Observer *program data summary*

NSW Ocean Trap & Line Fishery - line fishing western zone

Summary Authors and Year

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NSW Commercial Fishery Observer Program

The Fishery Management Strategy[1] (FMS) for each of the major commercial fisheries operating in NSW (excluding Rock Lobster and Abalone) require NSW Department of Primary Industries (DPI) to design and implement scientific observer programs for fisheries and methods where bycatches are either known or likely to be a significant problem or where existing data is out of date.

Key findings (*NSW Ocean Trap & Line Fishery)*

- A total of 279 fishing trips (~55,000 hook deployments) were monitored throughout northern NSW Ocean Trap & Line Fishery.
- Greater than 95% of the total observed catch was retained.
- Greater than 95% of discarded individuals were released alive.
- Despite more than 4,200 seabirds observed around fishing vessels, only one incidence of seabird bycatch was recorded.
- Over the two years of the study only two incidence of bycatch were recorded with threatened, endangered or protected sharks. Both individuals were released alive; and
- Small quantities of fishing gear (<0.5%) were lost during normal fishing operations.

Fishery description

The Ocean Trap and Line Fishery (OTLF) is one of eight major marine and estuarine based commercial fisheries in New South Wales. It is a multi-method, multi-species fishery using demersal fish traps and numerous line methods (e.g., handline, jigging, setline) to target demersal and pelagic fish in ocean waters along the length of the NSW coast[1]. A line fishing western zone endorsement (OTLLW) authorises the holder to use a line to take fish from ocean waters that are west of the 183 metre (100 fathoms) depth contour. Handlining is the main method used by OTLLW endorsement holders, with approximately 5,000 days effort reported per year from 2009/10 to 2019/20 (~50 - 70% of total OTLLW effort). Reported annual effort for other methods includes approximately; 620 days jigging (range; 549 - 893), 1,400 days trolling (range; 799 – 2,222), 200 days trotlining (range; 22 - 344), 455 days setlining (range; 191– 811) and, 150 days droplining (range; 80 – 325). In contrast to the main methods of handling and jigging, reported effort for dropline, poling, setline, trotline and trolling have declined in recent years (Figure 1).

Need for observer monitoring

The NSW Marine Estate State-wide Threat and Risk Assessment[2] (TARA) assigned a “high” overall risk level to the impact of the OTLF in the northern bioregion on threatened, endangered or protected

[1]https://www.dpi.nsw.gov.au/__data/assets/pdf_file/0003/632406/OTL-FMS.pdf

[2]https://www.marine.nsw.gov.au/__data/assets/pdf_file/0011/1352666/NSW-Marine-Estate-Threat-and-Risk-Assessment-Final-Report.pdf

fish and sharks. The key stressors included the incidental catch of species of conservation concern, with major and ongoing negative impacts likely affecting the recovery of species.

To quantify the true nature and extent of discarding (and threatened species interactions) by fishers in the OTLF in northern NSW, DPI designed and implemented an observer-based survey with appropriately high levels of replication with respect to the number of fishing days observed within a given spatial, temporal and/or fishing-method category.

Figure 1. Reported days effort for the main fishing methods from 2009/10 – 2019/20 (All NSW waters, OTLLW endorsement only).

Objectives

The broad objectives outlined for the observer-based survey were:

- Describe interactions with threatened, endangered or protected species (TEPS);
- Describe catch characteristics of the commercial line fishery, including the size-structure of retained and discarded catches.
- Describe bycatch in the line fishery; and
- Provide a detailed summary of gear used in the fishery.

