

Incidental capture of seabirds and New Zealand fur seals in southern bluefin tuna fisheries in New Zealand waters in 2006-07 and 2007-08

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Abstract

Incidental catch rates and estimated total captures of seabirds and New Zealand fur seals, *Arctocephalus forsteri*, are reported for vessels fishing in New Zealand waters for southern bluefin tuna *Thunnus maccoyi*.

Introduction

This paper reports on the incidental capture of seabirds and New Zealand fur seals, *Arctocephalus forsteri*, on vessels fishing for southern bluefin tuna in New Zealand waters during 2006-07 and 2007-08. The catch rates and total estimated capture of seabirds are estimated. This work updates material presented to previous meetings of the CCSBT-ERSWG (CCSBT-ERS/0111/05, 31, 32, CCSBT-ERS/0402/11, CCSBT-ERS/0602/07). New Zealand annually estimates seabird and marine mammal incidental take in trawl and longline fisheries in New Zealand waters. The results presented in this report are a subset of these estimations.

Methods

Ratio estimation rests on the assumption that the observed effort is similar to the unobserved effort. Fishing effort targeting the same species, with the same gear type, in the same area was considered similar. Effort was divided into strata based on the target species, fishing method, and fishing area. In this report, target species was restricted to southern bluefin tuna. The EEZ was divided into 4 areas for surface longline fishing (Figure 1).

The estimated total number of captures in a stratum, s , is

$$N_t^s = N_o^s + N_e^s \quad (1)$$

where N_o^s are the observed captures and N_e^s are the estimated captures during unobserved fishing. The unobserved captures are estimated using a ratio method. Note that the estimated total captures include the observed captures. The captures during unobserved fishing, N_e^s , were calculated by multiplying the unobserved effort by the observed capture rate,

$$N_e^s = \frac{N_o^s}{O^s} (E^s - O^s) \quad (1)$$

where O^s is the amount of observed fishing effort, and E^s is the total fishing effort. Effort is measured in tows for trawl fisheries, and hooks for longline fisheries.

Two approaches were taken to estimate captures N_e^{sy} in each year y :

1. For strata with more than 10 observed captures in the 10 year period, ratio estimates were calculated independently in each year,

$$N_e^{sy} = \frac{N_o^{sy}}{O^{sy}} (E^{sy} - O^{sy}) \quad (2)$$

2. For strata with 10 or fewer observed captures in the ten year period, the observed capture rate was estimated using observations from the whole ten year period, and then applied to the unobserved effort in each year,

$$N_e^{sy} = \frac{\sum_y N_o^{sy}}{\sum_y O^{sy}} (E^{sy} - O^{sy}) \quad (3)$$

When less than 1% of the strata, or less than 100 tows (or 10 000 hooks) were observed, an estimate was not attempted. If separate estimates were being calculated for each year (Equation 2), then the ratio estimate may have only been calculated for some of the ten years, depending on the observer coverage. In the case where the observed capture rate was calculated over all years (Equation 3), the check for sufficient observer coverage was made considering effort from the whole ten year period. This allowed estimates to be made in years when observer coverage was very low. The use of the second estimation method allows more strata to be included in the estimates.

Most of the southern bluefin fishing effort is in Areas 1 and 3 (see Figure 1), where there has been good observer coverage in all years (apart from effort in Area 1 in 2002-03). Captures were estimated using the catch rate over the whole ten year period for most species and area combinations. The exceptions were fur seal captures in Areas 1 and 3, white-capped albatross and white-chinned petrel captures in Area 3, other albatross captures (not white-capped albatrosses) in Areas 1 and 3, and other birds (not white-chinned petrels or sooty shearwaters) in Area 1 for which estimates were calculated independently for each year.

The uncertainty in the total captures N_t , was estimated by bootstrap resampling (e.g., Davison & Hinkley 1997). The observed fishing events were resampled 5000 times, and the total bycatch was recalculated for each sample from Equations (2, 3). The 95% confidence interval in the estimate was calculated from the 2.5% and 97.5% quantiles in the distribution of the resampled total catch. When the estimate was done with all years together, the confidence interval was a fixed proportion of the estimate in each year. This is because the uncertainty came from the capture rate estimate, which was applied across all years.

Results

New Zealand annually estimates seabird and marine mammal incidental take in fisheries in New Zealand waters. Results presented here are a subset of the results generated for trawl and longline fisheries in New Zealand waters (Abraham & Thompson 2009).

