



Rock lobster amateur harvest survey design for CRA 3

New Zealand Fisheries Assessment Report 2016/54

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ISSN 1179-5352 (online)

ISBN 978-1-77665-404-8 (online)

October 2016



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EXECUTIVE SUMMARY

Holdsworth, J.C. (2016). Rock lobster amateur harvest survey design for CRA 3. *New Zealand Fisheries Assessment Report 2016/54*. 27 p.

This document uses existing survey data to characterise the amateur harvest in CRA 3. Information is relatively sparse but recent initiatives such as the National Panel Survey (NPS) of amateur harvest and the creel and web camera coverage at the Gisborne Port boat ramp have increased the range and quality of data available. Some of the existing harvest survey methods employed in New Zealand and overseas are described. Two plausible options are proposed that fit the specific challenges presented in robustly estimating the amateur harvest of rock lobster in CRA 3 over a fishing year.

The CRA 3 Quota Management Area boundaries are from East Cape to the Wairoa River entrance in Hawke Bay. This covers a large and generally sparsely populated area with rugged exposed coast. The main settlements are linked by State Highways 2 and 35, about 290 km from Wairoa to East Cape. Gisborne is the main population centre and has a port with the best facilities for trailer and moored boats. Potting from boats is the main method used by recreational fishers to catch rock lobster and often fishers will check their pots early in the morning. Outside the main summer holiday period relatively few fishers may be actively fishing but their catch could be significant. Mahia and the beaches along the East Coast are busy summer holiday destinations and land based diving and potting for rock lobster is popular.

The population structure of rock lobster in CRA 3 is somewhat unique with a high proportion of small relatively slow growing males in the catch from East Cape to Poverty Bay and larger fish with a more even mix of sexes south of Poverty Bay, especially around Mahia Peninsula. The most recent stock assessment, conducted in 2014, concluded that current biomass (*B2014*) was 3.0 to 3.5 times *Bmin*. Current biomass was between 3 and 5 times *Bmsy*.

While some questions remain about how well offsite surveys estimate rock lobster harvest they do give insight into the main methods used by fishers to catch rock lobster. Data from the NPS of 2011–12 show that about half of CRA 3 harvest is from trailer boats and about 45% from land based and small boat methods.

Boat ramp interviews at the main Gisborne ramp recorded 243 rock lobster, of which 65% were released as undersized. Just over half of the catch was taken by potting (56%) with SCUBA diving the other main method. Catch was recorded across the year with a peak in December and January.

Boosting the number of mesh blocks sampled in the Lower North Island Region by 150 or 300 is being considered to increase the number of panellists and improve the accuracy of harvest estimates. Whether this will be sufficient to provide robust estimates for specialist fisheries in one sparsely populated region of the Lower North Island is yet to be determined. In principle increasing the sample size of fishers in the area of interest, as an add-on to an existing national offsite survey, is a viable option with predicted CVs in the range of 21% to 30% based on the results from the last NPS. The cost of this option will be provided in the report on project MAF2014/01 by NRB.

An alternative to the boosted NPS is a hybrid survey using an evolution of the Western Bay of Plenty and CRA 1 onsite design. The hybrid option proposed would consist of 60 survey days that would include dawn to dusk coverage at the main boat ramps, a bus route survey of secondary boat launch sites, a roving survey of summer camps, plus the use of web camera technology to reduce the need for long, fruitless interviewer wait times when conditions are not favourable. Cameras deployed on an additional 60 days collecting traffic counts only would help generate more robust estimates from low use sites which may be affected by the weather or the state of the tides. Web cameras would also help validate interview coverage and provide additional security for interviewers. CVs of 10% to 20% are possible based on the results of the CRA 1 survey. The cost of this option is estimated at \$260 000 + GST.

1 INTRODUCTION

1.1 Overview

Rock lobster is highly valued by commercial, recreational and customary fishers on the East Coast and Mahia Peninsula. The CRA 3 Quota Management Area covers the area from East Cape to the Wairoa River entrance in Hawke Bay. The commercial catch of the two rock lobster species has been managed under the Quota Management system (QMS) since 1990. The red rock lobster (*Jasus edwardsii*) TACC in CRA 3 is 261 t and a small amount of packhorse rock lobster (*Sagmariasus verreauxi*) is taken in the area. Commercial CPUE has increased significantly since 2004 but recreational fisher satisfaction is low, especially in the Gisborne area.

The red rock lobster population in CRA 3 has been monitored using commercial catch rates, length frequency data from commercial catches (log book and catch sampling data), tag-recapture data and a puerulus settlement index. The most recent stock assessment, conducted in 2014, concluded that current biomass (B_{2014}) was 3.0 to 3.5 times B_{min} . Current biomass was between 3 and 5 times B_{msy} . Current exploitation rate was 16% to 24%. Current and projected spawning stock biomass were estimated at about 1.5 times SSB_{msy} . Total biomass was estimated at more than half B_0 , and total numbers at 76% to 90% of N_0 (Haist et al. 2015).

The population structure of rock lobster in CRA 3 is somewhat unique, with a high proportion of small relatively slow growing males in the catch from East Cape to Poverty Bay and larger fish with a more even mix of sexes south of Poverty Bay, especially around Mahia Peninsula.

The coastal settlements of East Coast are popular holiday destinations. The rocky coastline and numerous reefs provide good habitat for rock lobster. The amateur fishery is managed by minimum size limits (male 54 mm, female 60mm), daily bag limits (6 rock lobster per person), pot limits (3 per person) and taking soft shell or rock lobster with eggs is prohibited. Packhorse are included in these catch limits but must be larger, with a minimum tail length of 216 mm.

1.2 Objectives

1. To design a survey to robustly estimate the recreational fisheries harvest of rock lobster in Gisborne – CRA 3 over a fishing year.
2. To provide cost estimates for delivery of the survey design developed under specific objective one.

1.3 Definition of terms used

Many of the terms used in this report will be familiar to researchers working on amateur harvest surveys in New Zealand. For clarity we provide some definitions from the glossary developed by the Marine Amateur Fisheries Working Group.

Aerial overflight method (Aerial-Access method) – a group of methods of estimating amateur harvest by combining a series of flights over the fishery to obtain counts/derive estimates of total effort with a series of boat ramp or access point sampling events to measure harvest per unit effort.

Avidity – the degree of participation by an amateur fisher.

Bus route method – series of access points used by amateur fishers that are sequentially surveyed by a roving interviewer. The direction and start points along the bus route are selected at random on each survey day to give an estimate of the total number of boats returning to the surveyed group of access points throughout that day. This estimate of total effort is combined with an average catch rate estimate to provide a harvest estimate for that survey day.

HPUE – harvest per unit effort is the quantity of fish harvested with one standard unit of fishing effort; e.g., the number of fish landed and retained per hour of surfcasting.

Meshblock – the smallest geographic unit for which statistical data is collected and processed by Statistics New Zealand. A meshblock is a defined geographic area, varying in size from part of a city block to large areas of rural land.

National Panel Survey – an offsite survey conducted by NRB in 2011/12 which enrolled eligible participants into a national panel using face-to-face recruitment (the sample frame was the national population). Data were collected over the entire fishing year using the text/phone diary method.

Offsite – research methods for estimating amateur fisheries harvest which occur away from the catch/landing location and rely on fisher recall of data.

Onsite – research methods for estimating amateur fisheries harvest which occur at the catch/landing location and involve observation of the fishing landing/activity.

Platform – from where fishing activity occurs (e.g. a boat). In the NPS survey fishers reporting a trip are asked what/where they fished from, and are given six options to clarify what is meant.

Recreational fisher – a term often used interchangeably with amateur fisher to describe non-commercial fishers who fish as a pastime or leisure activity within the amateur fisheries regulations.

Trailer boat – a motor boat that is generally stored on a trailer when not in use, rather than on a mooring or marina, commonly 4.5 to 8 m in length (ski boat in the USA).

Web camera (ramp) – a camera connected to a computer and the internet used to store a record of boat ramp traffic 24 hours per day.

1.4 Literature review

New Zealand Studies on recreational rock lobster harvest

Several reports have been written on potential survey methods used to estimate amateur harvest of rock lobster. Bradford and George came to the general conclusion “*that separate surveys to estimate rock lobster harvests would be difficult to carry out and expensive. More frequent general (offsite) recreational surveys in the North region where there is also a perceived need to have frequent recreational harvest estimates in several other Fishstocks would give information on recreational harvests in CRA 1 and 2. The numbers of diarists in such surveys are unlikely to be sufficient to give precise estimates in CRA 1 and 2*” (Bradford & George 2002).