Overview of sampling program

Commercial line fishers were observed in the northern bioregion of NSW (Ocean zones 1 – 4; Figure 2). Operational and catch data was collected by a scientific observer during randomly

[1]https://www.dpi.nsw.gov.au/__data/assets/pdf_file/0003/632406/OTL-FMS.pdf

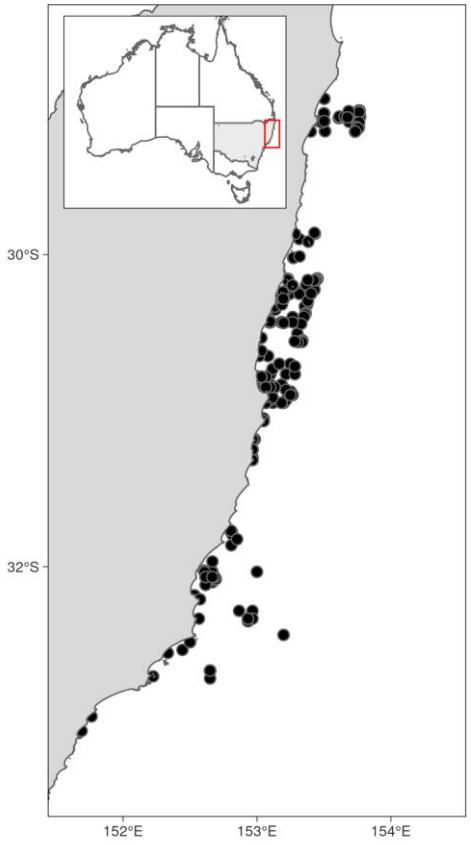
[2]https://www.marine.nsw.gov.au/__data/assets/pdf_file/0011/1352666/NSW-Marine-Estate-Threat-and-Risk-Assessment-Final-Report.pdf

selected fishing trips from June 2019 to July 2021. The number of trips, hook deployments and methods observed are summarised in Table 1.

Table 1. Number of trips, hook deployments (HKDP) and methods observed for each sampling period. Individual sampling periods relate to season (e.g., P1 = Spring 2019, P2 = Summer 2019/20…P8 = Winter 2021).

Period	Trips	HKDP	Methods
P1	12	3005	handline, jigging, setline, trolling
P2	10	3731	handline, jigging, setline, trolling
P3	89	24600	handline, jigging, trolling
P4	63	12377	handline, jigging, trolling
P5	41	3782	handline, jigging, trolling
P6	35	5666	handline, jigging, trolling
P7	21	3599	handline, jigging, trolling
P8	5	1510	handline, jigging, trolling

Figure 2. Spatial distribution of observed OTLLW fishing events.



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Retained and discarded catches

Greater than 95% of the total observed catch was retained. Discarded catches of primary and secondary species (defined within the OTLF FMS[1]) were approximately 20 and 10% of total observed catches for each group, respectively (Table 2).

Table 2 Number of individuals observed to be retained and discarded during observed trips. Data are shown for all primary and secondary species, and the most abundant byproduct species.

Category	Species	Retained	Discarded	Total
Primary	Australian Bonito (*Sarda australis*)	1402	0	1402
Primary	Banded Rockcod (*Hyporthodus ergastularius*)	18	0	18
Primary	Grey Morwong (*Nemadactylus douglasii*)	70	1	71
Primary	Silver Trevally (*Pseudocaranx georgianus*)	57	129	186
Primary	Snapper (*Chrysophrys auratus*)	596	215	811
Primary	Yellowfin Bream (*Acanthopagrus australis*)	133	108	241
Primary	Yellowtail Kingfish (*Seriola lalandi*)	172	125	297
Secondary	Eastern Pigfish (*Bodianus unimaculatus*)	17	0	0
Secondary	Gemfish (*Rexea solandri*)	0	1	1
Secondary	Mahi Mahi (*Coryphaena hippurus*)	204	71	275
Secondary	Mulloway (*Argyrosomus japonicus*)	124	3	127
Secondary	Pearl Perch (*Glaucosoma scapulare*)	226	12	238
Secondary	Silver Sweep (*Scorpis lineolata*)	67	46	113
Secondary	Spanish Mackerel (*Scomberomorus commerson*)	10	0	10
Secondary	Spotted Mackerel (*Scomberomorus munroi*)	92	0	92
Secondary	Teraglin (*Atractoscion atelodus*)	694	1	695
Secondary	School Shark (*Galeorhinus galeus*)	66	3	69
Secondary	Dusky Whaler (*Carcharhinus obscurus*)	35	2	37
Secondary	Gummy Shark (*Mustelus antarcticus*)	17	0	17
Secondary	Wobbegong (Orectolobidae - undifferentiated)	0	1	1
Byproduct	Blue Mackerel (*Scomber australasicus*)	2867	1	2868
Byproduct	Leaping Bonito (*Cybiosarda elegans*)	6318	0	6318
Byproduct	Mackerel Tuna (*Euthynnus affinis*)	116	1	117
Byproduct	Redfish (*Centroberyx affinis*)	95	17	112
Byproduct	Tailor (*Pomatomus saltatrix*)	667	14	681
Byproduct	Yellowtail Scad (*Trachurus novaezelandiae*)	1572	78	1650

