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Survey design for recreational fisheries in FMA 7

New Zealand Fisheries Assessment Report 2015/44

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EXECUTIVE SUMMARY

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Estimates of the recreational harvest of inshore species commonly caught by recreational fishers in FMA 7 are required, but attempts to quantify recreational landings in the past have only been partially successful. This is because offsite survey methods such as panel surveys are not cost effective at small spatial scales, and the precision of harvest estimates provided by the most recent national panel survey was lower than desirable for most species given the number of panellists that reporting fishing effort in this area. The feasibility of onsite survey methods in this area is also limited given: the geography of the Marlborough Sounds; the numerous and diverse nature of the access points that recreational fishers can set out from; the relatively high incidence of launch fishing in some areas; and the common occurrence of low cloud in this part of New Zealand. The recent introduction of a seasonal closure to blue cod harvesting in the Marlborough Sounds before Christmas has added a further level of complexity to the fishery. The aerial-access survey approach is considered to be the most viable means of estimating recreational harvests of key finfish species in this area, but a survey of the FMA 7 fishery in 2005–06 was only partially successful.

Four small scale field surveys of the recreational fisheries in FMA 7 were conducted during the summer of 2014–15 to assess whether changes to the survey design used in 2005–06 could be made to address the shortcomings and potential issues previously identified. These small scale studies were: an aerial survey; a roving on-the-water survey of the most intensively fished part of the Marlborough Sounds; and limited creel surveys in the Sounds and on the south west coast of the North Island respectively.

The data collected by these field studies suggests that the survey design used in 2005–06 could be significantly improved if: creel surveys were conducted at additional boat ramps in the Marlborough Sounds; if a greater number of days were surveyed during the year (in part to account for the introduction of the seasonal closure for blue cod); and if changes were made to the aerial survey flight route.

Results from both the Marlborough Sounds creel survey and the on-the-water roving survey suggest that the amount of creel survey data collected would be considerably increased if an additional two boat ramps and two marinas were surveyed (in addition to the two public ramps that were surveyed in in the Sounds during 2005–06). This change alone would address many of the shortcomings associated with the previous survey. Conversely, the creel survey conducted at boat ramps on the lower west coast of the North Island during the summer of 2014–15 suggests that there is little to be gained by surveying fishers returning to this ramp, as very few of those interviewed had fished across the Cook Strait in FMA 7. Observations from two aerial surveys conducted suggest that the closure of the Marlborough Sounds to blue cod fishing before Christmas does not have a marked influence on the spatial distribution of fishing effort in that area. The timing of the closed season should be considered nonetheless, as it will influence the relative level of blue cod harvesting from FMA 7 at different times of the year.

A revision of the aerial-access survey design used in 2005–06 is therefore proposed, given the findings of this study and a review of the approach followed at that time. The additional costs arising from the changes would be offset by the improved accuracy and defensibility of the estimates provided. We also propose the extension of an existing network of web cameras overlooking boat ramps in the North Island to include at least one camera system in FMA 7, for two reasons. Firstly, to assess the representativeness of the subsample of days surveyed as part of the proposed aerial-access design, and secondly, to initiate a long-term monitoring programme for recreational fisheries in this area.

1. INTRODUCTION

The purpose of this project is to design a survey method that can be used to provide unbiased, cost effective and reasonably precise harvest estimates for finfish and shellfish species commonly caught by recreational fishers in FMA 7. Methods that can be used to survey recreational fisheries can be divided into two broad groups; offsite methods and onsite methods. Offsite methods usually rely on a randomly selected sample of fishers who self-report their catch, which is then scaled up based on an estimate of the total number of fishers participating in the fishery during the period of interest. Onsite surveys are usually undertaken by fishery independent surveyors who directly observe and record data on fishing effort and catch occurring during a scalable subsample of surveyed days (or parts of those days) randomly drawn from temporal survey strata.

Offsite methods (such as panel surveys) can be used to provide harvest estimates for commonly caught finfish species such as snapper and blue cod, but associated estimates for shellfish species tend to be very imprecise unless large numbers of fishers are recruited into the diarist panel. Offsite methods become less cost effective at smaller spatial scales such as for FMA 7, especially when a substantial proportion of fishers live outside of the surrounding area. A significant proportion of the effort in some parts of FMA 7 potentially originates from elsewhere, as the Golden Bay, Tasman Bay and the Marlborough Sounds are popular holiday destinations. This means that an offsite survey will only provide reasonably precise harvest estimates for snapper and blue cod if residents from a much broader area are contacted during the screening survey (with consequent expense). Offsite surveys also require some form of concurrent onsite survey to provide mean weight estimates for commonly caught species, so that estimates of the number of fish harvested can be translated into tonnage estimates.

Onsite methods usually provide a more cost effective means of estimating recreational harvests at smaller spatial scales, but their suitability is context dependent. Some onsite methods are only viable at relatively small spatial scales, where the number of possible access points is limited. There are relatively few onsite methods that can be used to assess recreational fisheries at the scale of a Fisheries Management Area, and FMA 7 would rank as one of the more difficult FMAs to survey because:

- the FMA 7 coastline is extensive and the geography varies from the relatively unpopulated exposed west coast through to the convoluted and populated coastline of the Marlborough Sounds;
- there are a large number of access points and many of these are infrequently used and some distance from each other;
- an unknown proportion of the boating effort in the Marlborough Sounds originates from either local baches or from across the Cook Strait;
- launch based fishers can account for up to 35% of the boat-based fishing effort in some areas and these fishers do not usually return to boat ramps; and
- this area is prone to low cloud which hampers aerial surveys.

To date there have been two relatively large-scale onsite surveys of recreational fisheries in FMA 7. The first of these was a survey of the recreational scallop and dredge oyster fishery in Golden Bay and Tasman Bay (Cole et al. 2006) and the second was characterisation and aerial-access survey of all of FMA 7 except for that occurring on the exposed and relatively unfished northern west coast of the South Island, which was conducted in 2005–06 (Davey et al. 2008). Both of these surveys have provided valuable insights into how recreational fisheries in FMA 7 could be assessed by onsite methods, but have highlighted problems that need to be overcome if the estimates they provide are to have greater utility.

The purpose of this study is therefore to learn from our experience in 2005–06, rather than simply casting it aside, as an aerial-access survey (described fully in Hartill et al. 2011) is still likely to offer the most viable approach for an onsite survey at this spatial scale.

Accordingly, the specific objectives of this project were to design a survey tool to robustly estimate the recreational finfish and shellfish fisheries harvest in FMA 7, and to provide cost estimates for delivery of the survey design developed under specific objective 1. This report does not include the cost estimate information which is considered commercially sensitive and has been provided separately to the Ministry for Primary Industries.

