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New Zealand billfish and gamefish tagging, 2003–04

**J. Holdsworth
P. Saul**

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Blue Water Marine Research Ltd
RD3
Whangarei

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EXECUTIVE SUMMARY

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The gamefish tagging programme has been an integral part of the New Zealand marine sports fishery since the mid 1970s. The species that form the focus of the programme are striped marlin (*Tetrapturus audax*), mako shark (*Isurus oxyrinchus*), blue shark (*Prionace glauca*), yellowfin tuna (*Thunnus albacares*), and yellowtail kingfish (*Seriola lalandi*). Worldwide there has been a growing trend toward the catch and release of large pelagic species hooked by recreational fishers. The collection of movement and, on occasion, growth information through cooperative tagging programmes with recreational fishers is a cost-effective way of collecting information on large pelagic species that are difficult to study by other means. However, in cooperative programmes, tagging may be spread over a long period and it is difficult to control the tagging event and quality of reporting.

Release and recapture data for the 2003–04 season (July to June fishing year) are summarised in this report and compared with those from previous seasons. Particular recaptures that provide growth or movement information of significance or interest are described.

This season 2419 fish were reported tagged and released and 237 late reports were added to those of previous seasons. The number of striped marlin (1019) and yellowfin tuna (186) tagged increased in 2003–04 compared to recent seasons. The number of mako and blue sharks tagged has been significantly lower than the long-term average for the last two years.

A total of 52 recaptures was reported in the 2002–03 fishing season, including 32 yellowtail kingfish, 9 mako sharks, 4 striped marlin, 2 blue sharks, 2 yellowfin tuna, and 1 swordfish. Time at liberty ranged from 1 day for a kingfish at Channel Island to 3047 days (8 years 4 months) for a 90 kg swordfish caught off Gisborne. Distance between release and recapture points ranged from less than 1 nautical mile, recorded for 12 kingfish, to 1330 nautical miles (2460 km) by a mako shark, which was recaptured off Vanuatu in October 2003.

This season data from 356 kingfish measured on release and recapture were supplied to NIWA to estimate growth.

1. INTRODUCTION

1.1 Overview

The New Zealand Cooperative Gamefish Tagging Programme was initiated by the Ministry of Agriculture and Fisheries in 1975 following requests from gamefish clubs. Similar programmes had been established by New South Wales Fisheries in 1973 and by Woods Hole Oceanographic Institute, USA, in 1954. Although the tags supplied in New Zealand were initially intended for billfish, it was accepted that a variety of gamefish species would be tagged (Saul & Holdsworth 1992).

Generally the aims of cooperative tagging programmes are to provide basic information on: movement and migration patterns; age, growth, and longevity; and stock structure for defining management units (Ortiz et al. 2003). These programmes have gained widespread support from recreational anglers and provide the only logistically and economically feasible way to tag large numbers of billfish (Pepperell 1990).

The New Zealand Big Game Fishing Council (NZBGFC) has supported the programme since its inception and has purchased and distributed all tags through gamefish clubs since 1992. Administration of the data remained with the Ministry of Agriculture and Fisheries until 1996, when the Ministry of Fisheries was formed. Administration for most fisheries research was contracted out to the National Institute of Water and Atmospheric Research (NIWA). The administration of the billfish and gamefish tagging was put out to competitive tender by the Ministry of Fisheries in 2000.

This report is the annual gamefish tagging report for 2003–04 season prepared by Blue Water Marine Research as part of the reporting requirements for the Ministry of Fisheries project PEL2003/01.

1.2 Description of the fishery

The recreational fishery for large pelagic species is very important for many New Zealanders and contributes to tourism in New Zealand. The fishery operates mainly over the warm summer and autumn months. Striped marlin (*Tetrapturus audax*) is the mainstay of the gamefishery on the Northland east coast (Figure 1), with blue marlin (*Makaira nigricans*), and small numbers of black marlin (*Makaira indica*), shortbill spearfish (*Tetrapturus angustirostris*), and swordfish (*Xiphias gladius*) also caught. Yellowfin tuna (*Thunnus albacares*) and mako sharks (*Isurus oxyrinchus*) are largely an incidental bycatch of the billfish fishery in Northland, and there is a year round fishery for kingfish (*Seriola lalandi*). In the Bay of Plenty (Figure 1), yellowfin tuna and large yellowtail kingfish are the main pelagic gamefish sought, though at times striped marlin and blue marlin are targeted. On the North Island east coast fishing clubs, are established from Gisborne to Wairarapa (Figure 1). Shark species become increasingly important with distance south. Gamefishing has developed on the west coast of the North Island over the last 14 years with, at times, a very good marlin and tuna fishery accessed from the west coast harbours, and occasionally from beaches, as far south as Taranaki (Figure 1). In the South Island, the gamefishery is centred around Canterbury, Otago, and Fiordland (Figure 1), with blue shark (*Prionace glauca*) abundant and therefore the primary target species, along with porbeagle shark (*Lamna nasus*) and occasionally southern bluefin tuna (*Thunnus maccoyii*).

Where billfish and tuna are targeted by recreational anglers, surface trolling with artificial lures or baits is the predominant method of fishing, with most gamefish being caught on artificial lures trolled at speeds ranging from 4 to 10 knots. Since 1997 there has been a slight trend back towards the use of live baits for billfish, but most marlin are still caught on lures, as are many mako sharks. Some mako sharks and most other shark species are caught on drifted baits, either targeted or as an incidental catch during broadbill swordfish fishing.

Marlin species are also a bycatch of the commercial surface longline fishery that targets bigeye and southern bluefin tuna (*Thunnus obesus* and *T. maccoyii*). Within the New Zealand Exclusive Economic Zone (EEZ), commercial fishers are obliged by regulation to release all billfish, except swordfish, alive or dead. This regulation includes a provision that live billfish should be tagged if possible, and previously tagged marlin recaptured by commercial fishers are permitted to be boated and brought to port for scientific study.

1.3 Background

Data management and reporting for the Gamefish Tagging Programme is funded by the New Zealand Ministry of Fisheries, and the New Zealand Big Game Fishing Council purchases and distributes tags to fishing clubs and anglers at cost. Tags are supplied free of charge to commercial fishers who express an interest in tagging gamefish. Collection of tag report cards has been greatly assisted by the fishing clubs, most of which keep accurate records of captures and insist that tag report cards are handed in at the completion of successful trips.

For the last 11 years striped marlin, mako shark, blue shark, and yellowtail kingfish have been the focus of the programme. These species were selected during a review of the programme in 1992 on the basis that either there was potential to tag substantial numbers of fish and make sufficient recaptures to provide useful data, and/or they were species of national or international significance or concern. These criteria are still valid.

In October 2000, fishers and stakeholder groups were consulted on the scope and objectives of the programme and the resulting Gamefish Tagging Policy (Holdsworth & Saul 2003) was circulated to clubs and organisations. It was recommended that tagging of striped marlin, mako shark, blue shark, and kingfish continue, and that a trial to test angler willingness to tag and release yellowfin tuna be instigated. Objectives included increasing knowledge of the nature and range of migration of striped marlin and mako and blue sharks tagged in the southwest Pacific, and improving knowledge of kingfish growth and movement.

2. METHODS

The tags used in this programme have all used printed yellow streamers with a stainless steel dart anchor. Between 1975 and 1984, Floy FH-69 billfish tags supplied by the US National Marine Fisheries Service (NMFS) were issued with the prefix H before the tag number. During 1985, 1000 modified Floy tags were issued (model FH-69A, prefix G). Since 1986, the Hallprint billfish tags have been used (G series continued). All three tag types have stainless steel tag heads capable of being implanted with the same slotted stainless steel applicator. During 1995 and 1996 a number of striped marlin were recaptured with the tag head and a short section of the Hallprint plastic streamer, but no readable information. These tags could be identified as G series but had broken below the tag number. A modified Hallprint tag with stainless wire extending the full length of the tag was issued from December 1996 onward. The new tag type started with serial number G 53501.

Three thousand tags were purchased by the NZBGFC in October 2003, and because stocks were getting low a further 4000 were purchased in March 2004 for the 2004–05 season. The process of tagging gamefish has been described by Saul & Holdsworth (1992). Numbered tag report cards are issued with each tag. They collect vital information on the species, date, location, and size of the fish tagged. More recent tag cards have included a space for latitude and longitude of release, the skipper's phone number, and tick boxes for capture method and whether the hook was removed before release.

The individually numbered tags are printed with the address of the Ministry of Fisheries Auckland office and the words "Please measure or weigh – Reward". Tag cards and recapture reports are passed on to the

contractor for entry into the database. The fisher reporting a recaptured fish is sent a printed polo shirt as a reward along with a letter describing the release date and location, growth, movement, and time at liberty of the fish. A copy of that letter is also sent to the skipper and angler who tagged the fish.

Data presented in this report are variously summarised by species and season, month, and area. This year the fish tagged by season and species have been summarised separately for fish tagged inside New Zealand fisheries waters (Table 1) and fish tagged outside New Zealand fisheries waters (Table 2). New Zealand gamefish clubs have always used an austral fishing season starting on 1 July through to 30 June the following year. The tagging database and this report also use this definition of fishing season.

Large, lively fish are not easy to weigh and many are not removed from the water during tag and release. Therefore, weights are estimated by skipper or crew in most cases. Estimated weights have been summarised by 10 kg weight class rounded down as in previous NIWA gamefish tagging reports (Hartill & Davies 1999, 2000, 2001). For example, the 10 kg weight class includes fish from 10 to 19 kg.

More than half of the kingfish tagged are measured (fork length) by anglers before release. These data are more accurate records of the size of fish than estimated weights. The size distribution of tagged kingfish has been summarised by 5 cm length classes; lengths are rounded down. For kingfish records where the length was not measured, the estimated weight was converted to length using the following formula derived from the length weight relationship of Walsh et al. (2003), where length is in centimetres and weight is in grams:

$$\text{Length} = 3.3154 \text{Weight}^{0.3621}$$

Distances moved are expressed as minimum possible travel distances in nautical miles. Where straight lines between release and recapture positions cross landmasses, the shortest distance by sea was calculated.

3. RESULTS

3.1 Striped marlin

The number of striped marlin reported as tagged and released in the 2003–04 season was 993 inside New Zealand fisheries waters, which is an increase over the previous season (2002–03, 671) and slightly below the average of the previous 10 years (1005) (see Table 1). A further 544 striped marlin were reported as landed in gamefish club records (Roz Nelson, N.Z. Big Game Fishing Council, pers. comm.) It is estimated that 65% of recreationally caught striped marlin were tagged and released in 2003–04, up slightly from the previous season (60%). The number of striped marlin landed by fishers and not recorded in 2002–03 is not known. Several hundred striped marlin were tagged by a New Zealand recreational vessel on the Wanganella Bank, outside New Zealand fisheries waters, but not all the tag cards were available when summary tables were produced for this report (Table 2).

The monthly totals of striped marlin tagged over the last three seasons are shown in Figure 2a. More marlin were tagged in January in 2003–04 than in the previous two seasons. Catch normally peaks in March and tails off in May and June as the water cools. This season the first striped marlin caught by a recreational fisher in New Zealand waters was taken on 4 January 2004 by Ian Mason fishing out of Tutukaka (Roz Nelson, NZBGFC pers. comm.).

A summary of marlin tagged within Ministry of Fisheries statistical areas (Figure 2b) shows most striped marlin were tagged in areas 002 and 003 off East Northland and areas 047 and 048 near the Three Kings Islands. This season, 83% of all striped marlin tagged were released in these four areas. The Bay of Plenty

from Coromandel Peninsula to Cape Runaway accounted for 9% of striped marlin, with most of the remaining tag reports coming from the west coast of the North Island, between Manukau and Taranaki (Figure 2b).

