

ISSN 1441-8487

Number 21

PRELIMINARY ASSESSMENT OF THE
RECREATIONAL GAMEFISH FISHERY IN
TASMANIA, WITH PARTICULAR
REFERENCE TO SOUTHERN BLUEFIN
TUNA

Alastair J. Morton and Jeremy M. Lyle

December 2003

National Library of Australia Cataloguing-in-Publication Entry

Morton, A. J. 1975- .

Preliminary assessment of the recreational gamefish fishery in Tasmania, with particular reference to southern bluefin tuna.

Bibliography.

Includes index.

ISBN 1 86295 127 6.

1. Fishing - Tasmania. 2. Tuna fishing - Tasmania.
3. Southern bluefin tuna - Tasmania. I. Lyle, J. M.
II. Title. (Series : Technical report series (Tasmanian Aquaculture and Fisheries Institute) ; no. 20).

799.1209946

The opinions expressed in this report are those of the author/s and are not necessarily those of the Tasmanian Aquaculture and Fisheries Institute.

Enquires should be directed to the series editor:
Dr Alan Jordan
Tasmanian Aquaculture and Fisheries Institute,
Marine Research Laboratories,
University of Tasmania
Private Bag 49, Hobart, Tasmania 7001

© Tasmanian Aquaculture and Fisheries Institute, University of Tasmania 2003.

Copyright protects this publication. Except for purposes permitted by the Copyright Act, reproduction by whatever means is prohibited without the prior written permission of the Tasmanian Aquaculture and Fisheries Institute.

PRELIMINARY ASSESSMENT OF THE
RECREATIONAL GAMEFISH FISHERY IN
TASMANIA, WITH PARTICULAR
REFERENCE TO SOUTHERN BLUEFIN TUNA

A.J. Morton and J.M. Lyle

December 2003

Tasmanian Aquaculture and Fisheries Institute

Preliminary assessment of the recreational gamefish fishery in Tasmania, with particular reference to southern bluefin tuna

Alastair Morton and Jeremy Lyle

Executive Summary

A recreational gamefish fishery has existed in Tasmania for many years, but limited information is available in relation to levels of catch and participation. In the context of the overall recreational fishery, gamefishing is a relatively small but specialised part of the fishery that has a high profile in terms of the species targeted, capital investment in boats and fishing gear, and tourism impacts.

The primary aim of this study was to quantify the catch of southern bluefin tuna (SBT) by recreational fishers in Tasmania. It also provides catch and biological information on other gamefish species. The range of survey techniques utilised included; on-site surveys (including coverage of gamefishing competitions), fishing diaries/logbooks, and telephone interviews. These incorporated the various components of the fishery namely, gamefish club and non-club members (non-affiliates) and fishing activity from privately owned and charter boats. The on-site survey, conducted at Pirates Bay (Tasman Peninsula) between April and May 2003, was the primary survey technique as it provided the only effective means of sampling non-affiliate anglers.

Although no SBT were caught at Pirates Bay during the on-site surveys, the previous fishing component of the survey interview, coupled with logbook/diary information and anecdotal reports provided a conservative harvest estimate of 112 SBT (or approximately 2.5 tonnes) for the 2003 season. In relative terms, the previous fishing interviews also enabled inferences to be made about SBT catches in the 2002 season, which appeared to be approximately 10 times greater than catch in 2003. The impact of the poor season for SBT in 2003 on the levels of participation and effort in the gamefish fishery in general is unknown.

Traditionally the SBT fishery has been centred around the Tasman Peninsula, however, in 2003 the majority (70%) of the catch was taken off the south coast (south of Bruny and around Pedra Branca). Anecdotal information suggests that catch and effort for SBT has increased in this southern area in recent years.

In terms of catch composition, albacore clearly dominated the gamefish catch by number, with striped tuna of secondary importance. Both species occurred throughout the range of the fishery and were present from at least January through to May. The average weight of albacore tended to increase as the season progressed, but there was little evidence of any trend in sizes for striped tuna. Yellowfin tuna catches tended to be low, with most caught off the north-east coast (St Helens). Pelagic sharks (mako and blue sharks) and marlin were also targeted by gamefishers but catches were low.

At Pirates Bay, between April and May, the total catch of albacore was approximately 1525 fish, of which around 30% were taken by fishers on charter boats. Effort for this period equated to 512 fishing trips, one quarter undertaken on charter boats.

In relation to design, any ongoing monitoring of the gamefish fishery will need to take account of the inherent variability (spatial and temporal) in the availability of SBT. If on-site surveys were to be applied more generally to assess the gamefish fishery they need to be designed such that they can be implemented flexibly to respond to real-time developments in the fishery. Reports from experienced fishers, including charter boat operators and avid fishers, have the potential to assist in identifying where species are located/catches taken and then sampling effort directed accordingly.

Charter boat logbooks and gamefish angler diaries have the potential to be useful in assessing trends in catch and effort for these sectors, but do not provide complete coverage of the fishery and cannot be adjusted readily to take account of fishing activity by non-affiliated anglers fishing from private vessels.

As the wider issues relating to the management of the tuna fishery and rights of recreational fishers have yet to be fully defined, it is unclear what level of future monitoring may be required. The current study provides insight into the recreational and charter fisheries and highlights some of the logistical issues that will need to be addressed in the development of any future monitoring programs that support the management of the fishery.

Table of Contents

EXECUTIVE SUMMARY	1
1. INTRODUCTION	4
2. METHODS	7
2.1 SURVEY DESIGN	7
2.1.1 Overview	7
2.1.2 On-site surveys.....	7
2.1.3 Charter Boat Logbook	9
2.1.4 Gamefish Angler Diary	10
2.2 DATA ANALYSIS	11
2.2.1 On-site survey data	11
2.3 WEATHER CONDITIONS	11
3. RESULTS AND DISCUSSION	12
3.1 ON-SITE SURVEY	12
3.1.1 Overview	12
3.1.2 Club membership.....	13
3.1.3 Pirates Bay.....	14
3.1.3.1 Overview.....	14
3.1.3.2 Weather and fishing activity	15
3.1.3.3 Catch and effort estimates.....	15
3.1.4 Southport	16
3.2 GAMEFISH DIARY.....	17
3.2.1 Overview	17
3.2.2 Trip Characteristics	17
3.2.3 Catch.....	17
3.3 CHARTER BOAT LOGBOOK	19
3.3.1 Overview	19
3.3.2 Trip Characteristics	20
3.3.3 Catch.....	20
3.4 SIZE COMPOSITION	22
3.5 SBT CATCH ESTIMATES.....	24
4. CONCLUSIONS	26
4.1 GENERAL.....	26
4.2 FUTURE MONITORING	27
5. ACKNOWLEDGEMENTS	29
REFERENCES	29

1. Introduction

A recreational gamefish fishery has existed in Tasmania for many years but limited information is available relating to levels of catch, effort and participation. In the context of the overall recreational fishery, gamefishing may be a rare activity but it has a high profile in terms of the species targeted, capital investment in boats and fishing gear, and tourism impacts.

The fishery operates predominantly between January and June each year and species composition and abundance are highly variable throughout the season and between years. Trophy species are southern bluefin tuna (SBT) (*Thunnus maccoyii*), yellowfin tuna (*Thunnus albacares*), black marlin (*Makaira indica*) and striped marlin (*Tetrapturus audax*). There are also often large catches of albacore (*Thunnus alalunga*) and striped (skipjack) tuna (*Katsuwonus pelamis*) and occasional catches of mako shark (*Isurus oxyrinchus*).

The fishery is concentrated along the north-east, east and south-east coasts, with St Helens in the north-east and Eaglehawk Neck (Pirates Bay) in the south-east representing the main centres of the fishery. Significant gamefishing activity also exists off Flinders Island.

Traditionally, the recreational SBT fishery has been centred off the Tasman Peninsula (particularly from Pirates Bay), with most catches taken between April and May, but occasional catches as early as January and as late as July. Sporadic catches of SBT have also been reported in the past from the east-coast, as far north as Flinders Island, while in recent years there has been increased activity (and catches) off southern Tasmania, particularly off Southport, south of Bruny Island and around Pedra Branca (approximately 20 nautical miles south of the Tasmanian mainland).

