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Tini a Tangaroa

National Panel Survey of Marine Recreational Fishers 2017–18

New Zealand Fisheries Assessment Report 2019/24

J. Wynne–Jones
A. Gray
A. Heinemann
L. Hill
L. Walton

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Ministry for Primary Industries
PO Box 2526
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Telephone: 0800 00 83 33
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Wynne-Jones, J.; Gray, A.; Heinemann, A.; Hill, L; Walton, L. (2019). National Panel Survey of Marine Recreational Fishers 2017–2018.
***New Zealand Fisheries Assessment Report 2019/24*. 104 p.**

This report presents the results of a nationwide survey of 6975 empanelled marine fishers, and 2203 members of the public screened as 'non-fishers' who reported their actual fishing activity over the fishing year from 1 October 2017 to 30 September 2018. The survey was conducted by the National Research Bureau Ltd (NRB) on behalf of the Ministry for Primary Industries (MPI), with the division now called Fisheries New Zealand.

The survey was essentially a repeat of the National Panel Survey of Marine Recreational Fishers (NPS) conducted in 2011–12. The methodology was the same, using state-of-the-art social science methods and 'population based sampling' which allows results to be scaled up to a national level. The methods used were considered to be the most robust available for off-site surveys, important in producing the most accurate estimates of recreational marine fishing. Other surveys carried out concurrently by NIWA and other contractors were used to corroborate data gathered and provide mean fish weights used to estimate harvest by tonnes. Description and results of this complementary research is not covered in this report but is separately available.

The sample frame was based on meshblocks. A meshblock is the smallest geographical unit for which statistical data is reported by Statistics New Zealand. There are 46 629 meshblocks in New Zealand. For this survey, 1100 meshblocks were sampled and up to 32 houses per meshblock randomly selected to screen for homes in which there was at least one fisher. A random process was used to select a marine fisher (aged 15 or over) within a fishing household and this person was asked to join the fishing panel for the 2017–18 fishing year. In a separate process a sample of non-fishers was also identified in an attempt to measure 'drop in fishing' – in other words, non-fishing people that happened to fish during the survey period. They may have taken up the activity or perhaps fished by happenstance.

The sampling procedure resulted in 34 431 dwellings being physically visited by NRB interviewers. The screening response rate was 85% and of those successfully screened with one or more fishers, 91.7% agreed to participate in the panel (n=6975). These response rates are considered very good in terms of research standards, and similar to the 2011–12 survey (86% and 90.8% respectively).

The main technique to poll fishers repeatedly to see if they had marine fished, was via SMS texting which is convenient and of low burden to the respondent. Fishers chose an appropriate reporting frequency (weekly, fortnightly or monthly). They were simply asked if they had gone fishing (any method) or not and to reply YES or NO. If people didn't or couldn't text, they were instead rung by telephone. Where a person replied YES to the SMS (or contact was not made this way), they were telephoned to ask for details about any fishing. The telephone interviews were managed by a distributed CATI (computer assisted telephone interview) and the interviews were highly structured for accuracy of recall and reporting.

The collection of data for the ostensibly 'non-fishers' was conducted via a different method. They were telephoned at the six month mark and finally at the end of the survey to establish whether any fishing had been done, and what was harvested. The final sample of non-fishers interviewed at the six month mark was 2203 and at the 12 month mark 2079.

According to the methods of this survey, the total calculated number of 'fishing trips' in New Zealand in 2017–18 was 1 810 379, a 21.2% decline on the 2011–12 figure of 2 296 827.

It is noted that in 2011–12, 31.69% of dwellings were found to have at least one fisher compared with just 28.28% in the 2017–18 survey, indicating a lower engagement in fishing. In 2011–12 about 12% of the estimated resident population were estimated to be fishers but this has dropped to 9% in 2017–18. However, since the population has increased about 11% in that time a better comparison might be with

the estimated number of fishers, which has fallen nearly 18% from an estimated 422 000 to 348 000. Similar declines in the number of those who fish have been found in other countries, such as Australia.

Collected catch data were expanded by recognised statistical methods to produce harvest estimates (number) for the entire New Zealand population (aged 15 or older), for the whole country, by Fisheries Management Areas (FMA) and by fishstock for a number of species. Estimated harvests of major finfish and other species were converted to total harvest weight using the mean weight data provided by NIWA. Note that these figures exclude the harvest recorded by non-fishers but the effect of that element of harvest is separately discussed.

The total marine harvest of all marine species was estimated to be around 11 million by number. This included 7 million finfish and 3.9 million other marine species. The total harvest was recorded as lower than that of 2011–12 NPS where a total of 8.7 million finfish and 8.3 other marine species were estimated to have been harvested.

In terms of species, the top three finfish harvested accounted for 72% of all finfish harvested, which is very similar to the result from the 2011–12 survey of 74%. The most common finfish species by far was snapper which accounted for nearly 50% of the finfish harvested (52% in 2011–12). Of the other marine species harvested, the most common reported was pipi with a calculated harvest of 0.65 million by number, followed by tuatua (0.56 million) and scallops (0.56 million). This contrasts with the results from the 2011–12 survey where scallops were the most common other marine species harvested (1.7 million), followed by mussel (0.99 million) and tuatua (0.87 million). As well as fewer fishers, the reduction in scallop harvest is in part likely to be due to the closure of the QMA SCA 7.

1. INTRODUCTION

1.1 Background

Surveying marine recreational fishers' catch, in addition to that of commercial fishers, is vital to the assessment of the stock of fish and other marine life in New Zealand. The information is used by scientists, regulators and fisheries managers to better understand the sustainability of our fisheries, and determine what, if any, controls are needed.

The different methods of surveying recreational catch can be broken down into on-site and off-site methods. On-site surveys include boat ramp counts and intercept surveys, creel surveys, roving style surveys, and aerial over-flight surveys to observe boat activity. Off-site methods generally use interviews or self-reporting methods to measure fishing activity and harvest. Each method has its advantages and disadvantages in terms of species, spatial and temporal coverage, measurement accuracy and precision.

The National Panel Survey (NPS) of Marine Recreational Fishers 2017–2018 was an off-site survey. Although it relies on fishers staying in contact and what they are willing to disclose, the method has particular advantages in terms of geographical coverage, representativeness and scalability. A survey of 6975 fishers over 365 days, equates to 2 545 875 'people days' of measurement. With 'known probability' meshblock sampling, harvest estimates can be calculated for the entire population (aged 15 and over) for an entire year.

The history and development of the methodologies behind the survey are well documented elsewhere. Readers are particularly referred to Heinemann et al (2015).

To summarise briefly, earlier attempts at similar surveys (i.e. telephone-diary surveys before the 2011–12 NPS) had certain design and execution issues, particularly with 'self-selection'. For marine fishing, there appeared to be a propensity for the more avid fishers to participate in a panel and this tended to positively bias estimates of harvest. Other issues included uncertainty about the sample frame (whether it represented the population adequately), selective attrition of panellists, long time frames for reporting which could cause telescoping (subconsciously bringing in fishing outside a temporal frame into the surveyed frame), and recall issues (forgetting, averaging, claiming the catch of others, bad estimation).

The process for developing the current design of the National Panel Survey, first implemented for the 2011–12 NPS (also called the Large Scale Multi-Species Survey or LSMS), was extensive. It was the intention to remedy, as much as possible, many of the shortfalls of previous panel surveys and produce a more defensible approach by addressing shortcomings detected in earlier designs and making use of emerging telecommunications technology (e.g. Hartill et al. 2004, National Research Bureau 2011).

Development of the NPS design was not undertaken by a single party. The Ministry of Fisheries (now MPI), the National Research Bureau Ltd (commissioned to conduct the survey), representatives from NIWA, other fisheries scientists and involved parties, met over many months under the auspices of the Marine Amateur Fishing Working Group (MAFWG) and other forums, to discuss and inform the development of a systems-based approach to estimating recreational harvest, including the NPS survey. A number of trials and experiments were conducted to test SMS (text messaging, see Wynne-Jones and Heinemann 2010) reporting options, examine alternatives (e.g. 'snowball sampling', *sensu* Johnson & Sabin 2010, Griffiths et al. 2010), and test methods to be finally employed in the NPS and supporting system.

In 2011–12 the first NPS was conducted and supported by two completely independent on-site corroborating surveys, an aerial overflight survey of the boat-based fishery in FMA 1 (Hartill et al. 2013), and a multi-method creel survey of boat based fishers in the western Bay of Plenty (Holdsworth 2016). The resulting harvest estimates (Wynne-Jones et al. 2014) were compared in detail with those from the corroborating surveys by Edwards & Hartill (2015) who concluded that '*the recreational harvest estimates provided by three independent surveys in 2011–12 are reasonably accurate and fit for management purposes*'. The methods and outputs were also considered in 2013 by two international

experts in the estimation of recreational harvest who concluded that the NPS survey was '*well designed and implemented and appears to have produced statistically reliable information about harvest levels of most key fish stocks … a strong framework for repeat surveys*'.

Based on these reviews, and the need for updated information, MPI decided to repeat the 2011–12 survey, without any fundamental changes to the design, for the 2017–18 fishing year. In an attempt to increase precision and reliability, the sample was increased from 1000 meshblocks in 2011–12 to 1100 in 2017–18, with slightly more emphasis on non-urban areas. Weighting procedures were employed to ensure that this would still allow full comparability between surveys.

1.2 Survey objectives

The following objectives were set down by MPI in the commissioning of this project.

Overall objectives:

1. To continue the implementation of an integrated amateur harvest estimation system by providing estimates of absolute total amateur harvest on a stock basis to inform fisheries management.

Specific objectives:

1. To deliver a repeat of the 2011–12 National Panel Survey (Project MAF2010–01) in FMAs 1,2,3,5,7,8 and 9 during the period 1 October 2017 to 30 September 2018.

2. To estimate total amateur harvest by fishstock for all species recorded during the survey.

3. To collaborate with concurrent onsite survey project(s) to provide robust comparisons of harvest estimates for specified areas.

1.3 About this report

This report presents summary results from the National Panel Survey of Marine Recreational Fishers 2017–18. It is intended for a general readership but requires some understanding of the scientific method. The report is intended as a stand-alone document, covering the methodology, data collection, and a summary of the resulting harvest estimates.

The main body of this report gives details of the outcomes of the recruitment phase of the survey and the resultant makeup of the panellists in terms of demographics and stated fishing avidity. The process and success in monitoring the panellists is shown and an examination of the attrition conducted. The secondary survey of 'drop-in' fishers is also presented.

Key to this survey is the method of expanding the reported fishing by panellists to population estimates. Details of this are given in this report to better understand how the final harvest estimates were arrived at.

A section on fishing trip data follows, with weighted data presented by week, method/platform and by FMA (Fisheries Management Areas). The main output from this survey, the calculated harvest estimates in both number and tonnes, are presented for the whole of New Zealand. Harvest by species is shown by number, and where estimates of mean weight are available (most major species), by tonnage. Following this are various breakdowns for the species (by number not weight) including by FMA, by catch method, and by platform.

Harvest estimates are also shown for 18 frequently caught species in a readily accessible 'one fish to a page' format. For each fish or shellfish species, there is a summary of harvest (both number and tonnage) by QMA, harvest (number) by method and also platform, as well as bag size frequency by QMA. Tables of estimates at a finer spatial scale (i.e., each of the reporting areas shown in Figure 3, with and without the estimated catch on board charter vessels) are available on request from the Data Management team,

Science and Information, Fisheries New Zealand. It should be noted that estimates at such fine scale can be highly uncertain.

2. METHODOLOGY

2.1 Survey design summary

Key aspects of the survey's design (Figure 1) include:

- The areal frame was the 46 629 Census 2013 meshblocks. These are defined by Statistics New Zealand and are the smallest population based sampling areas.
- The following meshblocks were excluded from the frame as they are likely to contain no or few people.
    - All meshblocks in the Chatham Islands and other offshore islands with the exception of Waiheke Island.
    - All Oceanic, Inlet, and Inland Water meshblocks.
    - All meshblocks containing six or fewer Private Permanent Occupied (PPO) Dwellings at Census 2013.
- This left 39 292 meshblocks. The coverage of the New Zealand population is about 98.6%.
- The meshblocks were stratified by Territorial Authority (TA) to ensure that all TAs were sampled. To increase the sample size in small TAs a Kish allocation method (e.g. Kish 1992) was used to allocate the sample meshblocks. This balances between proportional allocation to TAs and equal allocation.
- The primary sampling units are 1100 meshblocks which were drawn from this reduced frame sorted in TA order and Urban Area order using a systematic probability proportional to size sampling scheme with the Census 2013 count of PPO Dwelling used as the size measure.
- Secondary sampling units are dwellings and up to 32 dwellings/homes within each sampled meshblock were selected. In 106 of the largest meshblocks an additional 16 dwellings were sampled. In total, 34 431 dwellings were approached for this survey.
- Face-to-face interviewing of an adult in each selected home was used to screen for marine fishers (aged 15 plus) of any avidity from seldom to frequent fishers. Proxy reporting by one adult for the home was permitted.
- Random (equal probability) selection of a fisher who was invited to be in the survey panel. Non replacement applied (i.e. no one else in the household could volunteer instead).
- The actual enrolment was of 6975 fishers into the 12 month 2017–18 fisher panel survey.
- Panellists were instructed on the reporting requirements, given a main survey information brochure, instructions on SMS (Short Message Service) texting procedures and a web address with further information including fishing areas and species identification.
- Incentives for participating in the survey were provided. This included a weekly draw for a case of wine and two major prizes for iPad Pro (or Samsung equivalent) tablets.
- Contact with fishers by automatic SMS or CATI (Computer Assisted Telephone Interview) occurred at least once every month, but as often as weekly, to determine: a) if they had fished or not; and b) if they did fish, the details of their harvest. These details were always obtained by a structured telephone interview.
- Collected data was expanded by recognised statistical methods to achieve harvest estimates for the entire New Zealand population (and by FMA, QMA etc.).
- An additional 'drop-in' survey of non-fishers was used to check on the harvest of any stated 'non-fishers' in the population who actually went fishing in 2017–18.

2.2 Survey design advantages

The original development phase of the survey method was substantial and included a trial of text reporting, and a comprehensive pilot stage. It could be argued that the final design is 'state-of-the-art' and as robust as current technology and the budget allowed for. Claimed key advantages of the survey method are:

- Meshblock sampling of homes and face-to-face interviewing and recruitment greatly reduces biases from working with samples based on listed/accessible telephone numbers, or postal address lists.
- True nationwide coverage.
- 'Known probability of selection sampling' allows more accurate weighting of collected data up to population estimates and estimation of uncertainty using standard statistical methods.
- Face-to-face recruitment improves agreement to participate and allows physical demonstration of materials and procedures.
- Removal of reliance on a self-completion fishing diary plus user friendly contact methods (including a SMS option) that minimises recall biases if diaries are not completed quickly, reduces respondent burden, minimises attrition rates and helps to maintain long term participation in the panel. There is no need to 'rotate' participants under such conditions.
- Overall higher frequency of contact, particularly with more avid fishers, reduces time between catch and reporting, thus reducing recall error.
- The SMS texting option allows a larger sample for the budget and provides instant and personal communication.
- The use of a CATI allows random allocation of interviewer to a fisher each call, reduces any interviewer effect, and ensures that a precise question stream is delivered – including verification and detailing of catch questions.
- These advantages were tested as part of the development and implementation of the 2011–12 NPS.

2.3 Survey schematic

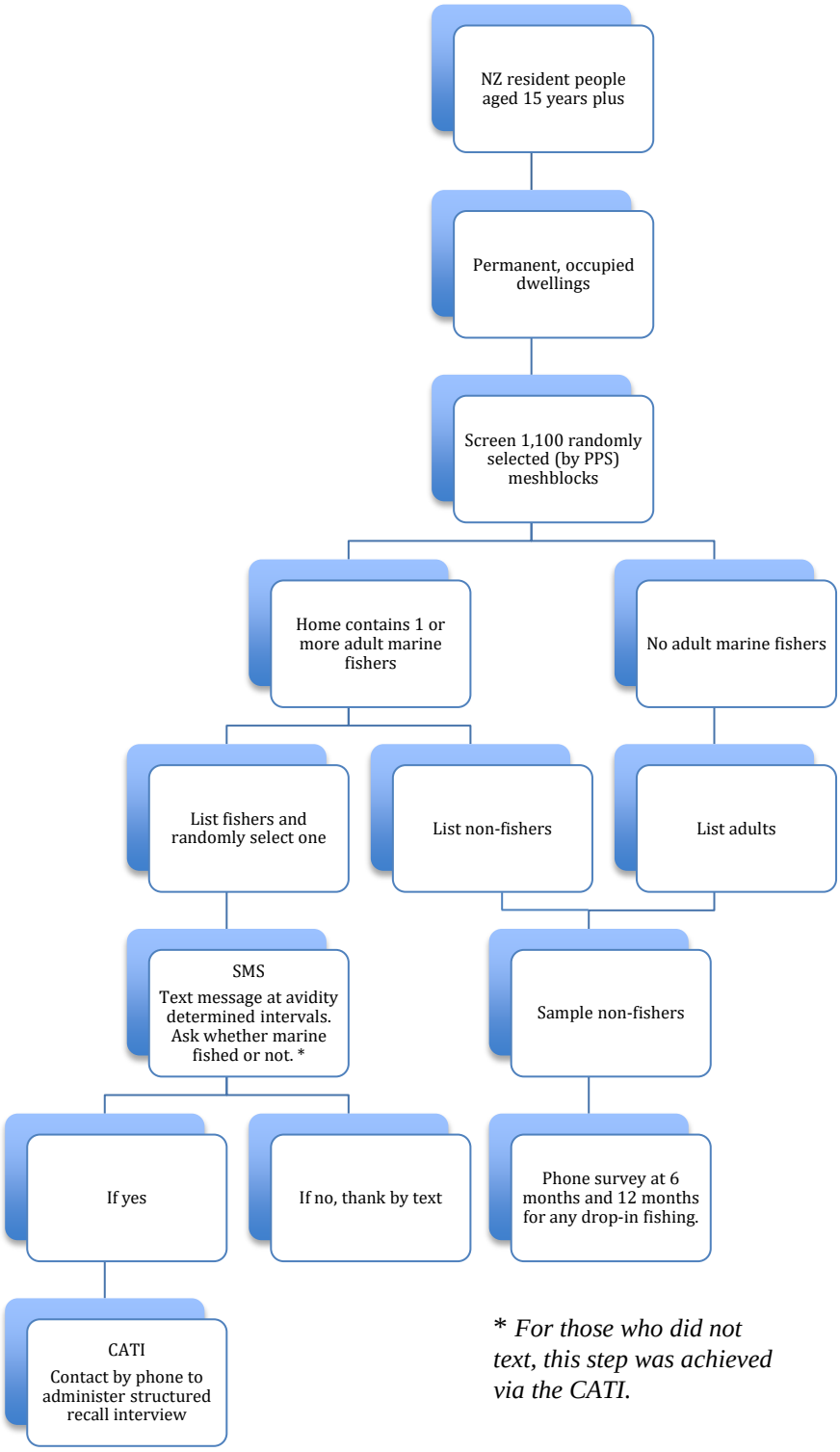


Figure 1: Schematic of panellist selection and contact approach used in the National Panel Survey.

2.4 Sampling process

The sampling process to select homes to screen, identify any fishing homes and select fishers to invite into the survey is shown in Table 1 below:

Table 1: Sampling process.

1.	Survey Frame:	Meshblocks as defined by Statistics NZ were the primary sampling units.
2.	Geographic Coverage:	All New Zealand, excluding small offshore islands. Waiheke was included but Stewart Island, Great Barrier Island and smaller islands were excluded. This was done for logistic/economic reasons.
3.	Qualifying Meshblocks:	Meshblocks with fewer than six homes were removed (Coverage of all New Zealand homes remains around 98.6%). Small meshblocks would yield few or zero fishers.
4.	Ordering Meshblocks:	Meshblocks were arranged North to South in a listing, and then sorted by Territorial Authority (TA) and within TA by urban, secondary urban and rural areas. The TAs are strata. This is a change from the 2011–12 NPS to ensure that each TA is sampled. The sample meshblocks are allocated to the strata using a Kish allocation which provides for intermediate steps between proportional allocation to TAs and equal allocation. Section 3 has a map showing the distribution of the sample across TAs.
5.	Selecting Meshblocks:	Within each TA the required sample of meshblocks is taken with a systematic probability proportional to size sampling scheme with the Census 2013 count of Private Permanent Occupied (PPO) Dwelling used as the size measure. This is implemented by taking a cumulative count of PPO Dwellings, working out the skip interval, k, taking a random number in the interval from 1 to k, and then taking every meshblock which the next k lands in.
6.	Maps of Meshblocks:	Mapping software was used that shows the boundaries of each meshblock and the streets it contains. Each chosen meshblock was printed in map form.
7.	Enumeration:	Interviewers enumerated the number of houses in the meshblocks they were assigned, to update them in relation to the latest 2013 Census. Every address was listed. Both enumeration and Census counts were recorded.
8.	Startpoint:	A startpoint address for each meshblock was selected randomly via the house listing and a grid selector not unlike a Kish Grid (Kish 1965 pp 398–404). Every house within a meshblock had an equal probability of being the start house.
9.	House Selection:	Up to 32 houses were selected to screen. Where there were fewer than 32 houses in a meshblock, all houses were selected. Where there were more than 32 houses, a direction to progress through the meshblock was randomly determined (again from the grid selector). Interviewers approached the first 32 houses on the route. No choices were available to interviewers about which houses to approach.
10.	Screening Process:	The first adult contacted at the house was screened to determine if there were any marine fishers in the home. The interviewer introduced the survey and presented the survey materials. They then used a formal screener and showcard to record on a Kish Grid in age order the first names (or initials)

of each normally resident person. Gender, age group ethnic group and fishing avidity of each person was sought.

11. Avidity Classifications: The choices of fishing avidity were:
    - A Non-fisher: Either 'never' fished or 'used to but given up'.
    - B Fish occasionally, but no more than three times a year.
    - C Fish several times a year, about four to nine times.
    - D Fish regularly, 10 times a year or more.

12. Respondent Selection: A combination of the Kish Grid and a Fisher Selector Table was used to choose one of the fishers in the household to be invited to participate in the year-long fishing panel. These devices are truly random and do not allow self-selection by any person into the survey. There was an equal probability of any fisher within a house being selected into the survey, no matter their avidity.

13. Respondent Substitution: No substitution of any refusing or uncontactable respondent was permitted.

14. Enrolment: If they agreed, the identified respondent was enrolled into the survey. This sometimes involved a separate visit to the home at a suitable time. Each enrolled fisher was given the survey materials (letter of introduction, information brochure, texting guide, memory jogger) and fully explained their role.

15. Call Frequency: Up to five calls were made at each sampled home to attempt to contact the respondent. Days of week and times of day for these calls were varied to maximise contact.

16. Call Integrity: NRB supervisors called back 20% of completed interviews to confirm the interview was done with the named persons, and how long it took.

17. Outcome Codes: Extensive coding of the outcome of each (household) respondent's contact attempts were recorded in order that formal internationally used response rates could be calculated (AAPOR 2016).

2.5 Screening and recruiting materials

Following, in Table 2, is a list of materials used by the interviewers to enable them to screen the homes and recruit fishers face-to-face into the 2017–18 NPS.

Table 2: Field interviewer's materials.

1. Meshblock sampling sheet.
2. Meshblock description and map.
3. Enumeration form.
4. Screener and fisher selector.
5. Showcard (age/ethnicity/Marine fishing)
6. Language Identifier
7. Letter of introduction*
8. Survey Information Brochure* (see Appendix 1)
9. Memory Jogger*
10. 'How we contact you' A5 brochure*

* These items were left with enrolled participants.

2.6 Website information for participants

Both NRB and MPI mounted web pages to explain the NPS to participants and also to inform those interested in the survey. The NRB website also included links to:

- Download Memory Jogger forms
- Download Fishing Survey Pamphlet
- Assist with fish identification (courtesy of United Fisheries)
- Identify fishing areas with expanded detail by area)

Images of the NRB website are shown in Appendix 2.

2.7 SMS method

Most participants elected to be initially contacted via the SMS system. The remainder, or those who did not (or could not) reply simply entered the CATI system to achieve the same outcome (i.e. they were contacted at their chosen telephone number and interviewed periodically).

A computer based system was used to provide a gateway into the SMS system to send and receive a high volume of messages. The platform selected allowed the use of a four digit shortcode and 'Freetext' service, where replies were free to the participant. This was held to be important to encourage response to the messages.

In the 2011–12 NPS the technology required 'groups' to be separately texted where the message was identical. 'Groups' were organised according to whether they were weekly, fortnightly or monthly reporters. In a slight variation (improvement) for this, the 2017–18 NPS, the technology was somewhat more advanced, and all participants could be texted in only one batch, but with the ability for fully customised messages. This ability was used to insert each fisher's first name into each message, as well as the exact reporting period. A selection of messages below (Figure 2) gives an idea of the format used.

Outbound text request – 8pm Sunday

Hi John. Did you fish/gather/dive in the week Mar5–Mar18? Please reply NO or YES. Use yes for any fishing even if no catch. Thanks. NZ Marine Fishing Survey.

Fisher reply options

Yes

No

Automated thank you to 'yes' response

Thanks for that! We will call you in the next few days to get your catch or non catch fishing :–) NZ Marine Fishing Survey.

Automated thank you to 'no' response

Thanks for that! Till next time :–) NZ Marine Fishing Survey.

Generic message for over time texts or non conforming replies

Hi. This is an auto response from the NZ Marine Fishing Survey. If your text is in regards to the survey, someone will contact you in the next few days :–)

Reminder text – 9.30am Monday

Hi. Just wondering if you missed our last message. See previous txt for details. Thanks. NZ Marine Fishing Survey.

Figure 2: Example SMS messages.

2.8 CATI operation

Separate to the 145 interviewers used to screen and recruit, were the telephone interviewers used to call the panel participants to either update whether they had fished or not (in the event of non-contact by SMS) or if they had fished, details about their fishing and any catch. Initially, 11 interviewers were trained for the start of the survey in October 2017, but further interviewers were recruited and trained for the peak season and a few replacements where an interviewer resigned. In all around 20 interviewers were trained.

Note that the CATI referred to here is not the traditional CATI with phone interviewers in the one building, but a 'distributed CATI' where each interviewer works in their own home and the sample and questionnaire is cloud served. The parameters for the CATI are set by the CATI manager who can control the size of the day-batch, the order which the sub-samples are rung, intervals between calls, maximum number of calls and so on.

The sample was served in a priority each week and could vary to (try to) get the best outcome. Typically, the order of contacting participants was like this:

1. Those who texted 'Yes'. Interviewed first to reduce any recall bias.
2. D avidity (most avid) Non-texters.
3. C avidity Non-texters.
4. B avidity Non-texters.
5. Others including non-contacted participants

The use of a highly structured CATI, which controls the sample as well as the routing and piping (customising questions depending on answers given) of the questionnaire reduces dependence on highly trained interviewers but still there is much the interviewers needed to be made familiar with. Training topics for the CATI interviewers included:

- Background and methods of the NPS.
- Familiarisation with participant's survey materials (including fish and area identification).
- Survey process.
- Nautical terms (useful in talking to fishers about areas fished).
- Fishing areas and map use.
- Interviewer manner (because they are the 'ambassadors of the project').
- CATI operation.
- Questionnaire administration.

The training included home study (including familiarisation of coastal town names and land points) and a full day at NRB's training facility. A comprehensive 'Interviewer Manual' was provided to each interviewer.

An important part of running a distributed CATI is ongoing support and encouragement. This was achieved with the usual means of group emails, text exchanges and phone calls. These means are also important to update the interviewers on any issues, provide hints about calling or interviewing etc. and answer any queries about the work.

2.9 CATI questionnaire

NRB and the Marine Amateur Fishing Working Group designed the CATI (Computer Assisted Telephone Interview) questionnaire to deliver temporally and spatially resolved estimates of fish harvest.

The purpose of the questionnaire was to find out, from each respondent, whether they had been fishing at all (any method) in a defined period (usually a week or weeks), and if so, details about fishing effort and any catch on a day-by-day basis.

The routing (branching, skips etc.) was conducted by the computer and depended on the answers given by the respondent. The following gives an overview of the major routing:

- For each week the program asked whether there was fishing on any day.
- For each fishing day, the program asked about fishing trips.
- For each trip the program asked details of each platform.
- For each platform the program asked about areas fished.
- For each area fished the program asked about fishing method.
- For each method the program asked if:
    1. Nothing was caught or gathered.
    2. Caught and all released or discarded.
    3. Fish or other species were caught and not discarded or released.
- For each method where something was caught the program asked details on species caught.
- For each species caught by a group catch method (i.e. not rod/line, or spear fishing), there were further questions about any shared effort in catching them in order to isolate personal harvest (this was found to be important during the development of the 2011–12 NPS).

Appendix 3 has a version of the CATI questionnaire.

2.10 Panel surveying frequency

The default surveying frequency used for the different avidity fishers is shown in Table 3. The schedule took into account only two fishing 'seasons' (winter versus not winter).

The schedule was based on matching the most appropriate reporting schedule according to the avidity of the fisher. This was expected to reduce the chance of annoying survey participants by an overzealous contact regime, while not testing the recall powers of the frequent fishers.

In addition, fishers were able to change their reporting frequency by agreement as the study progressed, either to increase the frequency (e.g. if a fisher was fishing more frequently than anticipated), or to decrease it (e.g. if a fisher was fishing less). This tailoring of reporting regime was designed to encourage on-going participation in the survey. A change to a fisher's schedule could also be made after discussion during the CATI interviews, or in response to direct contact with NRB.

Table 3: Default contact frequency by avidity.

	Avidity			
	A (non-fishers)	B (least avid)	C (middle avidity)	D (most avid)
Not winter (Oct to April)	6 monthly (no text)	Monthly	Fortnightly	Weekly
Winter (May to Sept)	6 monthly (no text)	Monthly	Monthly	Fortnightly

Note: for this survey a month comprises four weeks, or 28 days.

2.11 Weekly contact schedule

The NPS can be thought of as 53 weekly surveys (a year is 52 weeks plus one day). However, only the most avid fishers are actually surveyed weekly (in summer).

Every week, contact, by SMS or CATI, was made with survey participants according to their nominated contact frequency (e.g. weekly, fortnightly or monthly as in Table 3).

The basic contact regime is shown in Table 4. There was of course some variation on this, for instance for long weekends or where special efforts were made to contact 'hard to contact' participants. In the latter case calling was sometimes conducted on weekends. The 'appointmented' participants below is where certain participants could not be telephoned in usual CATI working hours (e.g. shift workers). The CATI program allowed appointments to be set to call these people at agreed times.

Table 4: Weekly contact schedule used when contacting panellists.

	SUN	MON	TUES	WED	THURS	FRI	SAT
9.30am		Text reminders to non responders					
8am–6pm			CATI surveys of appointmented participants	CATI surveys of appointmented participants	CATI surveys of appointmented participants		
6–9pm		CATI survey of yes texters, non texters and those overdue.	CATI survey of yes texters, non texters and those overdue.	CATI survey of yes texters, non texters and those overdue.	CATI survey of yes texters, non texters and those overdue.		
8.00pm	Texts to all due fishers asking if they fished over agreed period (weekly/ monthly etc.)						

Not shown are all the processes to make this system work, especially the several databases used to keep record of contact schedules, contact success – and to feed data between systems, e.g. to/from the SMS system, the CATI, the fishing database, the contact database).

2.12 Drop-in fisher survey method

A random sample of 4000 'A avidity fishers' (those who declared themselves as non-fishers) was drawn from all sampled homes where there was at least one declared non-fisher.

- 3591 were selected from non-fishing homes (but 863 of these had no phone numbers collected).
- 409 were selected from homes containing at least one fisher (B, C or D avidity).

A survey of these non-fishers was conducted at the six month mark (close to the most likely summertime fishing) and again at the end of the main survey as a final check.

The method was telephone interview with the interviewer following a structured paper-based questionnaire to record any fishing conducted. The question stream emulated that of the CATI questionnaire used to monitor the enrolled fishers. Data were collated and analysed separately from the main survey.

2.13 Survey fishing areas

For the 2011–12 NPS and 2017–18 NPS, 51 zones/areas were used to collect fishing and catch information via the CATI (Figure 3). These 51 areas can be used (Table 5) to estimate fishing and harvest within any given Fishery Management Area (FMA, excluding FMA 4, Chatham Islands) or Quota Management Area (QMA, excluding components in FMA 4), including the unusual QMAs that apply to paua, rock lobster (crayfish) and scallops.

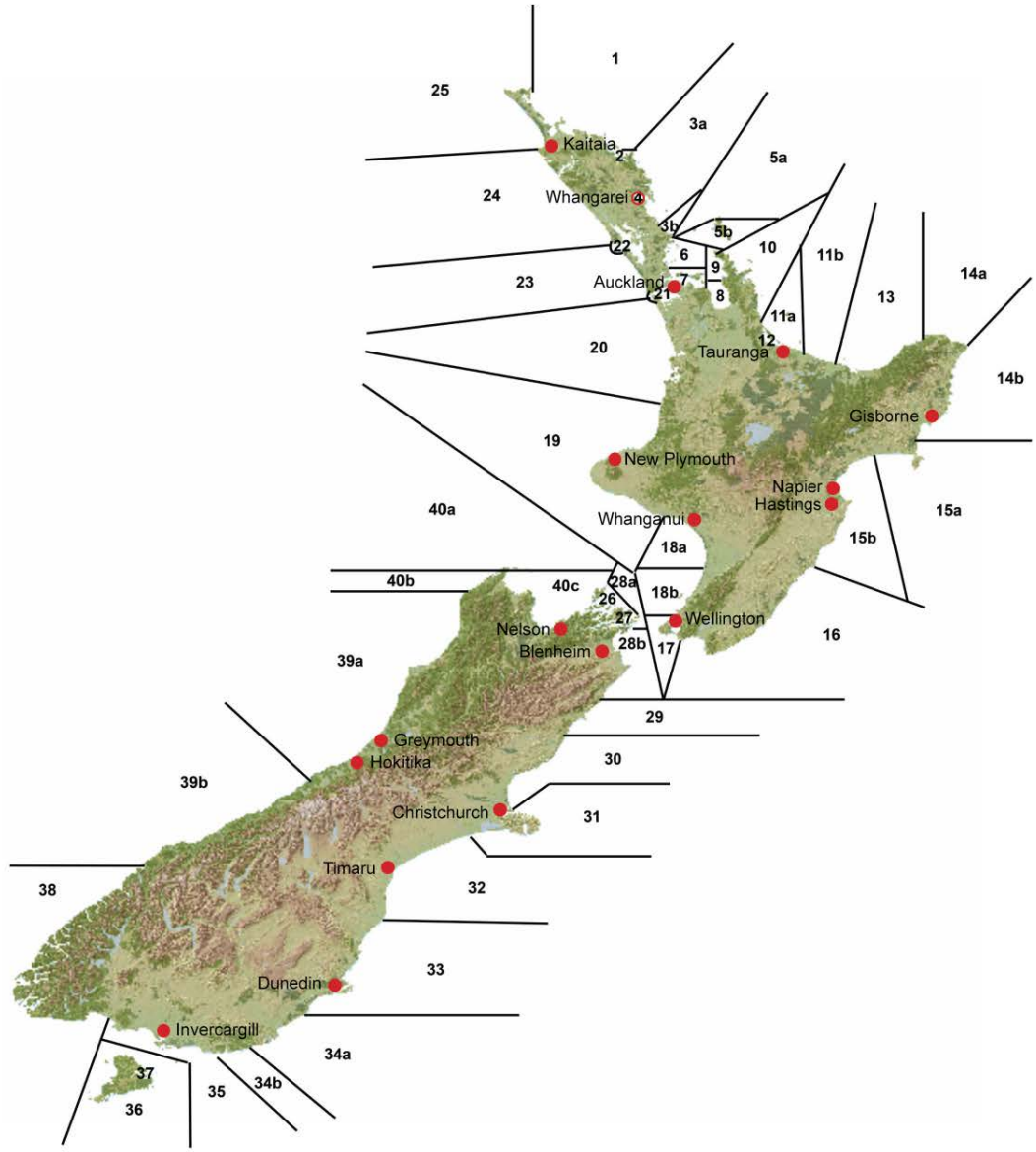


Figure 3: Fishing areas used by panellists when reporting the location of their fishing effort and catch.

