tonnes, greenweight) by species for the period 1990 to 2001 for pole-and-line gear (ALB = albacore; SKJ = skipjack tuna; YFN = yellowfin tuna). Zero entries are catches < 100 kg

Year	ALB	SKJ	YFN
1990	242.0		
1991	9.0	0.1	
1992	6.4		
1993	59.5	0.8	2.4
1994	62.1	6.2	0.9
1995	135.6	28.2	11.2
1996	26.5	115.4	5.7
1997		49.9	0.2
1998	1.3	0.6	
1999	0.2	10.9	0.9
2000	72.3	11.4	
2001	3.7	0.0	

Table 5. Catch estimates (tonnes, greenweight) by species for the period 1990 to 2001 for unclassified gear types (ALB = albacore; BIG = bigeye tuna; NTU/TOR = Pacific bluefin tuna; STN = southern bluefin tuna; SKJ = skipjack tuna; YFN = yellowfin tuna; SWO = swordfish). Zero entries are catches < 100 kg

Year	ALB	BIG	STN	SKJ	YFN	SWO
1990	43.7	0.1	165.2	116.5	0.1	
1991	15.3		6.2	0.0	0.1	0.1
1992	6.7		8.4	0.0		0.0
1993	11.3		1.7	0.0	0.2	0.3
1994	11.5	0.0	0.5		0.0	
1995	10.3	0.0	2.6	3.3	0.3	
1996	26.5	0.0	0.4	0.3	0.2	0.0
1997	14.4	0.0	1.8[1]	0.3	1.4	0.3
1998	5.1		1.6	1.8	0.0	
1999	1.5		1.7	0.2	0.0	
2000	0.2		0.0	0.1	0.0	
2001	2.1		0.0	0.5		0.0

[1] see footnote to Table 1

Table 6. Sex ratios of longline caught tuna and swordfish for the period 1987 to 2001

	male	female	n	ratio
albacore	1 701	1 477	3 178	1.2
southern bluefin tuna	12 346	10 585	22 931	1.2
bigeye tuna	816	852	1 668	1.0
yellowfin tuna	459	616	1 075	0.7
swordfish	726	2 478	3 204	0.3

Table 7. Summary of the number of status of longline caught tuna and swordfish on landing for the period 1992 to 2001 based on observer data, % dead is the additional mortality due to discarding or loss of fish on landing

	retained	discarded	lost	unknown	% dead
albacore	38 784	759	290	580	2.0
bigeye tuna	1 429	53	13	0	2.3
southern bluefin tuna	21 979	169	248	6	0.4
yellowfin tuna	1 154	98	17	1	1.8
swordfish	2 995	231	63	22	4.6

Table 8. Linear regression parameters of ln(fork length, cm) and ln(greenweight, kg) of longline caught tuna and swordfish by sex for the period 1987 to 2001 where ln(greenweight) is the response variable

	Sex	n	intercept	SE intercept	slope	SE slope	R^2
Albacore	male	1 110	-11.57	0.127	3.15	0.029	0.92
	female	1 075	-11.46	0.149	3.13	0.033	0.89
	combined	31 135	-10.34	0.022	2.88	0.005	0.92
Bigeye tuna	male	525	-10.76	0.201	2.99	0.041	0.91
	female	518	-9.63	0.222	2.76	0.045	0.88
	combined	1 075	-10.24	0.148	2.88	0.030	0.89
Southern bluefin tuna	male	11 014	-11.02	0.028	3.03	0.006	0.96
	female	9 450	-10.99	0.034	3.03	0.007	0.96
	combined	20 661	-11.01	0.022	3.03	0.004	0.96
Yellowfin tuna	male	184	-9.67	0.304	2.72	0.064	0.91
	female	212	-9.64	0.281	2.71	0.059	0.91
	combined	415	-9.37	0.187	2.66	0.039	0.92
Swordfish	male	517	-12.03	0.181	3.16	0.036	0.94
	female	1 664	-12.56	0.106	3.26	0.020	0.94
	combined	2 610	-12.41	0.082	3.23	0.016	0.94

Table 9. Average length of longline caught tuna (fork length, cm) and swordfish (eye to fork length, cm) by year based on observer data, values in parentheses are the coefficient of variation (%) of the mean length

