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Review of competition creel survey data provided by the Hawke's Bay Sport Fishing Club

New Zealand Fisheries Assessment Report 2017/43

B. Hartill

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This project provides a review of competition creel survey data collected by members of the Hawke's Bay Sport Fishing Club (HBSFC) since the summer of 2006–07. These data were collected by the club to provide evidence for declines in catch rates of commonly caught species, which was of increasing concern to club members. The interview data were recorded on paper forms, which were entered into an electronic database by NIWA so that they could be analysed alongside creel survey data collected intermittently at the same boat ramp by research providers since 1992–93.

Unstandardised catch rate indices were generated from the HBSFC data for the four most commonly caught finfish species. These indices suggested that angler success (in terms of landed catch) for red gurnard and snapper had declined over time, which was contrasted by an increasing trend in kahawai catch rates and little change in tarakihi catch rates. Similar trends were evident when catch rate indices were calculated in terms of catch per fisher trip and catch per boat trip; from all of the available data, and from a subset where data were excluded from competitions where large pelagic species were amongst the prize list (in an attempt to exclude surface fishing effort that was unlikely to catch red gurnard, snapper or tarakihi). Competition participants were also asked how many fish they had released, for each species. When counts of landed and released fish were combined when generating total catch per unit indices from the HBSFC creel survey data, indices for two of the most commonly released species were very different from those calculated from the landed catch alone (for snapper and kahawai). These differences may be due to short term recruitment driven peaks in the abundance of sub legal or undesirably small fish, but there is no way of determining the true cause as data on fish sizes were not collected as part of the club creel survey.

Catch rate indices were also calculated from the creel survey data collected by five fishery independent research providers at the same boat ramp since 1992–93. These surveys collected more detailed data on fishing methods used during a trip, species targeted, and on the number of hours fished by each fisher (all of which were not recorded as part of the HBSFC survey). It was therefore possible to calculate a conventional catch per hour catch rate index from these data, in addition to catch per boat trip and catch per fisher catch rate indices which were analogous to those calculated from the HBSFC data, to see whether different trends were apparent when data were available on fishing duration. These analyses, however, identified inconsistences in how the research provider surveys were conducted, which has highlighted the need for MPI research providers to follow a standardised creel survey format, to ensure consistency.

Fortunately, the most recent research provider creel surveys, which were conducted alongside the HBSFC creels survey in 2011–12, 2014–15, and 2015–16 (NIWA surveys), followed a consistent and documented survey format, and we could therefore directly compare the catch rate trends derived from data collected by the HBSFC and NIWA during these years. The results of these comparisons were inconclusive, but promising. Similar trends (between the HBSFC and NIWA surveys) were apparent for these three years for snapper and kahawai, but red gurnard catch rates were far lower for the NIWA survey in 2011–12, yet similar in 2014–15 and 2015–16. There was, however, a very poor correspondence between the tarakihi catch rate indices derived from the two data sources.

There are several reasons why these two independent indices of fisher success may have differed for two of the species of interest. The NIWA survey was conducted over a 12 month period, but the interviews conducted by the club were undertaken only during the competition season. For example, the duration of the HBSFC survey was much briefer in 2011–12, as only five competitions were

surveyed over a four month period in that year, which may explain why the red gurnard catch rate estimate in that year was so different from that calculated from data provide by the year round NIWA survey. It is also likely that some of the differences between the two sets of catch per unit indices are due to the fact that there was no reliable way of excluding surface method fishing effort from the HBSFC data (such as trolling) that was unlikely to result in catches of bottom associated species, such as red gurnard. The differences in tarakihi catch rates may also be due to differences in the relative incidence of deeper water fishing trips in the two data sets, but there is no way of determining which of the HBSFC data events might have occurred in deeper waters.

Both the HBSFC and the NIWA creel surveys are ongoing, and comparisons of catch rates for commonly caught species should be repeated in the future, when more data become available. Some recommendations are given that the HBSFC could adopt, if they wished to improve the specificity of the data they collect as part of their competition creel survey.

Objectives

Overall Objectives:

1. To assess the potential utility to inform fisheries management of catch and effort information collected by fishers or fishing organisations.

Specific Objectives:

1. To characterise catch and effort information collected by the Hawke's Bay Sports Fishing Club.

2. To compare estimates of catch per unit of effort, fish size, and bag distribution from information collected by the Hawke's Bay Sports Fishing Club and research surveys.

3. To describe the situations in which catch and effort information collected by fishers or fishing organisations are likely to be useful to support existing research programmes or otherwise inform fisheries management.

1. INTRODUCTION

Almost all of the quantitative data on recreational fisheries used to inform fisheries management has been collected by research providers conducting surveys on behalf of MPI and its predecessors. These surveys generally conform to standard scientific practices and are designed to ensure that data are collected in manner that is as reliable, unbiased and as representative as possible, given the resources available and the nature of the fishery being assessed. Survey designs and methods are usually peer reviewed by MPI's Marine Amateur Fisheries Working Group before they are implemented, to help ensure that the data they provide is ultimately fit for purpose.

Recreational fishing in New Zealand is diverse and widespread, however, and MPI funded surveys therefore usually focus on larger higher value fish stocks. One consequence of this focus is that there is often very little information available to inform localised fisheries management in some of the less intensively fished areas of New Zealand's coast. One area where there is relatively little quantitative data on recreational fishing is in Hawke Bay, where amateur fishers have expressed concerns about the declining state of their fishery. These concerns led to a decision by club members to collect their own catch effort data, which they have done since 2006–07. Club members designed a competition creel survey to monitor catch rate trends, and have used the resulting data to argue that there is valid evidence for continued concerns about declining fishing success and abundance.

The purpose of this study is to evaluate both the survey methods used and the data by this stakeholder group, alongside more limited information provided by more formal surveys conducted by MPI recognised research providers. Some of the conclusions drawn from this assessment may also apply to other self-reported data sources, but each source of stakeholder data should be assessed on its own merits, given the context within which it is collected, and the methods used.

2. METHODS

2.1 Calculating catch rate indices from HSBFC data

Most of the analyses given in this report are based on catch effort data collected during interviews with fishers returning to the Hawke's Bay Sport Fishing Club (HBSFC) boat ramp in Napier (Figure 1). Members of the HBSFC have been conducting interviews since 2006–07, to monitor trends in recreational fishing following concerns about declining catch rates. All interviews have been intentionally conducted on competition days only, to maximise the number of interviews obtained per hour of interviewing. Competition entrants tend to converge on the club ramp at the end of the day, just before the weigh-in, so the aggregate catch (number of each species landed and number released) was recorded for all fishers in the boat combined, rather than by fisher, to expedite each interview. Interviewers also recorded data on: the date, boat name, the number of fishers in each boat, and in some instances the type of fishing undertaken (21% of all records) and a description of the area fished, but none of this ancillary information has been used in analyses provided by the club.

Figure 1: View of the Hawke's Bay Sport Fishing Club boat ramp seen from a NIWA web camera.

All data were recorded on paper forms (see Appendix 1 for an example), which were filed in ring binders by competition date. Aggregate tallies were made for each competition day of: the number of boating parties interviewed, the number of fishers in each boat, and the number of species landed and released. These tallies were then summed at the end of each season so that the HBSFC could monitor trends in fishing success experienced by club members. Fifteen ring binders, containing interview data collected between 2007–08 and 2015–16 were lent by the HBSFC to NIWA, so that the paper forms and competition summaries could be scanned and then entered into a structured electronic database. The club was unable to locate the paper forms collected in 2006–07 when they provided their data to NIWA, although the data from this first year were found towards the end of this study, and these data could be punched and analysed alongside any other data that are collected in the future.

