Fisheries New Zealand

Tini a Tangaroa

# Mean weight estimates for recreational fisheries in 2022–23

New Zealand Fisheries Assessment Report 2024/28

N.K. Davey,
K.S. Johnson,
J.Q. Maggs

ISSN 1179-5352 (online)
ISBN 978-1-991308-00-9 (online)

**July 2024**

Te Kāwanatanga o Aotearoa
New Zealand Government

## Disclaimer



Requests for further copies should be directed to:

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

Email: Fisheries-Science.Editor@mpi.govt.nz
Telephone: 0800 00 83 33

This publication is also available on the Ministry for Primary Industries websites at:
http://www.mpi.govt.nz/news-and-resources/publications
http://fs.fish.govt.nz go to Document library/Research reports



Please cite this report as:

Davey, N.K.; Johnson, K.S; Maggs, J.Q. (2024). Mean weight estimates for recreational fisheries in 2022–23. *New Zealand Fisheries Assessment Report 2024/28.* 39 p.

**TABLE OF CONTENTS**

**Plain language summary**

Recreational fishers are not required to report fish caught so surveys need to be conducted to obtain estimates of recreational catch.

This report describes a study where the lengths of fish caught in the recreational fishery were measured from many locations around New Zealand.

These surveys were conducted at boat ramps on good weather days where the traffic was highest.

Fish lengths were converted into weights using known published length-weight relationships.

An annual or seasonal average weight estimate was provided for all quota stocks of interest to recreational fisheries.

These estimates were provided to the concurrent running National Panel Survey to produce harvest estimates for the whole country.

## EXECUTIVE SUMMARY

**Davey, N.K.[1]; Johnson, K.S.[1]; Maggs, J.Q.[1]; (2024). Mean weight estimates for recreational fisheries in 2022–23.**

*New Zealand Fisheries Assessment Report 2024/28.* **39 p.**

This report provides mean weight estimates for species commonly landed by recreational fishers from New Zealand stocks during the 2022–23 fishing year. Mean weight estimates are required by the concurrent national panel survey (NPS) to convert numbers of fish harvested by recreational fishers into harvest tonnage estimates. This survey repeats similar surveys conducted in 2011–12 and 2017–18.

Potential sources of catch data were identified at an early stage in the research planning. Species-specific length frequency data were available from other concurrent Fisheries New Zealand surveys of recreational fishers in Fishery Management Areas (FMAs) 1, 2, 7, 8, and 9. These included monitoring of recreational harvest of rock lobsters in FMA 1, and an ongoing creel survey of recreational fishers returning to key ramps overlooked by web cameras in FMAs 1, 2, 7, 8, and 9. Additionally, a dedicated creel survey was required to collect data for FMAs 1, 2, 3, 5, 7, 8, and 9, to provide coverage of recreational fisheries that were not surveyed by other programmes in the 2022–23 fishing year.

The collation of data from all sources provided a data set of 69 138 lengths for 87 species measured throughout New Zealand. A large proportion of these measurements were from snapper, but also blue cod, kahawai, red gurnard, rock lobster, tarakihi, and trevally. Published length-weight relationships were used to convert fish lengths into fish weights for quota managed species. From the converted weight data, mean fish weights were generated for each stock by season and for the whole year. Mean weights were also generated for each species, combining all the stocks. Mean weight estimates were also calculated by region for snapper, red gurnard, tarakihi, trevally and kahawai in FMA 1 and snapper in FMA 8.

The annual mean weight estimate for each stock was the preferred best estimate generally. However, previous programmes have found evidence of seasonal differences in the mean weights for some species commonly landed in the recreational fishery. Seasonal (summer/winter) mean weights were therefore compared using statistical t-tests. If seasonal differences were statistically significant, and if at least 50 measurements were available in each season, the seasonal mean weights were chosen as the best estimates. If fewer than 50 measurements were available in either season, the annual estimate was chosen regardless of the statistical difference. Likewise, if the annual estimate was based on fewer than 50 measurements, then the overall species mean weight was used as the best estimate for a given stock. This survey successfully provided mean weights estimates for all quota species of interest to recreational fisheries.

[1] National Institute of Water and Atmospheric Research Ltd (NIWA).

## 1. INTRODUCTION

New Zealand's marine fisheries are primarily managed based on harvest weight rather than the number of fish landed. Commercial fishers must report the tonnage of fish that they harvest from each fish stock whereas recreational fishers are not required to report their catch. As the recreational harvest from some fish stocks can be substantial, survey methods are required to provide estimates of recreational harvest tonnage.

Offsite survey methods such as the National Panel Survey (NPS) offer the only viable and cost-effective means of estimating the recreational harvest taken from New Zealand's varied and diverse inshore fisheries, as onsite methods such as creel surveys are costly at a national scale. Survey panellists are asked to report the number of fish that they caught rather than the weight of their catch. During a telephone diary survey in 1992–93, diarists were asked to report both the number of fish that they caught and to estimate the weight of each fish, but a comparison of weights reported by diarists with weights derived from an onsite creel survey has shown that diarists overestimate the size and hence the weight of the fish they retain (Ryan & Kilner 1994). Offsite surveys since then have relied on concurrent creel surveys to provide mean weight estimates which are used to convert offsite survey estimates of numbers of fish caught into recreational harvest tonnage estimates (Boyd & Gowing 2004, Hartill et al. 1998, Hartill & Davey 2015, Davey et al. 2019). As average fish weights of individual species can vary between fish stocks it is necessary to conduct onsite creel surveys throughout New Zealand. Similarly, average weight can vary by season, which it makes it necessary to survey throughout the year.

The two past national surveys of recreational fishers in New Zealand were the NPS conducted in 2011–12, and 2017–18 which provided recreational catch estimates for the 27 most caught fish (Wynne-Jones et al. 2014, Wynne-Jones et al. 2019). A recent 2022–23 NPS has been conducted (Heinemann & Gray in prep). The concurrent mean weight surveys provide mean weight estimates that can be used to convert estimates of numbers of fish caught by recreational fishers into harvest tonnage estimates that are more appropriate for fisheries management. Comparisons between the two previous surveys (Hartill & Davey 2015, Davey et al. 2019) and this survey will also be made here.

The overall objective of this project was to continue the implementation of an integrated amateur harvest estimation system by providing estimates of absolute total harvest on a stock basis to inform fisheries management. The specific objectives of this research project were: 1) to collate and collect length data describing amateur fisheries catch of key species throughout New Zealand; 2) to convert length data to weight data to inform estimation of the harvest of amateur fisheries; and 3) to collaborate with concurrent onsite and offsite survey projects to provide information to corroborate and, if possible, calibrate harvest estimates.

## 2. METHODS

Recreational harvest fish length measurements for commonly caught species were obtained from two sources (Figure 1):

- Concurrent creel surveys already scheduled for other purposes during the 2022–23 fishing year, in FMAs 1, 2, 7, 8, and 9.
- A creel survey of fishers returning to other boat ramps during the 2022–23 fishing year, that was conducted as part of this study, to provide further coverage of recreational fisheries in FMAs 1, 2, 3, 5, 7, 8, and 9.
- For red rock lobster, commercial logbook and commercial observer potting data collected during the summer of 2022–23 were included to improve coverage due to low numbers of lobster in the recreational creel data.

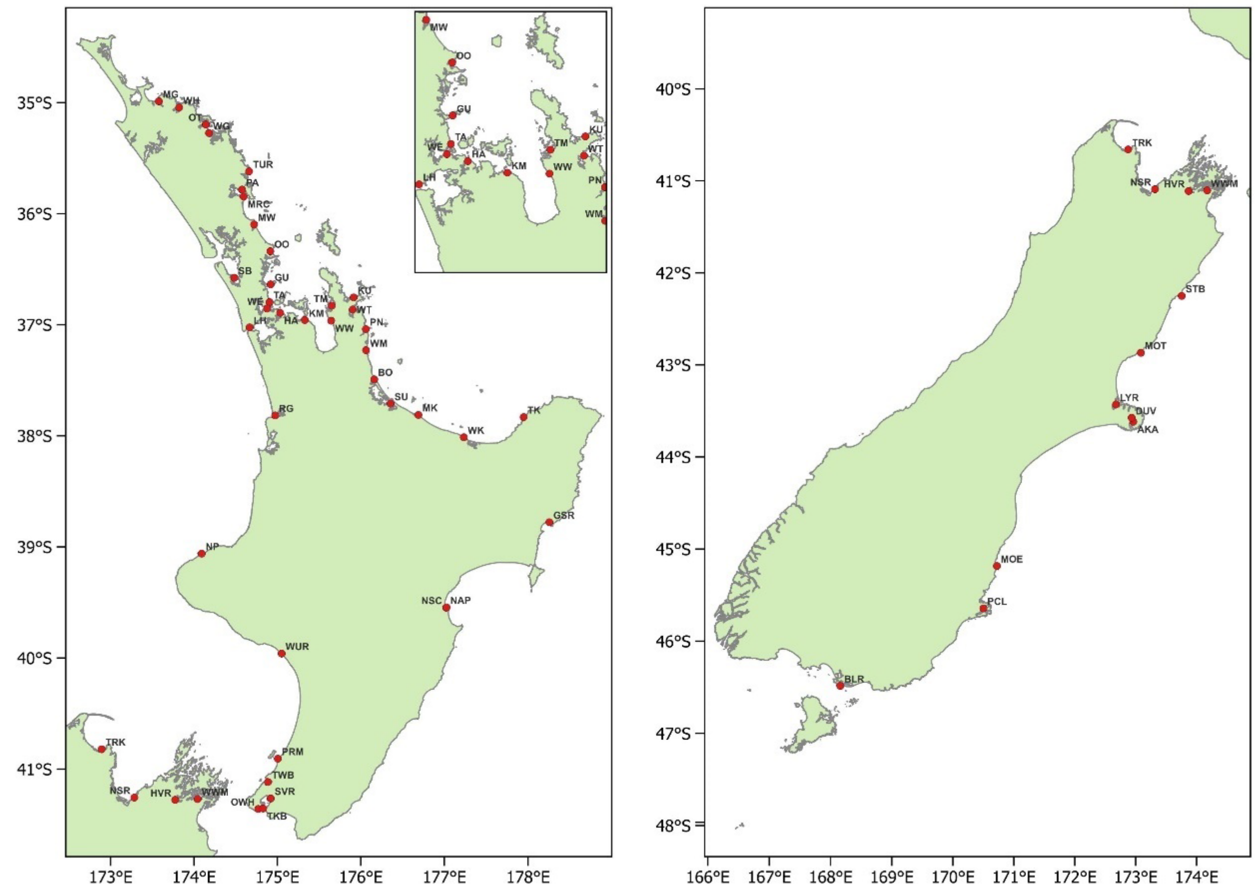



**Figure 1: Location of boat ramps where landed recreational catches were measured in 2022–23.**

## 2.1 Dedicated creel survey of recreational fishers in FMAs 1, 2, 3, 5, 7, 8, and 9.

A dedicated creel survey was required to collect fish length data for FMAs 1, 2, 3, 5, 7, 8, and 9 to provide additional coverage of recreational fisheries that were not going to be surveyed by other programmes scheduled for the 2022–23 fishing year. This augmented survey approach follows the methods used in 2011–12 (Hartill & Davey 2015) and 2018–19 (Davey et al. 2019).

The sampling methods used were designed to maximise the number of measurements obtained per interview hour, and sampling effort was therefore non-randomly allocated in space and time. Interviews were only conducted at the busiest ramps in each region (Figure 1). The selection of these ramps was based on both historical boat ramp interview data (which was limited in some areas) and conversations with others who had worked in these areas, such as fisheries officers. Interviews were conducted at boat ramps as these provide choke points through which relatively high volumes of traffic pass.

Interviews were conducted throughout the fishing year because seasonal differences in length frequency composition were found for some species in similar surveys in 1996 and in 2011–12 (Hartill et al. 1998, Hartill & Davey 2015). The season definitions used in the analysis of all data collected and collated as part of this programme are summer (1 October to 30 April) and winter (1 May to 30 September).

Interviewers were required to work primarily on weekends and public holidays, to maximise the likely potential number of fishers encountered. Midweek interviewing was only implemented if data was unable to be obtained on weekends (due to weather) and data collectors could assess that there were trailers present. This intermittent weekday sampling is unlikely to cause biased estimates of mean fish weight, as species specific comparisons of weekday and weekend length frequency data in 1996 found little apparent difference in mean size with respect to day type (Hartill et al. 1998). Three days were surveyed per month for the entire survey (winter and summer strata). Four-hour interview shifts were conducted on each survey day, with attempts to avoid consecutive days in the same weekend. Interviewers were asked to reschedule their survey to another weekend day in the same month if the weather forecast was unfavourable for fishing. When possible, we encouraged interviewers to reschedule their survey day when they found that no boat trailers were parked at their assigned ramp; however, this was not always possible.

The format of interviews conducted as part of this project and other concurrent recreational creel surveys followed that used in previous surveys over the last 30 years (e.g., Hartill et al. 1998, Hartill et al. 2007). As many fishing parties as possible were approached during each four-hour interview session and the interviewer was asked to select the next boat at random when there were too many boats to interview at any given time. Fishing parties were asked where they fished, for how long and by what methods, and who caught which fish. Individual fish were counted and then measured if time permitted. Finfish were measured to the nearest centimetre on a measuring board, but interviewers were also given a smaller measuring board to measure rock lobster tail widths (tail lengths for packhorse lobster) to the nearest millimetre.

## 2.2 Concurrent creel surveys of recreational fishers in FMAs 1, 2, 7, 8, and 9.

Species-specific length data were also available from concurrent surveys of recreational fishers conducted in FMAs 1, 2, 7, 8, and 9, for related purposes. These survey programmes were:

- An ongoing creel survey of recreational fishers returning to key ramps of which some sites are overlooked by web cameras in FMAs 1, 2, 7, 8, and 9 (Fisheries New Zealand project MAF2019-01). As part of this ongoing programme, digital camera systems are used to monitor changes in levels of recreational boating effort, alongside a creel survey that provides data used to estimate the proportion of boats that have been used for fishing, and the average catch per fishing boat. Some of these sites are now creel survey only having had the web cameras removed.
- The monitoring of recreational harvest of rock lobsters in CRA 1 and CRA 2 (Fisheries New Zealand projects MAF2022-05 and MAF2019-05). This also allowed fish length data to be collected alongside rock lobsters.

The format of the interviews conducted during these surveys were identical to that used in the dedicated survey discussed in Section 2.1.

