Finding suitable habitats for the recolonising NZ sea lion

Veronica F. Frans, MSc.

Dept. Wildlife Sciences, Georg-August University Göttingen, Germany

Current address: Dept. Fisheries and Wildlife, Center for Systems Integration and Sustainability, Michigan State University, USA

Dr Amélie Augé

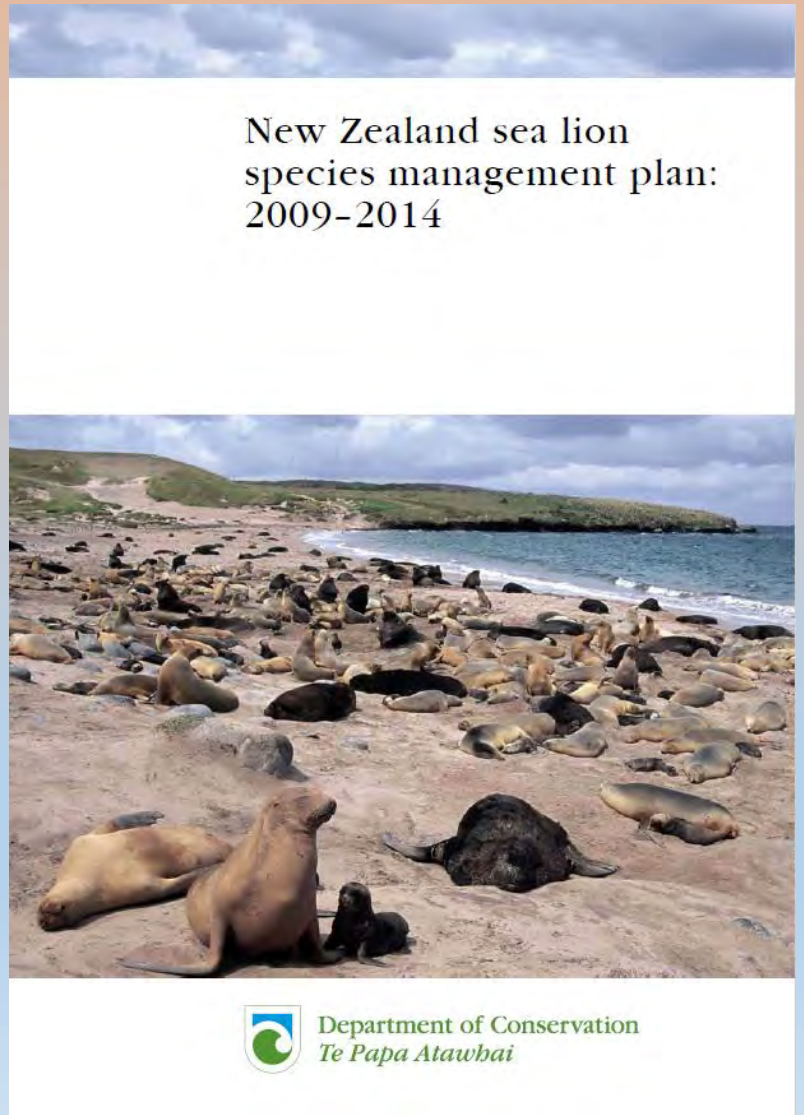
Northland Regional Council, Whangarei, NZ

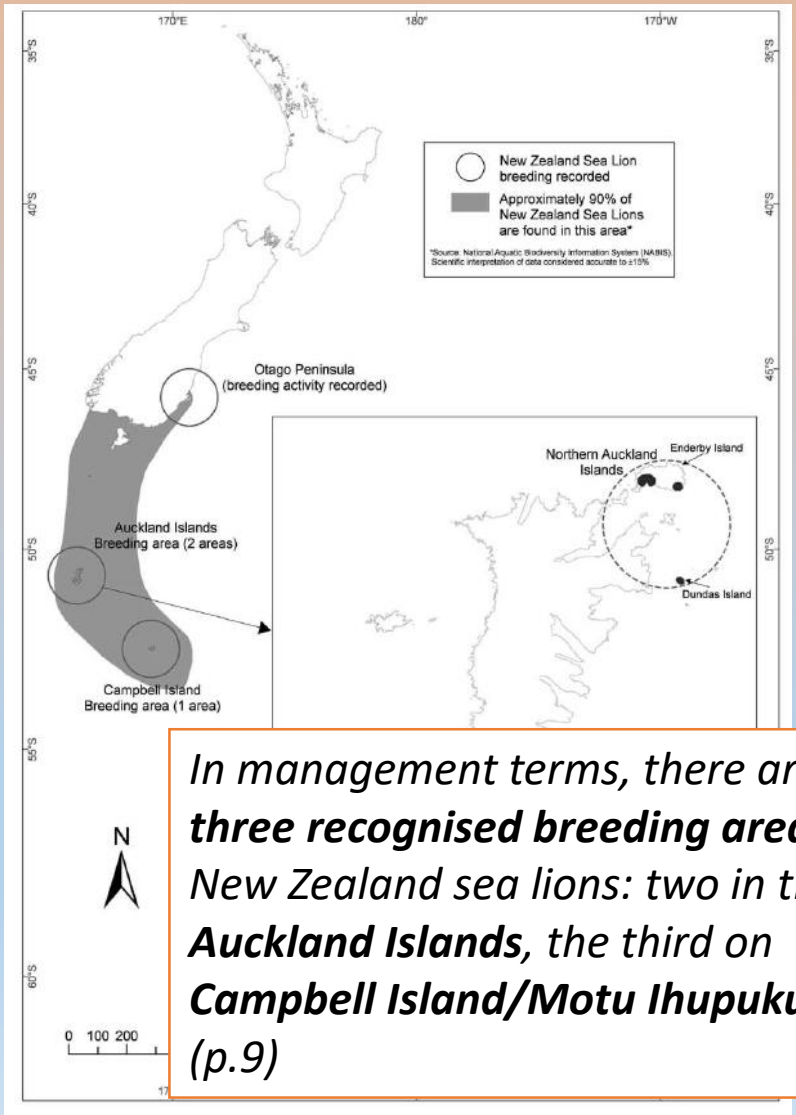
Conservation Services Programme and New Zealand sea lion Threat Management Plan – Technical Working Group – Wellington, 2019

