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Tini a Tangaroa

Identification of seabirds following review of footage from cameras on Aotearoa New Zealand commercial fishing vessels

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PLAIN LANGUAGE SUMMARY

The project sought to identify whether experienced experts could identify captured seabirds from video clips provided from the onboard camera programme.

A total of 492 clips were provided for review, and a total of 777 seabirds were recorded comprising 26 species. Expert reviewers were able to positively identify the seabirds to species in 97% (477) of all clips compared to 41% by the MPI footage review team. A high level of agreement was found between DOC expedited reviewers with 77–87% agreement.

The project demonstrated that the use of experts with experience in seabird identification can ensure rapid and accurate identification of seabird captures from camera footage identified by MPI footage reviewers.

EXECUTIVE SUMMARY

Bell, E.¹; Bell, M.² (2026). Identification of seabirds following review of footage from cameras on Aotearoa New Zealand commercial fishing vessels. *New Zealand Aquatic Environment and Biodiversity Report No. 373*. 17 p.

To understand the threat posed by incidental fisheries captures, accurate identification of seabirds captured in Aotearoa New Zealand fisheries is necessary. Historically, at-sea identification has been undertaken by Fisheries Observers with expert verification taking place during review of observer photographs and/or necropsy of bycaught individuals, however with the rollout of cameras on inshore commercial vessels, experts are required to assess and verify records of seabird interactions captured via camera footage to identify species to the lowest possible taxonomic level. This project aimed to assess the extent to which seabirds can be identified (i.e., taxonomic resolution) from camera footage, and to identify barriers to identification, such as in different fishing methods. The first set of images and videos were reviewed over three days in February 2025 by two seabird experts.

A total of 492 clips were provided for review. The first 42 events were reviewed independently by both experts to determine accuracy of the video footage and system, as well as consistency with seabird identification, and following this, the remaining footage was split by date, and each timeframe (each alternative day) was reviewed by one expert (with consultation where required).

Within these 492 clips, a total of 777 seabirds were recorded. An additional 15 clips were missing the interaction detail. Positive identification was confirmed in 97.0% (477) of all clips. Most birds were identified as being adults (97.8%; 760). A total of 26 species of seabird were recorded in these interactions. The larger number of interactions relative to the necropsy programme over the same timeframe reflects the broader coverage of the on board cameras programme.

Sometimes fishers presented seabirds to the cameras, which aided in identification. In addition, location (Fisheries Management Area) and date of capture information were used to assist with the identification of species, especially where visually similar species are expected in different locations. It is possible that further improvements in species identification may be possible if latitude and longitude of the captures are provided (as well as FMA), as well as if fishers were encouraged to present seabirds to the cameras.

Of the 777 seabirds reviewed, 42.2% had been identified to species level by the MPI camera review team, and of these 94.8% were identified correctly. The MPI camera review team also sorted 54.2% of the seabirds to the correct groups, but many could only be sorted into high level groups which limited the usefulness of the data for detailed analysis. Expert review of the camera imagery confirmed that 41.4% (322 seabirds) aligned to the species or species group that had been assigned by the MPI camera review team.

Of the 777 seabirds identified as part of this project, DOC had also provided identifications through the expedited expert identification process for 227 (29.2%) birds. There was a 76.7% (174/227) agreement to species level between the identification provided by the expert review and those provided by the DOC experts. For the events where there was disagreement between identification, 10.6% (24/227) was due to differing levels of taxonomic resolution.

The project demonstrated that the use of experts with experience in seabird identification can ensure rapid and accurate identification of seabirds from camera footage.

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1 INTRODUCTION

The accurate identification of seabirds captured in Aotearoa New Zealand fisheries is necessary for examining the current threat to population viability posed by incidental fisheries captures. Historically, at-sea identification has been undertaken by Fisheries Observers with expert verification taking place during review of observer photographs and/or necropsy of bycaught individuals, however with the rollout of cameras on inshore commercial vessels, experts are required to assess and verify records of seabird interactions captured via camera footage to identify species to the lowest possible taxonomic level.

The Manatū Ahu Matua/Ministry for Primary Industries (MPI) with the support from Te Papa Atawhai/Department of Conservation (DOC) are undertaking a project for species identification of camera-detected protected species captures in Aotearoa New Zealand fisheries. This phase of the work involves expert ornithologists identifying seabirds seen on footage (still images and video) recorded via onboard cameras on commercial fishing vessels in New Zealand waters. Data from this project will inform ongoing bycatch estimation, risk assessment, research, and modelling of the effects of fisheries bycatch on protected species populations.