2.14 Survey areas, FMAs and QMAs

Table 5 shows how the 51 survey areas can be used to derive harvest estimates for the FMAs (Fishery Management Areas) or specific QMAs (Quota Management Areas). Note that FMA 4 (Chatham Island and surrounding waters) is excluded from the scope of the survey.

Table 5: List of survey areas and equivalent FMAs and QMAs.

			QMA								
Area	Area Description	FMA	SNA/ KIN	KAH	BCO/ HPB/ TAR	GUR	TRE	ALB/ SKJ	CRA	SCA	PAU
1	North Cape to Cape Brett	1	1	1	1	1	1	1	1	1	1
2	Bay of Islands	1	1	1	1	1	1	1	1	1	1
3a	Cape Brett to Te Arai Point	1	1	1	1	1	1	1	1	1	1
3b	Te Arai Point to Cape Rodney	1	1	1	1	1	1	1	2	1	1
4	Whangarei Harbour & entrance	1	1	1	1	1	1	1	1	1	1
5a	North of Barrier Islands	1	1	1	1	1	1	1	2	1	1
5b	Barrier Islands	1	1	1	1	1	1	1	2	CS	1
6	Western Hauraki Gulf	1	1	1	1	1	1	1	2	CS	1
7	Inner Hauraki Gulf	1	1	1	1	1	1	1	2	CS	1
8	Firth of Thames	1	1	1	1	1	1	1	2	CS	1
9	Eastern Hauraki Gulf	1	1	1	1	1	1	1	2	CS	1
10	Eastern Coromandel	1	1	1	1	1	1	1	2	CS	1
11a	Northern Bay of Plenty	1	1	1	1	1	1	1	2	CS	1
11b	Middle Bay of Plenty	1	1	1	1	1	1	1	2	1A	1
12	Tauranga Harbour & entrances	1	1	1	1	1	1	1	2	CS	1
13	Eastern Bay of Plenty	1	1	1	1	1	1	1	2	1A	1
14a	East Cape – Northern	2	2	2	2	2	2	1	2	2A	2
14b	East Cape – Southern	2	2	2	2	2	2	1	3	2A	2
15a	Hawke Bay – Northern	2	2	2	2	2	2	1	3	2A	2
15b	Hawke Bay – Southern	2	2	2	2	2	2	1	4	2A	2
16	Cape Turnagain to Turakirae Head	2	2	2	2	2	2	1	4	2A	2
17	Turakirae Head to Titahi Bay	2	2	2	2	2	2	1	4	2A	2
18a	Waitotara River to Manawatu River	8	8	8	8	1	7	1	9	8A	2
18b	Manawatu River to Titahi Bay	8	8	8	8	1	7	1	4	8A	2
19	Waitotara River to Tirua Point	8	8	8	8	1	7	1	9	8A	2
20	Tirua Point to entrance area of Manukau	9	8	8	1	1	7	1	9	9A	1
21	Manukau Harbour & entrance area	9	8	8	1	1	7	1	9	9A	1
22	Kaipara Harbour & entrance area	9	8	8	1	1	7	1	9	9A	1
23	Manukau Entrance to Kaipara Entrance	9	8	8	1	1	7	1	9	9A	1
24	West of Northland	9	8	8	1	1	7	1	1	9A	1
25	Reef Point to North Cape	9	8	8	1	1	7	1	1	1	1
26	Marlborough Sounds	7	7	3	7	7	7	1	5	7	7

		QMA									
Area	**Area Description**	**FMA**	**SNA/ KIN**	**KAH**	**BCO/ HPB/ TAR**	**GUR**	**TRE**	**ALB/ SKJ**	**CRA**	**SCA**	**PAU**
27	Queen Charlotte Sound & Tory Channel	7	7	3	7	7	7	1	5	7	7
28a	Stephen Is to Tory Channel excl. sounds	7	7	3	7	7	7	1	5	7	7
28b	Tory Channel to Clarence River	7	7	3	7	7	7	1	5	7C	7
29	Clarence River to Conway River	3	3	3	3	3	3	1	5	3	3
30	Conway River to Sumner Beach	3	3	3	3	3	3	1	5	3	3
31	Sumner Beach to Rakaia River	3	3	3	3	3	3	1	5	3	3
32	Rakaia River to Waitaki River	3	3	3	3	3	3	1	5	3	3
33	Waitaki River to Tokomairiro River	3	3	3	3	3	3	1	7	3	5D
34a	Tokomairiro River to Long Point	3	3	3	3	3	3	1	7	3	5D
34b	Long Point to Slope Point	3	3	3	3	3	3	1	8	3	5D
35	Slope Point to Te Waewae Inlet	5	3	3	5	3	3	1	8	5	5D
36	Stewart Is, Ruapuke Island & surrounds	5	3	3	5	3	3	1	8	5	5B
37	Patterson Inlet on Stewart Island	5	3	3	5	3	3	1	8	5	5B
38	South West of the South Island	5	3	3	5	3	3	1	8	5	5A
39a	North West of the South Island	7	7	3	7	7	7	1	9	7A	6
39b	West of the South Island	7	7	3	7	7	7	1	8	7A	6
40a	North of the South Island	7	7	3	7	7	7	1	9	7B	7
40b	Cape Farwell to Kahurangi Point	7	7	3	7	7	7	1	9	7A	7
40c	Golden Bay and Tasman Bay	7	7	3	7	7	7	1	5	7	7

Species key: SNA=snapper, KIN=kingfish, KAH=kahawai, BCO=blue cod, HPB=hapuku/bass, TAR=tarakihi, GUR=gurnard, TRE=trevally, ALB=Albacore tuna, SKJ=skipjack tuna, CRA=rock lobster, SCA=scallop, PAU=paua.

3. SCREENING AND ENROLMENT OUTCOMES

3.1 Sampled meshblocks

Figure 4 shows how the 1100 sampled meshblocks were spread among Territorial Local Authorities (TAs). Table 6 lists each TA name together with the number of meshblocks sampled.

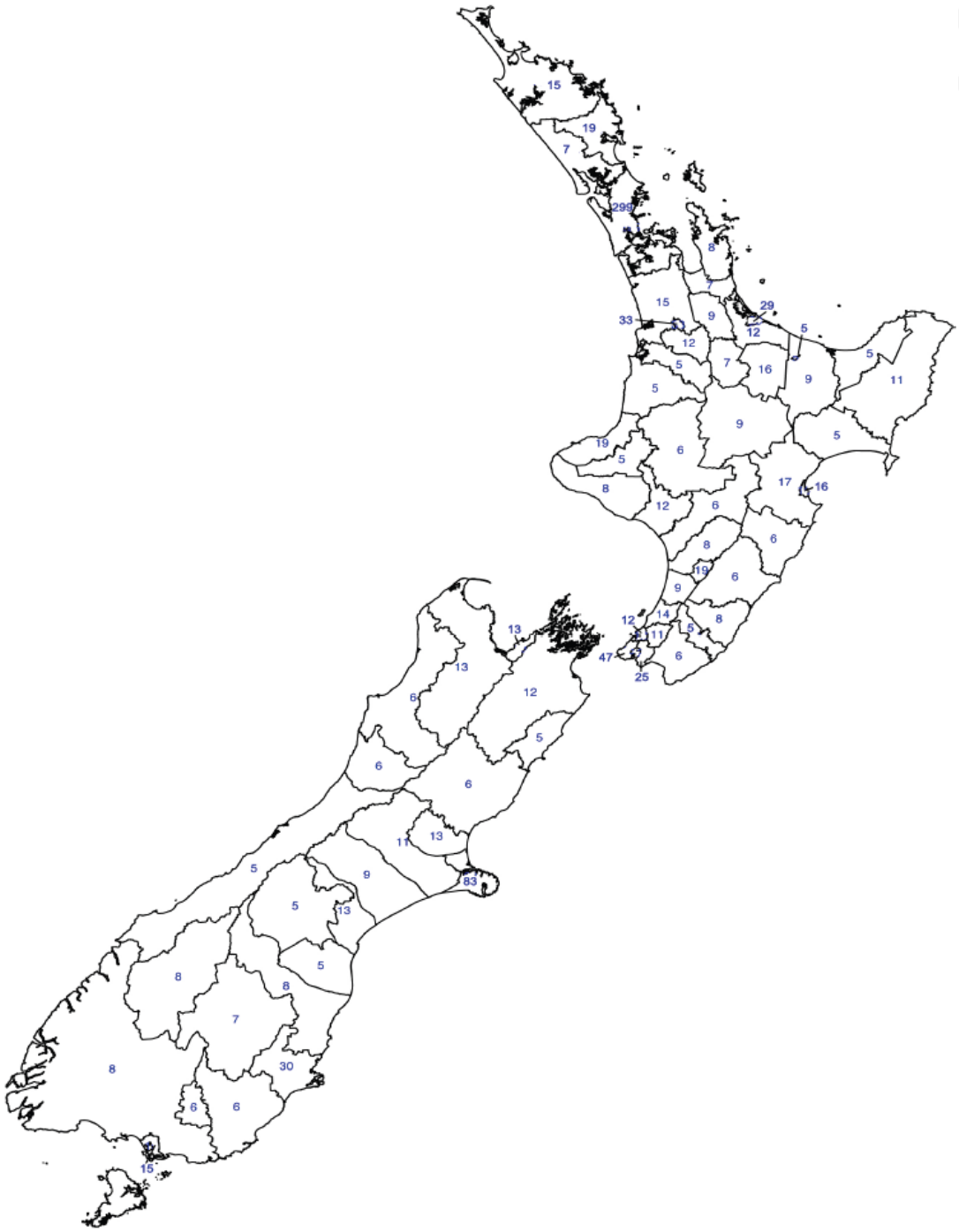


Figure 4: Location of sampled meshblocks according to TA.

Table 6: Count of sampled meshblocks by TA.

Territorial Local Authority	Meshblock Count	Territorial Authority	Meshblock Count
Far North District	15	Tararua District	6
Whangarei District	19	Horowhenua District	9
Kaipara District	7	Kapiti Coast District	14
Auckland City	299	Porirua City	12
Thames-Coromandel District	8	Upper Hutt City	11
Hauraki District	7	Lower Hutt City	25
Waikato District	15	Wellington City	47
Matamata-Piako District	9	Masterton District	8
Hamilton City	33	Carterton District	5
Waipa District	12	South Wairarapa District	6
Otorohanga District	5	Tasman District	13
South Waikato District	7	Nelson City	13
Waitomo District	5	Marlborough District	12
Taupo District	9	Buller District	6
Western Bay of Plenty	12	Grey District	6
Tauranga City	29	Westland District	5
Rotorua District	16	Hurunui District	6
Whakatane District	9	Kaikoura	5
Kawerau District	5	Waimakariri District	13
Opotiki District	5	Christchurch City	83
Gisborne District	11	Selwyn District	11
Wairoa District	5	Ashburton District	9
Hastings District	17	Timaru District	13
Napier City	16	Mackenzie District	5
Central Hawke's Bay District	6	Waimate District	5
New Plymouth District	19	Waitaki District	8
Stratford District	5	Central Otago District	7
South Taranaki District	8	Queenstown-Lakes District	8
Raupehu District	6	Dunedin City	30
Whanganui District	12	Clutha District	6
Rangitikei District	6	Southland District	8
Manawatu District	8	Gore District	6
Palmerston North City	19	Invercargill City	15

3.2 Calling outcome summary

Within the 1100 sampled meshblocks, 34 431 dwellings were visited, of which 27 038 were successfully screened (i.e. a household member agreed to answer the screening questions) from which 6975 fishers of B, C or D avidity[1] aged 15 or over agreed to be enrolled in the 2017–18 NPS (Table 7).

In the 2011–12 NPS, only 1000 meshblocks were visited and the final number of successfully enrolled fishers was 7013. So even though the number of meshblocks was increased by 10% for the 2017–18 survey, the yield of enrolled fishers was no higher.

Table 7: Number of dwellings visited and contact outcomes.

Screening Summary	
Dwellings Visited	34 431
Not Eligible (not usually resident etc.)	108
Vacant	1 877
Household refusal	2 380
No Reply	1 395
Access Denied *	932
Unavailable **	262
Language barrier	176
Incapacitated	194
Not Available ***	56
Other	13
Screened	27 038
	↓
Enrolment Summary	
Not Eligible (no fishers)	19 361
Respondent Refusal	521
Unavailable **	73
Not Available ***	83
Other	1
Language barrier	11
No Reply	1
Incapacitated	12
Enrolled	6 975

* Gated, dog etc.
** Not in area during survey dates
*** Not available when house visited

[1] See page 9 for avidity classifications.

3.3 Actual versus expected sample yield

In early October 2017 it was observed that despite conducting the fieldwork in the same manner as the previous 2011–12 NPS, the rate of locating fishers and getting them to agree to participate in the 2017–18 NPS was lower than expected.

Following is an analysis, based on data at the end of November, of the sample stages where factors affecting yield occurred. These factors are compared with those from the 2011–12 NPS in Table 8 to indicate differences. Note that subsequent to this comparison a remedial process (further screening in 106 large meshblocks) was added to boost screening.

Table 8: Factors impacting lower yield of participants in the 2017–18 NPS.

Factors	2011–12 NPS	2017–18 NPS	Factor's impact on yield (no. fishers)
Meshblocks	1 000	1 100	+701.4
Eligible dwellings per meshblock	*28.23	*27.34	-221.1
Screening response rate	85.71%	83.17%	-207.9
Fishing dwellings percentage	31.96%	28.28%	-807.6
Enrolment response rate	**90.69%	**90.16%	-41
		Total changes	-576.2
		*Total expected yield****	*6437.8*

* Maximum 32 per meshblock. The incidence of meshblocks with fewer than 32 houses and houses with no permanent residents affect this figure. ** This is a percentage of screened houses. *** Excluding booster meshblocks.

The table shows that the positive impact of increasing the number of meshblocks in the sampling design from 1000 to 1100 was overwhelmed by the impact of the lower incidence of dwellings containing at least one fisher. A slightly lower rate of the public agreeing to screen also had a smaller but negative effect on yield, as did the sample distribution into the regions, which resulted in us encountering more small (fewer than 32 houses) meshblocks than the previous survey.

Raising the final number of enrolled fishers to 6975 in the 2017–18 NPS was achieved by intensifying efforts to contact selected households plus a booster sample screening a further 16 houses in 106 of the largest meshblocks. The extra screening accounted for approximately 350 more fishers recruited than would otherwise have been achieved while persistent revisits to identify and enrol fishers made up the remainder.

Note that screening more homes in the 106 largest meshblocks does not compromise the probabilistic nature of the sample because the extra chances of selection in these meshblocks are accounted for in the weighting procedures.

3.4 Screening response rate

The screening response rate for the 2017–18 NPS was 84.9% (86% in 2011–12).

The response rate calculations, using industry standard methods, were based on the screening outcomes for all sampled dwellings as reported by the interviewers (Table 9).

Table 9: Categorisation of screening outcomes.

Category	Outcomes
Interviews (a_i)	Interviews (I)
Not Eligible (b_i)	Not eligible (NE), Vacant (V), Unavailable (U)
Eligibility Not Established (c_i)	No reply (NR), Access Denied (AD), Household refusal (HR)
Eligible Non Response (d_i)	Respondent refusal (RR), Not available (NA), Appointment (APT), Language (L), Incapacitated (INC), Hospitalised (HOS), Partial (P), Other (OTH)

An estimate of the eligible households within the PSU_i calculated as:

$$a_i + d_i + \frac{c_i \times (a_i + d_i)}{(a_i + b_i + d_i)}$$

The response rate for PSU_i is the number of interviews achieved divided by the estimated eligible households.

$$\frac{a_i}{a_i + d_i + \frac{c_i \times (a_i + d_i)}{(a_i + b_i + d_i)}}$$

This reduces to the following:

$$\frac{a_i \times (a_i + b_i + d_i)}{(a_i + d_i)(a_i + b_i + c_i + d_i)}$$

The response rate for a group of PSU's is the average of the response rate for the individual PSUs, weighted by the estimated number of eligible households within each.

Applying this formula to the screening outcomes resulted in the final screening response rate.

$$\frac{27\,038 \times (27\,038 + 2\,319 + 439)}{(27\,038 + 439) \times (27\,038 + 2\,319 + 4\,707 + 439)} = 85\%$$

3.5 Enrolment response rate

The enrolment response rate for the 2017–18 NPS, calculated by the same method as for the screening response rate, was 91.7%. This compares with 90.8% in 2011–12. Note that this response rate is 'of those successfully screened' (i.e. 91.7% of 85%).

$$\frac{6\,975 \times (6\,975 + 19\,434 + 628)}{(6\,975 + 628) \times (6\,975 + 19\,434 + 1 + 628)} = 91.7\%$$

3.6 Avidity mix of screened sample

Table 10 shows the raw number of those in the 2017–18 NPS according to the professed fishing avidity of household members and their age group. Random selection of fishers (B, C and D avidity) and their invitation into the survey was based on this sample.

Table 10: Avidity mix of screened sample – 2017–18 NPS.

	TOTAL	Age Group								
		15–19 yrs	20–24 yrs	25–34 yrs	35–44 yrs	45–54 yrs	55–64 yrs	65–74 yrs	75+ yrs	Miss-ing
Unweighted Base	57 110	4 170	4 782	9 432	9 357	9 512	8 250	6 632	4 412	563
A–Never/used to/gave it up/retired from it now	44 755 78.4%	3 231 77.5%	3 867 80.9%	7 307 77.5%	7 033 75.2%	7 074 74.4%	6 203 75.2%	5 401 81.4%	4 106 93.1%	533 94.7%
B–Occasionally, but not more than 3 times a year	6 384 11.2%	573 13.7%	537 11.2%	1 161 12.3%	1 207 12.9%	1 199 12.6%	967 11.7%	580 8.7%	148 3.4%	12 2.1%
C–Several times a year, about 4–9 times a year	3 816 6.7	259 6.2%	250 5.2%	615 6.5%	736 7.9%	777 8.2%	679 8.2%	395 6.0%	93 2.1%	12 2.1%
D–Regularly, 10 times a year or more	2 155 3.8%	107 2.6%	128 2.7%	349 3.7%	381 4.1%	462 4.8%	401 4.9%	256 3.9%	65 1.5%	6 1.1%

The random selection of fishers (B, C and D avidity) was taken from this sample. A further sample of non-fishers as potential 'drop ins' was later taken at the six month stage from the screened 'A avidity' household members.

3.7 Avidity mix of enrolled fishers

The avidity mix of the final sample for the 2017–18 NPS was remarkably similar to that of the 2011–12 NPS (Table 11).

Table 11: Stated avidity mix of enrolled fishers in the two National Panel Surveys.

Avidity	2017–18 NPS		2011–12 NPS	
B	3 496	50.1%	3 526	50.3%
C	2 197	31.5%	2 183	31.1%
D	1 282	18.4%	1 304	18.6%
TOTAL	6 975	100%	7 013	100%

4. MONITORING OF PANELLISTS

4.1 Enrolment rate

In both the 2017–18 NPS and the 2011–12 NPS there was a 'rolling enrolment' into the survey. Some of this was due to the lag in entering data from the fieldwork but there were also late enrolments due to on-going efforts to improve response rate.

The 2017–18 NPS had particular issues in terms of late enrolments (Table 12). Much of this was due to an extremely wet winter throughout New Zealand hampering fieldwork in August and September. There were also reports of a decrease in public willingness to participate – as well as the rather late decision to screen a further 16 houses in 106 meshblocks. A few Kaikoura meshblocks were also visited later than anticipated because road closures after the Kaikoura Earthquake prevented an earlier visit.

Table 12: Enrolments by week.

Fishing Week	Panellists enrolled
1	2 206
2	3 089
3	3 876
4	4 520
5	4 846
6	5 408
7	5 647
8	5 905
9+	6 975

The delay in the first four weeks is only procedurally problematic since those fishers still had recall periods of less than four weeks. Also, October is still a time of less frequent fishing. For fishers enrolled after the four week mark who had fished, recall periods were sometimes longer and this may entail some bias, likely to be positive but small.

4.2 Text responding rate

Approximately 85% of the participants agreed to join the texting programme, the most immediate way to respond to the initial question of whether they had fished of not (over the agreed responding period). However, not all of these people actually did respond to the outgoing SMS messages. Table 13 shows the relative success of the SMS programme for each week of the survey. Note that where texting was not operative, phone contact was used.

Table 13: Text responding rate for the 2017–18 NPS.

Fishing week	Text out	Replied YES	Replied NO	Yes + No	% responding
1	1 974	108	1 097	1 205	61.0%
2	1 145	106	617	723	63.1%
3	1 754	148	771	919	52.4%
4	1 459	210	644	854	58.5%
5	2 751	300	1 478	1 778	64.6%
6	3 109	409	1 642	2 051	66.0%
7	2 715	247	1 420	1 667	61.4%
8	2 734	292	1 468	1 760	64.4%
9	3 233	473	1 789	2 262	70.0%
10	2 998	463	1 885	2 348	78.3%
11	2 633	358	1 598	1 956	74.3%
12	2 504	300	1 593	1 893	75.6%
13	3 093	337	1 904	2 241	72.5%
14	2 952	436	1 427	1 863	63.1%
15	2 857	472	1 559	2 031	71.1%
16	2 621	459	1 408	1 867	71.2%
17	3 256	421	1 926	2 347	72.1%
18	2 691	423	1 594	2 017	75.0%
19	2 671	286	1 742	2 028	75.9%
20	2 381	227	1 641	1 868	78.5%
21	3 028	303	2 015	2 318	76.6%
22	2 632	273	1 844	2 117	80.4%
23	2 593	226	1 850	2 076	80.1%
24	2 310	200	1 662	1 862	80.6%
25	2 897	211	2 091	2 302	79.5%
26	2 612	196	1 910	2 106	80.6%
27	2 580	379	1 621	2 000	77.5%
28	2 480	312	1 609	1 921	77.5%
29	2 938	175	2 096	2 271	77.3%
30	2 692	164	1 933	2 097	77.9%
31	2 580	200	1 798	1 998	77.4%
32	1 694	115	1 172	1 287	76.0%
33	1 816	95	1 320	1 415	77.9%
34	1 668	85	1 240	1 325	79.4%
35	1 637	50	1 239	1 289	78.7%
36	1 628	92	1 143	1 235	75.9%
37	1 832	100	1 325	1 425	77.8%
38	1 650	71	1 243	1 314	79.6%
39	1 645	79	1 219	1 298	78.9%
40	1 586	91	1 113	1 204	75.9%
41	1 784	66	1 304	1 370	76.8%

Fishing week	Text out	Replied YES	Replied NO	Yes + No	% responding
42	1 667	74	1 225	1 299	77.9%
43	1 634	82	1 225	1 307	80.0%
44	1 575	59	1 153	1 212	77.0%
45	1 775	61	1 328	1 389	78.3%
46	1 662	100	1 196	1 296	78.0%
47	1 612	80	1 174	1 254	77.8%
48	1 587	89	1 129	1 218	76.7%
49	1 783	62	1 315	1 377	77.2%
50	1 679	79	1 223	1 302	77.5%
51	1 582	103	1 146	1 249	79.0%
52	1 547	106	1 088	1 194	77.2%
53	5 358	262	4 021	4 283	79.9%

The rate of responding is shown as starting at around 60% building to near 80% by the end of the survey. By way of comparison, in the 2011–12 NPS the rate of responding was at around 75% at the start of the survey, increasing to near 85% by the end of the survey. Reasons for more of the participants in the 2017–18 survey not replying to the texts are not completely known but we note the following.

SMS service provider: NRB's SMS service provider in the 2017–18 NPS was Modica as opposed to Datasquirt (now defunct) in 2011–12. It is not known how the two gateways varied in performance Analysis of numbers not replying in the first weeks, however, revealed a particular problem reaching or being able to receive replies from the 2 Degrees network – which was (supposedly) remedied after complaint. Other budget suppliers (mainly Skinny and Slingshot) also had some issues in that they offered some plans (or in one case handsets) restricted in their ability to reply to four digit shortcodes. Users were typically naïve to this limitation. As NRB steadily changed fishers who could not text to 'phone only' contact, and as participants learnt the protocol, reply rates can be seen to improve.

Coverage: Not all areas in New Zealand have good cell phone coverage. With a more regionally distributed sample it is possible more of the sample could have coverage issues. Coverage also varies when people go on holiday.

Smart Phone Usage: In the first NPS about 43% of New Zealand had smartphones. In the latest NPS the penetration was over 70%[2]. This is a dramatic enough change in and of itself, but how people use smartphones nowadays may have more influence. As smartphones have evolved, there are now many more uses and apps than ever before. In 2011 more users would be likely to be doing little more than phoning and texting. But by 2017 smartphones were typically used for a much wider variety of tasks including: Facebook, Messenger, iMessage, Viber, Instagram, WhatsApp, Herald, Stuff, TradeMe, Gmail, Spotify etc. Any of these could have a notification set and go 'ding' to alert. Thus, the arrival of a text is now, more than ever, in the context of a potentially high degree of 'clutter'. The level of importance and likelihood of responding to a text in this competing environment is unknown but likely to be reduced.

Despite these contact issues, fishers who did not respond to the text were routed to the alternative phone/CATI contact method so were not lost in this process.

[2] A survey by Research New Zealand found that more than 70 per cent of New Zealanders owned a smartphone in 2015, up from 48 per cent in 2013. The research showed that 91 per cent of 18 to 35–year–olds had a smartphone in 2015. For the 35–54 age bracket it was 78 per cent, and 45 per cent in the over–55 age group.

4.3 CATI success rate

NPS interviewers were trained and worked (from home) on the fishing CATI mainly 5pm till 9pm Monday to Thursday.

Table 14 shows the CATI success rate by week. In the table, interviews 'Due for week' include YES texters (where we know there was fishing), and those for whom we don't know about their fishing (those who did not text reply or who declined the text option). However, where a person was not contacted, they remained in the sample – thus the 'Due plus overdue for week' number was higher than the 'Due for week' by an amount that depends on the contact success rate.

Table 14: CATI success rate by week for the 2017–18 NPS.

Fishing Week	Due for week	Due plus overdue for week*	Completed via CATI	Not contacted this week
1	1 108	1 108	434	674
2	660	1 273	489	784
3	1 176	1 733	604	1 129
4	964	1 963	545	1 418
5	1 564	2 290	609	1 681
6	1 851	1 072	425	1 547
7	1 757	1 864	543	1 321
8	1 757	1 851	827	1 024
9	1 890	1 925	928	997
10	1 571	2 017	792	1 225
11	1 491	1 880	948	932
12	1 203	1 621	967	654
13	1 502	1 580	831	749
14**	1 758	2 056	873	1 183
15	1 722	1 961	936	1 025
16	1 666	1 960	875	1 085
17	1 817	1 898	980	918
18	1 418	1 688	958	730
19	1 276	1 496	836	660
20	1 048	1 300	681	619
21	1 365	1 472	822	650
22	1 112	1 342	749	593
23	1.053	1 241	702	539
24	941	1 166	640	526
25	1 136	1 229	657	572
26	1 013	1 247	621	626
27	1 305	1 519	617	902
28	1 274	1 538	649	889
29	1 318	1 449	470	979
30	1 231	1 520	447	960
31	1 254	1 528	568	960
32	873	1 328	430	898
33	785	1 166	402	764
34	655	1 058	347	711
35	662	1 052	377	675
36***	753	1 096	375	721
37	808	1 078	425	653
38	628	959	336	623

Fishing Week	Due for week	Due plus overdue for week*	Completed via CATI	Not contacted this week
39	666	986	342	644
40	702	1 027	388	639
41	740	982	387	595
42	659	931	330	601
43	637	929	335	594
44	625	928	308	620
45	703	979	315	664
46	713	1 011	370	641
47	704	1 018	315	703
48	714	1 026	320	706
49	729	1 026	319	707
50	727	1 047	402	645
51	661	1 001	374	627
52	677	1 002	326	676
53****	2 122	2 720	1 779	941

** This column is not just the sum of 'not contacted' and 'due for week'. This is because some 'not contacted' would fall due in any case the following week. ** 25th to 31st Dec – Christmas week. *** Change to less frequent winter polling. **** Fishers on all reporting finally polled to finalise survey.*

Note that an 'interview' can vary from a record of comprehensive fishing, through to a respondent merely saying that they didn't fish that week. The sample is served in a priority order each week and may vary each time to (try to) get the best outcome. Typically the order of contacting participants was like this:

1. Those who texted 'Yes'. They are interviewed first to reduce any recall effect.
2. D avidity (most avid) Non-texters.
3. C avidity Non-texters.
4. B avidity Non-texters.
5. Others including non-contacted participants

Non-contacted participants in particular were sometimes moved to just after the 'Yes' texters to try to resolve these cases.

The results show the challenge of reaching participants; it is generally not possible to contact all those where an interview was scheduled. People are out, on evening shift, have their phones off, are on holiday, refuse to cooperate, or have lost or changed their cell phone. However, when they are contacted eventually all past weeks can often be resolved (whether some fishing was conducted or, more commonly, none at all).

In the latest NPS the challenge of reaching participants was greater than in 2011–12 and much of this appears to be due to the lower number of landlines available to call and the higher number of mobiles. One of the problems with a mobile, is that it might be turned off or have a flat battery. Also, even if on, the mobile can show the number of the person ringing. If it is unknown to the owner, or if 'Caller ID Blocked' shows, the mobile owner can simply not answer the call. Where we ring landlines and there is no answer, there is usually no record of the attempt on the participant's phone. When ringing a cell phone, every call attempt is logged on the participants phone – so our persistent calls are evident and have every risk of being perceived as 'nagging' or 'hounding' someone (words used by participants). Ringing mobiles is not the same as ringing landlines.

Important to note though, is that the number 'not contacted this week' does not mean that these are the same people each time. Overall there were just 154 we were never able to contact (2.2%), although we received no data from 251 participants (3.6%) – this includes refusals to participate, despite being enrolled.

The total of 'non-contacted' participants was relatively low, but still not ideal. Reasons for not being able to contact the 154 people (and others later as the survey progressed) include: people deliberately giving us false numbers, inaccuracies in recording the numbers given, and people changing, losing or disconnecting phones.

Steps taken to improve the CATI contact rate have included: widening the calling times to include daytime hours; prioritising non-contacts in the order of contacting participants; trying to increase the number of landlines by asking the participants to provide a landline where available; and reverse look-up of addresses to try to obtain landline numbers. Where mobile numbers appear incorrect (in the event of lost phones, new phones, bad numbers etc.) participants were contacted by email and mail to seek valid numbers.

4.4 Final response by week

'Final Response by week' is the percentage of panellists for which data for each week had been obtained by the end of the survey. Note that when contact (text or phone interview) is made with a participant, it can lead to back-filling previous weeks with fishing or not fishing information. 'No data' is where we simply have no record of a person's fishing (or not) for that particular week, for any reason. A 'yes' text is not counted as a response unless an interview is obtained (Figure 5).

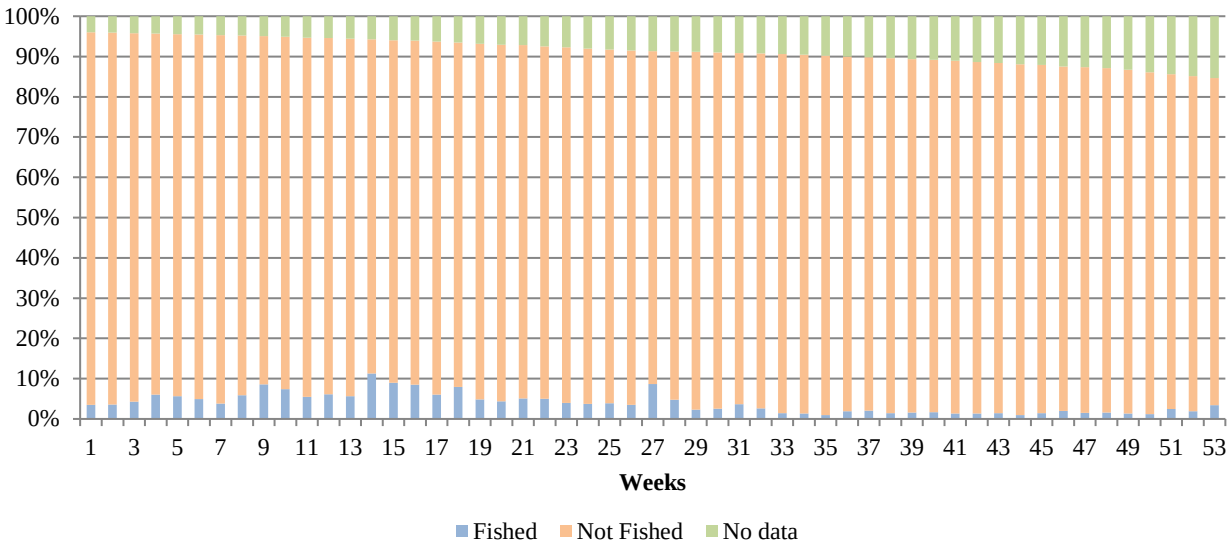


Figure 5: 2017–18 NPS final response by week.

The proportion of panellists that fished in any given week was low. This demonstrates that surveying fishing is likely to have particular issues as it is a relatively rare behaviour even in the fishing population.

In the 2017–18 NPS there was a steady challenge in contacting participants as the survey progressed. By the last week of the 2017–18 survey we had no recorded data for 15.4% of the originally enrolled fishers in the last week. In comparison, by the last week of the 2011–12 survey we had no recorded data for 7.6% of the originally enrolled fishers in that survey. The authors propose that both rates of responding are excellent for longitudinal surveys lasting a whole year, although there was clearly a decline between the 2011–12 and 2017–18 surveys.

4.5 Attrition

Table 15 shows cumulative attrition over various weeks of the 2017–18 NPS survey. Attrition included those who no longer wished to participate in the study (Resignations), as well as those for whom we no longer had sufficient contact information to successfully make contact, or who were away for a period (Suspended). Although attrition does not exactly equate to whether or not we have data for a week, it is a measure of how well the survey is tolerated by participants.

The level of attrition increased steadily throughout the survey with the highest rate at 50 weeks reaching 13.4% (8.4% in 2011–12). Much of this can be put down to the difficulties in contacting participants reliant on cell phones (i.e. no landline numbers). The attrition in the final week of the survey is a little lower because some participants had simply said, 'contact me at the end of the survey'. In addition, some participants were put back into the sample to try for contact at the end of the survey, which had a degree of success.

Table 15: Cumulative attrition.

Fishing week	Attrition
1	0.0%
10	3.0%
20	6.6%
30	7.9%
40	11.4%
50	13.4%
53	11.9%

It is pertinent to look at attrition according to stated avidity to try to ascertain whether this aspect relates to the propensity to stay reporting over the duration of the surveys (Table 16). There appears to be only a slightly higher chance that those of higher avidity will drop out from the survey.

Table 16: Attrition by avidity (cumulative).

Avidity	6 month attrition		12 month attrition	
B	258	7.4%	413	11.8%
C	193	8.8%	252	11.5%
D	125	9.7%	168	13.1%
TOTAL	576	8.3%	833	11.9%

Missing data caused by attrition and otherwise is dealt with via the statistical treatment outlined in Section 6.2.

5. DROP-IN SURVEY RESULTS

5.1 Response rate

Table 17 summarises final outcomes for both waves of the survey after the prescribed maximum of six telephone calls.

Table 17: Drop-in fisher survey telephone call final outcomes.

Code*	Description	First 6 Months	Second 6 months
I	**Interview – not fished**	**2 203**	**2 079**
NE or E	No phone number	863	867
E	Disconnected	202	283
E	Wrong number (incl. moved)	172	182
EU	Answer phone	255	434
EU	No reply	60	42
I	**Interview – fished**	**107**	**41**
E	Refused	35	42
E	Not available at time of call	38	3
E	Language difficulty	11	4
EU	Engaged	2	1
E	Other	13	9**
NE	Unavailable during survey	38	7
E	Incapacitated	1	6
	TOTAL	**4 000**	**4 000**

* Key: I = Interview, E = Eligible but not interviewed, NE = Not Eligible, EU = Eligibility Unknown
** Includes seven deceased

The sample of 4000 'A fishers' was drawn proportionately from both screened homes where there were no fishers, and those where there was at least one fisher in the home. In many cases, no phone numbers were available, however, because some of those screened but not enrolled as fishers can be cautious about handing out their phone numbers for future research. Nonetheless, the sample provided more than the target 2000 net interviews of which about 13% were originally screened as 'non-fishers in a fishing home'.