Seabirds

A summary of seabirds observed in bycatch data collected via the scientific observer programme during 2006-07 and 2007-08 is given in Table 1. The three most commonly caught species (Buller's albatross, White-capped albatross and Grey petrel) are considered Near Threatened by IUCN;. Seven species considered Vulnerable to Endangered by IUCN were also recorded as incidental bycatch from southern bluefin tuna surface longline fishing (Table 1).

Observer coverage is higher in Area 3, where most effort comes from the charter fleet, which has higher observer coverage. Figures 2 and 3 show the distribution of surface longline effort targeting southern bluefin tuna, observer coverage, and the seabird capture events for 2006-07 and 2007-08, respectively. Captures appear to occur more frequently in the more southern area of Area 3. Effort was more widespread to the north east in Area 1 during 2007-08 but captures were not observed in this area.

Ratio estimated total bycatch figures are given in detail for some species for 2006-07 and 2007-08 (Table 2) and for all seabirds combined over the ten year period from 1998-99 to 2007-08 (Table 3). There appears to be no clear trend in the total levels of seabird bycatch throughout the ten year period, 1998-99 to 2007-08, with the capture rate and total estimated bycatch fluctuating. The highest capture rate observed was in 2006-07 with 0.134 birds per thousand hooks (Table 3).

Fur seals

Similarly for seabirds, a summary of the bycatch of New Zealand fur seals, *Arctocephalus forsteri*, collected via the scientific observer programme during 2006-07 and 2007-08 is given in Table 4. Figures 4 and 5 show the distribution of surface longline effort targeting southern bluefin tuna, observer coverage, and the fur seal capture events for 2006-07 and 2007-08, respectively. There appears to be no particular trend in location of fur seal capture with variation between years.

Ratio estimated total bycatch figures are given for fur seals for 2006-07 and 2007-08 (Table 4). Most fur seals are caught alive and subsequently released (Figure 6). Relatively low numbers of fur seals were caught during 2006-07 and 2007-08 compared with previous years (Table 4). Over the ten year period from 1998-99 to 2007-08 there is a declining trend in the observed bycatch rate of fur seals (Figure 6).

Conclusions

This study shows that a wide range of seabird species are vulnerable to capture in surface longline fisheries targeting southern bluefin tuna. These species range in conservation status from Near Threatened to Endangered, with seven species having vulnerable to endangered threat classifications (see Table 1).

The birds that were caught were both dead and alive, with an important proportion (21%) landed alive. This indicates that birds were caught both at the set and during the haul, and mitigation techniques need to be applied during both parts of the fishing operation to avoid seabird captures.

There appears to be little concern required regarding the incidental capture of New Zealand fur seals. The capture rate of New Zealand fur seals in surface longline fisheries targeting southern bluefin tuna has declined over the last ten years. Most New Zealand fur seals are captured alive and subsequently released.

Acknowledgements

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References

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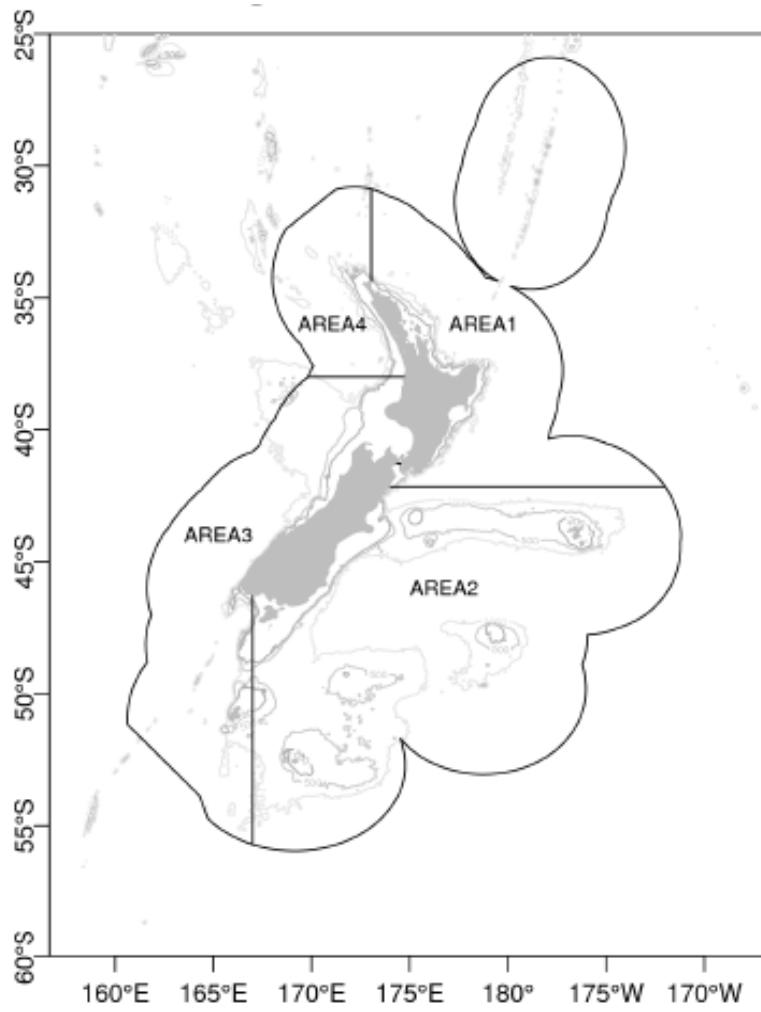