Hartill reviewed a range of approaches which could be employed, either individually or in unison, to provide potentially reliable harvest estimates for rock lobster (Hartill 2008). However, he considered large scale access point surveys to be too hard. “*Many survey techniques employ some form of creel survey, where a fishers catch and effort is recorded during an interview, usually at the end of a fishing trip. Creel surveys can be employed solely, to estimate the entire harvest, when all access points are covered, or as part of a larger survey which has other methodological components. In the latter case, creel surveys have been used in conjunction with telephone/diary surveys, or more recently, as part of aerial overflight surveys. It is not cost effective to solely use creel surveys for fisheries over large spatial scales as the number of potential access points is high, yet the incidence of lobster landings at each point is usually low*” (Hartill 2008).

A pilot study to assess the feasibility of estimating the amateur harvest in the main part of the Coromandel scallop fishery (SCA CS) and the rock lobster fishery from Cape Colville to Hot Water Beach was conducted over the summer of 2007–08 (Holdsworth & Walshe 2014). The survey recorded

6017 boat trips and 12 646 people returning to one of 15 access points covered during the 90 day survey. Rock lobster were measured and sexed and a mean weight used to estimate an amateur harvest of 7.3 t by boat based fishers (Holdsworth & Walshe 2014). It was concluded that the survey approach could be applied to a larger area although the number of sites will be limited by the cost considerations (particularly related to the number of interviewers required).

Subsequently a two year research project (MAF2010/02) was undertaken using the onsite survey method developed in the pilot study above for a larger area in the Western Bay of Plenty. A random stratified design was used to sample 45 days during the fishing year, with strata for summer and winter and week day and weekend/holiday. Mean daily catch within each stratum and each location type (main ramp, bus stop ramp, marina) was scaled to estimate the total harvest of scallop and rock lobster from recreational vessels in the survey area for 2010–11 and 2011–12 (Holdsworth & Walshe 2014). The harvest estimated from these specialist fisheries were then compared to the estimates obtained for the National Panel Survey for 2011–12 (Wynne-Jones et al. 2014). The boat based amateur harvest estimate was 9 t (CV 0.17) from the access survey and 15 t (CV 0.44) from the National Panel Survey in the same year (Edwards & Hartill 2015).

A survey of rock lobster, blue cod and sea perch was conducted in the Kaikoura area and the main launch site in North Canterbury at Motunau in 2012–13. A bus route method was used at the Kaikoura access points, while access was tidal at Motunau and almost all boats were intercepted on survey days. Many of the boats intercepted in Kaikoura were targeting rock lobster using pots and the total harvest including that from charter boats was 54.5 t (Kendrick & Hanley in press).

Blue Water Marine Research conducted a large scale onsite survey of recreational fishers between Rangiputa and Mangawhai Heads in East Northland in 2013–14 to estimate boat based amateur harvest for rock lobster. There were 67 access sites covered along 500 km of coastal roads which are often not well connected. A random stratified design was used with 60 survey days in the year from 1 April 2013 with strata for summer and winter and week day and weekend/holiday. A total of 12 174 boat trips were observed in 2013–14, with 68% of these involving some fishing activity. Greenweight harvest estimates were 25.4 t (CV 0.12) of red rock lobster and 5 t (CV 0.30) of packhorse rock lobster (Holdsworth 2014). This was expanded to estimate the harvest by amateur fishers for 2013–14 in the whole CRA 1 quota management area using the data from the National Panel Survey.

Most of the information collected on amateur harvest in CRA 3 has been from regional and national offsite surveys. These use telephone or face to face interviews to recruit diarists or more recently panellists. These surveys are large scale, covering all species, with the harvest from a limited sample of CRA 3 rock lobster fishers scaled up by the regional population. The offsite harvest estimates for rock lobster from the 2001 and earlier surveys are no longer considered reliable. Data from the National Panel Survey (NPS) of 2011–12 appears to be reliable for fisheries where a relatively large number of participants were enlisted. The harvest estimate from the NPS for CRA 3 of 14 000 rock lobster was based on data from a relatively small sample of just 26 fishers engaged in 47 rock lobster fishing events. The average weight was estimated from commercial data and gave a harvest weight of 8 tonnes (CV 0.33) (Wynne-Jones et al. 2014).

Two methods of offsite rock lobster survey in Tasmania

1. Telephone/diary survey method Tasmania

In 2012–13 a survey of Tasmanian residents was undertaken to determine the annual harvest by recreational fishers. The white pages directory provided the sample frame, with obvious business numbers, non-private dwellings and multiple listings removed. A total of 4035 dwellings were in the sample of residential numbers, of which 3290 households (81.5%) fully responded to the screening survey. Of those that intended to fish in 2012–13 almost 80% fully responded to the diary survey. In total, 780 Tasmanian households, representing 2095 persons aged five years and older, completed the diary survey with response rates consistent across all strata.

Participation rate of Tasmanian residents aged five years or older was derived from the initial screening survey. They estimate 21.6% (SE 0.8%) of the eligible population fished at least once in the 12 months prior to October 2012.

The authors note that average fish weights were derived from a number of sources and add additional uncertainty when harvest numbers are converted to total weight.

Catches of Rock Lobster (predominantly if not exclusively *Jasus edwardsii*) in the telephone-diary survey were mainly taken using pots (68% of the harvest) with diving the other major method (Lyle et al. 2014). The authors report “*characterisation of the recreational lobster fishery based on fishing region, method and seasonality in this study is consistent with that reported for a targeted survey of lobster licence-holders conducted over the same period (Lyle & Tracey, 2012). The harvest estimate for the current survey was 44,517 lobster.*”

2. Telephone survey of licence holders Tasmania

The results of this telephone-diary survey were compared to a targeted survey of licence holders. A random sample of licence-holders were contacted by telephone and invited to participate in the survey in which fishing activity was monitored throughout the 2010–11 season. A total of 603 licensed respondents completed the survey. The estimated harvest from the telephone-diary survey was “*significantly lower than that estimated for the survey of licence-holders (83,722 lobster). This discrepancy can be attributed to the use of different bases for data expansion (general population verses licence-holders) and the fact that the current survey provides a ‘big-picture’ assessment of the recreational fishery and specialised activities, such as use of pots and dive methods to target Rock Lobster, may not be as well represented compared with common activities such as line fishing for key scalefish species. This is highlighted by the fact that just 11% of all fishing events reported by diarists were targeted at Rock Lobster. In such instances where alternative estimates are available it is preferable to give greater weight to estimates from the more focussed surveys (i.e. Lyle and Tracey, 2012).*”

The results of this telephone-diary survey were also compared to a targeted survey of licence holders for abalone. The harvest estimate of abalone from the telephone-diary survey was 38 541 which is lower than that estimated for the survey of licence-holders (66 438). This discrepancy can be attributed to the same issues outlined for Rock Lobster noting that in this instance only 1% of all fishing events reported by diarists in this study were targeted at abalone.

Strip transect sampling Norway

A probability-based strip transect survey was used to estimate effort in the Norwegian fishery for European lobster *Homarus gammarus* (Kleiven et al. 2011). This fishery is conducted by both recreational and commercial fishers, but reliable information on total fishing effort and total catch is lacking. A strip transect sampling survey was conducted throughout the lobster fishing season in southern Norway to estimate the number of deployed lobster traps over time. Surface buoys marking lobster traps were counted along strip transects placed representatively in the survey area in five different weeks throughout the eight week lobstering season. The survey area was 175 km long and pots were almost all within the 40 m depth contour.

One hundred transects were generated perpendicular to the coast at a fixed distance (1.01 and 0.69 km) from a random starting point. These transects were divided into groups of 10, the aim being to conduct counts along three random transects within each group every survey period (weekly), totalling 120 transects/week. They aimed for a transect half-width of 70 m. Calibration studies were conducted to standardize transect width and to estimate and adjust for detection rates of buoys along transect strips. Mean number of lobster traps (recreational, commercial, and unknown) per square kilometre and associated variance was 48.95 (SE = 3.11) traps/km² per day in the first week, decreasing steadily to 5.96 (SE = 0.79) traps/km² per day in the eighth (and last) week of the lobster season. Estimated total number of deployed traps in the first week of the lobstering season was 23 100 traps/day (SE = 1500)

No catch or CPUE information was collected to convert the effort estimates to harvest weights (Kleiven et al. 2011).

2 METHODS

The development of options for this project has benefited from the input from MPI Science, fisheries management and compliance staff, the Marine Amateur Fisheries Working Group and NIWA fisheries scientists. Local fishers and members of the Gisborne Tatapouri Sport Fishing Club were always willing to discuss the nature of the rock lobster fishery in CRA 3. We also acknowledge the work and support from Chris Karamea Insley from the consulting firm *37 Degrees South* based in Gisborne (www.37ds.com/aboutus.asp). His contacts and connections with local communities in CRA 3 would be invaluable for recruiting and supervising interviewers if an onsite survey was selected. He also reviewed cost estimates for onsite surveys. Chris provided names of residents who were interested in assisting with this survey from near Port Awanui, and from Tokomaru Bay, Tolaga Bay, Pouawa, Gisborne and Mahia.