Background

Recolonisation and research objectives

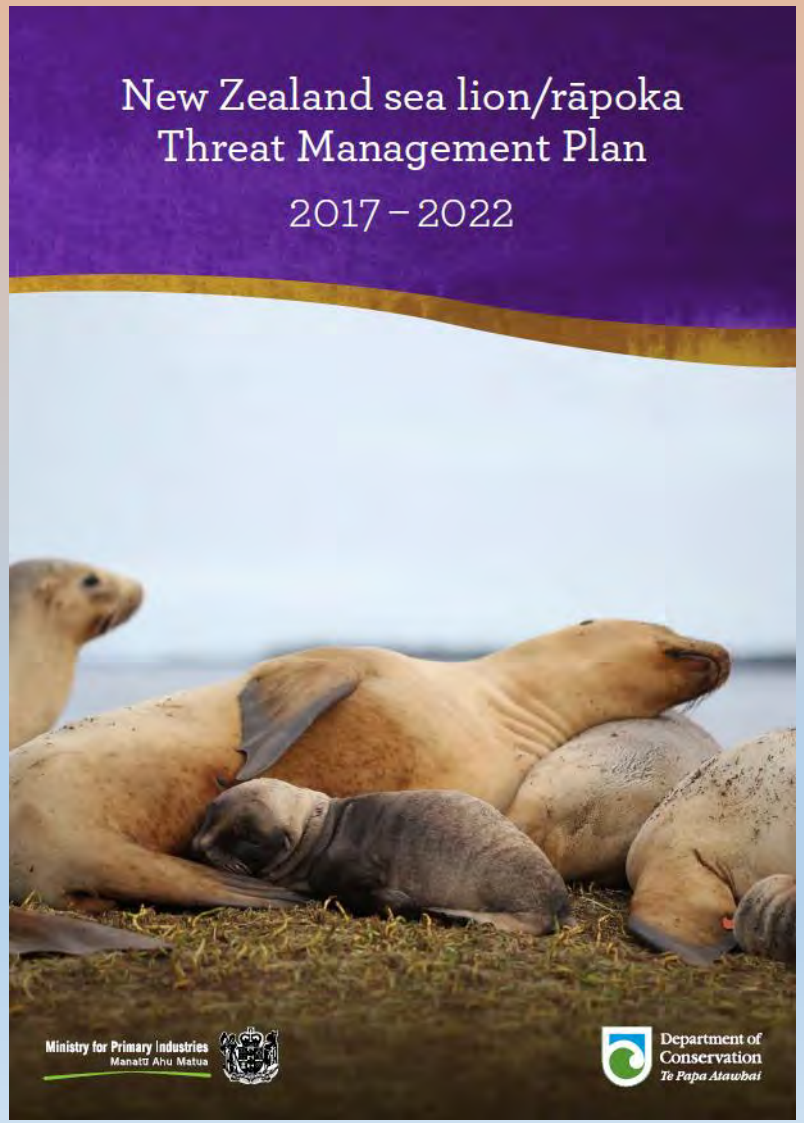
Background

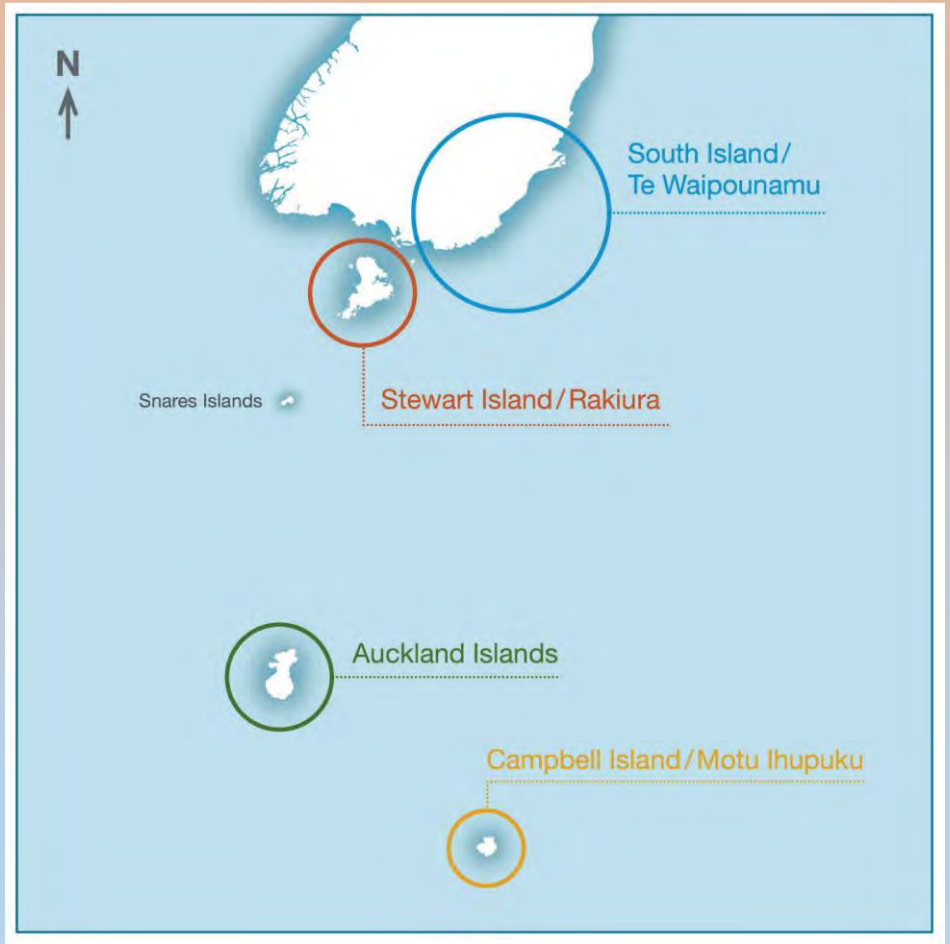




In management terms, there are ***three recognised breeding areas*** *for New Zealand sea lions: two in the* ***Auckland Islands****, the third on* ***Campbell Island/Motu Ihupuku****… (p.9)*

Background





Current New Zealand sea lion breeding sites. *(p.8)*

Background

Site specific measures of success

Stewart Island / Rakiura

Support population growth to achieve breeding colony status:

a. Pup counts remain higher than 33 for 5 years in a row, qualifying this site as a new breeding colony

b. Pup production continues to increase to allow for colonial breeding

c. There are no cases of deliberate human-caused mortality

d. Public involvement in the conservation of sea lions increases.

Auckland Islands

Pup production continues to increase from the 2014 count:

a. Adult female survival rate and pup survival rate improve

b. Pup numbers are consistently above 1,575 (2014 pup count) and ideally over 1,965 (2017 pup count).

South Island / Te Waipounamu

Support population growth:

a. Pup counts along this stretch of coastline increase to above 10 per year, eventually reaching 33, on track to achieving breeding colony status

b. There are no cases of deliberate human-caused mortality

c. Public involvement in the conservation of sea lions increases.

Campbell Island / Motu Ihupuku

Reduce pup mortality and support population growth:

a. Pup counts are consistently at or above 696 (2015 pup count)

b. Pup mortality rates are consistently lower than 40% per annum, and

c. Frequency and consistency of monitoring of sea lions has increased.

Background

CONGRATS FOR YOUR EFFORTS!

… as sea lions recolonise, where will they end up next?

Study objective

- To determine suitable sites on the mainland for NZ sea lion colonies using species distribution models.

Outline

- Modelling NZ sea lion habitat
- Model training results
- Mapping suitable sites on the mainland
- Accounting for potential human impacts
- Next steps
- Concluding remarks

- Conversation with the TWG (last 10-15 minutes)

Modelling NZ sea lion habitat

Model considerations and implementation.

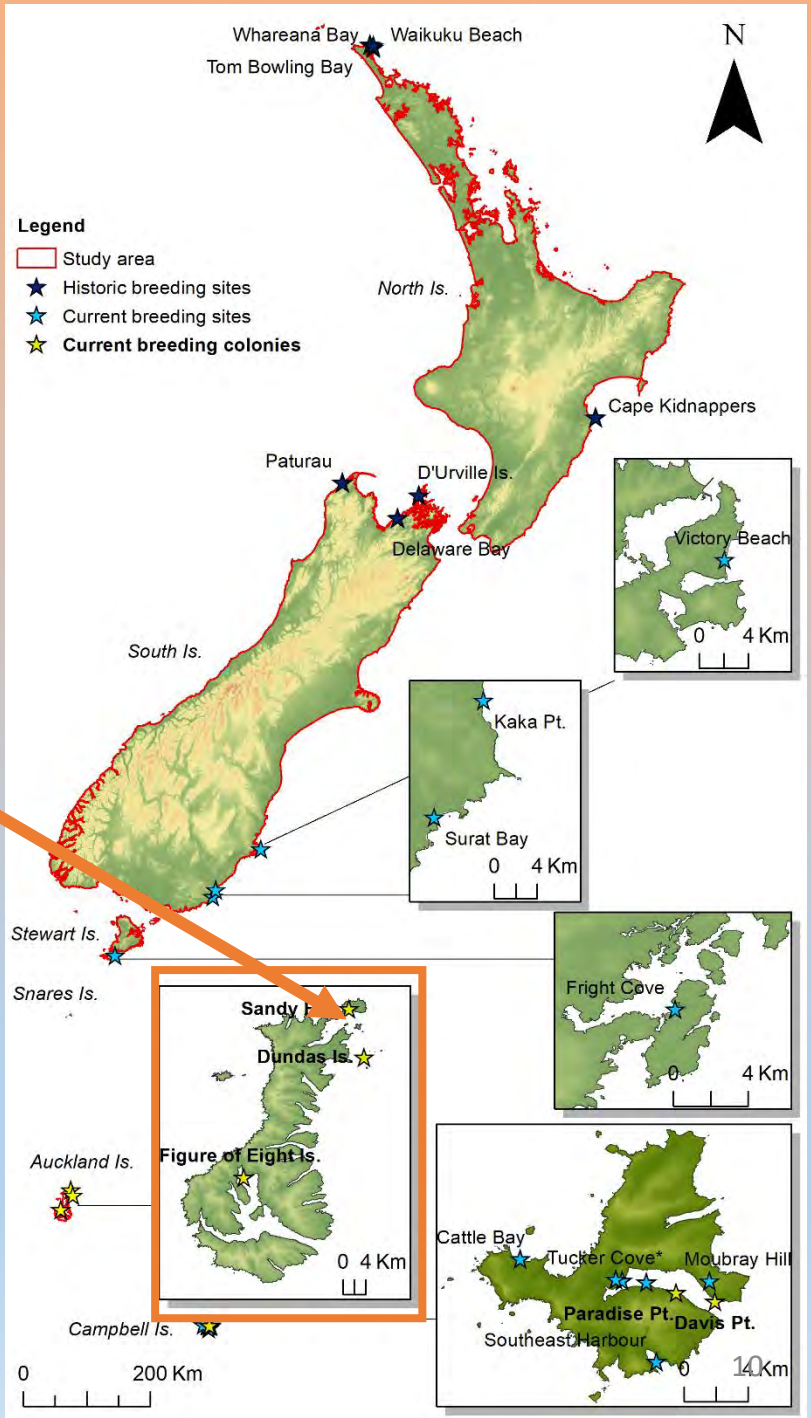
Areas of focus

Model training area:

