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Tini a Tangaroa

Recreational harvest of southern bluefin tuna in New Zealand, 2019–20

New Zealand Fisheries Assessment Report 2021/16

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ISSN 1179-5352 (online)

ISBN 978-1-99-100361-4 (online)

April 2021



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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 2020 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 2019–20 recreational harvest estimate for southern bluefin tuna.....	9
4. DISCUSSION.....	9
5. ACKNOWLEDGMENTS.....	11
6. REFERENCES	11
TABLES AND FIGURES.....	13

EXECUTIVE SUMMARY

Holdsworth J.C. (2021). Recreational harvest of southern bluefin tuna in New Zealand, 2019–20.

New Zealand Fisheries Assessment Report 2021/16. 20 p.

This report describes the New Zealand recreational catch of southern bluefin tuna in the 2019–20 fishing year. The species code for southern bluefin tuna (*Thunnus maccoyii*) 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 fishery that started in 2017 off the east coast of the North Island mainly in June and July.

The North Island catch is predominantly taken by trailer boats launching from Waihou Bay in the eastern Bay of Plenty. In 2020 an 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 provided accurate weights of individual fish and assisted with collection of SBT heads for otolith extraction. Catch records were obtained from 12 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 715 boat crews with 267 landed SBT. The total number of fish landed, estimated using average catch from surveyed boats and trailer counts of non-surveyed boats, was 305 SBT (with a CV of 0.015). A further 122 SBT were recorded by other sport fishing clubs. The average SBT weight from North Island club records in 2019–20 was 72.6 kg (s.d. 21.77 kg).

In 2020 there were 147 SBT retained by Amateur Fishing Charter Boats in the North Island with an estimated average weight of 73.7 kg (s.d. 28.29). This is a significant increase in fishing effort and harvest over previous seasons.

The South Island fishery was surveyed for the first time in 2020. Covid-19 and government restrictions on fishing from private boats from 23 March to 12 May 2020 greatly reduced the SBT target fishery and the proposed onsite survey in the South Island. A telephone list of SBT fishers was generated and used to collect information from a core group of 17 boat owners who had previously fished for SBT. There were eight SBT reported landed from March to June with an overall SBT average weight in the off-site survey of 72.5 kg (s.d. 55.67). A further six SBT were landed in March by anglers on charter boats with an average estimated weight of 24.3 kg (s.d. 8.41). Harvest reported as recreational catch taken from commercial vessels under section 111 of the Fisheries Act 1996 (671 kg) is also included in harvest estimates.

The total landed recreational catch estimated for 2019–20 is 587 SBT weighing 42.62 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 652 to 717 SBT and a point estimate of 685 SBT weighing 48.9 t.

The 2019–20 recreational fishery was affected by government restrictions on travel and fishing but SBT stayed within range later in the season which does not always happen. Catch rates off Cape Runaway were the highest during in the last week of July and 58% of Waihou Bay landed catch was taken that week.

1. INTRODUCTION

1.1 Objectives

Overall objectives:

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

Specific objectives:

1. To design an on-site survey to estimate amateur harvest of southern bluefin tuna in the eastern Bay of Plenty.
2. To design and implement a survey to estimate the amateur harvest of southern bluefin tuna on the west coast South Island.
3. To estimate the amateur southern bluefin tuna harvest for the 2020 southern bluefin tuna fishing year using the method developed in Specific Objectives 1 and 2, data from the amateur charter vessels, section 111 landings and sport fishing club records.
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 (SBT) 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 as a result of the revised national allocation of 1088 t following an update of the stock assessment by CCSBT and operation of the agreed management procedure. As a result, 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 for the next three years.

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 2019–20 New Zealand fishing year (1 October 2019 to 30 September 2020). 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 2020 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. The survey design was proposed in the tender response document and discussed with members of the Waihou Bay Sport Fishing Club and Bruce Hartill (NIWA). A presentation on the survey design for 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 November 2019. An important consideration was the uncertainty around when the fishing effort targeting SBT at Waihou Bay would occur. 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 9 August 2020 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 66 days;
3. Initial estimate of 18 days of on-site interviews to determine fishing effort and catch;
4. A decision rule that if there are 10 or more boat trailers at noon for boats over 5 m long, this would become a survey day (criteria reviewed in July);
5. One primary interviewer with a backup person trained and able to fill in if needed;
6. Collection of vessel and angler details to match with club records of weighed fish to avoid double counting;
7. Record the number of fishers per boat, fishing method, hours fished, individual catch, retained or released, and length measurements of landed SBT;
8. Collection of heads, where possible, and extraction of otoliths;
9. Record any capture and fate of seabirds.

Data were collected on hard copy forms following the design used 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. Fish presented to the weigh station were measured (fork length) and fish were measured in boats where time allowed. Interview sessions were extended to include boats that returned in the morning and early afternoon in 2020, because a number of fishers were returning to the ramp once they had caught an SBT. As in previous years, interview sessions ended before it was 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 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, 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 2020 calendar year because no recreational catch was reported between 1 October and 31 December 2019 or after the end of the commercial fishing year on 30 September 2020.

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. The health and safety policy does not allow interviewers to work on the boat ramps in the dark. The club did weigh fish on request into the evening, though 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, on days when there are 10 or more trailers for boats capable of fishing offshore, collected information on the number of boats intercepted and the number of SBT landed. Boat trip was used as the unit of fishing effort because it could be applied to both interview data and trailer counts. For survey days the mean landed catch per trip from survey interviews that day was multiplied by the number of boats not surveyed based on 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 skippers 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 10 000 estimates of total landed catch at Waihou Bay, which was used to generate an overall CV and 95% confidence intervals.

2.4 South Island survey

For the last two years, 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, the project included an objective to design and implement a survey to estimate the amateur harvest of southern bluefin tuna off the west coast South Island. 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.

A pilot survey was proposed to help characterise the fishery and collect contact details of SBT fishers. The main access points of Milford Sound, Deep Cove, Doubtful Sound, and Jackson Bay in Westland are relatively remote with sporadic use by SBT fishers. A stratified random survey of days was developed with a wind strength forecast cut off at 30 knots or more to spread survey effort across fishable days. This could produce an independent harvest estimate for the season, but there was a risk of low encounter rate of SBT fishers and small sample size. Survey forms, an interviewer manual, and a handout to fishers were produced.

