The Gamefish Tournament Monitoring Program – 1993 to 2000

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NON-TECHNICAL SUMMARY

Data was obtained from recreational fishers competing in gamefishing tournaments from fifteen east coast ports (Mooloolaba to Bermagui) over seven successive years (1993-2000). Tens of thousands of recreational boat fishing days were monitored and the catches of thousands of anglers recorded. The annual recreational catch rates (fish per boat day) of 31 species of gamefish were recorded for the seven year period. Trends in recreational fishing success for the principal tuna, billfish and shark species are discussed.

The Gamefish Tournament Monitoring Program (GTMP) provides fisheries managers with an estimate of the status of the recreational gamefish fishing industry and the relative well being of billfish and tuna resources in south-east Australian waters. In conjunction with similar information from the commercial sector, data from the GTMP will facilitate the implementation of appropriate management regimes for these sectors. Catch and effort data will allow management agencies to answer questions regarding resource sustainability and the allocation of fishing opportunity. This project satisfies the sustainability and monitoring research priorities nominated by the Eastern Tuna Management Advisory Committee for the Tuna and Billfish Fishery.

This report provides estimates of Catch Per Unit of Effort (CPUE) for species taken by competition gamefishers from the south-east coast of Australia for seven fishing seasons over the period 1993/94 – 1999/2000 inclusive. Other fishery characteristics such as rates of tagging and releasing of fish, spatial catch and effort information, results of post - fishing interviews and fleet structure are confined to the latter four-year period of this study (1996/97 to 1999/2000 inclusive).

Reported Catch

Gamefishing tournaments monitored by this study operate a self-imposed mandatory radio reporting system, commonly known as ‘scheds’ (short for schedules). Sched reports require competing fishing boats to report their location and details of fish captures at regular intervals during a fishing day. Data on fishing activities reported over the scheds provides the primary source of data used in this report.

Directed Effort and Targeted Species

Eighty-four percent of the gamefishing fleet targeted billfish and/or tunas with the remainder of the fleet (16%) targeting shark species.

Anglers target a range of mostly pelagic species including billfishes (black, blue and striped marlin), tunas (yellowfin, big eye, albacore, skipjack and bonitos), sharks (tiger, mako, hammerhead and whalers) and sportfish (dolphin fish, kingfish, wahoo).

Twenty-two species of gamefish were recorded during the latter four year period of the study with billfishes comprising the majority of the catch (59.6%) followed by tunas (18.4%), sharks (11.7%) and sportfish (10.3%). Black marlin was the most common billfish species (53.1% of billfish catch) with yellowfin tuna (70.5% of tunas), mako shark (40.1% of the shark catch) and dolphin fish or mahi mahi (73.0% of sportfishes) being the most popular species within their respective species groups.

Catch Rates

Catch rates for all species were calculated according to the main target preference of the gamefishing fleet (billfishes and/or tunas and shark targeters). Catch rates were found to be highly variable indicating year to year fluctuations in the availability and relative abundance of most

species. Results indicated no serial decline in any of the targeted species. High catch rates for black marlin were achieved for the 1996/97 and 1998/99 seasons when large numbers of small (15-20kg) fish were reported relatively close to shore during tournaments held on the north and central coasts of NSW. Catch rates for blue marlin appear to be increasing over time, which may be a result of increased targeting of this species by tournament anglers.

Tag-and-release

The proportions of fish that were tagged-and-released after capture were extremely high amongst tournament anglers with over 88% of all species combined being tagged-and-released. This figure varied among and within the major species groups with the highest tag-and-release rates evident among billfishes (92.6% of all billfish were tagged-and-released) followed by sportfish (91.8%), tunas (85.5%) and sharks (74.4%). Other high rates of tag- and-release examples include 96.5% of black marlin, 91.6% of yellowfin tuna, 92.6% of hammerhead sharks and 92.6% of dolphin fish. Tiger shark was the only species where the proportion of fish captured or harvested for weighing was greater than the tag-and-release component with 29.8% of tiger sharks being tagged-and-released. The capture of large tiger sharks attracts high pointscores within competitions, this being a major incentive to retain this species for weighing.

Unreported Catch

During the 1998/99 fishing season, data from dockside interviews were obtained to provide estimates of the harvest of baitfish and the unreported catch (fish not required to be reported during scheds). A total of 929 boat trips were surveyed from 39 tournament days. Over half the gamefishing fleet reported that they directed a portion of their fishing day to the capture of baitfish. The remainder of the fleet exclusively used artificial lures for the capture of target species. Ten species were identified as being harvested for bait with slimy mackerel being the most common (84% of the baitfish harvest by number of fish). The capture of slimy mackerel by gamefish anglers may be substantial, we provide a preliminary estimate of between 2.4 and 2.6 tonnes of slimy mackerel for the 39 survey days that were sampled. Twenty-four species were recorded in the unreported catch category during scheds. This figure mainly includes non-pointscore fish that were retained for eating.

Spatial Effort

Data from the Port Stephens Interclub tournament, was analysed to assess variation in spatial fishing effort and catch. It was found that boats who targeted billfish species showed marked variation in where they expended their fishing effort from year to year but little change in fishing locations was observed among shark fishers. The strength and direction of currents associated with the East Australia Current is the most likely explanation for the differences in year to year availability and location of gamefish species in relation to distance from the coast.

Fleet Structure

The gamefishing fleet participating in monitored tournaments consisted of a variety of vessels ranging from a 4.4 metre trailer boat up to a 23 metre vessel. 37.3% of the fleet were less than 7m in length, the majority which were trailerable boats. There has long been a perception that gamefishing is the exclusive domain of large cruiser type boats but the high proportion of trailer boats in the fleet indicates that the gamefishing fleet is comprised of a diverse range of vessels.

1. INTRODUCTION

The East Coast Tuna and Billfish Fishery is a multi-species, multi-gear fishery that targets tunas (yellowfin, bluefin, striped, big-eye, albacore), billfish (black, striped and blue marlin, sailfish, spearfish, swordfish), and sharks (whalers, tiger, mako, hammerhead, thresher) along the east Australian seaboard. Commercial vessels from foreign and domestic ports participate in the fishery using longlines, purse seines, handlines and rod and reel techniques. The East Coast Tuna and Billfish Fishery is one of Australia's premier commercial fisheries with annual catches in the order of 5,500 tonnes and an annual value of approximately $75m. Recreational fishers use rod and reel techniques for the capture of gamefish within this fishery.

Fishing occurs from northern Queensland to southern Tasmania, from the coast to the limit of Australia's Exclusive Economic Zone, but seasonal aggregations of fish concentrate fishing effort in particular regions. Stock assessments of the major fishery resources, and fishery assessments of the domestic and foreign commercial tuna fishing sectors, have been conducted by CSIRO Division of Fisheries and Oceanography, but relatively little information has been gathered on the recreational fishing sector. Historical information on the development of recreational gamefishing off eastern Australia has been presented to various inter-agency Fisheries Assessment Groups and a survey technique for collecting fishery statistics from the recreational sector during organised gamefishing tournaments was developed in 1990 (West 1990). This method was pilot tested, proven and implemented in 1993 (Pepperell and Henry 1998). This report presented data for three fishing seasons 1993 to 1995. The methodology used in this initial report was adopted by the NSW Fisheries Gamefish Tournament Monitoring Program (GTMP) and continued with for the four year period 1996 to 2000.

The primary objective of this study was to measure indices of fishing success or Catch Per Unit of Effort (CPUE), expressed as the number of fish caught per boat per fishing day. Data from Pepperell and Henry (1998) for the 3 year period 1993-1996 was obtained and modified to provide a consistent dataset of CPUE indices for the 7 year period 1993-2000. These indices of CPUE provide information on the relative distribution and abundance of tuna and billfish resources on the south-east coast of Australia and the potential for conflict with other fishing sectors. These indices of fishing success were required at several temporal and spatial scales to complete an understanding of all components of the Eastern Tuna and Billfish Fishery.

Other details on fishery characteristics presented in this current report include fish catch (numbers of fish reported), fishing effort, species diversity and size composition of the catch. Data for these 'other' details presented in this report is restricted to the latter 4 year period of this study (1996 to 2000). For details on these 'other' fishery characteristics prior to 1996 see Pepperell and Henry (1998).

Collection of catch and effort data from anglers requires a distinctly different approach to collecting data from commercial fishers. The population of anglers is larger and more diffuse than commercial fishers. Commercial fishers are required to complete logbooks on their fishing activities as a condition of their licence whereas recreational anglers are not required to submit details on their fishing activities to any fisheries agency. To determine accurately the magnitude of fishing effort and success rates of recreational anglers, targeted research programs are required. Within the recreational fishing sector there are several large user-groups which require separate consideration to assess their potential impact on fish stocks and to address resource allocation issues between the competing recreational and commercial fishing sectors. This current study focuses on the club-based recreational fishery for gamefish species along the south-east coast of Australia. The methodology used in this report involves the integration of a catch reporting system

within the already existing practice of mandatory regular radio reports from all vessels during gamefishing tournaments.

NSW Fisheries works closely with the recreational gamefish sector through the GTMP and the Gamefish Tagging Program (GTP) as part of a strategic approach in the assessment of the catch and effort associated with the principal gamefish species. The tournament monitoring program is designed to assess trends in fishing effort, success rates of anglers, spatial distribution of catches and sizes of fish caught. The monitoring program aims to develop a long-term series of data for the 'organised' or club-based component of the east coast gamefish fishery to assist in the better management of gamefish species.

Information from the gamefish tagging, gamefish monitoring programs and commercial catch records will be complemented by information flowing from the National Survey of Recreational and Indigenous Fishing. This survey, due to be completed in late 2002, will provide estimates of the total catch of all sectors of the recreational fishery. It is anticipated that this broad-based study will assist with providing a greater understanding of all participants (club and non-club anglers) of the east coast gamefish fishery. Data generated from the tournament monitoring database will assist the national survey in providing more precise and accurate estimates of the total catch of gamefishers.

1.1. Description of the Gamefish Fishery

The recreational gamefish fishery comprises three identifiable components, charter boat fishing, non-club fishing and organised (club-based) angling. Effort is concentrated in waters adjacent to the major metropolitan areas and a number of popular fishing ports where facilities to support large numbers of purpose built fishing craft exist. Popular gamefishing ports selected for this study include Mooloolaba, Southport, Coffs Harbour, Port Macquarie, Port Stephens, Lake Macquarie, the ports of the Sydney Region, Wollongong, Greenwell Point, Ulladulla, Batemans Bay, Bermagui and Eden.

1.1.1. Tournament Regulations

Club-based game fishing in Australia is administered by the Game Fishing Association of Australia (GFAA) and state Game Fishing Associations affiliated with the GFAA.

The GFAA have established rules and regulations that govern the capture of gamefish during GFAA certified tournaments throughout Australia. These codes are formulated to promote ethical and sportsman-like angling practices, to establish uniform regulations for the compilation of Australian gamefish records and to provide basic angling guidelines for use in fishing tournaments. A series of stringent regulations govern the fishing equipment (fishing tackle) used, and general angling procedures for the hooking, capturing and tagging of gamefish. Failure to comply with these regulations will result in the disqualification of fish for tournament pointscores or records (see GFAA 1999).

Changes in game and sportfishing regulations have resulted in a change in the behaviour of participants in gamefish competitions. Changes to the rules reflect a change of attitude among the gamefishing fraternity from "big-game" hunter to conservation-oriented angler. The growing trend worldwide to tag-and-release fishing among gamefish anglers is evidence of this change of attitude. The Gamefish Tagging Program was initiated by NSW Fisheries in 1973 and was instrumental in influencing this worldwide trend towards responsible use of gamefish resources by recreational gamefishers.

State gamefishing organisations may impose further regulations to gamefishing practices within those guidelines set by the GFAA. For example, the New South Wales Game Fishing Association has imposed minimum weight limits for all competition landings of marlin, sharks and tunas. To be eligible for weighing in a tournament, sharks and marlin must weigh greater than 80kg (if captured on line with a rated breaking strain of greater than 10kg). Yellowfin tuna that weigh less than 15kg cannot be weighed at tournaments. These regulations limit the numbers of fish captured for weighing and have encouraged the tag-and-release of the majority of gamefish caught by tournament anglers. The range of tournament regulations has also led to a standardisation of fishing methods between competitors which provides a useful basis for analysis of variables within the recreational gamefish fishery.

1.1.2. Main Target Species

For the purposes of this report, saltwater 'gamefish' are those recognised as such by the GFAA, a full list of these species is presented in Appendix 1.

To provide a basis for comparison and analysis, species caught by gamefishing vessels were classified into the following four main species groups: Billfish, Tunas, Sharks and Sportfish. Within these groupings examples of the main target species include:

Billfish: black, blue and striped marlin, sailfish, spearfish and swordfish

Tunas: yellowfin, bluefin, bigeye, longtail, albacore, skipjack and bonitos

Sharks: tiger, mako, hammerhead, blue and whalers

Sportfish: dolphin fish, wahoo, kingfish, cobia, spanish mackerel, barracuda

1.1.3. Fishing Methods

There are three main methods used to target groups of gamefish, each using rod and reel techniques for the hooking and capture of fish.

1) **Trolling**; with lures, live or dead baits is the method primarily used to target billfish, most tunas and 'other' sportfishes other than sharks (casting lures is sometimes employed for the capture of smaller gamefish).

2) **Drifting** while burleying; (leaving a trail of fish oil and minced fish) and using dead baits, fillets and sometimes live baits. This is the principal method for targeting sharks.

3) **Drifting** while 'cubing'; (leaving a trail of chopped baitfish) is a popular method for targeting yellowfin tuna and albacore.

1.1.4. Fishing Seasons

The scheduling of gamefishing events is generally related to expected migration patterns of billfishes, tunas and sharks for the various locations along the coast which maximises the chances of anglers obtaining good catches of gamefish species. The East Australian Current (EAC) runs along Australia's east coast bringing water from the warm Coral Sea to the Tasman sea off southern NSW. The EAC has an important influence on the seasonal distribution of some gamefish species off eastern Australia (Kailola et al.1993). As the EAC flows southward it frequently spreads across the continental shelf and moves close inshore, these inshore incursions often

bringing with them many species targeted by gamefish anglers. Goadby (1987) provides a description of the locations and gamefish species likely to be caught at differing periods of the year along the east Australian coast.

The fishing season for the competition gamefish fishery on the south-east Queensland and NSW coast begins in September of each year with the first tournament held at Coffs Harbour in the northern region of NSW. Fishing continues through the Summer and Autumn period (the peak time for tournament fishing effort) with the last tournament being held in early June of the following calendar year at Bermagui in the south of NSW. No tournaments are held during the months of July and August.

The term 'Fishing Season' as used in this report is defined with the starting year and concluding year of the tournament season. For example, 1996/97 represents a ten-month fishing season, which began in September of 1996 and concluded in June 1997.

Figure 1. Gamefish boats returning to port for weighing of catch and return of tag cards. Note flags on the outriggers indicate the tagging or capture of fish.

2. METHODS

2.1. Tournament Locations

The area covered by this study was restricted to south-east Queensland to Southern NSW. Fifteen ports were selected for monitoring the major gamefishing tournaments during the four fishing seasons from 1996-2000 for the region extending from Mooloolaba in south-east Queensland to Bermagui in southern NSW (Figure 2).

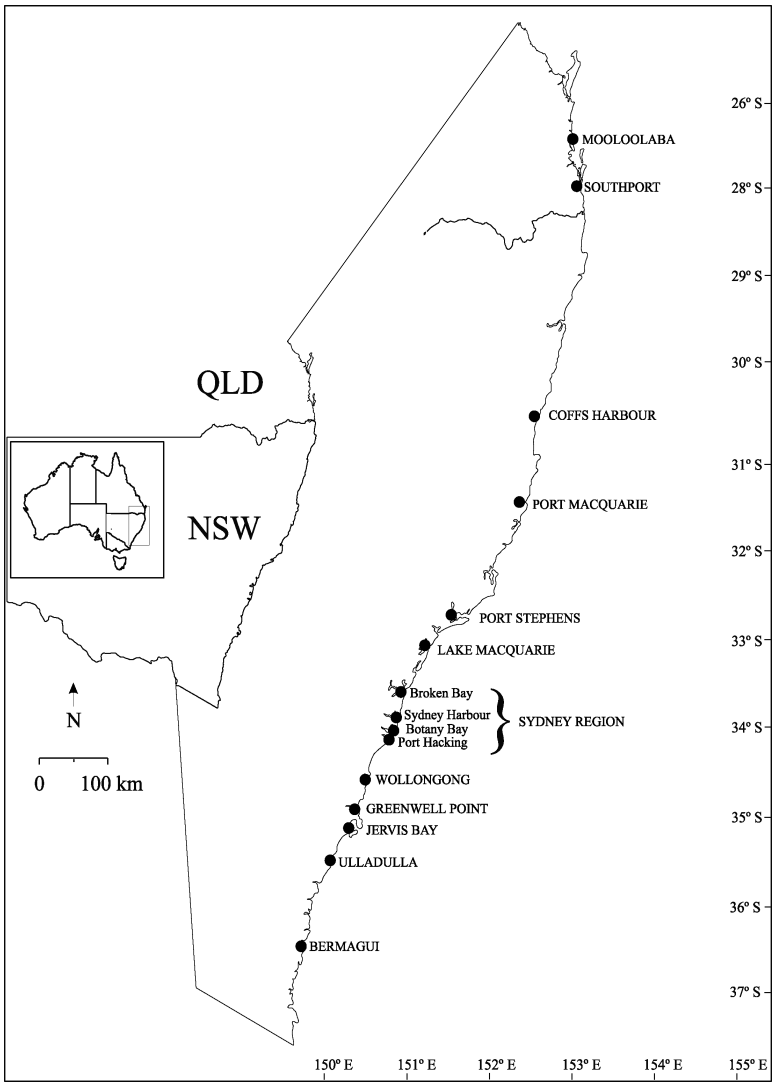

Figure 2. Location of gamefishing tournaments monitored for this study.

2.2. Data Sources

2.2.1. Radio Schedules (Scheds)

Gamefishing tournaments monitored by this study operate a self-imposed mandatory radio reporting system, which requires competing fishing boats to report their location and details of fish captures at regular intervals during a fishing day. These radio reports are commonly known as 'scheds' (short for schedules) and are primarily used as a safety measure to quickly locate a vessel in case of emergency. The timing of scheds can vary between tournaments ranging from reports given at each hour of the fishing day up to three hourly intervals during the day. Information common to all monitored tournaments collected during 'scheds' included the boat number and name, number of persons on board and the species and numbers of any fish caught. The capture status of boats is also given at scheds and is consistently given as the 'zero, zero, zero' system i.e. the number of strikes, hookups and captures (tagged-and-released and harvested fish). The location of the boat is also reported at each sched and is usually given as a grid reference from a tournament map. Tournament maps are provided by organising clubs and vary in the size of reporting grids from port to port. Figure 3 presents an example of a grid map used during gamefishing tournaments, this example presents a version of the map used during competitions held out of Port Stephens in central NSW.

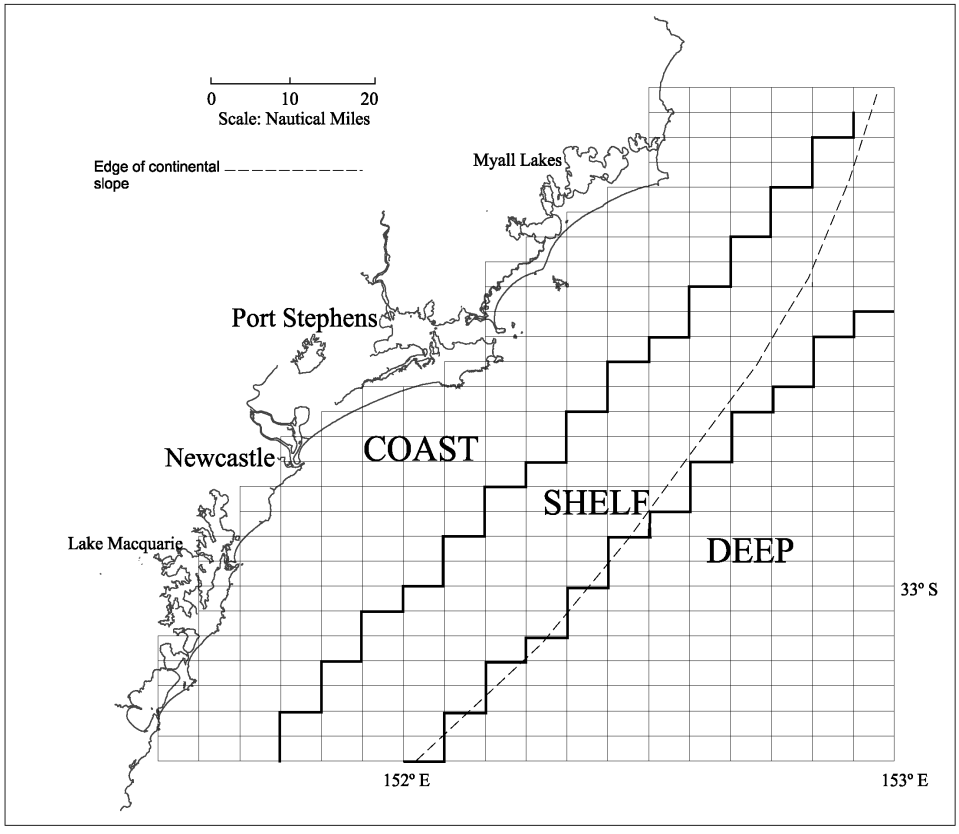

Figure 3. Grid map as used in the NSW interclub tournament.

The species and numbers of fish reported, annual estimates of catch per unit effort (number of reported fish per boat day) and other fishing fleet details were derived from sched data. NSW Fisheries research staff were present at all major tournaments to record sched data. Figure 4 shows a typical radio base in operation during a gamefishing tournament.

Figure 4. Tournament staff recording information from radio scheds.

2.2.2. Post-Fishing Interviews

NSW Fisheries research staff interviewed boat crews at selected tournaments during fishing season 1998/99. Species and numbers of fish that went unreported during radio scheds were recorded via interviews of boat crews at dockside or boat ramp locations after fishing. These interviews were done to obtain an estimate of the baitfish harvest taken by gamefishers and to estimate the unreported catch (fish not required to be reported at the radio scheds).

Interviews of anglers were done at boat ramps, weigh stations and marinas. If the fishing fleet returned to multiple access sites within a port, sites were selected at random for interviewing. Boats returning to a site were then randomly selected for interview. This work continued well after the official close of competition to allow for boats that had made long trips after the cessation of fishing to be included.

Staff availability and the size of the tournament determined the selection of tournaments for interviewing boat crews. When possible, extra staff were recruited for the larger tournaments to do interviews. Figure 5 shows a NSW Fisheries staff member interviewing a representative of a boat crew at the end of a fishing day.

Figure 5. NSW Fisheries staff interviewing gamefish anglers at the end of a fishing day.

2.2.3. Gamefish Tagging Program

The Gamefish Tagging Program (GTP) was established in 1973 to collect biological information on the major gamefish species targeted by recreational anglers. NSW Fisheries supplies fish tags to members of registered fishing clubs associated with the Gamefishing Association of Australia (GFAA) and/or the Australian National Sportfishing Association (ANSA).

Anglers place tags into a range of gamefish and sportfish species that are recommended by the program (see Appendix 2 for a list of the recommended species). The program requires participating anglers to record details of tagged fish on cards that are returned to NSW Fisheries for entry into the tagging program database. The species, date and location of capture, estimated length and weight of fish are recorded.

The GTP is one of the longest running recreational tagging programs in the world and provides information regarding size, growth, distribution and movements of fish. The program encourages the release of juvenile fish, discourages retention of large catches and encourages anglers to adhere to principles of sustainability.

The database from the GTP has been used in this report for three purposes:

1) to monitor trends within the east coast gamefish fishery;

2) to determine the proportion of fish tagged during the monitored tournaments in relation to all fish tagged during the 1998/99 fishing season within the study area, and

3) to determine the average weight of gamefish species (using data from tagged fish and weigh station records).

2.2.4. AFMA Logbook Data

Commercial logbook data from the Australian Fisheries Management Authority (AFMA) were accessed to obtain estimates on the annual average weight of fish caught by commercial longline methods for 1998/99. This data was used to provide a preliminary analysis comparing average annual weights obtained for recreational anglers involved in the GTMP for 1998/99 with commercially caught fish. Commercial fishing data was obtained from the longline eastern tuna and billfish fishery as this fishery has the highest potential for direct interaction with the recreational gamefish fishery in the study region. Data queries from AFMA were restricted to fishing management areas A and B off the south-east coast of Australia (Figure 6 and see Campbell et al. 1998). These boundaries most closely reflect the study area selected for the GTMP. Comparisons of mean weights were restricted to only a few species. Meaningful data comparisons between the commercial and recreational fisheries could only be made for striped marlin, yellowfin tuna and albacore.

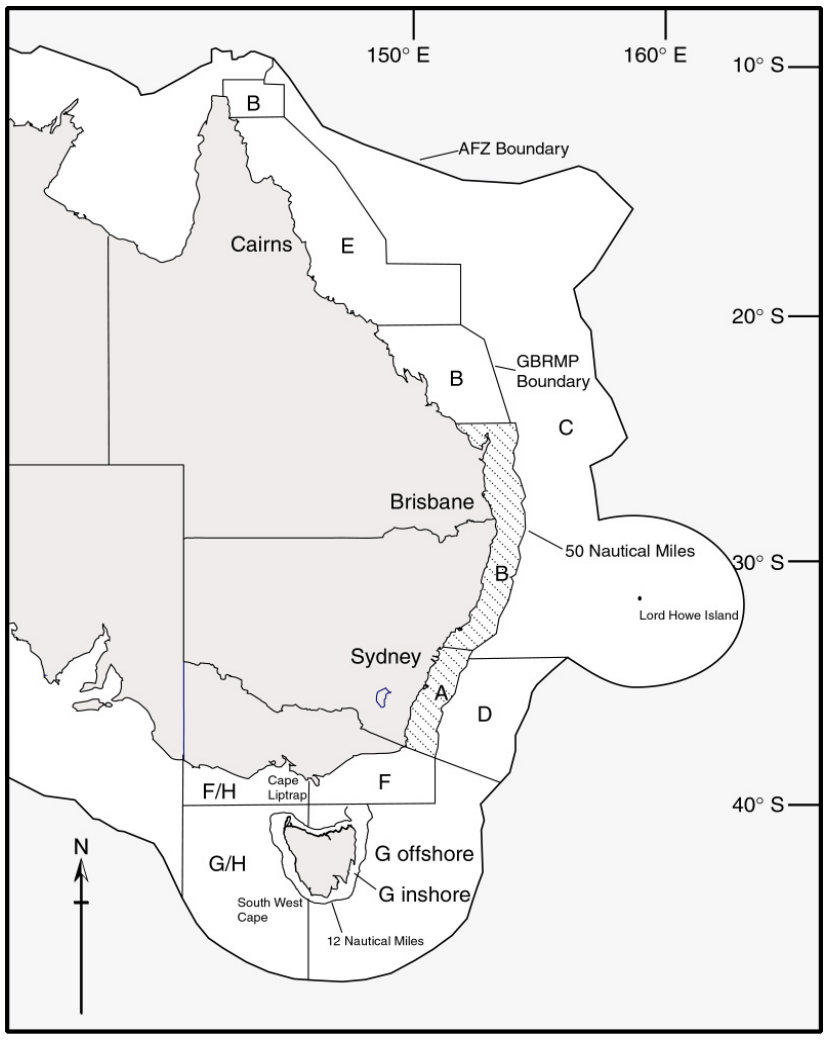

Figure 6. Map of the Australian Fishing Zones (AFZ). Shaded areas (east coast A and B) indicate the areas where data on the weights of commercially caught fish from the billfish and tuna longline fishery were sourced.