The electronic data were groomed to identify and address obvious errors in the data. Each paper form was assigned a record number when the data were punched, but sequential records for the same date often had different competition names. Checks against electronic scans of forms identified two reasons for incorrect competition names; alternative spelling by the interviewer; and the use of photocopies of blank forms used during a previous competition, where the previous competition name was already recorded on the blank form. Also in many cases the survey date was not written on a form, but this could be inferred from the sequencing of the forms and the competition name. Varied spelling, codes and descriptions were also used to record information on fishing methods used (when recorded), locations fished, and names for some of the less commonly caught species. While none of these issues would have resulted in incorrect manual catch and boat tallies, inconsistencies in data recording become more problematic when summarising and analysing a long term time series of electronic catch and effort data. No data punching errors were identified when a subsample of electronic records were reconciled against electronic scans of paper forms. Summary statistics of the number of boats and fishers participating in each year's competitions are given in Table 1.

Table 1: Number of boats interviewed (and fishers in interviewed boats in brackets) by competition and by fishing season (September to May). Fishing competitions that offered prizes for large pelagic species, such as tunas and sharks, are denoted by an asterisk. For some analyses the data from these competitions were removed to quasi standardise the dataset by fishing method. Totals are given for all competitions in each year, and for those competitions where large pelagic species were not among the target species.

Competition name	2007–08	2008–09	2009–10	2010–11	2011–12	2012–13	2013–14	2014–15	2015–16
Barton Marine Pot Fish	20 (69)	–	–	–	–	–	–	–	–
Xmas Open *	70 (214)	–	–	–	–	–	–	–	–
Plumbing World	6 (21)	–	–	–	–	–	–	–	–
Danks *	210 (646)	154 (492)	–	–	–	–	–	–	–
Coruba *-	171 (601)	121 (441)	176 (561)	109 (333)	–	164 (528)	–	–	–
Twilight	25 (87)	–	–	34 (108)	–	–	9 (26)	–	–
Snapper Bonanza	139 (401)	98 (314)	99 (301)	236 (714)	29 (88)	94 (277)	37 (115)	–	–
Tumu Timbers	38 (144)	24 (101)	22 (89)	37 (134)	–	46 (167)	30 (112)	–	–
Fruit Growers	25 (85)	23 (80)	–	60 (204)	34 (112)	–	17 (69)	24 (81)	27 (97)
Ladies Day	17 (58)	22 (92)	–	–	–	41 (135)	–	44 (149)	17 (80)
Opening Day	36 (118)	30 (107)	46 (151)	37 (111)	36 (104)	47 (131)	46 (140)	30 (91)	22 (75)
Farmlands *	40 (161)	–	50 (177)	44 (152)	–	37 (135)	–	39 (135)	54 (187)
Carters	37 (142)	–	–	54 (168)	–	35 (130)	18 (62)	23 (82)	22 (69)
Ryobi	–	66 (219)	100 (288)	–	–	–	–	–	–
Pot Fish	–	35 (115)	–	41 (124)	35 (100)	–	–	–	–
Holiday Open *	–	79 (257)	–	–	–	33 (105)	–	–	–
Pak'n Save *	–	27 (107)	149 (440)	147 (444)	–	79 (242)	20 (75)	69 (197)	–
DB Pot Fish	–	–	84 (262)	–	–	–	–	–	–
Pan Pac	–	–	–	22 (80)	11 (37)	41 (110)	15 (61)	19 (65)	–
Closing Day	–	–	–	26 (85)	–	–	19 (55)	24 (72)	17 (50)
Firmans Marine	–	–	–	70 (236)	–	–	36 (115)	41 (135)	36 (121)
Mico Plumbing	–	–	–	–	–	11 (39)	11 (39)	6 (24)	–
Edward Gibbon	–	–	–	–	–	29 (87)	–	–	25 (79)
Resene Paints *	–	–	–	–	–	25 (87)	–	16 (54)	17 (48)
Heretaunga Club	–	–	–	–	–	–	9 (35)	–	–
Top Boat/Aqua Marine	–	–	–	–	–	–	–	28 (90)	–
Ideal Electrical *	–	–	–	–	–	–	–	20 (72)	21 (76)
Top Boat	–	–	–	–	–	–	–	35 (95)	25 (79)
Mega Fish *	–	–	–	–	–	–	–	–	114 (362)
Breakers Classic *	–	–	–	–	–	–	–	–	108 (334)
Pollets Top Boat	–	–	–	–	–	–	–	–	29 (79)
Total	834 (2 747)	679 (2 325)	726 (2 269)	917 (2 893)	145 (441)	682 (2 173)	267 (904)	418 (1 342)	534 (1 736)
Competitions excl pleagics	343 (1 125)	298 (1 028)	351 (1 091)	617 (1 964)	145 (441)	344 (1 076)	247 (829)	274 (884)	220 (729)
% excluding pelagics	41 (41)	44 (44)	48 (48)	67 (68)	100 (100)	50 (50)	93 (92)	66 (66)	41 (42)

The measure of fishing success that the HBSFC has been using to monitor trends in fishing success over time has been the average number of fish caught of a given species per boat. Similar catch rate indices were calculated for this study, for the four most commonly caught species (see Appendix 2a for totals of the number of each species landed by interviewed fishers during each competition year, and Appendix 2b for the reported number of fish of each species released). Alternative measures of fishing success were also calculated from the available club data, to determine how robust these catch rate indices were to alternative interpretations of fishing effort. Interviewers routinely recorded the number of fishers in each boat, and these data were used to calculate indices of the average catch per fisher, to allow for changes in boat occupancy over time.

We were not able to calculate more conventional catch per hour catch rate indices, as no data were recorded on the number of hours fished during a trip. An implicit assumption has therefore been made when calculating catch rate indices from the HBSFC data; that there has been no change in the average duration of fishing trips over time, regardless of any change in localised abundance (fishing trips may be shorter when catch rates are higher and a satisfactory catch is more readily attained).

Catch rates indices were calculated only for those species where at least 500 fish were landed during most years (red gurnard, snapper, kahawai, and tarakihi) as there is little merit in calculating indices for less commonly caught species. This is because a small number of atypically successful fishing events can have an undue influence on the average catch rates for that year in a way that most other fishers have not experienced.

Recreational fishers use a wide variety of fishing methods to target a variety of species, and the calculation of catch rate indices from recreational catch effort data is therefore usually restricted to events where a core group of common and relevant fishing methods have, or could have, been used to target the species of interest. While the HBSFC survey form has a space for the interviewer to record the fishing method(s) used, a record of the fishing methods used was only available on 21% of the available forms. This is unfortunate because, for the majority of fishing events, there is no way of identifying and removing trips where fishing methods were used which were unlikely to result in a catch of the species of interest. Trolling effort, for example, should not be considered when assessing changes in red gurnard catch rates over time. A wide range of species are encountered in this area, however, so it is likely that fishers will employ a variety of fishing methods during a trip.

Fortunately, good records were kept of the target species for each competition, and these data were used to identify competitions where there was an incentive for contestants to target pelagic species using pelagic fishing methods such as trolling. Alternative catch rate indices were therefore calculated from a subset of the data, for competitions where prizes were not offered for large pelagic species, such albacore tuna and sharks. This filtering of the data removed 85% of events where trolling effort was recorded as one of the fishing methods used in the 21% of events where the interviewer recorded some form of fishing effort. This still suggests, however, that some data from the remaining data would have included fishing events where fishers used surface fishing methods such as trolling, during competitions where prizes were not offered for large pelagic species, and ideally these events should not have been considered when calculating catch rate indices for bottom associated species, such as red gurnard, snapper and tarakihi.

All four of the catch rate indices calculated for each species (catch per boat trip and catch per fisher trip; calculated from all competition data vs just those trips undertaken when large pelagic species did not occur in the prize pool) were divided by their geometric means, so that their trends could be directly compared on a common scale.

Catch rate indices are usually calculated in terms of landed catches per unit of effort, but fishers interviewed as part of the club creel survey were also asked about any catch that they had released during their trip. The landed and released catches for each trip were therefore combined to so that total catch rate indices could be calculated, to see if their trends differed from more conventional landed catch rate indices.

