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Tini a Tangaroa

# Recreational harvest of southern bluefin tuna in New Zealand, 2017–18.

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## EXECUTIVE SUMMARY

**Holdsworth J.C. (2019) Recreational harvest of southern bluefin tuna in New Zealand, 2017–18.**

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This report describes the New Zealand recreational catch of southern bluefin tuna in the 2017–18 fishing year (October 2017 to September 2018). The species code for southern bluefin tuna (*Thunnus maccoyii*) in the New Zealand commercial fishery is STN. In this report we use internationally recognised abbreviation for southern bluefin tuna SBT.

There are two distinct recreational fisheries for southern bluefin tuna (SBT) in New Zealand at present. One off the west coast of the South Island from January to July and a new fishery off the east coast of the North Island in June and July.

The North Island catch is predominantly taken by trailer boats launching from Waihau Bay in the eastern Bay of Plenty. In 2018 an on-site survey at the Waihau Bay boat ramp collected detailed catch and effort information from returning fishers. The Waihau 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 11 other North Island sportfishing clubs.

An adaptive sampling strategy was used to target on-site survey effort at Waihau Bay using trailer counts at 11:00 am each day during the survey period. Surveys on days when 10 or more boat trailers were present intercepted 336 boats with 34 landed SBT. The total landed catch, estimated using average catch from surveyed boats and trailer counts of non-surveyed boats, was 69 SBT (with a CV of 0.068). A further 22 SBT were recorded by other sport fishing clubs. The average SBT weight from North Island club records in 2017–18 was 78.3 kg (sd 19.13 kg).

Anecdotal information of the South Island fishery estimates the landed catch by private fishers to be in the range 60 to 100 SBT in 2017–18. In addition, there is logbook data of recreational catch from charter boats of 12 SBT, all from the South Island, with an average weight of 50.4 kg. Harvest reported as recreational catch taken from commercial vessels under section 111 of the Fisheries Act 1996 is also included.

An allowance was made for unaccounted catch by recreational fishers who were not interviewed or chose not to weigh their fish at a club. The Highly Migratory Species Working Group recommended adding 15% to 30% of landed catch to cover the likely range of unaccounted catch in 2017–18.

The recreational harvest estimate for SBT in 2017–18 is therefore 15 t and the estimated range calculated using survey confidence intervals and the range in unaccounted catch is 13.4 t to 17.0 t.

# 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 estimate the amateur southern bluefin tuna harvest for the 2018 southern bluefin tuna fishing year using the method developed in Specific Objective 1, data from the amateur charter vessels, section 111 landings and sport fishing club records.
3. To characterise the biological and temporal nature of the marine amateur harvest of southern bluefin tuna.
4. 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 (*Thunnus maccoyii*) is a single stock, primarily distributed between 30º S and 45º 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 et al. 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 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 most recent stock assessment, completed in 2017, indicates that several years of strong recruitment are reaching maturity and that spawning stock biomass is increasing and is likely to continue to increase (Anon 2017).

The SBT catch limit for New Zealand was 420 tonnes (t) in the early 1990s. On introduction to the 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 TAC increases following allocation decisions by the CCSBT.

In 2012 the Total Allowable Catch (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 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 was set at 1046 t and allowances were retained when the TAC was set from 1 October 2018.

### 1.3. Description of the recreational fishery

There has been a small recreational fishery on 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 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 Waihau Bay. Fish were caught by trolling lures using the same tackle as the summer billfish fishery. Members of the Waihau 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 Waihau 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 on charter boats, but anecdotal reports suggest that there are a number of private boats active in this fishery when the weather is suitable.

This report describes the recreational catch in the 2017–18 New Zealand fishing year (October 2017 to September 2018).

## 2. DATA SOURCES AND METHODS

### 2.1. The on-site survey

A major component of this survey was to collect information from fishers as they returned to the Waihau Bay boat ramp using on-site interviews. The survey design was proposed in the tender response document and discussed with members of the Waihau Bay Sport Fishing Club and Bruce Hartill (NIWA). A presentation on the survey design 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 April 2018. An important consideration was the uncertainty around when the fishing effort would occur. The remote location, weather conditions, and fishing success will influence fisher interest and peak fishing periods.

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

1. A survey period from 23 June to 5 August 2018 when SBT were most likely to be in the area
2. Mid-day trailer counts at Waihau Bay to estimate daily fishing effort for 44 days
3. Initial estimate of 15 days of on-site interviews to determine fishing effort and catch
4. If there are 10 or more boat trailers at noon this will 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 that can be matched with club records of weighed fish
7. Collection of number of fishers, individual catch and length measurements of landed SBT
8. Collection of heads, where possible, and extraction of otoliths.

Data was collected on hard copy forms, designed with assistance from Bruce Hartill (NIWA). These included seabird interaction questions and a laminated show card of seabird species groupings. The boat ramp was very busy at times and most of the interviews occurred while the boat was being loaded on the trailer. Most of the fish were measured while boats were at the weigh station.

Collection bins for heads were provided by the Waihau 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 and label 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 and Northland provided detailed catch records from weigh stations with certified scales. Clubs weigh and record fish caught by affiliated club members and in most cases 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 have used 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. Information in this report is effectively the same as the 2018 calendar year as no recreational catch has been reported between 1 October and 31 December 2017 or after 30 September 2018.

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

## 2.3. Expanded survey catch at Waihau 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 Waihau Bay Sport Fishing Club. On busy days many of the boats came up the boat ramp 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 observed catch will therefore be an underestimate of the total Waihau Bay landed catch.

The creel survey collected information on the number of boats intercepted and the number of SBT landed. Every day during the survey period the trailer count provided an estimate of number of boats fishing that day. Boat trip was used as the unit of fishing effort as it could be applied to interview data and trailer counts. For survey days the mean landed catch per trip targeting SBT from survey interviews was multiplied by the trailer count for that day minus boats not fishing for SBT. For non-survey days with trailers, all boats over 5 metres were assumed to be fishing for SBT, and the overall survey CPUE (ratio of means) was multiplied by the trailer count for that day.

