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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 2005–06 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 2280 fish were reported tagged and released. The number of striped marlin tagged (878) decreased in 2005–06 compared to recent seasons, and the size of fish also decreased. Fishing for striped marlin was significantly less successful on the upper west coast of the North Island than in 2004–05, but better off east Northland than in the previous year. The number of mako and blue sharks tagged has been significantly lower than the long-term average for the last four years. The lowest number of mako sharks since 1983–84 was tagged. The average estimated size of tagged blue sharks was the lowest recorded in this programme to date. The number of tagged kingfish rose by 20% in 2005–06, with substantial increases in release numbers in many areas, particularly around White Island and the Three Kings Islands. There was also a substantial decrease of kingfish tagged in Area 012, south of East Cape. The percentage of kingfish accurately measured on release was 65%, predominantly from a few of dedicated anglers and skippers. Sixteen kingfish were tagged off north Canterbury, for the first time. Numerous long-term recaptures of kingfish were made, but, as usual, few of these were far from the tagging location. However, two kingfish were recaptured more than 150 nautical miles from where they were released.

A total of 61 recaptures was reported in the 2005–06 fishing season, including 50 yellowtail kingfish, 3 mako sharks, 1 striped marlin, 1 blue marlin, 1 blue shark, and 1 yellowfin tuna. A striped marlin was recaptured off Northland after a year at liberty, the fourth such recovery to date. There is increasing evidence, based on analysis of striped marlin tag recapture data, that striped marlin move out of the EEZ and return the following season. There is no indication from existing information, however, whether this is the norm, or what percentage of striped marlin might return to New Zealand waters in consecutive years.

Twenty-eight kingfish were recaptured at White Island, one of them twice. Time at liberty ranged from 8 days for a kingfish at White Island to 2135 days (5 years 10 months) for a kingfish at the Rangatira Reef, Bay of Plenty. Distance between release and recapture points ranged from less than 1 nautical mile, recorded for 22 kingfish to 1300 nautical miles by a mako shark, which was recaptured off the Fiji Islands. A school shark was recaptured this season after 7025 days (19 years 3 months) at liberty.

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. The administration for the gamefish tagging programme was initially contracted out to the National Institute of Water and Atmospheric Research (NIWA) and in 2000 was put out to competitive tender by the Ministry of Fisheries.

This report is the annual gamefish tagging report for the 2005–06 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*), 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 productive marlin and tuna fishery accessed from the west coast harbours and beaches, as far south as Taranaki. 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*). There is a developing seasonal (winter) fishery for Pacific bluefin tuna (*Thunnus orientalis*) off the central west coast of the South Island, accessed from the ports of Greymouth and Westport. This fishery is associated with the spawning aggregations of hoki (*Macruronus novaezealandiae*) that are targeted by commercial vessels offshore between the months of July and September.

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 the species of interest. Collection of tag report cards has been greatly assisted by the fishing clubs, most of which keep accurate records of captures and require that tag report cards are handed in at the completion of successful trips.

For the last 12 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 in future yellowfin tuna be included. Objectives included increasing knowledge of the nature and range of migration of striped marlin, yellowfin tuna, 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 (G 53501) until March 2004 (G 92500). Tag supply had run low in 2004 and the manufacturer had a limited supply of stainless wire: 4000 tags were supplied with wire extending 35 mm up the tag. The tag number was printed lower on the tag and was over the area with wire. If the tag broke above the wire, as before, the tag number would remain. In 2005, 1000 tags with the nylon double-barbed anchors were purchased for billfish. This type of tag head was developed by the Billfish Foundation (US) and the NMFS and has been widely used on billfish in the USA and more recently in Australia. These large plastic head intra-muscular tags – type

PIMA – were purchased from Hallprint with the new prefix N and carried on the tag numbering sequence from the G series tags (N 102501 to N 103500). Both tag types are currently in use.

The process of tagging gamefish has been described by Saul & Holdsworth (1992). Numbered tag report cards are issued with each tag. They collect 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 and sex – 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 the recapture 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 from 1 July 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 give a more accurate record 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 as this remains the standard measure in marine navigation. 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 inside New Zealand fisheries waters in the 2005–06 season was 878, a substantial decrease on the 2004–05 season (1345) and significantly below the average of the previous 10 years (1032) (see Table 1). A further 630 striped marlin were reported as landed in gamefish club records (Roz Nelson, N.Z. Big Game Fishing Council, pers. comm.). It is estimated that 58% of recreationally caught striped marlin were tagged and released in 2005–06. The number of striped marlin landed by fishers and not recorded in 2005–06 is not known.

The monthly totals of striped marlin tagged over the last five seasons are shown in Figure 2a. February was again the peak month for striped marlin releases, followed by March. Striped marlin catches normally begin to fall after March and tail off in May and June as the water cools.

A summary of striped marlin tagged within Ministry of Fisheries statistical areas (Figure 2b) reveals a more typical pattern than in 2004–05, when fishing was particularly productive on the west coast of the North Island, especially from west of Cape Reinga down to the Hokianga Harbour. Area 047 – the most productive area in 2004–05 with 23% of tagged striped marlin for that season – accounted for only 3% in 2005–06. There was also a big reduction in Area 046, where the percentage dropped from 12% in 2004–05 to less than 1% in 2005–06.

Although catches in Area 048 remained low in comparison to many recent seasons, it was the top area for 2005–06, providing 33% of the total. Fishing was also productive off east Northland, particularly between Whangaroa and North Cape, where Area 002 provided 30% of the total. The Bay of Plenty, which experienced a bumper year for marlin in 2004–05 (15% of the total), accounted for 7% of tagged striped marlin in 2005–06.

Striped marlin estimated release weights for the last four seasons are plotted in Figure 3 and show a mode at 80 kg in 2005–06. The distribution of estimated weights is similar to that in 2003–04, with the exception that the minor peak around 110kg in 2003–04 occurs at 120 kg in 2005–06. Otherwise, there is a broad distribution between 60 kg and 130 kg, with a few outliers.

NZBGFC affiliated clubs have applied a voluntary minimum size of 90 kg for marlin since 1988. The proportion of striped marlin tagged and released estimated as 90 kg or larger was 68% in 2002–03, 66% in 2003–04, and 72% in 2004–05 (Figure 3). In 2005–06 the proportion of striped marlin tagged and released and estimated at 90kg or larger was 55%, lower than in any of the previous five seasons.

Only one striped marlin was recaptured during 2005–06. This marlin was at liberty for 374 days and was recaptured just 45 nautical miles from where it was originally tagged off Whangaroa in March 2005. It was recaptured near North Cape in April 2006. It was estimated at 95 kg on release, and at 130 kg on recapture. The recapture represented a relatively rare event, however, since it was only the fourth striped marlin in this programme to be recaptured the following season. Three of these recaptures have been in New Zealand and one in early January east of Byron Bay, Australia (20° 30'S 155° 10'E).

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, have been observed to travel to completely different regions of the southwest Pacific after leaving New Zealand.

There is a pattern of seasonal movement between New Zealand waters in summer and autumn and sub-tropical waters in winter and spring. A plot of distance vs days at liberty of striped marlin tagged in February and March shows that fish may be recaptured close to where they were tagged up to 2 months after release, and there is a trend of increasing distance over the next 6 months with recaptures occurring back in New Zealand about 12 months later (see Figure 2d). While the points are quite scattered there is a weak relationship with R^2 of 0.57. 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 2005–06 season was 186, down significantly (-62%) from the average number of makos tagged for the 10 previous seasons (see Table 1). According to NZBGFC records, 81% of all mako sharks caught by gamefish club members in 2005–06 were tagged and released. The number of makos released without being tagged is unknown.

Mako sharks are not generally a target species in northern New Zealand but are caught as a bycatch from vessels targeting billfish or tuna. Makos were tagged in 2005–06 almost all around the North Island (Figure 4). The catch dropped in most statistical areas in absolute terms, but the overall distribution of catch in percentage terms was very similar to that in 2004–05. The west coast of the North Island accounted for 45% of tagged makos (41% in 2004–05) with a rise in Area 042, off Manukau Harbour. There was also a rise in Area 048, which increased from 4% to 9% of the total, while the catch in east Northland was steady at 22% (21% in 2004–05) and the Bay of Plenty accounted for 16% (19% in 2004–05). The small catch on the east coast of the lower North Island was the same, at 7% of the total.

Most makos were tagged between January and June 2006 with a very strong mode in February, when twice as many makos were tagged than in any other month (Figure 5a). In recent seasons February has generally been the month in which most makos were tagged, the exception being 2004, in which both January and March had higher totals. It is likely that the NZBGFC National Contest, which occurs annually in February throughout New Zealand, has influenced the temporal distribution of mako tagging.