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 for 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 (maybe 20 to 40) 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. An important consideration in the survey design is that it needs to be affordable and repeatable if annual harvest estimates are required.

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. Individual SBT estimated weights were recorded for most (78%) 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 recreational landed catch from the eastern Bay of Plenty is not recorded in club records or by the on-site survey. Also the new South Island surveys of SBT landed catch by recreational fishers will not include all catch for 2019–20. 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 2019–20 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 these estimates was used as the point estimate. In 2019–20 the amateur fishing charter vessel retained catch was a significant proportion of overall catch and it is assumed that reporting is reasonably complete.

2.8 Biological data

Sport fishing club weigh stations are a good source of accurate size, date, and location data. Southern bluefin tuna length information was collected in conjunction with heads taken for otolith extraction by the creel survey at Waihou Bay. 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 were not confused with SBT.

3. RESULTS

3.1 Landed catch from the 2020 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 the development and distribution of the FishCare 'Southern Bluefin Tuna Guide to Best Practice for Recreational Fishers'. Trailer counts started on 6 June 2020 a week earlier than in 2019. New Zealand had recently suspended Covid-19 travel restrictions, but some uncertainty remained about containing the virus at borders as New Zealand citizens returned from overseas. The Waihou Bay Sport Fishing Club and the NZSFC supported and publicised requests from local kaumātua (Māori leaders) from Pararaki Hapu to discourage SBT fishers from travelling to Waihou Bay in 2020.

The first survey day at Waihou Bay was the 14 June 2020 because there were 14 boat trailers at 11:00 am and radio conversations confirmed that these boats were targeting SBT. One SBT was landed that day and this was the first SBT weighed for the season by the Waihou Bay Sport Fishing Club (Table 1). Fishing effort was relatively low through the rest of June. A reasonable weather window and some planned trips around full moon saw fishing effort peak on 4 July with 104 trailers counted at 11:00 am.

A survey total of 891 trailers for boats that were capable of offshore fishing was counted over 72 days, and 715 boat crews were intercepted and interviewed on the boat ramp. Overall, 80% of trailer count effort from the Waihou Bay boat ramp was surveyed. On five survey days the number of interviews exceeded the 11:00 trailer count (Table 1). Some of these boats returned before 11:00 and some trailers may have been parked away from the ramp on private property. This year no crews refused to answer the interview questions. There were 19 survey days with a total trailer count of 798 so the interview coverage was 90% on survey days.

A total of 267 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. A further 13 SBT were in the club weigh station records only, because they were caught on days with no survey or landed after dark (Table 1).

The distribution of fishing effort per day shows that most fishing effort occurred during weather windows in July. There were 8 days in July with more than 40 boat trailers counted (Table 1, Figure 1). Fishing continued into August and the survey ended on 16 August 2020. The number of SBT caught per day depends to some degree on fishing effort. In 2020 there were five days when 20 or more SBT were landed and these days were all in mid to late July (Figure 1).

Southern bluefin tuna catch per boat trip from the survey interviews is highest in late July and peaks on 30 July at 1.33 SBT per boat for the 24 crews interviewed that day (Figure 2). This catch rate is double the best catch rates seen in previous surveys and similar to the highest catch rates in 2017, which were based on club records because there was no survey that year.

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 is 304 SBT (CV 0.015) (Table 2). The distribution of bootstrap harvest estimates from the expanded survey data is shown in Figure 3.

The on-site survey collected information on the number of SBT landed per trip and the number of unsuccessful trips. In 2020, 71% of crews interviewed at Waihou Bay landed no SBT and of those that caught fish, 74% landed one fish per trip, 23% landed two fish, and 3% landed three fish per trip (Figure 4). In addition, 29 SBT were released or tagged and released from 25 trips.

3.2 Sport fishing club records

A total of 122 SBT were recorded landed by North Island sport fishing clubs other than Waihou Bay in 2019–20. Most of these fish were caught in July in the Bay of Plenty. In addition, there were SBT caught off Hawke Bay and Gisborne. The average weight for these fish was 72.6 kg (s.d. 21.64) (Table 2). There is some overlap between club records and charter vessel reporting.

The distribution of weights recorded by all North Island clubs over the last three years shows a high proportion of landed catch between 60 and 89 kg (Figure 5). This 2020 distribution is similar to that in 2019.

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 were 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.

The South Island SBT fishery and the harvest surveys were hampered in a number of ways in 2020. The interviewer travelled from Wellington to Te Anau, arriving the day after a severe storm and slips closed the road to Milford for five weeks. The road reopened in mid-March initially for tourist operators only. Good contacts were made with the manager of the hostel run by the Deep Cove Outdoor Education Trust in Doubtful Sound and the Honorary Fisheries Officer at Jackson Bay. They were provided with handouts for fishers and survey forms for SBT fishers and there was an on-site visit over Otago Anniversary Weekend (21 to 23 March 2020) to gather local knowledge. There was excellent cooperation and useful contact details for people who target SBT were obtained for the telephone survey.

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 under level 4 which ended on 27 April, nor under level 3 which ended on 12 May 2020. The Easter holidays, which are popular with SBT fishers in the South Island, fell in the middle of level 4 restrictions. There were no returning SBT fishers or catch encountered on the boat ramps surveyed.

The Respondent Driven Sampling off-site survey reached 17 SBT fishers using a variety of sources and referrals. Not all of these were able to fish in 2020. There were eight SBT reported landed after a slow start to the fishery. Four SBT estimated as 30 to 35 kg were landed in March, and four large SBT were landed in May and June with estimated weights between 70 kg and one fish estimated at 170 kg. The average weight for fish reported in the off-site survey was 72.5 kg (s.d. 28.29) (Table 2).

3.4 Amateur fishing charter boat records

An extract of amateur fishing charter vessel records from events where bluefin tuna were targeted or caught was provided by Fisheries New Zealand. This database allows free text entries for species codes or names so all southern bluefin tuna and Pacific bluefin tuna data were requested. There was a significant increase to charter fishing effort and retained catch in 2020 with a total of 125 vessel days (events) targeting SBT and 153 SBT retained (Table 3).