There was a relatively high rate of disconnected numbers and answer phones, particularly at the 12 month survey point. A major reason for this is increasing reliance on mobile phones as opposed to landlines which adds an obstacle to having access to reliable contact numbers over a year long period. Over 10% of the population will move address in a year period also, which also operates against contact numbers remaining valid over time.

The response rate can be calculated using the formula following. The letter codes are explained in Table 17 above.

$$RR = \frac{I \times (I + E + NE)}{(I + E) \times (I + E + NE + EU)}$$

The calculated response rate, assuming 'no phone number' as 'eligible but not interviewed' was **58.4%** at the six month point and **53.1%** at the 12 month point.

Since there is no evidence that refusal to provide a telephone number is related to the dependent variable (fishing), it is sensible to consider 'no phone number' as out of frame (i.e. not eligible) for a more realistic response rate calculation. The calculated response rate, assuming 'no phone number' as 'not eligible' was **76.5%** at the six month point and **70.5%** at the 12 month point.

5.2 Fishing activity

137 (5.9%) of the A Avidity respondents surveyed, reported that they had in fact fished, despite them declaring at the time of screening, to be non-fishers (based on the final number of respondents contacted). This compares with 5% as measured for the 2011–12 NPS.

A summary of the fishing and personal harvest recorded from this 'drop-in fishing' is shown in Table 18.

Table 18: Drop-in fisher survey fishing summary

	Non-fishers in fishing homes	Non-fishers in non-fishing homes	Total
Respondents contacted*	319	1 991	2 310
Fished	30	107	137
% Fished	*9.4%*	*5.4%*	*5.9%*
Trips	50	199	249
Harvest trips	28	96	124
Finfish harvested	155	425	580
Finfish harvested per head	*.49*	*.21*	*.25*
Other marine species harvested	19	770	789
Other marine species harvested per head	*.06*	*.38*	*.34*

** Includes approximately 190 contacted at 6 months only*

The number of annual trips reported by these ‘non-fishers’ was low as was the harvest rate. This results in the overall number of finfish caught per head being only about 0.25 of a fish (compared with 0.22 in 2011–12).

As in the 2011–12 survey, in 2017–18 fishing by A Avidity fishers in 'fishing homes' appears to be about double the rate for A Avidity fishers in 'non-fishing homes'.

Harvesting of marine species other than finfish (mainly shellfish) was conducted mainly by non-fishers in ‘non-fishing’ homes. Non-fishers in fishing homes harvested very few 'other marine species', a result very similar to that found in 2011–12.

5.3 Fishing by platform

Around half of the fishing 'trips' were from land (Figure 6), although this figure was 60% for non-fishers from fishing homes, compared with about 26% for non-fishers from non-fishing homes (Table 19). Fishing from a trailer boat was more common for non-fishers in fishing homes (54%) than non-fishers in non-fishing homes (19%).

Table 19: Drop-in fisher survey trips by platform.

	Non-fishers in fishing homes	Non-fishers in non-fishing homes	Total
Trailer boat	27	38	65
Large motor boat or launch	9	26	35
Trailer yacht	-	-	-
Larger yacht or keeler	1	2	3
Kayak, canoe, rowboat	-	10	10
Land or jetty	13	120	133
Something else*	-	3	3
TOTAL	50	199	249

* Includes Sealegs and two jetskis

5.4 Fishing by method

The most frequent method of fishing by the drop-in fishers was by rod or line (Table 20). Hand gathering was mainly undertaken by non-fishers in non-fishing homes. Note that more than one method could be attempted on a single trip, so the total count is slightly higher than for the previous table.

Table 20: Drop-in fisher survey trips by method.

	Non-fishers in fishing homes	Non-fishers in non-fishing homes	Total
Rod or line	44	150	194
Longline, kontiki, kite	2	8	10
Net	2	4	6
Pot	-	7	7
Dredge	-	2	2
Hand gather, flounder	2	21	23
Hand gather by diving	-	11	11
Spearfishing	-	-	-
TOTAL	50	203	253

5.5 Species personally harvested

The finfish species most frequently harvested by drop-in fishers was snapper (238) followed by kahawai (118) (Table 21). A total of 48 people in the drop-in survey harvested snapper and 34 harvested kahawai. The non-finfish species most frequently harvested was mussels (306) followed by pipi (162) and cockles (135). Note the low number of shellfish harvested by non-fishers in fishing homes – this finding is the same as for the 2011–12 NPS. The 306 mussels were however taken by just seven people, the pipi by three people and the cockles also by three people.

Table 21: Drop-in fisher survey species personally harvested.

	Harvest by non-fishers in fishing homes	Number of people harvesting	Harvest by non-fishers in non-fishing homes	Number of people harvesting	Total harvest
Snapper	106	17	132	31	238
Kahawai	23	8	95	26	118
Terakihi	10	2	15	2	25
Red gurnard	-	-	17	7	17
Blue cod	4	1	77	11	81
Trevally	2	1	-	-	2
Kingfish	3	3	2	1	5
Skipjack tuna	-	-	3	1	3
John dory	1	1	1	1	2
Rig	-	-	6	2	6
Mackerel	1	1	3	2	4
Flounder	-	-	5	1	5
Mullet	2	2	22	1	24
Spotty	-	-	19	4	19
Hapuku	3	2	5	1	8
Sea perch	-	-	8	3	8
Pilchard	-	-	5	1	5
Marlin	-	-	1	1	1
Red cod	-	-	3	2	3
Dogfish	-	-	2	1	2
Blue moki	-	-	4	1	4
Finfish total	**155**	**38**	**425**	**100**	**580**
Pipi	-	-	162	3	162
Cockles	-	-	135	3	135
Paua	7	2	34	6	41
Mussels	-	-	306	7	306
Lobster	-	-	15	3	15
Kina	12	1	85	5	97
Oysters	-	-	27	2	27
Pupu	-	-	6	1	6
Non finfish total	**19**	**3**	**770**	**30**	**789**

6. EXPANSION TO POPULATION-LEVEL DATA

6.1 Estimation method

The data on recreational fishers is collected from a probability based sample survey. Hence the usual method of estimating population quantities is to weight each respondent's data by the inverse of their probability of selection. Non-response at the respondent level (unit record level), occurs in two ways: households who refuse to participate in the avidity screening questionnaire; and people who when recruited to the panel refuse to participate. To account for this non-response, the selection (sample design) weights were modified.

The probability of selecting a sampled meshblock is:

$$\frac{nM_i}{\sum_N M_i}$$

where n, N, M_i are respectively the sample size, population number of meshblocks and number of occupied dwellings in meshblock i at the 2006 Census. The probability of selecting a dwelling within a meshblock is:

$$\frac{m_i}{M_i'}$$

where m_i, M_i' are respectively the number of dwellings screened for fishers in meshblock i and the number of occupied dwellings in meshblock i when NRB re-enumerated the meshblock at the time of the survey. If there are f_{ij} fishers in dwelling j in meshblock i, then the probability of selecting a fisher is:

$$\frac{1}{f_{ij}}$$

The overall probability of selection is the product of these three probabilities and the selection weight is the inverse of this overall probability:

$$\frac{\sum_N M_i M_i' f_{ij}}{nM_i m_i}$$

Since there is some nonresponse these selection weights are multiplied by a factor

$$\frac{(a_i + d_i)(a_i + b_i + c_i + d_i)}{a_i(a_i + b_i + d_i)}$$

where a_i, b_i, c_i, d_i are respectively the number of Eligible Responding Households, Not Eligible Households, Eligibility Not Established Households, and Eligible Non-Responding Households in meshblock i. This 'adjusted selection weight' is the inverse of the meshblock screening response rate as discussed in Section 3.4.

Although the median adjusted selection weight for fishers recruited to the panel was 70.8 with interquartile range (IQR) (53.5, 116.1), there are 21 fishers with weights greater than 466 (6 IQR above the median). These large weights arose for three reasons. First, the meshblock they lived in had substantial growth in the number of dwellings so that M_i' was very much greater than M_i and hence their ratio was much large than 1. Second, the response rate in their meshblock was much lower than average, for example only one or two eligible responding dwellings. Third, they lived in a dwelling with many fishers. Although variability in weights contributes to the overall sample error, truncating the weights (which is known as winsorization) produces some bias. For the more commonly caught species (see Section 9), the impact on the estimates by these respondents with extreme weights was very much smaller than the sample errors in part because there are a large number of fishers and trips contributing to the estimate[3]. Hence the weights were not truncated.

[3] For example, for the 21 fishers with weights over 466, truncating their weight to this level would reduce their contributions to total catch by typically small amounts. Specifically, for Snapper, Kahawai, Crayfish, and Paua, the reductions are 0.8%,

Some people refused to participate after being recruited to the panel, but this nonresponse was adjusted at the calibration stage (see Section 6.5).

The above nonresponse adjustment controls for broad meshblock characteristics, for example, inner city dwellings may be harder to contact than suburban dwellings. But nonresponse also varies according to broader geographic regions as well as demographic characteristics (gender, age, ethnicity).

Having conditioned on these characteristics, non-respondents are usually assumed to be missing at random. These sorts of characteristics could be used to build a model of the probability of responding and these model derived probabilities could be used to further adjust the selection weights at the level of an individual. An alternative, which in practice has a similar outcome is to calibrate the respondent data to known population totals for these characteristics. The details of the calibration will be discussed more fully in Section 6.5. But the next paragraphs will give a summary of what is meant by calibration.

The basic idea behind calibration is an adjustment of the (nonresponse adjusted) selection weights derived from the inverse of the inclusion probabilities adjusted for nonresponse. Call these the design weights

$$d_k = \frac{1}{\pi'_k}$$

(for respondent k). The adjustment is made so that the new weights, call these w_k, match known population totals of certain auxiliary variables, e.g. for age group or sex counts. But also, they need to be as close as possible to the d_k's. In effect the d_k's can be expressed in terms of what are called *g*-factors:

$$w_k = g_k d_k \text{ or } w_k = \frac{g_k}{\pi'_k}.$$

It is sensible to consider making the *g*-factors close to 1 by minimising an appropriate distance between 1 and the *g*-factors. For example, using the usual Euclidean distance we would minimise:

$$\sum_{k=1}^{N} (g_k - 1)^2$$

where the sum is over all the population. Of course we only have a sample so we need to minimise a sample version of this:

$$\sum_{k=1}^{n} \frac{1}{\pi'_k} (g_k - 1)^2$$

or

$$\sum_{k=1}^{n} \frac{1}{d_k} (w_k - d_k)^2$$

Hence the *g*-factors are sample dependent. This quantity is minimised subject to the new weights when applied to the variables thought to be related to nonresponse summing to known population totals. For example, if x_i is a (1–0 or dummy) variable which is 1 if the respondent is female aged 35–44 and zero otherwise, and the population count of such people is t_{x_i}, then the constraint is

$$\sum_{k=1}^{n} w_k \, x_{ik} = t_{x_i}.$$

0.2%, 0.7%, and 1.9% respectively. The coefficients of variation (or relative sample errors) are: 6%, 5%, 11% and 12% respectively.

One disadvantage of the Euclidean distance is that the calibrated weights can be negative. A distance which avoids this problem is

$$\sum_{k=1}^{n} w_k \log \frac{w_k}{d_k} - w_k + d_k$$

based on the iterative proportional fitting algorithm used to get maximum likelihood estimates in contingency tables (Deville & Sarndal 1992) and this approach has been used for this survey. With this distance, calibration can be seen to be a generalisation of the raking ratio method of adjusting sample totals to census totals where there is an incomplete multiway table. For example, there is no sex by age by ethnicity table but only a sex by age table and a sex by ethnicity table.

With a panel survey, it is possible that a person responds for some weeks but not others, for example, because they cannot be contacted. Where possible, these missing data have been backfilled at a subsequent interview. Some method of adjusting for this missing data has to be applied where this backfilling has not been possible. There are two possibilities. The first is to delete the person (and all the good information) from the sample and readjust the weights. The second is to use the person's or other respondent's recent information to impute for the missing values. This is discussed in more detail in Section 6.2.

With any survey item nonresponse can occur. For any time period during the 2017–18 survey, some questions may not be answered. Fortunately, this is not the case with key variables such as species, platform, method and area. But 128 people have, for example refused to give their gender, age or ethnicity or combinations of these. There were 16 stated avidity A, 2 stated avidity B, and 1 stated avidity C with missing gender. There were 39 stated avidity A, 8 stated avidity B, 8 stated avidity C, and 4 stated avidity D with missing age. There were 35 stated avidity A, 14 stated avidity B, 9 stated avidity C, and 3 stated avidity D with missing ethnicity. So, these missing values were imputed randomly based on avidity and the non-missing age gender or ethnicity distributions in the sample.

6.2 Treatment of missing data

The people who did not give information for all 53 weeks that the survey ran can be categorised as follows.

1. People who exited the population. In the sample of 3704 fishers who fished at least once there are 19 of these (0.5%). There are three ways this can occur: people may die during the year (around 32 000 in the population as a whole); people may migrate overseas during the year (around 90 000); and people may move out of private dwellings, for example go to prison. These reflect the natural dynamics of the population. For cost reasons, we do not capture incomers to the population, for example people who turn 15 during the survey (around 60 000), or who immigrate to New Zealand (around 144 000). In the screening sample we would expect to pick up about 1000 people who would exit the population of whom about 90–110 would be fishers. So, the observed number of exits is smaller than expected. Perhaps this is because fishers are less likely to exit the population.

2. People who could not be contacted or have resigned from the survey and where data are missing for too many weeks. In the sample there were 278 of these (7.5%). The cut-off for 'too many weeks missing data' is somewhat subjective. Many of these people have long continuous spans of missing data often ending in a resignation, as opposed to long continuous spans of non-missing data interspersed with the occasional missing week. Hence the motivation for the cut-off was whether data were available from that person for the summer season (in particular over the summer holidays) when fishing activity is highest. We chose a cut-off of 23 weeks; week 23 of the survey being the end of February. This is consistent with what was done in the 2011–12 survey. It is usual in household surveys to identify key variables/questions which if not answered lead to the whole record being dropped and the non-respondent being accounted for by adjusting the weights rather than imputing (in some manner) their responses. For example, in the Statistics

New Zealand Labour Force Survey, if labour force status cannot be established, the record is dropped (Statistics New Zealand 2016).

3. People who would not expect to have fished in the missing weeks. In the sample there are 95 of these (2.6%). Essentially, this accounts for the very avid fishers who have, for example, one or two missing weeks, or not so avid fishers who have a moderate number of missing weeks.

4. People who would expect to have fished in the missing weeks. In the sample there are 23 of these (0.6%).

The imputation categories according to stated fishing avidity is shown in Table 22. For Category 1 people their weight is retained, and they remain in the sample with no imputation for the missing records. For Category 2 people their weight is set to zero: effectively the same decision as a recruited person who refuses to participate at the outset. The expectation for Category 3 and 4 people is calculated from their activity during the weeks when they did participate in the survey. The probability of fishing in a week is calculated by averaging over all weeks, so this is potentially biased during the summer holidays. This is multiplied by the number of missing weeks and, if this rounded is less than 1, they are assumed to have not fished during the missing weeks. So, the Category 3 people retain their weight and no records are imputed. The few Category 4 people are candidates for imputation.

Table 22: Imputation category by stated avidity.

	Stated Avidity		
Imputation Category	**B**	**C**	**D**
1. Don't Impute: death in population	8	11	0
2. Don't Impute Adjust Weights: too many missing weeks	134	77	67
3. Don't Impute: Not expected to fish	64	18	13
4. Possibly Impute	5	8	10

The nearest neighbour imputation method used was the same as in the 2011–12 survey. For a fisher with a missing week, their data for the most recent non-missing week was used to define the nearest neighbour classes (fishing area, species, platform, and method). For example, if they caught snapper by rod in a trailer motorboat in the Inner Hauraki Gulf, we would look for other fishers who fished in the week of missing data with these characteristics.

After some analysis of the nearest neighbours for the few cases to be imputed it was decided that the imputation was unreliable. So, as in the 2011–12 survey we make the assumption that the non-responding fishers did not fish in the weeks where they did not provide data. This may introduce a small negative bias but as such panellists contributed only around 1% of the total estimated catch (Table 23) any such bias is likely to be much less than 1%.

Table 23 gives the (weighted) percentage of total fish over all species caught by people in the four categories, summed over the weeks they did respond.

Table 23: Imputation category by catch.

Imputation Category	**Finfish %**	**Non-finfish Species %**
1. Don't Impute: death in pop	0.3	0.9
2. Don't Impute Adjust Weights: too many missing weeks	0.6	1.0
3. Don't Impute: Not expected to fish	0.2	0.7
4. Possibly Impute	0.8	1.5

6.3 Variance estimates

Because the sample design was stratified by TA, the method of calculating the variance for the numbers was to use a delete n jackknife (JKn) where the unit deleted from a stratum was the primary sampling unit (PSU), a SNZ meshblock. For the 2011–12 survey, there was no stratification so a delete 1 (JK1) jackknife was used. All things being equal a stratified design should be slightly more accurate since the stratification should eliminate the variation in stratum means or even the variation in the stratum standard deviations (Cochran 1977 pp 99–101). The disproportionate allocation to TA will also increase the accuracy for the small regional councils.

Suppose we have an estimator $\hat{\theta}$ of some population parameter θ based on the full sample. Then the Jackknife Technique has the following steps.

1. Partition the sample of size n into K random groups of equal size m. We assume that, for any given sample s each group is a simple random sample from s even if it itself is not a simple random sample.
2. For each group $k \in K$, calculate $\hat{\theta}_{[-k]}$, an estimator of the same functional form as $\hat{\theta}$ but based on the data omitting the kth group.
3. Define for each $k \in K$, the kth pseudovalue $\hat{\theta}_{-k} = K\hat{\theta} - (K-1)\hat{\theta}_{[-k]}$. This is motivated by the case of the usual sample mean estimator where the sample value X_i can be written as $X_i = n\acute{X} - (n-1)\acute{X}_{[-k]}$ where $\acute{X}$ is the sample mean for the full sample and $\acute{X}_{[-k]}$ is the sample mean for the sample with the kth observation omitted.
4. Form the Jackknife estimator of θ $\hat{\theta}_{[JK]} = \frac{1}{K}\sum_1^K \hat{\theta}_{-k}$ which is an alternative estimator to $\hat{\theta}$. The difference between these two estimators is the Jackknife bias.
5. Form the Jackknife variance estimator $\hat{V}_{[JK1]} = \frac{1}{K(K-1)}\sum_1^K\left(\hat{\theta}_{-k} - \hat{\theta}_{[JK]}\right)^2$.

The estimator $\hat{V}_{[JK1]}$ is used to estimate $V\left(\hat{\theta}\right)$ as well as $V\left(\hat{\theta}_{[JK]}\right)$. If the $\hat{\theta}_{-k}$'s were uncorrelated then $\hat{V}_{[JK1]}$ would be unbiased for $V\left(\hat{\theta}_{[JK]}\right)$. But in general, they are correlated so unbiassedness does not hold. There are no exact results for the properties (bias variance, asymptotic distribution, etc.) of the Jackknife estimator and the Jackknife variance estimator for complex estimators, but empirical evidence suggests that it gives good estimates of sample errors for many complex statistics (Wolter 2007 Ch. 9).

A little algebra shows that $\hat{V}_{[JK1]}$ has an alternative representation as $\frac{(K-1)}{K}\sum_1^K\left(\hat{\theta}_{[-k]} - \acute{\theta}_.\right)^2$, where $\acute{\theta}_.$ is the mean of the $\hat{\theta}_{[-k]}$'s. This is possibly a more intuitive way of thinking about it as a modified variance of the Jackknife estimates.

If the Jackknife bias is large then is it usual to use the Jackknife Mean Square Error estimator (mse) $\hat{V}_{[JK2]} = \frac{1}{K(K-1)}\sum_1^K\left(\hat{\theta}_{-k} - \hat{\theta}\right)^2$ or alternatively $\frac{(K-1)}{K}\sum_1^K\left(\hat{\theta}_{[-k]} - \hat{\theta}\right)^2$

Usually in the case of complex designs the *naive* Jackknife estimator given above is adjusted so that for linear estimators the Jackknife variance corresponds to the usual analytic expression of the variance.

For multistage sampling such as the National Panel Survey the random groups for the Jackknife technique are usually the primary sampling units (PSUs; meshblocks in the case of this study but quite often random groups of PSUs).

For stratified samples one has to be more careful. One approach is to delete a PSU (or random group of PSUs) from one stratum only at a time. Here, since the stratum estimators are independent, we form for each stratum the estimate, say, the mse $\frac{(K-1)}{K}\sum_1^K\left(\hat{\theta}_{[-k]} - \hat{\theta}\right)^2$ whereas before $\hat{\theta}$ is the estimator of the population parameter θ, and $\hat{\theta}_{[-k]}$ is the estimator omitting the kth group in the stratum. Of course, the $K's$ will generally vary from strata to strata. For the overall mse we sum the stratum mse's.

Because the nonresponse adjustment was carried out at the meshblock level this variance estimation procedure incorporates variability due to this process. The jackknife estimates were calibrated to the population totals. This means that the variance estimates include the variability due to different types of nonresponse in the categories of the calibration variables. As mentioned above there are two usual methods of calculating the variance: about the average of the jackknife estimates; about the estimate. The latter has been used but because of the calibration these are effectively the same.

6.4 Fish weights employed

NIWA provided mean fish weight estimates for 26 species of finfish and three species of other marine species (Davey et al. 2019). These were based on fish measurements made during creel surveys of recreational fishers throughout New Zealand. In some cases, separate mean weight estimates were provided for summer and winter. In other cases, a yearly estimate was used which is a (weighted) average of the two seasonal weights. For the most commonly caught species there were often estimates for all or almost all Quota Management Areas (QMAs). In other cases, the QMA weights are an average across all or some QMAs.

Final harvest estimates for a fish stock were calculated by applying the appropriate (i.e. at the QMA level) mean fish weight to each respondent's catch count and then applying their calibrated weight and summing up across all respondents.

Because the weights of the major fish species also have measurement error this should be incorporated into the estimates of the weights. The samples to measure the species' weight is independent of the panel survey, so the usual estimator for a product of two independent variables has been used: if X, Y are independent then:

$$V(XY) = E(X)^2V(Y) + E(Y)^2V(X) + V(X)V(Y)$$

and hence the coefficient of variation (CV) squared is

$$\frac{V(XY)}{E(XY)^2} = \frac{V(XY)}{E(X)^2E(Y)^2} = \frac{V(Y)}{E(Y)^2} + \frac{V(X)}{E(X)^2} + \frac{V(X)}{E(X)^2}\frac{V(Y)}{E(Y)^2} = cv(X)^2 + cv(Y)^2 + cv(X)^2cv(Y)^2$$

For the most common caught species this CV is negligible because in most cases the CV of the fish weights are very small (ranging from almost 0.0% to 0.5%) and the CV of the fish counts are less than 1 so that the last term, the product of the CVs, is negligible. The CV of the product of the fish count and fish weight typically increased the CV by 0%, to 1%. So in practice they could be ignored, and they have not been included in the CV of the fish tonnage.

6.5 Details of calibration

The intention was to calibrate the response adjusted selection weights to known population totals from the 2018 National Census of Population and Dwellings undertaken by Statistics New Zealand (StatsNZ): specifically, by gender, age, ethnicity at the regional council level. However, the release of data from 2018 Census has been postponed until August 2019 while StatsNZ determine how to impute the large number of missing households and individuals. So, the data were not available for estimation.

Instead, StatsNZ estimated resident population (ERP) data have been used. These data are accurate at the regional council level for coarse classifications of age groups and gender. The classifications by ethnicity are more problematic. The only reliable estimates are for the two broad classifications Maori and non-Maori which are published for the June year and for finer age groups. As the panel survey started in October, the relevant population classification totals were provided by the September ERP. However, there is little difference between the estimates at the five-year age groups by gender, typically less than 0.5%. Another complicating factor is that actual age was not collected in the panel survey, rather age in age groups: '15–19', '20–24', '25–34', '35–44', '45–54', '55–64', '65–74', '75+'.

The non-availability of the Census 2018 data does however mean that the calibration data for the 2011–12 and 2017–18 surveys were determined on the same basis. The model chosen is the same as by Wynne-

Jones et al (2014). That is, two population tables were fitted using the iterative proportional fitting (ipf) algorithm. The first table was agegp*sex*eth, where agegp is the finer age group '15–19', '20–24', '25–34', '35–44', '45–54', '55–64', '65–74', '75+', and eth splits people who report Maori into one group and the rest into another. People with missing agegp, sex or eth were imputed. The second table was region broken into regional Council areas. Effectively the model is reduced four-way loglinear model: log(p) = agegp*sex*eth + region and using the ipf algorithm gives the maximum likelihood estimates as discussed at the end of Section 6.1.

The nonresponse adjusted selection weights by stated avidity have Kish design effects (deff) (which are essentially one plus the square of the CV of the weights) of 1.162, 1.523, 1.456, 1.477 for the stated avidities A, B, C, and D respectively. After modifying these weights for the stated avidities B, C, and D to account for panel response as discussed in Section 6.2, the Kish deffs are 1.580, 1.505 and 1.544 for the stated avidities B, C, and D respectively. Using the calibration increases these slightly to: 1.175, 1.626, 1.539 and 1.569. The 'coverage' factors (how much the sample estimate is rated up or down to match the population total) for the regional council estimates and age group gender and ethnicity are given for stated avidity B, C, or D in Tables 24 and 25.

Table 24: Survey coverage by region.

Region	Coverage	Region	Coverage
Auckland Region	1.25	Northland Region	1.06
Bay of Plenty Region	1.18	Otago Region	1.19
Canterbury Region	1.17	Southland Region	1.16
Gisborne Region	1.29	Taranaki Region	1.18
Hawkes Bay Region	1.23	Tasman Region	1.07
Manawatu-Wanganui Region	1.12	Waikato Region	1.20
Marlborough Region	1.13	Wellington Region	1.12
Nelson Region	1.17	West Coast Region	1.27

Table 25: Survey coverage by key demographics.

Age group	Gender	Ethnicity	Coverage	Age group	Gender	Ethnicity	Coverage
15–19	Male	Maori	1.39	15–19	Male	Non-Maori	1.20
20–24	Male	Maori	1.42	20–24	Male	Non-Maori	1.35
25–34	Male	Maori	1.24	25–34	Male	Non-Maori	1.18
35–44	Male	Maori	1.09	35–44	Male	Non-Maori	1.07
45–54	Male	Maori	1.05	45–54	Male	Non-Maori	1.16
55–64	Male	Maori	0.84	55–64	Male	Non-Maori	1.18
65–74	Male	Maori	1.18	65–74	Male	Non-Maori	1.17
75+	Male	Maori	0.77	75+	Male	Non-Maori	1.11
15–19	Female	Maori	1.56	15–19	Female	Non-Maori	1.31
20–24	Female	Maori	1.21	20–24	Female	Non-Maori	1.19
25–34	Female	Maori	1.25	25–34	Female	Non-Maori	1.26
35–44	Female	Maori	1.25	35–44	Female	Non-Maori	1.13
45–54	Female	Maori	1.64	45–54	Female	Non-Maori	1.11
55–64	Female	Maori	1.05	55–64	Female	Non-Maori	1.31
65–74	Female	Maori	1.11	65–74	Female	Non-Maori	1.19
75+	Female	Maori	0.96	75+	Female	Non-Maori	1.33

7. FISHING ACTIVITY

7.1 Total number of fishing trips

The total estimated number of fishing trips, both catch and non-catch, in 2017–18, weighted to population estimates was calculated as 1 963 950. This was a 20.4% lower estimate than for the 2011–12 NPS (2 466 787 trips). Both of these estimates include charter trips but exclude customary fishing trips and any recreational catch from a commercial vessel (data for these are separately gathered and reported to MPI). Compared with 2011–12, the number of B avidity trips were 18.2% lower, C avidity trips 17.7% lower and D avidity trips 20.4% lower.

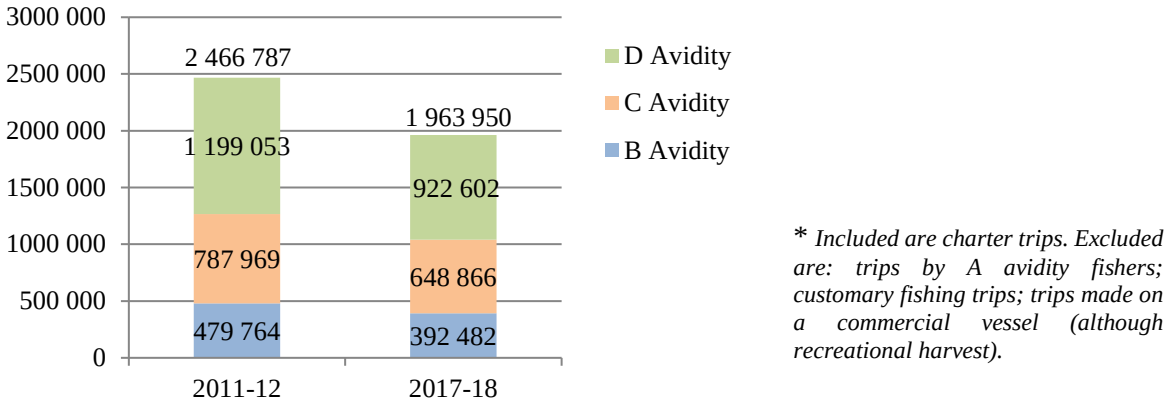


Figure 6: Estimated number of fishing trips by avidity and NPS year*.

7.2 Fishing trips by week

The estimated number of fishing trips reported in the 2017–18 NPS by week shows the expected pattern of heavier fishing in the summer (Figure 7). Note that the first week in 2017–18 shows a low number of trips because we have only included trips on day 1 of the 'fishing year' Sunday 1st October. The other weeks all show seven days of data.

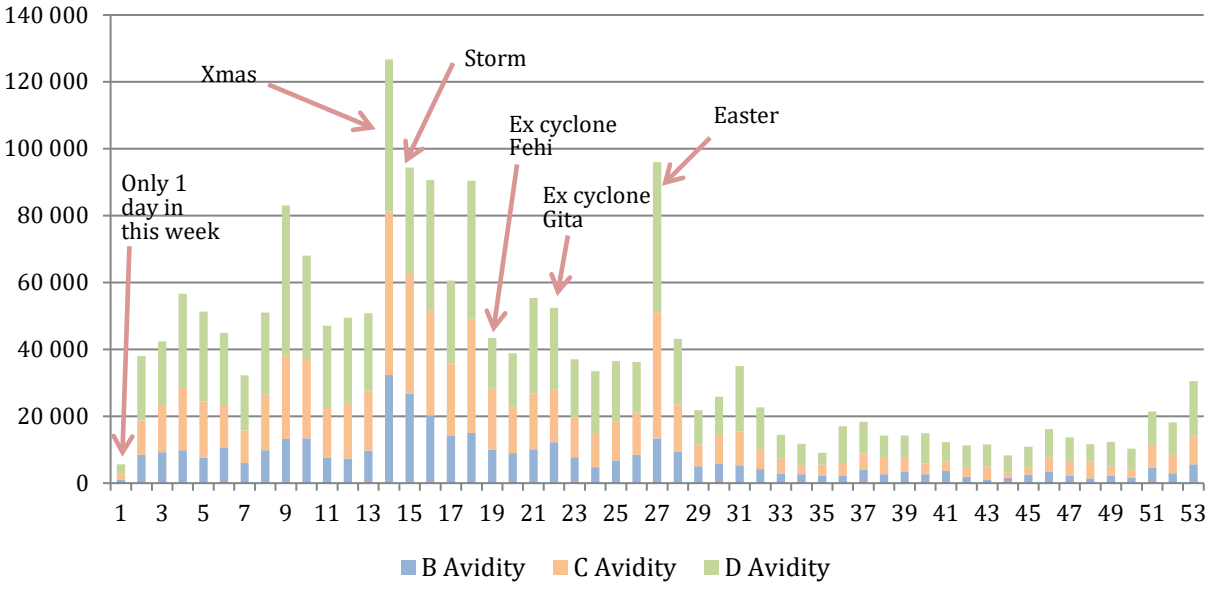


Figure 7: Estimated number of fishing trips by avidity and week (excluding customary and commercial).

The amount of fishing varies depending on many factors, such as which weeks contain holiday days other than weekends, weather, shellfish blooms etc. In particular we note that in 2017–18, week 15 (specifically January 4th and 5th) a significant storm hit New Zealand that would have severely curtailed fishing in this week. There was also ex-cyclone Fehi in week 19 (about 1st Feb), and ex-cyclone Gita which struck mainly the top of the South Island in week 22 (about 20 Feb). Week 27 in 2017–18 was Easter long weekend (with good weather) and shows a particularly high incidence of fishing.

The frequency of fishing trips appears generally in line with the fishers' stated avidity (B low, C medium, D high).

7.3 Fishing trips by method and platform

Where trips are viewed according to method and platform, it is evident that the most frequent method of fishing was by rod or line from a trailer boat. Some 880 019 trips were conducted this way which was 48.6% of the total (Table 26).

Fishing with a rod or line from land was next most frequent with 25.7% of trips conducted this way. The range of trips conducted by the various combinations of method versus platform show how diverse fishing effort is.

Table 26: Fishing trips by method and platform.**

		Method								
Platform		**Rod/line**	**Longline/ Kontiki**	**Net**	**Pot**	**Dredge**	**Hand gather from shore**	**Hand gather by diving**	**Spear-fishing**	**Other**
Trailer motor boat		880 019	26 501	13 836	21 165	4 945	2 022	49 372	14 396	805
	CV	0.05	0.16	0.18	0.17	0.27	0.28	0.12	0.17	0.51
	%*	53.2	22.2	30.1	61.6	78.1	3.3	40.0	42.4	36.7
Larger boat/launch		207 711	4 103	1 872	6 389	1 384	228	10 181	1 297	179
	CV	0.08	0.27	0.38	0.39	0.41	1.00	0.18	0.41	0.71
	%	12.6	3.4	4.1	18.6	21.9	0.4	8.2	3.8	8.2
Trailer yacht		3 565	150	0	164	0	0	164	0	0
	CV	0.26	1.00	0.00	1.01	0.00	0.00	1.00	0.00	0.00
	%	0.2	0.1	0	0.5	0	0	0.1	0	0
Larger yacht/keeler		13 960	525	448	0	0	83	204	83	68
	CV	0.21	1.00	0.78	0.00	0.00	1.00	0.59	1.00	1.00
	%	0.8	0.4	1.0	0	0	0.1	0.2	0.2	3.1
Kayak/rowboat		75 634	3 220	3 436	2 681	0	406	3 069	2 035	64
	CV	0.19	0.25	0.29	0.71	0.00	0.56	0.33	0.46	1.00
	%	4.6	2.7	7.5	7.8	0	0.7	2.5	6.0	2.9
Off land		464 605	84 402	26 012	3 468	0	59 316	59 539	15 818	1 010
	CV	0.07	0.16	0.21	0.34	0.00	0.09	0.15	0.16	0.62
	%	28.1	70.9	56.6	10.1	0	95.6	48.2	46.6	46.0
Other		8 457	207	384	475	0	0	913	340	68
	CV	0.24	1.00	0.55	0.55	0.00	0.00	0.41	0.72	1.00
	%	0.5	0.2	0.8	1.4	0	0	0.7	1.0	3.1

* Column percent ** Multiple response (e.g. a trip could involve more than 1 platform or method)

7.4 Fishing trips by month and FMA

The number of trips in a FMA indicates how popular each area is for recreational fishing, a popularity largely driven by proximity to population centres. See Section 2.14 for a description of FMA boundaries.