Despite the significance of the gamefish fishery in terms of participation, effort and economic activity (including charter boat operations), very little research has been conducted into any aspects of the fishery. The only available data on the gamefish fishery in Tasmania are reports by Smith (1994) and Evans (1995) on the catch of tuna from charter boats, and the recently completed National Survey of Recreational Fishing (Henry and Lyle, 2003). Some size composition information for recreational tuna catches is also available (Lyle and Campbell, 1999; Lyle et al., 2002).

In 1993, the estimated catch of SBT by charter operators in Tasmanian waters was 12.5 tonnes (678 fish) (Smith, 1994), almost double the catch of 6.9 tonnes (295 fish) taken the following year (Evans, 1995). Evans (1995) established that SBT accounted for just 2% of the tuna catch (all species) by number from north of Bicheno, compared to 26% of the catch taken to the south of Bicheno. However, charter vessels represent just one component of the recreational fishery, with a significant proportion of the catch caught by fishers from privately operated vessels. To get a comprehensive assessment of the total catch of SBT, it is important to use an assessment technique that incorporates all components of the fishery.

The National Survey, conducted in 2000/01, incorporated all components of the recreational fishery. However, as gamefishing is a 'rare' activity in the context of the overall fishery it was not well represented and as a result there is considerable uncertainty surrounding the precision of gamefishing catch and effort estimates. This uncertainty is reflected in the large standard error (relative standard error of 42%) associated with the harvest estimate of 12,700 tuna for Tasmania between May 2000 and April 2001 (Henry and Lyle, 2003). More detailed analysis of the data set revealed that over the 12-month survey a further 7,400 tuna were released by anglers and that there were approximately 9,600 fisher trips in which gamefish were targeted, one quarter of which resulted in no gamefish being caught. Overall, 36% of the trips, and 30% of the tuna catch, occurred off the north-east coast (around St Helens). By comparison, 56% of the trips, and two thirds of the catch, were taken off Tasman Peninsula. By species, albacore dominated accounting for 74% of catch, followed by SBT (about 12% of the total), and striped tuna (7%). As noted, the catch estimates have associated uncertainty but the National Survey did serve to confirm the importance of the gamefish fisheries in the St Helens and Tasman Peninsula regions, and the fact that albacore dominate the recreational tuna catch in Tasmania.

Size composition information for recreationally caught tunas in Tasmania is available from creel surveys conducted in 1997/98 (Lyle and Campbell, 1999) and 2000/01 (Lyle et al., 2002). In the earlier survey, SBT sampled from the Tasman Peninsula averaged 109 cm fork length (FL) or 28 kg, the largest fish measured being 160 cm FL. No SBT were measured in the 2000/01 survey conducted between September 2000 and April 2001, reflecting in part the limited coverage of landings at Pirates Bay. In both surveys, albacore were the most abundant tuna species sampled.

NSW Fisheries have coordinated a national gamefish tagging program since 1974 and this dataset represents a potential source of information about previous SBT catches. The first record of an SBT tagged in Tasmanian waters was in 1980 but since then very few fish have been tagged. Between 2001 and 2002 a total of 138 fish were tagged, representing over 60% of all tagged fish for Tasmania since 1980. Given the low numbers, it is not possible to use these data to infer any patterns in annual catches. When the size of tagged fish is compared between regions it is evident that the largest fish were tagged off Tasmania (average 96 cm and 20 kg), followed by South Australia (86 cm) and Victoria (77 cm). The smallest fish were caught in New South Wales and Western Australia (61 and 52 cm respectively). However, these data are confounded by the fact that the size of retained fish is unknown, and thus the size of tagged fish may not be representative of the overall catch.

SBT is a valuable species that forms the basis of a significant commercial fishery in Australia and other countries in the Asia-Pacific region. Due to international concern about the conservation of stocks, an international body, the Commission for the Conservation of Southern Bluefin Tuna (CCSBT) was established in 1994, of which Australia (along with Japan and New Zealand) was a founding member. The CCSBT is responsible for the setting of the global total allowable catch (TAC) and allocation amongst its members. The Australian TAC is currently 5265 tonnes, all of which has been allocated to the commercial sector. This effectively means that management authorities have not accommodated the recreational fishery in the national allocation

and the rights and access to the resource for both commercial and recreational fishers needs resolution.

Management of SBT is further complicated by the fact that, although the Commonwealth is responsible for the management of tunas, the states provide the only effective management of the recreational sector. Recreational tuna fishing in Tasmanian waters is currently managed through a combined daily bag limit of two fish for any of SBT, Yellowfin tuna, and Bigeye tuna (*Thunnus obesus*). In addition, a possession limit of three fish applies to these species.

This project aims to provide an accurate assessment of the recreational catch of SBT in Tasmania and thereby contribute to resolving inter-sectoral resource allocation issues. The project has three main objectives:

- Quantify the recreational catch of SBT for the 2003 fishing season.
- Describe the biological characteristics of the recreational SBT catch.
- Evaluate options for future monitoring of the recreational and charter fisheries for SBT.

In addition, catch and biological information will be collected for other gamefish species.

2. Methods

2.1 Survey design

2.1.1 Overview

For the purposes of this study fishers have been categorised as gamefish club members (by definition clubs affiliated to the Tasmanian Gamefishing Association (TGFA)) or non-affiliated anglers (but also including members of non-TGFA affiliated fishing clubs). Fishing may occur from charter boats or privately operated trailer boats or motor cruisers, with some fishers utilising both charter and private boats within a given fishing season. Recognising these categories, a methodological approach utilising several sampling techniques was used to assess catch, effort and the biological characteristics of the tuna catch. Three primary sources of information have been used in this study; (i) on-site or creel surveys, (ii) charter boat logbooks and (iii) gamefish angler diaries. Collectively, these data sources have the potential to provide complete coverage of the fishery along with some degree of cross-referencing or validation. Secondary data sources used in this study include catch information from gamefish competitions and opportunistic or anecdotal catch reports.

Due to logistic and budgetary constraints, the focus of this study has been on the tuna fishery off the Tasman Peninsula, and as such the survey does not provide a comprehensive assessment of the SBT nor the entire gamefish fishery in Tasmania. Results do provide minimum estimates of catch and effort for the 2003 fishing season, with some insights into the nature of the gamefish fishery.

2.1.2 On-site surveys

The on-site survey was implemented to cover the (anticipated) period of most intensive fishing for SBT, April and May 2003 inclusive, and was centred on the Pirates Bay boat ramp and jetty (Figure 1). The survey involved a stratified random sampling design with all possible fishing days in the survey period divided amongst 3 strata; *viz* (i) weekdays, (ii) weekends and public holidays, and (iii) fishing competitions. For the weekday stratum, 15 out of the total of 40 days were selected, providing a sampling rate of 37%. As anecdotal information suggested that most fishing effort occurred on weekends and public holidays, a higher sampling rate was applied to this stratum, with 13 out of the total of 19 days selected, providing just under 70% coverage. In relation to fishing competitions, all three days of the annual Tom Jenkins Memorial Bluefin Championship (25 - 27 April) were included in the survey.

Initially, a further eight days (across all strata) were randomly allocated to survey boat ramps at Fortescue Bay and Port Arthur, providing supplementary information about fishing effort for comparison with effort levels out of Pirates Bay. In addition, information on the total number of boat trailers at Fortescue Bay was compiled opportunistically on a daily basis by the ranger at Fortescue Bay.

In addition to the Tom Jenkins Memorial Bluefin Championship, there are five other major gamefishing competitions held annually in Tasmania, two based out of St Helens and one each at Flinders Island, Coles Bay, and Southport. Due to financial constraints coverage of all competitions was not possible. However, all days of the G.N. Electrical Competition at Coles Bay and the Far South Competition at Southport were surveyed, these competitions being considered the most likely to include some SBT captures.

A standard interview was used for all on-site surveys. Creel clerks started at midday each day and finished when all boats were off the water, or when all known gamefish boats had been taken into account¹. At the start of each session the number of boat-trailers was recorded, and throughout the sampling session any boats being launched or retrieved (or recreational boats docking at the jetty or on moorings) were noted. At the end of each session the number of boats that had been retrieved, number of trailers remaining, and number of interviews were compiled along with weather observations and any additional comments.