This phase of the work acts as a pilot to assess the incoming information associated with having cameras on vessels, including the extent to which seabirds can be identified (i.e., taxonomic resolution) from camera footage, and any barriers to identification such as differences between fishing methods. In addition to analytical aspects, this project will allow for the anticipated scale of work for ongoing expert identification to be assessed. If successful, additional camera footage reviews could be undertaken at a later date. This work also provided an opportunity to compare the expedited expert identification undertaken by DOC with the expert identifications undertaken during this project.

Wildlife Management International Ltd (WMIL) was contracted by MPI to undertake this pilot.

The first review of images and videos were reviewed over three days in February 2025 (11 to 13 February inclusive) by two seabird experts (Elizabeth Bell, WMIL, and Mike Bell, Toroa Consulting) at the MPI office in Whakatū/Nelson. This report outlines the work and results from this first review. Te Reo names are used throughout the document for all bird species after the first use (e.g., karetau kauae mā/white-chinned petrel) except where a te reo name is the same for multiple different species, such as toroa for many of the known albatross species.

This research was listed as a DOC Conservation Services Programme project (INT2023-02) and subsequently this project was contracted by MPI to facilitate more streamlined access to camera footage.

1.1 OBJECTIVES

The project objectives are:

- a) To assess the taxonomic resolution of cameras during processing of camera footage and assess the effectiveness of expert identification of protected seabird species using footage captured by on-board cameras.
- b) To determine, through examination of camera footage clips, the taxon and, where possible other characteristics of protected seabird species captured in Aotearoa New Zealand fisheries (for live captures or dead specimens discarded at sea), including comparing identification undertaken by DOC and the MPI camera review team with identifications undertaken during this project.
- c) To inform future process of expert review of protected species captures once cameras are fully deployed and identify any potential barriers to the use of cameras for identification of protected seabird species.

2 METHODS

To test this expert identification process, a sample of images and video footage of the protected species (seabird-only) capture or interaction was selected for review. This footage was reviewed using the MPI systems already in place for cameras on vessels. Clips showing the interaction were produced by the MPI camera review team and then uploaded into the MPI database system. The clips had associated data (i.e., date, time, Fisheries Management Area (FMA as location), fisher ID, etc.) provided in a Microsoft Excel™ spreadsheet.

The review was undertaken in the MPI office in Nelson using MPI devices; a laptop was assigned to each expert reviewer with large secondary screens to allow improved video or image screening.

All data was recorded directly into MPI Microsoft Excel™ spreadsheets and uploaded automatically onto the MPI online secure storage system.

A total of 492 clips were provided for review. The clips covered the period from 29 August 2023 to 16 December 2024.

The first 42 events were reviewed independently by both experts to determine accuracy of the video footage and system, as well as consistency with seabird identification, and following this, the remaining footage was split by date, and each timeframe (each alternative day) was reviewed by one expert.

The following was recorded:

- a. species identification, to the lowest taxonomic level possible,
- b. sex (where possible),
- c. age (where possible).

The expert identification was then also compared to all MPI camera review team identifications, and a subset of 230 events of DOC expedited expert identification, which allowed for an additional assessment of species level agreement and taxonomic resolution from both processes.

3 RESULTS

3.1 Review

Over the three-day review period, a total of 492 clips were reviewed in 33.5 hours (Table 1). Within these 492 clips, a total of 777 seabirds were recorded (Table 1). An additional 15 clips could not have the seabird identified due to the clip missing the interaction detail (and more footage has been requested) (Table 1). Positive identification was confirmed in 97.0% (n=477) of all clips.

The first 42 clips that were independently reviewed had 100% consistency in seabird species identification between both experts. One clip within these 42 clips could not have the seabird identified due to the clip missing the interaction.

Over the review period, there was an average of 14.7 clips reviewed per hour (or 23.6 seabirds identified per hour) by the two experts. As more seabirds can be identified per hour due to multiple catch events of the same species, it is more accurate to use clips per hour as a measure to estimate the number of future sessions that will be needed to review camera footage.

3.2 Condition of seabirds

The majority of the interactions (88.5%; n=688) of these clips were of dead birds (Table 1), and a number of the released alive birds were unlikely to survive due to the injuries sustained or they were exhibiting disorientated behaviour. Notes regarding condition of several of the alive birds were noted in the MPI review spreadsheet.

Table 1: The number of seabird interaction clips reviewed, total number of live or dead seabirds, total number of clips that could not have the seabird identification confirmed, and total review time by the two experts, 11–13 February 2025.

Expert	Total number of clips reviewed	Total number of seabirds		Unknown (insufficient data)	Time to review (hours)
		Alive	Dead		
Both experts	42	9	66	1	4.0
Expert 1	205	46	229	2	14.5
Expert 2	245	34	393	12	15.0
	492	89	688	15	33.5
Total			777		

3.3 Seabird identification

Overall, the footage quality was good. The speed of the identification by the experts often depended on the quality of footage of the seabird itself with aspects such as distance from the interaction, state (e.g., injuries to the seabird), or if the view of the bird was obscured by a fisher or vessel infrastructure. Occasionally fishers presented the seabird to the camera which assisted the identification process and speed of the review.