2. METHODS

The 2005–06 survey methods and results were reviewed to identify areas where significant improvements could be made to the aerial overflight sampling design. This review identified four substantive issues that warranted further investigation, as described below.

Interviews were conducted at only two boat ramps in the inner Marlborough Sounds (compared to three ramps sampled in Golden/Tasman Bay). This meant that there was insufficient information available to characterise diurnal catch and effort profiles for many of the surveyed days in the Marlborough Sounds, despite appreciable fishing effort being observed from the air.

Low cloud prevented or curtailed aerial survey flights on 12 of the 40 preselected survey days. Although regressions of aerial counts against interview-based fishing activity data were used to predict the count on unflyable days (which often coincided with poor fishing weather), the predictive power of these regressions was poor given the lack of interview data available on some days.

Not enough survey days were allocated to the winter/weekday stratum, and the average level of harvesting on these days was therefore poorly estimated.

About 48% of the boats observed from the air in 2005–06 were found in the outer Marlborough Sounds (Figure 1), but only 15% of the fishing parties interviewed had fished in that area. This was problematic because 80% of the estimated blue cod harvest (118.8 t out 148.6 t with an overall CV of 0.16) came from an area, yet the diurnal profile of effort was poorly described on many survey days.

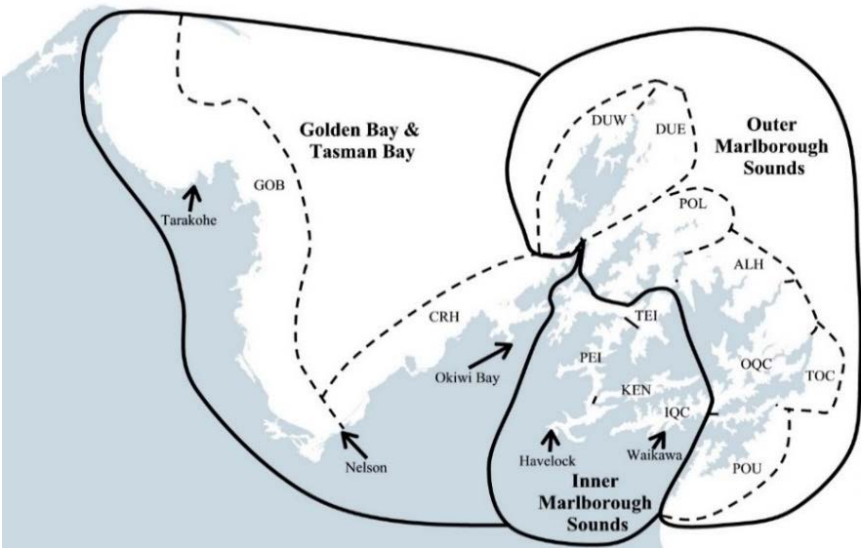

Figure 1: Spatial stratifications used for the three regions surveyed in 2005–06: Golden/Tasman Bay, the Inner Marlborough Sounds and the Outer Marlborough Sounds. Areas of water defined by solid lines denote spatial strata for which harvest estimates were calculated. Dashed lines and three letter codes denote small scale survey stratum definitions which were commonly used by aerial observers and boat ramp interviewers. Place names with arrows denote the locations of ramps surveyed in 2005–06. The IQC survey stratum was ultimately reallocated from the Inner Marlborough Sounds to the Outer Marlborough Sounds analytical stratum when harvest estimates were calculated. Taken from Davey et al. (2008).

Four small scale field studies were undertaken during the summer of 2014–15 to assess measures that could be used to address the above shortcomings identified with the aerial-access survey design used in 2005–06.

2.1 Creel surveys in the Marlborough Sounds

Most of the shortcomings identified with the aerial-access survey design used in 2005–06 were due to the low level of creel survey interviewing that took place in the Marlborough Sounds, as interviews were conducted at only two boat ramps in that area; at the public ramp at Waikawa, and at Havelock (although some boats leaving Okiwi Bay in Croisilles Harbour would have fished in the Marlborough Sounds). A small scale creel survey was therefore undertaken to assess the additional level of interview data that would be collected if interviews were collected at a further three ramps; at the marina ramp at Waikawa, at Picton, and at Elaine Bay (Figure 2).

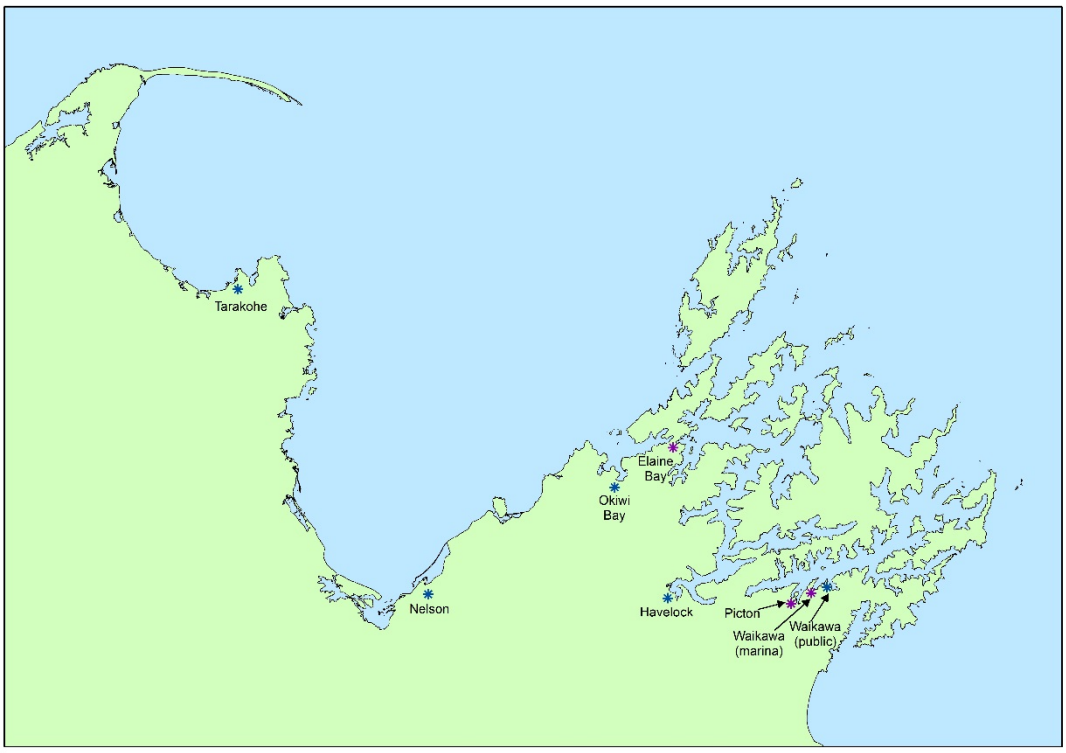

Figure 2: Location of surveyed boat ramps. Blue asterisks denote the location of ramps surveyed during the 2005–06 aerial-access survey and purple asterisks denote the three new ramps also considered in this study.