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For combined line fishing methods (Figure 3) and observed setline fishing trips (Figure 4) mean retained catches of primary, secondary and byproduct species were greater than discarded catches in all sampling periods.

Figure 3. Mean (± SE) retained and discarded catches (number-per-trip) of primary, secondary byproduct and total individuals (excluding setline catches) across sampling periods.

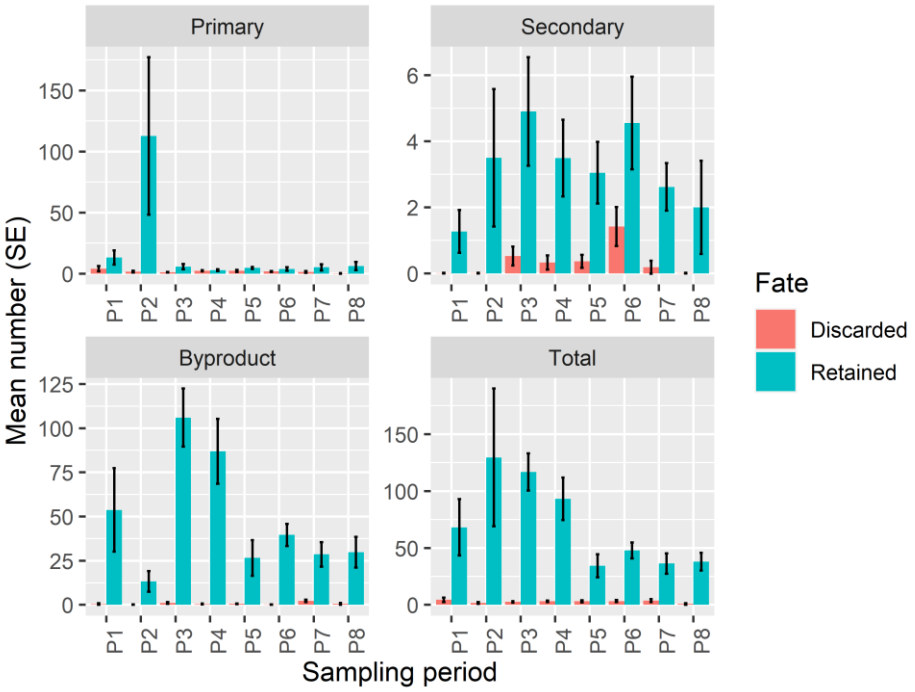
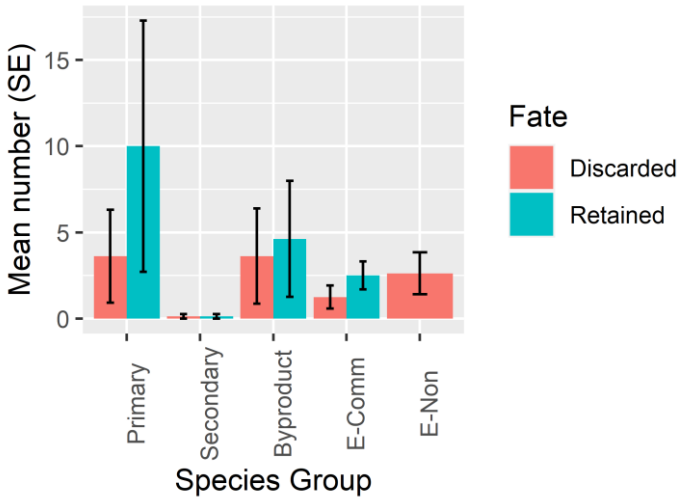