The majority of the clips were reviewed independently by the two experts and seabirds were rapidly identified, often as soon as the seabird came into view, allowing for a quick process. When reviewing the interactions, any difficult video clips were discussed collaboratively to get a consensus of the identification.

A total of 26 species of seabird were recorded in these interactions (Table 2), with kawau tikitiki/spotted shag (XPP, *Phalacrocorax punctatus*) being the most recorded species (n=208). In addition 139 toroa/New Zealand white-capped albatross (XWM, *Thalassarche steadi*), 107 toanui/flesh-footed shearwaters (XFS, *Ardenna carneipes*), 101 tītī/sooty shearwater (XSH, *Ardenna grisea*), 52 karetai kauae mā/white-chinned petrel (XWC, *Procellaria aequinoctialis*), 36 toroa/Salvin’s albatross (XSA, *Thalassarche salvini*), 29 toroa/southern royal albatross (XRA, *Diomedea epomophora*) and 21 toroa/northern royal albatross (XNR, *Diomedea sanfordi*) have been caught and killed (Table 2). The larger number of interactions relative to the necropsy programme over the same timeframe reflects the broader coverage of the on board cameras programme.

The majority (97.3%) of the seabirds were identified to species with only nine albatross (XAL or XMA), five black-browed albatross (XKM), one Antipodean or Gibson’s albatross (XAG), four Bullers/Pacific albatross (XPB), one wandering albatross (XWA), and one *Procellaria* petrel (XPC) not being identified to species level (Table 2).

Identification to a specific (lower) taxa level was also completed for several seabird interactions; seven great (Antipodean/Gibson’s) albatross (XAG) were confirmed as four toroa/Antipodean albatross (XAN; *Diomedea antipodensis*) and three toroa/Gibson’s albatross (XAU; *Diomedea gibsoni*); eight Stewart Island shags were confirmed as either matapo/Otago shag (n=7; XOS; *Leucocarbo chalconotus*) or mapo/Foveaux shag (n=1; XFO; *Leucocarbo stewarti*); and 12 Bullers or Pacific albatross were confirmed as toroa/Buller’s albatross (XBM; *Thalassarche bulleri*). Location and date of capture information was used to assist with the identification of the Otago and Foveaux shags (as these species are recognised as separated by geographic boundaries; Rawlence et al. 2016, Checklist Committee 2024) and Buller’s albatross (separated from Pacific albatross by breeding season, morphometric characteristics, and foraging range at specific times of the year; Fischer et al. 2022). As FMA were the

only location information provided, if latitude and longitude of the captures were provided, improvements for species identification may be possible.

Table 2: Number of dead or live interactions of seabird species identified in interaction clips, 11–13 February 2025, ordered from most to least captures.

Species (Code)	Alive	Dead	Total
Kawau tikitiki/Spotted shag (XPP)		208	208
Toroa/New Zealand white-capped albatross (XWM)	13	126	139
Toanui/Flesh-footed shearwater (XFS)	10	97	107
Tītī/Sooty shearwater (XSH)	15	86	101
Karetai kauae mā/White-chinned petrel (XWC)	12	40	52
Toroa/Salvin's albatross (XSA)		36	36
Toroa/Southern royal albatross (XRA)	7	22	29
Toroa/Northern royal albatross (XNR)	4	17	21
Toroa/Buller's albatross (XBM)	1	11	12
Tākoketai/Black petrel (XBP)	7	1	8
Matapo/Otago shag (XOS)		7	7
Hoiho/Yellow-eyed penguin (XYP)		6	6
Small albatross unidentified (XMA)		5	5
Black-browed albatross unidentified (XKM)	3	2	5
Albatross unidentified (XAL)		4	4
Toroa/Antipodean albatross (XAN)	2	2	4
Pacific/Buller's albatross (XPB)	1	3	4
Tāiko/Westland petrel (XWP)		4	4
Toroa/Gibson's albatross (XAU)	1	2	3
Cape petrels (XCP)	3		3
Toroa/Southern black-browed albatross (XSM)	3		3
Pāngurunguru /Northern giant petrel (XNP)	2		2
Kāruhiruhi/Pied shag (XPS)		2	2
Tarāpunga/Red-billed gull (XRB)		2	2
Wandering albatross unidentified (XWA)		2	2
Great albatross unidentified (XAG)		1	1
Kuaka/Common diving petrel (XDP)	1		1
Tītī Wainui/Fairy prion (XFP)	1		1
Pakahā/Fluttering shearwater (XFL)	1		1
Oi/Grey-faced petrel (XGF)		1	1
Reoreo/Grey-backed storm petrel (XGB)	1		1
Mapo/Foveaux shag (XFO)		1	1
Procellaria unidentified (XPC)	1		1
Total	89	688	777

Most interactions (50.7%; n=394) were from the bottom trawl method (Table 3), followed by surface/midwater longline (29.1%, n=226) and bottom longline (15.3%, n=119). All these methods included interactions that could not be resolved to the species level. Bottom trawl was the only method with interactions that could only be resolved to the genus or family level - nine albatross (XAL or XMA), and one Procellaria petrel (XPC). Six of these were warp interactions, three net captures and one was a deck strike.

