Updated analysis of spine-tailed devil ray post-release survival

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Project INT2018-05

Climate, Freshwater & Ocean Science

NIWA
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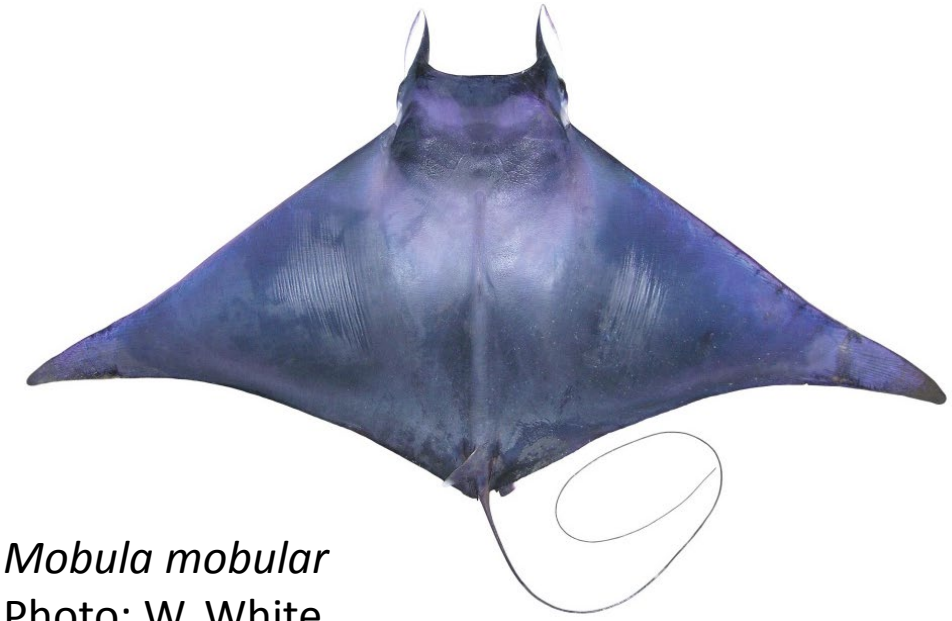
Devilrays in New Zealand

- Two species of mobulid rays occur in New Zealand waters
- spinetail devilray (*Mobula mobular*) (previously *M. japanica*) (to 3.1 m disk width)
- giant manta ray (*Mobula birostris*) (previously *Manta birostris*) (to > 7 m disk width)
- They are seasonal migrants from tropical waters to the north, occurring around northern North Island only in summer
- Both species have been protected in NZ waters since July 2010
- Spinetail devilray is caught in purse seine fisheries for skipjack tuna



Mobula mobular
Photo: W. White

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Project objectives

Objective 1. To provide updated estimates of post release survival of *Mobula mobular* bycatch in purse seine fisheries

Objective 2. To identify operational, biological and environmental factors which affect the likelihood of post-release mortality

Objective 3. To provide recommendations on the most effective methods to reduce post-release mortality

