

At-sea distribution and population dynamics of Black Petrel, *Procellaria parkinsoni*, on Great Barrier Island, Hauraki Gulf, New Zealand



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BLACK PETREL RESEARCH PROJECT



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- Department of Conservation (DOC) developed this long-term research project on Great Barrier Island
 - To begin a mark-recapture programme
 - To determine baseline population dynamics, including an accurate population estimate
 - To determine breeding success (and causes of failures)
 - To determine at-sea distribution of the Great Barrier Island black petrel population
 - To determine population trends (including survival and recruitment)





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Photo: Dave Boyle

- Medium-sized petrel
- All black
- Endemic to New Zealand
- On Great Barrier Island (c. 5000 birds)
- On Little Barrier Island (c. 250 birds)



Photo: Dave Boyle





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- Breed from October to June
 - Adults return to the colony in mid-October to clean burrows, pair and mate, then depart on “honeymoon”
 - Return to colony in late November to lay a single egg
 - Incubate egg for 57 days
 - Eggs hatch from late January through February
 - Chicks fledge after 107 days (from mid-April through to late June)
 - Adults and chicks migrate to South America for winter

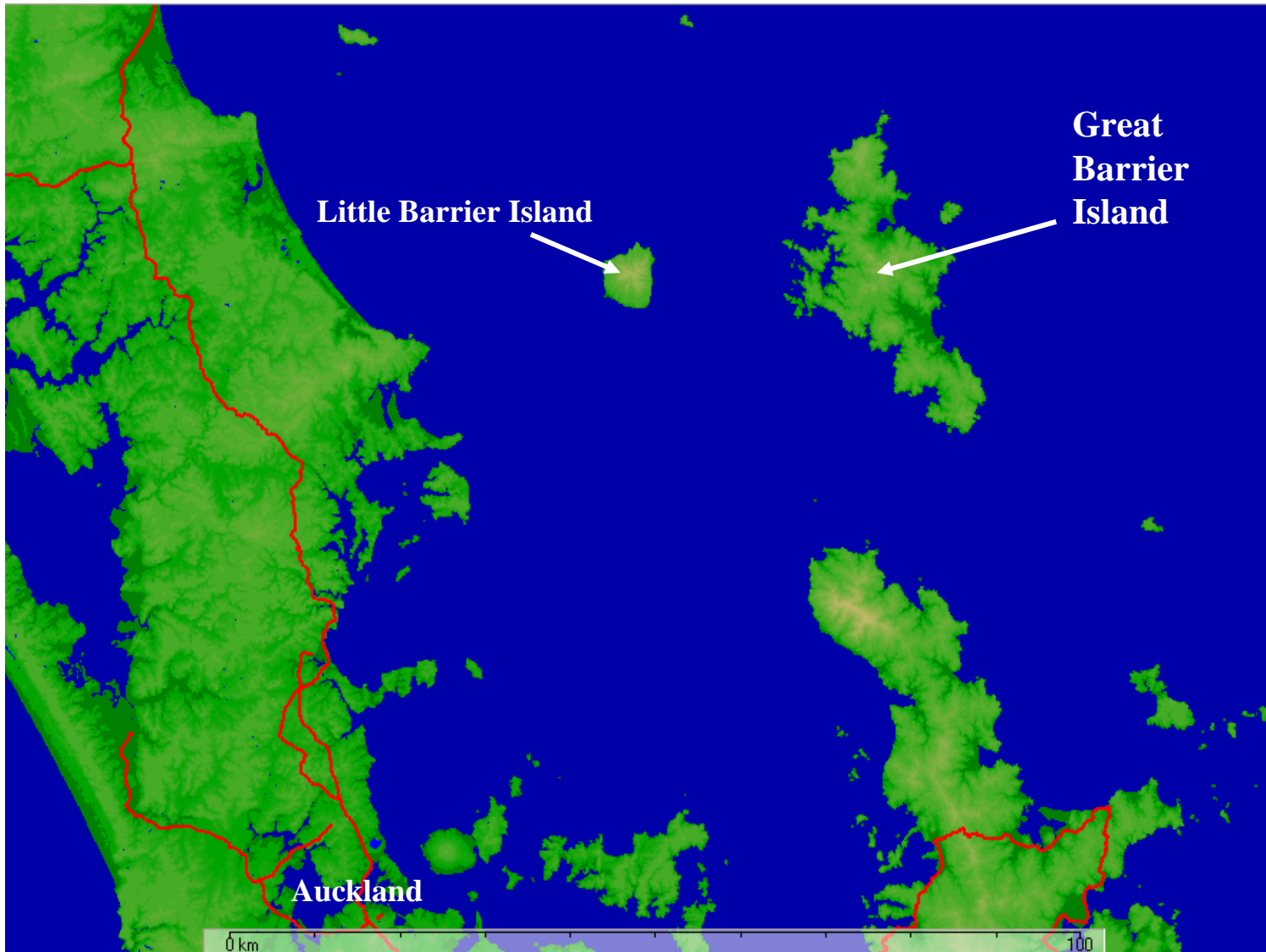




BLACK PETREL STUDY SITE GREAT BARRIER ISLAND



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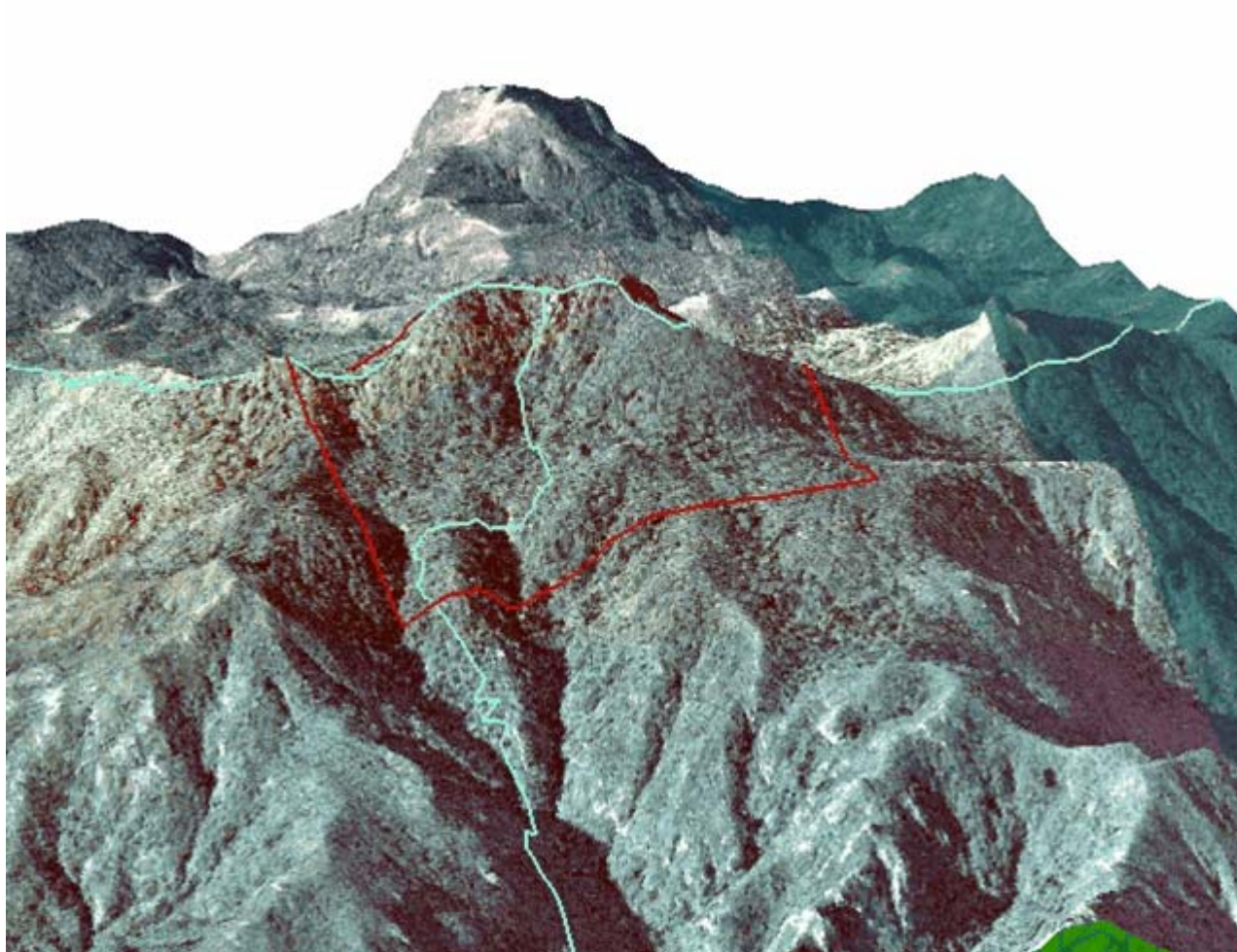