Figure 1. Areas used for surface longline analysis in this report.

Table 1. List of seabird species caught in southern bluefin tuna target target longline fisheries, their IUCN threat classifications and numbers of each that were observed caught, and subsequently identified during necropsy, during 2006-07 and 2007-08.

Species Common name	Scientific Name	IUCN threat classification	2006-07		2007-08		Total captures
			Observed captures	Necropsied	Observed captures	Necropsied	
Buller's albatross	<i>Thalassarche bulleri</i>	Near Threatened	50	35	18	9	68
White-capped albatross	<i>Thalassarche steadi</i>	Near Threatened	28	25	3	3	31
Grey petrel	<i>Procellaria cinerea</i>	Near Threatened	17	17	1	1	18
White-chinned petrel	<i>Procellaria aequinoctialis</i>	Vulnerable A4bcde	3	3	4	4	7
Gibson's albatross	<i>Diomedea gibsoni</i>	Vulnerable D2	3	3			3
Campbell albatross	<i>Thalassarche impavida</i>	Vulnerable D2	3	3			3
Black-browed albatross	<i>Thalassarche melanophrys</i>	Endangered A4bd		0	11	0	2
Antipodean albatross	<i>Diomedea antipodensis</i>	Vulnerable D2	1	1	1	1	2
Salvin's albatross	<i>Thalassarche salvini</i>	Vulnerable D2	1	1	1	0	2
Cape petrel	<i>Daption</i> spp.	Least concern	1	0			1
Sooty shearwater	<i>Puffinus griseus</i>	Near Threatened	1	0			1
Wandering albatross	<i>Diomedea exulans</i> spp.	Vulnerable A4bd			1	1	1
Unidentified albatross	Diomedeidae (Family)		1	0			1

Table 2. Summary of all bird captures in the southern bluefin longline fishery, broken down by fishing areas, with the number of hooks, numbers of hooks observed, percentage of hooks observed, number of observed captures, capture rate per ten thousand hooks and total estimated captures with 95% confidence intervals.

	Hooks	Observed				Estimated	
		No. hooks observed	% obs	Species	Observed Captures	Rate	Estimated captures
2007-08							
Area 3	654625	254208	38.8	White capped albatross	3	0.12	8 (3-16)
				White chinned petrel	4	0.16	10 (6-17)
				Other albatross	17	0.67	44 (31-59)
Area 1	451700	91864	20.3	White capped albatross	0	0	1 (0-2)
				Other albatross ¹	5	0.54	25 (9-47)
				Other birds ²	1	0.11	5 (1-13)
Area 4	1500	0	0.0				
2006-07							
Area 3	1109950	588130	53.0	White capped albatross	27	0.46	51 (37-70)
				White chinned petrel	3	0.05	6 (3-9)
				Sooty shearwater	1	0.02	1 (1-1)
				Other albatrosses ³	53	0.9	100 (82-120)
				Other birds ⁴	0	0	1 (0-1)
Area 1	828261	242942	29.3	White capped albatross	1	0.04	2 (1-5)
				Other albatrosses ⁵	8	0.33	27 (13-45)
				Other birds ⁶	18	0.74	61 (40-85)
Area 4	1000	0	0.0				