Six 6 hour interview sessions were conducted at all six ramps. The interview sessions were scheduled to occur on weekend days in the late afternoon and early evening, when traffic was likely to peak, to get an indication of the relative level of fishing effort returning to each ramp. All interviews followed a standardised format used in all previous NIWA creel surveys (including the 2005–06 aerial-access survey) to provide data on: the time at which each boat returned to the ramp, whether the boat was used for fishing, the number of fishers on board, where they fished, fishing methods used, fisher demographics, and the number and size of each species caught by each fisher.

The interview sessions were scheduled over a five month period between the 10th of October 2014 and the 10th of March 2015, which roughly coincided with the peak recreational fishing season in the Marlborough Sounds. Three of the six sessions at each ramp were scheduled to take place before the 19th of December and another three after that date. This temporal split reflected the timing of the closed season for blue cod in the Marlborough Sounds, which was introduced on 1 September 2012. The closed

season lasts from 1 September to 19 December inclusive, and fishers are not permitted to catch or transport blue cod through the closed area (Figure 3) unless they can prove that the blue cod were caught elsewhere.

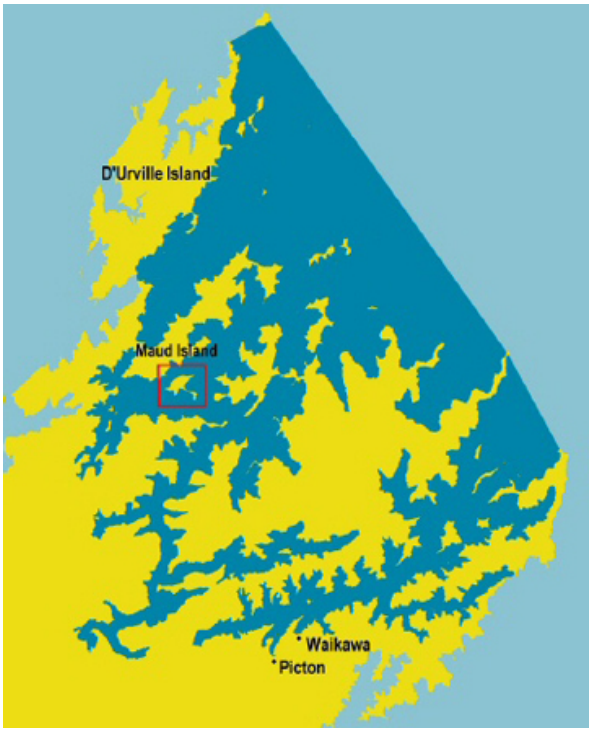

Figure 3: Seasonal closed area for blue cod fishing lasting 1 September to 19 December inclusive.

One potential problem with a creel survey conducted in the Marlborough Sounds is that many fishers may start their fishing trip from a bach/crib and would not therefore return to a surveyed boat ramp on the same day. A small number of addition creel survey sessions were therefore also conducted at the public ramp at Waikawa on Sundays, and fishers interviewed on these days were asked if they had fished the previous day. The purpose of these interviews was to determine if further data could be collected on fishing activity on a preselected survey day, if interviews were also conducted on the following day, when bach/crib based fishers returned to the mainland after a weekend away.

2.2 Roving boat surveys

Two roving surveys were also conducted of recreational boats fishing in Queen Charlotte Sound and Tory Channel. The purpose of these surveys was to determine where fishing boats originated from (including from baches/cribs), including the five ramps surveyed as part of this study, and to assess the merit of surveying further access points. The roving survey focused on these two bodies of water, which were intensively fished areas in 2005–06, accounting for 48% of the boats fishing in the Outer Marlborough Sounds over the 12 month survey period (as observed from the air). A larger scale roving survey was not considered to be logistically feasible.

The GPS location of each interviewed boat was recorded and each vessel was classified as being either: a trailer boat, a launch, a yacht, a charter boat, a jet ski or a kayak. The occupants of each boat were also asked the date that they intended to return to their original point of departure, as fishers setting out from baches may spend further nights at their holiday home before returning to the mainland. Occupants were also asked how many were fishing or intended to fish that day, as estimates of the average number of occupants in each boat type are required for an aerial-access survey.

The first roving survey took place on the 26th of October 2014, during the closed blue cod season, and the second survey during the open season, on the 8th of March 2015.

2.3 Creel surveys on the lower west coast of the North Island

One potential explanation for the low proportion of fishers returning to the ramps surveyed in the Marlborough Sounds in 2005–06 is that a significant proportion of fishing parties set out from boat ramps and marinas across the Cook Strait. Six 6 hour boat ramp interview sessions were also conducted on the lower west coast of the North Island, at Paraparaumu, the marina and boat ramp at the Mana Cruising Club, at twin bridges in Paremata, and at Plimmerton. The format of these interviews followed that used in the Marlborough Sounds, with creel survey sessions taking place on six weekend days between the 10th of October 2014 and the 10th of March 2015.

2.4 Aerial surveys

Two aerial surveys of the Marlborough Sounds were undertaken to gauge whether the introduction of the closed season for blue cod (1 December to 19 December) has had a marked effect on the spatial distribution of recreational fishing effort in this area. Fishing effort outside of the closed area during the closed season may have increased or decreased since 2005–06, given the distance that fishers must now travel if they wish to harvest blue cod. During the open season, fishing effort may have at least partially shifted to inner areas, as there is little to be gained by travelling a large distance given the restrictive slot size limit and the 2 blue cod daily bag limit now in place. The timing of these flights coincided with the boat based roving surveys of Queen Charlotte Sounds and Tory Channel (i.e., on 26th October 2014 and 8th March 2015). The approximate location of each boat was recorded on a marine chart and each boat was classified (trailer boat, launch, etc).

Although the purpose of these flights was to assess the spatial distribution of fishing effort in the Marlborough Sounds, coastal areas of Golden Bay and Tasman Bay were also flown, to assess the time required to also survey these areas.

3. RESULTS

3.1 Creel surveys in the Marlborough Sounds

The average number of recreational fishing boats returning to each of the surveyed boat ramps during the summer of 2014–15 varied considerably, with the ramps surveyed in 2005–06 accounting for the majority of the boats encountered (Table 1). Regardless, these results suggest, however, that additional interviewing of boats returning to Picton and at the marina at Waikawa would be beneficial, especially if boats were also approached when berthing at the marinas at each site (which was not attempted in this study). Relatively few boats were encountered at Elaine Bay, where problems were also experienced attracting applicants to the interviewer position as few people live in that area.

