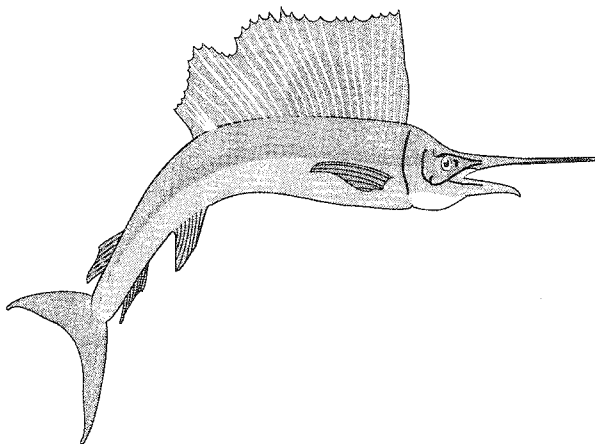


# **New Zealand billfish and gamefish tagging, 1998–99**

**Bruce Hartill  
Nick M. Davies**



**NIWA Technical Report 79  
ISSN 1174-2631  
2000**

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**NIWA Technical Report 79  
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**Published by NIWA  
Wellington  
2000**

Inquiries to:  
Publication Services, NIWA,  
PO Box 14-901, Wellington, New Zealand

**ISSN 1174-2631  
ISBN 0-478-23205-5**

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Citation: Hartill, B. & Davies, N. M. 2000:  
New Zealand billfish and gamefish tagging, 1998–99.  
*NIWA Technical Report 79*. 30 p.

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## Introduction

In 1975, the New Zealand Ministry of Agriculture and Fisheries implemented a cooperative gamefish tagging programme at the request of angling groups. Before that, recreational fishers had tagged many gamefish, and high recovery rates of tagged fish promised to provide valuable information on growth and movement. Since 1975 recreational anglers have voluntarily reported all tag release and recapture information which has then been stored on a database and analysed for fish movement and growth.

The programme became significant in the management of billfish species in 1988, when the Minister of Fisheries implemented a fishing moratorium that restricted access to the Auckland Fishery Management Area for foreign licensed tuna longline vessels and prohibited the retention of any commercially caught billfish, except swordfish, by domestic vessels in northern New Zealand waters. As part of the moratorium, recreational fishers were encouraged to tag at least 50% of all striped marlin (*Tetrapturus audax*) caught. Information from recaptures could then provide some basis for describing the geographic distribution of striped marlin, and the degree of interaction between the recreational and commercial fisheries for striped marlin.

A review of the programme in November 1991 determined that it has the potential to provide data useful for improving management of other key recreational gamefish species, such as kingfish (*Seriola lalandi*), mako shark (*Isurus oxyrinchus*), and blue shark (*Prionace glauca*). The objective of tagging these species was to collect and analyse information on growth and movement. The overall results on billfish and gamefish distribution and movement provide the Ministry of Fisheries with information to gauge the effectiveness of measures to reduce conflict between the recreational gamefish and commercial tuna longline fisheries.

For the 1998–99 fishing year, the Ministry of Fisheries contracted NIWA to manage the gamefish tagging database as part of a database management project (project number DMAN905). This report summarises the results obtained from the tagging programme from 1 July 1998 to 30 June 1999. Results of previous seasons have been summarised in a time series of reports: 1995–96 (Holdsworth & Saul 1998), 1996–97 (Davies & Hartill 1998), and 1997–98 (Hartill & Davies 1999).

## Methods

Billfish and gamefish were tagged through an existing cooperative arrangement with recreational and commercial fishers who voluntarily tag and release billfish and gamefish species. These releases and recaptures by recreational anglers and commercial fishermen formed the basis of the programme in 1998–99.

As in previous years, fish were tagged with a visual implant tag, as described by Davies & Hartill (1998). The distribution of tags to recreational fishing clubs through the New Zealand Big Game Fishing Council (NZBGFC) and the tagging methodology has been described by Saul & Holdsworth (1992). The NZBGFC distributed over 3000 tags to gamefish clubs and participating anglers before, and during, the 1998–99 billfish season (October–April). Tags were also supplied to commercial fishers by NIWA on an individual boat basis. Participants completed a fish tagging report card, recording relevant information on the release of a tagged fish and submitted it either through their clubs or directly to NIWA. All release details were entered into a relational tagging database, which is archived on the central Ministry of Fisheries database, managed by NIWA in Wellington, at the end of the fishing year.

The message on the tag informs anglers that a reward will be offered for details of the recapture of tagged fish. These recapture details are then entered into the relational tagging database.

For each species, tag release and recapture information was summarised by fish size, the spatial and temporal distribution of releases and recaptures, and the respective catch by the recreational and commercial fishing sectors. Almost all the results given in this report, such as seasons and localities,

are very strongly dependent on the presence and timing of recreational gamefishing and commercial longlining activities. Size distributions were categorised by 10 cm length intervals. The size of fish released or recaptured is given in length and weight. Often these sizes are only estimates, especially when the fish is not landed. Length data in this report are based on, in order of preference, measured length, measured weight converted to length, estimated length, and estimated weight converted to length. Weights were converted to lengths using the best available length-weight relationships (Table 1).

Blue shark lengths derived from weights were likely to be underestimates as they were based on a conversion to standard length as no conversion parameters were available for total length estimation. When both measured lengths and weight estimates were reported, conversion of weight estimates using a standard length-weight relationship resulted in length estimates which were similar to those reported by the fisher. As length estimates were given for 90% of the blue shark releases reported, the use of lengths derived from weights is unlikely to have had much influence on the length frequency presented.

The spatial distribution of release and recapture locations of tagged fish was summarised using Ministry of Fisheries commercial statistical reporting areas (Figure 1). Fine resolution plots of release locations for main species were produced from the information on the fish tagging report cards. The temporal distributions of releases and recaptures were categorised by calendar month. Releases and recaptures were categorised according to the commercial or recreational methods of capture.

Net movements of billfish, mako sharks, blue sharks, and kingfish were determined from the release and recapture locations. The frequency of fish moving between statistical areas was tabulated to determine broad patterns in movement of mako shark, blue shark, and kingfish. Detailed charts were produced of both local and long distance movements of recaptured striped marlin for which release data were available.

## **Results**

### **Striped marlin**

A total of 1535 striped marlin was tagged and released by commercial and recreational fishers between 1 July 1998 and 30 June 1999 (Table 2), which is the highest number reported since the programme began in 1975. The total number of marlin caught by gamefish clubs was 2349 (estimated from gamefish club records, Ros Nelson, NZBGFC, pers. comm.). Therefore, during the 1998–99 season, 65% of all striped marlin caught were tagged and released, compared with 62% in 1997–98, 68% in 1996–97, and 58% in 1995–96. Nineteen striped marlin were tagged and released by commercial fishers (Appendix 1).

A wide size range of striped marlin was tagged and released with an mean estimated length of 223.5 cm (Figure 2). The NZBGFC and member clubs encourage the tagging and releasing of marlin under 90 kg (about 231 cm long) and do not recognise landed fish less than this weight for contests or trophies. The length distribution of released striped marlin indicates that about 45% of tagged fish were over 90 kg.

There has been a marked increase in the number of striped marlin tagged off New Plymouth (statistical area 041, Figure 1), where 214 were tagged in the 1998–99 season (Figure 3), far more than in any other previous year. Most releases were once again made along the east Northland coast, and in the areas around the Three Kings Islands and North Cape (Figure 4, Appendices 1 and 2).

The monthly distribution of releases show this to be a summer–autumn fishery with few striped marlin being tagged and released before January (Figure 5). The seasonal pattern of releases is broadly similar to that in previous years (Davies & Hartill 1998, Holdsworth & Saul 1998, Hartill & Davies 1999).

The distribution of tagging effort for striped marlin within the recreational fleet was strongly skewed, as in previous seasons, with a few vessels responsible for a high proportion of the releases. Nine vessels (less than 2% of the participating fleet) accounted for 20% of the marlin tagged and released (Table 3).

During the 1998–99 season, 13 tagged striped marlin were recaptured, more than in any previous season. There has also been a reported recapture from a previous season. Before this season only 40 striped marlin recaptures had been reported since tagging started in 1975. Of those recaptured this season, seven were caught by recreational vessels in New Zealand waters and six by commercial vessels in the tropics (Tables 4 and 5). Striped marlin recaptured by recreational fishers had been at liberty for 2–62 days, during which they travelled 0–94 n. miles. Commercial recaptures occurred after 33–1032 days after travelling 854–1091 n. miles. Two striped marlin were recaptured near Fiji, two near Tonga, one west of New Caledonia, and one off the east Australian coast. Unfortunately, no release information is available for one of the 13 recaptures. All of the tagged marlin for which release data are available were released by recreational fishers.

Marlin are capable of moving large distances in a short time (Figure 6), and it is possible that they do not remain resident in New Zealand waters for periods greater than a few months. It appears from short term recaptures that inshore coastal movements (Figure 7a) occur during the fishing season, with out of season recaptures indicating widespread offshore movements towards the tropics as local waters cool. Striped marlin recaptured in the tropics (Figure 7b) are usually caught by commercial longliners.

## **Mako shark**

More mako sharks (747) were tagged this season than in the previous season (*see* Table 2). A broad size range of mako sharks was tagged and released, with a mean estimated length of 163.1 cm (*see* Figure 2). A large proportion of mako were tagged on the west coast (46%), which is a reflection of the increased striped marlin catch in this area during the 1998–99 season (Figure 8). As in previous years, many mako were tagged and released off the east Northland coast (Davies & Hartill 1998, Holdsworth & Saul 1998, Hartill & Davies 1999). A few mako were also tagged in other waters off the North Island and 15 were tagged off Dunedin (Figure 9). The high numbers of mako tagged in February compared to the number of striped marlin released in that month indicates an early season for mako this year (*see* Figure 5). The distribution of tagging effort is relatively uniform throughout the recreational fishing fleet (*see* Table 3).

A total of 15 mako sharks was recaptured this season, 6 by recreational fishers and 9 by commercial fishers (*see* Tables 4 and 5). Of these, no release information is available for two recaptures. Seven mako were recaptured outside New Zealand waters, as far away as Fiji and Australia. Over 14% of all mako recaptures occur in the waters around Fiji (Table 6). The number of reported recaptures from Fiji has increased considerably in the last 3 years and probably reflects a greater awareness of this programme by commercial longliners in that area. Movements of tagged mako in New Zealand waters appear to be localised around east Northland, with some movement to the Bay of Plenty and the west coast.

Movement of mako may be inferred from patterns in the net distance moved by tagged fish relative to their time at liberty (*see* Figure 6). Tagged mako recaptured near their release point (under 400 n. miles), generally appear to be caught during the same time of year after being at liberty for 1 or more years. However, as mako is a bycatch of the striped marlin target fishery, this pattern may reflect a strong seasonality in fishing effort rather than seasonality in mako availability caused by movement of tagged fish in and out of New Zealand waters. Large movements of tagged mako do occur with recaptures taking place 1000 n. miles or more from the point of release, mostly in the tropics. There is no clear seasonal pattern in the timing of these tropical recaptures.