2.3. Definition of 'Catch'

Club regulations and tournament rules result in various definitions of catch, which provide the basis for classification and analysis of the total catch and catch rates. Definitions of the categories of catch used for this report are as follows:

2.3.1. Reported Catch

Reported catch consists of all fish reported during radio scheds. This includes fish tagged-and-released and fished retained (or harvested) for weighing in a competition. The majority of fish taken by gamefish anglers are reported over the scheds during a tournament day. Reported catch forms the basis for analysis of long-term trends used in the monitoring program. Within the reported catch, captures can be further classified as:

a) Pointscore Fish

This includes fish that are awarded a pointscore for fishing competitions. This category includes fish that were either tagged-and-released and fish that were harvested and retained for weighing (classified hereon as 'weighed' fish). Generally, all fish within this category are reported during scheds.

b) 'Not Weighed' Fish

A small number of fish not eligible for competition points are occasionally reported during radio scheds. This category of catch is commonly classified as 'not weighed'. The majority of fish categorised as non-pointscore fish are usually not reported during radio scheds. Definitions of non-pointscore fish that are not reported are presented below in the Unreported Catch category. In this report, fish that *were reported* under the "not weighed" category were used in the analysis of the *reported* catch.

2.3.2. Unreported Catch

Unreported catch consists of fish that are caught but not reported during radio scheds. Two further categories of unreported catch were identified for this report and used for analysis of the *unreported* component of the catch:

a) Baitfish - species directly targeted for use as baitfish, and

b) Non-Pointscore Species - a combination of tournament regulations and angler preferences determine whether fish are classified as "non-pointscore" fish. Ineligible species (those fish not prescribed a pointscore for a tournament), mutilated fish, fish weighing less than the breaking strain of the line (under line class) and fish weighing less than a self imposed weight limit are some of the tournament rules which preclude fish from being awarded a pointscore. Retaining fish for eating and voluntarily releasing fish for ethical reasons (without tagging) are other reasons why fish may also be classified as non-pointscore.

2.3.3. Tagged-and-Released Catch

The term "Tagged-and-Released" as used in this report refers to fish that were hooked and brought to the boat and tagged-and-released after capture under the guidelines of the Gamefish Tagging Program. Tagged-and-released fish are recorded as reported catch.

2.3.4. Harvested Catch

The term "harvested catch" as used in this report refers to fish that were killed and retained for weighing in a competition, for consumption, or for use as bait or burley. Harvested fish may be found within both reported and unreported catch categories.

2.4. Reported Catch

2.4.1. Catch Per Unit of Effort (CPUE)

A core objective of this report is to provide estimates of CPUE for the major gamefish species taken by anglers in competitions. The analyses of CPUE used for this report differs from that used by Pepperell and Henry 1998 as they estimated CPUE indices based on estimates of the total catch (both reported and unreported catch estimates combined).

Due to funding and staffing constraints, it was only possible to interview tournament anglers for one year during the 1996-2000 period to collect data on the unreported catch (1998/99 fishing season). It was decided in this current report to analyse CPUE estimates using only the reported catch to provide a consistent and comparable set of data for the entire seven year period of the monitoring program. Data used in this analysis of CPUE for the three fishing seasons covered by Pepperell and Henry (1998) were accessed and standardised to conform to the locations and fishing seasons defined for this current study.

Monitoring CPUE indices through time provides information on the relative distribution and availability of the major species targeted by recreational gamefishers. Catch rates have often been used in recreational fishing studies as an index of fish abundance on the assumption that more fish are caught per fishing hour or day when fish are abundant than when they are scarce (Hoenig et al. 1997). However, a range of factors other than abundance influences angler catch rates, these include angler skills and motivation and environmental conditions (e.g. the weather and availability of prey for targeted species).

To obtain more precise estimates of CPUE, it was desirable to partition the recreational gamefishing fleet according to the fish species or group of species being targeted to determine the directed fishing effort (Pollock et al. 1994). Fishing method strongly influences the catch of targeted species caught during tournaments. The gamefishing fleet for each monitored tournament was grouped according to the primary target preference of each boat for each fishing day into either Billfish/Tuna boats or Shark fishing boats. These primary target classifications were determined from direct questioning of each boat during radio scheds for their target preference or from reported fishing method during the scheds. In the majority of cases, trolling fishing methods indicated billfish and tuna targeters whilst drifting methods indicated fishing for sharks. Data obtained from post-fishing interviews were also used to determine and verify the primary target preference of competition vessels.

On some occasions a vessel may participate in both Billfish/Tuna and Shark fishing during the one fishing trip. For example, a 'Shark' fishing boat may troll on the way out to a fishing ground to capture small tunas for use as bait. In such instances, the boat was classified as a 'Shark' boat as fishing for sharks was the primary target preference for the majority of the day's fishing.

CPUE is expressed as the number of fish reported per boat per day for each major species and species target group (Billfish, Sharks, Tunas and Sportfish). CPUE estimates for the reported catch were derived from the total reported catch for each tournament day i.e. tagged-and-released fish plus weighed and 'not weighed' fish combined.

Days were regarded as the primary sampling unit for each of the defined strata with variances based on the variance among days. General equations used to calculate strata estimates of CPUE were taken from Pollock et al. (1994). When combining estimates of CPUE and their variances across strata, analytical methods described in Pollock et al. (1994) were followed.

Separate estimates of CPUE for each fishing season from 1993/94 to 1999/2000 for all reported species and target groups were calculated for the following fishing effort or target categories:

a) Directed effort by Billfish/Tuna boats

b) Directed effort by Shark Boats

c) Combined effort for Billfish/Tuna and Shark boats

2.4.2. Catch Summaries for Reported Catch

The reported catch for each competition fishing day was considered to be a 'census' of the reported catch component as data for the entire fishing fleet was recorded. Species and numbers of fish that were reported during scheds (tagged-and-released, weighed and 'not weighed' fish) were tallied at the end of a fishing day for all competition boats to obtain a summary of the total reported daily catch for all monitored tournaments. These daily summaries were then combined to provide annual summaries of the reported catch which covered each gamefishing season monitored for this report.

2.5. Unreported Catch

2.5.1. Estimates of numbers of Baitfish, Non-Pointscore fish and CPUE

To provide estimates of the catch and CPUE for the unreported catch component the gamefishing fleet was sampled over 39 fishing days during the 1998/99 fishing season. Estimates presented in this report for the unreported category of catch are intended to indicate the species captured and detail the methods needed to monitor the trends in CPUE or availability of species through time for this component of the catch.

Crew members of tournament fishing boats were interviewed at the completion of a fishing day by trained survey staff to obtain details on their catch that went unreported during the radio scheds.

Interviews provided data that would be expanded to provide an estimate of the total baitfish harvest and capture of non-pointscore species for the entire fleet for each sampled fishing day. An expanded estimate of total daily catch was only made for species that occurred in two or more interviews during a tournament fishing day. Numbers of fish for species that did not meet this expansion criterion were simply recorded and added to the total daily estimate. This was done to prevent the expansion of 'rare event' captures.

Separate estimates of harvest and CPUE for baitfish and non-pointscore species for each of the main fishing type strata (Billfish/Tuna and Shark boats) were calculated for each fishing day that was sampled.

2.5.2. Baitfishing Harvest and CPUE

Many gamefishing boats allocate a portion of their fishing day to the capture of baitfish. The harvest of baitfish species during gamefishing events can be significant. Glaister and Diplock (1993) identified over 45 species that were harvested for use as bait.

Interviews with boat crews established the number of boats harvesting baitfish, the species taken and the number of baitfish harvested. Fish that were returned to the water alive or kept alive for a subsequent fishing trip were not recorded. Baitfishing practices for the two main fishing type strata (Billfish/Tuna and Shark boats) were determined and separate estimates calculated for each of these strata.

Daily estimates obtained for the baitfishing harvest of Billfish/Tuna boats and Shark boats were then combined to obtain an estimate of the total daily harvest of baitfish. These daily estimates were then combined to obtain an estimate for the 39 tournament days sampled during the 1998/99 fishing season for each stratum.

2.5.3. Estimated Weight of Baitfish Harvest

To obtain an estimate of the total catch by weight of a species, it is necessary to obtain and measure a representative sample of the sizes of baitfish from surveyed tournament days. Stewart et al. (1993) detailed the difficulties involved in obtaining a representative sample of baitfish from gamefish anglers as fishing activity is widespread and much of the catch is used at sea. Further to this, measuring the lengths of any remaining baitfish at the end of a fishing day may encounter biases. For example, a bias towards smaller baitfish may result if only the smallest baits were left in a bait tank at the end of a day after all the larger fish had been used. For this report, we did not attempt to measure any baitfish to obtain estimates of the weight of harvests. Estimates of the total *numbers* of baitfish for the 39 surveyed days are presented.

However, to provide an indication of the baitfish harvest by weight taken during tournaments, we provide a 'best available' estimate of the weight of slimy mackerel taken during the 39 tournament days. To obtain this weight estimate, data on the weights of slimy mackerel was obtained from Stewart et al. (1998) and incorporated into calculations that estimated the numbers of fish.

2.5.4. Non-Pointscore Species

Data on the numbers and species of unreported non-pointscore species were also gathered via post-fishing interviews during 1998/99. Expanded estimates of non-pointscore species and CPUE for each fishing day were calculated as per the methods used for the estimation of the baitfish harvest.

2.6. Weights of Gamefish

Data for fish that were harvested and weighed at the end of the fishing day was obtained from fishing club weigh-station records. The Gamefish Tagging Program requires anglers to record the estimated weight of tagged fish and this information was used to derive mean estimated weights of the species tagged-and-released. Average weight estimates were calculated for tagged fish,

weighed fish and for tagged and weighed fish combined for the 1998/99 and 1999/00 fishing seasons.

2.7. The Port Stephens Interclub Competition - Spatial Fishing Effort and Catch

The distribution of fishing effort and catch is often influenced by the location of gamefish species in relation to distance from the coast. For example, some billfish species are found mainly in deep oceanic waters far off the coast (e.g. shortbill spearfish and blue marlin) whereas other target species such as skipjack or striped tuna may be found throughout all waters targeted by gamefishers.

Sched data from the NSW Interclub Competition was used to assess spatial fishing effort and catch. The Interclub competition is the largest gamefishing tournament in Australia. The Interclub takes place over a four day period at Port Stephens each February with upwards of 250 competing boats. Location data from scheds were used to plot fishing effort and reported catch in relation to three fishing sectors of varying distances from shore for four tournaments held in years 1997, 1998, 1999 and 2000 (Figure 5).

The three fishing sectors were classified as Coast, Shelf and Deep.

a) Coast : Waters from the shoreline out to approximately the 60 fathom depth contour (approximately 20-25 nautical miles (nm) offshore).

b) Shelf : Waters encompassing the continental slope (between approximately 20-25 nm and 35-40nm offshore).

c) Deep : Waters beyond the continental slope (approximately >40nm offshore).

Fishing effort was measured as the cumulative number of fishing location reports recorded from all scheds from each sector (Coast, Shelf, Deep) for each tournament year. Location is defined as a sector or grid from the map used during the tournament. Effort data was further stratified by fishing type (Billfish/Tuna or Shark boats). The reported catch was also plotted for each fishing sector according to the main species groups (Billfish, Tunas, Sharks and Sportfish) that were reported for each tournament of the 4-year period.

2.8. Fleet Structure

Lengths of boats were recorded to provide a general description of the gamefish fleet. Data from eight selected tournaments during the 1999/2000 fishing season were used. The boat name and state registration number were recorded from tournament entry forms. Many individual boats fish in more than one tournament throughout the fishing season, therefore care was taken not to double count boats which fished in more than one of the selected tournaments. Some gamefishing boats share the same name. In these instances, registration numbers were used to differentiate boats.

2.9. Data Quality

Self-reported data may suffer from vagaries of anglers' memory, knowledge and truthfulness (Pollock et al. 1994). Biases that may be present in self reported data include recall bias, prestige bias, rounding bias, intentional deception and species misidentification (Pollock et al.1994).

The following aspects of the monitoring program help to minimise some of the biases associated with self-reported data:

- The short time frame between capture and reporting at scheds and interviews may assist the recall ability of anglers (a maximum of three hours between capture and reporting of catch). Shorter time periods are often used for the majority of tournaments.

- The 'prize' nature and small numbers of target species caught aids recall of captures.

- The use of tag capture cards to record data assists anglers in recalling details of fishing events.

- Fish that were weighed at the end of a fishing day could be identified and verified by survey staff for tournaments where staff were present at weigh-ins.

- Unreported fish that had been harvested and returned to port could be counted and identified by survey staff if the boat was interviewed at the end of the fishing day.

- Data from post-fishing interviews assisted with validating catches reported at scheds.

2.9.1. Data Recording

Some clubs have developed a range of methods to capture data electronically. These programs are mainly designed to calculate the pointscores for tagged-and-released and weighed fish and do not record the entire range of data associated with scheds, hence the need to develop a standardised datasheet for all gamefishing tournaments (see Pepperell and Henry 1998). A form designed to capture sched data for tournament seasons 1993/94 to 1995/96 was also used for the 1996/97 season. This form was superceded with one that was designed for use with Machine Readable Software (MRS) i.e. data that is scanned, verified and automatically stored into a database, for the 1997/98, 1998/99 and 1999/2000 seasons. This was designed for use by trained NSW Fisheries staff.

NSW Fisheries research staff attended all monitored gamefishing tournaments and transcribed all radio sched data. Sched data was also recorded directly onto a computer for 6 tournaments during 1997/98, 1998/99 and 1999/2000 via a spreadsheet program developed by Fred Studden of the Lake Macquarie Gamefishing Club. NSW Fisheries staff assisted with data entry and cross-checked the electronic records with those recorded on paper for these tournaments.

Interview forms for doing post-fishing interviews for the 1998/99 fishing season were also designed with MRS software. MRS software enabled more rapid data entry and storage and helped to minimise keystroke errors.

2.9.2. Tagging of Fish Within Gamefish Competitions

Data collected from the gamefish tagging program were used to assess whether results from the club based gamefish monitoring program were representative of the recreational catch of gamefish species by all anglers that targeted gamefish (club and non-club anglers alike). Participants in the tagging program are drawn from all sectors of the gamefish community (club, non-club and charter). We compared the species composition and proportion of fish tagged during tournaments to non-tournament fishing. The tagging database query was restricted to the coastal area defined for this study (Mooloolaba in south-east Queensland to Bermagui in southern NSW) for the ten month fishing season in 1998/99.

3. RESULTS AND DISCUSSION

3.1. Tournament Details

The number of anglers, number of boats in attendance (categorised by directed effort - Billfish/ Tuna and Shark boats) and other tournament details for each tournament monitored over the period from 1996-2000 are summarised in Table 1 and detailed in Appendices 3-6. For general details of tournaments prior to this period (1993 to 1995) see Pepperell and Henry (1998).

The number of tournaments monitored increased markedly for seasons 1998/99 and 1999/2000 (21 tournaments) compared to the previous two seasons (5 and 8 tournaments respectively), a result primarily due to the availability of extra funding for the latter seasons. Accordingly, the number of all other data elements gathered for the 1998/99 and 1999/2000 seasons also increased with 119 tournament days, over 3,000 fishing boat trips and in excess of 13,000 anglers providing information for both these seasons.

Post fishing surveys were done in the 1998/99 season to estimate the unreported catch (baitfish harvest and non-pointscore fish) with 926 boat trips from 39 tournament days being surveyed (Table 1).

Table 1. Summary statistics for all monitored tournaments for the 4-year period 1996/97 to 1999/2000 inclusive.

Summary Data	Fishing Season				
	1996/97	1997/98	1998/99	1999/200	Total All Years
No. Tournaments Monitored	5	8	21	21	55
No. Tournament Days	14	14	55	59	142
No. Billfish Boat Fishing Days	985 (85%)	1194 (85%)	2519 (84%)	2803 (85%)	7501 (84%)
No. Shark Boat Fishing Days	179 (15%)	218 (15%)	497 (16%)	484 (15%)	1378 (16%)
Total No. Fishing Days	1164	1412	3016	3287	8879
No. Billfish Angler Trips	4280 (84%)	5576 (84%)	10749 (82%)	12091 (85%)	32696 (84%)
No. Shark Angler Trips	830 (16%)	1091 (16%)	2297 (18%)	2107 (15%)	6325 (16%)
Total No. Angler Trips	5110	6667	13046	14198	39021
No. Tournament Days Interviewed	4*	-	39	-	
No. Boat Trips Interviewed	262*	-	926	-	

* Data from interviews done in 96/97 presented in Pepperell and Henry (1998)
Figures presented in brackets show the proportions of Billfish to Shark fishing effort for each season

3.2. Reported Catch - Trends in Catch Per Unit Effort

In this report, we present CPUE data for the reported catch for the 7-year period 1993/94 - 1999/2000. Other fishery characteristics such as spatial catch and effort information, results of post-fishing interviews, rates of tag-and release and fleet structure are confined to the latter 4-year period (1996/97 to 1999/2000 inclusive). Findings on these 'other' fishery characteristics for the initial 3-year period, are detailed in Pepperell and Henry (1998).

Eighty four percent of all competing boats targeted billfish and/or tunas over the four fishing seasons combined (1996/97-1999/2000), with the remaining 16% of the fleet targeting sharks (Table 1).

Catch rate estimates were calculated for each fishing type defined in this study (Billfish/Tuna boats and Shark boats), allowing for more precise CPUE estimates for the major species target groups (Billfish, Tunas, Sharks and Sportfish) and individual species within these categories.

Catch per unit effort is expressed as the number of fish landed per boat per day. Figures 7 to 10 present catch per unit effort estimates for the reported catch for each major species group and selected species within those groups for each fishing season from 1993/94 through to 1999/2000 for the entire study area. CPUE estimates and associated standard errors for all species caught by Billfish/Tuna, Shark and both target categories combined are presented in Appendices 7-10.

Catch per unit effort estimates for Billfishes, Tunas and Sportfish presented in Figure 7a,b, and d were derived from the reported catches of Billfish /Tuna fishing boats only, as species within these major groups are more directly targeted by Billfish/Tuna boats than shark boats (see Appendix 7 for source of data for these figures and standard error estimates). Catch per unit effort estimates presented for all shark species combined (Figure 7c) were derived from the reported catch by Shark fishing boats (see Appendix 8 for details of CPUE data for this strata).

3.2.1. Billfish CPUE

Catch rates of all Billfish species combined ranged from a low of 0.192 per boat day in 1994/95 to 0.581 per boat day in 1996/97 (Figure 7a).

1998/99 recorded the next highest peak in CPUE (0.548 fish per boat day, Figure 7a). Higher catch rates of black marlin for both the 1996/97 and 1998/99 seasons resulted when large numbers of small (15-20kg) black marlin were reported relatively close to shore during NSW north coast tournaments held in summer.

Black marlin catch rates for these two peak seasons were 0.425 and 0.292 fish per boat day for the 1996/97 and 1998/99 seasons (Figure 8a). This influx of juvenile black marlin was observed during the Port Stephens Interclub tournament of 1997 and the 1999 Port Macquarie Golden Lure tournament. For example, during the Golden Lure Tournament a single boat tagged-and-released 38 black marlin in one fishing day.

Catch rates of blue marlin ranged between 0.014 to 0.037 fish per boat day for the 4 year period 1993/94 to 1996/97 but increased in 1997/98 and 1998/99 (0.098 and 0.078 fish per boat day respectively, Figure 8b). These higher catch rates for blue marlin may be a result of an increase in directed effort towards this species during these latter seasons rather than an increase in blue marlin availability. Blue marlin are a highly sought-after 'prize' species, generally found in continental slope waters between 150 and 300 m deep (Kailoa et al.1993). Blue marlin were once regarded as being rare in south-east Queensland and NSW waters with a marked increase in numbers captured by recreational fishers being noted by the mid 1990's. This increase was attributed to boats fishing

further offshore and adapting their trolling techniques to Hawaiian style straight running lures (Kailoa et al.1993).

Data from the gamefish tagging database also reflects an increase in blue marlin captures in recent years. Provisional data from the program indicates that over 93% of all tagged blue marlin were captured in the most recent decade (prior to 1997/98, Figure 11 and NSW Fisheries unpublished data). The annual proportion of tagged blue marlin among all marlin species tagged each financial year (blue, black and striped marlin) increased from the late 1980's. For the decade prior to 1988/89, the average annual composition of blue marlin among all marlin tagged was only 0.79%. This figure increased to an annual average of 9.21% for the following decade from 1998/99 to 1997/98 (Figure 11).

Catch rates of striped marlin have remained stable during the 7-year period ranging from 0.084 to 0.173 fish per boat day (Figure 8c). Catches of striped marlin were more prevalent during the south coast tournaments in the later Summer/Autumn period of each gamefishing season. Anecdotal evidence suggests that catches of striped marlin were exceptional in the latter 2 seasons of the study (1998/99 and 1999/2000) with charter skippers in the port of Bermagui reporting large numbers of striped marlin during these seasons. Results from the tournament data suggest slightly elevated catch rates compared to previous years but this does not correspond to the anecdotal reports of outstanding striped marlin catches in the south of the state during these seasons. The broad temporal and spatial scale of the monitoring program may prevent these outstanding localised events becoming apparent in the data. High catch rates evident in one particular area and season may be moderated by low catch rate levels from other parts of the study region.

Sailfish catch rates were low and highly variable over the six year period with figures ranging from a low of 0.0008 in 1996/97 to 0.025 fish per boat day in 1994/95 (Figure 8d). The majority of sailfish were captured during tournaments in south-east Queensland, mainly centered on the Sunshine Coast and Gold Coast areas. Very few sailfish were caught during NSW tournaments probably because they prefer water temperatures of around 28ºC (Nakamura 1985), a temperature not commonly reached in the southern zone of NSW waters during the gamefishing season. The low catch rates for sailfish may be an example of catch rates being moderated by the broad based nature of this study as mentioned in the striped marlin example given above. Sailfish are mainly caught in numbers in the south-east Queensland area where competitions are held. The catch rate levels achieved in this area are again moderated by the data from all tournaments in the entire study region over the course of an entire fishing season. Nevertheless it is possible to assess the relative success rate from year to year for species monitored in this study. It is recommended that further work assessing CPUE data on a more local, finer scale be done to determine whether a particular fishing region experienced good or poor fishing seasons.

3.2.2. Tuna CPUE

Catch rates for all tuna species combined varied from a low of 0.322 in 1998/99 to a high of 0.822 fish per boat day during 1995/96 (Billfish/Tuna directed effort, Figure 7).

Catch rates for albacore were variable between seasons with CPUE alternating from negligible to moderate from season to season (Figure 9a). Albacore prefer cooler surface waters between 15.6º C to 19.4º C (Collette et al. 1983) which is the most likely explanation for the increase in catch rates of albacore late in the gamefish season, usually in the months between April and June in the southern region of the study area.

Anecdotal evidence suggested that fishing success rates for albacore were historically low in the latter half of the study period. Taking into account the longer-term seven-year period of this study, all seasons experienced low success rates for albacore. Albacore displayed an alternating cycle between low success rates followed by poorer seasons (Figure 9a).

Catch rates for yellowfin tuna indicate a possible declining trend since 1995/96. Yellowfin tuna catch rates ranged from a low 0.088 in 1997/98 to a high of 0.552 fish per boat day in 1995/96 (Figure9b). Yellowfin tuna are more directly targeted during the tournaments held in the southern region of the study area during the Autumn period of each gamefishing season, but are also widely caught as 'by-catch' to boats primarily targeting billfishes in most other tournaments.

3.2.3. Shark CPUE

Catch rate figures for all shark species combined showed a slightly increasing trend during the six year period of this study, with only a minor decrease in catch rates evident during the fishing season of 1997/98. Catch rates climbed from 0.370 in 1993/94 to a peak of 0.734 per boat per day in 1998/99 (Figure 7).

Effort directed at shark species remained relatively stable from year to year. Mako and whaler sharks showed generally increasing trends through time (Figures 10c and d) which may have influenced the increasing CPUE figures for all shark species combined (Figure 7). Tiger shark CPUE remained relatively stable during the majority of the 7-year period. Season 1998/99 displayed a decrease in tiger shark cpue to 0.081 fish per boat day. In other years cpue ranged between 0.105 and 0.151 fish per boat day (Figure 10a). Other shark species displayed marked variability in CPUE from year to year e.g. hammerhead sharks (Figure 10b). As effort remained stable during this period, the apparent rise in shark CPUE may possibly be attributed to the following factors. Shark fishers may have become more experienced and skilled at catching sharks, the growth in technology for locating fish is improved or there may have been a greater number of sharks available for capture in recent seasons.

3.2.4. Sportfish CPUE

Estimates of catch rates for all sportfish combined ranged between a low of 0.047 fish per boat day in 1997/98 to a high of 0.133 fish per boat day in 1998/99 (Figure 7). The peak in catch rates in 1998/99 is most probably attributed to good catches of dolphin fish and yellowtail kingfish observed in this year (Figure 9c and 9d). Anecdotal evidence suggests that stocks of kingfish are increasing following several seasons of poor catches.

The majority of sportfish species captured during gamefishing competitions are not directly targeted but are most often caught as by-catch to the primary target species. Species such as dolphin fish and wahoo are generally caught on trolled lures set for billfish and/or tunas. Occasionally, sportfish species are targeted if schools of fish are located during the fishing day or when the major gamefish target species are scarce. The low catch rates evident in the suite of sportfish species captured by gamefishing boats generally reflect their non-target status and lower levels of directed effort, compared to the major target species within the Billfish and Shark categories.

