



Fisheries New Zealand

Tini a Tangaroa

Recreational harvest of southern bluefin tuna in New Zealand, 2020–21

New Zealand Fisheries Assessment Report 2022/01

J.C. Holdsworth

ISSN 1179-5352 (online)

ISBN 978-1-99-102623-1 (online)

January 2022



Requests for further copies should be directed to:

Fisheries Science Editor
Fisheries New Zealand
Ministry for Primary Industries
PO Box 2526
Wellington 6140
NEW ZEALAND

Email: Fisheries-Science.Editor@mpi.govt.nz

Telephone: 0800 00 83 33

This publication is also available on the Ministry for Primary Industries websites at:

<http://www.mpi.govt.nz/news-and-resources/publications>

<http://fs.fish.govt.nz> go to Document library/Research reports

© **Crown Copyright – Fisheries New Zealand**

TABLE OF CONTENTS

EXECUTIVE SUMMARY	1
1. INTRODUCTION.....	2
1.1 Objectives.....	2
1.2 Overview	2
1.3 Description of the recreational fishery	3
2. DATA SOURCES AND METHODS.....	4
2.1 North Island survey	4
2.2 Sport fishing club records.....	4
2.3 Expanded survey catch at Waihau Bay	5
2.4 South Island survey	5
2.5 Amateur fishing charter boat records	6
2.6 Section 111 landings	6
2.7 Allowance for unaccounted catch	6
2.8 Biological data.....	6
3. RESULTS.....	7
3.1 Landed catch from the 2021 Waihau Bay survey	7
3.2 Sport fishing club records.....	8
3.3 Survey of South Island fishers.....	8
3.4 Amateur fishing charter boat records	8
3.5 Section 111 landings	9
3.6 Otoliths collected.....	9
3.7 2020–21 recreational harvest estimate for southern bluefin tuna.....	9
4. DISCUSSION.....	9
5. ACKNOWLEDGMENTS.....	11
6. REFERENCES	11
7. TABLES AND FIGURES.....	13

EXECUTIVE SUMMARY

Holdsworth, J.C.¹ (2022). Recreational harvest of southern bluefin tuna in New Zealand, 2020–21.

New Zealand Fisheries Assessment Report 2022/01. 19 p.

This report describes the New Zealand recreational catch of southern bluefin tuna in the 2020–21 fishing year. The species code for southern bluefin tuna (*Thunnus maccoyii*) used for catch reporting in the New Zealand commercial fishery is STN. In this report, the internationally recognised abbreviation for southern bluefin tuna, SBT, is used.

There are two distinct recreational fisheries for southern bluefin tuna in New Zealand at present. One off the west coast of the South Island from February to July and a target fishery that started in 2017 off the east coast of the North Island mainly in June and July.

The North Island recreational catch is predominantly taken by trailer boats launching from Waihou Bay in the eastern Bay of Plenty. In 2021 the fourth annual on-site (creel) survey at the Waihou Bay boat ramp collected detailed catch and effort information from returning fishers. The Waihou Bay Sport Fishing Club weigh station provided accurate weights of individual fish and assisted with collection of SBT heads for otolith extraction. Catch records were obtained from 14 other North Island sport fishing clubs.

An adaptive sampling strategy was used to target survey effort at Waihou Bay on days when 10 or more trailer boats were targeting SBT. Trailer counts at 11:00 am each day during the survey period were used to estimate fishing effort. The survey intercepted 699 boat crews who landed 305 SBT in 2021. The total survey estimate of landed catch using average catch from surveyed boats and trailer counts of non-surveyed boats was 432 SBT (with a CV of 0.023). A further 86 SBT were recorded by other North Island sport fishing clubs with an average weight of 72.49 kg (s.d. 24.13). There were 431 individual boat names recorded from the Waihou Bay survey interviews.

In 2021 there were 108 SBT retained by Amateur Fishing Charter Boats in the North Island with an estimated average weight of 74.86 kg (s.d. 21.77). Fishing effort and retained catch was less than in 2020. The number of SBT reported as released was 59, also less than in the previous season.

Catch estimates for the South Island fishery were made using an off-site telephone survey of SBT fishers. The contact list of fishers is still being expanded with 35 boat owners included in 2021. There were 32 SBT reported landed from February to June with an overall SBT average weight in the off-site survey of 45.2 kg (s.d. 36.26). A further 41 SBT were landed from March to May by anglers on South Island charter boats with an average estimated weight of 24.2 kg (s.d. 8.41). Harvest reported as recreational catch taken from commercial vessels under section 111 of the Fisheries Act 1996 (879 kg) is also included in harvest estimates.

The combined SBT harvest by charter vessels in 2020–21 based on recorded estimated weights was 9.0 t. The total landed recreational catch estimated for 2020–21 is 589 SBT weighing 48.73 t. Allowing an additional 15% to 30% for unaccounted landed catch by private vessels plus the reported catch from charter vessels gives a range of 759 to 844 SBT and a point estimate of 802 SBT weighing 57.2 t.

The SBT recreational fishery was not significantly affected by government Covid-19 restrictions on travel and fishing in 2021, although there were restrictions in place for Auckland in February and March and international travel was very limited.

¹ Blue Water Marine Research, New Zealand.

1. INTRODUCTION

1.1 Objectives

Overall objective:

1. To improve the estimates of the recreational catch and size composition of southern bluefin tuna (*Thunnus maccoyii*) in New Zealand fisheries waters during the 2021 fishing season.

Specific objectives:

1. To undertake an on-site survey to estimate amateur harvest of southern bluefin tuna in the eastern Bay of Plenty.
2. To design and undertake a survey to estimate the amateur harvest of southern bluefin tuna off the west coast South Island.
3. To estimate the amateur southern bluefin tuna harvest for the 2021 southern bluefin tuna fishing season using the method developed in Specific Objectives 1 and 2, data from the amateur charter vessels, section 111 landings, sport fishing club records, and any other appropriate reporting methods.
4. To characterise the biological and temporal nature of the marine amateur harvest of southern bluefin tuna.
5. To collect otoliths from southern bluefin tuna caught by recreational fishing vessels fishing in the eastern Bay of Plenty.

1.2 Overview

Southern bluefin tuna (SBT, *Thunnus maccoyii*) is a single stock, primarily distributed between 30° S and 45° S, with one confirmed spawning area in the Indian Ocean between Java and Western Australia (Farley & Davis 1998, Patterson et al. 2008). Initial growth is rapid with juveniles reaching 50 cm at one year old. Southern bluefin tuna up to 5 years old undertake annual cyclical migrations in which they generally spend austral summers in the Great Australian Bight and move east as far as New Zealand or west into the Indian Ocean as far as South Africa during the winter (Basson & Farley 2014, Bestley et al. 2010). Fish older than five years disperse widely across the southern oceans from the western Atlantic across the Indian Ocean to the Tasman Sea. They can live to 30 years old and reach a maximum size of about 190 cm fork length and 140 kg by 20 years old. Most southern bluefin tuna are mature by 12 years of age (Gunn et al. 2008).

Large Japanese surface longline vessels were attracted to New Zealand waters during the 1960s to catch southern bluefin tuna. During the 1970s and 1980s some of the fleet, along with vessels from Korea, took up licences to fish part of the year in New Zealand waters. The New Zealand domestic surface longline fishery expanded rapidly during the 1990s, targeting swordfish, bigeye tuna, and southern bluefin tuna (Ministry for Primary Industries 2017).

New Zealand is a founding member of the Commission for Conservation of Southern Bluefin Tuna (CCSBT), an intergovernmental organisation responsible for the conservation and management of SBT. Member countries receive an allocation from the global total allowable catch and must report all sources of SBT fishing mortality each year. This includes recreational catch.

The SBT catch limit for New Zealand was 420 tonnes (t) in the early 1990s. On introduction to the Quota Management System (QMS) in 2004 the Total Allowable Commercial Catch (TACC) was set at 413 t, with a recreational allowance of 4 t, a customary allowance at 1 t, and other sources of fishing related mortality at 2 t. There have been a number of Total Allowable Catch (TAC) increases following allocation decisions by the CCSBT.

In 2012 the TAC was set at 830 t, with a TACC of 817 t, a recreational allowance of 8 t, a customary allowance at 1 t, and other sources of fishing related mortality at 4 t. In 2018 an in-season adjustment increased the TAC by 88 t to allocate the revised national allocation of 1088 t following an update of the stock assessment by CCSBT and operation of the agreed management procedure. Following

consultation, the available Annual Catch Entitlement for commercial fishers was increased to 1046 t, the recreational allowance was set at 20 t, the customary allowance was set at 2 t, and other sources of fishing related mortality was set at 20 t. The TACC and allowances were retained when the TAC was set from 1 October 2018.