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Mount Hobson (Hirakimata)



- Covers 35 hectares around the summit.
- 377 study burrows (including 152 in nine census grids)
- Burrows are accessed through entrance or study hatch



METHODS



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TRIP 1 – MATING AND “HONEYMOON”

- October
- Mark-recapture of adults at the colony
 - Identify as many birds as possible in study area
 - Check study burrows during the day
 - Night captures at known launch sites and along the track system
- Random transect searches within study site for banded bird during day
- Retrieval of light loggers (deployed 2007/08 season)





METHODS



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TRIP 2 – EGG LAYING AND EARLY INCUBATION

- December
- Mark-recapture of adults at the colony
 - Identify as many birds as possible in study area
 - Check study burrows during the day
 - Night captures at known launch sites and along the track system
- Random transect searches within study site for banded bird during day
- Monitor study burrows for presence of egg
- Determine status of adults (breeding, non-breeding etc.)
- Determine sex of adults
- Retrieval and Deployment of light (Lotek and BAS) and GPS loggers





METHODS



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TRIP 3 – HATCHING AND CHICK REARING

- January/February
- Continue to monitor study burrows for presence of egg or chick
- Identify both partners in burrows used for breeding
- Determine causes of failure (e.g. predation, infertile egg etc.)
- Continue mark-recapture of adults at the colony
- Retrieval of all Lotek and BAS light and GPS loggers
- Random transect searches within study site for banded bird during day





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TRIP 4 – PRIOR TO CHICK FLEDGING

- Late April or Early May
- Band all surviving chicks
- Assessment for causes of breeding attempt failure
- Breeding success rate confirmed (chicks fledged from eggs laid)





RESULTS – POPULATION DYNAMICS



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BREEDING STATUS

- Number of study burrows used for breeding varies from 63-77%
- Breeding success varies from 67-84% (chicks fledged from eggs laid)

BANDING DATA

- 2516 birds have been captured to date
- 1254 banded as adults
- 1262 banded as chicks
- First record of immigration (LBI female now breeding on GBI)





RESULTS – POPULATION DYNAMICS



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RETURNED CHICKS

- 79 “chicks” have been recaptured at the colony
- Earliest age at first return is 3 years [mean 5.0 ± 0.2]
- Earliest age at first breeding is 5 years [mean 5.9 ± 0.2]
- Earliest age at first successful breeding is 5 years [mean 6.1 ± 0.3]

JUVENILE SURVIVAL

- Mean apparent juvenile survival estimate
= 0.4599 (± 0.03) during the first 3 years of life
- Mean apparent juvenile survival estimate increased to 0.8992 (± 0.04) for birds > 3 years old