The mean daily catch per boat declined across the survey period. It was decided not to post stratify fishing effort and CPUE based on the observed periods of fishing effort as this can artificially lower survey variance estimates.

Variances associated with landed catch on survey days was estimated by resampling catch per boat trip 1000 times with replacement from survey data to assign catch to uninterviewed boats on that day. The average catch rate across all boats (interviewed and not interviewed) was resampled to give 1000 bootstrap estimates of daily catch per boat. These estimates were multiplied by the trailer count for the day to give 1000 bootstrap estimates of the catch on that day.

Variances associated with landed catch on non-survey days was estimated by bootstrapping an estimate of CPUE from all survey days and multiplying this by the trailer count for non-survey days.

Variances associated with total landed catch was estimated by adding the bootstrap estimates from survey days to estimates from non-survey to generate an overall CV and 95% confidence intervals for total landed catch.

### 2.4. Amateur fishing charter boat records

An extract of amateur charter vessel (AFCV) records from events where southern bluefin and Pacific bluefin tuna were targeted or caught was obtained from Fisheries New Zealand. The AFCV database contains a number of errors, some of which are important for estimating SBT catch in the past. Three fish recorded as SBT were over 200 kg and caught in FMA 7 prior to 2018. These were assumed to be Pacific bluefin. Some fishing trips reporting targeting SBT were in East Northland in January and February by charter boats known to be targeting marlin in years prior to 2018. These were removed from the dataset of trips targeting SBT.

### 2.5. Section 111 landings

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

### 2.6. Allowance for unaccounted catch

There is anecdotal information that some recreational fishers landed SBT that were not recorded in club records or by the on-site survey. In 2017 the NZSFC added 15% to the national SBT landed catch by recreational fishers as an estimate of unaccounted catch. This was based on the high proportion of catch landed at Waihau Bay and the observation from weigh masters that fishers wanted to weigh all their catch in this new fishery that year.

The Highly Migratory Species Working Group recommended adding 15% to 30% of landed catch to cover the likely range of unaccounted catch in 2017–18. The 95% confidence intervals from the Waihau Bay on-site survey were also used to estimate the upper and lower bounds of the SBT harvest. The mid-point of these estimates was used as the point estimate for 2017–18.

### 2.7. 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 for otolith extraction by the creel survey at Waihau Bay. We summarise the size distribution of SBT weighed and length distribution of fish sampled for otoliths.

# 3. RESULTS

## 3.1. Landed catch from the 2018 on-site survey

Blue Water Marine Research discussed and coordinated the lead up to the on-site survey with members of the Waihau Bay Sport Fishing Club. This included information posted on social media and the development of the FishCare "Southern Bluefin Tuna Guide to Best Practice for Recreational Fishers". There was limited fishing effort in early June out of Gisborne and Waihau Bay. Interviewers were trained on 16 June but there were few boats fishing that weekend. One fisher had landed a SBT and tagged two others on 10 June but had not reported this at the time.

The first survey day was the 22 June, a day earlier than planned, as there were 15 boat trailers at noon and radio conversations confirmed that these boats were targeting SBT. Four SBT were landed and 4 tagged and released that day (Table 1). This was also the first day in 2018 that a SBT was weighed by the Waihau Bay Sport Fishing Club. The following day the club weighed two SBT from two boats that returned to the ramp before noon. For the remainder of the survey trailer counts were made at 11:00 am.

A total of 676 trailers for offshore capable boats were counted over 47 days and 336 (49.7%) boat crews were intercepted and interviewed on the boat ramp. Only one crew refused to answer the interview questions. A total of 61 landed SBT were observed at the ramp and/or club weigh station and 34 (55.7%) of these were from surveyed boats (Table 1). Only 3 fish (9%) recorded by the interviewer were not weighed and recorded by the club. Boats that returned to the ramp after dark or fished on days with fewer than 10 trailers at the11:00 am trailer count were not surveyed.

The distribution of fishing effort and number of SBT caught per day shows a peak in effort in the last three days of June and a peak in catch on Saturday 23 June (Figure 1). Reports of good catch rates and several three-day weather windows in late June and early July attracted hundreds of fishers to Waihau Bay, which became very congested. Eight survey days were completed in the first 15 days of the season and one survey day (30 June) had two interviewers working in tandem. Poor weather and low catch rates meant that there was limited fishing effort for the remainder of the survey. Southern bluefin tuna catch per boat trip from the survey data declined across each of the three main weather windows (Figure 2).

The total number of SBT landed at Waihau 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 days when there were fewer than 10 trailers, had the same average CPUE as surveyed boats. The expanded survey estimate of Waihau Bay landed catch is 69 SBT (CV 0.068). The distribution of bootstrap harvest estimates from the expanded survey data is shown in Figure 3. The combined survey and weigh station landed catch was 61 SBT, 11.6% less than the expanded survey estimate.

The onsite survey collected information on the number of SBT landed per trip and the number of unsuccessful trips. In 2018, 90% of crews interviewed landed no SBT and of those that did, 91% landed one fish per trip and the other 9% two fish per trip (Figure 4). Three boats caught three fish in a day and they all tagged two and kept one. According to weigh station records, more fish were caught and landed in 2017 with 65% of successful trips landing one SBT, 23% landing two and 12% landing three or more (Figure 4). There is no estimate of unsuccessful trips in 2017.

In 2018 77% of trailer boat trips targeting SBT from Waihau Bay had two or three fishers on board and 22.5% had four to six fishers (Figure 5). Two solo fishers were interviewed.

## 3.2. Sport fishing club records and other sources

A total of 80 SBT were recorded landed by North Island sport fishing clubs in 2017–18. The tally from Waihau Bay was 58, there were 9 weighed at Whakatane and 13 weighed by other fishing clubs. Most of these fish were caught in the last week of June in the western Bay of Plenty. This is true for other

clubs as well as for Waihau Bay. The main exceptions were a 36 kg fish caught out of Whangaroa in early February and a 109 kg SBT weighed at Mahia at the end of May.