2.2 Calculating catch rate indices from research provider survey data

Recreational fisher interview (creel) survey data are also available from a second independent data source for the HBSFC boat ramp, as MPI (and previously MAF and MFish) have occasionally commissioned fishery independent research providers to conduct creel surveys at this the same boat ramp in the past (Table 2). Five surveys have been conducted at this ramp since 1992–93, by three different research providers, who each followed a different survey format (a consistent survey format has been used since 2011–12, by NIWA). Four of these surveys were conducted over a 12 month period, and the surveyed days were selected at random for all five surveys, rather than focussing on competition days. This alternative source of information therefore potentially provides a more representative and longer term, albeit intermittent, indication of how fisher success may have changed over time.

Table 2: Summary statistics for fishery independent research provider creel surveys conducted at the HBSFC ramp.

Fishing year	Days surveyed	Hours surveyed	Start date	End date	Boats fishing	Fishers interviewed	Fishers per boat	% of boats with zero catch	Hours fished per fisher
1992–93	24	173	20/12/92	18/04/93	494	1 245	2.52	10%	2.26
1999–00	43	110	18/12/99	26/11/00	257	507	1.97	8%	3.18
2011–12	24	96	16/10/11	30/09/12	232	664	2.86	7%	4.67
2014–15	60	232	05/10/14	20/09/15	337	959	2.85	11%	5.16
2015–16	59	234	04/10/15	18/09/16	366	1 050	2.87	8%	5.38
Total	210	845			1 686	4 425			

Catch rate indices were generated from these data for the same species as those for which indices were calculated from the HBSFC data (red gurnard, snapper, kahawai, and tarakihi; see Appendix 3 for the number of fish of each species landed by fishers interviewed during research provider surveys), as these were also the four species most commonly encountered during the research provider surveys. Both catch per boat and catch per fisher indices (potential bottom fishing methods only) were calculated from these data, for direct comparison with similar indices generated from the HBSFC survey data (where data from competitions where large pelagic species were targeted was excluded).

Non-parametric bootstrapping was used to estimate standard errors for both the club and research provider catch rate indices, to further inform the comparison of both sets of indices. Fishing party interview data were bootstrapped by boat, within each fishing year, to give an indication of the uncertainty associated with each index value.

Unlike the HBSFC survey, fishers participating in the research provider surveys are routinely asked how long they had fished for during their trip. Bootstrapped catch per fisher trip and catch per hour catch rate indices were therefore generated from the research provider data to assess the potential extent to which different trends in fisher success could become apparent when data on trip duration was also collected.

3. RESULTS

3.1 Catch rate indices calculated from HBSFC data

All four of the catch rate indices calculated for each species show broadly similar trends (Figure 2, landed catch only). There are almost no differences when catch per boat and catch per fisher indices are compared for each dataset, as there has been relatively little change in boat occupancy over time. Some differences are more apparent when indices calculated from all the available data are compared with those calculated when competition data from events where tuna and other large pelagics such as shark species (not including dogfish) have been dropped from the dataset.

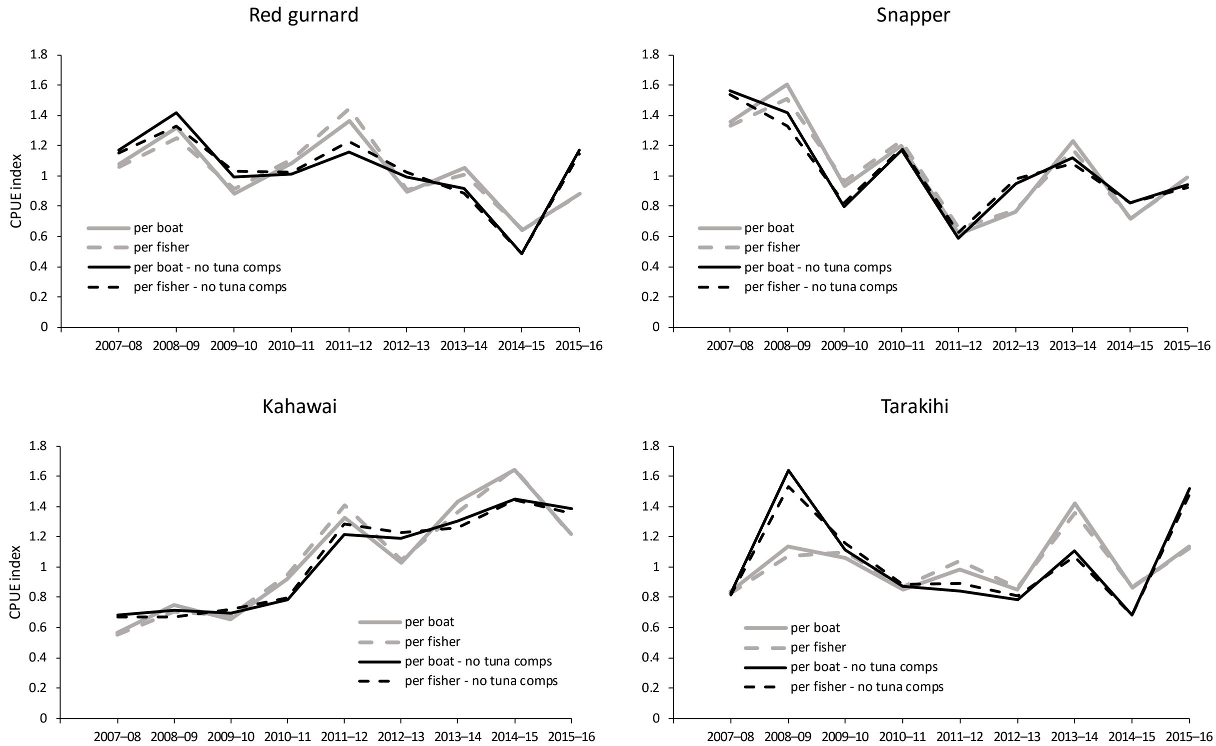

Figure 2: Comparison of four unstandardized catch rate indices (landed catch only) generated for the four finfish species most commonly landed by fishers interviewed by members of the HBSFC on competition days. All four indices for each species are divided by their respective geometric means, so that they can be compared on a similar scale.

All four indices calculated for red gurnard show fluctuating, but declining catch rates over most of the nine year period for which data are available. Between 2007–08 and 2014–15 the average rate at which red gurnard were landed by boats returning during competition events where prizes were not offered for large pelagic species declined from 7–8 to 3 fish per boat, and from 2.5 to 0.9 gurnard per fisher. There is, however, evidence of an increase in the catch rate of gurnard at the end of the time series, between 2014–15 and 2015–16, but it is too early to say whether this increase will be sustained given the degree to which catch rates have fluctuated over the short term. A cursory examination of creel survey data collected at the same boat ramp by NIWA during the current 2016–17 fishing year suggests similar or greater levels of fisher success when targeting this species, as the majority of the boating parties interviewed by NIWA have landed reasonable numbers of gurnard.

Landed snapper catch rates by competition entrants also fluctuated, declining from around 3.5 fish per boat and 1 fish per fisher in 2007–08, to less than 1.8 fish per boat and 0.6 fish per fisher in 2011–12;

after which there was a modest overall increase in fisher success. There has been a steady overall increase in the rate at which kahawai have been landed by competition entrants over the past nine years, increasing from around 1.3 to 2.6 fish per boat, and 0.4 to 0.8 fish per angler. There is no evidence of a long term trend in the rate at which tarakihi have been landed by competition entrants since 2007–08, with catch rates fluctuating around 1.7 fish per boat and 0.5 fish per fisher.

Catch rate indices for two of the four most commonly caught species followed very different trends when the released catch was added to the landed catch when calculating catch rate indices (Figure 3). The far greater degree of difference between the landed catch and total catch rate indices calculated for snapper and kahawai reflects the higher release rate for these species (26.0% and 72.8% respectively – see Appendices 2a and 2b). The release rates for red gurnard and tarakihi were much lower (12.6% and 11.8%) and the inclusion of the additional released catch consequently has little influence on any catch rate index.