Striped marlin release weights by 10 kg weight class for the last four seasons show more 70 and 80 kg fish tagged in 2003–04 than in other years, with a mode at 80 kg (Figure 3). In the two preceding seasons the mode was in the 90 kg size class (Figure 3). NZBGFC affiliated clubs have applied a voluntary minimum size of 90 kg for marlin since 1988. Landed fish under this weight are recorded, but not recognised by clubs for contests or trophies. The proportion of striped marlin tagged and released that were estimated as 90 kg or larger was 74% in 2001–02, 68% in 2002–03, and 66% in 2003–04.

Four tagged striped marlin were recaptured during 2003–04. Two striped marlin tagged near North Cape in April 2003 were caught by tuna longliners and reported. The first was recaptured on 13 July 2003, 80 nautical miles south of Tahiti. This fish was estimated at 80 kg on both release and recapture and had travelled a *minimum distance of 1550 nautical miles in 95 days at liberty*. The second striped marlin was recaptured on 18 September 2003 in the mid Tasman Sea (28° 20' S 159° 19' E). This fish was estimated at 80 kg on release and measured 188 cm eye-fork length (about 85 kg) on recapture. It had been at liberty for 149 days and was caught 810 nautical miles from where it was released.

A New Zealand tuna longline vessel caught a tagged striped marlin 54 nautical miles northeast of Cape Brett on 12 March 2004. Unfortunately, the tag card had not been received for this fish at the time of writing. The tag (number G 74295) was issued to the Mercury Bay Ocean Sports Club and was in new condition on recapture, so the fish was almost certainly tagged earlier in 2004. It is hoped that this tag will be able to be traced.

The fourth striped marlin recaptured this season was caught by recreational angler Mitchell Durie on the charter vessel *Pursuit* at the Middlesex Bank, Three Kings, on 7 April 2004. This fish had been tagged 31 days earlier by Wayne Unkovich after 40 minutes on the line at the King Bank. The fish was described as quite lean and estimated at 90 kg on release. It weighed 93 kg on recapture and had travelled a minimum distance of 27 nautical miles. There was a relatively large clump of gooseneck barnacles growing on the middle of the tag with a smaller amount near the trailing end. The tag wound had not healed well and the skipper was not sure if the tag would have stayed in place much longer.

Most striped marlin recaptures in New Zealand fisheries waters have been made within 2 months of release and show movement north, south, and offshore from the east coast of Northland (Figure 4). Two fish have been recaptured the following season (329 days and 375 days) relatively close their release points, and two fish have moved between the east and west coasts within a season (Figure 4).

Long-distance recaptures for striped marlin on the programme show a wide spread of locations across the southwest Pacific and Tasman Sea (see Figure 2c). Fish tagged in the same season, even in the same month and area, can travel to different regions of the southwest Pacific when they leave New Zealand.

About a quarter of striped marlin recaptures have been made within 20 nautical miles of their release points up to 10 weeks after release (see Figure 2d). There is also a cluster of eight recaptures with displacement of around 1000 nautical miles between 5 and 10 weeks after release. Some fish have travelled further (up to 3250 nautical miles), and two fish have been recaptured back in New Zealand waters after a year (see Figure 2d). Overall the recapture rate is 0.5 % (see Table 3) and most striped marlin (84%) have been recaptured within 5 months of release.

3.2 Mako shark

The number of mako sharks tagged in New Zealand fisheries waters during the 2003–04 season was 169, down significantly (-75%) from the average number of makos tagged for the 10 previous seasons, but up slightly on the number tagged in 2002–03 (155) (see Table 1). According to NZBGFC records, the proportion of mako sharks caught that were tagged by gamefish club members in 2002–03 was 68%. The number of makos released without being tagged is unknown.

Generally, makos are not a target species in northern New Zealand but are caught as a bycatch in areas fished for billfish or tuna. Most makos tagged in 2003–04 were caught in waters off the North Island from New Plymouth on the west coast around to Whakatane on the east coast (Figure 5). Of the 169 mako sharks tagged and released, 50% were tagged off east Northland and the Three Kings area, 18% off Coromandel/Bay of Plenty, and 25% off the west coast of the North Island (Figure 5).

Most makos were tagged between January and July 2001–02 with a seasonal mode in February (Figure 6a). There were generally fewer fish in all months in 2002–03, but releases follow a similar seasonal pattern. In 2003–04 more makos were tagged in January than other months, unlike the previous two seasons which showed a strong mode of releases in February (Figure 6a).

The size distribution of makos tagged in 2003–04 shows a broad spread of estimated sizes from 10 kg to 100 kg with a mode at 30 kg (Figure 6b). A higher proportion of small makos (less than 30 kg) were tagged than in the previous season.

The distribution of mako shark recaptures plotted as distance travelled against days at liberty shows clusters of recaptures close to the release points in the first few months, then again after about one year, and again after two years (Figure 6d). There is also a band of recaptures between 800 and 1250 nautical miles for fish at liberty from 36 days to 5 years or more. Most of the points in this band represent movement into the subtropics and reports to tuna longline vessels based in Fiji, and other Pacific island nations. However, 16% (11 of the 67) are fish that were caught in temperate Australian waters (south of 30° S).

There were nine tagged mako recaptures reported in 2003–04, the same number as in 2002–03, but down on previous seasons (Table 3). Time at liberty for these fish ranged from 11 to 1122 days and three were recaptured outside the New Zealand economic zone (Figure 6c). All were caught north of New Zealand: one recaptured in September had moved a minimum distance of 500 nautical miles in 237 days; the second was recaptured in October, 1330 nautical miles from its release point after 591 days; and the third was recaptured east of Iles Loyaute, New Caledonia, in September. No tag release card has so far been returned for the latter fish, although the tag was issued to, and probably used by, a New Plymouth Sportfishing and Underwater Club member.

A 140 kg mako tagged at Mayor Island, Bay of Plenty, by the crew on the vessel *Ubique* three years ago was recaptured this season by a recreational fisher northwest of White Island, Bay of Plenty. It weighed 164.2 kg and was caught just 30 nautical miles from its release point. Overall, the recapture rate for mako sharks on the programme is 2.8% (Table 3).

3.3 Blue shark

There were 105 blue sharks tagged in New Zealand fisheries waters during the 2003–04 season, more than during the 2002–03 season (78) (see Table 1). The average for the previous 10 years for this species is 260 per season. Sixty-one blue sharks were tagged off Otago Heads, predominantly in February (Figures 7 and 8a).

As was the case in previous seasons, most blue sharks tagged in 2003–04 were estimated at between 30 and 50 kg (Figure 8b).

The distribution of tagged blue shark recaptures plotted as distance travelled against days at liberty shows a group of 12 recaptures close to their release points in the first month after release, then another group of 5 recaptures close to the release points after one year (Figure 8d). As with mako sharks, there is also a band of recaptures between 1200 and 1800 nautical miles for fish at liberty from 3 months to 3 years. One-third of blue shark recaptures have been recorded from outside New Zealand waters. In some aspects, the recapture locations are similar to those reported for striped marlin and mako sharks – Australia, New Caledonia, Fiji, Tonga, French Polynesia (Figure 8c) – but there have also been two other more extensive movements. One shark travelled to the Indian Ocean (40° 21' S, 109° 20' E), a minimum travel distance of 3100 nautical miles from Tutukaka, east Northland in 206 days and the other travelled 4630 nautical miles east, almost to Chile (31°16' S 85°10' W) in 624 days.

In the 2003–04 fishing season two blue shark recaptures were reported. A fish tagged in Pegasus Bay, Canterbury, on 26 February 2004 was recaptured 28 days later by a tuna longliner in Hawke Bay. The second blue shark, tagged at Otago Heads in February 2003, was reported by a Japanese tuna longline vessel fishing in the south Tasman Sea in June 2004 (472 days at liberty). Overall, the recapture rate for blue sharks on the programme is 1.7% (Table 3).

3.4 Kingfish

The number of kingfish tagged and released in New Zealand fisheries waters during 2003–04 was 759, 7% higher than the mean number tagged in the previous 10 seasons and 113 more than last season (see Table 1). Most kingfish are tagged over summer and autumn. In 2003–04, tagging numbers were low over winter, high in January, then peaked again in May (Figure 9a). This season, kingfish were tagged mainly in the waters off the Three Kings Islands (35%); east Northland (13%); Coromandel/Bay of Plenty (31%); and the west coast of the North Island (19%) (Figure 9b). There were more kingfish tagged and recaptured around the Three Kings and off the west coast out of Raglan Harbour, where a few keen fishers tagged and measured most of the fish in statistical area 42.

Sixty percent of kingfish were measured on release in 2003–04, the same percentage as last season. Kingfish size distribution is therefore presented as length frequency. Where length at release was not supplied by anglers, it was calculated from the estimated weight, as described in the methods section.

The size of kingfish tagged ranged from 48 to 150 cm, with most fish between 70 and 120 cm (Figure 9c). The length mode for measured fish was in the 100 cm size class, while the combined length mode (measured and estimated) was in the 95 cm size class. Anglers have been asked not to use gamefish tags on kingfish less than 65 cm fork length, which was the minimum legal size. In January 2004, a new kingfish minimum legal size of 75 cm was introduced for recreational fishers.

In the 2003–04 season 32 kingfish recaptures were reported (Table 3). Time at liberty ranged from 1 to 2118 days (5 years 10 months).

Four of the recaptured kingfish were tagged at Gannet Island, west coast of the North Island. Two of these were recaptured in the same area 3 weeks later, while the third moved 55 nautical miles south to Waitara in 33 days and the fourth moved 95 nautical miles north in 62 days (Figure 9d).

There were seven kingfish tagged at White Island, Bay of Plenty, and recaptured around that island and associated reef systems this season. Time at liberty ranged from 11 to 1571 days for these fish. Very few

kingfish (4%) tagged at White Island are ever recaptured away from the island (Figure 10), and it is also very rare for a coastally tagged kingfish to be recaptured there. A 96 cm (13.5 kg) kingfish tagged at Cape Runaway in February 2002 was recaptured just north of White Island in April 2004 and measured 108 cm (15 kg).

Overall, 93% of kingfish recaptures have been reported within 50 nautical miles of their release points. A separate plot of distance against days at liberty for fish tagged in all areas excluding White Island (Figure 10) shows more dispersal for these fish and a greater number of fish moving more than 10 nautical miles (31%) than the White Island fish.

Last season a kingfish tagged at the Three Kings Islands was recaptured at Great Barrier Island. This season a Three Kings fish moved down the west coast and was caught by a Ukrainian trawler 25 nautical miles off Port Waikato. This fish had moved 225 nautical miles south in 660 days.

A 5 kg (estimate 75 cm) kingfish tagged at Cape Karikari in June 1998 was recaptured 10 nautical miles away in March 2004. It had been at liberty for 2118 days (5 years 9 months) and measured 115 cm (estimate 23 kg). This represents an average growth rate of about 7 cm per year over this time.

Overall, the recapture rate for kingfish is 8.4% for this programme (Table 3).

3.5 Yellowfin tuna

There were more yellowfin available to recreational fishers in New Zealand fisheries waters during 2003–04 compared with the previous season, resulting in 177 being tagged, up from 76 in 2002–03. Most were estimated to be 10–25 kg on release (Figure 11a). The main areas where yellowfin were tagged was the Three Kings, east Northland, and the Bay of Plenty (Figure 11b). Gamefish clubs reported landing and weighing 831 yellowfin in 2003–04 plus 153 tagged (Roz Nelson, NZBGFC, pers. comm.) giving a 16% tagging rate. Undoubtedly, some yellowfin would have been taken by non-club members or not recorded, but these numbers are unknown.