## 2.3 Deriving fish stock specific mean weight estimates from creel survey data

All length data were assigned to a species-specific Quota Management Area (QMA). For some fish stocks the QMA is comprised of more than one Fisheries Management Area (FMA). For example, SNA 1 is a QMA for snapper which has fish stock boundaries corresponding to FMA 1, whereas GUR 1 is the QMA definition for red gurnard caught in FMAs 1 and 9 combined. Some other QMAs are subsets of FMAs (e.g., those for PAU 5A, PAU 5B, etc) or have boundaries that are not coincident with those of FMAs (e.g., those for rock lobster stocks CRA 1 to CRA 9). Each fish length was assigned to a QMA based on the area fished, and not the location of the ramp surveyed (some ramps are close to QMA boundaries). Some species such as albacore and skipjack tuna are highly migratory and not currently part of the Quota Management System (QMS) and are therefore treated as single stocks.

Where possible, recreational catch in FMA 1 is assessed relative to three separate regions: East Northland (ENLD) (North Cape to Cape Rodney), the Hauraki Gulf (HAGU) (Cape Rodney to Cape Colville), and the Bay of Plenty (BPLE) (Cape Colville to Cape Runaway). The species mix and catch size distributions in these regions can differ markedly. Mean weight estimates for snapper, kahawai, red gurnard, tarakihi and trevally were calculated separately for these three regions. Mean weight estimates for snapper in SNA 8 were also calculated separately for harbours (Manukau and Kaipara), north (open coast fishery north of Tirua Point), and south coasts (open coast south of Tirua Point).

Mean weights were calculated separately for diving and for potting for all CRA stocks where possible, as divers tend to land larger fish than those caught by fishers using pots.

## 2.4 Length-weight relationships used to derive mean weight estimates

Interviewers measured but did not weigh fish, because weighing fish increases the duration of an interview and length measurements have a greater general utility. Standard length-weight relationships (Table 1) were used to convert individual measurements into fish weights, which were then averaged.

Length-weight relationships given in Table 1 were used to convert measurements of the 25 most caught QMS species and also for albacore and skipjack tuna. The resulting individual fish weights were then averaged for each QMA, and by region of QMA 1 for some commonly caught species. Mean weight estimates were calculated by season (summer – October to April and winter – May to September) and for all of 2022–23, and t-tests were used to determine whether seasonal or annual mean weight estimates should be used for each fish stock. Only seasonal estimates that were statistically different from each other ($p < 0.05$) were used in preference to annually averaged mean weights and then only if at least 50 length measurements were available in each season. If fewer than 50 length measurements were available for the year, then the overall combined species mean weight was used for a given stock. The standard errors calculated for estimates with low sample sizes are likely to be underestimates, as the distribution of the underlying data will be potentially poorly defined and highly influenced by a small number of individual measurements.

**Table 1: Length-weight regression parameters used to convert fish measurements into weight estimates and corresponding references.**

| Species or Fishstock | Species | | *a* | *b* | Reference |
|---|---|---|---|---|---|
| BAR | Barracouta | *Thyrsites atun* | 0.0075 | 2.900 | Hurst & Bagley (1994) |
| BCO | Blue cod | *Parapercis colias* | 5E-06 | 3.197 | Beentjes (Unpub. Data) |
| BNS | Bluenose | *Hyperoglyphe antarctica* | 0.0096 | 3.173 | Horn (1988) |
| BUT | Butterfish | *Odax pullus* | 6.1E-06 | 3.239 | Paul et al. (2000) |
| CRA 1,2,3,4,5 (Male) | Red rock lobster | *Jasus edwardsii* | 4.2E-06 | 2.935 | MFish (2010a) |
| CRA 1,2,3,4,5 (Female) | Red rock lobster | *Jasus edwardsii* | 1.3E-05 | 2.545 | MFish (2010a) |
| CRA 7,8,9 (Male) | Red rock lobster | *Jasus edwardsii* | 3.4E-06 | 2.967 | MFish (2010a) |
| CRA 7,8,9 (Female) | Red rock lobster | *Jasus edwardsii* | 1E-05 | 2.632 | MFish (2010a) |
| EMA | Blue mackerel | *Scomber australasicus* | 0.0088 | 3.110 | Shaun-ror (1970) |
| FLA | Flatfish | *Rhombosolea* spp. | 0.0380 | 2.660 | McGregor (Unpub. Data) |
| GMU | Grey mullet | *Mugil cephalus* | 0.0424 | 2.826 | Breen & McKenzie (unpublished) |
| GUR 1 | Red gurnard | *Chelidonichthys kumu* | 0.0100 | 2.990 | Elder (1976) |
| GUR 2 | Red gurnard | *Chelidonichthys kumu* | 0.0053 | 3.190 | Stevenson (2000) |
| HPB 1* | Hapuku/Bass | *Polyprion oxygeneios & P. americanus* | 0.0142 | 3.003 | Johnston (1993) |
| HPB 2* | Hapuku/Bass | *Polyprion oxygeneios & P. americanus* | 0.0242 | 2.867 | Johnston (1993) |
| HPB 7,8* | Hapuku/Bass | *Polyprion oxygeneios & P. americanus* | 0.0142 | 2.998 | Johnston (1993) |
| JDO | John dory | *Zeus faber* | 0.0480 | 2.700 | MFish (2010a) |
| JMA 1 | Jack mackerel | *Trachurus spp.* | 0.0093 | 3.100 | Hartill et al. (2022) |
| JMA 7 | Jack mackerel | *Trachurus spp.* | 0.0255 | 2.840 | Horn (1991) |
| KAH | Kahawai | *Arripis trutta* | 0.0236 | 2.890 | Hartill & Walsh (2005) |

**Table 1: continued**

| Stock | Species | | *a* | *b* | Reference |
|---|---|---|---|---|---|
| MOK | Blue moki | *Latridopsis ciliaris* | 0.0550 | 2.713 | Francis (1979) |
| PAU | Paua | *Haliotis iris* | 3E-08 | 3.303 | Schiel & Breen (1991) |
| POR | Porae | *Nemadactylus douglasi* | 0.0057 | 3.175 | Taylor & Willis (1998) |
| RCO | Red cod | *Pseudophycis bachus* | 0.0092 | 3.001 | Beentjes (1992) |
| SCA | Scallop | *Pecten novaezelandiae* | 0.0004 | 2.690 | Cryer & Parkinson (2006) |
| SNA | Snapper | *Pagrus auratus* | 0.0447 | 2.793 | Paul (1976) |
| SPD | Spiny dogfish | *Squalus acanthias* | 0.0021 | 3.150 | Hanchet (1986) |
| SPE | Sea perch | *Helicolenus spp.* | 0.0078 | 3.219 | Schofield & Livingston (1996) |
| SPO | Rig | *Mustelus lenticulatus* | 0.0010 | 3.320 | Francis (Unpub. Data) |
| TAR | Tarakihi | *Nemadactylus macropterus* | 0.0141 | 3.087 | Tong & Vooren (1972) |
| TRE | Trevally | *Pseudocaranx dentex* | 0.0160 | 3.064 | James (1984) |
| TRU | Trumpeter | *Latris lineata* | 0.0116 | 3.090 | Beentjes et al. (2010) |
| YEM | Yellow eyed mullet | *Aldrichetta forsteri* | 0.0068 | 3.200 | Gorman (1962) |

*HAP and BAS stock codes use the same set of length-weight regression parameters as HPB.
weight = a length$^b$ where greenweights are in grams for all species except blue cod, red rock lobster, and butterfish (kilograms), and lengths are in centimetres except for red rock lobster, scallops, and paua (millimetres)

| Species code | Species name | | *b0* | *b1* | Source |
|---|---|---|---|---|---|
| ALB | Albacore tuna | *Thunnus alalunga* | -10.29 | 2.900 | MFish (2010b) |
| SKJ | Skipjack tuna | *Katsuwonus pelamis* | -11.7 | 3.160 | Habib et al. (1981) |

Where ln(weight) = $b0 + b1 \times$ ln(fork length) and greenweights are in kilograms, fork lengths are in centimetres

## 2.5 Commercial logbook and commercial observer lobster potting data

Very few red rock lobster were measured in the creel survey. Consequently, commercial logbook and commercial observer potting data were used to augment the sample size for mean weight estimates as done in the 2017–18 mean weight survey (Davey et al. 2019). Permission was provided from the New Zealand Rock Lobster Industry Council to use commercial logbook data. Both commercial data sources were requested from Fisheries New Zealand and received on the 19 February 2024 under replog 15559. At the time of this request commercial data was only available for 01 October 2022 to 31 March 2023 of the 2022–23 recreational fishing year.

The commercial data was pooled and then groomed before being used to estimate mean weights. All lobster measurements were removed if the lobster was considered illegal to take in the recreational fishery. That is, all lobster below the recreational sex-specific minimum legal size and all berried females were removed from the commercial dataset. All data records had a pot escape gap value of 1, indicating that normal escape gaps were used.

The mean weights produced from commercial data were used only for red rock lobster stocks with insufficient creel survey records.

# 3. RESULTS

## 3.1 Collection and collation of fish length data

The most intensive sampling of recreational catches in 2022–23 took place in FMA 1 as part of concurrent rock lobster surveys specifically looking at the CRA 1 and CRA 2 regions (Table 2). Interviews of recreational fishers were conducted at the busiest ramps in each region, and interviews were conducted in afternoons, generally on weekends only. Midweek days were also worked if ramps were part of the web camera programme (MAF2019-01) regardless of the weather. The overall level of sampling effort in FMA 1 was high, with 7142 boats interviewed during the 7420 hours that interviewers were present at FMA 1 ramps. This was approximately one boat per hour.

The level of sampling effort and numbers of boats interviewed in other parts of New Zealand was far lower than in FMA 1 (Table 3). The sole purpose of surveying at 15 of these ramps was to provide fish measurements which were not available as a by-product of other surveys conducted for other purposes in 2022–23. Most interviewers completed their required minimum number of hours interviewing (144 hours) with only the interviewers at Whanganui and Napier Sail club not reaching this target. The remaining eight ramps were part of the web camera programme and interview hours ranged from 239 to 248 among the sites.

The total number of fish measurements available from all data sources for commonly caught species by QMA, and for some species by region of FMA 1, are given in Table 4. A small number of species accounted for most of the measured fish during the survey.

**Table 2: The number of hours that interviewers were present at boat ramps and the number of fishing boats that they fully interviewed by region of FMA 1, by ramp, by season.**

| | | Hours worked | | | Fishing boats interviewed | | |
|---|---|---|---|---|---|---|---|
| Region | Ramp | Summer | Winter | Full year | Summer | Winter | Full year |
| FMA 1 | Mangonui | 169 | 64 | 233 | 122 | 28 | 150 |
| East Northland | Marsden Cove | 152 | 56 | 208 | 266 | 45 | 311 |
| | Mangawhai | 231 | 64 | 295 | 202 | 32 | 234 |
| | Opito Bay | 36 | 48 | 84 | 109 | 110 | 219 |
| | Parua Bay (public) | 96 | 56 | 152 | 37 | 11 | 48 |
| | Parua Bay (club) | 172 | 64 | 236 | 298 | 43 | 341 |
| | Tutukaka | 161 | 52 | 213 | 222 | 28 | 250 |
| | Waitangi | 144 | 40 | 184 | 88 | 25 | 113 |
| | Whangaroa | 157 | 48 | 205 | 178 | 29 | 207 |
| | Total | 1 317 | 492 | 1 809 | 1 522 | 351 | 1 873 |
| FMA 1 | Gulf Harbour | 205 | 60 | 265 | 415 | 50 | 465 |
| Hauraki Gulf | Half Moon Bay | 156 | 64 | 220 | 335 | 55 | 390 |
| | Kawakawa Bay (public) | 84 | 60 | 144 | 287 | 181 | 468 |
| | Kuaotunu | 188 | 54 | 242 | 241 | 71 | 312 |
| | Omaha | 180 | 60 | 240 | 224 | 112 | 336 |
| | Takapuna | 84 | 59 | 143 | 149 | 82 | 231 |
| | Te Kouma | 84 | 56 | 140 | 232 | 112 | 344 |
| | Westhaven | 84 | 60 | 144 | 111 | 69 | 180 |
| | Waikawau | 168 | 64 | 232 | 337 | 76 | 413 |
| | Total | 1 232 | 537 | 1 769 | 2 331 | 808 | 3 139 |
| FMA 1 | Bowentown | 82 | 64 | 147 | 179 | 125 | 304 |
| Bay of Plenty | Maketu | 172 | 54 | 226 | 34 | 71 | 105 |
| | Pauanui | 173 | 28 | 201 | 109 | 32 | 141 |
| | Sulphur Point | 389 | 100 | 489 | 734 | 85 | 819 |
| | Te Kaha | 176 | 48 | 224 | 113 | 37 | 150 |
| | Whakatane | 203 | 56 | 259 | 204 | 31 | 235 |
| | Whangamata | 128 | 16 | 144 | 129 | 25 | 154 |
| | Whitianga | 182 | 50 | 232 | 205 | 17 | 222 |
| | Total | 1 505 | 416 | 1 921 | 1 707 | 423 | 2 130 |

**Table 3: The number of hours that interviewers were present at boat ramps and the number of fishing boats that they fully interviewed by region of FMA 2, 3, 5, 7, 8 and 9, by ramp, by season.**

| | | Hours worked | | | Fishing boats interviewed | | |
|---|---|---|---|---|---|---|---|
| Region | Ramp | Summer | Winter | Full year | Summer | Winter | Full year |
| FMA 2 | Gisborne | 179 | 68 | 247 | 156 | 33 | 189 |
| | Napier | 175 | 64 | 239 | 207 | 8 | 215 |
| | Napier Sailing Club | 84 | 52 | 136 | 216 | 48 | 264 |
| | Owhiro Bay | 84 | 60 | 144 | 50 | 18 | 68 |
| | Seaview | 84 | 60 | 144 | 116 | 75 | 191 |
| | Total | 606 | 304 | 910 | 745 | 182 | 927 |
| FMA 3 | Akaroa | 100 | 64 | 164 | 148 | 50 | 198 |
| | South Bay (Kaikoura) | 85 | 60 | 145 | 172 | 59 | 231 |
| | Lyttelton | 91 | 51 | 142 | 47 | 44 | 91 |
| | Moeraki | 85 | 60 | 145 | 164 | 42 | 206 |
| | Motunau | 84 | 61 | 145 | 129 | 41 | 170 |
| | Port Chalmers | 84 | 56 | 140 | 107 | 56 | 163 |
| | Total | 528 | 352 | 880 | 767 | 292 | 1 059 |
| FMA 5 | Bluff | 84 | 60 | 144 | 113 | 58 | 171 |
| FMA 7 | Havelock | 84 | 60 | 144 | 136 | 76 | 212 |
| | Nelson | 172 | 72 | 244 | 336 | 65 | 401 |
| | Tarakohe | 86 | 60 | 146 | 222 | 37 | 259 |
| | Waikawa | 172 | 76 | 248 | 225 | 47 | 272 |
| | Total | 513 | 268 | 781 | 919 | 225 | 1 144 |
| FMA 8 | New Plymouth | 176 | 64 | 240 | 149 | 44 | 193 |
| | Paraparaumu | 84 | 60 | 144 | 128 | 57 | 185 |
| | Twin Bridges | 86 | 61 | 146 | 324 | 152 | 476 |
| | Whanganui | 85 | 47 | 133 | 84 | 91 | 175 |
| | Total | 431 | 232 | 663 | 685 | 344 | 1 029 |
| FMA 9 | Little Huia | 164 | 59 | 223 | 137 | 9 | 146 |
| | Raglan | 179 | 65 | 244 | 132 | 20 | 152 |
| | Shelley Beach | 157 | 60 | 217 | 253 | 9 | 262 |
| | Total | 500 | 184 | 684 | 522 | 38 | 560 |