- Auckland Islands
- **Sandy Bay population**

Model projection area:

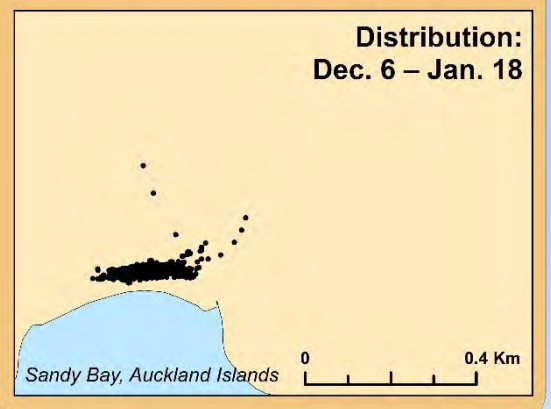
- Mainland
- + Stewart Island



Species focus: female breeding behaviour

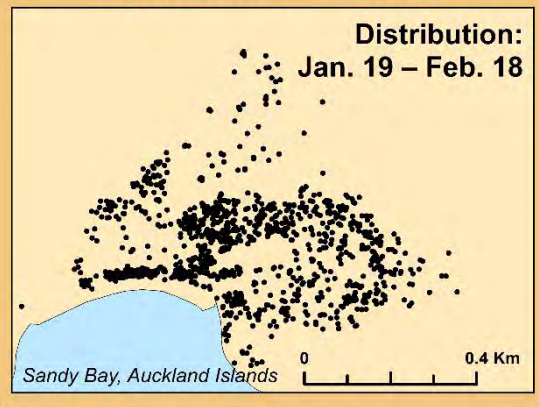
BREEDING

- Slightly before and after pups are born.
- Female preference for sand.
- ≤ 100 m from the coast.
- Densely aggregated dispersal
- (85 females / 100 m^2).



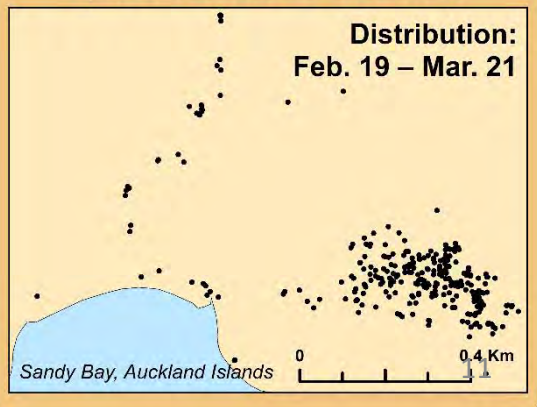
TRANSITION

- Females begin to move pups inland.
- Preference for grassy and forested areas behind the beach.
- Less dense dispersal
- (1 female / 100 m^2).



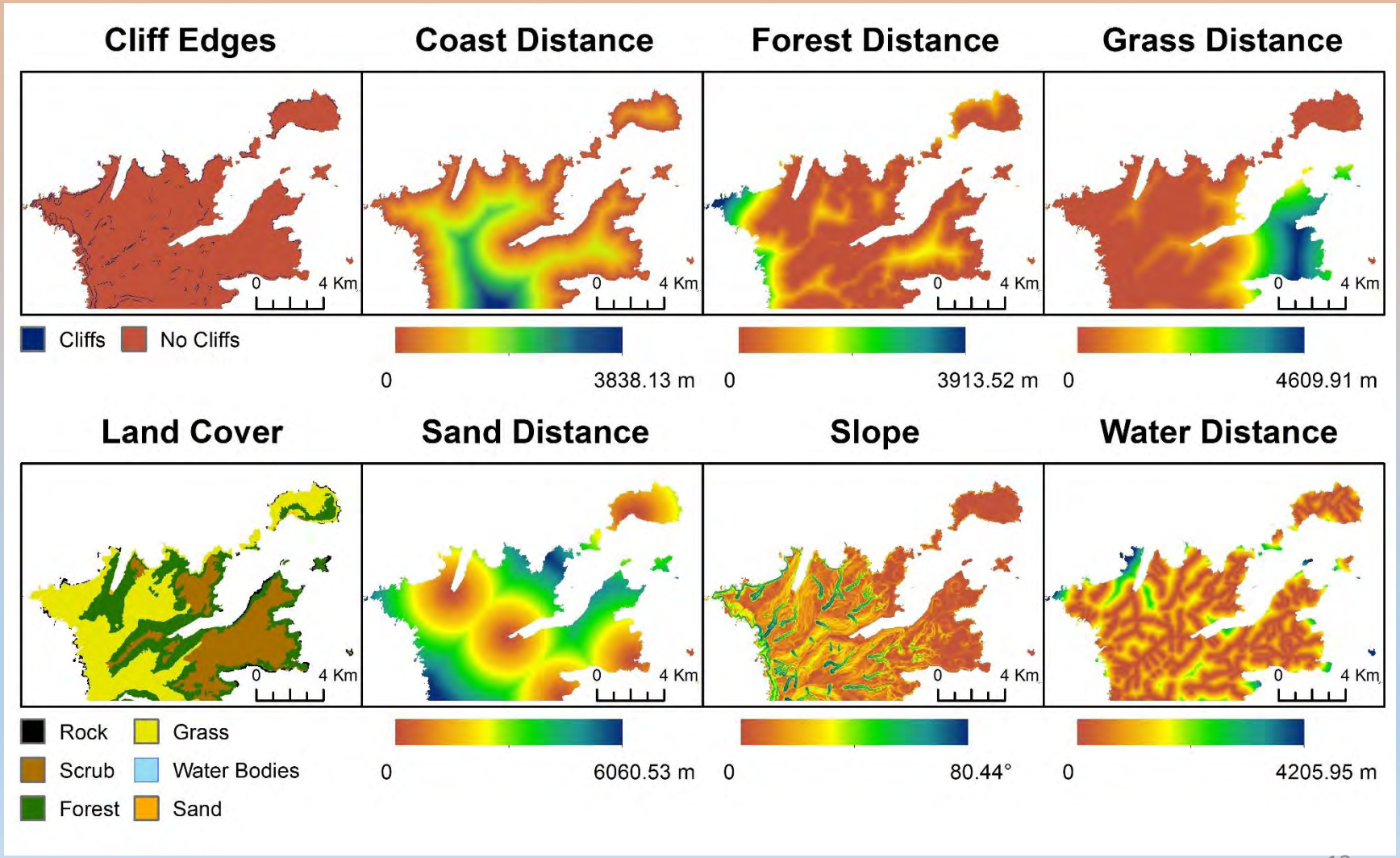
DISPERSION

- Female and pup move 1100-2000 m inland.
- Preference for forest, or they swim away from the breeding site entirely.
- Completely dispersed
- (0.01 females / 100 m^2).



