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University
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Space-usage models for tiger sharks

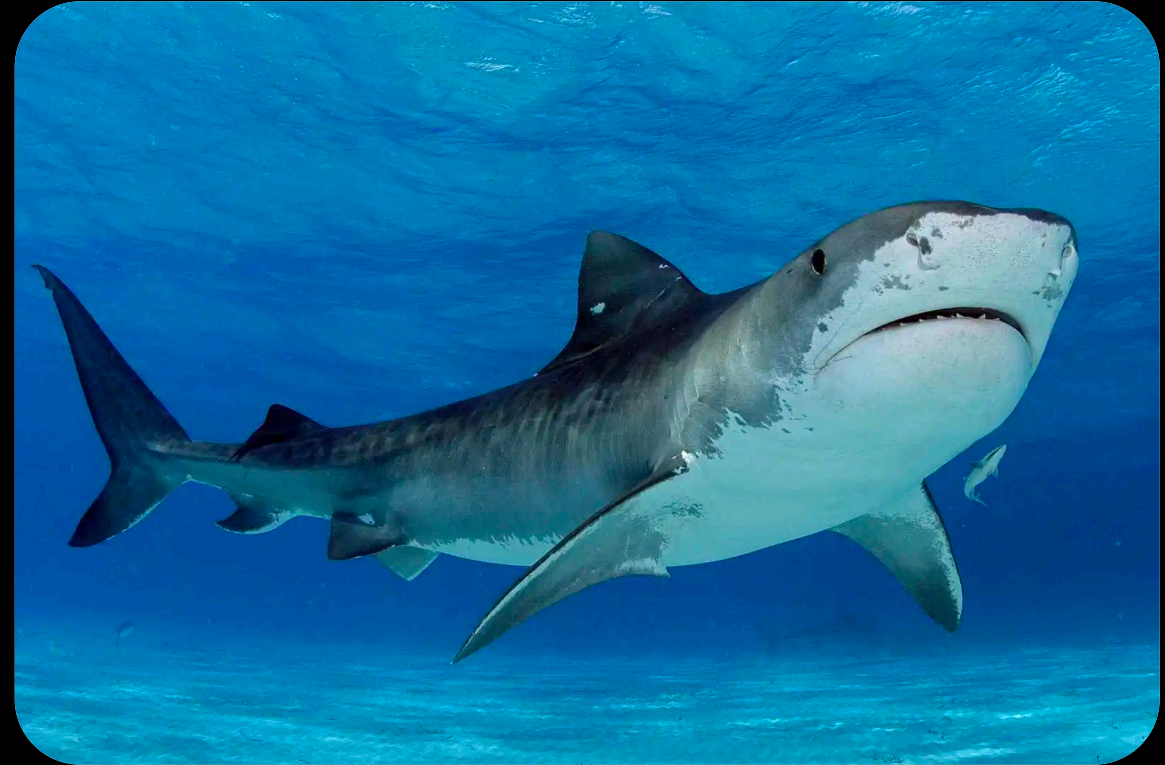
Department of Biological Sciences
Yuri Niella (PhD candidate)