Table 27 shows that the majority of trips in New Zealand (56.4%) were conducted in FMA 1 (East Northland, the Hauraki Gulf, and the Bay of Plenty). Just over 10% of trips were conducted in FMA 2 with all other areas under 10%. All FMAs show similar seasonality with less fishing being conducted from May through to September.

Table 27: Fishing trips by month and FMA.**

		FMA						
Month		**1**	**2**	**3**	**5**	**7**	**8**	**9**
Oct17		105 102	26 830	14 179	3 569	21 146	13 598	15 824
	CV	0.07	0.11	0.16	0.36	0.13	0.15	0.14
	%*	9.5	13.2	12.2	9.3	11.8	9.8	8.8
Nov17		112 523	28 711	14 356	4 940	18 709	25 117	21 296
	CV	0.07	0.20	0.13	0.27	0.13	0.16	0.14
	%	10.2	14.2	12.3	12.8	10.4	18.1	11.8
Dec17		170 196	34 937	20 714	4 116	35 112	23 996	32 227
	CV	0.06	0.10	0.13	0.27	0.10	0.13	0.13
	%	15.4	17.2	17.8	10.7	19.6	17.3	17.9
Jan18		188 015	45 831	20 083	4 076	37 862	25 901	29 357
	CV	0.08	0.11	0.13	0.23	0.10	0.14	0.14
	%	17.0	22.6	17.2	10.6	21.1	18.7	16.3
Feb18		105 755	17 581	9 155	6 928	14 320	11 417	17 338
	CV	0.08	0.14	0.20	0.81	0.17	0.16	0.13
	%	9.5	8.7	7.9	18.0	8.0	8.2	9.6
Mar18		118 802	14 475	11 628	4 522	18 186	17 924	24 218
	CV	0.08	0.15	0.21	0.22	0.15	0.16	0.14
	%	10.7	7.1	10.0	11.7	10.2	12.9	13.4
Apr18		95 484	10 753	7 421	2 184	13 888	6 280	12 586
	CV	0.08	0.16	0.20	0.36	0.15	0.20	0.19
	%	8.6	5.3	6.4	5.7	7.8	4.5	7.0
May18		43 453	3 874	2 879	2 603	3 316	3 625	4 742
	CV	0.12	0.25	0.37	0.32	0.24	0.26	0.22
	%	3.9	1.9	2.5	6.8	1.9	2.6	2.6
Jun18		45 540	4 303	3 855	2 159	4 954	2 897	5 666
	CV	0.11	0.26	0.35	0.47	0.25	0.24	0.24
	%	4.1	2.1	3.3	5.6	2.8	2.1	3.1
Jul18		33 835	3 317	2 916	225	2 289	936	3 311
	CV	0.11	0.22	0.23	0.75	0.24	0.29	0.27
	%	3.1	1.6	2.5	0.6	1.3	0.7	1.8
Aug18		32 790	5 863	2 816	1 928	5 067	3 214	4 134
	CV	0.10	0.22	0.21	0.42	0.21	0.20	0.27
	%	3.0	2.9	2.4	5.0	2.8	2.3	2.3
Sep18		56 560	6 428	6 581	1 234	4 282	3 629	9 747
	CV	0.09	0.18	0.30	0.37	0.23	0.20	0.25
	%	5.1	3.2	5.6	3.2	2.4	2.6	5.4

** Column percent ** Multiple response (e.g. a trip could involve more than 1 FMA)*

7.5 Fishing trips by method and FMA

Fishing using a rod and line is by far the most common method in each FMA with usage ranging from 85.7% in FMA 1 to 55.7% in FMA 5.

However, there is some variation in the other methods used in each FMA (Table 28); hand gathering or floundering from the shore was more prevalent in FMA 5 whilst using a kontiki or longline was very prevalent in FMA 8 and somewhat more prevalent in FMA 7 and FMA 9.

Table 28: Fishing trips by method and FMA.**

		FMA						
Method		**1**	**2**	**3**	**5**	**7**	**8**	**9**
Rod/line		987 073	144 142	83 543	26 171	161 302	95 182	151 139
	CV	0.06	0.11	0.11	0.15	0.08	0.10	0.11
	%*	85.7	64.8	66.4	55.7	82.0	64.8	81.8
Longline/kontiki		56 113	7 358	2 559	582	11 327	26 751	14 226
	CV	0.17	0.28	0.44	0.72	0.29	0.37	0.28
	%	4.9	3.3	2.0	1.2	5.8	18.2	7.7
Net		14 960	6 398	2 615	1 659	6 693	7 049	6 615
	CV	0.19	0.34	0.47	0.44	0.31	0.68	0.25
	%	1.3	2.9	2.1	3.5	3.4	4.8	3.6
Pot		1 391	15 562	9 619	2 262	4 165	1 072	271
	CV	0.41	0.22	0.42	0.43	0.38	0.56	1.00
	%	0.1	7.0	7.6	4.8	2.1	0.7	0.1
Dredge		3 874	0	0	1 061	0	35	1 359
	CV	0.33	0	0	0.45	0	1.00	0.43
	%	0.3	0.0	0.0	2.3	0.0	0.0	0.7
Hand gather from shore		24 782	6 517	9 660	3 781	3 095	6 129	8 091
	CV	0.17	0.22	0.21	0.32	0.26	0.23	0.19
	%	2.2	2.9	7.7	8.0	1.6	4.2	4.4
Hand gather by diving		49 751	33 434	12 669	10 203	5 815	8 846	2 724
	CV	0.12	0.15	0.22	0.43	0.22	0.28	0.38
	%	4.3	15.0	10.1	21.7	3.0	6.0	1.5
Spearfishing		12 301	8 676	5 204	1 295	4 288	1 908	242
	CV	0.20	0.29	0.34	0.57	0.26	0.46	0.80
	%	1.1	3.9	4.1	2.8	2.2	1.3	0.1
Other		1 859	336	0	0	0	0	0
	CV	0.41	0.78	0	0	0	0	0
	%	0.2	0.2	0.0	0.0	0.0	0.0	0.0

** Column percent ** Multiple response (e.g. a trip could involve more than 1 method or FMA)*

7.6 Fishing trips by platform and FMA

Fishing from trailer boats was most frequent in FMA 1 and FMA 7 whereas fishing from land was common in the other FMAs (Table 29).

Table 29: Fishing trips by platform and FMA.**

		FMA						
Platform		**1**	**2**	**3**	**5**	**7**	**8**	**9**
Trailer motor boat		597 428	66 746	40 698	15 946	101 804	45 064	78 291
	CV	0.07	0.13	0.13	0.19	0.11	0.15	0.14
	%*	53.7	32.9	34.8	41.4	56.6	32.5	43.3
Larger boat/launch		152 891	10 803	8 215	5 932	20 159	8 213	15 332
	CV	0.10	0.18	0.30	0.29	0.15	0.21	0.16
	%	13.7	5.3	7.0	15.4	11.2	5.9	8.5
Trailer yacht		2 418	75	458	234	429	264	0
	CV	0.33	1.00	0.58	0.77	0.93	1.00	0.00
	%	0.2	0.0	0.4	0.6	0.2	0.2	0
Larger yacht/keeler		9 884	170	163	796	3 935	38	99
	CV	0.26	0.82	1.00	0.58	0.35	1.00	1.00
	%	0.9	0.1	0.1	2.1	2.2	0.0	0.1
Kayak/rowboat		58 173	11 088	2 232	1 288	5 068	6 862	2 435
	CV	0.23	0.34	0.36	0.57	0.30	0.34	0.42
	%	5.2	5.5	1.9	3.3	2.8	5.0	1.3
Off land		286 866	113 249	64 426	14 073	46 431	77 694	83 438
	CV	0.09	0.12	0.13	0.42	0.12	0.15	0.14
	%	25.8	55.8	55.1	36.6	25.8	56.1	46.2
Other		5 010	959	712	216	1 906	399	1 066
	CV	0.29	0.48	0.63	0.64	0.72	0.73	0.60
	%	0.5	0.5	0.6	0.6	1.1	0.3	0.6

** Column percentage ** Multiple response (e.g. a trip could involve more than 1 platform or FMA)*

7.7 Fishers by FMA

The estimated number of persons who fished (at least once, including no catch) in each of the FMAs is shown in Table 30. Substantially more fishers fished in FMA1 than any other FMA. Compared with the 2011–12 NPS, more fishers fished in FMA 5 (+14.3%), a similar number fished in FMA 7 (-3.6%), but fewer fished in each of the other FMAs (-13.1% to -22.7%).

Table 30: Fishers by FMA.

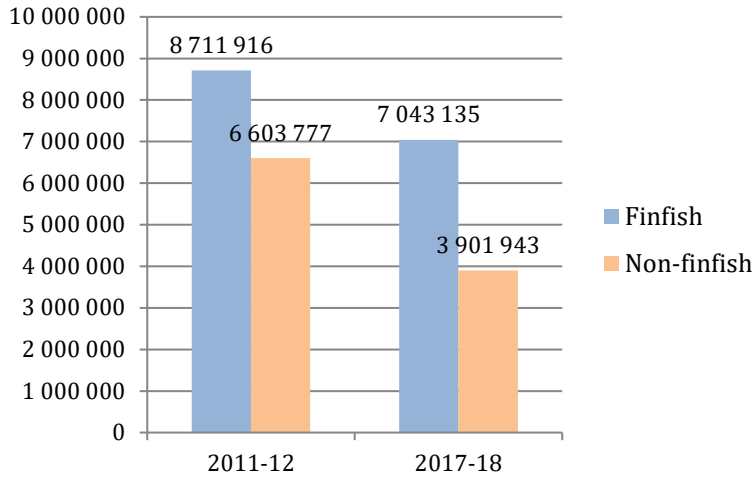
	FMA						
	1	**2**	**3**	**5**	**7**	**8**	**9**
2017–18 Estimate	228 086	47 827	34 850	11 923	45 834	36 779	57 708
2011–12 Estimate	268 559	61 834	42 678	10 432	47 521	42 344	57 216

8. HARVEST ESTMATES

8.1 Total recreational marine harvest

The total number of both finfish and non-finfish (weighted to population estimates) harvested and reported in the NPS surveys in 2011–12 and 2017–18 are shown following in Figure 8. The term 'harvested' means that a fish was caught and not put back.

The estimated total recreational harvest for finfish in 2017–18 was 7 043 135 fish. The total count for non-finfish was 3 901 943. These estimates are lower than those from the 2011–12 NPS by 19.2% and 40.9% respectively.



* *Harvest from charter trips is included, but harvest from A avidity fishers (due to its minor contribution and difficulty of accurate measurement); customary fishing; and recreational catch from commercial vessels are excluded. The 2011–12 count for non-finfish species does not include one extreme weighted count of kina for a particular fisher, removed as an outlier.*

Figure 8: Estimated total marine harvest by NPS year*.

The lower count of finfish is perhaps not unexpected as it was noted in Section 7.1 that the total number of fishing trips in 2017–18 was lower than 2011–12 by 20.4%.

That the lower count of non-finfish was so much greater (40.9%) is worthy of further investigation and comment. Section 8.12 includes a table showing the species with the greatest differences. In addition to the lower effort in 2017–18 (fewer trips were undertaken), several major events occurred which would have a particular influence on the harvest of non-finfish species. One was the closure of SCA 7 at the time of the survey (Golden Bay, Tasman Bay, and the Marlborough Sounds). No scallops could be taken in this significant scallop area. Another was the Kaikoura earthquake which occurred on 14th November 2016. Subsequent to this, due to uplift and damage to large areas of the coast, the Kaikoura area was shut for fishing – again over the duration of the 2017–18 survey. This area is known for its abundance of (for example) paua and crayfish. These events are contributory to the lower counts of non-finfish species harvested.

8.2 Finfish harvest by avidity

For the 2017–18 survey year, D avidity fishers harvested 3.93 million or 55.9% of the finfish, C avidity fishers harvested 30.7%, and B avidity 13.5% (Figure 9). The total harvest of finfish was lower for the 2017–18 survey year than 2011–12 and this varied by avidity. The greatest reduction (23.1%) was by D avidity fishers, the most avid fishers. C avidity fishers showed a reduction of 11.2% and B avidity (the least avid) 18.3%.

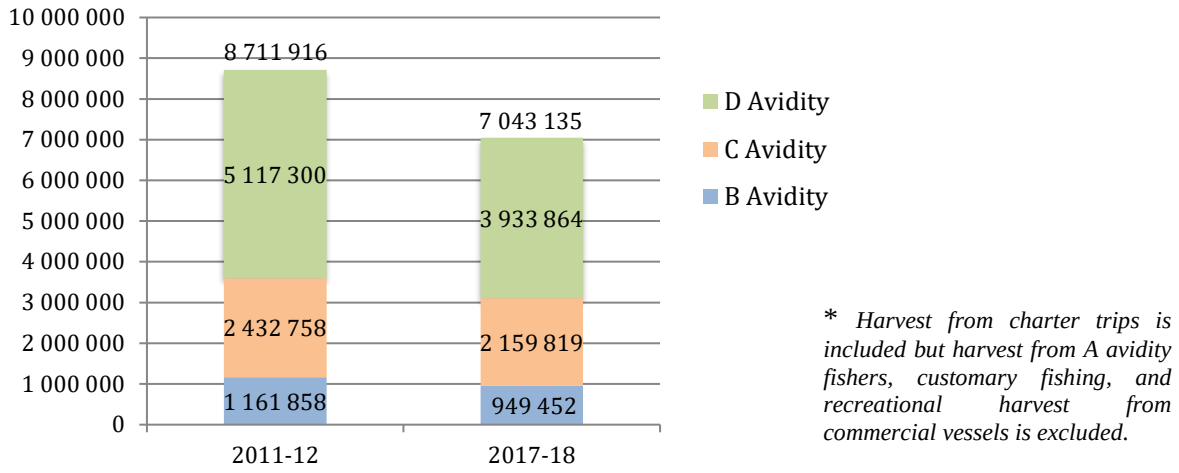


Figure 9: Total number of finfish harvested by avidity and NPS year*.

8.3 Finfish harvest by week

In general, the number of fish caught each week (Figure 10) mirrors the pattern in the number of trips by week (see Figure 8). Differences in fishing success rates cause some differences – for instance the estimated catch on week 14 (Christmas week) was lower than in week 27 (Easter weekend) even though many more trips occurred in the former.

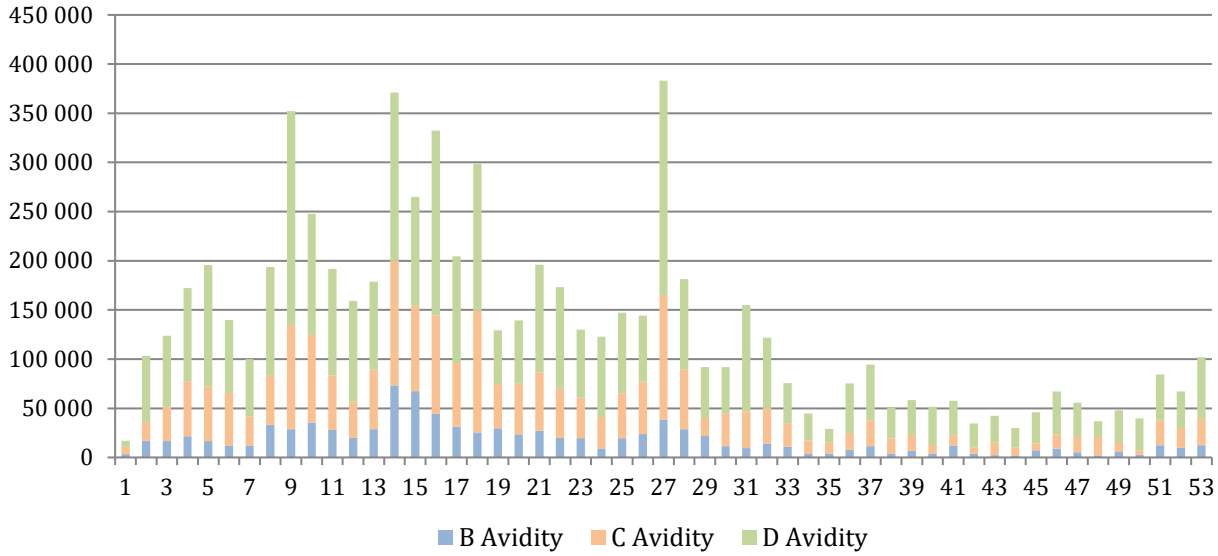


Figure 10: Estimated number of finfish harvested by avidity and week (excluding customary and commercial).

8.4 Finfish harvest by species in detail

The three most commonly harvested species in 2017–18 accounted for 72.4% of all finfish taken, by number (Table 31). The most frequently harvested species by far was snapper with 3 496 711 being taken or 4267 tonnes, close to half of all finfish harvest. The second most commonly harvested finfish was kahawai of which 1 009 675 were harvested or 1702 tonnes. Harvest for blue cod, the most common species caught in the South Island, was 594 934 or 292.74 tonnes.

Table 31: NZ finfish total harvest (table sorted by harvest number).

	Fishers (n)	Events (n)	Harvest (n)	CV	Mean Weight (kg)	Harvest (tonnes)	CV
Snapper	2 059	7 973	3 496 711	0.06	1.22	4 266.89	0.06
Kahawai	1 623	4 144	1 009 675	0.05	1.69	1 702.02	0.05
Blue cod	587	1 459	594 934	0.09	.49	292.74	0.09
Red gurnard	656	1 490	360 059	0.10	.54	194.81	0.10
Tarakihi	390	802	302 990	0.12	.74	224.66	0.12
Trevally	464	776	138 185	0.08	1.52	210.28	0.08
Sea perch	115	214	116 948	0.32	.54	62.66	0.32
Mullet yellow eyed/herring	130	215	108 492	0.18	0.29	31.58	0.18
Flounder, sole or other flatfish	133	292	95 859	0.18	.41	39.09	0.18
Kingfish	371	619	89 744	0.13	8.22	738.04	0.13
Jack mackerel	102	155	82 736	0.22	.30	24.84	0.22
Butterfish	88	211	67 490	0.19	1.22	82.16	0.19
Mullet grey	47	76	65 966	0.38	0.78	51.73	0.38
Pilchard	28	48	60 455	0.46	-	-	-
Hapuku/bass	134	224	38 272	0.14	5.96	228.21	0.14
Rig shark	153	235	35 369	0.15	1.59	56.24	0.15
Blue moki	74	140	31 939	0.20	1.96	62.68	0.20
Red cod	118	170	30 200	0.19	1.05	31.83	0.19
Skipjack tuna	76	112	29 892	0.17	1.80	53.80	0.17
Garfish	19	29	28 354	0.55	-	-	-
John dory	124	182	26 064	0.18	1.17	30.37	0.18
Mackerel blue/slimy/English	39	46	20 620	0.38	1.12	23.04	0.38
Barracouta	92	118	18 581	0.16	2.40	44.53	0.16
Koheru	17	25	17 824	0.46	-	-	-
Spotty/paketi	23	50	17 149	0.47	-	-	-
Spiny dogfish shark	54	68	13 985	0.23	1.53	21.42	0.23
Blue maomao	40	48	13 072	0.32	-	-	-
Albacore tuna	42	58	12 463	0.22	4.55	56.74	0.22
Bluenose	49	57	9 629	0.24	4.79	46.15	0.24
Gemfish	28	37	8 466	0.29	-	-	-
Parore	25	32	8 245	0.31	-	-	-
Trumpeter	27	44	8 244	0.33	2.6	21.44	0.33
Wrasse	16	28	7 988	0.42	-	-	-
Porae	31	34	7 000	0.30	1.23	8.64	0.30
School shark	42	50	6 826	0.26	-	-	-
Eel	24	27	3 244	0.28	-	-	-
Elephant fish	22	33	3 047	0.31	-	-	-
Red moki	6	7	2 950	0.69	-	-	-
Stingray	22	24	2 841	0.25	-	-	-
Parrot fish*	13	18	2 800	0.38	-	-	-
Leatherjacket	10	11	2 709	0.40	-	-	-
Pigfish	11	12	2 185	0.38	-	-	-
Maori chief	10	10	2 145	0.43	-	-	-
Trout/sea trout	9	13	1 980	0.49	-	-	-
Moki	13	16	1 836	0.36	-	-	-

	Fishers (n)	Events (n)	Harvest (n)	CV	Mean Weight (kg)	Harvest (tonnes)	CV
Rock cod	10	12	1 775	0.42	-	-	-
Marlin	12	13	1 168	0.31	-	-	-
Hammerhead shark	8	10	1 158	0.46	-	-	-
Perch	8	8	1 065	0.44	-	-	-
Mako shark	3	4	1 048	0.77	-	-	-
Warehou	5	5	1 038	0.51	-	-	-
Sand shark	6	7	701	0.51	-	-	-
Salmon	7	8	587	0.42	-	-	-
Stargazer/monkfish	4	5	555	0.74	-	-	-
Carpet shark	6	6	422	0.46	-	-	-
Conger eel	6	6	368	0.48	-	-	-
Ling	6	6	320	0.46	-	-	-
Bronze whaler shark	2	2	203	0.73	-	-	-
Bream/brim*	1	1	32	1.01	-	-	-
Other finfish	95	110	26 530	0.18	-	-	-

** Fisher's description*

8.5 Finfish harvest compared with 2011–12

Table 32 shows the estimated harvest for each finfish species for both the 2011–12 NPS and the 2017–18 NPS. For 18 finfish species, the harvest was higher in 2017–18. For 42 finfish species the harvest was lower in 2017–18. The harvest of snapper was much lower in 2017–18 (23.2% lower than in 2011–12). For kahawai, the harvest was 13.7% lower than in 2011–12 and the harvest of blue cod was 12.8% lower.

Table 32: 2017–18 Finfish harvest estimate compared with 2011–12 (table sorted by absolute difference of fish harvested in the two years).

	2017–18	2011–12	Difference
Snapper	3 496 711	4 552 908	-1 056 197
Kahawai	1 009 675	1 170 324	-160 649
Blue cod	594 934	682 550	-87 616
Red gurnard	360 059	430 531	-70 472
Tarakihi	302 990	361 256	-58 266
Flounder, sole or other flatfish	95 859	143 619	-47 760
Sea perch	116 948	160 581	-43 633
Jack mackerel	82 736	121 116	-38 380
Trevally	138 185	173 762	-35 577
School shark	6 826	30 555	-23 729
Barracouta	18 581	39 652	-21 071
Blue maomao	13 072	31 488	-18 416
Mullet yellow eyed/herring	108 492	125 972	-17 480
Eel	3 244	19 621	-16 377
Bream/brim*	32	14 070	-14 038
Mackerel blue/slimy/English	20 620	32 976	-12 356
Rig shark	35 369	47 718	-12 349
Skipjack tuna	29 892	41 182	-11 290
Albacore tuna	12 463	21 898	-9 435
Spiny dogfish shark	13 985	22 200	-8 215
Stingray	2 841	11 053	-8 212

	2017–18	2011–12	Difference
Porae	7 000	15 004	-8 004
John dory	26 064	32 303	-6 239
Red cod	30 200	33 963	-3 763
Rock cod	1 775	5 252	-3 477
Elephant fish	3 047	6 198	-3 151
Sand shark	701	3 719	-3 018
Maori chief	2 145	4 574	-2 429
Butterfish	67 490	69 831	-2 341
Salmon	587	2 824	-2 237
Parrot fish*	2 800	4 276	-1 476
Perch	1 065	2 247	-1 182
Moki	1 836	2 976	-1 140
Ling	320	1 333	-1 013
Warehou	1 038	1 968	-930
Trout/sea trout	1 980	2 720	-740
Bronze whaler shark	203	570	-367
Hammerhead shark	1 158	1 429	-271
Leatherjacket	2 709	2 936	-227
Conger eel	368	488	-120
Pigfish	2 185	2 247	-62
Carpet shark	422	452	-30
Stargazer/monkfish	555	534	21
Marlin	1 168	985	183
Mako shark	1 048	529	519
Wrasse	7 988	7 252	736
Hapuku/bass	38 272	37 502	770
Red moki	2 950	1 853	1 097
Trumpeter	8 244	6 548	1 696
Bluenose	9 629	7 784	1 845
Parore	8 245	4 328	3 917
Blue moki	31 939	27 926	4 013
Garfish	28 354	23 123	5 231
Gemfish	8 466	2 889	5 577
Spotty/paketi	17 149	9 055	8 094
Koheru	17 824	3 834	13 990
Kingfish	89 744	64 700	25 044
Mullet grey	65 966	38 127	27 839
Pilchard	60 455	23 231	37 224
Other finfish	26 530	19 374	7 156

8.6 Finfish harvest by species and FMA

The harvest of different species of finfish varies by FMA (Table 33), largely because of their relative abundance. For instance, snapper was predominantly harvested in northern FMAs and blue cod in southern FMAs. The much-reduced harvest of snapper in FMA 1 in 2017–18 accounts for about 70% of the total reduction of the harvest of all finfish between 2011–12 and 2017–18.

Table 33: Finfish harvest by FMA (table sorted alphabetically).

	FMA						
	1	**2**	**3**	**5**	**7**	**8**	**9**
Albacore tuna	2 993	3 477	0	76	105	1 483	4 328
Barracouta	1 109	6 083	4 653	648	3 493	2 366	229
Blue maomao	11 908	286	0	0	0	435	443
Blue moki	1 476	9 839	8 324	7 018	5 131	152	0
Bluenose	6 282	1 298	405	0	355	0	1 289
Bream/brim	0	32	0	0	0	0	0
Bronze whaler shark	203	0	0	0	0	0	0
Butterfish	10 678	20 478	15 217	8 411	9 615	3 090	0
Carpet shark	0	0	200	0	96	127	0
Cod blue	12 647	48 140	202 765	139 176	129 038	60 666	2 503
Cod red	2 212	5 704	6 048	363	3 049	12 737	87
Conger eel	0	265	206	0	0	568	0
Eel	924	987	207	61	102	963	0
Elephant fish	0	339	2 458	60	189	0	0
Flounder, sole or other flatfish	30 299	7 639	14 554	8 763	12 930	14 685	6 989
Garfish	11 212	8 571	0	0	1 401	7 171	0
Gemfish	7 023	1 299	0	0	27	0	117
Hammerhead shark	967	0	0	0	0	0	191
Hapuku/bass	9 722	9 175	8 474	1 389	5 937	1 047	2 528
Jack mackerel	55 016	7 694	0	0	11 365	1 376	7 285
John dory	22 456	1 164	183	0	699	1 423	139
Kahawai	564 665	132 087	19 970	37	48 120	89 249	155 548
Kingfish	69 473	9 602	350	358	3 289	2 132	4 539
Koheru	16 672	120	0	0	0	73	959
Leatherjacket	2 398	0	133	0	0	178	0
Ling	0	122	17	0	180	0	0
Mackerel blue/slimy/English	15 036	1 209	0	0	3 782	228	364
Mako shark	44	765	0	0	0	0	240
Maori chief	0	0	0	0	2 145	0	0
Marlin	607	55	0	0	0	72	435
Moki	373	668	353	0	307	135	0
Mullet grey	38 088	2 400	25	0	300	4 517	20 637
Mullet yellow eyed/herring	39 584	10 629	12 576	251	10 804	19 818	14 830
Parore	7 302	109	0	0	0	0	834
Parrot fish	1 576	222	806	195	0	0	0
Perch	0	0	801	0	223	40	0
Pigfish	2 185	0	0	0	0	0	0
Pilchard	14 962	2 875	4 407	0	10 346	27 671	193

	FMA						
	1	**2**	**3**	**5**	**7**	**8**	**9**
Porae	5 397	435	0	0	0	0	1 169
Red gurnard	86 902	71 702	2 485	1 001	60 759	55 314	81 896
Red moki	2 132	314	0	0	0	504	0
Rig shark	2 074	3 044	6 300	3 071	11 688	7 435	1 756
Rock cod	832	0	172	0	0	0	771
Salmon	0	0	404	77	60	47	0
Sand shark	96	0	0	98	268	196	43
School shark	926	1 804	627	349	2 001	847	271
Sea perch	478	3 287	67 712	27 993	13 824	3 654	0
Skipjack tuna	22 668	1 554	0	305	136	225	5 004
Snapper	2 601 267	83 304	3 417	3 640	97 974	178 712	528 397
Spiny dogfish shark	55	2 703	2 912	1 504	5 019	1 001	791
Spotty/paketi	78	9 778	0	0	7 165	128	0
Stargazer/monkfish	156	0	0	0	399	0	0
Stingray	908	183	290	0	288	90	1 081
Tarakihi	67 103	148 159	6 622	5 545	31 668	37 706	6 187
Trevally	95 097	10 988	91	130	3 486	5 568	22 826
Trout/sea trout	66	0	1 113	56	411	334	0
Trumpeter	0	32	3 596	22 668	142	0	0
Warehou	0	265	206	0	0	568	0
Wrasse	0	966	1 386	3 270	2 366	0	0
Other finfish	13 054	1 623	4 143	794	1 726	3 084	2 107

8.7 Finfish harvest by species and method

Most finfish were harvested using rod and line (Table 34) although moki and butterfish were taken mainly by spearfishing, mullet were taken mainly by net, and flatfish were taken mainly by net or using hand-held spears from the shore.

Table 34: Finfish harvest by species and method (table sorted alphabetically).

	Rod/line	Longline/ Kontiki	Net	Pot	Dredge	Hand gather from shore	Hand gather by diving	Spear-fishing	Other
Albacore tuna	12 207	256	0	0	0	0	0	0	0
Barracouta	18 316	0	47	218	0	0	0	0	0
Blue maomao	12 823	0	0	0	0	0	0	249	0
Blue moki	8 048	465	10 671	0	0	0	0	12 755	0
Bluenose	9 427	201	0	0	0	0	0	0	0
Bream/brim	32	0	0	0	0	0	0	0	0
Bronze whaler shark	75	127	0	0	0	0	0	0	0
Butterfish	4 974	79	11 290	0	0	0	0	51 146	0
Carpet shark	339	0	84	0	0	0	0	0	0
Cod blue	588 777	1 788	928	1 637	0	0	0	1804	0
Cod red	21 633	7 929	512	126	0	0	0	0	0
Conger eel	171	133	10	54	0	0	0	0	0
Eel	2 652	536	0	0	0	24	0	0	32
Elephant fish	1 812	1 235	0	0	0	0	0	0	0
Flounder, sole or other flatfish	5 246	695	60 578	0	0	17 809	0	11 531	0
Garfish	6 976	0	20 544	0	0	0	0	835	0
Gemfish	8 466	0	0	0	0	0	0	0	0
Hammerhead shark	820	148	190	0	0	0	0	0	0
Hapuku/bass	37 573	664	0	0	0	0	0	35	0
Jack mackerel	79 989	157	2 590	0	0	0	0	0	0
John dory	23 846	0	334	0	0	0	0	1 883	0
Kahawai	934 142	48 848	23 950	0	0	0	0	2 734	0
Kingfish	84 803	826	74	0	0	0	0	4 041	0
Koheru	17 748	0	77	0	0	0	0	0	0
Leatherjacket	1 919	0	0	0	0	0	0	790	0
Ling	303	0	0	0	0	0	0	17	0
Mackerel blue/slimy/English	20 620	0	0	0	0	0	0	0	0
Mako shark	1 048	0	0	0	0	0	0	0	0
Maori chief	2 145	0	0	0	0	0	0	0	0
Marlin	1 096	72	0	0	0	0	0	0	0
Moki	394	0	187	0	0	0	0	1 254	0
Mullet grey	10 982	860	54 124	0	0	0	0	0	0
Mullet yellow eyed/herring	66 121	0	41 388	0	0	0	0	982	0
Parore	3 015	0	4 834	0	0	0	0	397	0
Parrot fish	2 800	0	0	0	0	0	0	0	0
Perch	1 065	0	0	0	0	0	0	0	0
Pigfish	2 185	0	0	0	0	0	0	0	0

	Rod/line	Longline/ Kontiki	Net	Pot	Dredge	Hand gather from shore	Hand gather by diving	Spear-fishing	Other
Pilchard	34 624	0	25 830	0	0	0	0	0	0
Porae	3 837	423	2 167	0	0	0	0	574	0
Red gurnard	323 328	34 668	1 777	0	0	0	0	285	0
Red moki	0	486	333	0	0	0	0	2 132	0
Rig shark	27 105	3 878	4 386	0	0	0	0	0	0
Rock cod	1 775	0	0	0	0	0	0	0	0
Salmon	587	0	0	0	0	0	0	0	0
Sand shark	334	99	268	0	0	0	0	0	0
Sea perch	116 565	234	48	0	0	0	0	101	0
School shark	6 108	718	0	0	0	0	0	0	0
Skipjack tuna	27 979	576	1 337	0	0	0	0	0	0
Snapper	3 307 737	175 495	7 001	0	0	0	0	6 478	0
Spiny dogfish shark	9 799	1232	2 954	0	0	0	0	0	0
Spotty/paketi	17 149	0	0	0	0	0	0	0	0
Stargazer/monkfish	69	87	399	0	0	0	0	0	0
Stingray	1 455	293	1 093	0	0	0	0	0	0
Tarakihi	297 261	663	1 452	0	0	0	0	3 614	0
Trevally	134 160	1 869	907	0	0	0	0	1 249	0
Trout/sea trout	1 729	0	251	0	0	0	0	0	0
Trumpeter	8 244	0	0	0	0	0	0	0	0
Warehou	1 038	0	0	0	0	0	0	0	0
Wrasse	4 655	0	2 900	0	0	0	0	432	0
Other finfish	19 369	1 268	4 023	0	0	0	0	1 870	0

8.8 Finfish harvest by species and platform

Although the great majority of finfish were taken from trailer boats (Table 35) there were distinct variations between species. For example, only 12% of snapper were harvested off land compared with 33% of kahawai, 62% of rig (spotted dogfish) and 98% of elephant fish.

Table 35: Finfish harvest by species and platform (table sorted alphabetically).