## Blue shark

The number of blue sharks tagged in 1998–99 was 276 (*see* Table 2). The size range of tagged fish was broad, with the largest individual estimated to be over 3.0 m and some fish in the 90–100 cm length category (*see* Figure 2). The mean estimated length of blue sharks tagged and released was 140.2 cm.

Over 80% of releases were made off the Otago coast (Figure 10): most of the others were off the east coast of the North Island (Figure 11). The season was concentrated, with over 72% of blue sharks tagged in February (*see* Figure 5). The distribution of tagging effort was strongly skewed, with two boats from Dunedin releasing over 80% of all blue sharks tagged (*see* Table 3).

Nine blue shark recaptures were reported during this season, the same number as in the previous year. Of the nine blue sharks recaptured this season, six were released off the Otago coast, five of which were released this year. Eight of the nine recaptures were made by commercial fishers, five of which were recaptured overseas, one as far away as the Philippines. Before 1997–98, only 19 blue sharks had been recaptured since tagging began in 1975. There is no clear relationship between net distance moved and time at liberty, although several blue sharks have been caught close to the point of release after long periods at liberty (*see* Figure 6). The most distant recapture to date was off the coast of Chile (Table 7).

## Kingfish

The number of kingfish tagged has declined over the last 5 years, with 306 tagged this season compared with the high of 1444 in 1994–95 (*see* Table 2). The kingfish tagged and released this season spanned a wide range of reported lengths, with a mean estimated length of 75.3 cm (*see* Figure 2).

Most tagging (67%) was in statistical area 012 (Figure 12): most of the other releases were off the east coast of the North Island (Figure 13). One recreational boat was responsible for more than 69% of all kingfish tagged and released (*see* Table 3). Kingfish were tagged throughout the year with effort peaking in February (*see* Figure 5).

The number of recaptures has declined from 72 in 1995–96 to 21 in 1998–99 (Davies & Hartill 1998, Holdsworth & Saul 1998, Hartill & Davies 1999). This decline probably reflects availability of tagged kingfish which are being released in declining numbers. Of the 21 recaptures, 8 were by commercial fishers off east Northland and East Cape (*see* Table 5): recaptures by recreational fishers mostly occurred off east Northland (*see* Table 4).

Most (86%) of the tagged kingfish recaptures have been within the fishing statistical area in which they were released, suggesting that large scale movements are uncommon (Table 8), although a few recaptures have been reported previously from the Wanganella Bank and Australia. The short distances moved by kingfish recaptured this season are consistent with previous results in which tagged kingfish are recaptured close to the point of release even after long periods at liberty (Davies & Hartill 1998, Holdsworth & Saul 1998, Hartill & Davies 1999).



## Discussion

Almost all the results given in this report, such as seasons and localities, are very strongly dependent on the presence and timing of recreational gamefishing and commercial longlining activities. A total of 31 843 gamefish has been tagged to date, 2985 during the 1998–99 season. Over 65% of the marlin caught this season were tagged and released, which corresponds to similar tagging levels in previous seasons: 62% in 1997–98, 68% in 1996–97, and 58% in 1995–96. This high incidence of marlin tagged and the proportion of tagged marlin over 90 kg both indicate ongoing interest in and cooperation by anglers with, this programme. More marlin were tagged this year, 1535, than in any previous season, particularly off New Plymouth, with releases occurring throughout the waters off the northern half of the North Island.

A record number of striped marlin recaptures was reported this year, 13 from this season and 1 from the previous season. In the last two seasons there have been 25 reported recaptures of striped marlin compared to 29 recaptures before this. The increased recapture rates, which have also been observed for mako and blue sharks, may be partially attributed to the introduction during the 1996–97 season of wire reinforced tags which were designed to reduce susceptibility to tag loss or damage and hence improve tag recapture rates. Tagged marlin are recaptured after small scale coastal movements, or after movement to the tropics where they are recaptured by commercial longliners. These patterns are similar to those inferred from recapture data for mako sharks.

As in previous years, few billfish and gamefish were tagged by commercial fishers, although 46% of tag recaptures in 1998–99 were reported by them. Over 51% of the commercial tag returns were from offshore fisheries. Given the low level of tagging by commercial fishers, it is not possible to gauge the level of overlap in fishing activity on the marlin populations by the commercial and recreational fishing sectors. The movements of recaptured marlin and mako and blue shark indicate that parts of these stocks may be encountered by both the recreational and commercial fishing fleets operating on the east coast of the North Island and in the tropics.

Several factors may combine to increase the amount of information to be derived from this programme on striped marlin movement and distribution. The high levels of striped marlin tagging achieved in recent years will increase the effective tagged population. The new, robust tag will reduce tag damage and loss of release information. The insistence of gamefish clubs that tag release information is provided by their members has resulted in higher levels of data collection than reported for cooperative tagging studies in other countries (Peel *et al.* 1996). Anglers who are not members of a gamefishing club, including commercial fishers, have also been encouraged to supply release information on tagged gamefish through recommendations made in popular articles (Hartill 1998, 1999).

## Acknowledgments

The New Zealand Big Game Fishing Council and all its affiliated clubs are thanked for their continued cooperation in the tagging and release of gamefish and for the reporting of release and recapture information that make this programme a success. In particular, Ros Nelson is thanked for her cooperation in providing information useful to this programme. Thanks are also due to those commercial fishers who have participated in this programme and to Rob Tasker for his great efforts with the database. Funding for this project (DMAN905) was provided by the Ministry of Fisheries.

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**Table 1: Parameters used to derive length from weight measurements**

$$Length = b \sqrt{\frac{weight}{a}}$$

(weight in g, length in cm)

Species	<i>a</i>	<i>b</i>	Measurement method	Source
Striped marlin	0.0134	2.8900	Fork length	Holdsworth (unpub. data)
Blue shark	$2.328 \times 10^{-6}$	3.294	Standard length	Nakano et al. (1985)
Kingfish	0.0246	2.8463	Fork length	McGregor (unpub. data)

$$Length = \frac{\left( b \sqrt{\frac{weight}{a}} \right) - c}{d}$$

(weight in g, length in cm)

Species	<i>a</i>	<i>b</i>	<i>c</i>	<i>d</i>	Source
Mako shark	$5.432 \times 10^{-6}$	3.1407	-1.7101	0.9286	Kohler <i>et al.</i> (1995)

**Table 2 : Numbers of fish tagged and released by species and season (1 July to 30 June) for each year of the gamefish tagging programme, and recapture totals as at 30 June 1999**

Season	STM	MAK	BWS	KIN	ALB	BEM	BKM	SWO	YFN	SHA	OSP	Total
1974-75	-	9	1	-	-	-	-	-	-	-	-	10
1975-76	3	17	-	1	-	-	-	-	-	2	-	23
1976-77	2	34	1	1	-	-	-	-	1	-	1	40
1977-78	7	58	-	15	-	-	-	-	-	-	-	80
1978-79	18	152	1	107	1	2	-	-	-	1	4	286
1979-80	17	129	25	22	-	-	-	-	-	3	-	196
1980-81	2	116	7	7	6	-	1	-	-	2	1	142
1981-82	11	185	99	30	14	-	-	-	-	3	3	345
1982-83	6	151	18	56	11	-	-	-	1	4	1	248
1983-84	9	220	15	54	9	-	-	-	5	7	-	319
1984-85	-	99	10	148	-	-	-	-	25	4	2	288
1985-86	2	211	23	324	-	-	-	-	8	1	6	575
1986-87	2	177	12	376	8	-	-	-	7	31	13	626
1987-88	97	505	91	689	40	1	1	6	13	47	44	1 534
1988-89	371	370	122	371	98	1	-	4	63	32	23	1 455
1989-90	365	424	83	427	87	6	4	4	140	26	22	1 588
1990-91	229	417	90	526	40	-	2	5	24	32	24	1 389
1991-92	241	353	128	389	21	5	2	20	39	40	19	1 257
1992-93	386	352	64	693	64	11	1	36	13	24	30	1 674
1993-94	929	667	164	1 100	27	20	2	3	104	19	37	3 072
1994-95	1 206	1 532	175	1 444	5	29	4	10	215	23	60	4 703
1995-96	1 104	1 158	163	634	-	46	6	3	110	30	31	3 285
1996-97	1 300	920	343	416	8	26	5	4	33	36	19	3 110
1997-98	898	517	723	362	1	24	5	-	3	54	11	2 598
1998-99	1 535	747	276	306	1	43	2	2	19	40	14	2 985
Unknown date	-	6	1	5	-	-	-	-	1	-	2	15
Total releases	8 740	9 526	2 635	8 503	441	214	35	97	824	461	367	31 843
Total recaptures	54	232	37	826	-	1	1	-	7	31	16	1 205

**Species key**

ALB	albacore	KIN	kingfish	SWO	broadbill swordfish
BEM	blue marlin	MAK	mako shark	YFN	yellowfin tuna
BKM	black marlin	SHA	other shark species	OSP	all other species
BWS	blue shark	STM	striped marlin		

**Table 3 : The number of boats tagging a given number of fish with the cumulative percentage of fish tagged by species (cum%, cumulative percentage) \***

	Striped marlin		Mako shark		Blue shark		Kingfish		Other species					
	No. boats	No. fish cum %	No. boats	No. fish cum %	No. boats	No. fish cum %	No. boats	No. fish cum %	No. boats	No. fish cum %				
1	48	3	1	19	3	1	122	44	1	207	69	1	7	6
1	45	6	1	18	5	1	100	80	1	9	72	2	6	16
1	42	9	2	17	10	1	8	83	6	4	80	1	1	20
1	38	11	1	12	11	1	5	85	6	3	86	2	2	27
1	31	13	1	11	13	2	4	88	11	2	93	7	3	44
1	28	15	1	10	14	4	2	91	21	1	100	11	2	63
1	26	17	1	9	15	25	1	100	21	1	100	45	1	100
1	24	19	1	8	16									
1	20	20	5	7	21									
2	19	22	4	6	24									
5	17	28	13	5	33									
3	15	31	21	4	44									
1	14	32	27	3	55									
3	13	34	67	2	73									
1	12	35	201	1	100									
2	11	37												
4	10	39												
5	9	42												
7	8	46												
13	7	52												
11	6	56												
11	5	60												
23	4	66												
39	3	73												
85	2	85												
235	1	100												
<b>Total</b>	<b>459</b>	<b>1524</b>	<b>347</b>	<b>745</b>	<b>35</b>	<b>276</b>	<b>46</b>	<b>301</b>	<b>69</b>	<b>120</b>				

\* Fish not included when vessel is unknown

**Table 4 : Numbers of tagged fish recaptured during the 1998–99 season by recreational fishers by species and statistical area\***

