Overlap of black petrel distributions with New Zealand fisheries
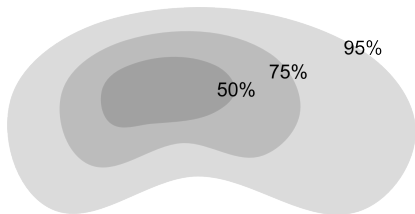
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`www.dragonfly.co.nz`

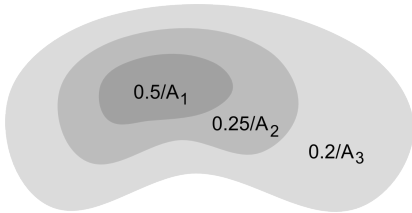Presentation for the Department of Conservation
CSP working group – 21 October 2011

Defining overlap

- Distribution from kernel density of tracking data
- Specified as 50%, 75%, and 95% contours
- Represents a utilization time: during the survey birds 50% of the time the tracks were within the 50% contour, etc.

Defining overlap

- Define a weighting, equivalent to the normalised density
- Within the inner contour the weighting is 0.5 divided by the area
- Integrates to 1
- Has units of km^{-2}
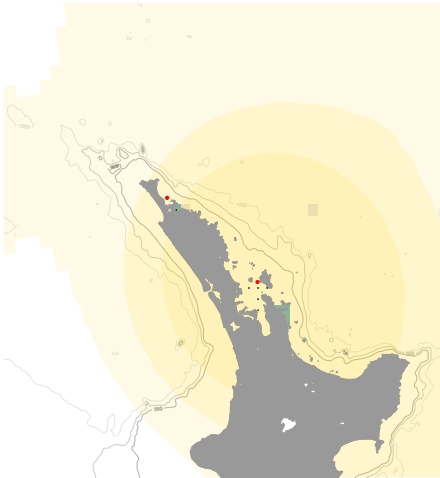
Defining overlap
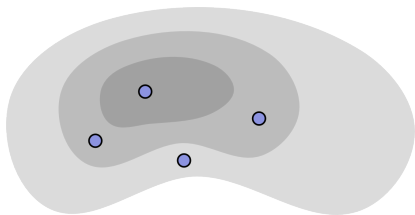
- Overlap is the sum of the weighted fishing effort
- Take the three areas to be 1, 2, and 5 km^2
- In this case, the overlap is $0.5 + 2 \times 0.25/2 + 0.2/5 = 0.79$ tows km^{-2}

Overlap from fisheries data

- Use data from other protected species reporting
- Define fisheries based on target species
- For each fishery calculate the overlap with the distribution from each of the five breeding season distributions
- Use fisheries data from 2005–06 to 2009–10 fishing years

Snapper bottom longline

Overlap with 2005–06 incubation data

Legend:
- $> 10^5$ hooks
- 10^4 - 10^5 hooks
- 10^3 - 10^4 hooks
- $> 2 \times 10^4$ obs hooks
- 10^4 - 2×10^4 obs hooks
- $< 10^4$ obs hooks
- observed captures
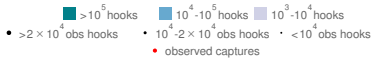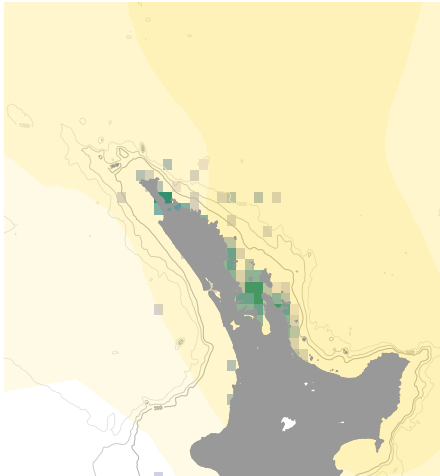
- Distribution roughly centered on Great Barrier Island
- Very little effort
- Two observed black petrel captures

Snapper bottom longline

Overlap with 2007–08 incubation data

Legend:
- $>10^5$ hooks
- 10^4-10^5 hooks
- 10^3-10^4 hooks
- $>2 \times 10^4$ obs hooks
- 10^4-2×10^4 obs hooks
- $<10^4$ obs hooks
- observed captures
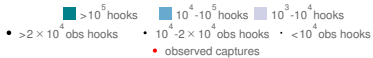
- Distribution larger in area and offshore
- Effort in Hauraki Gulf
- No observer data