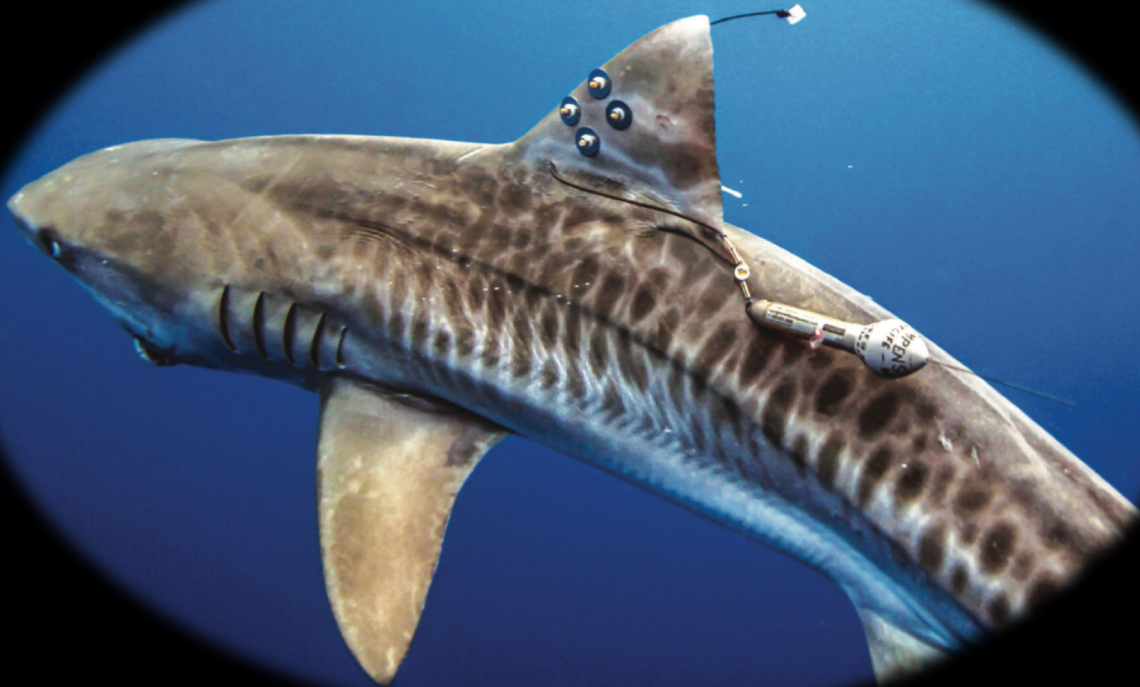
Dr Bonnie Holmes
Dr Paul Butcher
Dr Robert Harcourt

Tiger shark (*Galeocerdo cuvier*)

- Circumglobally distributed
Tropical & temperate waters
- Coastal distribution x oceanic migrations
- Incidents with humans



Satellite Telemetry



- Study long-range movement patterns
(days - years)
- State-space models
Movement behaviors
Resident x Migratory
- Collect environmental data
 - **Temperature**
 - **Depth**
 - **Temperature at depth (thermocline)**

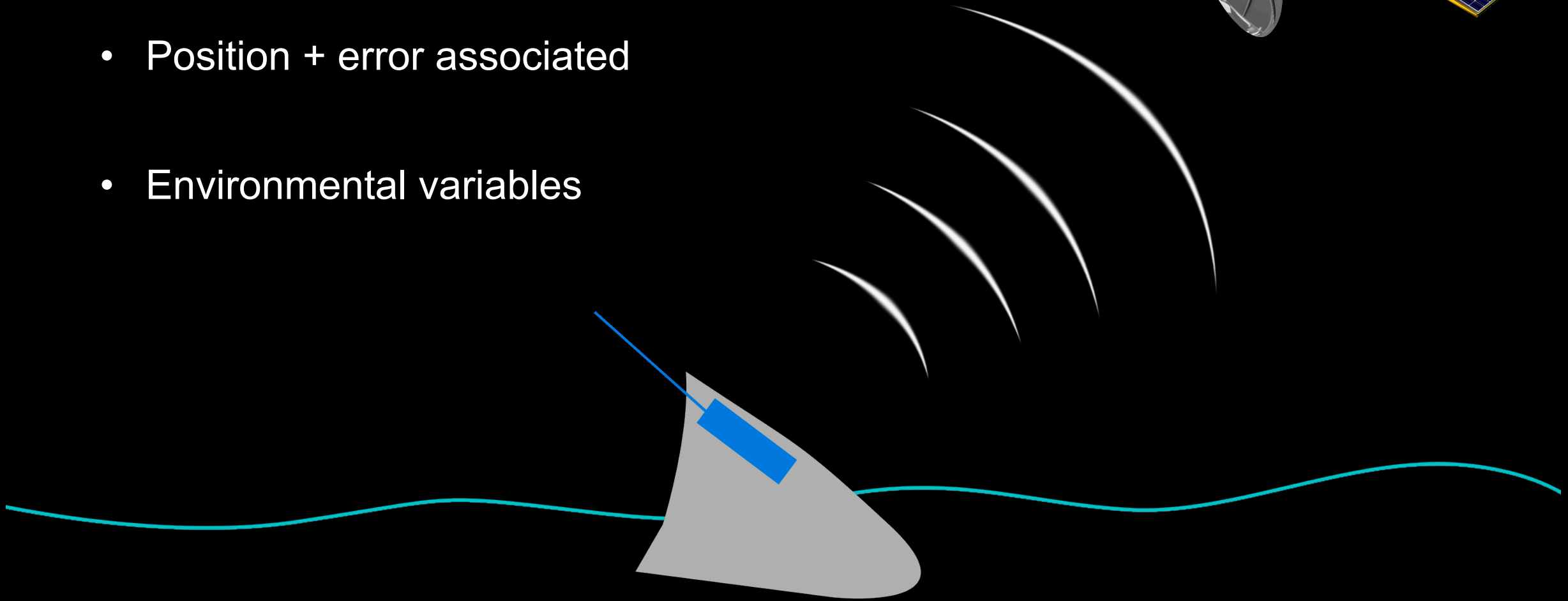
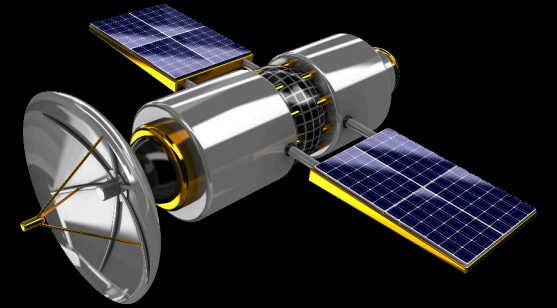
But...how does it work exactly?