In 2018 the average weight of SBT from North Island sport fishing clubs was 78.3 kg (sd 19.13). This compares to an average weight in 2017 of 72 kg. In 2018 the proportion of SBT in the 50 and 60 kg size classes were lower while the proportion in the 70 and 80 kg size classes were higher than in 2017 (Figure 6).

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 2018 indicate that a few dedicated fishers target SBT out of the Fiords and occasionally Jackson Bay. The water temperature was 3.5 degrees warmer in 2018 and the SBT turned up earlier than over the past four seasons. Information from people active in the fishery is that immature fish of 20 to 50 kg were being caught in January and February 2018 and their anecdotal catch estimate over this period was 50 to 80 SBT. Larger fish of 50 to 100 kg turn up later, in April, May and June. There were some large fish caught in the 80 to 110 kg range and a report on Facebook of a 128 kg SBT. The weather at this time of year is often difficult and the catch rate less consistent. Our estimate is 10 to 20 fish in the second part of the season. We use a point estimate of 80 SBT for the South Island fishery, the midpoint of the range of 60 to 100 fish.

### 3.3. Amateur fishing charter boat records

An extract of amateur fishing charter vessel (AFCV) records from events where bluefin tuna were targeted or caught was provided by Fisheries New Zealand (Replog 12040). This database allows free text entries for species codes or names so all southern bluefin tuna and Pacific bluefin tuna data was requested. A total of 12 SBT were reported in 2017–18, from 37 targeted fishing events, all in the 2018 calendar year. Sixteen of these events were off the eastern North Island but no SBT were caught on those charter trips. AFCV data from previous years is shown in Table 2.

The total number of SBT recorded as caught in the AFCV database since 2010 is 151, of which 134 (89%) were retained. There is a requirement for skippers to record the estimated weight of retained SBT. The average annual weight for fish caught in FMA 5 is under 45 kg while fish caught in FMA 7, off Westport and Greymouth, average over 85 kg (Figure 7). In 2018 SBT were caught in FMA 5 (83%) and FMA 7 (17%). Overall the average weight was 50.4 kg. This average was applied to the South Island non-charter recreational catch to estimate the total landed weight (Table 4).

### 3.4. Section 111 landings

Southern bluefin tuna caught by commercial fishers and retained as recreational catch is recorded on catch effort landing returns (CELRs). In the 2017–18 fishing year the reported s 111 landings were 502 kg. The highest annual weight of s 111 catch reported over the last 4 years was 1038 kg in 2016–17 (Table 3).

### 3.5. Otoliths collected

A total of 32 otolith sets were extracted from southern bluefin tuna intercepted during the creel survey at Waihau Bay in 2018. The weight of these fish ranged from 30.9 to 155.1 kg with a mode at 70 to 80 kg (Figure 8). The fork length of these fish ranged from 122 to 199 cm with a mode at 160 to 165 cm (Figure 9). Measurements were made with a tape measure over the curve of the body. A measuring mat for straight line lengths under the fish was provided but there was not time or space to collect this on most occasions.

### 3.6. 2017–18 recreational harvest estimate for southern bluefin tuna

The total landed catch from the on-site survey and other available data sources is 202 SBT in 2017–18. Allowing an additional 15% to 30% for unaccounted catch gives a range of 232 to 263 SBT and a point estimate of 247 SBT (Table 4).

The mean weight for SBT recorded by North Island fishing clubs of 78.3 kg was multiplied by North Island club catch and the mean weight from Amateur Fishing Charter Vessels in the South Island of 50.4 kg was multiplied by the South Island estimated catch. The total harvest weight for recreational SBT in the 2017–18 fishing year is 15 t and the estimated range calculated using survey confidence intervals and the range in unaccounted catch is 13.4 t to 17.0 t (Table 4).

## 4. DISCUSSION

This is the first dedicated project to estimate the recreational harvest of southern bluefin tuna in New Zealand. Since the 1970s the recreational catch has been taken mostly on 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 since 2010 to report the number and weight of SBT caught. However, prior to 2017 annual charter boat catch was fewer than 40 fish per year.

A rapid development of the North Island fishery in July 2017 came predominantly from private fishers using trailer boats. Word spread rapidly in July 2017 that high catch rates of large SBT were within range of recreational fishers off Cape Runaway. The main components of this project were an on-site survey at the Waihau Bay boat ramp in June and July 2018 and collection and collation of fishing club records. There was very good support from clubs and generally good support from recreational fishers for this.

On peak fishing days Waihau Bay became very congested and boats started launching three hours before dawn and many were returning well after dusk. There was a limited opportunity to interview fishers as they retrieved their boats then left. The survey interviewers collected data from 326 boats over 9 survey days. The health and safety policy does not allow interviewers to work on the ramp after dark so the daily trailer counts at 11:00 were essential to estimate total fishing effort. The club weigh station was open after dark recording 58 SBT, while the creel survey recorded 34 SBT, 31 of which were weighed by the club. To some extent this validates the assumption that most of the SBT landed at Waihau Bay in 2017 were weighed and recorded by the club. Many fishers were also willing to leave tuna heads with labels attached for otolith extraction, but it was difficult at times to get accurate straight-line fork lengths from whole fish. Measuring callipers would increase accuracy of lengths but are cumbersome on a busy multi lane boat ramp. There were no seabirds reported caught or tangled by any of the crews interviewed at Waihau Bay.

Trailer counts taken at 11:00 may underestimate fishing effort on busy days as it was not possible to count trailers that were taken back to a private residence. In future a web camera on the ramp may provide alternative counts of daily boat trips on most days, but during peak periods many boats anchored out for the night and did not return to the ramp.

Commercial fishers have long known that SBT are present north of Cape Runaway in June and July. In 2017 these fish were found relatively close to the Cape, within range of recreational fishers. In 2018 however, there were fewer SBT within range and the best fishing was two weeks earlier than the previous year. It is likely that recreational catch and effort in this fishery will vary from year to year.