Table 1: Summary statistics for interview sessions conducted at boat ramps in the Marlborough Sounds.

	Sessions	Hours	All boats	Fishing boats	% boats Fishing	Fishing boats per hour
Elaine Bay*	6	37	31	30	97%	0.8
Havelock	6	36	88	51	58%	1.4
Okiwi Bay+	6	35	116	114	98%	3.2
Picton*	6	36	121	40	33%	1.1
Waikawa (marina ramp)*	7	42	231	103	45%	2.4
Waikawa (public ramp)	10	60	365	207	57%	3.5
Total	41	246	952	545		

* Boat ramps surveyed for the first time, as part of this study.

\+ The majority of the boats returning to Okiwi Bay had fished in Tasman Bay and not in the Marlborough Sounds

The survey strata fished by parties interviewed at each ramp differed and the selection of boat ramps surveyed should consider the catchment of each ramp to ensure that creel survey data are collected from all areas fished. Fishers returning to Picton accounted for over half of the fishing effort in IQC (Inner Queen Charlotte Sounds) and a small proportion of the effort in TOC (Tory Channel) which suggests that surveying at this access point should be considered if an aerial-access survey were to take place (Table 2). The benefits of conducting interviews at the previously unsurveyed marina ramp at Waikawa appear to be much greater, because this development would increase the number of fishers interviewed on each survey day, especially from launch and yacht based fishers who are not normally encountered at boat ramps.

Surveys of fishers returning to the low traffic access point at Elaine Bay could boost the amount of data collected from TEI (Tennyson Inlet), POL (around Port Ligar) and to a lesser extent ALH (off Alligator Head), but these survey strata accounted for a relatively low proportion of the boats observed during aerial surveys of the Marlborough Sounds in 2005–06.

None of the boats interviewed at any of the surveyed ramps had fished in POU (Port Underwood) where 14% of the boats observed from the air had fished in 2005–06. However, only a small number of boats were observed fishing from the air in this area in 2014–15 (see Section 3.4).

Table 2: Areas fished by those interviewed at each boat ramp and the relative level of data that each ramp potentially provides on fishing in each area.

								Marlborough Sounds	
	Survey strata[#]	Elaine Bay	Havelock	Okiwi	Picton	Waikawa (marina)	Waikawa (public)	% of 2005–06 Creel total*	% of 2014–15 Aerial total[+]
Inner	TEI	86%	14%	–	–	–	–	9%	7%
Marlborough	KEN	–	100%	–	–	–	–	7%	12%
Sounds	PEI	–	100%	–	–	–	–	4%	10%
Outer	ALH	18%	28%	–	–	32%	22%	1%	5%
Marlborough	DUE	–	58%	42%	–	–	–	1%	5%
Sounds	IQC	–	1%	–	55%	15%	29%	16%	8%
	OQC	–	–	–	1%	45%	54%	37%	20%
	POL	37%	63%	–	–	–	–	2%	4%
	POU	–	–	–	–	–	–	–	14%
	TOC	–	–	–	7%	41%	52%	22%	10%
Tasman Bay	CRH	–	–	100%	–	–	–		
	DUW	–	–	100%	–	–	–		

[#] See Figure 1 for spatial definitions of the small scale strata
* Creel survey data collected during the summer of 2014–15
[+] Aerial survey data collected throughout 2005–06

The most commonly landed finfish species at all six ramps was blue cod, and the most commonly landed shellfish were scallops (Table 3). The introduction of the closed season, slot limit and 2 blue cod daily bag limit in 2012 should have reduced the incidence of cod landings since 2005–06.

More snapper were expected given the recent anecdotal increase in recreational landings of this species, especially in the Inner Marlborough Sounds, which accounted for 38% of the 2005–06 snapper harvest estimate, but relative few recreational landings included catches of snapper.

Table 3: The number of the four most commonly caught species landed at each ramp.

		Number landed			
	Fishers	Blue cod	Snapper	Rock lobster	Scallops
Elaine Bay	43	52	1	0	393
Havelock	67	63	20	0	305
Okiwi	208	457	29	7	1 734
Picton	52	27	3	3	967
Waikawa (marina ramp)	197	202	0	11	3 324
Waikawa (public ramp)	377	350	1	55	8 101
Total	944	1 151	54	76	14 824

One way of potentially interviewing a greater proportion of the fishers who fished on a survey day would be to also conduct interviews on following days, and to ask intercepted fishers about any fishing that may have occurred on the preceding scheduled survey day. Only a very small proportion of the fishers interviewed at the public ramp at Waikawa on the last day of a weekend claimed to have fished earlier in the weekend (Table 4), which suggests that very little additional data would be obtained if creel surveys were also conducted on days following a scheduled survey day.

Table 4: Number of fishing boat parties encountered during paired day weekend creel surveying at the public ramp at Waikawa and the number of those returning on the Sunday who claimed to have fished on the previous day.

Date	Day	Fishing boats interviewed	Fished on Saturday
25/10/14	Saturday	26	
27/10/14	Labour Day	6	3
29/11/14	Saturday	10	
30/11/14	Sunday	9	0
06/12/14	Saturday	18	
07/12/14	Sunday	6	0
03/01/15	Saturday	30	
04/01/15	Sunday	33	1
10/01/15	Saturday	28	
11/01/15	Sunday	29	0

3.2 Roving boat surveys

There were 52 boating parties interviewed during the on-the-water roving survey on the 25th of October 2014, when the Marlborough Sounds were closed to blue cod fishing, but only 22 boats were encountered on the 8th of March when the closed season was no longer in force (Table 5). This is probably because the first survey occurred during the first day of the Labour Day weekend, and higher winds and rain were forecast for the following two days which would have resulted in a concentration of effort on the Saturday. Most boats were encountered in the outer Queen Charlotte Sounds on both days. The majority of boats encountered in all three areas were trailer boats, but launches made up a greater proportion of the boats encountered in October, which is to be expected on a long weekend.

Table 5: Numbers of each boat type encountered during boat based roving surveys of Inner and Outer Queen Charlotte Sounds and Tory Channel on the 25th of October 2014 (during the closed season) and on the 8th of March 2015 (closed season). See Figure 1 where each area is defined.

Date	Boat type	Inner Queen Charlotte	Outer Queen Charlotte	Tory Channel	Total
25/10/14	Trailer boat	9	17	8	34
	Launch	4	14	–	18
	Yacht	1	3	–	4
	Charter boat	–	–	–	–
08/03/15	Trailer boat	3	7	6	16
	Launch	–	5	–	5
	Yacht	–	–	–	–
	Charter boat	–	–	1	1

As in 2005–06, almost all boats used by recreational fishers in this area can be classified as being either trailer boats or launches, which have similar occupancy rates, but significantly more fishers were found in charter boats and fewer in yachts (Table 6). The occupancy rates for each type of vessel are very similar to those obtained from a similar survey undertaken in the Hauraki Gulf in 2003–04.

