

6. Review of the domestic recreational fishery for striped marlin

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6.1 Introduction

A recreational fishery for marlin, including striped marlin, has existed off the east coast of Australia since the 1930s, and off the west coast since 1949. In the period since, the number of striped marlin caught by recreational fishermen has varied between decades, but in the past 10 years there has been a rapid increase in the number of striped marlin tagged and released off southeastern Australia. Increased tagging also occurred off Western Australia in 1999. The increasing tag release ethic has resulted from a growing conservation awareness amongst the recreational gamefishing community. This chapter will define the recreational fishery for striped marlin from three approaches:

1. A description of the historical development of the fishery and the methods and gears used to target marlin, and in particular striped marlin;
2. An analyses of club capture records;
3. A summary of gamefishing tournament catch per unit effort records and reports.

Tag-release and recapture data, as well as charter boat catch and effort data, have been collected for the recreational fishery also, but this data and the associated analyses are presented in Appendix I (Tagging data analyses) and Chapter 7 (Fishery interactions analyses).

This chapter concentrates on the east coast fishery simply through sheer weight of information available, due to the more extensive and larger size of this fishery. However, where possible, data and information pertaining to both Western Australia and New Zealand recreational gamefishing will also be presented. For information on recreational gamefishing in the wider Western and Central Pacific Ocean, refer to reports by Whitelaw (2001; 2003).

6.2 Historical development of the recreational fishery for striped marlin

6.2.1 Introduction

A detailed history of recreational fishing for marlin in Australia was produced as part of the Report of the Black and Blue Marlin Working Group on Assessment of Black and Blue Marlin in the Australian Fishing Zone (Campbell et al, 2002). While the emphasis in that work was on blue and black marlin, because striped marlin overlap with, and are caught by the same methods as the other marlins, substantial parts of that history are identical for the striped marlin recreational fisheries. Therefore, it is appropriate to update the relevant sections from the previous report here, modifying and adding to them as necessary to provide an up-to-date history for recreational fishing for striped marlin in Australia. It is also worth noting that 95.6% of all striped marlin tagged and released off the east coast of Australia were released in waters off NSW. As such, this section focuses mainly on recreational marlin fishing development and regulations pertaining to NSW. However, a brief description of the Western Australian fishery is also presented (Section 6.5), and other states are referred to where possible.

6.2.2 Development of the recreational marlin fishery

The first Australian game fishing rules were formulated in 1908 for the game fishing section of the New South Wales Anglers' Casting Club. This was only ten years after the formation of

the first game fishing club in the world, the Tuna Club of Avalon, formed on Catalina Island, California in 1898 by Charles Holder. The next reference to organised (regulated) game fishing in Australia appears to have been the formation of a game fishing division of the Newcastle Angling Club in 1928, (D’Ombrain 1957) while the first club dedicated solely to game fishing was the Great Barrier Reef Game Fish Angling Club, formed in 1929 (Dunn 1991).

The Game Fishing Association of Australia (GFAA) was formed on 30 June 1938. This occurred at a time of great interest in this new form of fishing, following a much-publicised visit to Australia by the American author and adventurer, Zane Grey during which he captured a variety of game fish, including a number of striped marlin. The formation of GFAA pre-dated that of the world body which dictates angling rules, the International Game Fish Association (IGFA), which was founded on 7 June 1939. The principles and concepts of line classes and angler ethics existed well before this, having been established by Holder, but the formation of national and international governing bodies allowed the development of organised game fishing under uniform rules and regulations.

Although the general rules and regulations governing game fishing in Australia have been ‘fine tuned’ with time, the general principles have been relatively consistent since the 1940s. Regulations cover virtually every aspect of game fishing, from all of the gear involved in hooking, playing and gaffing or tagging a fish, including: rods, reels, breaking strain of line, type of line, length of terminal tackle (double lines, leaders and traces), arrangement of hooks, type of hooks, length of gaff ropes, length of tag pole and so on; to the practice and sequence of events following a strike, right up to boating or tagging a fish. For example, no one other than the angler may strike the fish, and subsequently touch the rod or reel, the rod may not be rested on the gunwale of the boat, a member of the crew may only touch the leader to ‘trace’ the fish, and so on.

Although point scores for marlin have changed from time to time, and may vary between different affiliated clubs, points awarded to marlin for both capture and tag and release, have always been the same for each of the three marlin species (blue, black and striped). This means that there has never been a reason to selectively target particular marlin species (including striped marlin) on the basis of point score alone. The only possible exception to this might be blue marlin, the average size of which, in New South Wales, Western Australia and southern Queensland waters, is larger than that of black and striped marlin. This may have resulted in targeting of blue marlin for capture, at least by some boats, since the mid 1980s. A report by Murphy et al (2002) indicated an increase in the proportion of blue marlin captured, suggesting a shift in effort away from other billfish. Because striped marlin are more often encountered when fishing for blue marlin off southeastern Australia than are black marlin (black marlin tending to be caught more inshore than blue or striped), this may also have resulted in more striped marlin being caught and/or tagged than would have been the case if the blue marlin fishery had not developed.

6.2.3 Changes in rules and regulations

Some changes in the rules and regulations which govern organised game fishing have almost certainly influenced catches of marlin, including striped marlin. Rules and by-laws formulated by the GFAA and the State Game Fishing Associations, are based on the general principle of allowing a hooked fish a fair chance of escape. It should be noted that the rules governing game fishing tournaments are formulated by the organisations themselves, while regulations pertaining to bag limits and permitted gears are generally established by state governments. It is also important to note that changes in regulations often reflect shifts in attitudes, perceptions and ethics of both the angling community, and the general public. It is considered that two main areas of rules and regulations which have changed, and which may have

affected catches of marlin, including proportions of fish tagged and released through time (and therefore, decreased fishing mortality) are:

1. Changes in permissible line classes; and
2. Imposition of a series of size limits on marlin, imposed by the fishery itself. Club and state associations impose size limits for point scoring purposes, creating a system by which tag and release is encouraged for all but the largest specimens.

Line classes: Metrication of line classes occurred in 1976/77. This meant that some variations in breaking strain of official line classes came into force at that time. Table 6.1 shows the conversions between old and new line classes. As can be seen, in all cases, the post 1976/77 breaking strains were higher than the old, with all four of the lighter line classes effectively increased by 10%. The effect of this change would have been to theoretically enhance the chances of capture of a given fish using the metric line class, compared with the imperial. This could mean that a higher percentage of marlin might be captured after the change, especially in the late 1970s and early 1980s, when few marlin were being tagged in New South Wales. Conversely, as the tagging ethic gradually became established, the increase in effective breaking strain may have resulted in a higher success rate of bringing hooked fish to the boat for tagging.

Prior to 1978, the only line classes permitted by GFAA, as shown in Table 6.1, were 3, 6, 10, 15, 24, 37 and 60 kg breaking strain. In 1980, a 2 kg line class was introduced, and in 1982, three more line classes were added: 1, 4 and 8 kg. The effects of these introductions are unknown, but they are likely to have been minor, especially regarding the capture of striped marlin. Although some specialist anglers certainly targeted the new record categories for these line classes which became available for all gamefish species, including striped marlin, the proportion of this 'redirected' fishing effort would have been small compared to overall effort before and after the introductions.

The New South Wales Game Fishing Association (NSWGFA) has never taken line class into account for tagging point scores for marlin. If a marlin is caught and tagged on regulation tackle, regardless of line class, points for a tagged marlin will be automatically awarded. For this reason, vessels that intend to tag marlin exclusively have generally used relatively heavy line classes (exceptions would be charter boats fishing for records in light line categories, or using saltwater fly). In other states, line class is taken into account but this varies at the discretion of tournament organisers, whereas New South Wales tournaments generally adhere to the line class recommendations of the NSWGFA.

Imposition of minimum sizes for marlin: The Queensland light and heavy tackle fisheries for marlin have been predominantly tag and release since the late 1970s, in part to promote the tag and release ethic. In order to increase the proportions of marlin being tagged in NSW,

Table 6.1 - Changes to breaking strains of lines caused by metrication in 1976/77.

Old class(lb)	Old class(kg)	New class(kg)	% Increase
6	2.73	3	9.9
12	5.45	6	10.1
20	9.09	10	10
30	13.64	15	10
50	22.73	24	5.6
80	36.36	37	1.8
130	59.09	60	1.5

the NSW Game Fishing Association, from time to time, has regulated for minimum sizes of all species of marlin being brought to weigh stations by all clubs. The sequence of these regulations was:

1. July 1985: The first minimum weight (50kg) was introduced (for all line classes).
2. November 1989: The minimum weight was increased to 60kg (for all line classes).
3. May 1997: A minimum weight of 80kg for marlin caught on 15kg line class and above was introduced. The minimum weight for marlin caught on line classes under 15kg remained at 60kg.

These changes in regulations had immediate impacts on the numbers of all marlin, including striped marlin, being brought to weigh stations, and need to be considered when analysing historic catch and tagging data (see Figure 6.17). Not only did minimum sizes result in less fish being weighed, but they have also had an influence on the class of tackle being used to fish for striped marlin, and therefore, possibly, on the actual catch rate (catch per unit of effort – CPUE). This effect would presumably have been to increase average CPUE since the use of light tackle, and therefore, longer ‘fight’ times, would decline with each change to the size limit. Points for tagged marlin are awarded irrespective of line class used, and therefore, the use of heavier tackle would ensure shorter ‘fight’ times, less lost fish and more intervening fishing time.

It is important to note that these minimum sizes have been introduced by the fishery itself, specifically to encourage tag and release. The impact of these regulations means that fish which are estimated to be smaller than the existing minimum weight will be tagged and released in all point scoring events (including regular competition days throughout the game fishing season).

The influence of peer pressure in this regard should not be underestimated. As size limits have been adopted, it has come to be considered very ‘bad form’ to land a fish that is under that limit. Also, as game fishing has evolved, it has become increasingly less acceptable to weigh marlin for the sake of it. Possible exceptions to this ‘code’ are the weighing of record fish, and the landing of one’s first marlin, especially if a junior angler. This shift in attitude within the fishery itself has seen the tagging sections of competitions become increasingly prestigious, regardless of the size of the marlin being hooked. Therefore, for both mandatory and voluntary reasons, not only has the proportion of marlin being tagged as increased steadily, but also the size of the fish being tagged.

Because the effect of introduction of size limits has been to markedly reduce the number of captured (and landed) marlin estimated to be less than the prevailing weight limit, it is essential to combine the numbers of fish both captured and tagged through time to gain an understanding of trends in overall catches. The imposition of size limits has almost certainly had a marked effect on the proportions of striped and black marlin being weighed (but has probably had very little effect on blue marlin, since the great majority of blue marlin which occur off eastern Australia are larger than any of these limits) Nevertheless, as noted, for ethical reasons, the proportion of blue marlin being tagged has also increased markedly in recent years.