There were two yellowfin recaptures reported in 2003–04. One was tagged and released in January 2000 near the Poor Knights Islands and recaptured in May 2000 by a tuna longliner off Cape Reinga. Details on this recapture are poor and the tag was not returned until 4 years later when a tagged mako was caught and reported from the same vessel. The second yellowfin reported this year was an 18 kg fish recaptured in the mid Tasman Sea by a tuna longline vessel in October 2003. This fish had been tagged and released in February 2003 at North Cape. Therefore, it had moved a minimum distance of 567 nautical miles northwest in 237 days. Five yellowfin have been recaptured outside New Zealand fisheries waters and three of these have been caught in the mid Tasman Sea (Figure 11 c). Overall, the recapture rate for yellowfin tuna is 0.9% for this programme (Table 3).

3.6 Other billfish

Compared with the earlier years of the programme, blue marlin have been tagged in greater numbers over the last three seasons, mainly by anglers in the Kingdom of Tonga (see Tables 1 and 2). Of the 72 blue marlin tagged in the 2002–03 season, 8 were tagged in New Zealand between January and May (Figure 12a), 47 in Tongan waters, and 17 by New Zealand recreational vessels fishing around other Pacific Island nations. Most blue marlin were tagged between July and October in the Pacific Islands (Figure 12a). The fish tagged in Tonga were generally estimated at 150 kg or less, while in New Zealand they were estimated at 150 kg or more in 2003–04 (Figure 12b).

The overall recapture rate of blue marlin is now 0.9% for this programme (Table 3).

Broadbill swordfish have been tagged in modest numbers by recreational anglers and commercial fishers for some years. The release locations for all seasons combined are mainly off the northeast coast of the North Island, from the banks north of the Three Kings Islands to East Cape (Figure 12c). The size of swordfish tagged range mostly between 5 kg and 120 kg with a mode at 20–30 kg (Figure 12d).

A swordfish estimated at 90 kg and measuring 1650 cm from the lower jaw to the tail fork was recaptured in June 2004 by a tuna longliner off Gisborne. This fish had been tagged by a commercial fisher 80 nautical miles northeast of East Cape in February 1996 and was estimated at 20 kg at the time. Therefore, this fish had been at liberty for 3047 days (8 years 4 months) and was recaptured 113 nautical miles from its release point and grew an estimated 70 kg during this time.

The growth rate for this fish is slower than that reported for the only other swordfish recapture for the programme to date. This fish was recaptured in February 2002 by an Australian longliner near the Wanganella Bank and had been tagged from a Japanese longline vessel north of New Zealand. It was estimated to weigh 12 kg on release and 160 kg on recapture 10 years and 8 months later (Holdsworth & Saul 2003). The overall recapture rate of swordfish is now 1.8% for this programme (Table 3).

3.7 General

Overall, 5656 tags were issued to clubs and individuals by the NZBGFC in the 2003–04 season. The number of tags issued and number used in each region in 2003–04 is given in Figure 13. The selection of regions is based on the commonly fished gamefish areas. The percentage of tags used in 2003–04 shows that in some South Island regions tags issued in previous seasons have been used. To the end of July, 2419 tag report cards had been handed in for 2003–04. Despite requests in tagging newsletters and the NZBGFC newsletters, a few clubs and individuals handed tag cards in too late for inclusion in this report.

4. DISCUSSION

The 2003–04 season, was a good one for striped marlin, with over 1000 tagged and released – the highest tally for the last 5 years. NZBGFC records show that the tagging percentage has increased from 60% in 2002–03 to 65% this season. Also there were Four striped marlin reported recaptured in 2003–04, the most in a single season for the last 4 years. As this report was being finalised a significant number (300) of tag report cards for striped marlin tagged at the Wanganella Bank were received from the Ministry of Fisheries. These fish had been tagged between January and June from *Ultimate Lady*, a large privately owned vessel from New Zealand, and have not been included in the tables and figures in this report.

This year, there was a higher proportion of striped marlin in the 70 and 80 kg size class than in previous years. These smaller fish are probably entering the New Zealand recreational fishery for the first time and may represent a strong year class. It is unknown what proportion of one season's striped marlin return to New Zealand the following year. Some do, as two tagged striped marlin have been recaptured close to their release points (5 and 35 nautical miles) the following year. However, a striped marlin tagged at Raglan in 1999 was recaptured off Byron Bay, Australia, in early January the following season. These results, although based on few fish, suggest that some but not all striped marlin may return to New Zealand annually. A strong year class in one season could flow on to following seasons.

Two long distance striped marlin recaptures in 2003–04, in the mid Tasman Sea and French Polynesia, show that fish tagged in the same location in the same month can head in quite different directions. Independent movement by tagged striped marlin has been observed in the results of this programme in previous seasons and also in the 2003 New Zealand Marine Research Foundation pop-up satellite tagging programme (T.J. Sippel et al., Blue Water Marine Research, unpublished results). The wide spread of recapture locations is not apparent for fish tagged in Australian fisheries waters. Movements have been largely north and south in the western Tasman and Coral Seas. As yet there is no report of an Australian tagged fish being recaptured in New Zealand. There have been three New Zealand tagged striped marlin caught in Australian coastal waters.

Australian anglers have been tagging marlin since 1973 as part of cooperative programme with the New South Wales Fisheries Service. Over 8000 striped marlin have been tagged, with 71 recaptures reported by 2001 (Ortiz et al. 2003). Over 20 000 striped marlin have been tagged and released since 1963 as part of the National Marine Fisheries Service cooperative tagging programme run by the Southwest Fisheries Science Center in the USA. Most of these marlin are tagged in the northeastern Pacific, mainly by recreational fishers in California, Hawaii, and Mexico. Long-distance recaptures of striped marlin tagged in Mexico do show some seasonal offshore movement and movement into waters off southern California. Striped marlin tagged in southern California return south, but also have been recaptured in the north Pacific, around the Hawaiian Islands, and three fish have crossed the equator into the southeastern Pacific Ocean (Ortiz et al. 2003). Some marlin are tagged and released by anglers in the island nations of the tropical South Pacific, but generally they use tags from Australian or New Zealand programmes. There are also tags available from The Billfish Foundation (TBF) located in Florida, USA, who run a worldwide billfish tagging and research programme.

It was encouraging to receive a report of a striped marlin from a New Zealand tuna longline vessel this season and ironic that the recreational angler who tagged this fish did not hand in the tag card or may have used the wrong card for the appropriate tag. Missing tag cards are more of a problem with recaptured mako sharks, and generally recreational reporting of marlin tag and release in New Zealand is good. Gamefish clubs require members to produce completed tag cards for their catch records, but inevitably (and unfortunately) some cards are either not filled in, or go astray.

The number of mako sharks tagged and released this season remained near the historical low (155) of last season. Over 1500 makos were tagged and released in 1994–95 season and the mean of the 10 seasons before 2003–04 was 672 makos. The number of recaptures is also low, probably as a result of fewer fish being tagged and released. Because of two very poor years of mako abundance, it is therefore recommended that the Ministry investigate other indicators of a decline in mako shark abundance. The catch of mako sharks on surface longlines has been increasing (Ayers et al. 2004) and there is some concern among recreational fishers regarding the sustainability of mako stocks in New Zealand waters.

Recreational fishers do not always hand in tag report cards for mako sharks. This season three of the nine recaptures had no release information. Over the last 10 years about 10% of mako recaptures have no matching tag cards.

The number of blue sharks tagged increased slightly in 2003–04 over the previous season. The number tagged can often depend on the fishing conditions off Otago Heads during February, when blue sharks are targeted. Nearly 20% of blue sharks were tagged off the North Island in 2003–04, which is a marked change to the previous season when there were none tagged around the North Island. There were two blue shark recaptures in 2002–03, both inside New Zealand fisheries waters.

Most kingfish were tagged from three or four boats. In some cases, crew had been specifically supplied with tags and used measuring boards to measure fork length on release and recapture. Much of our best

information on kingfish growth has come from the White Island area where there is a resident population of large fish with a relatively high recapture rate. Rick Pollock, the skipper of the charter vessel *Pursuit*, has made a significant contribution to a number of kingfish research projects and stands out in his contribution to the tag and release programme. Almost a third of the 12 000 kingfish on the tagging database have come from his vessels and almost all have been measured. He has reported hundreds of recaptures, occasionally the same fish for the second or third time.

In May 2004, NIWA requested an extract of records of kingfish measured on release and recapture from the tagging database. A total of 356 records was available and each was given a reliability score determined by the method used to measure them. The highest reliability score was given to fish measured on a measuring board on release and recapture by Rick Pollock, Bert Lee of Tolaga Bay, or by MAF science staff. Over one-third (35%) were in this category. The results of estimating kingfish growth from tagging, along with those derived from an ageing study will be contained in a latter report (J. McKenzie et al., NIWA).

The gamefish tagging policy, developed with stakeholder and MFish input, places the emphasis on tagging and measuring large kingfish (100 cm or more) to collect data on growth and movement of these fish. Since the 2000–01 season, 50% of kingfish have been measured or estimated at 100 cm or more on release and a further 20% are in the 90–99 cm size class.

The second long-term recapture of a swordfish from just 113 releases, spread over a number of years, suggests that some good growth and movement data could be collected if significant numbers of small swordfish were measured, tagged, and released. Female swordfish grow much larger and presumably faster than males. The apparent difference in growth rates of the two fish so far recaptured on the programme (8.4 kg per year vs 14 kg per year) suggests recording the sex of fish on recapture would be highly desirable.

5. ACKNOWLEDGMENTS

Thanks to all those who participated in this programme by releasing or reporting tagged fish. The N.Z. Big Game Fishing Council and all affiliated clubs are thanked for their cooperation and the purchase and distribution of tags. The Ministry of Fisheries provided funding for this project, "Management of data from the gamefish tag recapture programme" PEL2003/01.

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Table 1: Number of fish tagged and released by species, and season, and the mean number of releases for the 10 seasons previous to 2003–04, for fish in the tagged inside the New Zealand EEZ only.

Season	BEM	BKM	BWS	KIN	MAK	SHA	SAI	SSF	STM	SWO	YFN	OSP	Total
1974–75			1		9								10
1975–76				1	17	2			3		1		24
1976–77			1	1	34				2				38
1977–78				15	58				7				80
1978–79			1	107	152	1			18			5	284
1979–80			26	22	129	3			17				197
1980–81		1	7	7	116	2			2			7	142
1981–82			99	30	185	3			11			17	345
1982–83			18	55	151	4			6		2	11	247
1983–84			15	54	220	7			9		6	9	320
1984–85			10	143	98	4					25	2	282
1985–86			23	318	211	1			2		6	4	565
1986–87			12	365	177	31			2		5	18	610
1987–88	1	1	91	689	505	47			97	6	13	82	1 532
1988–89	1		122	371	370	32			371	4	63	116	1 450
1989–90	1	2	87	427	424	26		2	365	4	139	100	1 577
1990–91			90	528	417	32		7	229	5	24	51	1 383
1991–92	1	1	128	389	353	40		1	239	20	39	38	1 249
1992–93	1		64	692	352	24		8	383	36	10	75	1 645
1993–94	10		162	1 100	666	19		17	928	3	92	38	3 035
1994–95	4		175	1 443	1 529	23		29	1 202	10	200	24	4 639
1995–96	7	3	163	643	1 158	30		13	1 102	3	110	5	3 237
1996–97	6	5	343	416	920	36		5	1 301	4	33	9	3 078
1997–98	8	1	724	364	518	54		1	895		3	4	2 572
1998–99	36	1	276	311	754	40		6	1 541	2	17	8	2 992
1999–00	51	2	314	818	398	56		2	787	2	27	40	2 497
2000–01	34		203	606	277	72		1	851	6	17	4	2 071
2001–02	21	2	163	775	346	69		13	768	3	7	3	2 170
2002–03	3	1	78	646	155	54		14	671	3	76	2	1 703
2003–04	8		105	759	169	61		6	993	2	177	6	2 286
Total	193	20	3 501	12 095	10 868	773	0	125	1 2802	113	1 092	678	42 260
Previous 10 year Mean	18	2	260	712	672	45		10	1 005	4	58	14	2 799

BEM blue marlin
 BKM black marlin
 BWS blue shark
 KIN kingfish
 MAK mako shark
 SHA other shark species

SAI sailfish
 SSF shortbill spearfish
 STM striped marlin
 SWO broadbill swordfish
 YFN yellowfin tuna
 OSP all other species

Table 2: Number of fish tagged and released by species and season, in the New Zealand gamefish tagging database, for fish caught outside the New Zealand EEZ.

