Risk of commercial fisheries to seabird populations within the New Zealand EEZ

Yvan Richard*, Edward Abraham*, and Dominique Filippi†

*Dragonfly Science
† Sextant Technology Ltd

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Introduction

New Zealand: “seabird capital of the world”

- 85 species, many of them endemic
- Many species are listed as threatened, and their interaction with fisheries may be one of the major causes
- Level-2 risk assessment, contracted by the Ministry of Fisheries (now MPI)

Introduction

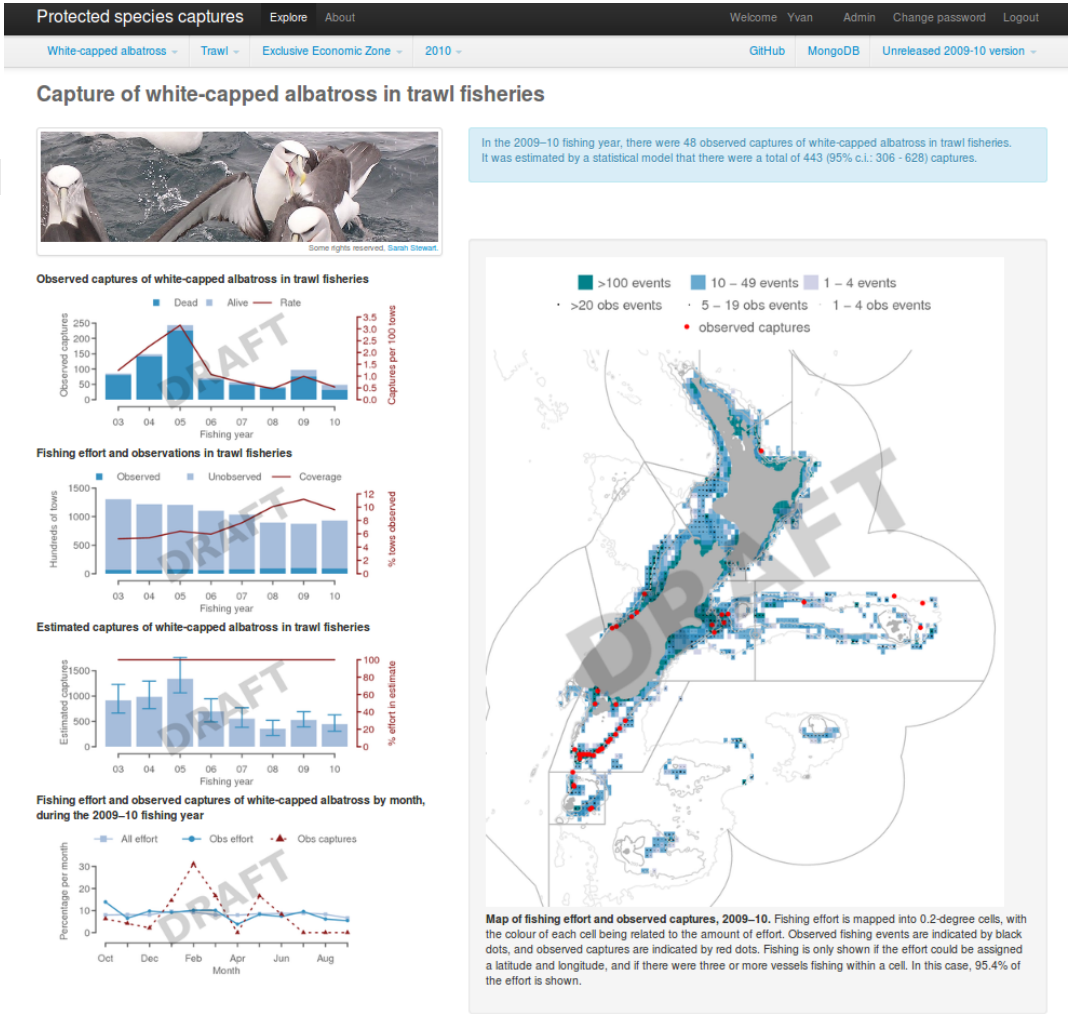
Level-2 risk assessment

- Built up on Sharp (2011) and Waugh (2009)
- Explicit parameter uncertainty
- Compared estimated fisheries mortality with estimated population productivity
- Only commercial trawl, bottom and surface longline fishing
- Species and fishery type level (64 species, 16 fishery groups)
- Semi-quantitative (lack of data to build population models)

Seabird bycatch

- A lot of work on estimating annual captures
- So far on a few species with enough observations
- http://data.dragonfly.co.nz/psc publicly available soon

- Demographic impact?
- Poorly observed fisheries?