Anglers were interviewed at the boatramp or at the jetty upon completion of the fishing trip. Structured interviews were conducted with the type of fishing activity undertaken established at the outset. If the party had not been engaged in gamefishing, the type of activity was classified and the interview terminated. For gamefishing trips, regardless of whether any fish were caught or not, the number of fishers, their gender, and whether or not they belonged to a gamefishing club was established. Furthermore, it was established whether the trip was undertaken as part of a fishing competition (including club rally days), and whether it was a chartered fishing trip. The time spent gamefishing, general fishing location, method (bait, lures or both) and catch numbers (kept, released and tagged) by species were also ascertained. Where feasible, fish were measured for fork length. Finally, for each fisher it was established whether they had participated in the survey previously and, if not, they were questioned about personal catches (kept and released) of SBT taken off Tasmania during 2003 (i.e. prior to interview). Fishers who had been interviewed previously were asked whether they had caught any SBT in the period since their last interview. All respondents were also asked to recall the number of days fished for tuna (in Tasmania) during 2002 and to estimate the number of SBT personally caught (kept and released) during the 2002 season. By identifying first time survey respondents, multiple counting of fishing history for respondents interviewed more than once could be avoided.

¹ Information provided by TGFA members and charter boat operators confirmed that very few game boats would be expected to return from fishing trips before midday.

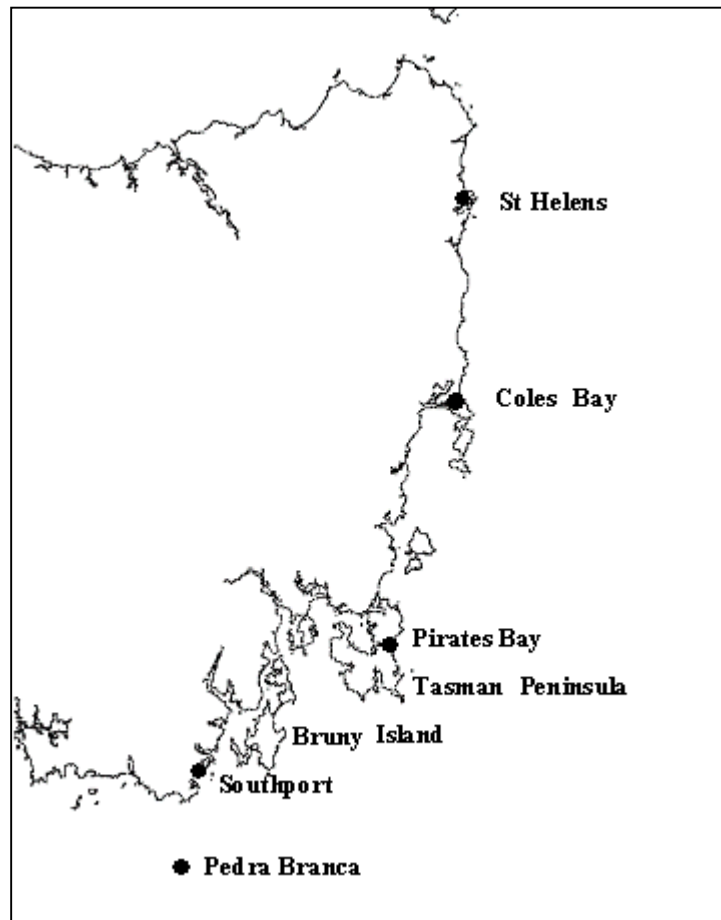


Fig. 1. Map of Tasmania showing important gamefishing locations

2.1.3 Charter Boat Logbook

A charter boat logbook developed by the Sea Charter Boat Operators of Tasmania (SCBOOT) and managed by DPIWE and TAFI was implemented in early 2003, with logbooks distributed to all SCBOOT members. Logbooks were also sent to four non-member charter boat operators recognising the potential for these operators to catch SBT. Charter operations occur around Tasmania and therefore logbook coverage is State-wide.

Completion of the logbook was voluntary and thus the actual coverage of the charter industry (based on catch returns) is uncertain. Furthermore, since logbooks were not available prior to the start of 2003, some early season fishing activity will not have been reported. To address such concerns and to ensure complete coverage of any SBT catches, participating charter operators were contacted in June 2003 and questioned about the numbers of SBT caught during the 2003 season, thus filling in the information gaps and also allowing some cross-referencing with logbook returns.

The Charter Boat logbook provided a daily summary of the charter operations and was comprised of four sections; *viz* trip details, charter activity type(s), catch information and wildlife interactions. In trip details, date, vessel name, skipper and crew details, port of operation, departure and return times, main fishing area (using fishing blocks that apply to commercial fishers) and number of clients were recorded. Several categories of fishing activity² were distinguished, with gamefishing of relevance to this study. Effort was recorded in terms of fishing duration and number of lines fished. When fish were caught, the species and numbers retained and released, and total retained weights were routinely recorded. Fish lengths were an optional piece of information. The wildlife interaction section was used to document whether any interactions with seabirds or marine mammals occurred, the species involved and the type(s) of interaction(s).

This logbook is ongoing and only gamefishing operations during the period January to the end of June 2003 have been included in the analyses.

2.1.4 Gamefish Angler Diary

The TGFA is the main body representing recreational gamefishing in Tasmania, with four affiliated clubs; the Tuna Club of Tasmania, St Helens Gamefishing Club, Gamefishing Club of Northern Tasmania and Southern Gamefishing Club. These clubs have a combined membership of over 600 persons. At the end of February 2003 the TGFA executive, in conjunction with TAFI, mailed out fishing diaries to all club members. The diaries were voluntary and were designed to encompass gamefishing activities to the end of June. At the completion of the survey period, fishers were requested to return the completed diaries (even if no fishing or no catch was taken) to the TGFA using reply paid envelopes.

Data was provided on a daily or trip basis. Details include, date, whether fishing was part of a competition/club rally or not, fishing location, number of fishers, total hours fished and fishing method(s). In the personal catch section, the numbers of tuna and other gamefish by species caught (kept and released) on the trip was recorded. In an optional section, the total catch of SBT, albacore, yellowfin and striped tuna taken by all fishers on the boat was recorded. This latter section allowed for some cross-referencing with diary returns from other fishers, and also provided coverage in situations where not all fishers on a trip completed the diary or were participating in the diary survey (such as non-club members).

² Includes non-fishing activities, for example eco-tours.

2.2 Data analysis

2.2.1 On-site survey data

Expansion factors for the catch and effort analyses were calculated as the proportion of gamefish parties (boats)³ interviewed across all survey days (i.e. to account for parties that were not interviewed on any given day) multiplied by the proportion of days sampled for that stratum.

Catch (number of tuna per gamefishing party) distributions exhibited strong non-normality indicating that statistical methods that assume an underlying normal distribution were not appropriate. As an alternative, bootstrapping techniques (5,000 replicates) were applied to the data, with expansion factors for each stratum calculated as above. Confidence limits were determined using the percentile method (Haddon, 2001).

2.2.2 Logbook and diary data

Non-response proved to be an important issue in the charter boat logbook and angler diary components of this study. Thus information was simply summed across all respondents to produce *minimum* estimates of catch and effort. Expansion of such data to account for persons who did not respond (i.e. did not complete and return the logbook or diary) was considered problematic, primarily because the behaviour (i.e. level of fishing activity and catches) of these non-respondents is likely to be quite different to respondents. Thus without empirically determined non-response adjustments, large biases could be introduced in the data. Non-response is a common problem encountered with fishing surveys, especially those involving voluntary self-administered reporting systems as used for the charter boat logbook and gamefish angler diaries.

2.3 Weather conditions

Weather observations from the Bureau of Meteorology were obtained for Tasman Island from 1st March to 30th June 2003 in order to investigate possible correlations between fishing effort and weather conditions. Data variables are recorded at 3 hourly intervals throughout the day, and include wind direction (compass points), wind speed (kts), temperature (°C) and precipitation (mm).

³ Some subjectivity was necessary in determining whether non-interviewed parties had been gamefishing or not, however, in the vast majority of instances we are confident that based on the type of vessel, presence of gamefishing gear and information provided by other fishers we have accurately categorised fishing parties.