**Table 4: Number of measurements by species by Quota Management Area from all available data sources.**

| | | QMA 1 | | | | | QMA 2 | QMA 3 | QMA 4 | QMA 5 | QMA 7 | QMA 8 | QMA 9 | Unassigned | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Species | Species name | ENLD | HAGU | BPLE | unspecified region | All | | | | | | | | | |
| SNA | Snapper | 6 109 | 18 182 | 8 525 | – | 32 816 | 1 403 | 1 | – | – | 2 374 | 3 779 | – | – | 40 373 |
| BCO | Blue cod | – | – | – | 65 | 65 | 471 | 5 401 | – | 2 338 | 1 010 | 359 | – | – | 9 644 |
| KAH | Kahawai | 722 | 1 497 | 1 459 | – | 3 678 | 892 | 621 | – | – | – | 1 408 | – | – | 6 599 |
| GUR | Gurnard | 129 | 207 | 191 | 127 | 654 | 679 | 56 | – | – | 640 | 265 | – | – | 2 294 |
| CRA | Rock lobster | – | – | – | 250 | 250 | 348 | 1 | 327 | 1 220 | – | – | 118 | – | 2 264 |
| TRE | Trevally | 478 | 288 | 773 | – | 1 539 | 105 | 1 | – | – | 244 | – | – | – | 1 889 |
| TAR | Tarakihi | 44 | 1 | 259 | – | 304 | 374 | 105 | – | 3 | 75 | 200 | – | – | 1 061 |
| SPE | Sea perch | – | – | – | 16 | 16 | 26 | 858 | – | 1 | 144 | – | – | – | 1 045 |
| BUT | Butterfish | 1 | – | – | 137 | 138 | 167 | 157 | – | – | 149 | – | – | – | 611 |
| KIN | Kingfish | – | – | – | 321 | 321 | 83 | 4 | – | – | 18 | 41 | – | – | 467 |
| PAU | Paua | – | – | – | 6 | 6 | 4 | 138 | – | – | 190 | – | – | – | 338 |
| HAP | Hapuku | – | – | – | 32 | 32 | 37 | 120 | – | – | 38 | 1 | – | – | 228 |
| SKJ | Skipjack tuna | 2 | – | – | 273 | 275 | – | – | – | – | – | – | – | – | 275 |
| FLA * | Flatfish | – | – | – | 12 | 12 | 1 | 186 | – | – | 4 | – | – | – | 203 |
| BMA | Blue maomao | – | – | – | – | – | – | – | – | – | – | – | – | 155 | 155 |
| JMA | Jack mackerel | – | – | – | 95 | 95 | – | – | – | – | 44 | – | – | – | 139 |
| MOK | Blue moki | – | – | – | 114 | 114 | – | – | – | – | – | – | – | – | 114 |
| JDO | John Dory | – | – | – | 91 | 91 | 12 | – | – | – | 6 | – | – | – | 109 |
| WSE | Wrasse spp. | – | – | – | – | – | – | – | – | – | – | – | – | 97 | 97 |
| EMA | Blue mackerel | – | – | – | 23 | 23 | 44 | – | – | – | 6 | 17 | 4 | – | 94 |
| SKI | Gemfish | – | – | – | – | – | – | – | – | – | – | – | – | 86 | 86 |
| ALB | Albacore tuna | – | – | – | 82 | 82 | – | – | – | – | – | – | – | – | 82 |
| RSN | Red snapper | – | – | – | – | – | – | – | – | – | – | – | – | 78 | 78 |
| BNS | Bluenose | – | – | – | 51 | 51 | – | 25 | – | – | 1 | – | – | – | 77 |
| RPI | Red pigfish | – | – | – | – | – | – | – | – | – | – | – | – | 61 | 61 |
| PHC | Packhorse crayfish | – | – | – | – | – | – | – | – | – | – | – | – | 59 | 59 |
| PMA | Pink maomao | – | – | – | – | – | – | – | – | – | – | – | – | 58 | 58 |

**Table 4: continued: Number of measurements by species by Quota Management Area from all available data sources.**

| | | QMA 1 | | | | | QMA 2 | QMA 3 | QMA 4 | QMA 5 | QMA 7 | QMA 8 | QMA 9 | Unassigned | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Species | Species | ENLD | HAGU | BPLE | unspecified region | All | | | | | | | | | |
| HPB | Hapuku/Bass | – | – | – | 8 | 8 | 20 | 19 | – | – | 10 | – | – | – | 57 |
| SCH | School shark | – | – | – | – | – | – | – | – | – | – | – | – | 51 | 51 |
| RCO | Red cod | – | – | – | 9 | 9 | 13 | 26 | – | – | 1 | – | – | – | 49 |
| BAR | Barracouta | – | – | – | 26 | 26 | – | – | – | – | 22 | – | – | – | 48 |
| SPO | Rig | – | – | – | – | – | – | 29 | – | – | 14 | 1 | – | – | 44 |
| TRU | Trumpeter | – | – | – | 2 | 2 | – | 29 | – | 7 | – | 1 | – | – | 39 |
| POR | Porae | – | – | – | 33 | 33 | 1 | – | – | – | – | – | – | – | 34 |
| KOH | Koheru | – | – | – | – | – | – | – | – | – | – | – | – | 26 | 26 |
| RMO | Red moki | – | – | – | – | – | – | – | – | – | – | – | – | 20 | 20 |
| YEM | Yellow eyed mullet | – | – | – | 14 | 14 | – | – | – | – | – | – | – | – | 14 |
| GMU | Grey mullet | – | – | – | 7 | 7 | – | – | – | – | 3 | – | – | – | 10 |
| SPD | Spiny dogfish | – | – | – | – | – | – | – | – | 3 | 2 | 2 | – | – | 7 |
| BAS | Bass | – | – | – | 6 | 6 | – | – | – | – | – | – | – | – | 6 |
| 49 other spp. | | – | – | – | – | – | – | – | – | – | – | – | – | 233 | 233 |
| Total | | 7 485 | 20 175 | 11 207 | 1 800 | 40 667 | 4 680 | 7 777 | 327 | 3 572 | 4 995 | 6 074 | 122 | 924 | 69 138 |

* Flatfish codes FLA, FLO and LSO combined

## 3.2 Mean weight estimates

**Snapper**

Snapper was the most encountered species in all three regions of SNA 1 (32 816 measured), SNA 2 (1403 measured), SNA 7 (2374 measured) and SNA 8 (3779 measured) (Table 4, 5, Appendix 1a, b, c). Seasonal differences in mean weight occurred for the Hauraki Gulf (HAGU), with summer fish being on average heavier than winter fish. There were no seasonal differences seen for East Northland (ENLD) or Bay of Plenty (BPLE) hence the best estimate of mean weight was the annual estimate. Significant seasonal differences were also detected for SNA 8 landed fish from the south coast with winter fish being significantly heavier than summer fish; however, the SNA 8 harbours and north coast sub-regions did not have significant seasonal differences in mean weight estimates.

**Blue cod**

Blue cod was another species encountered in high numbers (9644 measured) in 2022–23, especially in BCO 3, BCO 5 and BCO 7 (Table 4, 5, Appendix 1d). Overall, 5401 blue cod were measured in BCO 3 resulting in this species being the most commonly encountered fish in the South Island. Significant seasonal differences were detected in BCO 2, BCO 3, BCO 4 and BCO 7 with fish landed in the winter being on average heavier than those landed in the summer. BCO 5 reversed this seasonal difference with the summer fish being on average heavier than the winter fish.

**Kahawai**

Kahawai was the second most frequently encountered species in all regions of QMA 1 (3678) and in QMA 8 (1408) (Table 4, 5, Appendix 1e). There was a significant seasonal difference in the average weight of kahawai landed in the BPLE region of KAH 1: winter landed fish were heavier than summer landed fish; however, the seasonal difference was reversed for the HAGU region with the summer fish being heavier. Kahawai landed in KAH 8 were significantly heavier in the winter than in the summer.

**Red gurnard**

Red gurnard was commonly encountered in most areas (Table 4, 5, Appendix 1f, 1g). The GUR 1 management area spans the east and west coasts at the top of the North Island and the size composition differs between these areas. There was a significant seasonal difference for red gurnard landed in the BPLE region and the east region of GUR 1, with fish landed in winter being on average heavier than those landed in summer. There were no significant seasonal differences in mean weights for the west region of GUR 1, or for GUR 2 or GUR 3. There was a seasonal difference in mean weights in GUR 7 with fish landed in summer weighing more on average than fish landed in winter. GUR 8 also had a seasonal difference in mean weight, but winter fish weighed more on average than summer fish.

**Tarakihi**

Tarakihi was landed in most surveyed areas, with most measured fish coming from TAR 1 and TAR 8 (Table 4, 5, Appendix 1h, 1i). For TAR 1 east, there were enough fish measured to provide an annual mean weight only for the BPLE region. For the ENLD and HAGU regions, the mean weight estimate was based on the combined length data for ENLD, HAGU and BPLE. No length measurements were available for TAR 1 west. None of the regions had enough fish measured to evaluate any seasonality in the weight.

**Trevally**

Many measurements of trevally were taken from fish landed in TRE 1 (1539 measured) with seasonal differences in weights detected from ENLD only (Table 4, 5, Appendix 1j). Trevally measured in ENLD were on average heavier in the summer than the winter. HAGU and BPLE did not have a seasonally significant mean weight difference.

**Hāpuku/Bass**
Due to issues with identification by interviewers, small numbers of bass, and to maintain consistency with previous surveys in 2011–12 and 2018–19, we have provided separate estimates of hāpuku (HAP) and bass (BAS) and then an additional combined estimate for HPB (BAS + HAP + HPB-unseparated) (Table 5).

For bass there were only six measurements, so no mean weight estimates were generated. For hāpuku, only HAP 3 had enough measurements (120) to provide an annual estimate. The remaining HAP 1, 2, 7 and 8 stocks had too few measurements, so were assigned the overall species mean weight estimate. There were no significant differences seasonally for any mean weights of hāpuku. For HPB combined both HPB 2 and HPB 3 had enough measurements to produce an annual mean weight estimate. For the remaining areas HPB 1, 7 and 8 were combined to produce an annual mean weight estimate.

**Other species**
Mean weights were calculated for all other finfish species, but for most of these there were relatively few measurements available, so all data were combined to provide a single mean weight estimate for the species (Table 5).

**Shellfish**
A small number of pāua were measured during the 2022–23 fishing year (Table 4, 6). No significant seasonal difference were detected for any of the pāua stocks. An annual estimate was produced for PAU 3, PAU 7 and the other stocks were assigned an overall species level mean weight estimate.

**Red rock lobster**
Weights of rock lobster harvested by recreational fishers varied considerably by QMA, sex and fishing method (Table 7).

Annual mean weights are recommended for all rock lobster stocks except for CRA 5 (pot), where there was a significant seasonal difference, with the winter caught fish being on average heavier than the summer fish.

**Table 5: Mean weight estimates (g) for finfish species commonly caught by recreational fishers by QMA, by season and for both seasons combined for the 2022–23 fishing year. Asterisks' denote where t-tests have detected a significant difference between seasonal mean weight estimates. Best estimates are boxed. P-Values * P<0.05, ** P<0.01, *** P<0.00**

| | | Summer | | | Winter | | | All year | | | Seasonal | Best estimate |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Fishstock | Region | Estimate | SE | n | Estimate | SE | n | Estimate | SE | n | difference | |
| ALB | | 7 239 | 424.5 | 81 | 11 222 | – | 1 | 7 288 | 422.0 | 82 | – | all ALB |
| BAS 1 | | 3 643 | 338.8 | 6 | – | – | – | 3 643 | 338.8 | 6 | – | all BAS |
| BAR 1 | | 2 065 | 372.5 | 21 | 1 695 | 386.0 | 5 | 1 993 | 308.4 | 26 | – | too few |
| BAR 7 | | 2 400 | 308.9 | 17 | 1 910 | 220.4 | 5 | 2 288 | 245.6 | 22 | – | too few |
| | | 2 214 | 246.3 | 38 | 1 802 | 212.6 | 10 | 2 129 | 200.5 | 48 | – | all BAR |
| BCO 1 | | 521 | 35.3 | 48 | 469 | 38.0 | 17 | 508 | 27.9 | 65 | – | Annual |
| BCO 2 | | 527 | 12.8 | 299 | 590 | 22.6 | 172 | 550 | 11.7 | 471 | * | Seasonal |
| BCO 3 | | 557 | 2.9 | 4 196 | 576 | 7.0 | 1 205 | 561 | 2.8 | 5 401 | * | Seasonal |
| BCO 5 | | 553 | 3.1 | 1 909 | 526 | 5.4 | 429 | 548 | 2.7 | 2 338 | *** | Seasonal |
| BCO 7 | | 494 | 8.2 | 739 | 540 | 17.6 | 271 | 506 | 7.7 | 1 010 | * | Seasonal |
| BCO 8 | | 412 | 14.2 | 175 | 639 | 20.7 | 184 | 528 | 14.0 | 359 | *** | Seasonal |
| | | 545 | 2.2 | 7 366 | 568 | 5.0 | 2 278 | 551 | 2.0 | 9 644 | *** | not used |
| BNS 1 | | 7 511 | 684.9 | 42 | 15 227 | 1905.7 | 9 | 8 873 | 769.6 | 51 | ** | Annual |
| BNS 3 | | 4 078 | 823.3 | 21 | 4 789 | 989.1 | 4 | 4 191 | 704.9 | 25 | – | too few |
| BNS 7 | | – | – | – | 4 004 | – | 1 | 4 004 | – | 1 | – | too few |
| | | 6 367 | 567.4 | 63 | 11 443 | 1867.2 | 14 | 7 290 | 611.3 | 77 | * | for BNS 3, 7 |