In previous seasons most charter fishing effort and catch has come from the Fiordland area on the west coast of the South Island. The SBT catch was down in the South Island with six SBT retained and one released. The average weight of retained SBT was 24.3 kg (s.d. 8.41) (Table 2).

In 2020 the charter fishing effort and catch increased in the North Island, 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 mid to late July (Figure 6). 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 147 SBT were retained on North Island charter vessels and 72 (33% of catch) released. The proportion of catch released increased later in the season as the fishing improved (Figure 6).

Many of the charter fishing events targeting SBT were 6 hours long with an overall average of 5.5 hours (s.d. 1.6). Retained catch for successful days was mostly 1 to 3 SBT (88%), and a few events retained 4 to 6 fish (Figure 7); 32% of events did not catch or retain SBT.

The average estimated weight of SBT retained by charter vessels off the east coast of the North Island is 73.7 kg (s.d. 28.29) and the total harvest weight for 2020 is 10.7 t (Table 2).

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 2019–20 fishing year, the reported section 111 landings were 671 kg. The highest annual weight of section 111 catch reported over the last six years was 1038 kg in 2016–17 (Table 4).

3.6 Otoliths collected

A total of 90 usable otolith sets were extracted from southern bluefin tuna intercepted during the creel survey at Waihou Bay in 2020. The weight of these fish ranged from 29.6 kg to 148.6 kg with a mode at 70 to 80 kg (Figure 8). The fork length of these fish ranged from 119 to 203 cm with a broad mode from 155 to 170 cm (Figure 9). Measurements were made with the fish on top of a measuring mat.

3.7 2019–20 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 2019–20 of 42.6 t (Table 2).

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 46.6 t to 51.3 t of SBT and a point estimate recreational SBT catch in 2019–20 of 48.9 t (Table 2).

4. DISCUSSION

This is the third dedicated project to estimate the recreational harvest of southern bluefin tuna in New Zealand. Since the 1970s the recreational catch has been taken mostly off the west coast of the South Island by a small number of fishers 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.

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 under level 4 or level 3 which ended on 12 May 2020. Travel restrictions were suspended, but some uncertainty remained about containing the virus at borders as New Zealand citizens returned from overseas. The Waihou Bay Sport Fishing Club and the NZSFC supported and publicised requests from local kaumatua from Pararaki Hapu to discourage SBT fishers from travelling to Waihou Bay in

2020. This reduced fishing effort in June. By mid-June water temperatures were in the range preferred by SBT in this area (about 17 °C) and currents were favourable for fishing off Cape Runaway (Figure 10). In July there was more confidence that Covid-19 was not being transmitted in the community and fishing effort increased. There was also a significant increase over previous years in launches and charter boats fishing for SBT in the area off Cape Runaway.

An adaptive sampling strategy was used to target survey effort on days when fishing effort was above a pre-determined level (Moore et al. 2015). The Waihou Bay survey ran for 72 days collecting counts of empty boat trailers. The on-site survey at the Waihou Bay boat ramp covered 19 days when 10 or more trailers were counted and interviewed fishers from 715 boat trips. This year no crews refused to answer the interview questions.

A total of 267 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. A further 13 SBT were in the club weigh station records only because they were caught on days with no survey or landed after dark (Table 1). The expanded Waihou Bay survey estimate of landed catch, that includes non-survey days and boats returning after dark, is 305 SBT (CV 0.015) for 2020.

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.

The main fishing method used was trolling lures (97% of trips interviewed). There were no seabirds reported caught or tangled by any of the crews interviewed at Waihou Bay. There was one Pacific bluefin tuna reported by a charter vessel fishing off Cape Runaway on 28 July 2020 while targeting SBT.

Fishing effort at Waihou Bay has tended to peak around the full moon in either June or July. This occurred in July 2020 but the catch rates were low. Plotting the catch per boat day from the three on-site surveys by day of the moon cycle shows catch rates are highest 3 to 6 days before the full moon or about 10 days after (Figure 11). However, fishing effort was not consistent across days.

This was the first year of surveying private fishers in the South Island. Data are available from charter vessels and recreational catch on commercial vessels because it is required to be reported to Fisheries New Zealand. Attempts to establish a pilot on-site survey were disrupted in February when the Milford Sound Road was washed out and in March by Covid-19 restrictions. 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 has had a good response from participants and is worth continuing and expanding. There was no catch reported in February 2020 in the South Island telephone survey or charter vessel records. Small SBT were reported in March and a few large fish were caught in May.

The estimated recreational harvest of SBT in 2018–19 was 25.9 t with 66% of the total from the Waihou Bay survey estimate. The national harvest estimate in 2019–20 was nearly double that, at 48.9 t, with 51% from the Waihou Bay survey estimate. There are several factors that have contributed to this increase:

- SBT were more available to recreational fishers than in the previous two survey years because they were within range of trailer boats and in good numbers throughout July.
- More launches and charter vessels travelled to the eastern Bay of Plenty to target SBT and catch rates were good at times.
- Fishers from other ports were catching SBT in the western Bay of Plenty and east of Great Barrier Island later in the season which does not always happen.
- Catch rates were the highest for the season in late July, which has not happened before. This aligned with a good weather window and 58% of Waihou Bay landed catch was taken in the last week of July.

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. In 2017 and 2020, SBT were within range 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, possibly with the moon phase. This recreational fishery in the eastern Bay of Plenty has only existed for four years. Catch rates have varied significantly within and between years and the fishery is still evolving.

5. ACKNOWLEDGMENTS

Many thanks to Christine Elmiger and the Waihou 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 STN2019-02.