	Statistical area												Total
	002	003	005	010	013	014	017	041	042	47	48	999	
Striped marlin	5	–	–	–	–	–	–	–	1	1	–	–	7
Mako shark	1	–	–	–	1	–	–	1	–	–	–	3	6
Kingfish	2	5	–	1	2	1	–	–	–	1	1	–	13
Blue shark	–	–	–	–	–	–	1	–	–	–	–	–	1
School shark	–	–	–	–	–	–	–	–	–	–	–	1	1
Total	8	5	0	1	3	1	1	1	1	2	1	4	28

\* 999 Denotes fish recaptured outside statistical areas

**Table 5 : Numbers of tagged fish recaptured during the 1998–99 season by commercial fishers by species and statistical area\***

	Statistical area									Total
	002	003	004	011	012	014	030	034	999	
Striped marlin	–	–	–	–	–	–	–	–	6	6
Mako shark	1	2	–	1	–	–	–	1	4	9
Kingfish	1	2	–	–	3	1	–	–	1	8
Blue shark	–	–	1	–	–	–	2	–	5	8
Bronze whaler shark	–	–	–	–	–	–	–	–	1	1
School shark	1	–	–	–	–	–	–	–	–	1
Total	3	4	1	1	3	1	2	1	17	33

\* 999 Denotes fish recaptured outside statistical areas

**Table 6 : Movement of mako sharks as indicated from statistical areas of release and recapture since 1975**

Release area	Recapture area																										Total				
	001	002	003	004	005	008	009	010	011	012	013	014	014	039	040	041	042	047	048	???	AUS	CAL	COR	FIJ	KER	MAQ		SOL	TAS	TON	WAN
002	1	6	4	1	-	1	-	1	-	2	-	-	-	-	-	-	-	-	-	-	1	-	1	-	11	-	-	2	-	-	30
003	1	7	34	1	-	7	5	3	3	1	8	1	1	1	1	-	1	3	1	2	3	2	-	12	-	1	1	1	-	100	
005	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	1	
008	-	1	1	-	1	1	2	1	-	1	2	-	-	1	-	-	-	-	-	-	-	-	-	5	-	-	-	-	-	16	
009	-	-	3	-	-	3	5	1	1	-	1	-	-	-	-	-	-	-	-	-	-	1	1	-	1	-	1	1	-	19	
010	-	1	-	-	1	-	2	3	-	2	2	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	10	
012	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	
013	-	1	-	-	-	1	-	1	-	-	-	3	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	7	
014	-	1	1	-	-	2	1	1	-	-	3	4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	12	
041	-	1	-	-	-	-	-	-	1	-	-	1	-	-	-	1	1	-	-	-	-	-	1	-	-	-	-	1	-	6	
042	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	1	1	-	-	-	-	-	-	-	-	-	-	-	-	3	
043	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	
046	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	1	
047	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	1	
048	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	1	
Total	2	18	44	2	2	13	16	10	7	2	17	9	2	2	2	2	3	4	1	3	6	4	1	30	1	1	1	4	1	209	

AUS, Australia; CAL, New Caledonia; COR, Coral Sea; FIJ, Fiji; KER, Kermadec; MAQ, Marquesas Islands; SOL, Solomon Islands; TAS, Tasman Sea; TON, Tonga; WAN, Wanganella Bank; ???, area unknown

**Table 7 : Movement of blue sharks as indicated from statistical areas of release and recapture since 1975**

Release area	Recapture area																	Total								
	002	003	004	008	010	011	012	013	014	014	017	024	030	040	043	???	AUS		CAL	CHL	ECP	FIJ	MAQ	PHL	TAH	
002	-	-	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2
003	1	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	5
009	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
010	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
013	-	-	-	-	1	1	-	2	-	-	-	-	-	-	-	1	2	-	-	1	-	-	-	-	-	8
014	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2
016	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
017	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	1
024	-	-	-	-	-	-	1	-	-	-	2	2	-	-	-	-	-	-	1	-	-	1	1	1	-	10
041	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	2
042	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	1
Total	1	3	1	1	2	1	1	2	1	1	2	2	1	1	1	2	4	1	1	1	1	2	1	1	1	34

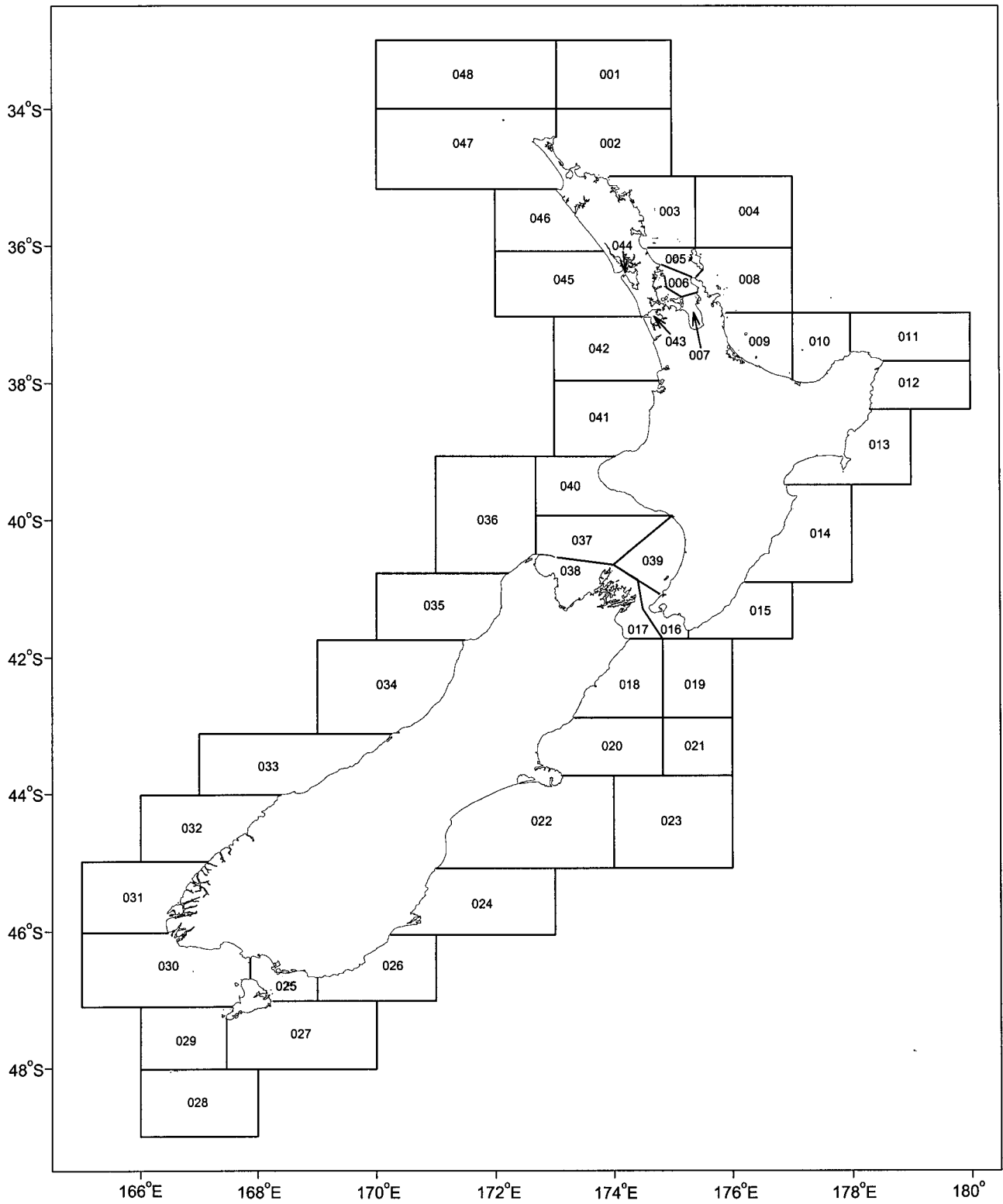
AUS, Australia; CAL, New Caledonia; CHL, Chile; ECP, off East Cape; FIJ, Fiji; MAQ, Marquesas Islands; PHL, Philippines; TAH, Tahiti; ???, area unknown