3. Results and Discussion

3.1 On-site survey

3.1.1 Overview

Out of the 31 sampling sessions (fishing days) allocated at Pirates Bay, 26 were actually surveyed. Sampling sessions on two weekdays were abandoned due to bad weather (and not replaced), and three weekday sessions were cancelled late in the season, due to low (negligible) levels of effort (and catch) observed in previous sessions. All three days of the Bluefin Championship were surveyed.

Fortescue Bay and Port Arthur were not surveyed as originally intended due to very low fishing effort originating from both sites. Between 1-3 trailers on weekdays, and 2-9 trailers on weekends, were recorded by the park ranger at Fortescue Bay. Most fishing effort out of Fortescue Bay was concentrated over the Easter long weekend (18 – 27 April) with the number of trailers on some days exceeding 30 (although the proportion of gamefish parties is unknown, anecdotal evidence suggests that it was probably greater than half). Anglers who fished from Fortescue Bay were predominantly camping at the site. Only two gamefishing parties were interviewed at Port Arthur (no catch was taken). Data for Fortescue Bay and Port Arthur have not been used in subsequent analyses.

The G.N. Electrical Competition at Coles Bay was abandoned due to bad weather and no fishing was undertaken. Both days of the Far South competition were surveyed as intended.

Over the survey period, 402 fishing parties were interviewed at all sites, seventeen of which had fished from charter boats. Due to time restrictions at the boat ramp, and a desire to keep the disruption of clients to a minimum, charter boats were not consistently surveyed. However, in Pirates Bay, coverage of charter boat fishing activity was achieved through the Charter Boat logbook. Unless otherwise specified, trip and catch information from charter boats has been excluded from the on-site survey analysis.

Over 98 % (395) of fishing parties provided a full response, with only seven interviews obtaining incomplete data, two of which were a refusal to answer at least one section of the interview. The remaining five incomplete responses were because of time constraints at the boat ramp, requiring the interview to be terminated prior to completion.

3.1.2 Club membership

Gamefishing parties, including charter boats, accounted for 345 interviews with 1083 fishers characterised as to their club affiliation. This is a cumulative measure of fishers encountered during the survey as fishers could potentially be interviewed on multiple occasions. Club members accounted for around half of the fishers interviewed, and not unexpectedly comprised the majority of fishers at the Pirates Bay and Southport gamefish competitions, 70% and 87% respectively (Table 1). However, on weekdays and weekends and public holidays, club members accounted for just 17% of the total number of gamefishers.

Table 1. Number of interviews based on club membership and gender.
Some fishers were interviewed on multiple occasions

Location	Strata	TGFA member		Non affiliate	
		Male	Female	Male	Female
Pirates Bay	W'days	8	0	44	3
Pirates Bay	W'ends	65	3	293	29
Pirates Bay	Comp's	324	16	131	12
Port Arthur		0	0	6	0
Southport		128	2	18	1
Total		525	21	492	45

As it was established whether fishers had been interviewed previously, it was possible to determine the actual number of persons who participated in the survey, noting that some individuals were interviewed more than once. Based on first-time interviews we estimate that 677 fishers participated in the survey, of whom one third were gamefish club members, indicating that club members were more likely to have been interviewed on multiple occasions (Table 2). Gamefishing is a predominantly male activity, with females comprising just 7% of all fishers interviewed.

Table 2. Number of persons interviewed based on club membership and gender
Based on first-time interviews

Location	Strata	GFA member		Non affiliate	
		Male	Female	Male	Female
Pirates Bay	W'days	5	0	40	3
Pirates Bay	W'ends	46	1	263	26
Pirates Bay	Comp's	122	6	93	9
Port Arthur		0	0	6	0
Southport		41	1	14	1
Total		214	8	416	39

3.1.3 Pirates Bay

3.1.3.1 Overview

At Pirates Bay, 278 gamefishing parties were interviewed, half of which occurred during the Tom Jenkins Memorial Bluefin Championship (Table 3). According to TGFA records, 54 parties (boats) including several on charter boats registered for the competition, of which 49 were interviewed at least once by survey clerks (not all vessels in the competition moored or landed at Pirates Bay). Over the three days of the competition 17 parties were interviewed once, 15 twice and 17 on all three days.

Despite allocating one quarter of the sampling effort to weekdays they yielded just 5% of the recorded fishing effort. A total of 98 non-gamefishing parties were encountered at Pirates Bay, of which around half were interviewed. Of the remainder, non-gamefishing parties were identified by direct observation of activity (vessels operating within sight of the boat ramp), gear carried (e.g. rock lobster pots) and boat type or class.

Table 3. Sampling rates and numbers of vessels surveyed (excluding charter boats) at Pirates Bay between April–May 2003

	Stratum			Total
	Weekdays	Weekends	Comp's	
Total no. of days	40	19	3	62
No. of days surveyed	10	13	3	26
Proportion of days surveyed	0.25	0.68	1	0.42
No. of gamefish boats	17	133	142	292
Gamefish boats surveyed	14	123	141	278
Proportion of gamefish boats surveyed	0.82	0.92	0.99	0.95
No. of non gamefish boats	26	65	7	98

Excluding charter operators, a total of 914 fish representing three species were caught, of which 70% were retained (Table 4). Albacore accounted for 94% of the retained catch by number, with very small quantities of striped tuna and mako shark also taken. Of the 235 albacore that were released, 109 were tagged. The total catch of albacore caught by fishers surveyed in the Bluefin Championship (including those who fished on charter boats) was 598, of which 374 were retained (many of which were not weighed in). No SBT were caught by any fishing parties that were sampled during the on-site survey.

No gamefish were caught on 114 (41%) trips, of which 76 were in April, and 38 in May. The lower number of nil catches in May reflects a decrease in effort, rather than a change in success rate.

Table 4. Reported catches (no.) of gamefish taken at Pirates Bay between April–May 2003.

	Total	Kept	Tagged
Albacore	897	662	109
Striped tuna	15	8	0
Mako shark	2	2	0
Total	914	672	109

3.1.3.2 Weather and fishing activity

For Tasman Island, wind speed, in combination with direction (the two variables thought most likely to influence fisher behaviour) were investigated to determine possible relationships between weather and recreational fishing effort (number of boats) out of Pirates Bay. Wind speed tended to be variable over a given 24 hour period, and for analysis the average 3-hourly wind speeds for the period 0300 - 1200 hrs was estimated, this being the time frame that fishers are most likely to use when making judgements about whether or not to fish. Average wind speed for each day of the survey period was plotted against the total number of boats (both gamefish and non gamefish) that fished out of Pirates Bay that day (Fig. 2). Virtually no fishing occurred on days with average wind speeds of greater than 20 knots, with greatest activity observed on days when wind speeds averaged less than 15 knots. In terms of subsequent data analysis it was decided to infer zero fishing effort for non-sampled days when wind speeds averaged greater than 20 knots. Only two days, 18 and 31 May, fitted this criterion. It is reasonable to assume that there was no fishing on these days, especially as both occurred late in the survey when fishing effort targeted for gamefish species was already very low.

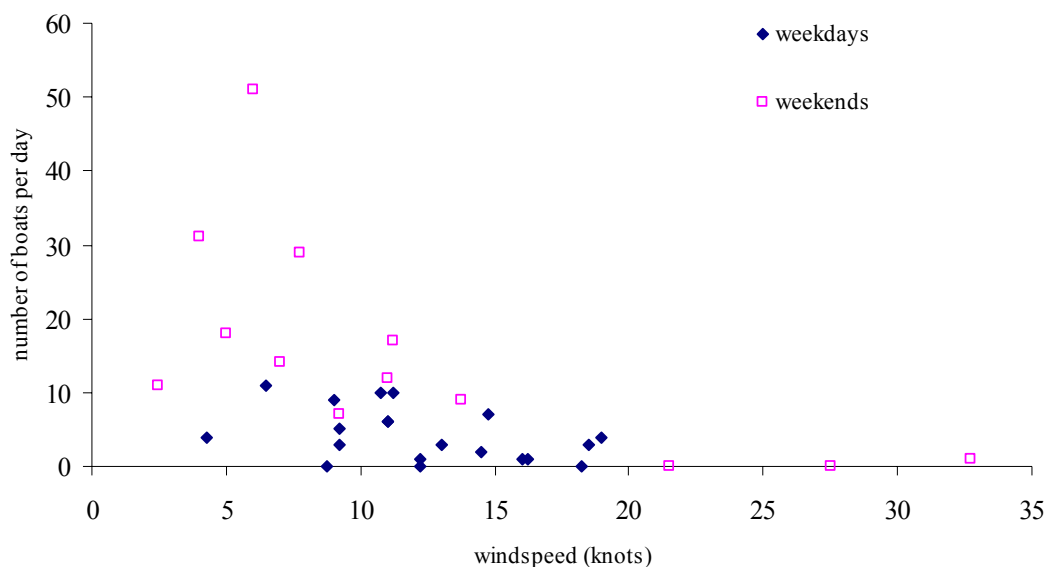


Fig. 2. Average daily wind speed and numbers of boats (by day type) fishing from Pirates Bay between April–May 2003.