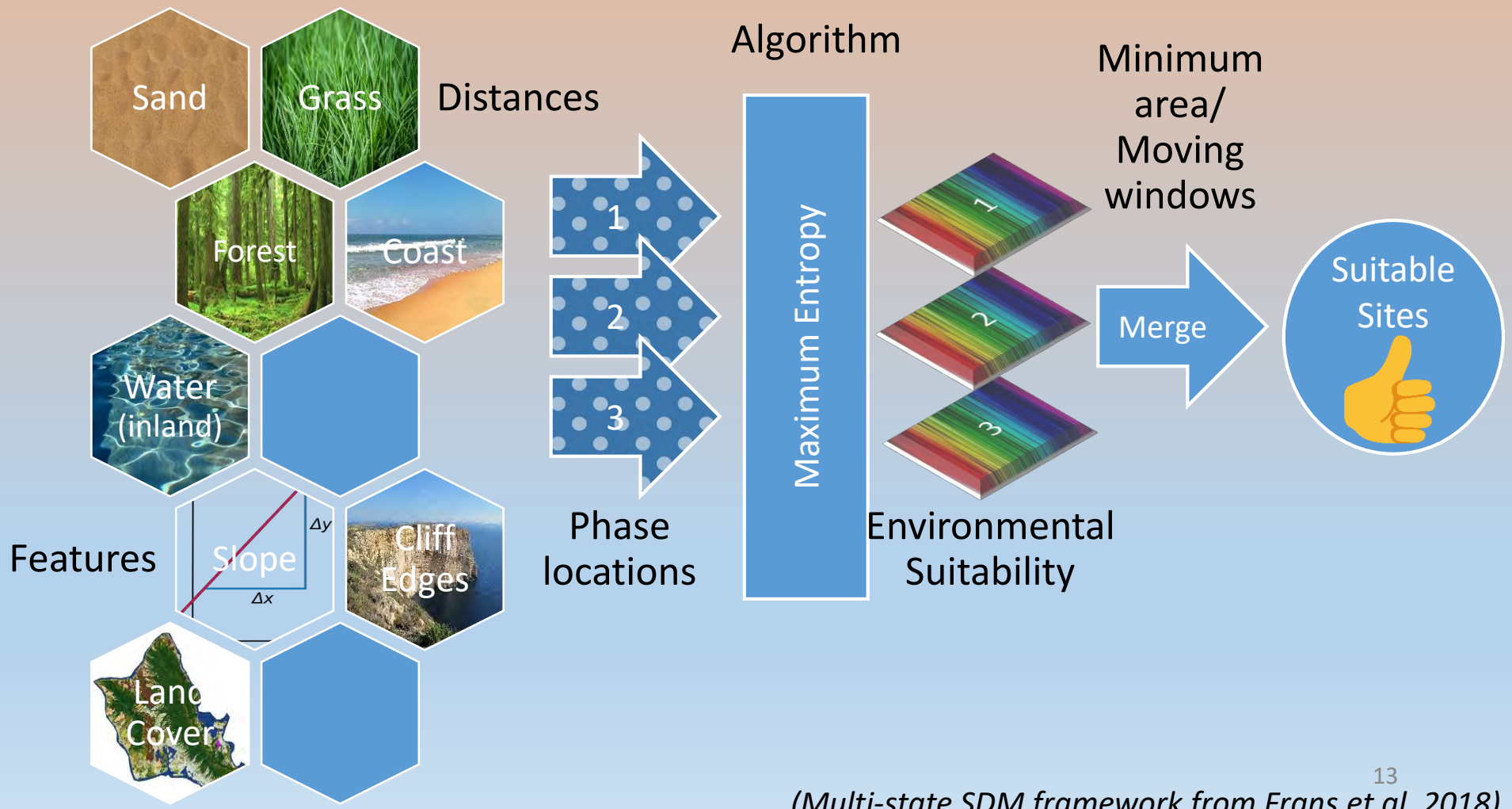
(data from Augé et al. 2012 ; photo credit: A. Augé)

Defining habitat features



(Variable selection based on Augé et al. 2012)

Habitat modelling: multi-state SDM

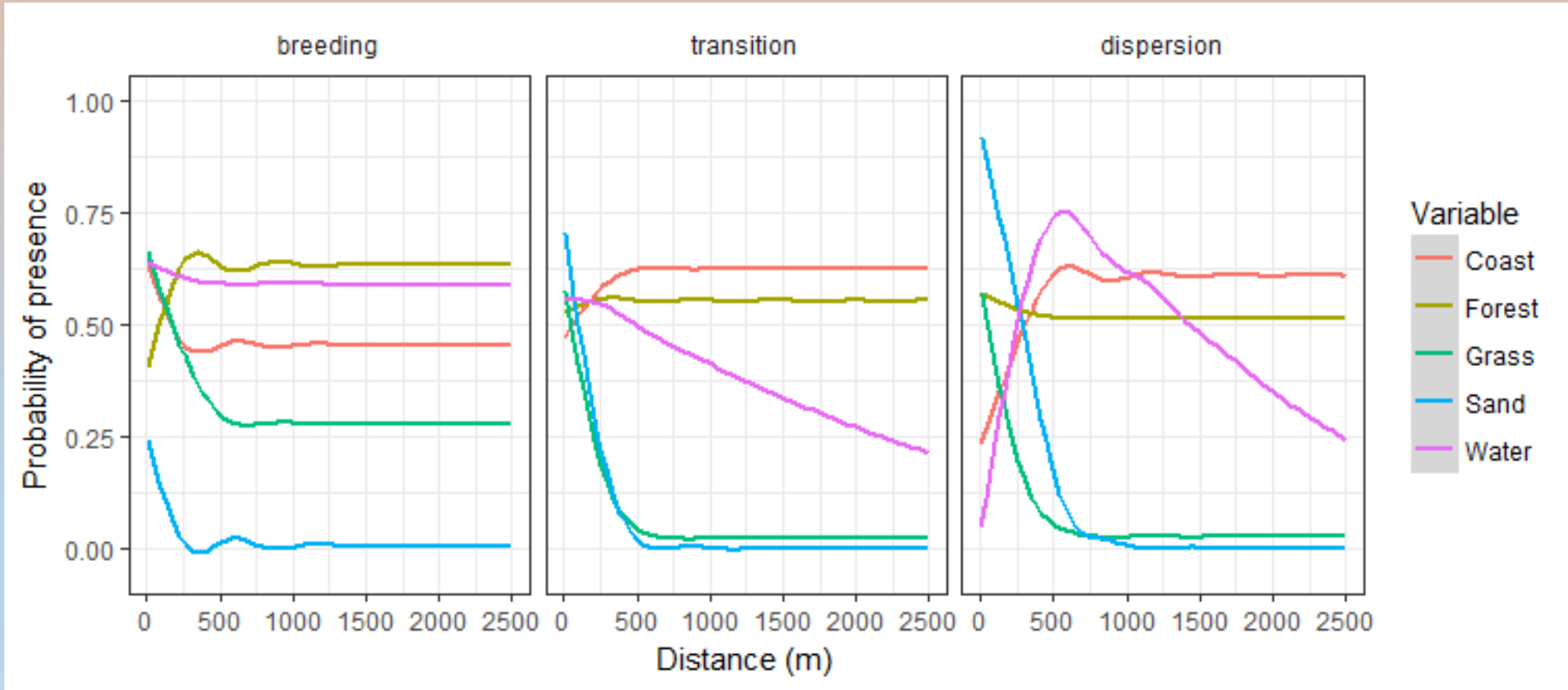


(Multi-state SDM framework from Frans et al. 2018)

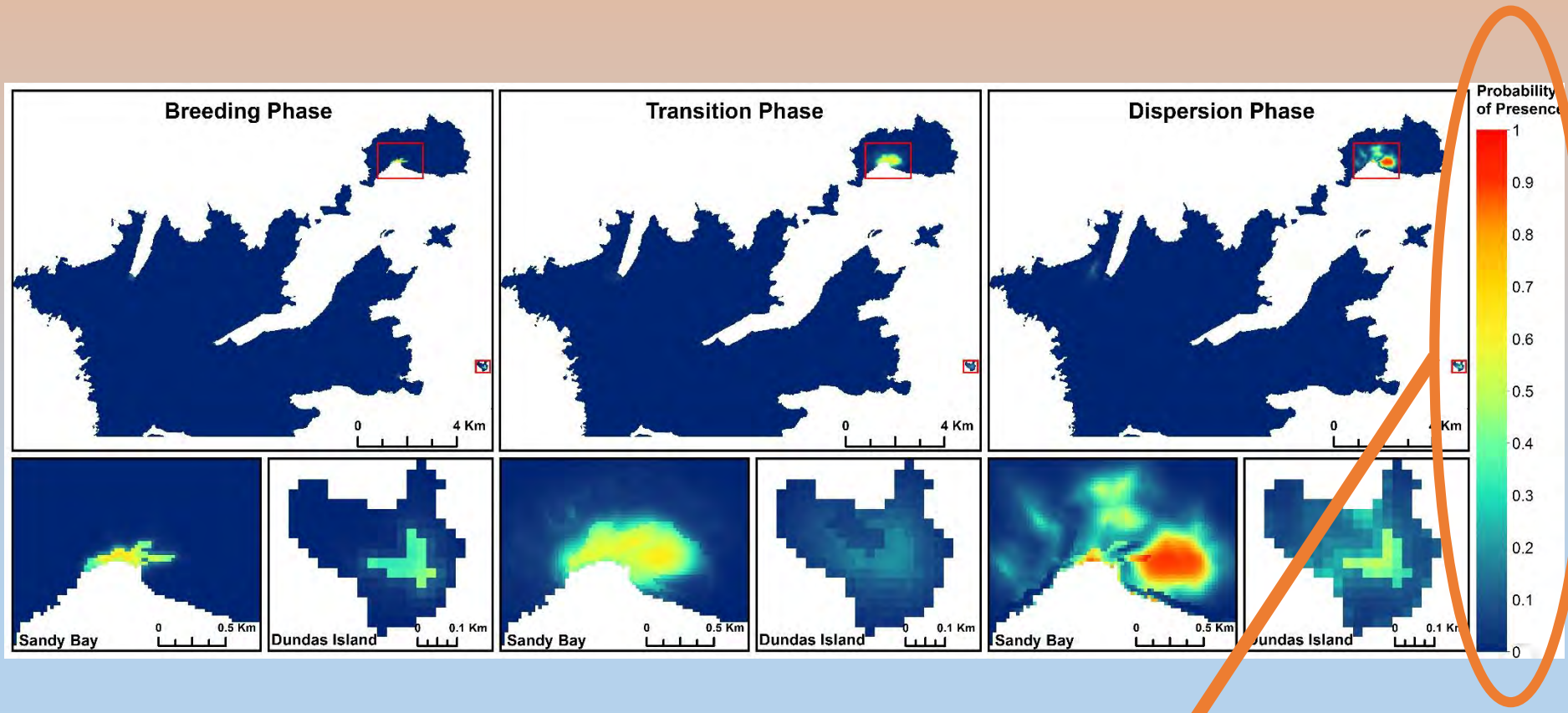
Model training results

Capturing NZ sea lion ecology and testing on existing colonies.