Background

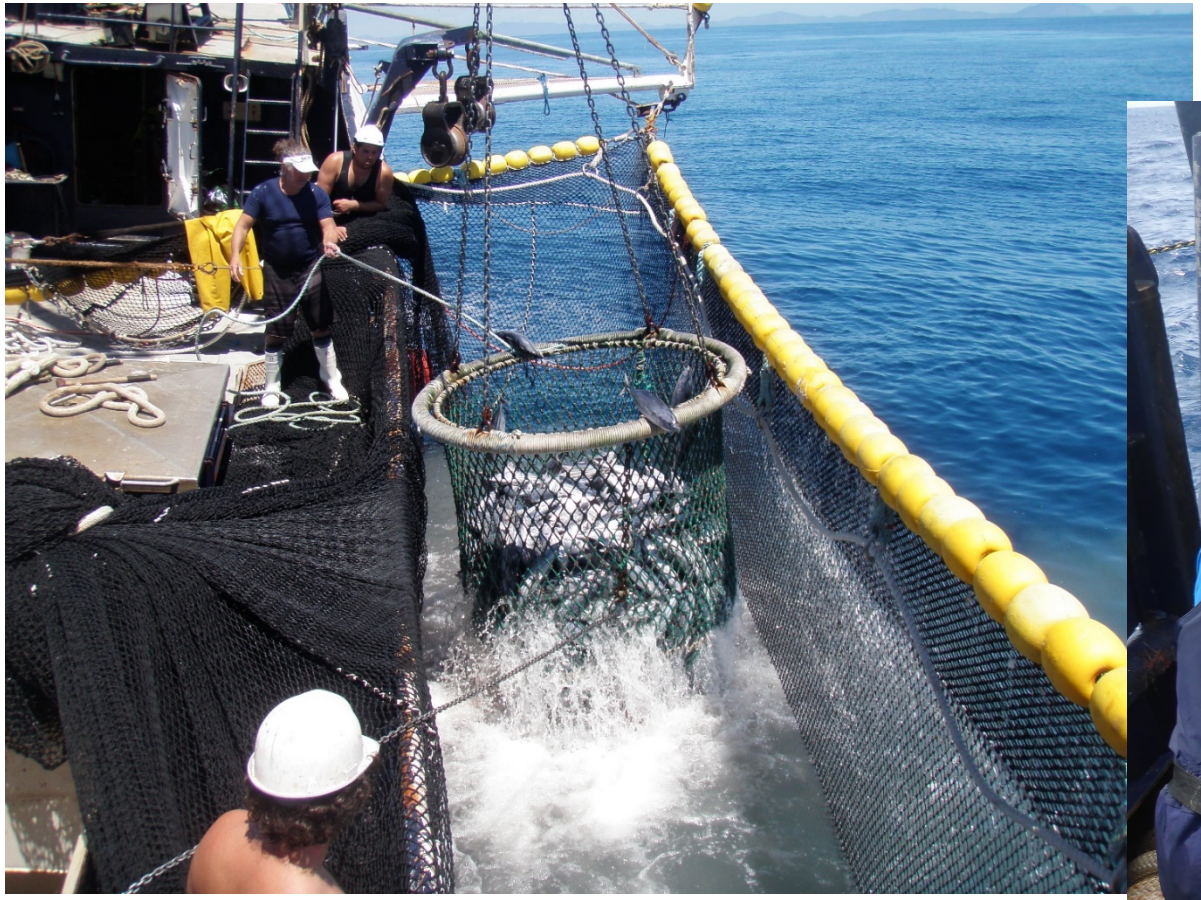
- Previously, we reported on similar objectives up to the end of the 2015 fishing year using analyses of data collected from commercial fishers, fishery fisheries observers, and a satellite tagging study.
- In this study, we update some of our previous analyses using observer and tagging data to the end of the 2018–19 fishing year

Jones, E.; Francis, M. 2012: Protected rays – occurrence and development of mitigation methods in the New Zealand tuna purse seine fishery. NIWA Client Report WLG2012-49. 36 p.

Francis, M. P. 2014: Survival and depth distribution of spinetail devilrays (*Mobula japanica*) released from purse-seine catches. NIWA Client Report WLG2014-2. 23 p.

Francis, M. P.; Jones, E. G. 2017: Movement, depth distribution and survival of spinetail devilrays (*Mobula japanica*) tagged and released from purse-seine catches in New Zealand. Aquatic conservation: marine and freshwater ecosystems 27: 219–236.