6.2.4 Government regulations

As a result of an agreement between the States and the Commonwealth, State Governments presently manage recreational fishing, including game fishing, within and beyond their State’s 3-mile limits. Even so, very few State laws apply specifically to the recreational capture or tagging of marlin. The only laws that do apply relate to bag limits and sale. In New South Wales, a limit of two marlin of each species, sailfish, spearfish or swordfish per angler per day applies (the lowest bag limit category available), while in Western Australia, the ‘bag’ limit is one marlin per angler per day with no distinction made between species. Bag limits

for marlin do not apply in other States. It is illegal to sell recreationally caught fish in any State or Territory.

6.2.5 Changes to game fishing gear, techniques and practices

The previous discussion demonstrates that game fishing in Australia has undergone major technological, logistic and attitudinal changes through time. Many of these changes have very likely accelerated over the past 15 years or so. Some of these changes have been the result of different targeting practices. Other changes have been imposed because of ethics, and have caused changes in targeting. All these changes may have affected effectiveness of effort and catch of striped marlin, both landed and tagged, through time. This section attempts to provide a chronology of the various phases through which the southeastern marlin fishery has evolved (particularly where striped marlin are concerned), taking into account the main influences which have contributed to each phase. It should be noted that this chronology applies primarily to the gamefish fishery of southeastern Australia, since this is where the great majority of striped marlin have been caught recreationally since the origins of the fishery.

First phase of fishery: Late 1800s to mid 1930s: Marlin had been caught off eastern Australia as early as 1854. In that year, a black marlin was landed inside Broken Bay, north of Sydney, using a handline baited with a mackerel (presumably, a slimy mackerel, *Scomber australasticus*). Reported in the 'Illustrated Sydney News', it is not clear if the fish was caught by a commercial or recreational fisherman, but the illustration and notes clearly indicate that the fish was a black marlin, weighing "somewhat in excess of 2cwt" (102kg). A photograph of a black marlin reported to have been caught in 1905 in a net inside Port Jackson (Sydney Harbour) is shown in Stead (1933). In 1913, the first verified recreational capture of a marlin on rod and reel was made in Australian waters. This was a black marlin weighing 70 pounds (32kg) caught off Port Stephens by Dr Mark Lidwill (Dunn 1991). This historic fish was donated to the Australian Museum, where its skeleton is still on public display. This fish apparently caused much interest among the angling fraternity, and game fishing from Port Stephens was pursued by some keen parties of Sydney anglers. Such a group recorded some of their catches between 1913 and 1920, and one of their photos from that time records two striped marlin (and a mako shark) caught during one day's fishing (Dunn 1991). The striped marlin weighed 350 pounds (159 kg) and 226 pounds (102 kg) and are the first known records of the capture of striped marlin by any method in Australian waters.

Second phase: Mid 1930s to late 1950s: Although striped marlin were being caught as early as the 1910s, it was not until the mid 1930s that Australia was recognised as an important game fishing location, primarily because of some notable captures of striped marlin off Bermagui. Although a well-publicised black marlin of 262lb was caught off Bermagui in 1933, the seminal event appears to have been the capture of 14 marlin in one day in 1935 off Bermagui by two Melbourne anglers, Bill Wallis and Roy Michaelis. The records of this catch have been lost, but a photo (published in Dunn 1991) clearly shows that all 14 were striped marlin – as identified by their very high dorsal fins, long lower jaws, pectoral fin shapes and slender bodies (Pepperell and Grewe 1999). News of this catch attracted the attention of American author and game fisher, Zane Grey. As a result, he made his first visit to Bermagui the following year (1936) and over a six week period, caught 13 marlin. Striped marlin dominated his statistics for this trip, with the tally being 10 striped and 3 black marlin. During the next five years, until fishing ceased due to World War II, game fishing at Bermagui was quite active, and records indicate that 242 marlin were weighed. Of these, 93 (38.4%) were black marlin and 150 (62%) were striped marlin, indicating the dominance of the latter species in the catch composition of that time.

Immediately after World War II, the NSW Game Fishing Association, in particular, the Sydney Game Fishing Club, became very active. Indicating this increase in effort, the

1948/49 annual report of the NSW Game Fishing Association noted that one member, Max Lawson, was reported to have caught his 100th marlin that season, clearly showing that catching marlin off New South Wales was no longer a rare event. Interestingly, however, striped marlin formed only a small proportion of the catch of marlin off Sydney in the late 1940s and early 1950s. As a matter of interest, in 1940, some of the earliest experiments in tagging marlin were carried out by pioneer gamefish angler and writer, Athel D’Ombrain. He released several black marlin off Port Stephens bearing numbered brass discs attached to their tails (Pepperell 1997).

Third phase: Early 1960s to mid 1970s: This period saw considerable growth in the popularity of game fishing. Many of the still existing southeastern game fishing clubs were formed at this time and numbers of events and competitions increased concomitantly. In 1963, a centrally organised tagging program for large pelagic fishes had been commenced in the United States, and using equipment from that program, tag and release began in Australia with the tagging of the first fish in 1968, a black marlin, by television personality, Bob Dyer, off the Great Barrier Reef. Tags used in Australia initially came from the United States, firstly from the Woods Hole Oceanographic Institution, then from the National Marine Fisheries Service (NMFS), California.

The Australian Gamefish Tagging Program was launched by NSW Fisheries in December 1973. Based on the successful American system, tags were issued to game fishing clubs throughout Australia (with the agreement of all State Ministers) and marlin began to be tagged from that time, to the present. The first striped marlin which appears on the NSW Fisheries tagging data base was tagged off Greenwell Point, New South Wales on 17 April 1974 by John O’Brien.

Fourth phase: Mid 1970s to mid 1980s: During this time the fishery began to operate regularly to the edge of the continental shelf, using larger, faster boats. The tagging program was developing, but, although tagging of billfish was quickly adopted in Queensland during this period, acceptance in New South Wales was slower, and captures still dominated there. Black marlin was the main species being caught inside the continental shelf, although several confirmed blue marlin were caught off central and southern New South Wales. Striped marlin was an important, but not major component of the catch during this period. In fact, from 1974 until the end of the 1985 season, only 46 striped marlin were tagged in Australian waters.

Fifth phase: Mid 1980s to mid 1990s: This was the time when the tagging of marlin increased dramatically in the New South Wales fishery. It was also during this period that the regular occurrence of blue marlin off the southeastern Australian coast was proven. Travel to and beyond the edge of the continental shelf was now routine, and the use of high speed, straight running lures was found to be effective on not only blue marlin, but on striped marlin and yellowfin tuna. This ‘bycatch’ probably encouraged more vessels to make the longer, more expensive trip to ‘the shelf’, although it should be emphasised that blue marlin were the primary target of this expansion of effort.

While striped marlin were often caught by boats fishing wider off the coast, it was also noted that on occasions, groups, or ‘pods’ of striped marlin would rise to the surface behind trolled lures, but would be difficult to hook in such circumstances. No targeting techniques for striped marlin had yet been developed, but these sorts of observations hinted at later techniques which would prove to be successful in targeting striped marlin.

Sixth phase: mid 1990s to present: Compared with black marlin, striped marlin were a relatively minor component of the recreational marlin catch off southeastern Australia until the early 1990s (Figure 6.1). Since then, the numbers of striped marlin being caught (mostly

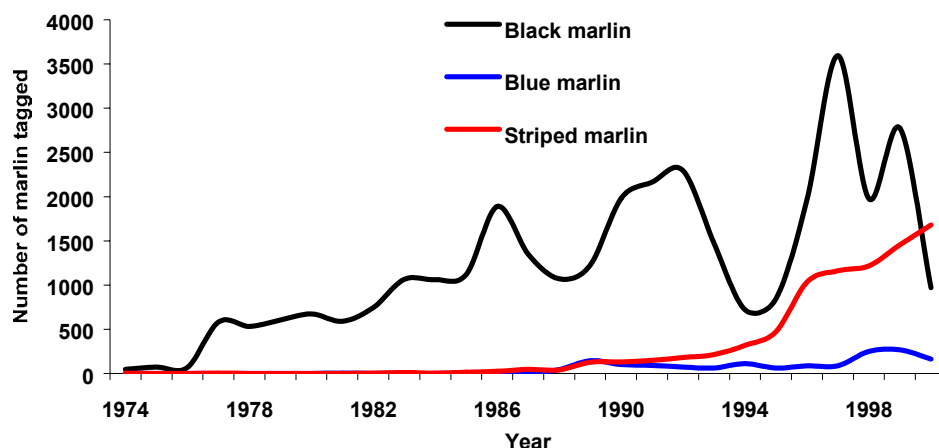


Figure 6.1 – Comparison of the numbers of black, blue and striped marlin taggings off NSW. (Source: NSW Fisheries).

tagged) has increased markedly, to become the dominant species of marlin in the New South Wales sector of the fishery. It is not entirely certain why this has happened. Catch rate standardisations presented in Chapter 8 suggest that it may have at least in part been due to increased abundance or availability of marlin at this time. A full discussion of this issue is presented in Chapter 8. Some expert anglers and captains consider that methodology has played a major role, in particular, the adoption of the ‘livebaiting’ and ‘switch baiting’ methods. With the advent of reliable Global Positioning Systems (GPS) and powerful, colour depth sounders, undersea features such as deep canyons, seamounts and reefs are easily located. In addition, it has been found that such features often hold large quantities of ‘bait’ (slimy mackerel, jack mackerel, pilchards etc) which in turn, attract feeding aggregations of striped marlin. Unlike the other marlins, striped marlin feed cooperatively by ‘balling’ baitfish schools, and the detection of such bait balls is an important aspect of striped marlin fishing. Once a bait ball is located, the attendant marlin are

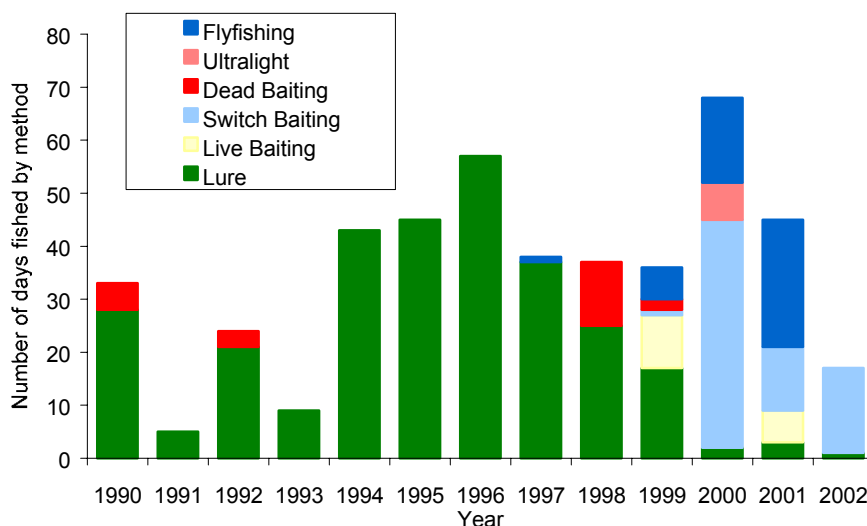


Figure 6.2 – Number of days fished by method according to records collected from Col Grimes, a deckhand who routinely worked on up to five boats per season, between 1990 and 2002. His records indicate the predominant method used for each day of fishing, and as such provide a “snapshot” of gear and method changes that have occurred in the charter boat fishery for striped marlin in the past 12 years.

