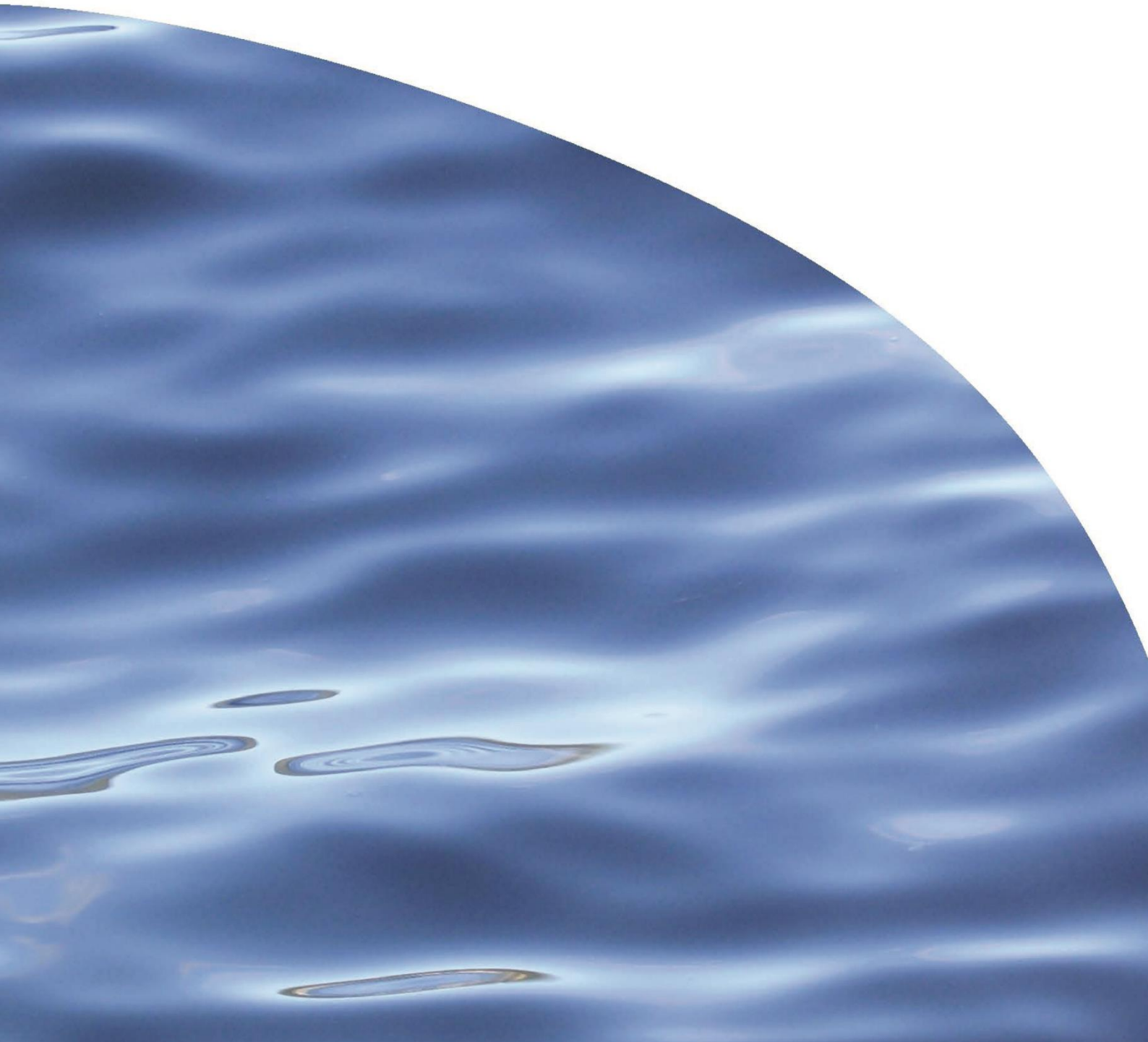
CAWTHRON
The power of science®

REPORT NO. 3439

INT2017-03: IDENTIFICATION OF MARINE MAMMALS CAPTURED IN NEW ZEALAND FISHERIES 2018/19



INT2017-03: IDENTIFICATION OF MARINE MAMMALS CAPTURED IN NEW ZEALAND FISHERIES 2018/19

SIMON CHILDERHOUSE, OLIVIA JOHNSTON

Prepared for Department of Conservation

CAWTHRON INSTITUTE
98 Halifax Street East, Nelson 7010 | Private Bag 2, Nelson 7042 | New Zealand
Ph. +64 3 548 2319 | Fax. +64 3 546 9464
www.cawthron.org.nz

REVIEWED BY:
Deanna Clement

APPROVED FOR RELEASE BY:
Grant Hopkins

ISSUE DATE: 21 November 2019

RECOMMENDED CITATION: Childerhouse S, Johnston O 2019. INT2017-03: Identification of marine mammals captured in New Zealand fisheries 2018/19. Prepared for the Department of Conservation. Cawthron Report No. 3439. 15 p. plus appendix.

1. INTRODUCTION

The Cawthron Institute (Cawthron) has been contracted by the Department of Conservation (DOC) to review Fisheries New Zealand (FNZ) observer identification records of incidental marine mammal captures in New Zealand fisheries: Project INT2017-03. This project forms one part of the wider Conservation Services Programme (CSP) research programme which also covers the identification of bycaught turtles and protected fish species and is designed to complement the existing seabird identification project. These other species are addressed in separate reports.

The accurate determination of the taxon of marine mammals captured in New Zealand (NZ) fisheries is vital for examining the potential threats to population viability posed by incidental fisheries captures. Observers on commercial vessels are not always able to identify marine mammals with high precision, and the assessment of the age class may require expert knowledge. Information gained through this project will link to FNZ databases and will inform ongoing capture estimations, risk assessments, research, and modelling of the effects of fisheries incidental capture (i.e. bycatch) on various marine mammal species.