Ray handling



Brailing

Ray handling

Hauling aboard in net bunt

Ray handling

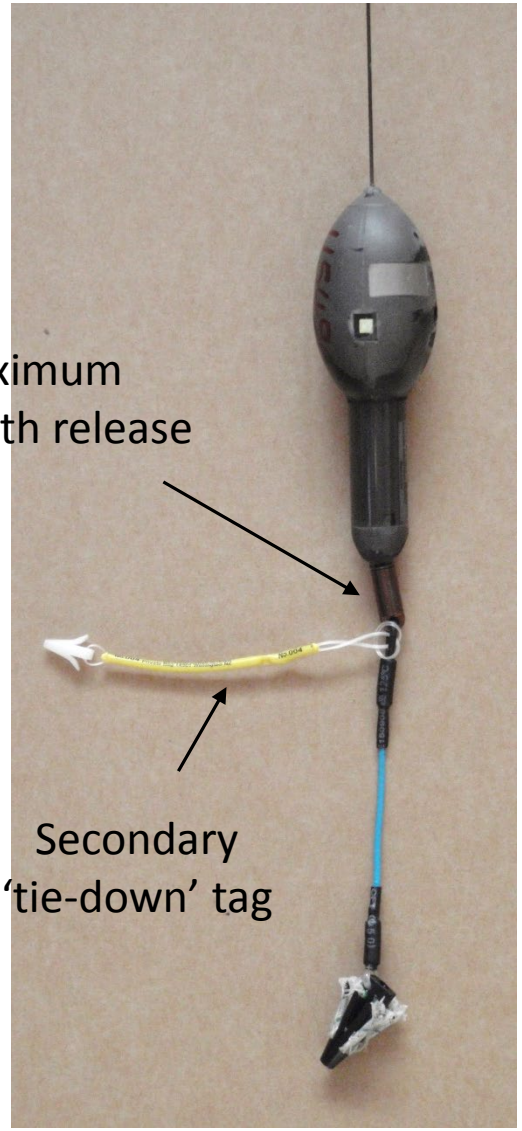
Sling

Ray handling

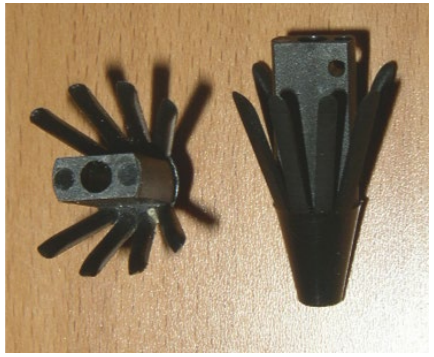
Cargo net

Release mortality - methods

- Wildlife Computers ‘popup’ tags (miniPATs and sPATs) used to assess survival, and gather data on movement, depth and temperature
- Tags deployed by observers
- A ‘constant depth release’ was programmed to activate after 3 days if there were no changes in depth
- A maximum depth release is set at 1800 m
- Popup programmed for 30 days after release



