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New Zealand billfish and gamefish tagging, 1999–2000

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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 1999–2000 fishing year, the Ministry of Fisheries contracted NIWA to manage the gamefish tagging database as part of a database management project (project number DMAN005). This report summarises the results obtained from the tagging programme from 1 July 1999 to 30 June 2000. Results of previous seasons have been summarised in a time series of reports: 1995–96 (Holdsworth & Saul 1998), 1996–97 (Davies & Hartill 1998), 1997–98 (Hartill & Davies 1999), and 1998–99 (Hartill & Davies 2000).

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 1999–2000.

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 1999–2000 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 the 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 790 striped marlin was tagged and released by commercial and recreational fishers between 1 July 1999 and 30 June 2000 (Table 2), which is the lowest number reported since the 1992–93 season. This reflects the low total number of marlin caught by club members, estimated from gamefish club records this season at 1188, compared with 2349 in the previous season (Ros Nelson, NZBGFC Secretary, pers. comm.). Over 66% of all striped marlin caught by club members during the 1999–2000 season were tagged and released, compared with 65% in 1998–99, 62% in 1997–98, 68% in 1996–97, and 58% in 1995–96. This shows continuing interest in this programme despite low catches.

A wide size range of striped marlin was tagged and released from 170 to 270 cm fork length with an estimated mean length of 227.2 cm (Figure 2a). The NZBGFC and member clubs encourage the tagging and releasing of marlin under 90 kg (about 231 cm fork length) and do not recognise landed fish under this weight for contests or trophies. The length distribution of released striped marlin indicates that about 42% of tagged fish were over 90 kg.

As in previous seasons, most striped marlin tagged were caught off the east Northland coast and in the areas around the Three Kings Islands and North Cape (Figure 3). Most of the remaining releases took place in the Bay of Plenty and off the west coast of the North Island (Figure 4). More marlin had been tagged in these areas in previous seasons (Davies & Hartill 1998, Hartill & Davies 1999, 2000).

The monthly distribution of releases shows this to be a summer–autumn fishery with almost all striped marlin being tagged and released between January and May (Figure 5a). The seasonal pattern of releases is broadly similar to that in previous years (Davies & Hartill 1998, Holdsworth & Saul 1998, Hartill & Davies 1999, 2000).

The distribution of tagging effort for striped marlin within the recreational fleet was strongly skewed, as in previous seasons, with few vessels responsible for a high proportion of the releases. Eleven vessels (less than 4% of the participating fleet) accounted for 33% of the marlin tagged and released (Table 3).

Five tagged striped marlin were recaptured during the 1999–2000 season. There has also been a reported recapture from a previous season. Before this season only 54 striped marlin had been recaptured since tagging started in 1975. As recaptured marlin are usually caught within 6 months of being tagged (Figure 6a), the number of recaptures within a season is usually closely related to the numbers of tagged marlin released. An example of this is the 1998–99 season during which more marlin were tagged and recaptured than in any other season, 1544 and 14 fish respectively (Hartill & Davies 2000) (this includes one recapture from last season reported since June 1999). Of the marlin recaptured this season, one was caught by a recreational fisher in the Bay of Plenty (Table 4) and four by commercial vessels in the tropics (Table 5).

The striped marlin recaptured by the recreational fisher had been at liberty for 39 days, during which it travelled a minimum straight line distance of 236 n miles from east Northland to the Bay of Plenty. Commercial recaptures occurred after 67 to 320 days after travelling 957 to 3157 n miles. These periods at liberty and distances travelled are substantially greater than usually observed (Figure 6a). The most distant recapture was near the Marquesas Islands, where the marlin was caught after 134 days at liberty after travelling 3157 n. miles. This is the second most distant recapture on record. One marlin was recaptured after 320 days at liberty, the third longest period on record, having travelled 1123 n. miles when it was caught 60 miles east of Byron Bay, Australia. The remaining two marlin were caught off Kadavu Island, Fiji, and off Argo Bank, New Caledonia, having travelled 957 n. miles in 67 days and 1205 n miles in 263 days respectively. All the recaptured marlin for which release data are available were released by recreational fishers. A marlin recapture from last season, which was reported in November 1999, occurred in the Solomon Sea having travelled 1858 n. miles in 222 days.

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

Mako shark

The number of mako sharks tagged this season, 395, was the lowest since the 1992–93 season (see Table 2). A broad size range of mako sharks was tagged and released, from 70 to 310 cm total length, with a mean length of 173.2 cm (Figure 2b). As with striped marlin, usually the target species, most mako were tagged and released off the east Northland coast and around the Three Kings Islands and North Cape (Figure 8). In contrast to marlin, however, a substantial number (over 28%) of mako were tagged on the west coast of the North Island (Figure 9). Mako were also tagged in low numbers elsewhere off the North Island and 10 were tagged off Dunedin (see Figure 8). The mako season appears to have been similar to that of the marlin fishery, with numbers tagged peaking in February (Figure 5b). The distribution of tagging effort is relatively uniform throughout the recreational fishing fleet (see Table 3).

Twenty-three mako sharks were recaptured this season, 5 by recreational fishers and 19 by commercial fishers (see Tables 4 and 5). Thirteen mako were recaptured outside New Zealand waters, 11 around Fiji and 2 off Australia, all by commercial fishers. Over 17% of all mako recaptures to date have been in the waters around Fiji (Table 6). The number of recaptures from Fiji has increased considerably in the last four years. 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 of the North Island.

Seasonal movement of mako may be inferred from patterns in the net distance moved by tagged fish relative to their time at liberty (Figure 6b). Tagged mako recaptured near to the point of release (under 400 n. mile) appear to be caught during the same time of year after being at liberty for one or more years, and, in one case, as much as 6 years later. However, as mako are a bycatch of the target striped marlin fishery, this pattern probably reflects the strong seasonality in fishing effort rather than seasonality in their 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 about 1000 n. miles from the point of release, mostly in the tropics. No clear seasonal pattern in the timing of these recaptures is apparent.

Blue shark

A total of 307 blue sharks was tagged in the 1998–99 season, the third highest seasonal total to date (see Table 2). The size range of tagged blue sharks was broad, with the largest individual estimated to be over 3.6 m total length with over 54% of fish in the 121–130 cm length category (Figure 2c). The mean length of blue sharks tagged and released was 142.5 cm.

Over 70% of the blue shark releases were made off the Otago coast (Figure 10) compared with 80% in the previous season (Hartill & Davies 2000). Most of the remaining releases occurred off the east coast of the North Island (Figure 11). The season was concentrated with over 87% of blue sharks tagged in February (see Figure 5c). The distribution of tagging effort was strongly skewed, with two boats from Dunedin releasing over 70% of all blue sharks tagged (see Table 3).

Ten blue shark recaptures occurred this season (see Tables 4 and 5), compared with 10 in the 1998–99 season and 9 in the 1997–98 season (Hartill & Davies 1999, 2000). Before the 1997–98 season, only 19 blue sharks had been recaptured since tagging began in 1975. Of the 10 blue sharks recaptured, 9 were released off the Otago coast, 4 of which were released this year. Five of the 10 recaptures were made by commercial fishers. 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 (Figure 6c). The most distant recapture to date has been off Chile (Table 7).

Kingfish

There has been renewed interest in tagging kingfish, with 762 released this season compared with 311–416 fish tagged in the previous three seasons (see Table 2). The kingfish tagged and released this season spanned a wide range of reported fork lengths, with a mean length of 83.5 cm (Figure 2d).

Most tagging took place in the Bay of Plenty, where over 45% of releases occurred (Figure 12). Most of the remaining releases occurred off the east Northland coast (15%) and off East Cape (29%; Figure 13). Two charter boats were responsible for more than 77% of all kingfish tagged and released (see Table 3). Kingfish were tagged throughout the year with effort peaking in February (Figure 5d).

There has been a corresponding increase in the number of recaptures with 53 fish recaught this season, 43 in the Bay of Plenty by recreational fishers (see Table 4). Recaptures by commercial fishers occurred in the Bay of Plenty and off East Cape (see Table 5).

Most (86%) of the tagged kingfish recaptures have occurred 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 from the Wanganella Bank and Australia in the past. The short distances moved by kingfish recaptured this season are consistent with previous results where 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, 2000).

Discussion

The number of striped marlin and mako sharks tagged and released during the 1999–2000 season is the lowest since the 1992–93 season. The proportion of striped marlin which were tagged and released is comparable with previous seasons, however, suggesting that the drop in the numbers tagged is due to low numbers of marlin caught and not a lack of interest in the programme by recreational fishers. As there is no information on the annual recreational fishing effort, it is not possible to determine whether this drop is due to a reduction in total fishing effort or reduced catch rates.

The low number of marlin tagged and released during the 1999–2000 season is also reflected in the number of reported recaptures, which was 5, with 1 belated report from last season, compared with 13 reported captures during the 1998–99 season and 1 belated report from the 1997–98 season (Hartill & Davies 2000). Movement patterns of striped marlin, mako sharks, blue sharks, and kingfish inferred from release and recapture data received during the 1999–2000 season are consistent with those from previous seasons. Striped marlin are usually recaptured close to the point of release after a short time at liberty or in the tropics, usually within a year of their release. Mako sharks are recaptured both close to the point of release and in the tropics, especially around Fiji. Blue sharks appear to show no defined movement patterns, and kingfish are usually recaptured close to the point of release. The incidence of recaptures, however, both temporal and spatial, is strongly dependent on the presence and timing of fishing effort, both recreational and commercial. As the distribution of fishing effort is patchy and not always known, the generality of movement trends observed from tag release and recapture data is difficult to assess.