There is limited information from the South Island fishery. The best fishing is early in the year when juveniles are caught, but the number of fishers is relatively small. Fishing effort is sporadic and weather dependant in May and June.

A study in Australia looked at how to collect SBT harvest estimates from recreational fishers with a focus on south eastern states (Moore et al. 2015). The fishing season for SBT in Victoria, South Australia, and Tasmania extends from January to July, similar to the fishery in the South Island in New Zealand. In southern New South Wales, SBT move up the coast from the Victorian border to south of Sydney in June and July with a transit time of two to three weeks. This is similar to the situation in the North Island fishery.

A pilot study in South Australia completed 151 on-site ramp days and intercepted 45 anglers targeting SBT, all from five sampling days. No SBT anglers were encountered on any other survey day, suggesting that the sampling coverage in the trial was too low to adequately capture the spatially diffuse and temporally episodic nature of recreational SBT fishing in South Australia (Moore et al. 2015).

Large scale off-site surveys of recreational harvest in Australia did not sample enough SBT fishers for reliable estimates, so targeted surveys were required. The University of Tasmania has been contracted to undertake a national survey of recreational fisher effort, catch, release and harvest estimates of SBT and other large tuna and billfish. This survey commenced on 1 December 2018 and will run for a year.

A probability-based intercept survey (on-site survey) will be used in the large SBT fisheries in South Australia and Victoria. Day will be used as the primary sampling unit (PSU), which will be stratified by region, season and day type (weekday or weekend/holiday). A total of 550 ramp survey days will be used in South Australia alone (www.agriculture.gov.au).

In future on-site surveys an adaptive sampling strategy may be trialled to decrease cost and increase accuracy. The approach that showed the greatest potential for estimating SBT recreational catch was one in which survey effort in an area is triggered by a spike in fishing activity above a predetermined threshold. This however requires continual background monitoring of activity at known locations (Moore et al. 2015).

In Tasmania and New South Wales there will be off-site phone surveys of fishers based on owners of boats in the Tasmanian recreational vessel registry and the NSW general fishing licence database. In the longer-term there is interest in establishing a national Australian off-site sampling frame for SBT recreational catch (Moore et al. 2015).

## 5. ACKNOWLEDGMENTS

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

| | Trailer count | Survey interviews | Landed SBT survey | Landed SBT survey plus club | Tagged SBT |
|---|---|---|---|---|---|
| 10/06/2018 | | | | 1 | 2 |
| 16/06/2018 | 2 | | | 0 | |
| 17/06/2018 | 1 | | | 0 | |
| **22/06/2018** | **15** | **11** | **3** | **4** | **4** |
| **23/06/2018** | **19** | **17** | **9** | **17** | **2** |
| 24/06/2018 | 4 | | | 3 | |
| 25/06/2018 | 0 | | | | |
| 26/06/2018 | 0 | | | | |
| 27/06/2018 | 5 | | | 0 | |
| **28/06/2018** | **98** | **53** | **4** | **6** | |
| **29/06/2018** | **188** | **82** | **5** | **7** | |
| **30/06/2018** | **138** | **68** | **10** | **14** | |
| 1/07/2018 | 9 | | | 3 | |
| 2/07/2018 | 0 | | | | |
| 3/07/2018 | 8 | | | 1 | |
| **4/07/2018** | **46** | **30** | **1** | **2** | |
| **5/07/2018** | **48** | **42** | **0** | **0** | |
| **6/07/2018** | **23** | **18** | **2** | **3** | |
| 7/07/2018 | 7 | | | 0 | |
| 8/07/2018 | 0 | | | | |
| 9/07/2018 | 0 | | | | |
| 10/07/2018 | 1 | | | 0 | |
| 11/07/2018 | 0 | | | | |
| 12/07/2018 | 9 | | | 0 | |
| **13/07/2018** | **20** | **15** | **0** | **0** | |
| 14/07/2018 | 8 | | | 0 | |
| 15/07/2018 | 0 | | | | |
| 16/07/2018 | 0 | | | | |
| 17/07/2018 | 0 | | | | |
| 18/07/2018 | 3 | | | 0 | |
| 19/07/2018 | 6 | | | | |
| 20/07/2018 | 6 | | | 0 | |
| 21/07/2018 | 6 | | | 0 | |
| 22/07/2018 | 0 | | | | |
| 23/07/2018 | 2 | | | 0 | |
| 24/07/2018 | 2 | | | 0 | |
| 25/07/2018 | 4 | | | 0 | |
| 26/07/2018 | 0 | | | | |
| 27/07/2018 | 0 | | | | |
| 28/07/2018 | 0 | | | | |
| Totals | 678 | 336 | 34 | 61 | |

**Table 2: 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 | | | | |
| 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 |
| Total | 151 | 134 | 123 | 5 311 |

**Table 3: Recreational catch retained by fishers on commercial vessels under a Section 111 exemption.**

| October Fishing Year | 2014–15 | 2015–16 | 2016–17 | 2017–18 |
|---|---|---|---|---|
| Greenweight kg | 672 | 661 | 1 038 | 507 |

**Table 4: 2018 recreational harvest estimates from all available sources.**

| Source | Harvest # | Mean wt (kg) | Harvest wt (t) | Bootstrap 95% Confidence Intervals | |
|---|---|---|---|---|---|
| North Island | | | | | |
| Waihau Bay | 69 (CV 0.068) | 78.3 (sd 19.13) | 5.40 | 4.79 | 6.24 |
| Other NI clubs | 22 | 78.3 | 1.72 | 1.72 | 1.72 |
| South Island | | | | | |
| Report from club | 80 | 50.4 | 4.03 | 4.03 | 4.03 |
| National | | | | | |
| s 111 | 19 | 26.7 | 0.51 | 0.51 | 0.51 |
| AFCV records | 12 | 50.4 | 0.60 | 0.60 | 0.60 |
| Total | 202 | | 12.27 | 11.66 | 13.11 |
| Unaccounted catch | Plus 15 to 30% | | | | |
| Low estimate 15% | 232 | | 14.1 | **13.4** | 15.1 |
| High estimate 30% | 263 | | 15.9 | 15.2 | **17.0** |

| | Harvest # | Harvest wt (t) |
|---|---|---|
| **Point estimate** | **247** | **15.0** |