Umbrella
anchors

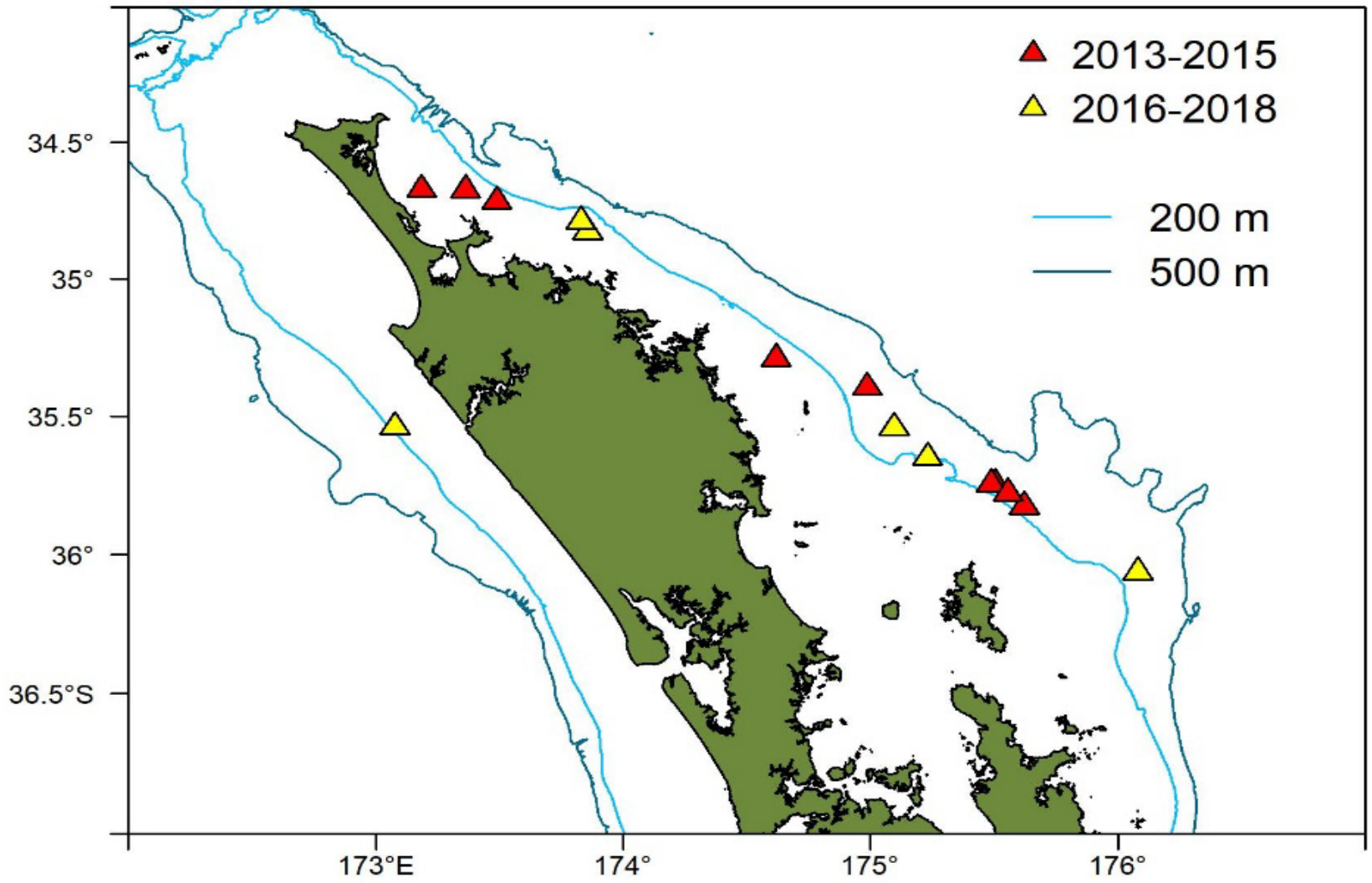


Tagging

Tagging

16 rays tagged 2013-2018, but only 14 transmitted data

Both sexes, 190-270 cm disk width (all adults except one)