On 13 September 2015 John Holdsworth, Linda Coulston and Hilton Webb met with East Coast residents and Iwi at Tokomaru Bay to discuss fishery issues and the options for the CRA 3 survey design. On 14 September John Holdsworth met with MPI compliance staff in Gisborne to discuss implementing this project.

The range of web camera technology is expanding rapidly and Marcus Krey of *Integrated Consulting Ltd* (www.4u2see.co.nz) provided assistance with discussing and pricing the options.

Blue Water Marine Research has some experience with recreational harvest surveys. They conducted a pilot survey in the western Bay of Plenty to estimate rock lobster and scallop harvest over 4 months in 2007–08 (REC2007-11) (Holdsworth & Walshe 2014). This survey was expanded to a larger area and ran for two years from October 2010 to September 2012 (MAF2010-02) covering 46 access points with a mix of roving creel surveys and all day coverage at main ramps. A similar method was deployed in East Northland covering 67 access points in 2013–14 (MAF2012-06) (Holdsworth 2014).

Over the last seven years the MAFWG has been working on the design, implementation and review of the Large Scale Multi Species harvest surveys for recreational fishers. The offsite panel survey methods currently used in amateur harvest surveys in New Zealand have been reviewed and published (Wynne-Jones et al. 2014).

Data was obtained on the harvest of rock lobster from the NIWA ramp surveys at the main Gisborne boat ramp during 2011–12. This was used to characterise the size of rock lobster encountered and the fishing methods used.

In 2014 NIWA installed a web camera at the Gisborne Port boat ramp to monitor the number of boat trips. Web Camera images were requested for the first three weeks of December, as it is often a busy period for local rock lobster fishers before the holiday rush. The intention was to look for behaviours that may be associated with rock lobster potting, such as early morning departures and short trip duration. Vessel characteristics, departure and return time were recorded from web camera images to help characterise boat traffic flows and trip duration.

A paper on strip transect sampling of potting effort in Norway (Kleiven et al. 2011) as supplied by Bruce Hartill (NIWA) was reviewed.

Gisborne District Council freedom camping areas and open season was obtained from the GDC website.

3 RESULTS

3.1 Characterisation of CRA 3 amateur harvest

Offsite surveys

Amateur harvest has been estimated from regional and national offsite surveys. These use telephone or face to face interviews to recruit diarists or more recently panellists. Each survey estimated the New Zealand amateur harvest by scaling up the number of rock lobster reported with a weighting for each diarist/panellist to the total regional population. While some questions remain about how well offsite surveys estimate rock lobster harvest they do give insight into the main methods used by fishers to catch rock lobster. Data from the National Panel Survey of 2011–12 show that about half of CRA 3 harvest is from trailer boats and about 45% from land based and small boat methods (Table 1) (Wynne-Jones et al. 2014). Kayaks and row boats methods tend to be launched close to the fishing location and seldom use formed boat ramps monitored by onsite surveys.

Potting and hand gathering by diving were the most successful methods, with about half of the harvest each, in the National Panel Survey (Table 2). However, data from national scale surveys may underestimate the catch of potters (Bradford & George 2002). *“Recreational fishers using pots to catch rock lobster may be poorly represented in the diary survey because of their apparently small number. For example, the fisher who made the most trips (142) in the North region 1993–94 diary survey was primarily using pots to catch rock lobster. He made more potting sets than the total number of recorded potting trips in CRA 2 in the 1996 national telephone diary survey (Bradford 1996, 1999)!”*

Table 1: Harvest reported from CRA 3 by platform in the National Panel Survey 2011–12.

Platform	Total number	CV	Proportion of Number	Weight (tonnes)
Trailer motor boat	7164	36%	51%	4.16
Larger motor boat or launch	593	100.0%	4%	0.31
Trailer yacht	0			
Larger yacht or keeler	0			
Kayak, canoe, or rowboat	2914	60%	21%	1.69
Off land, including beach, rocks	3295	48%	24%	1.91
Something else	0			
All Platforms	13912	33%		8.07

Table 2: Harvest reported from CRA 3 by method in the National Panel Survey 2011–12.

Method	Total number	CV	Proportion of Number	Weight (tonnes)
Rod or line	0			
Net	0			
Pot (eg. for crayfish)	6660	34%	48%	3.86
Dredge, grapple or rake	0			
Hand gather from shore	486	70%	3%	0.28
Hand gather by diving	6767	45%	49%	3.92
Spearfishing	0			
Some other method	0			
All Methods	13912	33%		8.07

Aerial overflight vessel counts 2012

An aerial survey of FMA 2 counting boats engaged in recreational fishing was conducted as part of an FMA 2 characterisation of the recreational fishery (MAF2011-06). It was conducted by Blue Water Marine Research with assistance of MPI staff from the Napier and Wellington office on Wednesday 4 January, close to the New Year's holidays and Saturday 21 January 2012 at the start of Wellington/Wairarapa Anniversary Weekend. On both days the survey started at Titahi Bay and finished near Cape Runaway. It was difficult to predict perfect weather for the whole day this summer across the whole FMA. Days with fine weather and reasonable visibility were selected for both days. However, there was wind of 15 to 20 knots in Cook Strait on the first day and about 15 knots of on shore wind in Poverty Bay on the second day. Generally it was 10 knots or less elsewhere on both days. Even with combined vessel counts across the two days the intensity of fishing activity around Wellington and Poverty Bay on peak days may be underestimated (Table 3). The zones used in Table 3 are those used in recreational fishing surveys (Appendix 1). The highest concentration of vessels seen during these overflights was around Mahia Peninsula and Gisborne in zone 14 and northern zone 15. At this time of day line fishing was the main method observed.

Table 3: Vessel counts by platform for the two aerial survey days combined.

Zone	Trailer	Kayak	Launch	Charter	Total	Percent
14	29	2	1	0	32	5.7
15	340	4	8	0	352	62.5
16	72	4	0	0	76	13.5
17	94	2	5	2	103	18.3
Total	535	12	14	2	563	
Percent	95.0	2.1	2.5	0.4		

Onsite ramp interview Gisborne 2011–12

Boat ramp surveys in support of the LSMS were conducted by NIWA at the main Gisborne ramp in 2011–12. Data for all trips catching or targeting rock lobster were provided by MPI (cd9739). Interview sessions were generally conducted in the afternoon during weekends to increase the sample size of fin fish length data. Fishers using pots tend to check them in the morning to reduce the chance of poaching by other fishers. The rock lobster catch by pot fishers may be under represented in this survey. A total of 243 rock lobster were recorded and 65% of these were released as undersized and 9% were not measured (Figure 1). Just over half of these rock lobster were taken by potting (56%) (Figure 2). Generally the rock lobster were small and 86% were male (Figure 3). Rock lobster catch was recorded across the year with a peak in December and January (Figure 4).

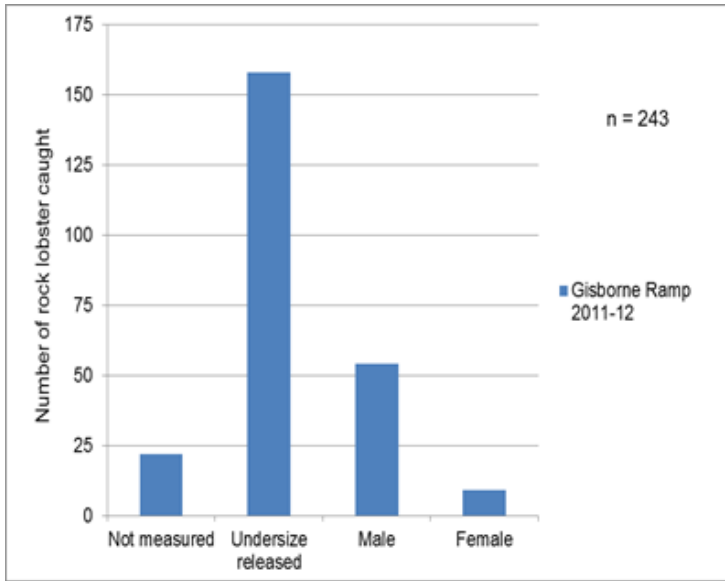


Figure 1: Rock lobsters recorded at the NIWA Gisborne Port boat ramp 2011–12.