Table 6.2 - Australian records for striped marlin

Date	Weight	Location
16-Feb-38	142.7 kg	Bermagui*
27-Feb-38	149.7 kg	Ulladulla*
20-Mar-38	163.6 kg	Bermagui*
3-Mar-38	146.4 kg	Bermagui*
20-Oct-68	153.3 kg	Sydney
28-Feb-76	154.7 kg	Tasmania
24-Oct-76	161.9 kg	Botany Bay
11-Apr-82	166.0 kg	Bermagui
12-Sep-85	169.5 kg	Sydney
14-May-88	172.0 kg	Bermagui
28-Mar-92	191.5 kg	Tathra

*Large striped marlin recorded before official GFAA records

then ‘teased’ to the surface with large, colourful trolled lures without hooks (teasers) and then, the teasers are switched for live baits fed quickly back to the fish. Using this method, in conjunction with efficient ‘stand-up’, relatively heavy tackle, catches of more than 10 striped marlin a day have been recorded in recent years. One charter vessel fishing off Bermagui tagged more than 200 marlin for the 1999/2000 season. Nearly all of these fish were striped marlin, caught using the above “switch bait” method. The transition from predominantly lure fishing to “switch bait” techniques is apparent in East Coast charter boat records, which were collected for analyses of catch and effort data (chapter 7) but also provided methods related information (Figure 6.2). Although the switch baiting method can help to explain very high catch rates of striped marlin from 1999 on, it was not in use to any marked extent before that time, and does not therefore explain increased catches of striped marlin in the earlier years of the 1990s.

6.2.6 Chronology of striped marlin record captures

Table 6.2 lists the all-tackle Australian records for striped marlin chronologically. Before 1940, there were no official records, but some large specimens caught about that time are included in the list, and marked with an asterix. This indicates that large striped marlin have been available off southeastern Australia since the origins of the gamefish fishery in the late 1930s, and that none of the record sized striped marlin have been caught north of Sydney.

6.2.7 Numbers of Clubs

While we have no measures of fishing effort through time for the gamefish fishery, the numbers of clubs affiliated with GFAA may give some indications of growth of interest in this form of fishing. Table 6.3 shows the number of member clubs throughout Australia for three years, representing the earliest year for which records exist, a year in the mid 1980s, and current affiliations. These show that numbers of clubs have either been maintained, or increased (NSW, Qld and WA).

6.3 Recreational gamefishing equipment

There are many components of equipment used for marlin fishing which have been altered and adopted through time, and in so doing, may have influenced the total catches (landed and tagged) and catch rates of striped marlin. In this section, each piece of equipment is

Table 6.3 - Numbers of clubs affiliated with the Game Fishing Association of Australia (GFAA).

State	1957*	1985**	2003
NSW	8	18	23
QLD	2	17	22
VIC	1	20	17
WA	1	5	11
SA	1	5	6
TAS	0	4	4
NT	0	5	5
Total	13	74	88

*From D'Ombra (1957)

** First annual report of GFAA containing these data

considered with a view to determining any changes that are likely to have affected catches and catch rates.

6.3.1 Line

As well as the traditional classes of 3, 6, 10, 15, 36 and 60kg breaking strain lines, some lighter line classes were introduced into game fishing in the early 1980s. World and Australian records could then be claimed on 1, 2, 3, 4, and 8kg breaking strain line, and the increasing use of such lines may have resulted in some lowering of the effective catch (or tag) per unit of fishing effort, since more fish would escape when hooked on such light line. It is impossible to quantify this, however, and the effect is considered to be minimal.

The quality of line available has steadily improved. From the early days of game and sportfishing, when linen thread lines were used, advances in monofilament nylon extrusion have produced high quality pre-tested 'tournament grade' lines. Crimping systems are now available which can attach terminal tackle to the main line without knot-fatigue problems. Newer 'gel-spun' lines with little stretch have also become available, but are yet to be widely used in game fishing.

6.3.2 Rods and Reels

The main changes to rods and reels have been in their design and materials used. Early long, heavy rods did not give the angler much advantage over the fish. However, since the mid 1980s, newer designs which feature shorter, fast-tapering rods have seen increased use and are very effective while standing using an efficient 'short stroking' technique. Even harnesses and rod buckets and gimbals have also improved dramatically, allowing the angler to play a fish much more effectively and comfortably. The effects of this new equipment and methods have been to shorten the fight time on a given fish — the longer a fish is on the line, the greater the likelihood of losing the fish. Increasingly, competitive gamefish anglers are fishing for tag points, in which case, line class becomes irrelevant, the object being to tag as many marlin as possible in the allotted time. Therefore, the use of these methods and gear increases the chances of tagging a marlin, and, in allowing heavier tackle to be used from small boats without a chair, ensures shorter fights and more actual fishing time between catches. Again, without data, it is not possible to quantify the effect of these changes. Nevertheless, it is very likely that this gear and technique have increased the numbers of hooked fish per unit of effort, and the ratio of hooked fish to actual captures or taggings considerably, thereby increasing the apparent catch per unit effort (fish per boat day).

Similarly, specialised lever-drag game fishing reels are now engineered to far higher standards and tolerances than previously. This results in more efficient and effective angling techniques, and fewer breakages or seizing-up of reels during the fight. Again, the major advances in this area have taken place since the mid to late 1980s. The combination of the move to tagging point scores, with gear that can 'beat' the fish quickly (rods, line, boats) means that, at least in theory, more effective time can be spent fishing, rather than fighting fish.

6.3.3 Lures

The use of lures in marlin fishing in Australia has almost certainly had an effect on catches and catch rates of marlin, in particular, through gear selectivity. It was not common to use lures to effectively target marlin before the early 1980s, trolling live or dead fish baits being the preferred methods. It was known that lure fishing caught blue marlin in Hawaii, but it was not until anglers began returning from Hawaii with these lures that the same methods proved effective here.

Although blue marlin were occasionally taken off the east coast since the mid 1950s, very few appeared in the catch records of clubs, or the tagging records of NSW Fisheries, until the 1980s. Because better boats had made the waters at the edge, and beyond, the continental shelf more accessible, a few dedicated boats began trolling in those areas with lures known to be successful on blue marlin off Hawaii. These lures, which track in a straight line, rather than zigzagging and jinking (and are hence known as straight runners) were immediately successful in attracting strikes from, and catches of, blue marlin. Because the blue marlin along the southeast coast tend to be larger than black and striped, the discovery of a 'new' fishery for larger marlin, beyond the normal fishing grounds, was an immediate trigger for an expansion of effort in this area. This relatively simple change of lures by some dedicated marlin anglers had a major and lasting effect on targeting and catches of marlin, especially blue marlin.

6.3.4 Hooks

Hooks used in marlin fishing have not changed a great deal through the history of the fishery. It is only in very recent years (since 1999) that the use of a new hook type has emerged, and will probably have an effect on some aspects of marlin catches in the immediate future. This development is the use of circle hooks, which tend to hook the fish in the side of the mouth, rather than deep in the throat or stomach. Although the 'hook-up' rate of circle hooks is less than the traditional 'J' hooks, the effective catch is similar since the circle hook is rarely thrown by the fish (Dr. Eric Prince, US National Marine Fisheries Service, Miami, personal communication). The use of circle hooks was minimal until very recently, but a wave of interest, generated by many articles in fishing magazines, has seen a sudden increase in their use in marlin fishing using both live and dead bait, from Cairns to Bermagui. It would be important to monitor the growth of the use of circle hooks in this fishery in future, since it is likely to have effects on catch rates, and perhaps more importantly, on potential survival of released fish.

6.3.5 Other equipment

As well as rods, reels, hooks, lures and line, other specialised equipment used for game fishing has also evolved and improved. Such equipment includes specially designed fishing chairs, 'outrigger' poles and rigging, methods of line release, rod buckets, and so on. All of these have improved, and while mainly making the job of hooking, and bringing a fish to the boat easier, have no doubt combined to increase the overall efficiency of the operation. An example of this would be a new bait system developed recently in the striped marlin fishery. This consists of a large, doughnut shaped bait tank which is located under the fighting chair.

The size of the tank allows large slimy mackerel to be kept in good condition for many hours, in preparation for the 'bait and switch' method referred to above.

6.3.6 Electronics

Sophisticated electronic navigation and depth (or echo) sounding equipment have caused a mini revolution in game fishing within the last 10 years, or even less. These have allowed boats to easily locate and then relocate bottom features, in particular, reefs, canyons and seamounts. Sounders can even discriminate balls of baitfish, which have been shown to be very important in locating striped marlin, in particular, and experienced charter captains claim to be able to discriminate individual marlin. As well as ensuring perfect navigation, GPS (Global Positioning System) also allows the boat to return to the site of a previous billfish 'encounter' or baitfish aggregation. Sometimes, these contacts are not obviously associated with bottom features, but nevertheless, use of GPS has shown that strikes from billfish often occur at the same locations. Temperature gauges are also standard equipment on all serious marlin fishing boats, and are used in locating temperature fronts (boundaries between different masses of water). Some fishers also take advantage of real-time infra-red and ocean colour satellite imagery that has only become readily available in the past several years. These satellite data may include an analysis that highlights areas that display features most likely to contain a particular gamefish species. Prior to this leap in technology, sea surface temperature data were available via facsimile from the Royal Australian Navy, but were seven days old when transmitted. These earlier data were available for the New South Wales coast from about 1985. Although presently not used in game fishing, there is growing interest in specialised 'bird radar' that is frequently used by high seas commercial tuna purse seine vessels. If and when this equipment becomes economically viable to fit to game fishing vessels, it is likely that it will be readily accepted in the same way that other electronic aids have been.