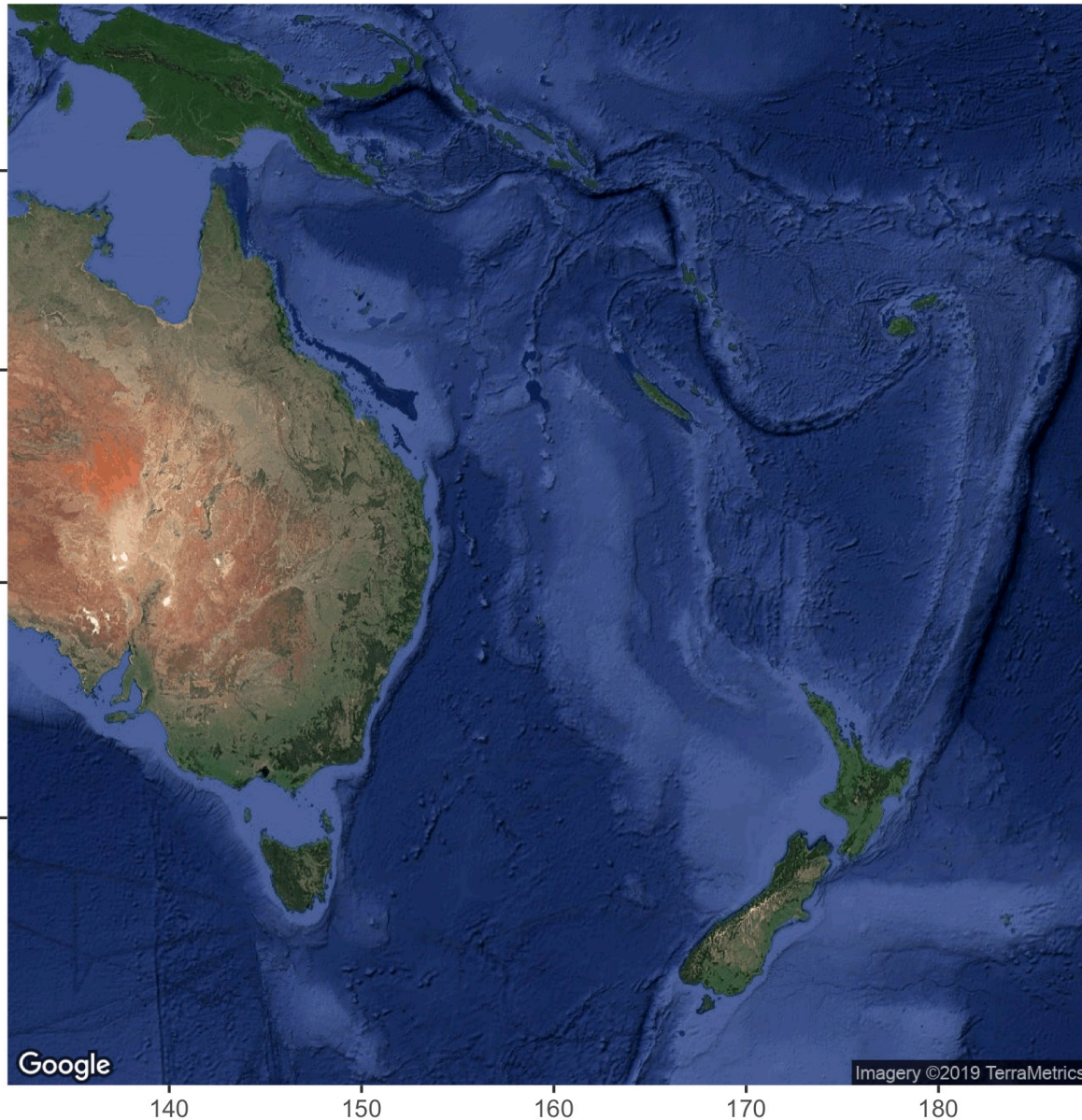
- 1) Programming satellite transmitters
Species / Study
- 2) Go “find” your sharks! :)
- 3) Attach transmitter to the animal
- 4) Hope the transmitter will work!
Yes, sometimes they don't! : (