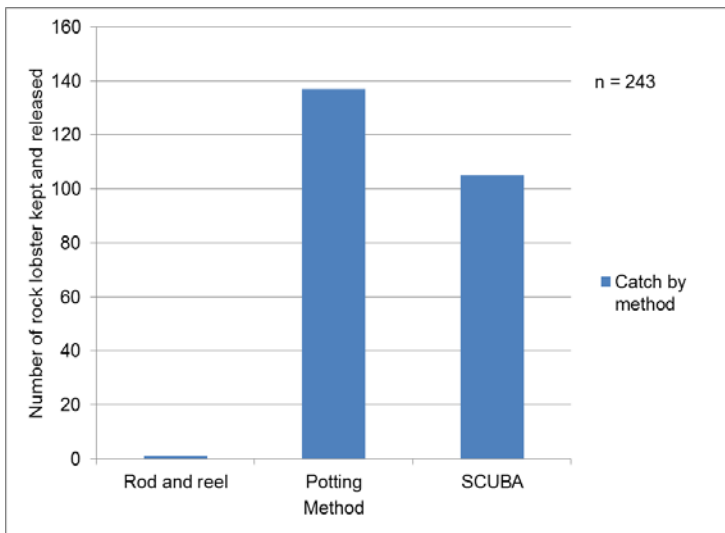


Figure 2: Rock lobsters recorded by method at the NIWA Gisborne Port boat ramp 2011–12.

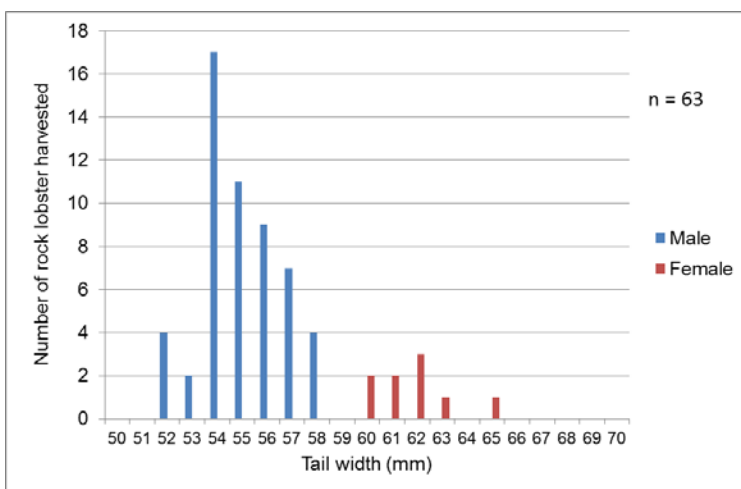


Figure 3: Rock lobsters recorded by tail width NIWA Gisborne Port boat ramp 2011–12.

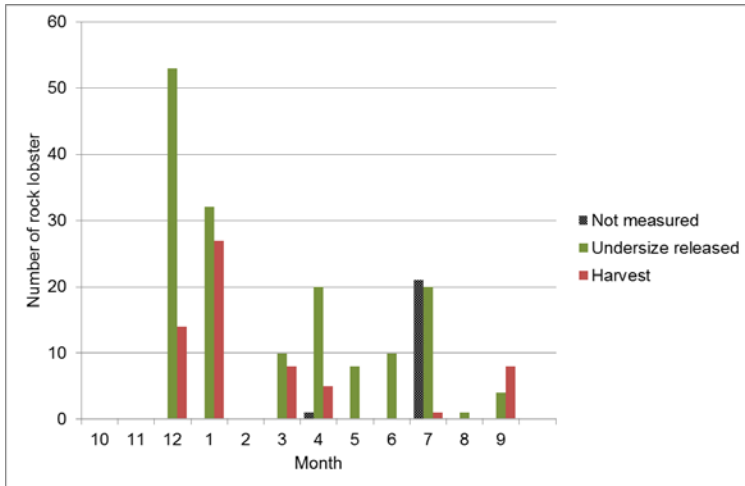


Figure 4: Rock lobsters recorded by month at the NIWA Gisborne Port boat ramp 2011–12

Web camera information 2014

Web camera images have been used in New Zealand for 10 years on some key boat ramps to measure traffic counts. Images from the Gisborne Port ramp were provided by NIWA and viewed for a period of expected high use by local fishers prior to the main holiday rush. The intention was to look for behaviours that may be associated with rock lobster potting, such as early morning departures and short trip duration. The counts of vessels returning by day start on Monday 1 December 2014 in Figure 5. The average number of departures and returns by hour of the day at weekends show that the highest departure rate during December 2014 was between 5:00 am and 7:00am NZST (Figure 6). There were small modes of return times between 6:00 am and 8:00 am and at 7:00 pm and the highest rate of return times was between 11:00 am and 5:00 pm. On week days departure and return times were more evenly spread with small modes at dawn and dusk (Figure 6).

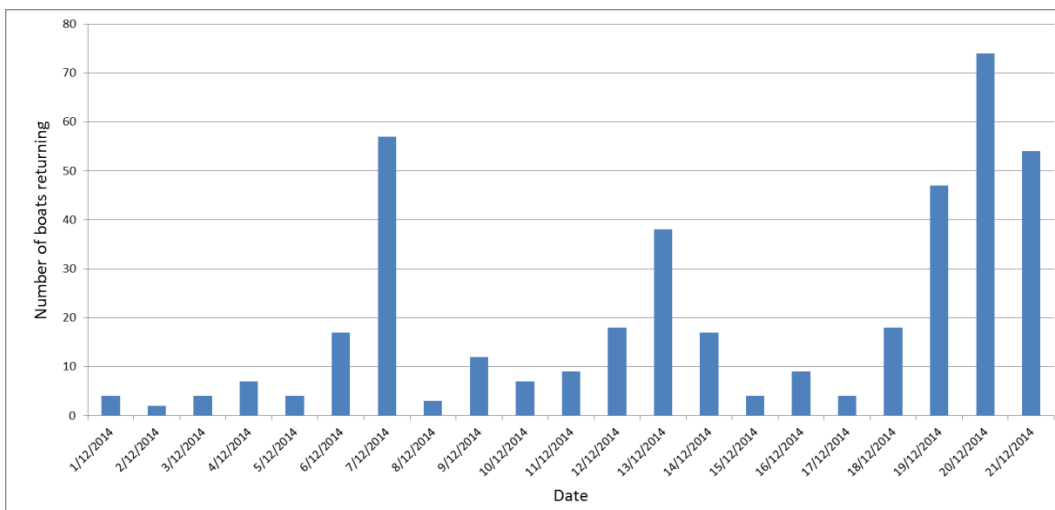


Figure 5: Vessel counts recorded by day at the Gisborne Port boat ramp December 2014.

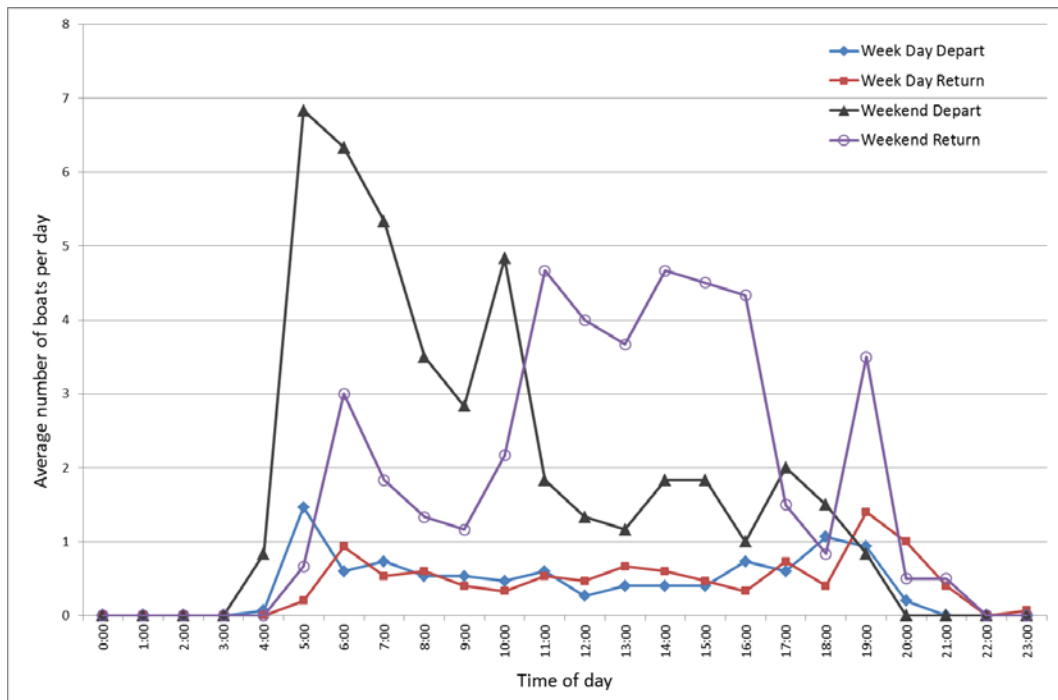


Figure 6: Average vessel counts per hour for departure and return times (NZ Standard Time) by weekend and week day at the Gisborne Port boat ramp December 2014.