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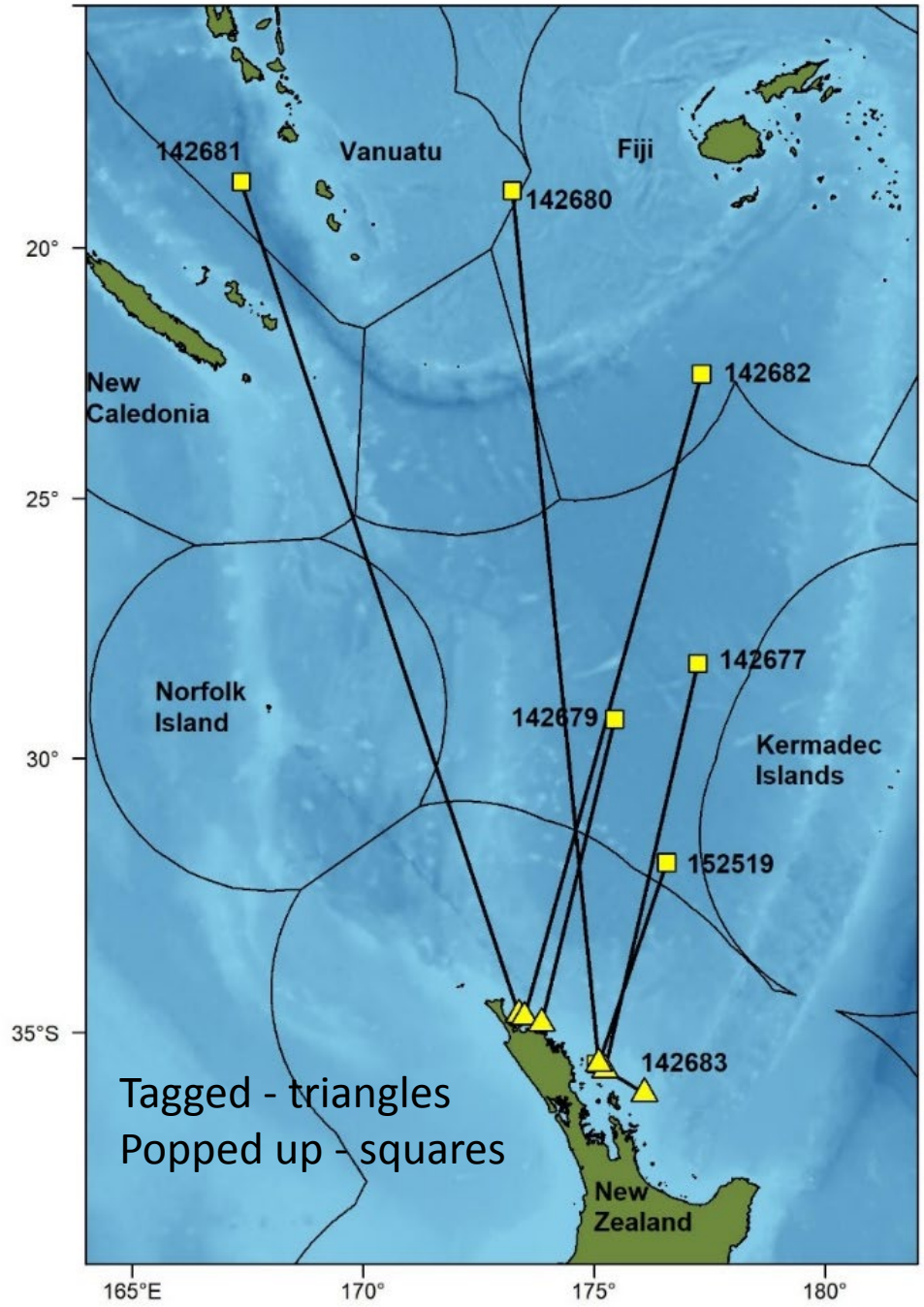
Movements

Most of the surviving tagged rays showed strong northward movements after release, with three tags popping off in Fiji and Vanuatu waters

The maximum distances travelled (via the shortest direct routes between tagging and popup locations) were 1404, 1867 and 1878 km respectively in 30 days



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Devil ray mortality

- Overall, 5/14 rays died (36%)
- In 2013−2015, 4/7 (57%) died
- In 2016−2018, 1/7 (14%) died

- All mortalities of tagged rays resulted from skunked sets followed by lifting of devil rays aboard in the bunt of the net.
- In contrast, all devil rays that were tagged from successful sets were brailed aboard, and all of them survived.