Table 6: Fisher occupancy rate by boat type, based on interviews with fishing parties interviewed during roving surveys in Queen Charlotte Sound and Tory Channel.

Boat Type	Average number of fishers
Trailer boats	3.06
Launches	3.17
Yachts	1.75
Charter boats	6

The intended destination of those fishing is of primary interest, as these data provide some insight into the degree of coverage provided by surveyed ramps. These data suggest that although 45% of those interviewed in Queen Charlotte Sounds and Tory Channel intended to return to ramps surveyed as part of this study, another 34% would have returned to the marinas at Waikawa and Picton adjoining the ramps surveyed at these sites (Table 7).

Table 7: Final destination of fishing boats encountered during boats based creel surveys.

Final destination	25 October	8 March	Percent usage
Waikawa ramp*	14	7	27%
Waikawa marina	14	2	21%
Picton marina	5	5	13%
Waikawa marina ramp*	9	1	13%
Picton marina ramp*	3	1	5%
Picton harbour mooring	2	1	4%
Seaview – Wellington	1	1	3%
Anakiwa	–	1	1%
Anakiwa ramp	1	–	1%
D'Urville east – bach	–	1	1%
Grove Arm – bach	1	–	1%
Inner Queen Charlotte – bach	–	1	1%
Momorangi ramp	1	–	1%
Mooring at Waikawa	1	–	1%
Ngakuta Bay ramp	1	–	1%
Outer Queen Charlotte – bach	1	–	1%
Staying at sea	–	1	1%
Tory Channel – bach	1	–	1%
Whatamanga Bay ramp	1	–	1%
Total	56	22	

* Ramps surveyed in 2014–15

Many of those interviewed did not intend to return to their original point of departure on the same day, however, and would not therefore have been interviewed on the same day as a flight scheduled as part of an aerial-access survey (Table 8). Additional surveying effort at these marinas should also therefore be considered if another aerial-access survey of FMA 7 is attempted, to maximise the estimate of rho (the ratio of the aerial count of fishing boats relative to the number of boats interviewed as surveyed ramps who claimed to be fishing at the time of the overflight on the same day) on each survey day.

Table 8: Percentage of boats interviewed during the two roving surveys who intended to return to a surveyed boat ramp at the end of the same day.

25 October 2014 (closed season)

	Inner Queen Charlotte	Outer Queen Charlotte	Tory Channel	
No	9	24	3	64%
Yes	5	10	5	36%
% Yes	36%	29%	63%	100%

8 March 2015 (open season)

	Inner Queen Charlotte	Outer Queen Charlotte	Tory Channel	
No	2	6	–	36%
Yes	1	6	7	64%
% Yes	33%	50%	100%	100%

3.3 Creel surveys on the lower west coast of the North Island

Creel surveys were also conducted on the lower west coast of the North Island, to determine whether appreciable numbers of fishers crossed the Cook Strait to fish in the Marlborough Sounds. The likelihood of this occurring is highly weather dependent and interviewers were therefore told to conduct their interviews on calm days, to maximise the chance of intercepting fishers returning from the South Island. The weather on the west coast of the North Island during the summer of 2014–15 was usually unfavourable for boating in open waters, however, and fewer creel survey sessions took place than planned because of repeated postponements of creel survey sessions (Table 9). Additional data were available from Twin Bridges, however, because creel surveys were routinely conducted at that ramp as part of another programme (MAF-2013/03 - Developing web camera monitoring in FMAs 2 & 8).

Only three boat parties were interviewed who had fished across the Cook Strait in the Marlborough Sounds and the low encounter rate of these fishers would not justify conducting creel surveys at these ramps as part of a FMA 7 aerial-access survey.

Table 9: Summary statistics for interview sessions conducted at boat ramps on the lower west coast of the North Island.

Surveyed ramp	Session (target)	Session (actual)	Fishing boats interviewed	Boats fishing in the Marlborough Sounds
Mana Cruising Club	6	4	22	0
Plimmerton	6	4	21	0
Paraparaumu	6	5	25	0
Twin Bridges	6	33	138	3
Total	24	46	206	3

3.4 Aerial surveys

Two aerial surveys were conducted to determine whether the closure of the Marlborough Sounds to blue cod fishing between the 1st of September and the 19th of December had a noticeable influence on the spatial distribution of fishing effort. The first flight took place during the closed blue cod season, on the 25th of October 2014 and the second during the open season, on the 8th of March 2015. The flight route for the October flight is shown in Figure 4, which is very similar to that flown in March.