Season	BEM	BKM	BWS	KIN	MAK	SHA	SAI	SSF	STM	SWO	YFN	OSP	Total
1974-75													0
1975-76													0
1976-77													0
1977-78													0
1978-79													0
1979-80													0
1980-81													0
1981-82													0
1982-83													0
1983-84													0
1984-85													0
1985-86											2	2	4
1986-87											2	4	6
1987-88													0
1988-89													0
1989-90	6	2						1			1		10
1990-91		2					4						6
1991-92	4	1							2				7
1992-93	10	1		1			5	1	3		3	5	29
1993-94	10	2			1		5		1		12	3	34
1994-95	25	4		1	2		9		4		15	4	64
1995-96	39	3					4	2	2			7	57
1996-97	20						4		1				25
1997-98	16	4					6		3				29
1998-99	7	1					2				2		12
1999-00	13	1					11	1	4				30
2000-01	37	1					8						46
2001-02	48	1					11		1				61
2002-03	57						15	2	6				80
2003-04	64	17		1			14	2	26		9		133
Total	356	40	0	3	3	0	98	9	53	0	46	25	633

BEM	blue marlin	SAI	sailfish
BKM	black marlin	SSF	shortbill spearfish
BWS	blue shark	STM	striped marlin
KIN	kingfish	SWO	broadbill swordfish
MAK	mako shark	YFN	yellowfin tuna
SHA	other shark species	OSP	all other species

Table 3: Number of fish recaptured by species and season. Total and recapture rate by species.

Season	BEM	BKM	BWS	KIN	MAK	SHA	SCH	STM	SWO	YFN	OSP	Total
1976-77				1	2							3
1977-78					3							3
1978-79				7	6							13
1979-80				3	3						1	7
1980-81				2	3							5
1981-82				2	8							10
1982-83			1	11	5							17
1983-84				9	1							10
1984-85				10	7							17
1985-86				56	10							66
1986-87				92	9	1	3					105
1987-88				77	8	-	1				3	89
1988-89			2	91	13	-	1	1			3	111
1989-90			-	45	10	2	4	2			-	63
1990-91			3	37	7	-	3	1		1	1	53
1991-92			3	31	12	1	-	-		-	3	50
1992-93			2	43	3	-	2	3		-	-	53
1993-94			1	54	10	1	4	4		1	-	75
1994-95			2	86	16	-	-	6		-	1	111
1995-96		1	1	71	32	-	1	6		3	1	116
1996-97		-	4	52	35	-	2	5		1	1	100
1997-98	1	-	9	26	17	-	2	12		1	1	69
1998-99	-	-	10	20	15	2	2	14		-	-	63
1999-00	1	-	11	57	23	1	4	5		1	2	104
2000-01	1	-	4	29	15	3	-	2		1	1	56
2001-02	-	-	3	48	16	1	-	2	1	-	-	71
2002-03	2	-	-	27	9	1	1	1	-	-	1	42
2003-04	-	-	2	32	9	1	1	4	1	1	-	52
Total recaptured	5	1	58	1 019	307	14	31	68	2	10	19	1 534
Releases	551	60	3 501	12 098	10 871	661	112	12 814	113	1 138	935	
Recapture rate (%)	0.9	1.7	1.7	8.4	2.8	2.1	27.7	0.5	1.8	0.9	2.0	

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

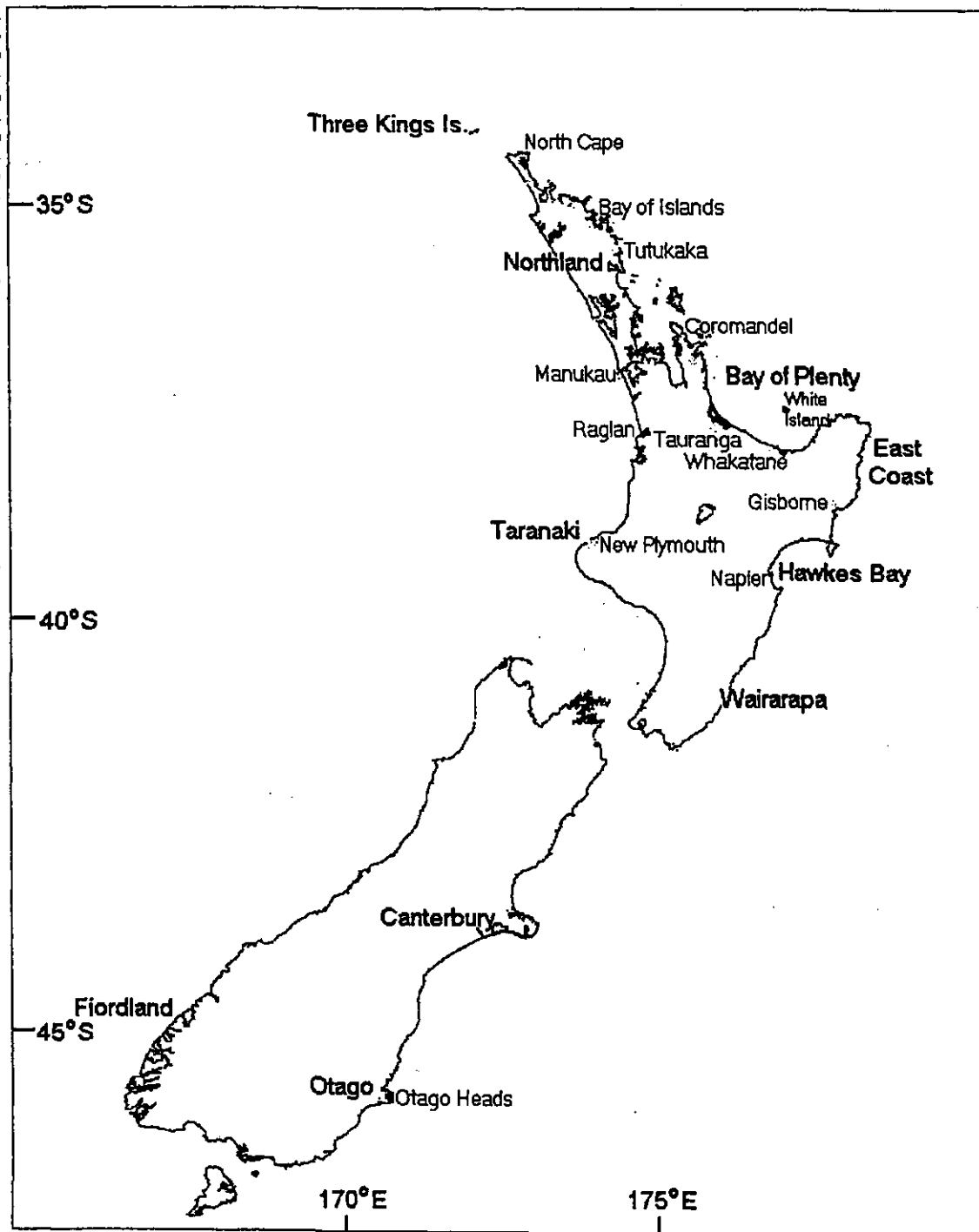


Figure 1: Location of the main areas of gamefish tagging in New Zealand.

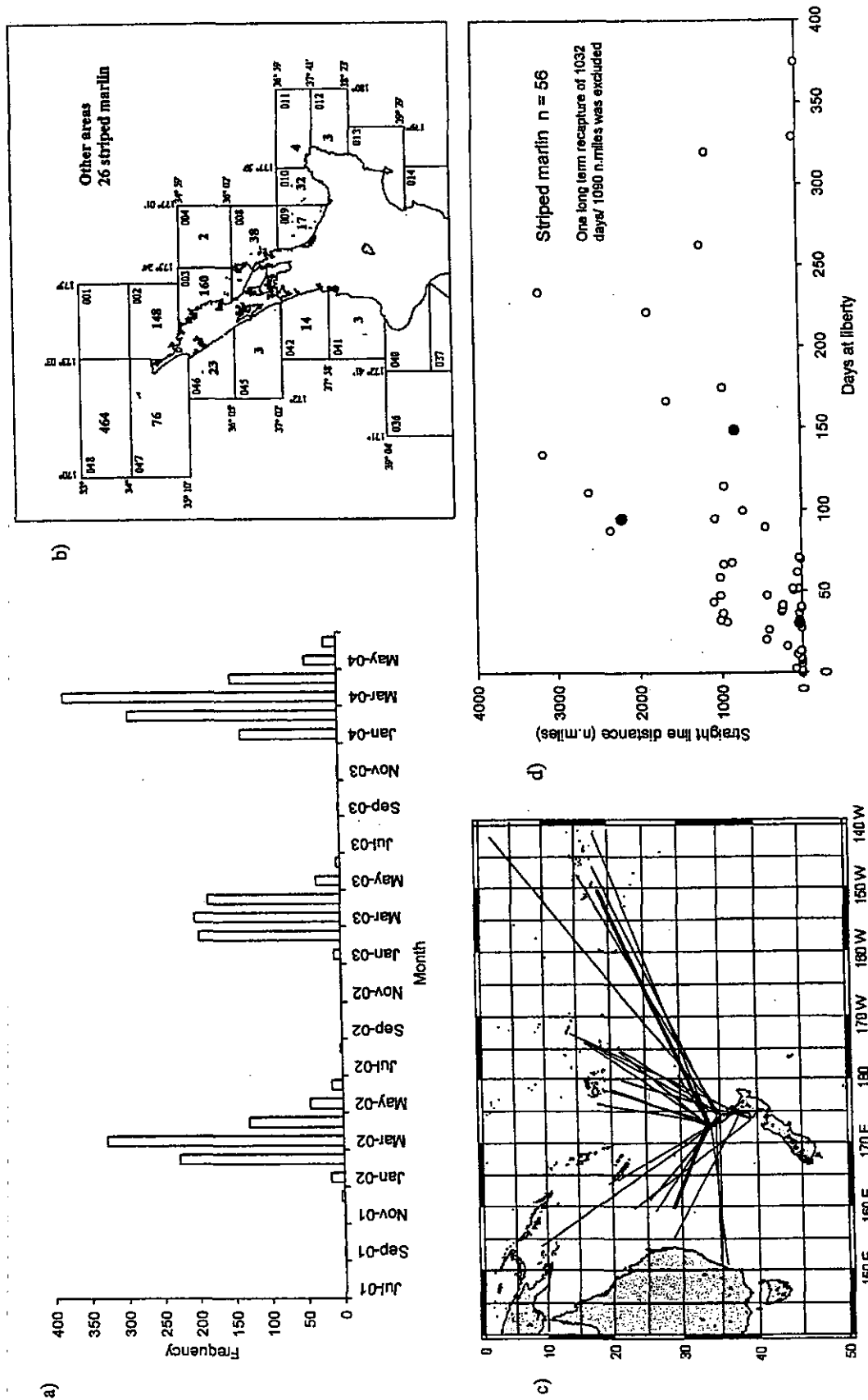


Figure 2: (a) Number of striped marlin released by month 2001-04; (b) Numbers of striped marlin released by statistical reporting area in 2003-04; (c) Long distance movements of tagged striped marlin, 2003-04 in bold; (d) Striped marlin days at liberty and straight-line distance travelled, solid markers for 2003-04.