The size distribution of makos tagged in 2005–06 shows that most were estimated to be 80 kg or less, with a mode at 40 kg (Figure 5b). A few large makos between 200 and 300 kg were also tagged.

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 5d). 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 from tuna longline vessels based in Fiji and other Pacific island nations. However, 11 long distance recaptures in this band are for mako that were caught in temperate Australian waters (south of 30°S).

There were three tagged mako recaptures reported in 2005–06, but one of these related to an earlier year, so only two were recaptured during the season. This is the lowest number since 1983–84 (Table 3). The decline in recaptures is not surprising, since release numbers in recent seasons have also dropped considerably.

The historical recapture was that of a mako tagged off Kawhia in February 1999, and recaptured by an angler in New South Wales, Australia, in May 2000. This report was received in June 2006, but better late than never! It was originally caught on a lure and estimated at 30 kg on release. When it was recaptured in Australia, it measured 130 cm in length after 462 days at liberty.

The first of the 2005–06 recaptures was made by a tuna longline vessel near Fiji in October 2005. This shark was caught off the Manukau Harbour in March 2005, at which time it was estimated to weigh 150 kg. It was released, like many lure-caught sharks, with a hook in its jaw. before recapture it had travelled 1300 nautical miles in 229 days.

The second 2005–06 recapture was also a large fish. It was estimated at 140 kg when tagged off the Bay of Islands from the charter boat *Major Tom II* in January 2005. It was also caught on a lure and released with a hook in the jaw. After 292 days it was caught by a commercial fisher near the Cook Islands, having travelled 1240 nautical miles. Overall, the recapture rate for mako sharks in this programme is 2.8%.

3.3 Blue shark

There were 88 blue sharks tagged in New Zealand fisheries waters during the 2005–06 season, fewer than any season in the last 10 years except for 2002–03 (see Table 1). The average for the previous 10 years for this species is 240 per season. Fifty-two blue sharks were tagged off Otago Heads, predominantly in February (Figures 6 and 7a). The only other area where significant numbers of blue sharks were tagged was Area 042, off the Manukau Harbour. The size of tagged blue sharks in 2005–06 declined again from the 2004–05 season, in which the modal weight class was 40kg. The mode for 2005–06 was 30 kg, lower than ever before in this programme. There were also more blue sharks in the second most-important size class (20 kg), than in all the size classes 40 kg and above combined (Figure 7b.). Overall, 75% of tagged blue sharks were estimated to weigh 30 kg or less.

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 7d). 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 respects, the recapture locations are similar to those reported for striped marlin and mako sharks – Australia, New Caledonia, Fiji, Tonga, French Polynesia (Figure 7c). This may reflect fishing effort in the southwest Pacific, and/or variable tag reporting, rather than distribution of the species. However, 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 2005–06 fishing season one blue shark recapture was reported. This was another historical recapture reported during the current year. An estimated 25 kg blue shark was tagged in February 1998 off Otago Heads from the vessel *Pedro*. It was recaptured 730 nautical miles west in the south Tasman Sea by a Japanese tuna longline vessel after 446 days, in May 1999. Overall, the recapture rate for blue sharks on the programme is 1.7% (Table 3).

3.4 Kingfish

The year 2005–06 was very successful for kingfish tagging. The number of kingfish tagged and released in New Zealand fisheries waters was 1008, 61% higher than the mean number tagged in the previous 10 seasons and 20% more than in 2004–05 (see Table 1). In most years, most kingfish are tagged over summer and autumn, but this season varied from the norm. In 2005–06, tagging numbers were high between January and March with a peak in February, but were also high in May and June (Figure 8a). The distribution of tagging effort (see Figure 8b) in 2005–06 changed markedly from the previous season. Effort was reduced slightly on the west coast of the North Island, with a decline in Area 042 from 27% to 18% of the total and a smaller decline in Area 047. However, tagging effort increased substantially at the Three Kings Islands and in east Northland. This was offset by a very substantial decline in Area 012 (Tolaga Bay/East Cape), with the departure of one charter operator which saw tagging effort there decline from 22% in 2004–05, to just 2% in 2005–06. On the positive side was the re-emergence of White Island (Area 010) as the major location of kingfish tagging. Anglers tagged 295 kingfish, or 29% of all releases, in this area. In 2004–05, Area 010 contributed just 98 fish, or 12% of the total. Sixteen kingfish were also tagged and released in North Canterbury for the first time (not shown on Figure 8b).

Sixty-five percent of tagged kingfish were measured on release in 2005–06, down from 77% in 2004–05 but higher than the 60% achieved in the previous two seasons. Kingfish size distribution is 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 45 to 150 cm, with most fish between 65 and 115 cm (Figure 8c). The length distribution was broad this season with modes at 75 cm and also from 100 to 109 cm. Most of the larger fish in 2005–06 were tagged at White Island or in the Three Kings area. Anglers have previously been asked not to use gamefish tags on kingfish less than 65 cm fork length, which had been the minimum legal size. In January 2004, a new kingfish minimum legal size of 75 cm was introduced for recreational fishers. Although anglers are generally following the instruction not to tag kingfish smaller than 65 cm, as Figure 8c clearly shows, it is also clear that they are less certain about what to do with kingfish below the new minimum legal size of 75 cm. In 2005–06 75 of the 661 measured tagged kingfish were under 75 cm. Where the length was estimated, in 210 instances, a further 75 kingfish were less than 75 cm. However, given that some anglers also estimated the size of these latter fish at up to 10 kg, there must be some uncertainty about the accuracy of the estimated lengths. At 75 cm fork length, most kingfish weigh about 5 kg. Even so, 15% of kingfish tagged were known or estimated to be sub-legal.

Fifty kingfish recaptures were reported in 2005–06 (Table 3). Time at liberty ranged from 8 to 2135 days (6 years 10 months) and displacement ranged from 0 to 168 nautical miles.

Twenty-eight kingfish were recaptured – one of them twice – in Area 010, all of them at White Island or the adjacent reefs. Rather unusually, two of these recaptures were tagged in other statistical areas. One came from Mayor Island, and the other from Tolaga Bay, south of East Cape. The greatest distance was covered by an 87 cm kingfish tagged at Tolaga Reef in February 2005, which was recaptured at Laisons Reef, near the Volkner Rocks after 269 days. It was measured on recapture at 89 cm, and had travelled 168 nautical miles and was re-released with the tag intact. The kingfish tagged at Mayor Island was caught on a lure in January 2003 and estimated at 10 kg on release. It was recaptured at the Volkner Rocks after 1064 days, 42 nautical miles from the release point and estimated to be 17 kg. The original tag was found to be in good condition, so the kingfish was returned to the water with the tag still on it. It was subsequently caught again after another 62 days, a short distance away at Laisons Reef. It was measured at 110 cm and estimated to weigh 17.5 kg and was released for a third time. All of the other recaptures made near White Island had moved 4 nautical miles or less, and were caught after periods at liberty from 8 to 2135 days.

Several other long-distance kingfish tag recoveries were reported. These included another kingfish tagged off Tolaga Bay, which was recaptured at East Cape, a distance of 86 nautical miles, after 1225 days (3 years 4 months). It was measured on release and again on recapture and had increased from 67 cm to 89 cm over that time. An 80 cm kingfish tagged in February 2003 off Portland Island on the northern side of Hawke Bay, was recaptured in a commercial purse seine net off Bare Island in October 2005. The recapture was made 50 nautical miles down the coast after 985 days (2 years 8 months), and the fish was measured at 98.5 cm and weighed 18.06 kg at that time. A long-distance coastal movement was reported when a kingfish tagged northwest of North Cape in February 2002 was recaptured in April 2006 on the Bream Knolls, 15 nautical miles north of the Mokohinau Islands. The kingfish had been caught on a lure and estimated at 18 kg on release. On recapture after 1521 days (4 years 2 months), it weighed 20 kg and measured 120 cm in length.

On the west coast of the North Island, a kingfish measuring 75 cm tagged at Gannet Island was recaptured in a trawl net after 189 days. It was caught 22 nautical miles from Gannet Island, and measured 79 cm on recapture. A kingfish recaptured in 2004–05 but reported this year moved from the Three Kings Islands to the King Bank, a distance of 14 nautical miles, in 11 days. It was estimated to weigh 28 kg on both occasions. Only one other kingfish was recaptured more than 5 nautical miles from where it was tagged. It was tagged off Cape Karikari and estimated at 10 kg on release, and was recaptured 10 nautical miles south in Doubtless Bay after 480 days.