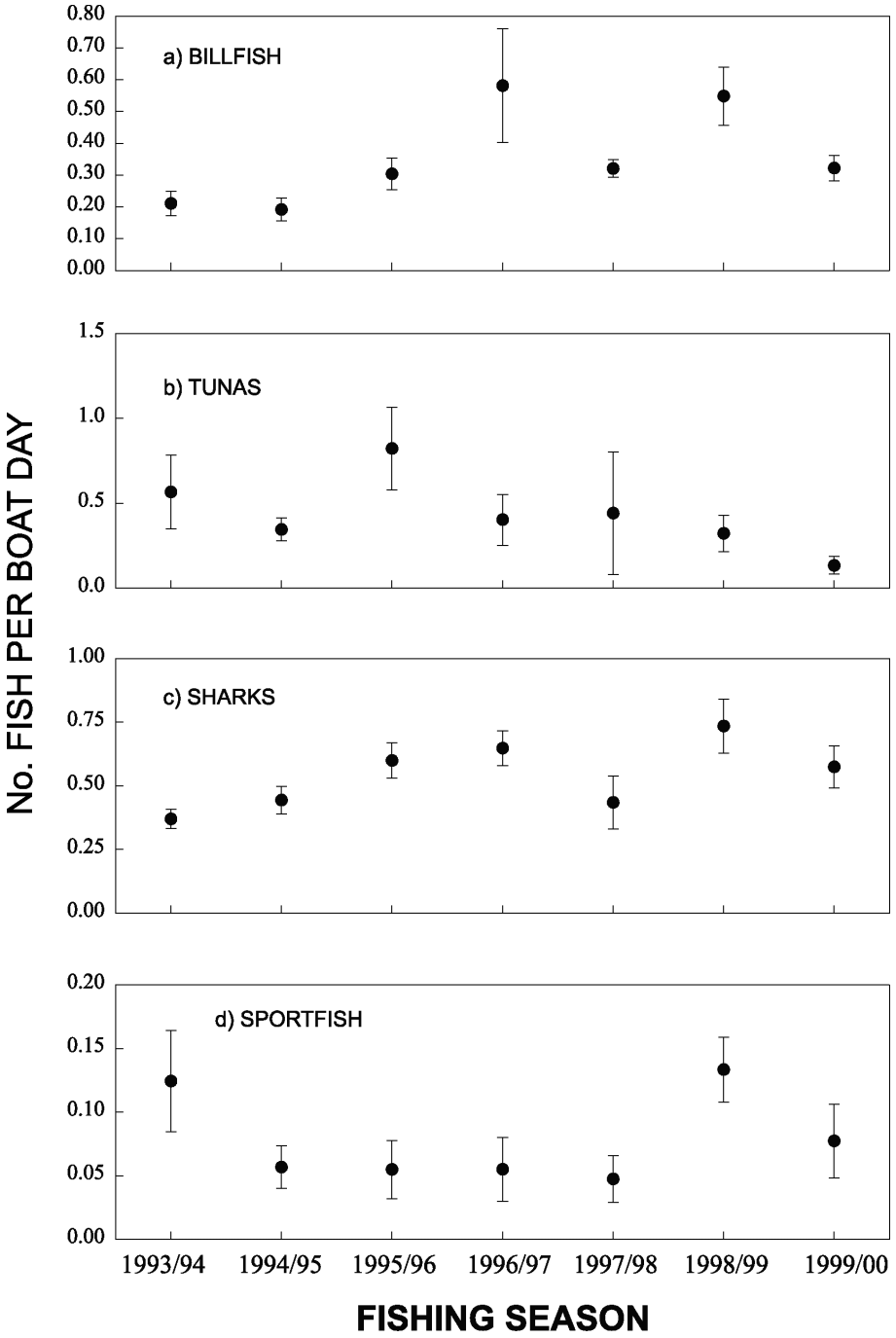

Figure 7. Estimated annual CPUE of a) all billfishes combined, b) all tunas combined, c) all sharks combined and d) all sportfish combined for seven fishing seasons from 1993/94 to 1999/2000 inclusive. Source of data: Billfish/Tuna directed effort, for details see Appendix 7.

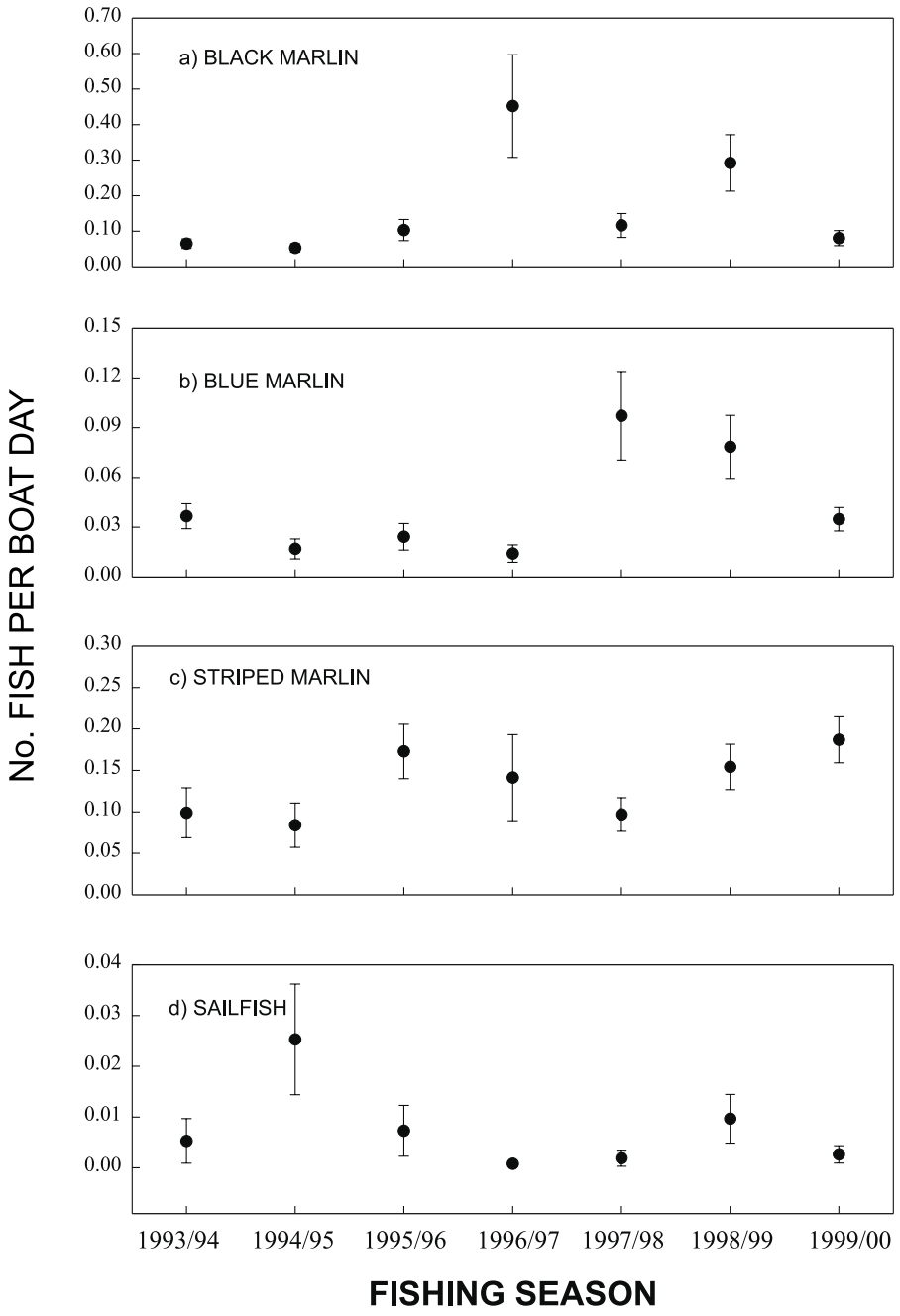

Figure 8. Estimated annual CPUE of a) black marlin, b) blue marlin, c) striped marlin and d) sailfish for seven fishing seasons from 1993/94 to 1999/00 inclusive. Source of data: Billfish/Tuna directed effort, for details see Appendix 7.

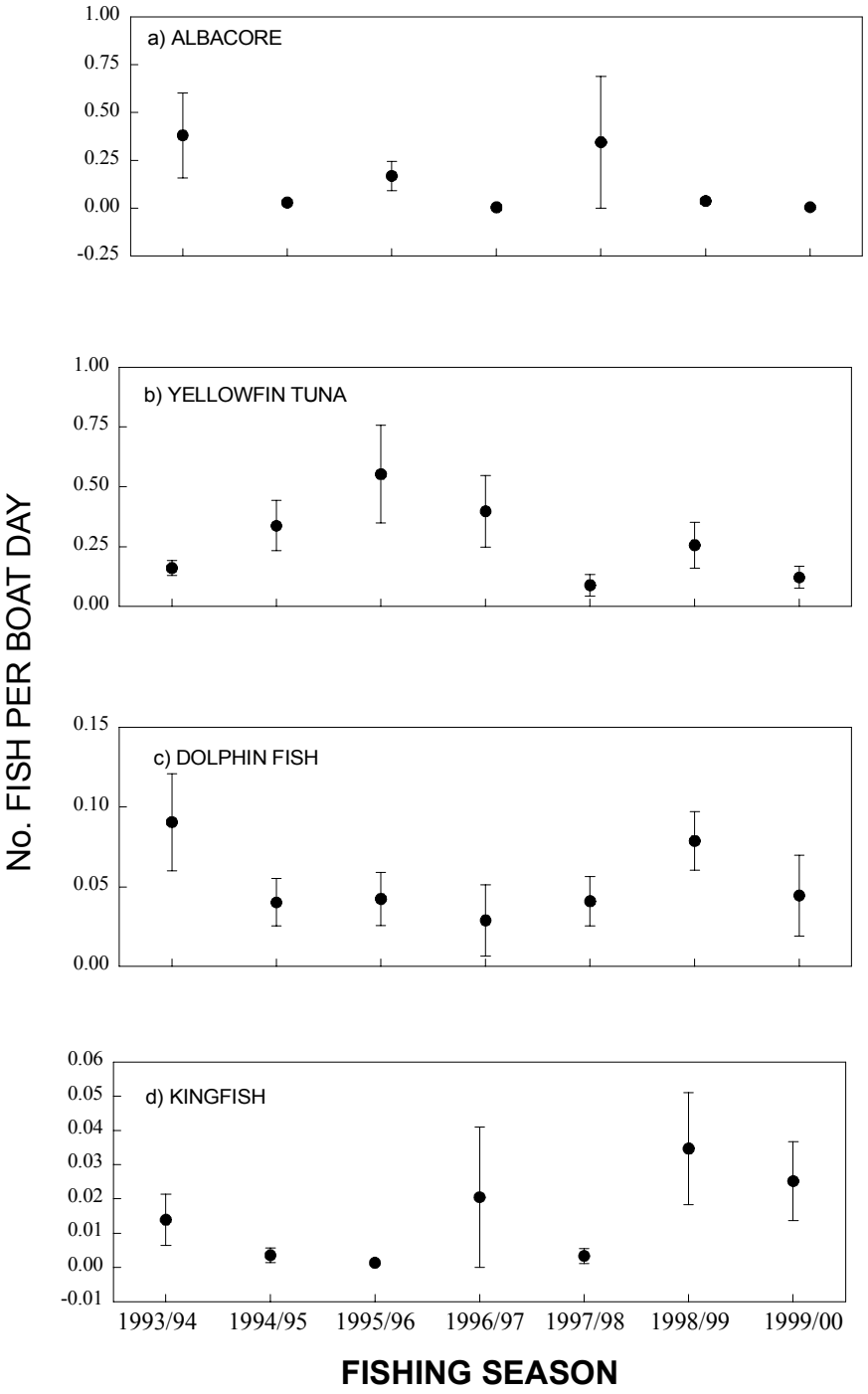

Figure 9. Estimated annual CPUE of a) albacore, b) yellowfin tuna, c) dolphin fish and d) kingfish for seven fishing seasons from 1993/94 to 1999/2000 inclusive. Source of data: Billfish/Tuna directed effort, for details see Appendix 7.

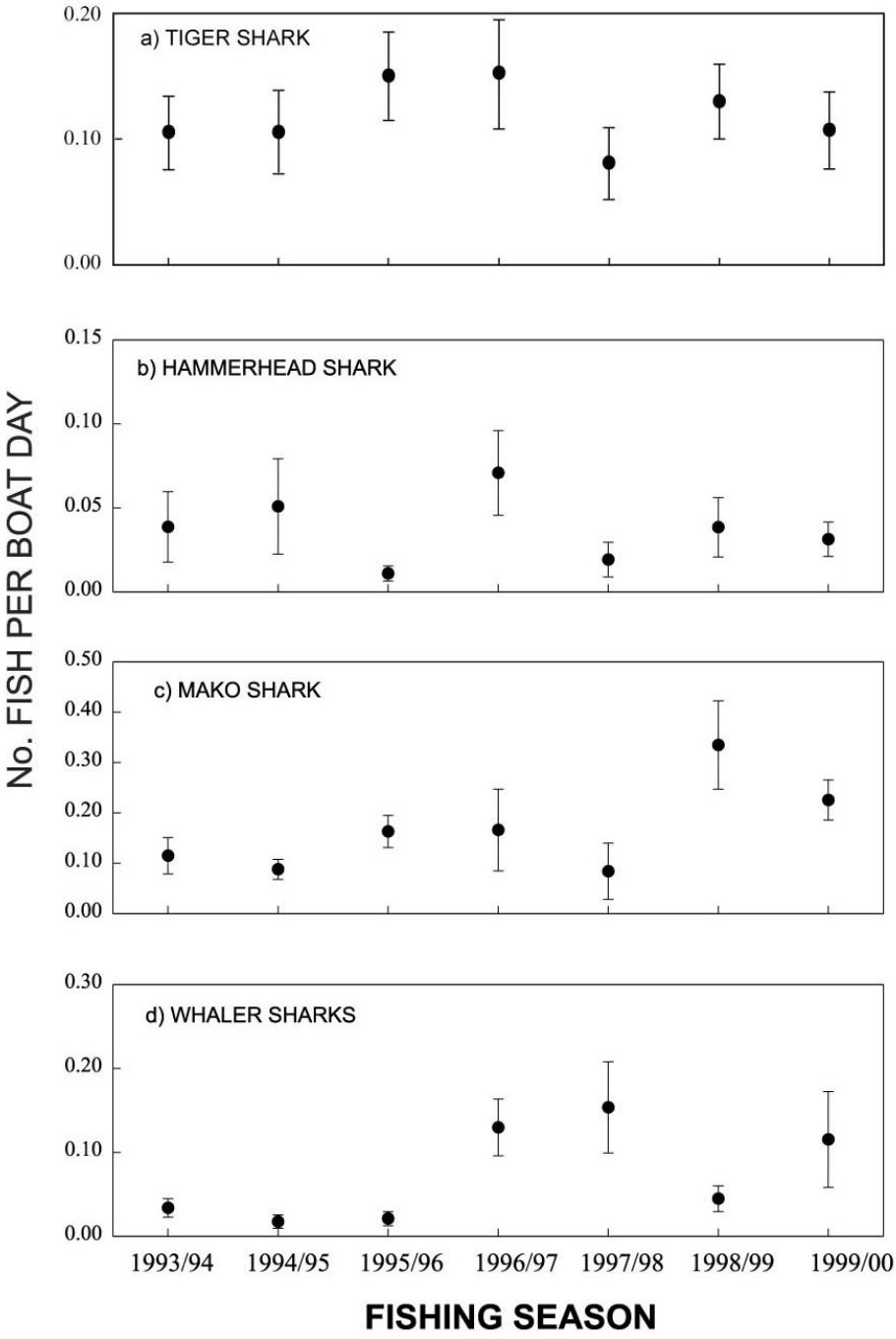

Figure 10. Estimated annual CPUE of a) tiger shark, b) hammerhead shark, c) mako shark and d) whaler sharks for seven fishing seasons from 1993/94 to 1999/2000 inclusive. Source of data: Shark directed effort, for details see Appendix 8.

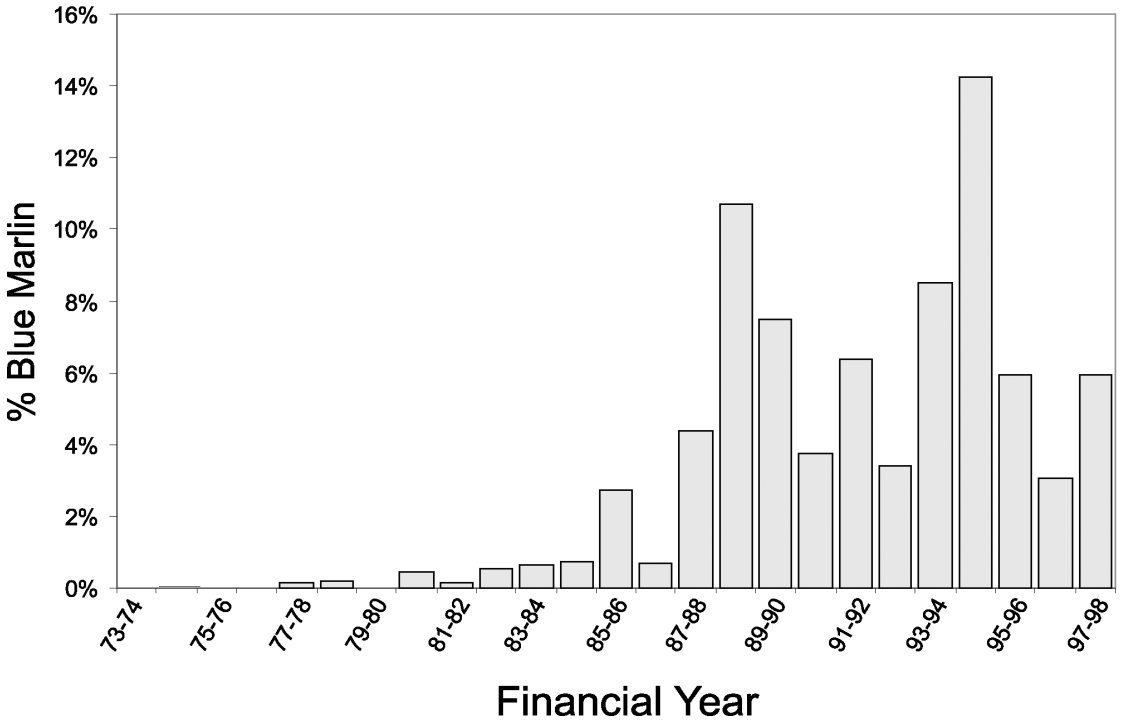

Figure 11. The proportional contribution of tagged blue marlin among all tagged marlin species (blue, black and striped) for each financial year from 1973/74 to 1997/98 inclusive.

3.3. Reported Catch - Numbers of Fish

3.3.1. Catch Composition

Figures 12-16 provide a summary of the numbers of all reported fish for each species group (billfish, sharks, tunas and sportfish) and for selected species within each group. The species and number of fish reported during scheds for the 4 fishing seasons combined (1996/97-1999/2000) are summarised in Appendix 11. Details on the numbers of reported fish for each capture category (tagged-and-released, weighed and 'not weighed' fish) for each of the 4 fishing seasons are presented in Appendices 12-15 and a summary of these four seasons by capture category are presented in Appendix 16.

Twenty-three species were reported during the four-year study period with billfishes as a group comprising the greatest number (59.6% of total reported catch). Tunas represented 18.4% of the reported catch followed by Sharks (11.7%) and sportfish (10.3%, Figure 12). The dominance of billfishes in the catch reflects the greater amount of effort directed at these species with 84% of all boats primarily targeting billfish with the remainder (16%) targeting sharks (Table 1).

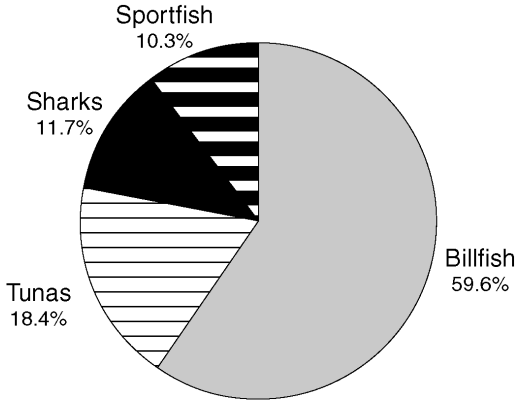

Figure 12. Catch composition for main target groups for monitored tournaments during the four-year period 1996/97 to 1999/2000.

3.3.2. Billfish Catch

Five species of billfish were recorded with black marlin being the most numerous of the billfishes (53.1%, Figure 13). Black marlin were caught in large numbers during the 1996/97 and 1998/99 seasons when large numbers of juvenile black marlin were captured at a number of tournaments. Striped marlin was the next most numerous billfish (32.7% of billfishes) followed by blue marlin (12.5%). Black marlin are more closely associated with landmasses than either blue or striped marlin, consequently catches of black marlin are higher closer to the continental slope and in the East Australian Current (EAC) than further offshore (Campbell and Miller 1998). Sailfish and shortbill spearfish were reported in low numbers (1.0% and 0.8% of the reported billfish catch, respectively).

Catches of sailfish are generally restricted to the south-east Queensland tournaments and are mainly seen in offshore NSW waters where warmer currents associated with the EAC occur (Nakamura 1985). It should be noted that only a few south-east Queensland tournaments were monitored during the study period. To assess the status of sailfish availability more accurately, the program should be expanded to cater for more tournaments in the south-east Queensland region. Shortbill spearfish are sporadically captured as they are thought to be primarily an oceanic fish, rarely appearing within 500km of the coast (Nakamura 1985).

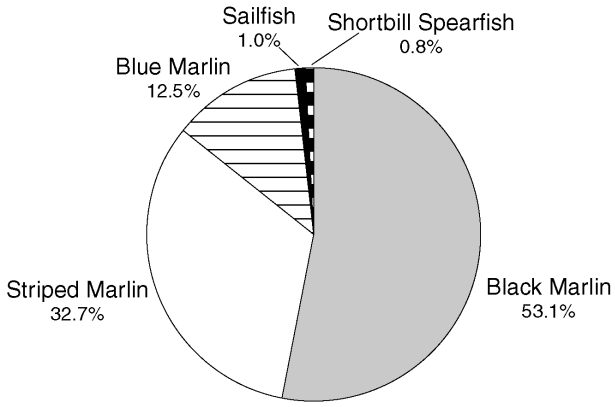

Figure 13. Catch composition of billfish species for monitored tournaments during the four-year period 1996/97 to 1999/2000.

3.3.3. Tuna Catch

Six species of tuna were reported during the four-year study period with yellowfin tuna comprising the majority (70.5%) of the reported tuna catches (Figure 14).

Yellowfin tuna are more commonly directly targeted during the tournaments held in the southern region of NSW mostly off Bermagui, by boats that use the drifting and cubing technique. Boats classified as Billfish/Tuna targeters often simultaneously target billfish and tunas with tackle rigged to capture both species groups. If schools of yellowfin tuna are located, these boats may readily focus their effort to the capture of yellowfin tuna while they are in the area.

Albacore was the next most reported tuna species comprising 26.8% of the reported tuna catch over the four-year study period (Figure 14). Albacore prefer more temperate waters than other tunas (Campbell and Miller 1998) and are generally targeted more heavily during the NSW south coast tournaments held toward the end of the gamefishing season in late autumn and early winter. Other tuna species were less common in the reported catch with only five southern bluefin tuna being reported during the 4-year period, perhaps reflecting the low stock status of this species at present. Skipjack and mackerel tunas are commonly captured by gamefishers but are not usually reported during scheds as these species do not attract pointscores, hence their low representation in the reported catch figures presented here. More comprehensive data on these species can be found in the unreported catch results (see section 3.5).

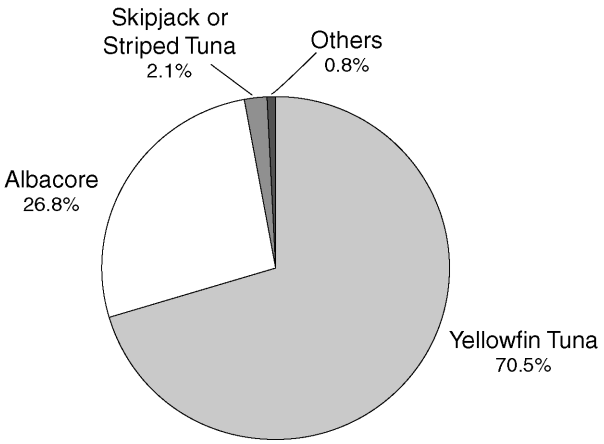

Figure 14. Catch composition of tunas for monitored tournaments during the four-year period 1996/97 to 1999/2000.

3.3.4. Shark Catch

Six species of sharks were reported with shortfin mako sharks being the most numerous in the shark catch (40.1%). Tiger sharks were next in importance (17.4%) followed by whaler sharks (16.7%), hammerhead (13%) and blue sharks (12%) (Figure 15).

Mako sharks were dominant within the shark catch. Both major target groups within the gamefish fishery (Billfish/Tuna and Shark targeters) commonly catch them. Mako sharks often take lures and trolled baits set for billfish and tunas, as well as being captured using burleying and drifting techniques used more commonly by boats targeting sharks.

Tiger sharks are a highly targeted shark species, as they may attain large sizes and therefore attract high pointscores during competitions (Pepperell and Henry 1998). For the purpose of this report, whaler sharks were presented as a group ('whalers'), as the identification of different whaler species is difficult. There are over thirty species of whaler shark found in Australian waters (Last and Stevens 1994) with many species being very similar. The varying abilities of fishers to identify the different whaler species prompted the decision to group all reports of whaler sharks into the one category. Within the study area there are approximately 8 species commonly present with bronze, silky and spinner whalers being the most common (Dennis Reid pers comm).

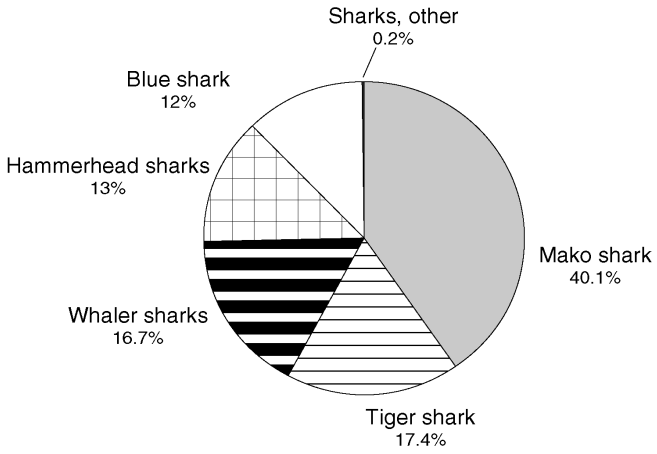

Figure 15. Catch composition of sharks for monitored tournaments during the four-year period 1996/97 to 1999/2000.

3.3.5. Sportfish Catch

Five species of sportfish were reported in gamefishing catches during the four year study period with dolphin fish (mahi mahi) comprising the majority of the reported sportfish catch (73%) followed by yellowtail kingfish and wahoo (15.7% and 10.3% respectively, Figure 16).

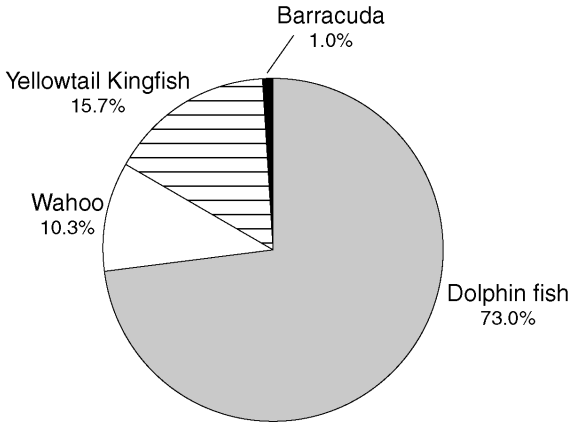

Figure 16. Catch composition of sportfish for monitored tournaments during the four-year period 1996/97 to 1999/2000.