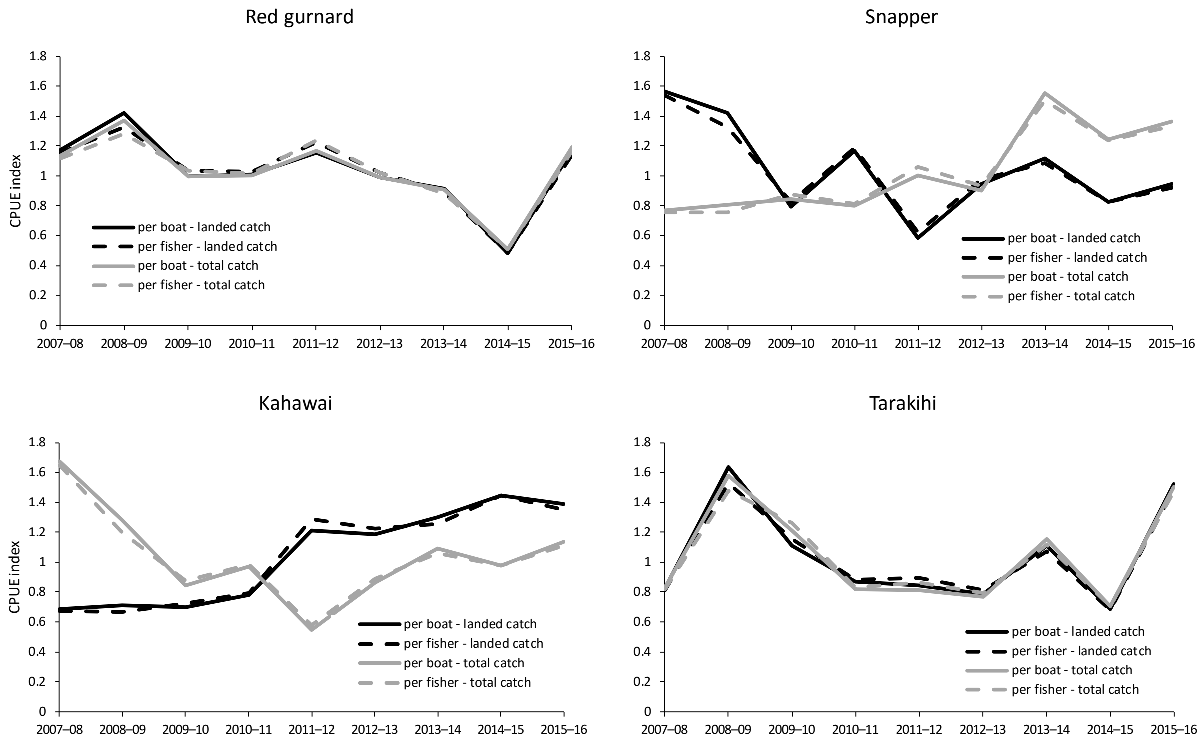

Figure 3: Comparison of unstandardized landed catch and total catch rate indices generated for the four species most commonly landed by fishers participating in competitions, where large pelagic species were not included in the prize species list. The landed catch indices shown here are the same as those shown in Figure 2. All four indices for each species are divided by their respective geometric means, so that they can be compared on a similar scale.

3.2 Catch rate indices calculated from research provider data

There is a consistent, but unexpected pattern evident when three alternative catch rate indices calculated from research provider creel survey data are compared for the four most commonly caught species (Figure 4). The catch per hour fished catch rate estimates are higher than the catch per fisher and catch per boat catch rates estimates for the first two surveys (conducted by MAF in 1992–93 and by Kingett Mitchel in 1999–00), but lower for the last three surveys (which were all conducted by NIWA following a standardised interview format). This pattern is probably due to differences in the way questions were asked and answers were recorded, as some inconsistencies are apparent in some of the summary statistics given in Table 2. The average trip duration inferred from the 1992–93 creel survey data was only 2.26 hours long, which is far shorter than in any other year, whereas the average number of fishers per boat in 1999–00 was only 1.97 fishers, which was far lower than in any other survey year. These results suggest that the most consistent and reliable data collected by research providers at the HBSFC ramp was that collected by NIWA in recent years. Any comparisons of catch rates calculated from the HBSFC competition creel survey data should therefore be restricted to the creel survey data collected by NIWA since 2011–12.

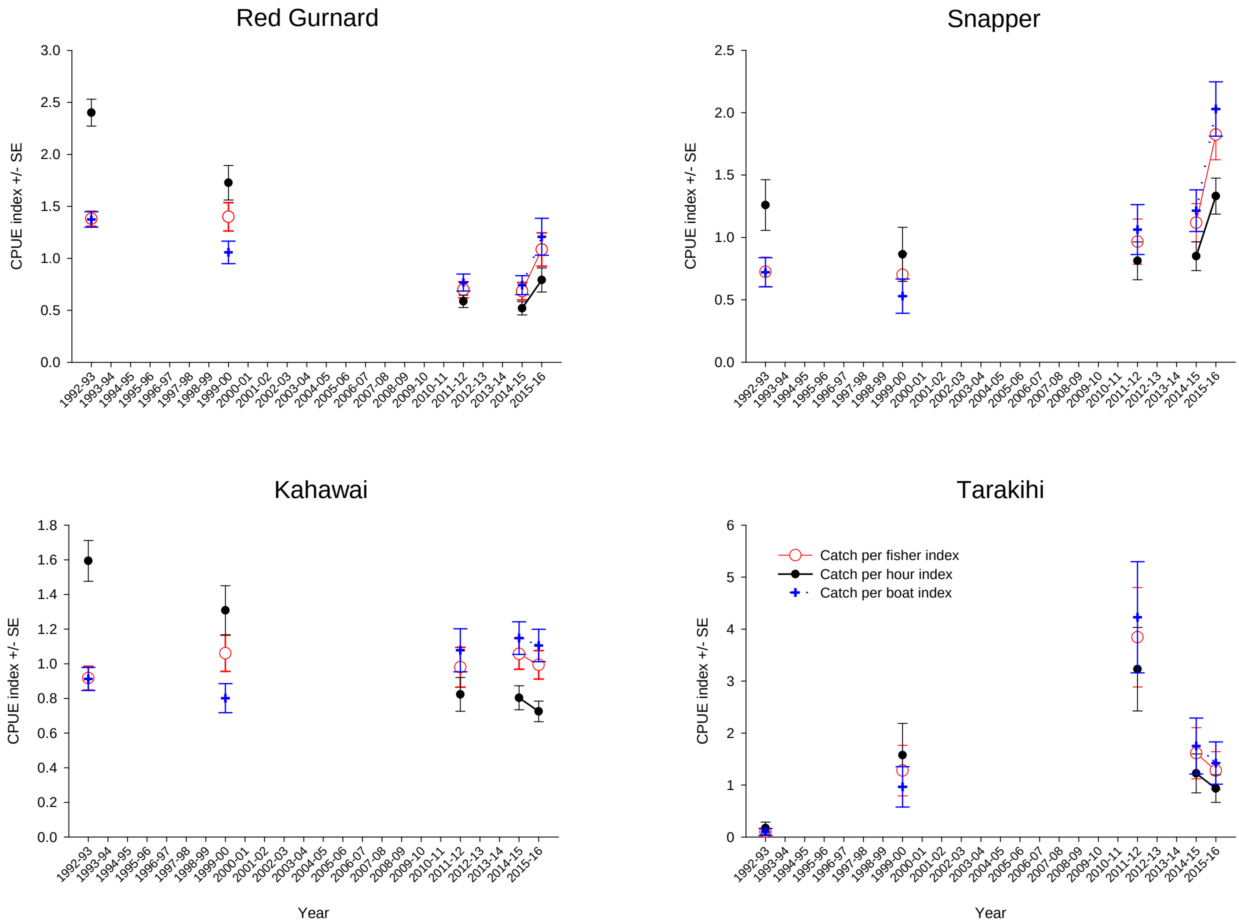

Figure 4: Comparison of unstandardized catch rate indices calculated from creel survey data collected at the HBSFC by fishery independent research providers since 1992–93. Three alternative measures for fishing effort were used when calculating indices for each species. All catch rate indices have been divided by their geometric means so that they can be directly compared.