6.3.7 Boats

The main changes in relation to the effect of boats on striped marlin fishing relate to their range and seaworthiness. Boats used in the fishery have steadily increased in power, size and reliability. After World War II, until the mid 1970s, it was unusual to fish more than about 15km of the home port. Engines were either single, or if twin, rated at less than 150hp. The increasing availability of much larger engines (200hp and much greater), as well as advances in fibreglass and electronic technology, made trips to the edge of the continental shelf and beyond fast, safe and comfortable. Increasing affluence in the early 1980s also very likely contributed to the accessibility of advanced boats and equipment. One other aspect of boat design has been the increasing availability of 'off-the-shelf' boats specifically fitted out for game fishing in the factory. This allows even the novice angler to immediately take advantage of all of the latest gear and electronic technology.

Of course, not all changes have been available to all individuals, but the accumulation of improvements and knowledge have made it progressively easier to target, hook, and catch or release marlin over the past 40 years. Thus, the examination of trends in CPUE of the recreational fishery over time must take these factors into account.

6.3.8 Development of gamefishing methods

Since the inception of targeted gamefishing for marlin, methods have evolved continually, with changes to the species sought and the preferred method used to catch each species. Furthermore, as discussed above, the objective of gamefishers has changed significantly over the years, and to such a degree that effective targeting of various species requires development of alternative gamefishing methods. A major problem in the interpretation of recreational catch data in terms of relative fish abundance is the wide range of techniques used and the extreme variation in the suitability of these various techniques (in addition to a

general paucity of nominal effort data for the vast majority of the fleet). Furthermore, the skill of individual gamefishers in employing the various techniques will vary significantly, further complicating the interpretation of nominal catch rate data from recreational fisheries. A general understanding of the range of methods employed in gamefishing provides an indication of the complexity associated with the interpretation of gamefishing data. The following section identifies and describes briefly recreational fishing methods used to capture striped marlin in Australian waters.

6.3.9 Live Baiting

The term live baiting refers to the use of small live baitfish that are hooked lightly to allow them to survive while being fished. The most common live baits are slimy mackerel, yellowtail scad, bonito and various species of small tuna. Live baits are generally either trolled slowly (<3 knots) or fished from a drifting or anchored vessel. Slow trolling has been the predominant live baiting method, although in recent years, live bait switching has become popular.

One technique that has become more common involves fishing live baits deeper in the water column by attaching lead weights to the lines and/or slowly reversing the vessel into the direction of the wind/sea. By utilising these procedures the bait rig is free of the water drag imparted while drifting or trolling. Downriggers are sometimes used to deploy live baits, particularly while slow trolling.

Live baiting is also the method of choice for the small but dedicated group of land based gamefishers who catch a small number of black marlin while fishing from rock platforms such as those in the vicinity of Jervis Bay, NSW. These gamefishers deploy live baits that are fished under small floats or balloons. To the author's knowledge, no striped marlin have been captured yet, using this method.

Generally, while teasers are frequently used in conjunction with slow trolled live baits, dedicated berleying/cubing (release of dead fish, offal and blood into the water) in pursuit of marlin is rare although not unknown. This is in contrast to some yellowfin tuna and most shark fishing wherein the use of berley is the method of choice. It should be noted, however, that striped marlin are occasionally caught by this method (see next section), and indeed, are the most likely marlin species to be so caught.

The large catches of striped marlin by the recreational sector since the late 1990s have been enhanced by the use of live bait techniques in places such as Sydney, Port Stephens and Bermagui.

6.3.10 Dead Baiting

The term 'dead baiting' generally refers to the trolling (4-8 knots) of 'rigged' dead fish. A range of species is used for this purpose. These fish are rigged in such a manner as to cause them to either skip along the surface ('skipping bait') or 'swim' just under the surface ('swimming bait'). The use of downriggers to present dead baits has increased in the last ten years, but is still relatively uncommon outside the Cape Bowling Green and Cape Moreton light tackle fisheries that generally target small black marlin.

Trolling dead baits is the predominant method for targeting black marlin in the northern Queensland heavy tackle charter fishery and, for many years, using much smaller baits, the predominant method in the light tackle fisheries for black marlin and sailfish of both northern and southern Queensland. In the light tackle fisheries, there has been a tendency to change to live bait fishing in recent years. Few striped marlin are caught in those fisheries, however.

One method which incidentally catches striped marlin in New South Wales fisheries is the use of large dead baits intended for sharks and fished from a drifting or anchored boat. For unknown reasons, striped marlin are by far the most likely of the billfish species to be caught by this method, and while it is not a common occurrence, it occurs often enough to be considered in any analysis of the game fishery for striped marlin.

6.3.11 Lure Trolling

Lure trolling involves the towing of artificial 'baits', generally plastic 'skirted' lures, at speeds ranging between 6 and 10 knots. Lure trolling is a popular method for many novice billfish anglers due to the relative ease of purchase and rigging compared to other methods. It is also a common method used to locate billfish concentrations, particularly due to the high speeds used and the ability to cover large areas during searching. After concentrations of marlin are located, the fisher has the opportunity to fish with more productive methods such as live baiting or switch baiting. Lure trolling is the primary method used to target blue marlin due to the large areas that must be searched to catch this species, the most oceanic of all billfish. Lure trolling is still a popular method for fishers targeting striped and black marlin, primarily due to its simplicity and relatively low cost.

6.3.12 Teasers

Teasers are generally any hookless natural or artificial bait or object used while trolling or drifting to attract the 'attention' of billfish. There are two common forms of teaser. One, the 'witchdoctor', is a piece of mirror covered, brightly painted wood around 2-3ft in length which dives to several metres below the surface while trolled and wobbles with water pressure to send off large flashes of reflected light. The second is called a 'daisy chain' and refers to a series of lures (various but commonly soft rubber squid imitations) or dead natural baits one behind the other and rigged to splash along the surface of the water behind the boat while trolled.

6.3.13 Bait and Switch/Switch Baiting

When a marlin is raised by the teaser, it is quickly drawn away from the fish and immediately substituted with a live or dead bait attached to a hook. The method is extremely effective for hooking striped marlin as it combines the searching capability of lures and dead baits with the hooking efficiency of live baits. It is also believed that the billfish becomes 'agitated or excited' by the process and is more likely to attack the hooked live or dead bait. This method generally requires experienced crews of several members and is more suited to larger vessels especially those with a flybridge or tower to observe the attacking fish. Switch baiting has grown in use in the past five years to the point where it has become a major specialised method in several recreational striped marlin fisheries, in particular, Port Stephens and Bermagui.

6.3.14 Saltwater Fly Fishing

This highly specialized form of marlin fishing is intentionally difficult to undertake and inefficient, and is therefore generally only attempted when marlin numbers are expected to be high in an area. With the apparent increased availability of striped marlin in recent years off the NSW coast, this method has become popular with some of the specialized charter boats, mainly fishing from the Port Stephens area. The method involves teasing marlin to the surface in much the same fashion as in switch baiting, but instead of presenting the marlin with a live (or dead) bait, a saltwater fly is cast near the head of the fish. Striped marlin are considered the best marlin species for this type of fishing since they are more prone to teasing than the other two species, and when abundant in an area, many 'shots' at fish may be expected in a day's fishing. Because of the difficulties in hooking a fish, and after doing so, bringing it to the boat, the method has a very poor catch per unit of effort.

6.3.15 Circle Hooks

In recent years there has been an increase in the use of circle hooks in live and dead baits (not in artificial lures or flies) in response to angler concerns over the survival of deeply hooked billfish caught on the traditional 'J' hooks. Several tournaments are now considering prescribing the use of circle hooks with the intention of reducing mortalities of released marlin. Otherwise, anglers are free to use or not use circle hooks as they please, and the frequency of their use within the fishery is unknown. Some clubs in Queensland have established point score systems to promote the use of circle hooks.

6.3.16 Live Bait

There has been an on-going debate among many in the gamefishing regarding the use of live baits. Elements of this debate were generated through concern over the increased rate of 'gut-hooking' associated with live baits and the perception that increased mortality of released fish would result. Others believe that the use of live bait does not require the same level of skill as other methods and therefore is not in keeping with the spirit of gamefishing. Again, the incidence of live bait fishing is unknown within the fishery since no such statistics are kept during organized events.

6.4 Brief history of the southeast charter fishery for striped marlin

In Australia, charter fishing, specifically for marlin, could be regarded as beginning with the visit of American author Zane Grey in 1936 when he successfully chartered a number of vessels, notably the 'Avalon' at Bermagui, and indeed, captured a number of striped marlin. The intervention of the Second World War postponed the enthusiasm that this successful trip had generated, but by 1948 game fishing off the eastern coast was gaining popularity. At that time the annual report of the NSW Game Fishing Association listed a number of charter boats available for game fishing, including three in Sydney, two at Port Stephens, two at Newcastle, one each at Shell Harbour, Jervis Bay and Ulladulla, and six at Bermagui. The charter fishery which targets, or at least catches striped marlin on a regular basis is geographically defined between Port Stephens in the north and Merimbula in the south. There is some charter fishing to the north (Coffs Harbour) and to the south (Eden) of this zone, but the vast majority of catch and effort occurs there. Since about the mid 1990s, apparent increased availability and/or targeting of striped marlin has almost certainly enhanced the New South Wales charter boat fishery. It is thought that this has encouraged more charter vessels to enter the fishery, especially at Port Stephens and Bermagui.

As noted, Bermagui has had a charter fishery which targets marlin for at least some of the time since the origins of marlin fishing in Australia. The active current fleet size is about 6 vessels, and these spend nearly all their charter days fishing from their home port. Over the past four years or so, large numbers of striped marlin have been caught (tagged and released) from Bermagui charter vessels, most using the switch baiting method. The charter fishery at Port Stephens has developed rapidly in recent years, and since 1997, has been swelled by a number of vessels from the Cairns based black marlin fleet which travel there for the late summer/early autumn fishery. One aspect of this particular fishery is the growing popularity of salt-water fly-fishing for marlin, and many world records for all three species of marlin have been set off Port Stephens in the past three years. These are not large fish, but are records for the tippet classes and light line classes being used. The Sydney based charter fleet is relatively small (about 6 boats on average), and does not tend to target striped marlin per se. It is what could be termed a mixed marlin fleet, with perhaps a less discriminatory clientele than those who charter from Bermagui or Port Stephens. One very active charter boat has operated from Merimbula over the last decade or so, and has specialised in targeting striped marlin in the region. A description of catch and effort data pertaining to striped marlin which has been collected from charter boats operating off the east coast, is presented in Chapter 7.