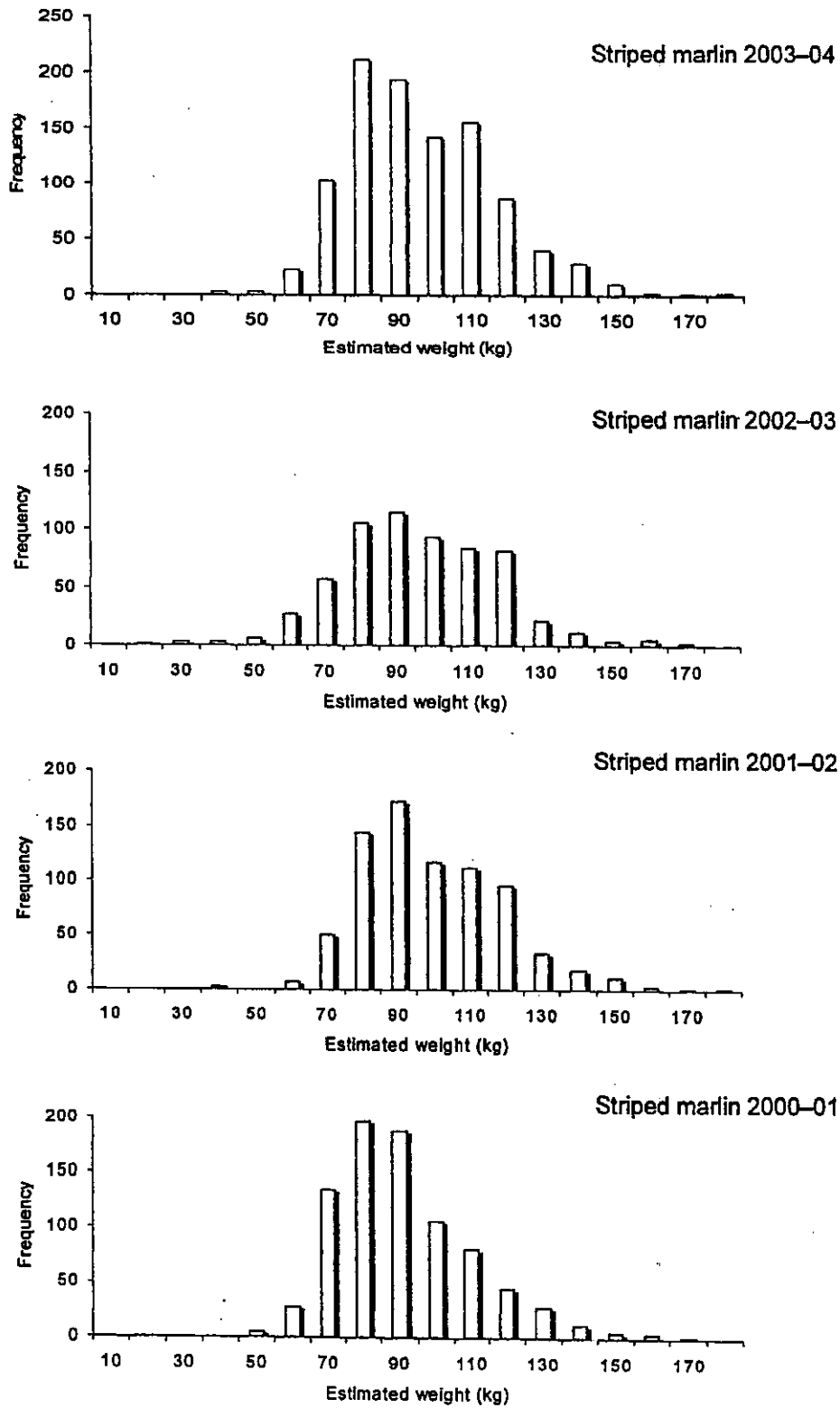


Figure 3: Striped marlin release weights by season, 2000-01 to 2003-04.

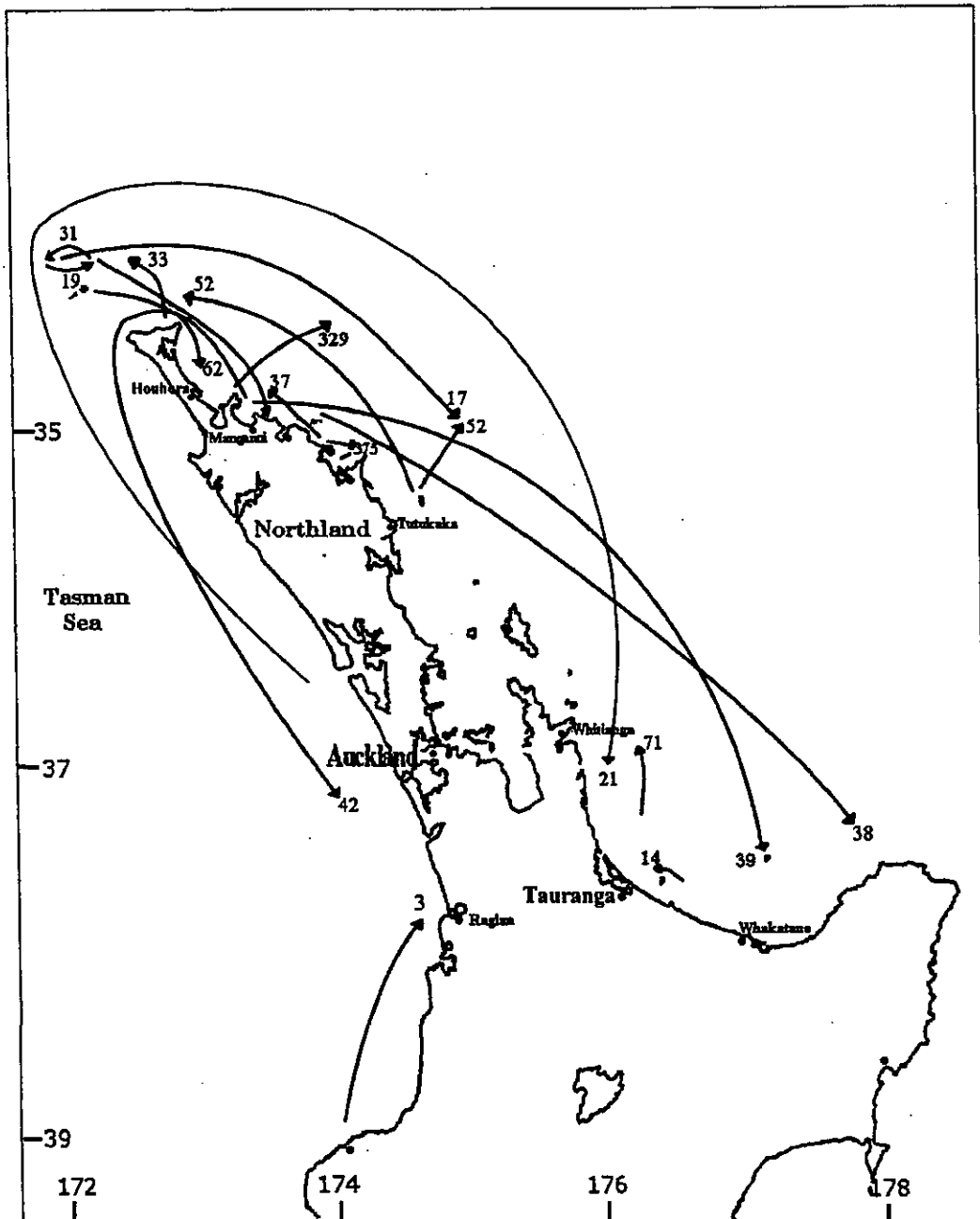


Figure 4: Striped marlin recaptures in New Zealand fisheries waters – all seasons combined. Number of days at liberty are given near recapture point.

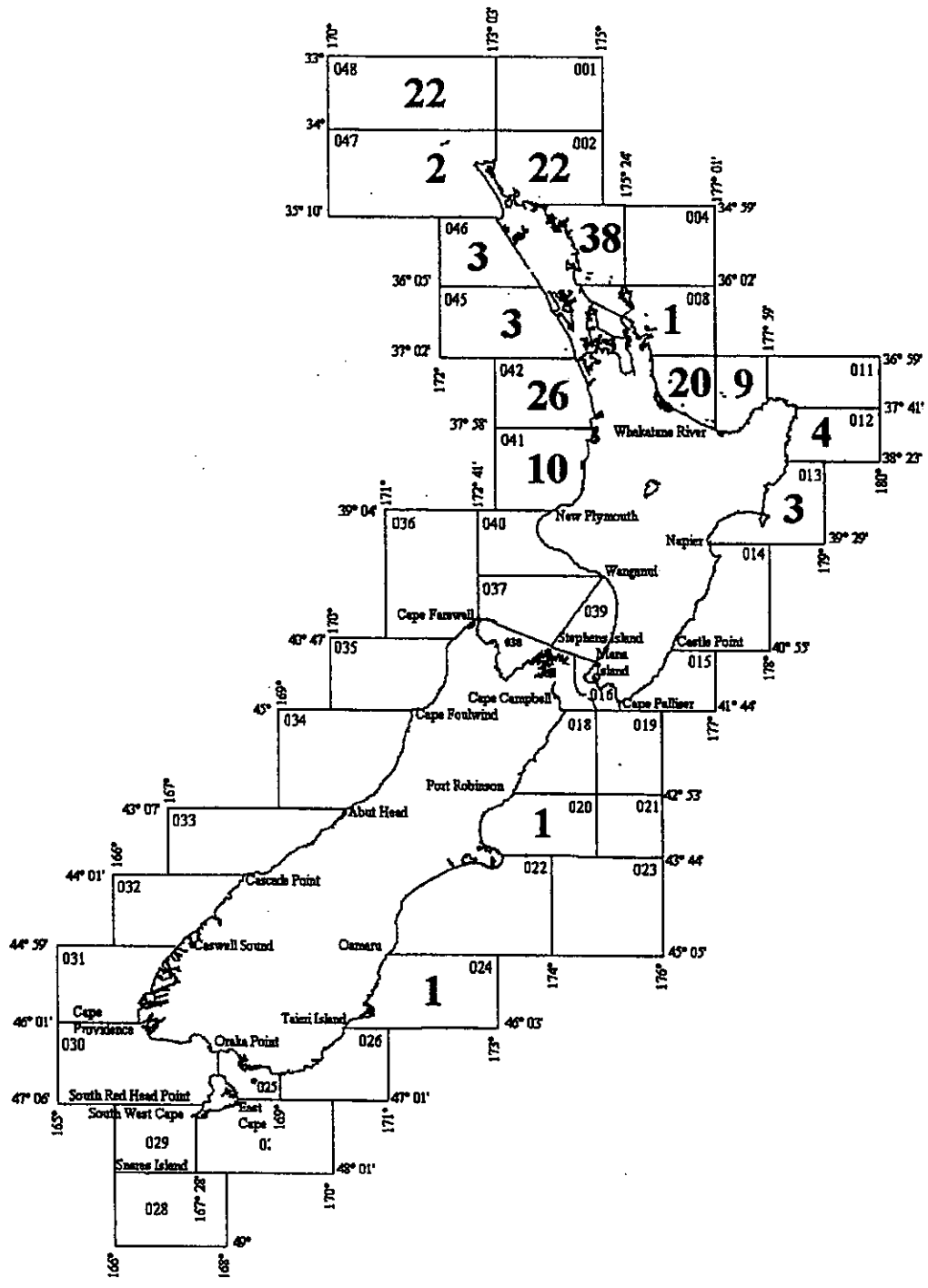
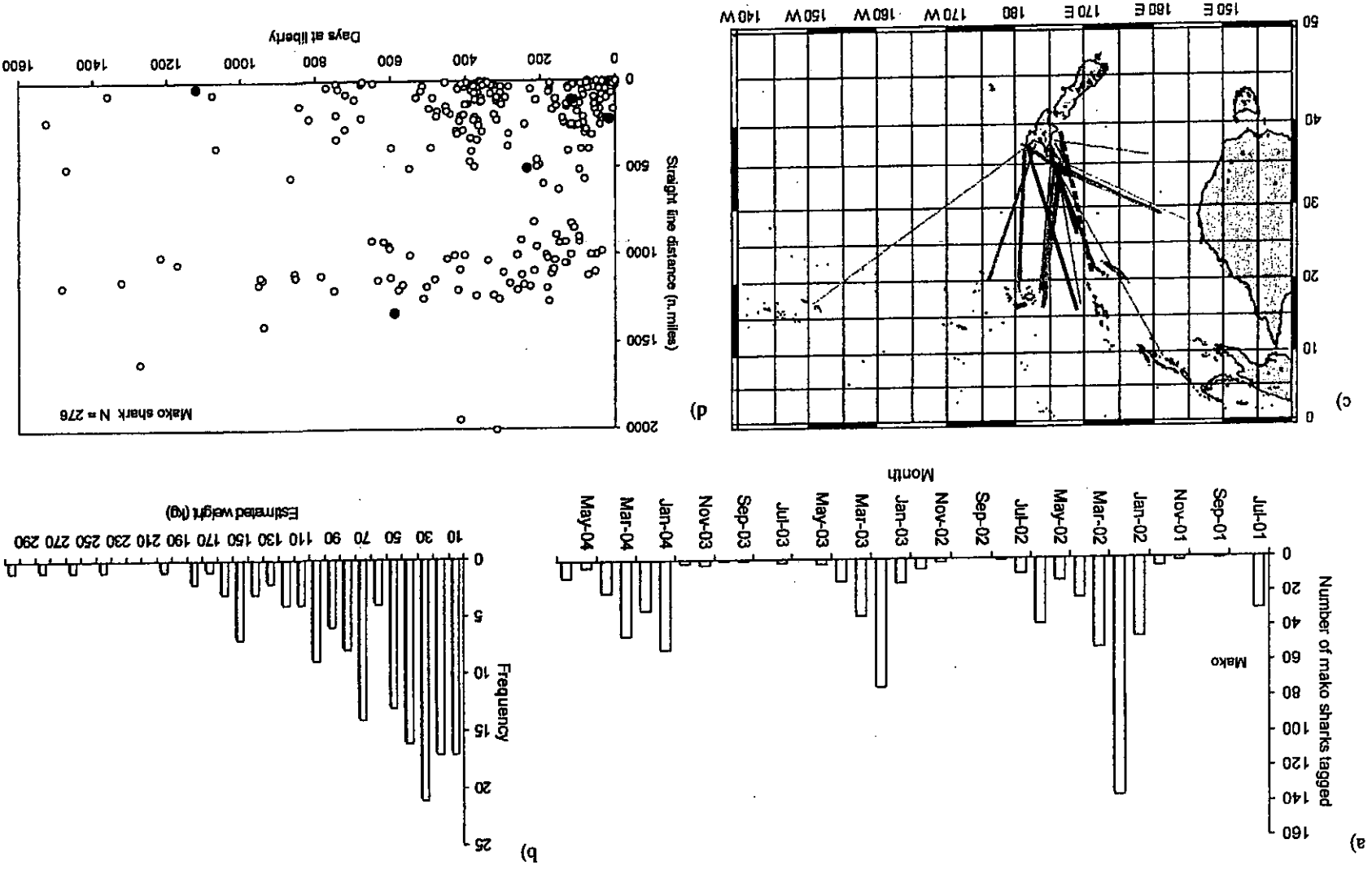