3.3.1 Alignment between MPI camera review team and expert identification

Both MPI camera reviewers and observers have historically relied upon post-hoc expert identification to update video or at-sea species or genus level identification. Camera reviewers and observers are tasked with accurately identifying interaction events, with specialist programmes such as the DOC led necropsy and photographic identification and this trial used to update groomed datasets with the best available species level identifications.

Expert review of the camera imagery confirmed that 41.4% of the 777 seabirds aligned to the species or group assigned by the MPI camera review team (Table 4). Of these 777 seabirds reviewed, 328 seabirds (42.2%) were identified to species level by the MPI camera review team (i.e., black petrel, flesh footed shearwater, northern giant petrel, northern royal albatross, spotted shag, pied shag, southern royal albatross, red-billed gull, Salvin's albatross, sooty shearwater, southern black-browed albatross, white-chinned petrel, New Zealand white-capped albatross, Westland petrel and yellow-eyed penguin) and of these 328 seabirds, 94.8% of these were identified correctly.

The MPI camera review team also sorted 54.2% of the seabirds to the correct groups, but many of these seabirds were only sorted into high level groups such as albatross (unidentified), small albatross (unidentified), and petrel/prion/shearwater (unidentified) which limits the usefulness of the data for detailed analysis.

The MPI camera review team incorrectly identified 34 seabirds (4.4%) which were mostly albatross species (especially northern royal albatross, southern royal albatross, Salvin's albatross and New Zealand white-capped albatross), shearwaters (especially sooty shearwater and flesh-footed shearwater) or petrels (especially white-chinned petrel and black petrel).

In comparison, the external experts identified 763 seabirds (97.3%) to species level and identified an additional 12 seabirds (1.5%) to a higher taxa level than the reviewers (Table 4).

These results highlight the ongoing importance of the expert review and identification of seabirds to improve the resolution of taxonomic information available to subsequent research projects.

3.3.2 Alignment between DOC identification and expert identification

Of the 777 seabirds identified as part of this project, DOC had also provided identifications through the expedited expert identification process for 230 (29.6%) of these. Three expedited identifications have been excluded as the experts requested additional footage to be able to identify those species more clearly; as such, only 227 (29.2%) identifications have been compared (Table 5).

There was a 76.7% (174/227) agreement to species level between the identification provided here and those provided by DOC experts (Table 5). For the events where there was disagreement between identification, 10.6% (24/227) was due to differing levels of taxonomic resolution, so 12.8% (29/227) of the disagreement was due to disagreement in species identification. If the disagreement due to different levels of taxonomic resolution is considered "agreement", then the level of agreement between experts increases to 87.2% (198/227).

Table 3: Number of interactions of seabird species by fishing method identified in interaction clips, 11–13 February 2025.

Species (Code)	Fishing method					
	Bottom Trawl (BT)	Surface-Midwater Long Line (SLL)	Bottom Long Line (BLL)	Set Net (Gill Net) (SN)	Precision Bottom Trawl (BT)	Total
Albatross unidentified (XAL)	4					4
Black-browed albatross unidentified (XKM)		4	1			5
Cape petrels (XCP)				3		3
Hoiho/Yellow-eyed penguin (XYP)				6		6
Karetai kauae mā/White-chinned petrel (XWC)	4	46		2		52
Kāruhiruhi/Pied shag (XPS)	1			1		2
Kawau tikitiki/Spotted shag (XPP)	208					208
Kuaka/Common diving petrel (XDP)	1					1
Matapo/Otago shag or Mapo/Foveaux shag (XSI)				8		8
Oi/Grey-faced petrel (XGF)			1			1
Pacific/Buller's albatross (XPB)	1	15				16
Pakahā/Fluttering shearwater (XFL)			1			1
Pāngurunguru /Northern giant petrel (XNP)				2		2
Procellaria unidentified (XPC)	1					1
Reoreo/Grey-backed storm petrel (XGB)		1				1
Small albatross unidentified (XMA)	5					5
Tāiko/Westland petrel (XWP)		4				4
Tākoketai/Black petrel (XBP)		4	3		1	7
Tarāpunga/Red-billed gull (XRB)	1		1			2
Tītī Wainui/Fairy prion (XFP)	1					1
Tītī/Sooty shearwater (XSH)	91	1	6	2	1	100
Toanui/Flesh-footed shearwater (XFS)		3	103		1	106
Toroa/Antipodean or Toroa/Gibson's albatross (XAG)		8				8
Toroa/New Zealand white-capped albatross (XWM)	55	75	2	2	5	134
Toroa/Northern royal albatross (XNR)	2	17	1		1	20
Toroa/Salvin's albatross (XSA)	16	20				36
Toroa/Southern black-browed albatross (XSM)		3				3
Toroa/Southern royal albatross (XRA)	2	24		2	1	28
Wandering albatross unidentified (XWA)	1	1				2
Total	394	226	119	28	10	777