5) Location data

- Position + error associated
- Environmental variables



East coast of Australia



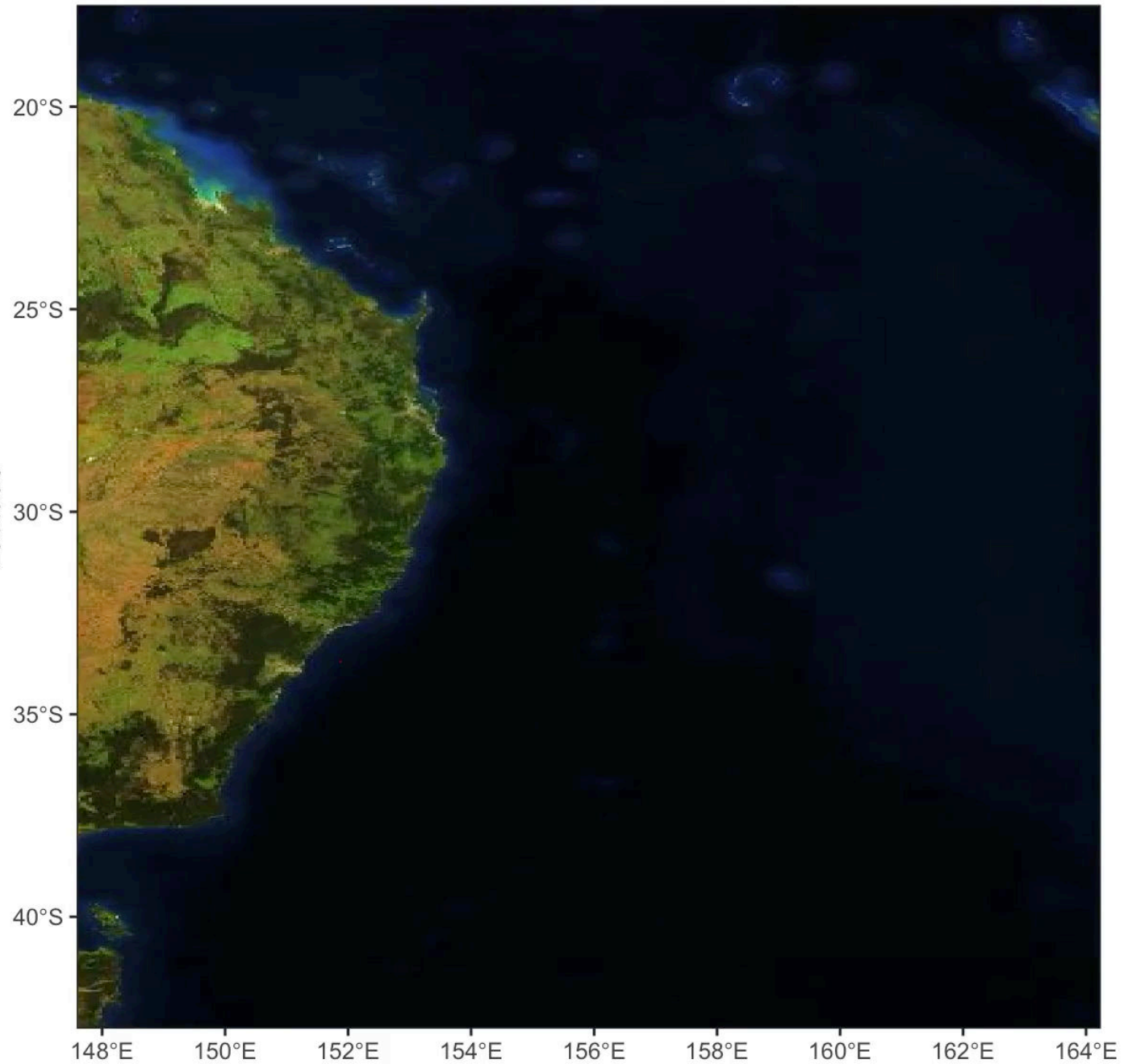
- Climate change:
Fastest temperature increases
- Ecological consequences:
Shifts in species distributions
Reduced foraging success
Mortality
- Tiger shark space-usage:
Changes in the last decade?