RESULTS – POPULATION DYNAMICS

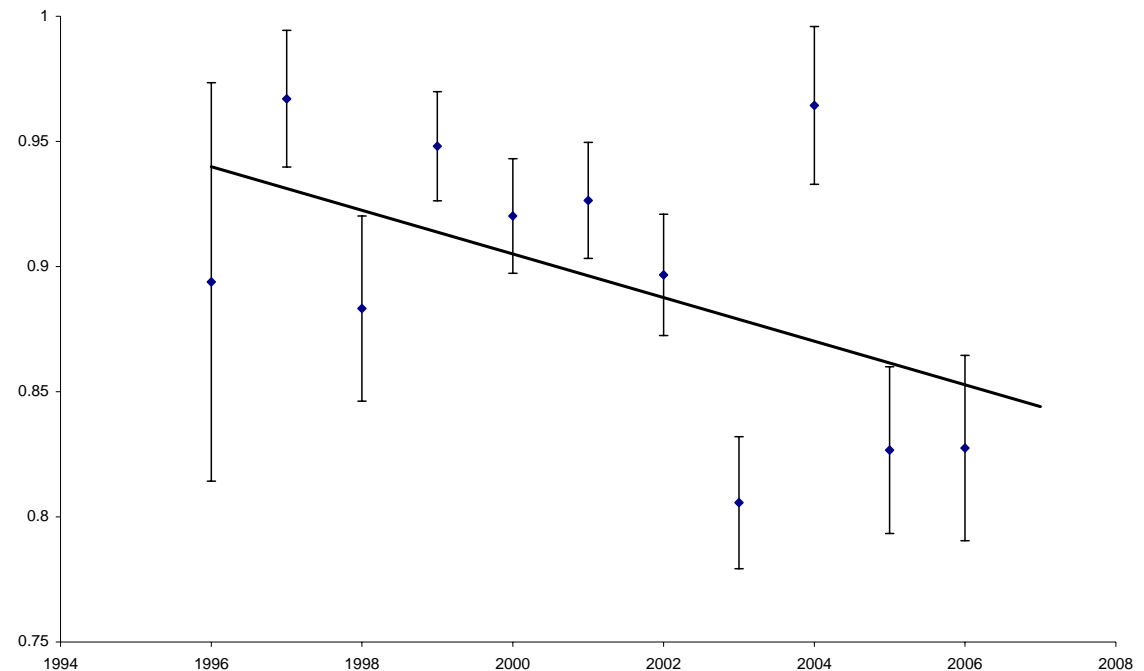


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ADULT SURVIVAL

Cormack Jolly Seber analysis [adult survival and probability of recapture model: $\Phi(t) P(t)$]

- Mean adult apparent survival = $0.8964 (\pm 0.03)$
- Mean probability of recapture from one year to the next = 0.7836 ± 0.03





RESULTS – POPULATION DYNAMICS



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DIVORCE

- Multi-state model to determine divorce rate
 - Overall divorce rate = 12.7% per year
 - Probability of breeding each year (despite divorce) = 64%

SKIPPING

- Multi-state model to determine the probability of transition from one state to another
 - Successful breeder or an unsuccessful breeder changing to a non-breeder = 0.2806 (28%)
 - But, if a bird does skip a year, it is more likely to breed successfully the following year (42% compared to 35%)





AT-SEA DISTRIBUTION



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2005/06 season

- 11 LOTEK light loggers deployed in December 2005 and retrieved in February 2006 (covering incubation and early chick rearing)
- 6 males, 3 females, 2 unknown
- 17 tracks recorded

2007/08 season

- 28 LOTEK light logger deployed in December 2007
- 10 males, 5 females, 13 unknown
- 8 retrieved in February 2008 (covering incubation and early chick rearing)
- 20 loggers left on to record migration to South America and non-breeding stage movements





AT-SEA DISTRIBUTION



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2008/09 season

- Retrieve LOTEK loggers in October 2008
- Download data and redeploy LOTEK loggers in December 2008
- Deploy an additional 10 BAS Trak light loggers and 5 GPS loggers in December 2008
- Deploy loggers on equal mix of sexes
- Retrieve all loggers in February 2009
- Download data
- Analysis of tracks in relation to fisheries, environmental data, risk of interaction etc.





RESULTS - AT-SEA DISTRIBUTION



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LOTEK LIGHT LOGGERS

- 11 birds came from nine burrows
- Loggers worn for between 42 and 57 days
- Showed no adverse affects
- 17 foraging trips were recorded
 - 6 birds made two foraging trips
 - 5 birds made only one long foraging trip
 - 65% of the trips were longer than 15 days
 - Maximum trip duration was 39 days
 - Maximum trip distances varied from 1487 to 9850 km
 - Both males and females had variable foraging areas