Response to habitat features



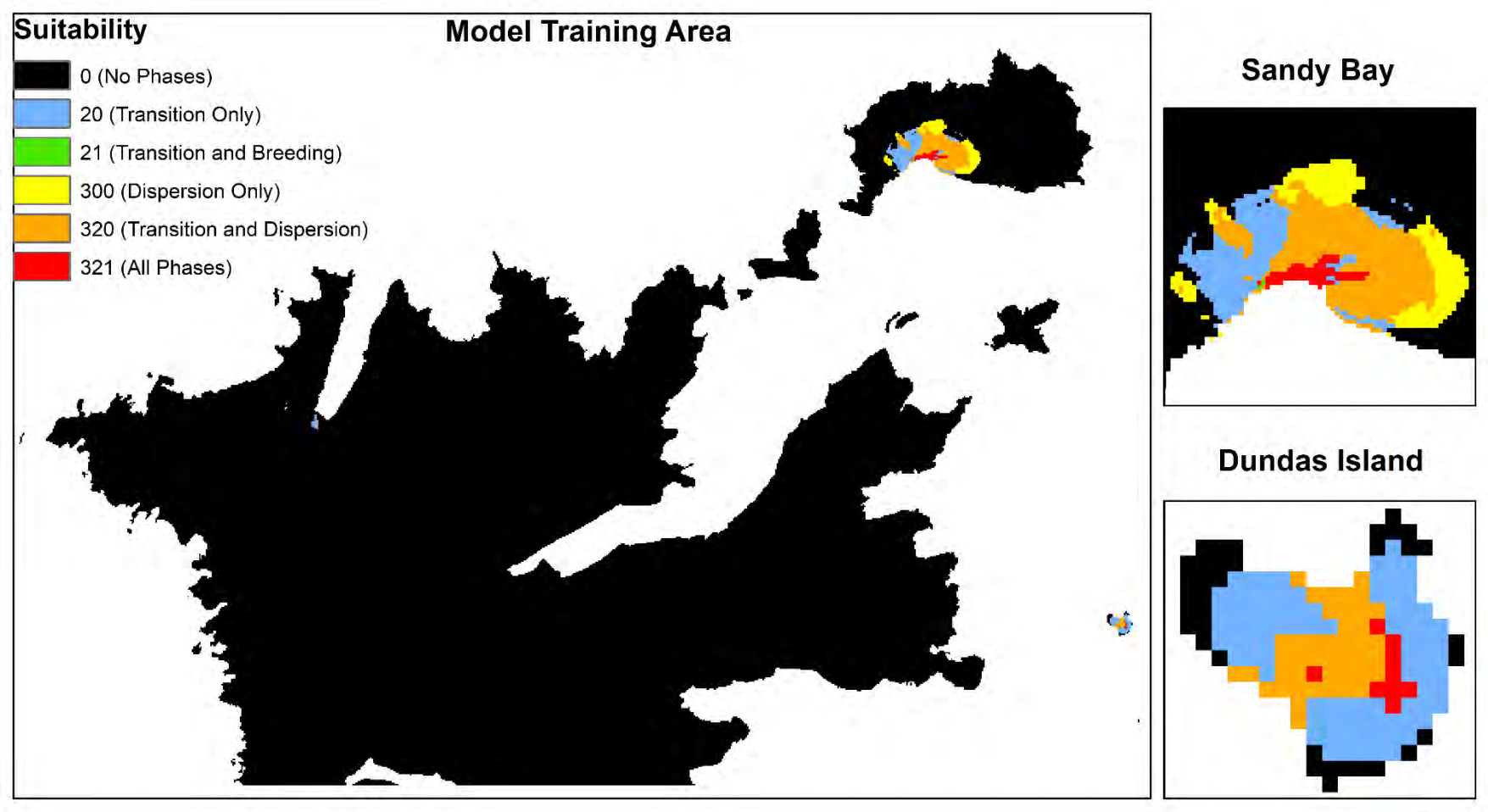
Suitability by behavioural state



Next:

Apply statistical thresholds
(suitable/not suitable or low/high probability)