The aims of this project were to determine, primarily through examination of photographs, the taxon of marine mammals observed captured in New Zealand (NZ) fisheries (for live captures and dead specimens discarded at sea), and where possible, the sex, age-class and provenance of the animals. The outputs from the project include: (i) a marine mammal identification spreadsheet for upload to FNZ; and (ii) a report summarising the photographs assessed. This report covers data collected from marine mammals captured between 01 July 2018 to 30 June 2019.

2. METHODS

When government observers aboard fishing vessels record an incidental capture of a dead marine mammal, a photographic record is often collected. Live interactions are also photographed wherever possible. The CSP undertakes a review of all photographs obtained from marine mammal interactions to confirm important information. Cawthron is undertaking this expert review under contract to the CSP. The objective of this research is for all marine mammal photographs and their subsequent identification to be examined to determine the accuracy of the assignments made by FNZ observers in the field. This includes an assessment of the following assignments: species, sex, age and provenance.

Details on the date, time, location and fishery data (e.g. fishing method, fishery area and target species) linked to capture events are provided to CSP by FNZ and these records were then reviewed by Cawthron.

Where there was any uncertainty in assignment of taxa during the image cross-referencing process, a second experienced researcher did a blind review of the data. The final assessment was then made collectively by both researchers. If the taxon was unable to be determined (i.e. only a part of the body was recovered) or there was uncertainty (i.e. poor photograph quality), the event was identified and recommended for follow-up genetic analysis. [Genetic samples of all by-caught marine mammals are routinely collected by observers.]

When a specimen was identified from a photograph, the identification features used were fully described. These data are categorised by taxon and fishery stratum (fishing method, fishery area and target species). All data were recorded in a spreadsheet with each event being linked to the original FNZ observer data through either a unique identifier (i.e. tag ID – unique to that event) or, if there was no unique identifier, it was linked to the specific event using other event-specific data (e.g. trip number, date, time, specimen number, etc.).