Figure 4. Mean (± SE) retained and discarded catches (number-per-trip) of primary, secondary, byproduct, commercial elasmobranch (E-Comm) and non-commercial elasmobranchs (E-Non) caught on observed setline fishing trips (pooled across sampling periods).



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Size-structure of observed catches of commercial species

When size composition data was expressed relative to the minimum legal size (MLS), the proportion retained ranged from; 31% for Silver Trevally, 55% for Yellowfin Bream, 58% for Yellowtail Kingfish, 73% for Snapper, 74% for Mahi Mahi to >95% for Grey Morwong, Mulloway, Pearl Perch, Spanish Mackerel, Spotted Mackerel, Tailor and Teraglin (Figure 5). For species with no MLS, the proportion retained ranged from; 42% for Silver Sweep to > 95% for Australian Bonito, Leaping Bonito, Mackerel Tuna and Redfish.

Figure 5. Size-structure of observed catches for species where >50 individuals were measured (n = number measured).

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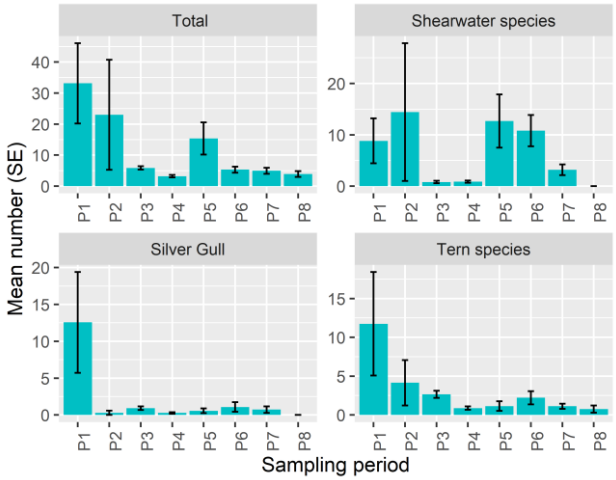
Wildlife abundance

Over the duration of the study, 17 taxa of seabirds, 2 marine mammals and 1 marine reptile were identified within the observation area around fishing vessels. A total of 4,913 individual seabirds were counted or estimated from extrapolated counts during 452 observations (Table 3). Approximately 55% of total seabirds observed were from the Shearwater species group (Table 3). The mean number of seabirds around vessels was generally higher during Spring (P1, P5) and Summer (P2, P6) sampling periods (Figure 6).

Table 3 Number of wildlife observation events (Obs.), total number of individuals and frequency of occurrence (%) of the most abundant species/species groups across sampling periods.

Period	Obs.	Total birds		Shearwater species		Silver Gull		Tern species	
	n	n	%	n	%	n	%	n	%
P1	16	530	93.8	141	50.0	201	43.8	188	37.5
P2	7	161	85.7	101	25.6	2	0.2	29	57.1
P3	144	847	79.9	117	13.9	134	15.3	381	31.9
P4	84	271	84.5	73	21.4	23	8.3	74	25.0
P5	66	1013	92.4	837	43.9	37	6.0	75	21.2
P6	80	1128	87.5	865	75.0	86	10.0	177	21.3
P7	43	214	81.4	137	44.2	31	9.3	48	27.9
P8	12	47	91.7	0	0.0	0	0.0	9	25.0

Figure 6. Mean number (± SE) of total birds, Shearwater species, Silver Gull, and Tern species observed during wildlife observation events across sampling periods.