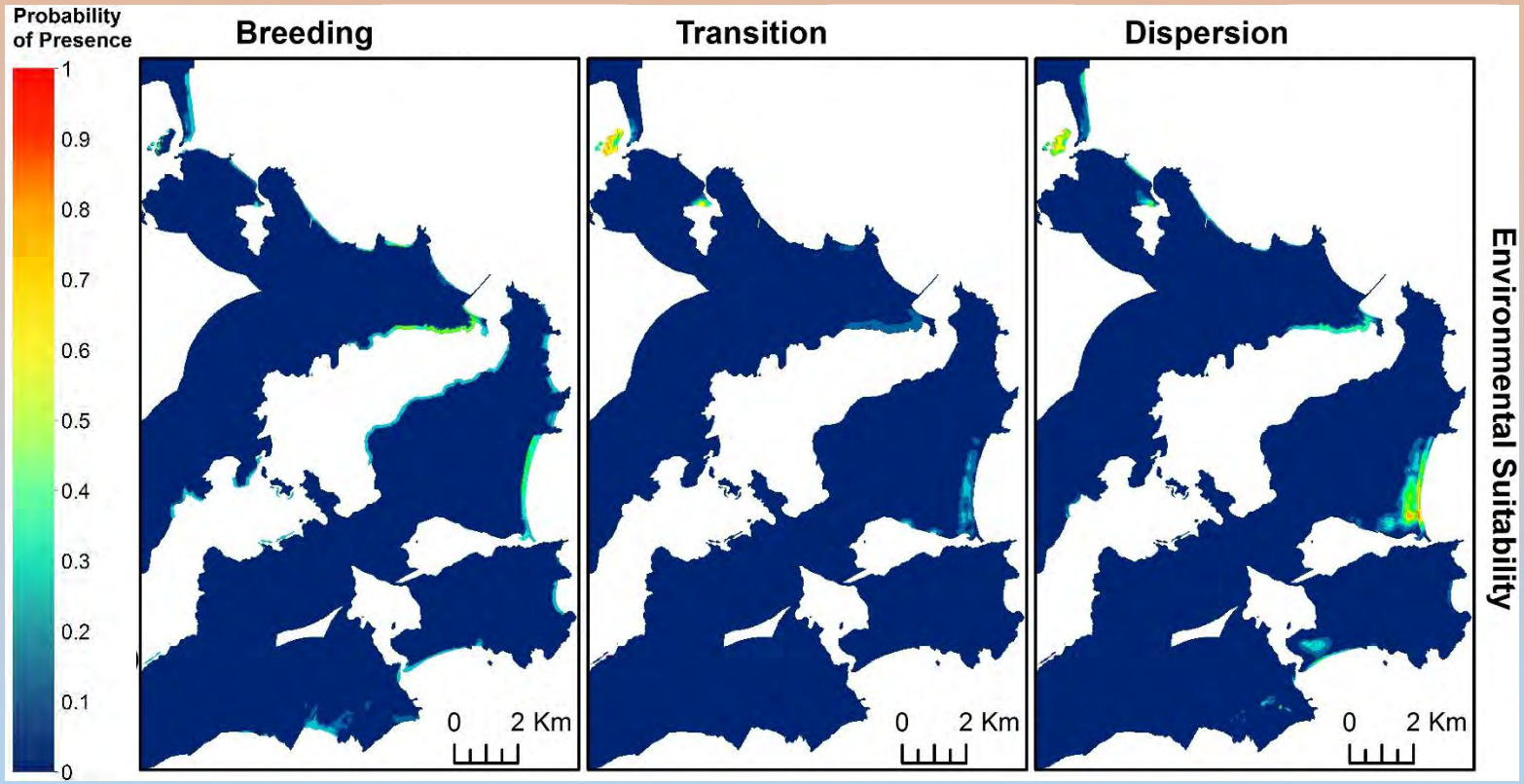
Combining states of movement



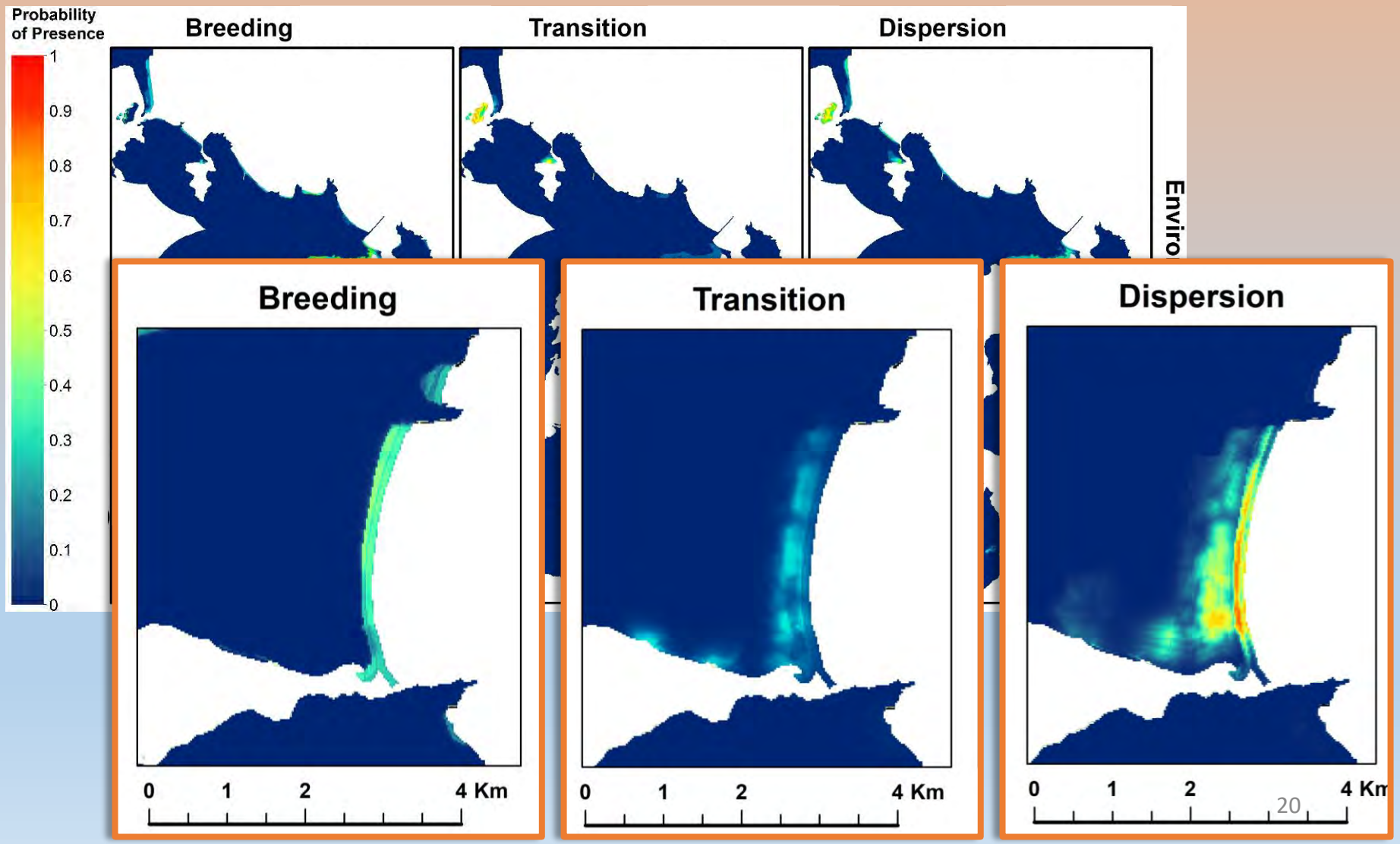
Mapping suitable sites on the mainland

Using NZ sea lion ecology to predict habitat suitability for future recolonisation.