¹Buller's albatross (5)

²Grey petrel (1)

³Buller's albatross (1), Antipodean albatross (1), Salvin's albatross (1), Wandering albatross (1), Black browed albatross (1)

⁴Buller's albatross (49), Gibson's albatross (2), Campbell albatross (1), Unidentified albatross (1)

⁵Campbell albatross (2), Buller's albatross (1) Antopodean albatross (1), Black-browed albatross (1), Southern black-browed albatross (1), Salvin's albatross (1), Gibson's albatross (1)

⁶Grey petrel (17), Cape petrel (1)

Table 3. Summary of all birds captures in the southern bluefin longline fishery in New Zealand waters, for ten fishing years, with the number of hooks, number of hooks observed, percentage of hooks observed, number of observed captures, capture rate per ten thousand hooks, and total estimated captures with 95% confidence intervals.

Year	Observed				Estimated	
	Hooks	No. obs	% obs	Captured	Rate	Estimated captures
2007-08	1,107,825	346,072	31.2	30	0.87	93 (68-122)
2006-07	1,939,211	831,072	42.9	111	1.34	249 (214-288)
2005-06	1,493,418	576,234	38.6	29	0.5	189 (103-294)
2004-05	1,662,079	656,231	39.5	36	0.55	93 (64-127)
2003-04	3,193,936	1,343,064	42.1	70	0.52	251 (133-389)
2002-03	3,509,003	1,051,810	30.0	43	0.41	58 (51-68)
2001-02	2,813,894	793,297	28.2	83	1.05	302 (126-655)
2000-01	1,906,725	785,940	41.2	15	0.19	24 (20-29)
1999-2000	1,743,562	721,190	41.4	41	0.57	324 (79-643)
1998-99	1,892,036	1,171,046	61.9	74	0.63	264 (168-369)