The 2020 SBT stock assessment results estimate that stock biomass is increasing and was about 20% of unfished levels of Total Reproductive Output (similar to spawning stock biomass) in 2019. The stock was projected to be at 29% of unfished levels by 2035, close to the management target of 30% (Anon 2020).

In 2020 the Extended Commission meeting agreed to retain the global SBT TAC of 17 647 tonnes per year from 2021 to 2023 inclusive as calculated by the management procedure and recommended by the Extended Scientific Committee. However, the Commission agreed that it no longer needed to set aside 306 t of the global TAC for unaccounted mortalities. An allocation negotiation resulted in a 14 t increase in New Zealand's SBT catch limit. Fisheries New Zealand included a review of the SBT TAC in the October 2021 sustainability round and the recreational allowance was increased to 34 t.

1.3 Description of the recreational fishery

There has been a small recreational fishery off the west coast of the South Island mainly from Fiordland over summer since the 1970s. The Fiordland Game Fishing Club was formed and was a member of the New Zealand Sport Fishing Council (NZSFC) until the late 1980s. Most of the SBT were less than 30 kg and caught on 10 kg line (Marquand 1978). A recreational fishery for Pacific bluefin tuna (*Thunnus orientalis*) developed in 2005 off the west coast of the South Island with charter boats fishing from Greymouth and Hokitika. Occasionally southern bluefin tuna were caught in this fishery during August and September.

An east coast North Island recreational fishery rapidly emerged in June and July 2017. Social media posts by commercial fishers, along with good catch rates and favourable weather, attracted hundreds of anglers to the eastern Bay of Plenty at short notice. Most fishers towed trailer boats and launched at Waihou Bay. Fish were caught by trolling lures using the same tackle as the summer billfish fishery. Members of the Waihou Bay Sport Fishing Club operated a weigh station adjacent to the boat ramp, weighing and recording most of the catch. In addition, some fish were taken back to home clubs and weighed there.

NZSFC clubs recorded 266 southern bluefin tuna kept and landed in 2017 with a further 13 released from the east coast recreational fishery, mostly during late June and July 2017. Most of the North Island tuna landed were over 60 kg and the average weight was over 72 kg. The total landed weight of SBT recorded by clubs in 2017 was 19.4 tonnes. Over 90% of the North Island catch was landed at the Waihou Bay boat ramp.

In the South Island fishery six charter vessels recorded a recreational landed catch in 2017 of 47 SBT with an estimated weight of 1.9 t. Therefore, the average weight of these fish was 40.6 kg. South Island sport fishing clubs recorded a further eight SBT in 2017. It is not known if these fish were taken from charter boats, but there were a number of private boats active in this fishery when the weather was suitable.

This report describes the recreational catch in the 2020–21 New Zealand fishing year (1 October 2020 to 30 September 2021). Over the last 10 years there have been no NZSFC club records or charter boat records of SBT caught from October to December. Therefore, recreational catch estimated in this report will also apply for the 2021 calendar year.

2. DATA SOURCES AND METHODS

2.1 North Island survey

A major component of this survey was to collect information from fishers as they returned to the Waihou Bay boat ramp using on-site interviews. This was the fourth year that this on-site survey was conducted with support from fishers and members of the Waihou Bay Sport Fishing Club. A presentation on the survey design and results from 2019–20 was made to a joint meeting of the Marine Amateur Fisheries Working Group and Highly Migratory Species Working Group chaired by Fisheries New Zealand in December 2020. To date a large component of the recreational SBT catch has been taken from trailer boats fishing off Cape Runaway while the fish are within range during June and July. The remote location, weather conditions, and fishing success influences fisher interest and peak fishing periods.

The Waihou Bay on-site survey design was based around the following elements:

1. A survey period from 5 June to 10 August 2021 when SBT were most likely to be in the area;
2. Daily trailer counts at Waihou Bay at 11:00 am to estimate daily fishing effort for 67 days;
3. An adaptive survey approach with a decision rule that if there are 10 or more boat trailers for boats over 5 m long, this would become a survey day during June. The threshold was raised to 15 boat trailers in July due to increased fishing effort;
4. One primary interviewer able to interview boats as they return, to provide high coverage of boats returning on survey days;
5. Collection of vessel and angler details to match with club records of weighed fish to avoid double counting;
6. Records of the number of fishers per boat, fishing method, hours fished, individual catch, retained or released, and length measurements of landed SBT;
7. Collection of heads, where possible, and extraction of otoliths;
8. Records of any capture and fate of seabirds.

Data were collected on hard copy forms developed in 2018 (Holdsworth 2019). These included seabird interaction questions and a laminated show card of seabird species groupings. The boat ramp was busy at times and most of the interviews were initiated while the boat was being loaded onto the trailer. Where possible SBT were measured (fork length) and accurate weights were available from the club weigh station located next to the boat ramp. Estimated weights were recorded for fish landed but not weighed and those released. Interview sessions have been extended to include boats that returned in the morning and early afternoon since 2020, because a number of fishers were returning to the ramp as soon as one SBT was caught. Interview sessions ended before dark, in line with the health and safety policy.

Collection bins for heads were provided by the Waihou Bay Sport Fishing Club. Fish were measured and a head number issued to the fisher. Generally, the fish were processed on the boat and the head with label attached was left in the bin. Heads were collected and taken to a private property for otolith removal.

2.2 Sport fishing club records

New Zealand Sport Fishing Council clubs from Bay of Plenty, Gisborne, Hawkes Bay, Auckland, and Northland provided detailed catch records from weigh stations with certified scales. Clubs weigh and record fish caught by affiliated club members and generally for non-members on request. Club records include details of date, species, boat and angler name, fish weight, and usually location of capture. If the fish is being weighed on behalf of another club this is identified as a 'courtesy weigh'. Sport fishing clubs traditionally target yellowfin tuna and billfish over the summer months (December to May) and use an austral fishing year from 1 July to 30 June. The recreational SBT fishery cuts across the end of this fishing year and the start of the next. However, information in this report is effectively the same as for the 2021 calendar year because no recreational SBT catch was reported

between 1 October and 31 December 2020 or after the end of the commercial fishing year on 30 September 2021.

All available club catch records are compiled into a spreadsheet and sorted by date, vessel, weight, and angler so that fish that have been entered by two clubs—the club that weighs the fish and the club that the angler belongs to—are not double counted. Landed fish that are recorded in the ramp survey are also matched with club records using date, vessel, and angler to ensure that these fish are not double counted.

2.3 Expanded survey catch at Waihou Bay

The observed total catch includes the number of SBT intercepted by the on-site survey plus the number of non-survey SBT weighed by the Waihou Bay Sport Fishing Club. On busy days some boats are hauled out after dark. Interviewers do not work on the boat ramps after dark, though the club did weigh fish on request into the evening. Some boats with fish may have returned after the weigh station was closed. The catch observed during the survey will therefore be an incomplete record of all Waihou Bay landed catch.

Trailer counts at 11:00 every day during the survey period provided an estimate of total fishing trips. The creel survey collected information on the number of boats intercepted and the number of SBT landed, on days when there were 10 or more trailers for boats capable of fishing offshore. Boat trip was used as the unit of fishing effort because it could be applied to both interview data and trailer counts. The availability of SBT within range of recreational vessels is variable. For survey days the mean landed catch per trip from survey interviews that day was multiplied by the trailer count for that day. For non-survey days with trailers the overall survey CPUE (ratio of means) was multiplied by the trailer count for that day.

The variance associated with the landed catch was estimated by resampling catch per boat trip with replacement on each survey day to assign catch to boat crews that were not interviewed, based on the trailer count for that day. For days with trailer counts less than 10 that were not surveyed, CPUE from all survey days was resampled with replacement for the number of trailers counted for all non-survey days.

The variance associated with total landed catch was estimated by adding the bootstrap estimates from survey days and non-survey days to give 2000 estimates of total landed catch at Waihou Bay, which were used to generate an overall CV and 95% confidence intervals.