Table 4: Identification of seabird interactions recorded by MPI reviewers compared with identification by experts, 11–13 February 2025.

Reviewer ID	Identification (ID) by MPI Reviewers				Identification by Experts					
	All seabirds				ID confirmed to GROUP by Experts			ID confirmed to SPECIES by Experts		
	Total	ID Agree	ID Agree as Group	ID Disagree	Total	Species	No. per species	Total	Species	No. per species
Antipodean and Gibson's albatross	1			1				1	Northern royal albatross	1
Albatross (unidentified)	56	2	54		2	Black-browed albatross (unidentified)	1	52	Antipodean albatross	1
						Small albatross (unidentified) ³	1		Buller's albatross	1
									Northern royal albatross	2
									Southern royal albatross	7
									Salvin's albatross	4
									NZ white-capped albatross	37
Black (Parkinson's) petrel	4	3		1				1	Sooty shearwater	1
Cape petrels	3	3								
Flesh-footed shearwater	101	100		1				1	White-chinned petrel	1
Great albatrosses	27		27		2	Antipodean and Gibson's albatross	1	25	Antipodean albatross	2
						Wandering albatross (unidentified)	1		Gibson's albatross	1
									Northern royal albatross	6
									Southern royal albatross	16
Shags (unidentified)	151		150	1				151	Flesh-footed shearwater	1
									Spotted shag	143
									Foveaux shag	1
									Otago shag	6
Black-browed albatross (unidentified)	4	1	2	1				3	Salvin's albatross	1

³ Suspected to be Salvin's or NZ white-capped albatross but could not be confirmed.

Reviewer ID	Identification (ID) by MPI Reviewers				Identification by Experts						
	All seabirds				ID confirmed to GROUP by Experts			ID confirmed to SPECIES by Experts			
	Total	ID Agree	ID Agree as Group	ID Disagree	Total	Species	No. per species	Total	Species	No. per species	
									Southern black-browed albatross	2	
Smaller albatrosses	102	4	94	5	5	Wandering albatross (unidentified)	1	93	Northern royal albatross	1	
						Black-browed albatross (unidentified)	2		Southern royal albatross	1	
						Buller's and Pacific albatross	2		White-chinned petrel	2	
									Buller's albatross	3	
									Salvin's albatross	22	
									NZ white-capped albatross	64	
Northern giant petrel	1	1									
Northern royal albatross	6	5		1				1	Southern royal albatross	1	
Buller's and Pacific albatross	8	1	7					7	Buller's albatross	7	
Procellaria petrels (unidentified)	20		19	1				20	Flesh-footed shearwater	1	
									Black (Parkinson's) petrel	2	
									White-chinned petrel	13	
									Westland petrel	4	
Petrel (unidentified)	7		7		1	Procellaria petrels (unidentified)	1	6	Black (Parkinson's) petrel	1	
									White-chinned petrel	5	
Mid-sized petrels and shearwaters (unidentified)	32		32					32	Black (Parkinson's) petrel	1	
									White-chinned petrel	14	
									Flesh-footed shearwater	1	
									Sooty shearwater	16	
Prions (unidentified)	1		1					1	Fairy prion	1	
Spotted shag	65	64		1				1	Sooty shearwater	1	
Pied shag	2	2									