3. RESULTS

3.1. Data summary

There were 106 marine mammal bycatch events reported between 1 July 2018 to 30 June 2019 (Table 1). Of these events, 89 (84%) had photos or videos that could be assessed to confirm taxa identification and other information. One of the records comprised a video rather than photos but has been combined here for analysis. The remaining 17 (16%) events had no photos associated with them and were therefore not able to be assessed. The following sections will report on the 89 events for which reasonable photos or video were available. There is some discussion of potential reasons for a lack of photos in Section 3.8.

Table 1. Summary of marine mammal bycatch events for the 2018/19 year as reported by observers. Note: Species codes are the official codes used by Fisheries New Zealand: FUR – New Zealand fur seal; HSL – New Zealand sea lion.

Species code (as identified by observer)	Common name	Species name	Photographic records?		All records
			No	Yes	
FUR	New Zealand fur seal	*Arctocephalus forsteri*	15	78	93
HSL	New Zealand sea lion	*Phocarctos hookeri*	2	11	13
Total			17	89	106

3.2. Species identification

Taxa identification by observers was confirmed as correct in all events where reasonable quality photos were available (Table 2).

Table 2. Summary of expert identified marine mammal bycatch events for the 2018/19 year for which photos were available. Note: Species codes are the official codes used by Fisheries New Zealand: FUR – New Zealand fur seal; HSL – New Zealand sea lion.

Species code (as identified by expert)	No. of events with photos	No. (%) correctly identified to taxa
FUR	78	78 (100%)
HSL	11	11 (100%)
Total	89	89 (100%)

3.3. Sex identification

There were two fields in the supplied data that reported sex information about the bycaught marine mammal: *Sex* and *Observer sex*. In all cases, assignment of sex was made into one or the other of these fields by the observer with no overlap. There were no notes to distinguish between these two fields. Therefore, the entries from these two fields were combined in a single field named *Combined observer sex* which was used for reporting the observer-determined sex for that event.

Of the 89 events where photos were available, all events had a sex assignment by the observer. Of the 89 events where sex was recorded by observers, it was only possible to confirm sex from 29 (33%) of these events and the remainder of events had photos of insufficient quality[1]. Of these 29 events, 25 (86%) were confirmed as correct. All the events where the sex was identified by the observer as male were confirmed as male except for one event. For the five events where the sex was identified by the observer as female, two (40%) events were confirmed as female and the other three were identified as males (Table 3).

Table 3. Cross-reference of sex identification of bycaught marine mammals by observer and experts during the 2018/19 year for which photos were available. Note: Sex codes: 1 – male, 2 – female, 3 – sex unable to be determined, 4 – not sexed. Green squares show where observer identification of sex agreed with expert observation.

Sex (as identified by observer)	Sex (as confirmed by expert				Total
	1	2	3	4	
1	23	1	41		65
2	3	2	9		14
3	1		4		5
4			3	2	5
No code					
Total	27	3	57	2	89

3.4. Age identification

The estimation of the age of a marine mammal is complicated and is best accomplished from the direct ageing of an individual through methods such as examining cross sections of teeth, earwax plugs, examination of sexual organs and stomach contents (e.g. for milk) and/or DNA molecular methods. This information was not available for these bycaught individuals and therefore general age categories were assigned to individuals based on visual criteria from photos.

Age class was determined using observer length records and the following generalised criteria:

- ***Calf/pup*** *(e.g. age 0)*: dolphin/whale – less than one third of the length of an average adult female, sometimes neonatal folds if very young; seal/sea lion – less than one third of the length of an average adult female; pup pelage.

[1] Male gender can often be established with accurate size lengths, as there is typically a maximum female size (above which, the animal is likely to be a male). Using observer recorded size length alone (where there were no photos or they were of insufficient quality) indicates that another 14 male identifications are potentially correct. However, this approach only provides a single line of evidence, relies on accurate observer measurements, and is biased to determining only large males, therefore it has not been included in the overall assessment.