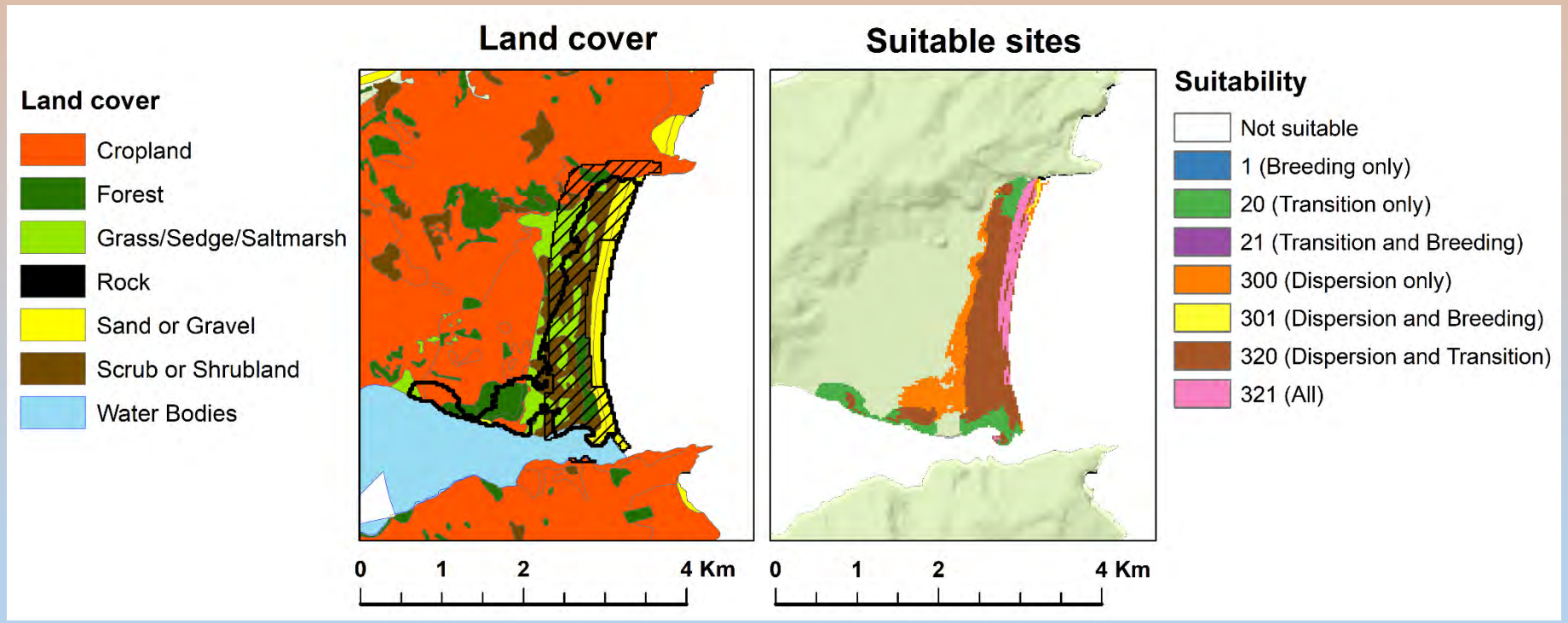
Example: Victory Beach, Otago



Example: Victory Beach, Otago

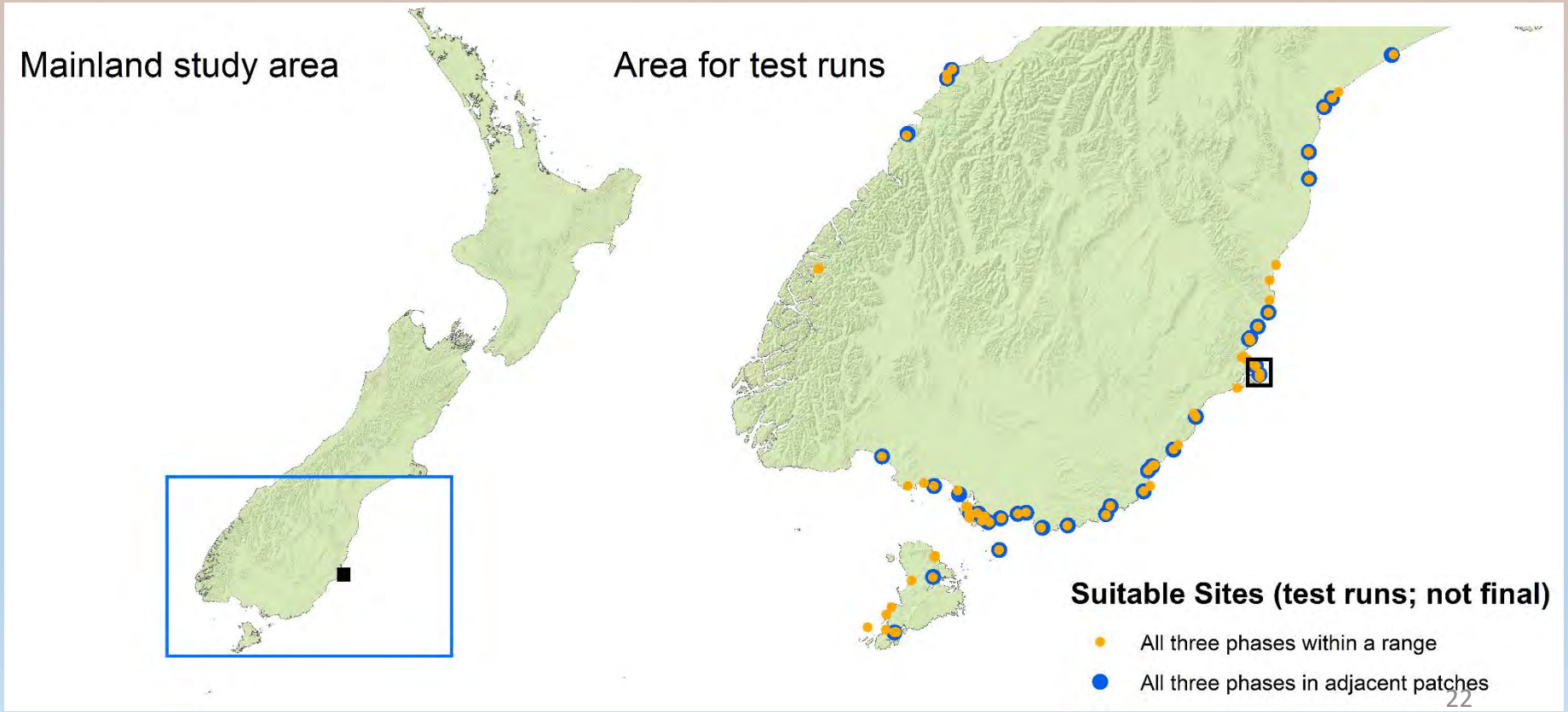


Example: Victory Beach, Otago



Extracting sites: test run results

- Test run: suitable sites for ≥50 females and pups

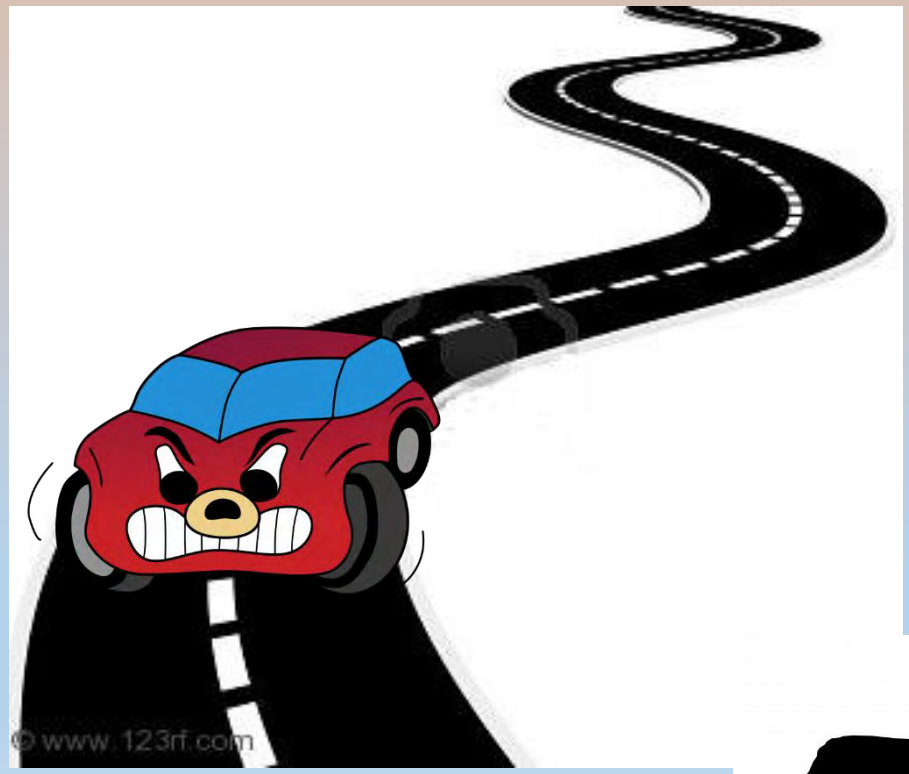


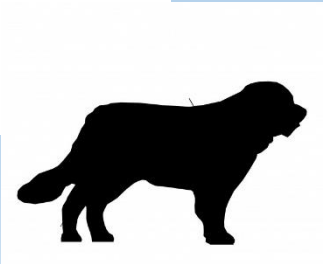
Accounting for potential human impacts

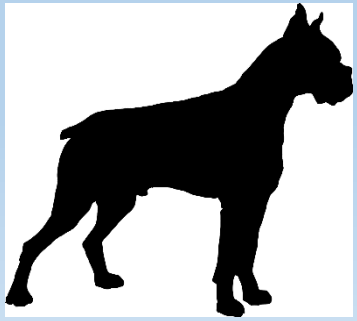
Environmental suitability vs. anthropogenic suitability.

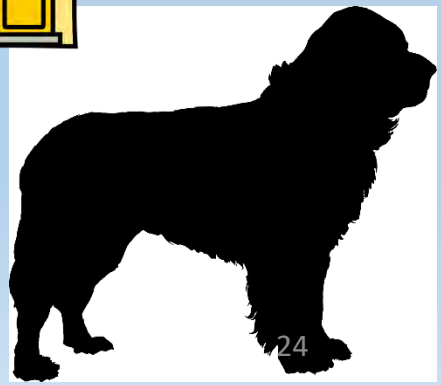
Environmentally suitable, **<u>but…</u>**