**Table 5: - continued: Mean weight estimates (g) for finfish.**

| | | Summer | | | Winter | | | All year | | | Seasonal | Best estimate |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Fishstock | Region | Estimate | SE | n | Estimate | SE | n | Estimate | SE | n | difference | |
| BUT 1 | | 893 | 59.9 | 93 | 818 | 34.6 | 45 | 868 | 42.0 | 138 | – | Annual |
| BUT 2 | | 1 241 | 42.1 | 110 | 1 345 | 51.4 | 57 | 1 277 | 32.9 | 167 | – | Annual |
| BUT 3 | | 1 007 | 31.8 | 157 | – | – | – | 1 007 | 31.8 | 157 | – | Annual |
| BUT 7 | | 1 036 | 39.7 | 133 | 1 448 | 151.4 | 16 | 1 080 | 40.2 | 149 | * | Annual |
| | | 1 046 | 21.4 | 493 | 1 158 | 42.4 | 118 | 1 067 | 19.2 | 611 | * | not used |
| EMA 1 | | 1 045 | 131.9 | 19 | 227 | 94.9 | 4 | 903 | 127.8 | 23 | *** | too few |
| EMA 2 | | 1 239 | 157.7 | 20 | 1 208 | 81.2 | 24 | 1 222 | 83.2 | 44 | – | too few |
| EMA 7 | | 669 | 157.1 | 15 | 1 779 | 165.4 | 12 | 1 162 | 155.6 | 27 | *** | too few |
| | | 1 013 | 90.4 | 54 | 1 281 | 97.7 | 40 | 1 127 | 67.6 | 94 | * | all EMA |
| FLA 1 | | 233 | 27.0 | 12 | – | – | – | 233 | 27.0 | 12 | – | all FLA |
| GMU 1 | | 1 036 | 79.6 | 7 | – | – | – | 1 036 | 79.6 | 7 | – | too few |
| GMU 7 | | 311 | 12.7 | 3 | – | – | – | 311 | 12.7 | 3 | – | too few |
| | | 818 | 123.3 | 10 | – | – | – | 818 | 123.3 | 10 | – | all GMU |

**Table 5: - continued: Mean weight estimates (g) for finfish.**

| | | Summer | | | Winter | | | All year | | | Seasonal | Best estimate |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Fishstock | Region | Estimate | SE | n | Estimate | SE | n | Estimate | SE | n | difference | |
| GUR 1 | | 452 | 9.2 | 492 | 465 | 14.7 | 161 | 455 | 7.8 | 653 | – | by region |
| | ENLD | 428 | 12.6 | 94 | 390 | 22.6 | 35 | 418 | 11.1 | 129 | – | Annual |
| | HAGU | 369 | 9.5 | 156 | 396 | 17.9 | 51 | 376 | 8.4 | 207 | – | Annual |
| | BPLE | 432 | 16.4 | 136 | 521 | 30.0 | 55 | 458 | 14.8 | 191 | * | Seasonal |
| | GUR 1 east | 406 | 7.7 | 386 | 443 | 15.3 | 141 | 416 | 7.0 | 527 | * | Seasonal |
| | GUR 1 west | 622 | 26.0 | 106 | 614 | 34.3 | 20 | 621 | 22.5 | 126 | – | Annual |
| GUR 2 | | 628 | 9.7 | 611 | 668 | 38.9 | 68 | 632 | 9.5 | 679 | – | Annual |
| GUR 3 | | 618 | 31.4 | 47 | 746 | 32.3 | 9 | 639 | 27.5 | 56 | ** | Annual |
| GUR 7 | | 556 | 9.5 | 511 | 513 | 16.7 | 129 | 547 | 8.3 | 640 | * | Seasonal |
| GUR 8 | | 539 | 22.9 | 137 | 599 | 13.7 | 129 | 568 | 13.6 | 266 | * | Seasonal |
| | | 552 | 5.5 | 1 798 | 545 | 9.7 | 496 | 551 | 4.8 | 2 294 | – | not used |
| | | | | | | | | | | | | |
| HAP 1 | | 5 115 | 689.0 | 25 | 7 178 | 852.5 | 7 | 5 566 | 584.3 | 32 | – | too few |
| HAP 2 | | 8 279 | 856.0 | 28 | 6 905 | 876.5 | 9 | 7 945 | 683.4 | 37 | – | too few |
| HAP 3 | | 4 933 | 334.6 | 93 | 8 217 | 578.7 | 27 | 5 672 | 315.2 | 120 | *** | Annual |
| HAP 7 | | 10 258 | 829.3 | 25 | 7 300 | 1110.4 | 13 | 9 246 | 695.4 | 38 | * | too few |
| HAP 8 | | 14 070 | – | 1 | – | – | – | 14 070 | – | 1 | – | too few |
| | | 6 331 | 318.3 | 172 | 7 663 | 414.9 | 56 | 6 658 | 263.2 | 228 | * | for HAP 1, 2, 7, 8 |

**Table 5: - continued: Mean weight estimates (g) for finfish.**

| | | Summer | | | Winter | | | All year | | | Seasonal | Best estimate |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Fishstock | Region | Estimate | SE | n | Estimate | SE | n | Estimate | SE | n | difference | |
| HPB 1 | | 7 215 | 1605.1 | 8 | – | – | – | 7 215 | 1605.1 | 8 | – | too few |
| HPB 2 | | 7 969 | 1127.4 | 11 | 9 640 | 2597.3 | 9 | 8 721 | 1297.1 | 20 | – | too few |
| HPB 3 | | – | – | – | 5 584 | 608.2 | 19 | 5 584 | 608.2 | 19 | – | too few |
| HPB 7 | | 9 720 | 2070.4 | 4 | 7 611 | 625.8 | 6 | 8 454 | 905.9 | 10 | – | too few |
| | | 8 011 | 834.4 | 23 | 7 015 | 805.0 | 34 | 7 417 | 585.2 | 57 | – | for HPB 1, 2, 3, 7 |
| | | | | | | | | | | | | |
| JDO 1 | | 1 311 | 63.9 | 62 | 1 179 | 68.6 | 29 | 1 269 | 48.9 | 91 | – | Annual |
| JDO 2 | | 2 128 | 374.2 | 6 | 1 374 | 130.6 | 6 | 1 751 | 220.5 | 12 | – | too few |
| JDO 7 | | 1 342 | 140.2 | 6 | – | – | – | 1 342 | 140.2 | 6 | – | too few |
| | | 1 380 | 66.5 | 74 | 1 212 | 61.6 | 35 | 1 326 | 49.7 | 109 | – | for JDO 2, 7 |
| | | | | | | | | | | | | |
| JMA 1 | | 414 | 37.9 | 81 | 407 | 80.1 | 14 | 413 | 34.2 | 95 | – | Annual |
| JMA 7 | | 612 | 109.3 | 37 | 432 | 50.7 | 7 | 583 | 92.5 | 44 | – | too few |
| | | 476 | 43.6 | 118 | 416 | 55.2 | 21 | 467 | 37.9 | 139 | – | for JMA 7 |

**Table 5: - continued: Mean weight estimates (g) for finfish.**

| | | Summer | | | Winter | | | All year | | | Seasonal | Best estimate |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Fishstock | Region | Estimate | SE | n | Estimate | SE | n | Estimate | SE | n | difference | |
| KAH 1 | | 1 574 | 13.8 | 2 602 | 1 524 | 18.5 | 1 076 | 1 559 | 11.2 | 3 678 | * | by region |
| | ENLD | 1 453 | 25.0 | 525 | 1 411 | 35.2 | 197 | 1 441 | 20.6 | 722 | – | Annual |
| | HAGU | 1 512 | 25.7 | 986 | 1 395 | 26.7 | 511 | 1 472 | 19.3 | 1 497 | ** | Seasonal |
| | BPLE | 1 687 | 19.6 | 1 091 | 1 762 | 31.1 | 368 | 1 706 | 16.6 | 1 459 | * | Seasonal |
| KAH 2 | | 1 694 | 29.8 | 629 | 1 759 | 40.9 | 263 | 1 713 | 24.2 | 892 | – | Annual |
| KAH 3 | | 1 276 | 33.7 | 494 | 1 455 | 71.1 | 127 | 1 313 | 30.6 | 621 | * | Seasonal |
| KAH 8 | | 1 561 | 26.0 | 1 103 | 1 735 | 38.1 | 305 | 1 599 | 22.0 | 1 408 | *** | Seasonal |
| | | 1 556 | 11.0 | 4 828 | 1 590 | 15.4 | 1 771 | 1 565 | 9.0 | 6 599 | – | not used |
| KIN 1 | | 9 850 | 276.5 | 288 | 10 854 | 922.7 | 33 | 9 954 | 265.6 | 321 | – | Annual |
| KIN 2 | | 11 163 | 560.0 | 81 | 11 263 | 1278.1 | 2 | 11 165 | 546.9 | 83 | – | Annual |
| KIN 3 | | 10 380 | 2131.2 | 3 | 12 201 | – | 1 | 10 835 | 1574.3 | 4 | – | too few |
| KIN 7 | | 9 403 | 818.6 | 15 | 7 574 | 646.6 | 3 | 9 098 | 703.9 | 18 | – | too few |
| KIN 8 | | 12 180 | 992.5 | 27 | 9 940 | 719.5 | 14 | 11 415 | 712.3 | 41 | – | too few |
| | | 10 247 | 234.9 | 414 | 10 468 | 613.5 | 53 | 10 272 | 219.4 | 467 | – | for KIN 3, 7, 8 |
| MOK 1 | | 2 168 | 121.6 | 94 | 1 953 | 171.2 | 20 | 2 131 | 104.7 | 114 | – | all MOK |
| POR 1 | | 1 223 | 125.3 | 25 | 1 059 | 265.3 | 8 | 1 184 | 113.2 | 33 | – | too few |
| POR 2 | | 224 | – | 1 | – | – | – | 224 | – | 1 | – | too few |
| | | 1 185 | 126.4 | 26 | 1 059 | 265.3 | 8 | 1 155 | 113.3 | 34 | – | all POR |

**Table 5: - continued: Mean weight estimates (g) for finfish.**

| | | Summer | | | Winter | | | All year | | | Seasonal | Best estimate |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Fishstock | Region | Estimate (g) | SE | n | Estimate (g) | SE | n | Estimate (g) | SE | n | difference | Estimate |
| RCO 1 | | 503 | 95.0 | 6 | 1 463 | 46.9 | 3 | 823 | 171.9 | 9 | *** | too few |
| RCO 2 | | 1 098 | 112.5 | 12 | 1 545 | – | 1 | 1 133 | 109.0 | 13 | – | too few |
| RCO 3 | | 869 | 112.8 | 23 | 1 193 | 620.9 | 3 | 907 | 117.9 | 26 | – | too few |
| RCO 7 | | 470 | – | 1 | – | – | – | 470 | – | 1 | – | too few |
| | | 873 | 76.1 | 42 | 1 359 | 242.8 | 7 | 942 | 76.8 | 49 | – | all RCO |
| SKJ | | 2 087 | 63.3 | 273 | 1 492 | 102.3 | 2 | 2 083 | 63.0 | 275 | – | all SKJ |
| SNA 1 | | 1 152 | 4.6 | 24 555 | 1 092 | 6.9 | 8 261 | 1 137 | 3.9 | 32 816 | *** | by region |
| | ENLD | 1 313 | 13.4 | 4 886 | 1 286 | 29.1 | 1 223 | 1 308 | 12.2 | 6 109 | – | Annual |
| | HAGU | 1 044 | 5.4 | 12 883 | 997 | 6.3 | 5 299 | 1 030 | 4.3 | 18 182 | *** | Seasonal |
| | BPLE | 1 242 | 8.5 | 6 786 | 1 246 | 15.1 | 1 739 | 1 243 | 7.4 | 8 525 | – | Annual |
| SNA 2 | | 1 282 | 24.0 | 1 208 | 1 610 | 67.4 | 195 | 1 327 | 22.9 | 1 403 | *** | Seasonal |
| SNA 3 | | 846 | – | 1 | – | – | – | 846 | – | 1 | – | too few |
| SNA 7 | | 1 446 | 26.7 | 2 189 | 1 836 | 101.0 | 185 | 1 476 | 25.9 | 2 374 | *** | Seasonal |
| SNA 8 | | 1 517 | 19.4 | 2 747 | 2 014 | 40.2 | 1 032 | 1 653 | 18.2 | 3 779 | *** | by region |
| | Harbours | 1 501 | 29.7 | 919 | 1 450 | 263.3 | 19 | 1 500 | 29.5 | 938 | – | Annual |
| | N coast | 1 279 | 57.8 | 238 | 1 975 | 244.9 | 31 | 1 359 | 59.8 | 269 | ** | Annual |
| | S coast | 1 568 | 27.5 | 1 578 | 2 026 | 41.2 | 982 | 1 744 | 23.6 | 2 560 | *** | Seasonal |
| | | 1 211 | 4.7 | 30 700 | 1 215 | 8.2 | 9 673 | 1 212 | 4.0 | 40 373 | – | for SNA 3 |

**Table 5: - continued: Mean weight estimates (g) for finfish.**

| | | Summer | | | Winter | | | All year | | | Seasonal | Best estimate |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Fishstock | Region | Estimate | SE | n | Estimate | SE | n | Estimate | SE | n | difference | |
| SPD 5 | | 374 | 81.0 | 3 | – | – | – | 374 | 81.0 | 3 | – | too few |
| SPD 7 | | 602 | – | 1 | 1 362 | – | 1 | 982 | 380.4 | 2 | – | too few |
| SPD 8 | | – | – | – | 701 | 228.7 | 2 | 701 | 228.7 | 2 | – | too few |
| | | 431 | 80.7 | 4 | 921 | 257.0 | 3 | 641 | 145.3 | 7 | – | all SPD |
| SPE 1 | | 678 | 90.7 | 15 | 1 305 | – | 1 | 717 | 93.5 | 16 | – | too few |
| SPE 2 | | 386 | 32.6 | 19 | 411 | 39.5 | 7 | 393 | 25.8 | 26 | – | too few |
| SPE 3 | | 498 | 8.3 | 635 | 507 | 18.4 | 223 | 501 | 7.8 | 858 | – | Annual |
| SPE 5 | | – | – | – | 1 116 | – | 1 | 1 116 | – | 1 | – | too few |
| SPE 7 | | 528 | 23.0 | 112 | 636 | 112.6 | 32 | 552 | 30.7 | 144 | – | Annual |
| | | 503 | 7.8 | 781 | 525 | 21.1 | 264 | 509 | 7.9 | 1 045 | – | for SPE 1, 2, 5 |
| SPO 3 | | 3 091 | 484.1 | 17 | 2 265 | 1357.5 | 12 | 2 749 | 619.7 | 29 | – | too few |
| SPO 7 | | 1 942 | 293.9 | 8 | 2 355 | 1629.9 | 6 | 2 119 | 683.9 | 14 | – | too few |
| SPO 8 | | 245 | – | 1 | – | – | – | 245 | – | 1 | – | too few |
| | | 2 628 | 354.5 | 26 | 2 295 | 1027.4 | 18 | 2 492 | 463.1 | 44 | – | all SPO |