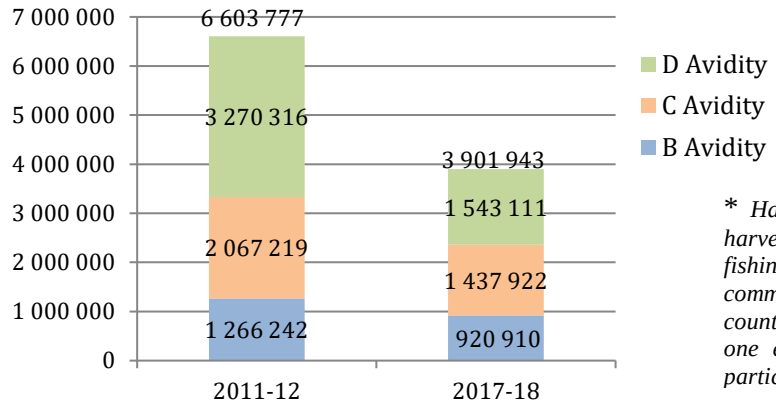
	Trailer motor boat	Larger boat/ launch	Trailer yacht	Larger yacht/ keeler	Kayak/ rowboat	Off land	Other
Albacore tuna	11 120	1 182	0	160	0	0	0
Barracouta	9 465	5 711	163	163	789	2 290	0
Blue maomao	9 681	3 174	0	0	118	100	0
Blue moki	8 811	3 703	0	0	3 703	15 031	692
Bluenose	8 355	1 274	0	0	0	0	0
Bream/brim	32	0	0	0	0	0	0
Bronze whaler shark	0	0	0	0	0	203	0
Butterfish	31 341	1 595	0	0	8 171	25 479	904
Carpet shark	26	0	0	0	69	327	0
Cod blue	450 927	107 305	1 699	5 699	13 783	8 819	6 701
Cod red	11 800	1 539	0	0	1 274	15 247	341
Conger eel	54	51	0	0	0	253	10
Eel	649	113	0	0	32	2 450	0
Elephant fish	35	0	0	0	15	2 997	0
Flounder, sole or other flatfish	20 074	10 543	0	0	14 445	50 796	0
Garfish	1 744	2 046	0	0	642	23 922	0
Gemfish	5 339	3 112	0	0	0	15	0
Hammerhead shark	469	541	0	0	0	148	0
Hapuku/bass	23 705	14 122	0	0	153	293	0
Jack mackerel	43 269	7 224	0	256	4 741	27 246	0
John dory	18 122	4 537	0	76	1 235	2 018	76
Kahawai	510 110	119 001	224	4 986	36 666	334 550	4 137
Kingfish	60 467	16 540	226	360	1454	10 399	298
Koheru	10 524	6 649	0	0	0	651	0
Leatherjacket	2 313	106	0	0	0	290	0
Ling	198	96	0	0	0	27	0
Mackerel blue/slimy/English	14 907	1 542	0	0	243	3 928	0
Mako shark	284	765	0	0	0	0	0
Maori chief	823	1106	0	216	0	0	0
Marlin	862	306	0	0	0	0	0
Moki	726	269	0	0	0	715	126
Mullet grey	38 679	0	0	223	4 515	21 763	786
Mullet yellow eyed/herring	20 998	3 753	0	0	3 117	80 624	0
Parore	2 317	118	0	346	259	4 510	697
Parrot fish	1 388	779	0	0	61	572	0
Perch	744	214	0	0	106	0	0
Pigfish	1 466	541	0	0	0	178	0
Pilchard	14 954	1 159	0	995	1 026	42 319	0
Porae	3 624	245	0	0	156	2975	0

	Trailer motor boat	Larger boat/ launch	Trailer yacht	Larger yacht/ keeler	Kayak/ rowboat	Off land	Other
Red gurnard	268 657	42 069	62	1 040	10 486	35 704	2 041
Red moki	747	0	0	0	123	2 080	0
Rig shark	11 334	1 684	0	0	467	21 885	0
Rock cod	570	0	0	0	0	1 205	0
Salmon	0	0	0	0	0	587	0
Sand shark	138	464	0	0	0	99	0
Sea perch	64 283	46 523	0	241	3 524	1 837	539
School shark	4 084	1 380	0	0	120	1 241	0
Skipjack tuna	23 751	5 386	0	470	0	121	165
Snapper	2 364 219	563 340	3 113	13 293	117 939	420 063	14 744
Spiny dogfish shark	6 575	2 827	0	0	907	3 096	580
Spotty/paketi	3 871	898	0	364	0	12 017	0
Stargazer/monkfish	399	0	0	0	0	156	0
Stingray	907	283	0	0	120	1531	0
Tarakihi	230 253	56 493	0	211	3 237	12 308	488
Trevally	78 689	23 141	0	915	3 901	30 830	708
Trout/sea trout	366	0	0	0	100	1 513	0
Trumpeter	5 953	1 870	0	0	379	0	42
Warehou	0	450	0	0	0	588	0
Wrasse	2 351	321	0	0	1 202	2 374	1 740
Other finfish	13 725	6 140	0	165	48	6 453	0

8.9 Non-finfish harvest by avidity

Avid (D avidity) fishers harvested 39.5% of the non-finfish species in 2017–18, C avidity 36.9% and B avidity 23.6% (Figure 11). This is a more even spread across avidity classes than for finfish (see Figure 9).

The non-finfish harvest was also lower than in the 2011–12 year, mostly because D avidity fishers harvested 52.8% less non-finfish in 2017–18. C avidity harvested 30.4% less and B avidity 27.3%.



* *Harvest from charter trips is included but harvest from A avidity fishers, customary fishing and recreational harvest from commercial vessels are excluded. The 2011–12 count for non–finfish species does not include one extreme weighted count of kina for a particular fisher, removed as an outlier.*

Figure 11: Total number of non-finfish harvested by avidity and NPS year*.

8.10 Non-finfish harvest by week

The number of non-finfish harvested each week does not seem to mirror the trips as closely as for finfish (Figure 12). Harvest was much higher in summer than in winter, although harvest in week 20, the week after ex cyclone Fehi in early February, was particularly low.

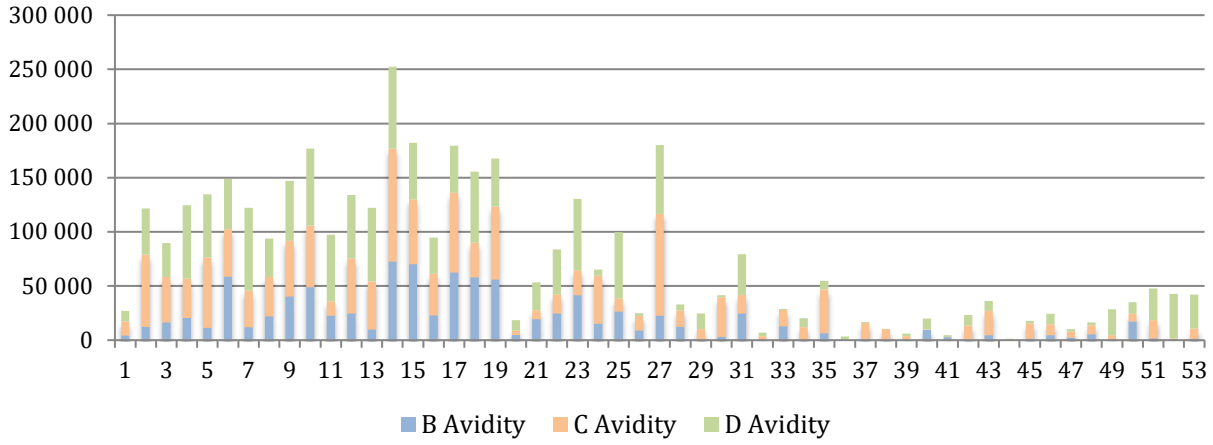


Figure 12: Estimated number of non-finfish harvested by avidity and week (excluding customary and commercial).

8.11 Non-finfish harvest by species in detail

Pipi, tuatua and scallops were the most commonly harvested species in 2017–18 (Table 36), followed by kina, paua, mussels, and cockles.

Table 36: Non-finfish harvest (table sorted alphabetically).

	Fishers (n)	Events (n)	Harvest (n)	CV	Mean Weight (kg)	Harvest (tonnes)	CV
Cockles	54	73	340 246	0.28	-	-	-
Crab	14	16	10 336	0.53	-	-	-
Crayfish/lobster packhorse/green	17	33	11 883	0.78	-	-	-
Crayfish/lobster Spanish	10	12	3 762	0.40	-	-	-
Crayfish/lobster spiny/red	261	819	209 446	0.11	0.75	158.00	0.11
Kina	149	268	539 808	0.15	-	-	-
Mussel	95	147	341 864	0.17	-	-	-
Octopus	12	14	1 703	0.35	-	-	-
Oyster	41	72	186 060	0.26	-	-	-
Paddle crab	3	9	5 914	0.88	-	-	-
Paua ordinary	259	590	425 661	0.11	0.32	134.70	0.11
Paua yellow foot	9	9	3 014	0.50	-	-	-
Pipi	67	100	647 978	0.24	-	-	-
Puupuu/cats eye/cooks turban	2	3	6 077	0.75	-	-	-
Scallops	117	249	561 592	0.14	0.11	62.13	0.14
Squid	15	17	6 705	0.51	-	-	-
Tuatua	44	81	564 401	0.31	-	-	-
Other marine	12	16	35 494	0.52	-	-	

8.12 Non-finfish harvest compared with 2011–12

The estimated harvest in 2017–18 was lower than in 2011–12 for 12 species and higher for six species (Table 37). Among the more commonly taken species, the harvest of scallops, mussels, and cockles was more than 50% lower than in 2011–12, whereas the harvest of pipi and kina were about the same as in 2011–12. Only quite rarely-taken species like Spanish lobster, packhorse rock lobster, and squid had greatly increased estimated harvests in 2017–18 compared with 2011–12, and the methodological challenges in surveying harvest for such rare species (especially the wide CVs) need to be borne in mind where drawing inferences from these estimates.

Table 37: Non-finfish harvest by FMA (table sorted by estimated absolute change in harvest).

	2011–12	2017–18	Difference
Scallops	1 669 681	561 592	-1 108 089
Mussel	983 347	341 864	-641 483
Cockles	734 742	340 246	-394 496
Tuatua	869 751	564 401	-305 350
Oyster	303 190	186 060	-117 130
Paua ordinary	525 634	425 661	-99 973
Puupuu/cats eye/cooks turban	38 304	6 077	-32 227
Crayfish/lobster spiny/red	226 271	209 446	-16 825
Kina	553 990	539 808	-14 182
Paua yellow foot	14 076	3 014	-11 062
Crab	16 749	10 336	-6 413
Paddle crab	9 354	5 914	-3 440
Octopus	1 521	1 703	182
Squid	4 682	6 705	2 023
Crayfish/lobster Spanish	196	3 762	3 566
Crayfish/lobster packhorse/green	4 080	11 883	7 803
Pipi	622 288	647 978	25 690
Other marine	25 921	35 494	9 573

8.13 Non-finfish harvest by species and FMA

The harvest of each species varies considerably by FMA, largely following the distribution of each species and the state of some of the stocks and their current fishery management settings (Table 38). For example, 42% of rock lobster and 66% of ordinary paua were harvested from the lower half of the North Island (FMA 2 and FMA 8) despite this area of New Zealand accounting for less than 15% of the total coastline. Over 90% of harvested scallops came from FMA 1, reflecting the low biomass and closure of the scallop fishery in FMA 7 (in 2011–12 806 943 scallops were harvested from FMA 7 which was 48.3% of the total). However, the Kaikoura fishery closure may have had less overall effect on non-finfish harvest than might have been anticipated. Although the share of paua in FMA 3 (of which Kaikoura is a part) went from 20.9% in 2011–12 down to 13.3% in 2017–18, the share of rock lobster harvested in the same area stayed about the same, measuring 15% in 2011–12 and 17.2% in 2017–18.

Table 38: Non-finfish harvest by FMA (table sorted alphabetically).

	FMA						
	1	**2**	**3**	**5**	**7**	**8**	**9**
Cockles	181 518	1 492	103 359	6 761	24 778	0	22 337
Crab	2 380	838	1 086	0	5 139	893	0
Crayfish/lobster packhorse/green	2 080	9 413	330	0	0	60	0
Crayfish/lobster Spanish	928	2 236	598	0	0	0	0
Crayfish/lobster spiny/red	37 157	70 539	36 003	14 329	29 237	18 125	4 055
Kina	296 104	180 549	4 655	9 638	2 297	34 339	12 227
Mussel	147 365	53 524	43 179	22 995	55 194	2 838	16 769
Octopus	1 038	110	128	116	136	176	0
Oyster	39 832	0	16 588	50 569	3 477	0	75 594
Paddle crab	775	0	0	0	5 139	0	0
Paua ordinary	17 487	222 716	56 656	44 405	13 652	60 524	10 220
Paua yellow foot	0	2 761	10	0	0	243	0
Pipi	361 783	16 157	14 892	12 326	27 997	102 037	112 785
Puupuu/cats eye/cooks turban	0	0	2 126	0	0	3 951	0
Scallops	521 272	5 252	0	921	0	0	34 147
Squid	5 929	146	0	0	295	0	335
Tuatua	280 366	9 205	11 439	10 629	3 020	29 998	219 744
Other marine	2 592	3 897	15 023	13 586	336	60	0

8.14 Non-finfish harvest by species and method

Most non-finfish were harvested by hand gathering from a boat or from the shore (Table 39), although there are some specialist fisheries such as for rock lobster, where 38% were taken in lobster pots, and for scallops, where 14% were taken by dredge in 2017–18.

Table 39: Non-finfish harvest by species and method (table sorted alphabetically).

	Rod/ line	Long- line/ Kontiki	Net	Pot	Dredge	Hand gather from shore	Hand gather by diving	Spear- fishing	Other
Cockles	0	0	0	0	0	340 246	0	0	0
Crab	173	144	3 044	6 109	0	144	723	0	0
Crayfish/lobster pack/green	0	0	0	9 262	0	0	2 621	0	0
Crayfish/lobster Spanish	0	0	0	1 285	0	0	2 477	0	0
Crayfish/lobster spiny/red	0	0	0	78 735	0	291	130 419	0	0
Kina	0	0	0	0	0	89 304	450 504	0	0
Mussel	0	0	0	0	0	231 953	104 448	0	5 462
Octopus	1 211	0	116	0	0	233	69	75	0
Oyster	0	0	0	0	39 628	138 380	8 053	0	0
Paddle crab	1 597	0	0	2 569	0	1 747	0	0	0
Paua ordinary	0	0	0	0	0	70 684	354 977	0	0
Paua yellow foot	0	0	0	0	0	304	2 709	0	0
Pipi	0	0	0	0	0	629 454	18 524	0	0
Puupuu/cats eye/cooks turban	0	0	0	0	0	3 951	2 126	0	0
Scallops	0	0	0	0	76 758	15 991	468 843	0	0
Squid	3 050	3 229	0	0	0	0	0	425	0
Tuatua	0	0	0	0	0	564 401	0	0	0
Other marine	0	0	0	0	0	35 434	0	60	0

8.15 Non-finfish harvest by species and platform

Most harvest of non-finfish species was taken from the land (71% in total, Table 40), although rock lobsters, scallops, and squid were taken predominantly (at least 66%) from trailer boats.

Table 40: Non-finfish harvest by species and platform (table sorted alphabetically).

	Trailer motor boat	Larger boat/ launch	Trailer yacht	Larger yacht/ keeler	Kayak/ Rowboat	Off land	Other
Cockles	20 906	0	0	1 651	0	317 689	0
Crayfish/lobster Spanish	1 599	941	0	0	0	624	598
Crayfish/lobster spiny/red	138 619	19 788	0	504	3 848	45 789	897
Crayfish/lobster packhorse/green	1 611	200	0	0	9 194	878	0
Kina	130 158	9 618	0	0	2 913	381 382	15 737
Mussel	57 703	5 799	0	0	20 274	258 087	0
Oyster	39 759	6 682	0	0	509	139 110	0
Paua ordinary	72 578	12 498	164	0	6 913	329 975	3 533
Paua yellow foot	252	0	0	0	0	2 761	0
Pipi	13 027	7 743	0	0	0	627 208	0
Scallops	370 333	128 608	0	1 536	0	61 115	0
Squid	4 670	391	0	0	0	1 644	0
Tuatua	0	0	0	0	0	564 401	0
Octopus	775	288	0	0	116	525	0
Puupuu/cats eye/cooks turban	0	0	0	0	0	6 077	0
Crab	116	0	0	0	0	10 220	0
Paddle crab	0	0	0	0	0	5 914	0
Other marine	3 957	0	0	0	0	31 537	0

9. HARVEST ESTMATES FOR SELECTED SPECIES

9.1 Albacore tuna

The total estimated harvest for the 2017–18 fishing year for albacore tuna was 12 463 fish or 56.7 tonnes (Table 41). There is only one fishstock for this species so all of the harvest is recorded as being from ALB 1. Almost all of the harvest was by rod or line (Figure 13) and 89% from trailer boats (Figure 14). Bag sizes were mainly in the range one to four and with most bags (78.9%) consisting of either one or two fish (Table 42).

Table 41: Albacore tuna harvest by fishstock.

QMA.ALB	Fishers (n)	Events (n)	Harvest (n)	CV	Mean Weight (kg)	Harvest (tonnes)	CV
1	42	58	12 463	0.22	4.55	56.74	0.22
TOTAL	42	58	12 463	0.22	4.55	56.74	0.22

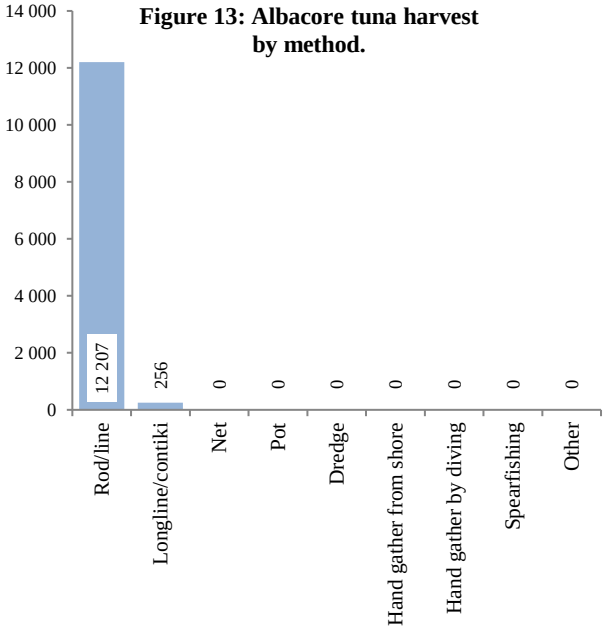


Figure 13: Albacore tuna harvest by method.

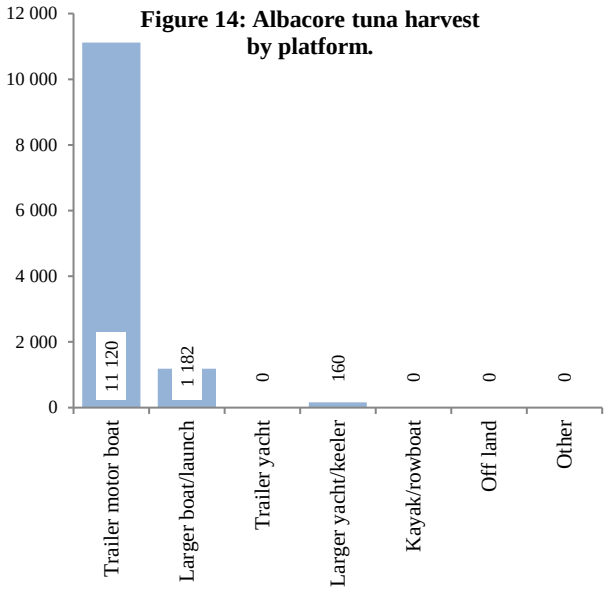


Figure 14: Albacore tuna harvest by platform.

Table 42: Albacore tuna bag size by QMA (row percent)[4].

	Bag Size								
QMA	<1	1	2	3	4	5	6	7	8
1	0.0	52.5	26.4	12.3	4.9	0.0	2.0	0.0	1.8
TOTAL	0.0	52.5	26.4	12.3	4.9	0.0	2.0	0.0	1.8

[4] Bag size tables show the number of fishers with that bag size. Bag sizes of less than 1.0 are possible because of shared catch situations. Zero catches are not shown, as 'targeting without harvest' is not measured.

9.2 Blue cod

The total estimated harvest for blue cod for the 2017–18 fishing year was 594 934 fish, or 292.7 tonnes (Table 43). Blue cod were caught in most waters but nearly 80% of the harvest was from three QMAs – BCO 3 (East Coast of the South Island), BCO 5 (South of the South Island) and BCO 7 (West Coast of the South Island plus Golden Bay and Tasman Bay). Almost all of the blue cod was caught with a rod or line (Figure 15). Longline, cod pots or spearfishing only account for a fraction of the harvest. It appears that more blue cod (18%) was caught from larger boats/launches than is the case for snapper and kahawai (Figure 16). The most frequent bag size (34%) was two fish. Next was a bag size of just one fish (19%) (Table 44).

Table 43: Blue cod harvest by fishstock.

QMA.BCO	Fishers (n)	Events (n)	Harvest (n)	CV	Mean Weight (kg)	Harvest (tonnes)	CV
1	66	85	13 276	0.18	0.45	5.99	0.18
2	81	139	48 140	0.26	0.58	28.09	0.26
3	123	295	202 765	0.18	0.49	98.54	0.18
5	92	239	139 176	0.20	0.48	66.86	0.20
7	201	535	129 038	0.12	0.49	62.76	0.12
8	73	166	62 539	0.20	0.49	30.51	0.20
TOTAL	587	1 459	594 934	0.09	0.49	292.74	0.09

Figure 15: Blue cod harvest by method.

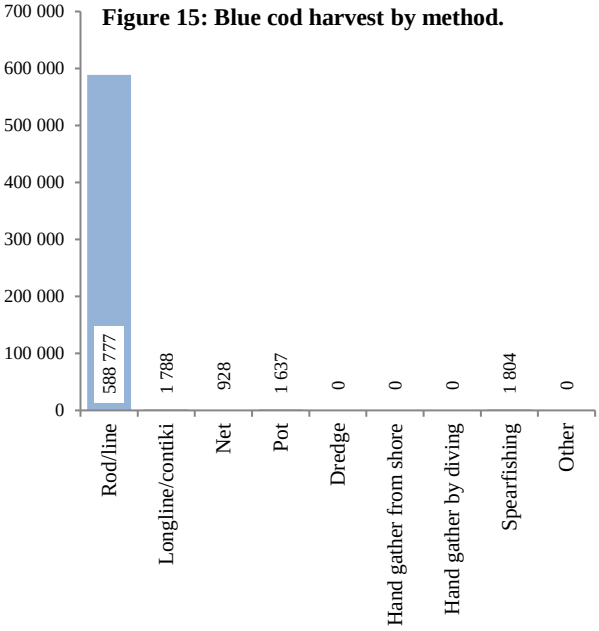


Figure 16: Blue cod harvest by platform.

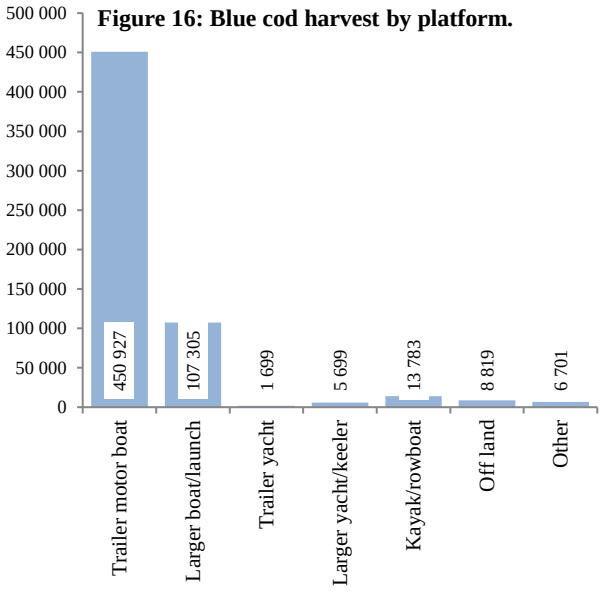


Table 44: Blue cod bag size by QMA (row percent).

	Bag Size													
QMA	<1	1	2	3	4	5	6	7	8	9	10	11	12	13+
1	0.0	61.2	25.3	8.1	4.3	1.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	0.0	33.8	19.8	10.3	12.3	3.8	7.2	1.0	1.5	0.0	2.4	0.1	5.4	2.3
3	0.0	7.9	13.2	9.6	8.7	6.2	6.4	6.4	3.5	1.6	15.2	0.1	3.2	18.1
5	0.0	6.6	16.6	15.6	6.9	5.7	4.4	7.6	3.9	1.8	15.1	0.0	4.8	11.2
7	0.6	18.5	60.4	7.3	5.6	2.5	1.9	0.6	0.9	0.2	0.9	0.0	0.0	0.4
8	0.0	19.9	15.5	10.7	7.9	7.2	10.5	4.1	6.6	1.1	13.8	0.0	0.4	2.4
TOTAL	0.3	19.0	34.3	9.7	7.2	4.2	4.4	3.1	2.4	0.7	7.1	0.0	1.9	5.7

9.3 Bluenose

The total estimated harvest for bluenose for the 2017–18 fishing year was 9 629 fish, or 46.2 tonnes (Table 45). Most of the bluenose (78.6%) were caught in BNS 1 (top third of the North Island). Almost all of the bluenose was caught using a rod or line (Figure 17) and all from boats (Figure 18). 86.8% were taken using a trailer boat and 13.2% using a larger boat or launch. Bag sizes were mostly (95.7%) from one to five fish and many caught just a single fish (43.9%) (Table 46).

Table 45: Bluenose harvest by fishstock.

QMA.BNS	Fishers (n)	Events (n)	Harvest (n)	CV	Mean Weight (kg)	Harvest (tonnes)	CV
1	33	38	7 571	0.29	4.81	36.45	0.29
2	7	8	1 298	0.43	4.71	6.12	0.43
3	5	7	405	0.60	4.71	1.91	0.60
7	4	4	355	0.60	4.71	1.67	0.60
8	0	0	0	-	-	0.00	-
TOTAL	49	57	9 629	0.24	4.79	46.15	0.24

Figure 17: Bluenose harvest by method.

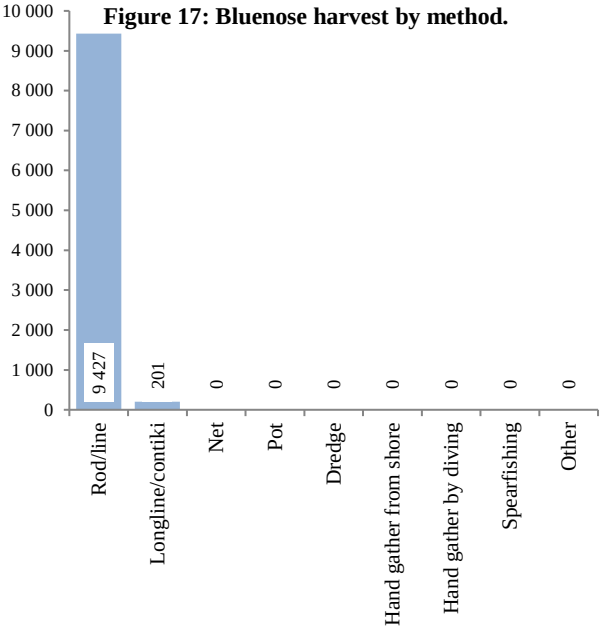


Figure 18: Bluenose harvest by platform.

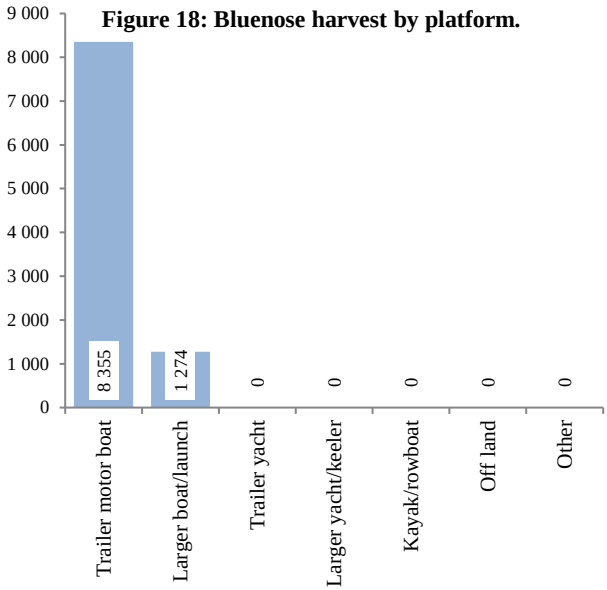


Table 46: Bluenose bag size by QMA (row percent).

	Bag Size									
QMA	**<1**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
1	0.0	45.1	32.1	6.0	2.9	9.3	0.0	3.7	0.0	0.9
2	0.0	18.2	20.4	32.3	24.8	4.3	0.0	0.0	0.0	0.0
3	0.0	41.8	9.5	41.1	0.0	7.6	0.0	0.0	0.0	0.0
7	0.0	86.4	0.0	0.0	0.0	0.0	0.0	13.6	0.0	0.0
8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TOTAL	0.0	43.9	28.4	10.1	5.0	8.3	0.0	3.6	0.0	0.7

9.4 Flatfish including flounder

The total estimated harvest for flatfish (flounder/sole/brill/turbot) for the 2017–18 fishing year was 95 859 fish, or 39.1 tonnes (Table 47). Flatfish are taken from most areas around New Zealand but the most (39%) from FLA 1 (top third of the North Island). Flatfish are caught by a variety of methods (Figure 19) with netting being the most frequent (63%). About 53% were recorded as being caught from the shore (including 'hand gather from shore') which is very different from most of the finfish species where catch by boat is predominant (Figure 20). Twelve percent were recorded as being caught by spearfishing, but it is likely many of these would have actually been caught via hand held spear (and should more correctly be counted as by floundering from shore/hand gathering). The range of bag sizes was very wide, although 68.5% were from a bag size of three or fewer fish (Table 48).

Table 47: Flatfish including flounder harvest by fishstock.

QMA.FLA	Fishers (n)	Events (n)	Harvest (n)	CV	Mean Weight (kg)	Harvest (tonnes)	CV
1	44	79	37 289	0.28	0.41	15.21	0.28
2	45	110	22 324	0.41	0.41	9.10	0.41
3	26	46	23 316	0.38	0.41	9.51	0.38
7	19	57	12 930	0.43	0.41	5.27	0.43
TOTAL	133	292	95 859	0.18	0.41	39.09	0.18

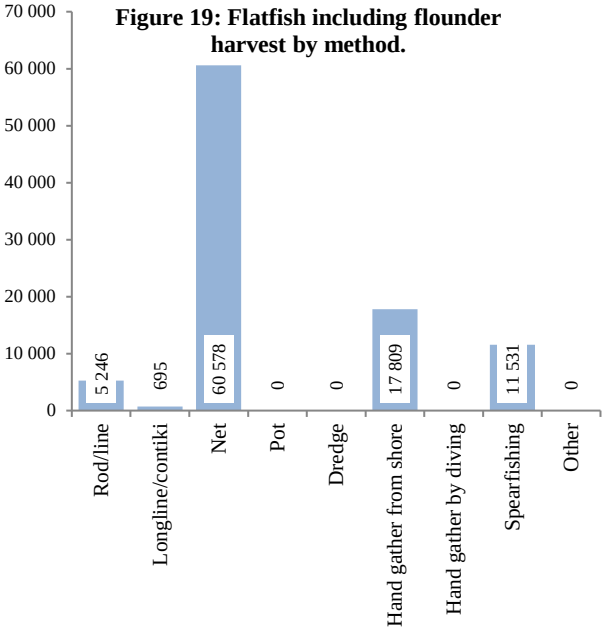


Figure 19: Flatfish including flounder harvest by method.

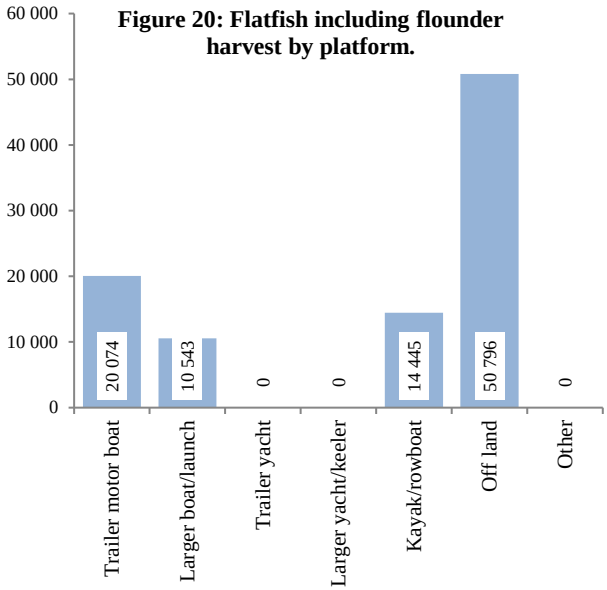


Figure 20: Flatfish including flounder harvest by platform.

Table 48: Flatfish including flounder bag size by QMA (row percent).

	Bag Size													
QMA	<1	1	2	3	4	5	6	7	8	9	10	11	12	13+
1	3.1	21.5	27.0	10.8	7.2	9.7	2.3	5.2	0.7	0.7	3.7	0.0	4.4	3.9
2	12.1	26.2	27.0	15.0	4.2	5.6	0.4	2.4	2.8	0.0	3.3	0.0	0.4	0.6
3	0.0	22.8	23.4	17.1	6.7	1.7	4.4	0.0	0.0	1.4	0.0	0.0	1.4	21.0
7	8.7	15.2	30.1	7.8	7.6	8.4	1.9	1.9	2.2	0.0	3.1	3.1	8.2	2.1
TOTAL	6.3	22.5	26.8	12.9	6.2	6.8	2.0	2.9	1.4	0.5	2.8	0.4	3.1	5.5

9.5 Hapuku/bass

The total estimated harvest for hapuku/bass for the 2017–18 fishing year was 38 272 fish, or 228.2 tonnes (Table 49). Most (56%) hapuku were caught in the upper half of the North Island, 32% in HPB 1 and 24% in HPB 2. Virtually all of this species was taken by rod and line (Figure 21). Harvesting from trailer boats was most common (61.9%) followed by harvesting from larger boats (37%) (Figure 22). About half of bag sizes (52.8%) were just one fish, with a further 20.7% of bags being of two fish (Table 50).

Table 49: Hapuku/bass harvest by fishstock.

QMA.HPB	Fishers (n)	Events (n)	Harvest (n)	CV	Mean Weight (kg)	Harvest (tonnes)	CV
1	44	69	12 250	0.21	5.96	73.05	0.21
2	36	54	9 175	0.29	5.96	54.71	0.29
3	25	42	8 474	0.36	5.96	50.53	0.36
5	8	10	1 389	0.42	5.96	8.28	0.42
7	21	38	5 937	0.35	5.96	35.40	0.35
8	7	11	1 047	0.49	5.96	6.24	0.49
TOTAL	134	224	38 272	0.14	5.96	228.21	0.14

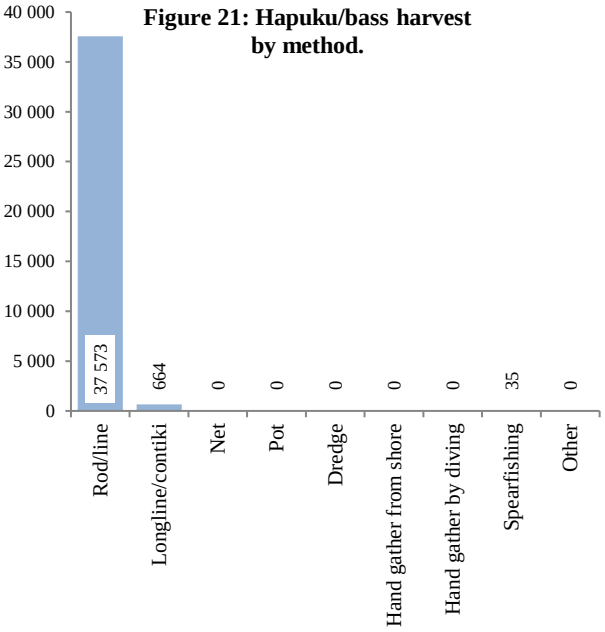


Figure 21: Hapuku/bass harvest by method.

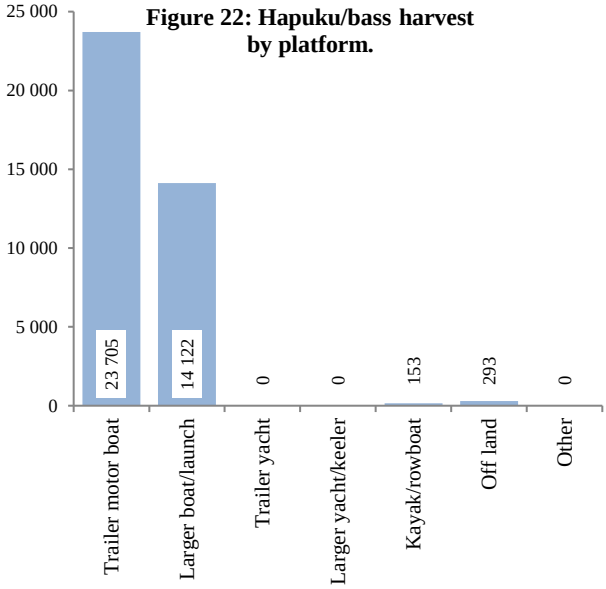


Figure 22: Hapuku/bass harvest by platform.

Table 50: Hapuku/bass bag size by QMA (row percent).