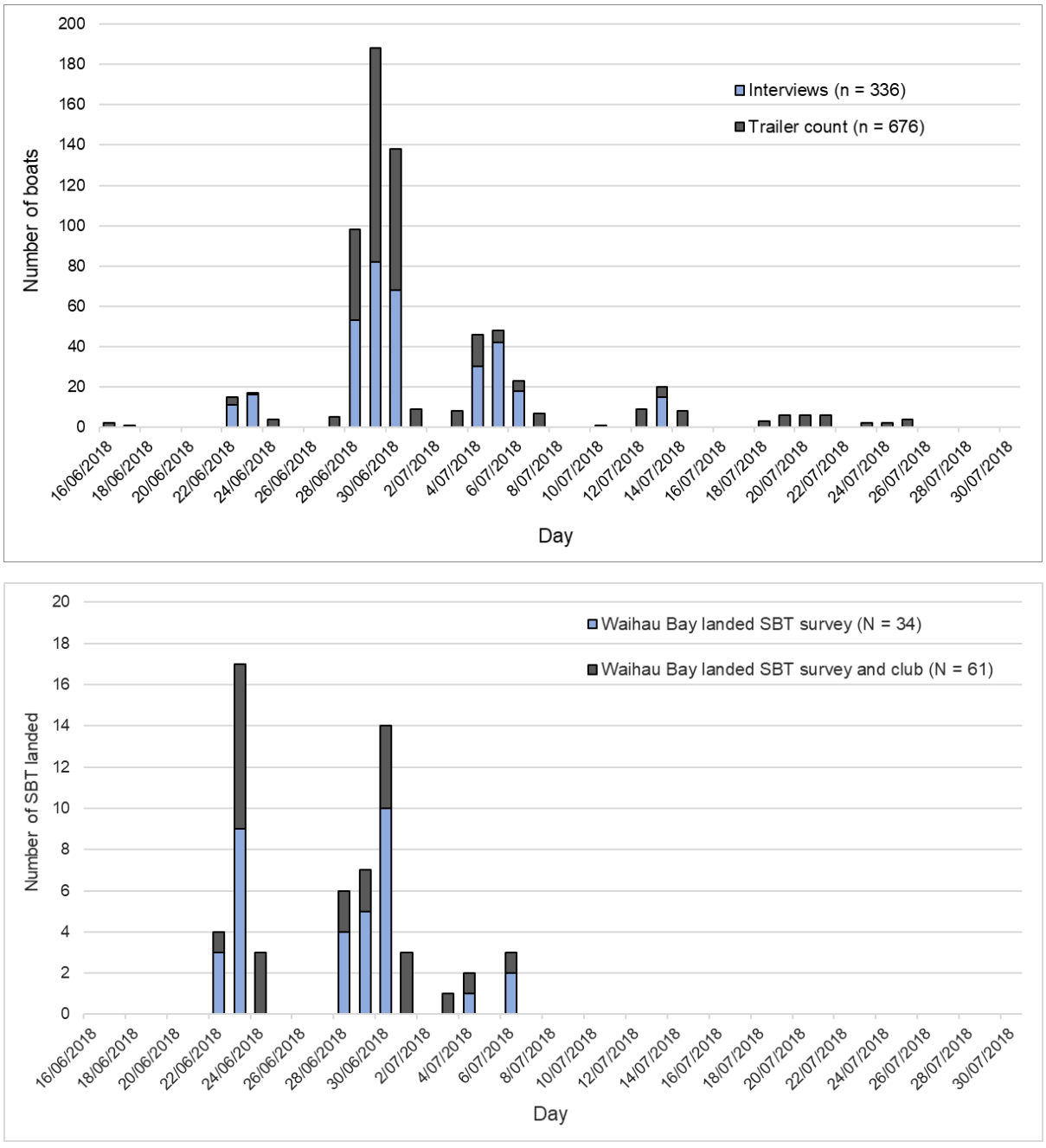


**Figure 1: Waihau Bay trailer counts and interviews completed by day (top) and number of landed SBT captured in survey interviews plus club weigh station observations per day (bottom).**