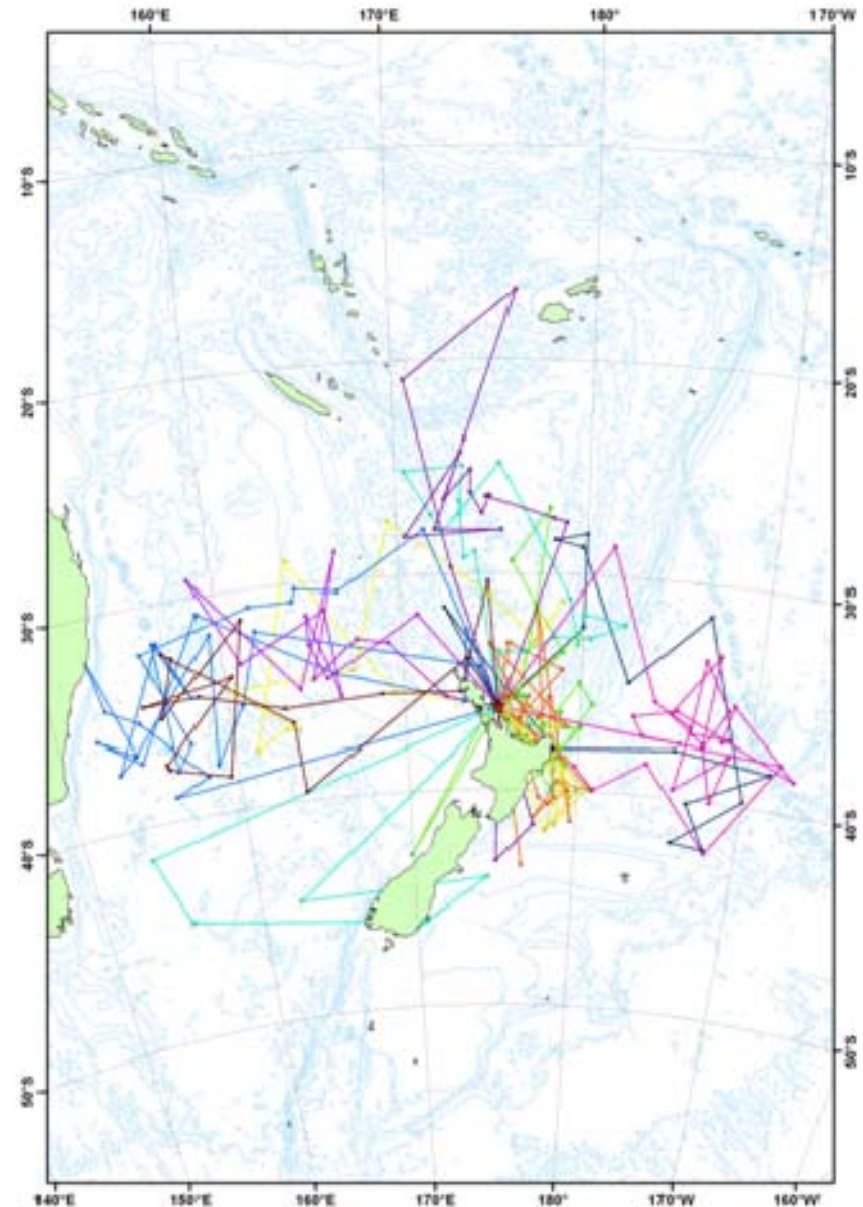


RESULTS – AT-SEA DISTRIBUTION



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- Mainly travelling to the west and east of northern New Zealand
- 1 male travelled much further south than the other birds
- 1 male travelled north of New Zealand (to Fiji)
- 4 birds approached the Chatham Rise
- 4 birds travelled towards the Australia
- 5 birds foraged in the Bay of Plenty and East Cape area
- Showed distantly different foraging patterns