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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
6/06/2020	2				16/07/2020	0			
7/06/2020	1				17/07/2020	0			
8/06/2020	0				18/07/2020	2			
9/06/2020	0				19/07/2020	2			
10/06/2020	4				20/07/2020	0			
11/06/2020	0				21/07/2020	2			2
12/06/2020	0				22/07/2020	0			
13/06/2020	6				23/07/2020	0			
14/06/2020	14	15	1	1	24/07/2020	1			
15/06/2020	21	20	6	6	25/07/2020	46	39	5	5
16/06/2020	20	17	10	10	26/07/2020	78	63	16	16
17/06/2020	7				27/07/2020	66	69	51	52
18/06/2020	1			1	28/07/2020	37	36	34	40
19/06/2020	1			1	29/07/2020	27	28	14	14
20/06/2020	1				30/07/2020	24	24	32	33
21/06/2020	0				31/07/2020	1			1
22/06/2020	0				1/08/2020	0			
23/06/2020	3				2/08/2020	2			
24/06/2020	2				3/08/2020	2			
25/06/2020	0				4/08/2020	9			4
26/06/2020	1				5/08/2020	27	27	6	7
27/06/2020	1				6/08/2020	17	20	3	3
28/06/2020	1				7/08/2020	0			
29/06/2020	0				8/08/2020	3			
30/06/2020	12	16	5	5	9/08/2020	4			
1/07/2020	36	36	11	11	10/08/2020	1			
2/07/2020	0		0		11/08/2020	1			
3/07/2020	70	60	3	3	12/08/2020	2			
4/07/2020	104	81	8	8	13/08/2020	3			
5/07/2020	0				14/08/2020	3			
6/07/2020	0				15/08/2020	9			
7/07/2020	0				16/08/2020	8			
8/07/2020	1				17/08/2020	0			
9/07/2020	0				18/08/2020	0			
10/07/2020	41	30	7	7	Total	891	715	267	291
11/07/2020	76	57	12	13					
12/07/2020	5		0	1					
13/07/2020	1		0	1					
14/07/2020	34	31	19	21					
15/07/2020	48	46	24	25					

Table 2: Recreational harvest estimates for 2019–20 from available sources with an allowance for unaccounted catch of 22.5% and range of 15% to 30%.

Source	Harvest no.	Mean wgt (kg)	Harvest wgt (t)
North Island			
Waihou Bay Survey	304 (CV 0.015)	71.16	21.63
Other club catch NI	122	72.60	8.86
Charter vessel	147	73.70	10.74
South Island			
Phone survey	8	72.5	0.58
Charter vessel	6	24.3	0.15
National			
section 111	?		0.671
Total	587		42.62
Plus unaccounted catch			
Low estimate 15%	652		46.6
High estimate 30%	717		51.3
Point estimate	685		48.9

Table 3: Southern bluefin tuna effort and catch from amateur fishing charter vessel logbooks by year.

	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

Table 4: 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
Greenweight kg	672	661	1 038	507	454	671

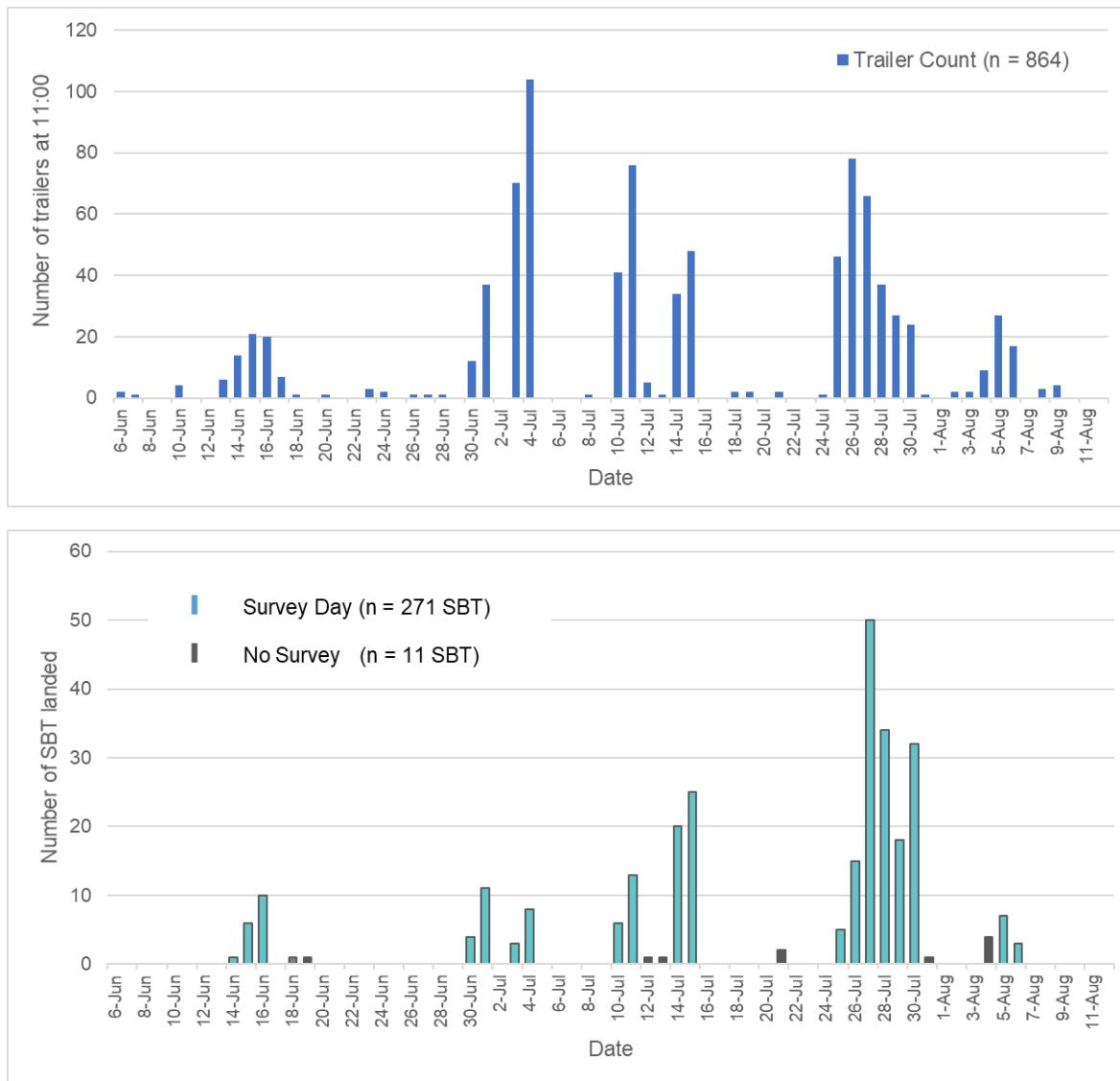


Figure 1: Waihou Bay trailer counts in 2020 by day (top) and number of landed SBT captured in survey interviews plus club weigh station observations on survey days and non-survey days at Waihou Bay (bottom).