Skunked = unsuccessful set in which all or most of the tuna escaped

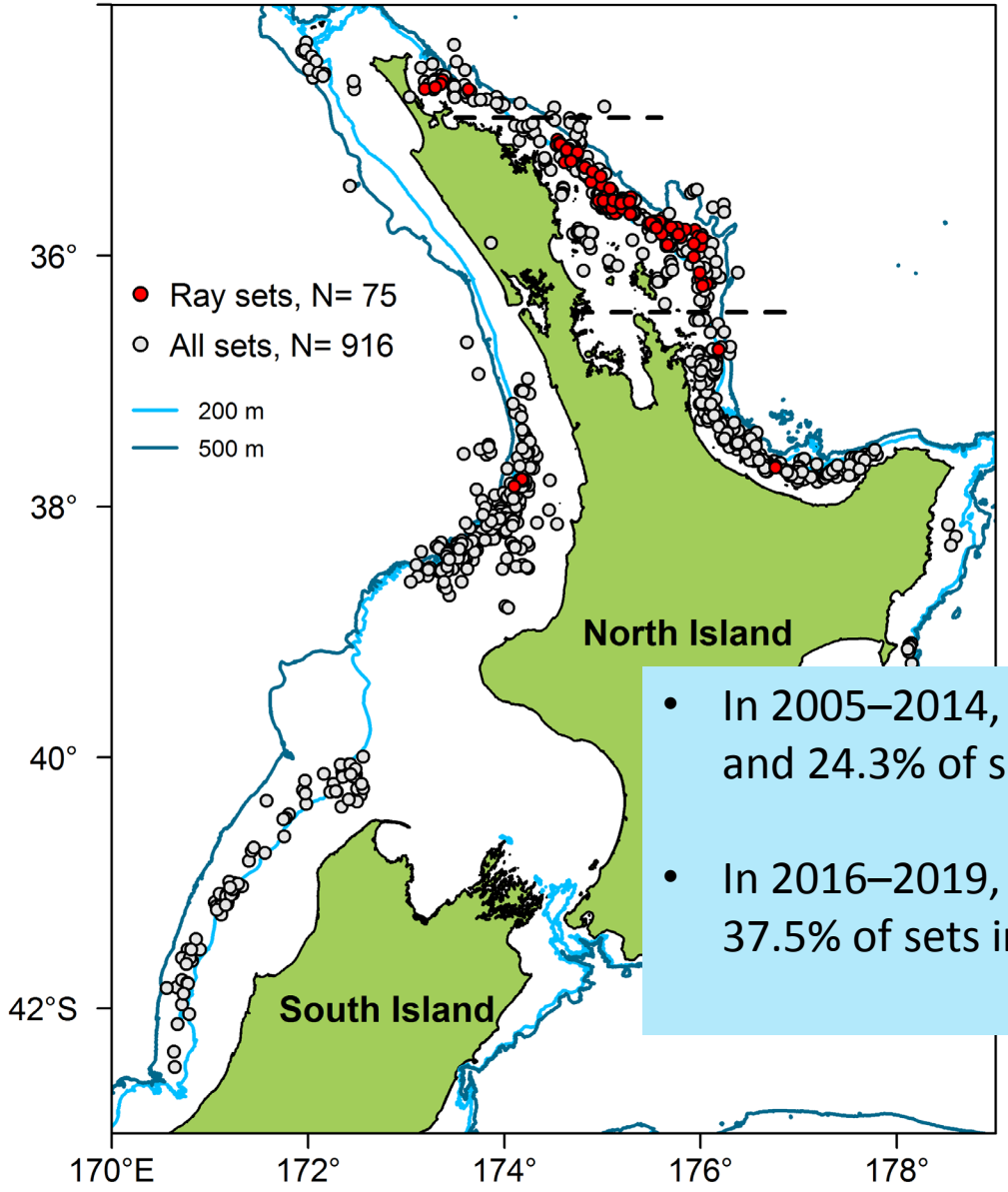
Onboard and release handling, and fate of tagged rays

Tags that did not report data are not included. A, alive; D, dead.