3.1.3.3 Catch and effort estimates

By expanding the survey data to account for sub-sampling, a total of 383 private vessel gamefishing trips were estimated to have been undertaken out of Pirates Bay between 1st April and 31st May 2003, yielding a total catch of 1053 tuna (95% CI of 893-1217) of which 801 (679-993) were retained (Table 5). Albacore dominated, with an estimated 1025 fish (870-1193) or 97% of the tuna catch, of which 790 (667-923) were retained.

The retained weight of albacore was calculated using the average size determined from length measurements (refer section 3.4) and the length-weight relationship:

$$W = 1.09 \times 10^{-5} * L^{3.14}$$

where W is body weight (kg), L is fork length (cm) (source AFMA).

Recreational fishers (private vessels) fishing out of Pirates Bay retained approximately 3.2 tonnes of albacore over the survey period. It is not, however, possible to estimate the total weight of albacore caught as we have no information on the size of fish that were released. Weight estimates for striped tuna are also not available as very few individuals were measured for length.

Table 5. Expanded catch estimates (no. and weight) for tuna taken by privately-owned vessels fishing out of Pirates Bay between April-May 2003.

95% Confidence Intervals (CI) are not estimated for striped tuna due to low numbers.

Species		Total catch estimate	95% CI	Retained catch estimate	95% CI
Albacore	No.	1025	870 - 1193	790	667 - 923
	Wt(t)	-	-	3.2	2.7 - 3.7
Striped tuna	No.	28	-	11	-
Total tuna	No.	1053	893-1217	801	679-993

3.1.4 Southport

On both days of the Far South competition, all boats returning to the Southport boat ramp or jetty were intercepted, and the fishing parties interviewed. In total, 56 fishing parties were interviewed, of which 49 had gamefished (all of which were in the competition). The gamefishers belonged to 34 different parties, with several parties interviewed on both days of the competition. This is fewer than the 44 boats that registered with the TGFA to take part in the competition, but it is known that some parties did not return to the Southport jetty or boat ramp to weigh-in fish. No tuna were caught on either day of the competition.

3.2 Gamefish Diary

3.2.1 Overview

Out of a total of 612 diaries that were sent to club members in February 2003, only 57 were returned at the completion of the season, representing a response rate of less than 10%. Of those fishers who did respond, nine did no gamefishing during the survey period, resulting in fishing data for just 48 diarists. The very poor response rate means that expansion of the data could not be justified, and subsequent analyses are, therefore, limited to the simple aggregation of information.

3.2.2 Trip Characteristics

Diarists reported 357 trips, or an average of just over 7 trips per fisher, of which over half (59%) were on club competition or rally days (Table 6). Most fishing activity occurred in March and April, with these two months accounting for 90% of fishing trips over the four-month survey period. Overall, diarists caught gamefish (tuna or pelagic sharks) on about 70% (225) of the fishing trips, with success rates declining through the season, from about 88% of trips in March, to 75% in April and to just 13% in May.

Fishing duration was recorded for 327 trips, representing a total of 2188 hours fishing time or just under seven hours per fishing trip. Lures were used exclusively on 91% of trips, both bait and lures on 7%, and bait only was used on just 2% of trips. Bait was generally used when targeting mako or blue sharks.

Table 6. Monthly reported fishing activity by diarists between February- June 2003

Month	No. of diarists		No. trips	% Trips
	Did not Fish	Fished		
February*		1	3	1
March	12	44	187	52
April	17	39	136	38
May	38	15	30	8
June	52	1	1	<1
Total			357	100

* February was out of scope of the survey period

3.2.3 Catch

A total of 798 fish across seven species, were caught by diarists, of which just under half were retained (Table 7). This represents an average catch rate of 2.2 fish per trip. Albacore dominated the catch by numbers, accounting for 56% of the total, and striped tuna (35% of the total) were of secondary importance. Low numbers of yellowtail kingfish, yellowfin tuna, SBT and pelagic sharks were also recorded. Slightly more than half of the albacore, yellowtail kingfish, SBT and mako shark were retained, whereas just one quarter of the striped tuna were retained. All yellowfin tuna were retained.

Table 7. Total reported catch (no.) by responding gamefish club diarists.

	Catch	Kept	% Retained
Albacore	452	269	59
Striped tuna	286	78	28
Yellowfin tuna	17	17	100
Southern bluefin tuna	10	7	70
Mako shark	10	6	60
Blue shark	1	0	0
Yellowtail kingfish	22	12	54
Total	798	389	45

Fishing location was recorded for the majority (90%) of trips, and these have been grouped into two regions separated at about Bicheno, north-east (including St Helens, and Flinders Island) and the south-east (including Freycinet Peninsula, Tasman Peninsula and Southport). Albacore and striped tuna dominated catches in both areas, whereas yellowfin tuna and blue shark were restricted to the north-east, and SBT were only recorded from the south-east (Table 8). Mako shark and yellowtail kingfish were recorded in low numbers in both regions.

Table 8. Regional breakdown of catches (no.) by responding gamefish club diarists.

Species	North-east		South-east	
	Catch	Kept	Catch	Kept
Albacore	133	95	253	124
Striped tuna	78	23	156	33
Yellowfin tuna	15	15	0	0
Southern bluefin tuna	0	0	10	7
Mako shark	7	3	3	3
Blue shark	1	0	0	0
Yellowtail kingfish	21	11	1	1
Total	255	147	423	168

Although most of the fishing effort (59%) occurred on competition or rally days, these trips accounted for only 39% of the total catch taken, due mainly to lower striped tuna catches on competition days (Table 9). Yellowfin tuna were the only species for which greater numbers were caught on competition or rally days.

Table 9. Total catches (no.) taken on competition (or rally days) versus non-competition days by responding gamefish club diarists.

Species	Non-comp.		Comp.	
	Catch	Kept	Catch	Kept
Albacore	218	143	234	126
Striped tuna	220	57	66	21
Yellowfin tuna	2	2	15	15
Southern bluefin tuna	10	7	0	0
Mako shark	9	5	1	1
Blue shark	1	0	0	0
Yellowtail kingfish	22	12	0	0
Total	482	226	316	163

In order to link diary and on-site surveys, we have restricted analysis to trips out of Pirates Bay. March and April were the only months in which diarists reported gamefish catches, with 2 SBT taken in March (prior to the on-site survey) but none in April or May (Fig. 3). Over 110 albacore and 25 striped tuna were taken between March and April, of which 73 albacore and 2 striped tuna were taken during the period that corresponded to the on-site survey.

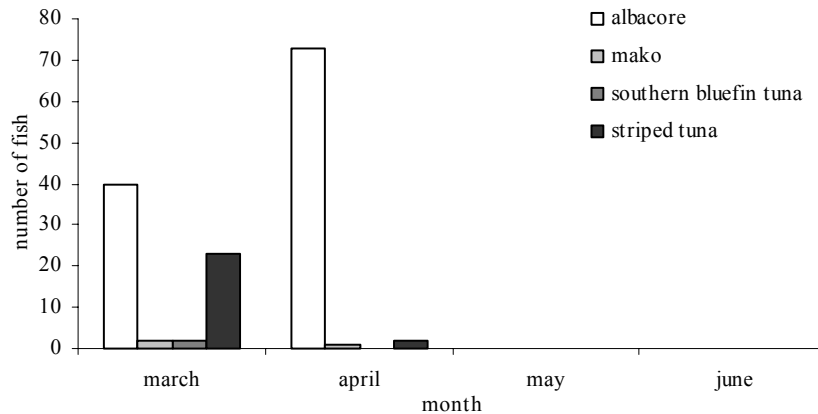


Fig. 3. Retained monthly catches (no.) for diarists fishing out of Pirates Bay during 2003.