- ***Juvenile*** *(e.g. age 1+)*: dolphin/whale – approximately one half of the length of an average adult female, sexually immature; seal/sea lion – approximately one half of the length of an average adult female, sexually immature; lack of pup pelage.
- ***Adults*** *(e.g. variable age)*: dolphin/whale – greater than one half the length of an average adult female, sexually mature; seal/sea lion – greater than one half the length of an average adult female, sexually mature, secondary sexual characteristics (e.g. mane).
- ***Indeterminate***: photos where age class could not be assigned.

Age class classification using only photos is likely to be inaccurate for individuals transitioning between these categories. Potential identification inaccuracies are especially possible for those in the juvenile category as there is considerable variation when individuals attain a specific size and sexual maturity. It is likely to be more accurate for very young individuals and fully mature individuals that fit clearly into a single category. We also used experienced marine mammal researchers to assign an age class who were familiar with most of the species appearing in these records to improve the accuracy of age class assignment.

Age class could be determined for 83 (93%) bycatch events (Table 4). Of the events where age could be assigned, 96% (n = 80) of events were estimated to be adults with low numbers of calves, pups and/or juveniles. This is an interesting result and could be due a range of possible reasons including:

1. It can be challenging to accurately determine a juvenile from an adult from photos and size length records alone. Generally, the criteria are based on reproductive maturity, which cannot be easily assessed from external characteristics and is generally confirmed from examination of reproductive organs. This may mean that the number of actual number of juveniles is underestimated; and/or
2. Many species have different foraging behaviour and ranges between different age classes and therefore the fisheries which have most of the bycatch may have a genuinely higher proportion of adults with juveniles foraging elsewhere.

It is not possible to distinguish between these two possibilities without reliable data on actual reproductive maturity status, which would require the direct examination of reproductive organs and potentially, even the collection of histopathology samples for examination by an expert.

Table 4. Summary of marine mammal age class data for bycatch events during 2018/19 for which photos were available. Note: Species codes are the official codes used by Fisheries New Zealand: FUR – New Zealand fur seal; HSL – New Zealand sea lion.

Species code (as identified by expert)	Age class assignment					Total
	Calf	Juvenile	Juvenile/Adult	Adult	Indeterminate	
FUR		1		70	6	77
HSL		2		10		12
Total	0	3	0	80	6	89

3.5. Dead before being caught

There are some events where a marine mammal is caught but that was clearly not killed as part of that specific fishing event. For example, if a very decomposed marine mammal or a skull with no flesh and signs of extensive weathering appears in the catch, it was clearly not killed in that fishing event (e.g. tow or set). In this case, while the event is technically recorded as a dead marine mammal capture, the death is not related to that specific fishing event. We added a new field *Dead before being caught* to try and address this issue as these events should not be attributed to the fishery as a mortality event. We recommend that a similar field is added to the observer reporting forms to distinguish between a marine mammal capture which was clearly dead before being caught vs a marine mammal that was likely killed in that fishery event.

In 2018/19, there were three bycatch events where a decomposing FUR, HSL, or part thereof, was recorded by an observer. Lice and decomposition were evident in photos (where available), confirming the observer's findings/comments. Given the state of decomposition, it is considered unlikely that the specimens were killed in the fishery event. Details of this event have not been reported here due to privacy issues but details are available from DOC upon request.

3.6. Provenance

Provenance is the likely origin of a bycaught individual. It is only possible to determine the provenance of an individual if it has been previously marked (e.g. tagged, branded, biopsied) and that marking data is available.

There were two HSL caught in 2018/19 that were previously tagged. A sea lion with tag M386 was caught offshore northeast of the Auckland Islands in a trawl targeting hoki. M386 was a female that was tagged in January 2010 at Sandy Bay on Enderby Island. She was resighted once in 2012 but hasn't been seen since. A male HSL tagged W534 on Dundas Island in January 2012 was caught offshore south east of

the Auckland Islands in a trawl targeting scampi. He was resighted once in January 2015, also on Dundas Island.