Figure 5: Mako sharks tagged and released by statistical reporting area in 2003–04

Figure 6: (a) Number of tagged mako sharks released by month, 2001-04; (b) Mako shark estimated release weight frequency, 2003-04; (c) Long distance movements of tagged mako sharks for 2001-02 and 2002-03 (grey) 2003-04 (black) 2003-04 with no release card (Black dashed line); (d) Mako shark days at liberty and distance travelled for all seasons with solid markers for 2003-04 (one long-term recapture of 4118 days and 190 nautical miles not plotted; one long distance recapture of 3000 nautical miles and 190 days not plotted).



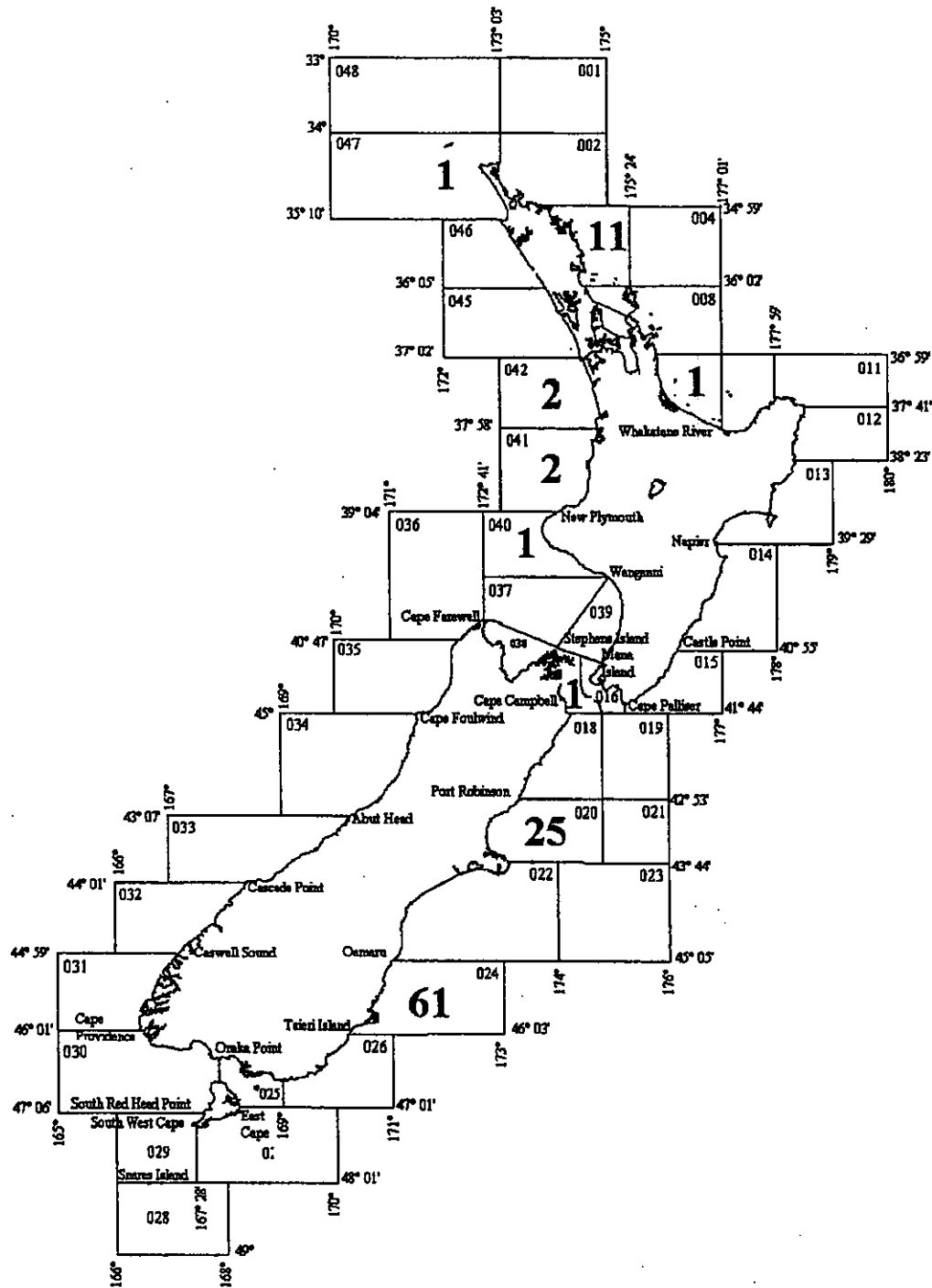


Figure 7: Blue sharks tagged and released by statistical reporting area in 2002-03.

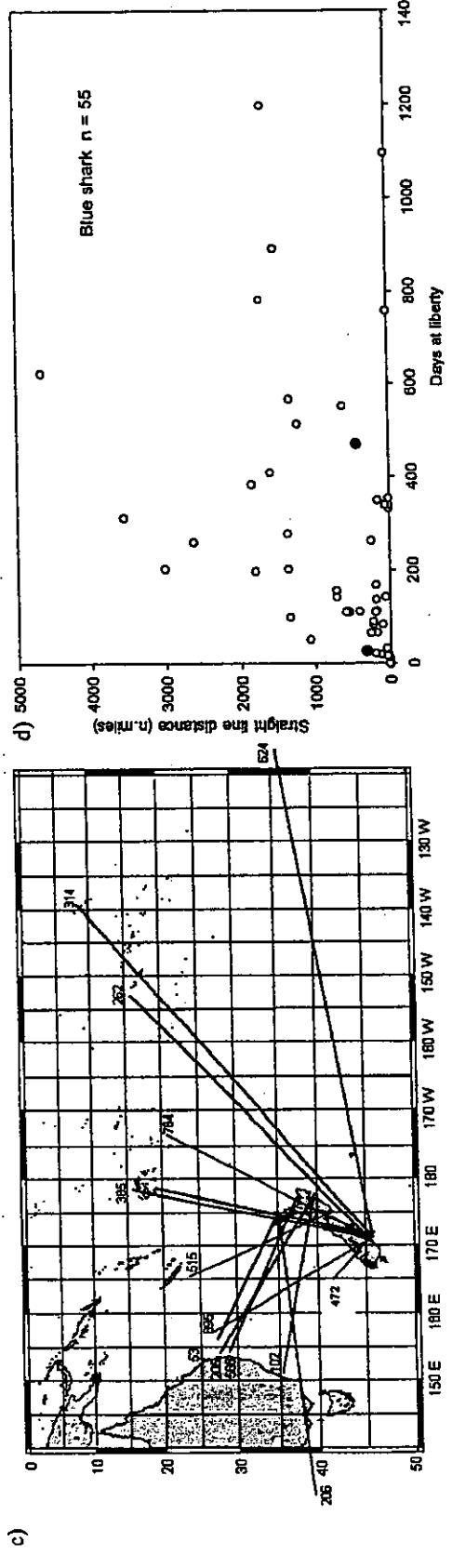
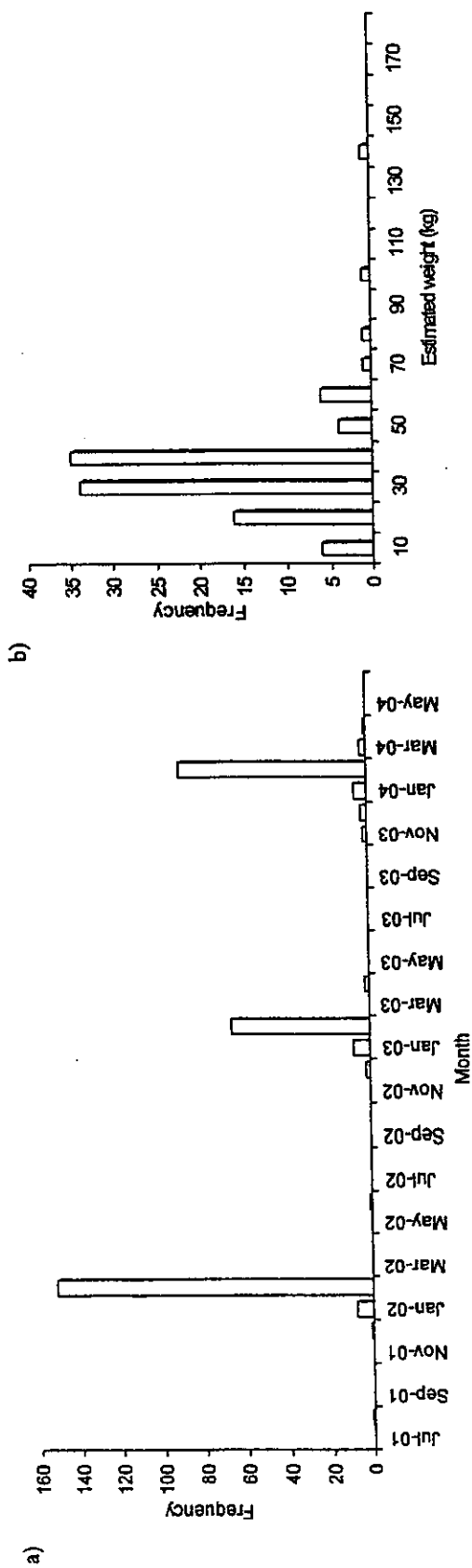


Figure 8: (a) Number of tagged blue sharks released by month 2001–04; (b) Blue shark estimated release weight frequency 2003–04; (c) Long distance movements of tagged blue sharks all seasons (days at liberty at recapture point); (d) Blue shark days at liberty and straight line distance travelled.