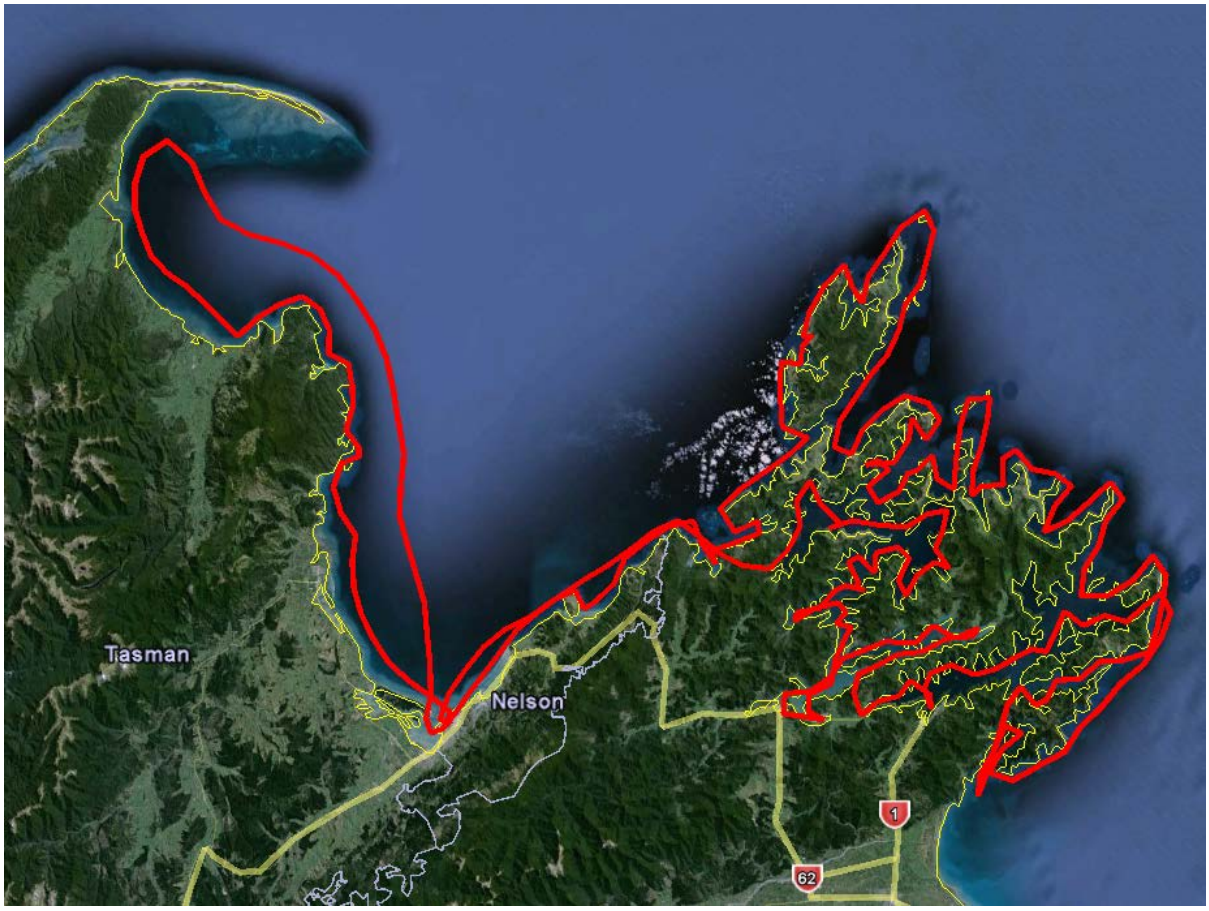

Figure 4: Flight route flown on the 25th of October 2014. A similar route was flown on the 8th of March 2015, but which included Endeavour Inlet, which was overlooked during the first flight.

Recreational fishing was observed throughout the Marlborough Sounds during both flights, although the observed level of recreational fishing effort was much higher on the 25th of October (155 boats versus 44 boats on the 8th of March), which is to be expected on a long weekend (Figures 5 and 6). Although a single flight during each season gives limited insight into changes in the spatial distribution of fishing effort, there was no consistent difference in the relative spatial distribution of boats observed on the two days (see Figure 7 also). The most marked difference was the relatively intense fishing in Croisilles Harbour (north of Okiwi Bay) during the closed season, which is to be expected, as this area was not closed to blue cod harvesting at that time. There was, however, no corresponding shift in effort to the south east coast of the Marlborough Sounds.

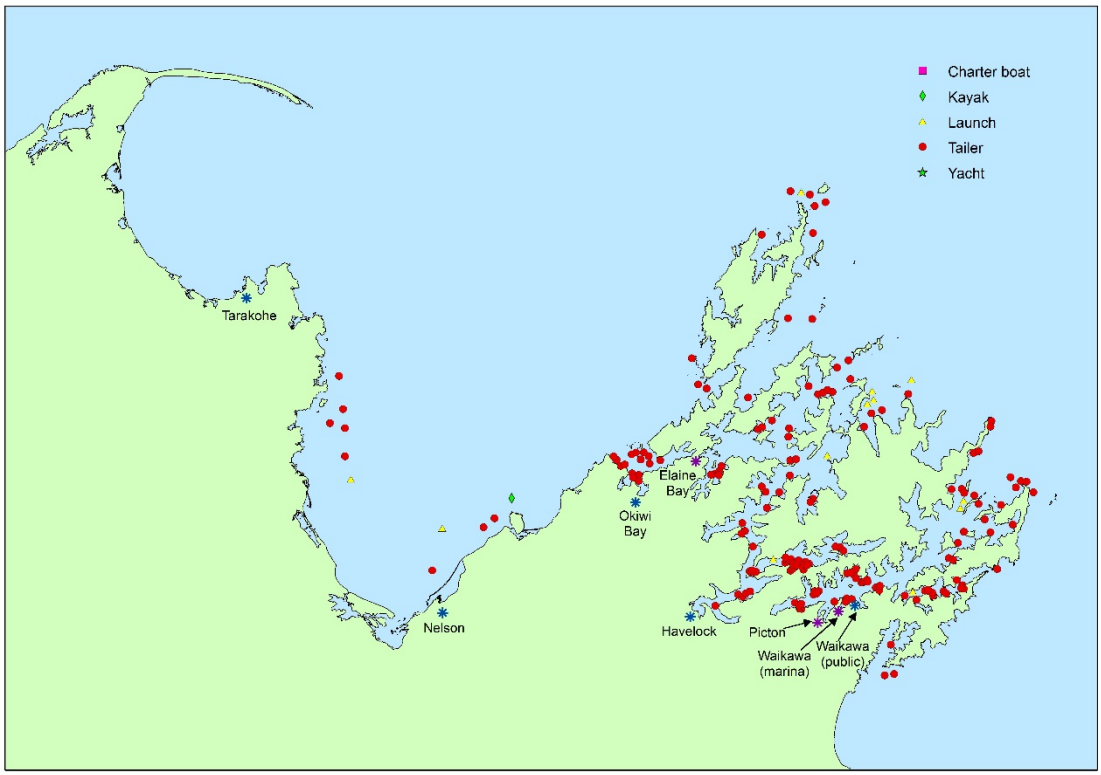

Figure 5: Location of recreational fishing boats observed during the aerial survey of the Marlborough Sounds on the 25th of October 2014.