The degree of similarity between catch rates calculated from the HBSFC and NIWA data varies by species (Figures 5 and 6). The snapper and kahawai catch rate indices calculated from these two data sources follow broadly similar trends. Red gurnard catch rates calculated from the two data sources were, however, substantially different in 2011–12 (when the numbers of boating parties interviewed during the HBSFC survey and the NIWA survey were lower than in any other year – see Tables 1 and 2), very similar in 2014–15, and then increased to differing degrees in 2015–16. The tarakihi catch rate indices calculated from the two data sources followed very different trends.

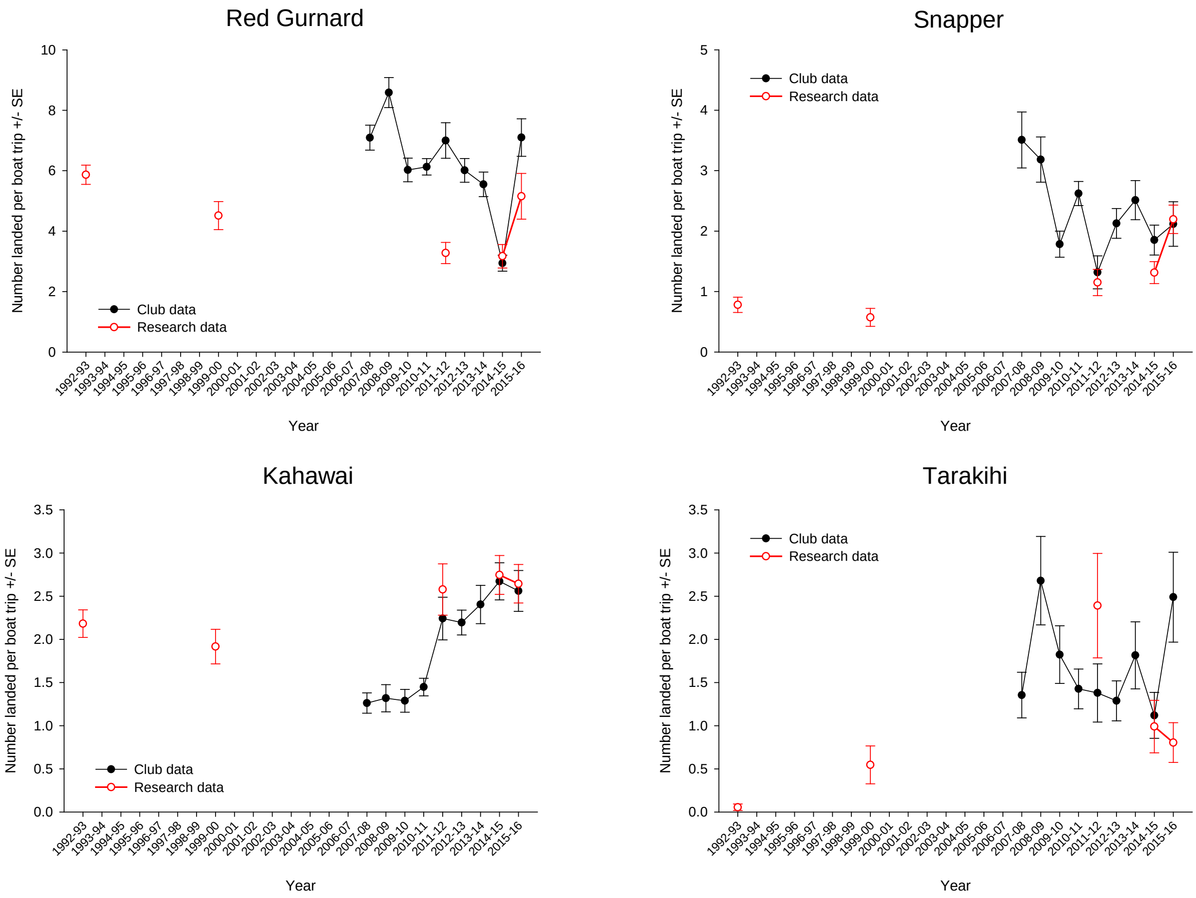

Figure 5: Comparison of seasonal catch per boat trip estimates derived from club completion creel survey data with annual catch per boat trip estimates derived from research provider run creel survey data, for the four most commonly landed finfish species.

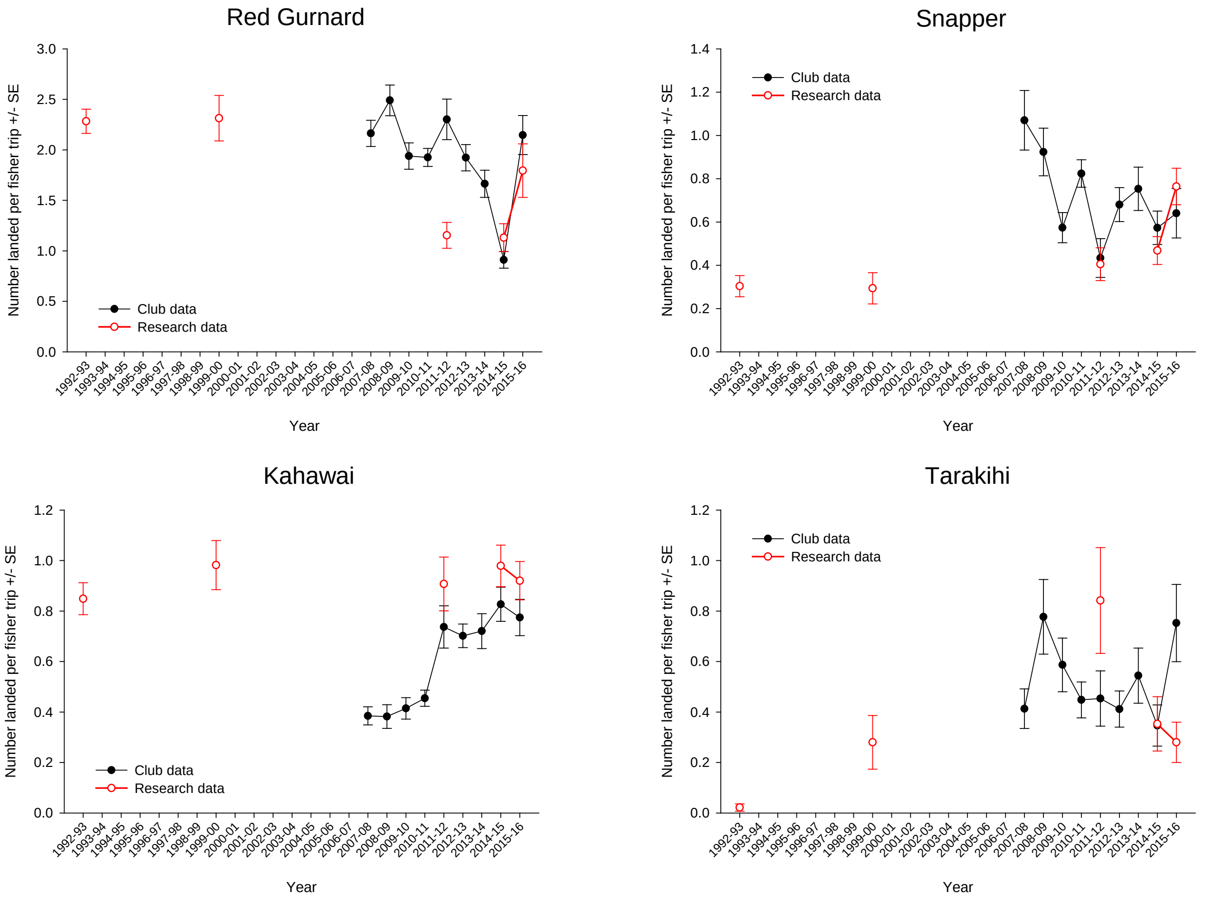

Figure 6: Comparison of seasonal catch per fisher trip estimates derived from club completion creel survey data with annual catch per fisher trip estimates derived from research provider run creel survey data, for the four most commonly landed finfish species.