It has recently been suggested that the use of the stainless steel dart tag (both reinforced and non-reinforced) currently used in this programme often results in inflamed irritable wounds (Pollack 2000). Pollack suggested that a surgical grade nylon tag similar to that used by the Billfish Foundation should be used. The replacement of stainless steel dart tags by nylon tags could be considered in future seasons. However, the relative retention properties of the two tag types should first be assessed experimentally before recommendations are made.

Acknowledgments

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References

Davies, N.M.;, Hartill, B. (1998). New Zealand billfish and gamefish tagging, 1996–97. *NIWA Technical Report No. 35*. 33 p.

Hartill, B.; Davies, N.M. (1999). New Zealand billfish and gamefish tagging, 1997–98. *NIWA Technical Report No. 57*. 39 p.

Hartill, B.; Davies, N.M. (2000). New Zealand billfish and gamefish tagging, 1998–99. *NIWA Technical Report No. 79*. 20 p.

Holdsworth, J.; Saul, P. (1998). New Zealand billfish and gamefish tagging, 1995–96. *NIWA Technical Report No. 16* 18 p.

Kohler, N.E.; Casey, J.C.; Turner, P.A. (1995). Length-weight relationships for 13 species of sharks from the western North Atlantic. *Fishery Bulletin 93(2)*: 412–418.

Nakano, H.; Makihara, M.; Shimazaki, K. (1985). Distribution and biological characteristics of the blue shark in the central north Pacific. *Bulletin of the Faculty of Fisheries, Hokkaido University 36(3)*: 99–133.

Pollack, R. (2000). To tag or not to tag. *New Zealand Fisherman, February 2000*: 34–37.

Saul, P., Holdsworth, J. (1992). Cooperative gamefish tagging in New Zealand waters, 1985–90. *New Zealand Fisheries Technical Report No. 33*. 24 p.

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

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

(weight in g, length in cm)

Species	*a*	*b*	Measurement method	Source
Striped marlin	0.0134	2.8900	Fork length	Holdsworth (unpub. data)
Blue shark	2.328×10^{-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	*a*	*b*	*c*	*d*	Source
Mako shark	5.432×10^{-6}	3.1407	-1.7101	0.9286	Kohler et al. (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 2000.**

Season	STM	MAK	BWS	KIN	ALB	BEM	BKM	SWO	YFN	SHA	OSP	Total
1974–75	–	8	1	–	–	–	–	–	–	–	–	9
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	87	427	87	6	4	4	140	26	18	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	1 531	175	1 444	5	29	4	10	215	23	60	4 702
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	518	724	362	1	24	5	–	3	54	11	2 600
1998–99	1 544	753	276	311	1	43	2	2	19	41	14	3 006
1999–2000	790	395	307	762	24	64	3	2	27	75	30	2 479
Unknown date	–	6	1	6	–	–	–	–	1	–	2	16
Total releases	9 539	9 926	2 947	9 277	465	278	38	99	851	537	393	34 350
Total recaptures	60	257	48	881	–	2	1	–	7	36	18	1 310

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	44	6	1	15	4	1	124	40	1	405	53	1	20	9
	1	33	10	3	7	9	1	92	70	1	181	77	1	19	17
	1	32	14	3	6	14	1	37	82	1	14	79	1	14	24
	1	22	17	5	5	20	1	7	85	1	11	80	1	12	29
	1	20	19	6	4	26	1	5	86	1	10	81	1	10	33
	2	19	24	19	3	41	2	3	88	1	9	83	1	8	37
	2	18	28	45	2	63	5	2	92	2	7	85	2	7	43
	1	17	31	145	1	100	26	1	100	4	6	88	1	6	46
	1	15	33							5	5	91	1	5	48
	2	13	36							3	4	93	5	4	57
	1	12	37							3	3	94	3	3	61
	2	11	40							11	2	97	15	2	74
	1	10	41							26	1	100	58	1	100
	2	9	44												
	3	8	47												
	3	7	49												
	6	6	54												
	8	5	59												
	11	4	65												
	15	3	70												
	38	2	80												
	159	1	100												
Total	262	790		227	395		38	307		60	762		91	225	

***Table 4*: Numbers of tagged fish recaptured during the 1999–00 season by recreational fishers by species and statistical area.**

	Statistical area								
	002	003	007	009	010	016	020	024	Total
Striped marlin	–	–	–	–	1	–	–	–	1
Mako shark	–	2	–	1	–	–	1	–	4
Kingfish	1	2	1	32	11	1	–	–	48
Blue shark	–	–	–	–	–	–	–	4	4
School shark	–	1	–	–	–	–	–	–	1
Trevally	–	–	–	–	1	–	–	–	1
Trumpeter	–	–	–	–	–	–	1	–	1
Total	1	5	1	33	13	1	2	4	60

***Table 5*: Numbers of tagged fish recaptured during the 1999–00 season by commercial fishers by species and statistical area*.**

	Statistical area											
	002	003	010	013	016	030	037	040	041	047	999	Total
Striped marlin	–	–	–	–	–	–	–	–	–	–	4	4
Mako shark	1	1	–	1	1	–	–	–	1	1	13	19
Kingfish	–	–	2	3	–	–	–	–	–	–	–	5
Blue shark	–	–	–	–	–	1	1	–	–	–	4	6
Bronze whaler shark	–	1	–	–	–	–	–	–	–	–	–	1
School shark	–	–	–	–	–	–	–	1	–	1	–	2
Blue marlin	–	–	–	–	–	–	–	–	–	–	1	1
Total	1	2	2	4	1	1	1	1	1	2	22	38

* 999 denotes fish recaptured outside statistical areas

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

	Recapture area																															
Release area	001	002	003	004	005	008	009	010	011	012	013	014	016	020	039	040	041	042	047	048	???	AUS	CAL	COR	FIJ	KER	LHR	MAQ	SOL	TAS	TON	WAN	Total
002	1	6	4	1	–	1	–	–	2	–	–	–	–	–	–	–	–	–	–	–	1	–	1	–	14	–	–	–	–	2	–	–	33
003	2	9	43	1	–	7	5	5	3	1	9	2	–	1	1	1	–	1	5	1	1	3	2	–	17	–	–	1	1	1	–	–	123
005	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1
008	–	1	1	–	1	1	2	1	–	1	2	–	–	–	–	1	–	–	–	–	–	–	–	–	5	–	–	–	–	–	–	–	16
009	–	–	3	–	–	3	6	1	1	–	2	–	–	–	–	–	–	–	–	–	–	1	1	–	1	–	–	–	–	1	1	–	21
010	–	1	–	–	1	–	2	3	–	–	2	–	–	–	–	–	–	–	–	–	–	1	–	–	1	–	–	–	–	–	–	–	11
012	–	–	–	–	–	–	–	–	–	–	1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1
013	–	–	1	–	–	1	–	1	–	–	–	3	–	–	–	–	–	–	–	–	–	–	–	–	1	1	–	–	–	–	–	–	8
014	–	1	1	–	–	–	2	1	–	–	3	4	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	12
041	–	1	–	–	–	–	–	–	1	–	–	1	1	–	–	–	–	1	–	–	–	1	–	1	1	–	–	–	–	–	–	1	9
042	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	–	1	1	–	–	–	1	–	–	–	–	–	–	–	–	–	–	4
043	–	1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1
045	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1
046	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	–	–	–	–	–	–	–	1
047	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	–	–	–	–	–	1	–	–	–	–	–	–	–	2
048	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	–	–	–	–	1	–	–	–	–	–	2
Total	3	20	53	2	2	13	17	12	7	2	19	10	1	1	2	2	3	3	6	1	2	8	4	1	42	1	1	1	1	4	1	1	246

AUS, Australia; CAL, New Caledonia; COR, Coral Sea; FIJ, Fiji; KER, Kermadecs; LHR, Lord Howe Rise: 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.**

	Recapture area																									
Release area	002	003	004	008	010	011	012	013	014	017	024	030	037	040	043	???	AUS	CAL	CHL	FIJ	MAQ	PHL	RUM	TAH	TON	Total
002	–	–	1	1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	2
003	1	3	–	–	–	–	–	–	–	–	–	–	–	–	–	–	3	–	–	–	–	–	–	–	–	7
009	–	–	–	–	1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1
010	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	–	–	–	–	–	–	–	–	1
013	–	–	–	–	1	1	–	2	–	–	–	–	–	–	–	1	2	–	–	–	–	–	1	–	–	8
014	–	–	–	–	–	–	–	–	1	1	–	–	–	–	–	1	–	–	–	–	–	–	–	–	–	3
016	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	–	–	–	–	–	–	–	1
017	–	–	–	–	–	–	–	–	–	1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1
024	–	–	–	–	–	–	1	–	–	–	6	3	1	–	–	–	1	–	1	1	1	1	1	1	1	19
041	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	–	–	–	–	1	–	–	–	–	–	2
042	–	–	–	–	–	–	–	–	–	–	–	–	–	1	–	–	–	–	–	–	–	–	–	–	–	1
Total	1	3	1	1	2	1	1	2	1	2	6	3	1	1	1	2	7	1	1	2	1	1	2	1	1	46