The 22 kingfish that displayed no movement at all were free between 8 and 2135 days. Nineteen fish that moved less than 5 nautical miles were free between 12 and 1866 days. Three kingfish that moved slightly longer distances (10 to 22 nautical miles) were free from 11 to 480 days, while the five fish that moved the most – from 42 to 168 nautical miles – were at liberty between 269 and 1521 days (Figure 9a). Four of these five kingfish were free for over two years. Overall, the recapture rate for kingfish is 8.0% for this programme.

3.5 Yellowfin tuna

Only four yellowfin tuna were tagged in the 2005–06 season. Yellowfin were scarce throughout the fishery during 2005–06, and only 346 were landed in total by NZBGFC-affiliated clubs. In past seasons, yellowfin tagging has been successful only when the fish were abundant, which was certainly not the case in 2005–06.

There was one recapture of a yellowfin tuna, however. This fish was estimated at 15 kg when it was tagged at the Middlesex Bank, north of the Three Kings Islands, in March 2004. It was recaptured by an Australian tuna longliner in August 2005, 1000 nautical miles west from its tagging location, after 501 days. It measured 113 cm on recapture. Overall, the recapture rate for yellowfin tuna is 1.0% for this programme.

3.6 Other billfish

Compared with the earlier years of the programme, blue marlin have been tagged in greater numbers over the last few seasons, mainly by anglers in the Kingdom of Tonga (see Tables 1 and 2). Of the 57 blue marlin tagged in the 2005–06 season, 17 were tagged in New Zealand between January and May (Figure 10a). Most blue marlin were tagged between July and October in the Pacific Islands (Figure 10a). The fish tagged in Tonga were generally estimated at 180 kg or less. Many of the fish were much smaller, between 70 kg and 90 kg. In New Zealand waters, blue marlin under 120 kg are rarely reported. All but one of the 17 blue marlin tagged within the EEZ were estimated at 160 kg or more in 2005–06 (Figure 10b). One blue marlin recapture was reported this season. This fish was tagged in the Coral Sea by the travelling New Zealand charter boat *Striker* in September 2003. It was estimated to weigh 90 kg. It was recaptured in October 2005 by a commercial tuna longliner, west of Vanuatu. At this time it was 240 nautical miles north of the tagging location after 743 days at liberty, and was estimated to weigh 150 kg.

The overall recapture rate of blue marlin is now 0.8% for this programme (Table 3). There were 5 swordfish, 2 black marlin and 11 shortbill spearfish tagged in New Zealand fisheries waters in 2005–06, but no recaptures.

3.7 Other species

Each year anglers tag and release a small variety of species that are not considered to be mainstream parts of the programme. Most of these are sharks, including school shark, hammerhead shark, thresher shark, and bronze whaler. The number of “other sharks” tagged in 2005–06 was 71, comparable to the previous five years. Three shark tags from species other than mako and blue shark were returned in the 2005–06 season. Two of these were school sharks, and the other was identified – when tagged – as a bronze whaler, *Carcharinus brachyurus*. This recapture is of interest, because it was recaptured west of Tuvalu, 600 nautical miles northwest of Fiji, by a commercial vessel. It had been tagged in the eastern Bay of Plenty in January 1999, at which time its estimated weight was 80 kg. In October 2005 it was recaptured 1800 nautical miles north of the tagging location. It is likely that this shark was not a bronze whaler, but one of the oceanic whaler sharks that are known to visit New Zealand waters during the southern summer.

However, identification of the whalers is problematic, and for this reason the New Zealand records kept by the NZBGFC deliberately refer only to "*Carcharinus sp.*"

Two school sharks were recaptured, one being notable as the longest-term recapture made in this programme. The shark was tagged in Parengarenga Harbour, Northland, in December 1986, and was recaptured by a commercial fisher in March 2006. The time at liberty was 7025 days, or more than 19 years. Considering that the school shark was of adult size (estimated 19 kg) when tagged, this is confirmation that the school shark is indeed a long-lived species.

3.8 General

Overall, 5145 gamefish dart tags with stainless steel anchors were issued to clubs and individuals by the NZBGFC in the 2005–06 season. For the first time this season the Hallprint PIMA tags were issued on request by Blue Water Marine Research. One thousand tags were purchased but were not delivered until March 2006. Two hundred and eighty of these tags have been issued and 74 used. The overall number of tags issued and number used in each region in 2005–06 is given in Figure 11. The selection of regions is based on the commonly fished gamefish areas. To the end of July, 2280 tag report cards had been handed in for fish tagged in 2005–06.

4. DISCUSSION

The number of striped marlin tagged in New Zealand waters in the 2005–06 season was down on to the previous two seasons. The fishing conditions on the banks north of the Three Kings Islands were seldom optimal, and striped marlin abundance was reported to be down by most of the professional charter skippers who fished that area. Elsewhere, fishing on the east coast of Northland was as good as in any recent seasons. The tagging percentage of 58% was lower than in any of the last five years. However, this is also highly influenced by the charter and private vessels that fish the Three Kings, where almost all of the striped marlin are tagged because of the distance from the nearest port.

The weight distribution of striped marlin in 2005–06 was similar to that of 2003–04, with a mode at 80 kg, and fewer fish in the 90–110 kg range than in 2004–05. In absolute terms, the number of 70 kg and 80 kg fish reported was very similar to 2004–05, but because there were fewer large striped marlin the importance of the smaller size classes was emphasised. Again, this can be in part attributed to the limited success on the upper west coast of the North Island, where striped marlin are commonly larger than on the east coast.

Only one striped marlin was recaptured in 2005–06, but it was a noteworthy recapture, since it was caught near its tagging location in a subsequent season. It is assumed that this fish spent the winter months in subtropical waters as all available data from tagging, catch rates, and biology indicate this migratory behaviour. A plot distance vs days for striped marlin tagged in February and March shows a trend of movement away from New Zealand and then return. It is unknown what proportion of one season's striped marlin return to New Zealand the following year. Some certainly do, because three tagged striped marlin have been recaptured close to their release points (5, 35, and 45 nautical miles) the following year. One was recaptured after 11 months off Queensland, Australia, and the longest term recapture of a striped marlin in any tagging programme was for a fish tagged at the King Bank and recaptured in 1999 off Bermagui, Australia, after 2 years 10 months.

The estimated weight from the striped marlin recapture this year of 130 kg was significantly greater than the release weight of 95 kg and may be an overestimate. The release weight of striped marlin is estimated with the fish in the water. A comparison of the estimated release weights with actual weight on recapture was given in the 2002–03 tagging report (Holdsworth & Saul 2004).

The tag recovered from the striped marlin in 2006 was well anchored, but it had a clump of more than 20 goose barnacles (*Lepas anatifera*), the largest of which was 30 mm long. These hitchhikers grow quickly and the drag they created would have eventually pulled the tag out of the fish. Tag failure or tag shedding appears to be a problem with striped marlin that contributes to relatively low recapture rates worldwide. The Billfish Foundation, NMFS, and NSW Fisheries all use the double-barbed nylon tag for billfish. Higher recapture rates with this type of tag are reported for blue marlin, white marlin, and sailfish (Ortiz et al. 2003). Historically, the striped marlin recapture rates were higher with the stainless steel tag anchor (NMFS Southwest Fisheries Centre 1.35%) than rates reported with the nylon anchor (The Billfish Foundation 0.38%) (Ortiz et al. 2003). The Hallprint PIMA tag with the same nylon head is being trialled in this programme, as some fishers insisted that they are superior. Fishers are encouraged to double tag billfish during the trial.

A striped marlin stock assessment has been undertaken and presented to the WCPFC for the southwest Pacific. The results are still preliminary but the Scientific Committee is recommending that there should be no increase in fishing mortality (ie., fishing effort) on striped marlin in the southwestern Pacific as a precautionary measure. This recommendation applies particularly to the Coral Sea and Tasman Sea as these areas account for most of the striped marlin catch in the region.

The number of mako sharks tagged and released this season was lower than in the previous two years, and remained well below the long-term average. Anglers again reported very few sightings of mako sharks, particularly in the areas off the northeast of the North Island, where they were formerly common. The number of recaptures is also low, probably as a result of fewer fish being tagged and released. The catch of mako sharks on surface longlines has been increasing (Ayers et al. 2004).

The number of blue sharks tagged decreased again in 2005–06 over the previous season. The estimated weight of tagged blue sharks also declined to the lowest level yet recorded in this programme. The number tagged is influenced by the fishing conditions off Otago Heads during February, when blue sharks are targeted during a national game fishing contest: 52 of the 88 blue sharks were tagged off Otago Heads, with the remaining blue sharks being released in a widespread variety of locations around the North Island. Anglers continue to report that sightings of blue sharks – once extremely common – are now a rarity inshore. There was one blue shark recapture in 2005–06.