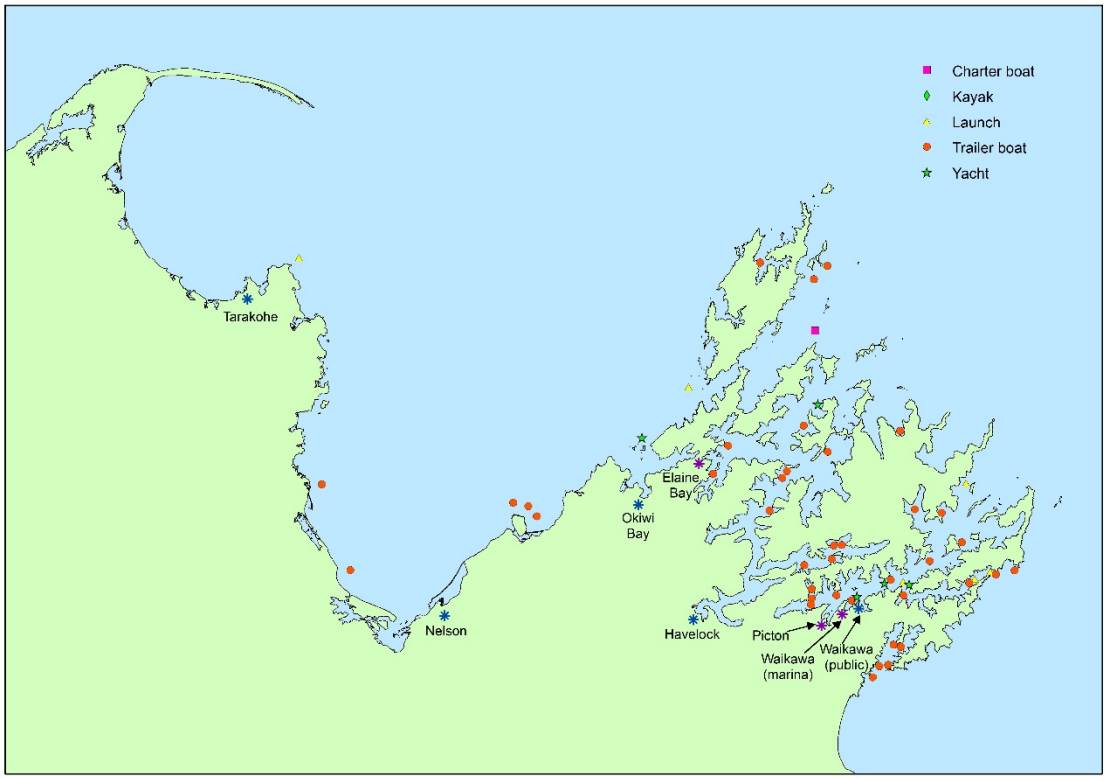

Figure 6: Location of recreational fishing boats observed during the aerial survey of the Marlborough Sounds on the 8th of March 2015.

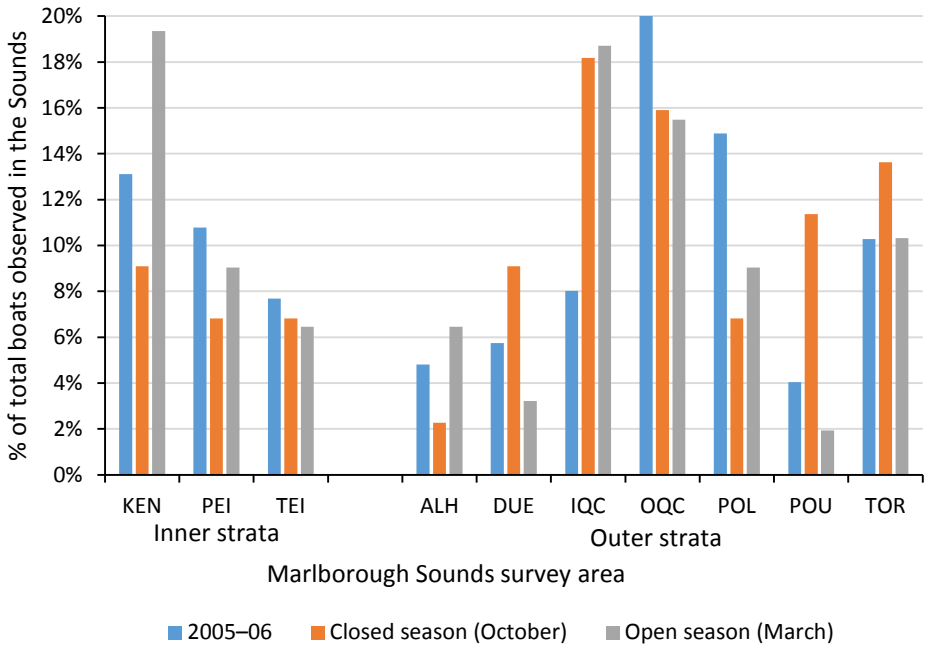

Figure 7: Spatial distribution of boats observed during aerial surveys in 2005–06 relative to that observed on the 25th of October 2014 and 8th of March 2015.

The majority of recreational fishing boats observed were classified as trailer boats (94% in October and 77% in March) and the majority of these boats would have ultimately returned to a public access point that is potentially surveyable.

4. DISCUSSION AND RECOMMENDATIONS

The results of the four small scale field surveys undertaken as part of this study suggest that problems with the aerial-access survey design used in 2005–06 could be largely overcome if relatively minor changes to the survey design and its implementation were made.

The main limitation of the 2005–06 survey design was that insufficient creel survey data were collected on fishing in the outer Marlborough Sounds on most survey days, which was problematic for two reasons. Firstly because the diurnal catch and effort profiles derived from creel survey data were often poorly informed, as only a small proportion of the boats observed from the air returned to surveyed ramps on surveyed days. Secondly, because flights in all or parts of FMA 7 were cancelled on many days because of low cloud, and the regressions of aerial counts against the number of interviewed parties who claimed to be fishing at the time of the overflight, which were used to predict flight counts for unflown days, were also poorly informed.

Both of these issues could be addressed if creel surveys were conducted at two additional boat ramps in the Marlborough Sounds and an associated marina, as interviews were only conducted at two ramps in the Sounds in 2005–06. Both the on-the-water roving survey and the small scale creel survey data conducted in the Marlborough Sounds suggest that significantly more data would be available if fishers were also interviewed when returned to the ramps at the Waikawa marina and at Picton, in addition to the previously surveyed public ramps at Waikawa and at Havelock. The roving survey data suggests that there would also be merit in interviewing fishers returning to marina berths at Waikawa and Picton, although surveying at marinas is more difficult than surveying at nearby boat ramps and extra staff would be needed to achieve this. A key assumption with aerial-access surveys is that the pattern of fishing activity and average catch of uninterviewed parties as the same as that experienced by those who are interviewed when they return to surveyed boat ramps on each survey day. Although this is

probably a reasonably assumption, the only way to test it would be to do a full census at all potential access points, which is neither logistically feasible nor cost effective.

Additional interviewing could be attempted at lower intensity access points, such as at Elaine Bay, which was surveyed as part of this study, but this is unlikely to be cost effective. There also appears to be little merit in conducting surveys of fishers returning to the North Island after they had spent the day fishing in the Marlborough Sounds, as the encounter rate of these fishers was very low and very weather dependent. The possibility remains, however, that very little creel data will be available on fishing in the very outer regions of the Marlborough Sounds, such as off D'Urville Island, although these areas do not appear to be heavily fished.

The reason why only five ramps were surveyed in 2005–06 (two of which were located in the Marlborough Sounds) was because of cost constraints, which also meant that it was only possible to schedule 40 survey days given the budget available at that time. One consequence of this was that only five survey days were allocated to the relatively large (150 days) but quiet winter midweek temporal stratum. Unfortunately aerial flights were cancelled or curtailed on four of the five scheduled survey days, and this meant that the estimated average daily level of effort and catch from this temporal stratum was poorly informed. A minimum of eight days should therefore be assigned to any temporal stratum in the future to minimise the risk of this occurring again.