AUS, Australia; CAL, New Caledonia; CHL, Chile; FIJ, Fiji; MAQ, Marquesas Islands; PHL, Philippines; RUM, Rumbles; TAH, Tahiti; TON, Tonga; ???, area unknown

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

	Recapture area																							
Release area	002	003	005	006	007	008	009	010	011	012	013	014	016	039	042	043	045	047	048	???	AUS	COL	WAN	Total
002	62	11	1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	–	–	–	75
003	6	129	3	1	3	2	1	–	–	–	–	1	–	–	–	–	–	1	–	3	–	–	1	151
005	–	2	5	–	1	–	–	–	–	–	–	–	–	–	–	1	–	–	–	–	–	–	–	9
006	–	1	1	3	5	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	10
007	–	1	–	4	11	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	16
008	–	1	1	1	–	6	–	–	–	–	1	–	–	–	–	–	–	–	–	–	–	–	–	10
009	–	2	–	–	–	2	88	6	–	–	–	–	–	–	–	–	–	–	–	–	2	–	–	100
010	1	1	2	–	–	3	13	407	2	1	2	–	–	1	–	–	–	–	–	–	–	–	–	433
011	–	–	–	–	–	–	–	1	7	1	1	–	–	–	1	–	–	–	–	–	–	1	–	12
012	–	–	–	–	–	1	1	1	1	7	5	3	1	–	–	–	–	–	–	–	–	–	–	20
013	–	1	–	–	–	–	–	1	–	–	4	1	–	–	–	–	–	–	–	–	–	–	–	7
014	–	–	–	–	–	–	–	–	–	–	–	2	–	–	–	–	–	–	–	–	–	–	–	2
043	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	5	–	1	–	–	–	–	–	6
044	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	–	–	–	–	–	–	1
045	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	–	–	–	1
047	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	10	1	1	–	–	–	12
048	1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	2	–	–	–	–	4
Total	70	149	13	9	20	14	103	416	10	9	13	7	1	1	1	6	1	13	3	6	2	1	1	869

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

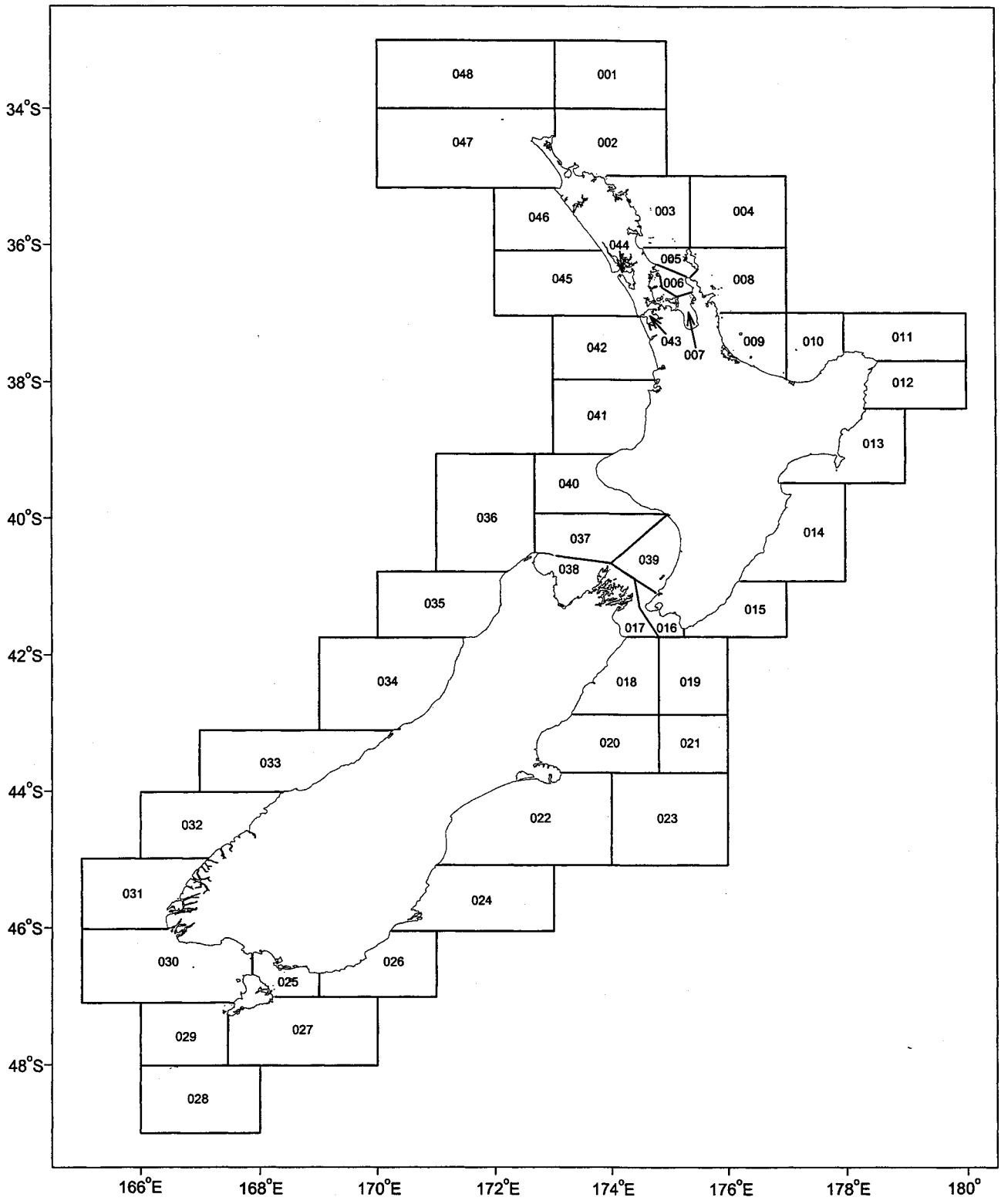

***Figure 1*: Commercial fisheries statistical reporting areas.**

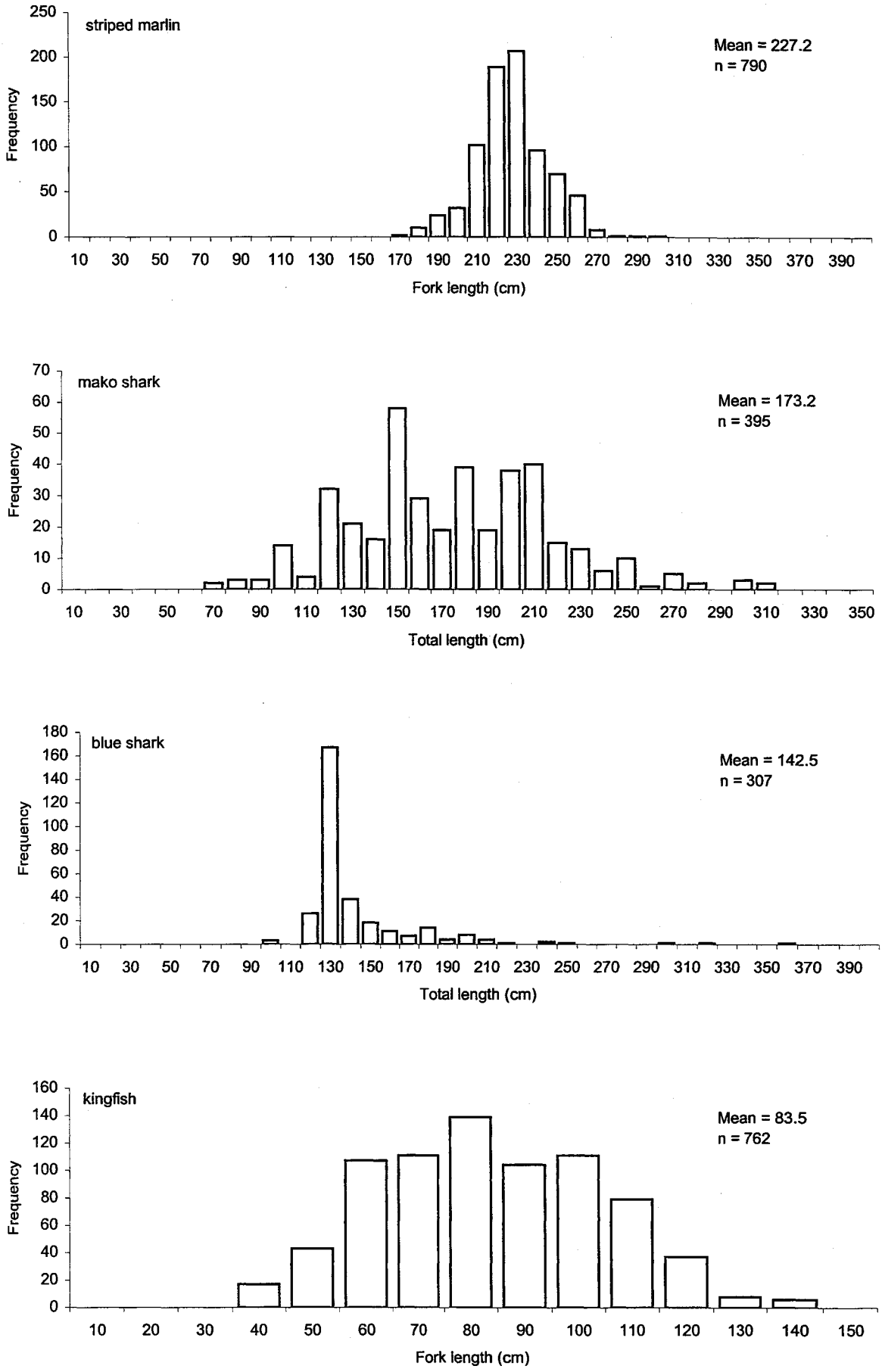

***Figure 2*: Length frequency distribution of striped marlin, mako shark, blue shark, and kingfish tagged and released during the 1999–2000 season.**