The Scientific Committee of the WCPFC supported dedicated shark research programmes, especially for species that rank highly in the Ecological Risk Assessment. New Zealand is developing its own National Plan of Action for sharks that will help identify species at risk in New Zealand waters. A large proportion of the recreational shark catch is now tagged and released which should assist in the research and conservation of these species.

The increase in kingfish tagged off Raglan, on the North Island west coast, has continued. It was a feature of the 2004–05 season. By the end of the 2004–05 season, five kingfish from Area 042 had been recaptured. In the 2005–06 season, six more of these fish were recovered, five of which were measured on release and recapture. In similar vein, the increased kingfish tagging in the Three Kings area has been paying dividends in a number of valuable returns, with most of the fish also measured on release.

There have been sufficient data collected from long distance recaptures to discuss the dispersion of four fish species from New Zealand, and with which countries we share these highly migratory species. In the

southwestern Pacific Ocean mako, blue shark, and striped marlin are mostly taken as a bycatch on surface longline vessels targeting bigeye, yellowfin, and albacore tuna. These vessels are the main source of tag returns from outside the New Zealand fisheries waters (200 nautical mile EEZ). Ninety-six mako sharks have been recaptured outside New Zealand waters and 50 of these have been reported from Fiji. Most of the rest of the reported mako recaptures come from New Caledonia, Australia, and the Tasman Sea, west of New Zealand. Blue shark recaptures come from similar areas to the north and northwest of New Zealand, but of 22 offshore recaptures 4 have travelled northeast or east. One blue shark was captured close to South America, and one was recaptured southwest of Perth, West Australia, indicating a broader distribution than shown by New Zealand tagged makos. Striped marlin also seem to fan out into the subtropical southwest Pacific in what appear to be three main directions: northwest to the north Tasman Sea; north to Fiji, Tonga, and Samoa; and northeast to French Polynesia. Although there have been only eight long distance yellowfin tuna recaptures, four of these have come from international waters in the mid Tasman Sea northwest of New Zealand, an area fished by vessels from Australia, Japan, and Chinese Taipei in recent years (Western and Central Pacific Fisheries Commission Tuna Fishery Yearbook 2005). Also fishing in the waters of the island nations in the southwest Pacific are vessels from China, Korea, the Philippines, and Spain, as well as domestic fleets mainly out of New Caledonia, Vanuatu, Fiji, Tonga, Cook Islands, Samoa, American Samoa, and French Polynesia.

5. ACKNOWLEDGMENTS

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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 2005–06, for fish tagged inside the New Zealand EEZ only.

Season	BEM	BKM	BWS	KIN	MAK	SHA	SSF	STM	SWO	TOR	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	778	346	69	13	771	3		7	3	2 176
2002–03	6	1	78	646	155	54	14	671	3		76	2	1 706
2003–04	8		106	771	188	64	8	1 051	2		184	6	2 388
2004–05	29	5	101	806	241	61	7	1 345	6		81		2 682
2005–06	17	2	88	1 008	186	71	11	878	5	7	4	3	2 280
Total	242	27	3 691	13 924	11 314	908	145	15 086	124	7	1 184	681	47 333
Previous 10 year mean	21	3	247	616	496	54	7	1 032	3		56	8	2 540

BEM	blue marlin	SSF	shortbill spearfish
BKM	black marlin	STM	striped marlin
BWS	blue shark	SWO	broadbill swordfish
KIN	kingfish	TOR	Pacific bluefin
MAK	mako shark	YFN	yellowfin tuna
SHA	other shark species	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													
1975-76													
1976-77													
1977-78													
1978-79													
1979-80													
1980-81													
1981-82													
1982-83													
1983-84													
1984-85													
1985-86											2	2	4
1986-87											2	4	6
1987-88													
1988-89													
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	53						15	2	6				76
2003-04	78	18		1	1		15	4	308		12	1	438
2004-05	69	3			1		6	3	9		4		95
2005-06	40						4	1	68			1	114
Total	475	44		3	5		109	15	412		53	27	1 143

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

Season	BEM	BKM	BWS	KIN	MAK	SHA	SAI	SSF	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	4							105
1987-88				77	8	1						3	89
1988-89			2	91	13	1			1			3	111
1989-90			-	45	10	6			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	5			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	4			14		-	-	63
1999-00	1	-	11	57	23	5			5		-	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	2			1	-	-	1	42
2003-04	-	-	2	32	9	2			4	1	2	-	52
2004-05	-	-	2	38	6	1			4	-	2	-	52
	1	-	1	50	3	3			1	-	1	1	61
Total	6	1	61	1 107	316	46	0	0	73	2	13	20	1 647
Releases	717	71	3 691	13 927	11 319	908	109	160	15 498	124	1 237	708	
Recapture rate (%)	0.8	1.4	1.7	7.9	2.8	5.1			0.5	1.6	1.1	2.8	

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

SCH school shark
 STM striped marlin
 SWO broadbill swordfish
 YFN yellowfin tuna
 OSP all other species