**Table 5: - continued: Mean weight estimates (g) for finfish.**

| | | Summer | | | Winter | | | All year | | | Seasonal | Best estimate |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Fishstock | Region | Estimate (g) | SE | n | Estimate (g) | SE | n | Estimate (g) | SE | n | difference | Estimate |
| TAR 1 | | 966 | 25.1 | 252 | 914 | 32.9 | 52 | 957 | 21.5 | 304 | – | for ENLD, HAGU |
| | ENLD | 998 | 61.5 | 35 | 1 085 | 73.1 | 9 | 1 015 | 51.1 | 44 | – | too few |
| | HAGU | 687 | – | 1 | – | – | – | 687 | – | 1 | – | too few |
| | BPLE | 962 | 27.5 | 216 | 878 | 34.7 | 43 | 948 | 23.7 | 259 | – | Annual |
| TAR 2 | | 1 058 | 27.7 | 268 | 1 021 | 42.9 | 106 | 1 047 | 23.3 | 374 | – | Annual |
| TAR 3 | | 975 | 73.9 | 97 | 772 | 146.6 | 8 | 959 | 69.2 | 105 | – | Annual |
| TAR 5 | | 1 155 | 256.9 | 3 | – | – | – | 1 155 | 256.9 | 3 | – | too few |
| TAR 7 | | 886 | 79.3 | 69 | 646 | 91.2 | 6 | 866 | 73.6 | 75 | – | Annual |
| TAR 8 | | 1 068 | 52.1 | 164 | 1 559 | 129.9 | 36 | 1 156 | 50.4 | 200 | ** | Annual |
| | | 1 010 | 18.6 | 853 | 1 067 | 36.7 | 208 | 1 021 | 16.6 | 1 061 | – | for TAR 5 |
| | | | | | | | | | | | | |
| TRE 1 | | 1 341 | 21.0 | 1 258 | 1 341 | 40.4 | 281 | 1 341 | 18.7 | 1 539 | – | by region |
| | ENLD | 1 323 | 44.2 | 387 | 1 168 | 64.1 | 91 | 1 293 | 37.9 | 478 | * | Seasonal |
| | HAGU | 1 042 | 34.7 | 257 | 915 | 84.8 | 31 | 1 028 | 32.3 | 288 | – | Annual |
| | BPLE | 1 478 | 27.7 | 614 | 1 523 | 54.5 | 159 | 1 487 | 24.7 | 773 | – | Annual |
| TRE 2 | | 1 521 | 119.3 | 54 | 1 739 | 116.4 | 51 | 1 627 | 83.7 | 105 | – | Annual |
| TRE 3 | | – | – | – | 861 | – | 1 | 861 | – | 1 | – | too few |
| TRE 7 | | 2 204 | 111.1 | 184 | 1 754 | 106.1 | 60 | 2 093 | 88.5 | 244 | ** | Seasonal |
| | | 1 454 | 23.8 | 1 496 | 1 454 | 37.5 | 393 | 1 454 | 20.4 | 1 889 | – | for TRE 3 |

**Table 5: - continued: Mean weight estimates (g) for finfish.**

| Fishstock | Region | Summer | | | Winter | | | All year | | | Seasonal difference | Best estimate |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Estimate | SE | n | Estimate | SE | n | Estimate | SE | n | | |
| TRU 1 | | 849 | 35.0 | 2 | – | – | – | 849 | 35.0 | 2 | – | too few |
| TRU 3 | | 1 644 | 409.6 | 24 | 848 | 65.1 | 5 | 1 507 | 342.6 | 29 | – | too few |
| TRU 5 | | 1 290 | 211.4 | 3 | 1 642 | 603.8 | 4 | 1 491 | 340.0 | 7 | – | too few |
| TRU 8 | | – | – | – | 1 204 | – | 1 | 1 204 | – | 1 | – | too few |
| | | 1 553 | 340.7 | 29 | 1 201 | 255.1 | 10 | 1 463 | 261.1 | 39 | – | all TRU |
| YEM 1 | | 325 | 64.6 | 14 | – | – | – | 325 | 64.6 | 14 | – | all YEM |

**Table 6: Mean weight estimates (g) for pāua, which are commonly caught by recreational fishers by QMA, by season and for both seasons combined for the 2022–23 fishing year. Asterisks denote where t-tests have detected a significant difference between seasonal mean weight estimates. Best estimates are boxed. P-Values * P<0.05, ** P<0.01, *** P<0.00**

| Fishstock | Summer | | | Winter | | | All year | | | Seasonal difference | Best estimate |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Estimate | SE | n | Estimate | SE | n | Estimate | SE | n | | |
| PAU 1 | 246 | 47.3 | 6 | – | – | – | 246 | 47.3 | 6 | – | too few |
| PAU 2 | – | – | – | 284 | 27.7 | 4 | 284 | 27.7 | 4 | – | too few |
| PAU 3 | 288 | 2.8 | 131 | 305 | 13.5 | 7 | 289 | 2.7 | 138 | – | Annual |
| PAU 7 | 285 | 2.3 | 171 | 324 | 18.9 | 19 | 289 | 2.9 | 190 | – | Annual |
| | 286 | 1.9 | 308 | 314 | 12.9 | 30 | 288 | 2.1 | 338 | * | for PAU 1, 2 |

**Table 7: Mean weight estimates (g) for red rock lobster by QMA, by fishing method for the 2022–23 fishing year. Best estimates are boxed. P-Values * P<0.05, ** P<0.01, *** P<0.00. # based on weighted mean weight from commercial observer and logbook data (2022–23 summer)**

| Fishstock | Summer | | | Winter | | | All year | | | Seasonal difference | Best estimate |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Estimate | SE | n | Estimate | SE | n | Estimate | SE | N | | |
| CRA 1 (diver) | 792 | 23.6 | 224 | 1 016 | 55.8 | 26 | 815 | 22.3 | 250 | *** | Annual |
| CRA 2 (diver) | 846 | 24.3 | 273 | 934 | 42.2 | 64 | 863 | 21.3 | 337 | – | Annual |
| CRA 3 (diver) | 689 | – | 1 | – | – | – | 620 | – | 3 210 | – | Annual # |
| CRA 4 (diver) | 720 | 24.6 | 247 | 809 | 42.6 | 75 | 741 | 21.4 | 322 | – | Annual |
| CRA 5 (diver) | 883 | 16.2 | 720 | 1 288 | 111.0 | 31 | 900 | 16.4 | 751 | ** | Annual |
| CRA 7 (diver) | No creel data available | | | | | | 710 | – | 803 | – | Annual # |
| CRA 8 (diver) | No creel data available | | | | | | 723 | – | 10 577 | – | Annual # |
| CRA 9 (diver) | 597 | 23.1 | 58 | 1 505 | 147.0 | 22 | 846 | 62.8 | 80 | *** | Annual |
| CRA 1 (pot) | No creel data available | | | | | | 715 | – | 3 912 | – | Annual # |
| CRA 2 (pot) | 507 | 21.3 | 8 | 1 342 | 190.5 | 3 | 707 | – | 1 698 | * | Annual # |
| CRA 3 (pot) | No creel data available | | | | | | 620 | – | 3 210 | – | Annual # |
| CRA 4 (pot) | 740 | 164.0 | 5 | – | – | – | 613 | – | 7 709 | – | Annual # |
| CRA 5 (pot) | 674 | 10.3 | 345 | 968 | 50.1 | 124 | 752 | 16.4 | 469 | *** | Seasonal |
| CRA 7 (pot) | No creel data available | | | | | | 710 | – | 803 | – | Annual # |
| CRA 8 (pot) | No creel data available | | | | | | 723 | – | 10 577 | – | Annual # |
| CRA 9 (pot) | 590 | 33.4 | 38 | – | – | – | 762 | – | 245 | – | Annual # |

## 4. DISCUSSION

The purpose of this project was to provide estimates of the mean weight of recreationally caught fish species so that they can be used in combination with estimates from the third National Panel Survey (NPS) of the number of fish caught to estimate overall recreational harvest. The 2011–12 NPS provided estimates of the numbers of recreationally caught fish, which were then combined with mean fish weight estimates provided by a concurrent creel survey (Hartill & Davey 2015) to provide estimates in tonnage of the recreational harvest, by QMA, of the 27 most commonly caught and landed fish throughout the country (Wynne-Jones et al. 2014). This approach was repeated during the 2017–18 fishing year and a concurrent mean weight survey (Davey et al. 2019) generated mean weights for the NPS to then provide estimates in tonnage of the recreational harvest, by QMA, of the 25 most caught and landed fish (Wynne-Jones et al. 2019). A third NPS was conducted during the 2022–23 fishing year and the mean weights presented here will be used to translate these estimates of numbers of fish into a more useful harvest tonnage estimate by the NPS.

All the surveys and data collections ran throughout the year as the size structure of recreational landings from any area can potentially change throughout a year. As the main objective of most of the surveys outside FMA 1 was to get fish measurements, interviewers were encouraged to utilise busy times on the ramp as much as possible. Hartill et al. (1998) compared mean weight estimates for fish landed during weekends and during the week and found little differences between day type in either summer or winter.

The number of fish measured overall was 69 138, which was less than the 2011–12 survey (118 057 fish) (Hartill & Davey 2015) but comparable to the 2017–18 survey (85 425 fish) (Davey et al. 2019). This was expected, as in previous surveys there have been extensive concurrent FMA 1 aerial-access surveys, which did not take place during the 2022–23 fishing year. The concurrent rock lobster surveys did, however, assist in collecting a representative sample for mean weight estimates in some species in FMA 1 and 2.

The number of snapper measured in SNA 1 during the 2011–12 mean weight survey (Hartill & Davey 2015) was comparable to the number measured in the 2017–18 survey (69 698 in 2011–12; 53 428 in 2017–18) (Davey et al. 2019), reflecting similar levels of sampling effort in these two surveys. This decreased to 40 373 in this survey reflecting a change in sampling effort as well as a reduction in the bag limit of snapper in SNA 1. The Hauraki Gulf and Bay of Plenty regions showed seasonal differences in the two previous surveys, but this survey only showed a seasonal difference in mean weight estimates in the Hauraki Gulf.

A seasonal difference was also detected in the mean weight of SNA 2 in this survey, with the winter fish being heavier on average than the summer fish, which was not evident in the past.

The mean weight of snapper in SNA 7 in 2017–18 was similar to the 2011–12 survey estimates, with no seasonal differences detected in either of the fishing years; however the 2022–23 survey did detect a seasonal estimate with winter fish being on average heavier than summer fish (Hartill & Davey 2015, Davey et al. 2019).

A substantial number of snapper were measured on the west coast of the North Island (SNA 8) in this and previous surveys, with different mean weights calculated in all three regions. Seasonal differences were not detected in regional mean weight estimates in 2011–12 but were evident in 2017–18, when in the harbours the winter mean weight estimates was significantly higher than the summer estimates but significantly lower in the south coast region. This survey also detected a seasonal difference in mean weights for the south coast with the winter being much higher than the summer estimate.

Blue cod was the second most caught and measured fish in this survey and the most common fish caught around the South Island. In previous surveys blue cod have been measured in high numbers. However, the number of blue cod measured in BCO 3 during the 2022–23 survey (5401) was approximately five times higher than the number measured in 2011–12 or 2018–19. In in 2011–12 seasonal differences were detected in BCO 1, 5, and 7 while in 2017–18 seasonal differences were only detected in BCO 5 and BCO 8 (Hartill & Davey 2015, Davey et al. 2019). The 2022–23 survey detected seasonal differences in BCO 2, 3, 4, 5, 7 and 8. Only BCO 1 did not have a seasonal difference in average mean weights. The seasonality in mean weight of blue cod is variable but usually often it was winter fish that were significantly heavier than summer fish. In BCO 7 there is a closed blue cod fishing season in the Marlborough Sounds for the period 1 September until 19 December, which has been in place since 2015. This means there are almost four months during which blue cod were not landed from part of a key BCO stock, limiting the number of measurements available to inform summer and winter seasons in this area.

Kahawai was the third most landed and measured fish in 2022–23. In surveys in 2011–12 and 2017–18 over 10 000 fish were measured in each survey; however, this was down to 6599 fish in this survey, due to the decrease in sampling effort in FMA 1. For the 2011–12 fishing year, seasonal differences were detected in all KAH QMAs and within the regions of KAH 1 (Hartill & Davey 2015). In 2017–18 only Hauraki Gulf had a seasonal difference (Davey et al. 2019). In the 2022–23 fishing year there were still enough fish measurements to consider regional differences within KAH 1. The East Northland region did not have any seasonal differences, but seasonal differences were detected in the Hauraki Gulf and Bay of Plenty. The season with the heaviest fish varied between surveys.

Over 2000 measurements were taken for red gurnard for the 2022–23 year. Like all predominantly northern fish, the number of measurements was lower than in 2011–12 (4501) (Hartill & Davey 2015) and in 2017–18 (3155) (Davey et al. 2019). The 2011–12 survey, which measured more fish, also had more seasonal differences detected (Hartill & Davey 2015). Bay of Plenty was the only region to also have a seasonal difference in 2017–18 (Davey et al. 2019), and in all surveys the winter fish were on average heavier than the summer fish. In the 2022–23 survey there were enough measurements for mean weight estimates in some of the QMAs. GUR 1 has five regions and two of these (Bay of Plenty and GUR 1 east) had a significant seasonal difference with winter fish being heavier on average than summer fish. The remaining regions in GUR 1 used annual mean weight estimates. There were no major differences in mean weights between survey years.

Bradford (1996) suggested that at least 1000 measurements are required to detect a 100 g weight difference over time. Only eight species from this survey have at least 1000 measurements available including the five discussed above along with sea perch, tarakihi and trevally. Obtaining 1000 measurements for the other recreationally caught species would be prohibitively expensive. Our boat ramp interviewers are required to measure all species that are landed, not just the species associated with a specific objective. The following QMA species did not reach the total number of fish measured so the average mean weight should be used with caution: barracouta, bass, flat fish (brill, sole, flounder, and turbot combined), grey mullet, porae, red cod, spiny dogfish, rig, trumpeter, and yellow eyed mullet.

Creel surveys did not provide enough rock lobster measurements for robust mean weight estimates to be calculated for both potting and diving. However additional individual fish measurement data are available for rock lobster from commercial fishers using pots with similar escapement sizes. Separate mean weight estimates were calculated for rock lobster caught by divers and by fishers using pots, as an analysis of data collected during the 2011–12 mean weight survey highlighted the fact that divers tend to take larger rock lobster on average than those taken by pot fishers (Hartill & Davey 2015). The mean weight estimates for diver caught lobster in 2017–18 and 2022–23 were again larger than those caught by fishers using pots (Davey et al. 2019). Possible explanations for this are discussed in Hartill & Davey 2015 and Davey et al. 2019. which suggest that divers can potentially target larger fish because more fish are encountered, and that fishers using pots are more likely to carefully measure and take fish when they are close to the minimum legal-size limit.