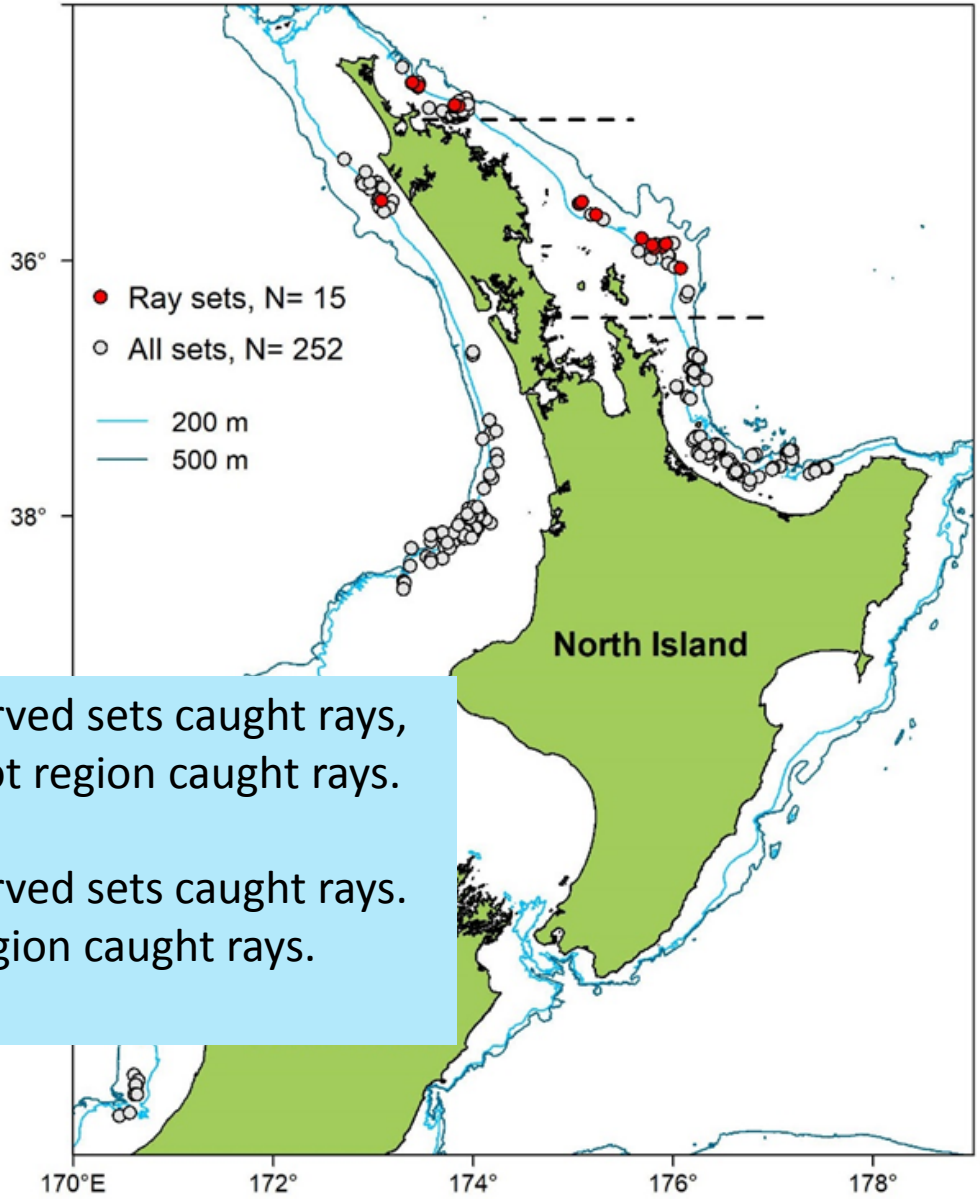
	Bringing onboard handling	
Release handling	Brailed onboard	Lifted onboard in the net
Skunked sets		
Released directly from net into water (lowered or rolled)		A, A
Released from deck - lifted by crew		D, D
Released from deck - by brailer		D
Released from deck - cargo net & winch		A, D
Successful sets		
Released from deck - by brailer	A	
Released from deck – lifted by crew	A, A	D
Released from deck - rope sling & winch	A, A	
Released from deck - cargo net & winch	A	

Observed devilray captures by purse seiners

2005-2014



2016-2019



- In 2005–2014, 8.2% of all observed sets caught rays, and 24.3% of sets in the hotspot region caught rays.
- In 2016–2019, 6.0% of all observed sets caught rays. 37.5% of sets in the hotspot region caught rays.

Observer data on handling methods

- From 2013, observers started collecting more detailed information on handling and release methods
- Ten purse seine trips aboard five different vessels were observed in 2013–2019.
- On these trips, 36 sets caught 71 devil rays, an average of 2.0 rays per set.
- Handling information was provided for 58 of those 71 rays
- 22 came from skunked sets, and 36 from successful or partially successful sets.