Reviewer ID	Identification (ID) by MPI Reviewers				Identification by Experts					
	All seabirds				ID confirmed to GROUP by Experts			ID confirmed to SPECIES by Experts		
	Total	ID Agree	ID Agree as Group	ID Disagree	Total	Species	No. per species	Total	Species	No. per species
Southern royal albatross	5	3		2				2	Northern royal albatross	1
									Gibson's albatross	1
Red-billed gull	2	2								
Royal albatrosses (unidentified)	1		1					1	Northern royal albatross	1
Salvin's albatross	10	8		2	1	Buller's and Pacific albatross ⁴	1	1	NZ white-capped albatross	1
Seagull (unidentified)	1			1	1	Albatrosses (unidentified)	1			
Otago and Foveaux shag (unidentified)	1							1	Otago shag	1
Southern black-browed albatross	2	1		1	1	Black-browed albatross ⁵	1			
Storm petrels (unidentified)	2	1		1				2	Grey-backed storm petrel	1
									Common diving petrel	1
Shearwaters (unidentified)	5		1	4				5	Fluttering shearwater	1
									Great-winged (grey-faced) petrel	1
									Southern royal albatross	1
									White-chinned petrel	2
Giant petrels (unidentified)	1			1				1	White-chinned petrel	1
Wandering albatross	5		2	3				5	Antipodean albatross	1
									Gibson's albatross	1
									Buller's albatross	1
									Northern royal albatross	2
White-chinned petrel	5	4		1				1	Black (Parkinson's) petrel	1

⁴ Suspected to be Buller's albatross.

⁵ Couldn't see identifying features to confirm as Southern black-browed albatross.

Reviewer ID	Identification (ID) by MPI Reviewers				Identification by Experts						
	All seabirds				ID confirmed to GROUP by Experts			ID confirmed to SPECIES by Experts			
	Total	ID Agree	ID Agree as Group	ID Disagree	Total	Species	No. per species	Total	Species	No. per species	
NZ white-capped albatross	41	37	1	3	1	Albatrosses (unidentified) ⁶	1	3	Northern royal albatross	2	
									Salvin's albatross	1	
Westland petrel	1			1				1	White-chinned petrel	1	
Petrel, prion or shearwater (unidentified)	21		21					21	Flesh-footed shearwater	4	
									Northern giant petrel	1	
									Sooty shearwater	8	
									White-chinned petrel	8	
Yellow-eyed penguin	6	6									
TOTAL	777	322	421	34	14			441			
Total percentage		41.4	54.2	4.4	1.8			56.8			
Total percentage of expert ID confirmation					1.8			98.2			

⁶ Only a few bones and feathers; likely to be NZ white-capped albatross as this was the only species surrounding vessel but cannot be confirmed.

Table 5: Identification of the 227 seabird interactions identified by DOC compared with identification by experts, 11-13 February 2025.

Species (Code)	All seabirds			ID as confirmed by DOC		ID as confirmed by Experts				
	Total	ID Agree	ID Agree as Group	ID Disagree	Total	Species	No. per species	Total	Species	No. per species
Antipodean and Gibson's albatross (XAG)	7	7			7	Antipodean albatross	3	7	Antipodean albatross	3
						Gibson's albatross	4		Gibson's albatross	4
Buller's albatross (XBM)	2		1	1	2	Pacific and Buller's albatross	1	2	Buller's albatross	2
						NZ White-capped albatross	1			
Black (Parkinson's) petrel (XBP)	4	2	1	1	4	Black petrel	2	4	Black petrel	4
						White-chinned petrel	1			
						Petrel (unknown)	1			
Flesh-footed shearwater (XFS)	31	30		1	31	Flesh-footed shearwater	30	31	Flesh-footed shearwater	31
						Mid-sized petrel or shearwater (unidentified)	1			
Black-browed albatross (unidentified) (XKM)	1	1			1	Black-browed albatross (unidentified)	1	1	Black-browed albatross (unidentified)	1
Northern royal albatross (XNR)	17	8	4	5	17	Northern royal albatross	8	17	Northern royal albatross	17
						Great albatross (unidentified)	5			
						Gibson's albatross	2			
						Southern royal albatross	3			
Spotted shag (XPP)	49	49			49	Spotted shag	49	49	Spotted shag	49
Southern royal albatross (XRA)	22	10	3	9	22	Southern royal albatross	10	22	Southern royal albatross	22
						Antipodean or Gibson's albatross	5			
						Albatross (unidentified)	1			
						Northern royal albatross	2			
						Mollymawk (unidentified)	1			
						Great albatross (unidentified)	3			
Salvin's albatross (XSA)	10	7		3	10	Salvin's albatross	7	10	Salvin's albatross	10
						NZ white-capped albatross	2			
						Shy-type albatross	1			