	Bag Size													
QMA	<1	1	2	3	4	5	6	7	8	9	10	11	12	13+
1	0.0	54.3	25.6	14.0	3.0	0.4	1.1	1.1	0.0	0.4	0.0	0.0	0.0	0.0
2	0.0	66.0	9.1	4.9	8.5	9.3	0.0	0.0	2.1	0.0	0.0	0.0	0.0	0.0
3	0.0	42.8	25.9	8.5	11.0	6.7	0.0	0.0	0.0	0.0	2.7	0.0	0.0	2.5
5	33.6	32.5	21.0	8.9	0.0	0.0	4.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
7	5.7	35.3	28.0	19.7	7.0	0.0	4.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
8	0.0	89.7	0.0	0.0	3.1	7.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TOTAL	2.7	52.8	20.7	11.0	6.0	3.7	1.3	0.4	0.5	0.2	0.4	0.0	0.0	0.4

9.6 John dory

The total estimated harvest for John dory for the 2017–18 fishing year was 26 064 fish, or 30.4 tonnes (Table 51). Most of the John dory (86.7%) were taken from JDO 1 (top third of the North Island). Almost all (95%) of John dory were caught by rod and line (Figure 23). Only 7.7% of John dory were taken from land (Figure 24); 69.5% were caught from a trailer boat and 17.4% from a larger boat or launch. The predominant bag size was just one fish (80.7% of bags) (Table 52).

Table 51: John dory harvest by fishstock.

QMA.JDO	Fishers (n)	Events (n)	Harvest (n)	CV	Mean Weight (kg)	Harvest (tonnes)	CV
1	103	148	22 595	0.20	1.16	26.26	0.20
2	16	26	2 587	0.34	1.18	3.06	0.34
3	1	1	183	1.00	1.18	0.22	1.00
7	6	7	699	0.47	1.18	0.83	0.47
TOTAL	124	182	26 064	0.18	1.17	30.37	0.18

Figure 23: John dory harvest by method.

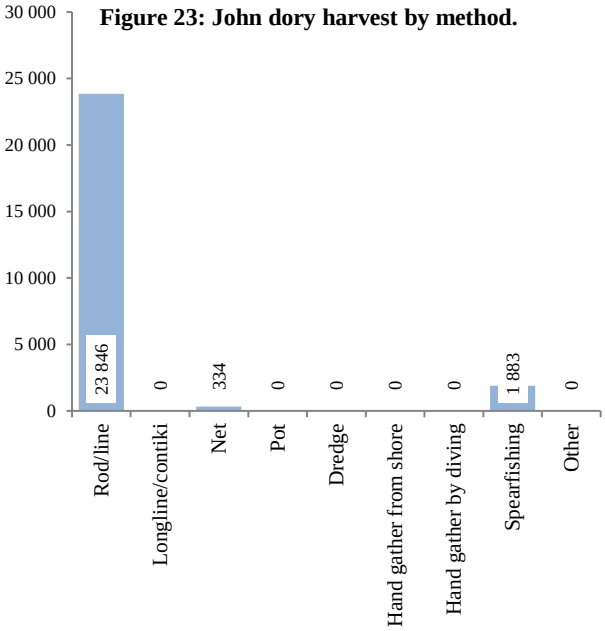


Figure 24: John dory harvest by platform.

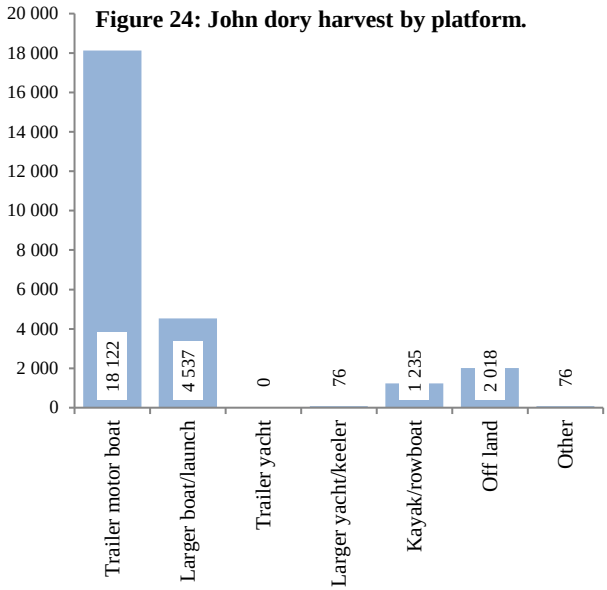


Table 52: John dory bag size by QMA (row percent).

	Bag Size										
QMA	<1	1	2	3	4	5	6	7	8	9	10
1	0.0	79.8	13.6	4.9	1.7	0.0	0.0	0.0	0.0	0.0	0.0
2	0.0	87.7	5.6	0.0	0.0	0.0	0.0	0.0	4.4	0.0	2.2
3	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
7	17.4	82.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TOTAL	0.7	80.7	12.3	4.3	1.5	0.0	0.0	0.0	0.4	0.0	0.2

9.7 Kahawai

The total estimated harvest for kahawai for the 2017–18 fishing year was 1 009 675 fish, or 1702 tonnes (Table 53). Kahawai were caught across New Zealand but over half (55.9%) were caught in KAH 1. Kahawai were mainly (Figure 25) caught by rod and line (92.5%). Just over half of the kahawai were caught from a trailer boat (50.2%) but a third were taken off land (Figure 26). Bag sizes for kahawai were mainly small; 38.9% were one fish, 27.1% two fish and 12.9% three fish (Table 54).

Table 53: Kahawai harvest by fishstock.

QMA.KAH	Fishers (n)	Events (n)	Harvest (n)	CV	Mean Weight (kg)	Harvest (tonnes)	CV
1	962	2 356	564 665	0.07	1.71	966.39	0.07
2	209	548	132 087	0.14	1.70	224.24	0.14
3	169	311	68 127	0.15	1.06	71.98	0.15
8	400	929	244 797	0.11	1.80	439.42	0.11
TOTAL	1 623	4 144	1 009 675	0.05	1.69	1 702.02	0.05

Figure 25: Kahawai harvest by method.

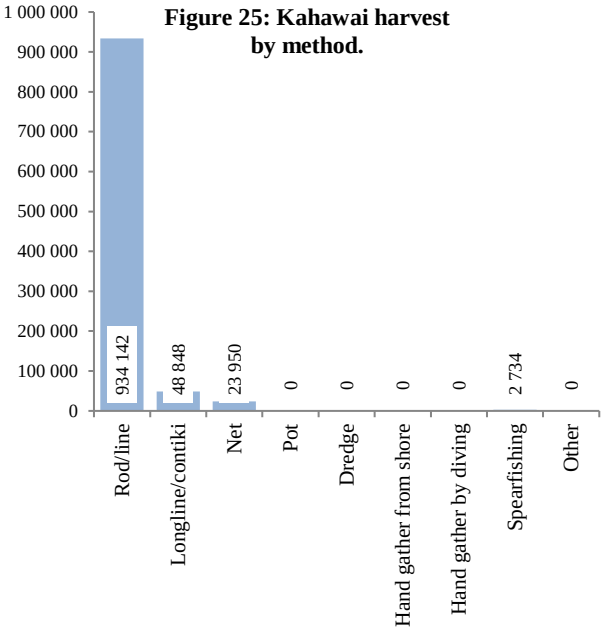


Figure 26: Kahawai harvest by platform.

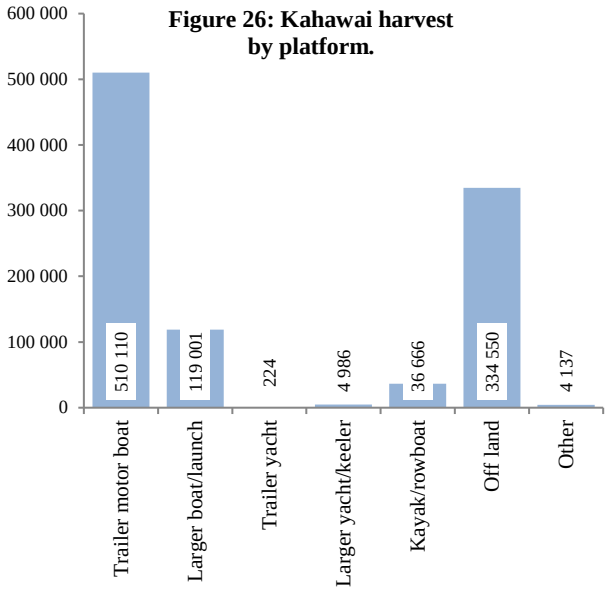


Table 54: Kahawai bag size by QMA (row percent).

	Bag Size													
QMA	<1	1	2	3	4	5	6	7	8	9	10	11	12	13+
1	2.0	41.5	27.1	13.5	6.3	3.0	3.2	1.0	1.1	0.2	0.4	0.2	0.2	0.2
2	1.2	31.8	30.3	14.5	9.7	4.1	4.3	0.7	1.6	0.3	1.2	0.0	0.0	0.3
3	1.9	45.8	25.3	12.7	5.3	1.8	3.6	0.4	0.5	0.0	0.6	0.1	0.7	1.3
8	4.1	33.8	26.0	10.5	10.2	5.8	5.4	1.3	0.4	0.6	0.9	0.1	0.0	0.8
TOTAL	2.4	38.9	27.1	12.9	7.5	3.7	3.8	1.0	1.0	0.3	0.6	0.1	0.2	0.4

9.8 Kingfish

The total estimated harvest for kingfish for the 2017–18 fishing year was 89 744 fish, or 738 tonnes (Table 55). Most (77.4%) of the kingfish harvest was taken from KIN 1 (north east coast of the North Island). Almost all kingfish were caught with a rod and line (Figure 27), with a smaller numbers taken by spearfishing (4.5%). Only 11.6% were taken off land with the remainder from boats (Figure 28). Bag sizes for kingfish were small with 77.3% being just the one fish and 15.9% being two fish (Table 56).

Table 55: Kingfish harvest by fishstock.

QMA.KIN	Fishers (n)	Events (n)	Harvest (n)	CV	Mean Weight (kg)	Harvest (tonnes)	CV
1	269	455	69 473	0.16	8.22	570.83	0.16
2	48	80	9 602	0.28	8.25	79.21	0.28
3	5	5	708	0.48	8.25	5.84	0.48
7	23	27	3 289	0.25	8.25	27.13	0.25
8	34	52	6 672	0.22	8.25	55.03	0.22
TOTAL	371	619	89 744	0.13	8.22	738.04	0.13

Figure 27: Kingfish harvest by method.

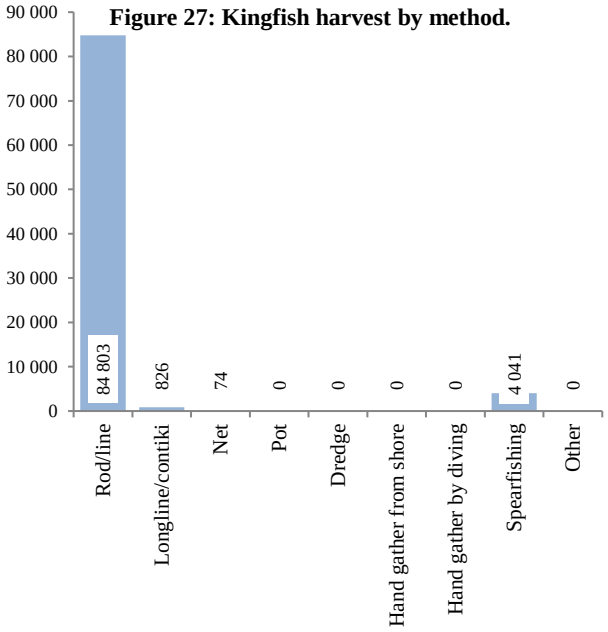


Figure 28: Kingfish harvest by platform.

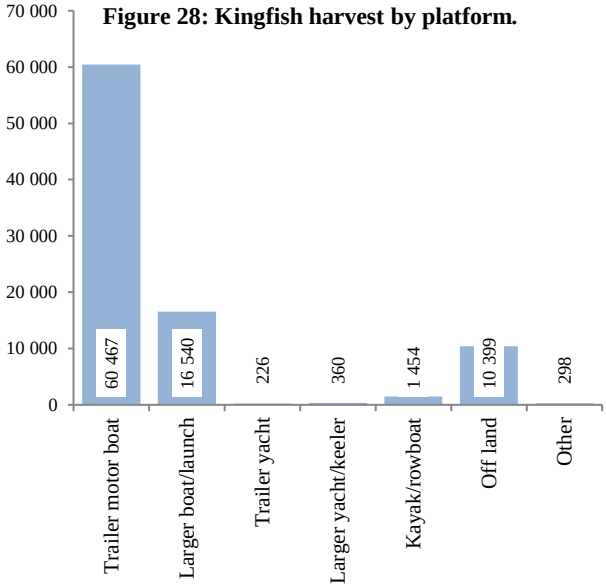


Table 56: Kingfish bag size by QMA (row percent).

	Bag Size								
QMA	<1	1	2	3	4	5	6	7	8
1	1.0	77.7	14.6	3.0	1.7	1.0	0.2	0.6	0.1
2	1.6	70.2	26.3	1.9	0.0	0.0	0.0	0.0	0.0
3	0.0	56.4	43.6	0.0	0.0	0.0	0.0	0.0	0.0
7	0.0	83.0	10.8	6.2	0.0	0.0	0.0	0.0	0.0
8	0.0	82.6	13.2	1.7	0.0	2.5	0.0	0.0	0.0
TOTAL	1.0	77.3	15.9	2.9	1.3	1.0	0.1	0.5	0.1

9.9 Lobster/crayfish (spiny/red)

The total estimated harvest for rock lobster for the 2017–18 fishing year was 209 446 lobsters, or 158 tonnes (Table 57). The harvest was spread across QMAs, with the exception of CRA 7 where the catch was minimal. Most rock lobster was taken by hand gathering by diving (62.3%), almost all of the rest using rock lobster pots (Figure 29). Around 20% of rock lobsters were taken off land; divers may enter the water from land as well as from the more prevalent boat based platforms (Figure 30). Table 58 shows a fairly even spread of bag sizes between one and six. Bags of two or fewer make up 49.9% of bags.

Table 57: Lobster/crayfish harvest by fishstock.

QMA.CRA	Fishers (n)	Events (n)	Harvest (n)	CV	Mean Weight (kg)	Harvest (tonnes)	CV
1	34	65	19 350	0.47	0.82	15.91	0.47
2	33	79	19 123	0.35	0.74	14.21	0.36
3	30	90	22 515	0.26	0.54	12.21	0.26
4	72	195	52 145	0.21	0.79	41.38	0.23
5	61	265	51 464	0.21	0.80	40.96	0.21
7	1	1	82	1.00	1.12	0.09	1.00
8	25	62	24 732	0.36	0.65	16.17	0.36
9	22	62	20 034	0.34	0.85	17.07	0.34
TOTAL	261	819	209 446	0.11	0.75	158.00	0.11

Figure 29: Lobster/crayfish harvest by method.

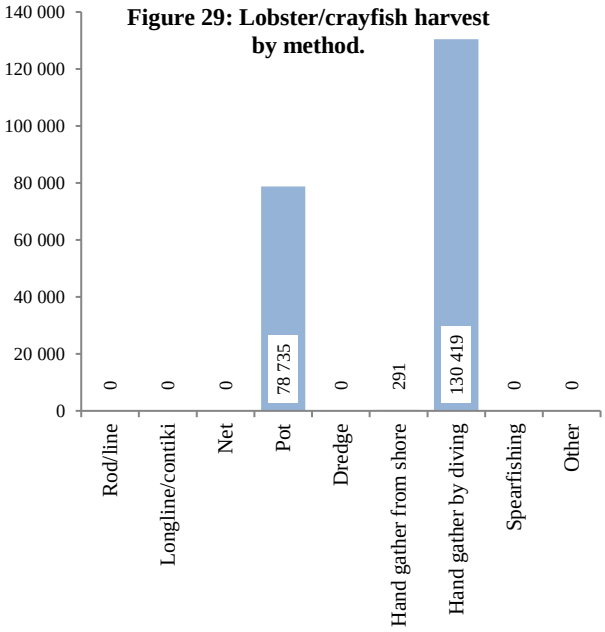


Figure 30: Lobster/crayfish harvest by platform.

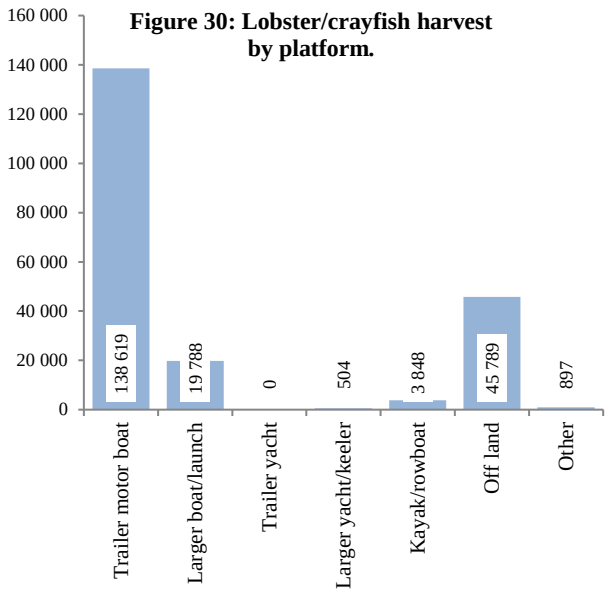


Table 58: Lobster/crayfish bag size by QMA (row percent).

	Bag Size													
QMA	<1	1	2	3	4	5	6	7	8	9	10	11	12	13+
1	3.7	29.6	26.7	14.6	9.1	7.8	8.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	2.2	12.9	32.2	23.8	16.2	1.8	8.8	0.0	2.1	0.0	0.0	0.0	0.0	0.0
3	6.6	14.9	28.0	9.9	14.0	9.5	13.2	1.9	1.9	0.0	0.0	0.0	0.0	0.0
4	3.9	29.4	21.4	15.5	9.6	4.0	10.6	1.2	0.4	0.0	0.8	0.4	0.0	2.8
5	1.9	26.9	21.3	16.7	8.6	4.8	17.8	0.0	0.6	0.0	0.7	0.0	0.6	0.0
7	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
8	21.7	6.0	9.3	5.5	5.7	5.4	22.8	7.4	1.8	0.0	3.4	0.0	1.5	9.5
9	0.0	15.2	19.2	16.7	17.9	4.9	22.6	0.0	1.1	2.5	0.0	0.0	0.0	0.0
TOTAL	4.4	22.8	22.7	15.3	10.9	5.2	14.2	1.1	0.9	0.2	0.6	0.1	0.3	1.4

9.10 Paua (ordinary)

The total estimated harvest for paua for the 2017–18 fishing year was 425 661 paua, or 134.7 tonnes (Table 59). There are eight paua QMAs but 66.5% of the harvest was taken from PAU 2, on the southern coast of the North Island. Most paua (83.4%) were taken by hand gathering by diving and the remainder hand gathering from the shore (Figure 31). This is one species where access is most often from the land, and 77% of the harvest was taken off the land (Figure 32). There was a spread of bag sizes but many people (43.3%) appear to reach the bag size limit of 10 paua (Table 60).

Table 59: Paua harvest by fishstock.

QMA.PAU	Fishers (n)	Events (n)	Harvest (n)	CV	Mean Weight (kg)	Harvest (tonnes)	CV
1	27	41	27 707	0.34	0.32	8.74	0.34
2	151	367	283 240	0.15	0.29	83.22	0.15
3	21	46	28 140	0.35	0.31	8.79	0.35
5A	3	4	2 419	0.76	0.35	0.85	0.76
5B	10	21	15 361	0.45	0.64	9.85	0.45
5D	48	88	55 141	0.21	0.35	19.28	0.21
6	3	7	3 076	0.60	0.31	0.95	0.61
7	11	16	10 576	0.36	0.29	3.02	0.36
TOTAL	259	590	425 661	0.11	0.32	134.70	0.11

Figure 31: Paua harvest by method.

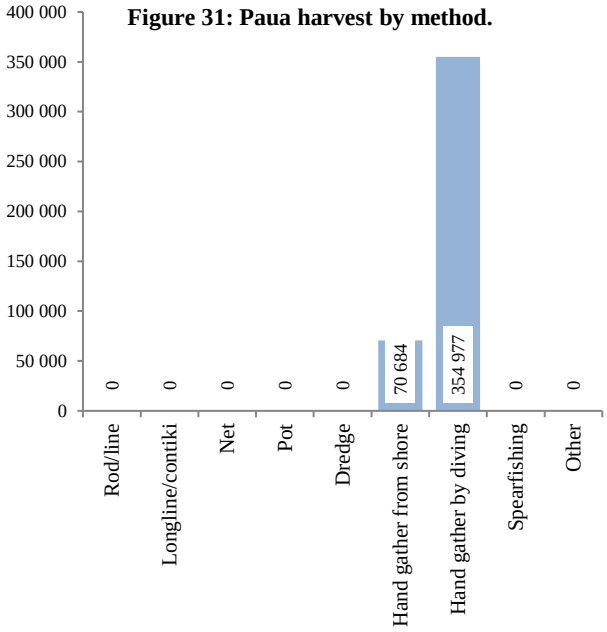


Figure 32: Paua harvest by platform.

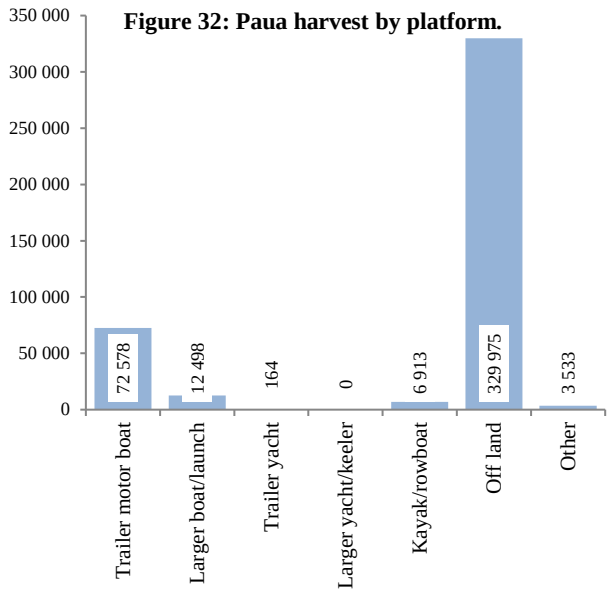


Table 60: Paua bag size by QMA (row percent).

	Bag Size													
QMA	<1	1	2	3	4	5	6	7	8	9	10	11 to 19	20	21+
1	0.0	14.2	4.9	6.0	10.7	18.1	7.7	6.4	4.9	0.0	27.3	0.0	0.0	0.0
2	0.0	4.5	8.4	4.1	4.3	4.9	4.8	1.5	9.2	2.9	52.4	0.5	1.5	1.0
3	0.0	19.4	28.9	10.3	3.9	2.4	4.8	0.8	7.5	0.0	17.0	0.0	0.0	4.9
5A	0.0	0.0	0.0	17.3	0.0	47.1	0.0	0.0	0.0	0.0	0.0	0.0	35.6	0.0
5B	0.0	6.0	61.0	0.0	0.0	5.5	2.5	0.0	0.0	0.0	23.9	1.1	0.0	0.0
5D	1.2	2.3	7.4	5.8	9.4	10.6	8.1	1.8	0.9	3.4	48.1	0.0	0.0	1.0
6	0.0	0.0	0.0	0.0	21.0	0.0	10.7	10.7	10.7	0.0	46.8	0.0	0.0	0.0
7	0.0	17.7	11.2	6.5	14.4	0.0	9.8	4.3	19.7	2.9	13.6	0.0	0.0	0.0
TOTAL	0.1	6.8	13.0	4.9	5.6	6.5	5.5	1.9	7.4	2.2	43.3	0.4	1.0	1.2

9.11 Red cod

The total estimated harvest for red cod for the 2017–18 fishing year was 30 200 fish, or 31.8 tonnes (Table 61). Red cod were caught in most waters but 61% of the harvest was from RCO 2 (east and south coasts of the North Island). Most of the red cod (71.6%) was caught with a rod and line and 26.3% via longline or kontiki (Figure 33). About half (50.5%) are caught off land (Figure 34) and only 5% are taken from larger boats or launches (compared with 18% of blue cod). Bag sizes were generally small (Table 62), with 54.8% being just a single fish or less (in the case of shared catch).

Table 61: Red cod harvest by fishstock.

QMA.RCO	Fishers (n)	Events (n)	Harvest (n)	CV	Mean Weight (kg)	Harvest (tonnes)	CV
1	15	15	2 300	0.34	1.05	2.42	0.34
2	57	94	18 441	0.28	1.05	19.44	0.28
3	31	38	6 411	0.27	1.05	6.76	0.27
7	17	23	3 049	0.31	1.05	3.21	0.31
TOTAL	118	170	30 200	0.19	1.05	31.83	0.19

Figure 33: Red cod harvest by method.

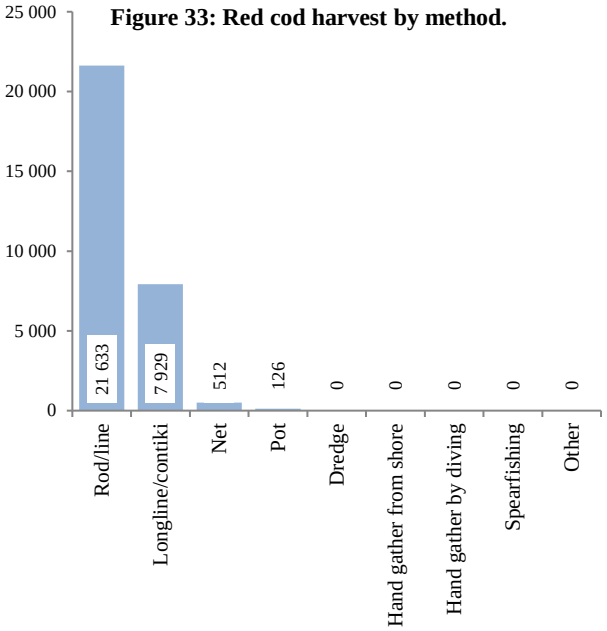


Figure 34: Red cod harvest by platform.

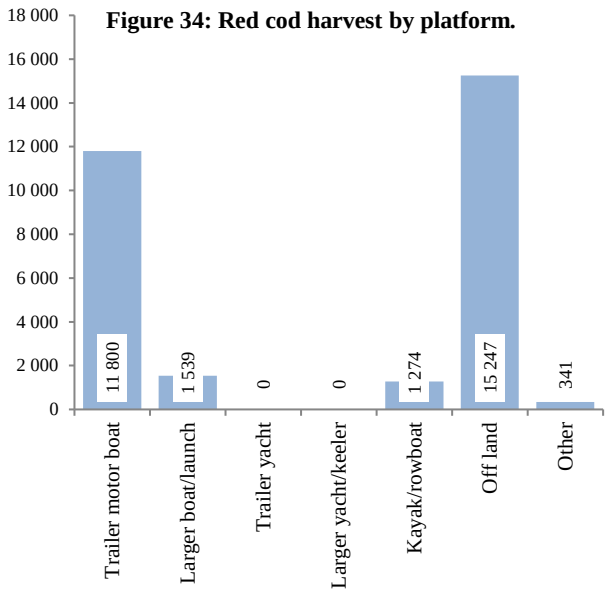


Table 62: Red cod bag size by QMA (row percent).

	Bag Size													
QMA	<1	1	2	3	4	5	6	7	8	9	10	11	12	13+
1	0.0	68.0	24.4	4.0	0.0	0.0	0.0	0.0	0.0	0.0	3.6	0.0	0.0	0.0
2	10.8	39.5	23.4	13.5	4.4	1.6	0.9	3.2	0.0	0.0	0.5	0.0	1.2	1.0
3	1.4	59.1	20.0	8.4	11.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
7	14.8	38.9	26.8	14.2	3.4	0.0	1.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TOTAL	8.0	46.8	23.1	11.5	5.5	0.9	0.7	1.8	0.0	0.0	0.6	0.0	0.6	0.5

9.12 Red gurnard

The total estimated harvest for red gurnard for the 2017–18 fishing year was 360 059 fish, or 194.8 tonnes (Table 63). Red gurnard was caught across the five QMA areas, but mainly in GUR 1 (top of the North Island) where 46.9% of red gurnard were harvested. Most red gurnard (89.8%) were caught using a rod and line (Figure 35) and mostly by boat (Figure 36). Only 9.9% were taken from land. Bag sizes were generally low (Table 64), and a bag of one fish was most common (42.6% of bags).

Table 63: Red gurnard harvest by fishstock.

QMA.GUR	Fishers (n)	Events (n)	Harvest (n)	CV	Mean Weight (kg)	Harvest (tonnes)	CV
1	366	734	168 798	0.14	0.51	85.75	0.15
2	79	237	71 702	0.28	0.54	38.98	0.28
3	14	17	3 486	0.39	0.49	1.70	0.39
7	112	242	60 759	0.18	0.62	37.59	0.18
8	98	260	55 314	0.19	0.56	30.79	0.19
TOTAL	656	1 490	360 059	0.10	0.54	194.81	0.10

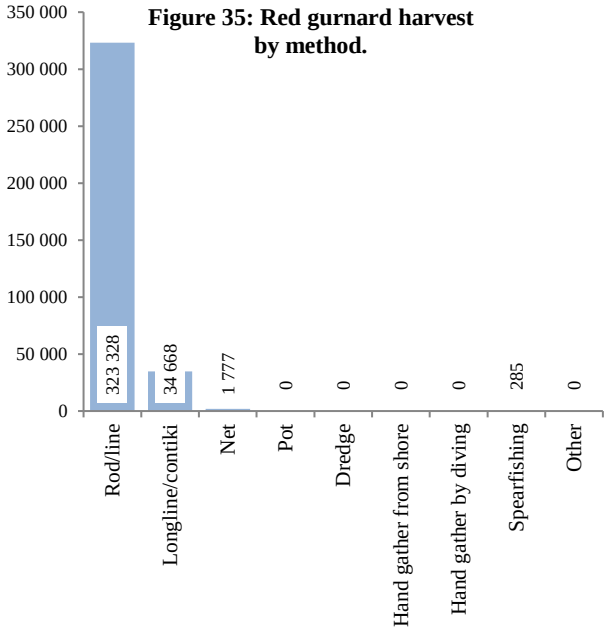


Figure 35: Red gurnard harvest by method.

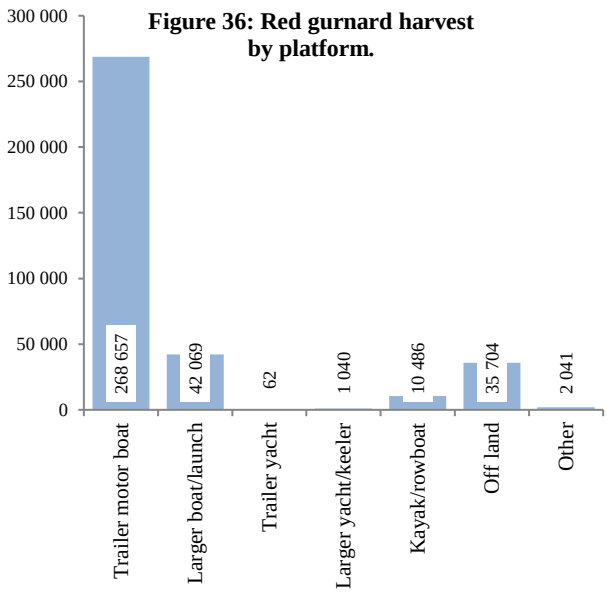


Figure 36: Red gurnard harvest by platform.

Table 64: Red gurnard bag size by QMA (row percent).

	Bag Size													
QMA	<1	1	2	3	4	5	6	7	8	9	10	11	12	13+
1	4.3	48.5	23.4	8.2	5.5	3.5	4.2	1.4	0.3	0.3	0.1	0.0	0.1	0.1
2	1.5	32.2	15.9	13.7	10.7	7.7	5.1	3.5	2.9	0.4	3.7	0.0	0.8	2.0
3	0.0	39.1	24.8	27.3	5.0	0.0	0.0	0.0	0.0	0.0	0.0	3.7	0.0	0.0
7	0.9	40.6	28.2	11.8	5.8	3.0	1.2	1.2	1.5	1.0	0.7	1.2	0.6	2.3
8	14.2	32.7	22.0	11.3	8.1	2.1	2.7	1.6	2.4	0.3	1.1	0.3	0.7	0.6
TOTAL	4.8	42.6	22.9	10.2	6.7	3.8	3.6	1.7	1.1	0.4	0.9	0.3	0.4	0.8

9.13 Scallop

The total estimated harvest for scallops for the 2017–18 fishing year was 561 592 scallops, or 62.1 tonnes (greenweight) (Table 65). There are many QMAs for this species, but 93% of the harvest occurred in just two (60% in the Coromandel fishery, SCA CS, and 33% in Northland, SCA 1). Note that SCA 7 was closed for scallop fishing throughout this survey. Harvest in this survey year was mainly by hand gathering (Figure 37) (83.5%) with 10.9% taken from the land (Figure 38). Bag sizes were variable (Table 66) but 57.3% of bags included the legal limit of 20 scallops.

Table 65: Scallop harvest by fishstock.

QMA.SCA	Fishers (n)	Events (n)	Harvest (n)	CV	Mean Weight (kg)	Harvest (tonnes)	CV
1	32	76	183 105	0.26	0.11	20.46	0.26
1A	0	0	0	-	-	0.00	-
2A	3	3	5 252	0.62	0.11	0.58	0.62
3	0	0	0	-	-	0.00	-
5	1	1	921	1.00	0.11	0.10	1.00
7	0	0	0	-	-	0.00	-
7A	0	0	0	-	-	0.00	-
7B	0	0	0	-	-	0.00	-
7C	0	0	0	-	-	0.00	-
8A	0	0	0	-	-	0.00	-
9A	11	18	34 147	0.46	0.11	3.76	0.46
CS	72	151	338 167	0.18	0.11	37.23	0.18
TOTAL	117	249	561 592	0.14	0.11	62.13	0.14

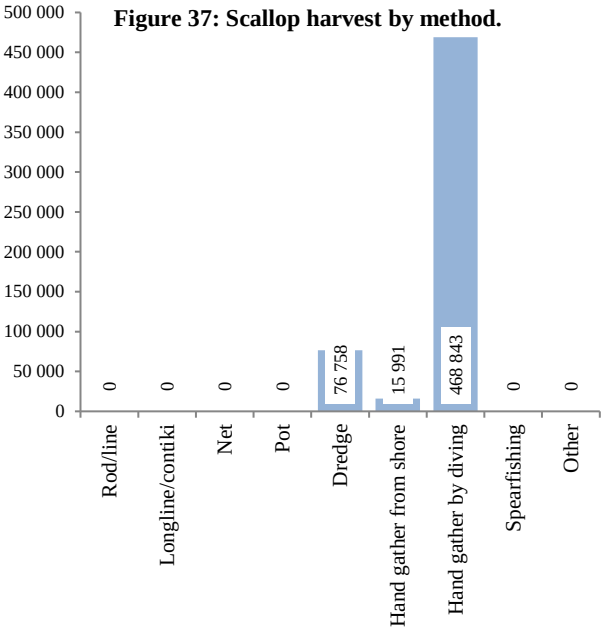


Figure 37: Scallop harvest by method.

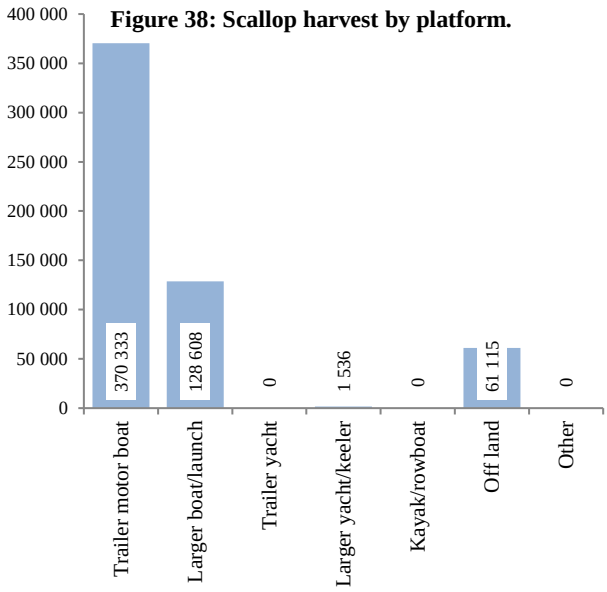


Figure 38: Scallop harvest by platform.

Table 66: Scallop bag size by QMA (Row Percent).