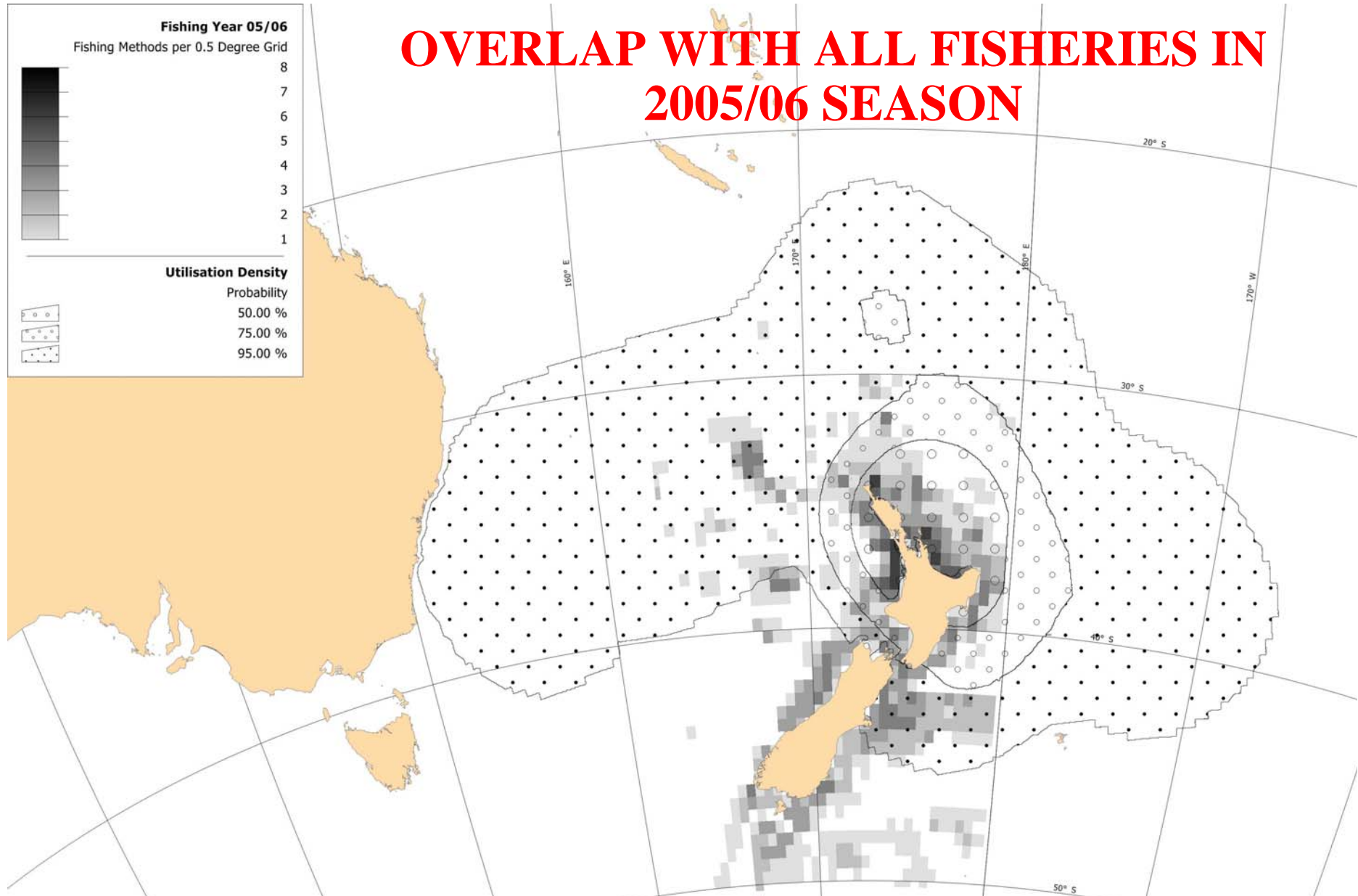


RESULTS – AT-SEA DISTRIBUTION



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OVERLAP WITH ALL FISHERIES IN 2005/06 SEASON