- Potential human impacts to the recolonising NZSL

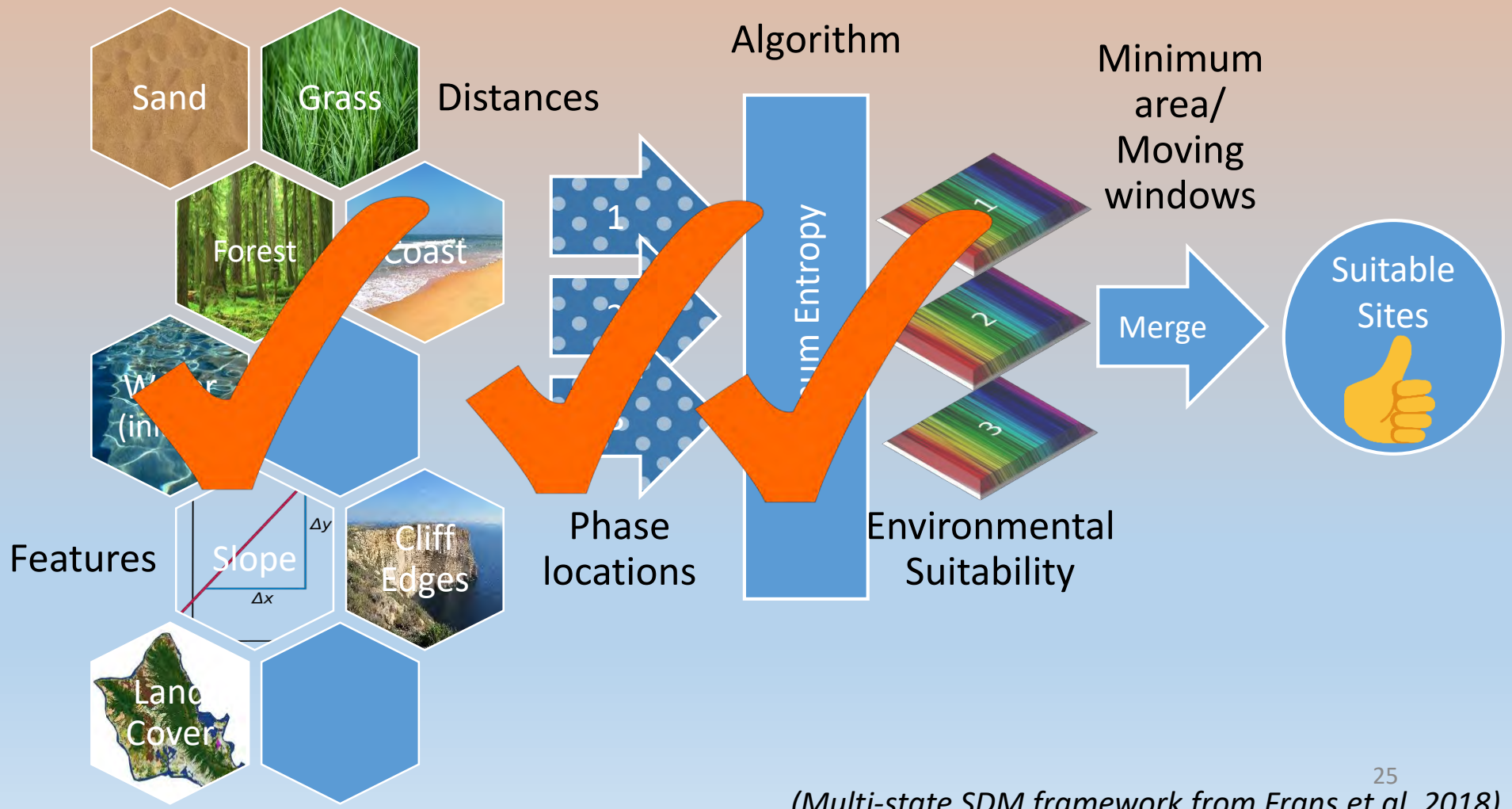






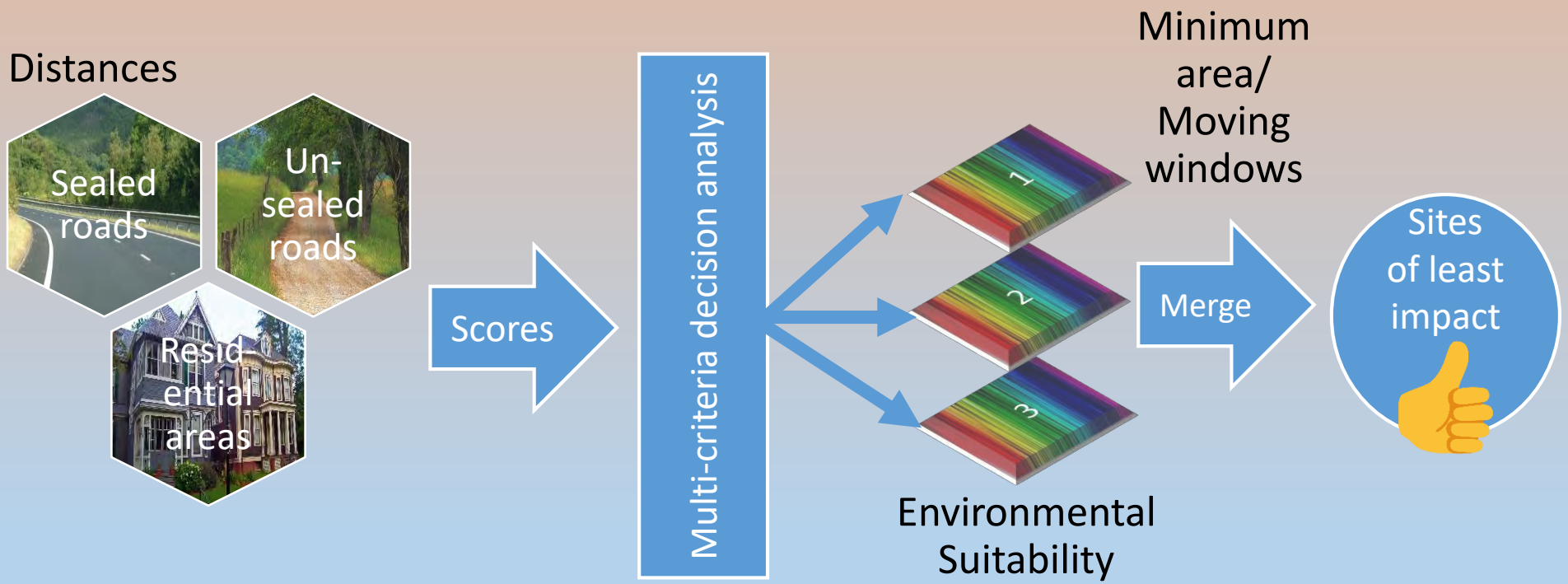


Habitat modelling



(Multi-state SDM framework from Frans et al. 2018)

Habitat modelling: human impacts



(Multi-state SDM framework from Frans et al. 2018; MCDA from MacMillan et al. 2016)

Results?

- Work in progress! ☺

Next steps

Work in progress, database-building, future considerations.

Next steps…

- Refine minimum area patches (fine-tuning) for the three behavioural states
- Calculate human impacts and apply to environmental suitability maps
- Generate lists of sites and habitat features for use in DOC's database
- Consult with others (you? ☺) on what information is most useful for management
- Develop ideas for future studies

Creating a database - ideas

- Extract general information about each site
  - env. suitability scores
  - area size for each phase
  - max. colony capacity (female numbers)
  - average human impact score
  - % private land
  - % public land
  - human barriers present (fences)
- Consult DOC for areas of focus and other parameters of concern

Geographic data-set (GIS)

- Input for DOC's database
- Map layers:
  - Rasters
  - Points
  - Polygons
- Data table:
  - Site characteristics (extracted from GIS)
  - Potential human impacts

Concluding remarks

- Work in progress!
  - Final results by June 2019
- Benefits of the study:
  - Information on areas with habitat features that are most similar to an existing, well-established colony
  - Insight and preparation for future recolonisation events
  - Prioritisation of sites for groundtruthing or discovering new mom/pup pairs
  - Highlights on potential human impacts – outreach opportunities
  - Spatial database to assist in establishing future management plans/goals

Many works brought into this study

Marine Mammal Science

MARINE MAMMAL SCIENCE, 28(3): 620–637 (July 2012)
© 2011 by the Society for Marine Mammalogy
DOI: 10.1111/j.1748-7692.2011.00515.x

On-land habitat preferences of female New Zealand sea lions at Sandy Bay, Auckland Islands

Amélie A. Augé[1]
Spatial Ecology Research Facility,
School of Surveying,
University of Otago,
PO Box 56,
Dunedin, New Zealand
E-mail: amelie.auge@gmail.com

B. Louise Chilvers
Aquatic and Threats Unit,
Department of Conservation,
PO Box 10-420,
Wellington, New Zealand

Renaud Mathieu
Spatial Ecology Research Facility,
School of Surveying,
University of Otago,
PO Box 56,
Dunedin, New Zealand
and
Earth Observation Research Group,
Natural Characteristics and Environment, CSIR,
PO Box 395,
Pretoria 0001, South Africa

Antoni B. Moore
School of Surveying,
University of Otago,
PO Box 56,
Dunedin, New Zealand

Abstract

Terrestrial habitat is important for breeding in most pinnipeds. On land, most species remain near the shore, but New Zealand (NZ) sea lions, *Phocarctos hookeri*, often rest inland up to 1.5 km from the sea. Only three breeding areas of NZ sea lions exist today after the species was extirpated from its historical range (NZ mainland). The study was conducted at the Sandy Bay breeding colony, Auckland Islands, between December 2002 and March 2003. We used daily Global Positioning System locations of breeding females with pups and mapping in a Geographic

Ocean & Coastal Management 130 (2016) 162–171

Contents lists available at ScienceDirect

Ocean & Coastal Management

journal homepage: www.elsevier.com/locate/ocecoaman

ELSEVIER

GIS-based multi-criteria analysis of breeding habitats for recolonising species: New Zealand sea lions

Hamish MacMillan [a, b], Antoni B. Moore [a, *], Amélie A. Augé [a, c], B. Louise Chilvers [d, e]

[a] School of Surveying, University of Otago, Dunedin, New Zealand
[b] Trimble New Zealand, P.O
[c] ARC Centre of Excellence
[d] Marine Species and Threa
[e] Wildbase, Institute of Vete

ARTICLE IN

Article history:
Received 21 January 2014
Received in revised form

Received: 31 March 2017 | Accepted: 9 June 2017

DOI: 10.1111/2041-210X.12847

RESEARCH ARTICLE

Methods in Ecology and Evolution

Quantifying apart what belongs together: A multi-state species distribution modelling framework for species using distinct habitats

Veronica F. Frans[1,2] | Amélie A. Augé[3,4] | Hendrik Edelhoff[1] | Stefan Erasmi[5] | Niko Balkenhol[1] | Jan O. Engler[1,6]

[1]Department of Wildlife Sciences, University of Göttingen, Göttingen, Germany
[2]Workgroup on Endangered Species, University of Göttingen, Göttingen, Germany
[3]School of Surveying, University of Otago, Dunedin, New Zealand

Abstract

1. Species distribution models (SDMs) have been used to inform scientists and conservationists about the status and change in occurrence patterns in threatened species. Many mobile species use multiple functionally distinct habitats, and cannot

Thanks!

Questions?

Email: verofrans[at]gmail.com
Twitter: @VFFRANS
https://www.researchgate.net/profile/Veronica_Frans2

Photo credit: A. Augé

Conversation with the TWG

Opportunities for feedback from people in the field.

Questions for you!

- What kinds of information on the suitable sites would be most helpful for current/upcoming management actions?
- Where can I get information on all sites where females and pups have been found (non-colonies) for model evaluation/validation?
- Would marine habitat also be of interest in a future study?
- Should we consider groundtruthing? Test the model predictions in the field?