**Table 8 : Movement of kingfish as indicated from statistical areas of release and recapture since 1975**

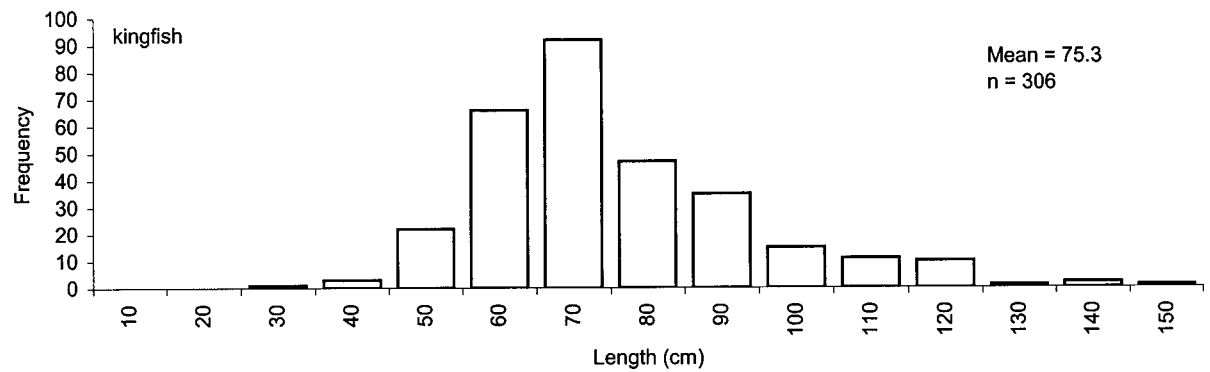
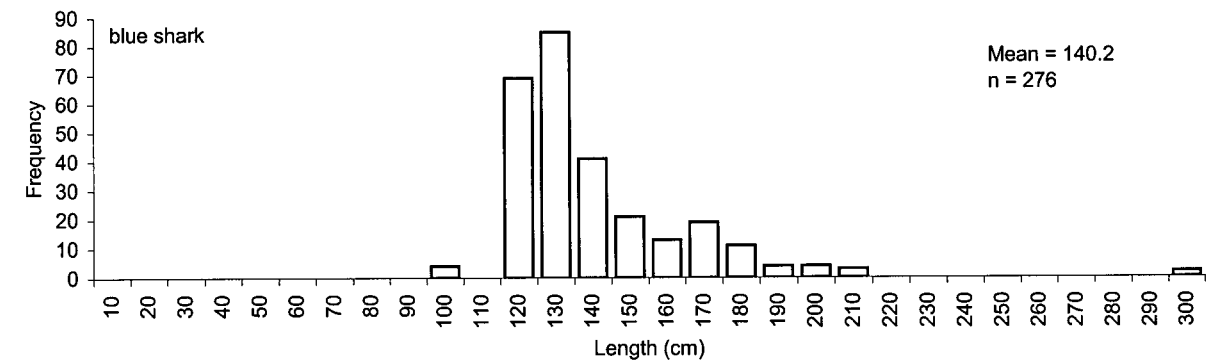
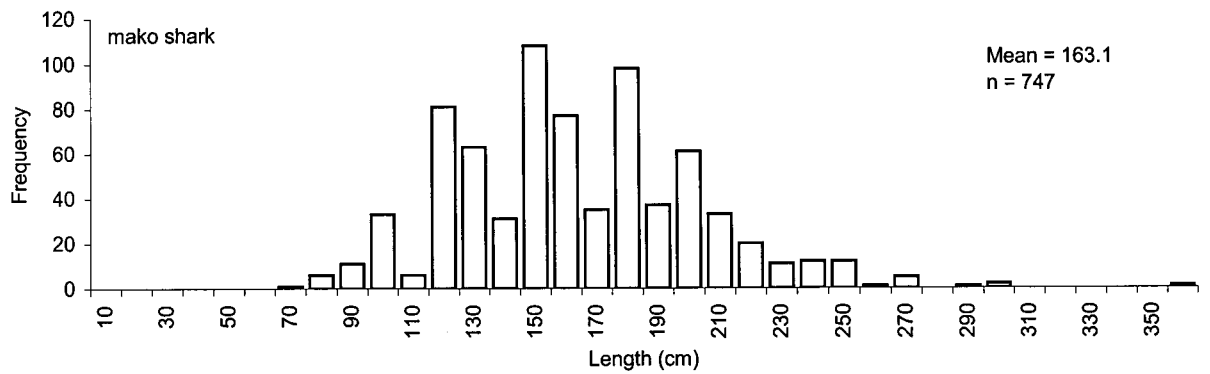
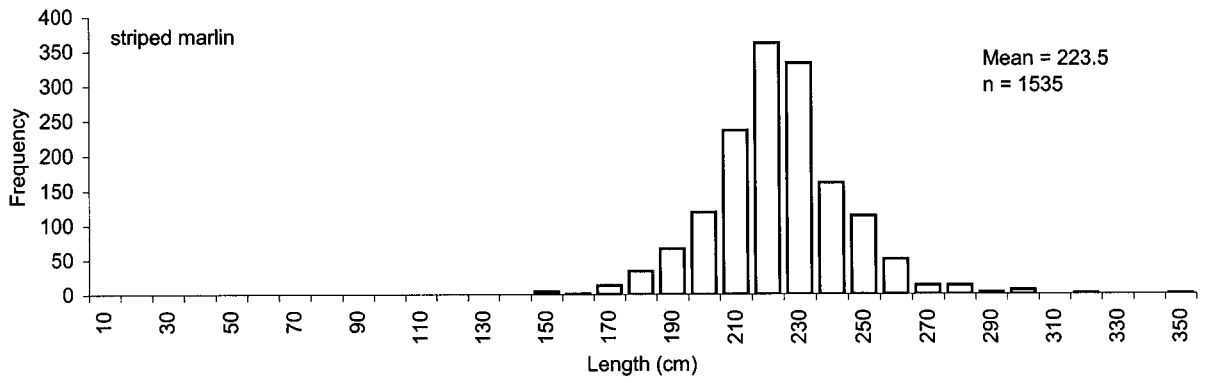
Release area	Recapture area																	Total						
	002	003	005	006	007	008	009	010	011	012	013	014	039	042	043	045	047		048	???	AUS	COL	WAN	
002	61	11	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	74
003	6	132	3	1	3	2	1	-	-	-	1	-	-	-	-	-	1	-	-	3	-	-	1	154
005	-	2	4	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	7
006	-	1	1	3	5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	10
007	-	1	-	4	11	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	16
008	-	1	1	1	-	6	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	10
009	-	2	-	-	-	2	39	6	-	-	-	-	-	-	-	-	-	-	-	-	2	-	-	51
010	1	3	2	-	-	3	12	406	2	1	2	-	1	-	-	-	-	-	-	-	-	-	-	433
011	-	-	-	-	-	-	-	1	7	1	1	-	-	1	-	-	-	-	-	-	1	-	-	12
012	-	-	-	-	-	1	1	-	1	10	2	3	-	-	-	-	-	-	-	-	-	-	-	18
013	-	1	-	-	-	-	-	-	-	-	4	1	-	-	-	-	-	-	-	-	-	-	-	6
014	-	-	-	-	-	-	-	-	-	-	2	2	-	-	-	-	-	-	-	-	-	-	-	2
043	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5	-	1	-	-	-	-	-	-	6
044	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	1
045	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	1
047	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	10	1	1	-	-	-	-	12
048	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	2	-	-	-	-	-	4
Total	69	154	12	9	19	14	53	413	10	12	10	7	1	1	6	1	13	3	6	2	2	1	1	817

AUS, Australia; COL, Colville Ridge; WAN, Wanganella Bank; ???, area unknown

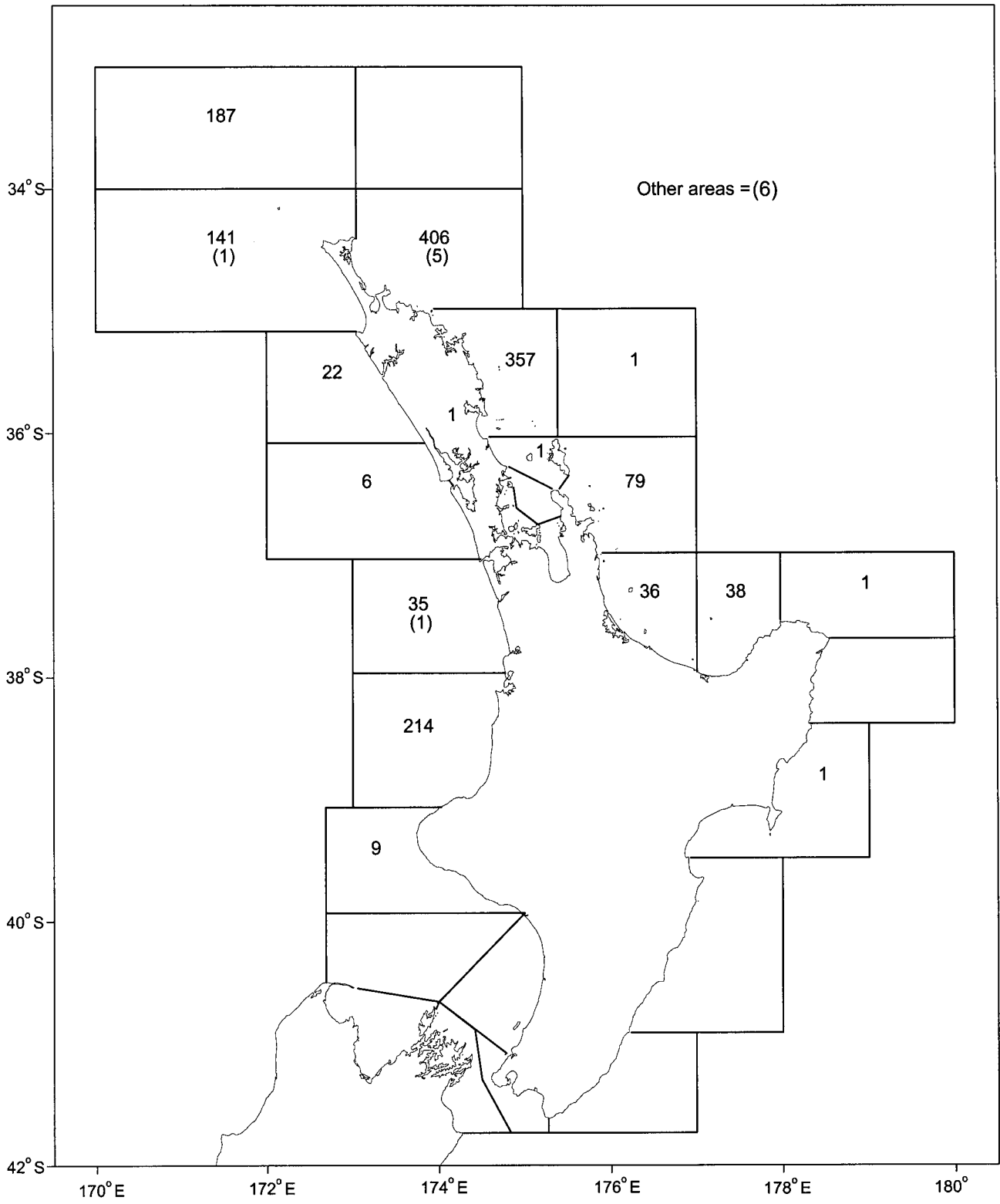




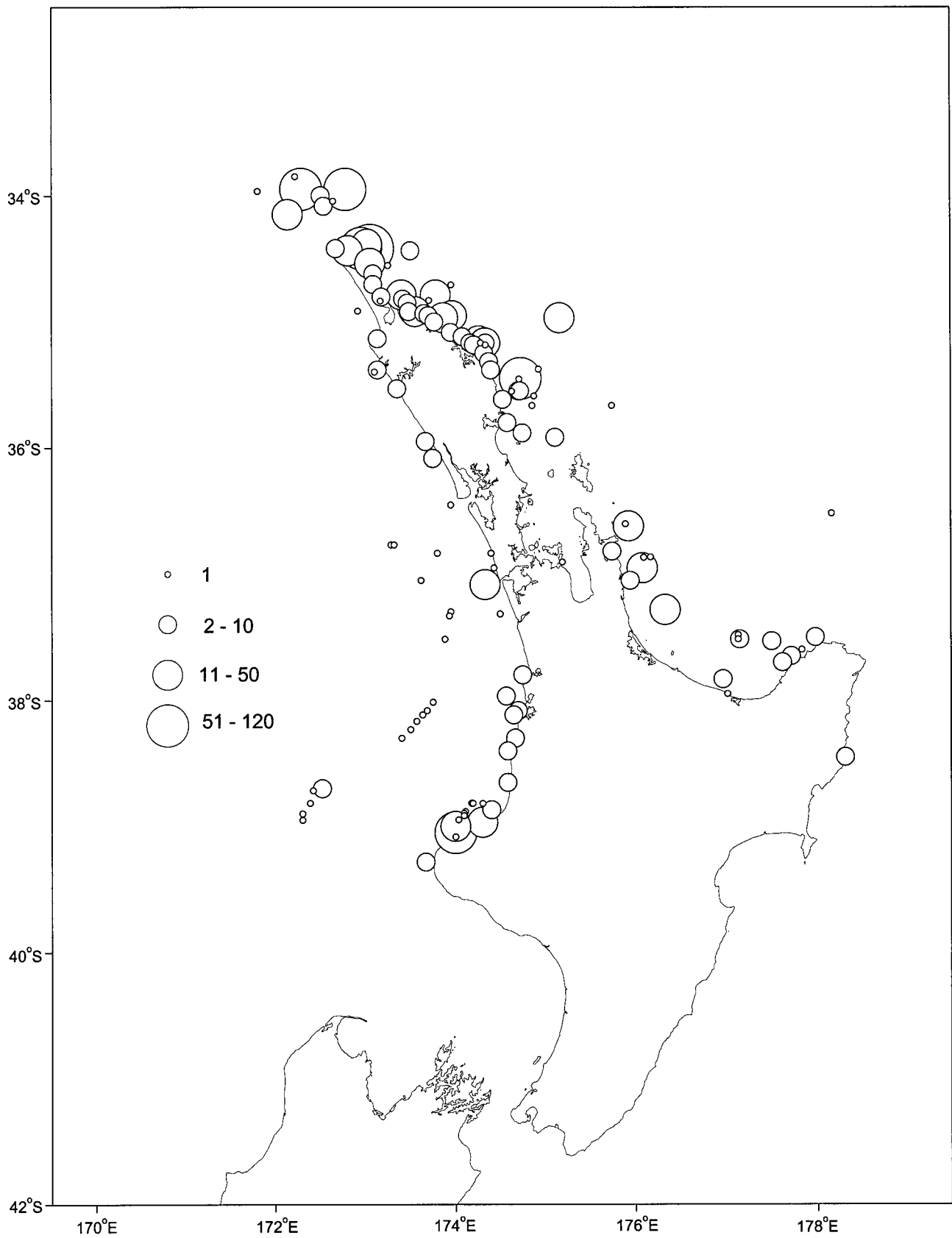
**Figure 1: Commercial fisheries statistical reporting areas.**