	ALB		BIG		STN		YFN		SWO	
1987	85.8	(12.2)			165.9	(5.9)			166.0	(18.9)
1988	89.1	(9.9)	142.1	(8.6)	168.2	(4.1)			175.3	(21.1)
1989	87.0	(12.7)	131.6	(12.1)	169.6	(7.3)			171.5	(18.6)
1990	87.5	(12.0)	144.9	(11.1)	159.3	(15.5)	123.3	(3.0)	170.3	(21.2)
1991	86.7	(13.2)	123.7	(11.5)	158.7	(17.5)			177.9	(20.9)
1992	83.5	(12.5)	140.5	(9.2)	152.3	(16.8)			166.5	(20.8)
1993	86.5	(10.4)	142.1	(9.3)	147.3	(20.1)			187.4	(21.1)
1994	85.0	(14.5)	141.4	(8.8)	147.1	(14.8)	116.4	(10.7)	177.4	(22.1)
1995	73.2	(14.7)	133.4	(12.2)	149.1	(14.2)	113.7	(11.8)	179.5	(22.3)
1996	76.4	(13.3)	126.3	(20.2)	140.0	(15.3)	108.4	(14.8)	174.6	(18.6)
1997	80.2	(12.4)	118.5	(15.5)	154.9	(12.6)	109.4	(8.5)	183.7	(19.0)
1998	84.5	(11.0)	133.7	(10.2)	147.2	(16.0)	123.9	(9.5)	173.8	(23.6)
1999	87.2	(11.1)	130.7	(12.6)	154.2	(13.1)	131.2	(13.1)	203.4	(21.5)
2000	86.6	(12.7)	135.8	(12.1)	146.1	(15.8)	114.3	(18.8)	187.9	(23.5)
2001	79.0	(12.4)	132.5	(12.8)	140.4	(16.0)	122.5	(8.1)	166.8	(28.5)

Appendix 1. Fish species (numbers of individuals) caught on tuna longlines since 1990 by calendar year. Summary based on Ministry of Fisheries observer data.

Tuna		**2001**	**2000**	**1990-1999**
Albacore tuna	*Thunnus alalunga*	8 914	1 341	36 460
Southern bluefin tuna	*Thunnus maccoyii*	3 063	1 801	18 490
Butterfly tuna	*Gasterochisma melampus*	254	305	2 679
Bigeye tuna	*Thunnus obesus*	386	97	1 435
Yellowfin tuna	*Thunnus albacares*	369	49	869
Skipjack tuna	*Katsuwonus pelamis*	89	6	182
Slender tuna	*Allothunnus fallai*	4	7	125
Northern bluefin tuna	*Thunnus thynnus*	18	4	113
Frigate tuna	*Auxis thazard*			1
Billfish				
Swordfish	*Xiphias gladius*	826	308	2 966
Striped marlin	*Tetrapturus audax*	81	14	251
Shortbill spearfish	*Tetrapturus angustirostris*	7	2	46
Blue marlin	*Makaira mazara*	2		6
Black marlin	*Makaira indica*	4		
Marlin, unspecified				2
Sharks and rays				
Blue shark	*Prionace glauca*	8 650	6 025	87 617
Porbeagle shark	*Lamna nasus*	666	965	12 841
Mako shark	*Isurus oxyrinchus*	395	123	2 456
Owston's dogfish	*Centroscymnus owstoni*	126	456	2 326
School shark	*Galeorhinus galeus*	117	129	2 117
Deepwater dogfish, other		7		1 576
Pelagic stingray	*Pteroplatytrygon violacea*	223	65	621
Thresher shark	*Alopias vulpinus*	141	75	485
Spiny dogfish	*Squalus acanthias*	7	2	159
Shark unspecified		5	1	130
Ray, other		7		63
Bronze whaler shark	*Carcharhinus brachyurus*	9	2	33
Bigeye thresher	*Alopias superciliosus*	5	1	14
Skate	Rajidae			11
Oceanic whitetip shark	*Carcharhinus longimanus*	2	1	6
Hammerhead shark	*Sphyrna zygaena*	1	1	6
Great white shark	*Carcharodon carcharias*			3
Carpet shark	*Cephaloscyllium isabellum*			2
Seven gill shark	*Notorynchus cepedianus*			1
Sharpnose seven gill shark	*Heptranchias perlo*			1
Tiger shark	*Galeocerdo cuvier*			1

Appendix 1 continued.