Estimating fatalities

Data

- From bird captures recorded by government observers
- In trawl, surface & bottom longline fisheries
- Data between 2003/04 and 2008/09

Vulnerability

- Captures assumed to be proportional to the density of birds at each fishing event.
- Species vulnerability to capture, varying among fisheries.

$$C_{fgs} \sim \text{Poisson}(\mu_{fgs})$$
$$\mu_{fgs} = v_{gs} d_{fs} N_s E_f$$

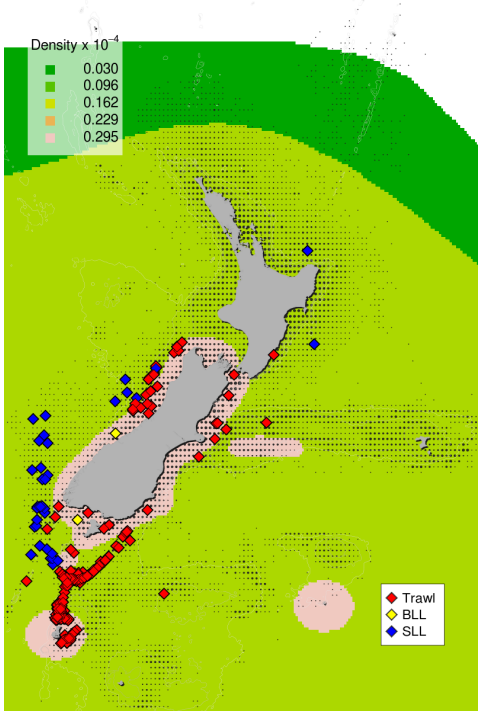
μ_{fgs}	mean captures for fishing event f in fishery group g and for species s
v_{gs}	vulnerability of species s to captures in fishery group g
$d_{fs}N_s$	number of birds of species s present at fishing event f
E_f	fishing effort during event f

Bird density

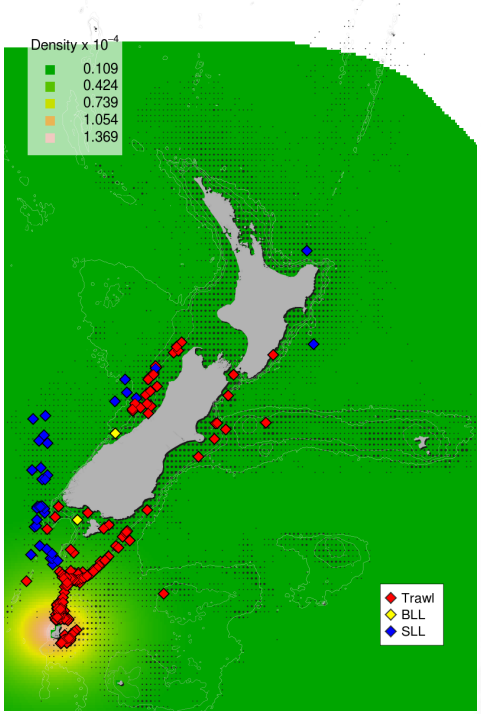
- Used NABIS, Birdlife Tracking database, data on colonies.
- Two distributions: with and without colonies.

Example: White-capped albatross (*Thalassarche steadi*).

Without colonies



With colonies



Potential annual fatalities

Estimating observable captures

- Fitted model to predict captures on unobserved fishing events

Estimating potential fatalities

- Included cryptic mortality
- Multipliers based on Watkins et al. (2008) & Brothers et al. (2010)
- Depends on type of seabirds

Estimating population productivity

Potential Biological Removal (PBR)

- based only on population size and maximum growth rate
- designed to maintain populations above their Maximum Net Productivity Level (MNPL)
- developed and tested for marine mammals