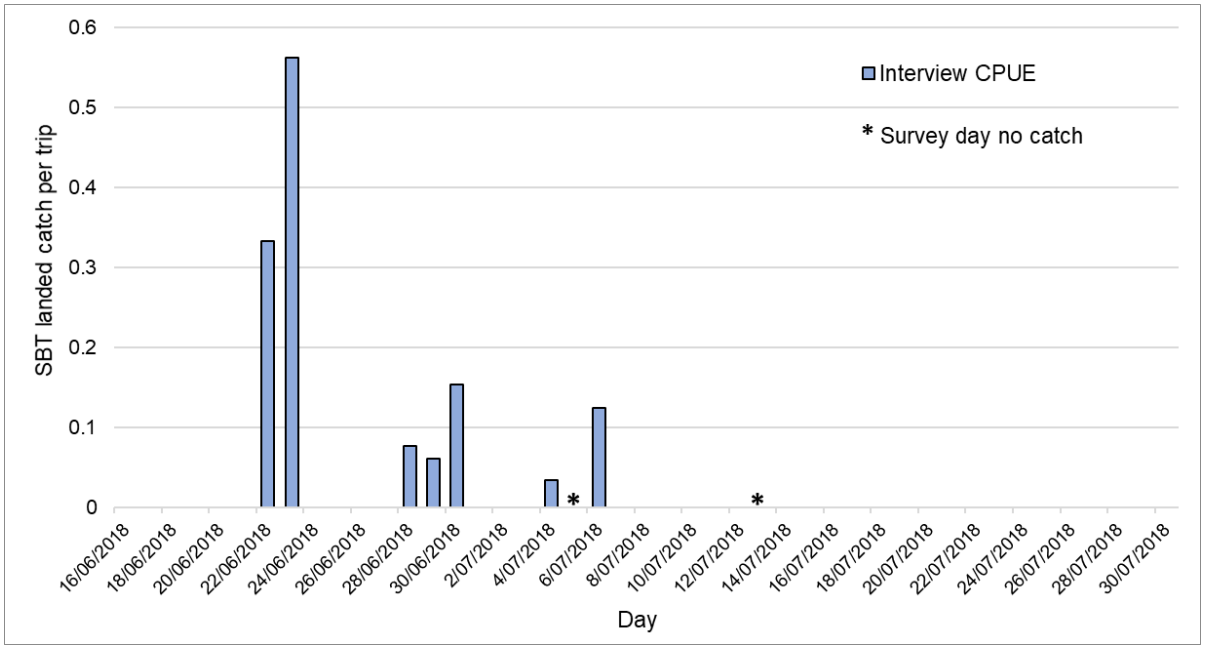


**Figure 2: The catch rate of SBT per boat trip from the Waihau Bay on-site survey.**

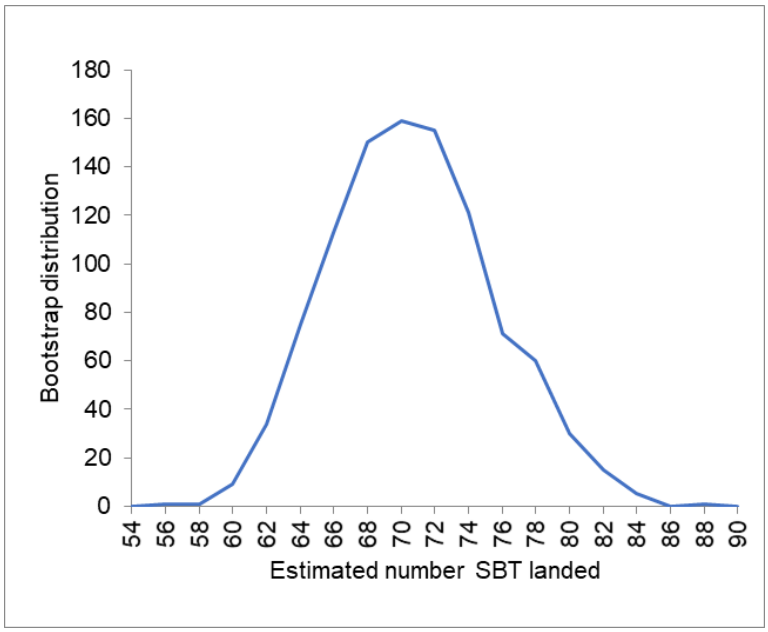


**Figure 3: The bootstrap distribution of expanded survey harvest from Waihau Bay.**

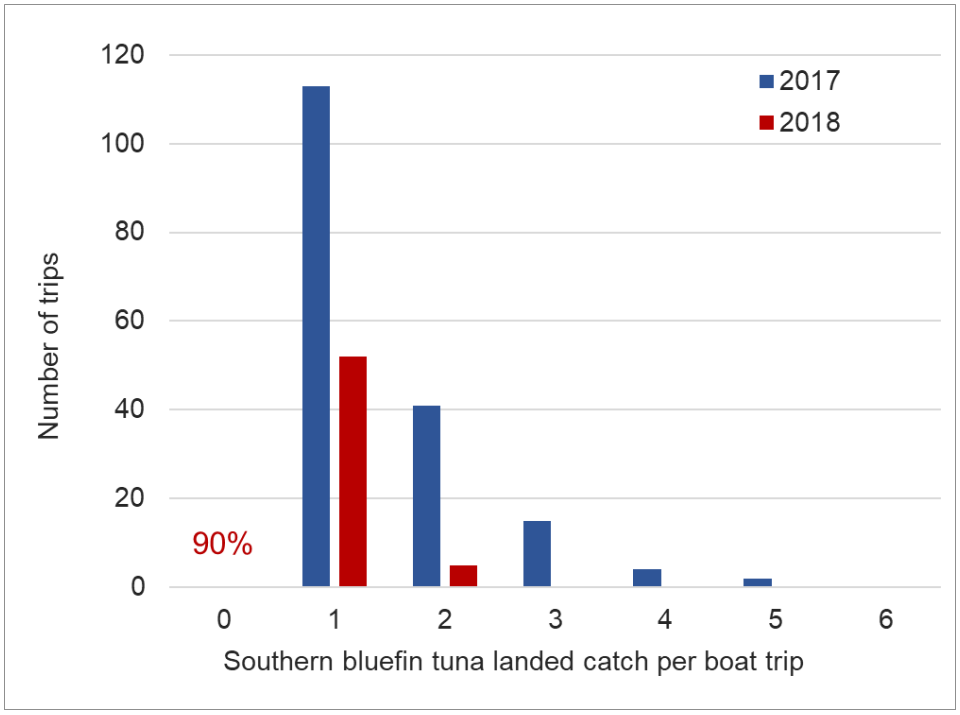


**Figure 4: The number of SBT landed per boat trip in 2017 from club records and from on-site survey data in 2018. 90% of surveyed boat trips did not land a SBT in 2018.**