Yellowtail kingfish provide good sport on light tackle, if schools of kingfish are found boats may directly target them. Dolphin fish may also be directly targeted if schools are found during a fishing day. A range of other sportfish are captured, mainly as incidental captures to the main target groups and are often not reported.

Estimates of the catch of these 'other' sportfish species are presented in the following section on unreported catch (see section 3.5).

3.4. Tag-and-Release of Fish within Tournaments

Figure 17 presents summaries of tag-and-release rates for the 4-year study period for the major species groups and for selected species within those groups. Details on the numbers and proportions of tagged-and-released, weighed and 'not weighed' fish for each fishing season over the 4-year period (1996/97 to 1999/2000 inclusive) are presented in Appendices 12-15. A summary of tag-and-release rates for the total four year period is also presented in Appendix 16.

Over 88% of reported fish for all species combined were tagged-and-released during monitored gamefishing tournaments during the 4-year period of this study. This figure varied among and within species groups but tagging was highest amongst billfishes (92.6%) followed by sportfish (91.8%), tunas (85.5%) and sharks (74.4%), (Figure 17a, Appendix 16).

The NSWGFA has self-imposed size limits on billfishes, sharks and yellowfin tunas. Billfish and shark fishers who catch a fish on tackle with a breaking strain of greater than or equal to 10kg may not retain fish that weigh less than 80kg. No points are awarded if fish meeting these criteria are brought to the weighstation. If anglers use breaking strain line less than 10kg in strength, billfish and sharks must weigh 60kg or greater before being eligible for a pointscore in the weighed fish category. The majority of fish caught by gamefishers do not meet these stringent criteria i.e. most fish caught during tournaments weigh less than these self imposed limits resulting in a majority of these species being tagged-and-released.

Additional factors that support the tag-and-release of fish captured at gamefish tournaments include:

- Many tournaments are 'tag only' events with no fish allowed to be weighed.
- The tagging section of tournaments is seen as the most prestigious.
- Some boat crews pride themselves on being known as 'tag only' boats and refuse to kill any fish for pointscores.
- Some anglers will only weigh large 'trophy' fish that are likely to be either record breaking or tournament winning fish that attract maximum competition points.

'High grading' of fish may occur during some tournaments. Many tournaments offer prizes for the heaviest fish within a species category (heaviest marlin, heaviest shark, tuna and 'other' sportfish). For example, fish weighed during the early stages of a tournament set a benchmark for other anglers to follow. If subsequent captures do not exceed the 'benchmark' weight, these fish are usually tagged-and-released. If a fish is estimated to exceed the 'benchmark' weight the angler may then decide to retain the fish for weighing in the heaviest fish category. This high grading continues until the end of the tournament period. High grading of captures also contributes to the high tag-and-release figures evident for most tournaments. If an exceptionally large fish is caught during the early stages of a tournament, this may prevent the weighing of other fish for that species during the latter stages of the competition.

Prizes for tagging fish often exceed or equal those on offer for the heaviest weight category, encouraging anglers towards the tag-and-release ethic.

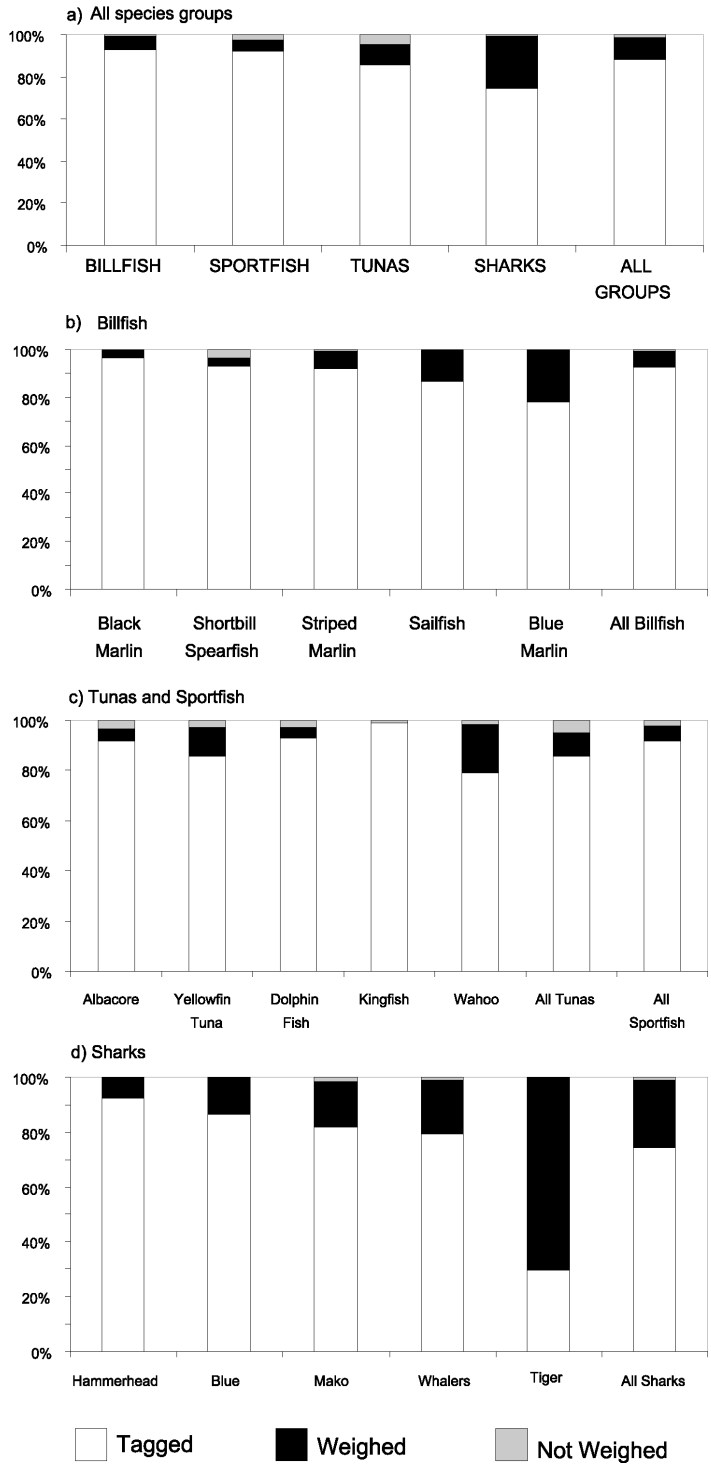

Figure 17. Proportions of tagged and released, weighed and 'not weighed' fish for a) major species groups, b) billfishes, c) tunas and sportfish and d) sharks for four fishing seasons 1996/97 to 1999/2000.

3.4.1. Billfish Tag-and-Release

The highest rate of tagging among billfishes was for black marlin at 96.5%. Large numbers of juvenile black marlin (between 15-30kg) were tagged-and-released during each gamefishing season. The lowest proportion of tagged to weighed fish amongst billfishes was for blue marlin at 78.0% (Figure 17b, Appendix 16). On average, blue marlin targeted in the study area tended to be larger than the other billfishes thus a higher proportion of this species were retained for weighing to attract maximum competition points in the heaviest billfish prize category. Gamefishers actively target these bigger fish using lures and gear that are likely to result in a successful capture of a large fish. Blue marlin are also considered to be a highly desirable 'trophy' fish, less commonly caught than black or striped marlin, resulting in a higher proportion being brought to the weighstation.

3.4.2. Tuna Tag-and-Release

Albacore and yellowfin tuna are the two most commonly caught tunas reported during tournaments. Tagging of tuna species attained rates of 91.6% and 85.6% respectively (Figure 17c, Appendix 16).

The majority of albacore and yellowfin tuna captured during tournaments were generally small fish that did not meet capture criteria set under tournament regulations. Most tournaments within NSW have a self-imposed minimum weight limit of 15kg for yellowfin tuna. These fish have a slightly higher tag-and-release rate in comparison to the other tunas, probably due to the self imposed weight limit. Albacore and yellowfin tuna are a highly prized food fish with many retained for eating. Albacore and yellowfin tuna also contribute significantly to the retained unreported catch, reflecting their status as prized food fish.

3.4.3. Shark Tag-and-Release

Tagging rates for most shark species were similar for other species groups (between 80% and 100%). Tiger sharks were a notable exception with only 29.8% being tagged-and-released. The remainder (70.2%) were harvested for weighing (Figure 17d, Appendix 16). These figures were also similar to those reported by Pepperell and Henry (1998). The capture of large tiger sharks attracts high competition points, which provides a strong incentive to land and weigh this species (Pepperell and Henry 1998). Prize categories for the heaviest shark landed also contribute to the high weighing rate for this species as tiger sharks are on average the largest shark species encountered during the gamefishing season.

During the fishing season of 1996/97 one great white shark was tagged-and-released, none during 1997/98 and two were tagged during 1998/99. Two great whites were voluntarily released ('not weighed') during 1999/2000 (Appendices 12-15). Great White sharks are now a protected species under the Endangered Species Act, which prevents the active targeting of this species, although it is permissible to tag-and-release white sharks which are unintentionally hooked.

3.4.4. Sportfish Tag-and-Release

Very high tagging rates were reported for most sportfish species with rates ranging between 79.1% (wahoo) and 92.6% (dolphin fish) for the 4 year study period (Figure 17c Appendix 16). The exception to this trend was for barracuda but the very low numbers of this species reported during tournaments preclude any meaningful analysis. Dolphin fish, wahoo and spanish mackerel are

highly prized table fish but anglers preferred to tag-and-release these species in high numbers rather than keep them for eating. Explanations for the high tagging rates amongst sportfish include fish weighing less than the line class they are caught on and direct targeting of schools to accumulate tag-and-release points during tournaments when prized billfish and shark species are scarce.

3.4.5. Tagging of Fish by Competition Gamefishers

Of all fish tagged in the Gamefish Tagging Program during the 1998/99 fishing season 23% were tagged during tournaments monitored for this study. Tagging during monitored tournaments accounted for 25% of all billfish, 20% of tunas, 48% of sharks and 12% of sportfish tagged in the study region during 1998/99 (Appendix 17).

Competition anglers tagged 68% of blue marlin and 67% of shortbill spearfish during the 1998/99 season (Appendix 17). High rates of competition tagging were also recorded for mako sharks (80%), wahoo (60%) and tiger sharks (56%). The major gamefishing species target groups were well represented during tournaments with the exception of Sportfish. Some Sportfish species such as kingfish are more heavily targeted by anglers affiliated with the Australian National Sportfish Association (ANSA) than with gamefishing clubs. Along with the GFAA, ANSA are a prominent participant in the Gamefish Tagging Program.

The high rate of tagging associated with tournaments reflects the organised nature of competitions with competitors being familiar with the benefits of tag-and-release programs and the incentive to tag most fish to attain competition points. The rate of tagging amongst tournament anglers is possibly higher than that presented here as we only covered the major tournaments within the study area. There are many other smaller scale tournaments and club pointscore days where the tagging of fish is highly encouraged.

3.4.6. Tag mortality

The recapture and reporting rates of marlin that are tagged-and-released are traditionally low with less than 2% of all tagged marlin species being reported as recaptured (Ortiz et al 2001, in press). Factors such as high dispersal rates, tag loss and low reporting rates contribute to low recapture rates. Mortality of tagged fish may also result as a consequence of tagging as fish are subject to varying degrees of stress from the capture process (Campbell et al. 1996). Mortality rates will differ between species, as some are better able to withstand the stresses of the capture process. Muoneke and Childress (1994) reviewed hooking mortalities for a range of recreational fisheries and found that in 52% of studies, mortalities of 10% or less occurred. In 70% of studies, hooking mortalities of less than 20% were recorded. A study on the hooking mortality of released black marlin estimated a mortality around 13% (Campbell et al. 1996).

Concern about post tagging mortality has led to investigations of angling techniques that may lessen hooking mortality rates. Gamefish anglers have traditionally used ‘J’ shaped hooks in gamefish tackle. In a recent study (Prince et al. In press), it was found that the use of ‘circle’ hooks may reduce injuries suffered by hooked fish and possibly increase the survival rate after release. Hook up rates, tag rates, hook location and degree of bleeding were compared between anglers who used ‘J’ hooks and those who used circle hooks in a controlled study done for the recreational sailfish fishery off the Bahamas. For fish hooked with ‘J’ hooks, 46% of all fish were deeply hooked compared with only 2% of fish captured using circle hooks. Bleeding was observed in 57% of fish hooked via ‘J’ hooks but only 6% of fish hooked with circle hooks showed signs of bleeding.

3.5. Unreported Catch

The estimates of unreported catch (baitfish harvest and non-pointscore fish) presented in this report represent the catches for 39 surveyed days only and were not extrapolated to the entire number of tournament fishing days during the 1998/99 gamefishing season. The estimated numbers of fish presented in this report are indicative of the relative take of these unreported catches.

3.5.1. Unreported Baitfish Harvest (numbers of fish)

Over half the fishing fleet directed a portion of their daily fishing effort towards the capture of baitfish during surveyed tournament days with 59% of Billfish/Tuna boats and 54% of Shark boats fishing for baitfish species. Stewart et al. (1998) surveyed bait usage at three tournaments, the NSW Interclub (Port Stephens) in 1996 and 1997 and the Canberra Yellowfin (Bermagui) tournament of 1996. Varying levels of effort directed at baitfish were found ranging from 32% of the fleet at Interclub 1996, 69% of the fleet fishing for baitfish at Interclub 1997 and 83% of the fleet at the Canberra yellowfin tournament of 1996 (average of 61%), a level of baitfishing effort similar to that found for this study. Levels of baitfishing effort vary from tournament to tournament depending on the primary species being targeted and the availability of baitfish on local baitgrounds.

The remainder of the fleet (41% of surveyed Billfish/Tuna boats) either used artificial lures exclusively or baits captured on a previous occasion or, in the case of many shark fishers (46% of the shark fishing fleet), used burley and bait obtained away from the tournament location.

Ten species were identified as being harvested for use as bait during the 1998/99 fishing season. Three species comprised over 98% (by number) of the baitfish harvest (all types of fishing combined). Slimy mackerel was the most common species with over 84% of the baitfish harvest (estimated number 9,621) followed by skipjack tuna (8.06% of harvest, estimated number 922 fish) and yellowtail and jack mackerel (5.95% of harvest, estimated number 681 fish) for both Billfish/Tuna and Shark fishing types combined (see Appendix 18 for estimates and standard errors). Seven other species made small contributions to the baitfish harvest, most of which were incidentally caught while boats were targeting the main baitfish species. Catch rates for the major baitfish species varied with slimy mackerel averaging a little over four fish per boat day for all boats that targeted baitfish.

Slimy mackerel is a small species that school in large congregations and is readily captured with either small baited hooks or bait jigs. Catch rates and harvest ratios for skipjack tuna were higher among Shark boats (1.545 fish per boat day) in comparison to Billfish/Tuna boats (0.330 fish per boat day, Appendix 18). Skipjack tuna are often preferred to capture the larger sized marlin and sharks due to their greater size. Shark anglers preferred the larger sized skipjack tuna for use as bait in comparison to Billfish/Tuna targeters who generally used the smaller slimy mackerel for the majority of marlin and tunas that were targeted. Shark anglers also used skipjacks as ingredients for burley mixes, skipjack being an oily fish with a high blood content which attracts sharks to anglers' baits.

3.5.2. Estimate of Slimy Mackerel Harvest by Weight

The size of the total recreational harvest of baitfish by weight is unknown but Stewart et al. (1998) indicated that recreational anglers are significant users of baitfish resources, particularly for slimy mackerel and yellowtail. These two species are the most popular and readily available baitfish in south-east Australia (see Glaister and Diplock 1993 for summary maps of the major baitfishing grounds in NSW). Using average weight data for slimy mackerel obtained from Stewart et al.

(1993), in combination with data on the estimated numbers of fish from this report, we estimated that the harvest of slimy mackerel by weight for the 39 surveyed tournament days was between 2.4 and 2.6 tonnes. These figures, which only represent a proportion of the total number of fishing days during a gamefishing season, indicate that the total harvest of slimy mackerel by club based gamefish anglers may be substantial. Further work is needed to provide more detailed estimates of total baitfish harvest for the gamefishing sector.

3.5.3. Unreported Non-Pointscore Species (numbers of fish)

Twenty-four species of fish were recorded as non-pointscore fish from post-fishing interviews during the 1998/99 fishing season. Three species comprised over 94% of the unreported catch with skipjack or striped tuna being the most numerous (76.85% of the unreported catch, estimated number 1,639 fish, Appendix 16). This species was followed by dolphin fish (13.24% of catch, estimated number 282 fish) and bonitos (4.39% of catch, estimated number 94 fish, Appendix 19).

Skipjack tuna are a widely distributed species found throughout the entire range of the east coast gamefish fishery. Skipjack was the most abundant by-catch for both Billfish/Tuna boats and Shark targeters. They are commonly caught by Billfish/Tuna boats on lines set for more prized tunas such as yellowfin tuna and albacore. In most instances for Shark boats, skipjack tunas were caught when targeting them for use as bait.

Dolphin fish, yellowfin tuna, wahoo, albacore, kingfish and mako sharks are prized table fish with many of these unreported species being retained for eating. Although some of these species attract points for tagging, interviews revealed that on many occasions anglers decided to forfeit a pointscore to consume these prized food fish. Other tunas (bonitos, mackerel tuna, frigate mackerel) captured incidentally were in most cases used as bait on the fishing day or kept for subsequent fishing trips to be used as bait or burley.

Billfish/Tuna fishing boats captured a more diverse array of non-pointscore species compared to Shark boats (22 species compared to 7 species for Shark fishers, Appendix 19). This reflects the methods used by Shark boats, with less chance for the capture of the smaller pelagic species that are commonly caught as by-catch by trolling methods used by Billfish/Tuna boats. Shark fishers catch billfish and sportfishes mainly as a consequence of their trolling to and from shark fishing grounds, the lesser effort expended trolling by shark fishers also reflects the lesser diversity in their unreported catch.

A number of competition boats took ‘time out’ from chasing pelagic gamefish during some tournament days and fished for reef species for the table. Thirty-six fish (comprising 1.69% of the unreported catch) were recorded from a combination of 8 reef dwelling species (Appendix 19). These species included snapper, leather jackets, morwong and pigfish.

3.6. Weights of Gamefish

Figure 18a-c presents mean weights for tagged-and-released fish and weighed fish combined for selected species. Weight data for all gamefish species during the 2 seasons 1998/99 and 1999/2000 are presented in Appendices 20 and 21. Large differences existed between the estimated average weight of tagged and weighed fish with ‘weighed’ fish, on average, being heavier (Appendix 20). The smaller weights of tagged fish in comparison to weighed fish are a result of tournament regulations, which prevent the weighing of ‘undersize’ fish.

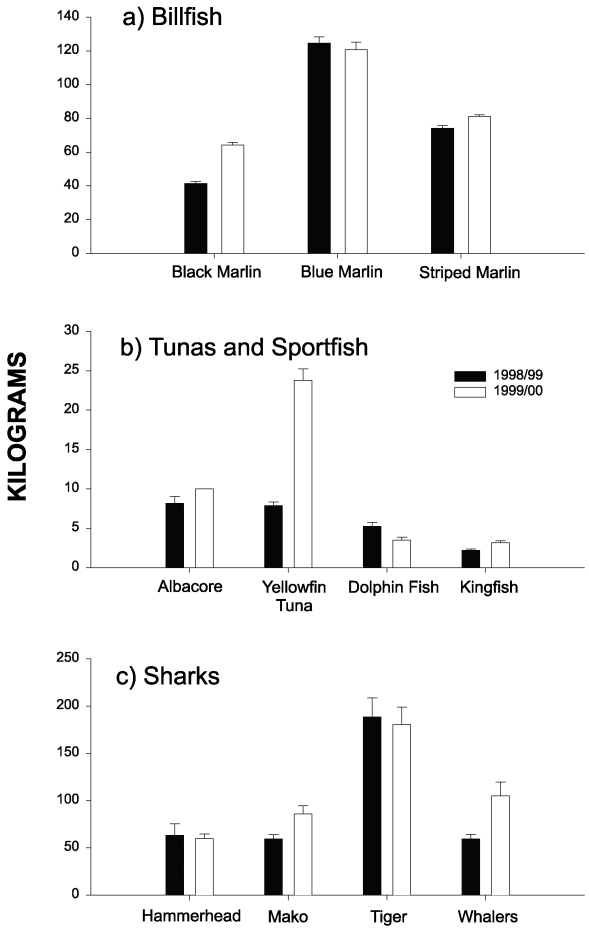

Figure 18. Mean weights of selected species (tagged and weighed fish combined) for two fishing seasons, 1998/99 and 1999/2000

3.6.1. Billfish Mean Weights

The mean weight of black marlin was greater in 1999/2000 (64.18kg) compared to 1998/99 (41.34kg, Figure 18a). There appeared to be an increase in the size of tagged black marlin during 1999/2000 compared to 1998/99. This reflects the generally small size of the majority of black marlin tagged during the 1998/99 season.

Blue marlin were much larger than either black or striped marlin for all weight categories (Figure 18a). Blue marlin captures in the study area tend to contain larger individuals than either black or striped marlin. Blue marlin can attain sizes to over 900kg compared to expected maximum weights for black marlin (700kg) and striped marlin (200kg) (Nakamura 1985). A world line class record blue marlin of 452 kg was captured off Batemans Bay in March 1999.

3.6.2. Tuna Mean Weights

There was little difference in the sizes of most tunas and sportfish between the 2 monitored seasons but yellowfin tuna showed a marked increase in mean weight during the latter season (Figure 18b). The mean weight of yellowfin tuna during 1998/99 was only 7.88kg compared to 23.78 kg during 1999/2000.

3.6.3. Shark Mean Weights

Tiger sharks had the largest estimated average weight among all sharks with mean weights of 188.64kg &180.51 kg for the 2 seasons (Figure 18c). The next heaviest shark taxon was whaler sharks with a mean estimated weight of 73.69kg and 104.90kg for the 1998/99 and 1999/2000 seasons respectively (Figure 18c, Appendices 20-21).

3.6.4. Sportfish Mean Weights

The heaviest sportfish was wahoo with an estimated mean weight of 14.89kg during 99/2000 followed by barracuda (14.00 kg - 1998/99). There was little difference in mean weights between seasons for the major sportfish species taken by gamefishers (Appendices 20-21).

3.7. Port Stephens Interclub Tournament

3.7.1. Interclub Fishing Effort

There was marked variation in the location of Billfish/Tuna fishing effort from year to year in the Port Stephens Interclub Tournament but little change was observed in the areas fished by Shark boats from year to year (Figure 19a-b).

During the 1997 tournament, over 80% of Billfish/Tuna effort was spent in the 'coast' zone (within 20 nautical miles (nm) of the coast) with minor amounts of effort spent in the remaining 'shelf' and 'deep' zones (Figure 19a). During the subsequent years of 1998 and 1999, similar amounts of effort were spent in the 'shelf' zone (around 50% of fishing effort) between 20 and 40nm from the coast, (Figure 19a). The proportion of fishing effort spent in the 'deep' zone (> 40nm from the coast) rose from around 3% of effort in 1997 to 15% of effort in the 1999 tournament for the Billfish/Tuna fleet.

The large proportion of effort spent in the inshore zone during 1997 was attributed to the availability of black marlin within this area when large numbers of juveniles were present very close to shore (Pepperell and Henry 1998). During this year the catch of black marlin was the highest on record for this tournament. The following years reverted to a more ‘normal’ pattern with the majority of effort being spent around the continental shelf areas followed by the coastal zone.

The rise in Billfish/Tuna effort from year to year in the 'deep' zone may be attributable to an increase in effort directed at blue marlin as the larger blue marlin tend to inhabit the deeper offshore areas (Nakamura 1985).

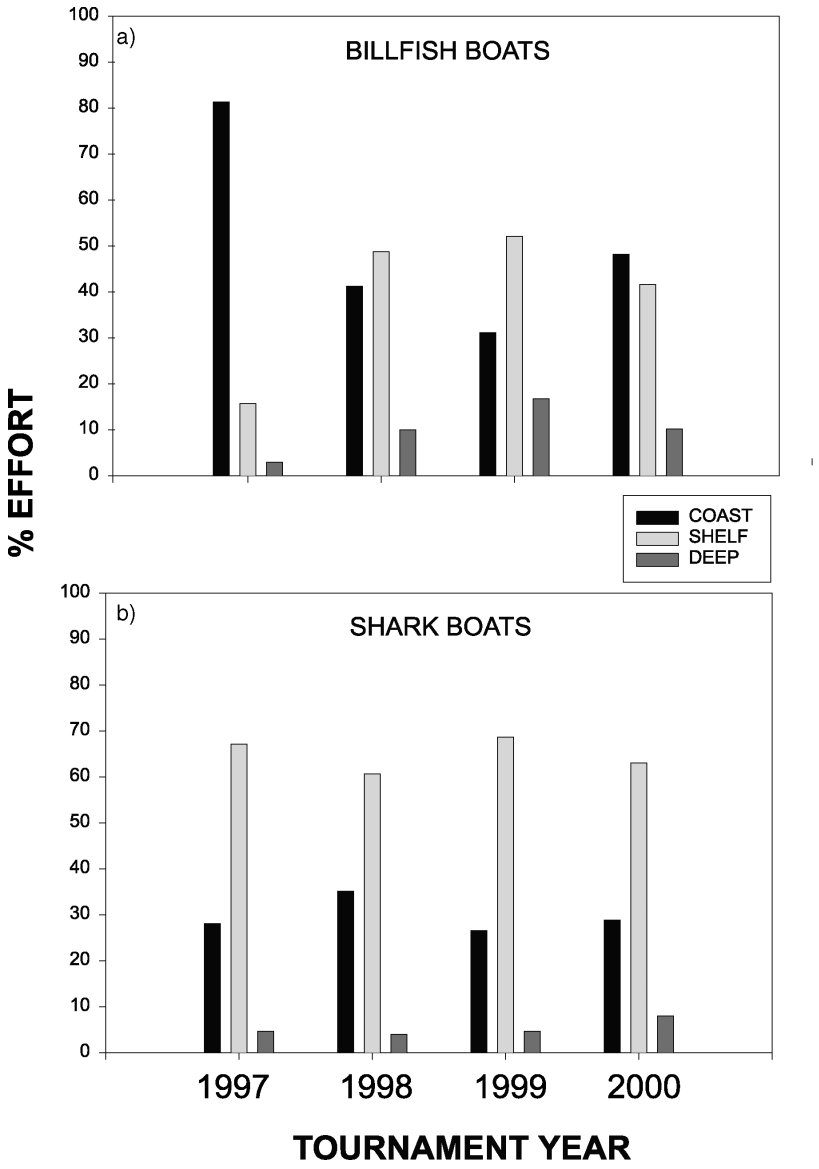

Figure 19. The contributing proportions of fishing effort for a) Billfish/Tuna and b) Shark boats during the Port Stephens Interclub tournament for three depth zones for tournament years 1997, 1998, 1999 and 2000.