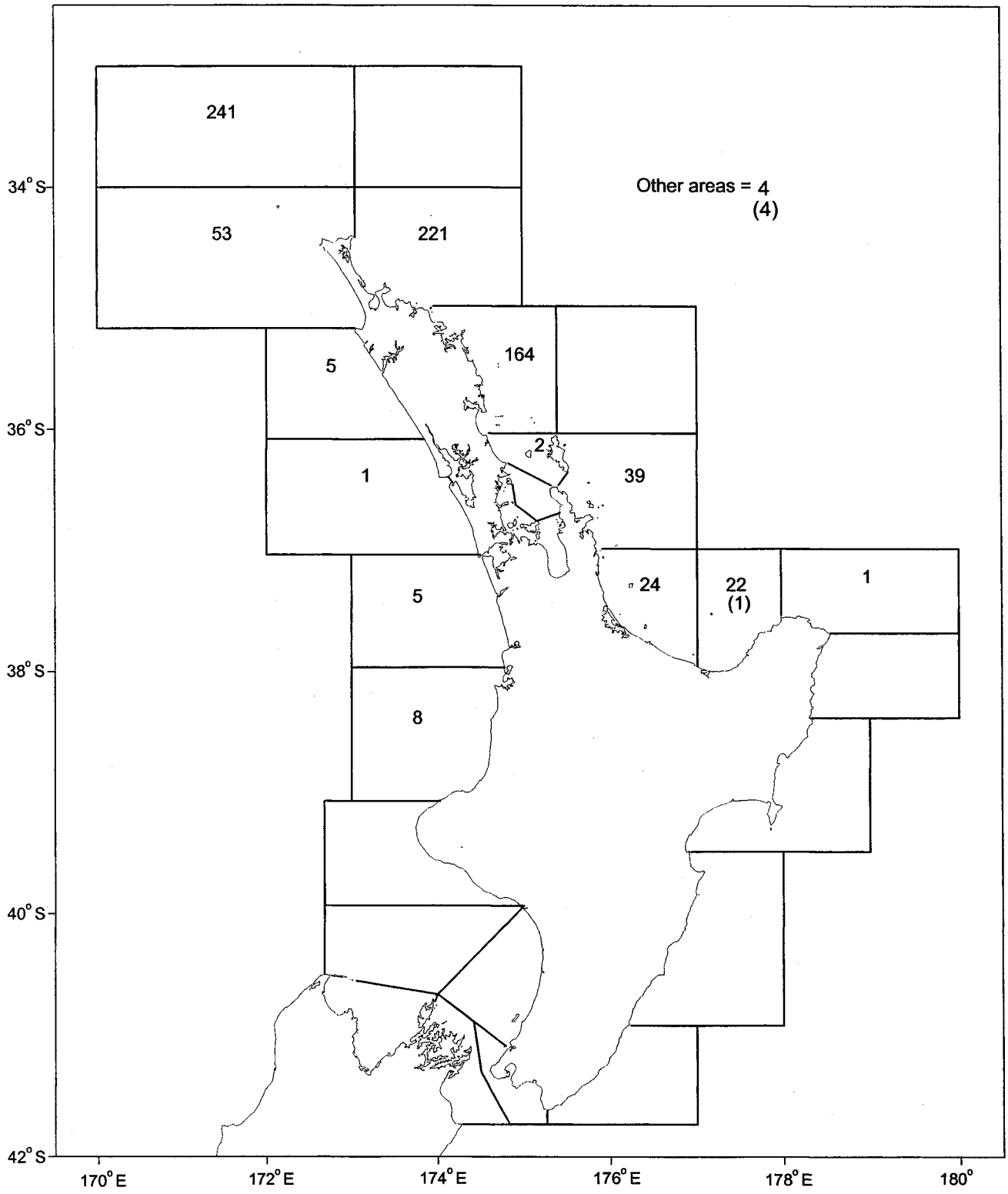

Figure 3: **Numbers of striped marlin released and recaptured (in parentheses) by statistical reporting area during the 1999–2000 season.**

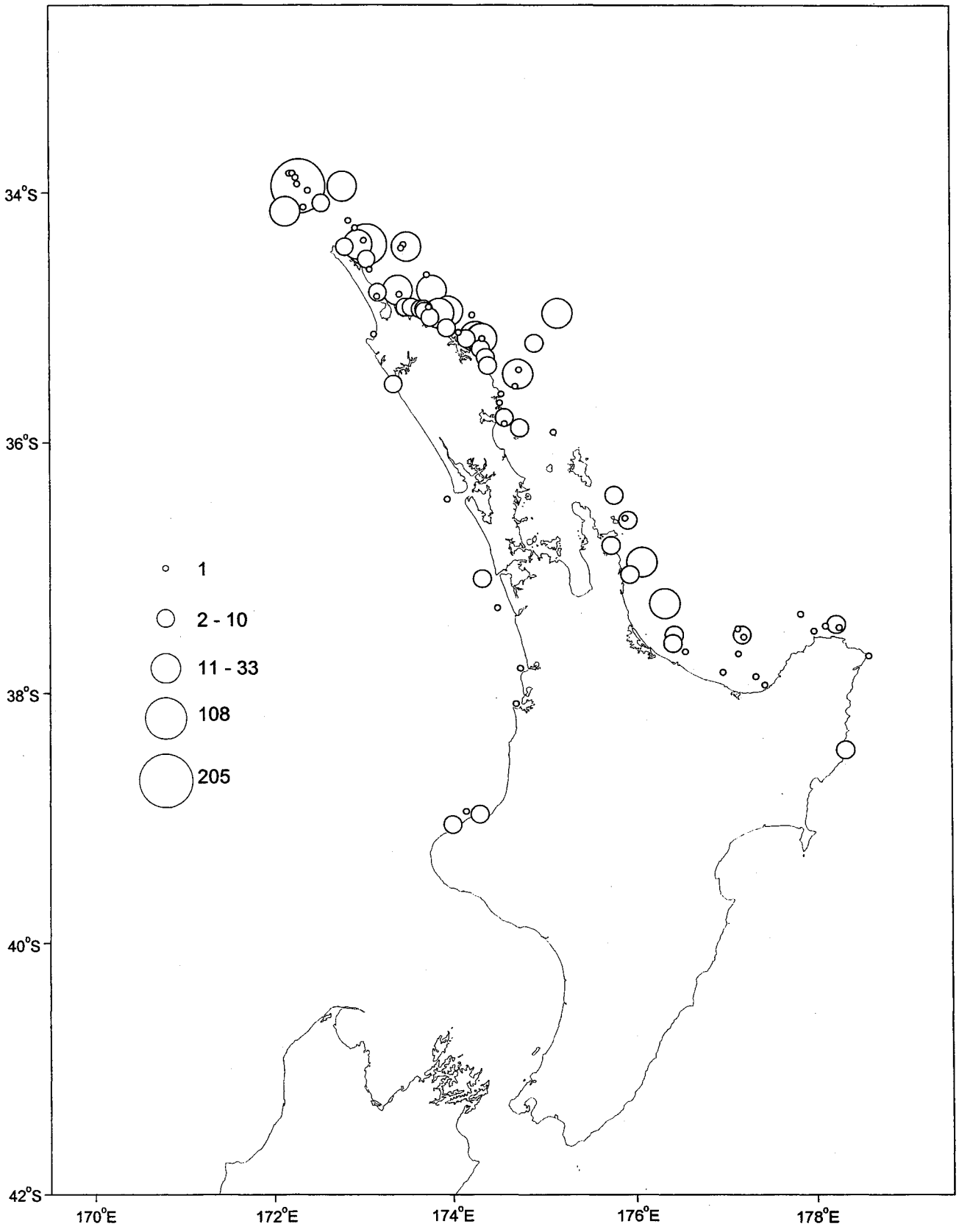

Figure 4: **Distribution of striped marlin tagged and released during the 1999–2000 season.**