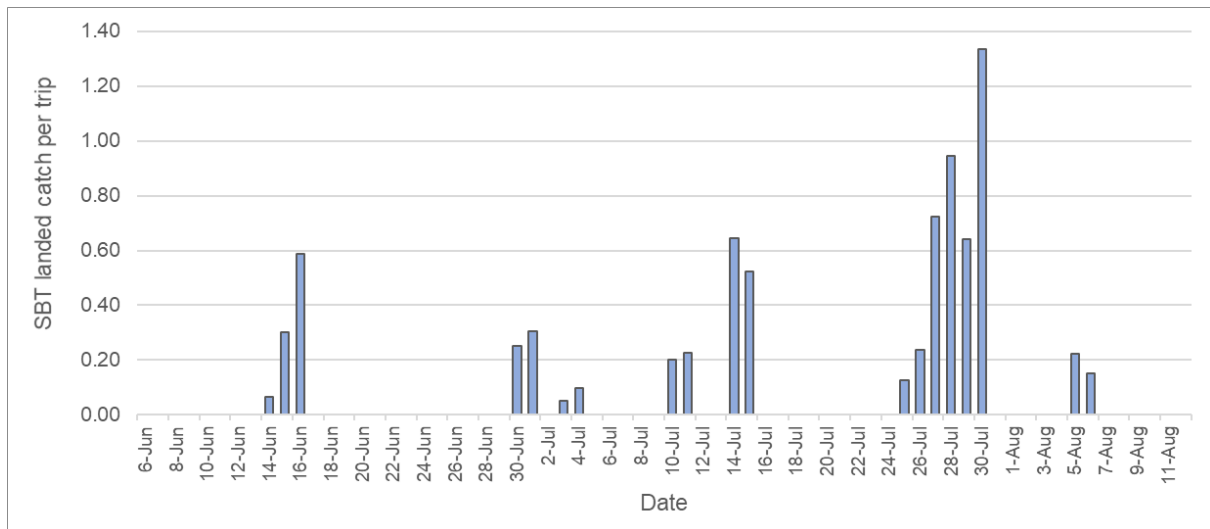


Figure 2: The catch rate of SBT per boat day from the Waihou Bay on-site survey 2020.

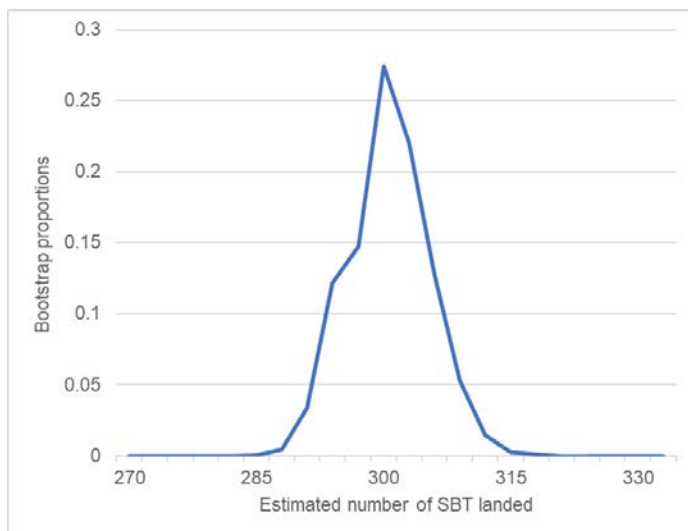


Figure 3: The bootstrap distribution of expanded survey harvest estimate from Waihou Bay 2020.

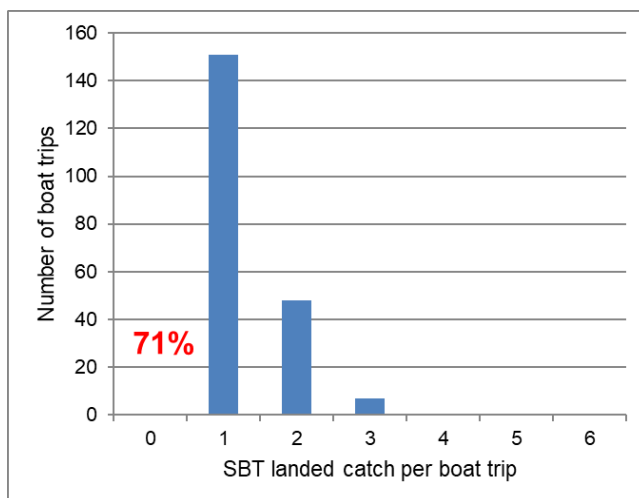


Figure 4: The number of SBT landed per private boat trip (day) in 2020 from on-site survey data and the proportion of trips with zero catch (red).