6.5 Recreational Fishing for Striped Marlin in Western Australia

A history and summary of game fishing in Western Australia is given in Campbell et al (1998). In summary, and updating where information pertaining to striped marlin is available, the Western Australian Game Fishing Association (WAGFA) was formed in 1949, along with the first club, the Perth Game Fishing Club. Most of the other long standing clubs became active by the early 1970s. There are currently 11 clubs affiliated with the WAGFA, the most active marlin fishing clubs being Exmouth GFC, Norwest GFC and Perth GFC. Two northern clubs, King Bay GFC (Dampier) and Broome Fishing Club, are also very active, but because of their geography, by far the most important billfish which they target is sailfish. There are currently just over 1,000 members of game fishing clubs in Western Australia. As noted in Campbell et al (1998), anglers who do not belong to affiliated game fishing clubs also catch billfish, including striped marlin, off Western Australia, but without a specifically designed study to determine their numbers or their catch, it is not possible to quantify this non-club, or 'leisure' sector of the recreational billfish fishery.

Because of the high incidence of sailfish in the north of the State, the main species of billfish targeted and caught (tagged) in Western Australia are sailfish, which numerically dominate the total catch. However, as noted, the great majority of the sailfish are caught off Dampier and Broome. Marlin species are targeted from Exmouth south, with all three species of Indo-Pacific marlin, black, blue and striped marlin, included in the historic catch. Striped marlin are certainly not a common species of marlin caught in Western Australia, but good numbers appear from time to time.

The main fishing centres from which striped marlin are caught by gamefish anglers in Western Australia are Perth south to Cape Naturaliste, and Exmouth. Consequently, the main clubs which have taken or tagged striped marlin in Western Australia are the Perth GFC and Exmouth GFC. Game fishing clubs are active in other centres as far north as Broome, but very few striped marlin catches have been recorded from these.

Campbell et al (1998) indicated that a total of only 38 striped marlin had been tagged in WA between 1977 and 1997. More up to date figures derived from the Australian Gamefish Tagging Program, operated by NSW Fisheries, and from the US based Billfish Foundation show that the total number of striped marlin tagged in WA was actually 54 in 1997 and stood at 172 by late 2002 (although figures for 2001 and 2002 are incomplete). Figure 6.3 indicates that the number of striped marlin tagged each year for the whole State (virtually the total caught, since only a few striped marlin have ever been boated in Western Australia) was always less than ten from the first records in 1979 until 1996.

However, in 1997, 1998 and especially 1999, there was a sudden increase in the numbers of striped marlin which were contacted by the recreational fleet, reaching a sharp peak of 90 fish tagged in 1999. This sudden jump in numbers of striped marlin caught appears to have been due to an unusual influx of fish, mainly off Perth. Of the 90 fish tagged in 1999, 82 were tagged at or near the Rottnest Trench while 2 were tagged off the Abrolhos Islands and 6 were tagged off Exmouth. The cause of this unusual influx of striped marlin is not known, but in the same year, record numbers of blue and black marlin were also tagged in Western Australia, suggesting a possible environmental shift which occurred that year. Since the peak of striped marlin catches in 1999, the numbers tagged returned to their historic levels of less than ten per year.

As an indicator of the relative catch of striped marlin in the total marlin catch of gamefish anglers in Western Australia, Figure 6.3 also shows the number of black and blue marlin caught off Western Australia since the first marlin was tagged in 1979. Clearly, except for 1997, 1998 and the particularly unusual year of 1999, striped marlin have historically represented a relatively small fraction of the recreational marlin catch

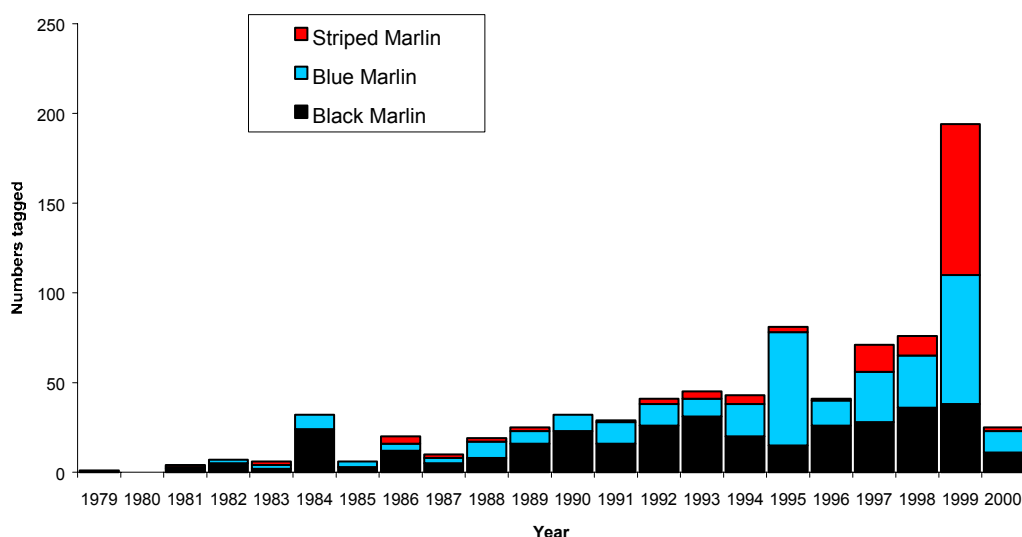


Figure 6.3 - Numbers of each of the three species of marlin tagged off Western Australia. Figures for 2000 are incomplete.

in Western Australia. This was also the case off eastern Australia for several decades, until new methods for catching striped marlin developed in the 1990s, along with an apparent increased availability of the species (see Chapter 8). It is possible that similar adoption of such techniques in Western Australia may increase catches of striped marlin in the future, but this possibility necessarily remains speculative at present.

The estimated sizes of all striped marlin tagged in Western Australia are shown in Figure 6.4. This indicates two possible modes, one at 40 to 50kg and another at 71 to 80kg. On the east coast, the primary mode of size of striped marlin tagged corresponds to the larger mode in WA, while smaller fish in the 40 to 50kg range are not common on the east coast. This suggests that the Western Australian gamefish fishery may contact striped marlin at an earlier stage in their life cycle than is the case in the east. Of course, this would need to be verified by comparative ageing studies.

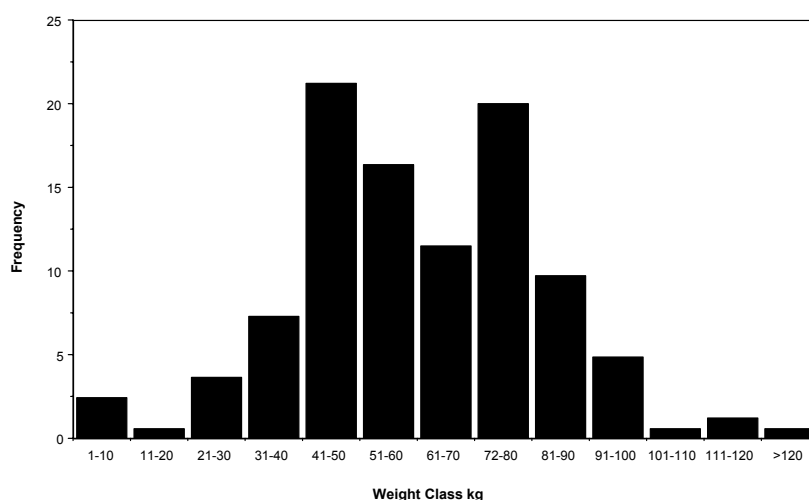


Figure 6.4 Estimated sizes of striped marlin tagged off Western Australia, 1979 to 2002 (n = 166).

6.6 Trends from club capture records

6.6.1 Introduction

Game fishing clubs operating under specific rules and regulations have operated off New South Wales since 1936, the year the Game Fishing Association of Australia was formed. Fortunately, since the origins of game fishing in this country, most organized clubs have routinely recorded, on an annual basis, all gamefish captured (and later, tagged) by club members. These lists are normally published as part of each club's Annual Reports to its members, and if they can be obtained, form a unique and valuable, if scattered, historic record of captures through time. While no fishing effort data are available to complement these records (at least, not until the commencement of monitoring of catch and effort at NSW game fishing tournaments in 1994), these composite records are still very useful for a range of analyses, including species composition of the catch through time, size composition of individual species through time, absolute numbers landed, by species through time, and so on. Because changes in fishing practices and fishing rules and regulations have occurred through the available time series, it is important to note and take these into account when using and analysing these data. The following game fishing clubs supplied capture data:

- Bermagui Big Game Anglers Club
- Botany Bay Game Fishing Club
- Broken Bay Game Fishing Club
- Canberra Game Fishing Club
- Lake Macquarie Game Fishing Club
- Latrobe Valley Game Fishing Club
- Newcastle and Port Stephens Game Fishing Club
- Port Hacking Game Fishing Club
- Shoalhaven Game Fishing Club
- South Gippsland Game Fishing Club
- Sydney Game Fishing Club
- Victorian Game Fishing Club

While these clubs range from Port Stephens to Victoria, the three Victorian clubs all fish primarily from Bermagui in southern New South Wales, and it is highly likely that all the striped marlin recorded by them were landed in southern New South Wales. Game Fishing Clubs do exist to the north of Port Stephens, but none of these publish their catches in Annual Reports, and they have far fewer members than the ones listed. Furthermore, relatively few striped marlin are known to be caught north of Port Stephens so it is considered that the data collected from the above clubs represents the great majority of striped marlin landed by organized gamefish anglers off southeast Australia.

The records span the years 1936 to 2001, although obviously not all clubs have been extant throughout this period. The data presented prior to the 1950s probably represent all of the club captures of striped marlin at the time. Bermagui Big Game Anglers Club and the NSW Game Fishing Association were virtually the only 'organized' game fishing during this period, and all of their records have been obtained and entered. NSW GFA became the Sydney Game Fishing Club in 1951, maintaining continuity of records since then.

Every effort has been made to locate annual reports for every year of each club's existence. However, it is important to note that some gaps occur in the records for a number of clubs. These gaps occur either because exhaustive searches by club secretaries failed to locate them, or annual summaries were never compiled and published by clubs.

The number of clubs contributing data varies through the time series (Figure 6.5) being highest in the mid 1980s and 1990s. The annual number of reported striped marlin club captures shows two peaks in 1988 and in 1996 (Figure 6.5).