The plot of duration by departure time for all days combined shows clusters of short duration trips of 40 to 100 minutes at dawn and again trips of 40 to 70 minutes just before dusk (Figure 7). There was a group of the same boats that returned every day or two at this time. This was consistent with checking rock lobster pots in the morning and setting fresh baits in evening. Access point surveys will need to cover the early morning period when fishers return from checking their pots.

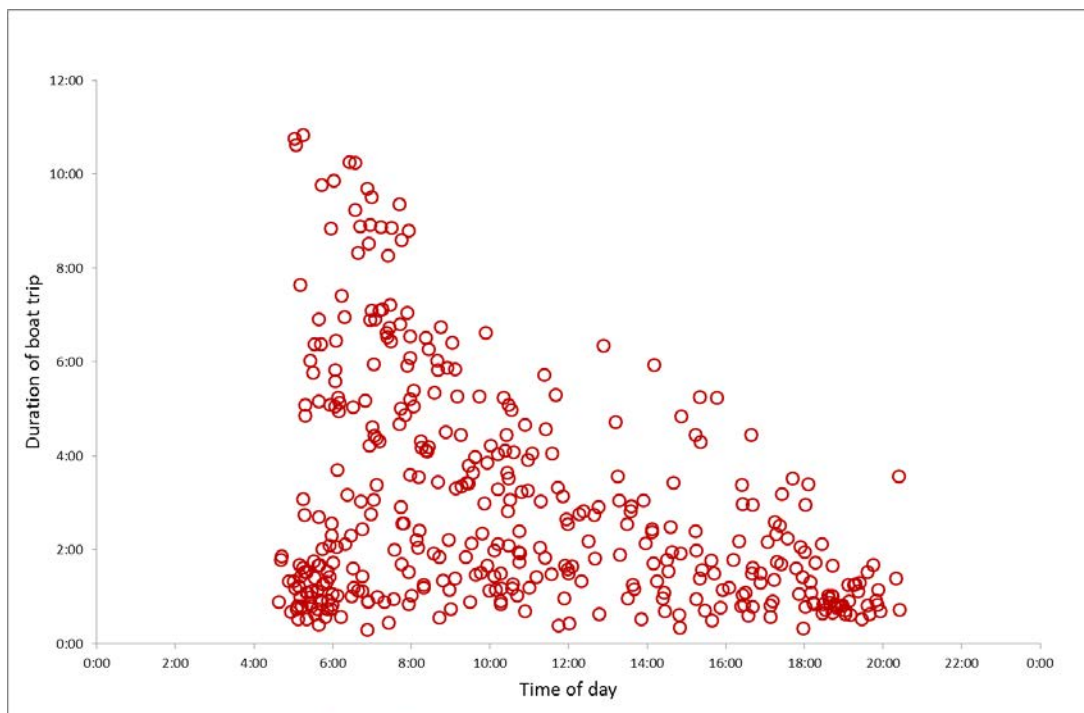


Figure 7: Duration of boat trip by departure time at the Gisborne Port boat ramp December 2014.

3.2 Distribution of access points

In discussions with fishers and MPI staff we have identified the following access points in CRA 3:

- Six main formed boat ramps for recreational use (Whangawahi-Mahia, Gisborne Port, Gisborne Marina Park, Tatapouri Beach, Tolaga Bay and Tokomaru Bay)
- In addition there are 17 beach launch sites or land access points that are identifiable, several of these are in front of camp sites or beach front dwellings
- Gisborne also has a small marina near the Port boat ramp.

Most recreational potting effort is concentrated in the Gisborne area. Experienced fishers say that pots are mostly removed over winter with the main fishing period from October to May. At the main beaches on the East Coast and around Mahia the December – January holiday period has by far the most rock lobster fishing effort.

The distribution of these public access points is plotted on Google Satellite images in Appendix 2. Other locations may be identified if an onsite survey is selected. We acknowledge that there is access to the coast across private land which will not be possible to collect data from using an onsite survey.

Another feature of the East Coast region is the number of summer camping areas controlled by permit by the Gisborne District Council. Last season these were open from 28/09/14 to 08/04/15 except Turihaua which is open 26th Dec to 1st Feb every year. MPI Fisheries Officers commented that shore diving and small boat activity for rock lobster from these camp sites was quite high over the peak summer period 19 December to 7 of February. Permits are relatively cheap being \$16.00 for 2 nights or \$31.00 for 10 nights. The location of these areas is shown on the www.gdc.govt.nz website.

In summary CRA 3 is a large and generally sparsely populated area with rugged exposed coast. The main settlements are linked by State Highways 2 and 35, about 290 km from Wairoa to East Cape. Many of the popular holiday beaches are on side roads. Gisborne is the main population centre and has a port with the best facilities for trailer and moored boats. Potting from boats is the main method used by recreational fishers to catch rock lobster and often fishers will check their pots early in the morning. Outside the main summer holiday period relatively few fishers may be actively fishing, but their catch could be significant. Mahia and the beaches along the East Coast are busy summer holiday destinations and land based diving and potting for rock lobster is popular.

3.3 Survey Options

CRA 3 will be difficult to survey using an offsite survey method such as the panel survey method developed in 2011–12 due to poor cell phone coverage across the area, extended periods of fishing at remote locations and within year fluctuations in available abundance. Similarly an onsite survey design will be difficult due to the number of access points for land based fishers along an extensive and in places remote coastline, typically with relatively low use at most boat ramp access points. The main methods that could be used to collect data needed for a robust harvest estimate are described below. None provide the complete answer so it is recommended that several methods be combined into a hybrid survey approach.

3.3.1 National Panel Survey

CRA 3 is difficult to survey using a large scale offsite survey method such as the NPS due to the low population density in the region and relatively few active rock lobster fishers. Poor cell phone coverage across the area and extended periods of fishing at remote locations limit the use of regular SMS messages and phone interviews to collect harvest information. If the sample size is small it may not be representative of all rock lobster fishers, which can bias the result. In 2011–12 the NPS captured just 26 fishers in CRA 3 and the harvest estimate of 8 t has a high CV of 33% (Wynne-Jones et al. 2014).

A study of the rock lobster data collected in the 1996 telephone diary survey estimated that a sample size of 450 panellists would be needed to detect a 20% increase or 25% decrease in amateur harvest (Bradford & George 2002).

There is an option of an increased sampling rate in areas of special interest in the next NPS. This may capture more fishers who are resident in CRA 3 or the Lower North Island but may not capture the summer visitors from outside the area. NRB are investigating the potential for improving rock lobster harvest estimates in the lower North Island as part of the survey design phase of the next NPS.

The panel survey captures all the fishing activity and harvest for a respondent over 12 months. This includes landbased activity, which is hard to capture with onsite surveys.

The method of recruiting panellists, then collecting data from them and scaling it up, is described in Wynne-Jones et al. (2014). The sample frame for the NPS was all people 15 years and older resident in each territorial district and their weighting was the inverse probability of the person being selected. Harvest estimates generated were in numbers of fish and the CV for CRA 3 in the last survey was 32%. If the sample size is increased the CV may be lower but likely to be within the range seen in other North Island QMAs with CVs of 21% to 30%. Some onsite survey data was needed to estimate the average size of rock lobster harvested by amateur fishers in CRA 3 (Hartill & Davey 2015).

Summary

The advantages of the NPS include that it is a proven method based on a probabilistic sample of the population that collects a whole years data from cooperating fishers. This includes catch from remote areas, land based access points, and trips that return after dark, which are not covered by most on site surveys. There will be another NPS in 2016–17 as part of planned 5 yearly cycle and a CRA 3 harvest estimate will be generated. The feasibility of increasing the sampling rate in areas like CRA 3 is being investigated.

Disadvantages are that it does not estimate the catch for visitors to New Zealand or for people aged 14 years or younger. The fact that a panellist knows that their catch will be recorded could change their fishing behaviour (observation bias) or that they want to be seen as a successful fisher (prestige bias). The offsite survey will not provide an estimate of the average size of rock lobster and contacting panellists using SMS messages is problematic in areas with poor cell phone coverage. Obtaining 450 panellists who catch rock lobster in CRA 3, as recommended by Bradford and George, would not be cost effective even if it was possible.

The National Panel Survey will be conducted in 2017–18, but will need some onsite information on the tail width and sex of rock lobster to produce an estimated harvest weight.

3.3.2 Regional Offsite Survey

A telephone survey of rock lobster fishers appears to have worked well in Tasmania where there is a register of amateur fishers who purchased a rock lobster fishing licence (Lyle & Tracey 2012). The harvest estimate from a sample of 603 licence holders was nearly double that estimated from a population based survey (similar to the NPS) in the same year. The problem in New Zealand is there is no similar sample frame of rock lobster fishers. Recreational fishers in New Zealand do not need to register or pay a licence to fish in the sea. The introduction of a mandatory registration or fishing licence will need support from the Government and fishers, which is unlikely in the time frame considered for this project. A subset of fishers could be enrolled to supply catch rate information but there is no way of estimating total rock lobster fishing effort, nor total number of rock lobster fishers for the year as a sample frame. Therefore there is no reliable way to scale catch data to total harvest.