2.4 South Island survey

Prior to 2020, recreational harvest estimates for SBT for the South Island comprised data from the amateur fishing charter vessel reporting system, reports on commercial fishing catch and effort returns of SBT catch by recreational methods for personal use under section 111 of the Fisheries Act 1996, and anecdotal reports from well-connected people on the catch by private fishers. In 2019–20, a survey to estimate the amateur harvest of southern bluefin tuna off the west coast South Island was initiated. The focus of the design was to estimate the number and weight of SBT caught by amateur fishers on private boats. The main platform used in this fishery is trailer boats launched from a limited number of access points in Fiordland.

One advantage of a relatively small group of committed SBT fishers is that they tend to know who else has been fishing and share information amongst themselves. There are survey techniques that use Respondent Driven Sampling (i.e. ‘Snowballing’) to recruit hard-to-reach components of populations. A register of South Island boat owners who target SBT was generated from sport fishing clubs and known contacts. There have been studies in Australia and New Zealand that have investigated the potential of this approach and found problems with its ability to determine the harvest of particular species (Griffiths 2012, Heinemann & Gray 2010). Most of these relate to potential biases that can

come from the individuals used in the initial sample and the non-random selection of survey respondents from their network of contacts.

In the South Island SBT fishery there are a finite number of boats actively engaged in the fishery and recruiting most of them to respond to a regular SMS and phone survey, similar to the National Panel Survey, would go a long way toward characterising this fishery and providing unscaled catch and effort for the core fleet. Southern bluefin tuna are suitable for this approach because the species is easily identified, catches are memorable, and management restrictions are not likely to cause anglers to under-report catch (Pollock et al. 1994). The bycatch of SBT by fishers targeting inshore species is likely to be small.

2.5 Amateur fishing charter boat records

An extract of amateur fishing charter vessel (AFCV) records from events where southern bluefin and Pacific bluefin tuna were targeted or caught was obtained from Fisheries New Zealand. A review of the AFCV database was undertaken in 2019 that identified a range of potential errors to look for (Hartill et al. 2020). The extract received was unfiltered and was checked for missing or out of range entries.

The AFCV records were matched with fishing club records and duplicate entries removed from the club records used in the harvest estimates. Catch by trailered charter boats fishing out of Waihou Bay during the survey period were removed from the charter records to avoid double counting catch when calculating national harvest estimates. This is because trailer counts on non-survey days and boats that return after dark will include charter boat trailers. Individual SBT estimated weights were recorded for most (87%) landed catch records. These were used to calculate the average weight and standard deviation of retained SBT.

2.6 Section 111 landings

Southern bluefin tuna caught by commercial fishers using recreational fishing gear may be retained for personal use under an approval provided by Fisheries New Zealand under section 111 of the Fisheries Act 1996. The weight of these fish must be recorded on the Catch Landing Return with destination code F. Fisheries New Zealand provided the number of records and sum of estimated weights for section 111 landings.

2.7 Allowance for unaccounted catch

There is anecdotal information that some SBT are processed onboard and are not included in club records or landed at Waihou Bay during the survey period. Coverage of South Island fishers in the telephone survey is still incomplete. In 2018, a factor of 15% to 30% was added to the national SBT catch recorded by recreational fishers as an estimate of unaccounted catch.

For the 2020–21 project, the Highly Migratory Species Working Group again recommended adding 15% to 30% to landed catch by private fishers to cover the likely range of unaccounted catch. The midpoint of this range was used as the point estimate. In 2020–21, for the amateur fishing charter vessel retained catch, it was assumed that reporting was reasonably complete and no adjustment for unaccounted charter catch was made.

2.8 Biological data

Sport fishing club weigh stations maintain catch records including weights from certified scales, date, and location data. Southern bluefin tuna length information was collected where possible from the Waihou Bay on-site survey and in conjunction with the collection of fish heads for otolith extraction from the club weigh station. The weight and length distributions of SBT sampled for otoliths were summarised. An identification guide for large tuna caught in New Zealand was produced and

distributed to clubs to ensure Pacific bluefin and bigeye tuna (*Thunnus obesus*) were not confused with SBT.

3. RESULTS

3.1 Landed catch from the 2021 Waihou Bay survey

Blue Water Marine Research discussed and coordinated the lead-up to the on-site survey with members of the Waihou Bay Sport Fishing Club. This included updating the FishCare ‘Southern Bluefin Tuna Guide to Best Practice for Recreational Fishers’. Trailer counts started on Saturday 5 June 2021 and there were no Covid-19 travel restrictions in June and July. There were 16 boats fishing that day and all crews were interviewed. Only two crews had been targeting SBT, the rest were fishing inshore waters.

The first SBT landed at Waihou Bay was on 11 June 2021. There were 7 boat trailers at 11:00 am that day, so it was not a survey day. One SBT was landed on 12 June which was a survey day (Table 1). Fishing effort was relatively low until 23 June. This was a reasonable weather window and some planned trips around full moon saw the trailer count reach 84 on 24 June.

A survey total of 1037 boat trailers were counted over 72 days which is an increase on counts from previous surveys (Table 2). There were 16 survey days with 699 boat crews intercepted and interviewed on the boat ramp. The proportion of crews interviewed vs. the trailer counts on survey days was 80%. Overall, 67% of total trailer count effort from the survey period were interviewed. Most crews were cooperative during the survey, even when the ramp was busy, and no crews refused to answer the interview questions this year.

A total of 305 landed SBT were reported to the interviewer at the ramp. Of these 112 SBT (37%) were processed at sea or not weighed at Waihou Bay. A further 50 SBT were in the Waihou Bay Sport Fishing Club weigh station records only, because they were caught on days with no survey or landed after dark.

The distribution of fishing effort per day shows that most fishing effort occurred during weather windows from 23 June to 24 July. There were 10 days in this period with more than 50 boat trailers counted (Table 1, Figure 1a). Fishing effort for SBT from Waihou Bay ended in early August and the survey finished on 10 August 2021. All New Zealand was subject to level 4 Covid-19 restrictions from 18 August 2021.

The number of SBT caught per day was highest on fishable days during the last week of June and first week of July and there were seven days when 20 or more SBT were landed at Waihou Bay during this period (Figure 1b). As recorded in previous surveys, a significant proportion of Waihou Bay landed catch occurs over a single weather window. In 2021, 56% of landed catch was taken over the first six days of July; in 2020, the high catch period was the last week of July and in 2019 it was the last week of June (Figure 2).

Southern bluefin tuna catch rate derived from the survey interviews peaked on 4 and 5 July 2021 with more than 0.85 SBT per boat day and 10% of those fish were released (Figure 3). To date, the highest catch rate from previous surveys was 1.33 SBT per boat day for 24 crews interviewed on 30 July 2020.

The total number of SBT landed at Waihou Bay was estimated using survey CPUE and trailer counts to expand the survey data. This assumes that all fishers accurately reported their landed catch when interviewed and that boats that returned after dark or on non-survey days had the same average CPUE as surveyed boats. The expanded survey estimate of Waihou Bay landed catch in 2021 is 445 SBT (CV 0.023) (Table 3). The distribution of bootstrap estimated harvest numbers from the expanded survey data is shown in Figure 4. The average weight of STB weighed and estimated was 76.09 kg.

The on-site survey collected information on the number of SBT landed per trip and the number of unsuccessful trips. In 2021, 68% of crews interviewed at Waihou Bay landed no SBT that day and of those that caught fish, 73% landed one fish per trip, 22% landed two fish, and 5% landed three fish per trip (Figure 5). In addition, 29 SBT were released or tagged and released from 22 separate trips. There were 431 individual boat names recorded from the Waihou Bay survey interviews.

3.2 Sport fishing club records

A total of 86 SBT were recorded landed by North Island sport fishing clubs other than those in the Waihou Bay survey and club records in 2020–21. Most of these fish were caught in June and July in the Bay of Plenty. In addition, there were SBT caught off Hawke Bay and Gisborne. The average weight for these fish was 72.5 kg (s.d. 24.13) (Table 3). There is some overlap between club records and charter vessel reporting by trailer boats.

The distribution of weights recorded by all North Island clubs including Waihou Bay in 2021 has a mode of landed catch between at 70 to 80 kg in 2021, which is similar to 2020 (Figure 6). There were more large fish weighed in 2021 with a higher proportion of landed catch in the 90 to 130 kg size bins than in previous surveys. This plot does not include fish not weighed (which tend to be smaller fish).

3.3 Survey of South Island fishers

There is limited information about the South Island fishery which has operated out of Fiordland since the 1970s. The Fiordland Sport Fishing Club recorded 18 to 36 SBT per year in the late 1970s. Most of these SBT were small and caught in February during the NZSFC Nationals tournament. The club disbanded around 1990. Reports from members of other South Island fishing clubs in 2019 indicate that a few dedicated fishers target SBT out of the fiords and occasionally Jackson Bay.