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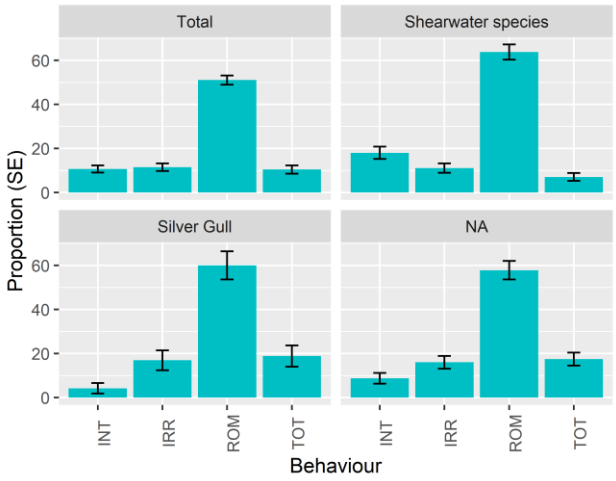
The behaviour of seabirds attending vessels was similar among species, with most birds roaming widely and only a small proportion of observed activity recorded as irregularly or intensively searching for food (Figure 7).

Figure 7. Mean proportion (± SE) of behaviour engaged in each of four activity categories; intensively searching (INT), irregularly searching (IRR), roaming widely (ROM) and totally disinterested (TOT) for; Total birds, Shearwater species, Silver Gull, and Tern species. Data are pooled across sampling periods.



Wildlife interactions

One Flesh-footed Shearwater (*Puffinus carneipes*) was hooked and released alive.

Interactions with threatened, endangered and protected species (TEPS)

Observed interactions with TEPS, included bycatch of one Scalloped Hammerhead (*Sphyrna lewini*) and one Greynurse Shark (*Carcharias taurus*). Both individuals were highly active upon gear retrieval, had no external wounds, skin damage or bruising, were not bleeding, and were observed to vigorously swim away from the vessel when immediately released following capture.

Lost fishing gear

A total of 264 hooks (< 0.5% of total hooks used) were lost for a variety of reasons (e.g., snagged on bottom, bitten off) during observed trips.

What's next?

To complete the sampling design, DPI observers will be observing a small number of fishing trips from Ocean Zones 5 to 7 from January to May 2022.

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Acknowledgements

This project would not have been possible with assistance of NSW OTLLW endorsement holders, skippers and their crews who voluntarily hosted and provided assistance to observers during fishing trips.

https://www.marine.nsw.gov.au/knowledge-centre/newsroom/news/commercial-fishers-and-scientists-working-together-to-support-sustainable-fishing

This research was funded by the NSW Government under the Marine Estate Management Strategy. The ten-year Strategy was developed by the NSW Marine Estate Management Authority to coordinate the management of the marine estate.

https://www.marine.nsw.gov.au/marine-estate-programs/marine-estate-management-strategy

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Appendix

List of all species observed to be caught during the survey. Data are the number of individuals observed to be retained (Ret.) and discarded (Dis.) with the number of trips in parentheses. CAAB Nos are the codes for Aquatic Biota (http://www.marine.csiro.au/caab). Order based on CAAB Nos.