An increase in effort directed at blue marlin has been observed across the entire east coast fleet in recent years and this may also be reflected in the data from the Interclub tournament. It may also be possible that the Billfish/Tuna fleet had to search wider to obtain successful catches during this year, and / or billfish may have been more widespread over all zones than for the previous two years.

The majority of Shark fishing occoured in the 'shelf' region of the tournament area. The next most popular fishing zone was 'coast' with little effort directed at sharks in the offshore 'deep' areas (Figure 19b).

The effort distribution data may possibly be of use to determine areas where the recreational gamefishing fleet interacts with the commercial billfish and tuna fleet. Further analysis of this data for all monitored tournaments may reveal where interactions of the two fishing sectors overlap in time and space.

3.7.2. Interclub Catch

The catch of billfish during the Interclub tournaments generally reflects the trends observed in effort with the vast majority of billfish captured in the 'coast' zone in 1997. 92.9% of the billfish catch was taken from the 'coast' zone in this year (Figure 20a). The majority of billfish catches in subsequent years were from the 'shelf' areas where most effort was spent. In 1999 there was a rise in billfish catch from the 'deep' area, when greater numbers of striped and black marlin were taken from the deep zone than in previous years. The greater catches of these billfish species were perhaps a result of greater effort expended in the 'deep' zone during the 1999 tournament.

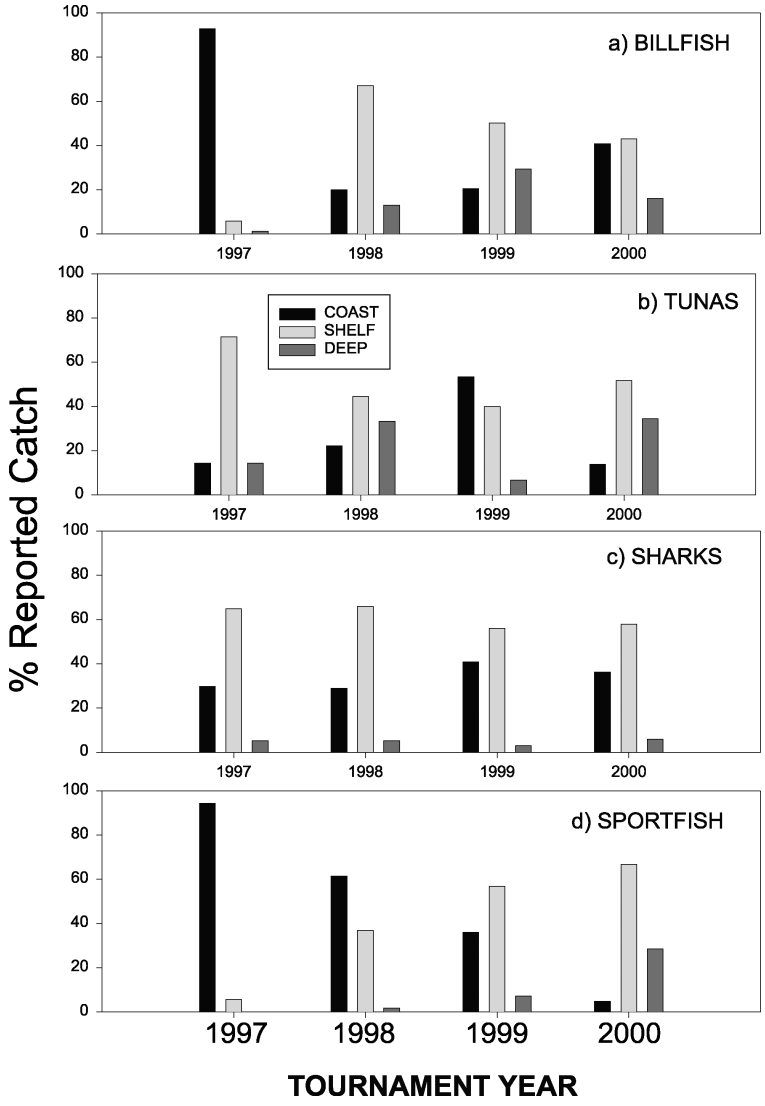

Figure 20. The contributing proportions of the number of reported fish for major target groups a) Billfish, b) Tunas, c) Sharks and d) Sportfish during the Port Stephens Interclub tournament for three depth zones for tournament years 1997, 1998, 1999 and 2000.

The reasons for inter annual variability in the location of fishing effort and catch of gamefish can be complex. The strength and direction of currents associated with the prevailing East Australian Current (EAC) can affect year to year availability and location of gamefish species in relation to distance from the coast. For example, the high catches of the 1997 tournament in the 'coast' region

was most probably attributable to a ‘tongue’ of warm water extending down the coast and passing close to the coastline, bringing with it large numbers of juvenile black marlin.

Catches of tunas varied in their location from year to year during Interclub tournaments, for example, in 1997 the majority of tuna species were taken from 'shelf' waters (Figure 20b). Although most Billfish/Tuna effort was spent in the 'coast' zone, very few tunas were captured from this region, tunas were found out wider during the 1997 tournament year. The location of tuna catches for the 1998 tournament displayed a similar pattern to 1997. During the 1999 tournament the majority of tunas were taken from the 'coast' zone, even though the major portion of Billfish/Tuna effort was spent in the 'shelf' region.

The capture of sharks closely followed the pattern of shark fishing effort from year to year with the majority of sharks being taken from the 'shelf' area (Figure 20c). The majority of sportfish catches were captured in 'coast' waters during the 1997 and 1998 tournaments with 'shelf' waters producing most sportfish during 1999.

An understanding of the dynamics of the movement into and the residence times of gamefish taxa is needed to assess the availability of fish to the gamefishing fleet at the time tournaments are held. For example, the availability of black marlin may depend on a high throughput with short residence times, or a smaller throughput with longer residence times (Davis et al. 1999). The latter situation is likely to increase the possibility of a more sizeable interaction between the gamefishing fleet and black marlin during the relatively short time periods when tournaments are held.

3.8. Interactions with the Commercial Fishery

The potential for sizeable interactions and conflict over the allocation of fish resources between the recreational and commercial fisheries for the major gamefish species has been a concern for many years.

The interactions between the two sectors can be defined in several ways. A potential interaction can be assumed to exist if two or more fleets fish the same stock. Such interactions can be distant if the fleets each fish in different localities (spatial interactions) or different seasons (temporal interactions) or more immediate if the fleets operate in close proximity in space and time. Evidence for interactions is usually based on tag returns, i.e. fish caught and tagged by one fleet being caught by another fleet. Other examples include anecdotal evidence of longline hooks in the mouths of billfish caught in the recreational sector (from billfish discarded or escaped from the commercial catch). The measurement of the size of these interactions in terms of the number of fish involved is usually very difficult to determine (Campbell et al. 1996).

Population size and distribution, movement rates, distance between fisheries and the size composition of catches can affect the extent of any interaction between the commercial and recreational sectors. Furthermore, various other environmental factors can be invoked to explain changes observed in the catches or strike rates of target species e.g. El Nino effects (Campbell et al. 1996). A detailed description of various models of interactions between recreational and commercial sectors targeting billfish and tuna are outlined in Synopsis on the Billfish Stocks and Fisheries within the eastern AFZ (Campbell et al. 1996).

Monitoring the sizes of fish captured by both recreational and commercial sectors may possibly be one way to assess the extent of interaction. For example, if the sizes of fish caught between the two groups are of a similar size distribution, it is possible there is an interaction for the same stock of fish. A preliminary assessment of the sizes of commercially and recreationally caught fish was done for some key species. There appears to be a difference between the mean weights of yellowfin tuna captured by recreational and commercial fishers during the study period and location. This may be a result of different year classes of yellowfin being fished by each sector.

The smaller run of yellowfin tuna caught by recreational fishers may have been a result of fishing closer to the coastline where smaller sized tunas may be more prevalent (see Pepperell and Diplock, 1989). Differences in mean sizes may also be a result of differences in fishing gear used by each sector. For example, commercial fishers may configure their gear for the capture of larger individuals, limiting the capture of smaller sized fish. Tackle used by anglers may have been less discriminating in the sizes of tunas able to be caught.

The ability of this report to assess interactions between the commercial and recreational sectors using weight data is limited by the high degree of variability of the weight data within both the recreational and commercial datasets. Comparisons are further limited to the effects of an immediate interaction, i.e. both commercial and recreational fleets fishing at the same time and locations. Further exploration of weight and size data from both the recreational and commercial sectors is needed for more conclusive assessments about interactions between the two sectors in the study region.

There is potential for investigating historical datasets on estimated weights of fish for recreational gamefishers from the Gamefish Tagging Program and fish weights recorded at weighstations from data held by gamefishing clubs. Campbell et al. (2000) investigated the mean annual weights of black marlin from charter boat operators from 1970 to 1998 from the Cairns/Lizard Island region off north-east Australia. This data was incorporated into models investigating the interaction of commercial and recreational fisheries for black marlin in that region. A similar approach could be used to assess interactions between the fisheries in the study region selected for this study.

Spatial data on fishing effort and catch collected via the GTMP may also be of use in assessing fishery interactions. Tournament fishing boats routinely report their position and locations of catches via the scheds according to grids determined by each club. Gamefishing clubs use grid maps which differ in their scale from port to port. For example, tournaments held by the Bermagui Big Game Anglers Club out of Bermagui use a map with grids 2.8 by 2.8 nautical miles. The Shoalhaven Game Fishing Club (Greenwell Point) use maps with 2 by 4 nautical mile grids.

The AFMA logbook program for the commercial longline fishery requires boats to report their catches over much larger spatial scales than the areas sampled for this study. To enable a comparison of effort and catch between the two sectors it would be necessary to introduce a standardised grid reporting system for both recreational and commercial sectors. Grid maps used by the recreational fleet should replicate boundaries defined by AFMA or have the capacity to scale data collected from the recreational grids up to those used by AFMA. Standardising indices of effort and CPUE between the two sectors should also be done prior to any further analysis of fleet interactions.

3.9. Fleet Structure

A total of 466 individual boats were identified from eight tournaments monitored over the 1999/2000 season (Figure 21). The gamefishing fleet consisted of a diversity of vessels ranging in length from a 4.4 metre trailer boat to a cruiser of 23 metres in length. There is a perception that the gamefishing fleet in south-east Australia is dominated by expensive, large purpose built craft.

Our results do not support this perception with a large proportion of the fleet consisting of boats in the 5 to 6.9 m (37.3% of the fleet) and 7 to 8.9 m (26.8% of the fleet) length classes. The majority of boats in these categories are trailer boats that have been adapted for the rigors of gamefishing in open waters. Boats in this smaller category land some very large fish during tournaments. For example, a 460kg tiger shark was captured from a 5m vessel during the Golden Lure tournament of 1999. The increased use of trailer boats in tournaments is reflected in a recent trend to introduce separate prize categories for trailer boats and moored craft. This reflects the different capabilities of these two sectors in handling sea conditions and ability to fight and land fish.

The remainder of the fleet is comprised of a variety of larger craft usually sited from moorings and marinas in the various ports from where tournaments are held. These larger craft are more capable of fishing the outer regions of the tournament boundaries. To fish these outer areas comfortably within a tournament fishing day, boats need to be able to quickly access these areas during a variety of conditions and, due to their speed and size, the larger craft are more able to fish these areas than trailer boats.

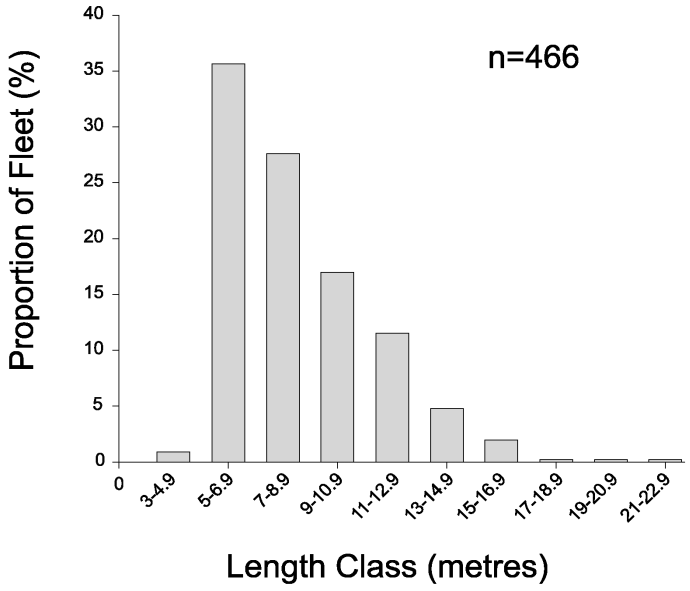

Figure 21. Total number of boats (n = 466) competing in eight tournaments over the 1999/2000 seasons with lengths categorised at 2m intervals.

3.10. Verification of Reported Catch

Recreational fisheries research programs that rely on the recollection of fishing events from anglers may be subject to biases arising from the misreporting of catch information. Biases may include recall bias (incorrect recollection of catches), prestige bias (inflating the actual catch and size of fish), rounding bias (rounding the numbers of fish caught either up or down), intentional deception (not reveling the 'truth' about catches to research staff) and species misidentification (Pollock et al.1994).

On board observer programs are routinely employed in commercial fisheries research to determine the extent of misreporting by placing a research staff member on vessels to verify the catches that come aboard. The use of an observer program for this study was not possible due to the limited resources of the GTMP.

Possible sources of bias relating to the GTMP include;

- Fish may have been misidentified at the time of reporting.
- Prestige bias may have influenced anglers to overstate their catch.
- At many tournaments, it is often found that a small proportion of boats cannot contact the radio base due to technical difficulties with their radios, these boats are recorded as ‘nothing heard’

at the time of the sched. These boats may well have caught fish during the day but their catches went unrecorded during these 'blacked out' sched reports.

- At some tournaments, the last sched of the day was used as a 'sign off' report to identify boats that have returned to port and to receive estimated times of return to port for boats still travelling. Often, catches made in the interval between the previous sched and the sign off went unreported.

Cross-checking catches reported via the scheds with club pointscore records (which are based on the tag card returns and weighstation records) for each tournament revealed little change from the sched data. The size and direction of biases associated with data collected from the GTMP may best be evaluated by an on board observer program.

4. CONCLUSIONS

Statutory responsibilities for management of many of the key recreational gamefish are now articulated through international cooperative arrangements, which fall within the principles of the United Nations Convention on the Law of the Sea (UNCLOS). This agreement requires that signatories cooperate to establish regional fisheries management regimes, and set minimum standards for data collection. Both agreements provide Australia with a number of international obligations towards the conservation and management of highly migratory species such as tuna and billfish. The objectives of the GTMP are consistent with the recommendations outlined in the assessment of the black and blue marlin in the Australian fishing zone (Black and Blue Marlin Working group June 2000). "To continue monitoring of recreational angling activities through data collection at fishing tournaments".

The collection of basic fishery data such as catch per unit effort information is required to provide the necessary resolution to observe trends and assess the status of the fishery, and to provide management strategies that will ensure their long term sustainability. Results from the GTMP provide the basis for comparison with results from the gamefish tagging and the charter boat monitoring programs and maximise the ability to monitor the recreational gamefish sector with the resources available. The cooperative approach adopted by these programs also fosters a mutually beneficial relationship between the angling public and NSW Fisheries, which encourages community ownership and responsibility for fisheries resources.

The aim of cooperative monitoring studies from a research perspective is not to provide detailed answers to stock assessment questions, but to monitor the relative changes in catch rates of species to provide possible trigger points for the review of current management arrangements. Data provided by charter boat operators, which indicated a 20-30% decline in the catch rates of black marlin, was instrumental in the modification of management arrangements resulting in restriction of commercial fishing effort in waters off Cairns (Black and Blue Marlin Working Group June 2000).

Information from the gamefish tagging, gamefish monitoring programs and commercial catch records will be complemented by information flowing from the National Survey of Recreational and Indigenous Fishing. This survey, due to be completed in late 2002 will provide estimates of the total catch of all sectors of the recreational fishery. It is anticipated that this broad-based study will provide a greater understanding of all participants (club and non-club anglers) of the east coast gamefish fishery. Data generated from the tournament monitoring database will assist the national survey in providing more precise and accurate estimates of the total catch of gamefishers.

5. RECOMMENDATIONS

The key to the success of the angler based data collection approach employed by the gamefish tagging and gamefish monitoring program is communication of results back to the user groups. The primary incentive for anglers to continue to support these programs is to ensure that the results of these programs are made widely available and demonstrate that the information is useful in the sustainable management of gamefish species.

The following recommendations seek to promote a better understanding of the aims of the program, to improve the level of awareness amongst anglers of the importance of the data collected for the management of the primary gamefish species and to modify current methodology to improve the accuracy and reliability of the data collected.

- All information concerning the gamefish programs is posted to the NSW Fisheries web site. Investigate the feasibility of using the web site to lodge tag returns.

- Provide educational material specifically designed for the angling community to more effectively communicate the objectives of the program.

- That tournament monitoring using sched data as the primary means of data collection is continued.

- To collect more accurate catch and effort data on all species targeted by gamefishers, provide resources to continue with routine post-fishing or dockside interviews for all monitored tournaments. The Angling Catch Database is a NSW Fisheries Research Program designed to collect catch and effort data from specific recreational fisheries. Currently, the program is operating for competition anglers in NSW freshwater fisheries. Angling Catch Database principles will ensure that all categories of fish are recorded and result in more reliable estimates of the catch for the gamefish fishery. For example, the current debate over allocation of baitfish resources in NSW waters would benefit from data gathered from interviews with tournament gamefishers. Regular monitoring of tournaments via interview techniques will provide data on the use of baitfish by recreational gamefishers and assist in the assessment of baitfish resources.

- Provide funding for an observer based program to verify species identification and accuracy of sched data.

- Provide a series of grid charts for all tournament ports, which standardise the size of grid. This will enable comparison of areas fished from port to port and possibly can be scaled up to compare with spatial catch of the commercial fleet who use a grid system to record catch. Data recorded in this would facilitate the incorporation of a GIS system to graphically plot grid effort and catch.

- Substantiate levels of post release mortality and investigate strategies to reduce capture-related stress and mortalities.

- Increase the number of south-east Queensland tournaments monitored to gain a more thorough understanding of the south-east Australian recreational gamefish fishery.

- Expand the number of tournaments monitored by the program to include data from the 'smaller' gamefishing events and club pointscore days.

- Investigate historical charter fishery records, weighstation records and the Gamefish Tagging Program to assess changes in the size of fish in the recreational fishery through time.

- Analyse catch rate data on a finer spatial scale to assess fishing success rates within particular regions of the study area.

- The GFAA and the NSWGFA should be consulted at all stages to encourage cooperation from all clubs in the development and implementation of the above recommendations.

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APPENDICIES

Appendix 1. List of species recognised by the GFAA as saltwater gamefish.

SPECIES GROUP	COMMON NAME	SCIENTIFIC NAME	Presence in reported catch
BILLFISH	BLACK MARLIN	*Makaira indica*	*
	BLUE MARLIN	*Makaira mazara*	*
	STRIPED MARLIN	*Tetrapturus audax*	*
	SAILFISH	*Istiophorus platypterus*	*
	SHORTBILL SPEARFISH	*Tetrapturus angustirostris*	*
	SWORDFISH	*Xiphias gladius*	
TUNAS	ALBACORE	*Thunnus alalunga*	*
	BONITOS	*Sarda spp.*	
	BIGEYE TUNA	*Thunnus obesus*	
	LONGTAIL TUNA	*Thunnus tonggol*	*
	MACKEREL TUNA	*Euthynnus affinis*	*
	SKIPJACK	*Katsuwonus pelamis*	*
	YELLOWFIN TUNA	*Thunnus albacares*	*
	SOUTHERN BLUEFIN TUNA	*Thunnus maccoyii*	*
	SHARK MACKEREL	*Grammatorcynus bicarinatus*	
	DOGTOOTH TUNA	*Gymnosarda unicolour*	
SHARKS & RAYS	BLUE SHARK	*Prionace glauca*	*
	HAMMERHEAD SHARK	*Sphyrna spp.*	*
	SHORTFIN MAKO SHARK	*Isurus oxyrinchus*	*
	TIGER SHARK	*Galeocerdo cuvier*	*
	WHALER SHARKS	*Carcharinus sp.*	*
	WHITE POINTER SHARK	*Carcharodon carcharius*	*
	THRESHER SHARK	*Alopias sp.*	
	PORBEAGLE SHARK	*lamna nasus*	
	TOPE	*Galeorhinus galeus*	
	GUMMY SHARK	*Mustelus antarcticus*	
	EAGLE RAY	*Myliobatus australis*	
SPORTISH	BARRACUDA	*Sphyraena barracuda*	*
	COBIA	*Rachycentron canadum*	
	DOLPHIN FISH	*Coryphaena hippurus*	*
	KINGFISH	*Seriola lalandi*	*
	WAHOO	*Acanthocybium solandri*	*
	AMBERJACK	*Seriola dumerili*	
	AUSTRALIAN SALMON	*Arripis trutta*	*
	SILVER TREVALLY	*Pseudocaranx dentex*	
	SNAPPER	*Pagrus auratus*	
	TAILOR	*Pomatomus saltatrix*	
	BONE FISH	*Albula vulpes*	
	GOLDEN TREVALLY	*Gnathanodon speciosus*	
	THREADFIN SALMON	*Polynemus sp.*	
	BROAD-BARRED SPANISH MACKEREL	*Scomberomorus semifasciatus*	
	GIANT TREVALLY	*Caranx ignobilis*	
	MULLOWAY	*Argyrosomus hololepidotus*	
	NARROW-BARRED SPANISH MACKEREL	*Scomberomorus commerson*	
	QUEENFISH	*Scomberoides spp.*	
	RAINBOW RUNNER	*Elegatis bipinnulata*	
	SAMSON FISH	*Seriola hippos*	
	SPOTTED MACKEREL	*Scomberomorus munroi*	
	BIGEYE TREVALLY	*Caranx sexfasciatus*	
	GOLD-SPOTTED TREVALLY	*Carangoides fulvoguttatus*	

* Species reported during scheds for 4 tournament seasons, 1996/97 to 1999/2000 inclusive.

Appendix 2. List of species recommended to be tagged for the Gamefish Tagging Program.

BILLFISH

Black Marlin
Blue Marlin
Striped Marlin
Sailfish
Broadbill Swordfish
Shortbill Spearfish

SHARKS

Blue Shark
Hammerhead
Mako
Thresher
Tiger
Whalers (all)
White

CARANGIDS

Amberjack
Samson Fish
Queenfish
Rainbow Runner
Yellowtail Kingfish

MACKERELS

Spanish (Broadbarred/Grey)
Spotted (all)
Tanguigue (Narrowbarred)
Wahoo

MISCELLANEOUS

Barracouta
Barracuda
Cobia
Dolphin Fish (Mahi Mahi)
Salmon (Australian
Salmon (Threadfin)

TUNAS

Albacore
Bigeye
Bonito (all)
Dogtooth
Large Scale (Shark Mackerel)
Longtail (Northern Bluefin)
Mackerel (Kawa Kawa)
Skipjack (Striped Tuna)
Southern Bluefin Tuna
Yellowfin

Appendix 3. Details of gamefishing tournaments monitored for this study during fishing season 1996/97.

			BILLFISH BOATS			SHARK BOATS			BILLFISH & SHARK BOATS COMBINED		
Date	Tournament Name	Port	No. Boats	No. Boats Surveyed	No. Anglers	No. Boats	No. Boats Surveyed	No. Anglers	Total No. Boats	Total No. Boats Surveyed	Total No. Anglers
20-Sep-96	Hot Current	Coffs Harbour	20	-	89	3	-	12	23	-	101
21-Sep-96	Hot Current	Coffs Harbour	37	-	154	3	-	13	40	-	167
23-Sep-96	Hot Current	Coffs Harbour	35	-	135	5	-	20	40	-	155
1-Feb-97	Big Fish Bonanza	Lake Macquarie	37	-	161	23	-	104	60	-	265
2-Feb-97	Big Fish Bonanza	Lake Macquarie	28	-	140	11	-	54	39	-	194
1-Feb-97	Jess Sams Open	Ulladulla	32	-	nr	6	-	nr	38	-	nr
2-Feb-97	Jess Sams Open	Ulladulla	35	-	nr	6	-	nr	41	-	nr
3-Feb-97	Jess Sams Open	Ulladulla	17	-	nr	-	-	-	17	-	nr
4-Feb-97	Jess Sams Light Tackle	Ulladulla	5	-	19	1	-	2	6	-	21
6-Feb-97	Jess Sams Light Tackle	Ulladulla	4	-	11	1	-	2	5	-	13
22-Feb-97	NSW Interclub	Port Stephens	183	ns	890	34	ns	169	217	11	1059
23-Feb-97	NSW Interclub	Port Stephens	183	ns	863	32	ns	174	215	12	1037
1-Mar-97	NSW Interclub	Port Stephens	185	ns	950	32	ns	161	217	118	1111
2-Mar-97	NSW Interclub	Port Stephens	184	ns	868	22	ns	119	206	121	987

ns = Not Specified. Data on number of boats were not reported to Billfish and Shark categories but are presented as total number of boats

nr = Not Recorded. Data on number of anglers was not recorded.

Appendix 4. Details of gamefishing tournaments monitored for this study during fishing season 1997/98.

			BILLFISH		SHARK		BILLFISH & BOATS	
Date	**Tournament**	**Port**	**No. Boats**	**No. Anglers**	**No. Boats**	**No. Anglers**	**Total No. Boats**	**Total No. Anglers**
31-Jan-98	Big Fish	Lake	44	206	28	116	72	322
1-Feb-98	Big Fish	Lake	45	206	26	118	71	324
21-Feb-98	NSW	Port	213	1072	36	206	249	1278
22-Feb-98	NSW	Port	209	1002	38	193	247	1195
23-Feb-98	Interclub Ladies	Port	67	390	5	32	72	422
25-Feb-98	Australian International Tournamen	Port	46	235	-	-	46	235
26-Feb-98	Australian International Tournamen	Port	36	184	-	-	36	184
28-Feb-98	NSW	Port	162	753	31	166	193	919
1-Mar-98	NSW	Port	209	995	34	179	243	1174
10-Apr-98	Sydney	Port	15	73	7	37	22	110
24-Apr-98	Bermagui	Bermagui	43	125	1		44	125
25-Apr-98	Bermagui	Bermagui	41	121	5	23	46	144
26-Apr-98	Bermagui	Bermagui	30	101	6	18	36	119
7-Jun-98	Jinkai Classic	Bermagui	34	113	1	3	35	116

NB - No dockside interviews were done during season

Appendix 5. Details of gamefishing tournaments monitored for this study during fishing season 1998/99.