Species (Code)	All seabirds					ID as confirmed by DOC			ID as confirmed by Experts	
	Total	ID Agree	ID Agree as Group	ID Disagree	Total	Species	No. per species	Total	Species	No. per species
Sooty shearwater (XSH)	20	19		1	20	Sooty shearwater	19	20	Sooty shearwater	20
						Mid-sized petrel or shearwater (unidentified)	1			
Southern black-browed albatross (XSM)	1		1		1	Mollymawk (unidentified)	1	1	Southern black-browed albatross	1
Wandering albatross (unidentified) (XWA)	1		1		1	Antipodean or Gibson's albatross	1	1	Wandering albatross (unidentified)	1
White-chinned petrel (XWC)	14	5	5	4	14	White-chinned petrel	5	14	White-chinned petrel	14
						Procellaria petrel (unidentified)	1			
						Petrel, prion or shearwater (unidentified)	1			
						Petrel (unidentified)	1			
						Mid-sized petrel or shearwater (unidentified)	2			
						NZ white-capped albatross	1			
						Westland petrel	2			
						Grey-faced petrel	1			
NZ White-capped albatross (XWM)	42	30	8	4	42	NZ white-capped albatross	30	42	NZ white-capped albatross	42
						Mollymawk (unidentified)	7			
						Albatross (unidentified)	3			
						Salvin's albatross	1			
						Antipodean and Gibson's albatross	1			
Yellow-eyed penguin (XYP)	6	6			6	Yellow-eyed penguin	6	6	Yellow-eyed penguin	6
TOTAL	227	174	24	29			227			227
Total percentage		76.7	10.6	12.8						

3.4 Type of interaction

Most of the clips were of single bird interactions (86.6%; n=426), but 51 clips (9.7%) showed interactions involving multiple seabirds (Table 6). These 51 clips accounted for 356 seabirds, with three interactions capturing over 20 birds in one event, and one of these capturing 88 seabirds (Table 6).

Table 6: . The total number of seabirds recorded in each interaction clip reviewed by each expert, 11-13 February 2025.

Number of seabirds per clip	Number of clips reviewed		Total clips
	Expert 1	Expert 2	
1	217	209	426
2	14	7	21
3	6	5	11
4	1	3	4
5		3	3
6	3	1	4
7	2		2
10		1	1
12	1		1
15	1		1
22	1		1
65		1	1
88		1	1
Total	246	231	477

3.5 Sex and age

Determining the sex of most seabird species is not possible due to the cryptic nature of males and females for most species (i.e., often only a slight size difference). Sex could be confirmed for most of the great (or wandering) albatross (e.g., toroa/Antipodes or toroa/Gibson's albatross) seen on the clips based on plumage characteristics. Toroa/southern royal albatross can also be determined using plumage characteristics, but there is an overlap between the sexes, so sex determination for intermediate phase birds should be used with caution.

Sex was confirmed for five toroa/Antipodean albatross (three female and two males) and two toroa/Gibson's albatross (both males). The rest of the seabirds could not be sexed.

Age could be identified in several seabirds, but again this depended on the clip quality or view of the bird, and species themselves (i.e., plumage and bill colour differences between adults and juveniles).

Most petrels and shearwaters do not have visible plumage differences, and although mollymawks, great albatross, and shags do have visible plumage differences, the speed at which some seabirds were discarded overboard made ageing and sexing of these birds impossible. Without seabirds in the hand during necropsy or at the breeding colony, sex and age determination using camera footage will be very difficult in most species.

Most birds were identified as adults (97.8%; n=760). Seven (0.9%) were identified as juveniles (four toroa/New Zealand white-capped albatross, two kawau tikitiki/spotted shag and one toroa/Salvin's albatross). The remaining ten seabirds (1.3%) could not be aged due to warp damage or blurry camera footage.

One key method to obtain sex and age (and provenance) is through banded seabirds. The value of banded or microchipped (i.e., RFID tagged) birds cannot be underestimated as this provides exact information on the species, including colony (i.e., location where banded), age if banded as a chick, breeding status if banded as an adult, and other details. Fishers could record any band details if a banded bird is part of an interaction. On-board observers already report and return banded seabirds as part of the necropsy programme. This information can be used to provide additional data for determining risk. Reporting band numbers from both live and dead seabirds will also allow seabird ecologists to identify mortality factors, update population trends, and improve survival modelling.

4 DISCUSSION

The identification of seabirds from the on-vessel cameras worked well, with over 97% of the clips reviewed having seabirds confirmed to species level regardless of video quality. With additional scrutiny applied through comparison with the DOC expedited expert identifications, the identity of seabirds had an agreement level of 77–87% depending on the taxonomic resolution applied.

This suggests that the use of experts with experience in seabird identification ensured rapid and accurate identification. Crucially, the current two experts have a unique combination of skills from seabird identification, at-sea observations, and in particular, long-term seabird necropsy experience which allowed accurate identification. Having necropsy experience is key to this identification process as many of the clips showed seabirds in very poor and mangled condition as well as often being waterlogged and greased, and the skills obtained by necropsying bycaught seabirds in varying, but similar, condition is invaluable. The current two experts reviewing this data focused on separate clips independently, which allowed for a quick process. Any difficult videos were discussed collaboratively to determine the identification. This is a standard process to identify seabirds at sea or across the necropsy table with mangled specimens, with experts often debating plumage, bill colour, wing patterns and other traits to confirm identification.