3.7. Fishery data

The following figures provide a brief summary of all bycatch events from the 2018/19 year in relation to fishing areas, injury status, month of event and fishing methods.

Almost all (93%; n = 83) of events were captures in a trawl fishery (Table 5). There was a reasonable geographic spread of captures around New Zealand, but most events were recorded in the Challenger (CHA) and Southern (SOU) Management Areas with 25% (n = 22) and 20% (n = 18) of all events, respectively (Table 6; Figure 1). Marine mammal bycatch events were recorded for 14 different target species with the main target species being hoki (HOK) and squid (SQU), comprising 37% (n = 33) and 33% (n = 29), respectively, of all events (Table 7).

Almost all (90%; n = 80) of the marine mammal bycatch events had the individual recorded as dead, but some (8%; n = 7) individuals were captured alive (Table 8). Most (63%; n = 62) bycaught animals were recorded as having no visible injuries in the relevant data column, however a range of injuries were often reported by the observer the notes/remarks column (Table 10), suggesting some injury status data are missing or were incorrectly recorded.

There were captures in all months of the year except November, with the most (28%; n = 25) captures occurring in July 2018.

Table 5. Summary of all marine mammal bycatch events for the 2018/19 year by fishing method. Species and fishing method codes are the official codes used by Fisheries New Zealand. FUR – New Zealand fur seal; HSL – New Zealand sea lion. Fishing method codes: SLL – Surface long line; SN – Set net; TWL – Trawl.

Species code (as identified by expert)	Fishing method			Total
	SLL	SN	TWL	
FUR	3	3	71	77
HSL			12	12
Total	3	3	83	89

Table 6. Summary of all marine mammal bycatch events for the 2018/19 year by Fishery Management Area (FMA). Species and FMA codes are the official codes used by Fisheries New Zealand. FUR – New Zealand fur seal; HSL – New Zealand sea lion. Fishery Management Area codes: KER (Kermadec), AKE (Auckland East), AKW (Auckland West), CEE (Central East), CEW (Central West), CHA (Challenger), SEC (Southeast Coast), SOE (Southeast), SOU (Southland), SOI (Sub-Antarctic Islands) and SUB (Sub-Antarctic).

Species code (as identified by expert)	Total								
	CEE	CEW	CHA	SEC	SOE	SOI	SOU	SUB	
FUR	11	1	22	4	3	3	18	15	77
HSL	1					9		2	12
Total	12	1	22	4	3	12	18	17	89