			BILLFISH BOATS			SHARK BOATS			BILLFISH & SHARK BOATS COMBINED		
Date	**Tournament Name**	**Port**	**No. Boats**	**No. Boats Surveyed**	**No. Anglers**	**No. Boats**	**No. Boats Surveyed**	**No. Anglers**	**Total No. Boats**	**Total No. Boats Surveyed**	**Total No. Anglers**
19-Sep-98	Wollongong Open & Central Zone 1	Wollongong	1	1	5	41	18	173	42	19	178
19-Sep-98	Hot Currents	Coffs Harbour	39	-	156	2	-	10	41	-	166
20-Sep-98	Hot Currents	Coffs Harbour	38	-	152	2	-	8	40	-	160
21-Sep-98	Hot Currents	Coffs Harbour	37	-	147	2	-	10	39	-	157
22-Sep-98	Hot Currents	Coffs Harbour	34	-	135	2	-	10	36	-	145
3-Oct-98	Shark Tournament	Lake Macquarie	1	-	5	32	-	129	33	-	134
4-Oct-98	Shark Tournament	Lake Macquarie	7	-	29	27	-	107	34	-	136
3-Oct-98	Port Hacking 100 and Central Zone 2	Port Hacking	7	6	26	39	21	185	46	27	211
4-Oct-98	Port Hacking 100 and Central Zone 2	Port Hacking	3	-	15	43	-	190	46	-	205
14-Nov-98	Shoalhaven Light Tackle	Greenwell Point	15	6	42	2	1	6	17	7	48
15-Nov-98	Shoalhaven Light Tackle	Greenwell Point	14	3	38	3	1	8	17	4	46
27-Nov-98	White Sands	Huskisson	44	9	145	9	1	31	53	10	176
28-Nov-98	White Sands	Huskisson	16	2	50	3	-	12	19	2	62
29-Nov-98	White Sands	Huskisson	41	5	132	8	1	22	49	6	154
20-Dec-98	Club Pointscore	Botany Bay	5	-	20	6	-	32	11	-	52
3-Jan-99	Golden Lure	Port Macquarie	28	14	139	8	-	37	36	14	176

Appendix 5 (cont).

			BILLFISH BOATS			SHARK BOATS			BILLFISH & SHARK BOATS COMBINED		
Date	**Tournament Name**	**Port**	**No. Boats**	**No. Boats Surveyed**	**No. Anglers**	**No. Boats**	**No. Boats Surveyed**	**No. Anglers**	**Total No. Boats**	**Total No. Boats Surveyed**	**Total No. Anglers**
4-Jan-99	Golden Lure	Port Macquarie	28	9	139	8	1	36	36	10	175
5-Jan-99	Ladies Day Golden Lure	Port Macquarie	18	-	94	4	-	26	22	-	120
7-Jan-99	Golden Lure	Port Macquarie	28	17	133	8	2	37	36	19	170
8-Jan-99	Golden Lure	Port Macquarie	27	13	-	8	2	40	35	15	166
23-Jan-99	Bill Heywood Memorial & Central Zone 3	Botany Bay	46	18	193	7	3	33	53	21	226
24-Jan-99	Bill Heywood Memorial & Central Zone 3	Botany Bay	28	-	129	6	-	34	34	-	163
23-Jan-99	Bluewater Classic	Bermagui	69	11	209	-	-	-	69	11	209
24-Jan-99	Bluewater Classic	Bermagui	90	35	262	-	-	-	90	35	262
25-Jan-99	Bluewater Classic	Bermagui	92	36	270	-	-	-	92	36	270
26-Jan-99	Bluewater Classic	Bermagui	84	40	242	-	-	-	84	40	242
30-Jan-99	Big Fish Bonanza	Lake Macquarie	44	15	213	20	11	90	64	26	303
31-Jan-99	Big Fish Bonanza	Lake Macquarie	40	5	183	15	9	64	55	14	247
5-Feb-99	Sunshine Coast Classic	Mooloolaba	19	-	95	-	-	-	19	-	95
6-Feb-99	Sunshine Coast Classic	Mooloolaba	22	-	107	-	-	-	22	-	107

Appendix 5 (cont).

			BILLFISH BOATS			SHARK BOATS			BILLFISH & SHARK BOATS COMBINED		
Date	**Tournament Name**	**Port**	**No. Boats**	**No. Boats Surveyed**	**No. Anglers**	**No. Boats**	**No. Boats Surveyed**	**No. Anglers**	**Total No. Boats**	**Total No. Boats Surveyed**	**Total No. Anglers**
27-Feb-99	NSW Interclub	Port Stephens	185	91	960	33	14	179	218	105	1139
28-Feb-99	NSW Interclub	Port Stephens	187	93	972	29	16	160	216	109	1132
1-Mar-99	Interclub Ladies Day	Port Stephens	55	-	311	3	-	13	58	-	324
3-Mar-99	Australian International Billfish Tournament	Port Stephens	34	-	182	3	-	16	37	-	198
4-Mar-99	Australian International Billfish Tournament	Port Stephens	33	-	171	4	-	23	37	-	194
6-Mar-99	NSW Interclub	Port Stephens	190	74	964	34	7	190	224	81	1154
7-Mar-99	NSW Interclub	Port Stephens	180	68	906	32	16	174	212	84	1080
6-Mar-99	Alliance Tag & Release	Bermagui	36	10	113	-	-	-	36	10	113
7-Mar-99	Alliance Tag & Release	Bermagui	31	7	103	-	-	-	31	7	103
8-Mar-99	Alliance Tag & Release	Bermagui	33	10	102	-	-	-	33	10	102
13-Mar-99	Billfish Shootout	Port Stephens	36	17	211	-	-	-	36	17	211
14-Mar-99	Billfish Shootout	Port Stephens	35	21	209	-	-	-	35	21	209
15-Mar-99	Billfish Shootout	Port Stephens	35	16	207	-	-	-	35	16	207
20-Mar-99	Broken Bay Invitational & Central Zone 4	Broken Bay	56	22	264	13	4	58	69	26	322
21-Mar-99	Broken Bay Invitational & Central Zone 4	Broken Bay	60	5	283	15	4	60	75	9	343

Appendix 5 (cont).

			BILLFISH BOATS			SHARK BOATS			BILLFISH & SHARK BOATS COMBINED		
Date	**Tournament Name**	**Port**	**No. Boats**	**No. Boats Surveyed**	**No. Anglers**	**No. Boats**	**No. Boats Surveyed**	**No. Anglers**	**Total No. Boats**	**Total No. Boats Surveyed**	**Total No. Anglers**
3-Apr-99	N&PSGFC 70th Anniversary	Port Stephens	13	11	63	4	1	16	17	12	79
4-Apr-99	N&PSGFC 70th Anniversary	Port Stephens	16	-	74	2	-	11	18	-	85
24-Apr-99	Bermagui Anniversary	Bermagui	6	5	19	1	1	3	7	6	22
25-Apr-99	Bermagui Anniversary	Bermagui	20	12	60	2	1	6	22	13	66
26-Apr-99	Bermagui Anniversary	Bermagui	19	15	57	3	1	9	22	16	66
1-May-99	Sydney Invitational & Central Zone 5	Port Jackson	30	9	116	2	2	7	32	11	123
2-May-99	Sydney Invitational & Central Zone 5	Port Jackson	33	4	142	5	2	22	38	6	164
15-May-99	Yellowfin Tournament	Bermagui	72	15	236	-	-	-	72	15	236
16-May-99	Yellowfin Tournament	Bermagui	83	17	278	3	2	8	86	19	286
17-May-99	Yellowfin Tournament	Bermagui	76	17	241	4	-	12	80	17	253

Appendix 6. Details of gamefishing tournaments monitored for this study during fishing season 1999/2000.

			BILLFISH BOATS		SHARK BOATS		BILLFISH & SHARK BOATS COMBINED	
Date	**Tournament Name**	**Port**	**No. Boats**	**No. Anglers**	**No. Boats**	**No. Anglers**	**Total No. Boats**	**Total No. Anglers**
18-Sep-99	Wollongong Open & Central Zone	Wollongong	11	35	23	98	34	133
19-Sep-99	Wollongong Open & Central Zone	Wollongong	6	25	10	43	16	68
18-Sep-99	Hot Current	Coffs Harbour	40	172	6	22	46	194
19-Sep-99	Hot Current	Coffs Harbour	36	154	10	40	46	194
20-Sep-99	Hot Current	Coffs Harbour	40	177	6	21	46	198
21-Sep-99	Hot Current	Coffs Harbour	32	137	8	28	40	165
2-Oct-99	Port Hacking Central Zone	Port Hacking	4	18	35	174	39	192
3-Oct-99	Port Hacking Central Zone	Port Hacking	6	25	34	140	40	165
2-Oct-99	Shark Tournament	Lake Macquarie	6	17	19	69	25	86
3-Oct-99	Shark Tournament	Lake Macquarie	5	19	18	27	23	46
3-Dec-99	White Sands	Huskisson	34	120	2	9	36	129
4-Dec-99	White Sands	Huskisson	29	113	8	28	37	141
5-Dec-99	White Sands	Huskisson	37	133	3	15	40	148
8-Jan-00	Golden Lure	Port Macquarie	31	148	5	27	36	175
9-Jan-00	Golden Lure	Port Macquarie	32	149	5	27	37	176

Appendix 6 (cont).

			BILLFISH BOATS		SHARK BOATS		BILLFISH & SHARK BOATS COMBINED	
Date	**Tournament Name**	**Port**	**No. Boats**	**No. Anglers**	**No. Boats**	**No. Anglers**	**Total No. Boats**	**Total No. Anglers**
11-Jan-00	Golden Lure	Port Macquarie	20	110	-	-	20	110
13-Jan-00*	Golden Lure	Port Macquarie	-	-	-	-	-	-
14-Jan-00	Golden Lure	Port Macquarie	6	33	3	15	9	48
14-Jan-00	Tollgate Islands	Batemans Bay	63	240	3	13	66	253
15-Jan-00	Tollgate Islands	Batemans Bay	65	263	1	3	66	266
16-Jan-00	Tollgate Islands	Batemans Bay	66	264	-	-	66	264
22-Jan-00	Bill Heywood Classic	Botany Bay	43	199	8	41	51	240
23-Jan-00	Bill Heywood Classic	Botany Bay	44	203	6	34	50	237
22-Jan-00	Bluewater Classic	Bermagui	78	274	3	8	81	282
23-Jan-00	Bluewater Classic	Bermagui	46	175	3	12	49	187
24-Jan-00	Bluewater Classic	Bermagui	75	265	6	15	81	280
25-Jan-00	Bluewater Classic	Bermagui	66	226	8	30	74	256
28-Jan-00	Jess Sams Open	Ulladulla	34	129	4	12	38	141
29-Jan-00	Jess Sams Open	Ulladulla	37	132	7	17	44	149
30-Jan-00	Jess Sams Open	Ulladulla	50	200	4	10	54	210
5-Feb-00	Big Fish Bonanza	Lake Macquarie	55	278	21	95	76	373
6-Feb-00	Big Fish Bonanza	Lake Macquarie	28	139	11	40	39	179

* Fishing cancelled on this day due to rough bar and seas

NB - No dockside interviews were done during season 1999/2000

Appendix 6 (cont).

			BILLFISH BOATS		SHARK BOATS		BILLFISH & SHARK BOATS COMBINED	
Date	Tournament Name	Port	No. Boats	No. Anglers	No. Boats	No. Anglers	Total No. Boats	Total No. Anglers
11-Feb-00	Southern Zone Interclub	Batemans Bay	17	58	-	-	17	58
12-Feb-00	Southern Zone Interclub	Batemans Bay	21	75	-	-	21	75
13-Feb-00	Southern Zone Interclub	Batemans Bay	12	48	-	-	12	48
12-Feb-00	Gold Coast Billfish Classic	Gold Coast	25	90	-	-	25	90
13-Feb-00	Gold Coast Billfish Classic	Gold Coast	25	90	-	-	25	90
19-Feb-00	George Bessoff Memorial	Port Stephens	11	47	4	18	15	65
20-Feb-00	George Bessoff Memorial	Port Stephens	11	44	4	22	15	66
26-Feb-00	NSW Interclub	Port Stephens	230	1154	15	86	245	1240
27-Feb-00	NSW Interclub	Port Stephens	195	994	36	185	231	1179
28-Feb-00	NSW Interclub - Ladies Day	Port Stephens	66	441	5	27	71	468
4-Mar-00	NSW Interclub	Port Stephens	206	1038	31	155	237	1193
5-Mar-00	NSW Interclub	Port Stephens	190	930	35	182	225	1112
11-Mar-00	Alliance Tag & Release	Bermagui	33	116	-	-	33	116
12-Mar-00	Alliance Tag & Release	Bermagui	33	123	-	-	33	123
13-Mar-00	Alliance Tag & Release	Bermagui	20	81	-	-	20	81
18-Mar-00	Broken Bay Invitational & Central Zone	Broken Bay	76	343	15	64	91	407
19-Mar-00	Broken Bay Invitational & Central Zone	Broken Bay	65	298	21	98	86	396

Appendix 6 (cont).

			BILLFISH BOATS		SHARK BOATS		BILLFISH & SHARK BOATS COMBINED	
Date	Tournament Name	Port	No. Boats	No. Anglers	No. Boats	No. Anglers	Total No. Boats	Total No. Anglers
24-Mar-00	Shoalhaven Open	Greenwell Point	16	53	1	0	17	53
25-Mar-00	Shoalhaven Open	Greenwell Point	22	77	7	28	29	105
26-Mar-00	Shoalhaven Open	Greenwell Point	21	70	7	33	28	103
31-Mar-00	Australian International Billfish Tournament	Batemans Bay	45	172	-	-	45	172
1-Apr-00	Australian International Billfish Tournament	Batemans Bay	44	186	-	-	44	186
2-Apr-00	Australian International Billfish Tournament	Batemans Bay	40	165	-	-	40	165
6-May-00	Port Jackson Central Zone	Port Jackson	9	41	6	31	15	72
7-May-00	Port Jackson Central Zone	Port Jackson	12	56	16	63	28	119
20-May-00	Yellowfin Tournament	Bermagui	82	258	1	2	83	260
21-May-00	Yellowfin Tournament	Bermagui	82	259	-	-	82	259
22-May-00	Yellowfin Tournament	Bermagui	69	212	-	-	69	212

NB - No dockside interviews were done during season 1999/2000

Appendix 7. Estimated mean catch rates for all species targeted by BILLFISH/TUNA fishing boats (±s.e.) during monitored gamefishing tournaments in south-east Queensland and NSW for 7 fishing seasons from 1993/94 to 1999/2000 inclusive.

		FISHING SEASON							
		1993/94		1994/95		1995/96		1996/97	
SPECIES GROUP	COMMON NAME	Mean Catch Rate (No. fish per boat day)	s.e.	Mean Catch Rate (No. fish per boat day)	s.e.	Mean Catch Rate (No. fish per boat day)	s.e.	Mean Catch Rate (No. fish per boat day)	s.e.
BILLFISH	BLACK MARLIN	0.0649 ±	0.0131	0.0531 ±	0.0120	0.1032 ±	0.0299	0.4251 ±	0.1444
	BLUE MARLIN	0.0366 ±	0.0075	0.0169 ±	0.0060	0.0242 ±	0.0080	0.0141 ±	0.0052
	STRIPED MARLIN	0.0988 ±	0.0301	0.0839 ±	0.0268	0.1728 ±	0.0328	0.1412 ±	0.0518
	SAILFISH	0.0053 ±	0.0044	0.0253 ±	0.0109	0.0073 ±	0.0050	0.0008 ±	0.0005
	SHORTBILL SPEARFISH	0.0052 ±	0.0025	0.0066 ±	0.0022	0.0009 ±	0.0006	0 ±	0
	SWORDFISH	0 ±	0	0 ±	0	0.0002 ±	0.0002	0 ±	0
TUNAS	ALBACORE	0.3806 ±	0.2213	0.0298 ±	0.0152	0.1689 ±	0.0770	0.0045 ±	0.0045
	BONITOS	0 ±	0	0.0002 ±	0.0002	0.0009 ±	0.0009	0 ±	0
	BIGEYE TUNA	0 ±	0	0.0013 ±	0.0013	0.0023 ±	0.0023	0 ±	0
	LONGTAIL TUNA	0.0005 ±	0.0005	0 ±	0	0 ±	0	0 ±	0
	MACKEREL TUNA	0 ±	0	0.0351 ±	0.0246	0.0009 ±	0.0009	0 ±	0
	SKIPJACK	0.0248 ±	0.0208	0.0115 ±	0.0067	0.0080 ±	0.0041	0 ±	0
	YELLOWFIN TUNA	0.1602 ±	0.0319	0.3372 ±	0.1050	0.5525 ±	0.2040	0.3977 ±	0.1499
	SOUTHERN BLUEFIN TUNA	0 ±	0	0 ±	0	0 ±	0	0 ±	0
	TUNA OTHER*	0 ±	0	0.0087 ±	0.0054	0 ±	0	0 ±	0

Appendix 7 (cont).

		FISHING SEASON											
		1993/94			1994/95			1995/96			1996/97		
SPECIES GROUP	COMMON NAME	Mean Catch Rate (No. fish per boat day)	±	s.e.	Mean Catch Rate (No. fish per boat day)	±	s.e.	Mean Catch Rate (No. fish per boat day)	±	s.e.	Mean Catch Rate (No. fish per boat day)	±	s.e.
SHARKS	BLUE SHARK	0.0018	±	0.0011	0.0021	±	0.0012	0.0112	±	0.0026	0.0046	±	0.0026
	HAMMERHEAD SHARK	0.0098	±	0.0033	0.0005	±	0.0003	0.0058	±	0.0024	0.0173	±	0.0125
	SHORTFIN MAKO SHARK	0.0047	±	0.0019	0.0039	±	0.0015	0.0129	±	0.0031	0.0008	±	0.0005
	TIGER SHARK	0.0031	±	0.0015	0	±	0	0.0059	±	0.0037	0.0043	±	0.0021
	WHALER SHARKS	0.0078	±	0.0023	0.0011	±	0.0008	0.0099	±	0.0038	0.0043	±	0.0024
	WHITE POINTER SHARK	0.0010	±	0.0009	0	±	0	0	±	0	0	±	0
	THRESHER SHARK	0	±	0	0	±	0	0.0005	±	0.0005	0	±	0
	SHARK OTHER*	0	±	0	0.0066	±	0.0038	0.0011	±	0.0011	0	±	0
SPORTFISH	BARRACUDA	0.0037	±	0.0037	0	±	0	0.0009	±	0.0009	0	±	0
	COBIA	0.0073	±	0.0040	0.0010	±	0.0010	0.0054	±	0.0033	0	±	0
	DOLPHIN FISH	0.0904	±	0.0304	0.0401	±	0.0148	0.0423	±	0.0166	0.0288	±	0.0223
	KINGFISH	0.0139	±	0.0075	0.0035	±	0.0021	0.0013	±	0.0008	0.0205	±	0.0142
	QUEENSLAND SCHOOL MACKEREL	0	±	0	0	±	0	0.0009	±	0.0009	0	±	0
	WAHOO	0.0053	±	0.0027	0	±	0	0.0047	±	0.0030	0.0057	±	0.0033
	AUSTRALIAN SALMON	0	±	0	0	±	0	0	±	0	0	±	0
	NARROW-BARRED SPANISH MACKEREL	0.0038	±	0.0026	0.0094	±	0.0072	0.0009	±	0.0009	0	±	0

* species unable to be accurately identified

Appendix 7 (cont).

		FISHING SEASON								
		1997/98			**1998/99**			**1999/2000**		
SPECIES GROUP	**COMMON NAME**	**Mean Catch Rate (No. fish per boat day)**		**s.e.**	**Mean Catch Rate (No. fish per boat day)**		**s.e.**	**Mean Catch Rate (No. fish per boat day)**		**s.e.**
BILLFISH	BLACK MARLIN	0.1162	±	0.0337	0.2920	±	0.0795	0.0805	±	0.0211
	BLUE MARLIN	0.0972	±	0.0267	0.0784	±	0.0190	0.0348	±	0.0071
	STRIPED MARLIN	0.0968	±	0.0203	0.1541	±	0.0273	0.1868	±	0.0277
	SAILFISH	0.0019	±	0.0016	0.0097	±	0.0048	0.0026	±	0.0017
	SHORTBILL SPEARFISH	0.0085	±	0.0034	0.0038	±	0.0025	0.0009	±	0.0006
	SWORDFISH	0	±	0	0	±	0	0	±	0
TUNAS	ALBACORE	0.3445	±	0.3445	0.0382	±	0.0169	0.0051	±	0.0037
	BONITOS	0	±	0	0	±	0	0	±	0
	BIGEYE TUNA	0	±	0	0	±	0	0	±	0
	LONGTAIL TUNA	0	±	0	0.0016	±	0.0011	0	±	0
	MACKEREL TUNA	0	±	0	0.0010	±	0.0010	0	±	0
	SKIPJACK	0.0060	±	0.0045	0.0200	±	0.0147	0	±	0
	YELLOWFIN TUNA	0.0885	±	0.0447	0.2554	±	0.0956	0.1210	±	0.0462
	SOUTHERN BLUEFIN TUNA	0.0017	±	0.0012	0	±	0	0	±	0
	TUNA OTHER*	0	±	0	0	±	0	0	±	0

Appendix 7 (cont).

		FISHING SEASON								
		1997/98			1998/99			1999/2000		
SPECIES GROUP	COMMON NAME	Mean Catch Rate (No. fish per boat day)		s.e.	Mean Catch Rate (No. fish per boat day)		s.e.	Mean Catch Rate (No. fish per boat day)		s.e.
SHARKS	BLUE SHARK	0.0038	±	0.0026	0.0129	±	0.0059	0.0059	±	0.0037
	HAMMERHEAD SHARK	0.0064	±	0.0033	0.0112	±	0.0039	0.0077	±	0.0023
	SHORTFIN MAKO SHARK	0.0302	±	0.0169	0.0536	±	0.0364	0.0138	±	0.0044
	TIGER SHARK	0.0146	±	0.0143	0.0024	±	0.0013	0.0051	±	0.0029
	WHALER SHARKS	0.0112	±	0.0054	0.0069	±	0.0038	0.0045	±	0.0018
	WHITE POINTER SHARK	0	±	0	0	±	0	0.0004	±	0.0004
	THRESHER SHARK	0	±	0	0	±	0	0	±	0
	SHARK OTHER*	0.0004	±	0.0004	0	±	0	0	±	0
SPORTFISH	BARRACUDA	0	±	0	0.0019	±	0.0019	0.0004	±	0.0003
	COBIA	0	±	0	0	±	0	0	±	0
	DOLPHIN FISH	0.0408	±	0.0154	0.0786	±	0.0182	0.0444	±	0.0253
	KINGFISH	0.0033	±	0.0022	0.0347	±	0.0164	0.0347	±	0.0164
	QUEENSLAND SCHOOL MACKEREL	0	±	0	0	±	0	0	±	0
	WAHOO	0.0032	±	0.0032	0.0150	±	0.0049	0.0034	±	0.0018
	AUSTRALIAN SALMON	0	±	0	0.0006	±	0.0006	0.0006	±	0.0006
	NARROW-BARRED SPANISH MACKEREL	0	±	0	0	±	0	0	±	0

* species unable to be accurately identified

Appendix 8. Estimated mean catch rates for all species targeted by SHARK fishing boats (±s.e.) during monitored gamefishing tournaments in south-east Queensland and NSW for 7 fishing seasons from 1993/94 to 1999/2000 inclusive.

		FISHING SEASON											
		1993/94			1994/95			1995/96			1996/97		
SPECIES GROUP	COMMON NAME	Mean Catch Rate (No. fish per boat day)		s.e.	Mean Catch Rate (No. fish per boat day)		s.e.	Mean Catch Rate (No. fish per boat day)		s.e.	Mean Catch Rate (No. fish per boat day)		s.e.
BILLFISH	BLACK MARLIN	0.0022	±	0.0012	0.0007	±	0.0007	0.0124	±	0.0070	0	±	0
	BLUE MARLIN	0.0007	±	0.0007	0	±	0	0	±	0	0	±	0
	STRIPED MARLIN	0.0064	±	0.0047	0.0021	±	0.0021	0.0177	±	0.0104	0	±	0
	SAILFISH	0	±	0	0	±	0	0	±	0	0	±	0
	SHORTBILL SPEARFISH	0	±	0	0.0006	±	0.0006	0	±	0	0	±	0
	SWORDFISH	-		-	-		-	-		-	-		-
TUNAS	ALBACORE	0.0021	±	0.0021	0	±	0	0	±	0	0	±	0
	BONITOS	-		-	-		-	-		-	-		-
	BIGEYE TUNA	-		-	-		-	-		-	-		-
	LONGTAIL TUNA	-		-	-		-	-		-	-		-
	MACKEREL TUNA	-		-	-		-	-		-	-		-
	SKIPJACK	0	±	0	0	±	0	0.0009	±	0.0009	0	±	0
	YELLOWFIN TUNA	0.0113	±	0.0067	0.0046	±	0.0046	0.0123	±	0.0123	0	±	0
	SOUTHERN BLUEFIN TUNA	-		-	-		-	-		-	-		-
	TUNA OTHER*	-		-	-		-	-		-	-		-

Appendix 8 (cont).

		FISHING SEASON											
		1993/94			1994/95			1995/96			1996/97		
SPECIES GROUP	COMMON NAME	Mean Catch Rate (No. fish per boat day)		s.e.	Mean Catch Rate (No. fish per boat day)		s.e.	Mean Catch Rate (No. fish per boat day)		s.e.	Mean Catch Rate (No. fish per boat day)		s.e.
SHARKS	BLUE SHARK	0.0127	±	0.0049	0.0506	±	0.0153	0.2009	±	0.0560	0.0260	±	0.0175
	HAMMERHEAD SHARK	0.0387	±	0.0209	0.0509	±	0.0284	0.0110	±	0.0045	0.0709	±	0.0252
	SHORTFIN MAKO SHARK	0.1148	±	0.0363	0.0880	±	0.0199	0.1630	±	0.0318	0.1660	±	0.0811
	TIGER SHARK	0.1051	±	0.0292	0.1054	±	0.0328	0.1502	±	0.0350	0.1517	±	0.0433
	WHALER SHARKS	0.0338	±	0.0110	0.0176	±	0.0080	0.0212	±	0.0084	0.1298	±	0.0338
	WHITE POINTER SHARK	0	±	0	0	±	0	0	±	0	0.0035	±	0.0035
	THRESHER SHARK	0.0032	±	0.0032	0	±	0	0.0046	±	0.0046	0	±	0
	SHARK OTHER*	0	±	0	0.0844	±	0.0513	0.0079	±	0.0058	0	±	0
SPORTFISH	BARRACUDA	-		-	-		-	-		-	-		-
	COBIA	-		-	-		-	-		-	-		-
	DOLPHIN FISH	0.0225	±	0.0131	0.0172	±	0.0116	0.0011	±	0.0011	0	±	0
	KINGFISH	0.0026	±	0.0026	0	±	0	0	±	0	0	±	0
	QUEENSLAND SCHOOL MACKEREL	-		-	-		-	-		-	-		-
	WAHOO	0	±	0	0	±	0	0	±	0	0	±	0
	AUSTRALIAN SALMON	-		-	-		-	-		-	-		-
	NARROW-BARRED SPANISH MACKEREL	-		-	-		-	-		-	-		-

- No shark fishing effort occurred on days when these species were captured
* species unable to be accurately identified

Appendix 8 (cont).