	Bag Size												
QMA	<1 to 4	5 to 9	10	11 to 14	15 to 19	20	21 to 24	25 to 29	30	31 to 39	40	41 to 49	50+
1	2.1	9.8	2.5	3.6	5.4	64.0	0.7	0.0	1.6	0.0	5.7	0.0	4.7
1A	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2A	0.0	0.0	0.0	0.0	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5	0.0	0.0	0.0	0.0	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
7A	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
7B	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
7C	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
8A	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
9A	2.3	22.9	2.3	12.3	6.3	48.9	0.0	0.0	4.8	0.0	0.0	0.0	0.0
CS	6.1	7.5	2.4	4.3	10.9	54.0	0.9	3.4	0.3	0.4	6.5	0.0	3.2
TOTAL	4.5	9.3	2.4	4.7	8.7	57.3	0.8	2.0	1.0	0.2	5.7	0.0	3.4

9.14 Sea perch

The total estimated harvest for sea perch for the 2017–18 fishing year was 116 948 fish, or 62.7 tonnes (Table 67). Sea perch were taken most frequently in southern QMAs. Over half of the harvest (57.9%) was taken from SPE 3, the east coast of the South Island. Almost all sea perch was taken by rod and line (Figure 39) and from a boat (Figure 40). Over half (55%) was taken from trailer boats with most of the rest (40%) taken from larger boats/launches. Over half of bags (57%) were of four or fewer fish (Table 68).

Table 67: Sea perch harvest by fishstock.

QMA.SPE	Fishers (n)	Events (n)	Harvest (n)	CV	Mean Weight (kg)	Harvest (tonnes)	CV
1	2	2	478	0.87	0.47	0.23	0.87
2	11	13	3 287	0.40	0.47	1.55	0.40
3	63	124	67 712	0.24	0.60	40.53	0.24
5	10	17	27 993	0.89	0.47	13.22	0.89
7	35	48	13 824	0.29	0.39	5.41	0.29
8	5	10	3 654	0.67	0.47	1.73	0.67
9	0	0	0	-	-	0.00	-
TOTAL	115	214	116 948	0.32	0.54	62.66	0.32

Figure 39: Sea perch harvest by method.

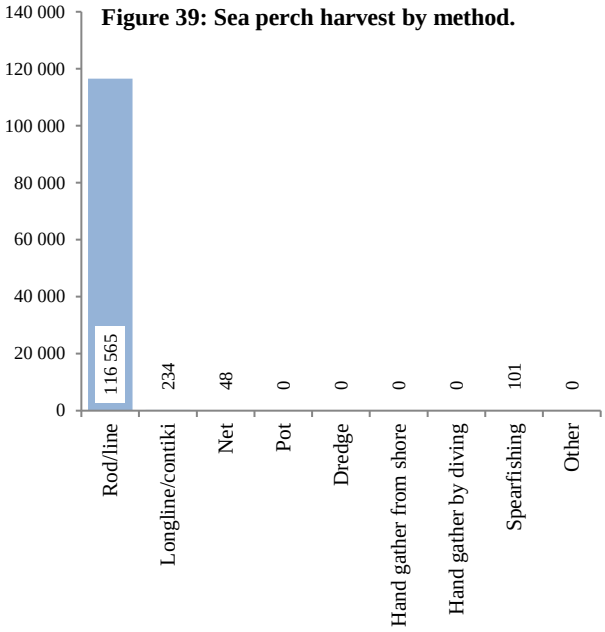


Figure 40: Sea perch harvest by platform.

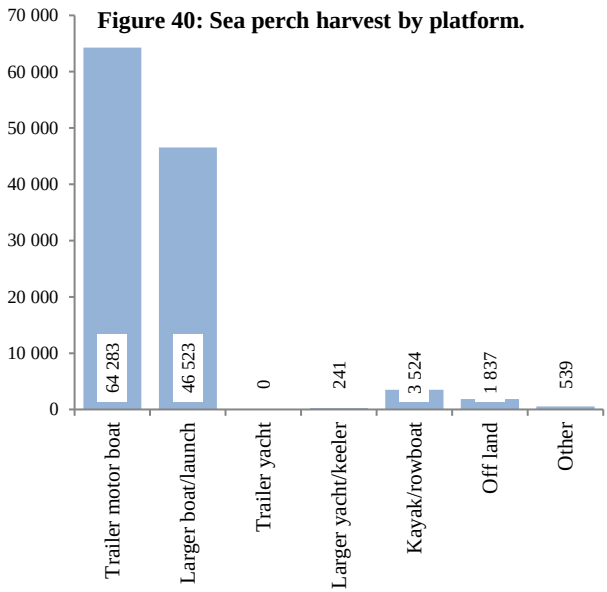


Table 68: Sea perch bag size by QMA (row percent).

	Bag Size													
QMA	<1	1	2	3	4	5	6	7	8	9	10	11	12	13+
1	0.0	32.3	0.0	67.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	8.2	0.0	43.8	27.1	4.6	10.7	3.4	0.0	2.1	0.0	0.0	0.0	0.0	0.0
3	0.0	12.5	16.1	8.1	7.2	5.9	7.6	5.7	2.9	0.4	14.5	3.4	1.7	14.0
5	0.0	4.5	31.9	3.4	0.0	1.7	5.8	0.0	0.0	0.0	0.0	2.9	0.0	49.8
7	0.0	34.3	20.5	20.5	1.3	8.0	2.2	0.0	10.3	0.0	0.0	0.0	2.8	0.0
8	0.0	14.4	4.2	53.8	13.1	0.0	0.0	0.0	0.0	0.0	14.4	0.0	0.0	0.0
9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TOTAL	0.5	16.4	19.9	14.8	5.0	5.8	5.4	3.0	4.1	0.2	8.3	2.1	1.6	12.9

9.15 Skipjack tuna

The total estimated harvest for skipjack tuna for the 2017–18 fishing year was 29 892 fish, or 53.8 tonnes (Table 69). There is only one QMA for this species so all this species is recorded as being from SKJ 1. Virtually all skipjack was taken by rod and line (Figure 41). Harvesting from larger boats was less common (Figure 42) this year with just 18% being taken from this platform compared with 38% in 2011–12. The bag size variation is quite wide (Table 70) but just one or two fish is the most common bag size (61%).

Table 69: Skipjack tuna harvest by fishstock.

QMA.SKJ	Fishers (n)	Events (n)	Harvest (n)	CV	Mean Weight (kg)	Harvest (tonnes)	CV
1	76	112	29 892	0.17	1.80	53.80	0.17
TOTAL	76	112	29 892	0.17	1.80	53.80	0.17

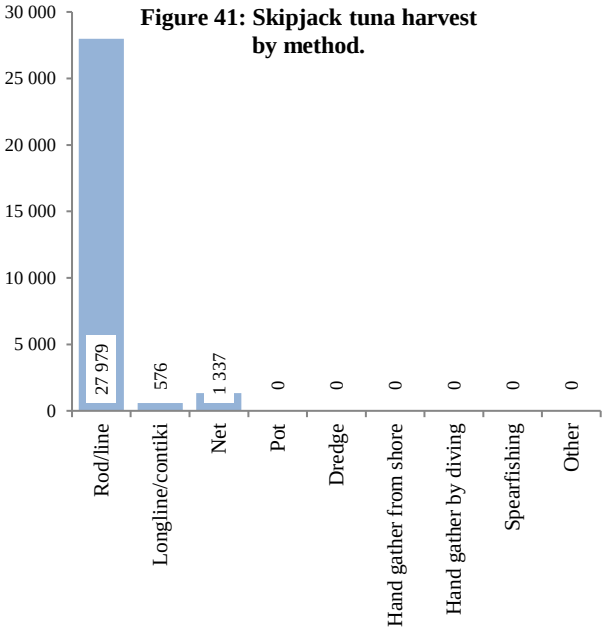


Figure 41: Skipjack tuna harvest by method.

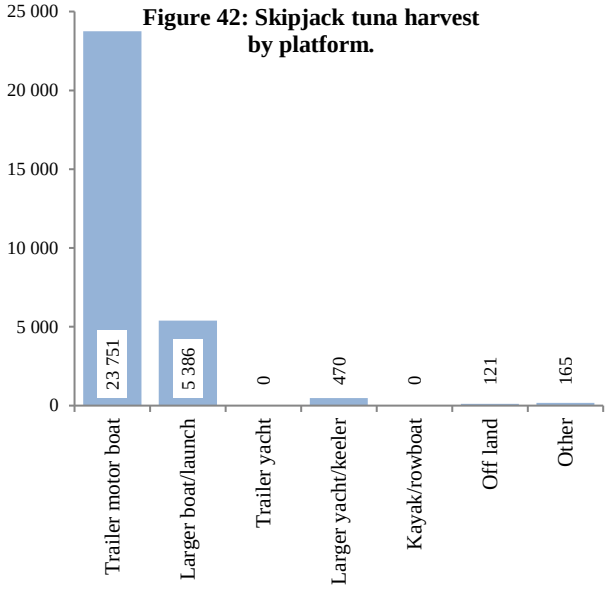


Figure 42: Skipjack tuna harvest by platform.

Table 70: Skipjack tuna bag size by QMA (row percent).

	Bag Size													
QMA	<1	1	2	3	4	5	6	7	8	9	10	11	12	13+
1	5.6	36.1	24.9	7.7	9.4	3.6	4.1	2.0	2.5	0.7	2.3	0.0	0.6	0.6
TOTAL	5.6	36.1	24.9	7.7	9.4	3.6	4.1	2.0	2.5	0.7	2.3	0.0	0.6	0.6

9.16 Snapper

The total estimated harvest for snapper, the most commonly taken finfish, for the 2017–18 fishing year was 3 496 711 fish, or 4 266.9 tonnes (Table 71). The bulk of this was harvested in SNA 1 where 2 601 267 fish or 74.4% of the snapper were taken. Snapper were almost exclusively caught by rod and line (94.6%) with just 5% being taken using the next most common method, longline/kontiki (Figure 43). Snapper were mainly caught from a trailer boat (67.6%) followed by larger boats/launches (16.1%), off land (12%) and from kayak/rowboat (3.4%) (Figure 44). Bag sizes were variable with about half of bags being three fish or fewer and half being four or more (Table 72).

Table 71: Snapper harvest by fishstock.

QMA.SNA	Fishers (n)	Events (n)	Harvest (n)	CV	Mean Weight (kg)	Harvest (tonnes)	CV
1	1 519	5 948	2 601 267	0.07	1.20	3 126.68	0.07
2	120	254	83 304	0.24	1.12	93.07	0.24
3	13	16	7 057	0.33	1.12	7.88	0.33
7	132	311	97 974	0.16	1.50	147.41	0.16
8	477	1 444	707 109	0.13	1.26	891.84	0.12
TOTAL	2 059	7 973	3 496 711	0.06	1.22	4 266.89	0.06

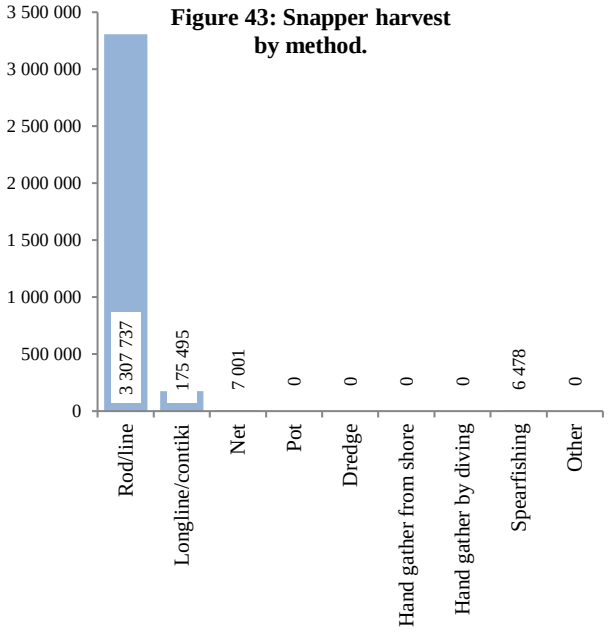


Figure 43: Snapper harvest by method.

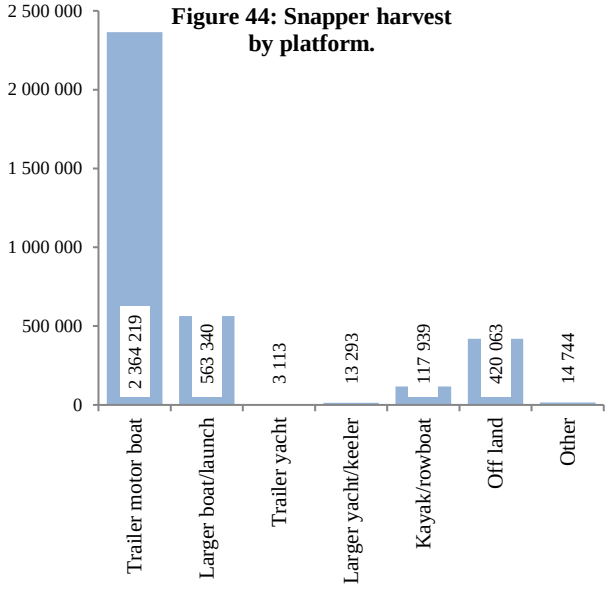


Figure 44: Snapper harvest by platform.

Table 72: Snapper bag size by QMA (row percent).

	Bag Size													
QMA	<1	1	2	3	4	5	6	7	8	9	10	11	12	13+
1	0.7	18.0	19.0	15.4	12.2	9.5	7.7	13.6	1.2	0.6	0.7	0.1	0.2	0.9
2	1.8	31.4	20.6	14.2	6.1	3.9	9.7	4.2	2.1	1.2	4.4	0.0	0.3	0.0
3	0.0	7.7	21.8	14.9	14.0	25.3	0.0	5.6	0.0	0.0	7.3	3.4	0.0	0.0
7	5.1	28.5	21.3	15.7	10.6	3.5	2.7	3.9	2.4	1.5	4.6	0.2	0.0	0.2
8	4.0	16.5	14.4	12.1	8.8	10.2	6.0	5.8	4.8	3.5	12.7	0.2	0.3	0.8
TOTAL	1.5	18.5	18.4	14.8	11.4	9.3	7.2	11.6	1.9	1.2	3.1	0.1	0.2	0.8

9.17 Tarakihi

The total estimated harvest for tarakihi for the 2017–18 fishing year was 302 990 fish, or 224.7 tonnes (Table 73). Nearly half of the tarakihi (48.9%) was harvested in TAR 2 which is the east and south coasts of the North Island. Next was TAR 1 (north of the North Island) where 24.2% of the fish were taken. Almost all tarakihi was taken by rod and line (Figure 45) and most from a trailer boat (76%) with a large boat the next most common platform (18.6%) (Figure 46). The range of bag sizes was quite large, but about half of bags (48.2%) were of one or two fish (Table 74).

Table 73: Tarakihi harvest by fishstock.

QMA.TAR	Fishers (n)	Events (n)	Harvest (n)	CV	Mean Weight (kg)	Harvest (tonnes)	CV
1	158	239	73 289	0.14	0.85	62.23	0.14
2	105	281	148 159	0.22	0.74	110.23	0.22
3	21	35	6 622	0.32	0.78	5.18	0.32
5	15	29	5 545	0.35	0.78	4.34	0.35
7	67	117	31 668	0.18	0.65	20.57	0.18
8	46	101	37 706	0.29	0.59	22.11	0.29
TOTAL	390	802	302 990	0.12	0.74	224.66	0.12

Figure 45: Tarakihi harvest by method.

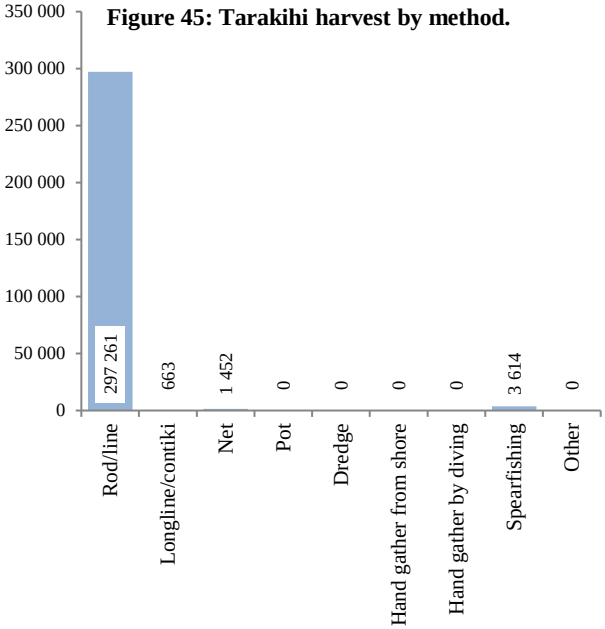


Figure 46: Tarakihi harvest by platform.

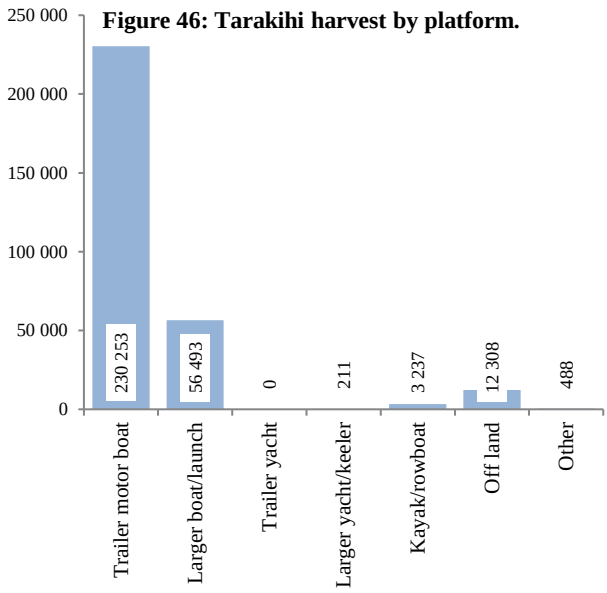


Table 74: Tarakihi bag size by QMA (row percent).

	Bag Size													
QMA	<1	1	2	3	4	5	6	7	8	9	10	11	12	13+
1	0.7	40.7	16.6	9.2	6.5	6.0	7.0	4.4	1.6	1.0	1.8	0.3	1.6	2.7
2	0.5	11.4	15.5	12.5	11.3	10.5	5.7	5.0	5.0	1.5	9.0	0.2	3.7	8.3
3	0.0	51.0	25.0	10.4	11.4	0.5	0.0	0.0	0.0	0.0	1.7	0.0	0.0	0.0
5	0.0	35.4	32.5	8.3	21.4	0.0	0.0	0.0	0.0	0.0	0.0	2.4	0.0	0.0
7	0.6	47.9	21.7	10.6	2.8	0.5	3.7	6.2	3.3	0.5	0.4	0.0	0.2	1.6
8	0.0	25.8	15.9	12.9	5.1	9.3	7.8	1.1	4.0	4.9	5.4	0.0	4.4	3.3
TOTAL	0.5	30.3	17.9	11.0	8.1	6.6	5.6	4.2	3.2	1.5	4.4	0.2	2.3	4.3

9.18 Trevally

The total estimated harvest for trevally for the 2017–18 fishing year was 138 185 fish, or 210.2 tonnes (Table 75). There are only four QMAs for trevally and 68.8% of trevally is taken from TRE 1 (north east coast of the North Island). Almost all the catch was by rod and line (97%) (Figure 47). Although most trevally was caught from a boat, an appreciable number (22.3%) was caught off land (Figure 48). Bag sizes for trevally were small, with 60% of bags being just one fish (Table 76).

Table 75: Trevally harvest by fishstock.

QMA.TRE	Fishers (n)	Events (n)	Harvest (n)	CV	Mean Weight (kg)	Harvest (tonnes)	CV
1	323	508	95 097	0.09	1.31	124.69	0.09
2	42	73	10 988	0.24	1.54	16.97	0.24
3	3	3	221	0.59	1.35	0.30	0.59
7	114	192	31 879	0.17	2.14	68.31	0.17
TOTAL	464	776	138 185	0.08	1.52	210.28	0.08

Figure 47: Trevally harvest by method.

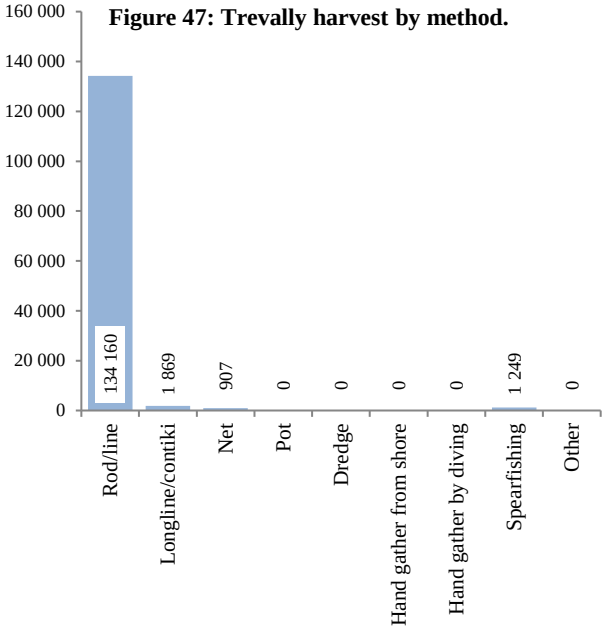


Figure 48: Trevally harvest by platform.

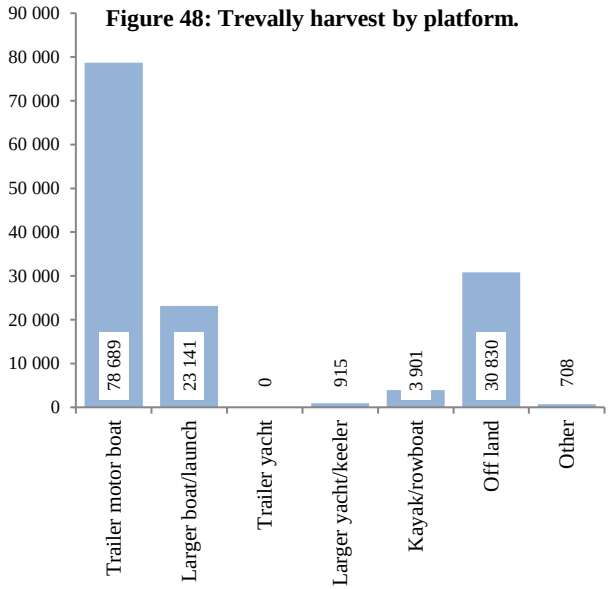


Table 76: Trevally bag size by QMA (row percent).

	Bag Size													
QMA	<1	1	2	3	4	5	6	7	8	9	10	11	12	13+
1	1.0	58.3	24.9	8.4	3.6	1.6	1.3	0.1	0.8	0.1	0.0	0.0	0.0	0.0
2	0.0	60.1	28.2	3.8	4.1	3.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6
3	0.0	80.8	19.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
7	0.8	63.3	30.3	1.6	1.2	0.0	1.0	1.8	0.0	0.0	0.0	0.0	0.0	0.0
TOTAL	0.9	59.8	26.5	6.3	3.0	1.3	1.1	0.5	0.5	0.1	0.0	0.0	0.0	0.0

10. DISCUSSION

This National Panel Survey of Marine Recreational Fishers 2017–2018 was effectively a repeat of the original survey conceived and developed from 2010 onwards and first conducted for the 2011–12 New Zealand fishing year. The methods were largely unchanged to allow direct comparisons between the two surveys. The current assumption is that this method will be applied every five or so years to estimate recreational marine harvest, the method being too expensive to implement annually.

After the completion and analysis of the 2011–12 survey, the harvest estimates were compared with those from independent contemporaneous on-site methods (Edwards & Hartill 2015) who concluded that '*the recreational harvest estimates provided by three independent surveys in 2011–12 are reasonably accurate and fit for management purposes*'. The methods and outputs were also considered in 2013 by two international experts in the estimation of recreational harvest who concluded that the NPS survey was '*well designed and implemented and appears to have produced statistically reliable information about harvest levels of most key fish stocks … a strong framework for repeat surveys*'. A retrospective evaluation was also conducted by the National Research Bureau which was included in the harvest estimate report (Wynne-Jones et al. 2014). Much of what was written about the approach then is still pertinent but is not revisited here. However, some further comment is made on some key changes that have occurred between the surveys because these give important context for understanding the results and when considering use of the survey techniques in the future.

Although there were some recruitment challenges, and attrition in 2017–18 was somewhat higher than in 2011–12, the survey was successfully run over the course of an entire fishing year, and data were successfully gathered and analysed for the bulk of the 6975 fishers enrolled in the survey. This of course is only possible with the assistance of the fishing public and reasonable acceptance of the often repetitive methods of canvasing people's fishing efforts and recording any fishing activity. Also, pending detailed analysis (project MAF 2018–01, results expected mid-2019), the harvest estimates for major fish stocks appear to be close to those generated by independent contemporaneous on-site methods in FMA 1 (project MAF2016–01, Hartill et al. 2019).

The following comments about issues encountered in 2017 are not intended to detract from the success of the survey but rather to facilitate its continued success in the future.

Section 3.3 of this report discusses actual versus expected sample yield. During the process of screening and recruitment, a lower than expected number of sampled homes with fishers was encountered. In 2011 the incidence was 32% and in 2017 about 28%. This had several ramifications for the 2017–18 survey.

A first ramification is that there appears to be a lower engagement in marine fishing in New Zealand in 2017–18 compared with 2011–12. If corroborated by other research, this would have proportionate implications on projected marine harvest and thus management of the fishing resources.

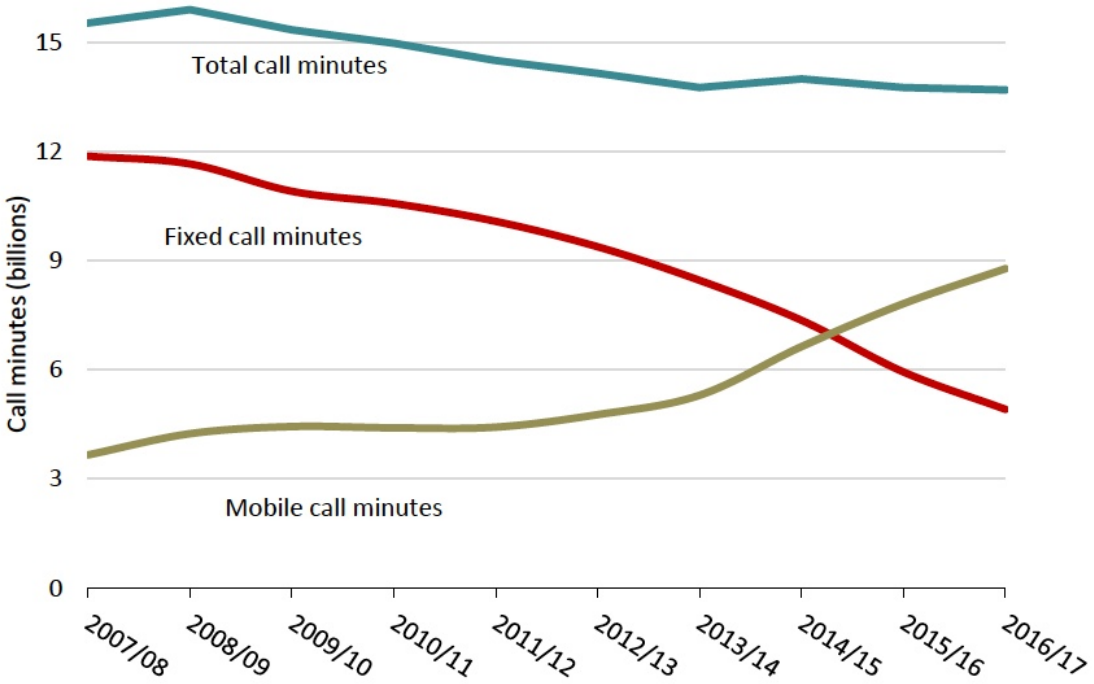
Second, although the survey covered 10% more meshblocks than in 2011–12 and a booster sample was added during recruitment (screening a further 16 houses in each of 106 of the largest meshblocks), the final sample size was 6 975 panellists rather than the planned 7 700. The expected benefits of increasing the sample size over the 2011–12 survey, such as improving error estimates, could not be realised.

If another repeat of the NPS is contemplated, any changes at that time in the incidence of fishing homes should be considered in the survey design. This could involve a pilot survey to estimate the incidence of fishing homes (and an estimate of levels of agreement to participate), or a structured plan to iteratively increase the number of homes screened during recruitment to provide the desired sample sizes. In the evaluation section of the 2011–12 report the idea of surveying all fishers in a sampled home was raised and perhaps this could be revisited to improve the economy and coverage of the survey approach (noting that fishers within households are correlated so precision does not increase proportionately with the number of fishers enrolled).

Another major finding of the 2017–18 NPS relates to the data gathering method, and in particular, reliance on the telephone to obtain fishing details. There are many advantages in telephone interviewing, and this includes improved response rates (not relying on self-motivated self-completion), and fidelity of response (the idea that a person is less likely to misinform or shortcut replies when talking to a real person).

But in the 2017–18 NPS, conducted a full six years since the last NPS, there was discovered a new issue with interviewing by telephone, and that is the phenomenon of reducing use of landlines.

Landlines should have wide usage in New Zealand because, unlike many other countries, we have 'free local calling' and in recent time the cost of landline plans has plummeted (from around $44 per month to about $10). This, however, has not stopped the population migrating to mobile phones, most of which are multi function smartphones. The advent of fibre to homes and popularity of 'naked broadband' (data without a voice line) also reduces the perceived need for a landline. Figure 49, taken from the 2017 Annual Telecommunications Monitoring Report by the Commerce Commission, shows a substantial reduction in the use of landlines in New Zealand and an increase in calling by mobile phone.



Source: Annual Telecommunications Monitoring Report. 2017 Key Facts (Commerce Commission New Zealand 2017)

Figure 49: Mobile calling overtakes fixed calling.

The move to mobile phones and dropping landline usage is also evident in the contact details provided by interviews in the 2011–12 and 2017–18 surveys (Table 77). In 2017–18, a much higher proportion of contacts were 'mobile only' compared with 2011–12.

Table 77: Telephone numbers obtained in two waves of the NPS.

	2017–18 NPS	2011–12 NPS
Landline only	509	707
Mobile only	4 128	1 502
Both landline and mobile	2 300	4 743
Neither	38	61
TOTAL	6 975	7 013

This very large reduction in the number of landline numbers provided by participants does not necessarily mean that they don't have a landline, it may simply mean that they have a preference for communication on their mobile.

In either event, the end result is that the survey interviewers were often faced with a task of telephoning mobile phones, rather than landlines, and there are some important differences. Most mobile phones have 'caller ID' and the users can more easily decide whether or not to answer a call from a number they don't recognise. Mobile phones can also be switched off, have a flat battery, be left on the charger or in the car or in a handbag etc. The result is that many more calls have to be made to achieve an interview when ringing a mobile phone and the rate of unsuccessful contacts is much higher than for landlines.

The ongoing move to mobile phones and away from landlines clearly has implications for future repeats of this type of survey, and some of the methods used during the NPS (e.g. prompting by text message) may have diminishing effectiveness in the future.

11. ACKNOWLEDGEMENTS

The survey involved gathering fishing information from panellists over an entire year. Despite some measure of automation now available (such as the CATI and SMS systems), there was still the on-going task of interviewing the many fishers to verify any fishing and determine a myriad of catch details. We would like to thank the NRB interviewers who tirelessly carried out this work.

We would also like to express our appreciation to the members of the public who agreed to participate in this survey, most of whom stayed in contact with us for the entire year-long survey. Thank you very much for your texts and allowing our interviewers to grill you about the details of your fishing. This survey would not be possible without your support and efforts for which we are most grateful. We trust you take some pleasure from knowing that your contributions are invaluable in informing the sustainable management of New Zealand's fisheries in the years to come.

This work was funded by Fisheries New Zealand under project MAF2016-01.

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APPENDIX 1: SURVEY INFORMATION BROCHURE

INFORMATION ABOUT THE MARINE FISHER AND NON-FISHER SURVEY

What's The Purpose Of The Survey?

The survey aims to establish the recreational marine fish and shellfish harvest in New Zealand. To do this, we need to measure how many people do (and don't) fish for recreation or food in the sea or saltwater estuaries, and what they catch.

What Kind Of Fishing?

Any saltwater (marine) fishing, for finfish, shellfish, crayfish or any other marine species. It includes any method of fishing like rod, line, hand gathering, spearing, netting or diving. It is about recreational fishing only, not commercial.

What If I Never Fish Or Have Given It Up?

We need a balance of people who don't fish at all, or only fish once in a while, as well as people who fish often.

What Do I Have To Do?

It's very easy. We just phone or text you to ask if you have been fishing. You just need to reply YES or NO to the text messages. All texts to us are **FREE**. Any phone interview about your fishing is very short - usually less than 6 minutes.

What Do You Ask Me If I Have Fished?

Only basic information about your fishing. We ask how often you fished, whether or not you caught anything, what species, and what method was used. We need to establish what you **'personally caught'** for our calculations. Please exclude the catch of others in your boat or group.

Will You Ask About My Best Fishing Spots?

No. The survey asks only for very big areas. For example, "Bay of Islands" or "Marlborough Sounds".

What If I Didn't Catch Anything?

It's very important for you to let us know this as it helps us get a true picture of fishing in New Zealand.

Will It Help The Survey If I Fish More Often, Or Less Often?

Please just do what is natural and usual for you.

Who Is Behind This Survey?

The Marine Fisher and Non-Fisher Survey is initiated and sponsored by the Ministry for Primary Industries. It is being conducted by an independent research agency (NRB Ltd) over 2017 and 2018.

Is My Privacy Protected?

Yes. Your name and contact details are used only for the survey. They are not passed on to any other party nor used for any other purpose. The survey conforms to the 1993 New Zealand Privacy Act.

How Do I Find Out More About This Survey?