A survey of boat owners in the South Island SBT fishery was initiated in 2020. Some good contacts were made but the fishery and data collection was hampered by slips that closed the road to Milford Sound after a February storm. On 23 March 2020 the New Zealand government introduced level 3 Covid-19 restrictions, followed by level 4 (stay at home) restrictions on 25 March. Recreational fishers were not allowed on the water until 12 May 2020 in level 2. In April 2021, Blue Water Marine Research created a catch reporting web page at www.fishcatch.co.nz that fishers could use to self-report SBT and other gamefish catch. So far there has been limited uptake of this option and no South Island STN reported.

The off-site telephone survey database expanded from 17 boat owners to 35 owners in 2021 using a variety of sources. Not all of these contacts fished for SBT in 2021 but some were able to provide referrals to other fishers. There were 32 SBT reported landed in the survey with an average weight of 45.2 kg (s.d. 36.26) and eight SBT were released (Table 3). Estimated weights ranged between 12 kg and 170 kg for landed fish.

3.4 Amateur fishing charter boat records

An extract of amateur fishing charter vessel records from events where southern bluefin tuna or Pacific bluefin tuna were targeted or caught was provided by Fisheries New Zealand. Charter fishing effort and retained SBT catch increased in 2020 and remained around 150 fish in 2021 (Table 4). The combined SBT harvest by charter vessels in 2020–21 based on recorded estimated weights was 9.0 t.

The South Island charter vessels reported retaining 41 SBT in 2021, which was higher than the previous 3 years. The average weight of retained SBT was 24.24 kg (s.d. 8.48) (Table 3).

In 2021, the charter fishing effort in the North Island was mainly off Cape Runaway in the eastern Bay of Plenty. Fishing started in mid June and followed similar trends to those for the Waihou Bay based fishery, with catch highest in the first week of July (Figure 7). Southern bluefin tuna were caught on most days until early August; large charter vessels were able to fish through most poor

weather days. A total of 137 SBT were caught on North Island charter vessels and 55 (40% of catch) released. There was a higher proportion of catch released in 2021 than in previous years and total charter fleet retained catch exceeded five per day on only two occasions (Figure 7).

The average duration of North Island charter fishing events targeting SBT in 2021 was 4.9 hours (s.d. 2.04). Retained catch for successful days was mostly 1 to 3 SBT (92%), with just 4 days with 4 fish retained (Figure 8). The average duration of South Island charter events was 1.1 hours (s.d. 0.70).

3.5 Section 111 landings

Southern bluefin tuna caught by commercial fishers and retained as recreational catch under section 111 of the Fisheries Act is recorded on Catch Effort Landing Returns. In the 2020–21 fishing year, the reported section 111 landings weighed 879 kg. The highest annual weight of section 111 catch reported over the last six years was 1038 kg in 2016–17 (Table 5).

3.6 Otoliths collected

A total of 45 usable otolith pairs were extracted from southern bluefin tuna intercepted during the creel survey at Waihou Bay in 2021. The weight of these fish ranged from 39.2 to 140.6 kg with a mode at 80 to 90 kg (Figure 9). The fork length of these fish ranged from 122 to 195 cm with a mode from 165 to 169 cm fork length (Figure 10). Measurements were made with the fish on top of a measuring mat.

3.7 2020–21 recreational harvest estimate for southern bluefin tuna

The total landed catch from the on-site survey at Waihou Bay, the sum of actual weights recorded by other North Island clubs, the number and average estimated weight from charter vessel logbooks, the sum of the weights from the South Island survey, and the non-commercial catch on commercial vessels sum to a national estimate of recreational SBT catch in 2020–21 of 48.63 t (Table 3).

In addition, an allowance is made for unaccounted landed catch, which is mostly fish not landed at Waihou Bay and not weighed at a club on return to port. In the past, an estimate of 15% to 30% for unaccounted landed catch has been made; this gives a range of 54.1 t to 60.3 t of SBT and a point estimate recreational SBT harvest in 2020–21 of 57.2 t (Table 2).

4. DISCUSSION

This is the fourth dedicated project to estimate the recreational harvest of southern bluefin tuna in New Zealand. From the 1970s until 2016 the recreational catch was almost all from the west coast of the South Island and total landings were assumed to be relatively small. Charter vessels taking recreational fishers on fishing trips have been required to report the number and weight of SBT caught since 2010. However, prior to 2015–16 the annual charter boat catch was fewer than 15 fish per year.

The North Island fishery developed rapidly in 2017 after reports of high catch rates of large SBT within range of recreational fishers off Cape Runaway. Private fishers with trailer boats remain the main participants in this fishery. The primary access point to the main fishing area is the boat ramp at Waihou Bay where an adaptive sampling strategy has been used since 2018 to target survey effort on days when fishing effort was above a pre-determined level (Moore et al. 2015).

Daily boat trailer counts undertaken at 11:00 am totalled 1037 across 67 days in 2021. The on-site survey at the Waihou Bay boat ramp covered 16 days and interviewed fishers from 699 boat trips. Not all boat trips targeted SBT but at the height of the season few inshore fishers were encountered because the ramp was busy and car parks full well before dawn. Having one main access point, with a high proportion of trips targeting SBT over a relatively short period, makes the on-site survey

particularly efficient. We are also fortunate to have an interviewer who monitors coastguard radio and lives close to the boat ramp and can intercept most boats returning to the ramp on survey days.

A number of SBT are caught early in the morning and increasingly crews will return to the ramp when they have one fish onboard. The Waihou Bay Sport Fishing Club weigh station is located adjacent to the boat ramp. In 2021, the club told fishers that the weigh station would be closing at 5:45 pm and they encouraged fishers to take just one SBT per boat and to bring the fish in to weigh as soon as possible after landing. Some fish were weighed after dark, depending on availability of a weigh master.

A total of 305 landed SBT were reported to the interviewer at the ramp. Of these 90 SBT (34%) were processed at sea or not weighed at Waihou Bay. This year no crews refused to answer the interview questions. A further 13 SBT were in the club weigh station records from non-survey days or landed after dark (Table 1). The expanded Waihou Bay survey estimate of landed catch, that scales up survey catch by trailer counts from all days, is 445 SBT (CV 0.023) for 2021.

The main fishing method used was trolling lures and there were no seabirds reported caught or tangled by any of the crews interviewed at Waihou Bay. Again, this year, many fishers were willing to leave tuna heads with labels attached for otolith extraction but getting accurate straight-line fork lengths from whole fish was not always possible.

Waihou Bay Sport Fishing Club has said that in 2022 they will only be weighing SBT for their club members and affiliated NZSFC club members. This is to ease congestion around the boat ramp, shop, and hotel which are adjacent to each other on Orete Point Road.

This was the second year of surveying private fishers in the South Island. Data are available from charter vessels and recreational catch on commercial vessels because of the Fisheries New Zealand data reporting requirements. The South Island SBT recreational fishery usually runs from January to May and is much more diffuse than the North Island SBT fishery. Previous on-site surveys of recreational catch from the southern South Island have struggled to collect sufficient data for harvest estimates, even for inshore species (Davey & Hartill 2011a, 2011b). The off-site telephone survey as part of this project has had a good response from participants and is worth continuing and expanding.

The estimated recreational harvest of SBT in 2019–20 was 48.9 t, with 51% from the Waihou Bay survey estimate. In 2020–21, the national SBT harvest point estimate increased to 57.2 t with 59% coming from the Waihou Bay survey, which includes trailered charter boats using the Waihou Bay ramp. Peak fishing effort and catch was for private and charter boats in the western Bay of Plenty was in the first week of July. This aligned with a good weather window and 60% of Waihou Bay survey harvest estimate was taken in that week.

There was lively online discussion about the value of tag and release and catch recording of gamefish in New Zealand early in 2021. Some people were interested in having an online catch reporting option for fish not included in NZSFC club records. Blue Water Marine Research developed a web page for reporting fish tagged and released or recaptured in the New Zealand Gamefish Tagging Programme at www.fishtagnz.co.nz. In April 2021, a catch reporting page was added to this site with a link from www.fishcatch.co.nz. The availability of this reporting option was included in a number of posts online, but uptake has been disappointing. There will be a more concerted effort to encourage online catch reporting in 2022.