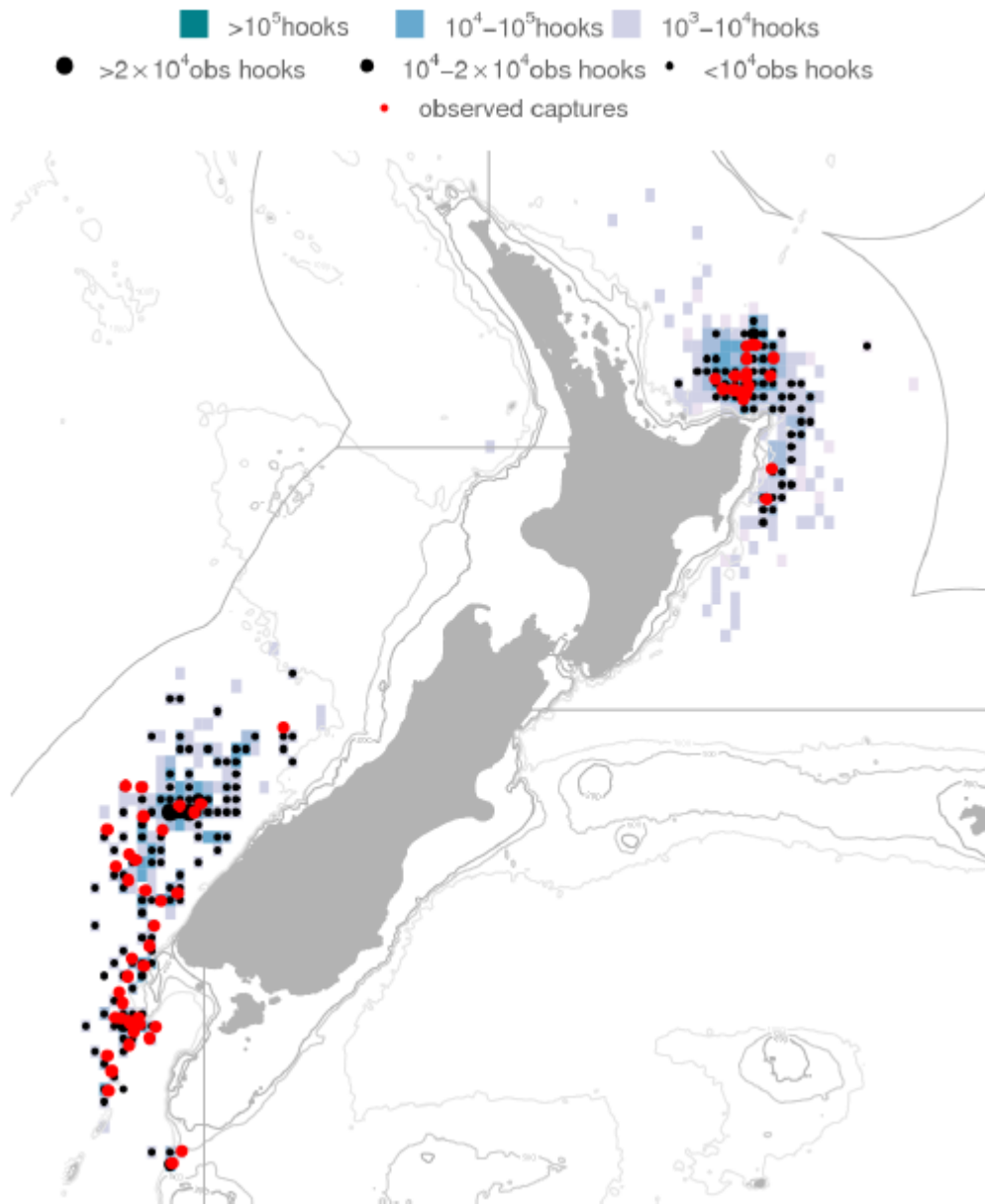


Figure 2. Map of the effort, observations and seabird captures for the 2006-07 fishing year. Cells are coloured by the fishing effort within each $0.2^\circ \times 0.2^\circ$ area. The number of observations is shown by a black dot, where the increasing size of the dot reflects increasing number of observations. Coloured cells with no black dot indicate unobserved effort. The location of captures is indicated by a red dot (with the location only being accurate to within 0.2° of longitude and latitude).