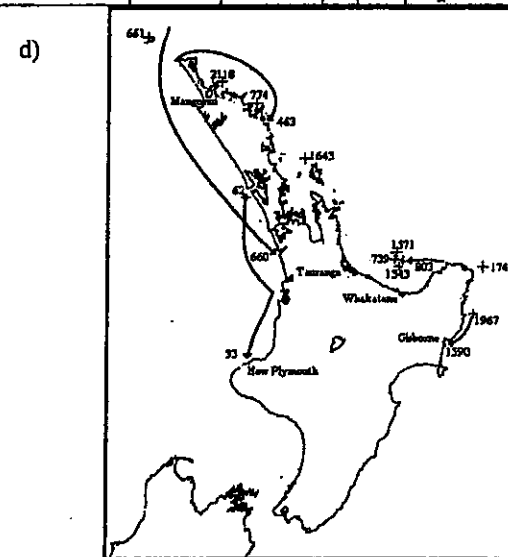
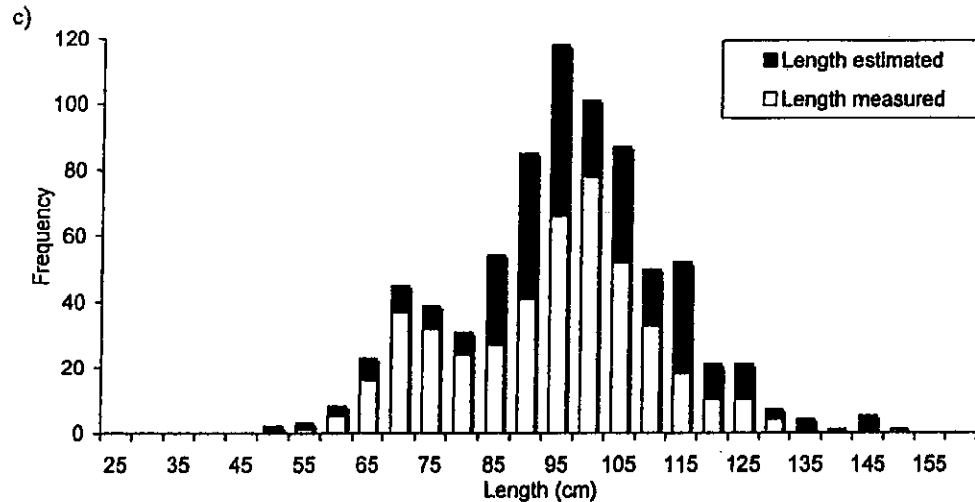
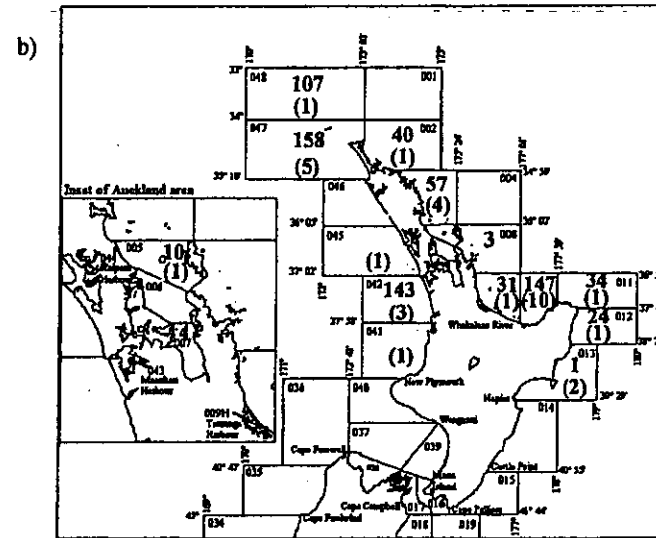
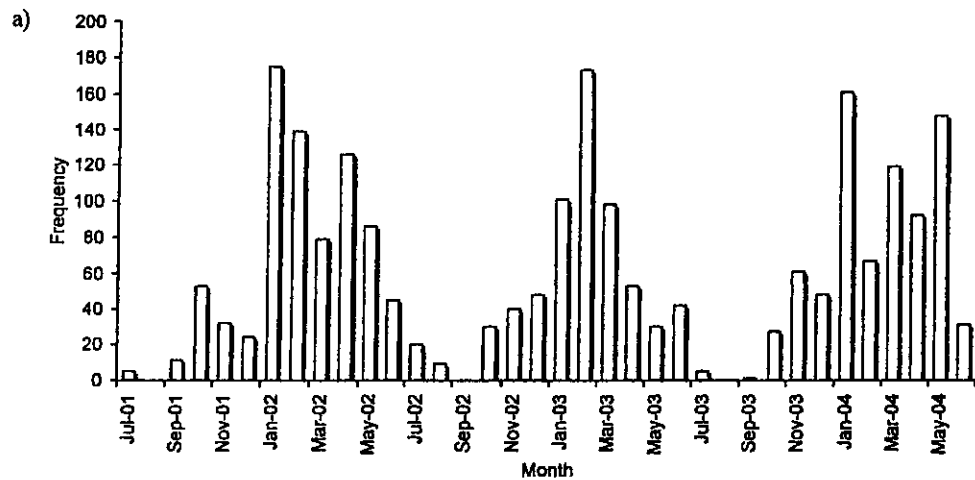


Figure 9: (a) Number of tagged kingfish released by month, 2001–04; (b) Numbers of kingfish released, and numbers recaptured (in parentheses), by statistical reporting area for the 2003–04 season; (c) Kingfish release length frequency in the 2003–04 season; (d) Kingfish movement indicated by recaptures 2003–04 with days at liberty near recapture point; crosses indicate recaptures in the same location (short-term recaptures not shown) .

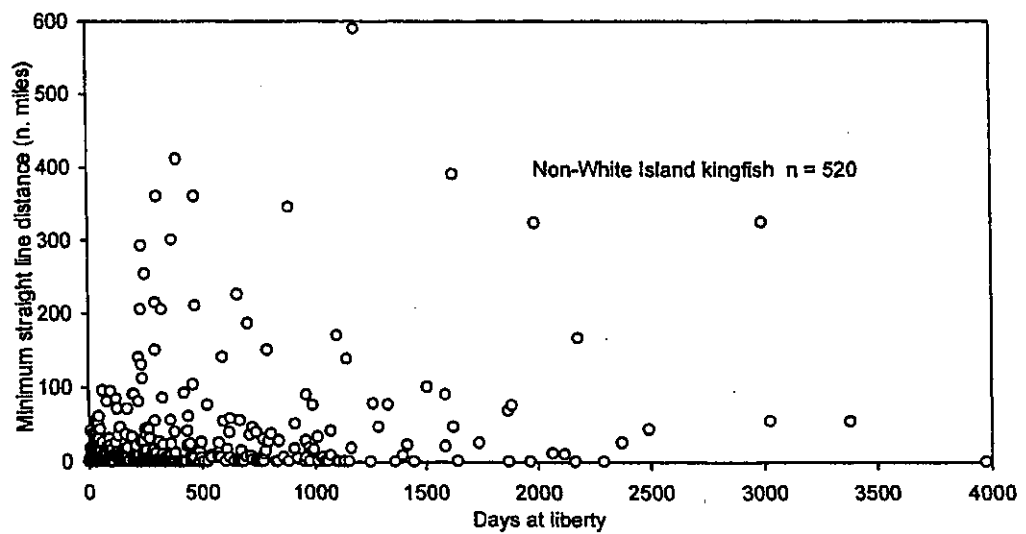
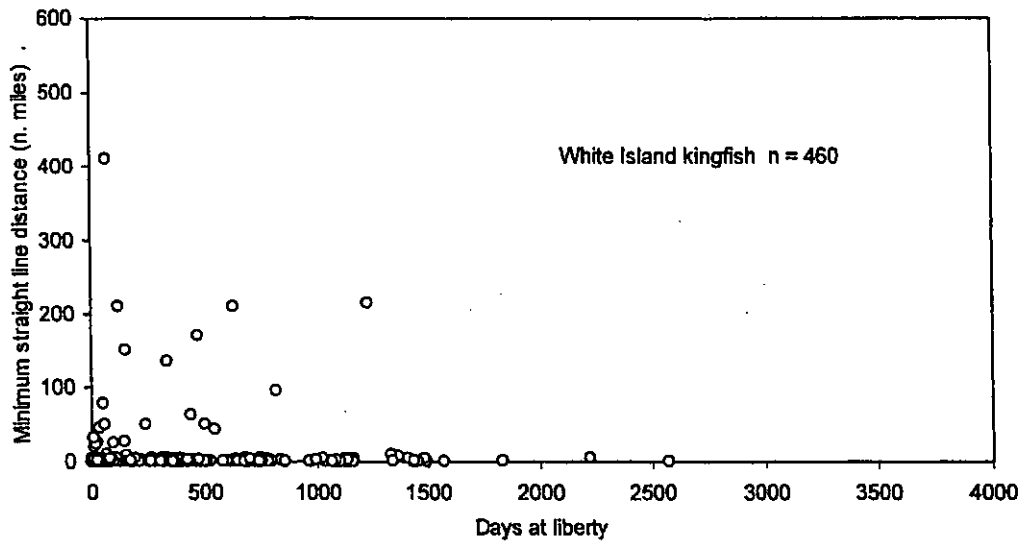


Figure 10: Kingfish days at liberty and straight-line distance travelled for White Island (top) and non White Island (bottom) released fish.