$$PBR = \frac{1}{2} r_{\max} N_{\min} f$$

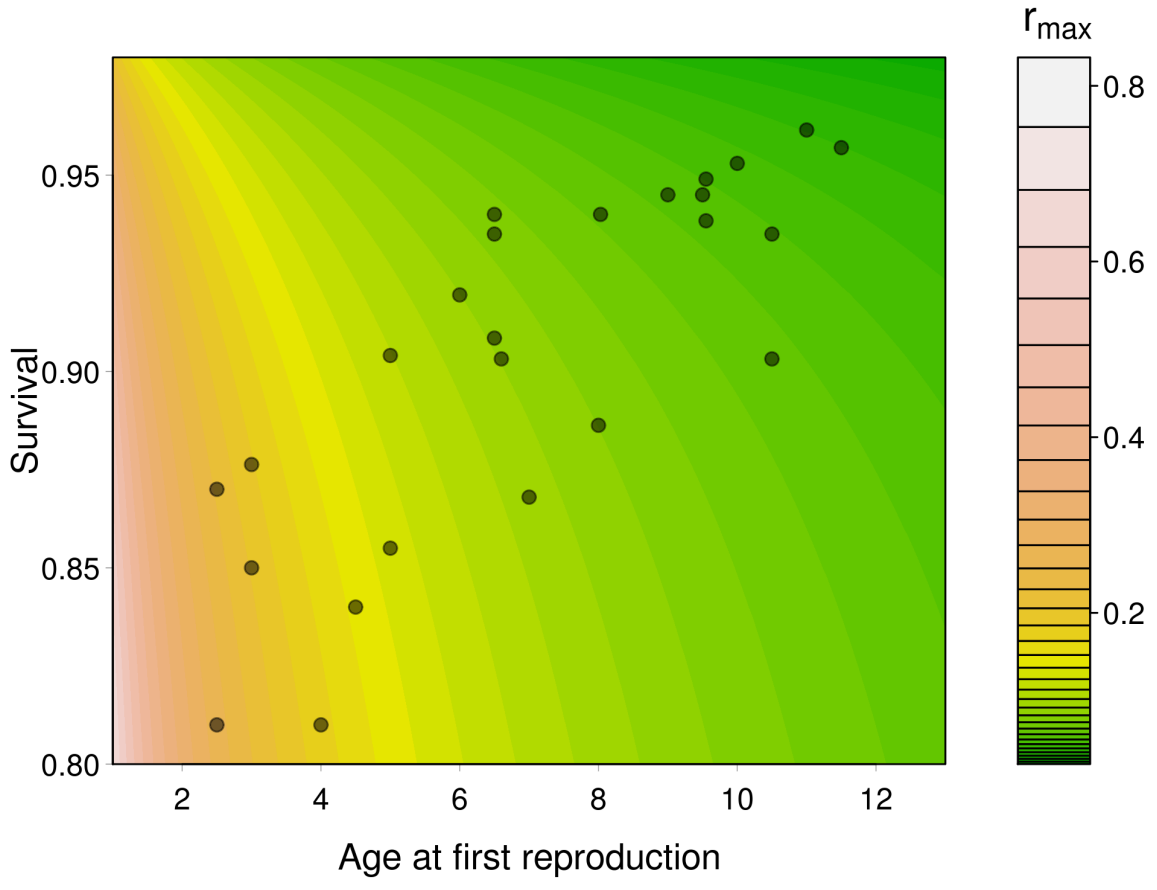
$N_{\min}$	conservative estimate of population size
$r_{\max}$	maximum population growth rate
f	recovery factor

Maximum growth rate - r_{max}

- Life history strategies, allometry. Niel & Lebreton (2005)
- Estimated from survival rate (S) and age at first reproduction (A)

$$\lambda_{max} = \exp\left[\left(A + \frac{S}{\lambda_{max} - S}\right)^{-1}\right]$$