3.3 Length composition of fish measured during research provider creel surveys

Fishers may also experience changes in the size of fish they encounter, but no information is available on the size composition of fish landed by HBSFC club members in recent years. Landed fish have been routinely measured during almost all creel surveys commissioned by MAF, MFish and MPI since the early 1990s, although fish were weighed instead of measured during a survey of central New Zealand fishers in 1992–93. Length frequency distributions are shown for the four species most commonly measured at the HBSFC boat ramp since 1999–00, to provide additional information on how fish sizes may have changed in recent years (Figure 7). There appears to have been very little change in the size composition of red gurnard measured at the HBSFC between 1999–00 and 2015–16, but a marked decline in the average length of snapper (from 51 cm to 37 cm), a small increase in the average size of kahawai landed (from 46 cm to 49 cm), and a more marked increase in the average size of tarakihi (from 29 cm to 35 cm, although the number of tarakihi measured in three out of four years was low).

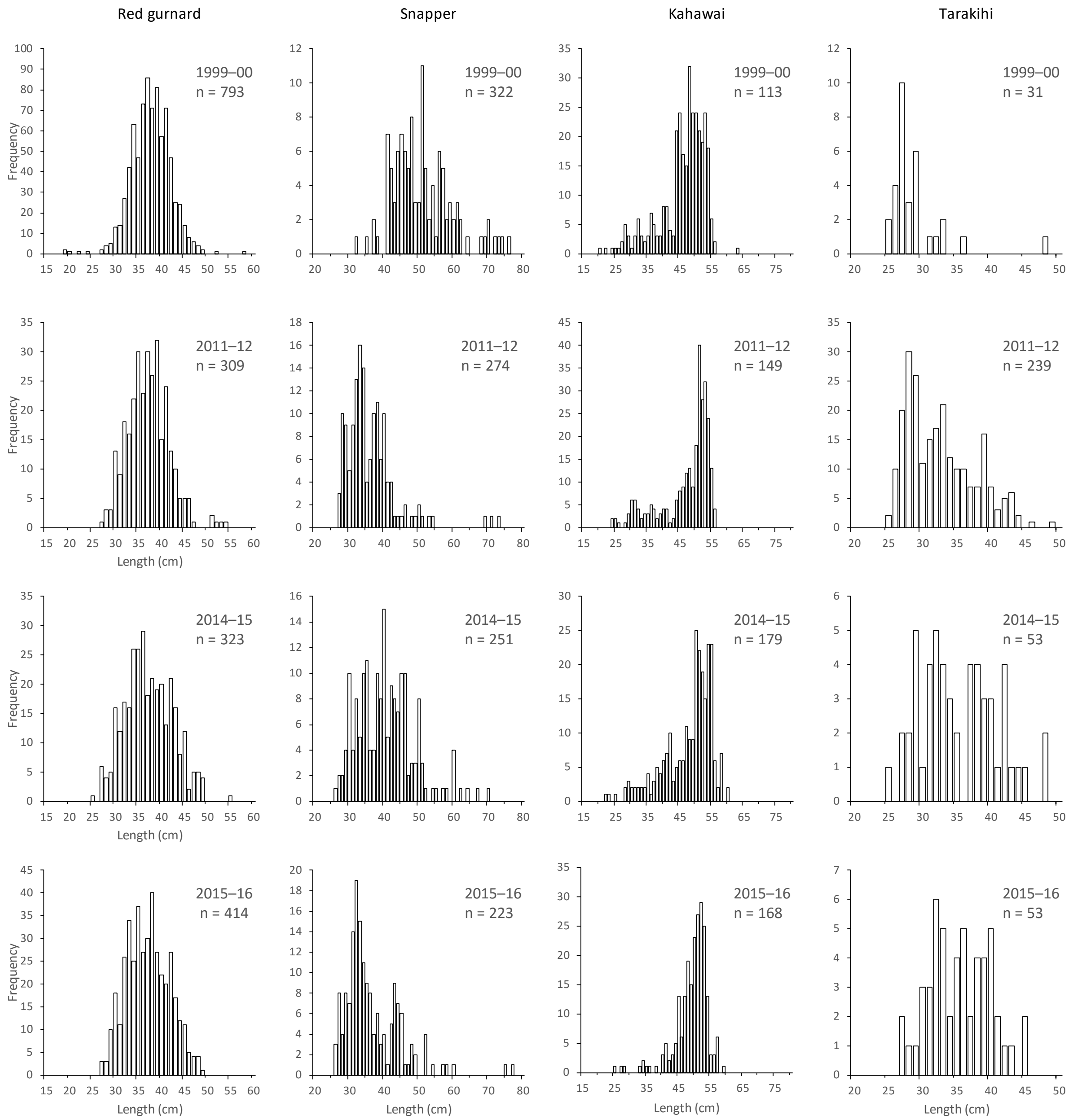

Figure 7: Length frequency distributions for the four finfish species (by column) most commonly landed and measured during creel surveys conducted by research providers at the HBSFC since 1999–00 (by row). Landed catches were not measured for length during the 1992–93 creel survey, as individual fish were weighed during this survey instead.

4. DISCUSSION

This report provides a review of catch effort data collected by a fishing club to track trends in fishing success given their concerns about declines in catch rates in local waters. It is important to make a distinction between this type of situation, where an interviewer asks others about their catch, and situations where data are provided by fishers who self-report their own catch and effort. This is because an interview format, such as that used by the HBSFC, at least partially negates several known sources of bias associated with self-reported data. For example, a group of self-selecting self-reporting fishers is less likely to be a representative sample of those who fish in an area than that provided by an interviewer initiated survey of all boats returning to a ramp or competition weigh-in, because more avid fishers are more likely to self-report their activity than less avid fishers as fishing is of greater interest to them. Also, the data collected during creel survey interviews and competitions are usually recorded soon after fishing has taken place, which lessens the possibility of any recall bias. Self-reporting fishers are also less likely to report zero catch events, whereas creel survey interviewers are more likely to interview fishers regardless of their fishing success. This under-reporting of zero catch events has also been detected in surveys conducted by fishery independent research providers, where the incidence of zero catch events reported by participants in offsite surveys (such as telephone diary surveys conducted in the 1990s, and the 2011–12 National Panel Survey) was usually lower than observed during concurrent creel surveys (Hartill & Edwards 2015, Hartill 2016). The conclusions drawn from this study therefore pertain to interviewer directed creel surveys conducted by stakeholder organisations, rather than other forms of self-monitoring which are potentially prone to other sources of bias.

The HBSFC survey reviewed here was conducted with a single objective in mind, and a very focused and parsimonious survey design was adopted to achieve that objective; to document the declining fishing success of their members over time. One limitation with adopting a short survey format to reduce respondent burden to increase the likelihood of fisher participation was that additional information was not collected, which could be used to directly refute alternative explanations for the trends observed, which is an important consideration when addressing a contentious issue such as localised depletion. There are many factors which can influence catch rates, which may themselves vary over time, regardless of any change in localised fish abundance, such as changes in fishing effort or location. Fishers use a broad range of fishing methods to target individual species, and use different methods to target different species. The HBSFC made some provision for this, as their form included a space where interviewers could record which fishing methods were used during a trip, but unfortunately this information was only recorded for 21% of the interviews undertaken. A form of standardisation for fishing methods has been attempted here, by setting aside data from competitions where tuna and other large pelagic species were included in the prize list, which should have lessened the incidence of surface fishing events such as trolling. It is still necessary to assume, however, that the incidence of surface method fishing events in the remaining data set is either relatively insignificant, or constant over time.

Another limitation with the parsimonious focus on fishing competitions is that prizes for individual species or fish sizes may have influenced which fish were targeted and landed during competitions, which may vary over time. In this case, however, the analyses presented here have focused on four commonly caught species which were not subject to any competition specific size limits.

Another issue that should have been considered further is the measure of effort used when calculating catch per unit effort indices (for a defined group of relevant fishing methods). The HBSFC interviewers recorded the aggregate catch per boat, but in most cases a record was also made of the number of fishers taking part in each trip. The recalculation of catch rates in terms of average catch per fisher trip, rather than per boat trip, was therefore straightforward, and broadly similar trends in catch rates were apparent regardless of which measure of effort was used. A simple analysis such as this can be used to negate the alternative explanation that changes in catch rates per boat trip are due to changes in boat occupancy, and hence the number of fishers involved in each fishing trip. Significant changes in average boat occupancy over time are unlikely, especially over a relatively short nine year timespan.