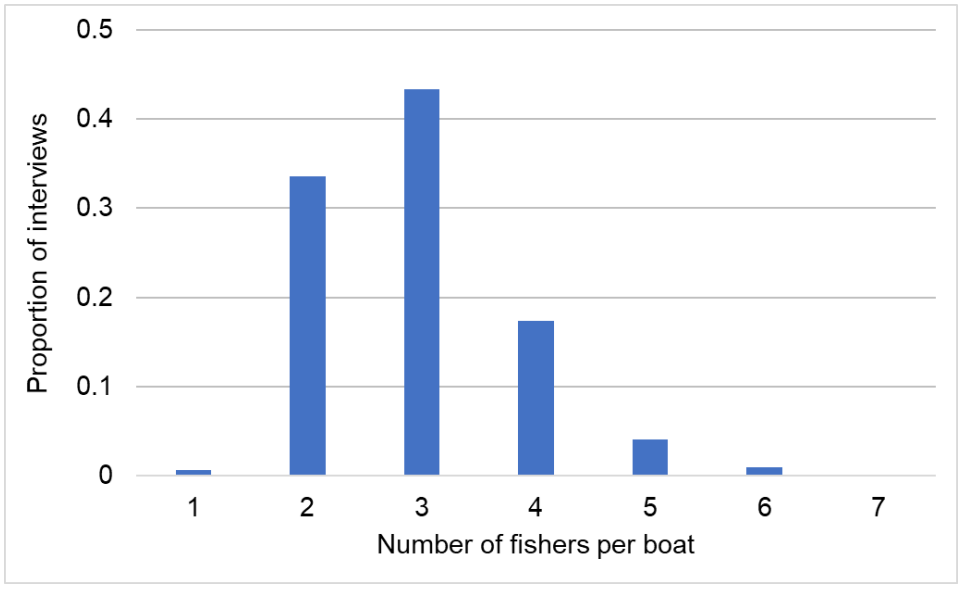


**Figure 5: The number of fishers per boat as a proportion of all onsite survey interviews.**

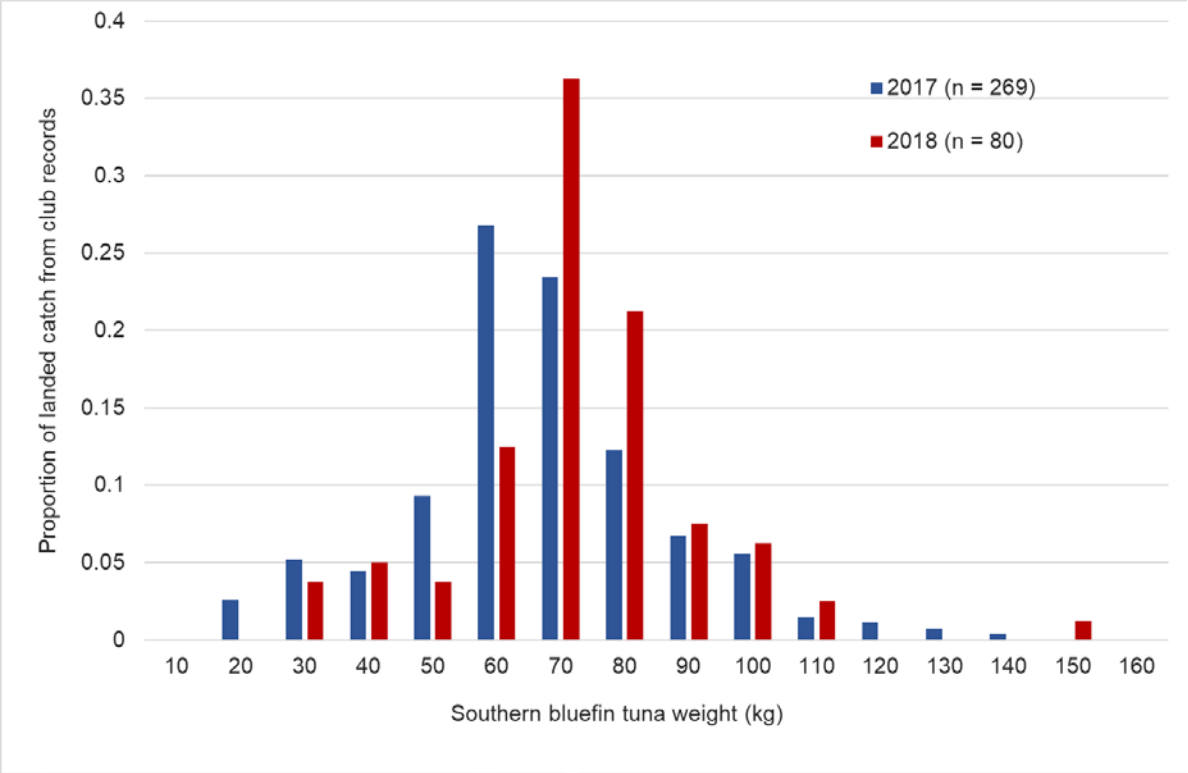


**Figure 6: The weight distribution of SBT weighed by North Island sport fishing clubs in 2017 and 2018.**

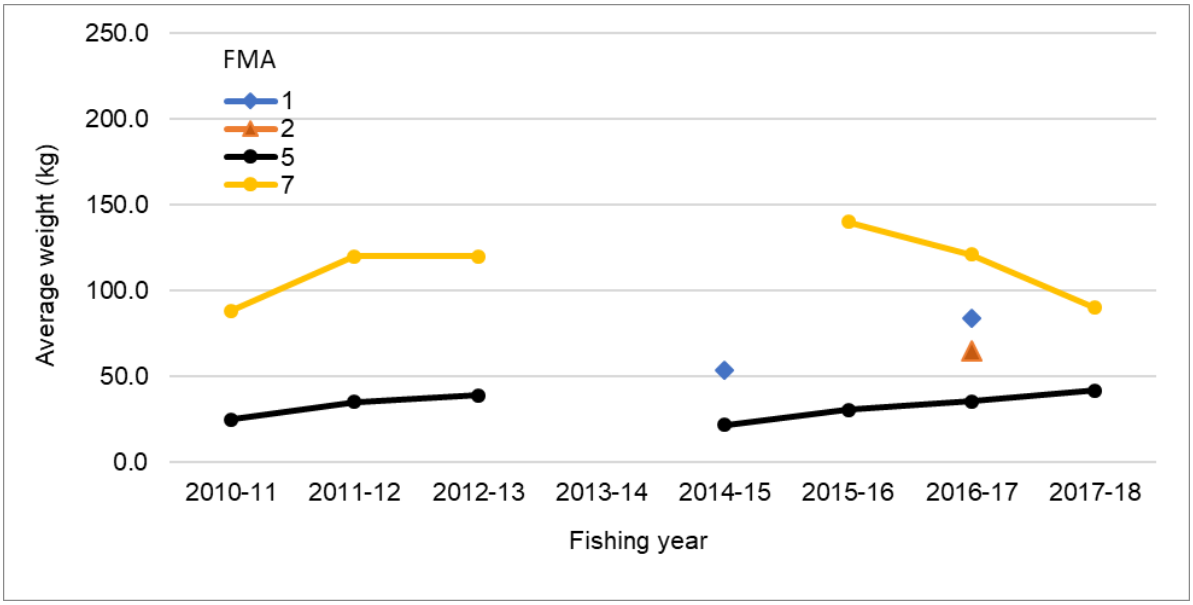


**Figure 7: Average weight of SBT reported by amateur fishing charter vessels by year and New Zealand Fisheries Management Area (FMA).**