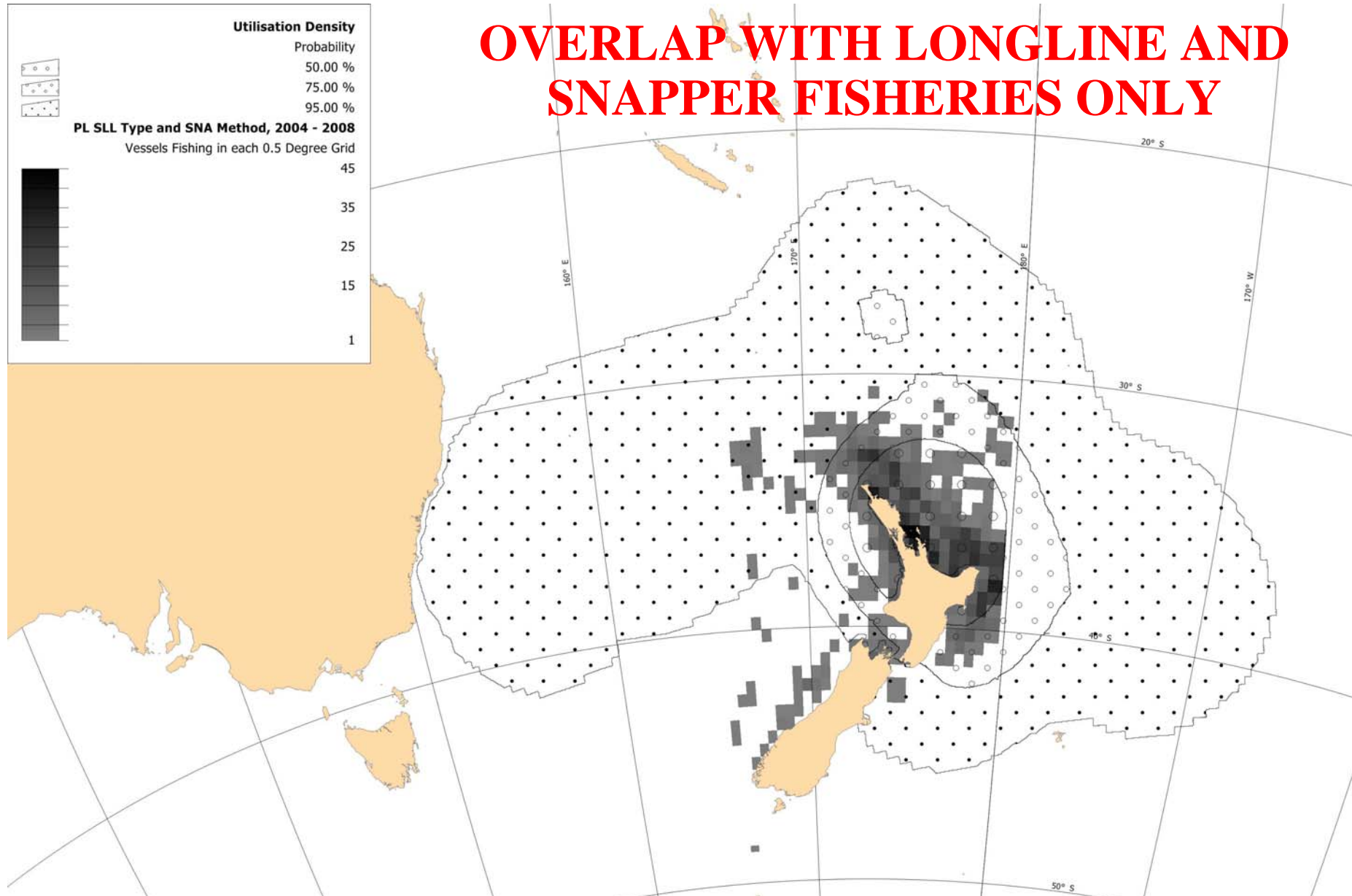


RESULTS – AT-SEA DISTRIBUTION



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OVERLAP WITH LONGLINE AND SNAPPER FISHERIES ONLY





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STILL TO COME

- Clarifying and filtering these preliminary results
- Gathering more foraging information this season using LOTEK and BAS Trak light & GPS loggers
- Relating logger results to environmental features (sea-surface temperature, bathymetry, chlorophyll, etc.)
- More population dynamics – including details of age of first return, age of first breeding, survival of adults and juveniles, population status
- Relate foraging behaviour and at-sea distribution to determine the level of risk from fisheries interaction





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- **Annual reports are published by DOC and are available from www.doc.govt.nz as PDF files**