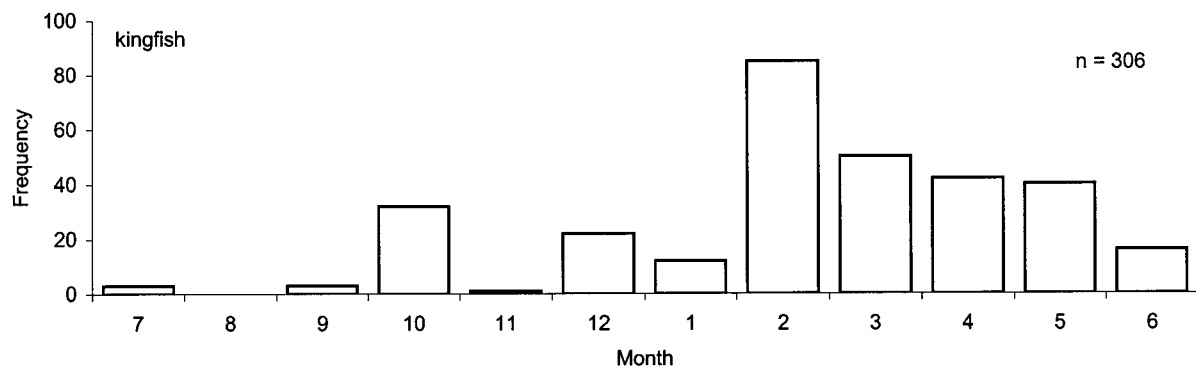
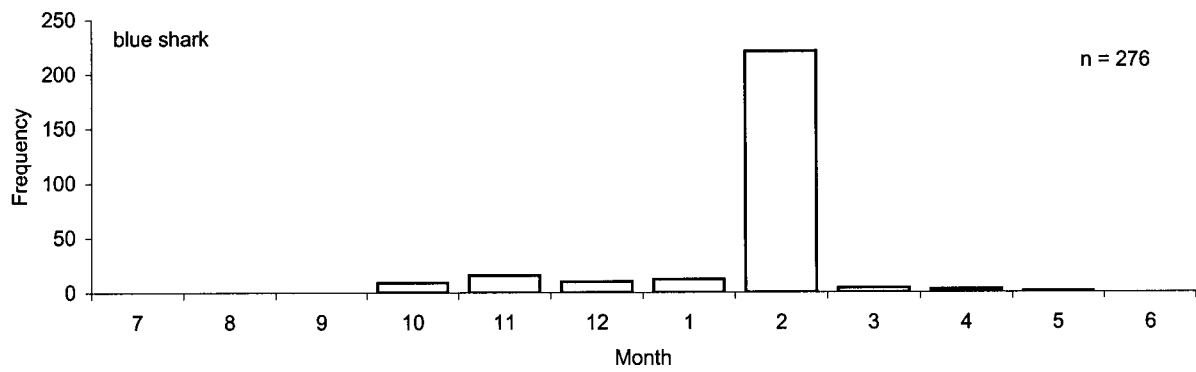
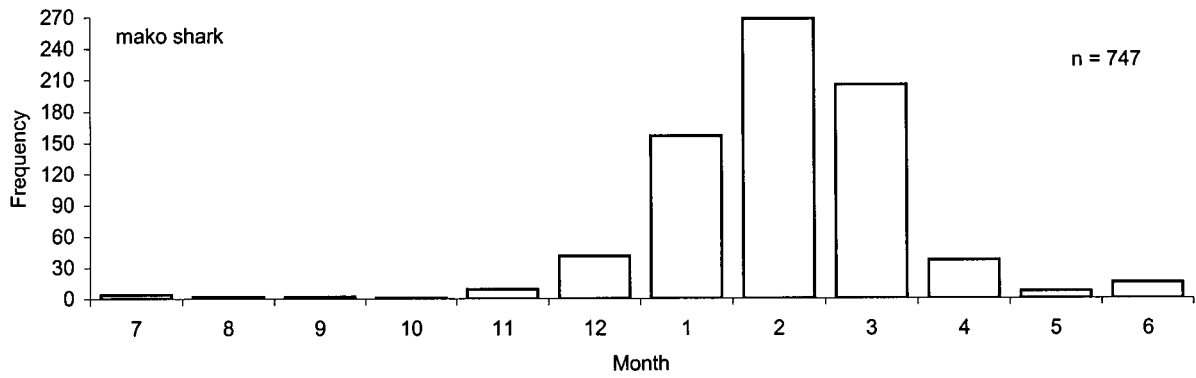
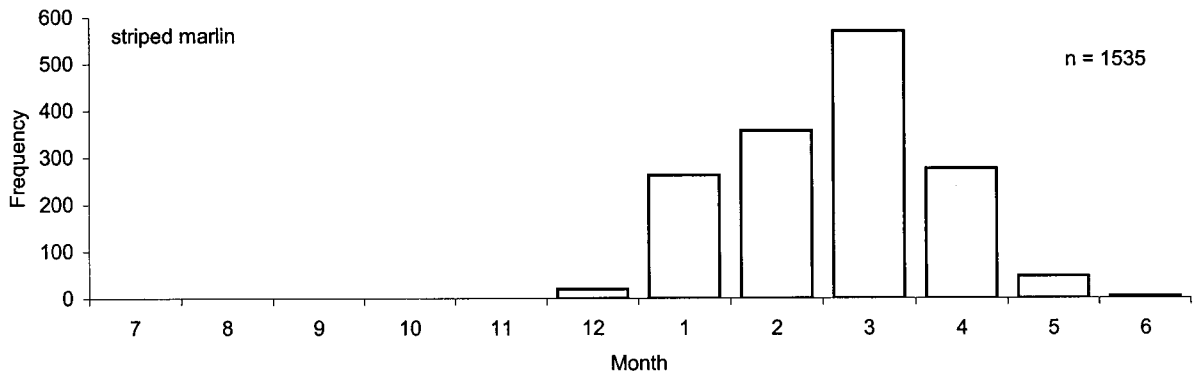
**Figure 2: Length frequency distribution of striped marlin, mako shark, blue shark, and kingfish tagged and released during the 1998–99 season.**



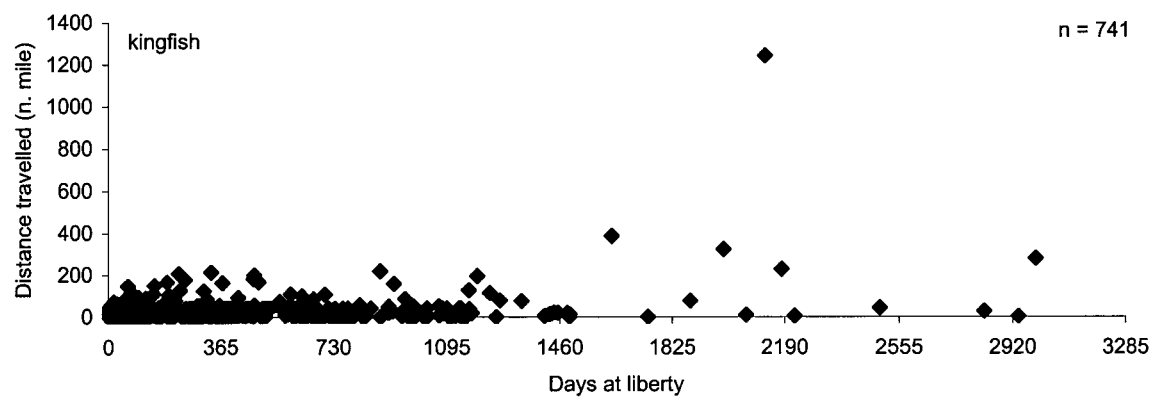
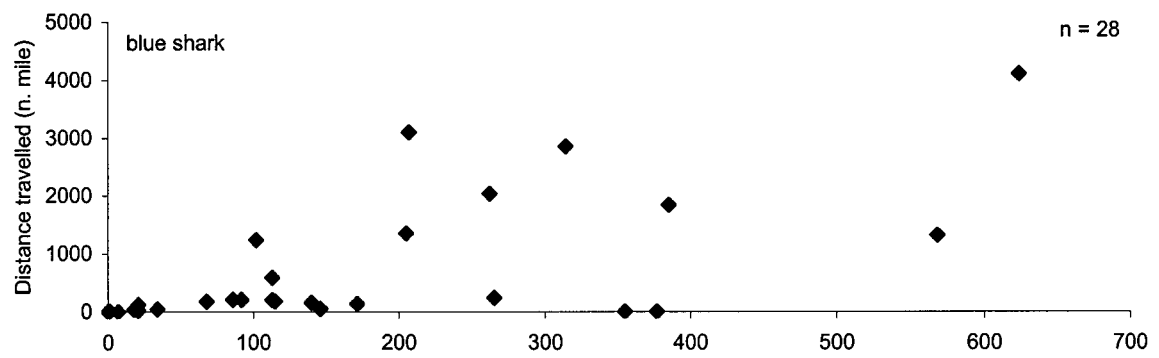
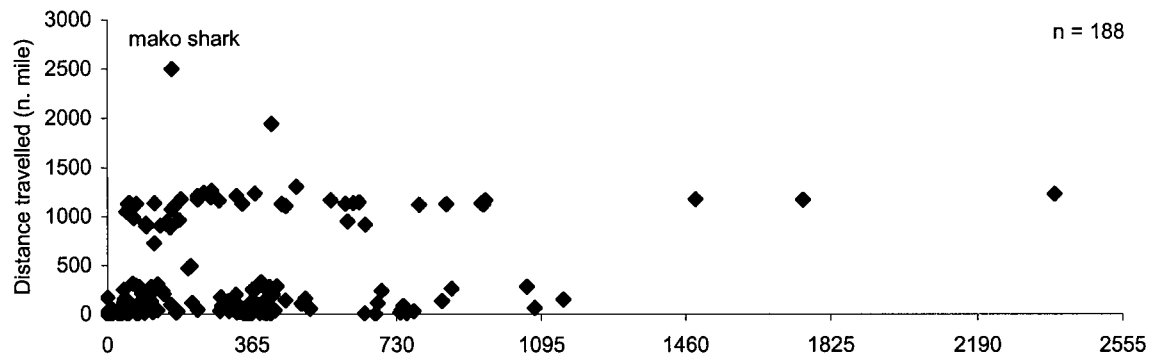
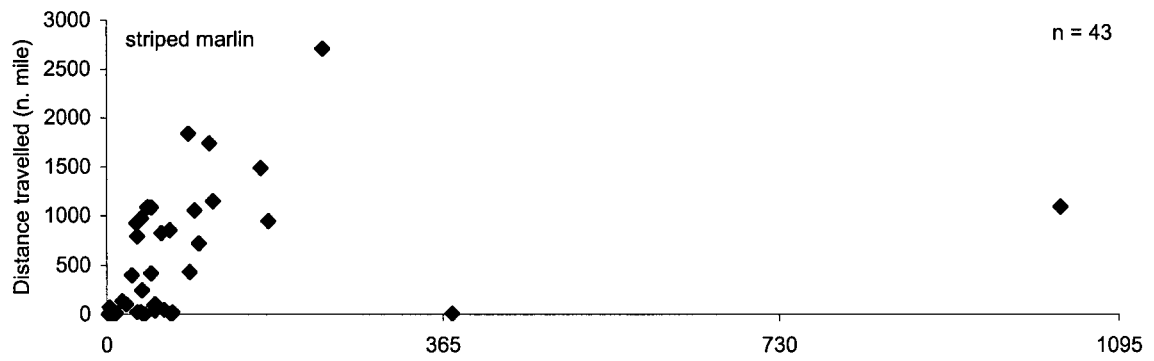
**Figure 3: Numbers of striped marlin released and recaptured (in parentheses) by statistical reporting area during the 1998–99 season.**