The Commission for the Conservation of Southern Bluefin Tuna funds the stock assessments for SBT and sets management targets, an international TAC, and annual country allocations for much of the international catch. In 2020, the CCSBT accepted the new stock assessment that estimated the current spawning stock biomass to have increased to 20% of the unfished reproductive biomass and projected that the stock would be close to the management target of 30% of unfished spawning stock biomass by 2035 with the current TAC. The advice from the Extended Scientific Committee to hold the TAC

at the current level until 2023 was agreed to by the Commission. Overall SBT abundance is predicted to increase over the next 15 years.

The size of the annual recreational harvest of SBT in New Zealand is affected by the availability of fish within range of trailer boats off Cape Runaway. For the last 3 years SBT have been available for much of June and July probably due to oceanic conditions and abundance of forage species. The fishing method is almost exclusively surface trolling with lures and catch rates vary week to week as pulses of fish move through this area. Later in the season SBT are found further west and north.

5. ACKNOWLEDGMENTS

Many thanks to Christine Elmiger and the Waihau Bay Sport Fishing Club for their assistance in the planning and implementation of this project. Thanks to the New Zealand Sport Fishing Council and affiliated clubs for their cooperation and for providing weigh station records. Particular thanks to survey interviewers Bill Beckett and Nicola Hayes for their commitment to this project. Many thanks to Jim and Sally Kemp for collecting and cataloguing the otoliths. This project was reviewed by the Fisheries New Zealand Highly Migratory Species Working Group chaired by Dr John Annala. Fisheries New Zealand provided funding through Project STN2020-01.

6. REFERENCES

- Anon. (2020). Report of the Twenty-Fifth Meeting of the Scientific Committee, 7 September 2020, ccsbt.org/en/content/latest-stock-assessment
- Basson, M.; Farley, J.H. (2014). A standardised abundance index from commercial spotting data of southern bluefin tuna (*Thunnus maccoyii*): random effects to the rescue. *PLoS ONE* 9(12): e116245. doi.org/10.1371/journal.pone.0116245
- Bestley, S.; Patterson, T.A.; Hindell, M.A.; Gunn, J.S. (2010). Predicting feeding success in a migratory predator: integrating telemetry, environment, and modelling techniques. *Ecology* 91: 2373–2384.
- Davey, N.K.; Hartill, B. (2011a). A characterisation of amateur fisheries in the Fiordland marine area based on monitoring between 2006 and 2008. *New Zealand Fisheries Assessment Report 2011/32*. 46 p.
- Davey, N.K.; Hartill, B. (2011b). Survey of the Southland recreational blue cod fishery during the 2009–2010 fishing year. *New Zealand Fisheries Assessment Report 2011/57*. 50 p.
- Farley, J.H.; Davis, T.L.O. (1998). Reproductive dynamics of southern bluefin tuna, *Thunnus maccoyii*. *Fisheries Bulletin* 96: 223–236.
- Griffiths, S.P. (2012). Recreational catch composition, catch rates, effort and expenditure in a specialised land-based pelagic game fish fishery. *Fisheries Research* 127–128: 40–44.
- Gunn, J.S.; Clear, N.P.; Carter, T.I.; Rees, A.J.; Stanley, C.A.; Farley, J.H.; Kalish, J.M. (2008). Age and growth in southern bluefin tuna, *Thunnus maccoyii* (Castelnau): direct estimation from otoliths, scales and vertebrae. *Fisheries Research* 92: 207–220.
- Hartill, B.; Holdsworth, J.C.; Bian, R. (2020). Review of Amateur Fishing Charter Vessel reporting and characterisation. *New Zealand Fisheries Assessment Report 2020/15*. 41 p.
- Heinemann, A; Gray, A. (2010). Using Snowball Survey techniques to capture amateur harvest estimate data in niche fisheries. Project MAF/2009/02. (Unpublished report held by Fisheries New Zealand, Wellington.)
- Holdsworth, J.C. (2019). Recreational harvest of southern bluefin tuna in New Zealand, 2017–18. *New Zealand Fisheries Assessment Report 2019/08*. 17 p.
- Marquand, D. (1978). Kiwis discover Fiordland game fish. *Modern Fishing*. September 1978 issue.
- Ministry for Primary Industries (2017). Fisheries Assessment Plenary, November 2017: stock assessments and stock status. Compiled by the Fisheries Science Group, Ministry for Primary Industries, Wellington, New Zealand. 500 p.

- Moore, A.; Hall, K.; Khageswor, G.; Tracey, S.; Hansen, S.; Stobutzki, I.; Ward, P.; Andrews, J.; Nicol, S.; Brown, P. (2015). Developing robust and cost-effective methods for estimating the national recreational catch of Southern Bluefin Tuna in Australia. *FRDC Project No. 2012/022.20*. 123 p.
- Patterson, T.A.; Evans, K.; Carter, T.I.; Gunn, J.S. (2008). Movement and behaviour of large southern bluefin tuna (*Thunnus maccoyii*) in the Australian region determined using pop-up satellite archival tags. *Fisheries Oceanography* 17: 352–367.
- Pollock, K.H., Jones, C.M., Brown, T.L. 1994. Angler survey methods and their implications in fisheries management. *American Fisheries Society Special Publication* 25. 371 p.

7. TABLES AND FIGURES

Table 1: Waihou Bay creel survey trailer counts, number of interviews, and SBT landed by day. Total landed SBT including Waihou Bay Sport Fishing Club weigh station records by fishers using Waihou Bay boat ramp. Survey days in bold.

Date	Trailer count	Survey interviews	Landed SBT survey	Landed SBT survey and club	Date	Trailer count	Survey interviews	Landed SBT survey	Landed SBT survey and club
5/06/21	16	16	0	0	11/07/21	25	26	6	6
6/06/21	1	0	0	0	12/07/21	0	0	0	0
7/06/21	0	0	0	0	13/07/21	5	0	0	0
8/06/21	0	0	0	0	14/07/21	75	58	9	12
9/06/21	0	0	0	0	15/07/21	12	0	0	3
10/06/21	0	0	0	0	16/07/21	2	0	0	1
11/06/21	7	0	0	1	17/07/21	0	0	0	0
12/06/21	15	11	1	1	18/07/21	0	0	0	0
13/06/21	4	0	0	2	19/07/21	0	0	0	0
14/06/21	1	0	0	0	20/07/21	33	31	8	8
15/06/21	2	0	0	0	21/07/21	28	0	0	14
16/06/21	0	0	0	0	22/07/21	1	0	0	0
17/06/21	1	0	0	3	23/07/21	65	37	4	4
18/06/21	28	23	9	10	24/07/21	59	50	0	0
19/06/21	14	14	1	1	25/07/21	3	0	0	0
20/06/21	0	0	0	0	26/07/21	0	0	0	0
21/06/21	0	0	0	0	27/07/21	0	0	0	0
22/06/21	4	0	0	1	28/07/21	0	0	0	0
23/06/21	62	47	26	27	29/07/21	13	0	0	1
24/06/21	84	72	51	53	30/07/21	14	0	0	0
25/06/21	2	0	0	0	31/07/21	7	0	0	0
26/06/21	0	0	0	0	1/08/21	5	0	0	0
27/06/21	0	0	0	0	2/08/21	5	0	0	0
28/06/21	0	0	0	0	3/08/21	2	0	0	0
29/06/21	0	0	0	0	4/08/21	0	0	0	0
30/06/21	7	0	0	1	5/08/21	0	0	0	0
1/07/21	51	46	29	33	6/08/21	0	0	0	0
2/07/21	58	54	27	27	7/08/21	0	0	0	0
3/07/21	96	69	23	23	8/08/21	0	0	0	0
4/07/21	112	72	59	61	9/08/21	0	0	0	0
5/07/21	85	73	52	52	10/08/21	0	0	0	0
6/07/21	9	0	0	2	Total	1037	699	305	355
7/07/21	0	0	0	0					
8/07/21	7	0	0	7					
9/07/21	12	0	0	1					
10/07/21	5	0	0	0					

Table 2: Waihou Bay creel survey trailer counts, number of interviews, and the number of SBT landed by year.

Year	Trailer count	Survey interviews	Landed SBT survey	Landed SBT survey and club
2017	–	–	–	207
2018	678	336	34	61
2019	852	537	118	196
2020	891	715	267	291
2021	1037	699	305	355

Table 3: Recreational harvest estimates for 2020–21 from available sources with an allowance for unaccounted catch of 22.5% and range of 15% to 30%.