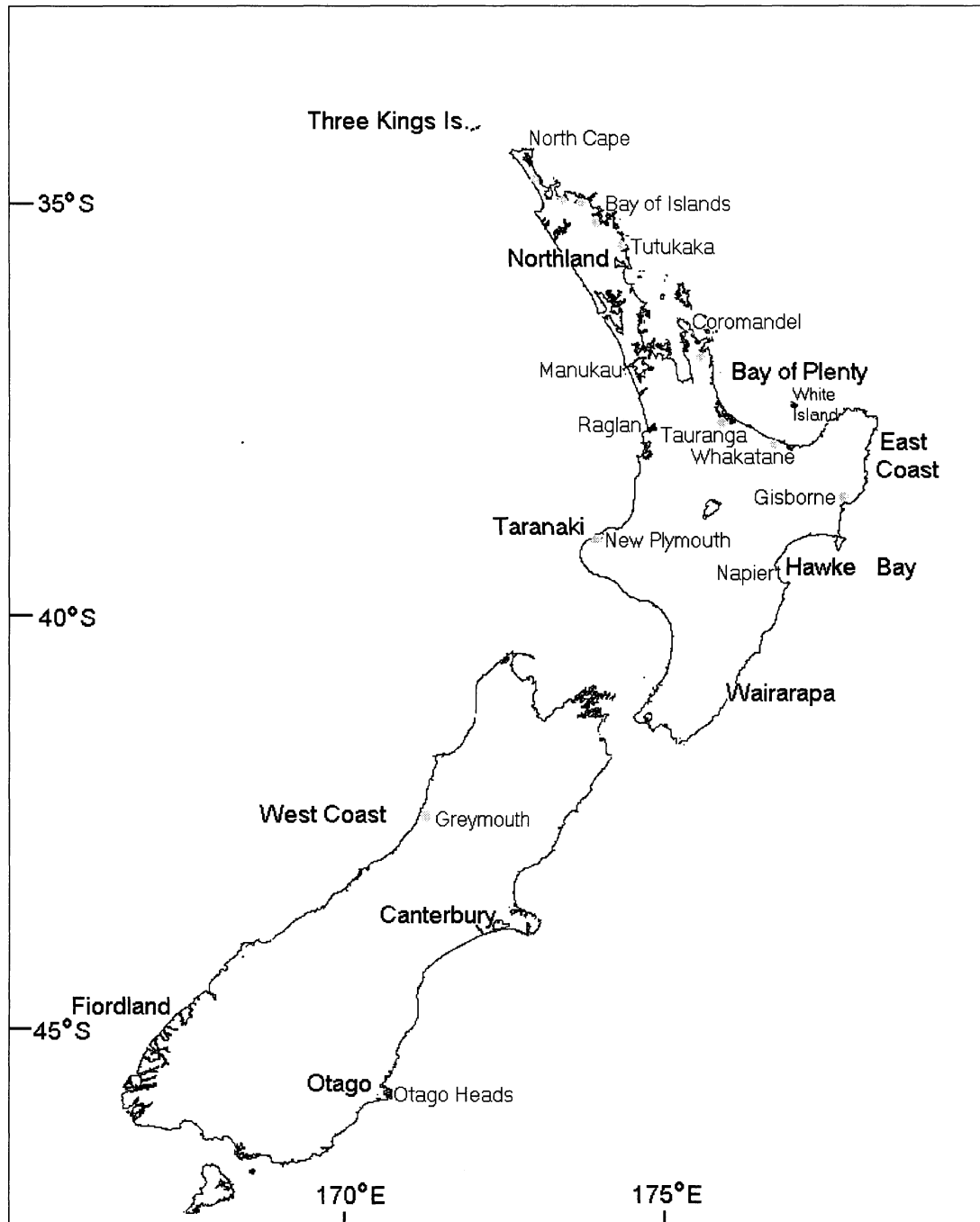
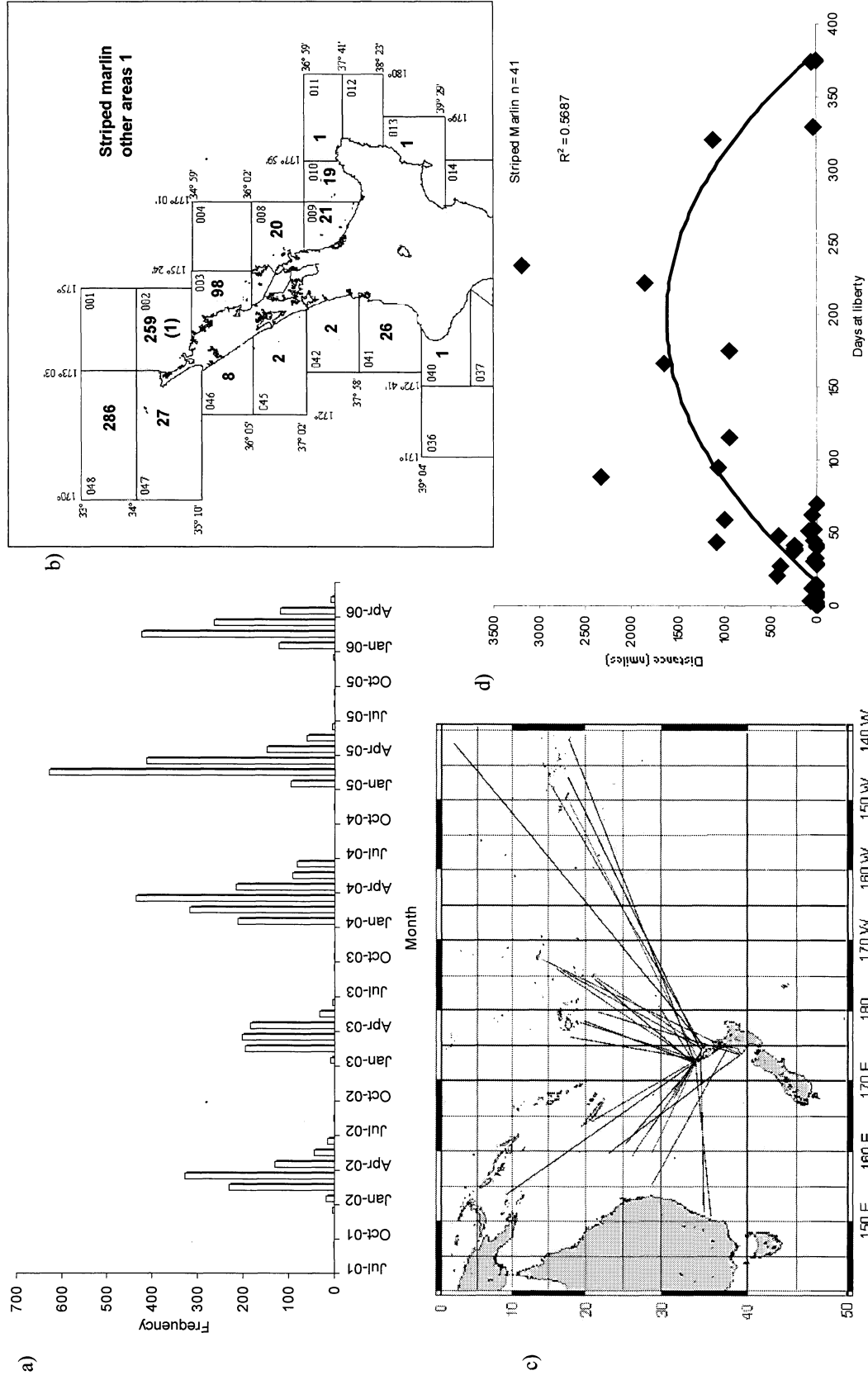


Figure 1: Location of the main areas of gamefish tagging in New Zealand.



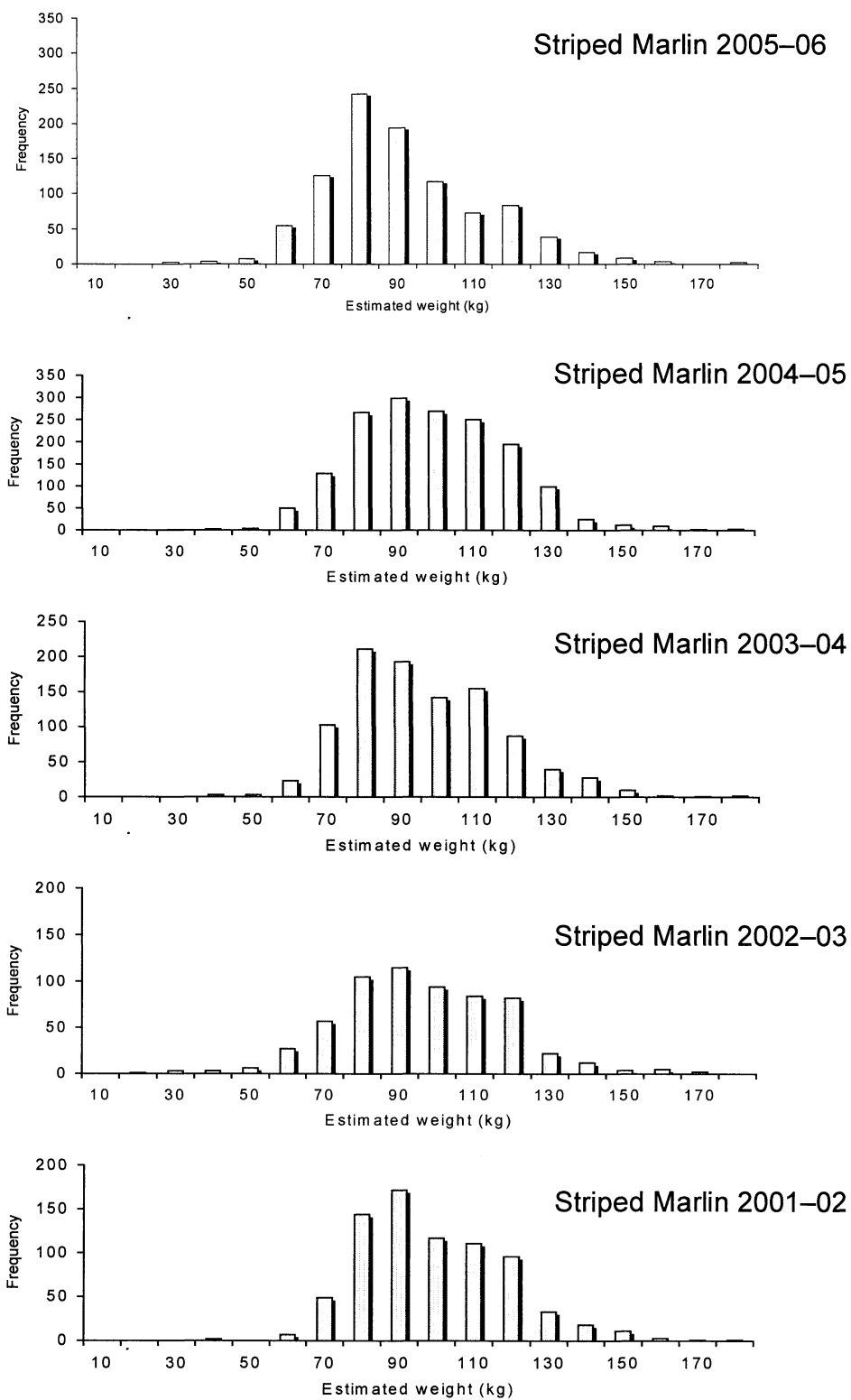


Figure 3: Striped marlin estimated release weights by season, 2001-02 to 2005-06.