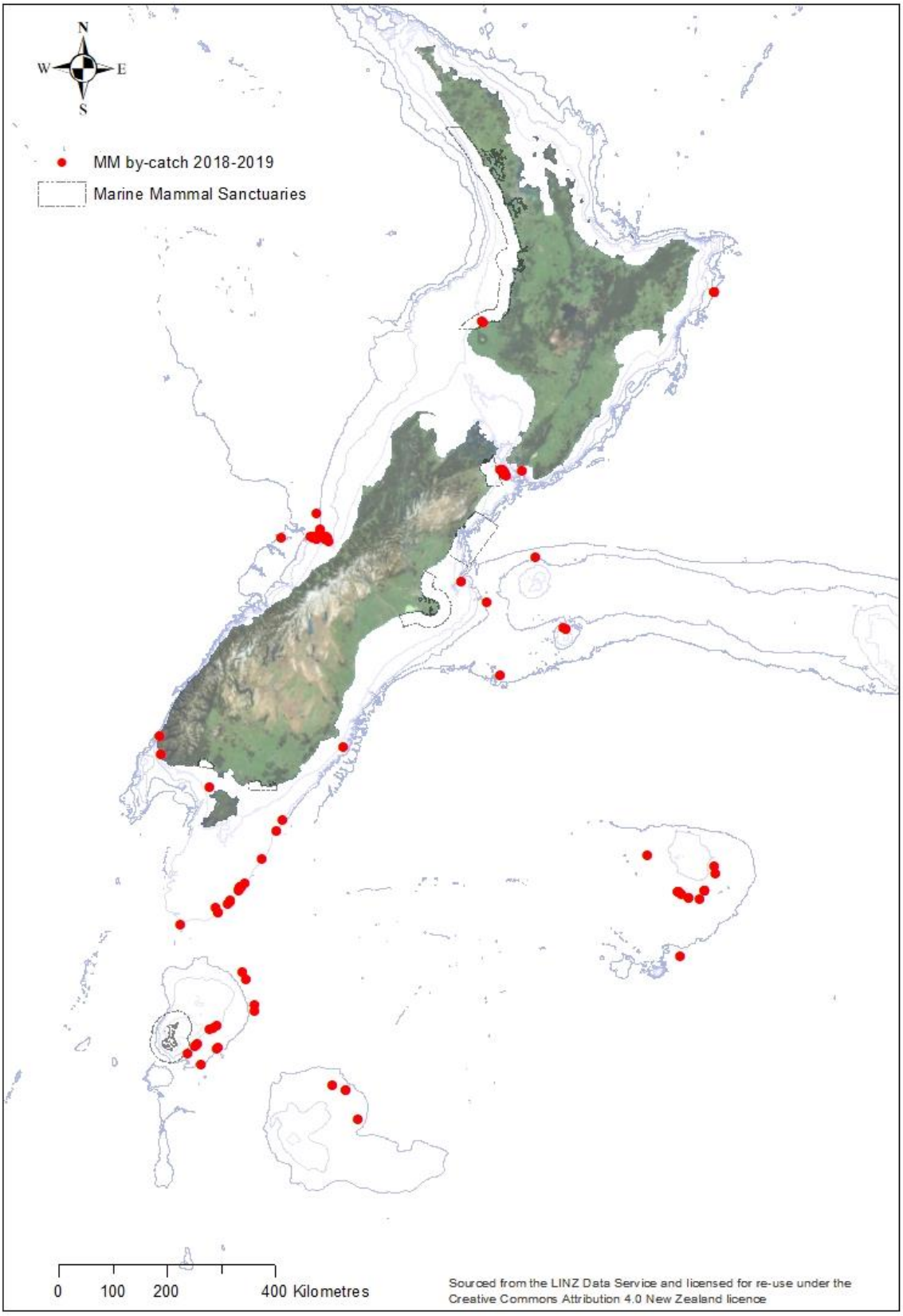


Figure 1. The location of all marine mammal bycatch events reported between 1 July 2018 and 30 June 2019.

Table 7. Summary of all marine mammal bycatch events for the 2018/19 year by Target species. Species codes are the official codes used by Fisheries New Zealand: FUR – New Zealand fur seal; HSL – New Zealand sea lion. Target Species codes: Definition of all codes are available at the following website: https://register.kupe.fishserve.co.nz/home/FindStock.

Species code (as identified by expert)	Target species									Total
	BOE	HOK	LIN	SBW	SCH	SCI	SQU	STN	WAR	
FUR	1	30	1	16	2		23	3	1	77
HSL		3		2		1	6			12
Total	1	33	1	18	2	1	29	3	1	89

Table 8. Summary of all marine mammal bycatch events for the 2018/19 year by life status. Species codes are the official codes used by Fisheries New Zealand: FUR – New Zealand fur seal; HSL – New Zealand sea lion. Species life status codes: 1 – Alive; 2 – Dead; 3 – Killed by crew; 4 – Decomposing.

Species code (as identified by expert)	Species life status code					Total
	1	2	3	4	5	
FUR	7	68		1	1	77
HSL		12				12
Total	7	80	0	1	1	89

Table 9. Summary of all marine mammal bycatch events for the 2018/19 year by month. Species codes are the official codes used by Fisheries New Zealand: FUR – New Zealand fur seal; HSL – New Zealand sea lion.