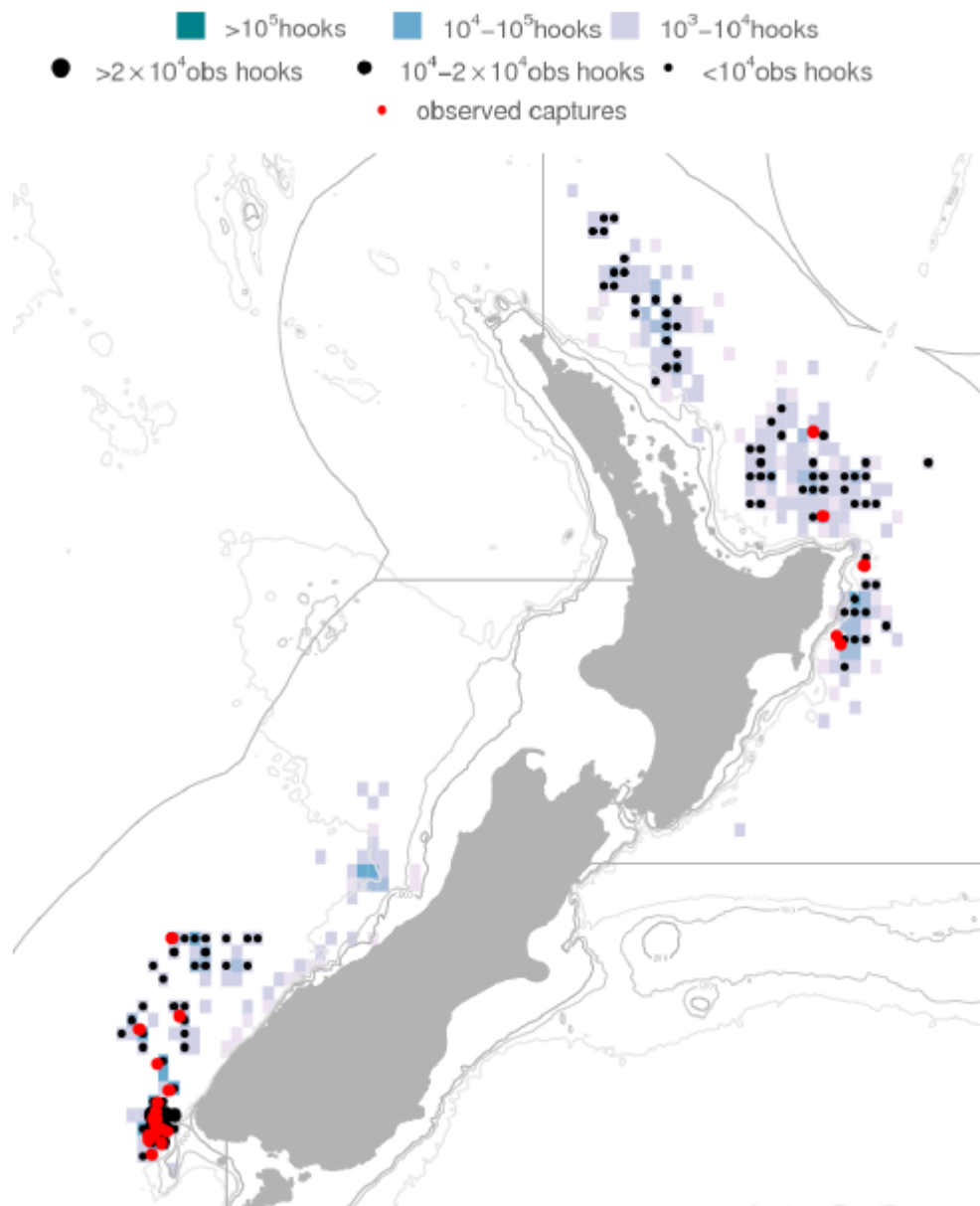


Figure 3. Map of the effort, observations and seabird captures for the 2007-08 fishing year. Cells are coloured by the fishing effort within each $0.2^\circ \times 0.2^\circ$ area. The number of observations is shown by a black dot, where the increasing size of the dot reflects increasing number of observations. Coloured cells with no black dot indicate unobserved effort. The location of captures is indicated by a red dot (with the location only being accurate to within 0.2° of longitude and latitude).