Here we have used existing published length-weight relationships for all the quota species for which 50 length measurements were available, and for albacore and skipjack tuna. Hartill & Davey (2015), prompted by reviewers of this research in 2011–12, carried out an additional review of the merits of non-linear and linear regressions of length-weight relationships. Data were available for comparisons for three species (kahawai, blue cod and scallops) and the choice of regression method had very little influence on accuracy of mean weight estimates. We therefore used the same length-weight relationships as used for the 2011–12 survey (Hartill and Davey, 2015) and the 2017–18 survey (Davey et al. 2019).

## 5. ACKNOWLEDGEMENTS

We thank Helena Armiger, Megan Carter, Rikki Taylor, Oliver Evans and Oliver Wade from NIWA and the numerous boat ramp interviewers, who collected the data for this survey. We thank the NIWA Fisheries Data Services team for entering the creel data forms on to electronic media. We also thank the New Zealand Rock Lobster Industry Council and Fisheries New Zealand for providing access to the commercial rock lobster data used to generate mean weight estimates for most rock lobster stocks. We also thank the many fishers who volunteered to be interviewed at boat ramps and have their fish measured.

We thank the Marine Amateur Fisheries Working Group members for constructive review of the survey and analytical methodology. Funding for this project, MAF2021-02, was provided by Fisheries New Zealand. This report was reviewed by Darren Stevens.

## 6. REFERENCES

Beentjes, M.P. (1992). Assessment of red cod based on recent trawl survey and catch sampling data. New Zealand Fisheries Assessment Research Document 1992/16. 41 p. (Unpublished report held by NIWA library, Wellington.)

Beentjes, M.P.; Manning, M.J.; Francis, M.P.; Ren, J.S.; Unwin, M.J. (2010). Characterisation of the trumpeter (*Latris lineata*) fishery in TRU 3 and TRU 4, and size at maturity. *New Zealand Fisheries Assessment Report 2010/31*. 33 p.

Boyd, R.O.; Gowing, L. (2004). 1999/2000 National marine recreational fishing survey: Results from the Boat Ramp Survey. 69 p. (Unpublished report held by Ministry for Primary Industries, Wellington).

Bradford, E. (1996). Accuracy of recreationalmean weights. NIWA internal report (Fisheries) No. 250. 12 p. (Unpublished report held in NIWA library, Wellington).

Breen, P.A.; McKenzie, J.R. (unpublished). A simple age-structured model for grey mullet (*Mugil cephalus*) stock assessment. Draft Fisheries Assessment Report

Cryer, M.; Parkinson, D.M. (2006). Biomass surveys and stock assessments for the Coromandel and Northland scallop fisheries, 2005. *New Zealand Fisheries Assessment Report 2006/34*. 53 p.

Davey, N.K.; Hartill, B.; Carter, M. (2019). Mean weight estimates for recreational fisheries in 2017–18. *New Zealand Fisheries Assessment Report 2019/25*. 32 p.

Elder, R.D. (1976). Studies on age and growth, reproduction and population dynamics of red gurnard, *Chelidonichthys kumu* (Lesson and Garnot), in the Hauraki Gulf, New Zealand. *Fisheries Research Bulletin No: 12*. 62 p.

Francis, M.P. (1979). A biological basis for the management of New Zealand moki (*Latridopsis ciliaris*) and smoothhound (*Mustelus lenticulatus*) fisheries (Unpublished data MSc thesis, University of Canterbury, Christchurch, New Zealand).

Gorman, T.B.S. (1962). Yellow-eyed mullet *Aldrichetta forsteri* cuvier and valencienne in Lake Ellesmere. *Fisheries Technical Report No. 7*. 20 p.

Habib, C.; Clement, I.T.; Fisher, K.A. (1981). The 1980-81 Purse-seine Skipjack Fishery in New Zealand Waters. *Fisheries Research Division Occasional Publication No. 36*. 48 p.

Hanchet, S.M. (1986). The distribution and abundance, reproduction, growth and life history characteristics of the spiny dogfish (*Squalus acanthias Linnaeus*) in New Zealand. PhD Thesis, University of Otago, New Zealand.

Hartill, B.; Bain, R.; Armiger, H.; Vaughan, M.; Rush, N. (2007). Recreational mean harvest estimates of snapper, kahawai, and kingfish in QMA 1 in 2004–5. *New Zealand Fisheries Assessment Report 2007/26*. 44 p.

Hartill, B.; Blackwell, R.; Bradford, E. (1998). Estimation of mean fish weights from the recreational catch landed at boat ramps in 1996. *NIWA Technical Report 31*. 40 p.

Hartill, B.; Davey, N. (2015). Mean weight estimates for recreational fisheries in 2011–12. Final Research Report 2015/25. 37 p.

Hartill, B.; Middleton, D.A.J.; Walsh, C.; Spong, K.; Ó Maolagáin, C. (2022). Catch-at-age sampling of *Trachurus novaezelandiae* from JMA 1 in 2019–20 and 2020–21. *New Zealand Fisheries Assessment Report 2022/37*. 16 p.

Hartill, B.; Walsh, C. (2005). Characterisation of the kahawai fisheries of New Zealand and review of biological knowledge. Final Research Report for Ministry of Fisheries Research Project KAH200401. (Unpublished report held by Ministry for Primary Industries, Wellington) 160 p.

Heinemann, A.; Gray, A.; (in prep). National Panel Survey of Marine Recreational Fishers 2022–23.

Horn, P.L. (1988). Bluenose. New Zealand Fisheries Assessment Research Document 1988/9. 13 p. (Unpublished report held by NIWA library, Wellington.)

Horn, P.L. (1991). Assessment of jack mackerel stocks off the central west coast, New Zealand, for the 1990–91 fishing year. New Zealand Fisheries Assessment Research Document 1991/6. (Unpublished report held by NIWA library, Wellington.) 14 p.

Hurst, R.J.; Bagley, N.W. (1994). Trawl survey of middle depth and inshore bottom species off Southland, February - March 1993 (TAN 9301). *New Zealand Fisheries Data Report No. 52*. 58 p.

James, G.D. (1984). Trevally. *Caranx georgianus*: age determination, population biology and fishery. Ministry of Agriculture and Fisheries. *Fisheries Research Bulletin; 25.* 51 p.

Johnston, R.G. (Ed.) (1993). Report from the Conversion Factors Working Group and Steering Committee 1992. MAF Fisheries, Greta Point Internal Report No. 2001. 171 p. (Unpublished report held in NIWA library, Wellington).

Ministry of Fisheries (2010a). Report from Fisheries Assessment Plenary, May 2010: stock assessments and yield estimates. Ministry of Fisheries, Wellington, New Zealand. 1158 p. (Unpublished report held in NIWA Greta Point library, Wellington.)

Ministry of Fisheries (2010b). Report from the Mid-Year Fishery Assessment Plenary, November 2010: stock assessments and yield estimates. 222 p. (Unpublished report held in NIWA Greta Point library, Wellington.)

Paul, L.J. (1976). A study on age, growth and population structure of the snapper, *Chrysophrys auratus* in Hauraki Gulf, *New Zealand Fisheries Research Bulletin, Ministry of Agriculture and Fisheries, New Zealand 13*: 63 p.

Paul, L.J.; Ó Maolagáin, C.; Francis, M.P.; Dunn, A.; Francis, R.I.C.C. (2000). Age, growth, mortality, and yield per recruit for butterfish (*Odax pullus*) in Cook Strait, New Zealand. *New Zealand Fisheries Assessment Report 2000/6*. 30 p.

Ryan, M.P.; Kilner, A.R. (1994). Comparison of boat ramp and fishing diary surveys of marine recreational fishing in MAF Fisheries Central Region. (Unpublished report held by Ministry for Primary Industries, Wellington).

Schiel, D.R.; Breen, P.A. (1991). Population structure, ageing and fishing mortality of the New Zealand abalone *Haliotis iris. Fishery Bulletin 89*: 681–691.

Schofield, K.A.; Livingston, M.E. (1996). Trawl survey of hoki and middle depth species on the Chatham Rise, January 1996 (TAN9601). *New Zealand Fisheries Data Report No. 71*. 50 p.

Shaun-ror, W. (1970). Age and growth of Taiwan spotted mackerel, *S. australasicus*. MSc thesis, Department of Zoology, Taiwan University. 38 p.

Stevenson, M.L. (2000). Assessment of red gurnard (*Chelidonichthys kumu*) stocks GUR 1 and GUR 2. *New Zealand Fisheries Assessment Report 2000/40*. 51p.

Taylor, R.B.; Willis, T.J. (1998). Relationships amongst length, weight and growth of north-eastern New Zealand reef fishes. *Marine and Freshwater Research 49*: 255–260.

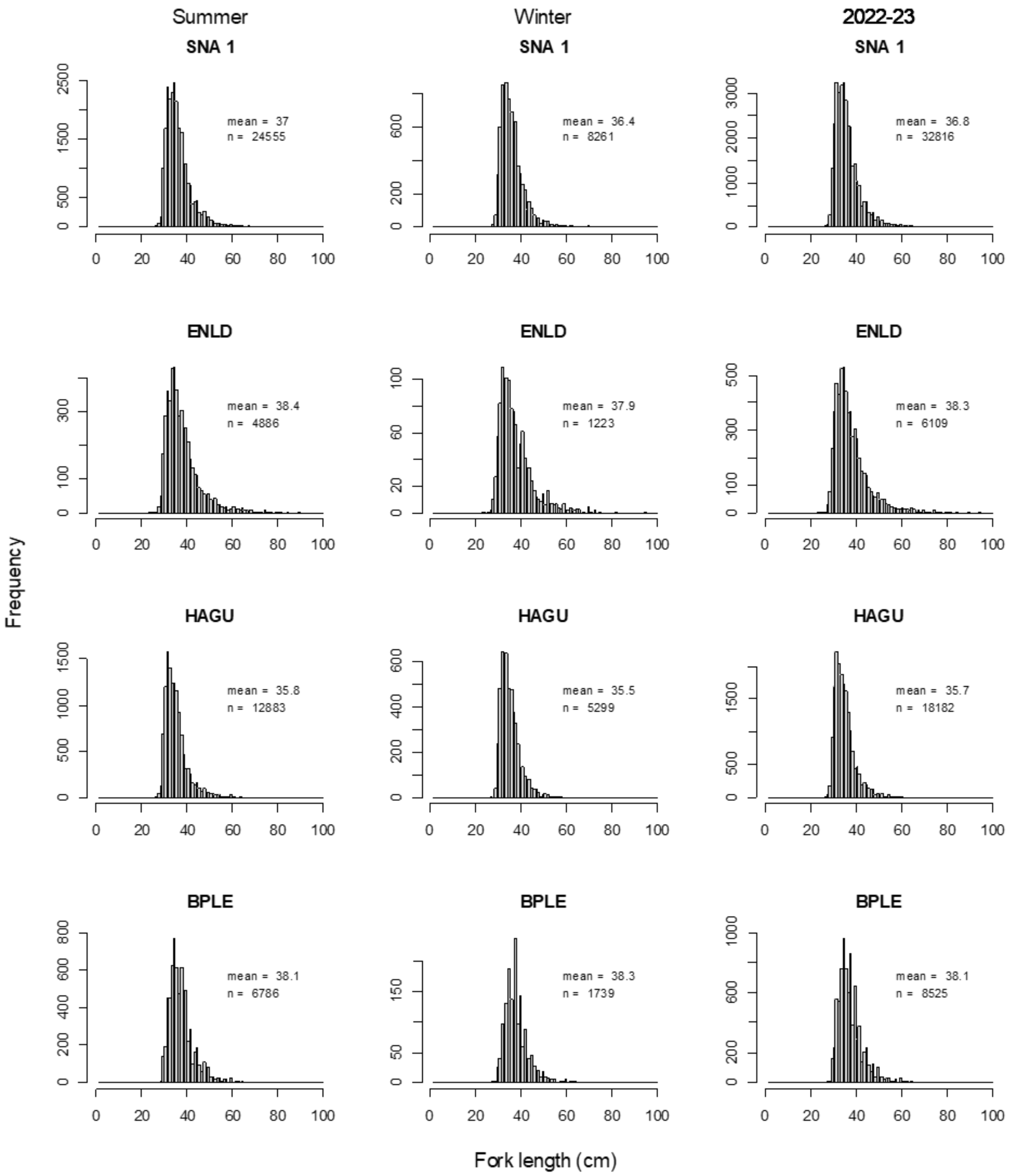
Tong, L.J.; Vooren, C.M. (1972). The biology of the New Zealand tarakihi *Cheilodactylus macropterus* Bloch and Schneider. *Fisheries Research Bulletin No. 6*. 60 p.

Wynne-Jones, J.; Gray, A.; Hill, L; Heinemann, A. (2014). National Panel Survey of Marine Recreational Fishers 2011–12: Harvest Estimates. *New Zealand Fisheries Assessment Report 2014/67.* 139 p.

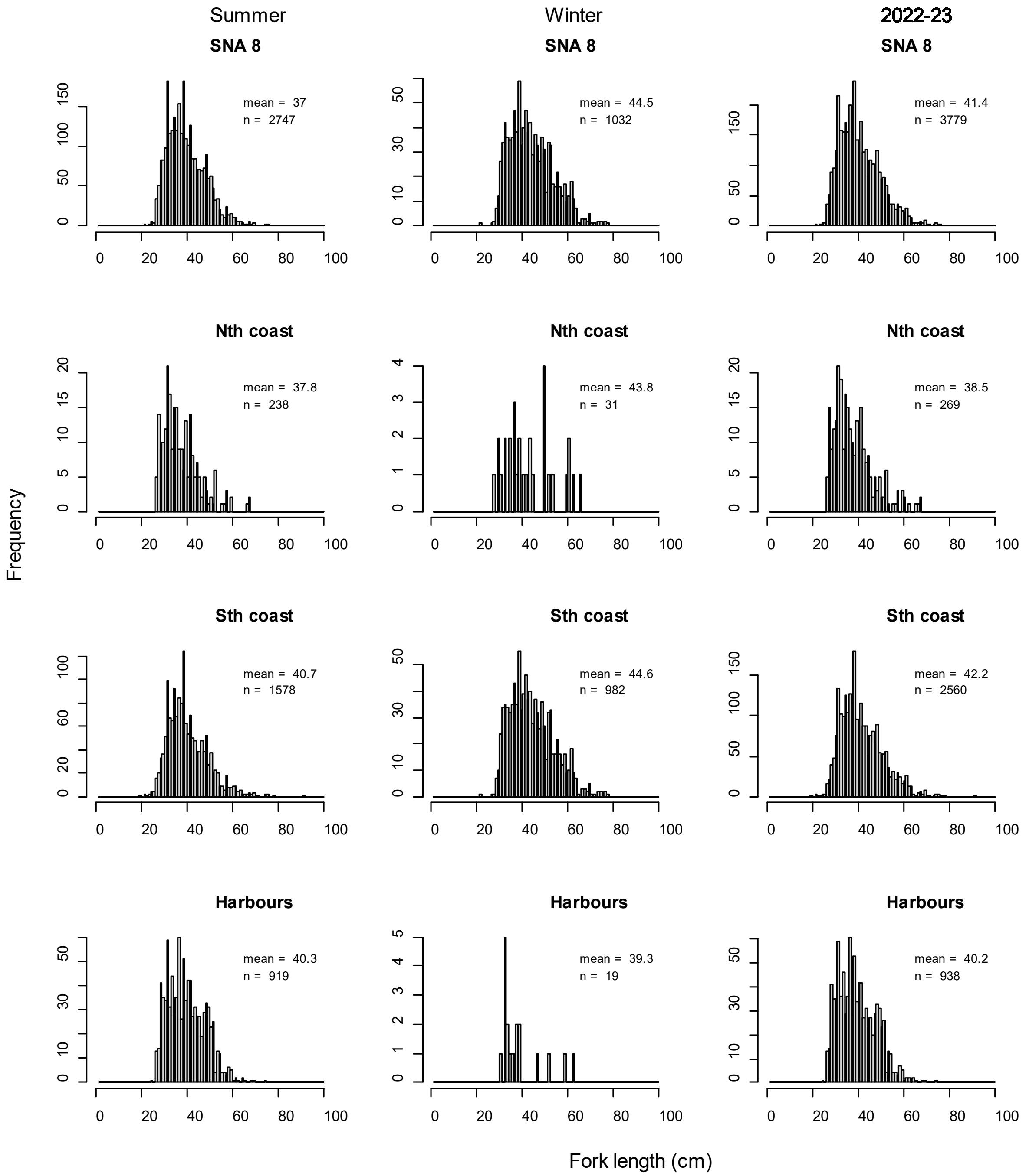
Wynne-Jones, J.; Gray, A.; Heinemann, A.; Hill, L.; Walton, L; (2019). National Panel Survey of Marine Recreational Fishers 2017–18. *New Zealand Fisheries Assessment Report 2019/24.* 104 p.