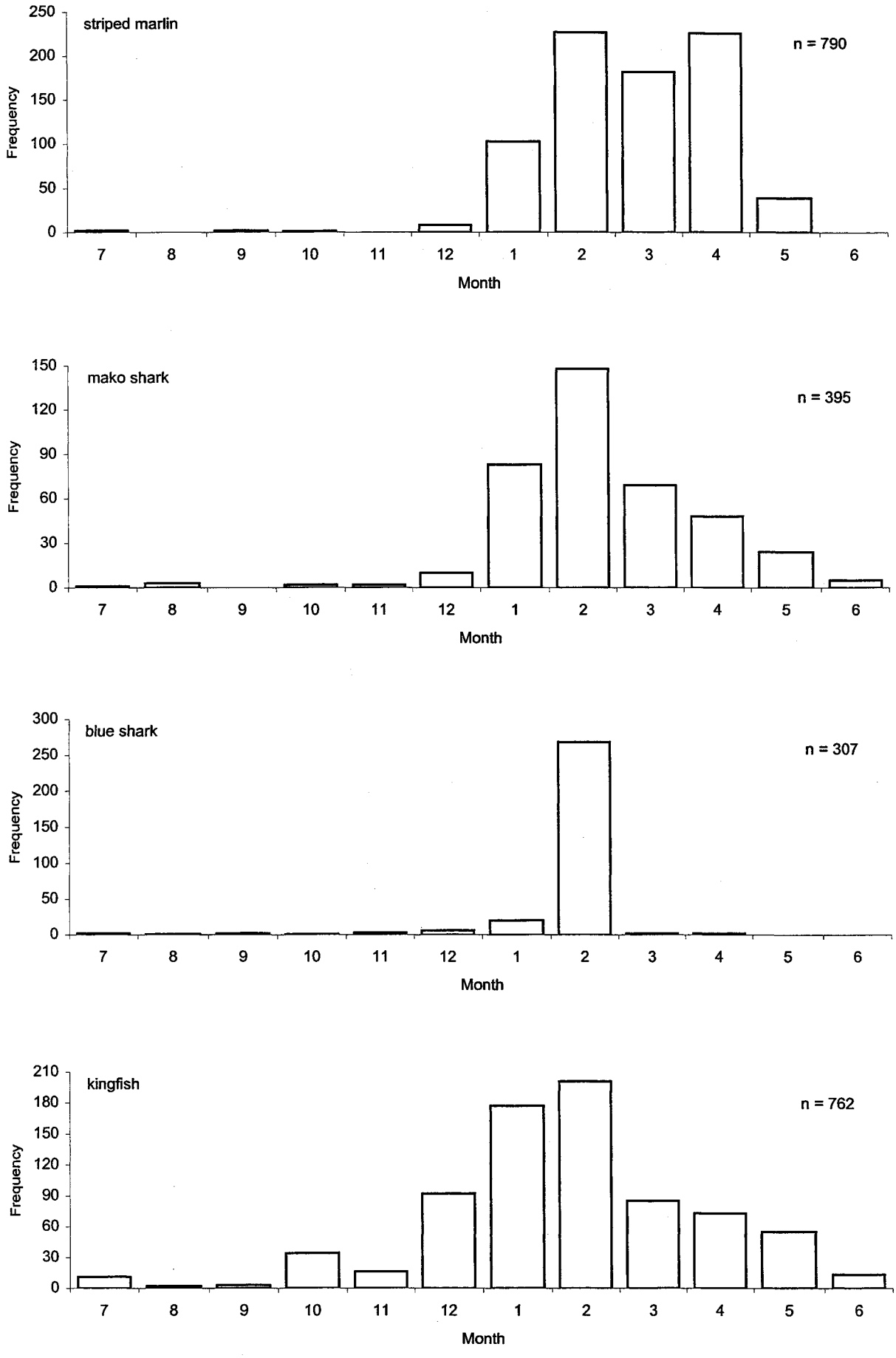

Figure 5: **Distribution of tagged fish release by month during the 1999–2000 season for striped marlin, mako shark, blue shark, and kingfish.**

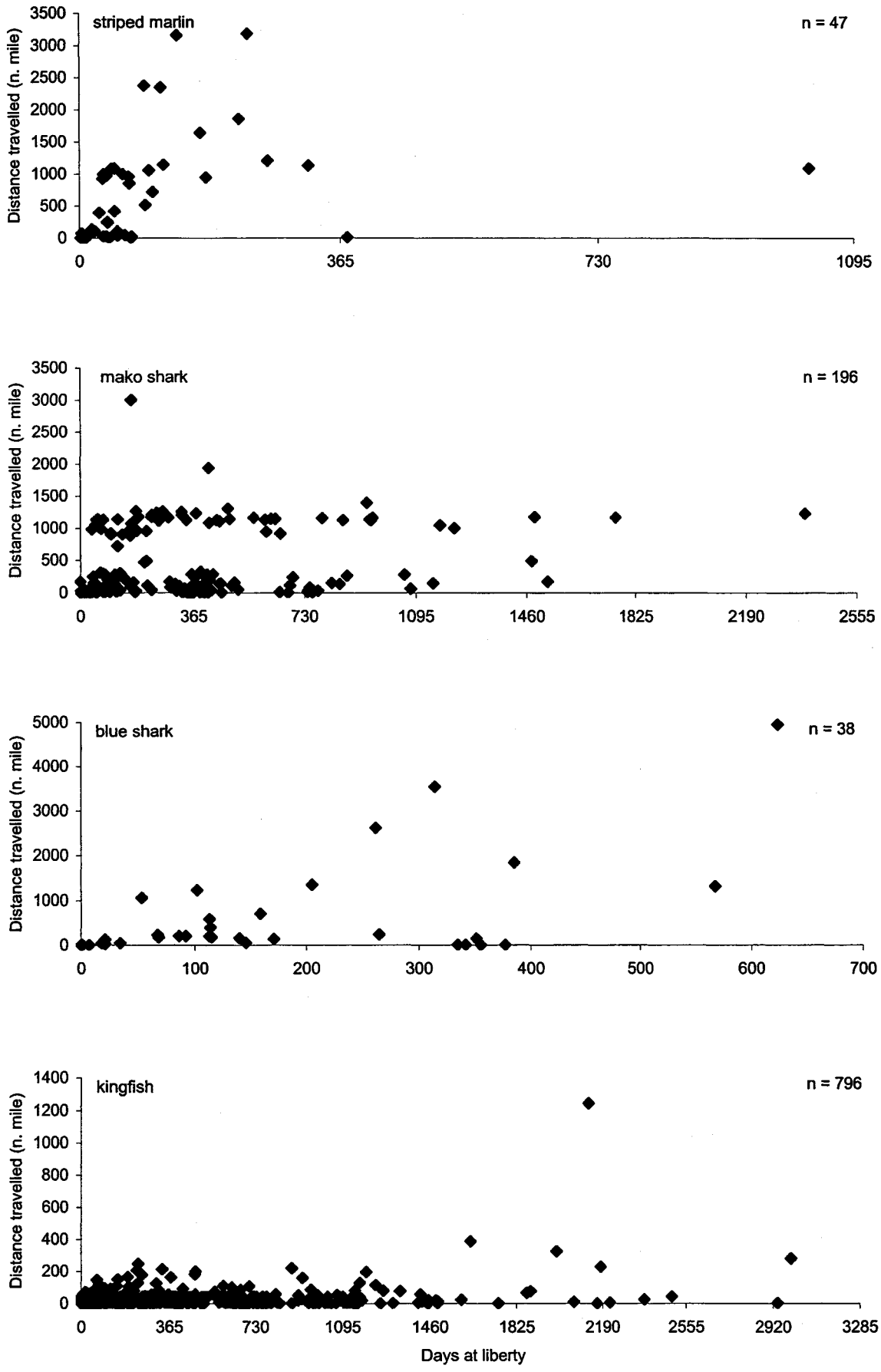

***Figure 6*: Net distance travelled by striped marlin, mako shark, blue shark, and kingfish relative to period at liberty.**