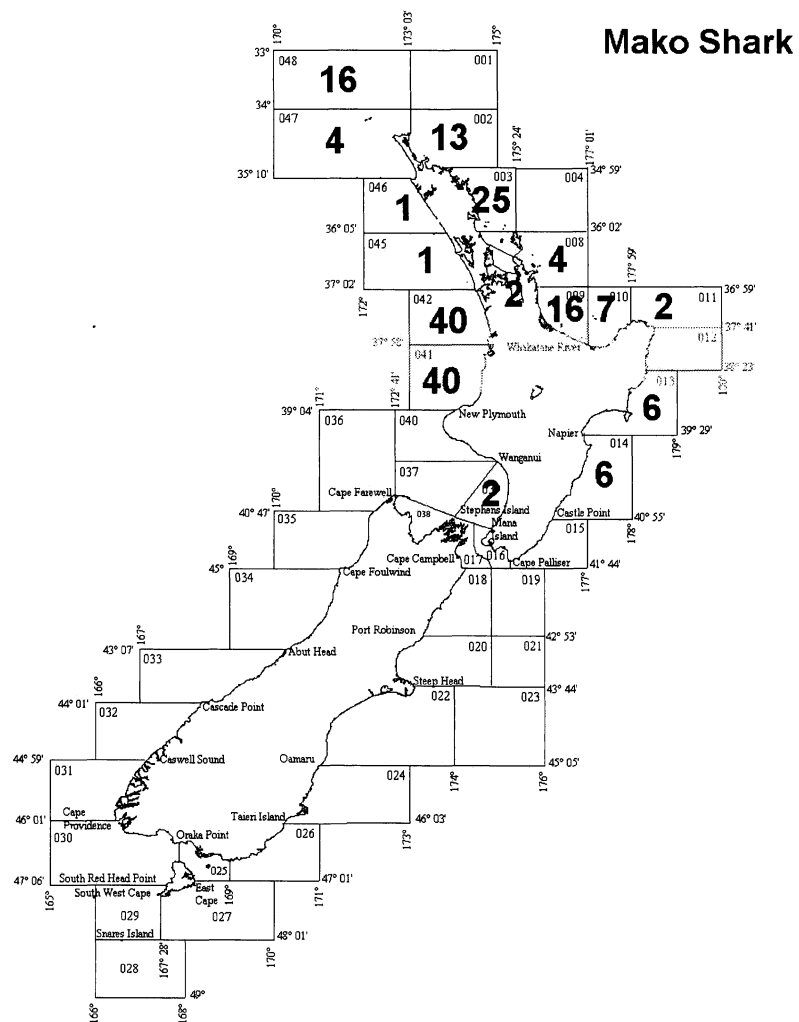


Figure 4: Mako sharks tagged and released by statistical reporting area in 2005–06.

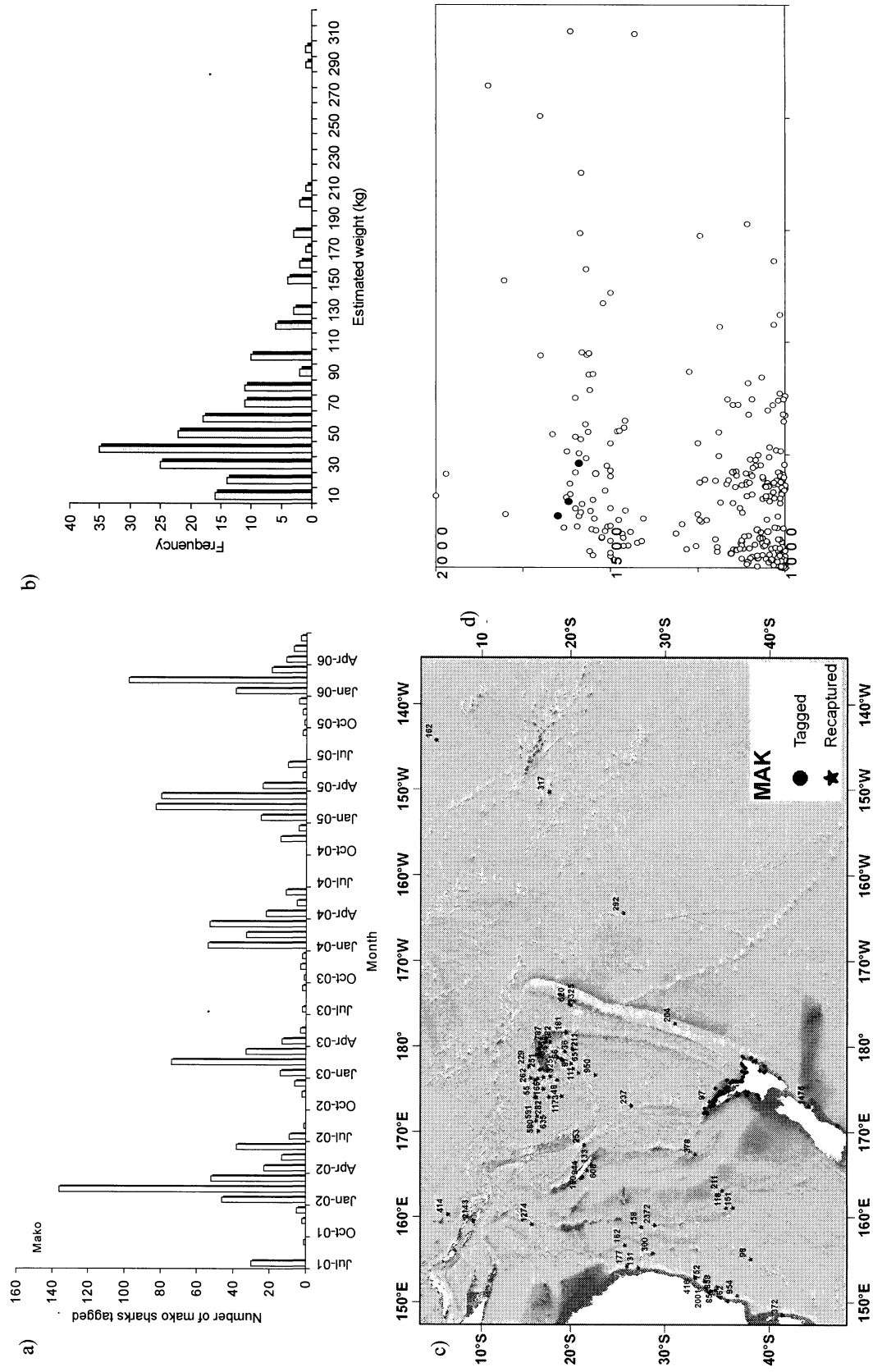


Figure 5: (a) Number of tagged mako sharks released by month, 2002-06; (b) Mako shark estimated release weight frequency, 2005-06; (c) Long distance movements of tagged mako sharks for all seasons combined (number of days at liberty next to recapture point); (d) Mako shark days at liberty and distance travelled for all seasons with solid markers for 2005-06 (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).

Blue shark

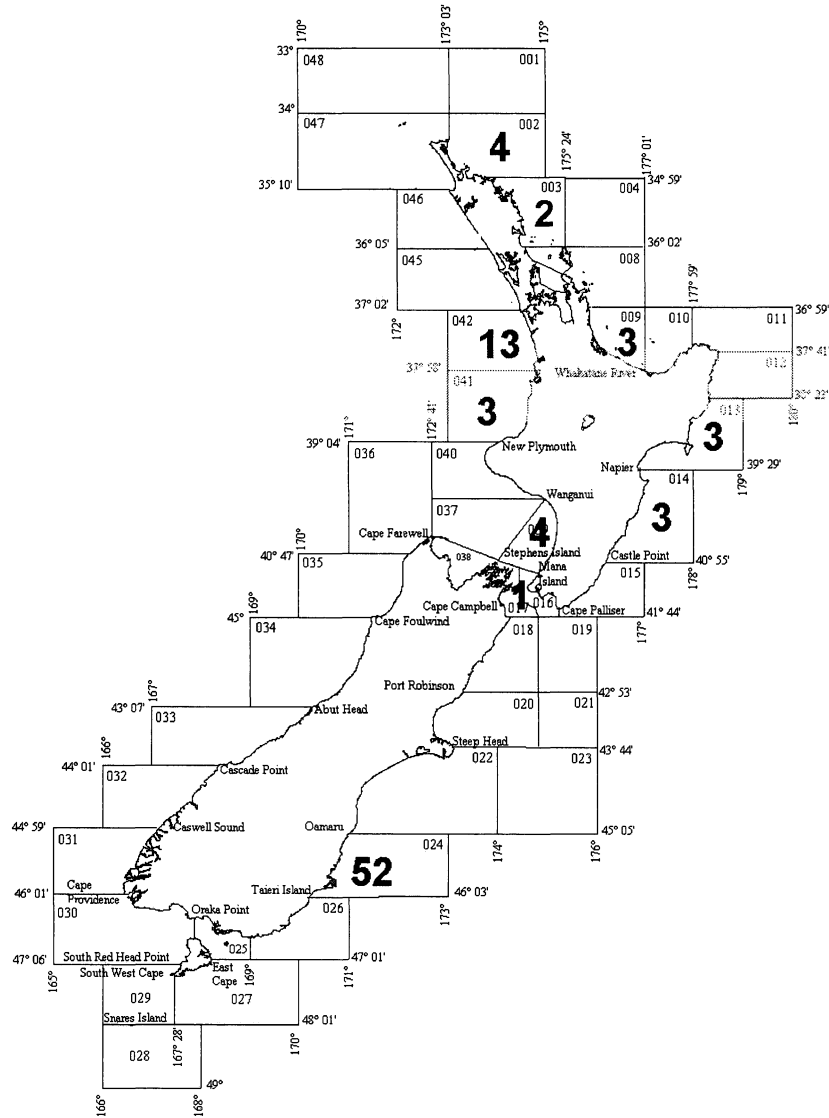


Figure 6: Blue sharks tagged and released by statistical reporting area in 2005-06.