Source	No. harvested	Mean wt (kg)	Harvest wt (t)
North Island			
Waihou Bay Survey	445 c.v. 0.023	76.09	33.86
Other club catch NI	86	72.49	6.23
Charter vessel (excluding Waihou Bay)	71	74.86	5.32
South Island			
Phone survey and clubs	32	45.19	1.45
Charter vessel	41	24.24	0.99
National			
section 111	?		0.88
Total	589		48.73
Plus unaccounted catch			
Low estimate 15%	759		54.1
High estimate 30%	844		60.3
Point estimate	802		57.2

Table 4: Southern bluefin tuna effort and catch from amateur fishing charter vessel logbooks by year including trailer boats fishing from Waihou Bay.

	Days with SBT target	Number of SBT caught	Number of SBT retained	Estimated landed weight (kg)
2010–11	1	6	4	397
2011–12	4	6	4	131
2012–13	7	12	12	550
2013–14	0	0	–	–
2014–15	16	6	2	95
2015–16	33	38	37	1 267
2016–17	53	54	52	2 274
2017–18	37	12	12	597
2018–19	63	47	42	1 821
2019–20	125	225	153	10 884
2020–21	102	208	149	9 079

Table 5: Recreational catch retained by fishers on commercial vessels under a section 111 approval.

October Fishing Year	2014–15	2015–16	2016–17	2017–18	2018–19	2019–20	2020–21
Greenweight kg	672	661	1 038	507	454	671	879

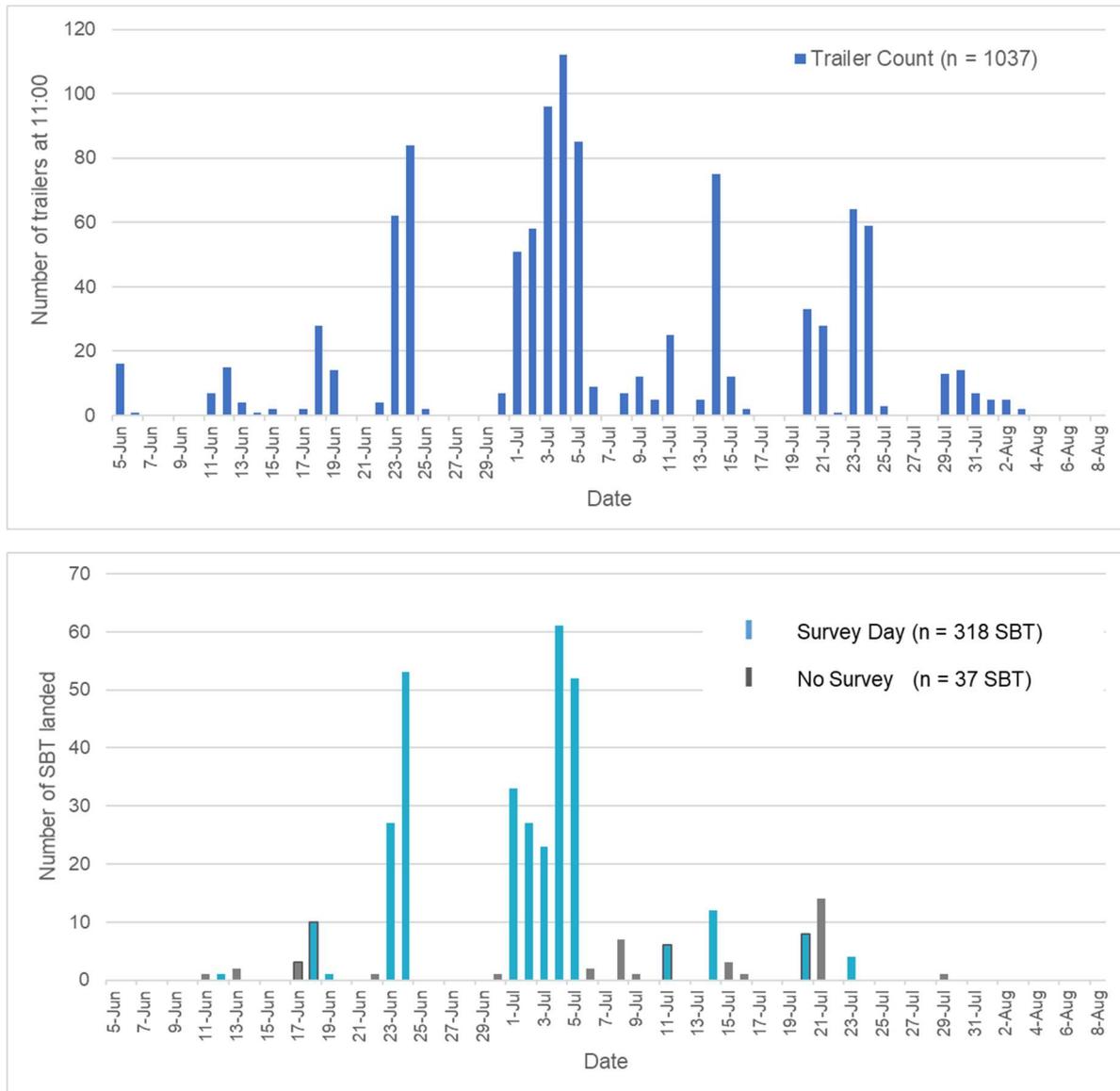


Figure 1: Waihou Bay trailer counts in 2021 by day (top) and number of landed SBT captured in survey interviews plus club weigh station observations on survey days and non-survey days at Waihou Bay (bottom).

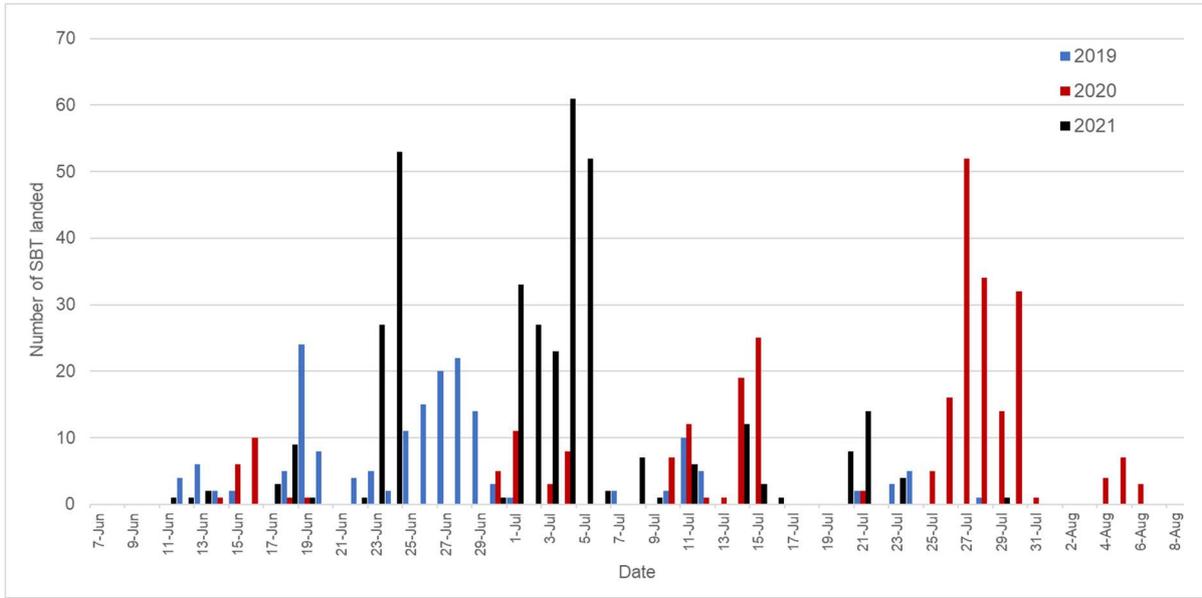


Figure 2: The daily number of landed SBT from survey interviews plus club weigh station observations on survey days and non-survey days at Waihou Bay by year since 2019.