CAAB	Species	Ret.	Dis.
23617000	Loligo Squids (*Loliginidae - undifferentiated*)	14 (4)	0
37007001	Port Jackson Shark (*Heterodontus portusjacksoni*)	0	1 (1)
37008001	Greynurse Shark (*Carcharias taurus*)	0	1 (1)
37013002	Collared Carpetshark (*Parascyllium collare*)	0	1 (1)
37013900	Wobbegong (*Orectolobidae - undifferentiated*)	0	1 (1)
37015000	Catshark Spp. (Scyliorhinidae - undifferentiated catsharks)	0	12 (2)
37015027	Grey Spotted Catshark (*Asymbolus analis*)	0	1 (1)
37017001	Gummy Shark (*Mustelus antarcticus*)	17 (11)	0
37017008	School Shark (*Galeorhinus galeus*)	66 (12)	3 (1)
37018001	Bronze Whaler (*Carcharhinus brachyurus*)	12 (6)	7 (5)
37018003	Dusky Whaler (*Carcharhinus obscurus*)	35 (6)	2 (2)
37018008	Silky Shark (*Carcharhinus falciformis*)	1 (1)	0
37018021	Bull Shark (*Carcharhinus leucas*)	1 (1)	0
37018022	Tiger Shark (Galeocerdo cuvier	1 (1)	3 (2)
37018023	Spinner Shark (*Carcharhinus brevipinna*)	0	2 (2)
37018039	Common Blacktip Shark (*Carcharhinus limbatus*)	5 (3)	0
37019001	Scalloped Hammerhead (*Sphyrna lewini*)	0	1 (1)
37019004	Smooth Hamerhead (Sphyrna zygaena)	0	6 (1)
37019902	Hammerhead Shark – Undif (*Sphyrna spp.*)	0	1 (1)
37020048	Greeneye Spurdog (*Squalus chloroculus*)	0	1 (1)
37023002	Common Sawshark (*Pristiophorus cirratus*)	0	2 (1)
37027006	Eastern Fiddler Ray (*Trygonorrhina fasciata*)	6 (2)	0
37027009	Eastern Shovelnose Ray (*Aptychotrema rostrata*)	4 (2)	0
37035001	Smooth Stingray (*Bathytoshia brevicaudata*)	0	3 (3)
37060006	Green Moray (*Gymnothorax prasinus*)	0	18 (3)
37085002	Australian Sardine (*Sardinops sagax*)	26 (1)	0
37085023	Southern Herring (*Herklotsichthys castelnaui*)	2 (1)	2 (1)
37085027	Freshwater Herring (*Potamalosa richmondia*)	14 (1)	0
37086001	Australian Anchovy (*Engraulis australis*)	26 (1)	0
37117001	Sergeant Baker (*Latropiscis purpurissatus*)	11 (6)	11 (9)
37118001	Largescale Saury (*Saurida undosquamis*)	2 (1)	0
37224005	Largetooth Beardie (*Lotella rhacina*)	4 (4)	0
37235000	Longtoms (*Belonidae - undifferentiated*)	0	1 (1)
37258003	Redfish (*Centroberyx affinis*)	95 (24)	17 (3)
37287001	Reef Ocean Perch (*Helicolenus percoides*)	7 (4)	0
37287066	Eastern Red Scorpionfish (*Scorpaena jacksoniensis*)	39 (19)	9 (5)