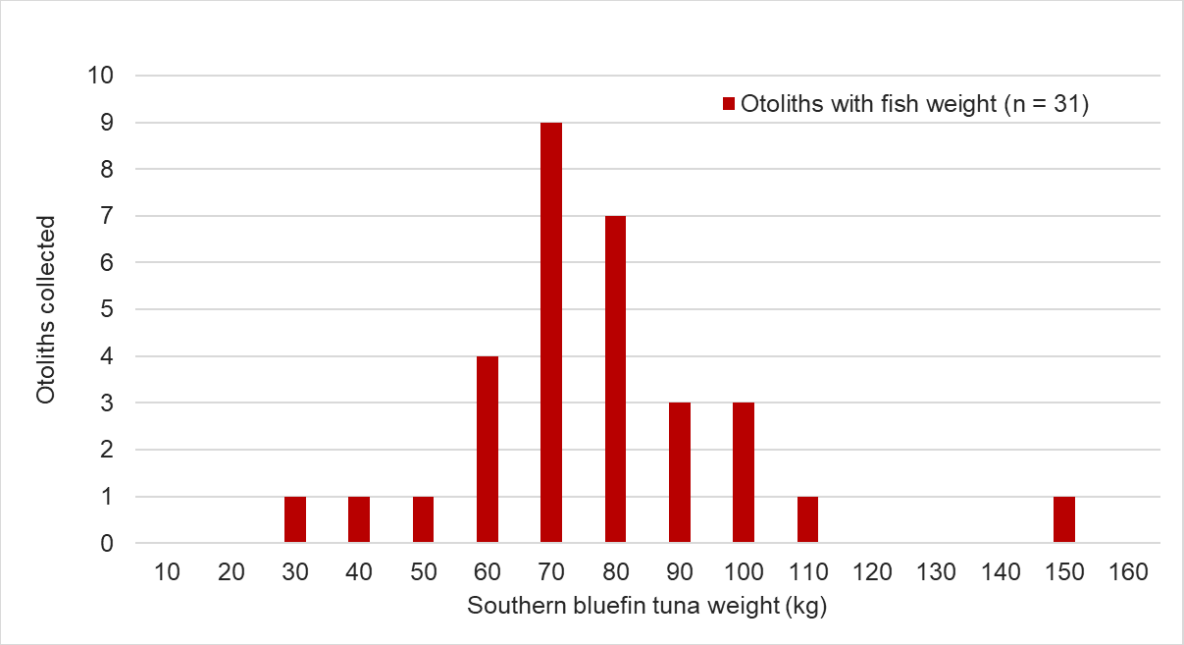


**Figure 8: Weight distribution of southern bluefin tuna caught in the recreational fishery from Waihau Bay which had otoliths removed.**

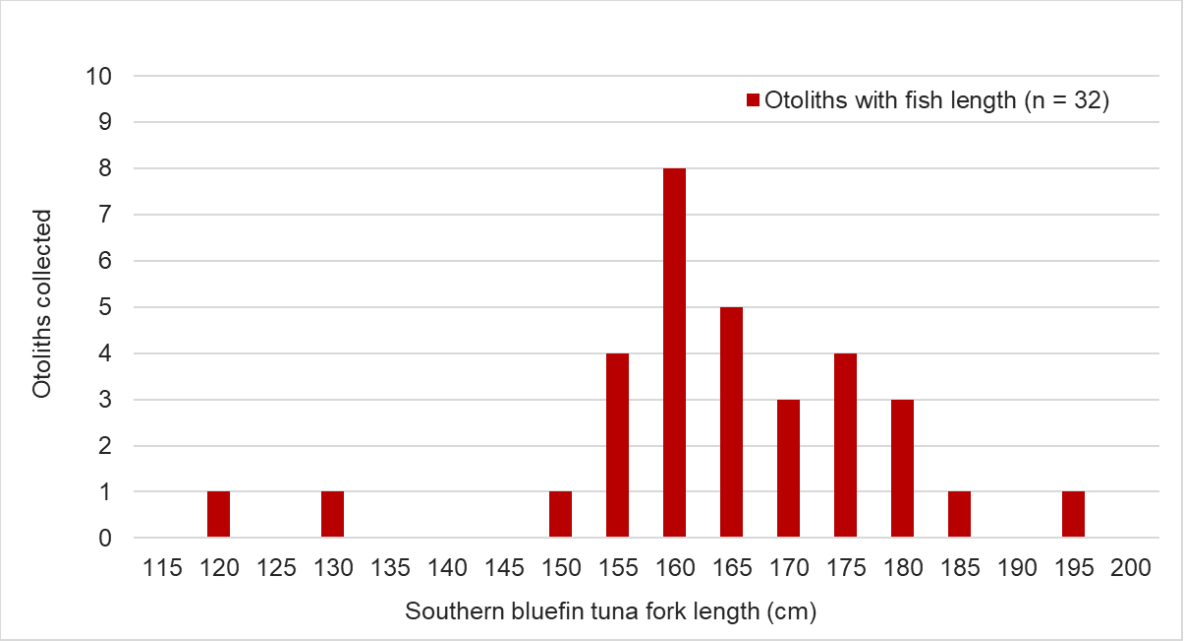


**Figure 9: Length distribution of southern bluefin tuna caught in the recreational fishery from Waihau Bay which had otoliths removed.**