If you have web access and wish to find out more about this survey, how to identify marine species, or detail of the fishing areas used in the survey go to **www.nrb.co.nz/fishingsurvey.php**. Otherwise please email fish@nrb.co.nz. Or phone 9am-5pm weekdays on 09 630 0655 or 0800 672 476.

nrb

Ministry for Primary Industries
Manatū Ahu Matua

FISH IDENTIFICATION CHART
Popular Marine Species

Blue Cod

Blue Maomao

Blue Mokih

Butterfis (G eenbone)

Elephant Fish

Garfis (R per)

Hapuku (Groper)

John Dory

Kahawaih

Kingfis

Koheru

Lemon Sole

Red Cod

Red Gurnard

Red Moki

Sand Flounder

Sea Perch (Jock Stewart, Scarpie)

Snapper

Trevally

Trumpeter

C

FISH IDENTIFICATION CHART
Sometimes Confusing Species

Bluenose

Warehou

Barracbuta

Gemfis

Blue Mackerel (Slimy/English)

Jack Mackerel

Yellow Eyed Mullet (herring)

Grey Mullet

Albacore Tuna

Skipjack Tuna (Bonito)

Tarakihi

Porae

School Shark (Tope, Flake)

Rig (Spotted Dogfis)

Spiny Dogfis (Bruno)

Red Rock Lobster (Crayfis, Spiny lobster)

Packhorse Lobster (Green)

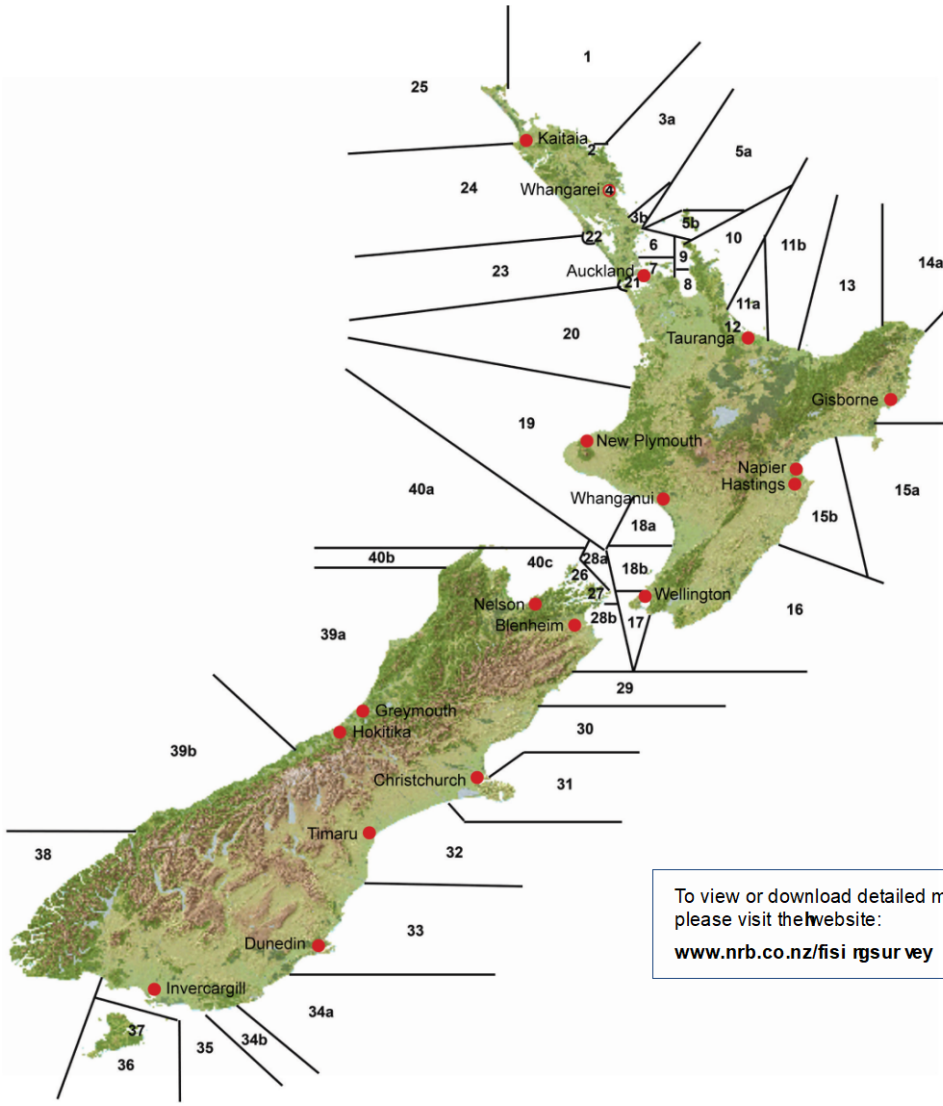
Spanish Lobster

Ordinary Paua / Yellow Foot Paua / Virgin Paua

Pipi

Tuatua

RECREATIONAL FISHING AREAS



To view or download detailed maps, please visit the website:

www.nrb.co.nz/fisi rgsur vey .php

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2 Bay of Islands
3a Cape Brett to Te Arai Point
3b Te Arai Point to Cape Rodney
4 Whangarei Harbour & entrance
5a North of Barrier Islands
5b Barrier Islands
6 Western Hauraki Gulf
7 Inner Hauraki Gulf
8 Firth of Thames
9 Eastern Hauraki Gulf
10 Eastern Coromandel
11a Northern Bay of Plenty
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12 Tauranga Harbour & entrances
13 Eastern Bay of Plenty
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16 Cape Turnagain to Turakirae Head
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24 West of Northland
25 Reef Point to North Cape
26 Marlborough Sounds
27 Queen Charlotte Sound & Tory Channel
28a Stephen Is to Tory Channel excl. sounds
28b Tory Channel to Clarence River
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30 Conway River to Sumner Beach
31 Sumner Beach to Rakaia River
32 Rakaia River to Waitaki River
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40b Cape Farewell to Kahurangi Point
40c Golden Bay and Tasman Bay

APPENDIX 2: NRB FISHING SURVEY WEBSITE CONTENT

NATIONAL RESEARCH BUREAU LTD

Home | Company Pro-le | Site Plan | Contact us | Job Opportunities

- Nationwide Surveys
- Central Government Research
- Local Government Research
- Customer Satisfaction
- Brand & Positioning Studies
- Advertising Research
- Focus Group Research
- Online Research
- Fieldwork Services
- Fishing Survey

MARINE FISHER AND NON-FISHER SURVEY
Information For Participants

Thank you for participating in the 2017/2018 Marine Fisher and Non-Fisher Survey. Your efforts in replying to our survey, and your accurate reporting, are very appreciated!!

Surveying recreational fishers catch (in addition to commercial fishers) is vital to the assessment of the stock of fish and other marine life in New Zealand. The information is used to better understand the situation of different species in our waters, and to help in the sustainable management of our fisheries.

The survey is all about the general public's recreational fishing in New Zealand's coastal waters and runs from October 2017 to the end of September 2018. As a survey participant, we are most interested to find out if you went fishing (any method at all) in any given week, and if you did, what was caught. We are also interested to hear if you didn't go fishing, because this is how we build a statistical picture of our fisheries. We are surveying very avid fishers, people who fish infrequently and some who usually don't fish at all. Everyone's answers are equally important to us.

About Prizes

We hope those invited into this survey will stay in it because they realize it is a much needed piece of research for the benefit of recreational marine fishers! However there are also random spot prizes to encourage you and thank you for your ongoing participation. This includes weekly draws (wine case or Fitbit Activity Tracker) and several major prizes for either an iPad Pro or a Samsung Galaxy Tab S3. We notify all winners and also post their names here: **FishingSurveySpotPrizes**

How often we contact you

How often we contact you, whether by text or by phone, depends on how frequently you go fishing. If you are a regular fisher, we plan to contact you weekly, but fortnightly in the winter. We do this so any fishing is fresh in your mind! We contact less regular fishers less often.

If you feel you are being contacted too frequently, or not often enough for the amount of fishing you are doing, let our telephone interviewers know this, and they will adjust how often we contact you. You can also email us about this at fish@nrb.co.nz.

About Texting

If we have asked you to text reply to us, please do this, as it is quick and easy for both you and us. All texts to us are FREE. When you get a text request to ask if you went fishing during a specified period, you simply reply YES if you did go fishing, or NO if you didn't. You don't need to add any other information because we ring for any further details we need. If you would like to stop us texting to you, just text STOP or tell us if/when we ring you.

It would be helpful if you could reply promptly to text requests. This is because we need to process all the replies weekly and follow up some with a phone call. Please try to text back to us either straight away (usually Sunday night), or at least before 11am on the following Monday morning. If you text later than this we can't use that information. But don't worry if you are out of range, or you occasionally forget. We will find out about any missed period at a later stage.

About Telephone Interviews

Any telephone interviews with you will be very brief and to the point. We do hope you take the trouble to allow us to catch up with you - we promise to be as quick as possible! If you have any preferred times you would like us to call, please let our interviewers know. They will log this and adjust our calling time to suit.

Memory Jogger

Some people like to write down their fishing to help them remember. Click **Download Memory Jogger** if you would like a handy form to print off. However it is not essential. We will contact you frequently so your memory of recent fishing or not is fresh. If you would like us to post you the form, just email fish@nrb.co.nz or ring 0800 672 476.

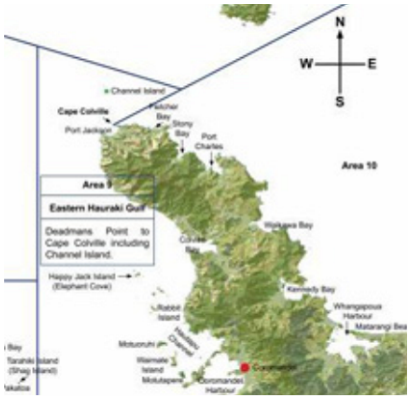
Identifying Species You Have Caught

Some people will catch species they do not recognise, or they may just want to check. When we first contacted you we will have given you a pamphlet with a few images of marine species to help you (it also has a map of the general fishing areas). For an online copy click **Download Fishing Survey Pamphlet**. You can also email or ring as for another copy if you wish.

If you wish to find out more about fish species, the web is pretty useful. Here is a site which is particularly good.

United Fisheries (has over 60 species)
http://www.unitedfisheries.co.nz/content/albacore-tuna-thunnus-alalunga

Fishing Areas



Actually you don't need to know too much about the areas you have fished in. Our interviewers will talk through it with you when/if they ring. We just need to place you in general areas. We don't need to find out your exact fishing spots and certainly won't tell others about them! If you are interested to find out more about the areas we use for this survey click **Download Fishing Survey Area Maps**.

Further Information

Please feel free to contact us at fish@nrb.co.nz or ring 0800 672 476.

APPENDIX 3: WORD VERSION OF CATI FISHING INTERVIEW

RECREATIONAL FISHING SURVEY QUESTIONS
(Word version of CATI)

ID
Respondent ID [6 digits: 4***** PSU digits and 2 house number digits – done automatically by CATI system]

WhichTelNo
Which telephone number did you use?
ⓘ If you have clicked the wrong button to come here, enter <Ctrl–Shift–Home> to return to the Respondent screen.
❍ 1. Home phone
❍ 2. Work phone
❍ 3. The mobile number

Intro1 [This intro used for those who have texted YES last week **and** those from non-texting groups]
Hello <INSERT RESPONDENTS NAME>. It's <INTERVIEWER'S NAME> from the Recreational Marine Fishing Survey.

<IF A YES TEXT RECEIVED>Thanks for your text saying you'd been fishing.

I'm calling to log your fishing activities into the study database.

❍ 1. Continue
[Go to FishYN]

Intro2 [This intro used for those who were supposed to text – but nothing received on time last week]
Hello <INSERT RESPONDENTS NAME>. It's <INTERVIEWER'S NAME> from the Recreational Marine Fishing Survey. I'm calling to log your fishing activities into the study database.

We didn't seem to get a text from you. Can I ask if you have changed your cell phone number, or if there is anything else you need to know about the texting procedure?
ⓘ If respondent says all ok, then select option 4.
ⓘ If respondent wants to opt out of the survey, then click on the 'refused' tab above.
ⓘ If respondent is unsure of the texting procedure say 'When you get our text asking if you have been fishing for a period, what you need to do is text a YES if you have been fishing, even if you didn't catch anything, or you text NO if you haven't been fishing in that period. You need to text before 10am on the Monday so we can get the text on time.'

❍ 1. Changed number
❍ 2. Said they did not receive the text from NRB
❍ 3. Don't wish to receive any more texts from NRB
❍ 4. Number not changed

[If 1 go to NewCellPhone, If 2 go to ConfirmCellPhone, If 3 go to NoMoreTexts. If 4 go to FishYN],

ConfirmCellPhone [If answered 2 at Intro2]
Can I confirm your cell phone number is <INSERT CELL PHONE NUMBER>?
❍ 1. Yes
❍ 5. No [note Using 1 and 5 for yes/no answers is a protocol to reduce key stroke error]

[If 1 go to Go to FishYN. If 5 go to NewCellPhone]

NewCellPhone [If answered 1 at Intro2]
What is your cell phone number?

[Go to FishYN]

NoMoreTexts [If answered 3 at Intro2]
That's fine, I'll just set it up so that you don't get any more texts and we phone you each time instead.

ⓘ If they change their mind and still want to text, go back to previous question and change answer.
ⓘ If respondent wants to opt out of the survey click on the 'refused' tab above.
❍ 1. Continue

FishYN
[If only last weeks fishing outstanding go to SingleWeekYN. If multiple periods to record go to MultiWeekYN]

SingleWeekYN [If only last weeks fishing outstanding]
Can I <INSERT 'confirm' IF YES TEXT RECEIVED OR 'ask if' IF OTHERWISE> you went fishing during the period Monday <INSERT DATE> to Sunday <INSERT DATE>? We are interested in any method of fishing including rod fishing, diving, gathering or trapping any marine species – and regardless of whether anything was caught or not. Remember, its salt water fishing only, whether recreational or customary – but no commercial! ⓘ DO NOT include any fresh water fishing but DO include estuary fishing.

❍ 1. Yes
❍ 5. No

[If 1 go to D1. If 5 terminate]

MultiWeekYN [If multiple periods to record] [Program only show periods yet to be resolved]
We've got a few periods where we don't know about your fishing. I wonder if you could help us with that.

We are interested in any method of fishing including rod fishing, diving, gathering or trapping any marine species – and regardless of whether anything was caught or not. Remember, its salt water fishing only, whether recreational or customary – but no commercial!
READ OUT EACH PERIOD IN TURN AND ASK IF THEY FISHED AT ALL FOR THAT PERIOD. ANSWER YES OR NO FOR EACH PERIOD

ⓘ Please take enough time for the respondent to consider and answer for each period. It is fine if they need to consult a calendar or wish to discuss with you what they did at the time to help with memory.
ⓘ DO NOT include any fresh water fishing but DO include estuary fishing.

Week 1.	Monday 26th September to Sunday 2nd October 2011	❍ Yes ❍ No ❍ D/K
Week 2.	Monday 3rd October to Sunday 9th	❍ Yes ❍ No ❍ D/K
Week 3.	Monday 10th October to Sunday 16th October	❍ Yes ❍ No ❍ D/K
Week 4.	Monday 17th October to Sunday 23rd October	❍ Yes ❍ No ❍ D/K
Week 5.	Monday 24th October to Sunday 30th October	❍ Yes ❍ No ❍ D/K
Week 6.	Monday 31st October to Sunday 6th November	❍ Yes ❍ No ❍ D/K
Week 7.	Monday 7th November to Sunday 13th November	❍ Yes ❍ No ❍ D/K
Week 8.	Monday 14th November to Sunday 20th November	❍ Yes ❍ No ❍ D/K
Week 9.	Monday 21st November to Sunday 27th November	❍ Yes ❍ No ❍ D/K
Week 10.	Monday 28th November to Sunday 4th December	❍ Yes ❍ No ❍ D/K
Week 11.	Monday 5th December to Sunday 11th December	❍ Yes ❍ No ❍ D/K
Week 12.	Monday 12th December to Sunday 18th December	❍ Yes ❍ No ❍ D/K
Week 13.	Monday 19th December to Sunday 25th December	❍ Yes ❍ No ❍ D/K
Week 14.	Monday 26th December to Sunday 1st January 2012	❍ Yes ❍ No ❍ D/K
Week 15.	Monday 2nd January to Sunday 8th January	❍ Yes ❍ No ❍ D/K

Week 16. Monday 9th January to Sunday 15th January ❍ Yes ❍ No ❍ D/K
Week 17. Monday 16th January to Sunday 22nd January ❍ Yes ❍ No ❍ D/K
Week 18 Monday 23rd January to Sunday 29th January ❍ Yes ❍ No ❍ D/K
Week 19. Monday 30th January to Sunday 5th February ❍ Yes ❍ No ❍ D/K
Week 20. Monday 6th February to Sunday 12th February ❍ Yes ❍ No ❍ D/K
Week 21. Monday 13th February to Sunday 19th February ❍ Yes ❍ No ❍ D/K
Week 22. Monday 20th February to Sunday 26th February ❍ Yes ❍ No ❍ D/K
Week 23. Monday 27th February to Sunday 4th March ❍ Yes ❍ No ❍ D/K
Week 24. Monday 5th March to Sunday 11th March ❍ Yes ❍ No ❍ D/K
Week 25. Monday 12th March to Sunday 18th March ❍ Yes ❍ No ❍ D/K
Week 26. Monday 19th March to Sunday 25th March ❍ Yes ❍ No ❍ D/K
Week 27. Monday 26th March to Sunday 1st April ❍ Yes ❍ No ❍ D/K
Week 28. Monday 2nd April to Sunday 8th April ❍ Yes ❍ No ❍ D/K
Week 29. Monday 9th April to Sunday 15th April ❍ Yes ❍ No ❍ D/K
Week 30. Monday 16th April to Sunday 22nd April ❍ Yes ❍ No ❍ D/K
Week 31. Monday 23rd April to Sunday 29th April ❍ Yes ❍ No ❍ D/K
Week 32. Monday 30th April to Sunday 6th May ❍ Yes ❍ No ❍ D/K
Week 33. Monday 7th May to Sunday 13th May ❍ Yes ❍ No ❍ D/K
Week 34. Monday 14th May to Sunday 20th May ❍ Yes ❍ No ❍ D/K
Week 35. Monday 21st May to Sunday 27th May ❍ Yes ❍ No ❍ D/K
Week 36. Monday 28th May to Sunday 3rd June ❍ Yes ❍ No ❍ D/K
Week 37. Monday 4th June to Sunday 10th June ❍ Yes ❍ No ❍ D/K
Week 38 Monday 11th June to Sunday 17th June ❍ Yes ❍ No ❍ D/K
Week 39. Monday 18th June to Sunday 24th June ❍ Yes ❍ No ❍ D/K
Week 40. Monday 25th June to Sunday 1st July ❍ Yes ❍ No ❍ D/K
Week 41. Monday 2nd July to Sunday 8th July ❍ Yes ❍ No ❍ D/K
Week 42. Monday 9th July to Sunday 15th July ❍ Yes ❍ No ❍ D/K
Week 43. Monday 16th July to Sunday 22nd July ❍ Yes ❍ No ❍ D/K
Week 44. Monday 23rd July to Sunday 29th July ❍ Yes ❍ No ❍ D/K
Week 45. Monday 30th July to Sunday 5th August ❍ Yes ❍ No ❍ D/K
Week 46. Monday 6th August to Sunday 12th August ❍ Yes ❍ No ❍ D/K
Week 47. Monday 13th August to Sunday 19th August ❍ Yes ❍ No ❍ D/K
Week 48. Monday 20th August to Sunday 26th August ❍ Yes ❍ No ❍ D/K
Week 49. Monday 27th August to Sunday 2nd September ❍ Yes ❍ No ❍ D/K
Week 50. Monday 3rd September to Sunday 9th September ❍ Yes ❍ No ❍ D/K
Week 51. Monday 10th September to Sunday 16th September ❍ Yes ❍ No ❍ D/K
Week 52. Monday 17th September to Sunday 23rd September ❍ Yes ❍ No ❍ D/K
Week 53. Monday 24th September to Sunday 30th September ❍ Yes ❍ No ❍ D/K

[Programmer note: Open 'FISHING DETAILS INTERVIEW' for each week in which fishing was done]

FISHING DETAILS INTERVIEW

D1
Considering only the period from Monday <INSERT DATE> to Sunday <INSERT DATE>, on which of these days did you fish, dive, gather or trap marine species – regardless of whether you caught anything or not?

ⓘ If only laying out pots or nets, do not count as a day – its only the harvesting day that counts
ⓘ Multiple answers permitted

❑ 1. Monday <DATE> [Up to 7 days allowed]
❑ 2. Tuesday <DATE>
❑ 3. Wednesday <DATE>
❑ 4. Thursday <DATE>
❑ 5. Friday <DATE>
❑ 6. Saturday <DATE>
❑ 7. Sunday <DATE> etc.

D2
Did any of your fishing activities include: a paid trip with a skipper of a charter boat?

ⓘ If a boat is hired or chartered without a hired skipper then select 'no'.

❍ 1. Yes
❍ 5. No
[If 'No', no further questions are asked about charter fishing]

D3
Did any of your fishing activities include: fishing with a customary permit or authorisation?

❍ 1. Yes
❍ 5. No
[If 'No', no further questions are asked about customary fishing]

D4
Did any of your fishing catch include: a personal allowance from a commercial catch?

❍ 1. Yes
❍ 5. No
[If 'No', no further questions are asked about personal allowance from a commercial catch]

T1
Thinking of <INSERT FIRST DAY AND DATE>. If we say a 'trip' is **each time you went out and fished** – how many separate trips did you make on that day? [Up to 5 trips allowed]

==> <day and date> [Note: running reminders help the interviewer follow which period etc. that is being asked about]

[ ]

P1
Thinking of your first trip. Which of these did you fish from?

ⓘ Read out answer options
ⓘ If diving, it's the platform used to launch from
ⓘ Multiple answers permitted

==> <day and date> ==> Trip (1 of <number of trips>)…

❑ 1. Trailer motor boat
❑ 2. Larger motor boat or launch
❑ 3. Trailer yacht
❑ 4. Larger yacht or keeler
❑ 5. Kayak, canoe, or rowboat
❑ 6. Off land, including beach, rocks or jetty
❑ 7. Other

P1a [Only asked if answered 'Other' at P1]
Please describe what you did your fishing from?

==> <day and date> ==> Trip (1 of <number of trips>)…

[ ]

P2 [Only asked if answered 'Yes' at D2]
Was that a paid trip with a charter operator and a skipper?

==> <day and date> ==> Trip (1 of x)…

❍ 1. Yes
❍ 5. No

P3[1] [Only asked if answered '1 to 5' at P1]
Which of these did you launch from when you were fishing from the <INSERT BOAT TYPE FROM P1>?
ⓘ Read out answer options

==> <day and date> ==> Trip (1 of <number of trips>) ==> Platform: <boat type> …

❍ 1. Ramp
❍ 2. Marina
❍ 3. Mooring
❍ 4. Beach
❍ 5. Jetty or wharf
❍ 6. Anchorage
❍ 9. Other

P3b [Only asked if answered 1 at P3]
What was the name of that ramp?

P3a [Only asked if answered 'Other' at P3]
Please describe where you did your fishing from?

==> <day and date> ==> Trip (1 of <number of trips>) ==> Platform: <boat type> …

L1
Thinking of when you were fishing from the <INSERT PLATFORM FROM P1>, What was the nearest city or township to where you were fishing?
ⓘ If necessary say 'fishing includes diving, gathering or trapping any marine species.'
ⓘ If multiple towns/cities type in up to three.

==> <day <day and date> ==> Trip (1 of <number of trips>) ==> Platform: <boat type> ==>

L2
And what was the nearest land point to where you were fishing?
ⓘ If you need to give guidance say 'well some examples are Simpson Point or Karaka Island or Waihi Beach'.
ⓘ If multiple land points type in up to three.

==> <day <day and date> ==> Trip (1 of <number of trips>) ==> Platform: <boat type> ==>

L3

I have to place your fishing in a specific area or areas. I have a map, but can you please help me work out which general area or areas you were fishing in? This is even if nothing was caught.

ⓘ USE YOUR MAPS!

ⓘ Interviewer to dialogue with respondents to identify the area/s fished.

ⓘ Multiple answers permitted

==> <day and date> ==> Trip (1 of <number of trips>) ==> Platform: <boat type> ==> zone <zone>

- ❑ 1. North Cape to Cape Brett
- ❑ 2. Bay of Islands
- ❑ 3a. Cape Brett to Te Arai Point
- ❑ 3b. Te Arai Point to Cape Rodney
- ❑ 4. Whangarei Harbour & entrance
- ❑ 5a. North of Barrier Islands
- ❑ 5b. Barrier Islands
- ❑ 6. Western Hauraki Gulf
- ❑ 7. Inner Hauraki Gulf
- ❑ 8. Firth of Thames
- ❑ 9. Eastern Hauraki Gulf
- ❑ 10. Eastern Coromandel
- ❑ 11a. Northern Bay of Plenty
- ❑ 11b. Middle Bay of Plenty
- ❑ 12. Tauranga Harbour & entrance
- ❑ 13. Eastern Bay of Plenty
- ❑ 14a. East Cape – Northern
- ❑ 14b. East Cape – Southern
- ❑ 15a. Hawke Bay – Northern
- ❑ 15b. Hawke Bay – Southern
- ❑ 16. Cape Turnagain to Turakirae Head
- ❑ 17. Turakirae Head to Titahi Bay
- ❑ 18a. Waitotara River to Manawatu River
- ❑ 18b. Manawatu River to Titahi Bay
- ❑ 19. Waitotara River to Tirua Point
- ❑ 20. Tirua Point to entrance area of Manukau
- ❑ 21. Manukau Harbour and entrance
- ❑ 22. Kaipara Harbour and entrance
- ❑ 23. Manukau Entrance to the Kaipara Entrance
- ❑ 24. West of Northland
- ❑ 25. Reef Point to North Cape
- ❑ 26. Marlborough Sounds
- ❑ 27. Queen Charlotte Sound & Tory Channel
- ❑ 28a. Stephen Is Tory Channel excl. sounds
- ❑ 28b. Tory Channel to Clarence River
- ❑ 29. Clarence River to Conway Rivers
- ❑ 30. Conway River to Sumner Beach
- ❑ 31. Sumner Beach to Rakaia River
- ❑ 32. Rakaia River to Waitaki River
- ❑ 33. Waitaki River to Tokomairiro River
- ❑ 34a. Tokomairiro River to Long Point
- ❑ 34b. Long Point to Slope Point
- ❑ 35. Slope Point to Te Waewae Inlet
- ❑ 36. Stewart Island, Ruapuke Island & surrounds
- ❑ 37. Patterson Inlet on Stewart Island
- ❑ 38. South West of the South Island
- ❑ 39a. North West of the South Island
- ❑ 39b. West of the South Island
- ❑ 40a. North of the South Island
- ❑ 40b. Cape Farewell to Kahurangi Point
- ❑ 40c. Golden Bay and Tasman Bay
- ❑ 41. Unknown (Interviewer can't establish zone)

M1
Thinking of when you were fishing in <INSERT ZONE>, which fishing method of methods did you use?

ⓘ Read out answer options, as needed
ⓘ Multiple answers permitted

==> <day <day and date> ==> Trip (1 of <number of trips>) ==> Platform: <boat type> ==> zone <zone>

❑ 1. Rod or line (not long line)
❑ 2. Long–line including set line, kontiki or kite
❑ 3. Net (not including landing net used if caught on line)
❑ 4. Pot (eg. for crayfish)
❑ 5. Dredge, grapple or rake
❑ 6. Hand gather or floundering from shore
❑ 7. Hand gather by diving
❑ 8. Spearfishing
❑ 9. Other

[Soft error check: If 2, 4 or 5 at M1 and 6 at P1 (land platform) say 'Are you sure – platform was land/beach/rocks/jetty']

M1a [Only asked if answered 'Other' at M1]
Can you please describe this 'other' method?

==> <day <day and date> ==> Trip (1 of <number of trips>) ==> Platform: <boat type> ==> zone <zone>

M1b [Only asked if answered '7' at M1]
When you were hand gathering by diving, was that…

ⓘ Read out answer options

==> <day <day and date> ==> Trip (1 of <number of trips>) ==> Platform: <boat type> ==> zone <zone>

❍ 1. Scuba diving
❍ 2. Snorkelling
❍ 3. Neither
❍ 4. Both

M1c [Only asked if answered '8' at M1]
When you were spearfishing, was that…

ⓘ Read out answer options

==> <day <day and date> ==> Trip (1 of <number of trips>) ==> Platform: <boat type> ==> zone <zone>

❍ 1. Scuba diving
❍ 2. Snorkelling
❍ 3. Neither
❍ 4. Both

M2 [Only asked if answered 'Yes' at D3]
Just to confirm, on that occasion were you recreational fishing, or fishing with a customary permit or authorisation?

==> <day <day and date> ==> Trip (1 of <number of trips>) ==> Platform: <boat type> ==> zone <zone>

❍ 1. Recreational / amateur
❍ 2. Customary permit or authorisation
❍ 3. Other

M3 [Only asked if answered '2' at M2]
Would you know what type? Would it be a customary authorisation under the kaimoana or South Island regulations… a customary permit… or something else?

ⓘ A customary permit is issued under Regulation 27 of the Fisheries Amateur Fishing Regs – hui, tangi.

==> <day <day and date> ==> Trip (1 of <number of trips>) ==> Platform: <boat type> ==> zone <zone>

❍ 1. Customary kaimoana or SI authorisation
❍ 2. Customary permit
❍ 3. Something else

M4 [Only asked if answered 'Other' at M2 or 'Something else' at M3]
Can you please tell me more about that?

==> <day <day and date> ==> Trip (1 of <number of trips>) ==> Platform: <boat type> ==> zone <zone>

C1a [ASKED OF ROD AND SPEAR FISHERS]
Thinking of when you were <INSERT FISHING METHOD>, including fish used for bait, which of these describes what happened with your **own** fishing?
ⓘ Read out all three answer options slowly!!
ⓘ If even one fish or other marine species was caught and kept by the fishing method, answer 3. This is even if others were discarded.

==> <day <day and date> ==> Trip (1 of <number of trips>) ==> Platform: <boat type> ==> zone <zone> ==> <method>

❍ 1. You yourself didn't catch or gather anything
❍ 2. You yourself caught something, but you released them all
❍ 3. You yourself caught something that you didn't release

C1b [ASKED FOR ALL OTHER METHODS]
Thinking of when you were <INSERT FISHING METHOD>, including fish used for bait, which of these describes your fishing?
ⓘ Read out all three answer options slowly!!
ⓘ If even one fish or other marine species was caught and kept by the fishing method, answer 3. This is even if others were discarded.

==> <day <day and date> ==> Trip (1 of <number of trips>) ==> Platform: <boat type> ==> zone <zone> ==> <method>
❍ 1. You didn't catch or gather anything
❍ 2. You caught or gathered something, but you released or discarded them all
❍ 3. You caught or gathered something that you didn't release or discard

C2

Including bait, what species did you [IF ROD OR SPEARFISHER: yourself] catch [If 2 AT C1: and release]. [IF ANSWERED 3 AT C1:] Please only include those species where at least one was kept.]

ⓘ If R says 'Yellowtail' ask if they mean Kingfish, Koheru or Jack Mackerel ⓘ Multiple answers permitted!

==> <day <day and date> ==> Trip (1 of <number of trips>) ==> Platform: <boat type> ==> zone <zone> ==> <method>

Fin Fish [Soft error check: if a named fin fish AND method = 'handgather by diving', then say 'Are you sure, method = handgather by diving?]

❑ 1. Barracouta
❑ 2. Blue Maomao
❑ 3. Blue Moki (If red, put under 'Other fish)
❑ 4. Bluenose
❑ 5. Butterfish (Greenbone)
❑ 6. Cod – Blue (always check if red or blue cod)
❑ 7. Cod – Red (if not red/blue, put under 'Other fish')
❑ 8. Flounder, Sole or other flatfish
❑ 9. Garfish (Piper)
❑ 10. Gemfish
❑ 11. Groper (Hapuku/Bass)
❑ 12. Gurnard – Red
❑ 13. John Dory
❑ 14. Kahawai
❑ 15. Koheru
❑ 16. Kingfish (Yellowtail)
❑ 17. Mackerel – Blue/Slimy/English
❑ 18. Mackerel – Jack Mackerel
❑ 19. Mullet – Yellow Eyed/Herring
❑ 20. Mullet – Grey (if not yellow eyed/grey, put under 'Other Fish')
❑ 21. Porae (Big Lips) (not Parore! Check)
❑ 22. Pilchard (Sardine, Sprat)
❑ 23. Sea perch (Jock Stewart, Scarpie)
❑ 24. Shark – Spiny Dogfish (Bruno)
❑ 25. Shark – Rig (Spotted Dogfish)
❑ 26. Shark – School shark (Tope)
❑ 27. Snapper
❑ 28. Stingray – any kind incl. Skate
❑ 29. Tarakihi
❑ 30. Trevally
❑ 31. Trumpeter
❑ 32. Tuna – Skipjack (Bonito)
❑ 33. Tuna – Albacore
❑ 34. Other fish 1 (specify)
❑ 35. Other fish 2 (specify)
❑ 36. Other fish 3 (specify)
❑ 37. Other fish 4 (specify)
❑ 38. Other fish 5 (specify)

Other Marine Species

❑ 39. Cockles
❑ 40. Crayfish/Lobster – Spanish
❑ 41. Crayfish/Lobster – Spiny/Red (most common)
❑ 42. Crayfish/Lobster – Packhorse/Green
❑ 43. Kina
❑ 44. Mussel – any but not Horse Mussel
❑ 45. Oyster – any type
❑ 46. Paua – ordinary
❑ 47. Paua – Yellow Foot
❑ 48. Pipi
❑ 49. Scallops

❑ 50. Squid – any kind
❑ 51. Tuatua
❑ 52. Other marine species 1 (specify)
❑ 53. Other marine species 2 (specify)
❑ 54. Other marine species 3 (specify)
❑ 55. Other marine species 4 (specify)

C2a1 [Only asked if there is 'Other' fin fish]
Please specify the other fin fish

==> <day <day and date> ==> Trip (1 of <number of trips>) ==> Platform: <boat type> ==> zone <zone> ==> <method>

C2b1
Please specify the other marine species [Only asked if there is 'Other' marine species]

==> <day <day and date> ==> Trip (1 of <number of trips>) ==> Platform: <boat type> ==> zone <zone> ==> <method>

C4 [Asked for each species caught OR where fish released only]
[IF 3 AT C1 AND ROD OR SPEAR FISHING METHOD:] **Remembering that's only the ones you yourself caught – not the group catch.** [All:] How many did you catch? [IF 3 AT C1:] and not release?

ⓘ If other than rod or spear fishing and R is not sure of his personal total, then record the number for the group
ⓘ If R gives a round number eg. 10, 20, 30 ask 'Is that the exact number caught, or just a rounded number' and probe for an exact number if necessary. [Round number checking]

==> <day <day and date> ==> Trip (1 of <number of trips>) ==> Platform: <boat type> ==> zone <zone> ==> <method> ==> fish <species>

[Note program allows '0'!]
[Soft error check: If a Rod or spear fisher AND a named fin fish (1–36) AND C4>10 say: 'Can I check again this was your own catch and not [IF BOAT (1–5 at P1):] the boat catch [OTHERWISE:] a group catch?']

[Questions from C5 onwards are not asked for fish released]

C5 [Only asked if answered 'Yes' at D4]
Were these part of a personal allowance from a commercial catch?

==> <day <day and date> ==> Trip (1 of <number of trips>) ==> Platform: <boat type> ==> zone <zone> ==> <method> ==> fish <species>

❍ 1. Yes
❍ 5. No

C5b [Only asked if answered 'Yes' at C5]
Was that in accordance with a 'general approval' or a 'particular approval'?

ⓘ If it helps: 'Those are the two different kinds of approval under section 111 of the Fisheries Act I believe. If you don't know which, just tell me that.'

==> <day <day and date> ==> Trip (1 of <number of trips>) ==> Platform: <boat type> ==> zone <zone> ==> <method> ==> fish <species>

❍ 1. General
❍ 2. Particular
❍ 3. Other
❍ 4. Not sure / Don't know

DIVISION OF GROUP CATCH

C6 [Only asked for methods other than spear fishing & rod fishing]
Was anyone else, apart from you, active in catching the <INSERT NUMBER OF THAT SPECIES> <INSERT NAME OF THAT SPECIES>?

==> <day <day and date> ==> Trip (1 of <number of trips>) ==> Platform: <boat type> ==> zone <zone> ==> <method> ==> fish <species>

❍ 1. Yes
❍ 5. No [Back to next fish/method/platform etc or finish if no more]

C7
How many people were active, in catching that including yourself? [Only asked if answered yes at C6]

==> <day <day and date> ==> Trip (1 of <number of trips>) ==> Platform: <boat type> ==> zone <zone> ==> <method> ==> fish <species>

[ ]

C8
So, would it be correct to say your personal catch was <INSERT CALCULATED NUMBER OF SPECIES DIVIDED BY HOW MANY PEOPLE INVOLVED> [Note could be a fraction eg. 6 fish and 5 people = 1.2 fish personally caught]

❍ 1. Yes [Back to next fish/method/platform etc or finish if no more]
❍ 5. No

C9
Could you please tell me how many of those <SPECIES> you see as your personal catch?

==> <day <day and date> ==> Trip (1 of <number of trips>) ==> Platform: <boat type> ==> zone <zone> ==> <method> ==> fish <species>

[ ]

C10
Could you give a brief reason why your personal catch was different from the average?

==> <day <day and date> ==> Trip (1 of <number of trips>) ==> Platform: <boat type> ==> zone <zone> ==> <method> ==> fish <species>

[ ]

OTHER ROUTING NOTES

This CATI programs routes according to answers given. It works in a 'tree' structure, progressing down each unresolved 'branch' in turn. Eg:

- For each day, the program asks details of each trip.
- For each trip the program asks details of each platform.
- For each platform the program asks details of each method.
- For each method the program asks if: 1) Nothing was caught or gathered 2) Caught and all released or discarded 3) Fish or other species were caught and not discarded or released
- For each method where something was caught, the program asks for details on species caught.

End