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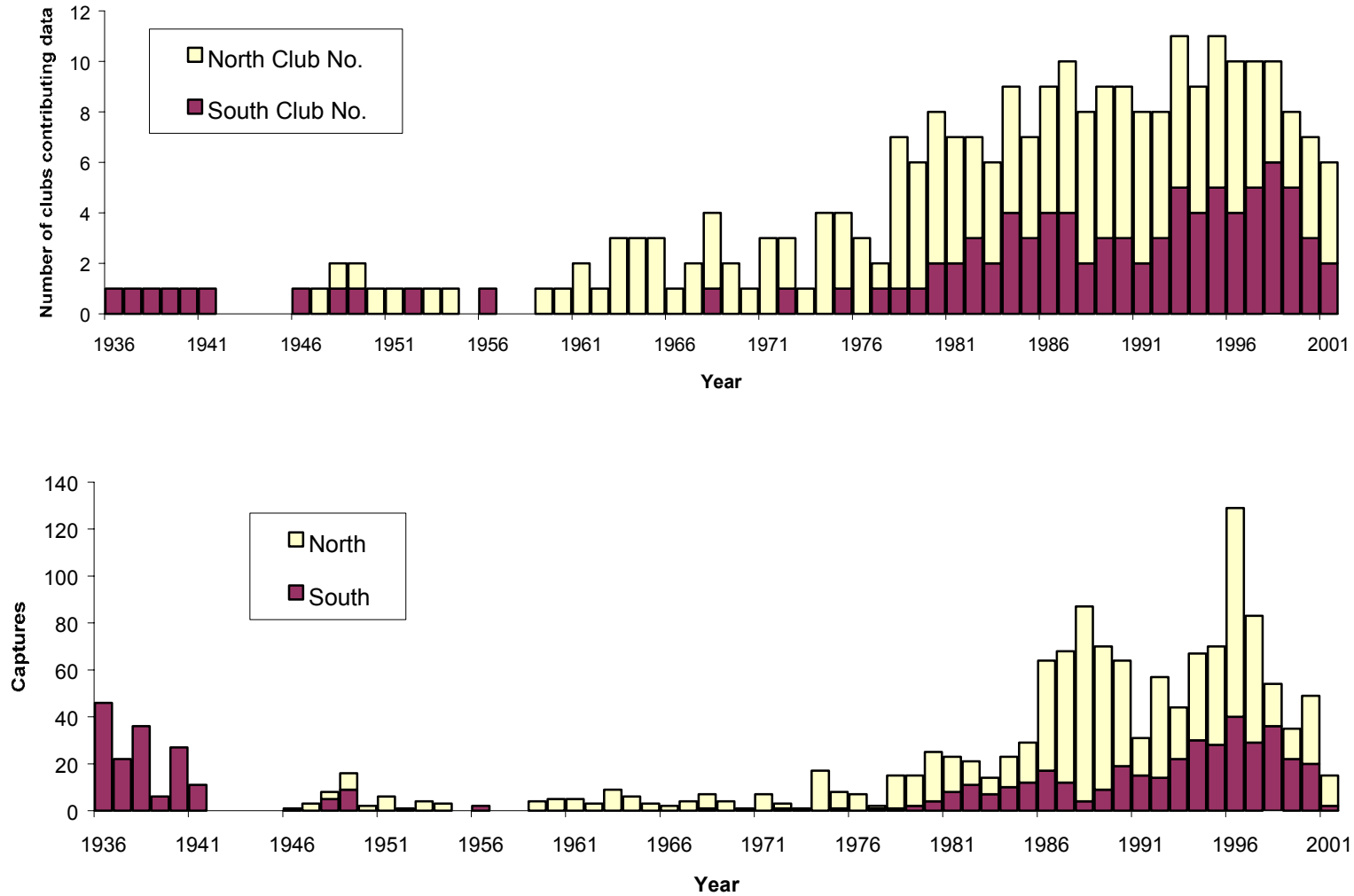


Figure 6.5 – a) Number of clubs contributing catch data for striped marlin for each region; B) Total annual catches recorded in club data for each region. Records have been divided into two groups according to club location, North (Port Stephens to Sydney) and South (South of Sydney).

Tag-release data (Appendix I) show that striped marlin caught in more southerly regions off the east coast tend to be larger than in the north (based on estimated sizes at release) (Figure 6.6) and this regional size trend is indeed confirmed by club capture data (Figure 6.7). 1984-5 was the only period when mean weights of marlin caught by northern clubs (Sydney and north) were higher than those of the southern clubs. However, the temporal trends in the mean landed weights must be interpreted with some caution for two reasons:

1. The number of records collected per year is highly variable, and generally very low during the period 1941-1980.
2. In 1985 a minimum size limit was imposed (50kg) and this was increased in 1989 (60kg) and again in 1997 (90kg for 15kg lines). The latter two size limit increases appear to be followed by periods of increasing mean weight, at least partly a result of these limit changes (as opposed to natural increases in mean weight of marlin).

Consequently any changes in the mean weight of marlin might be masked by the imposition of size limits. However, some general observations prior to implementation of these limits can be made. Mean weights for marlin landed by southern clubs were above 105kg between 1937-1941. Between 1946 and the mid 1970s, very little data was available for these clubs, with most of data coming from northern clubs. A general decline in mean weight is evident between 1950-1968 for northern caught marlin, followed by an increase to the mid 1980s. After an increase in late 1980s, mean weights have since fluctuated between 77 and 90 kg. Data from southern clubs was more consistent from the mid 1970s, and showed increases from 80 to 115kg by 1982. Mean weight then decreased to 66kg by 1988. Subsequent increases follow size limit increases such that by 2000, mean weight for southern club caught marlin had increased to 105kg.

It is notable however that mean weight for southern caught marlin was consistently greater than 105kg, when no size limits were imposed. However, since this period, mean sizes have generally been lower (excepting 1981-3) and have only recently increased above 100kg after a series of size limit increases.

Club capture data can be assessed for annual weight frequencies, with this type of information sometimes useful for identifying movement of cohorts through a fishery over successive years. However, although considerable club data was collected, this was spread over a long period, and it is difficult to infer any cohort trends when the data is assessed by year. Most years have too little data to allow such inference. Some putative cohort lines have been added to Figure 6.8 for the period between 1990-1999, when capture numbers are reasonably high. However, without any other data to support, these should be considered tenuous. Cohorts of size less than 50kg will be absent from the data due to laws restricting legal capture sizes.

6.6.2 New Zealand Club capture data

Historic capture data were also available from a major New Zealand gamefishing club, the Bay of Islands Swordfish club. Mean weight trends of striped marlin between 1944 and 1995 show a general decline in the mean weight of striped marlin landed by this club's members. This decline occurs from the late 1950s and it has been suggested that this is directly related to Japanese longline fishing pressure in the region. Whether changes in gear usage and selectivity have occurred over this period has not been investigated but would seem unlikely to explain the overall decline in mean weight. This data is discussed further in Chapter 7 (Interaction analyses).

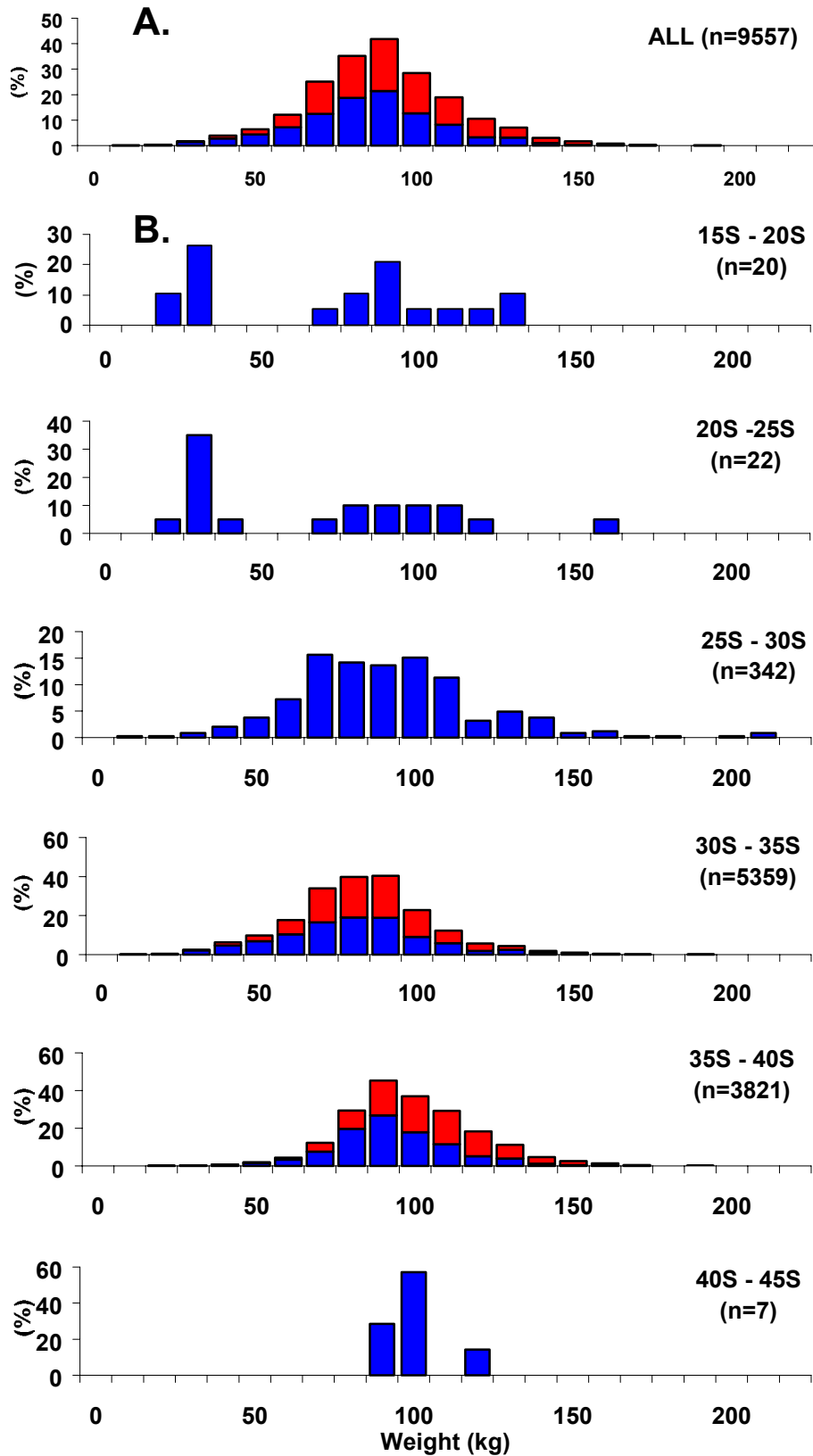


Figure 6.6 – Weight frequency distributions for striped marlin tagged and released during the period 1973-2000. (A) Overall weight frequency; (B) Weight frequency by 5° latitudinal areas (Sample number in parentheses). Scales are 1-10 kg, 11-20 kg.....; Red = capture data. Blue = tagging data. (Source: NSW Fisheries, 2002)