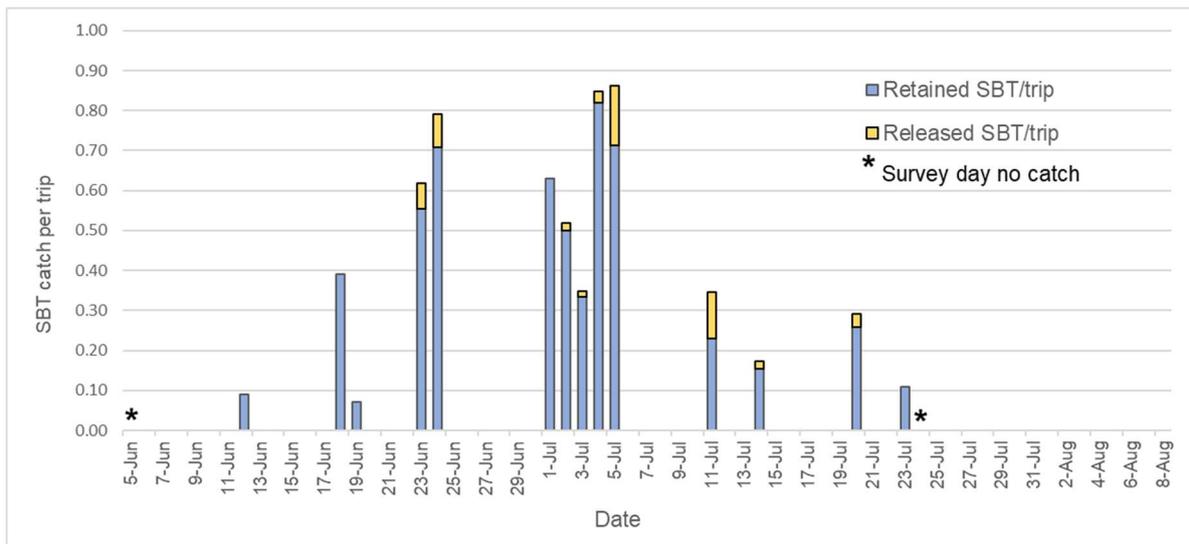


Figure 3: The daily catch rate of landed SBT per trip from the Waihou Bay on-site survey in 2021.

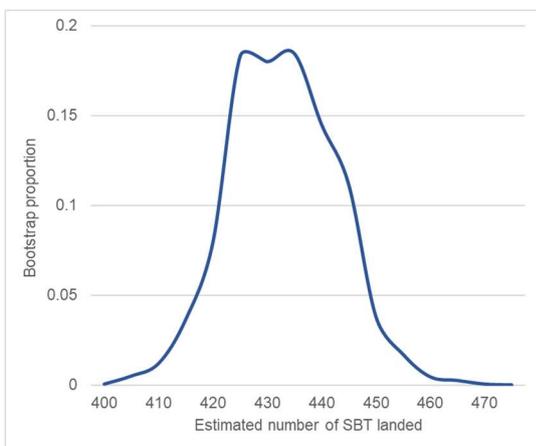


Figure 4: The bootstrap distribution of expanded survey harvest estimate from Waihou Bay 2021.

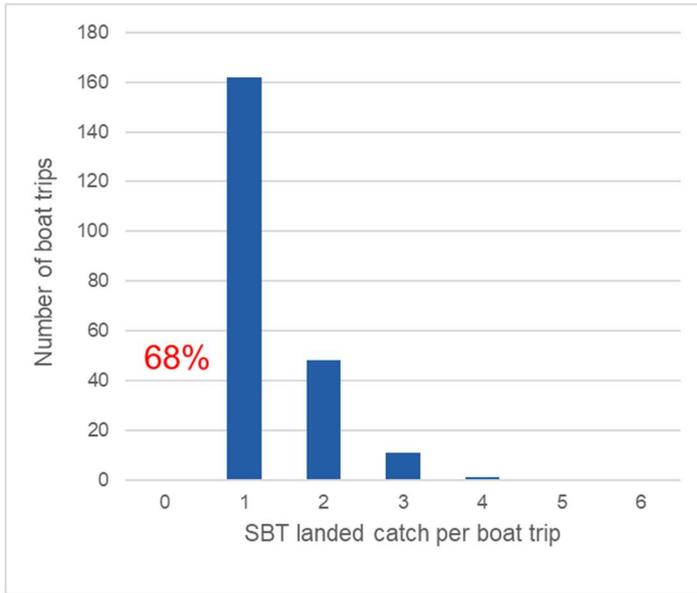


Figure 5: The number of SBT landed per private boat trip (day) in 2021 from on-site survey data and the proportion of trips with zero catch (red). (4 SBT from a charter trip)

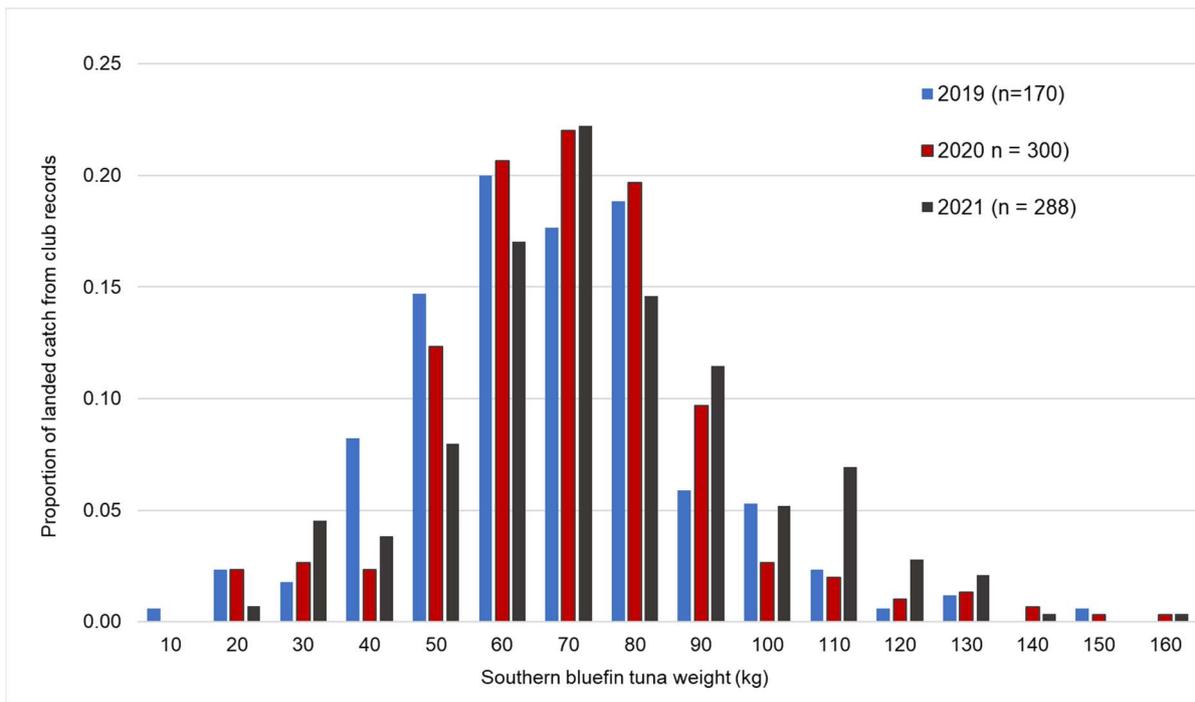


Figure 6: The weight distribution of SBT weighed by North Island sport fishing clubs 2019 to 2021.

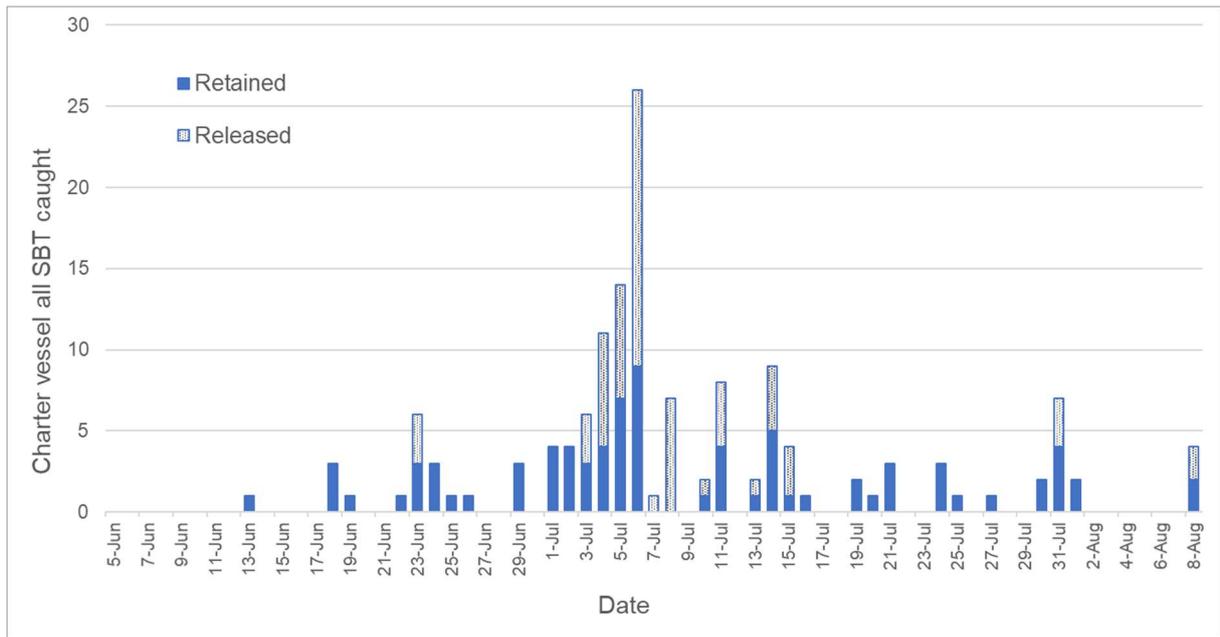


Figure 7: The number of SBT retained or released from amateur charter vessels by day in the North Island in 2021.