Future expert identification work should also include one of the reviewers of the DOC expedited expert identification process so that review sessions remain consistent. Particular attention should be given to when higher vs lower level of taxonomic identities are assigned. For example, even with insights on location and time of year, identifying Southern vs Northern Buller's (Pacific) albatrosses can remain challenging. In doubt, accurate higher-level taxonomic identities are preferred over inaccurate lower-level identities.

The high level of confirmed seabird identification from this pilot review gives confidence that the use of onboard cameras will work well for measuring seabird bycatch, but this will be reliant on suitably experienced expert reviewers. Further reviewing of camera footage to verify seabird bycatch reporting and provide robust seabird identification for use in capture and risk estimation is recommended.

Working within the MPI office where the camera review team were based was also an advantage as discussions about the process, requests for additional clips, and general support about the MPI systems were immediate and ensured that the review process went smoothly.

The experts provided lower taxonomic identification than the initial reviewer identification 58.4% of the time. It must be noted that the MPI camera review team produce high quality clips of the seabird interactions, often identifying an interaction from a small fragment of footage. In almost all situations, these clips contained enough detail to identify the seabird to species. The MPI camera review team should be congratulated on the skill with which they complete their role.

Despite skilfully identifying seabird interaction events and sorting the interaction clips, the MPI camera review team were only able to identify 42.2 % of seabirds to species level compared to 97.3% by the experts. Although the review team also sorted 54.2% of the seabirds to the right groups, many of these seabirds were only sorted into high level groups such as albatross (unidentified), small albatross

(unidentified), and petrel/prion/shearwater (unidentified) which does not allow for this data to be used for detailed risk or population trend analysis. Given the need for and importance of using this interaction data, in particular for seabird risk rankings, it is vital that identification to species level (or the lowest taxa possible) is made for as many interactions as possible. The experts identified 97.3% of the seabird interactions to species level which shows that the use of experts provided a significantly higher level of identification accuracy than the MPI camera review team.

When fishers presented the seabird to the camera this assisted with the identification process. To further improve the identification process, these presentations should be encouraged, especially if fishers are trained to know exactly where the cameras are, and the direction they are pointing, as often birds were held off camera by mistake. As the majority (nearly 90%) of the birds were recovered dead and many of those discarded by crew members, there should be more opportunity for fishers to show the birds to the onboard cameras. This process also highlighted the need for continued monitoring of the ability to accurately speciate interactions by fishing method, with these results showing that a majority of lower taxonomic resolution came from bottom trawl, probably because it is so hard to identify birds that had experienced warp strikes. It may be beneficial to consider additional identification methods, such as genetic identification techniques (e.g., Polanowski et al. 2024), for these particularly challenging situations.

As banded seabirds provide significant information on the birds themselves and their provenance, as well as analysis of risk, population trends and survival, it would also be helpful if fishers recorded band details of any banded bird (live or dead) that is part of an on-board interaction.

This trial has shown that using the current two experts the review process proved to be efficient with a significant number of clips reviewed over a short timeframe. It is expected that at least 500 clips can be processed within three working days by these two experts (i.e., 7.5 hours/day/person; 45 hours; approximately 16 clips per hour). It may be possible to increase the number of clips processed as the camera footage quality improves, with more targeted placement of cameras to ensure footage of seabirds is clearer, and fishers holding the birds in clear view of the camera as well as returning any banding information where possible. However, ongoing double-blind review should be continued for part of the clips to provide an assessment of agreement level for each review process.

The use of on-board cameras with footage reviewed by experts in conjunction with the necropsy programme will enable highly accurate identification of seabird interactions at sea.

5 CONCLUSIONS

If expert identification were to continue, the following would help to optimise identification efficiency:

- Review of the footage done in bulk (i.e., up to 500 clips) over a multiday session; every six-months (or at required timeframe);
- Continue the double-blind review of part of the clips to provide a measure of agreement for each bulk footage review session;
- Include a DOC reviewer in review sessions to ensure consistent techniques for determining species identification and decisions on taxonomic resolutions;
- Continue expedited DOC review to ensure expedited feedback to the liaison programme; and to include DOC reviewers as part of the expert review process to shed further light on identification confidence.
- Adding a column to the MPI review spreadsheet for explanation notes on how identification was made (i.e., plumage, bill colour, etc.) to allow for comparison between parties;
- The MPI camera review team continue to produce clips for expert review;
- Continue review work based at the MPI Nelson office;
- Provide precise location (GPS or latitude/longitude) data to the expert review team to aid identification of certain seabird species (e.g., Otago/Foveaux shags);

- Encourage fishers to hold seabirds up to the cameras whenever possible;
- Encourage fishers to record seabird band data and provide to MPI whenever possible.

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