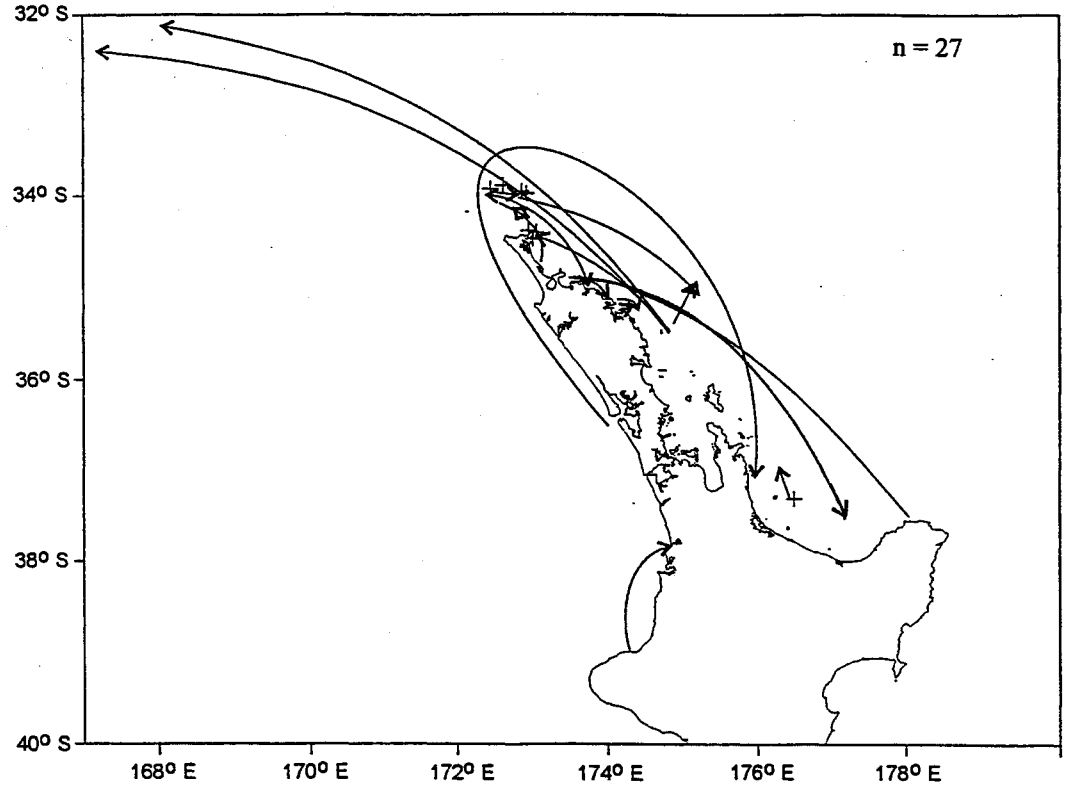

***Figure 7a*: Short distance movements of striped marlin recaptured since 1975. + denotes no net movement.**

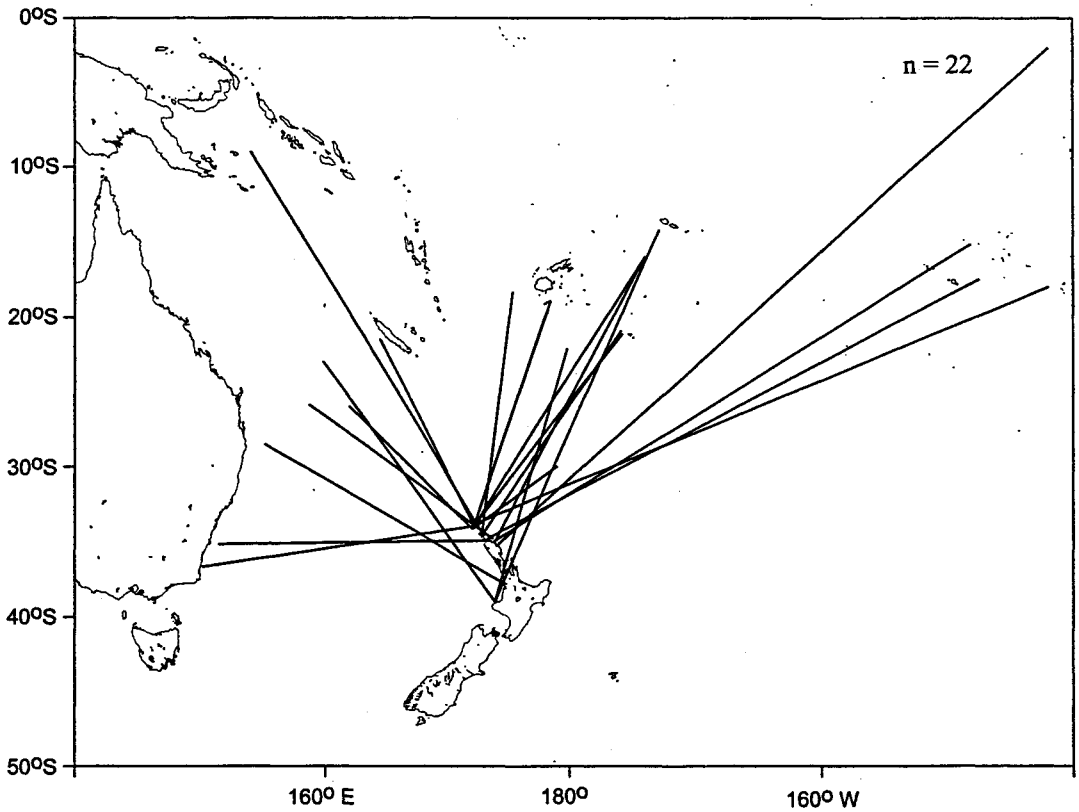

***Figure 7b*: Long distance movements of striped marlin recaptured since 1975.**

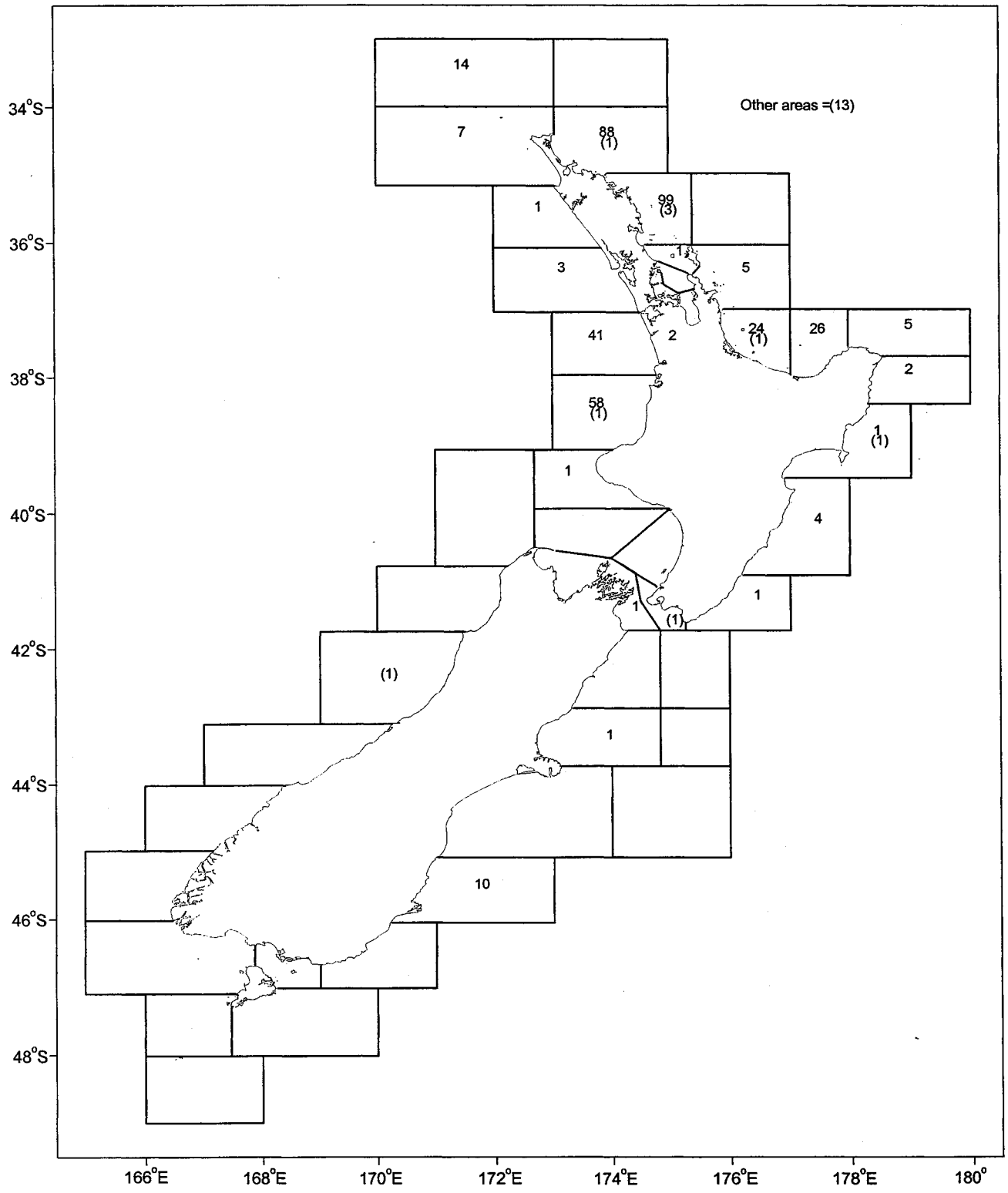

Figure 8: **Numbers of mako sharks released and recaptured (in parentheses) by statistical reporting area during the 1999–2000 season.**