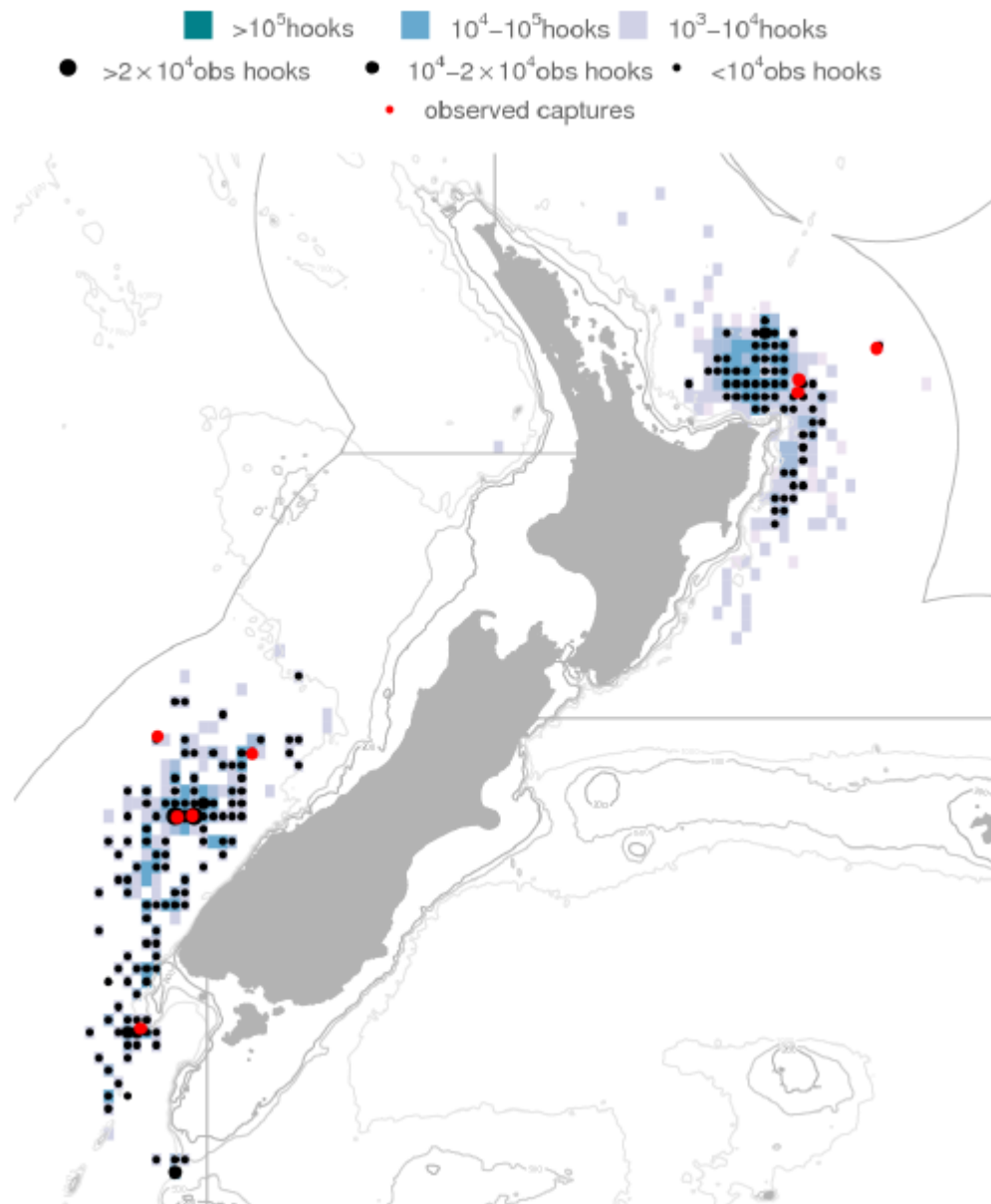


Figure 4. Map of the effort, observations and fur seal captures for the 2006-07 fishing year. Cells are coloured by the fishing effort within each $0.2^\circ \times 0.2^\circ$ area. The number of observations is shown by a black dot, where the increasing size of the dot reflects increasing number of observations. Coloured cells with no black dot indicate unobserved effort. The location of captures is indicated by a red dot (with the location only being accurate to within 0.2° of longitude and latitude).