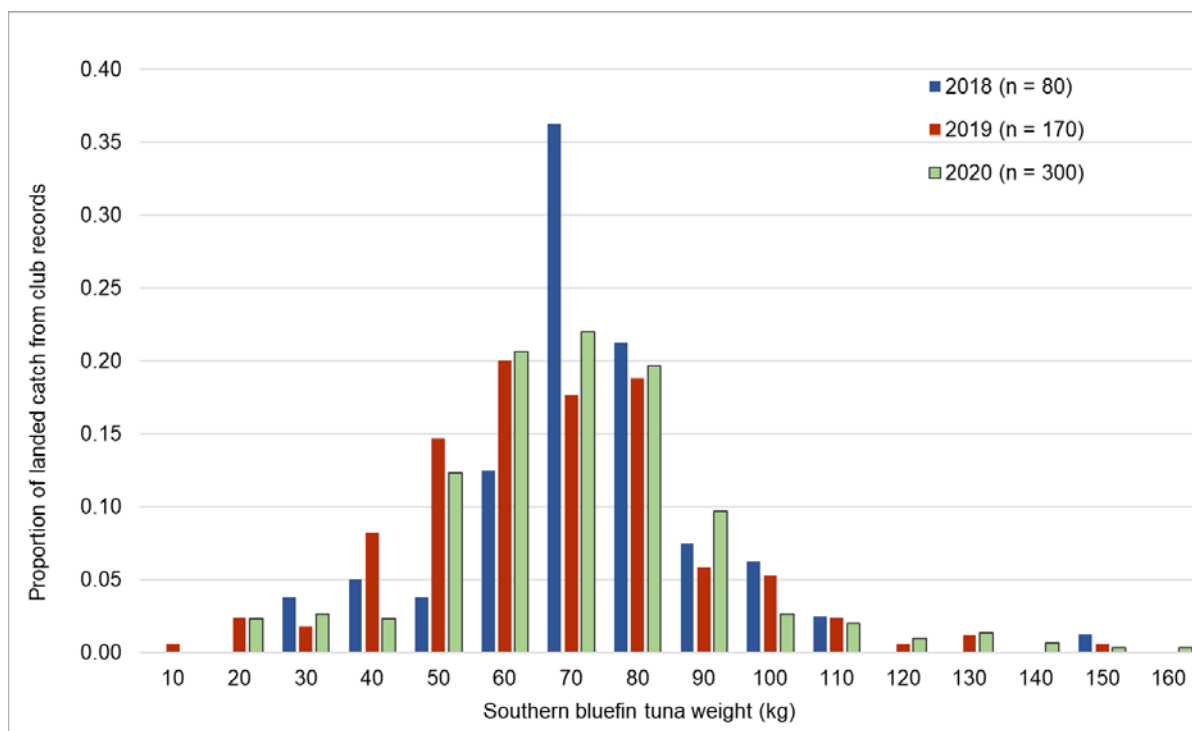


Figure 5: The weight distribution of SBT weighed by North Island sport fishing clubs 2018 to 2020.

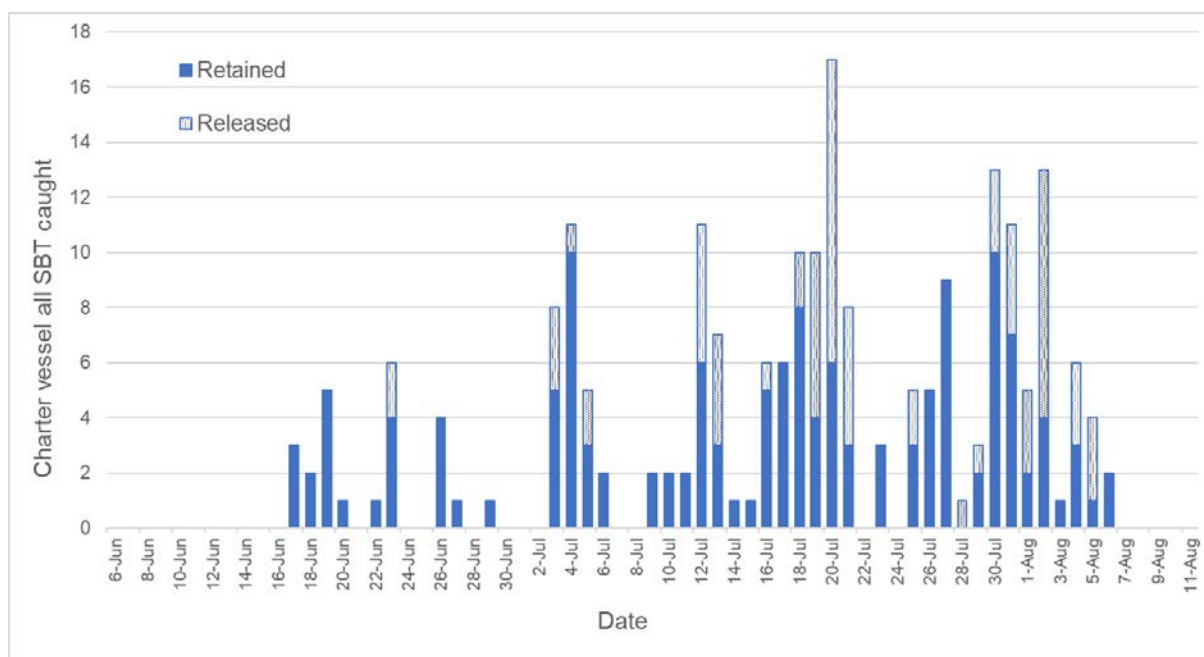


Figure 6: The number of SBT retained or released from amateur charter vessels by day in the North Island in 2020.

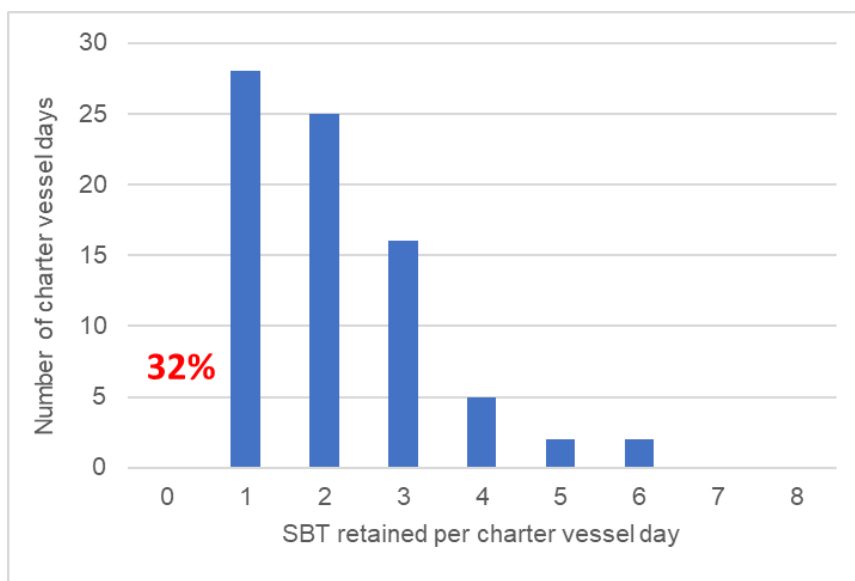


Figure 7: The number of SBT retained per charter vessel day when targeting SBT in the North Island in 2020 and the proportion of charter events with zero catch (red).