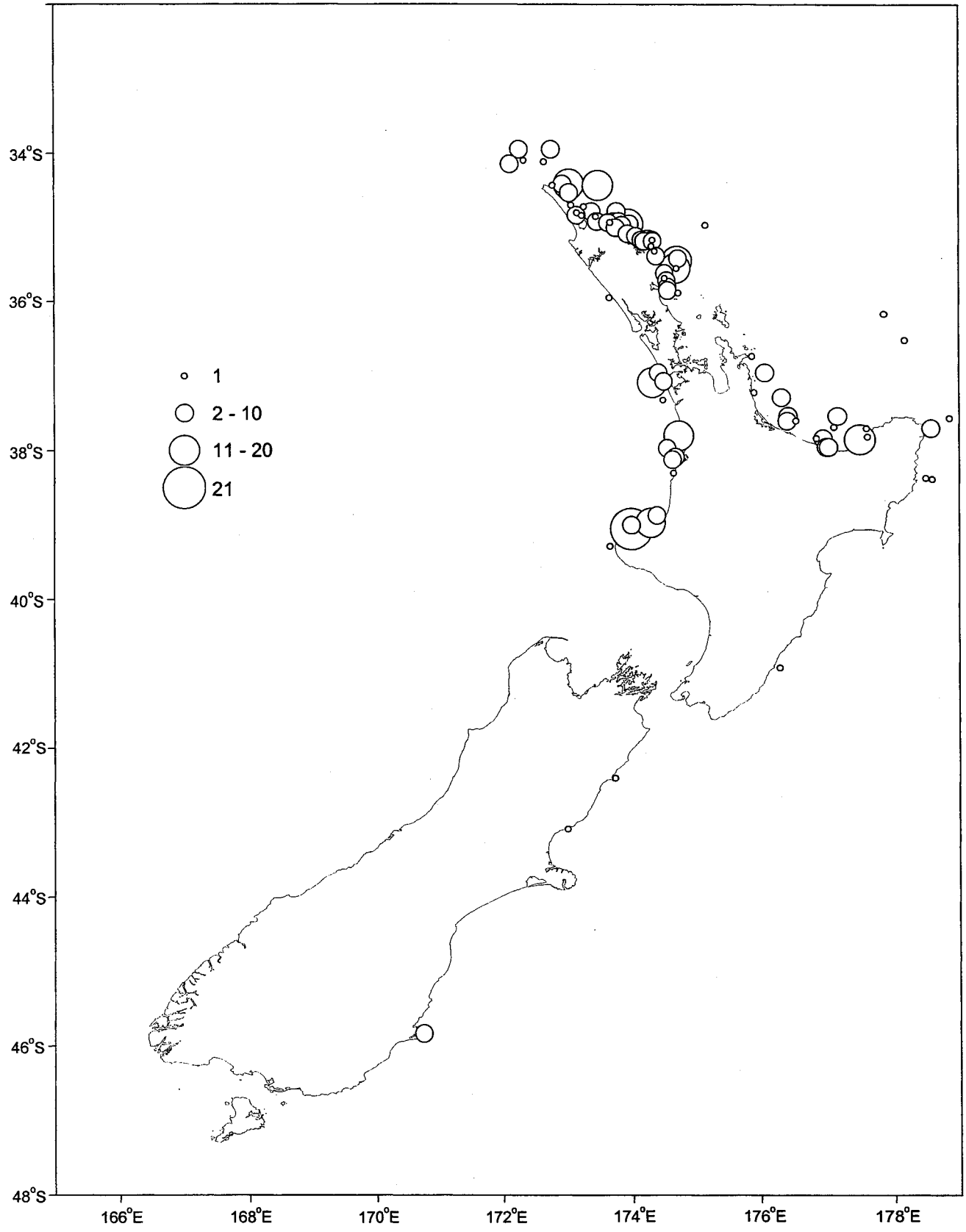

Figure 9: **Distribution of mako sharks tagged and released during the 1999–2000 season.**

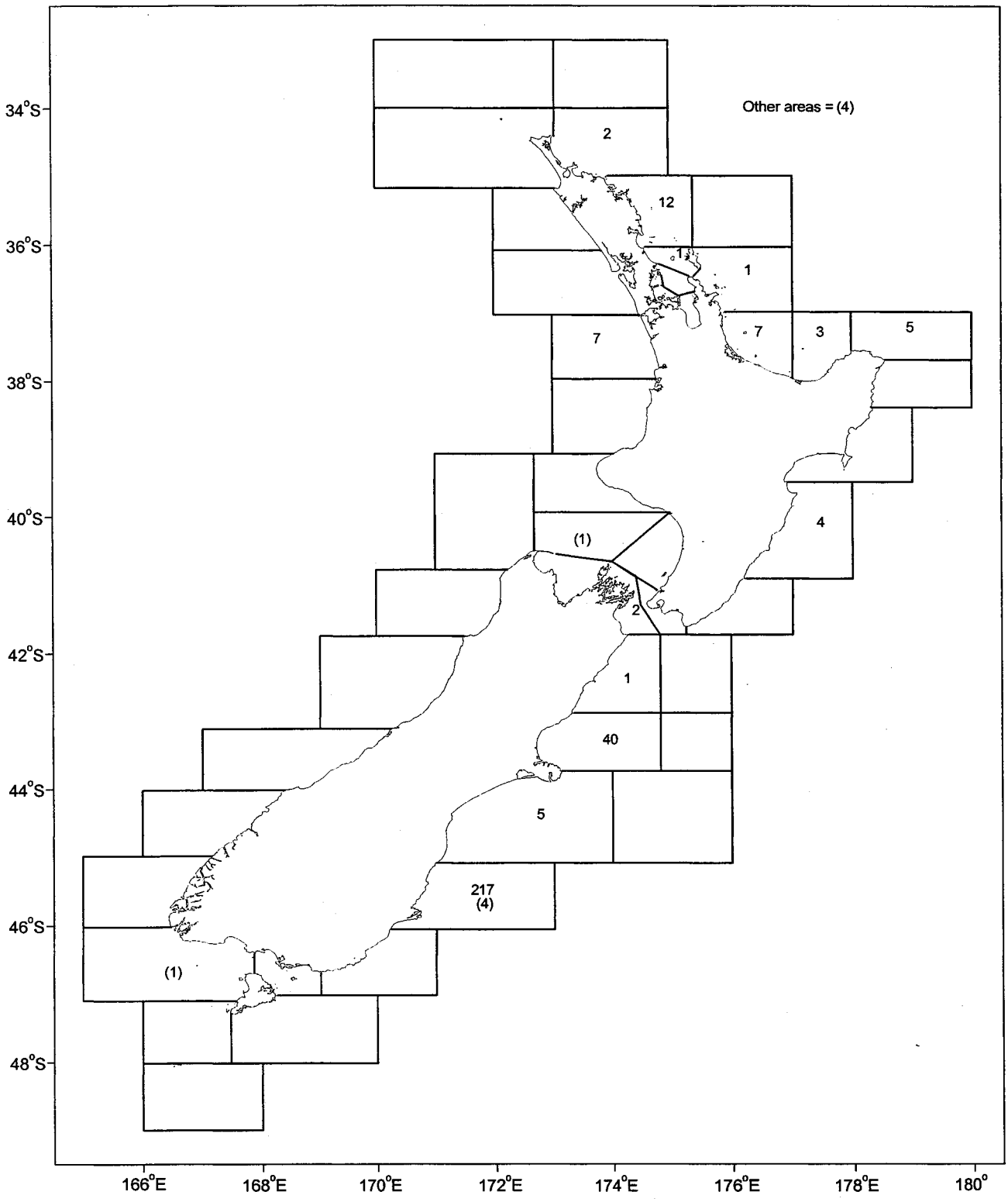

***Figure 10*: Numbers of blue sharks released and recaptured (in parentheses) by statistical reporting area during the 1999–2000 season.**

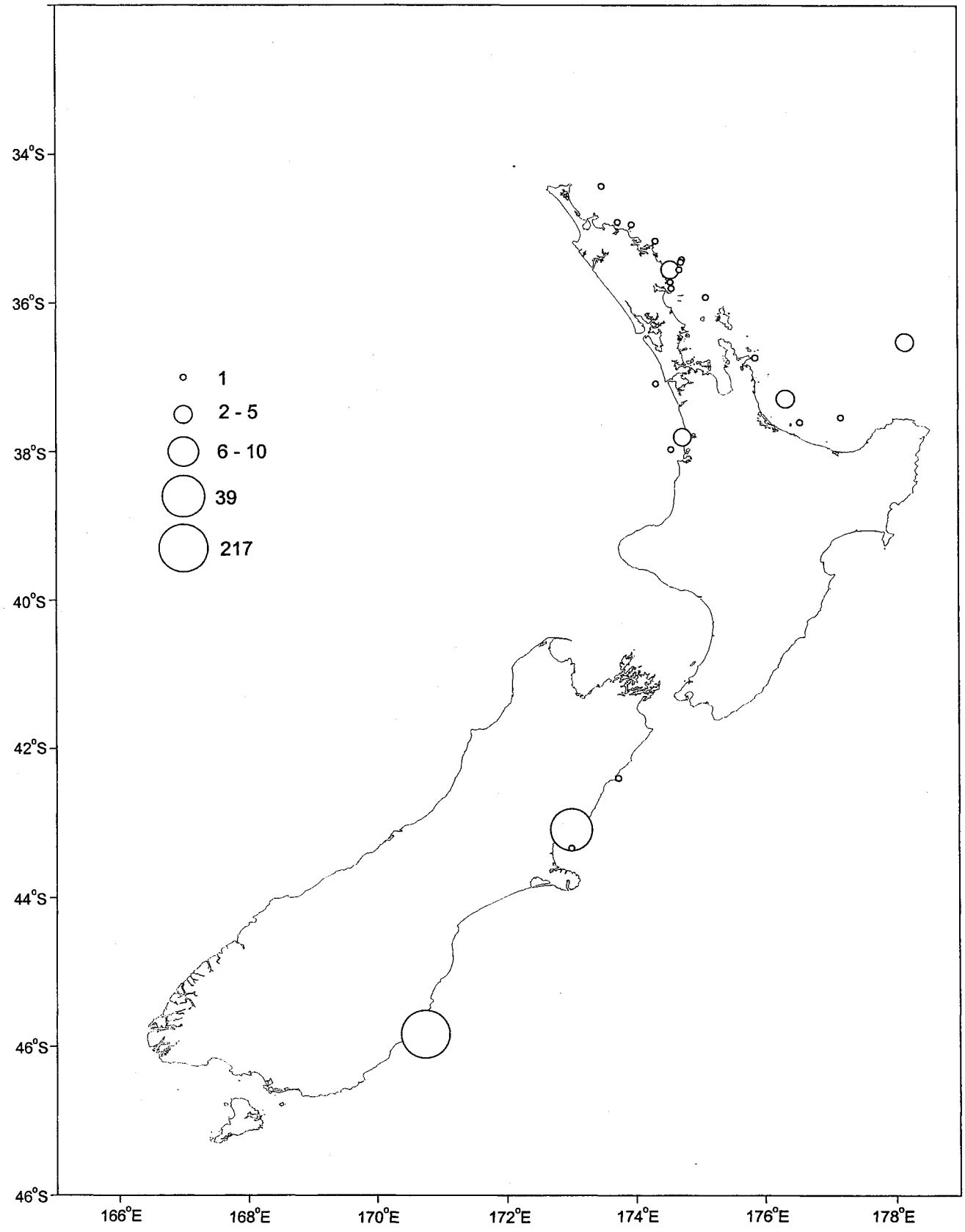

Figure 11: **Distribution of blue sharks tagged and released during the 1999–2000 season.**