Species code (as identified by expert)	Jul 18	Aug 18	Sep 18	Oct 18	Nov 18	Dec 18	Jan 19	Feb 19	Mar 19	Apr 19	May 19	Jun 19	Total
FUR	24	18	7			1	1	4	4	9	4	5	77
HSL	1	1	2	2			1	4				1	12
Total	25	19	9	2	0	1	2	8	4	9	4	6	89

Table 10. Summary of all marine mammal bycatch events for the 2018/19 year by observer described injury status. Species and Injury codes are the official codes used by Fisheries New Zealand. FUR – New Zealand fur seal; HSL – New Zealand sea lion. Injury Status codes: F – Open wound; J – Hook in mouth; L – Severed body part; M – Bleeding from orifices; O – Other; Q – Froth or foam present in mouth/nostrils; R – Body in rigor; U – Unknown; Z – No visible injuries. Note: the total is higher than the total number of events as some events had more than one injury code associated with it.

Species code	Injury status code									Total
(as identified by expert)	D	F	J	M	O	Q	R	U	Z	
FUR	1	3	3	1	2	16	4	3	54	87
HSL		1				1	1	1	8	12
Total	1	4	3	1	2	17	5	4	62	99

3.8. Photos

As noted in Section 3.1, there were 89 (84%) bycatch events with photos that could be assessed to confirm taxa identification and other information. The remaining 17 (16%) events had either no photos associated with them or had poor quality photos associated with them and therefore were not able to be assessed.

It was not possible to determine the reason for the absence of photos for some events as there were few notes. However, some common explanations were provided including: event occurred while the observer has not present and observer was notified by crew later; event was over quickly and not possible to get a photo (e.g. live fur seal hooked but the snood was cut quickly after the animal was identified); camera wasn't working; and/or some photos were apparently taken but are missing from the database.

Of the 89 events with photos, 17% (n = 15) were of good quality, 73% (n = 65) were of moderate quality and 10% (n = 9) were of poor quality. Overall, there were a mean of 4.6 (SE = 0.29) photos taken per event. It is important to note that a photo was deemed to be good quality if at least one photo was of good quality even if the remainder were of moderate or poor quality. There were many examples where multiple photos were taken but only a single photo was of useful quality.

Of the 89 events from the 2018/19 year where the observer had assigned sex, only 33% (n = 29) had photos of adequate quality so that sex could be confirmed by the expert. In most cases, there were no photos taken of the genital region or if they were taken, they were of insufficient quality for the expert to confirm the sex.

Some general comments:

1. The FNZ observer protocols for the collection of photos should be reviewed to ensure that observers have sufficient instructions in which photos to collect, for what purpose and how to collect high quality photos.
2. We appreciate that the working environment is particularly challenging for the collection of photos by observers but there is little use in collecting photos for subsequent expert identification unless they are good quality.
3. Multiple photos should be taken for each research question (e.g. species identification, sex, age, injuries) to maximise the chance of collecting a good photo.
4. One of the consistent challenges seen in photos was adequate lighting in photos. In many situations, lighting was inadequate which in turn frequently appeared to lead to loss of focus and lack of contrast. Adequate lighting is very important and should be considered when taking photos.
5. Camera quality is also important as is ensuring that an observer is trained to use it. For example, adjusting the ISO setting to a higher value can help when there is inadequate lighting.

4. DISCUSSION AND RECOMMENDATIONS

Overall, the observers did an excellent job in identifying species of marine mammals. The only potential improvement would be the more consistent identification of the CDD sub-species. Although there were only a limited number of photos to confirm the identification of sex by observers, they performed reasonably well with 86% of sex identified correctly. Interestingly all but one males were correctly identified by observers but only 40% of the individuals identified as a female were confirmed as female, although this was only from a small sample.