3.3 Charter Boat logbook

3.3.1 Overview

Ten charter boat operators who had conducted gamefishing operations over the period January to June 2003 returned information recorded in the logbooks. A further seven operators were identified as having conducted gamefishing operations over the same period, but as at September 2003 no information had been received.

In June 2003, all charter operators, including non-SCBOOT members who were known to conduct gamefishing charters, were contacted by telephone and asked to recall the approximate number of gamefishing trips and the number of SBT kept and released over the 2003 season. This survey was designed to provide coverage of SBT catches that may have been taken prior to the introduction of the logbook, and catches taken by operators who did not submit catch returns or participate in the logbook system. In analysing the data we have been careful to avoid double counting of catches reported in logbook, as well as the telephone survey, and are thus confident that information on the 2003 charter catch of SBT is comprehensive.

Trip information and the catches of species other than SBT are not, however, complete due to logbook non-response and non-coverage (some early season catches). It is uncertain as to how representative those charter operators who provided logbook returns are of those who did not and, therefore, it would not be valid to scale-up logbook data to account for non-responding operators.

Five charter boat operators are known to have conducted gamefishing operations from Pirates Bay between January and June 2003, all of whom apparently completed the logbook. Information was, however, only made available from three operators, the logbook of one operator was lost as a result of the vessel sinking. The two operators who had not submitted returns were contacted by telephone in September 2003 and asked to recall the total number of trips and the catch of albacore and SBT taken during 2003. The number of trips and the catch of albacore and SBT are thus comprehensive for Pirates Bay, although some of the input data may have been approximated.

3.3.2 Trip Characteristics

Seventeen charter boat operators conducted gamefishing charters during 2003, with an estimated 350 gamefish trips completed, of which 247 (about 70%) were recorded in the logbooks. All gamefishing operations were conducted off the east-coast, with 42% of trips reported from the north-east and 58% from the south-east coast.

Around 23% of all recorded trips occurred between January and February, however this may be an underestimate as logbooks were still being distributed at this time. The number of trips peaked in March (34%) before declining thereafter, from 29% in April to 13% in May to just a single trip conducted in June. Overall, gamefish were caught on 84% of charter trips involving gamefishing and 81% of trips originating from Pirates Bay.

Information on the numbers of clients and fishing duration was recorded for the vast majority of trips and averaged 6 persons and 6 hours fishing per trip.

3.3.3 Catch

Over 3,200 fish⁴ were caught on gamefishing charters, of which 75% were retained (Table 10). The vast majority of the albacore, mako shark, yellowfin tuna, and yellowtail kingfish were retained. All SBT, and half of the striped tuna were retained, whereas all striped marlin were released.

Albacore dominated catches by numbers, accounting for 62% of the total catch, striped tuna followed in importance (34% of the total catch). Trophy species such as yellowfin tuna, striped marlin, mako shark and SBT were all caught in low numbers. In fact only five SBT were recorded in logbook returns, all caught from Pirates Bay between February and March 2003. A further 13 were reported as part of the follow-up telephone survey suggesting that at least 18 SBT were caught from charter boats in Tasmania during 2003.

The majority of the gamefish catch (over 75%) was taken in March and April with catches dropping off markedly in May. Catches in January and February were low, however, as noted above this is confounded by the fact that logbooks were still being distributed at this time.

⁴ Excluding by-catch species such as barracouta and Australian salmon.

Almost nine tonnes of albacore was caught and retained by persons who fished from charter boats in 2003. Albacore was the only species to show a seasonal trend in size, the smallest fish (average of 3.8 kg) caught in January, increasing in size each month until the largest fish (average 6.3 kg) were caught in May. Over one tonne of mako shark, striped tuna and yellowfin tuna was also retained.

For comparison with the on-site survey (section 3.1.3), charter boats operating out of Pirates Bay took 500 albacore between April and May, approximately half of the estimated non-charter catch, and consistent with the gamefish sector, no SBT were taken.

Table 10. Total and retained catches (no. and weight) by month based on 2003 charter boat logbook data.

Note: not all kept fish were weighed

Species		January*	February*	March	April	May	Total
Albacore tuna	Catch (no.)	69	205	658	885	204	2,021
	Kept (no.)	59	186	597	715	171	1,728
	Weight (kg)	224	832	2,788	3,706	1,069	8,619
	Av. wt (kg)	3.8	4.5	4.9	5.6	6.3	5.2
Striped tuna	Catch (no.)	16	171	764	145	7	1,103
	Kept (no.)	10	131	356	76	3	576
	Weight (kg)	15	345	574	171	5	1,110
	Av. wt (kg)	1.5	3.1	2.0	2.3	1.7	2.3
Yellowfin tuna	Catch (no.)	7	11	39	11	0	68
	Kept (no.)	7	10	34	11	-	62
	Weight (kg)	180	167	714	170	-	1,231
	Av. wt (kg)	25.7	16.7	21.0	15.5	-	19.8
Southern bluefin tuna	Catch (no.)	0	3	2	0	0	5
	Kept (no.)	-	3	2	-	-	5
	Weight (kg)	-	85	31	-	-	116
	Av. wt (kg)	-	28.3	15.5	-	-	23.2
Striped marlin	Catch (no.)	0	2	2	0	0	4
	Kept (no.)	-	0	0	-	-	0
	Weight (kg)	-	-	-	-	-	-
	Av. wt (kg)	-	-	-	-	-	-
Mako shark	Catch (no.)	1	4	3	4	0	12
	Kept (no.)	1	4	2	3	-	10
	Weight (kg)	29	335	467	350	-	1,181
	Av. wt (kg)	29.0	83.8	233.5	116.7	-	118.1
Yellowtail kingfish	Catch (no.)	1	2	15	0	0	18
	Kept (no.)	0	2	11	-	-	13
	Weight (kg)	-	4	31	-	-	35
	Av. wt (kg)	-	2.0	2.8	-	-	2.7
Total	Catch (no.)	94	398	1,483	1,045	211	3,231
	Kept (no.)	77	336	1,002	805	174	2,394
	Weight (kg)	448	1,768	4,605	4,397	1,074	12,293

* incomplete coverage of fishing trips

By dividing the east coast into north-east and south-east regions, split at about Bicheno, it was apparent that albacore, mako shark, striped tuna and yellowfin tuna were caught in both regions (Table 11). SBT, however, were only caught in the south, and striped marlin and yellowtail kingfish were only caught in the north.

Table 11 Total and retained catches (no.) by region based on 2003 charter boat logbook data.
North-east and south-east coast divided by a line to the south of Bicheno

Species	North-east		South-east	
	Catch	Kept	Catch	Kept
Albacore	1,015	841	1,006	887
Striped tuna	332	231	771	345
Yellowfin tuna	65	59	3	3
Southern bluefin tuna	0	0	5	5
Striped marlin	4	0	0	0
Mako shark	6	5	6	5
Yellowtail kingfish	18	13	0	0
Total	1,440	1,149	1,791	1,245

3.4 Size composition

This section presents size information combined from the on-site surveys and charter boat logbook returns. Five or more length measurements were obtained for six gamefish species measured by charter boat operators, whereas during the on-site survey, only albacore were measured in enough numbers to provide an estimate of mean length (Table 12).

The average size of SBT was 91 cm for a weight of about 23 kg, however, these observations were based on a sample of only five fish. In a 1998 survey of catches from the Tasman Peninsula it was established that the majority of the SBT ranged from 90 – 130 cm, with a mean length of 109 cm (Lyle and Campbell, 1999). Charter boats reported average weights of 18 kg in 1993 (Smith 1994) and 23 kg⁵ in 1994 (Evans 1995).