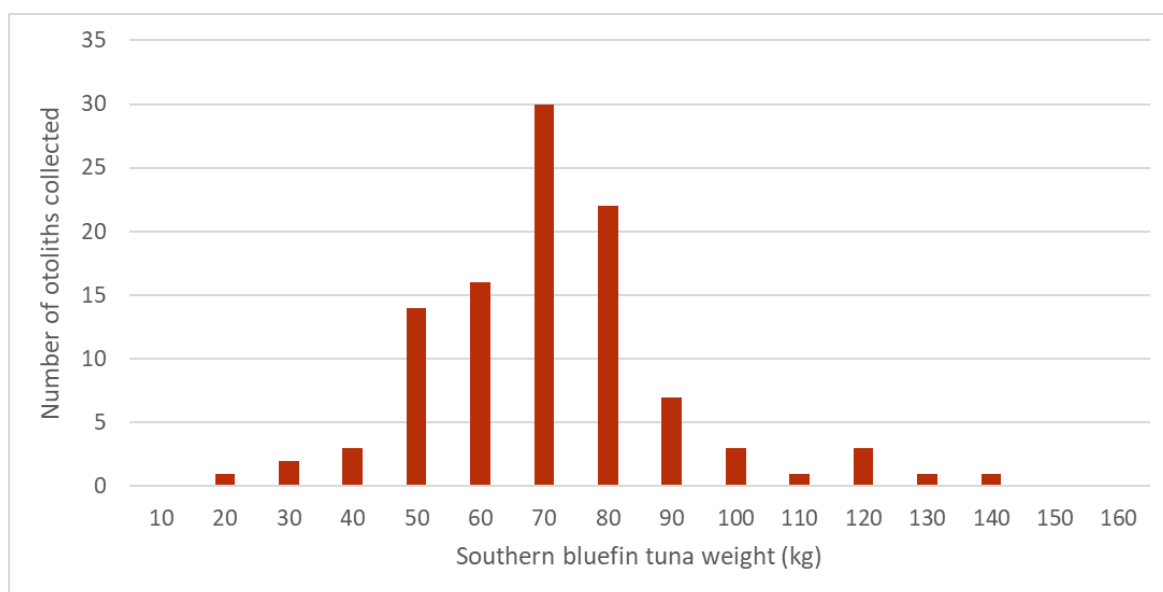


Figure 8: Weight distribution of southern bluefin tuna caught in the recreational fishery from Waihou Bay which had otoliths removed in 2020.

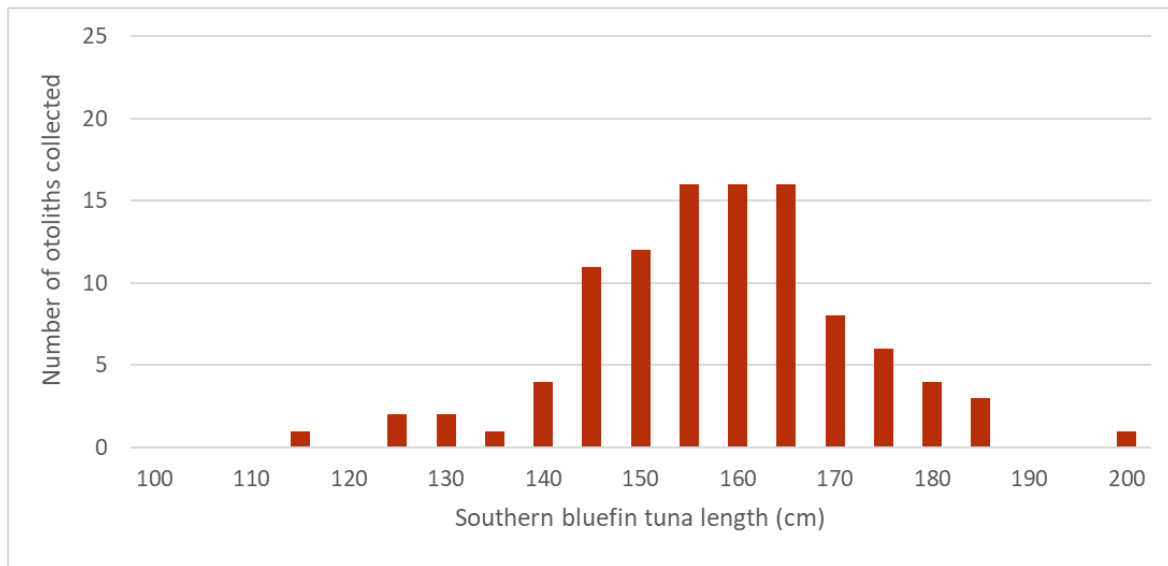


Figure 9: Length distribution of southern bluefin tuna caught in the recreational fishery from Waihou Bay which had otoliths removed in 2020.