There are some recommendations from the review of observer data:

1. ***Age estimation:*** Accurately determining age class from photos and ancillary data (e.g. body length) is challenging given the natural variation seen amongst individuals, meaning that there is no single measurement that can be used to reliably confirm either age class or actual age. While it is not clear if the estimated age class is used in any analysis, it could be informative and potentially beneficial in understanding any interaction. However, to achieve a high degree of confidence in assessing age class, additional work would be required from observers (e.g. direct assessment and sampling of reproductive organs) and it would also likely include a follow-up assessment by a trained biologist or vet. At present, the collection of an accurate total length and good quality photos is probably sufficient to provide an approximate age class for any bycaught individual. If additional

detail and a higher level of accuracy is required (e.g. actual age in years or reproductive status), then additional sampling (e.g. collection of teeth and reproductive organs) and analysis (e.g. tooth reading, histopathology) will be required.

2. ***Data records:*** Where images or data were not available (or were incomplete) the accuracy of marine mammal identifications was not able to be evaluated. It is important that data collected from observers are managed appropriately to ensure that all records and data are available for review. Some form of Quality Assurance may be useful to ensure that all records are present and stored appropriately.
3. ***Photographic quality:*** It would be useful to review the observer protocols for the collection of photos to ensure they are up to date and provide the required information. Photos serve a range of purposes (e.g. providing additional information on species, sex, age class and injuries) and practical descriptions of what photos are required for each research question need to be clearly provided. While most events had at least one good quality photo, many photos were of poor quality and not useful in providing any additional information. There is room for improvement in the collection of good quality photos (e.g. better lighting) but it is noted that it is a particularly challenging environment to try and collect photos.
4. ***Sex field:*** There were two fields for sex in the data provided: *Sex* and *Observer sex*. In all cases, assignment of sex was made into one or the other of these fields with no overlap. There were no notes to distinguish between these two fields and so they were combined in a single field for analysis named *Combined observer sex* which was used for reporting. We recommend that the two fields in the original data are reviewed and if they are reporting different things, then these are more clearly labelled and defined so the differences are made clear to observers. If they are not different, then one field should be removed.
5. ***Sex identification:*** While the identification of sex for males was correct for all but one event, the identification of females was only 40% accurate. Any notes and descriptions of sex identification methods should be reviewed and updated where necessary especially for female sex determination. It is also important to provide clear descriptions of the photos necessary to confirm the sex of an individual so that they can be confirmed independently as only 48% of events had photos of sufficient quality to confirm sex.
6. ***Dead before being caught:*** There are some events where a marine mammal is brought aboard but which was clearly not killed as part of that specific fishing event. For example, if a very decomposed marine mammal or a skull with no flesh and signs of extensive weathering appears in the catch, it was clearly not killed in that fishing event (e.g. tow or set). In this case, while the event is technically recorded as a dead marine mammal capture, the death is not related to that specific fishing event. We added a new field *Dead before being caught* to try and address this issue as these events should not be attributed to the fishery as a mortality event. We recommend that a similar field is added to the observer reporting forms to distinguish between a marine mammal capture which was

clearly dead before being caught vs a marine mammal that was likely killed in that fishery event.

7. ***Flipper tags or other identifying marks:*** To determine the provenance of a bycaught individual it is necessary for that individual to have been previously marked (e.g. tagged, branded, microchipped, biopsied). If a marked individual is caught it is essential that details of the mark are recorded. We recommend the following: (i) several high-quality photos are taken of the mark. If there is more than one mark (e.g. two tags or a tag and a brand), independent photos should be taken of both marks; (ii) the observer should attempt to read and confirm the mark and record that on their data sheets; and (iii) ideally, flipper tags would be removed from the individual and returned ashore for confirmation.

5. REFERENCES

Stockin K 2008. The New Zealand common dolphin (*Delphinus* sp.) - Identity, ecology and conservation. PhD thesis. Massey University, New Zealand. 255 p.

6. ACKNOWLDGEMENTS

We would like to acknowledge the dedication and hard work of the observers in collecting this information to a high standard. We fully appreciate the complexities and challenges of the role (the authors have worked as observers previously) and hope that our suggestions can help them in the work that they do. We would also like to thank Shannon Weaver and the Conservation Services Programme of the Department of Conservation for supporting this work. This research was funded by levies on the Commercial Fishing Industry.

7. APPENDICES

Appendix 1. Electronic data file to be sent separately.