2007
2013



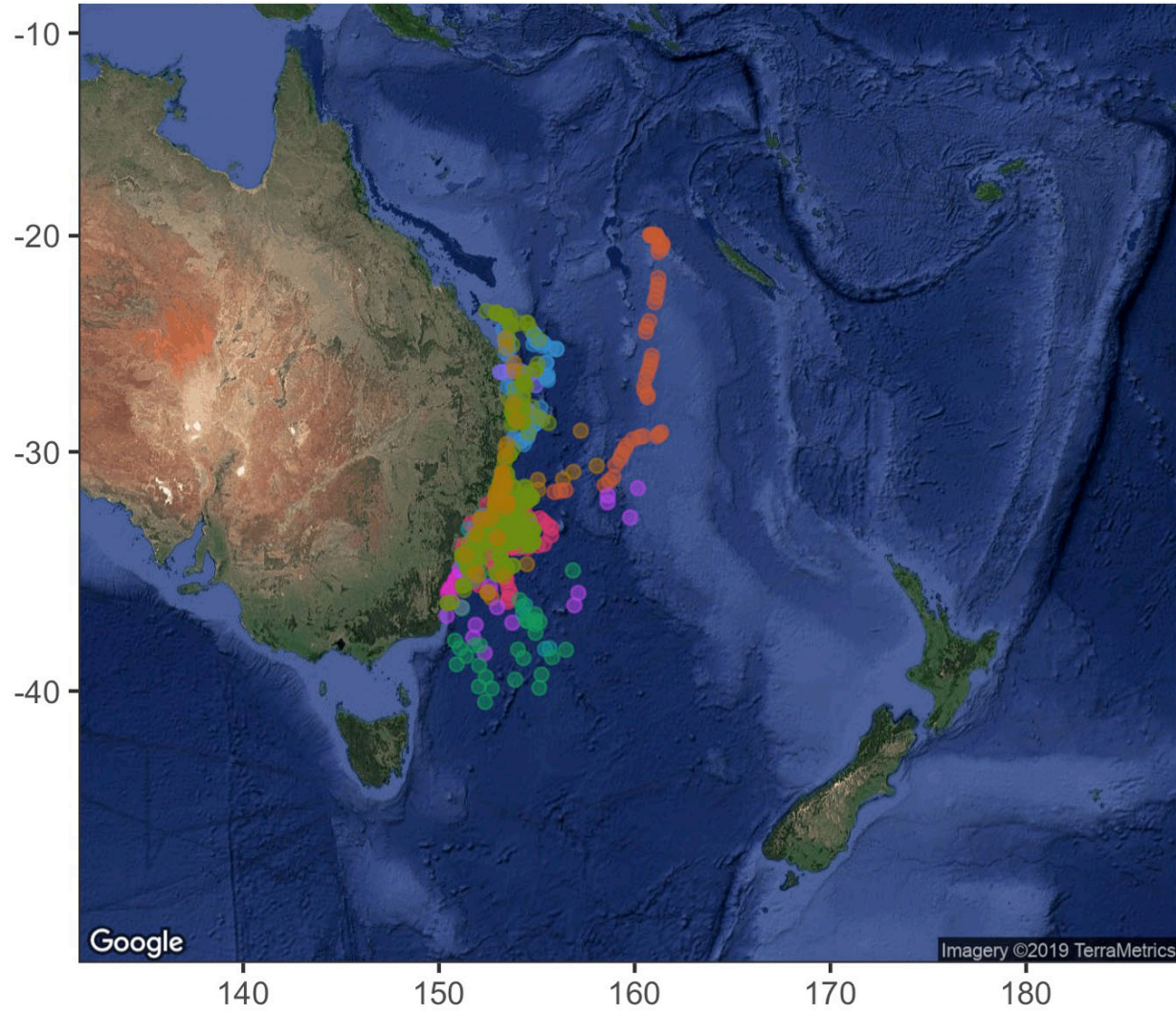
2017
2020

Tiger shark movements 2007 - 2013



- Track lengths
Days - Months
- Variety of “behavioral modes”
- Coastal x oceanic distribution