The mean lengths of albacore were similar for fish measured by charter operators and by survey staff at Pirates Bay, although the size range for charter boat catches was wider. The length frequency distribution for albacore, based on both data sources combined, indicates that fish ranged between 38 cm (1 kg) and 110 cm (28 kg), with a strong mode at around 51 cm and a mean length of 60.5 cm (4.3 kg) (Fig. 4). Previous surveys of recreational catches have produced similar average sizes for albacore, 60 cm (Lyle and Campbell, 1999) and 55 cm (Lyle et al., 2002).

⁵ Average for south-east coast.

Striped tuna ranged between 33 and 54 cm with a mode at around 40 cm and mean length of 42.5 cm, similar to the mean of 43 cm (range of 32 – 52 cm) obtained by Lyle et al. (2002) (Fig. 5).

Yellowfin tuna ranged between 75 – 120 cm with a mean length of 94 cm, which is substantially larger than the mean of 76 cm reported by Lyle et al. (2002), but less than the 106 cm obtained by Lyle and Campbell (1999). However, in the earlier studies sample sizes were very low (< 5 fish).

Mako shark ranged between 170 – 300 cm with a mean length of 230 cm, significantly greater than the means of 147 cm (Lyle and Campbell, 1999) and 185 cm (Lyle et al., 2002) obtained from previous surveys, however, very few mako shark were measured in previous or the current surveys.

Yellowtail kingfish ranged between 33 - 45 cm with a mean length of 36 cm. In previous studies of the recreational fishery, no yellowtail kingfish have been measured.

Table 12. Length details for gamefish species reported by charter operators during 2003.

Species	Sample size	Mean length (cm)	Min. length (cm)	Max. Length (cm)
Albacore	168	61.3	38	110
Albacore*	176	59.8	45	99
Striped tuna	45	42.5	33	54
Yellowfin tuna	22	94.1	75	120
Southern bluefin tuna	5	91.0	75	100
Mako shark	5	230	170	300
Yellowtail kingfish	6	36.2	33	45

* Measurements obtained from the on-site survey

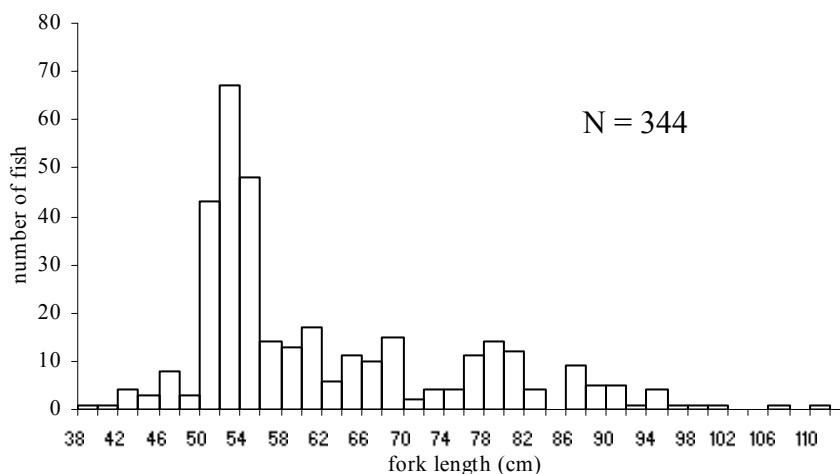


Fig. 4. Length frequency of albacore measured from charter boats and the on-site survey

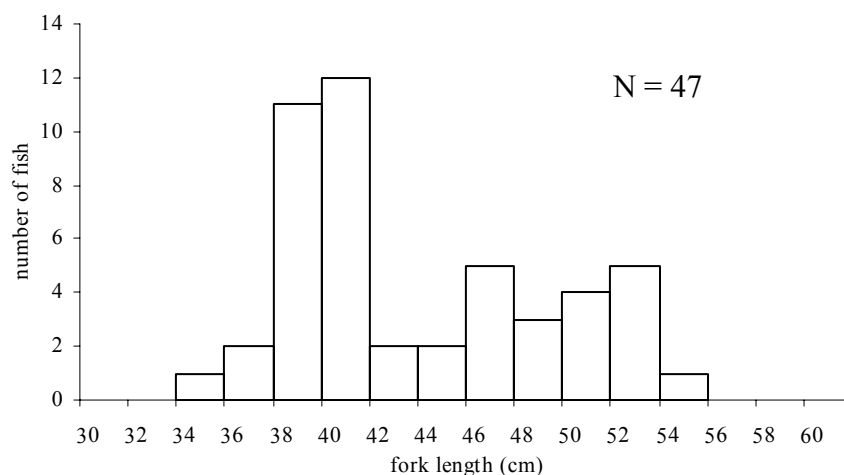


Fig. 5. Length frequency of striped tuna measured from charter boats and the on-site survey

3.5 SBT catch estimates

The primary objective of this study was to provide an estimate of the recreational catch of SBT in Tasmania for the 2003 season. In order to derive the catch estimate we have available five sources of information; 1) on-site survey interviews; 2) gamefishing competition records; 3) gamefish angler diaries; 4) charter boat logbooks, supplemented by a telephone survey; and 5) anecdotal catch reports (confirmed by TGFA executive or TAFI staff). Each component was then cross-referenced with other sources to ensure that fish were not double counted.

The on-site surveys indicated that no SBT were caught from the Tasman Peninsula during April-May, traditionally the peak of the SBT season. Cross referencing of information obtained from charter boat operators and gamefish club members indicated that the only SBT caught off the Peninsula were taken in the months prior to April-May. No SBT were caught at any of the six gamefishing competitions in Tasmania in 2003 and a total of 18 SBT were caught and retained by fishers on charter boats.

The most informative data source about SBT catches proved to be the on-site survey interviews, in which fishers were asked to estimate the number of SBT that they had personally caught in the 2003 season (prior to interview). While recall bias might ordinarily be expected to be a problem, the fact that catches tend to be small in number and memorable (SBT being recognised as a trophy species) and the fishing seasons clearly distinguishable (so telescoping to include catches taken in previous season was unlikely), means that data quality is believed to be good. Fishers reported a total of catch of 121 SBT in 2003, of which 89 were retained.

TGFA club members who returned diaries reported ten SBT caught, of which seven were retained. However, if vessel totals were included, then 15 SBT were caught, of which 13 had been previously accounted for in the recall component of the on-site survey. Charter boat catches accounted for 18 SBT and a further three SBT were confirmed caught outside of the survey. When all data sources are combined, the estimate of the recreational harvest of SBT in 2003 was 112 fish. Based on an average weight of about 23 kg (refer Table 10) this equates to a catch of about 2.5 tonnes.

Location of capture was established for most of the SBT, with the majority (70%) caught off the south coast (off Southport, south of Bruny Island and around Pedra Branca) and just 30% captured off Tasman Peninsula (all early in the season) (Table 13). Anecdotal evidence suggests that catches of SBT in this southern area are increasing, and we received reports suggesting that 2003 was the first season that striped tuna and yellowfin tuna were also caught off Pedra Branca.

Table 13. Locations of SBT caught in 2003

	Total	Kept
Southern Tasmania	69	49
Tasman Peninsula	21	21
Unknown	46	42
Total	136	112

Recreational catch estimates of 136 SBT caught and 112 retained for 2003 are considered conservative since coverage of the fishery was not comprehensive in space and time. Notwithstanding this, 2003 has been described as a very poor season for SBT, an observation that is supported when 2003 catches reported by on-site survey respondents (121 caught, 89 retained) are compared with catches taken by these same fishers in 2002 (1241 caught, 802 retained), a year generally acknowledged to have been a good season for SBT. Although, recall bias will have exerted a greater influence (tending to inflate catches) in the 2002 estimates, the fact that the difference was an order of magnitude greater is significant. The availability of SBT in coastal waters is known to vary markedly between years as reflected in the size of the recreational fishery and thus any form of management based on limiting or controlling catch levels will need to take account of this fact. How influential SBT availability is in determining the levels of fishing effort expended by both recreational and charter sectors, i.e. motivation to go gamefishing, remain uncertain but warrant investigation.

4. Conclusions

4.1 General

Southern bluefin tuna are distributed throughout the southern oceans predominantly between 30°S - 50°S. Their seasonal occurrence in Tasmanian waters is highly variable, and related to a complex interaction of factors including oceanographic currents and conditions, water temperature and prey availability (Young et al., 1997). Recognizing that the availability of SBT to the recreational and charter fisheries around Tasmania varies markedly from year to year, the 2003 season was poor and should not be taken in isolation.