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37288001	Red Gurnard (*Chelidonichthys kumu*)	1 (1)	0
37296001	Tiger Flathead (*Platycephalus richardsoni*)	1 (1)	0
37296002	Deepwater Flathead (*Platycephalus conatus*)	4 (4)	0
37296007	Bluespotted Flathead (*Platycephalus caeruleopunctatus*)	22 (14)	4 (4)
37296036	Longspine Flathead (*Platycephalus grandispinis*)	0	13 (5)
37296038	Marbled Flathead (*Platycephalus marmoratus*)	7 (5)	2 (2)
37311086	Maori Rockcod (*Epinephelus undulatostriatus*)	3 (2)	5 (1)
37311090	Eastern Wirrah (*Acanthistius ocellatus*)	19 (12)	4 (4)
37311091	Blackbanded Seaperch (*Hypoplectrodes annulatus*)	0	2 (2)
37311095	Longfin Perch (*Caprodon longimanus*)	10 (3)	0
37311147	Banded Rockcod (*Hyporthodus ergastularius*)	18 (7)	0
37320003	Pearl Perch (*Glaucosoma scapulare*)	226 (57)	12 (8)
37327002	Longfin Pike (*Dinolestes lewini*)	72 (14)	8 (2)
37334002	Tailor (*Pomatomus saltatrix*)	667 (33)	14 (4)
37336002	Remora (*Remora remora*)	0	1 (1)
37337002	Common Jack Mackerel (*Trachurus declivis*)	2 (1)	0
37337003	Yellowtail Scad (*Trachurus novaezelandiae*)	1572 (103)	78 (8)
37337007	Samsonfish (*Seriola hippos*)	12 (6)	0
37337011	Longnose Trevally (*Carangoides chrysophrys*)	1 (1)	0
37337021	Onion Trevally (*Carangoides coeruleopinnatus*)	0	21 (5)
37337027	Giant Trevally (*Caranx ignobilis*)	8 (1)	0
37337038	Diamond Trevally (*Alectis indicus*)	1 (1)	0
37337039	Bigeye Trevally (*Caranx sexfasciatus*)	5 (3)	2 (1)
37337062	Silver Trevally (*Pseudocaranx georgianus*)	57 (15)	130 (22)
37337904	Dart (*Trachinotus spp.*)	258 (9)	1 (1)
37338001	Mahi-Mahi (*Coryphaena hippurus*)	204 (16)	71 (13)
37346032	Rosy Snapper (*Pristipomoides filamentosus*)	1 (1)	0
37346033	Hussar (*Lutjanus adetii*)	0	1 (1)
37346049	False Fusilier (*Paracaesio xanthura*)	1 (1)	0
37346915	Moses Sea Perch (*Lutjanus russellii & Lutjanus sp.*)	4 (4)	0
37353001	Snapper (*Chrysophrys auratus*)	596 (111)	215 (56)
37353004	Yellowfin Bream (*Acanthopagrus australis*)	133 (33)	108 (27)
37353013	Tarwhine (*Rhabdosargus sarba*)	7 (6)	1 (1)
37354001	Mulloway (*Argyrosomus japonicus*)	124 (32)	3 (2)
37354020	Teraglin (*Atractoscion atelodus*)	695 (38)	1 (1)
37355001	Bluestriped Goatfish (*Upeneichthys lineatus*)	4 (3)	0
37356002	Diamondfish (*Monodactylus argenteus*)	6827 (26)	0
37357005	Blacktip Bullseye (*Pempheris affinis*)	0	12 (3)
37361009	Silver Sweep (*Scorpis lineolata*)	67 (7)	46 (8)
37361010	Mado (*Atypichthys strigatus*)	0	16 (10)
37372097	Girldled Scalyfin (*Parma unifasciata*)	0	1 (1)
37377002	Grey Morwong (*Nemadactylus douglasii*)	70 (26)	1 (1)
37377003	Red Morwong (*Morwong fuscus*)	1 (1)	0

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37384040	Southern Maori Wrasse (*Ophthalmolepis lineolatus*)	11 (6)	0
37384041	Crimsonband Wrasse (*Notolabrus gymnogenis*)	4 (3)	2 (1)
37384042	Venus Tuskfish (*Choerodon venustus*)	2 (1)	0
37384061	Eastern Pigfish (*Bodianus unimaculatus*)	17 (13)	0
37439001	Barracouta (*Thyrsites atun*)	51 (9)	0
37439002	Gemfish (*Rexea solandri*)	0	1 (1)
37441001	Blue Mackerel (*Scomber australasicus*)	2867 (99)	1 (1)
37441005	Albacore (*Thunnus alalunga*)	1 (1)	0
37441007	Spanish Mackerel (*Scomberomorus commerson*)	10 (6)	0
37441008	Leaping Bonito (*Cybiosarda elegans*)	6318 (35)	0
37441010	Mackerel Tuna (*Euthynnus affinis*)	116 (30)	1 (1)
37441013	Longtail Tuna (*Thunnus tonggol*)	4 (3)	0
37441015	Spotted Mackerel (*Scomberomorus munroi*)	92 (19)	0
37441020	Australian Bonito (*Sarda australis*)	1402 (61)	0
37465006	Ocean Jacket (*Nelusetta ayraud*)	2 (2)	0

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