$$r_{max} = \lambda_{max} - 1$$

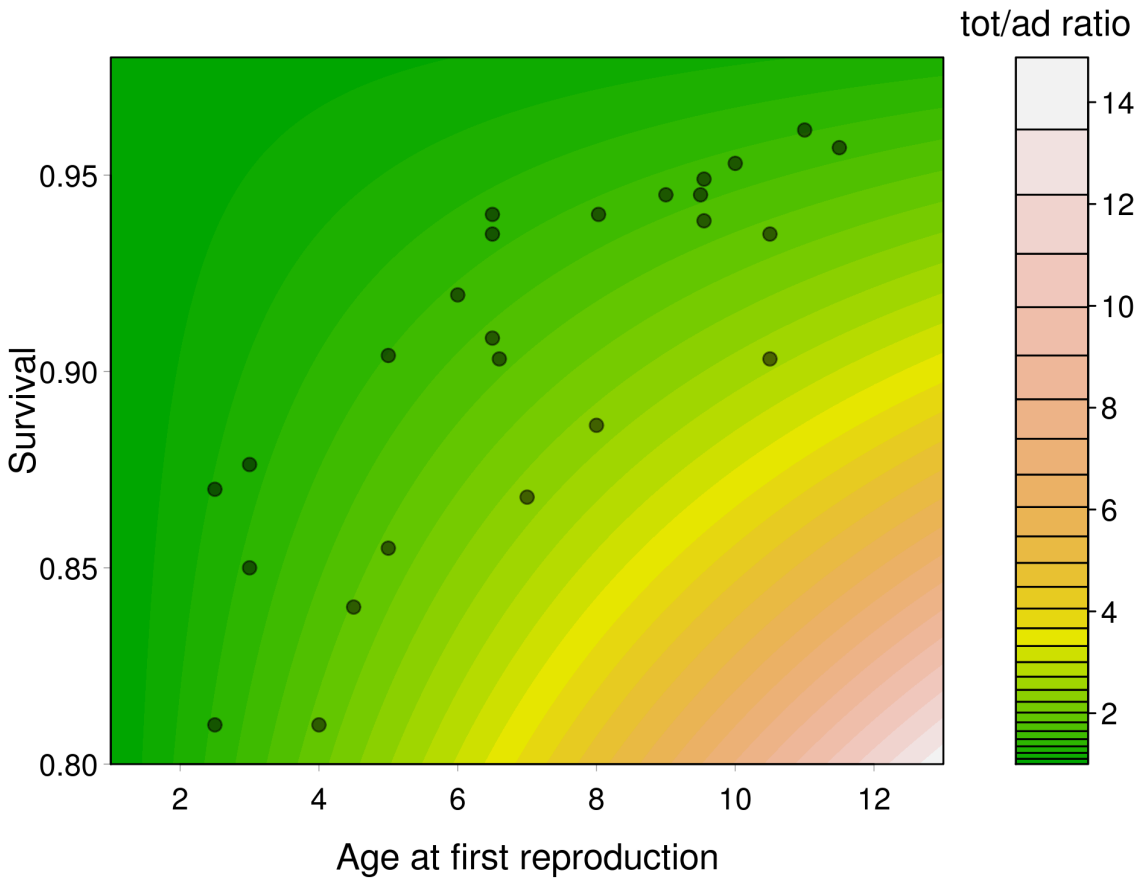


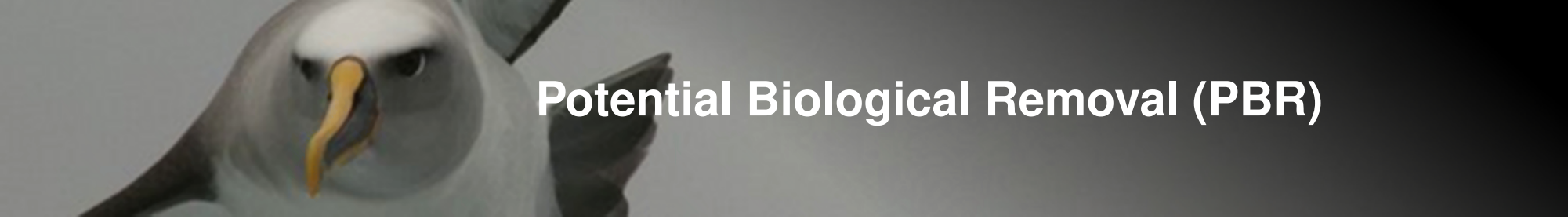
Population size - N_{min}

- Estimated from survival rate (S) and age at first reproduction (A)
- N_{min} by taking the lower quartile of the distribution of N_{BP}