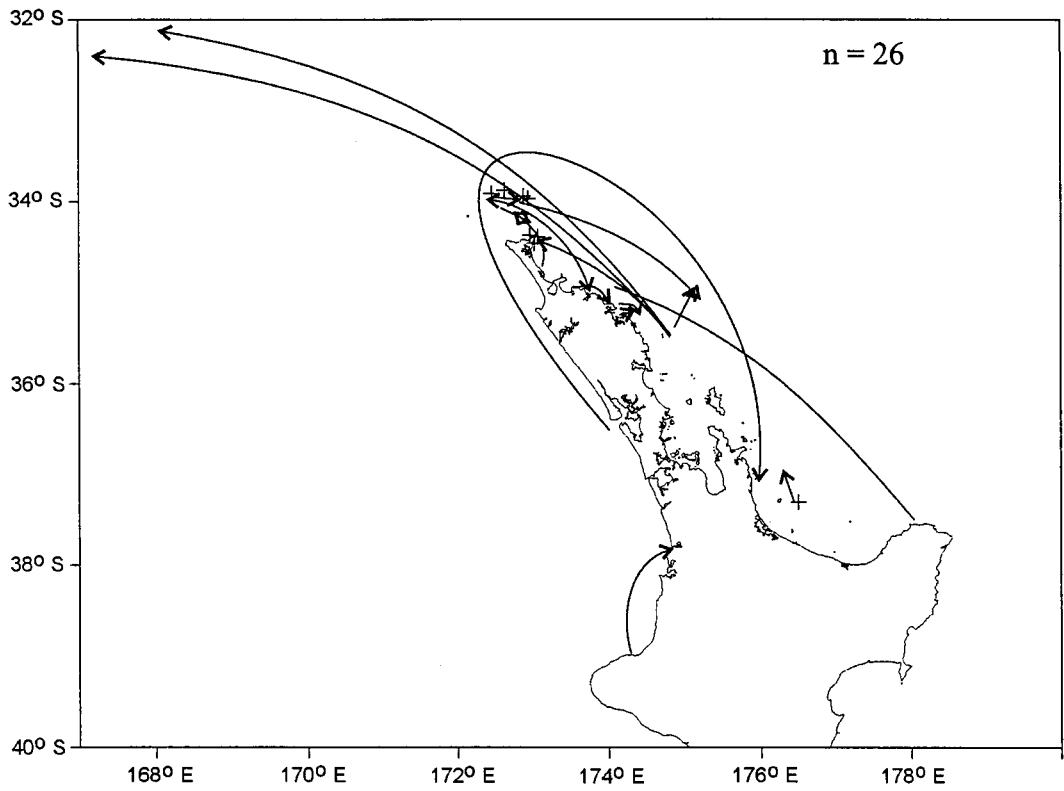
**Figure 4: Distribution of striped marlin tagged and released during the 1998–99 season.**



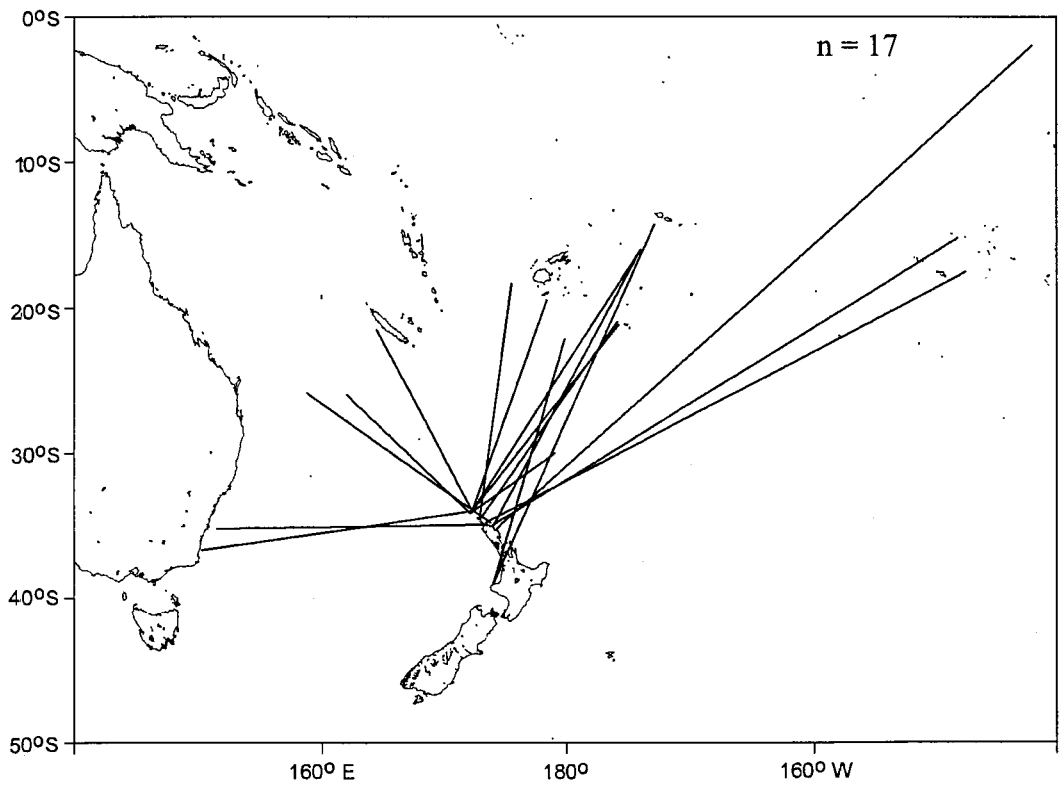
**Figure 5 : Distribution of tagged fish release by month during the 1998–99 season for striped marlin, mako shark, blue shark, and kingfish.**



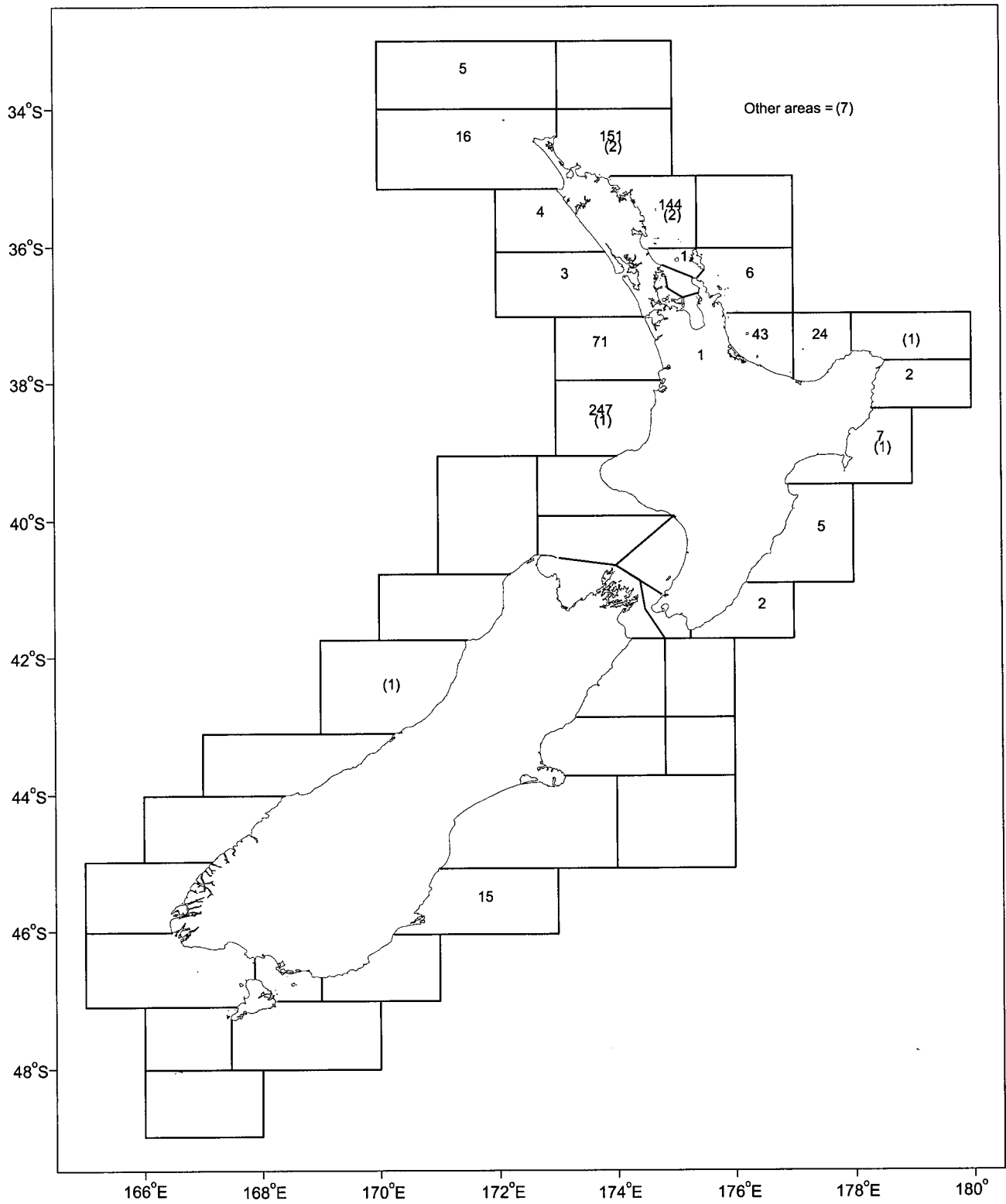
**Figure 6 : Net distance travelled by striped marlin, mako shark, blue shark, and kingfish relative to period at liberty.**