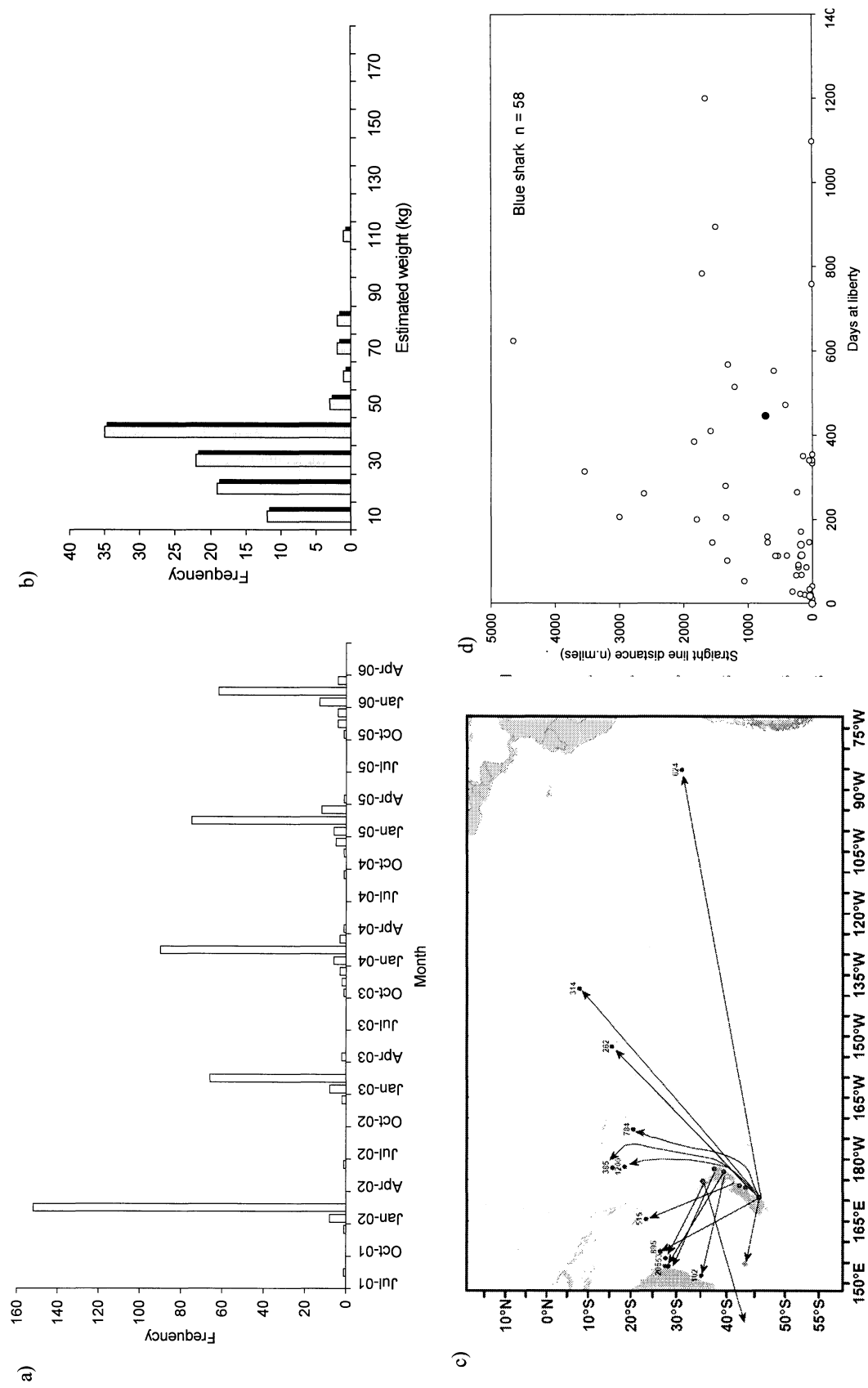


Figure 7: (a) Number of tagged blue sharks released by month, 2002–06; (b) Blue shark estimated release weight frequency 2005–06; (c) Long distance movements of tagged blue sharks all seasons (days at liberty at recapture point); (d) Blue shark days at liberty and straight line distance travelled.

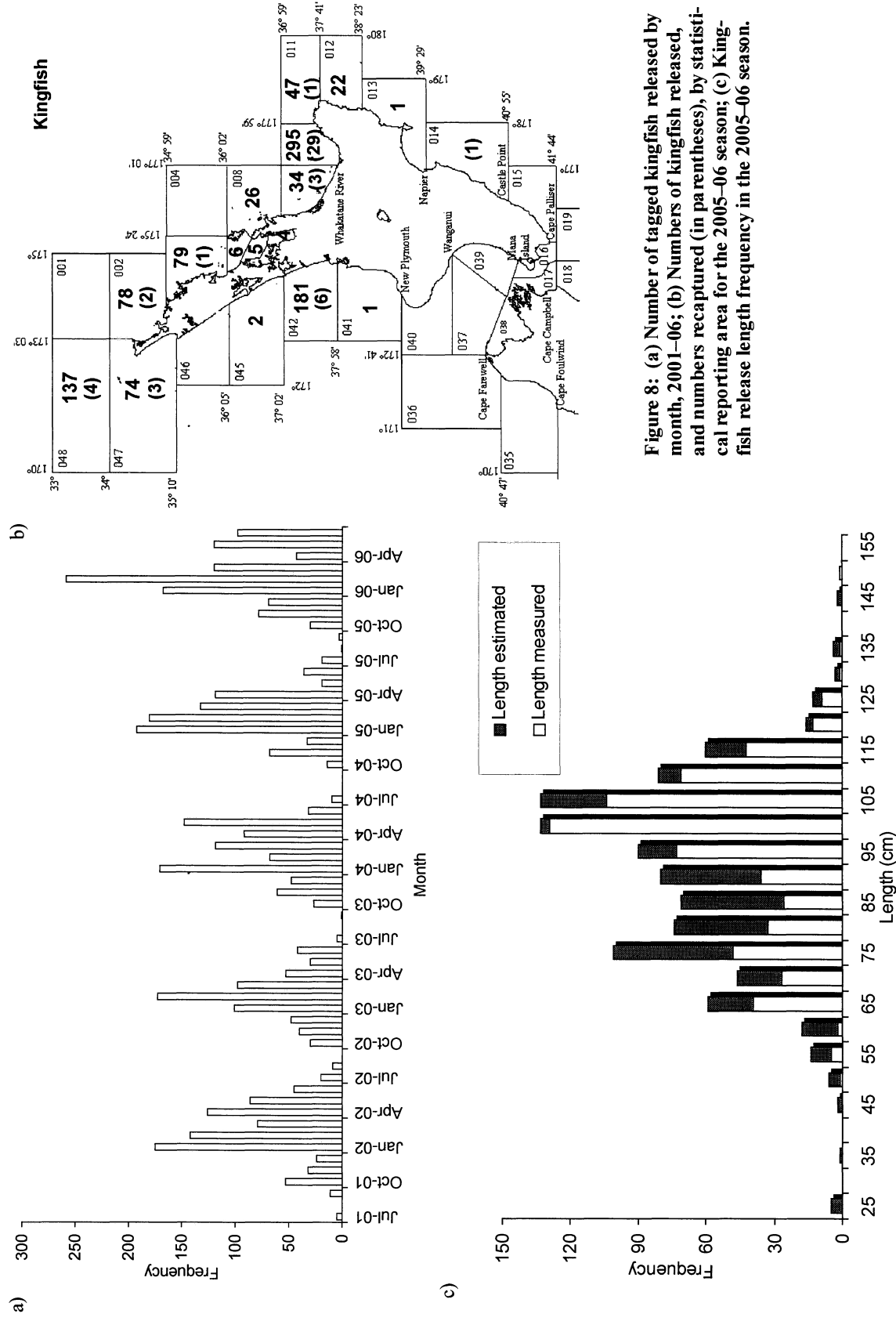


Figure 8: (a) Number of tagged kingfish released by month, 2001–06; (b) Numbers of kingfish released, and numbers recaptured (in parentheses), by statistical reporting area for the 2005–06 season; (c) Kingfish release length frequency in the 2005–06 season.