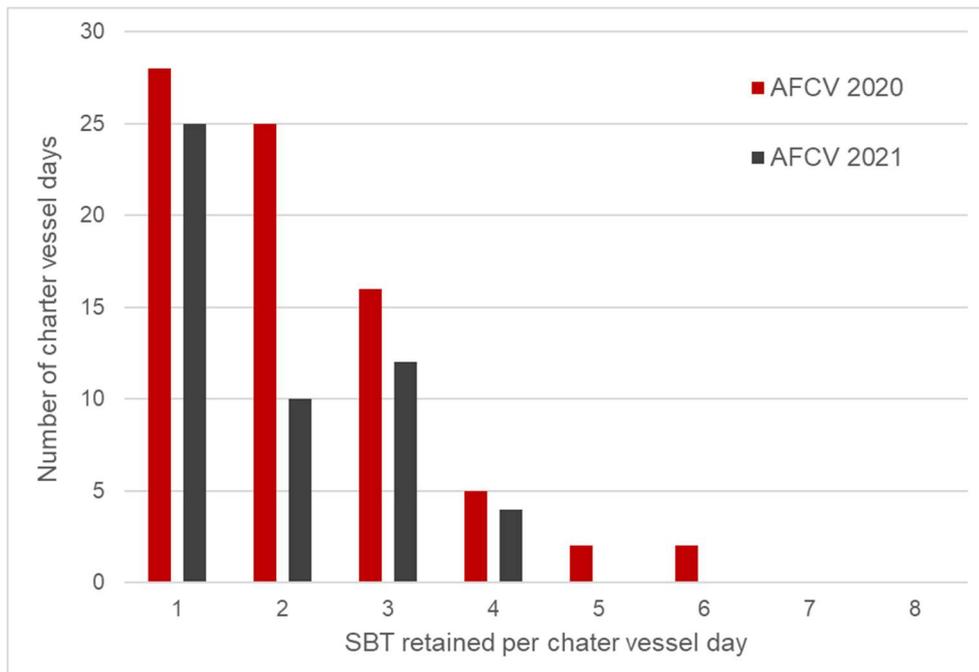


Figure 8: The number of SBT retained per amateur fishing charter vessel day when targeting SBT in the North Island in 2020 and 2021. AFCV is amateur fishing charter vessels.

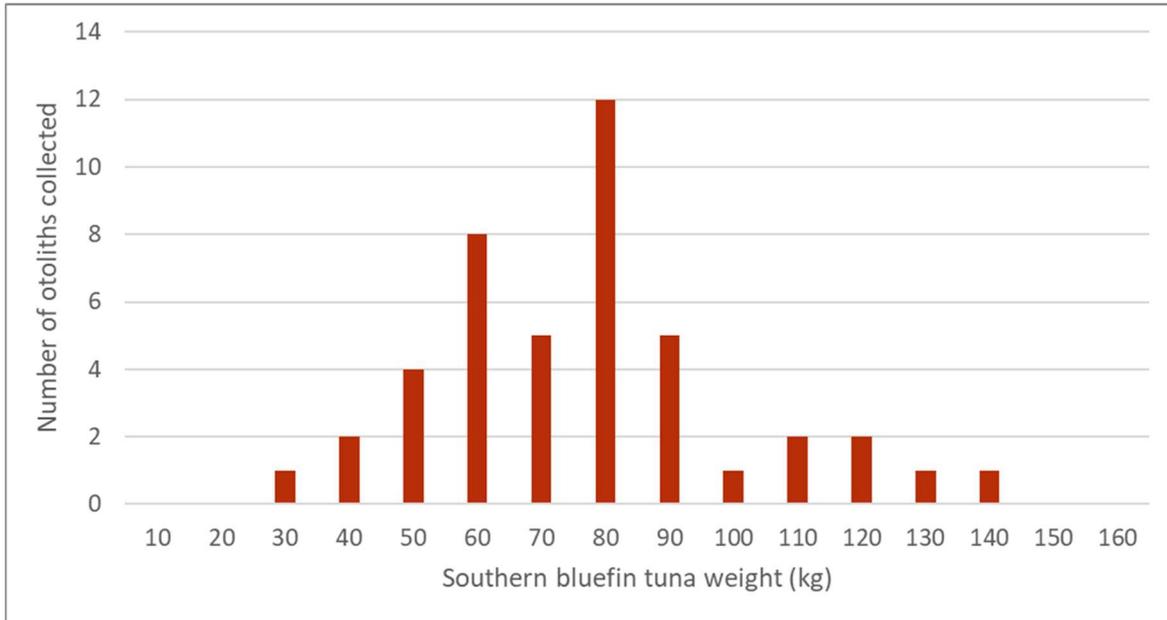


Figure 9: Weight distribution of southern bluefin tuna caught in the recreational fishery from Waihou Bay which had otoliths removed in 2021.

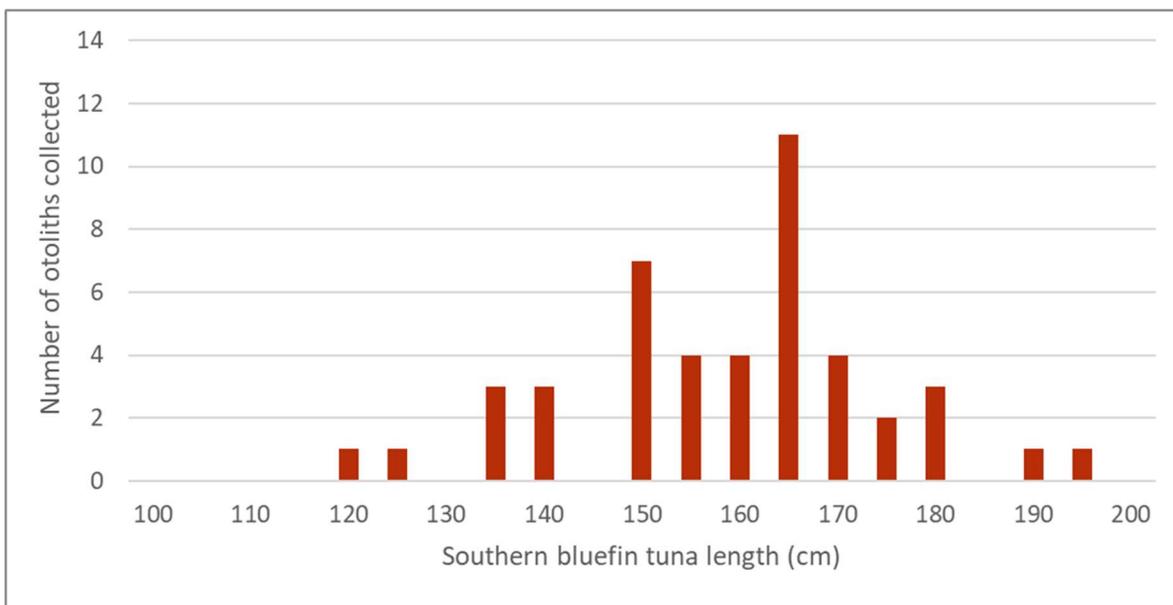


Figure 10: Length distribution of southern bluefin tuna caught in the recreational fishery from Waihou Bay which had otoliths removed in 2021.