**Figure 7a:** Short distance movements of striped marlin recaptured by June 1999, + denotes no net movement.

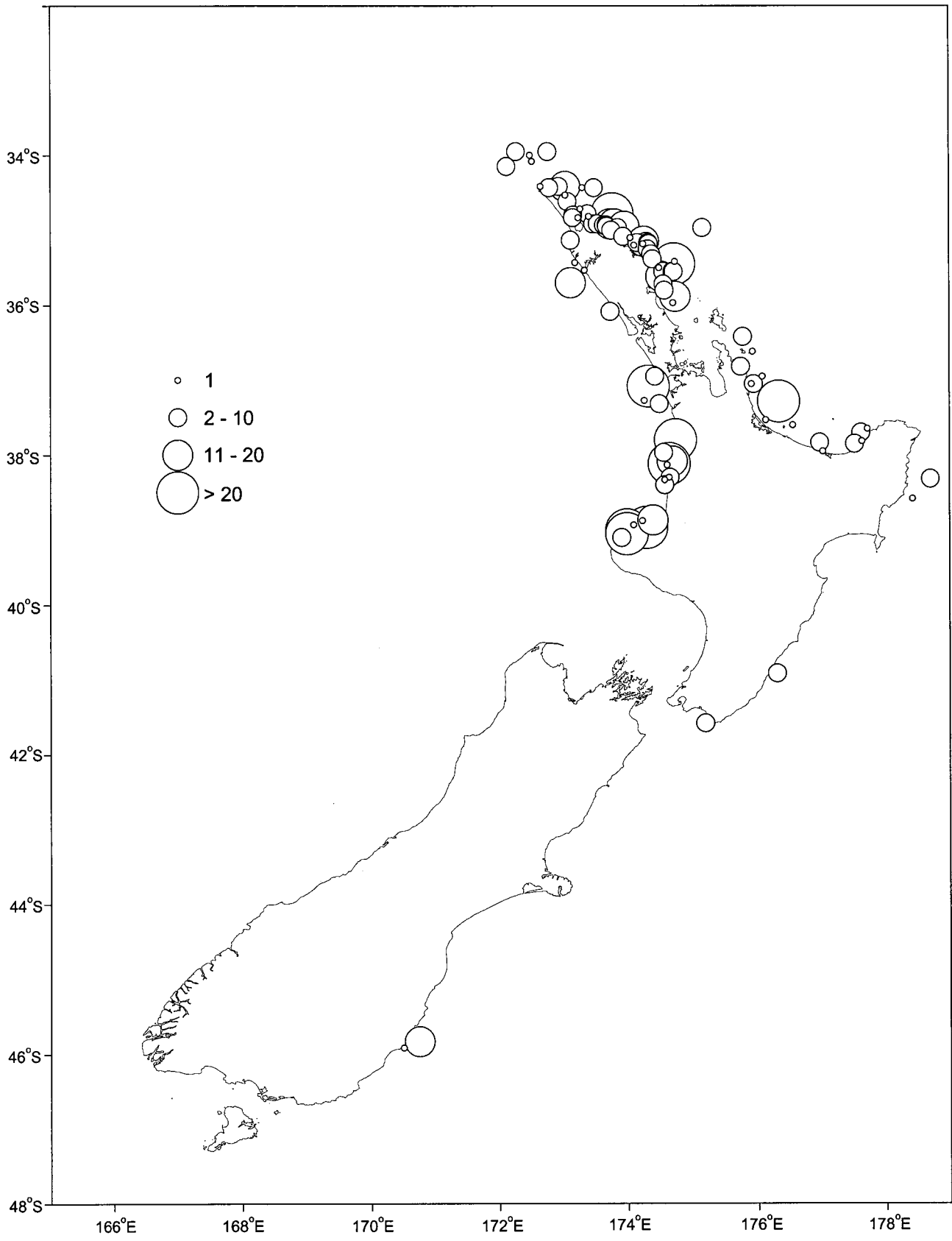


**Figure 7b:** Long distance movements of striped marlin recaptured by June 1999.

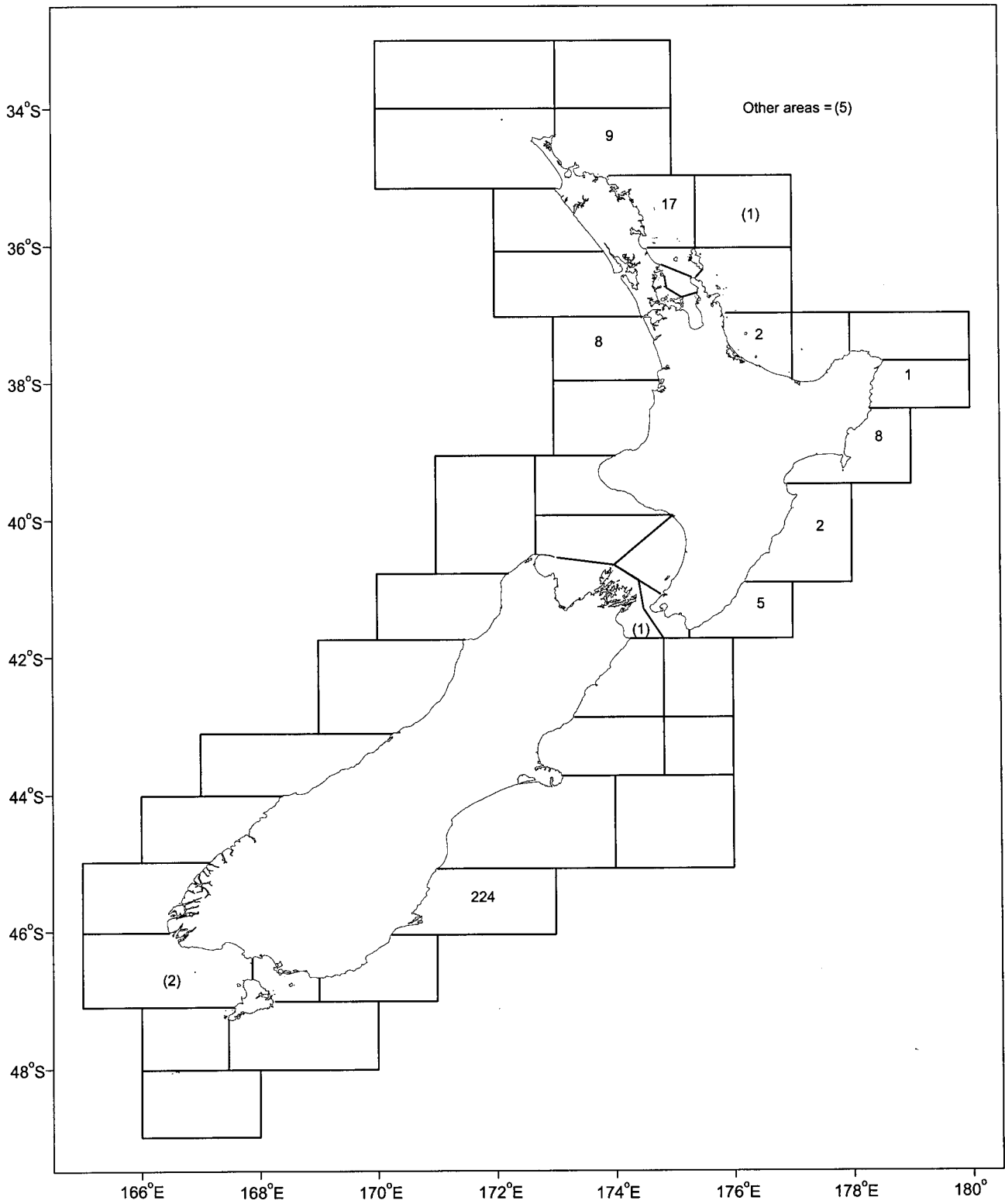


**Figure 8: Numbers of mako sharks released and recaptured (in parentheses) by statistical reporting area during the 1998-99 season.**