There is one database which may be useful, the register of permit holders for summer camping managed by the Gisborne District Council. A phone survey of permit holders after their holiday could give the

average number of rock lobster caught per site per day which could be scaled by the total number of days and sites occupied. Some spatial and temporal stratification may be needed. It is not known if the Gisborne District Council would allow the use of the permit data in this way.

Summary

A sampling frame is needed. The introduction of mandatory registration or fishing licence for rock lobster fishers will need support from the Government and fishers, which is unlikely in the time frame considered for this project. If a data base of numbers of people, names and phone numbers of summer campers is available from Gisborne District Council then an offsite survey could be a useful component of a hybrid survey.

A regional offsite survey could be a component of a hybrid approach.

3.3.3 Boat Based Access Point and Bus Route Survey

An onsite survey intercepts boat based fishers returning to launch sites or marinas. Face-to-face interviews record catch and fishing method and effort. The catch can also be accurately counted, sexed and measured. The method aims to get comprehensive coverage of access points on survey days, which works well for fisheries where most of the harvest is taken from trailer boats and there are a limited number of well-defined launch sites. This type of survey has been used successfully in the western Bay of Plenty (MAF2010-02), East Northland (MAF2012-06) and Kaikoura (MAF2012-04). The Kaikoura survey had a dawn start to interview sessions to help capture fishers with pots returning early in the morning with their catch. (Kendrick & Hanley in press). This approach would be required at CRA 3 access points where competition between potters is high.

Much of the cost for onsite surveys is for interviewer wages. Costs increase with the number of days surveyed. Survey days are selected at random within season and day type strata and proceed regardless of weather conditions. For the three recent surveys above, the total days surveyed ranged from 45 to 94 over 12 months. Where access points are numerous and reasonably close (within 30 minutes' drive) a bus route method (Pollock et al. 1994) can be used. This allows one interviewer to cover several access points each survey day. The bus route method works well when boat return times are spread across the day. Where there are access points with low usage and/or uneven distribution of return times (mainly early morning or mainly at high tide for example) the bus route method may not capture sufficient information, even with long wait times. In the CRA 1 survey only the high use area from Rangiputa to Mangawhai was covered. Even so 35% of access points covered by bus route interviewers recorded no rock lobster for the survey year.

At the busiest ramps interviewers can be stationed from dawn to dusk on survey days to provide the best coverage. In CRA 3 the Gisborne port ramp is an obvious candidate for all day coverage. Currently there is a NIWA web camera collecting images on this ramp for 24 hours per day, seven days per week as part of the project (MAF2014-04). Counts of vessels are made for 60 days per year and 4 hour interview sessions on the same 60 days record the proportion of vessels fishing and collect catch and effort information. If an onsite method was selected for CRA 3 the NIWA interview time and survey data should be incorporated.

The method for expanding onsite bus route and all day ramp data to full year harvest estimates for the survey area is described in reports to MPI (Holdsworth 2014, Kendrick & Hanley in press).

In CRA 1 a high proportion of the rock lobster catch for the whole QMA was taken by boat based methods in the survey area (69%) according to harvest by panellists in the NPS survey. In this case the survey estimate (34 300 rock lobster) could be expanded to estimate the total amateur harvest for all of CRA 1 by multiplying by the inverse proportion of 69% (1.45). A CV of 17% was estimated from bootstrap resampling of the harvest onsite harvest estimate from daily averages within each strata and the proportion of catch from boats within the survey area from NPS panellists (Holdsworth 2014). Some

key assumptions were that the proportion of fishers inside and outside the survey area was estimated accurately in the NPS and that the proportion did not change between 2011–12, when the NPS was undertaken, and 2013–14 when the CRA 1 onsite survey was conducted.

Summary

The advantages of an access point survey include that it includes the catch for visitors to New Zealand and people aged 14 years or younger. Fishers generally don't know that they will be surveyed until they return to the access point so behaviour is not modified by the survey. There is minimal chance of recall bias or prestige bias because the catch is counted and measured by the interviewer. Length frequency plots and an estimate of average size of rock lobster can be generated.

The disadvantages in a large sparsely populated area like CRA 3 include that data collection can be quite inefficient, with many hours of interview time spent on empty boat ramps. If fishers check their pots and return to their launch site early in the day all the rock lobster harvest could be finished by 8:00 am, but interviewers have to stay until dusk. Diving effort is distributed throughout the day, especially during holiday periods, but underwater visibility and sea conditions limit the number of suitable days. Small or infrequently used access points are often excluded from this type of survey and it is assumed that the harvest missed is not substantial.

A boat based access point survey could be a component of a hybrid approach.

3.3.4 Roving Access Point Survey

Roving surveys are commonly used to survey fisheries accessed from numerous (and potentially infrequently used) sites, or along stretches of fishable coastline. The survey interviewer moves along a defined stretch of the shore during each sampling event, making a progressive count (Hoenig et al. 1993) of the number of fishers, hand gatherers, boats, or trailers encountered. The timing and direction of each patrol is randomized and the progressive count is multiplied by the length of each survey period to provide an estimate of the total amount of effort taking place over that time. Fisher interviews provide a catch rate by species for that area.

Where land based diving or the use of kayaks is common, the roving method could be used to obtain better coverage for an onsite method – for example at beaches in front of camping areas at low tide. Another approach would be to walk through camping areas in the late afternoon and ask for people to report their catch. Signage at the camping area could let people know that the survey was on that year.

A roving access point survey could be a component of a hybrid approach.

3.3.5 Daily Activity Counts

Having information on the activity patterns at an access point would help design an access point survey. The web camera located at the Gisborne port ramp has not yet been in place for a full year but has already provided useful information on vessel traffic numbers.

Modular battery powered web camera units are available and these could be installed at other suitable boat access points to collect boat traffic activity patterns in CRA 3. Most boat ramps and fishing areas are exposed to wind and wave action so traffic counts for all survey days would be better than a stratified random survey count which may not produce a representative sample of high and low traffic days. Part of the expense of the web camera counts is the time taken to read the images. With light traffic loads at most times on CRA 3 ramps, reading time would be reduced. Interviews would be required to determine the number of boats fishing and the harvest. The average catch per vessel per strata could be applied to the traffic counts from survey days or all days.

Another method involves recruiting residents who live near or overlook access points to count boat trailers at one or two key periods of the day. This would provide an instantaneous count of effort at those key times. Protocols would need to be developed about how to record vessels leaving or returning at the time of the count, vessels left at anchor, and tidal launch sites. Interviews at access points would be needed to check the purpose of the trip and the composition of the catch in that area. The profile of daily harvest could be scaled up by the total trailer count in the same way as the aerial counts. This method would work best where there is an active fishery with a lot of boats, so may not be applicable in CRA 3.

Daily activity counts could be a component of a hybrid approach.

3.3.6 Aerial-Access Survey

The aerial-access survey method stations interviewers all day at access points which get the most use and which cover an area or fishery. This can provide more interviews for less cost than a bus route survey of the same area. The assumption is that the harvest per vessel is similar across all access points in the area. The harvest from vessels encountered is scaled by the number of vessels counted from the air at a peak time of day (Hartill et al. 2007, Hartill et al. 2011, Hartill et al. 2013). This method works best where there is an active boat based fishery with a predictable peak of activity around the middle of the day. As seen in the analysis of web camera images (Figures 6 and 7) fishing effort working pots early in the morning may not be proportional to mid-day finfish effort.

This supports the argument of Hartill (2008) that the aerial-access method “is unsuited to estimating harvest where a large proportion of the harvest is taken by divers or fishers using pots”.

3.3.7 Aerial-Access Ratio to another Species

Another method that has been tried for CRA 1 and CRA 2 is to use the ratio of the rock lobster to snapper harvest weight from boat ramp interviews to get an indirect estimate boat based rock lobster harvest (Hartill 2008). It is based on the premise that the aerial-access estimate of snapper for 2004–05 is robust for SNA 1 and that the ratio of rock lobster to snapper from face to face interviews is unbiased. The sample sizes were large, with over 3500 interviews in CRA 1 and over 7800 in CRA 2, excluding the inner Hauraki Gulf. An allowance was made for land based catch using the 2000–01 telephone diary estimates of rock lobster by platform. The results of 22 t for CRA 1 and 28 t for CRA 2 were considered underestimates that needed to be treated with caution (Hartill 2008).

Given that the scale of fishing effort in CRA 3 is probably an order of magnitude less than in CRA 2 and there is no aerial access survey likely for finfish species, this method will not be considered further.

3.3.8 Mark and Recapture Programme

There is some ongoing tagging of rock lobster in CRA 3, mainly to estimate growth rate. In some finfish stocks estimates of amateur harvest have been derived from the numbers of tags returned by recreational fishers relative to the number returned by commercial fishers with a known landed catch.