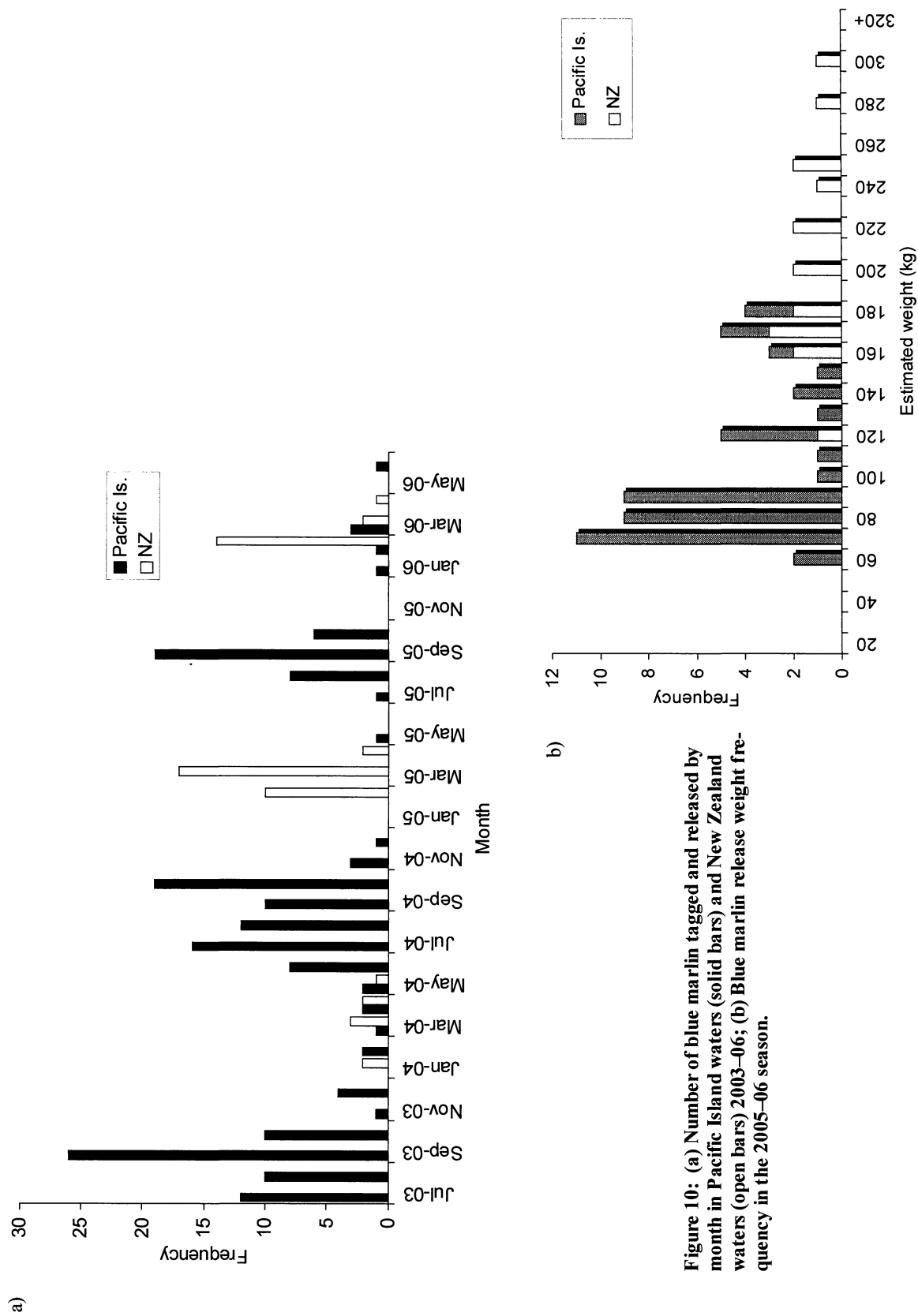


Figure 10: (a) Number of blue marlin tagged and released by month in Pacific Island waters (solid bars) and New Zealand waters (open bars) 2003–06; (b) Blue marlin release weight frequency in the 2005–06 season.

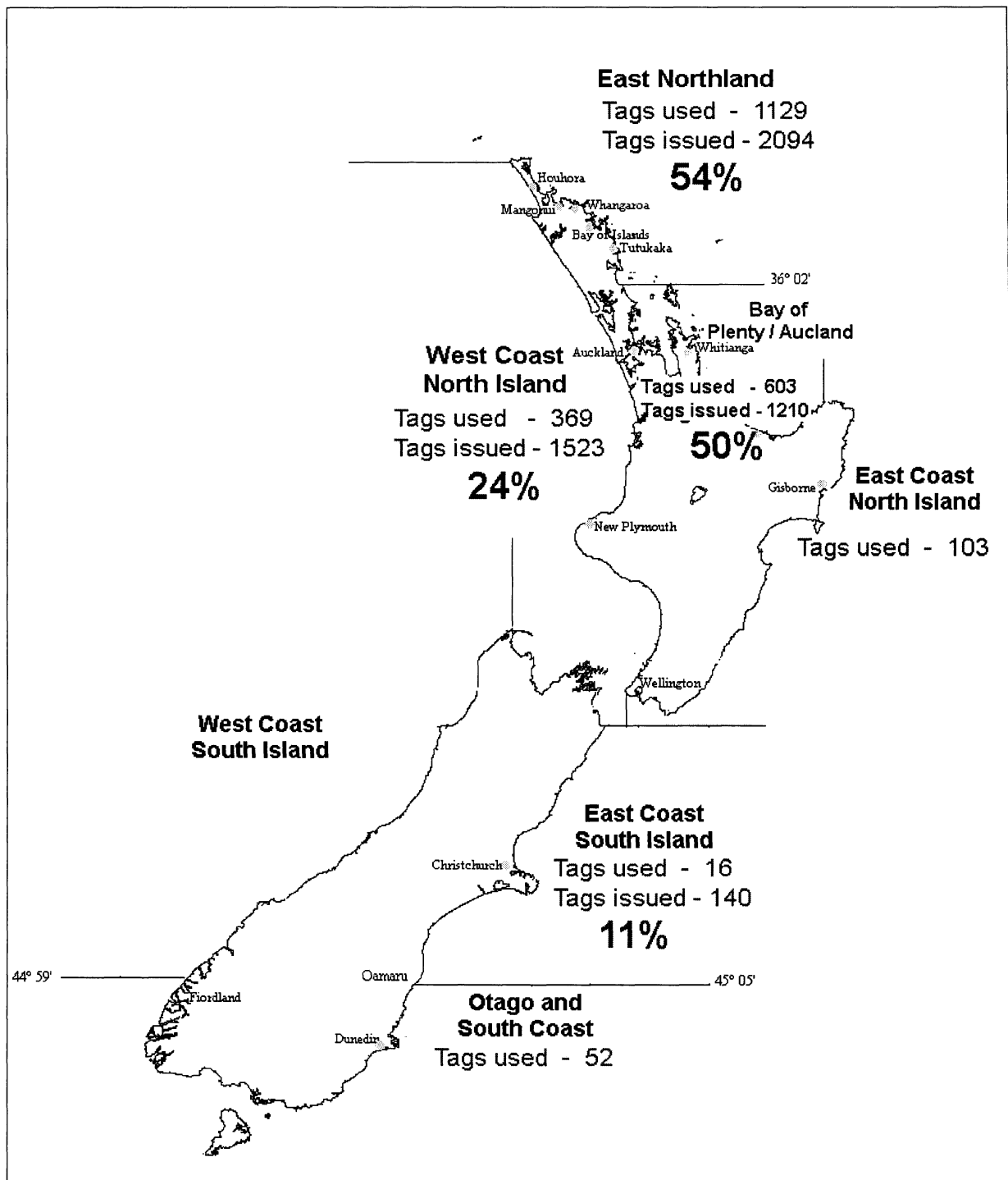


Figure 11: The number of tags issued to clubs and individuals and the number reported used by region for the 2005–06 season. The percentage of tags used can be influenced by the number of tags issued in previous seasons.