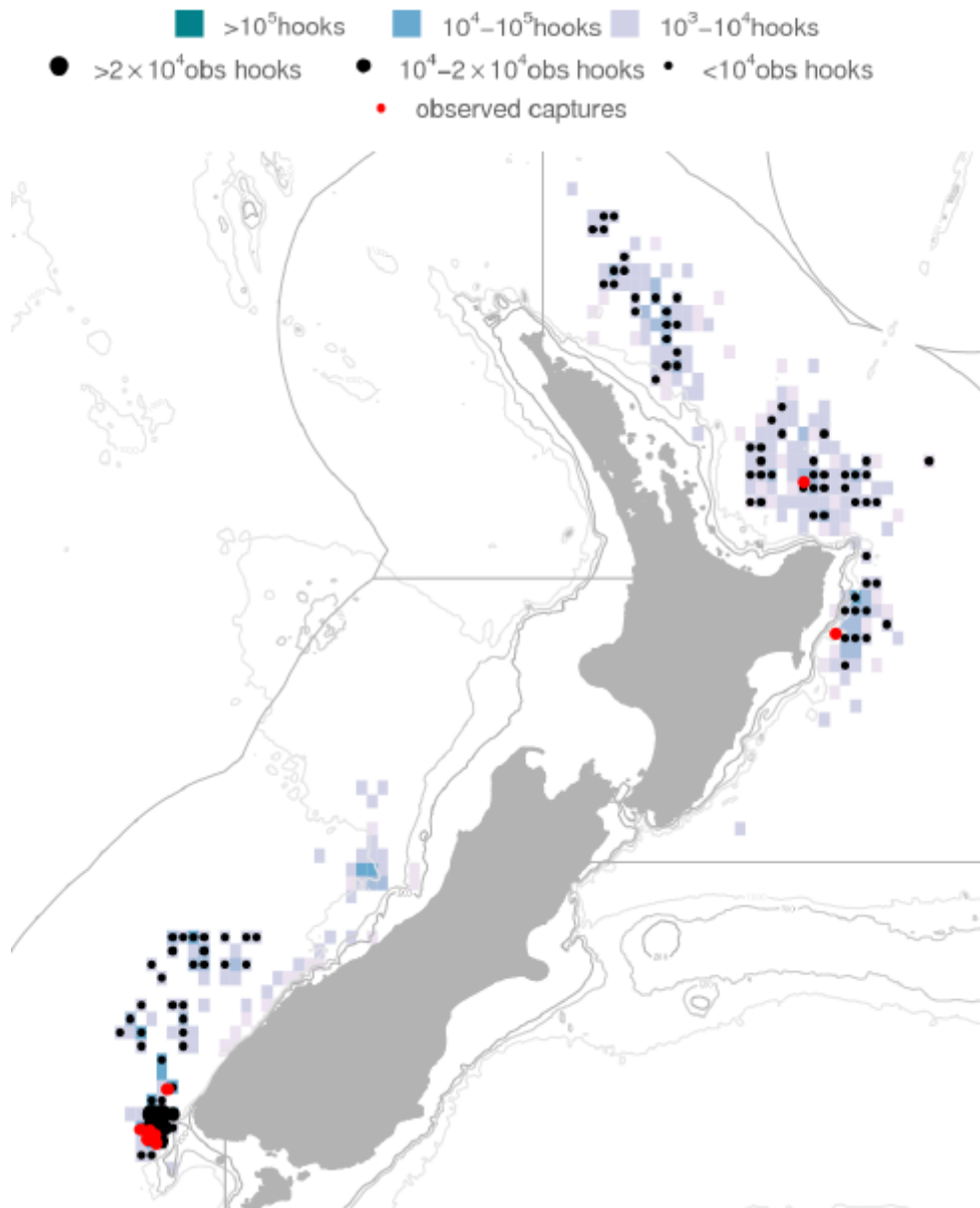


Figure 5. Map of the effort, observations and fur seal captures for the 2007-08 fishing year. Cells are coloured by the fishing effort within each $0.2^\circ \times 0.2^\circ$ area. The number of observations is shown by a black dot, where the increasing size of the dot reflects increasing number of observations. Coloured cells with no black dot indicate unobserved effort. The location of captures is indicated by a red dot (with the location only being accurate to within 0.2° of longitude and latitude).

Table 4. Summary of fur seal captures in the southern bluefin tuna longline fishery, broken down by fishing areas, with the number of hooks, numbers of hooks observed, percentage of hooks observed, number of observed captures, capture rate per ten thousand hooks and total estimated captures with 95% confidence intervals.

	Hooks	Observed				Estimated	
		No.obs	% obs	Captures	Rate	Estimated captures	95% CI
2007-08							
Area 3	654625	254208	38.8	6	0.24	15	(9-23)
Area 1	451700	91864	20.3	2	0.22	10	(2-22)
Area 4	1500	0	0.0	0		0	(0-0)
2006-07							
Area 3	1109950	588130	53.0	7	0.12	13	(8-20)
Area 1	828261	242942	29.3	3	0.12	10	(3-20)
Area 4	1000	0	0.0	0		0	(0-0)

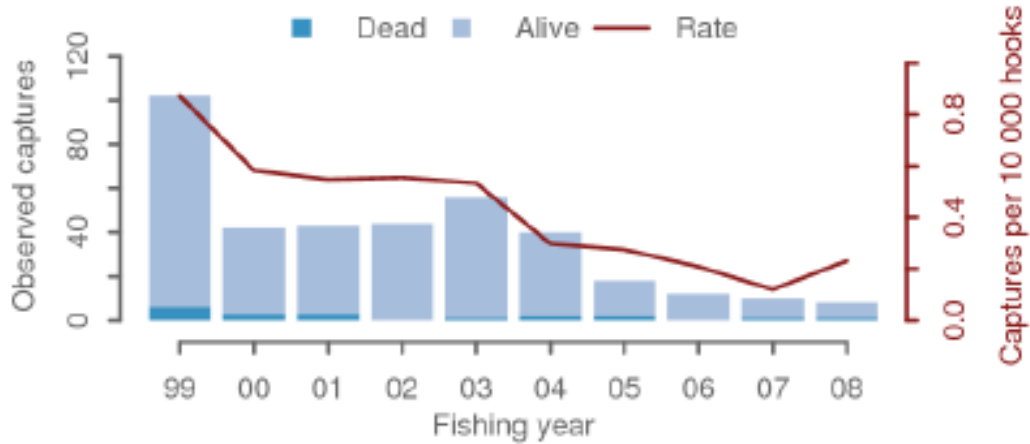


Figure 6. Time series of the observed fur seal captures from 1998-99 to 2007-08. bar height represents the total number of captures, with the darker portion of the bar representing dead captures and light portion representing live captures, The red line shows the ratio of number of captures to the observed fishing effort in each year.