		FISHING SEASON								
		1997/98			1998/99			1999/2000		
SPECIES GROUP	COMMON NAME	Mean Catch Rate (No. fish per boat day)		s.e.	Mean Catch Rate (No. fish per boat day)		s.e.	Mean Catch Rate (No. fish per boat day)		s.e.
BILLFISH	BLACK MARLIN	0.0161	±	0.0063	0.0304	±	0.0142	0.0242	±	0.0093
	BLUE MARLIN	0.0093	±	0.0052	0.0096	±	0.0069	0.0023	±	0.0023
	STRIPED MARLIN	0.0261	±	0.0167	0.0380	±	0.0165	0.0602	±	0.0214
	SAILFISH	0.0046	±	0.0031	0	±	0	0.0007	±	0.0007
	SHORTBILL SPEARFISH	0	±	0	0.0016	±	0.0016	-		-
	SWORDFISH	-		-	-		-	-		-
TUNAS	ALBACORE	0.0833	±	0.0833	0.0048	±	0.0048	0.0007	±	0.0007
	BONITOS	-		-	-		-	-		-
	BIGEYE TUNA	-		-	-		-	-		-
	LONGTAIL TUNA	-		-	-		-	-		-
	MACKEREL TUNA	-		-	-		-	-		-
	SKIPJACK	0	±	0	0	±	0	0	±	0
	YELLOWFIN TUNA	0.0833	±	0.0833	0.0795	±	0.0436	0.0043	±	0.0023
	SOUTHERN BLUEFIN TUNA	-		-	-		-	-		-
	TUNA OTHER*	-		-	-		-	-		-

Appendix 8 (cont).

		FISHING SEASON								
		1997/98			1998/99			1999/2000		
SPECIES GROUP	COMMON NAME	Mean Catch Rate (No. fish per boat day)		s.e.	Mean Catch Rate (No. fish per boat day)		s.e.	Mean Catch Rate (No. fish per boat day)		s.e.
SHARKS	BLUE SHARK	0.0606	±	0.0252	0.1277	±	0.0431	0.0273	±	0.0105
	HAMMERHEAD SHARK	0.0192	±	0.0103	0.0385	±	0.0177	0.0314	±	0.0102
	SHORTFIN MAKO SHARK	0.0841	±	0.0557	0.3345	±	0.0878	0.2255	±	0.0878
	TIGER SHARK	0.0809	±	0.0286	0.1302	±	0.0298	0.1071	±	0.0309
	WHALER SHARKS	0.1536	±	0.0544	0.0448	±	0.0154	0.1154	±	0.0571
	WHITE POINTER SHARK	0	±	0	0.0056	±	0.0042	0.0379	±	0.0038
	THRESHER SHARK	0	±	0	0	±	0	0	±	0
	SHARK OTHER*	0	±	0	0.0007	±	0.0007	0	±	0
SPORTFISH	BARRACUDA	-		-	-		-	-		-
	COBIA	-		-	-		-	-		-
	DOLPHIN FISH	0.2312	±	0.2258	0.0239	±	0.0202	0	±	0
	KINGFISH	0	±	0	0.0073	±	0.0073	0.0229	±	0.0139
	QUEENSLAND SCHOOL MACKEREL	-		-	-		-	-		-
	WAHOO	0	±	0	0.0144	±	0.0128	0.0144	±	0.0128
	AUSTRALIAN SALMON	-		-	-		-	-		-
	NARROW-BARRED SPANISH MACKEREL	-		-	-		-	-		-

- No shark fishing effort occurred on days when these species were captured

* species unable to be accurately identified

Appendix 9. Estimated mean catch rates for all species targeted by BILLFISH/TUNA and SHARK fishing boats combined (±s.e.) during monitored gamefishing tournaments in south-east Queensland and NSW for 7 fishing seasons from 1993/94 to 1999/2000 inclusive.

		FISHING SEASON											
		1993/94			1994/95			1995/96			1996/97		
SPECIES GROUP	COMMON NAME	Mean Catch Rate (No. fish per boat day)		s.e.	Mean Catch Rate (No. fish per boat day)		s.e.	Mean Catch Rate (No. fish per boat day)		s.e.	Mean Catch Rate (No. fish per boat day)		s.e.
BILLFISH	BLACK MARLIN	0.0589	±	0.0128	0.0497	±	0.0120	0.0936	±	0.0286	0.3539	±	0.1221
	BLUE MARLIN	0.0328	±	0.0072	0.0160	±	0.0060	0.0187	±	0.0054	0.0112	±	0.0041
	STRIPED MARLIN	0.0915	±	0.0299	0.0776	±	0.0272	0.1450	±	0.0269	0.1086	±	0.0370
	SAILFISH	0.0053	±	0.0044	0.0253	±	0.0111	0.0071	±	0.0048	0.0007	±	0.0005
	SHORTBILL SPEARFISH	0.0051	±	0.0025	0.0058	±	0.0022	0.0015	±	0.0009	0	±	0
	SWORDFISH	0	±	0	0	±	0	0.0002	±	0.0002	0	±	0
TUNAS	ALBACORE	0.3436	±	0.2038	0.0268	±	0.0130	0.1505	±	0.0699	0.0038	±	0.0038
	BONITOS	0	±	0	0.0002	±	0.0002	0.0009	±	0.0009	0	±	0
	BIGEYE TUNA	0	±	0	0	±	0	0.0034	±	0.0024	0	±	0
	LONGTAIL TUNA	0.0004	±	0.0004	0	±	0	0	±	0	0	±	0
	MACKEREL TUNA	0	±	0	0.0359	±	0.0252	0.0009	±	0.0009	0	±	0
	SKIPJACK	0.0247	±	0.0208	0.0117	±	0.0069	0.0077	±	0.0040	0	±	0
	YELLOWFIN TUNA	0.1425	±	0.0278	0.2058	±	0.0446	0.5890	±	0.2025	0.3381	±	0.1242
	SOUTHERN BLUEFIN TUNA	0	±	0	0	±	0	0	±	0	0	±	0
	TUNA OTHER	0	±	0	0.0089	±	0.0055	0	±	0	0	±	0

Appendix 9 (cont).

		FISHING SEASON											
		1993/94			1994/95			1995/96			1996/97		
SPECIES GROUP	COMMON NAME	Mean Catch Rate (No. fish per boat day)		s.e.	Mean Catch Rate (No. fish per boat day)		s.e.	Mean Catch Rate (No. fish per boat day)		s.e.	Mean Catch Rate (No. fish per boat day)		s.e.
SHARKS	BLUE SHARK	0.0039	±	0.0013	0.0082	±	0.0025	0.0357	±	0.0096	0.0106	±	0.0071
	HAMMERHEAD SHARK	0.0132	±	0.0035	0.0126	±	0.0085	0.0072	±	0.0023	0.0278	±	0.0126
	SHORTFIN MAKO SHARK	0.0152	±	0.0043	0.0133	±	0.0031	0.0315	±	0.0061	0.0227	±	0.0121
	TIGER SHARK	0.0188	±	0.0058	0.0208	±	0.0084	0.0227	±	0.0068	0.0341	±	0.0126
	WHALER SHARKS	0.0114	±	0.0028	0.0051	±	0.0021	0.0120	±	0.0039	0.0237	±	0.0063
	WHITE POINTER SHARK	0.0006	±	0.0005	0	±	0	0	±	0	0.0003	±	0.0003
	THRESHER SHARK	0.0005	±	0.0005	0	±	0	0.0008	±	0.0006	0	±	0
	SHARK OTHER	0	±	0	0.0107	±	0.0064	0.0015	±	0.0011	0	±	0
SPORTFISH	BARRACUDA	0.0037	±	0.0037	0	±	0	0.0009	±	0.0009	0	±	0
	COBIA	0.0073	±	0.0040	0.0010	±	0.0010	0.0053	±	0.0032	0	±	0
	DOLPHIN FISH	0.0871	±	0.0303	0.0404	±	0.0147	0.0388	±	0.0161	0.0246	±	0.0190
	KINGFISH	0.0133	±	0.0073	0.0031	±	0.0018	0.0010	±	0.0006	0.0173	±	0.0118
	QUEENSLAND SCHOOL MACKEREL	0	±	0	0	±	0	0.0009	±	0.0009	0	±	0
	WAHOO	0.0053	±	0.0027	0	±	0	0.0046	±	0.0029	0.0045	±	0.0026
	AUSTRALIAN SALMON	0	±	0	0	±	0	0	±	0	0	±	0
	NARROW-BARRED SPANISH MACKEREL	0.0038	±	0.0026	0.0097	±	0.0074	0.0009	±	0.0009	0	±	0

Appendix 9 (cont).

		FISHING SEASON								
		1997/98			1998/99			1999/2000		
SPECIES GROUP	COMMON NAME	Mean Catch Rate (No. fish per boat day)		s.e.	Mean Catch Rate (No. fish per boat day)		s.e.	Mean Catch Rate (No. fish per boat day)		s.e.
BILLFISH	BLACK MARLIN	0.1072	±	0.0337	0.2472	±	0.0644	0.0684	±	0.0161
	BLUE MARLIN	0.0841	±	0.0256	0.0711	±	0.0178	0.0298	±	0.0058
	STRIPED MARLIN	0.0841	±	0.0186	0.1224	±	0.0213	0.1718	±	0.0265
	SAILFISH	0.0024	±	0.0016	0.0091	±	0.0047	0.0022	±	0.0013
	SHORTBILL SPEARFISH	0.0074	±	0.0032	0.0035	±	0.0023	0.0007	±	0.0005
	SWORDFISH	0	±	0	0	±	0	0	±	0
TUNAS	ALBACORE	0.3367	±	0.3367	0.0257	±	0.0111	0.0020	±	0.0011
	BONITOS	0	±	0	0	±	0	0	±	0
	BIGEYE TUNA	0	±	0	0	±	0	0	±	0
	LONGTAIL TUNA	0	±	0	0.0015	±	0.0011	0	±	0
	MACKEREL TUNA	0	±	0	0.0010	±	0.0010	0	±	0
	SKIPJACK	0.0055	±	0.0041	0.0177	±	0.0130	0	±	0
	YELLOWFIN TUNA	0.0686	±	0.0310	0.1765	±	0.0740	0.0627	±	0.0127
	SOUTHERN BLUEFIN TUNA	0.0014	±	0.0010	0	±	0	0	±	0
	TUNA OTHER	0	±	0	0	±	0	0	±	0

Appendix 9 (cont).

		FISHING SEASON								
		1997/98			1998/99			1999/2000		
SPECIES GROUP	COMMON NAME	Mean Catch Rate (No. fish per boat day)	±	s.e.	Mean Catch Rate (No. fish per boat day)	±	s.e.	Mean Catch Rate (No. fish per boat day)	±	s.e.
SHARKS	BLUE SHARK	0.0117	±	0.0038	0.0323	±	0.0081	0.0157	±	0.0062
	HAMMERHEAD SHARK	0.0075	±	0.0033	0.0126	±	0.0035	0.0113	±	0.0027
	SHORTFIN MAKO SHARK	0.0393	±	0.0190	0.1279	±	0.0585	0.0663	±	0.0150
	TIGER SHARK	0.0225	±	0.0100	0.0246	±	0.0057	0.0259	±	0.0080
	WHALER SHARKS	0.0319	±	0.0103	0.0120	±	0.0029	0.0199	±	0.0089
	WHITE POINTER SHARK	0	±	0	0.0019	±	0.0017	0.0007	±	0.0005
	THRESHER SHARK	0	±	0	0	±	0	0	±	0
	SHARK OTHER	0.0004	±	0.0004	0.0001	±	0.0001	0	±	0
SPORTFISH	BARRACUDA	0	±	0	0.0019	±	0.0019	0.0004	±	0.0003
	COBIA	0	±	0	0	±	0	0	±	0
	DOLPHIN FISH	0.0923	±	0.0603	0.0642	±	0.0131	0.0406	±	0.0248
	KINGFISH	0.0026	±	0.0018	0.0311	±	0.0143	0.0258	±	0.0115
	QUEENSLAND SCHOOL MACKEREL	0	±	0	0	±	0	0	±	0
	WAHOO	0.0020	±	0.0020	0.0149	±	0.0050	0.0032	±	0.0015
	AUSTRALIAN SALMON	0	±	0	0.0005	±	0.0005	0	±	0
	NARROW-BARRED SPANISH MACKEREL	0	±	0	0	±	0	0	±	0

Appendix 10. Estimated catch rates for major species groups for each effort strata (BILLFISH/TUNA and SHARKBOATS) in south-east Queensland and NSW for 7 fishing seasons from 1993/94 to 1999/2000 inclusive.

		FISHING SEASON											
		1993/94			1994/95			1995/96			1996/97		
EFFORT CATEGORY	SPECIES GROUP	Mean Catch Rate (No. fish per boat day)	±	s.e.	Mean Catch Rate (No. fish per boat day)	±	s.e.	Mean Catch Rate (No. fish per boat day)	±	s.e.	Mean Catch Rate (No. fish per boat day)	±	s.e.
BILLFISH/TUNA	BILLFISH	0.2107	±	0.0376	0.1918	±	0.0360	0.3039	±	0.0497	0.5811	±	0.1786
	TUNAS	0.5661	±	0.2187	0.3450	±	0.0663	0.8217	±	0.2433	0.4021	±	0.1504
	SHARK	0.0282	±	0.0062	0.0149	±	0.0048	0.0460	±	0.0084	0.0312	±	0.0131
	SPORTFISH	0.1243	±	0.0399	0.0567	±	0.0167	0.0549	±	0.0229	0.0550	±	0.0249
SHARKS	BILLFISH	0.0112	±	0.0073	0.0039	±	0.0033	0.0313	±	0.0138	0.0000	±	0.0000
	TUNAS	0.0160	±	0.0096	0.0054	±	0.0054	0.0138	±	0.0128	0.0000	±	0.0000
	SHARK	0.3700	±	0.0374	0.4440	±	0.0545	0.5996	±	0.0699	0.6476	±	0.0685
	SPORTFISH	0.0301	±	0.0169	0.0201	±	0.0136	0.0011	±	0.0011	0.0000	±	0.0000
COMBINED EFFORT	BILLFISH	0.1945	±	0.0372	0.1745	±	0.0356	0.2664	±	0.0427	0.4749	±	0.1470
	TUNAS	0.5287	±	0.2144	0.2913	±	0.0538	0.7689	±	0.2285	0.3741	±	0.1479
	SHARKS	0.0638	±	0.0117	0.0838	±	0.0268	0.1116	±	0.0184	0.1192	±	0.0240
	SPORTFISH	0.1223	±	0.0399	0.0579	±	0.0167	0.0524	±	0.0229	0.0464	±	0.0211

Appendix 10 (cont).

		FISHING SEASON								
		1997/98			1998/99			1999/2000		
EFFORT CATEGORY	SPECIES GROUP	Mean Catch Rate (No. fish per boat day)	±	s.e.	Mean Catch Rate (No. fish per boat day)	±	s.e.	Mean Catch Rate (No. fish per boat day)	±	s.e.
BILLFISH/TUNA	BILLFISH	0.3205	±	0.0722	0.5479	±	0.0909	0.3219	±	0.0397
	TUNAS	0.4407	±	0.3600	0.3220	±	0.1072	0.1329	±	0.0518
	SHARK	0.0667	±	0.0201	0.0887	±	0.0376	0.0395	±	0.0089
	SPORTFISH	0.0474	±	0.0185	0.1333	±	0.0255	0.0773	±	0.0288
SHARKS	BILLFISH	0.0612	±	0.0198	0.0857	±	0.0277	0.0975	±	0.0268
	TUNAS	0.1818	±	0.1818	0.0908	±	0.0469	0.0067	±	0.0031
	SHARK	0.4346	±	0.1045	0.7345	±	0.1054	0.5741	±	0.0828
	SPORTFISH	0.2522	±	0.2462	0.0491	±	0.0434	0.0319	±	0.0207
COMBINED EFFORT	BILLFISH	0.2853	±	0.0722	0.4537	±	0.0752	0.1545	±	0.0273
	TUNAS	0.4123	±	0.3539	0.2227	±	0.0793	0.0304	±	0.0091
	SHARKS	0.1137	±	0.0215	0.2117	±	0.0674	0.0832	±	0.0199
	SPORTFISH	0.0969	±	0.0602	0.1147	±	0.0213	0.0244	±	0.0091

Appendix 11. The species and number of fish reported during scheds for 4 fishing seasons from 1996/97 to 1999/2000 inclusive. The proportional contributions of each species target group to the total reported catch and the contributing proportions of each species to its main target group are also reported.

		FISHING SEASON						
		1996/97	1997/98	1998/99	1999/200	4 seasons combined		
SPECIES GROUP	COMMON NAME	No. Fish	No. Fish	No. Fish	No. Fish	Total no. Fish	% of Species Group	% of all Fish Combined
BILLFISH	BLACK MARLIN	890	168	669	271	1998	53.1%	31.6%
	STRIPED MARLIN	175	107	378	571	1231	32.7%	19.5%
	BLUE MARLIN	24	130	215	100	469	12.5%	7.4%
	SAILFISH	2	4	24	8	38	1.0%	0.6%
	SHORTBILL SPEARFISH	-	12	12	5	29	0.8%	0.5%
	ALL BILLFISH	**1091**	**421**	**1298**	**955**	**3765**	**100.0%**	**59.6%**
TUNAS	YELLOWFIN TUNA	124	69	441	184	818	70.5%	13.0%
	ALBACORE	2	219	86	4	311	26.8%	4.9%
	SKIPJACK or STRIPED TUNA		5	19	-	24	2.1%	0.4%
	SOUTHERN BLUEFIN TUNA	-	5	-	-	5	0.4%	0.1%
	LONGTAIL TUNA	-	-	2	-	2	0.2%	0.0%
	MACKEREL TUNA	-	-	1	-	1	0.1%	0.0%
	ALL TUNAS	**126**	**298**	**549**	**188**	**1161**	**100.0%**	**18.4%**

Appendix 11 (cont).

		FISHING SEASON						
		1996/97	1997/98	1998/99	1999/200	4 seasons combined		
SPECIES GROUP	COMMON NAME	No. Fish	No. Fish	No. Fish	No. Fish	Total no. Fish	% of Species Group	% of all Fish Combined
SHARKS	SHORTFIN MAKO SHARK	11	29	308	148	496	66.9%	7.9%
	TIGER SHARK	54	30	76	55	215	29.0%	3.4%
	WHALER SHARKS	46	75	31	54	206	27.8%	3.3%
	HAMMERHEAD SHARK	39	23	36	65	163	22.0%	2.6%
	BLUE SHARK	12	22	85	31	150	20.2%	2.4%
	WHITE POINTER SHARK	1	-	2	2	5	0.7%	0.1%
	SHARK, OTHER	-	1	1	-	2	0.3%	0.0%
	ALL SHARKS	**163**	**180**	**539**	**355**	**741**	**100.0%**	**11.7%**
SPORTFISH	DOLPHIN FISH	66	89	246	73	474	73.0%	7.5%
	WAHOO	9	2	46	10	67	10.3%	1.1%
	KINGFISH	4	2	44	52	102	15.7%	1.6%
	BARRACUDA	-	-	2	3	5	0.8%	0.1%
	SALMON	-	-	1	-	1	0.2%	0.0%
	ALL SPORTFISH	**79**	**93**	**339**	**138**	**649**	**100.0%**	**10.3%**
ALL SPECIES COMBINED		**1459**	**992**	**2725**	**1636**	**6316**		**100%**

Appendix 12. The total numbers of tagged, weighed and 'not weighed' fish and the proportional contribution of each of these catch categories for all species reported during scheds for fishing season 1996/97.

FISHING SEASON: 96/97			Capture Category			
SPECIES GROUP	**COMMON NAME**		**Tagged**	**Weighed**	**Not Weighed**	**Total**
BILLFISH	BLACK MARLIN	No. Fish:	873	16	1	890
		%:	98.1%	1.8%	0.1%	100.0%
	BLUE MARLIN	No. Fish:	18	6	0	24
		%:	75.0%	25.0%	0.0%	100.0%
	STRIPED MARLIN	No. Fish:	165	10	0	175
		%:	94.3%	5.7%	0.0%	100.0%
	SAILFISH	No. Fish:	2	0	0	2
		%:	100.0%	0.0%	0.0%	100.0%
	SHORTBILL SPEARFISH	No. Fish:	0	0	0	0
		%:	0.0%	0.0%	0.0%	0
	ALL BILLFISH	**No. Fish:**	**1058**	**32**	**1**	**1091**
		%:	**97.0%**	**2.9%**	**0.1%**	**100.0%**

FISHING SEASON: 96/97			Capture Category			
SPECIES GROUP	**COMMON NAME**		**Tagged**	**Weighed**	**Not Weighed**	**Total**
TUNAS	ALBACORE	No. Fish:	2	0	0	2
		%:	100.0%	0.0%	0.0%	100.0%
	LONGTAIL TUNA	No. Fish:	0	0	0	0
		%:	0%	0%	0%	0%
	MACKEREL TUNA	No. Fish:	0	0	0	0
		%:	0.0%	0.0%	0.0%	0.0%
	SKIPJACK TUNA	No. Fish:	0	0	0	0
		%:	0.0%	0.0%	0.0%	0.0%
	YELLOWFIN TUNA	No. Fish:	115	7	2	124
		%:	92.7%	5.6%	1.6%	100.0%
	SOUTHERN BLUEFIN TUNA	No. Fish:	0	0	0	0
		%:	0.0%	0.0%	0.0%	0.0%
	ALL TUNAS	**No. Fish:**	**117**	**7**	**2**	**126**
		%:	**92.9%**	**5.6%**	**1.6%**	**100.0%**

NB. Rounding errors may be present among some estimates of the proportion of catch

Appendix 12 (cont).

FISHING SEASON: 96/97			Capture Category			
SPECIES GROUP	COMMON NAME		Tagged	Weighed	Not Weighed	Total
SHARKS	BLUE SHARK	No. Fish:	11	1	0	12
		%:	91.7%	8.3%	0.0%	100.0%
	HAMMERHEAD SHARK	No. Fish:	35	4	0	39
		%:	89.7%	10.3%	0.0%	100.0%
	SHORTFIN MAKO SHARK	No. Fish:	8	3	0	11
		%:	72.7%	27.3%	0.0%	100.0%
	TIGER SHARK	No. Fish:	11	43	0	54
		%:	20.4%	79.6%	0.0%	100.0%
	WHALER SHARKS	No. Fish:	37	8	1	46
		%:	80.4%	17.4%	2.2%	100.0%
	WHITE POINTER SHARK	No. Fish:	1	0	0	1
		%:	100.0%	0.0%	0.0%	100.0%
	SHARK, OTHER	No. Fish:	0	0	0	0
		%:	0.0%	0.0%	0.0%	0.0%
	ALL SHARKS	**No. Fish:**	**103**	**59**	**1**	**163**
		%:	**63.2%**	**36.2%**	**0.6%**	**100.0%**

FISHING SEASON: 96/97			Capture Category			
SPECIES GROUP	COMMON NAME		Tagged	Weighed	Not Weighed	Total
SPORTFISH	BARRACUDA	No. Fish:	0	0	0	0
		%:	0.0%	0.0%	0.0%	0.0%
	DOLPHIN FISH	No. Fish:	66	0	0	66
		%:	100.0%	0.0%	0.0%	100.0%
	KINGFISH	No. Fish:	4	0	0	4
		%:	100.0%	0.0%	0.0%	100.0%
	WAHOO	No. Fish:	8	1	0	9
		%:	88.9%	11.1%	0.0%	100.0%
	AUSTRALIAN SALMON	No. Fish:	0	0	0	0
		%:	0.0%	0.0%	0.0%	0.0%
	ALL SPORTFISH	**No. Fish:**	**78**	**1**	**0**	**79**
		%:	**98.7%**	**1.3%**	**0.0%**	**100.0%**

FISHING SEASON: 96/97					
ALL SPECIES COMBINED	**No. Fish:**	**1356**	**99**	**4**	**1459**
	%:	**92.9%**	**6.8%**	**0.3%**	**100.0%**

NB. Rounding errors may be present among some estimates of the proportion of catch

Appendix 13. The total numbers of tagged, weighed and 'not weighed' fish and the proportional contribution of each of these catch categories for all species reported during scheds for fishing season 1997/98.

FISHING SEASON: 97/98			Capture Category			
SPECIES GROUP	**COMMON NAME**		**Tagged**	**Weighed**	**Not Weighed**	**Total**
BILLFISH	BLACK MARLIN	No. Fish:	159	9	0	168
		%:	94.6%	5.4%	0.0%	100.0%
	BLUE MARLIN	No. Fish:	112	18	0	130
		%:	86.2%	13.8%	0.0%	100.0%
	STRIPED MARLIN	No. Fish:	98	9	0	107
		%:	91.6%	8.4%	0.0%	100.0%
	SAILFISH	No. Fish:	2	2	0	4
		%:	50.0%	50.0%	0.0%	100.0%
	SHORTBILL SPEARFISH	No. Fish:	12	0	0	12
		%:	100.0%	0.0%	0.0%	1
	ALL BILLFISH	**No. Fish:**	**383**	**38**	**0**	**421**
		%:	**91.0%**	**9.0%**	**0.0%**	**100.0%**

FISHING SEASON: 97/98			Capture Category			
SPECIES GROUP	**COMMON NAME**		**Tagged**	**Weighed**	**Not Weighed**	**Total**
TUNAS	ALBACORE	No. Fish:	207	5	7	219
		%:	94.5%	2.3%	3.2%	100.0%
	LONGTAIL TUNA	No. Fish:	0	0	0	0
		%:	0%	0%	0%	0%
	MACKEREL TUNA	No. Fish:	0	0	0	0
		%:	0.0%	0.0%	0.0%	0.0%
	SKIPJACK TUNA	No. Fish:	1	0	4	5
		%:	20.0%	0.0%	80.0%	100.0%
	YELLOWFIN TUNA	No. Fish:	61	8	0	69
		%:	88.4%	11.6%	0.0%	100.0%
	SOUTHERN BLUEFIN TUNA	No. Fish:	5	0	0	5
		%:	100.0%	0.0%	0.0%	100.0%
	ALL TUNAS	**No. Fish:**	**274**	**13**	**11**	**298**
		%:	**91.9%**	**4.4%**	**3.7%**	**100.0%**

NB. Rounding errors may be present among some estimates of the proportion of catch

Appendix 13 (cont).