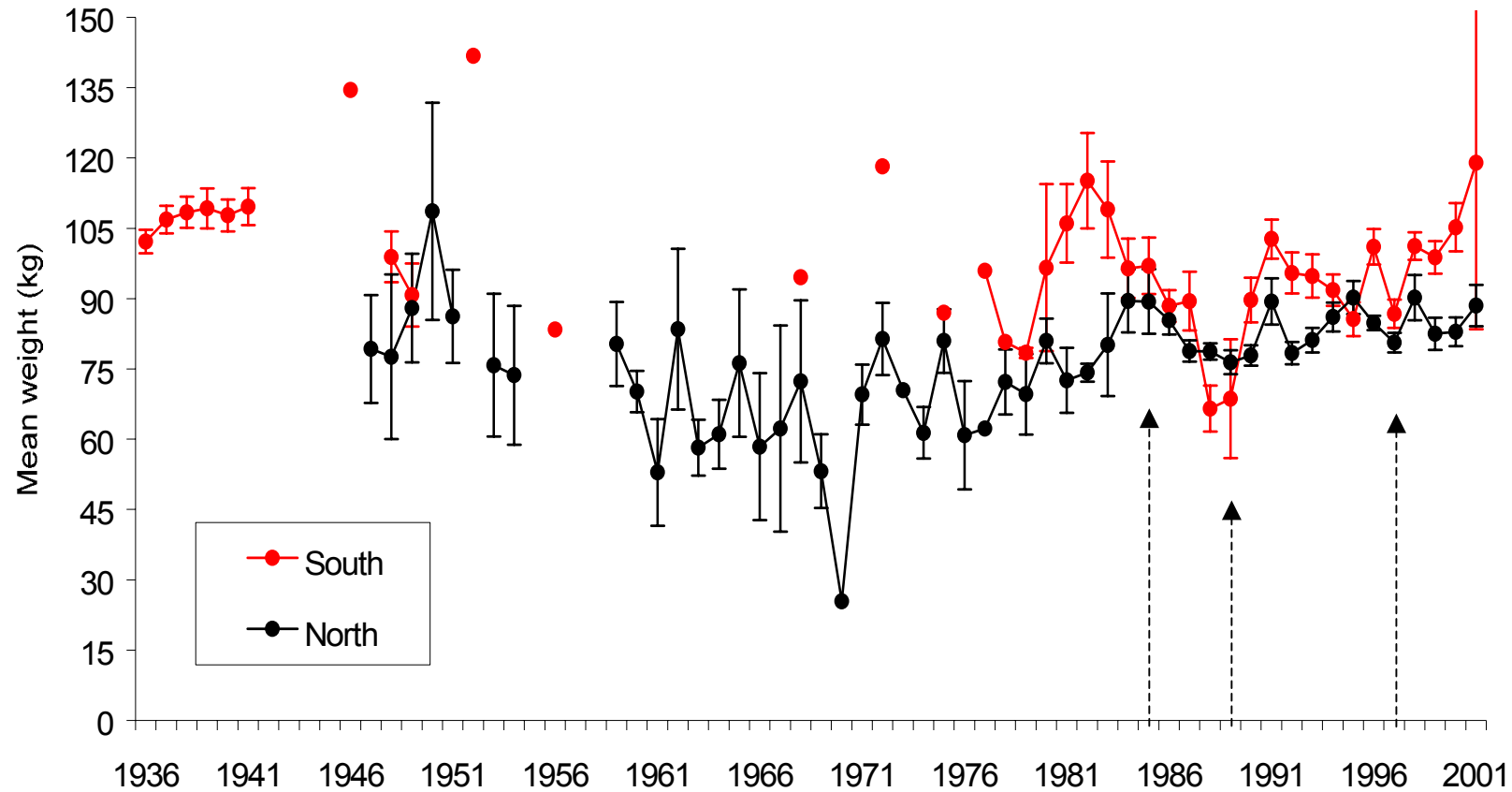


Figure 6.7 – Mean weight (kg \pm SE) of striped marlin captured by gamefishing clubs off the central and south east coast of Australia. Records have been divided into two groups according to club location, North (Port Stephens to Sydney) and South (South of Sydney). Arrows indicate timepoints for changes in minimum size rules in 1985, 1989 and 1997.

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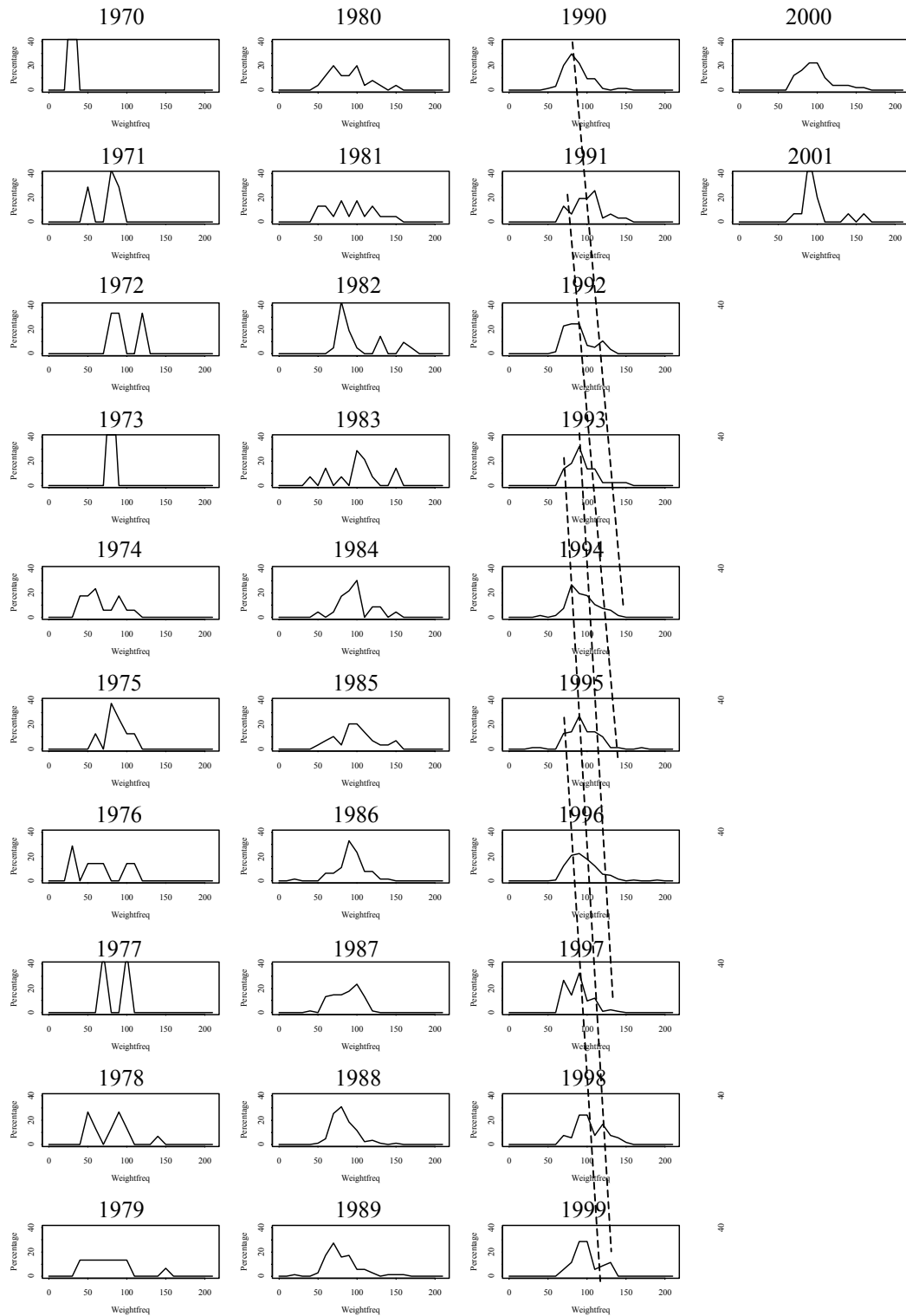


Figure 6.8 – Annual weight frequencies for club-captured striped marlin caught off the east coast of Australia. Data pre-1970 was not presented as sample numbers were considered too low. Tentative cohort lines included for the 1990s when sample numbers are high.

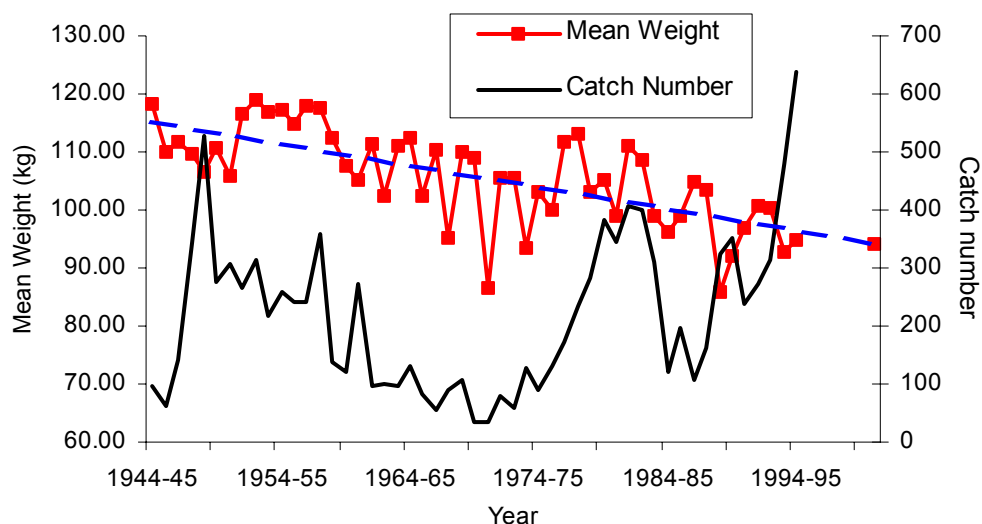


Figure 6.9 – Mean annual weights of marlin landed by Bay of Islands Swordfish Club in New Zealand, together with catch number per year. A linear regression trend line is fitted to the mean weights data, showing a declining trend in mean weight. (Source: Blue Water Marine Research 2002)

6.7 TRENDS FROM NSW GAMEFISH TOURNAMENT MONITORING PROGRAM

6.7.1 Introduction

Gamefishing tournaments have been monitored on the east coast through a program initiated by Pepperell Research through the Eastern Tuna Management Advisory Committee, and subsequently taken over by NSW Fisheries. The Gamefish Tournament Monitoring Program (GTMP) is designed to collect information on recreational catch, effort, sizes and spatial distribution of catches. The program has monitored tournaments from 15 east coast ports (Mooloolaba to Bermagui) throughout each game fishing season from 1993 to 2000, with catch rates recorded for 31 species (Murphy et al 2002; Pepperell and Henry, 1998). The fishing season constitutes a 10-month period from September to June. Data are collected via radio reports from participating boats at 2-3 hour intervals during each fishing day of a tournament. Catch data is collected in the form of number of strikes, hook-ups and actual captures (for weigh ins). Effort data is collected in the form of “directed effort”, whereby boats report on the species they are deliberately targeting or the method being used (which indicated species groups being targeted) at the same time they report on catch and effort data. CPUEs for species are calculated only for boats which actually targeted these species groups. It should be noted however that this method does not allow separation of effort by individual species. Details of the methods used to monitor these tournaments are described in Pepperell and Henry (1998), Murphy et. al. (2002) and Lowry and Murphy (2003). All data presented in this report are taken from these two publications, which together detail annual CPUE, spatial CPUE, tag release rates and fleet structure for the period 1993-2000.