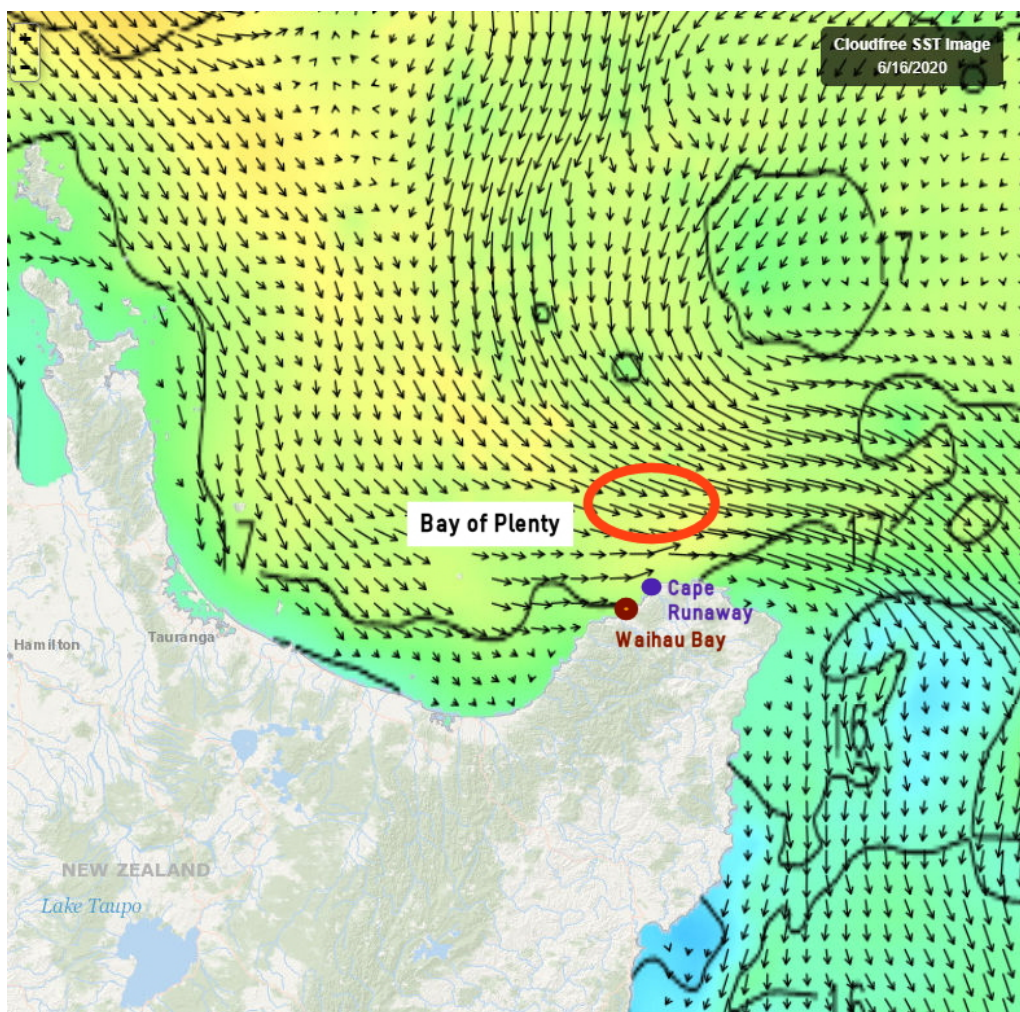


Figure 10: Predicted sea surface temperature and currents off the east coast of the North Island on 16 June 2020 from the Fish Track website. Main recreational fishing area outlined in red. The 17 °C isotherm is level with Waihou Bay and Cape Runaway.

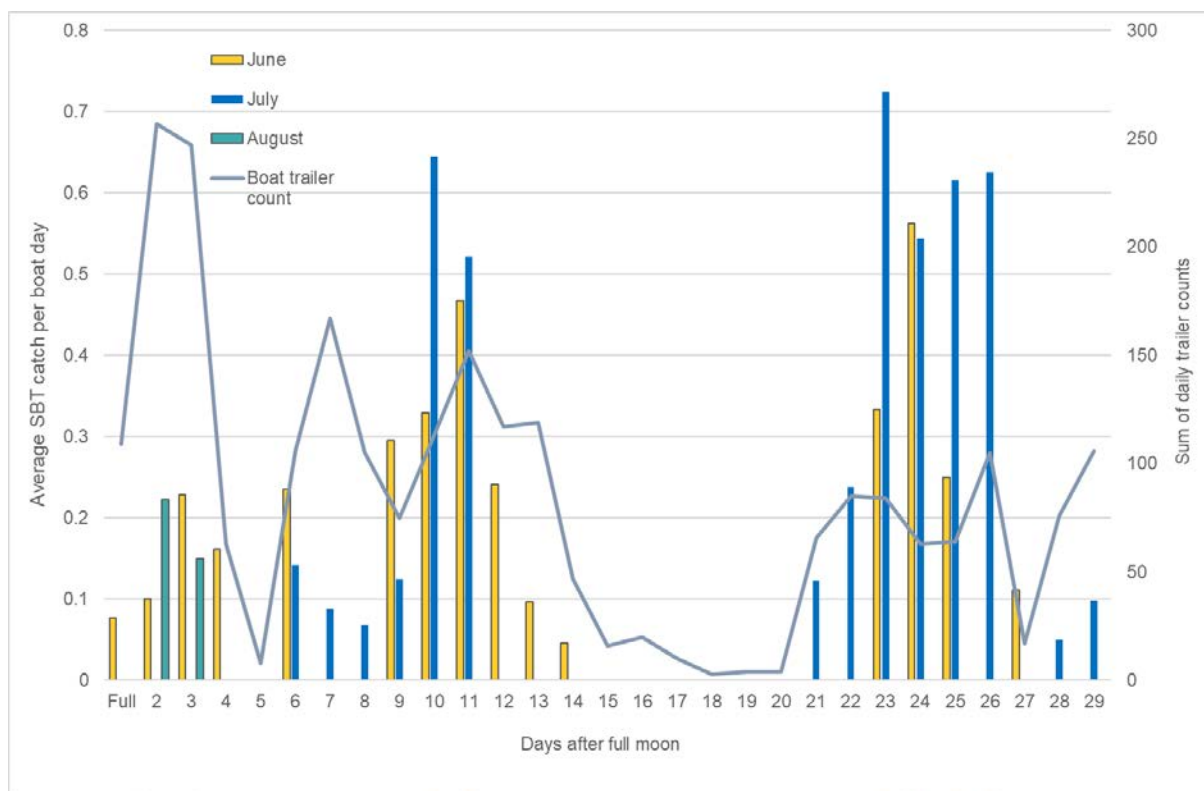


Figure 11: SBT catch per boat day averaged across three years of Waihou Bay on-site survey data by days in the lunar cycle (columns, left axis). Fishing effort has been consistently low in some periods (line, right axis).