FISHING SEASON: 97/98			Capture Category			
SPECIES GROUP	COMMON NAME		Tagged	Weighed	Not Weighed	Total
SHARKS	BLUE SHARK	No. Fish:	21	1	0	22
		%:	95.5%	4.5%	0.0%	100.0%
	HAMMERHEAD SHARK	No. Fish:	23	0	0	23
		%:	100.0%	0.0%	0.0%	100.0%
	SHORTFIN MAKO SHARK	No. Fish:	23	5	1	29
		%:	79.3%	17.2%	3.4%	100.0%
	TIGER SHARK	No. Fish:	5	25	0	30
		%:	16.7%	83.3%	0.0%	100.0%
	WHALER SHARKS	No. Fish:	67	8	0	75
		%:	89.3%	10.7%	0.0%	100.0%
	WHITE POINTER SHARK	No. Fish:	0	0	0	0
		%:	0.0%	0.0%	0.0%	0.0%
	SHARK, OTHER	No. Fish:	1	0	0	1
		%:	100.0%	0.0%	0.0%	100.0%
	ALL SHARKS	**No. Fish:**	**140**	**39**	**1**	**180**
		%:	**77.8%**	**21.7%**	**0.6%**	**100.0%**

FISHING SEASON: 97/98			Capture Category			
SPECIES GROUP	COMMON NAME		Tagged	Weighed	Not Weighed	Total
SPORTFISH	BARRACUDA	No. Fish:	0	0	0	0
		%:	0.0%	0.0%	0.0%	0.0%
	DOLPHIN FISH	No. Fish:	83	3	3	89
		%:	93.3%	3.4%	3.4%	100.0%
	KINGFISH	No. Fish:	2	0	0	2
		%:	100.0%	0.0%	0.0%	100.0%
	WAHOO	No. Fish:	2	0	0	2
		%:	100.0%	0.0%	0.0%	100.0%
	AUSTRALIAN SALMON	No. Fish:	0	0	0	0
		%:	0.0%	0.0%	0.0%	0.0%
	ALL SPORTFISH	**No. Fish:**	**87**	**3**	**3**	**93**
		%:	**93.5%**	**3.2%**	**3.2%**	**100.0%**

FISHING SEASON: 97/98					
ALL SPECIES COMBINED	**No. Fish:**	**884**	**93**	**15**	**992**
	%:	**89.1%**	**9.4%**	**1.5%**	**100.0%**

NB. Rounding errors may be present among some estimates of the proportion of catch

Appendix 14. The total numbers of tagged, weighed and 'not weighed' fish and the proportional contribution of each of these catch categories for all species reported during scheds for fishing season 1998/99.

FISHING SEASON: 98/99			Capture Category			
SPECIES GROUP	**COMMON NAME**		**Tagged**	**Weighed**	**Not Weighed**	**Total**
BILLFISH	BLACK MARLIN	No. Fish:	650	19	0	669
		%:	97.2%	2.8%	0.0%	100.0%
	BLUE MARLIN	No. Fish:	158	56	1	215
		%:	73.5%	26.0%	0.5%	100.0%
	STRIPED MARLIN	No. Fish:	343	34	1	378
		%:	90.7%	9.0%	0.3%	100.0%
	SAILFISH	No. Fish:	23	1	0	24
		%:	95.8%	4.2%	0.0%	100.0%
	SHORTBILL SPEARFISH	No. Fish:	10	1	1	12
		%:	83.3%	8.3%	8.3%	1
	ALL BILLFISH	**No. Fish:**	**1184**	**111**	**3**	**1298**
		%:	**91.2%**	**8.6%**	**0.2%**	**100.0%**

FISHING SEASON: 98/99			Capture Category			
SPECIES GROUP	**COMMON NAME**		**Tagged**	**Weighed**	**Not Weighed**	**Total**
TUNAS	ALBACORE	No. Fish:	72	11	3	86
		%:	83.7%	12.8%	3.5%	100.0%
	LONGTAIL TUNA	No. Fish:	1	1	0	2
		%:	50%	50%	0%	100%
	MACKEREL TUNA	No. Fish:	0	0	1	1
		%:	0.0%	0.0%	100.0%	100.0%
	SKIPJACK TUNA	No. Fish:	1	0	18	19
		%:	5.3%	0.0%	94.7%	100.0%
	YELLOWFIN TUNA	No. Fish:	382	43	16	441
		%:	86.6%	9.8%	3.6%	100.0%
	SOUTHERN BLUEFIN TUNA	No. Fish:	0	0	0	0
		%:	0.0%	0.0%	0.0%	0.0%
	ALL TUNAS	**No. Fish:**	**456**	**55**	**38**	**549**
		%:	**83.1%**	**10.0%**	**6.9%**	**100.0%**

NB. Rounding errors may be present among some estimates of the proportion of catch

Appendix 14 (cont).

FISHING SEASON: 98/99			Capture Category			
SPECIES GROUP	COMMON NAME		Tagged	Weighed	Not Weighed	Total
SHARKS	BLUE SHARK	No. Fish:	71	14	0	85
		%:	83.5%	16.5%	0.0%	100.0%
	HAMMERHEAD SHARK	No. Fish:	33	3	0	36
		%:	91.7%	8.3%	0.0%	100.0%
	SHORTFIN MAKO SHARK	No. Fish:	265	42	1	308
		%:	86.0%	13.6%	0.3%	100.0%
	TIGER SHARK	No. Fish:	23	53	0	76
		%:	30.3%	69.7%	0.0%	100.0%
	WHALER SHARKS	No. Fish:	21	9	1	31
		%:	67.7%	29.0%	3.2%	100.0%
	WHITE POINTER SHARK	No. Fish:	2	0	0	2
		%:	100.0%	0.0%	0.0%	100.0%
	SHARK, OTHER	No. Fish:	1	0	0	1
		%:	100.0%	0.0%	0.0%	100.0%
	ALL SHARKS	**No. Fish:**	**416**	**121**	**2**	**539**
		%:	**77.2%**	**22.4%**	**0.4%**	**100.0%**

FISHING SEASON: 98/99			Capture Category			
SPECIES GROUP	COMMON NAME		Tagged	Weighed	Not Weighed	Total
SPORTFISH	BARRACUDA	No. Fish:	0	2	0	2
		%:	0.0%	100.0%	0.0%	100.0%
	DOLPHIN FISH	No. Fish:	224	15	7	246
		%:	91.1%	6.1%	2.8%	100.0%
	KINGFISH	No. Fish:	44	0	0	44
		%:	100.0%	0.0%	0.0%	100.0%
	WAHOO	No. Fish:	37	8	1	46
		%:	80.4%	17.4%	2.2%	100.0%
	AUSTRALIAN SALMON	No. Fish:	1	0	0	1
		%:	100.0%	0.0%	0.0%	100.0%
	ALL SPORTFISH	**No. Fish:**	**306**	**25**	**8**	**339**
		%:	**90.3%**	**7.4%**	**2.4%**	**100.0%**

FISHING SEASON: 98/99					
ALL SPECIES COMBINED	**No. Fish:**	**2362**	**312**	**51**	**2725**
	%:	**86.7%**	**11.4%**	**1.9%**	**100.0%**

NB. Rounding errors may be present among some estimates of the proportion of catch

Appendix 15. The total numbers of tagged, weighed and 'not weighed' fish and the proportional contribution of each of these catch categories for all species reported during scheds for fishing season 1999/2000.

FISHING SEASON 99/00			Capture Category			
SPECIES GROUP	**COMMON NAME**		**Tagged**	**Weighed**	**Not Weighed**	**Total**
BILLFISH	BLACK MARLIN	No. Fish:	246	21	4	271
		%:	90.8%	7.7%	1.5%	100.0%
	BLUE MARLIN	No. Fish:	78	22	0	100
		%:	78.0%	22.0%	0.0%	100.0%
	STRIPED MARLIN	No. Fish:	528	35	8	571
		%:	92.5%	6.1%	1.4%	100.0%
	SAILFISH	No. Fish:	6	2	0	8
		%:	75.0%	25.0%	0.0%	100.0%
	SHORTBILL SPEARFISH	No. Fish:	5	0	0	5
		%:	1	0	0	1
	ALL BILLFISH	**No. Fish:**	**863**	**80**	**12**	**955**
		%:	90.4%	8.4%	1.3%	100.0%

FISHING SEASON 99/00			Capture Category			
SPECIES GROUP	**COMMON NAME**		**Tagged**	**Weighed**	**Not Weighed**	**Total**
TUNAS	ALBACORE	No. Fish:	4	0	0	4
		%:	100.0%	0.0%	0.0%	100.0%
	LONGTAIL TUNA	No. Fish:	0	0	0	0
		%:	0%	0%	0%	100%
	MACKEREL TUNA	No. Fish:	0	0	0	0
		%:	0.0%	0.0%	0.0%	0.0%
	SKIPJACK TUNA	No. Fish:	0	0	0	0
		%:	0.0%	0.0%	0.0%	0.0%
	YELLOWFIN TUNA	No. Fish:	142	37	5	184
		%:	77.2%	20.1%	2.7%	100.0%
	SOUTHERN BLUEFIN TUNA	No. Fish:	0	0	0	0
		%:	0.0%	0.0%	0.0%	0.0%
	ALL TUNAS	**No. Fish:**	**146**	**37**	**5**	**188**
		%:	**77.7%**	**19.7%**	**2.7%**	**100.0%**

NB. Rounding errors may be present among some estimates of the proportion of catch

Appendix 15 (cont).

FISHING SEASON 99/00			Capture Category			
SPECIES GROUP	**COMMON NAME**		**Tagged**	**Weighed**	**Not Weighed**	**Total**
SHARKS	BLUE SHARK	No. Fish:	27	4	0	31
		%:	87.1%	12.9%	0.0%	100.0%
	HAMMERHEAD SHARK	No. Fish:	60	5	0	65
		%:	92.3%	7.7%	0.0%	100.0%
	SHORTFIN MAKO SHARK	No. Fish:	110	33	5	148
		%:	74.3%	22.3%	3.4%	100.0%
	TIGER SHARK	No. Fish:	25	30	0	55
		%:	45.5%	54.5%	0.0%	100.0%
	WHALER SHARKS	No. Fish:	39	15	0	54
		%:	72.2%	27.8%	0.0%	100.0%
	WHITE POINTER SHARK	No. Fish:	0	0	2	2
		%:	0.0%	0.0%	100.0%	100.0%
	SHARK, OTHER	No. Fish:	0	0	0	0
		%:	0.0%	0.0%	0.0%	0.0%
	ALL SHARKS	**No. Fish:**	**261**	**87**	**7**	**355**
		%:	**73.5%**	**24.5%**	**2.0%**	**100.0%**

FISHING SEASON 99/00			Capture Category			
SPECIES GROUP	**COMMON NAME**		**Tagged**	**Weighed**	**Not Weighed**	**Total**
SPORTFISH	BARRACUDA	No. Fish:	2	1	0	3
		%:	66.7%	33.3%	0.0%	100.0%
	DOLPHIN FISH	No. Fish:	66	4	3	73
		%:	90.4%	5.5%	4.1%	100.0%
	KINGFISH	No. Fish:	51	0	1	52
		%:	98.1%	0.0%	1.9%	100.0%
	WAHOO	No. Fish:	6	4	0	10
		%:	60.0%	40.0%	0.0%	100.0%
	AUSTRALIAN SALMON	No. Fish:	1	0	0	1
		%:	100.0%	0.0%	0.0%	100.0%
	ALL SPORTFISH	**No. Fish:**	**126**	**9**	**4**	**139**
		%:	**90.6%**	**6.5%**	**2.9%**	**100.0%**

FISHING SEASON 99/00					
ALL SPECIES COMBINED	**No. Fish:**	**1396**	**213**	**28**	**1637**
	%:	**85.3%**	**13.0%**	**1.7%**	**100.0%**

NB. Rounding errors may be present among some estimates of the proportion of catch

Appendix 16. A summary of the numbers of tagged, weighed and 'not weighed' fish and the proportional contribution of each of these catch categories for all species reported during scheds for 4 fishing seasons 1996/97 to 1999/2000 inclusive.

ALL FISHING SEASONS COMBINED (96/97 to 99/00)			**Capture Category**			
SPECIES GROUP	**COMMON NAME**		**Tagged**	**Weighed**	**Not Weighed**	**Total**
BILLFISH	BLACK MARLIN	No. Fish:	1928	65	5	1998
		%:	96.5%	3.3%	0.3%	100.0%
	BLUE MARLIN	No. Fish:	366	102	1	469
		%:	78.0%	21.7%	0.2%	100.0%
	STRIPED MARLIN	No. Fish:	1134	88	9	1231
		%:	92.1%	7.1%	0.7%	100.0%
	SAILFISH	No. Fish:	33	5	0	38
		%:	86.8%	13.2%	0.0%	100.0%
	SHORTBILL SPEARFISH	No. Fish:	27	1	1	29
		%:	93.1%	3.4%	3.4%	1
	ALL BILLFISH	**No. Fish:**	**3488**	**261**	**16**	**3765**
		%:	**92.6%**	**6.9%**	**0.4%**	**100.0%**

ALL FISHING SEASONS COMBINED (96/97 to 99/00)			**Capture Category**			
SPECIES GROUP	**COMMON NAME**		**Tagged**	**Weighed**	**Not Weighed**	**Total**
TUNAS	ALBACORE	No. Fish:	285	16	10	311
		%:	91.6%	5.1%	3.2%	100.0%
	LONGTAIL TUNA	No. Fish:	1	1	0	2
		%:	50%	50%	0%	100%
	MACKEREL TUNA	No. Fish:	0	0	1	1
		%:	0.0%	0.0%	100.0%	100.0%
	SKIPJACK TUNA	No. Fish:	2	0	22	24
		%:	8.3%	0.0%	91.7%	100.0%
	YELLOWFIN TUNA	No. Fish:	700	95	23	818
		%:	85.6%	11.6%	2.8%	100.0%
	SOUTHERN BLUEFIN TUNA	No. Fish:	5	0	0	5
		%:	100.0%	0.0%	0.0%	100.0%
	ALL TUNAS	**No. Fish:**	**993**	**112**	**56**	**1161**
		%:	**85.5%**	**9.6%**	**4.8%**	**100.0%**

NB. Rounding errors may be present among some estimates of the proportion of catch

Appendix 16 (cont).

ALL FISHING SEASONS COMBINED (96/97 to 99/00)

SPECIES GROUP	COMMON NAME		Capture Category: Tagged	Weighed	Not Weighed	Total
SHARKS	BLUE SHARK	No. Fish:	130	20	0	150
		%:	86.7%	13.3%	0.0%	100.0%
	HAMMERHEAD SHARK	No. Fish:	151	12	0	163
		%:	92.6%	7.4%	0.0%	100.0%
	SHORTFIN MAKO SHARK	No. Fish:	406	83	7	496
		%:	81.9%	16.7%	1.4%	100.0%
	TIGER SHARK	No. Fish:	64	151	0	215
		%:	29.8%	70.2%	0.0%	100.0%
	WHALER SHARKS	No. Fish:	164	40	2	206
		%:	79.6%	19.4%	1.0%	100.0%
	WHITE POINTER SHARK	No. Fish:	3	0	2	5
		%:	60.0%	0.0%	40.0%	100.0%
	SHARK, OTHER	No. Fish:	2	0	0	2
		%:	100.0%	0.0%	0.0%	100.0%
	ALL SHARKS	**No. Fish:**	**920**	**306**	**11**	**1237**
		%:	**74.4%**	**24.7%**	**0.9%**	**100.0%**

ALL FISHING SEASONS COMBINED (96/97 to 99/00)

SPECIES GROUP	COMMON NAME		Capture Category: Tagged	Weighed	Not Weighed	Total
SPORTFISH	BARRACUDA	No. Fish:	2	3	0	5
		%:	40.0%	60.0%	0.0%	100.0%
	DOLPHIN FISH	No. Fish:	439	22	13	474
		%:	92.6%	4.6%	2.7%	100.0%
	KINGFISH	No. Fish:	101	0	1	102
		%:	99.0%	0.0%	1.0%	100.0%
	WAHOO	No. Fish:	53	13	1	67
		%:	79.1%	19.4%	1.5%	100.0%
	SALMON	No. Fish:	2	0	0	2
		%:	100.0%	0.0%	0.0%	100.0%
	ALL SPORTFISH	**No. Fish:**	**597**	**38**	**15**	**650**
		%:	**91.8%**	**5.8%**	**2.3%**	**100.0%**

ALL FISHING SEASONS COMBINED (96/97 to 99/00)

ALL SPECIES COMBINED	**No. Fish:**	**5998**	**717**	**98**	**6813**
	%:	**88.0%**	**10.5%**	**1.4%**	**100.0%**

NB. Rounding errors may be present among some estimates of the proportion of catch

Appendix 17. The total numbers of tagged fish from the gamefish-tagging program, the number of fish tagged during monitored gamefishing tournaments and the proportional contribution of tournament tagged fish for fishing season 1998/99.

SPECIES GROUP	SPECIES NAME	Total no. Fish Tagged	No. fish tagged in monitored tournaments	%
BILLFISH	BLACK MARLIN	2493	650	26%
	BLUE MARLIN	234	158	68%
	BROADBILL	4	-	-
	SAILFISH	682	23	3%
	SHORTBILL SPEARFISH	15	10	67%
	STRIPED MARLIN	1353	343	25%
	ALL BILLFISH:	**4781**	**1184**	**25%**
TUNAS	ALBACORE	180	72	40%
	AUSTRALIAN BONITO	132	-	-
	BIGEYE TUNA	3	-	-
	DOGTOOTH TUNA	5	-	-
	LONGTAIL TUNA	14	1	7%
	MACKEREL TUNA	493	-	-
	STRIPED TUNA	93	1	1%
	WATSONS LEAPING BONITO	1	-	-
	YELLOWFIN TUNA	1409	382	27%
	ALL TUNAS:	**2330**	**456**	**20%**
SHARKS	BLACKTIP SHARK	9	-	-
	BLUE SHARK	139	71	51%
	WHALER SHARK	180	21	12%
	HAMMERHEAD SHARK	160	33	21%
	MAKO SHARK	332	265	80%
	THRESHER SHARK	3	-	-
	TIGER SHARK	41	23	56%
	WHITE SHARK	2	2	100%
	ALL SHARKS:	**866**	**415**	**48%**

Appendix 17 (cont).

SPECIES GROUP	SPECIES NAME	Total no. Fish Tagged	No. fish tagged in monitored tournaments	%
SPORTFISH	AUSTRALIAN SALMON	213	-	-
	BARRACOUTA	3	-	-
	BARRACUDA	11	-	-
	BIGEYE TREVALLY	2	-	-
	BROAD BARRED SPANISH MACKEREL	1	-	-
	COBIA	18	-	-
	DOLPHIN FISH	635	224	35%
	GIANT TREVALLY	6	-	-
	NARROW BARRED SPANISH MACKEREL	11	-	-
	QLD SPOTTED MACKEREL	148	-	-
	RAINBOW RUNNER	8	-	-
	SAMSON FISH	14	-	-
	WAHOO	62	37	60%
	YELLOWTAIL KINGFISH	1315	44	3%
	QLD SCHOOL MACKEREL	1	-	-
	ALL SPORTFISH :	**2448**	**305**	**12%**
OTHER SPECIES*		13	-	-
	ALL SPECIES COMBINED:	**10438**	**2360**	**23%**

Appendix 18. The species composition of the baitfish harvest, estimates of numbers of fish and CPUE for each fishing effort strata; and the contributing proportion of each species to the estimated total numbers of fish. Note: these estimates were derived from interviews of the game fishing fleet for 39 fishing days during fishing season 1998/99.

	Billfish/Tuna Boats						Shark Boats						Billfish/Tuna and Shark Boats Combined						
Species Common Name	Estimated No. Fish		s.e.	CPUE		s.e.	Estimated No. Fish		s.e.	CPUE		s.e.	Estimated No. Fish		s.e.	CPUE		s.e.	% of total boated catch
SLIMY MACKEREL	9167	±	357	3.571	±	0.625	453	±	50	0.735	±	0.273	9621	±	361	4.043	±	0.696	84.10%
SKIPJACK TUNA	526	±	26	0.330	±	0.128	396	±	37	1.545	±	1	922	±	45	1.321	±	0.452	8.06%
YELLOWTAIL & JACK MACKEREL	598	±	35	0.268	±	0.099	83	±	9	0.318	±	0	681	±	35	0.462	±	0.161	5.95%
AUSTRALIAN BONITO	63	±	6	0.220	±	0.011	32	±	2	0.038	±	0	96	±	6	0.047	±	0.024	0.84%
GARFISH	94	±	11	0.041	±	0.033							94	±	11	0.041	±	0.040	0.82%
YELLOWFIN TUNA	1		-				19	±	4	0.019	±	0	20	±	4	0.016	±	0.016	0.17%
FRIGATE MACKEREL							2		-				2		-				0.02%
SILVER SWEEP	2		-										2		-				0.02%
DOLPHIN FISH	1		-										1		-				0.01%
TAILOR	1		-										1		-				0.01%

- summary of reported catch only - estimates and associated errors not calculated, see methods for further details.

Appendix 19. The species composition of the catch of non-pointscore species, estimates of numbers and numbers of fish for each fishing effort strata; and the contributing proportion of each species to the estimated total numbers of fish Note these estimates were derived from interviews of the game fishing fleet for 39 fishing days during fishing season 1998/99.

	Billfish/Tuna Boats						Shark Boats						Billfish/Tuna and Shark Boats Combined						
Species Common Name	Estimated No. Fish	±	s.e.	CPUE	±	s.e.	Estimated No. Fish	±	s.e.	CPUE	±	s.e.	Estimated No. Fish	±	s.e.	CPUE	±	s.e.	% of total catch
SKIPJACK TUNA	1534	±	48	0.785	±	0.160	105	±	11	0.314	±	0.136	1639	±	49	0.987	±	0.192	76.85%
DOLPHIN FISH	210	±	17	0.044	±	0.017	72	±	13	0.094	±	0.072	282	±	21	0.105	±	0.052	13.24%
AUSTRALIAN BONITO	94	±	5	0.039	±	0.017							94	±	5	0.034	±	0.017	4.39%
YELLOWFIN TUNA	14	±	1	0.009	±	0.005	4		-				18	±	1	0.018	±	0.008	0.86%
MACKEREL TUNA	14	±	1	0.004	±	0.002	1		-				15	±	1	0.005	±	0.003	0.71%
WAHOO	13	±	1	0.008	±	0.004	1		-				14	±	1	0.009	±	0.004	0.66%
FRIGATE MACKEREL	10	±	2	0.006	±	0.006	1		-				11	±	2	0.009	±	0.009	0.53%
KINGFISH	7		-										7		-				0.33%
ALBACORE	4		-										4		-				0.19%
BLACK MARLIN	2		-										2		-				0.09%
SOUTHERN BLUEFIN TUNA	2		-										2		-				0.09%
SHORTFIN MAKO SHARK	2		-										2		-				0.09%
BARRACOUTA	2		-										2		-				0.09%
BLUE SHARK							2		-				2		-				0.09%
HAMMERHEAD SHARK	1		-										1		-				0.05%
WHALER SHARKS	1		-										1		-				0.05%
OTHER SPECIES*	36												36						1.69%

- summary of reported catch only - estimates and associated errors not calculated, see methods for further details.

* a combination of 8 reef associated species captured by competition boats

Appendix 20. The estimated mean weights for gamefish species caught during monitored gamefishing tournaments in fishing season 1998/99. Estimates of weights are presented for tagged fish, weighed fish and tagged and weighed fish combined.

		Tagged Fish				Weighed Fish				Tagged and Weighed Fish Combined			
Species Group	Species	Number of Fish	Mean weight (kg)		se	Number of Fish	Mean weight (kg)		se	Number of Fish	Mean weight (kg)		se
BILLFISH	BLACK MARLIN	237	62.06	±	1.54	21	88.05	±	6.47	258	64.18	±	1.57
	BLUE MARLIN	59	109.54	±	3.96	22	150.86	±	9.64	81	120.77	±	4.37
	STRIPED MARLIN	463	80.76	±	1.02	35	85.89	±	3.49	498	81.12	±	0.98
	SAILFISH	5	38.40	±	3.40	2	41.00	±	6.00	7	39.14	±	2.73
	SHORTBILL SPEARFISH	5	20.40	±	3.26					5	20.40	±	3.26
TUNA	ALBACORE	1	10.00	±	-					1	10.00	±	-
	YELLOWFIN TUNA	77	17.23	±	0.79	34	38.62	±	3.19	111	23.78	±	1.45
SHARK	BLUE SHARK	4	46.25	±	7.18	2	74.00	±	14.00	6	55.50	±	8.24
	HAMMERHEAD	56	55.84	±	4.95	5	105.00	±	14.98	61	59.87	±	4.98
	MAKO SHARK	32	40.53	±	3.57	29	136.17	±	11.62	61	86.00	±	8.45
	TIGER SHARK	13	73.23	±	13.57	30	227.00	±	20.49	43	180.51	±	18.36
	WHALERS	17	57.00	±	8.08	13	167.54	±	22.89	30	104.90	±	14.76
SPORTFISH	DOLPHIN FISH	65	3.18	±	0.37	4	8.25	±	1.60	69	3.48	±	0.39
	KINGFISH	45	3.16	±	0.28					45	3.16	±	0.28
	WAHOO	5	10.40	±	2.01	4	20.50	±	1.85	9	14.89	±	2.20

- standard errors unable to be calculated - only one data point in sample

Appendix 21. The estimated mean weights for gamefish species caught during monitored gamefishing tournaments in fishing season 1999/2000. Estimates of weights are presented for tagged fish, weighed fish and tagged and weighed fish combined.

		Tagged Fish				Weighed Fish				Tagged and Weighed Fish Combined			
Species Group	Species	Number of Fish	Mean weight (kg)	±	se	Number of Fish	Mean weight (kg)	±	se	Number of Fish	Mean weight (kg)	±	se
BILLFISH	BLACK MARLIN	519	39.82	±	1.10	12	107.42	±	15.35	531	41.34	±	1.21
	BLUE MARLIN	97	113.13	±	3.63	37	154.56	±	7.14	134	124.57	±	3.64
	STRIPED MARLIN	224	72.90	±	1.43	17	91.56	±	5.48	241	74.22	±	1.41
	SAILFISH	11	32.27	±	3.53					11	32.27	±	3.53
	SHORTBILL SPEARFISH	3	36.67	±	3.33					3	36.67	±	3.33
TUNA	ALBACORE	43	7.79	±	1.02	7	10.43	±	0.56	50	8.16	±	0.89
	LONGTAIL TUNA	1	4.00	±	-	1	13.50	±	-	2	8.75	±	4.75
	YELLOWFIN TUNA	379	5.96	±	0.30	26	35.94	±	1.70	405	7.88	±	0.47
SHARK	BLUE SHARK	36	52.78	±	3.93	5	107.62	±	18.06	41	59.47	±	4.89
	HAMMERHEAD	25	44.00	±	3.98	4	183.75	±	58.66	29	63.28	±	12.06
	MAKO	92	48.55	±	3.56	24	101.75	±	11.76	116	59.56	±	4.21
	TIGER SHARK	7	63.57	±	12.28	30	217.82	±	21.32	37	188.64	±	20.08
	WHALERS	12	39.00	±	8.22	6	143.08	±	40.91	18	73.69	±	18.30
SPORTFISH	BARRACUDA					2	14.00	±	2.30	2	14.00	±	2.30
	DOLPHIN FISH	118	4.50	±	0.44	9	15.24	±	1.16	127	5.26	±	0.49
	KINGFISH	41	2.20	±	0.19					41	2.20	±	0.19
	WAHOO	18	11.33	±	0.64	6	9.23	±	0.84	24	10.81	±	0.55

- standard errors unable to be calculated - only one data point in sample

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