Recreational gamefishers harvested at least 112 SBT during 2003, representing a retained catch of about 2.5 tonnes, the majority taken from the south coast, off Southport, south of Bruny Island and around Pedra Branca. The Tasman Peninsula has traditionally been the centre of the recreational SBT fishery but there is growing recognition of the south coast as being highly productive, flagging the need to incorporate this area in future assessments. In relative terms, fishers who were interviewed in the on-site survey reported catching around 10 times more SBT in 2002 than in 2003, supporting anecdotal reports that 2002 (and 2001) were good years for SBT, and 2003 was a poor season.

In terms of catch composition, albacore clearly dominated catches by number, with striped tuna of secondary importance. Both species occurred throughout the range of the fishery and were present from at least January through to May. The average weight of albacore tended to increase as the season progressed, but there was little evidence of any trend in sizes for striped tuna. Yellowfin tuna catches tended to be low, with most caught off the north-east coast (St Helens). Pelagic sharks (mako and blue sharks) and marlin were also targeted by gamefishers but catches were low.

While it is not possible to estimate catches for the other gamefish species, some conclusions are possible about catch and effort for fishing trips originating from Pirates Bay between April and May. The total catch of albacore was approximately 1525 fish, of which around 30% were taken by charter boats. Effort for this period equated to 512 fishing trips, one quarter undertaken on charter boats.

The number of persons who went gamefishing during 2003 was not determined, but the on-site survey did indicate that greater numbers of non-affiliated anglers, compared to TGFA members, fished out of Pirates Bay during April and May. This observation does not, however, take into account the level of fishing activity, in terms of number of fishing trips undertaken nor catch rates, of either group.

Success rates, based on the proportion of trips that resulted in the capture of at least one gamefish, were about 60% for private boats fishing out of Pirates Bay between April and May and compared with success rates of about 70% for responding TGFA diarists and over 80% for gamefishing charters. Success rates are a function of many variables, including the skill and experience of the fishers, availability of the target species and prevailing environmental conditions.

An objective of this study was to describe the biological characteristics of the recreational SBT catch, but because of low catches very little information was collected. The mean length of SBT taken by charter boats was 91 cm and average weight was about 23 kg, but as these data are based on a very small sample size they may not be representative.

4.2 Future monitoring

The survey confirms that catches are highly variable in space and time, and that the 2003 season for recreational SBT catches was poor and not representative of the typical fishery. Faced with this strong interannual variability, management strategies should focus on catches averaged across years/seasons rather than on individual seasons as these will not represent the fishery. Availability of SBT to the recreational sector in Tasmania remains the result of a complex interaction of biological (e.g. availability of prey species) and environmental factors (e.g. water temperature).

While on-site surveys have obvious advantages in being able to observe catches directly and collect detailed fishing information with minimal non-response and recall bias problems, fisheries that are spatially and temporally dispersed with low levels of activity require high sampling intensities to produce reasonable precision in parameter estimation. The SBT fishery is a case in question where, as demonstrated in this study, fishing effort tends to be spread over a wide number of sites (from the Tasman Peninsula to southern Tasmania but also potentially to Bicheno) and levels of effort at given sites tends to be very low (for instance apart from fishing competitions the greatest number of gamefishing boats observed on a given sampling day was 25). Furthermore, timing and duration and even distribution of catches can vary markedly between years, further exacerbating the difficulty in providing robust estimates based on on-site survey methodologies. Despite intensive sampling at a single major fishing site over a limited period, this study produced tuna harvest estimates with a 95% confidence interval roughly equivalent to $\pm 15\%$ of the catch estimate.

If on-site surveys were to be applied more generally to assess the gamefish fishery they need be designed such that they can be implemented flexibly to respond to real-time developments in the fishery. Reports from experienced fishers, such as charter boat operators and avid fishers, have the potential to assist in identifying where species are located/catches taken and then sampling effort directed accordingly.

Charter boat logbooks and gamefish angler diaries have the potential to be useful in assessing catch and effort for these sectors, but do not provide complete coverage of the fishery, and cannot be adjusted readily to take account of fishing activity by non-affiliated anglers fishing from private vessels. As indicators of seasonal variability, on-going use of the logbook and diary may be justified, however, it is critical that response rates are improved if these data are to be of value. Gamefish angler diary response rates and data quality could be significantly improved by utilising a combined telephone-diary methodology applied in other studies in Tasmania (e.g. Forward and Lyle, 2002; Lyle, 2000). It is anticipated that compulsory reporting will be a component of any charter management plan introduced in Tasmania and this will overcome the non-response problem and ensure on-going data collection.

Collation of historic information about the SBT fishery may provide a valuable perspective of the fishery, particularly seasonal variability and significant developments that may have occurred over time. Interviews with past and present fishers and examination of club and competition records represent likely sources of data.

Ultimately the design of any monitoring program will depend upon a number of factors, including survey or management objectives, intended use of the data and required precision. Costs and feasibility (logistics) are also important considerations. As the wider issues relating to the management of the tuna fishery and rights of recreational fishers have yet to be fully defined, it is unclear what level of future monitoring may be required. For instance, different assessment options would be necessary if real-time monitoring and/or absolute catch estimates were required, as opposed to indicative or even relative estimates of catch. The current study provides insight into the recreational and charter fisheries and highlights some of the logistical issues that will need to be addressed in the development of any future monitoring programs that support the management of the fishery.

5. Acknowledgements

We would like to thank Julian Harrington and Sean Tracey for their assistance with the creel surveys, especially when everyone else was on holidays, and Colin van den Hoff and John Brooker for organising the distribution of the club member diaries. Ranger Stephen and Stuart Nichols provided invaluable reports on fishing activity. We would like to thank Malcolm Haddon for assistance with the analysis and Dirk Welsford for reviewing the manuscript.

The co-operation and assistance of the recreational gamefishers and charter boat operators of Tasmania is also gratefully acknowledged. Lastly we would like to thank Brett Cleary for an introduction to the thrills of catching of SBT.

The study was conducted by the Tasmanian Aquaculture and Fisheries Institute in collaboration with the Tasmanian Game Fishing Association and the Sea Charter Boat Operators of Tasmania with funding provided by the Department of Primary Industry Water and Environment through the Recreational Fishery Trust Fund.

References

- Evans, B. S.** (1995). Tasmanian tuna charter fishery - update, season 1994. Department of Primary Industry and Fisheries, Tasmania.
- Forward, J. and Lyle, J. M.** (2002). A survey of the 2000/01 Tasmanian recreational rock lobster fishery and options for future assessment. MRFC Final Report. Tasmanian Aquaculture and Fisheries Institute, University of Tasmania.
- Haddon, M.** (2001). Modelling and quantitative methods in fisheries. Florida: Chapman and Hall/CRC.
- Henry, G. W. and Lyle, J. M.** (2003). The national recreational and indigenous fishing survey. NSW Fisheries Final Report Series 48. NSW Fisheries Cronulla.
- Lyle, J. M.** (2000). Assessment of the licenced recreational fishery of Tasmania (Phase 2). FRDC Final Report. Tasmanian Aquaculture and Fisheries Institute, University of Tasmania.
- Lyle, J. M. and Campbell, D. A.** (1999). Species and size composition of recreational catches with particular reference to licenced fishing methods. MRFC Final Report. Tasmanian Aquaculture and Fisheries Institute University of Tasmania.
- Lyle, J. M., Forward, J. and Morton, A. J.** (2002). Species and size composition of recreational catches based on 2000/2001 CREEL surveys. Internal report. Tasmanian Aquaculture and Fisheries Institute University of Tasmania.
- Smith, J. T.** (1994). Charter fishing for tuna in Tasmania. 1. Department of Primary Industry and Fisheries Tasmania.
- Young, J. W., Lamb, T. D., Le, D., Bradford, R. W. and Whitelaw, A. W.** (1997). Feeding ecology and interannual variations in diet of southern bluefin tuna, *Thunnus maccoyii*, in relation to

coastal and oceanic waters off eastern Tasmania, Australia. *Environmental Biology of Fishes* **50**, 275-291.