Ideally data should be collected on the time spent fishing, as this provides a better indication of the effort required to take a catch, rather than simply calculating the catch per trip. Trip durations can potentially vary over time, in response to fishing success, as trips may be shorter when catch rates are higher, as levels of personal satisfaction and daily bag limits more readily attained. Creel surveys conducted by research providers routinely collect data on the time spent fishing, to allow for this possibility. The conventional catch rate measure used by research providers in New Zealand and abroad, is the number of fish landed per hour fished (per fisher), which is more likely to be a meaningful measure of changes in localised abundance.

While catch rate indices calculated from recreational or commercial data are usually based on the number or weight of fish landed per unit effort, recreational fishers are often asked about any catch they may have also released during their trip. When fishers' estimates of landed and released fish were combined when generating total catch per unit indices from the HBSFC creel survey data, the indices for two of the most commonly released species were very different from those calculated from the landed catch alone. There are several possible reasons for this, which are not necessarily due to changes in abundance. The size of any fish caught will have a bearing on whether or not it is retained by a fisher. Short term recruitment driven peaks in the abundance of sublegal or undesirably small fish (where there is no Minimum Legal Size (MLS) in place) will therefore result in higher release levels, which have nothing to do with the abundance of larger fish. Fishers are more likely to retain less desirable species if catch rates of other more desirable species decline. Changes in size and species catch composition can both, therefore, influence the likelihood of a fish being released. There is usually no reliable way of interpreting why changes in retention/release behaviour have occurred over time given the data available on the released catch, which is why catch rate estimation tends to focus on the landed catch, as is the case in this report. Any interpretation on catch rates based on landed catch data is more likely to be more reliable when there is a minimum legal size limit in place, which will largely influence whether a fish is released, such as for snapper, but not kahawai for which there is no MLS. Fishers interviewed by NIWA are asked to make a distinction between legal fish that are of legal size vs sub legal size, for this reason.

Data collected during five creel surveys conducted by research providers at the HBSFC since 1992–93 were used to investigate the sensitivity of catch rate indices to the measure of fishing effort used. Different catch rate trends were indeed evident when three alternative measures of fishing effort were considered: catch per boat trip, catch per fisher trip, and catch per fisher hour. Different trends are apparent for all four species examined over time, but the comparison of the three catch rate measures for each species has highlighted a consistent artefact in the data which is probably due to the survey format used by each research provider. Estimates of the average catch per hour were higher than the catch per fisher or catch per boat estimates for all four species in 1992–93 and in 1999–00, but lower for the three more recent surveys. The first two surveys were conducted by MAF and by Kingett Mitchell Ltd, whereas the last three surveys were all conducted by NIWA. The data from the 1992–93 survey suggest that the duration of fishing trips in that year was, on average, only half of that in other years, and the size of fishing parties interviewed in 1999–00 was, on average, substantially smaller than in other years. The primary purpose of these two early surveys was to collect fish size data, but unfortunately there is no documentation available on how these two early surveys were conducted, and there is no way of determining how questions were asked and how the data should be interpreted. These differences highlight the need for standardised creel survey formats that all research providers should adopt, which stakeholder organisations could also take into account when designing their own monitoring programmes. Fortunately almost all of the creel surveys of recreational fishers in New Zealand to date have followed a common interview format, for which survey format documentation is available.

Broad trends in catch rates can still be inferred from the three most recent research provider creel surveys, however, and a direct comparison of these with similar catch rate indices (number of fish landed per boat trip) calculated from the HBSFC data can be used to corroborate (or not) the latter. The degree of similarity between pairwise comparisons of catch rate indices derived from the two data sources for each species is the same, regardless of whether catch rates are expressed in terms of average catch per fisher or average catch per boat.

The similarity of the snapper and kahawai catch rate indices calculated from the two data sources suggests that the HBSFC data provides a reasonably reliable indication of the changes in fishing success experienced by club members over the past ten years, but similar comparisons for red gurnard and tarakihi are less promising. The marked difference between the two red gurnard catch rates estimates in 2011–12 could be due to the fact that creel survey data were only available from five competitions in that year, which occurred over a relatively short four month period between September and December (as the club interviewer was unwell during the second half of that competition season). The lack of congruence between the two tarakihi catch rate indices is perhaps less surprising, as tarakihi are predominantly caught in deeper waters where only a minority of fishing effort takes place. The differences in tarakihi catch rates are therefore probably due to differences in the relative incidence of deeper water fishing trips in the two data sets, which may in part be due to the incidence of competition prizes offered for deeper water species. More informative tarakihi catch rate indices could be generated from the NIWA creel survey data, by focusing on those trips where only deeper water species were targeted (such as tarakihi and hapuku/bass) but no information was collected on target species as part of the HBSFC survey. Both the HBSFC completion creel survey and the NIWA creel are ongoing, and a further comparison of catch rates calculated from these two data sources should be made in the future, when concurrent data are available from more than just three years.

Other types of data could be collected by stakeholder driven monitoring programmes, in a similar manner to that done by past surveys run by research providers. The benefits of collecting additional information during an interview potentially outweigh the marginal increase in time required to broaden the scope of an interview (and consequent increase in cost and respondent burden). In the case of the HBSFC survey, the issues discussed above could be addressed by asking one fisher in each party how long they spent using bottom fishing methods.

Broadening the focus of an interview can also broaden the potential use of any data collected over the long term. Members of the HBSFC have also previously participated in a questionnaire survey in 2002–03, which was undertaken by the club to provide baseline information on catch rates in an area where Napier Mussels Ltd were seeking a consent to set up a mussel farm. Club members filled out 129 questionnaire forms on fishing within the consented area, and 12 on fishing elsewhere. The rationale for the 2002–03 survey demonstrates why stakeholder driven surveys should also collect data on locations fished. Demands on marine space will increase over time, in a way that is often unforeseen, and the collection of spatially defined fishing location data is especially valuable in this regard. Catch rates can also vary by fishing location, especially by depth, and the collection of spatial data can be used to demonstrate changes in catch rates in different areas.

The simplest way of collecting fishing location data is to draw up a map of fishing zones which are identified by standardised codes. The definition of these zones should be at least partially defined by geographical features and should ideally encompass popular fishing locations, rather than subdividing them. Interviewed fishers can be asked to indicate which zone they had fished in, so that the appropriate code can be recorded, without having to reveal their favourite fishing location. Some data have been collected on locations fished, as part of the HBSFC completion creel survey, but a wide variety of location names have been recorded, in a variety of ways. Further, fishing locations have not been recorded in many instances. This means that there is no way of spatially comparing the data collected in the 2002–03 questionnaire with that subsequently collected during the completion creel surveys. While this may not be of immediate concern, as the mussel farm proposed in 2002–03 did not eventuate, decisions about the allocation of marine space in the future would be better informed if the club started to collect defined spatial fishing location data.

Data on changes in the size composition of commonly caught species can also be used to demonstrate changes in recreational fishing over time. Measuring fish can be time consuming, however, and prolonging a creel survey interview to do this might be unpopular, especially when competition contestants are in a hurry to weigh in their catch before a competition closes. Weigh-ins potentially provide a useful alternative source of data on changes in size composition for commonly caught species over time, as long as there are no competition specific rules that would influence the size of individual fish presented by contestants. The best competitions in this regard are those that offer spot prizes for commonly caught species, where any weighed in fish can earn a prize, regardless of its size. The HBSFC could therefore start to electronically record the size of each fish that is weighed in, as part of a long term database. The limited data available from the four creel surveys conducted by research providers since 1999–00 suggests that changes in the size composition of fish landed by club members over time may have mirrored changes in catch rates in some cases. The decline in the average size of snapper landed coincided with a decline in snapper catch rates over the same period, with the reverse being the case for kahawai.