There are a number of factors which rule out the use of the mark recapture method to estimate harvest in CRA 3. They are the need to tag large numbers of rock lobster spread across all of CRA 3, the high cost of tagging, and the requirement that tagged fish be equally available to recreational and commercial fishers. Some potential biases in reporting rates have also been identified as described in Hartill (2008).

This method is not considered further.

3.3.9 Strip Transect Sampling

In 2008 a method of estimating total potting effort was developed and trialled off the south east coast of Norway (Kleiven et al. 2011). There they have an eight week open season for commercial and recreational rock lobster potting with significant effort in the first two weeks, tailing off towards the end of the season. In this region a complex archipelago, 1–4 km wide, containing approximately 1900 islands exists between the mainland and the deep Norwegian trench. The mainland has hundreds of sheltered bays and coves and boats are left moored at many private jetties and small marinas. There are few locations where boat traffic is concentrated through specific access points. Transects were run perpendicular to a reference line drawn parallel to the coast. The start point of the first transect was selected at a random location in the southern segment. Sixty transects per week were sampled in each of two regional strata. As a small boat moved along each transect all floats within a 70 m strip either side of the transect were counted out to the 40 m depth contour. Every fifth float was approached and identified as commercial or recreational with the position, depth and distance from the transect line recorded.

In CRA 3 this method could be used to estimate the total number of recreational pots set per days. Geographical stratification could be used to improve precision of estimates by subdividing the study region into blocks that are likely to be similar in terms of fishing intensity. MPI Gisborne based Fisheries Officers say that recreational fishers should have their initial and surname as an identifier on their floats. Some fishers include a phone number, but this is not a requirement. A regular phone survey of potters who can be identified could provide the average number of rock lobster harvested per pot per day for each block. The count of floats along transects should be adjusted for the detection probability and used to estimate the mean number of pots per square kilometre in each survey strata using the methods described in Kleiven et al. (2011).

There are a number of difficulties with using a strip transect method similar to this in CRA 3. There is approximately 250 km of coastline to survey and the fishing year is 52 weeks long. The density of recreational pots is not high in most of CRA 3. Most of the coast and many launch sites are exposed to easterly and southerly quarter winds and swell. The method would need to be trialled in New Zealand conditions and only gives an estimate of the number of pots. Data would still be needed on the number of rock lobster harvested per pot and possibly size and sex of rock lobster taken. Although potting is an important method in CRA 3 it only accounted for 48% of the amateur harvest estimated in the NPS (Table 2). Another type of survey would be needed to capture the harvest information from non-potting methods.

The cost of an on the water survey could be kept down if it used boats that would be on the water anyway. Commercial fishers, possibly with trained observers on board, would know which pots were commercial and which were recreational. They also would have good quality electronic equipment which could be loaded with transect locations required for the day. Pot locations could be recorded on a tablet with suitable software. Reading the fisher name and phone number from a commercial boat may not be appreciated if seen by other fishers. There seems to be a degree of paranoia amongst potters about people interfering with their pots.

This type of survey could work in the Mahia and Gisborne areas where pot density is highest but Fisheries Officers say that further north in CRA 3 recreational pots are set in small patches close to access points. In this instance it would be easier to count total the number of floats from a boat or using a camera on a drone. A survey of catch rates would still be required.

Summary

On balance strip transect surveys are unlikely to provide enough information to significantly improve the annual amateur harvest estimate for CRA 3 but could be trialled in specific high use areas alongside an access point survey.

The main choices when deciding on a likely survey method for CRA 3 are set out in Figure 8.

CRA 3 Amateur Harvest Estimate (AHE)

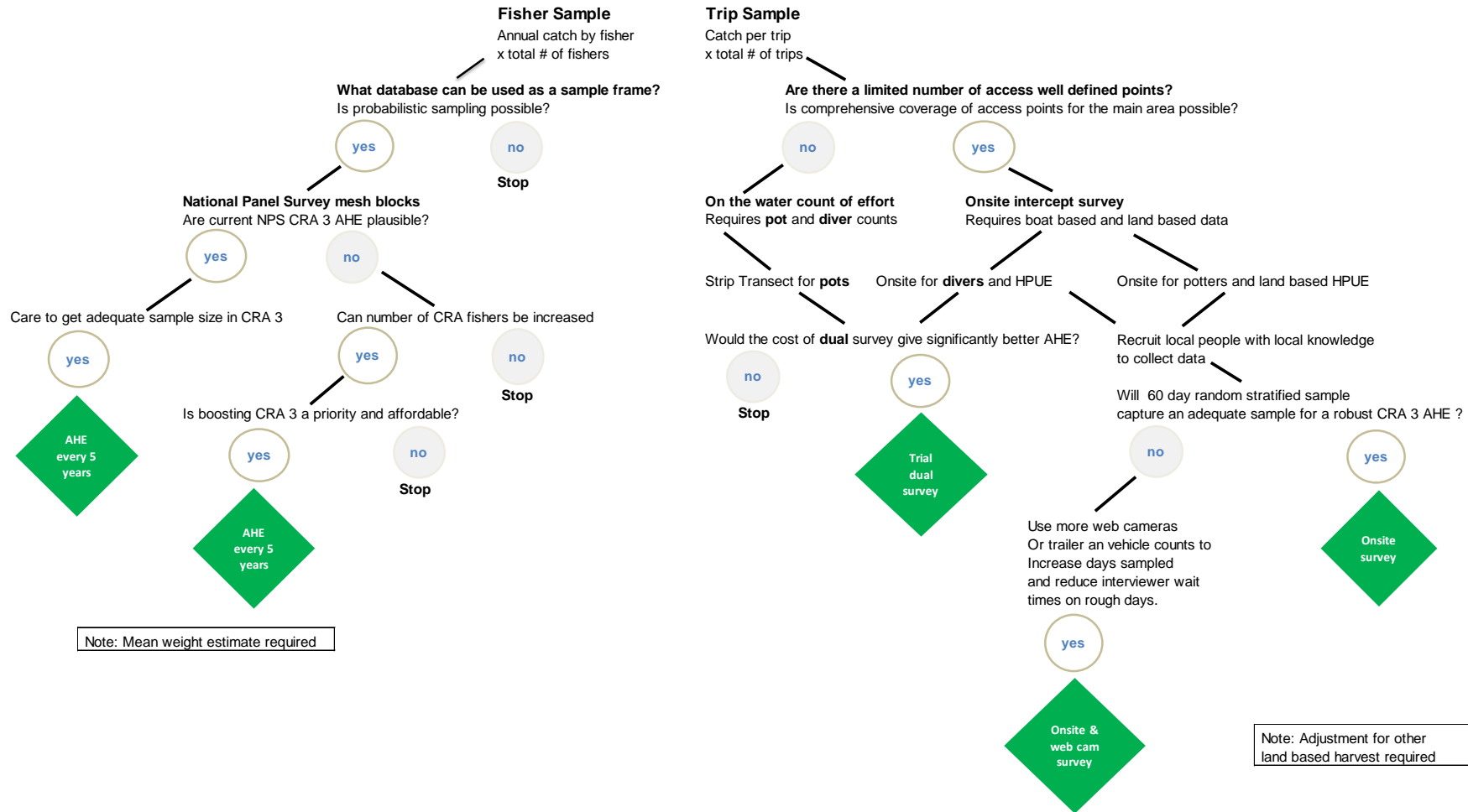


Figure 8: The main survey options for a CRA 3 amateur harvest estimate (AHE), green highlights for possible solutions.

3.3.10 Additional sources of information

The operators of charter boats used to take people fishing are required to register and report activity as well as the harvest of some species. An extract of rock lobster harvest within the survey area could be requested from MPI RDM.

Commercial fishers are allowed to keep up to six rock lobster per person per day for their own use under the provisions of Section 111 of the Fisheries Act (1996). The weight of rock lobster declared under Section 111 is reported in the annual rock lobster Plenary Report. In 2013–14 commercial fishers kept 2.9 tonnes in CRA 3 under Section 111.

4 CONCLUSIONS

There are a range of survey options considered in this report that could provide estimates of the amateur harvest of rock lobster in CRA 3. A number of these have been considered before and some have been implemented in parts of CRA 1, CRA 2 and CRA 5. In a previous review of survey methods for rock lobster Hartill (2008) suggested that a range of concurrent surveys could be used to obtain harvest estimates for separate fishing method components of the fishery and no single method was recommended.