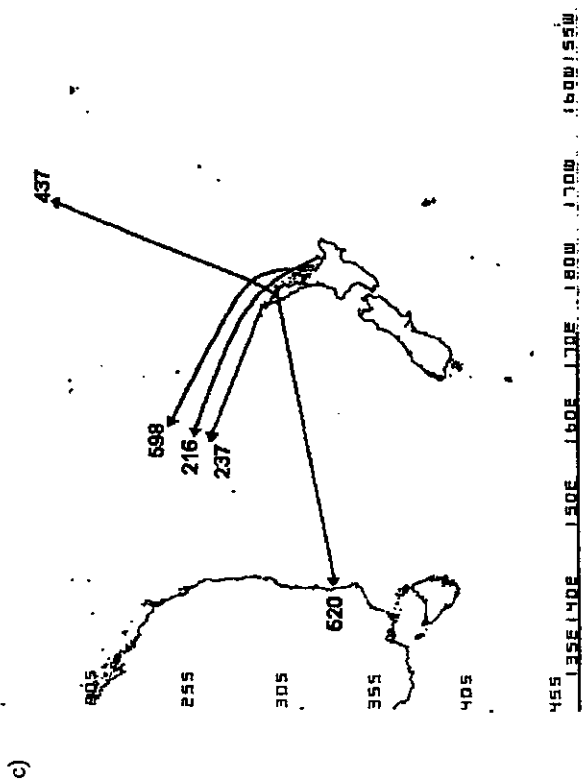
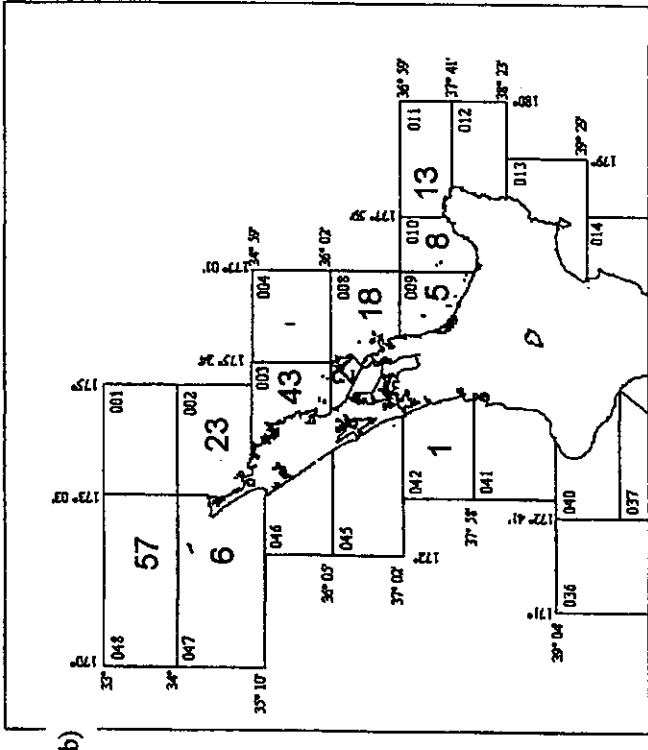
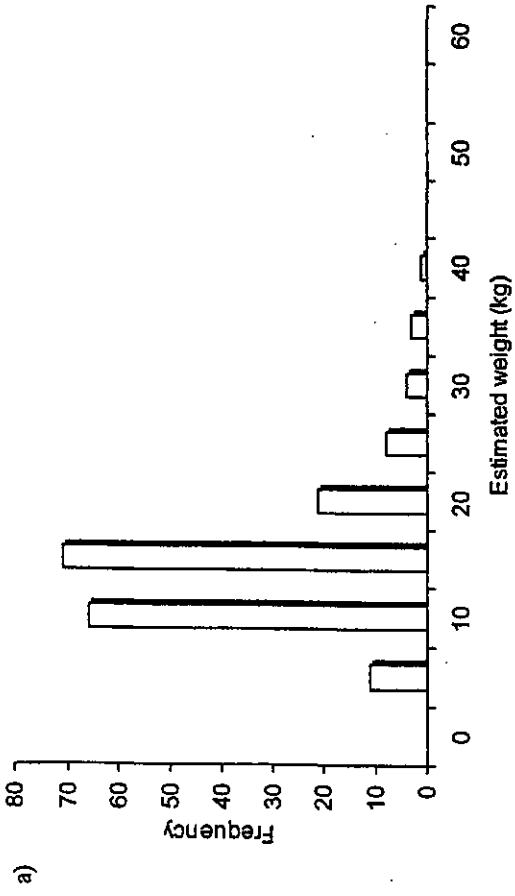


Figure 11: (a) Yellowfin tuna release weight frequency for the 2003-04 season; (b) Numbers of yellowfin tuna released, by statistical reporting area for the 2003-04 season; (c) Long distance yellowfin tuna recaptures with days at liberty near recapture point.

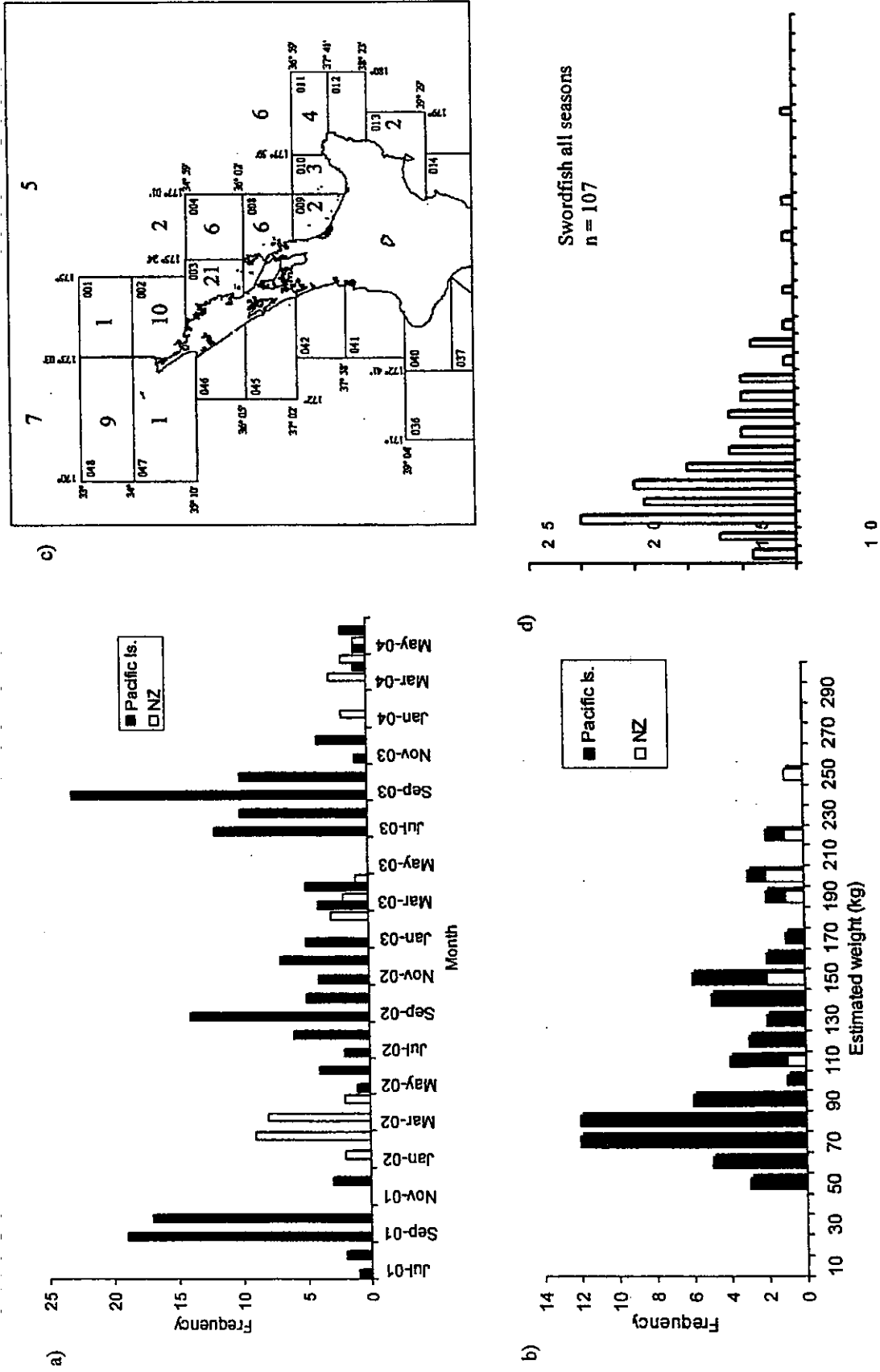


Figure 12: (a) Number of blue marlin tagged and released by month in Pacific Island waters (solid bars) and New Zealand waters (open bars) 2001-04; (b) Blue marlin release weight frequency in the 2003-04 season; (c) Number of swordfish tagged by statistical area for all seasons combined; (d) Swordfish release weight frequency for all seasons combined.

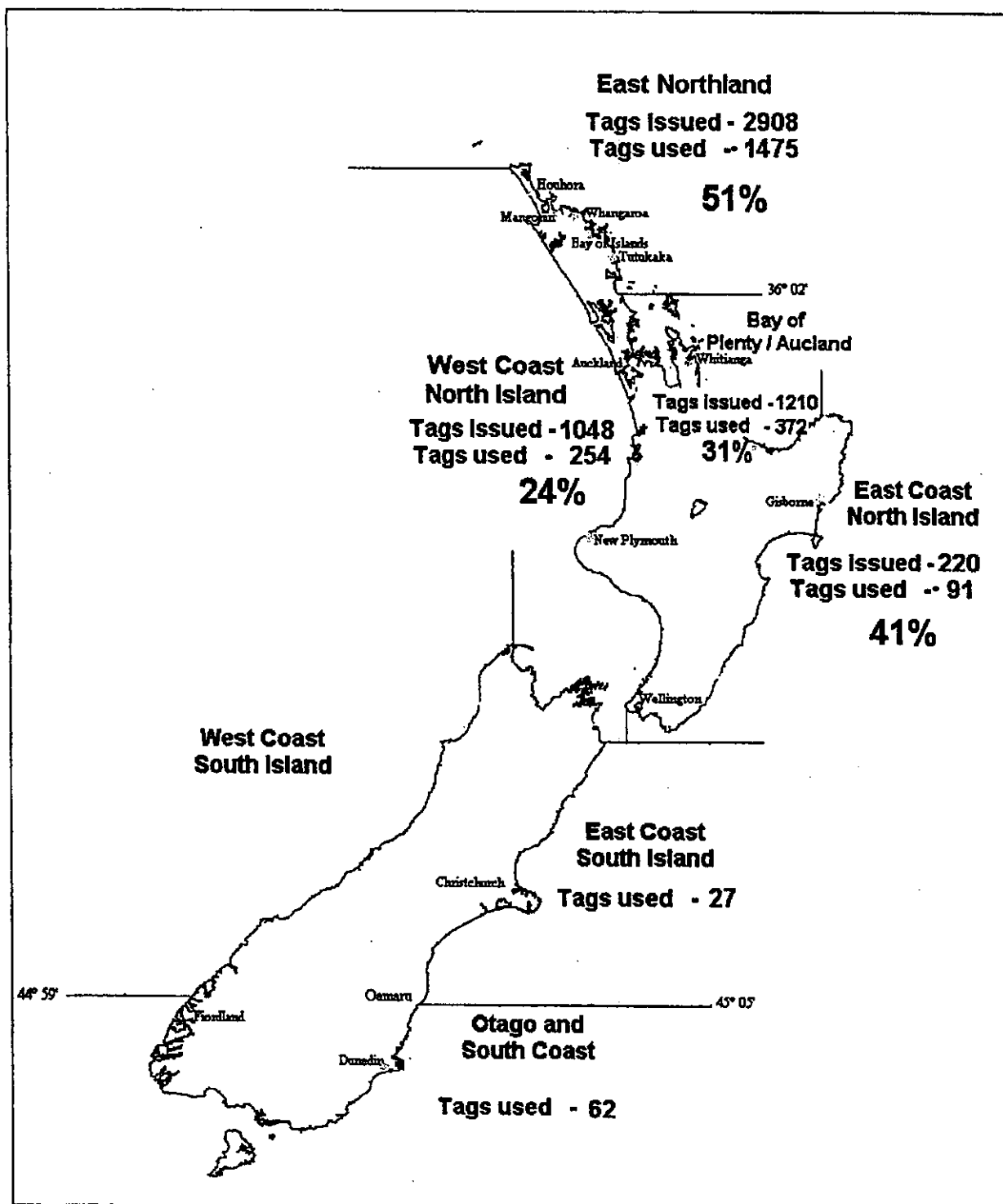


Figure 13: The number of tags issued to clubs and individuals and the number reported used by region for the 2003-04 season. The percentage of tags used can be influenced by the number of tags issued in previous seasons.