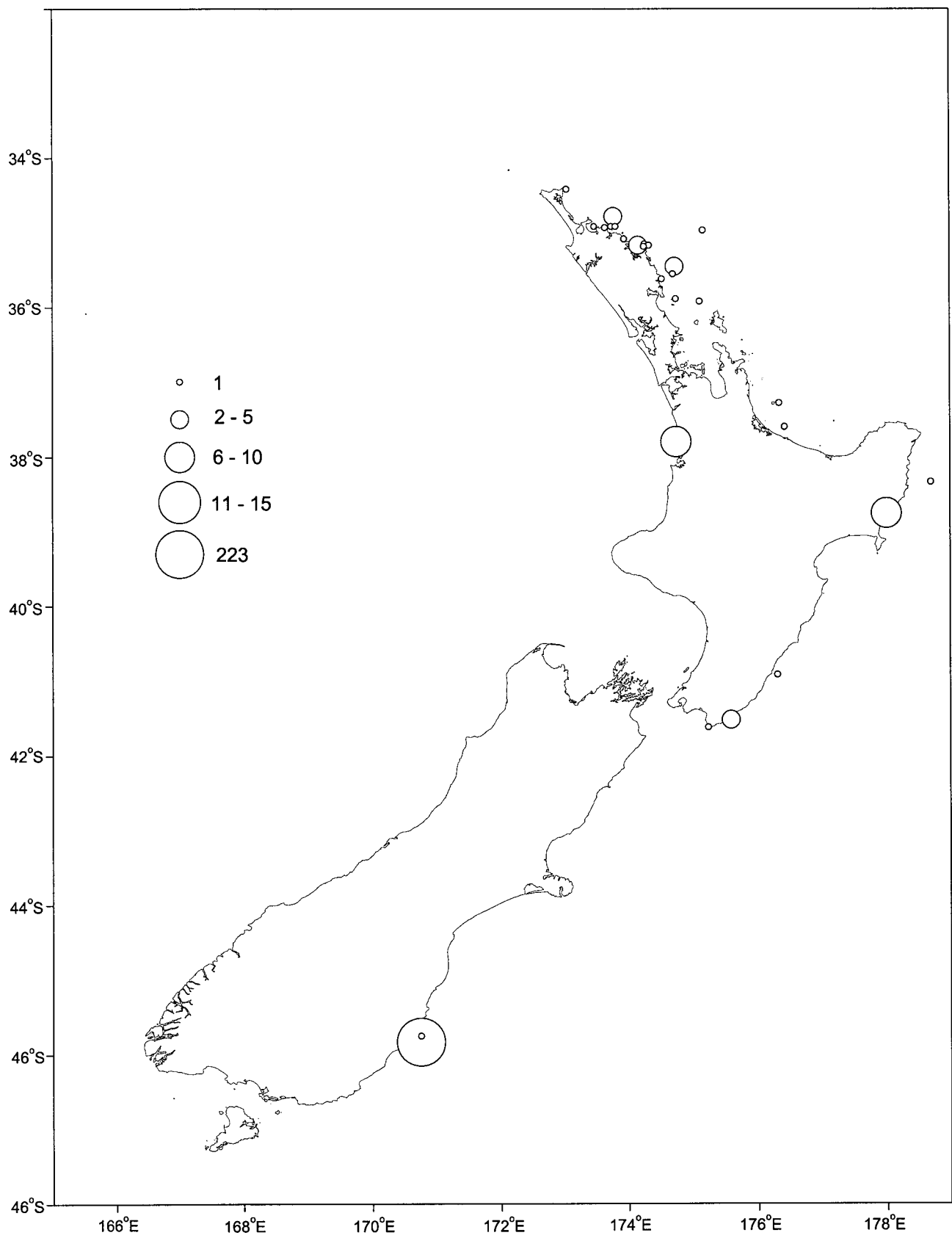




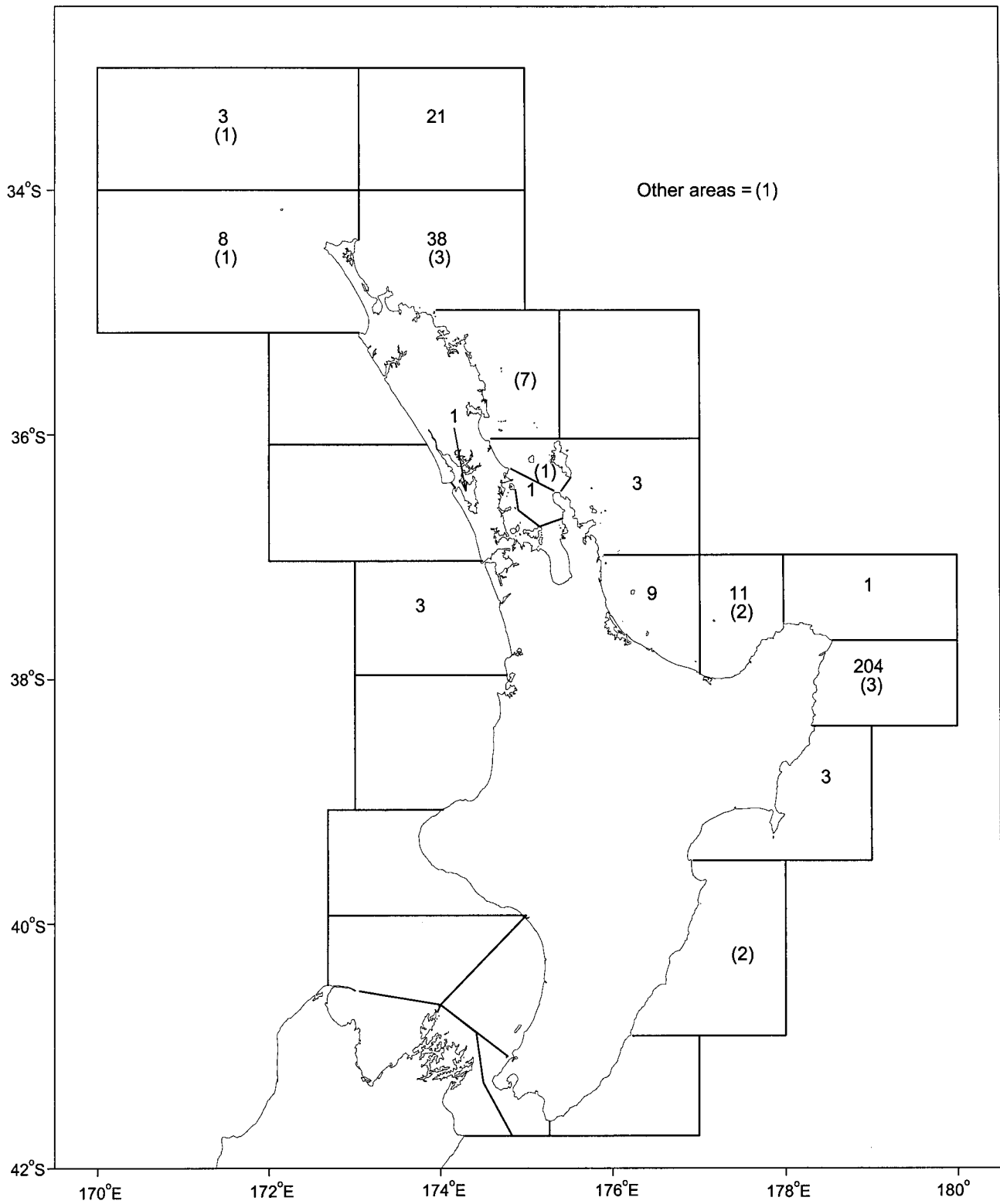
**Figure 9: Distribution of mako sharks tagged and released during the 1998–99 season.**



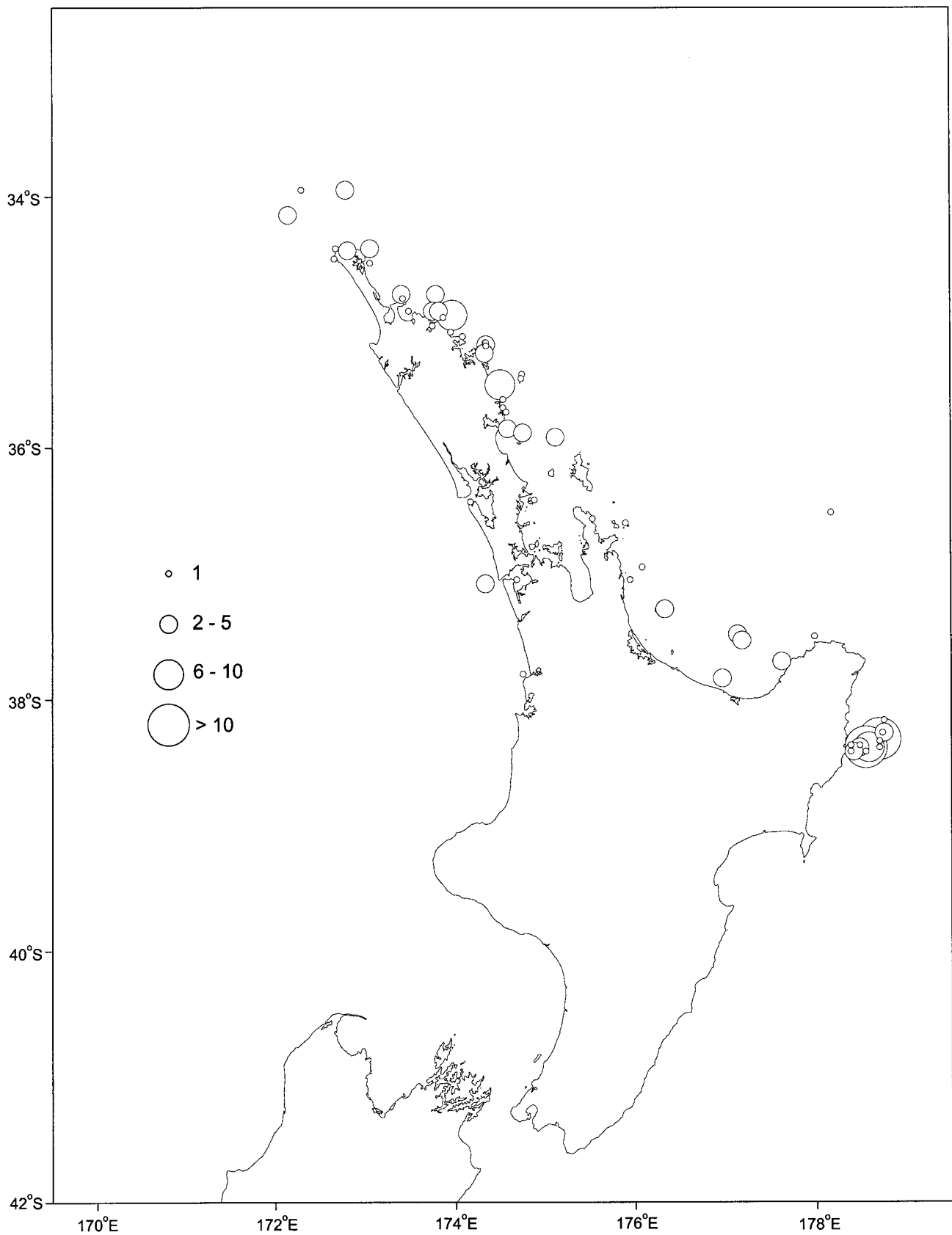
**Figure 10: Numbers of blue sharks released and recaptured (in parentheses) by statistical reporting area during the 1998-99 season.**



**Figure 11: Distribution of blue sharks tagged and released during the 1998-99 season.**



**Figure 12: Numbers of kingfish released and recaptured (in parentheses) by statistical reporting area during the 1998-99 season.**



**Figure 13: Distribution of kingfish tagged and released during the 1998–99 season.**

**Appendix 1: Numbers of fish tagged and released by commercial fishers by species and statistical area in the 1998–99 season**

Species	Statistical area										Total
	002	003	004	008	009	011	041	042	045	999	
Striped marlin	-	-	-	-	-	-	12	4	3		19
Mako shark	-	1	-	-	-	-	-	-	-		1
Other species	1	-	1	4	1	1	-	-	-		8
Total	1	1	1	4	1	1	12	4	3		28

**Appendix 2: Numbers of fish tagged and released by recreational fishers by species and statistical area in the 1998–99 season**

Species	Statistical area																			Total						
	002	003	004	005	006	007	008	009	010	011	012	013	014	015	024	040	041	042	043		044	045	046	047	048	999
Striped marlin	406	357	1	1	-	-	79	36	38	1	-	1	-	-	-	9	202	31	-	1	3	22	141	187	-	1516
Mako shark	151	143	-	1	-	1	6	43	24	-	2	7	5	2	15	-	247	71	-	-	3	4	16	5	-	746
Kingfish	21	38	-	-	1	-	3	9	11	1	204	3	-	-	-	-	-	3	-	1	-	-	8	3	-	306
Blue shark	9	17	-	-	-	-	-	2	-	-	1	8	2	5	224	-	-	8	-	-	-	-	-	-	-	276
Other shark species	4	7	-	-	1	1	-	2	4	-	1	-	-	-	11	-	1	1	2	2	-	-	1	1	-	39
Other species	21	23	-	-	-	-	5	6	4	-	-	-	-	-	-	-	-	-	-	-	-	-	2	1	12	74
Total	612	585	1	2	2	2	93	98	81	2	208	19	7	7	250	9	450	114	2	4	6	26	168	197	12	2 957

999 Denotes fish tagged and released outside statistical areas