Release handling	Bringing onboard handling: Remained in water	Brailed onboard	Lifted onboard	Total
Skunked sets				
Released while in water	8			8
Brailed over side - not brought on deck				0
Released directly from net into water (lowered or rolled)			8	8
Released from deck - lifted by crew			2	2
Released from deck - by brailer			2	2
Released from deck - rope sling & winch				0
Released from deck - cargo net & winch			2	2
Total from skunked sets				22
Successful sets				
Released while in water	3			3
Brailed over side - not brought on deck		5		5
Released from net lowered into water (lowered or rolled)			2	2
Released from deck – lifted by crew		4		4
Released from deck - by brailer		4	2	6
Released from deck - rope sling & winch		11		11
Released from deck - cargo net & winch		3		3
Released from deck - rope threaded through cut in wing		2		2
Total from successful sets				36
Total for onboard handling categories overall	11	29	18	58

Discussion

Since 2013, vessels may have avoided setting on ray-associated tuna schools, and this may have reduced the number of devil rays caught. When devil rays have been caught, there is evidence of improved handling. Data from before and since 2013 show that there were similar proportions of skunked and successful sets, and similar onboard handling, in the two periods, but there has been a recent increase in the frequency of vessels opening the net on skunked sets to let devil rays go in the water. By reducing the handling and physical and physiological trauma caused by lifting devil rays onboard, their chances of survival have probably increased.

The number of devil rays tagged is too small to draw strong conclusions, but a reduction in the mortality rate of released devil rays is consistent with observed improvements in handling and releasing methods used by purse seine crews.

Recommendations

Avoiding ray captures

1. Vessels should not set on tuna schools that are associated with rays. Rays are frequently seen by the pilots of spotter planes before setting, enabling vessels to avoid such schools in favour of those with no associated rays. In addition to reducing mortality of rays, avoiding ray sets would reduce the chance of skunked sets (rays are thought to spook the tuna and cause them to exit the net before pursing is complete) and reduce the time spent handling rays following their capture.
2. Vessels should avoid fishing in the hotspot area on the north-east coast of North Island. If fishing does occur in the hotspot, effort should be restricted to over the continental shelf (seabed depth less than 200 m) because rays are more common in oceanic waters beyond the shelf edge.

Recommendations

Reducing ray mortality

1. Rays should be removed from the net while still in the water. Options for releasing rays in the water include opening the net (especially for skunked sets with no tuna), sinking the corkline, and brailing the rays directly from the net into the sea.
2. If rays cannot be removed while in the water, they should be brailed out very early in the brailing process and returned rapidly to the sea.
3. Rays should be brailed out of the net in preference to being dragged aboard in the bunt.
4. Physical handling of rays on deck should be minimised so that rays are returned to the sea rapidly and with minimal trauma.
5. Vessels should carry and use a cargo net to facilitate the return of rays to the sea. Cargo nets should be constructed from soft straps or webbing, rather than thin twine.
6. Use of a rope sling to return rays to the sea should be discouraged.

Recommendations

Improved data collection and analysis

1. Data provided by spotter pilots flying in association with purse seiners should be analysed to determine (a) whether pilots are routinely recording ray sightings, and (b) to provide more information on the spatial and temporal distribution of rays, particularly in relation to defining the hotspot area in north-eastern North Island.
2. Observers record information on ray captures using the Protected Ray Interactions form. This form provides valuable data on things such as when and by whom a ray was first sighted, and crew handling techniques. However, no information is specifically collected on whether a cargo net is used, or other details of the ray handling such as whether a ray was brailed early or late in the brailing process. Additional fields should be added to the form for this purpose.
3. An updated analysis of commercial data would provide a larger data set from which to determine whether there have been any changes in the distribution of fishing effort, or ray captures and capture rates, in relation to factors such as month, location, and seabed depth

Acknowledgements

- Ministry for Primary Industries observers
- The skippers, crews, pilots and scientists who contributed assistance, information and ideas
- The fishing industry for their support of this work aboard their vessels
- The study was funded by the Department of Conservation and managed by Kris Ramm and Katie Clemens-Seely