# 7. APPENDIX 1

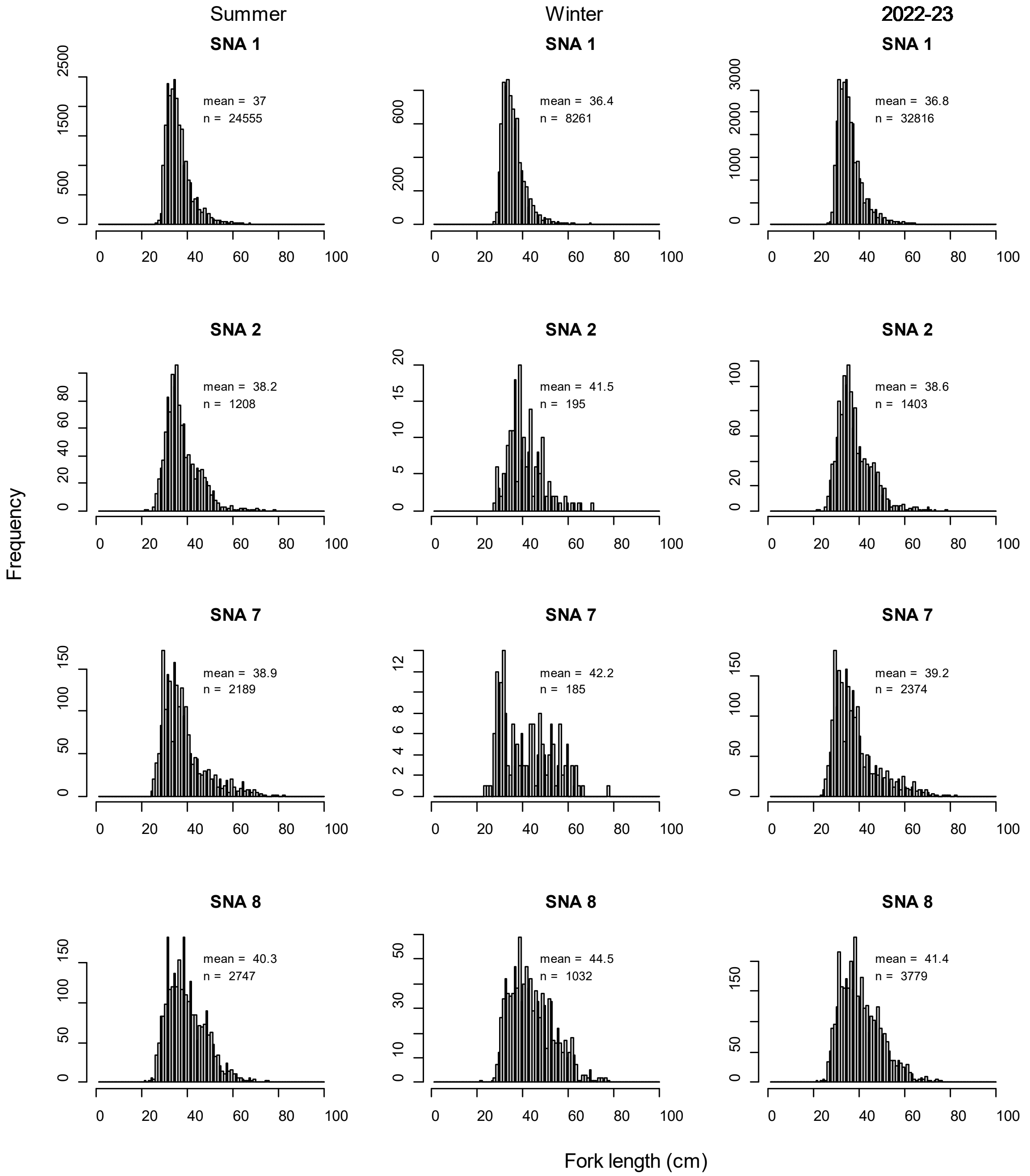
**Appendix 1a: Length frequency distribution for snapper in SNA 1 by region and season for the 2022–23 fishing year. n, number of individuals measured, means expressed in centimetres.**



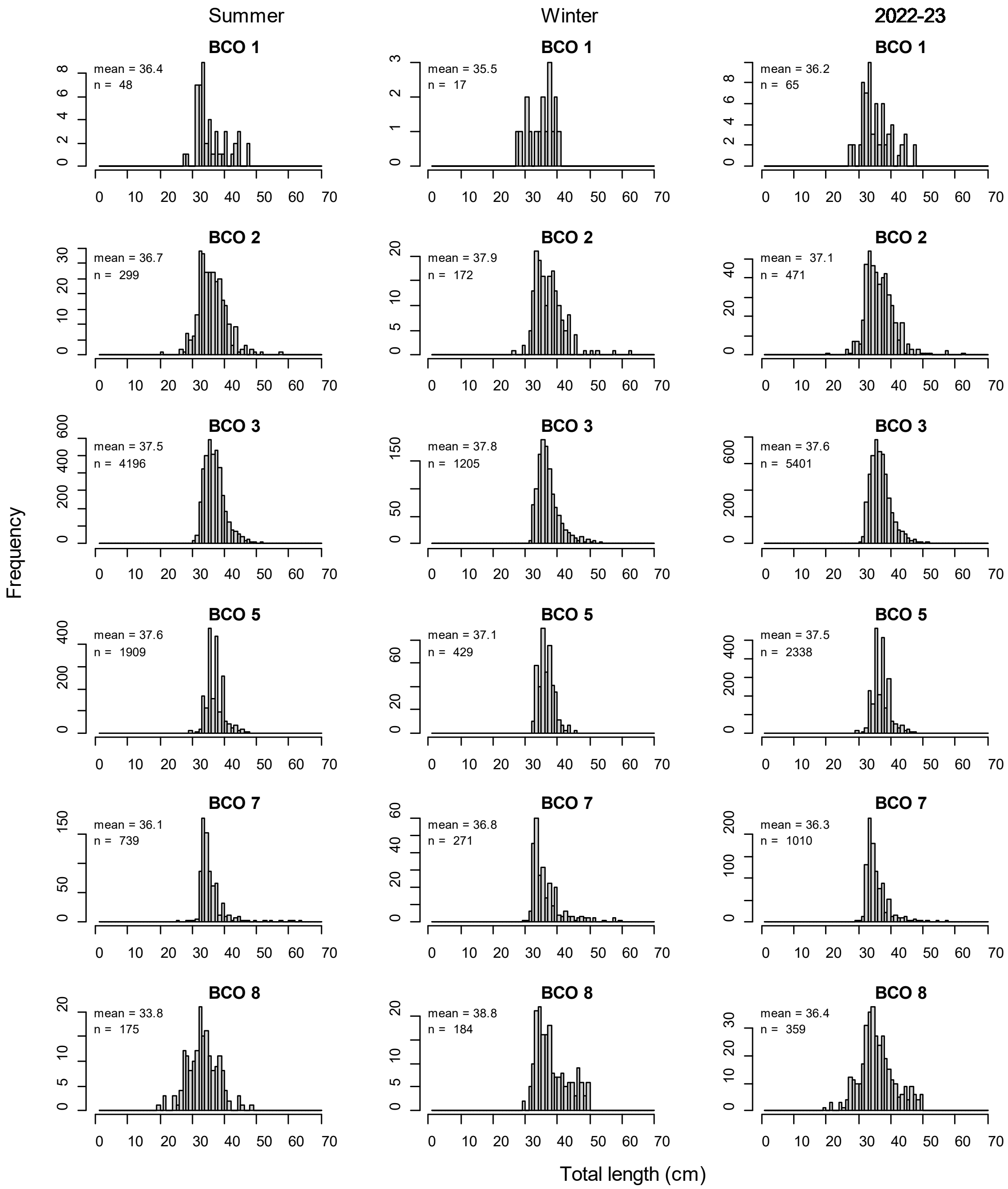
**Appendix 1b: Length frequency distributions for snapper measured in SNA 8 by region and season for the 2022–23 fishing year, means expressed in centimetres.**



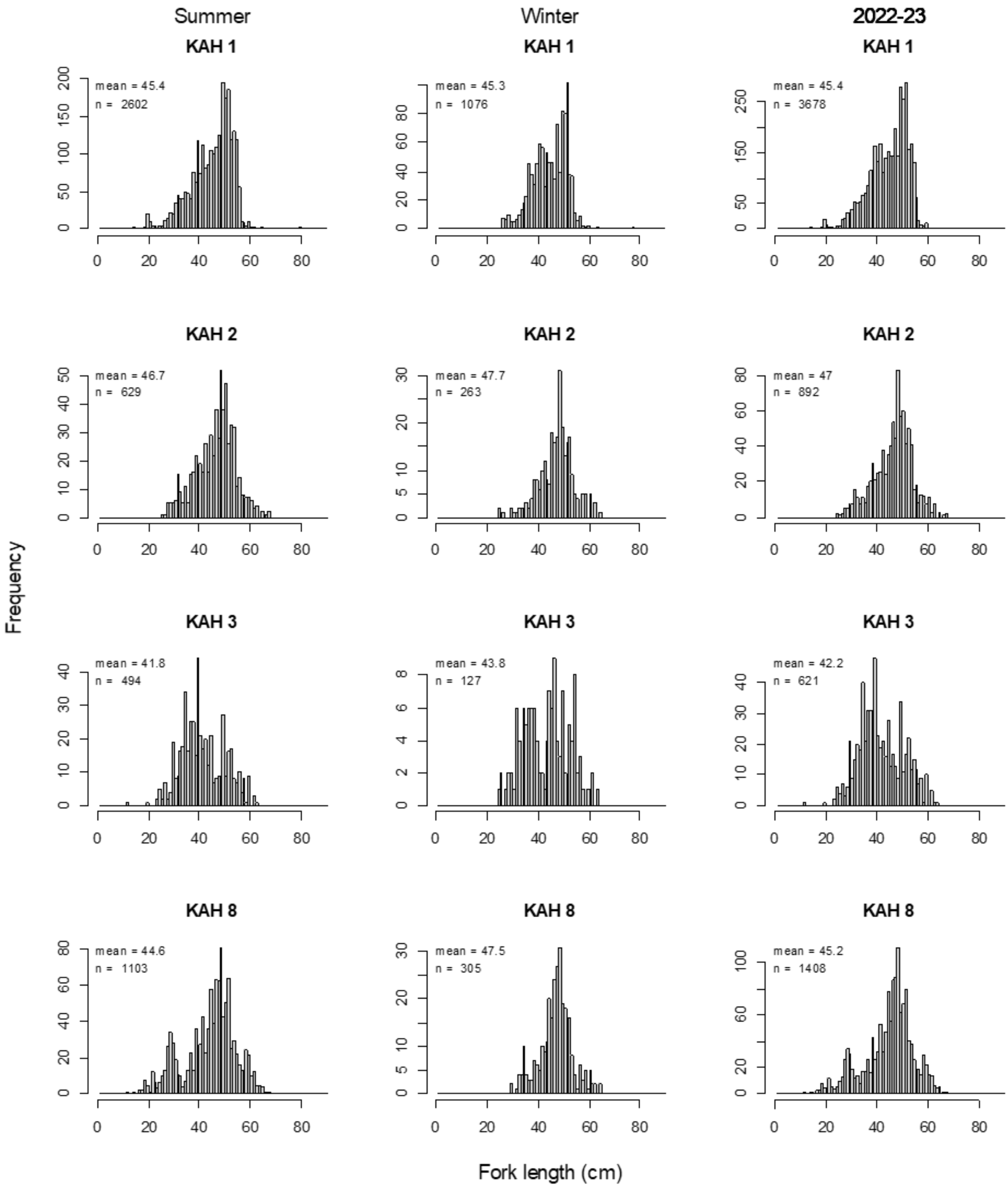
**Appendix 1c: Length frequency distributions for snapper measured by QMA and season for the 2022–23 fishing year, means expressed in centimetres.**