Snapper bottom longline

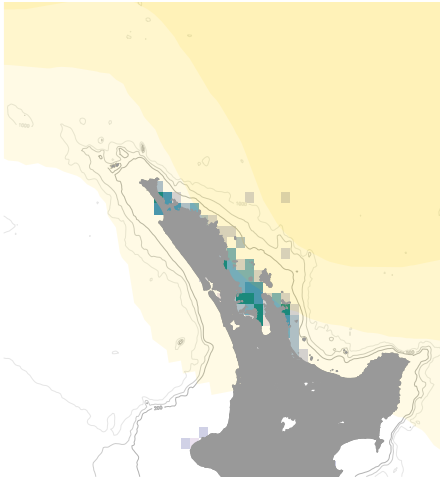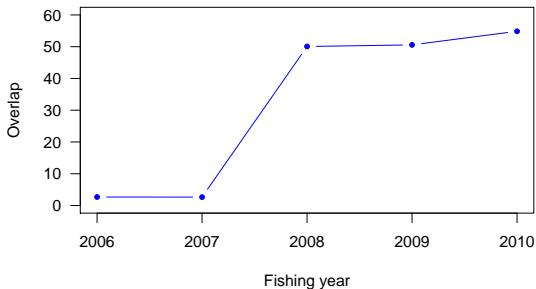Overlap with 2008–09 incubation data

- Distribution area increased again
- Hauraki gulf outside the 75% contour
- No observer data

Time variation in overlap

Bottom longline ($\times$ 10^{-3} hooks km^{-2})

- Overlap between incubation 2008—09 survey and a range of fishing years
- Only uses effort data during the incubation period (16 November to 31 January)

Fisheries overlap

Bottom longline ($\times\ 10^{-3}$ hooks km^{-2})

Fishery	Pre-egg	Incubation	Chick	Annual total
Snapper	32.65	42.15	119.48	194.28
Bluenose	5.07	27.52	62.71	95.30
Ling	1.63	17.30	14.67	33.60
Other	1.40	4.43	10.76	16.59

Note that overlap numbers are not comparable between different fishing methods

Fisheries overlap

Surface longline ($\times 10^{-3}$ hooks km^{-2})

Fishery	Pre-egg	Incubation	Chick	Annual total
Bigeye	3.84	7.89	51.04	62.77
Swordfish	0.63	0.48	4.86	5.97
Bluefin	0.02	0.00	2.20	2.22
Albacore	0	0.06	0.59	0.65
Other	0.00	0.12	1.99	2.11

Note that overlap numbers are not comparable between different fishing methods

Fisheries overlap

Trawl ($\times\ 10^{-3}$ hooks km^{-2})

Fishery	Pre-egg	Incubation	Chick	Annual total
Inshore	0.06	0.13	0.38	0.57
Scampi	0.00	0.02	0.03	0.05
Deepwater	0.00	0.01	0.03	0.04
Mackerel	0.01	0.01	0.01	0.03
Mid-depths	0.00	0.01	0.01	0.02
Flatfish	0.00	0.01	0.01	0.02
Hoki-hake-ling	0.00	0.01	0.00	0.01
SBW	0.00	0.00	0.00	0.00
Squid	0.00	0.00	0.00	0.00

Note that overlap numbers are not comparable between different fishing methods

Comparison with observed captures

Method	Fishery	Captures	Observed effort	Rate
Bottom longline	Snapper	25	1087	0.022
	Bluenose	14	340	0.041
	Hapuku	7	152	0.046
Surface longline	Bigeye	21	327	0.064
	Swordfish	1	72	0.013
Trawl	Scampi	4	1988	0.201
	Inshore	1	2159	0.046

Observed effort in 1000's of hooks for longline methods, and in tows for trawl fisheries. Rate in observed captures per 1000 hooks, or per 100 tows. Observed captures as used for estimating seabird bycatch, with some imputation of species codes.

Summary

- Fisheries with high overlap have observed captures
- No clear relationship between observed capture rate and overlap
- Considerable variation in distribution between repeated tracking surveys
- Useful analysis to carry out as part of the risk assessment purposes