$$\rho = S^{1-A}$$

$$N_{tot} = \frac{2N_{BP}}{P_B}\rho$$

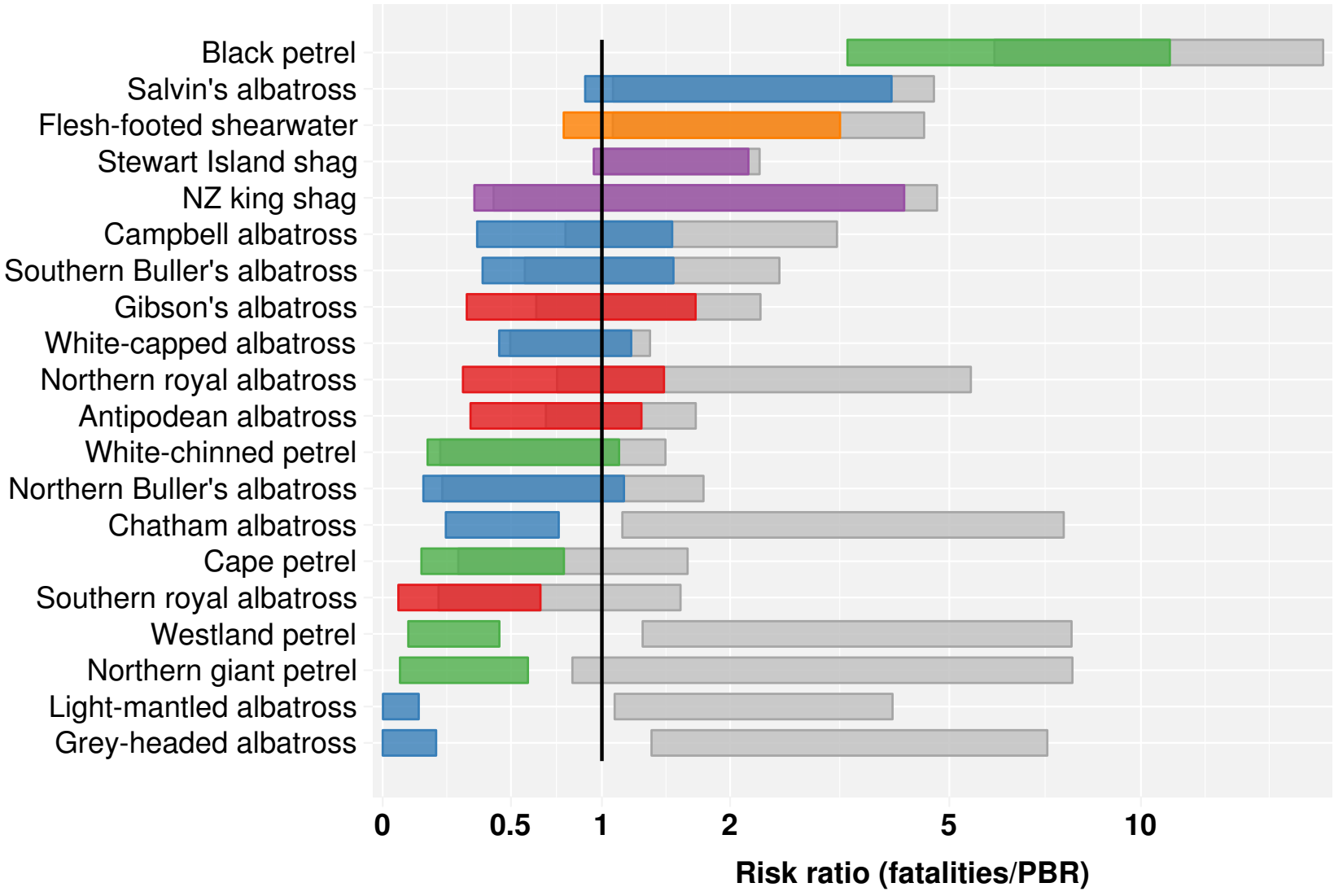




Potential Biological Removal (PBR)

- PBR calculated only from S, A, P_B, and f
- Estimates of S, A, and P_B from literature, groomed to keep best and most recent ones
- 205 final estimates, 65 using proxy species
- f defined according to IUCN red list status, from 0.1 (Critically Endangered) to 0.5 (Least Concern)
- Uncertainties from literature or created to match typical values

Species at risk



Side analyses

Sensitivity to uncertainties

- Inshore fisheries poorly observed
- Adult survival rate and number of annual breeding pairs

Time variation

- Captures in trawl fisheries has decreased, following fishing effort and the use of mitigation devices
- Possible increase in surface longline fisheries

Limitations

Some intrinsic problems...

- Wrong species identification
- Movement in/out the NZEEZ
- A few fisheries not included
  - e.g. recreational, setnet fisheries
- Other sources of mortality not taken into account underestimate risk
  - e.g. harvest at colonies, pollution, indirect trophic effects
- PBR might often be overestimated
  - r_{max}, adult ratio

Conclusions

- The species the most at risk are not the most caught
- Black petrel clearly at risk, urgent action needed
- Some fisheries with obvious lack of observations
  - Inshore fisheries: especially flatfish trawl, small bottom longline
- Some flaws potentially important
- Need international cooperation
- Risk assessments can guide management of research and fisheries

Thank you

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The report can be downloaded from:
http://fs.fish.govt.nz/Page.aspx?pk=113&dk=22912