Other bony fish		**2001**	**2000**	**1990-1999**
Rays bream	*Brama brama*	1173	2019	28176
Dealfish	*Trachipterus trachypterus*	1050	1201	8663
Lancetfish	*Alepisaurus ferox & A. brevirostris*	2770	353	3064
Moonfish	*Lampris guttatus*	721	477	4748
Oilfish	*Ruvettus pretiosus*	618	104	4890
Unknown fish		197	628	1988
Rudderfish	*Centrolophus niger*	290	439	1916
Escolar	*Lepidocybium flavobrunneum*	159	522	951
Sunfish	*Mola mola*	257	105	701
Hoki	*Macruronus novaezelandiae*	86	106	788
Big scale pomfret	*Taratichthys longipinnis*	82	95	658
Barracouta	*Thyrsites atun*	4	68	259
Black barracouta	*Nesiarchus nasutus*	30	130	102
Dolphinfish	*Coryphaena hippurus*	196		31
Flathead pomfret	*Taractes asper*	29	13	76
Hapuku bass	*Polyprion* spp	17	12	44
Kingfish	*Seriola lalandi*	14	1	52
Opah	*Lampris immaculatus*	13	6	39
Fanfish	*Pterycombus petersii*			48
Wingfish	*Pteraclis velifera*	2	1	18
Hake	*Lyconus* spp.		2	15
Gemfish	*Rexea solandri*	4	2	8
Pilotfish	*Naucrates ductor*	1		8
Barracudina	*Magnisudis prionosa*			8
Barracuda	*Sphyraena novaehollandiae*			7
Frostfish	*Lepidopus caudatus*	1		5
Scaly stargazer	*Pleuroscopus pseudodorsalis*	6		
Unicornfish	*Lophotus capellei*	1		5
Ribaldo	*Mora moro*			5
Bluenose	*Hyperoglyphe antarctica*			4
False frostfish	*Paradiplospinus gracilis*			4
Black mackerel	*Scombrolabrax heterolepis*	2		1
Scalloped dealfish	*Zu elongatus*			3
Blue cod	*Parapercis colias*			2
Pelagic butterfish	*Schedophilus maculatus*	2		
Ragfish	*Icichthys australis*			2
Bigeye scabbard fish	*Benthodesmus elongatus*			1
Blue mackerel	*Scomber australasicus*			1
Cubehead	*Cubiceps baxteri*			1
Large headed slickhead	*Rouleina* spp.		1	
Manefish	*Caristius* spp.			1
Pufferfish	*Sphoeroides pachygaster*			1
Red cod	*Pseudophycis bachus*			1
Tasmanian ruffe	*Tubbia tasmanica*			1
Wahoo	*Acanthocybium solandri*			1

White warehou	*Seriolella caerulea*	1

Appendix 2. Non-fish species (numbers of individuals) caught on tuna longlines since 1990 by calendar year. Summary based on Ministry of Fisheries observer data.

Marine mammals		**2001**	**2000**	**1990-1999**
Fur seal	*Arctocephalus forsteri*	43	49	317
Hookers sea lion	*Phocarctos hookeri*		1	
Bottlenose dolphin	*Tursiops truncatus*			1
Common dolphin	*Delphinus delphis*			2
Dusky dolphin	*Lagenorhynchus obscurus*		1	1
Porpoise				1
Orca	*Orcinus orca*			1
Hump backed whale	*Megaptera Novaeangliae*			1
Sperm whale	*Physeter macrocephalus*			1
Whale, unspecified		1		2
Marine reptiles				
Turtle	Probably leatherback	4		4
Seabirds (albatrosses)				
Antipodean wandering albatross	*Diomedea antipodensis*		3	93
Wandering albatross	*Diomedea exulans*			2
Gibson's albatross	*Diomedea gibsoni*		4	51
Northern Royal albatross	*Diomedea sanfordi*			2
Southern Royal albatross	*Diomedea epomorphora*		1	8
Wandering albatross	*Diomedea* spp.		1	18
Buller's albatross	*Thalassarche bulleri*	11	16	126
Chatham albatross	*Thalassarche eremita*			1
Campbell albatross	*Thalassarche impavida*	1	2	88
Grey-headed albatross	*Thalassarche chryostoma*			6
Salvin's albatross	*Thalassarche salvini*	1		13
Black-browed albatross	*Thalassarche melanophrys*		1	34
Black-browed albatross unidentified	*Thalassarche* spp.			1
White-capped albatross	*Thalassarche steadi*	3	6	111
Light-mantled albatross	*Phoebetria palpebrata*			41
Albatross unidentified				39
Seabirds (Petrels)				
Northern giant petrel	*Macronectes halli*			7
Southern giant petrel	*Macronectes giganteus*			2
Giant petrel unidentified	*Macronectes* spp.			
White-chinned petrel	*Procellaria aequinoctialis steadi*	2	7	51
Black petrel	*Procellaria parkinsoni*	5	5	7
Grey petrel	*Procellaria cinerea*		1	255
Westland petrel	*Procellaria westlandica*			1
Sooty shearwater	*Puffinus griseus*		2	4
Flesh-footed shearwater	*Puffinus carneipes hullianus*	30	15	137
Grey faced petrel	*Pterodroma macroptera*	1	1	
Southern cape pigeon	*Daption capensis capense*			7
Petrel unidentified				106
Seabird unidentified				109