An additional two temporal strata would also be required for an aerial–access survey of FMA 7 at the current time, because of the introduction of the closed season for blue cod in the Marlborough Sounds. The 2005–06 survey year was divided up into four temporal strata; two day-type strata (midweek days versus weekend and public holiday days) within two seasonal strata (summer versus winter). The closed season for blue cod in the Marlborough Sounds current runs from 1 September to 19 December, although the timing of this season is currently under review. The introduction of this closed season in 2012 means that it will now be necessary to further divide the two summer strata into four (before and after the 19th of December). Further, average daily landings of blue cod will differ considerably depending on whether the closed season is in force. All days falling between the 25th of December (Christmas Day) and the 20th of January (Wellington Anniversary Day) will be treated as public holidays because many take a protracted Christmas break over this period. A recommended six strata temporal survey design (based on the 2014–15 calendar) given on a minimum of eight scheduled survey days per stratum is as follows:

Season	Day-type	Days available	Days surveyed	Sampling intensity
Summer (Closed)	Weekend/public holiday	32	10	31%
	Midweek	78	8	10%
Summer (Open)	Weekend/public holiday	64	12	19%
	Midweek	69	8	12%
Winter	Weekend/public holiday	36	8	22%
	Midweek	87	8	9%
Total		366	54	

The additional allocation of further survey days to the two summer weekend/public holiday strata is required because the level of fishing effort on these days is potentially higher and therefore more variable. Although the relative allocation of survey effort to each stratum is informed by previous experience, simulations were not undertaken to optimise estimate precision for two reasons. Firstly because, apart from the two flights undertaken as part of this study, no data have been collected on the distribution and intensity of recreational fishing effort in the Marlborough Sounds since the introduction of the blue cod closed season in 2012, which will have had a significant impact on the spatial and

temporal distribution of fishing effort in this area. Secondly because any simulations of a simpler two season (four stratum) survey design based on data collected in 2005–06 would still be poorly informed given the number of flights in the previous survey that were weather affected.

Although the addition of 14 days and two temporal strata to the temporal sampling design used in 2005–06 should result in more robust and precise harvest estimates, the accuracy of these estimates will partially depend on how representative the randomised subsample of selected days is. Web cameras installed in FMA 1 have been used to continuously monitor daily traffic at key boat ramps, and these data were used in 2011–12 to assess whether harvest estimates provided by an aerial-access survey in that year were positively or negatively biased because of the chance pre-selection selection of busier or quieter survey days (Hartill & Edwards 2015). Although the randomised selection of a subsample of survey days from each temporal stratum should, on average, provide an unbiased sample, the results from 2011–12 suggest that this assumption should be tested so that the extent of this potential form of bias can be estimated.

No boat ramp web camera systems have been established in FMA 7 to date however, and we recommend that at least one camera should be installed before an aerial-access survey is conducted in this region. Web camera monitoring has been combined with the routine collection of creel survey data at 11 ramps along the North island coast, to estimate trends in effort and harvest as part of two other MPI programmes (MAF-2013/03 and MAF-2014/04). The data collected by one or more cameras installed in FMA 7 could be used to assess both the temporal representativeness of the aerial-access survey, and as a basis for monitoring longer term trends in recreational catch and effort. In 2005–06 the estimated recreational blue cod harvest from FMA 7 was mostly taken from the Marlborough Sounds (83%) whereas just over half of the snapper harvest was taken from Golden Bay/Tasman Bay (51%). The installation of at least one camera system in each of these regions would therefore be desirable, as trends in the harvest of these species in one area will not necessarily reflect trends in the other, especially given the fact that the Sounds are subject to a partial closure to blue cod harvesting during the early summer.

Another limitation of the 2005–06 survey was that the aggregation of small scale fishing areas into larger analytical strata was problematic, because the flight route varied between flights, passing in and out of each analytical stratum during the day. One assumption of the maximum count aerial-access method used is that the flight counts are essentially instantaneous, and it is therefore desirable to steadily work though all of the fishing areas within an analytical stratum as quickly as possible before moving on to the next stratum. A flight route has now been planned and the need for a progressive instantaneous count (as recommended by Pierce & Bindman (1994)) is better understood. The Cessna 185 used in this study is also more suitable for aerial survey work than the Cessna 172 and Piper Cherokee 140 aircraft used in 2005–06, as it is faster, but fitted with wing canards so that it can fly slower when needed.

Although the aerial-access survey method can be used to provide an estimate of the boat based harvest, which should account for the majority of the recreational harvest of the recreational species of interest here, other forms of harvest still need to be accounted for. Data from the most recent National Panel Survey (Wynne-Jones et al. 2014) have been used in the past to account for harvests taken by shore based methods (surf casting, kontikis). National Panel Survey data can also be used to estimate the relative harvest taken in other parts of a QMA, which do not fall within the survey area. The best source of information on harvests taken from charter boats is that provided by MPI's Amateur Charter Vessel–Activity Catch Return (ACV–ACR) system, which can be used to gauge the likely level of harvesting from this fleet. Finally, the harvest of those taking their recreational catch from commercial vessels can be quantified given mandatory S.111 reporting of this activity.

The first objective of this programme was to design a survey tool to robustly estimate the recreational finfish and shellfish fisheries harvest in FMA 7, but the proposed aerial-access approach can only be used to reliably estimate finfish harvests. This is because it is not possible to reliably observe and enumerate recreational harvesting of shellfish species such as rock lobster and scallops from the air.

The authors are not aware of any cost effective onsite survey approach that could be used to estimate harvests of these species in this area. One option is a relative harvest estimate, such as that provided for rock lobster in FMA 1 (Hartill 2008). The estimates provided by this approach are not based on a survey designed to provide recreational shellfish harvest estimates as such, as they are based on finfish harvest estimates, which are scaled by the weight of each shellfish species landed at surveyed ramps, relative to the landed weight of finfish.

We conclude that the small scale field studies discussed here suggest that significant improvements could be made to the aerial-access survey design used in 2005–06, to provide robust recreational harvest estimates for commonly caught finfish species. Catch sampling at additional access points and a higher intensity of temporal sampling should result in a greater correspondence between creel and aerial survey data, reducing much of the uncertainty attributable to the survey design used in 2005–06. Ancillary effort data should also be collected via web cameras to monitor both the representativeness of the survey day selection, and to monitor long term trends, as the benefits of this multi-method systematic approach has been demonstrated and adopted for recreational fisheries of northern New Zealand.

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