Ultimately any data provided by the HBSFC, or any other recreational stakeholder organisation wanting to self-monitor their fishery and report this information to MPI for use in fishery management, should be collected with MPI's Research and Science Information Standard (RSIS, see https://www.mpi.govt.nz/document-vault/3692) in mind from the outset. This Standard specifies key principles that data and research providers need to meet, to ensure that the information they provide is fit for fisheries management. Some input should therefore be sought from MPI or from a MPI recognised research provider who is familiar with the RSIS standard, and the rationale for the standards it specifies. Support should therefore be sought from MPI to facilitate this at an early stage, and to provide other support that may be required. For example, the data provided by the HBSFC that is referred to in this report was recorded on paper, and MPI provided support to get these data punched so that they could be databased, assessed and analysed electronically in accordance with the RSIS standard.

In summary, the data collected by the HBSFC competition creel survey are potentially informative, as very little information is available on recreational fishing success in this area from other sources, such as creel surveys commissioned by MPI. NIWA has started to routinely collect creel survey and web camera based ramp traffic data at the club ramp since 2014–15, but very little can be inferred about catch rates in this area from research provider creel surveys before that time, given the paucity of data and possible inconsistencies in the way data were recorded by past research providers. All evidence suggests that catch rates can vary considerably from year-to-year, as seen in other parts of the country. While comparisons of catch rate estimates derived from the HBSFC data and that provided by NIWA since 2011–12 show similar trends for two of the four commonly caught species assessed, there are some marked differences for the other two species. These comparisons should therefore be repeated in the future, when further data are available from both data sources. The HBSFC could make a small number of changes to their current interview format, which would both improve the specificity of the data collected, and improve their utility for fisheries managers in the future. The proposed changes are: asking one fisher in each boat how many hours they spent bottom fishing during their trip; and asking them to indicate a zone in which that fishing had taken place. The HBSFC should also consider keeping electronic records of catches landed during competition weigh-ins, in a single database, as well as keeping records of rules applying to each competition. Some of the insights gained from this review of the HBSFC completion creel survey are potentially applicable to similar self–monitoring programmes that other stakeholders may undertake in the future, but these are context specific. Perhaps the key point to consider is that input from experienced practitioners should be sought from the outset, to ensure that data are collected in a way that is most likely to meet MPI's RSIS standard so that it is readily adopted by fisheries managers when they are its intended recipient.

5. ACKNOWLEDGMENTS

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6. REFERENCES

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7. APPENDICES

Appendix 1: Example of a completed Hawke Bay Sport Fishing Club competition creel survey interview form.

MARINE RECREATIONAL CATCH RECORD

Fishing clubs need better information on the complete recreational catch per trip, and how catch rates change over time to ensure recreational fishing interests are protected. Please fill out one of these forms accurately (whether successful or not) to provide a complete picture of your fishery.

COMPETITION: Open day	DATE: 17/10/15
BOAT NAME: Wahoo	No. OF ANGLERS: 5
FISHING TYPE (i.e. bottom fishing, trolling, set lines etc):	

NUMBER OF FISH CAUGHT

SPECIES	NO. KEPT	NO. RELEASED	SPECIES	NO. KEPT	NO. RELEASED
Blue Cod			Snapper		
Kahawai	6		Albacore		
Red Cod			Skip Jack		
Gurnard	2		Marlin		
Rig			Carpet Shark		3
School Shark			Spiny Back Shark		20
Tarakihi			Mackeral		
Trevally					
Hapuku					
Kingfish		1			
Barracoutta					

SPECIES AND LOCATION OF MARINE MAMMALS OR SHARKS SEEN: Springs

GENERAL COMMENTS:

APPENDIX 2A: The number of fish of each species landed by fishers interviewed by members of the Hawke's Bay Sport Fishing Club on fishing competition days, by fishing season (September to May).

Species	2007–08	2008–09	2009–10	2010–11	2011–12	2012–13	2013–14	2014–15	2015–16	Total
Red gurnard	4 745	4 611	3 290	5 091	1 012	3 144	1 445	1 390	2 421	27 149
Snapper	2 500	2 336	1 454	2 360	189	1 090	705	647	1 137	12 418
Kahawai	817	864	807	1 431	323	1 191	648	1 169	1 104	8 354
Tarakihi	1 013	1 082	1 080	1 091	188	815	533	511	850	7 163
Albacore	625	529	543	174	–	506	5	88	348	2 818
Trevally	308	214	235	463	60	330	197	202	183	2 192
Blue cod	282	173	202	251	49	126	93	165	119	1 460
Hapuku/bass	250	185	232	156	3	315	67	48	109	1 365
Kingfish	73	56	119	82	8	137	63	85	207	830
Skipjack	24	206	25	290	–	69	18	33	59	724
Barracouta	92	91	64	144	40	55	97	45	82	710
Blue mackerel	4	77	94	202	3	99	34	71	64	648
Red cod	45	63	58	118	9	62	25	13	34	427
Trumpeter	39	10	21	6	–	25	17	4	7	129
37 other Spp	79	46	36	38	2	80	63	73	76	493

APPENDIX 2B: The number of fish of each species that fishers interviewed by members of the Hawke's Bay Sport Fishing Club on fishing competition days claimed to have released, by fishing season (September to May).

Species	2007–08	2008–09	2009–10	2010–11	2011–12	2012–13	2013–14	2014–15	2015–16	Total
Kahawai	3 501	2 708	2 517	3 543	551	2 547	1 928	2 185	2 905	22 385
Spiny dogfish	1 028	1 786	1 078	1 119	389	1 287	546	880	510	8 623
Barracouta	798	1 024	1 101	1 260	166	620	513	404	685	6 571
Snapper	1 285	443	481	342	37	160	223	435	949	4 355
Kingfish	473	352	723	516	14	510	397	415	794	4 194
Red gurnard	622	550	483	637	141	403	186	341	504	3 867
Albacore	762	1 166	420	146	–	340	–	56	401	3 291
Carpet shark	422	124	309	670	280	496	298	237	218	3 054
School shark	416	345	350	463	10	514	237	206	458	2 999
Red cod	85	149	214	677	50	433	98	43	643	2 392
Blue mackerel	1	65	389	282	10	345	242	149	178	1 661
Blue cod	216	125	230	176	32	167	73	169	254	1 442
Trevally	72	236	204	112	5	97	178	92	43	1 039
Tarakihi	103	98	242	105	20	95	80	80	136	959
38 other Spp	207	170	146	156	6	325	79	327	399	1 815

APPENDIX 3: The number of fish of each species landed (and measured in brackets) by fishers interviewed during research provider surveys, by survey year (as described in Table 2).

Species	1992–93	1999–00	2011–12	2014–15	2015–16	Landed
Red gurnard	2 795 (531)	1 064 (793)	763 (309)	998 (323)	1 886 (414)	7 506
Kahawai	1 260 (332)	445 (322)	621 (274)	985 (269)	1 072 (223)	4 383
Snapper	365 (72)	140 (113)	266 (149)	418 (180)	775 (168)	1 964
Tarakihi	26 (3)	124 (31)	529 (239)	300 (53)	281 (53)	1 260
Barracouta	442 (4)	4 (4)	23 (10)	15 (2)	65 (8)	549
Kingfish	284 (43)	74 (68)	23 (12)	100 (31)	59 (22)	540
Red cod	409 (76)	2 (2)	58 (38)	6 (5)	47 (11)	522
Trevaly	144 (28)	13 (12)	54 (45)	116 (34)	102 (17)	429
Blue cod	208 (30)	13 (13)	59 (25)	27 (16)	76 (18)	383
Albacore	41 (3)	29 (24)	–	42 (19)	72 (10)	184
Jack mackerel	102 (16)	3 (3)	46 (30)	18 (7)	13 ()	182
Hapuku/bass	47 (1)	1 (0)	39 (10)	30 (10)	28 (3)	145
Skipjack tuna	1 (0)	1 (1)	32 (22)	49 (30)	13 (1)	96
Rig	46 (2)	3 (1)	8 (1)	6 ()	21 (3)	84
School shark	4 (0)	–	16 (2)	40 (1)	15 (1)	75
30 other finfish specie	34 (6)	10 (10)	49 (20)	56 (27)	85 (20)	234