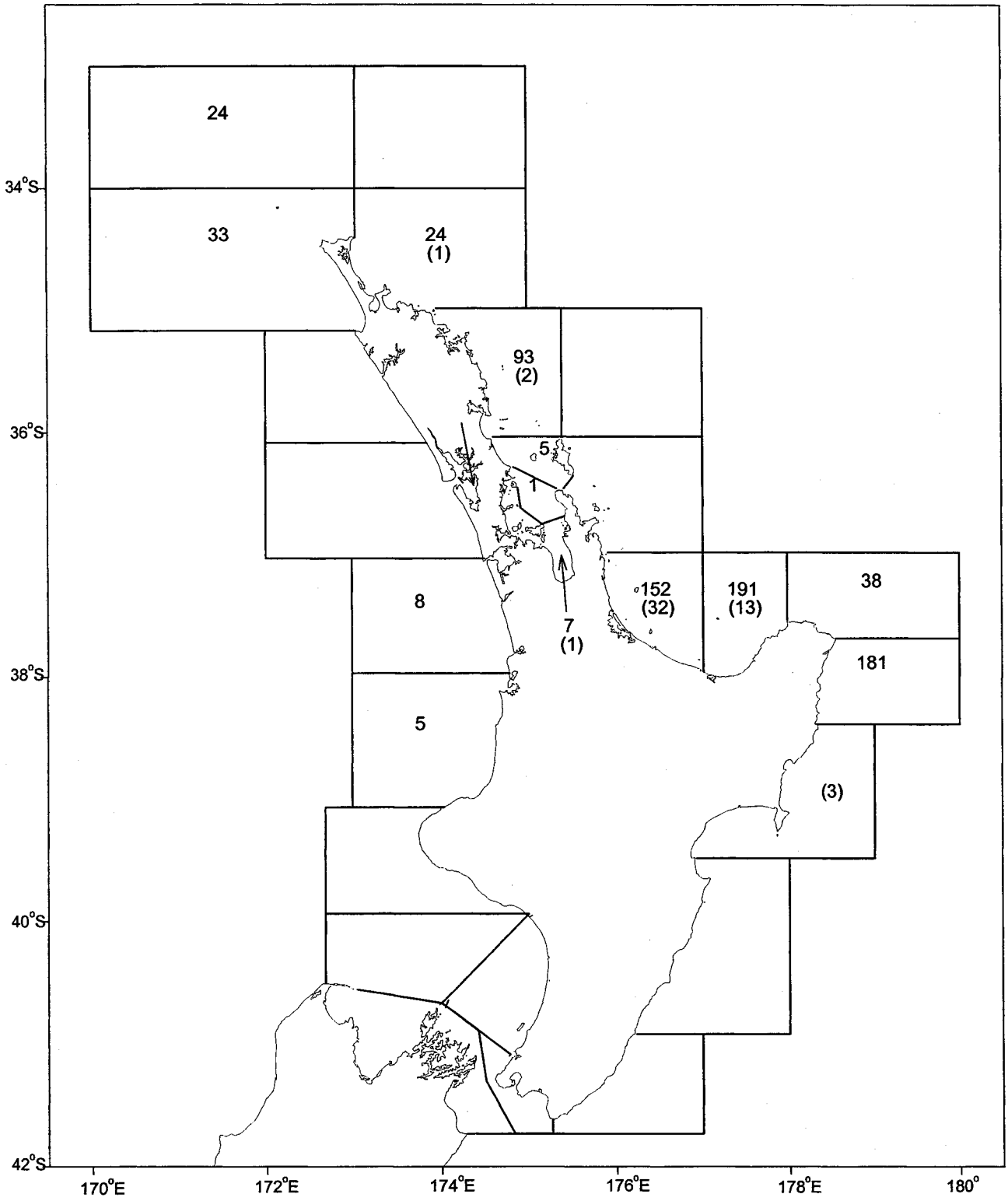

Figure 12: **Numbers of kingfish released and recaptured (in parentheses) by statistical reporting area during the 1999–2000 season.**

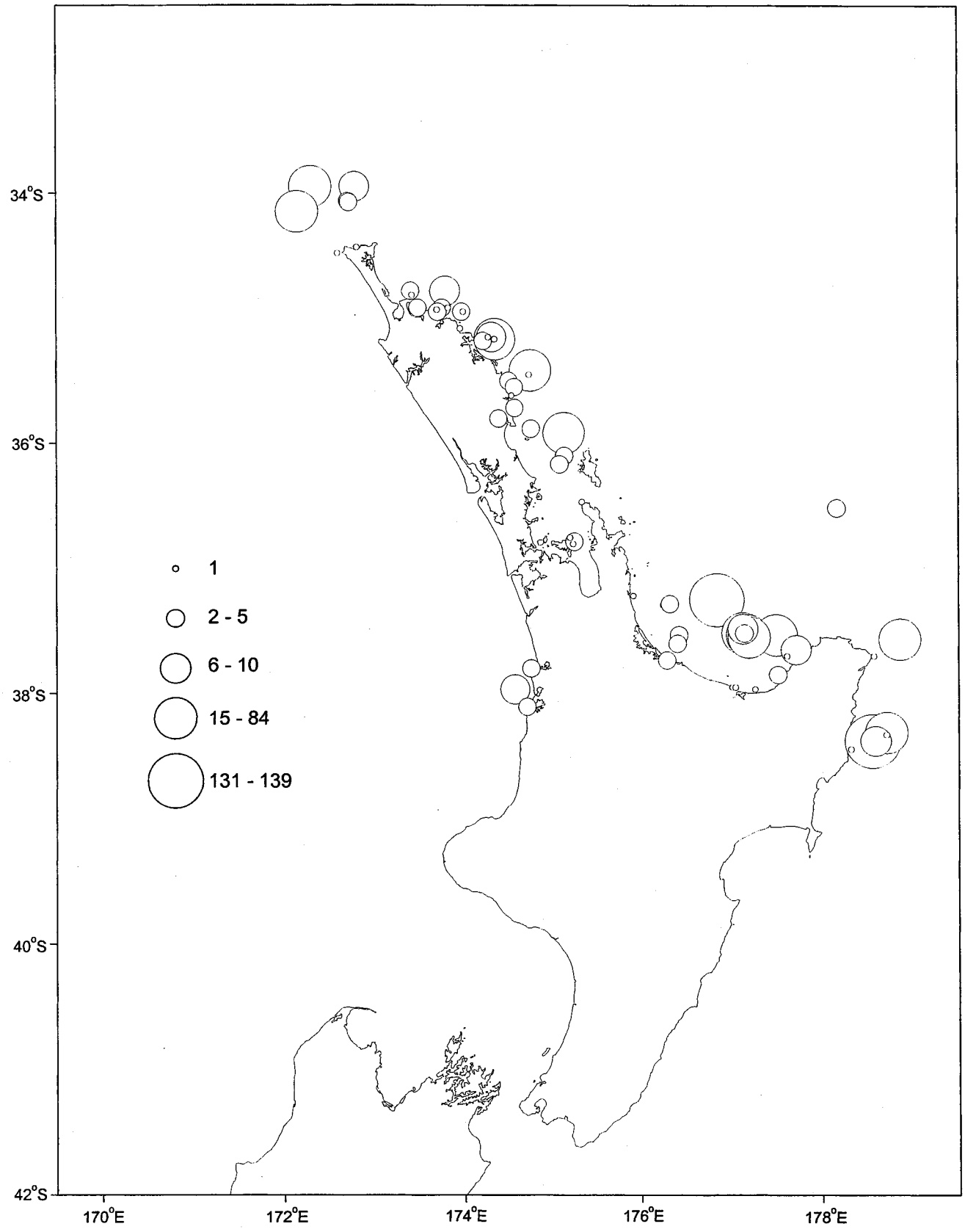

Figure 13: **Distribution of kingfish tagged and released during the 1999–2000 season.**

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