Since then the National Panel Survey has been developed and implemented. This survey can provide an independent estimate of rock lobster harvest in numbers of fish. There is a proposal to consider boosting the number of mesh blocks in the Lower North Island Region (FMA 2 and 8) by 150 or 300 when the next NPS is run. The NRB draft analysis predicts that this would increase the sample size of rock lobster fishers on the panel by 54% for a 150 mesh block increase. If this proportional increase was applied to the 2011–12 CRA 3 sample the number of rock lobster fishers on the panel would increase from 26 to 40. Based on results from the more populated North Island QMAs in the last NPS CVs of 21% to 30% could be expected from boosting the sample size. Specialist fisheries such as those for rock lobster are hard to adequately sample using population proportionate sample allocation, even when it is boosted within a region. The estimated cost of the boosted options will be in the final report for project MAF2014/01 prepared by NRB. This cost would not be attributable to CRA 3 alone, as the amateur harvest for a range of species in the lower North Island would be improved.

It is recommended that if the boosted NPS is selected to provide harvest estimates in CRA 3 that a concurrent access point survey is conducted to estimate the average weight of rock lobster harvested. The survey should focus on the summer months when effort is highest and collect rock lobster tail width and sex. Where possible undamaged rock lobster should also be weighed to develop robust tail width – weight relationships. The cost of a stand-alone survey based on 4 hour sessions at 4 ramps for 40 days in CRA 3 is \$38 000 + GST. The cost could be reduced if the survey was an add-on to existing projects such as the MAF2014/04 web camera and creel survey monitoring project.

The alternative to the boosted NPS is a hybrid survey using an evolution of Western Bay of Plenty and CRA 1 onsite design that would include a boat and land based access survey, plus the use of mobile web camera technology to increase the number of days sampled. This would help generate more robust estimates from low use sites which may be affected by weather, and the state of the tide, and reduce the need for long fruitless interviewer wait times when conditions are not favourable. Web cameras would also help validate interview coverage and provide additional security for interviewers.

A hybrid onsite survey to produce an amateur harvest estimate for CRA 3 could be based on the following methodology.

- Calculating total daily effort (boat trips) at the **ramps with all day coverage** is straightforward, with most boats intercepted and adjustments made for vessels that were missed or for those that refused to be interviewed on survey days.

- The direct expansion method used for data collected using the **bus route method** of boat launch sites expands observed effort by the inverse proportion of wait time and length of the fishing day and is described in detail in Holdsworth (2014).
- In CRA 3 the large number of land based access points would be hard to locate and monitor. Over summer there is limited accommodation with a lot of people concentrated in well used camp sites. A **roving survey of camp sites** in the late afternoon would give a count of total sites occupied and an estimate of average catch per camp site for that survey day from interviews of completed trips. This method would underestimate total land based harvest but would collect information to better characterise this important component of catch.
- The Gisborne Port boat ramp has an existing fixed web camera and 60 days of partial interview coverage as part of another project. This proposal would increase interview coverage to all day on the same 60 days and the web camera counts would add little useful information. The proposal is to count boat trips on an additional 60 random stratified survey days from the **fixed camera at Gisborne and four temporary cameras** at the other main boat ramps. The average harvest per trip from the previous full survey day for that site could be used to estimate amateur harvest for the camera only day.

The estimated cost of a web camera boosted hybrid onsite survey of access points comprising of:

- 61 days dawn to dusk coverage (allowing for existing interviewer web camera coverage at the Gisborne Port ramp associated with the NIWA web camera project).
- 3 main ramps, bus route and roving interviewers in five areas covering secondary ramps and land based access points.
- Inclusion of supplementary information from amateur charter boat reporting and s 111 records is:

\$230 000 + GST.

An additional 60 days from an additional four web cameras, installation and reading would cost about:

\$30 000 + GST

4.1 Future options

The amateur harvest survey method selected should ideally be repeatable and cost effective. Overseas experience has shown that offsite surveys become much more tractable when a database of licenced rock lobster fishers is available. Not only does this have contact details for licensees, it provides a good estimate of the total number of fishers involved in the fishery in any period in time, providing there is a high level of compliance, a low level of exemption, and timely entry of data for licenses issued (Hartill et al. 2012). A sample frame of registered rock lobster fishers in New Zealand would reduce survey costs and provide more robust amateur harvest estimates. The administrative and political costs of introducing a rock lobster licence or register would also need to be considered. This is beyond the scope of this project.

5 ACKNOWLEDGEMENTS

Thanks to MPI Fisheries Officers, science and management staff and members of the Gisborne Tapatouri Sport Fishing Club for sharing their knowledge of the area. Thanks to MPI and Bruce Hartill (NIWA) for supplying the web camera images and the paper on strip transect surveys. We also acknowledge the work and support from Chris Karamea Insley from the consulting firm *37 Degrees South* based in Gisborne. Marcus Krey from Integrated Consulting Ltd provided advice on camera options.

This project is funded by MPI project MAF2014-03. Thanks to Neville Smith and the Marine Amateur Fisheries Working Group for assisting in the design and review of this project.

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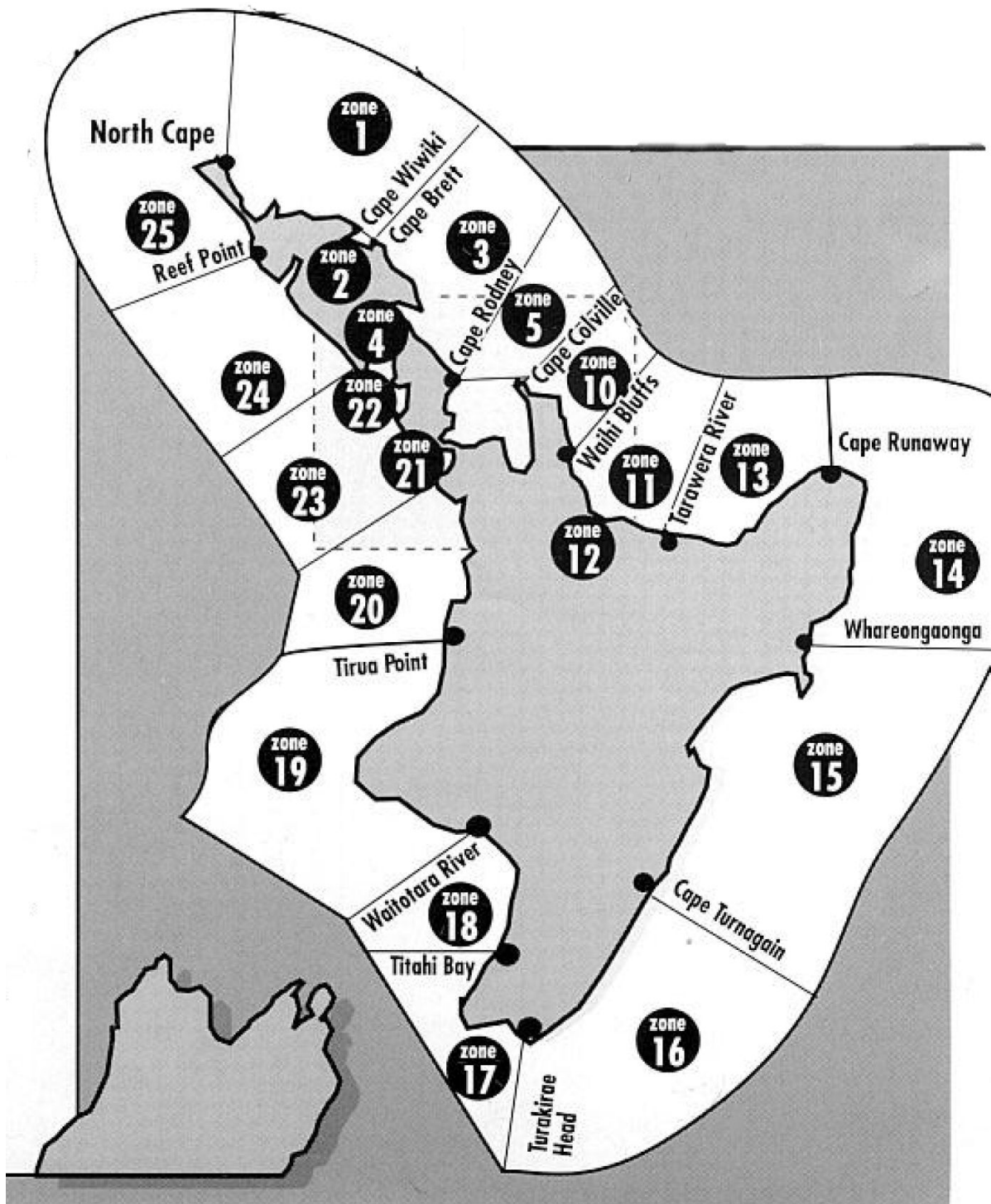
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7 APPENDIX 1. RECREATIONAL FISHING ZONES AROUND THE NORTH ISLAND.



8 APPENDIX 2. MAIN AND SECONDARY ACCESS POINTS IN CRA 3.

Key: Red closed circles – Main boat access points
Red open circles – Secondary boat access points
Yellow circles/areas – Well used land-based access areas