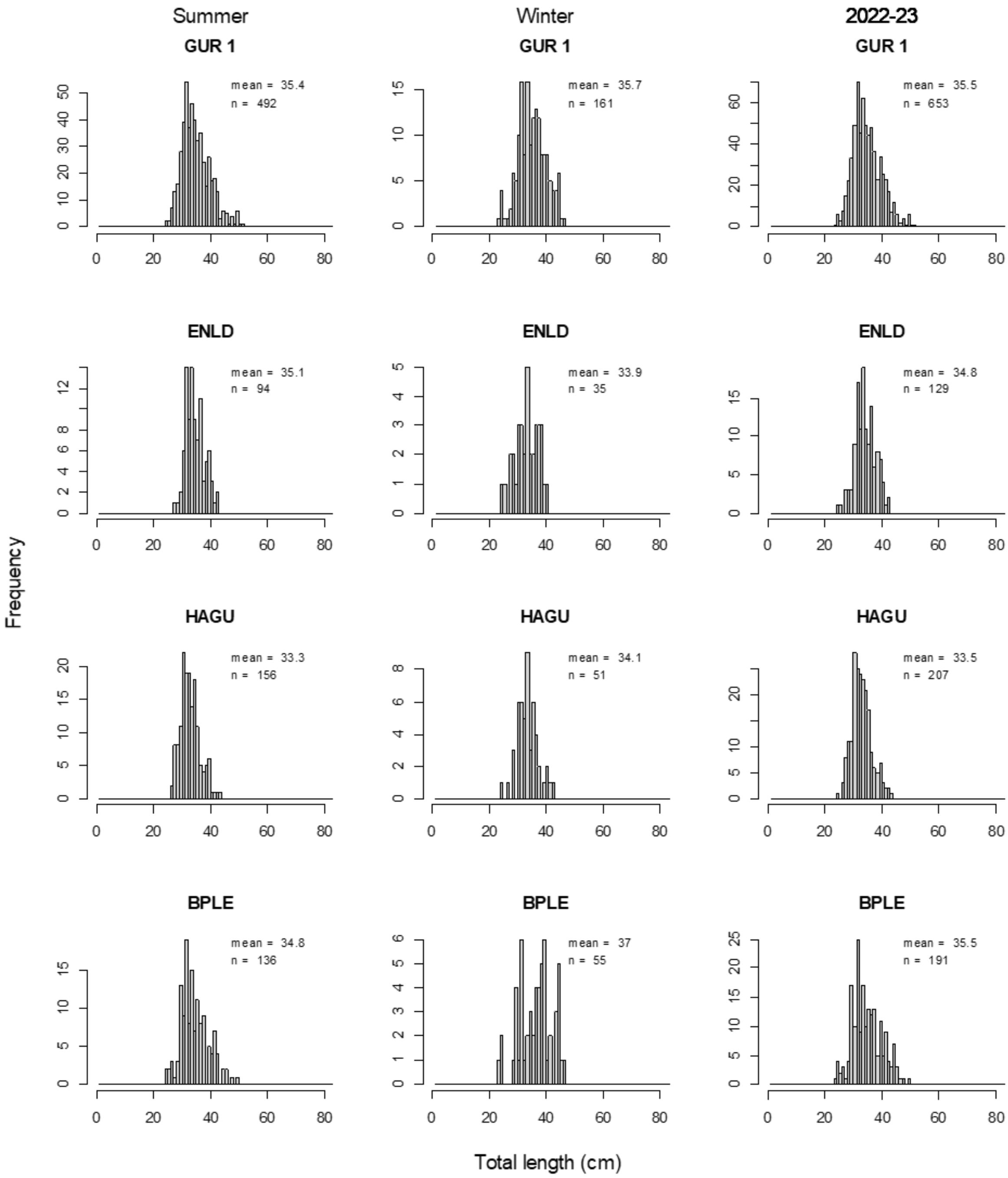
**Appendix 1d: Length frequency distributions for blue cod measured by QMA and season for the 2022–23 fishing year, means expressed in centimetres.**



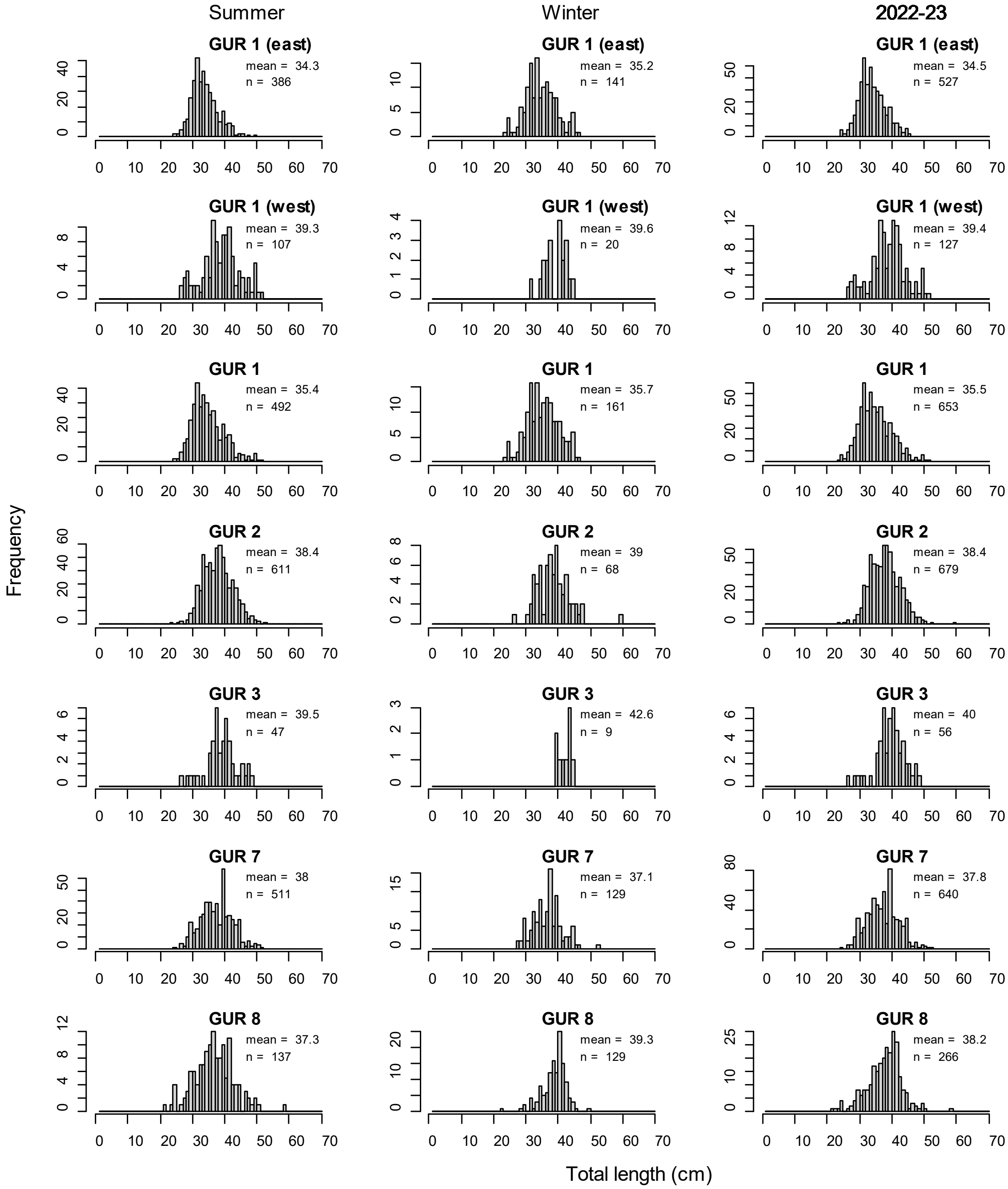
**Appendix 1e: Length frequency distributions for kahawai measured by QMA and season for the 2022–23 fishing year, means expressed in centimetres.**



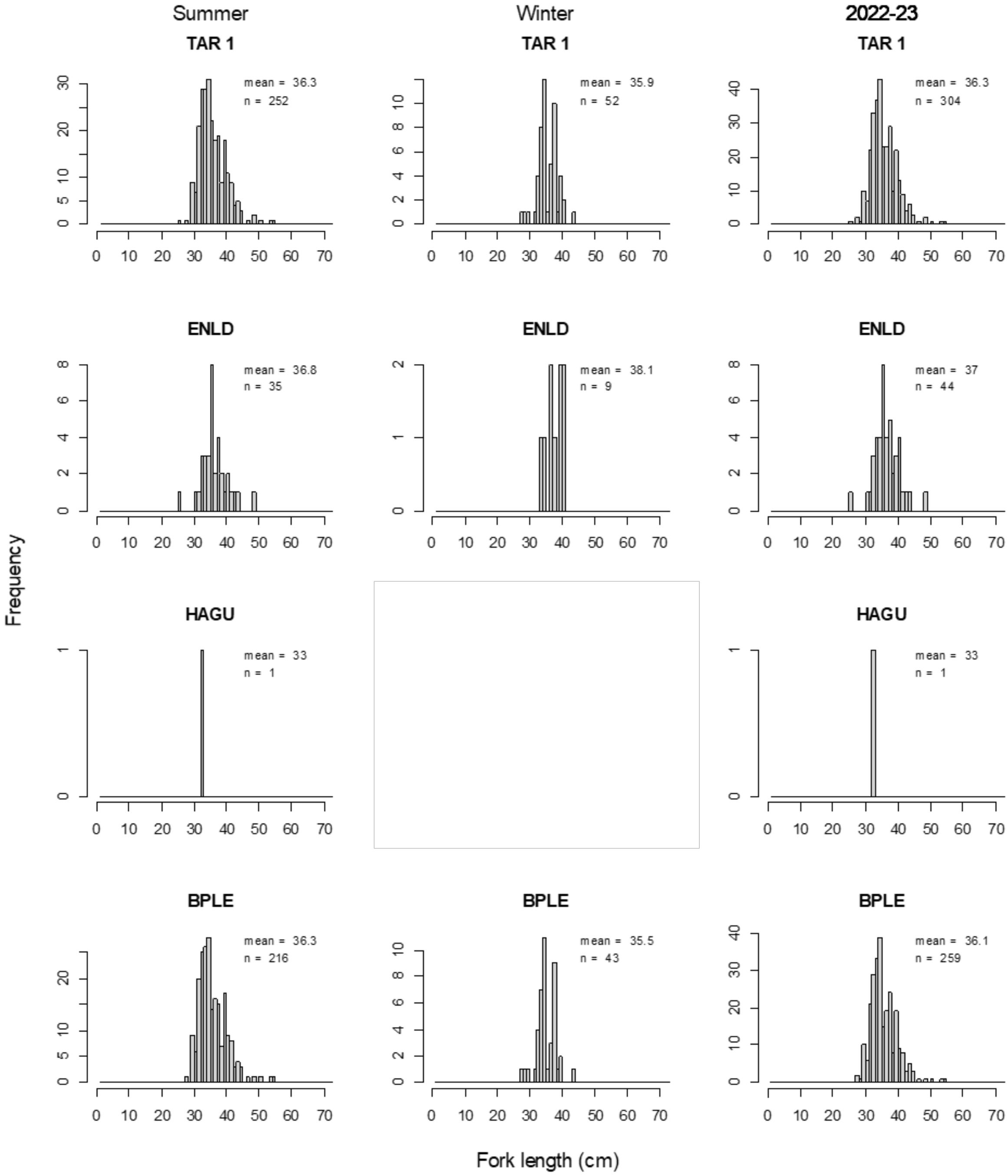
**Appendix 1f: Length frequency distributions for gurnard measured in GUR 1 by region and season for the 2022–23 fishing year, means expressed in centimetres.**



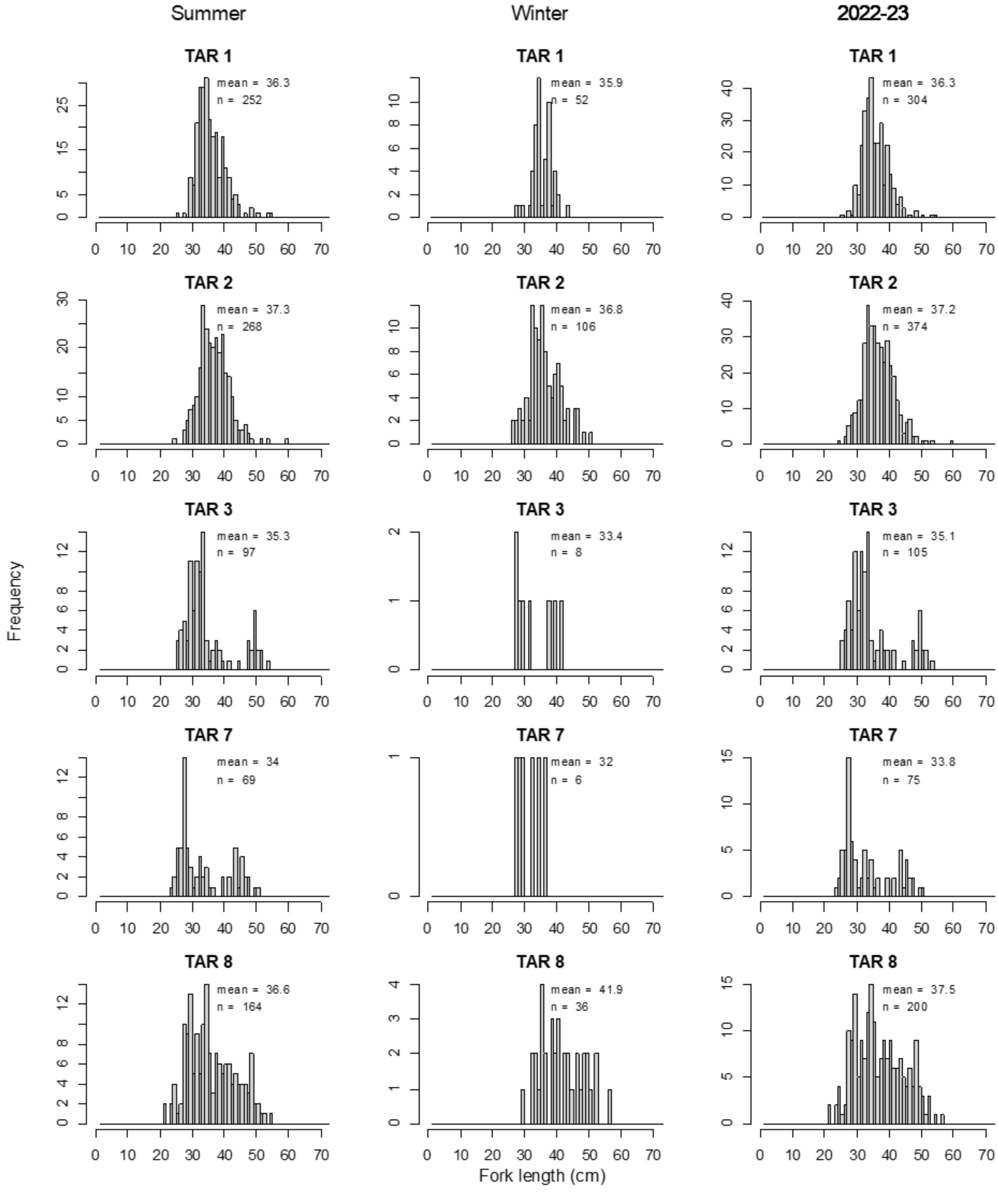
**Appendix 1g: Length frequency distributions for gurnard measured by QMA and season for the 2022–23 fishing year, means expressed in centimetres.**



**Appendix 1h: Length frequency distributions for tarakihi measured in TAR 1 by region and season for the 2022–23 fishing year. No winter measurements were available for the HAGU region, means expressed in centimetres.**



**Appendix 1i: Length frequency distributions for tarakihi measured in QMA and season for the 2022–23 fishing year, means expressed in centimetres.**



**Appendix 1j: Length frequency distributions for trevally measured in TRE 1 by region and season for the 2022–23 fishing year, means expressed in centimetres.**