Tournaments are scheduled according to the expected general movement patterns of billfishes, tunas and sharks for various localities along the coast (Murphy et al 2002). Availability and abundance of many of these species is related to the seasonal changes in the Eastern Australian current.

6.7.2 Findings of the GTMP

First it should be noted that there is no observed serial decline in the CPUEs (fish per boat day) for any species over this time period of the program (Figure 6.9a). Catch rates between years have been variable for most species targeted, suggesting annual variability in the availability and relative abundance of gamefish species. Similarly, trends in effort concentration by boats targeting billfish and tuna shift spatially between years (i.e. onshore-offshore) reflect variability in the strength and direction of currents which will also dictate the availability and location of gamefish in relation to distance from the coast. Tag and release is the predominant method employed now, with nearly 93% of billfish tagged and released during monitored tournaments. Billfish comprised nearly 60% of tournament catches during the period 1997-2000.

The GTMP also considers catch and effort on a spatial scale for the interclub tournament held in Port Stephens each year. Fishing zones are divided into three areas, being coast, shelf and deep.

Catch Per unit Effort (CPUE): The use of catch rates in recreational fishing studies as an index of abundance/availability need to be undertaken with caution, given that other factors such as angler skill, motivation, and environmental factors (weather and availability of baitfish to catch) will affect this index (similar to commercial data). However, the GTMP partitioned the tournament fleets according to the species groups they were targeting, thus determining a CPUE (marlin per boat day) based on directed effort (following Pollock et al 1994), as method strongly influences the catch of target species. Estimated weights of tagged and actual weights of captured fish were also recorded and collected.

Fishing effort was recorded as the cumulative reports of radio sheds from each zone. Note that self reported data suffers from a number of problems: recall bias prestige bias, rounding bias, intentional deception and species misidentification (Pollock et al. 1994). However, the regular reporting, prize nature, small numbers caught, use of tag cards and verification of weighed fish as well as dockside interviews helps overcome or reduce the potential impact of these biases.

Catch rates of striped marlin have remained relatively stable from 1993 to 2000 (range 0.084 to 0.173) with a slight increase in the most recent years of the program (1997/8 to 1999/2000 seasons) (Figure 6.9a). Catches tended to be higher in the southern coastal region in late Summer/Autumn of each season, with anecdotal evidence suggesting exceptional catches in the last recent seasons off Bermagui (2000/2001). However, this was not borne out by the GTMP data, possibly due to a diluting effect of whole broader regional trends upon localised regional trends. It should be noted that charter boat catch rate analyses presented later (Chapter 7) show catch rates for striped marlin are at a historically high level in 1999 and 2000, and a more detailed analyses of the GTMP data is recommended in order to tease out striped marlin targeted catch rates if possible (by selecting only boats that specifically target striped marlin).

Black marlin was generally the most numerous species of billfish caught during tournaments between 1993 and 2000 although more striped marlin were recorded in the 1999/2000 and 1993/1994 seasons. Black marlin associated closer to land than either blue or striped marlin.

There are large differences in the sizes of tagged fish (estimated sizes) and landed fish (weighed sizes) (Figure 6.9c) which are likely due to the fact that most anglers prefer to tag and release all fish, and that tournament regulations prevent the weighing of undersized fish, thus creating a bias in size range weighed, compared to what was actually “hooked”. Note only 0.7% of striped marlin caught in these tournaments were neither tag weight estimated nor landed and weighed.

STRIPED MARLIN: BIOLOGY AND FISHERIES

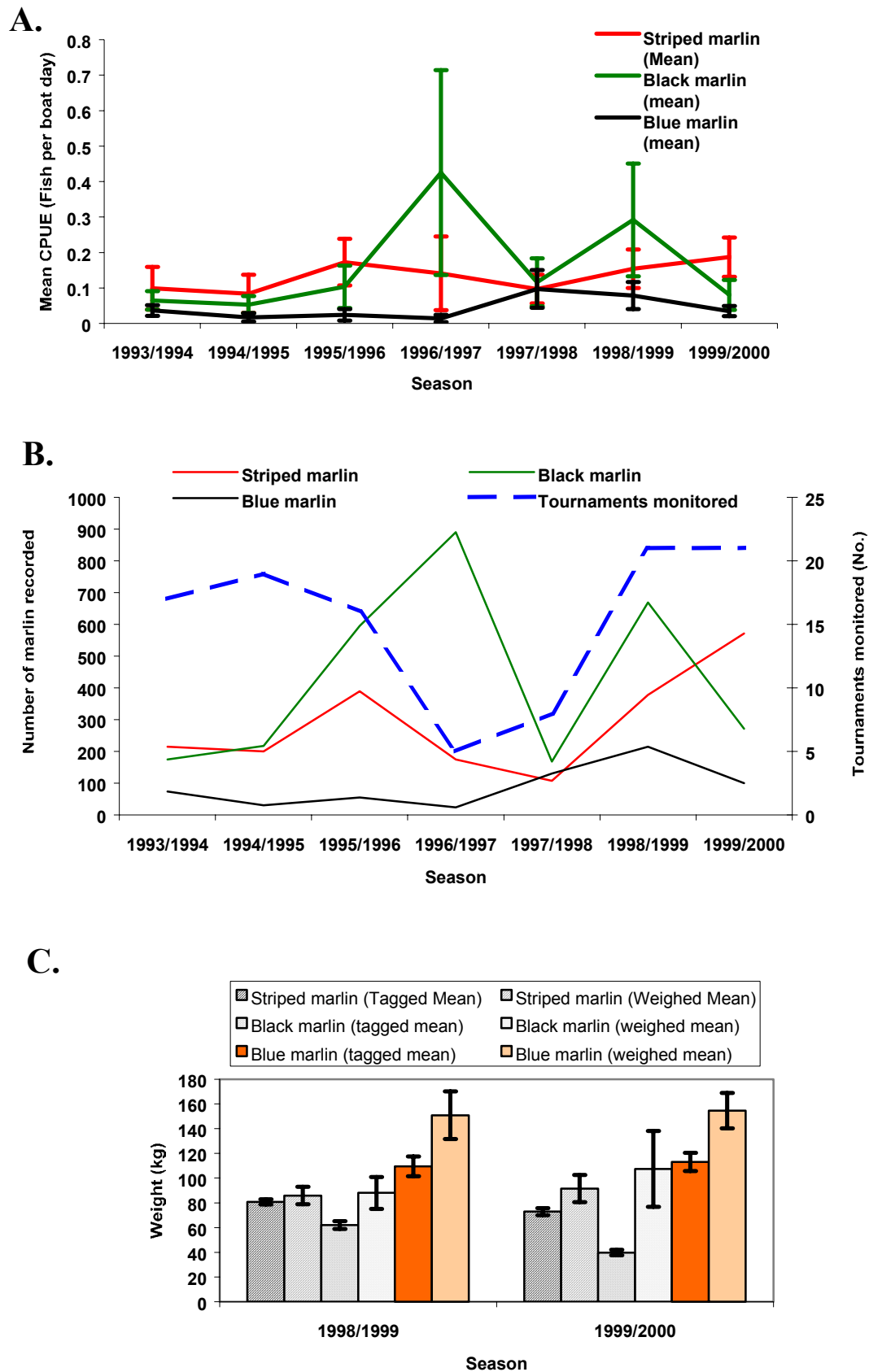


Figure 6.9 – A comparison of A) mean CPUEs(+2SE); B) Number of marlin caught and tournaments monitored; and C) Mean weights of tagged and captured marlin, for black blue and striped marlin tagged or captured during monitored gamefishing tournaments off the east coast of Australia for two seasons. (Source: NSW Fisheries, 2002; GTMP)

For the largest tournament, the Port Stephens Interclub Competition, the three fishing sectors were classified as coast, shelf and deep, and records taken with respect to these zones. An analysis of spatial variability in effort found that effort for boats targeting billfish shifted between the three zones considerably between years. For example, in 1997, 80% of effort was in the coast zone (targeting the available abundant black marlin), but shifted to 50% in the shelf zone and 15% in the deep zone in 1998 and 1999. These shifts in effort will likely correspond to changes in the catch rates for different marlin species which tend to inhabit different zones. (i.e. black marlin tend to be closer to shore, striped marlin on the shelf and blue marlin in deeper waters). The authors note that effort distribution data may be of use to determine areas where the recreational gamefishing fleet interacts with the commercial billfish and tuna fleet. Further finer scale analyses of these data for all monitored tournaments may reveal where interactions of the two fishing sectors overlap in time and space.

6.8 Charter boat catch and effort data

There has only recently been instigated a formal program in NSW for the recording and collection of charter boat catch and effort information. However, some charter boat operators have kept detailed catch and effort records for their own purposes, over many years. Such data has in the past been shown to be very useful in analyses of fisheries interactions (e.g. Campbell et al 2000). In order to facilitate analyses of both localised abundance trends (Chapter 8) and potential interactions between commercial and recreational fisheries catching or tagging striped marlin (Chapter 7), charter boat operators were contacted and asked to supply detailed catch and effort data from their logbooks and diaries. Many of these charter operators generously donated their time to extract data and supply it for analyses within the current report. A full description of this data and associated catch, effort and CPUE trends is given in the next Chapter.

6.9 Mortality in the recreational fishery

Recreational gamefisheries have gradually lent further away from the practice of capture and retention of billfish, such that in recent years, tag-release is the predominant practice in this fishery. Mortalities due to capture and retention by gamefishers are very low compared to that of the commercial longline fishery off the east coast of Australia. However there has been considerable debate, both domestically and internationally, over possible post release mortality that might occur in recreational gamefisheries. Archival and satellite tagging studies of tag-released striped marlin in the U.S. recreational fishery have given widely varying results, indicating that anywhere between 0-24% of tag released striped marlin died within days of release (Holts and Bedford, 1990; Tillman, 2002; Domeier et al., 2003). There is considerable debate over the effect of handling methods and how these may have varied between the different studies, and consequently effected post release mortality. Future studies will hopefully resolve this issue further.