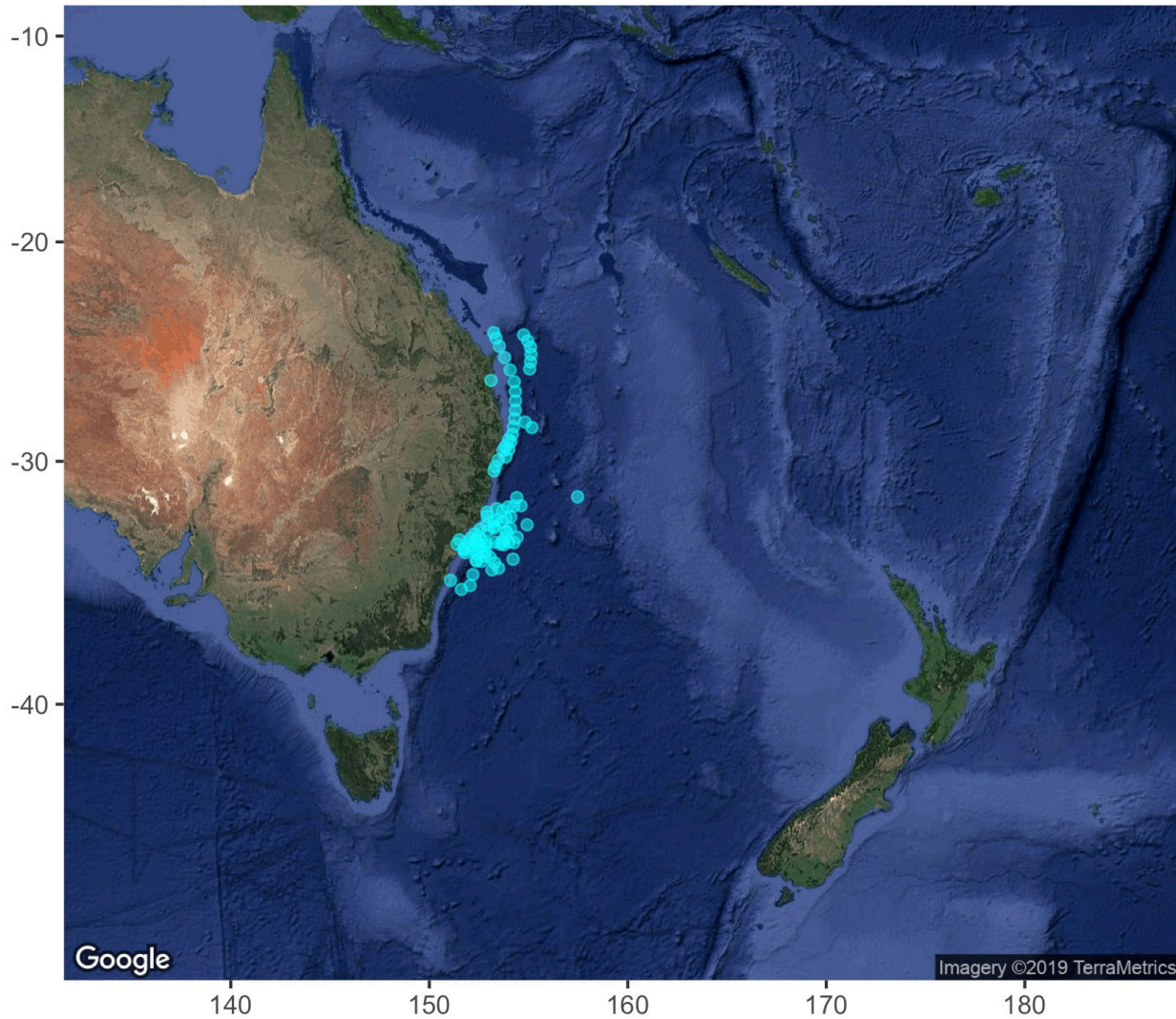
Track data



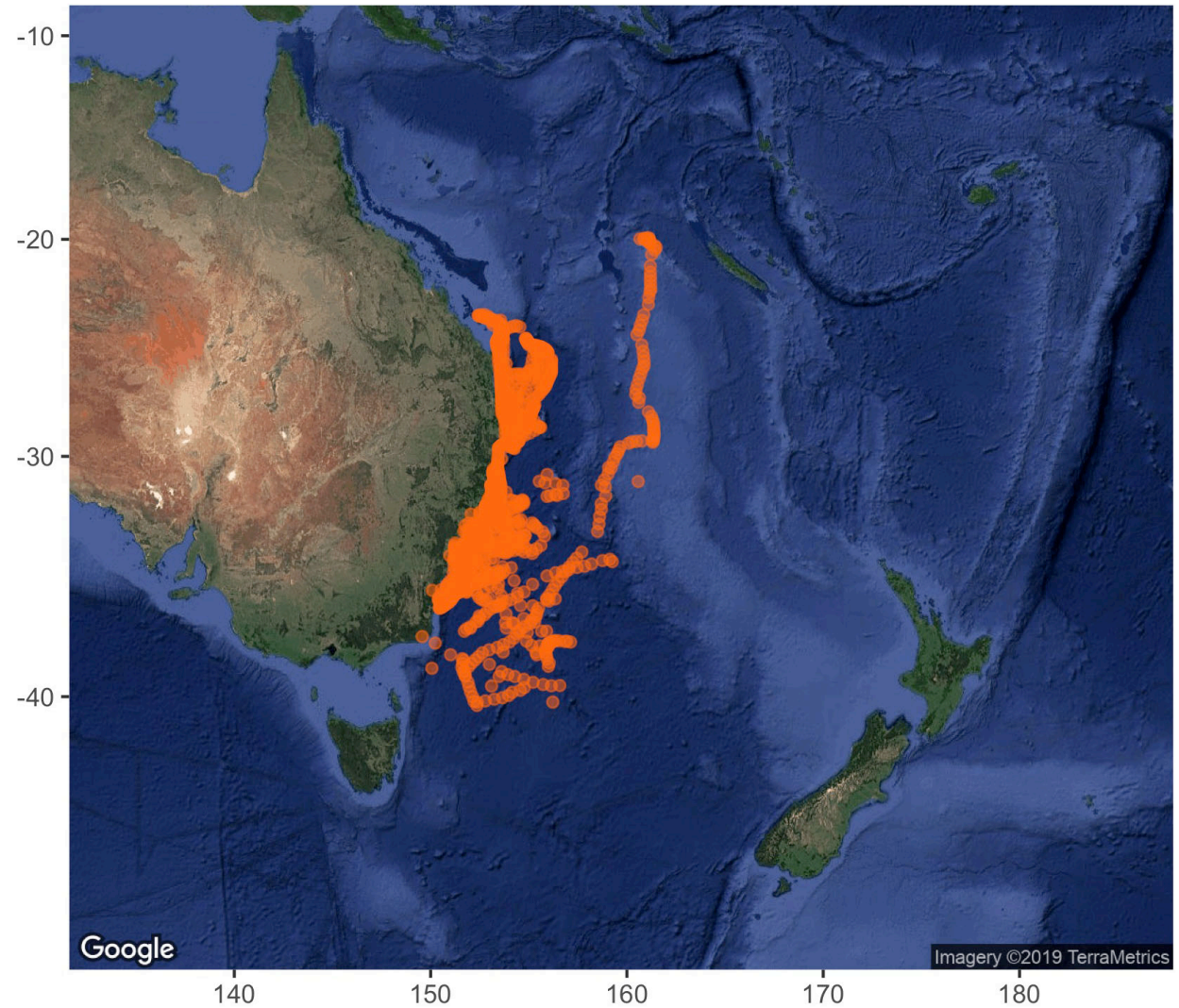
- | | | | |
|--------|--------|--------|---------|
| ● TS#1 | ● TS#4 | ● TS#7 | ● TS#10 |
| ● TS#2 | ● TS#5 | ● TS#8 | ● TS#11 |
| ● TS#3 | ● TS#6 | ● TS#9 | |

Bayesian state-space model (2007-2013)

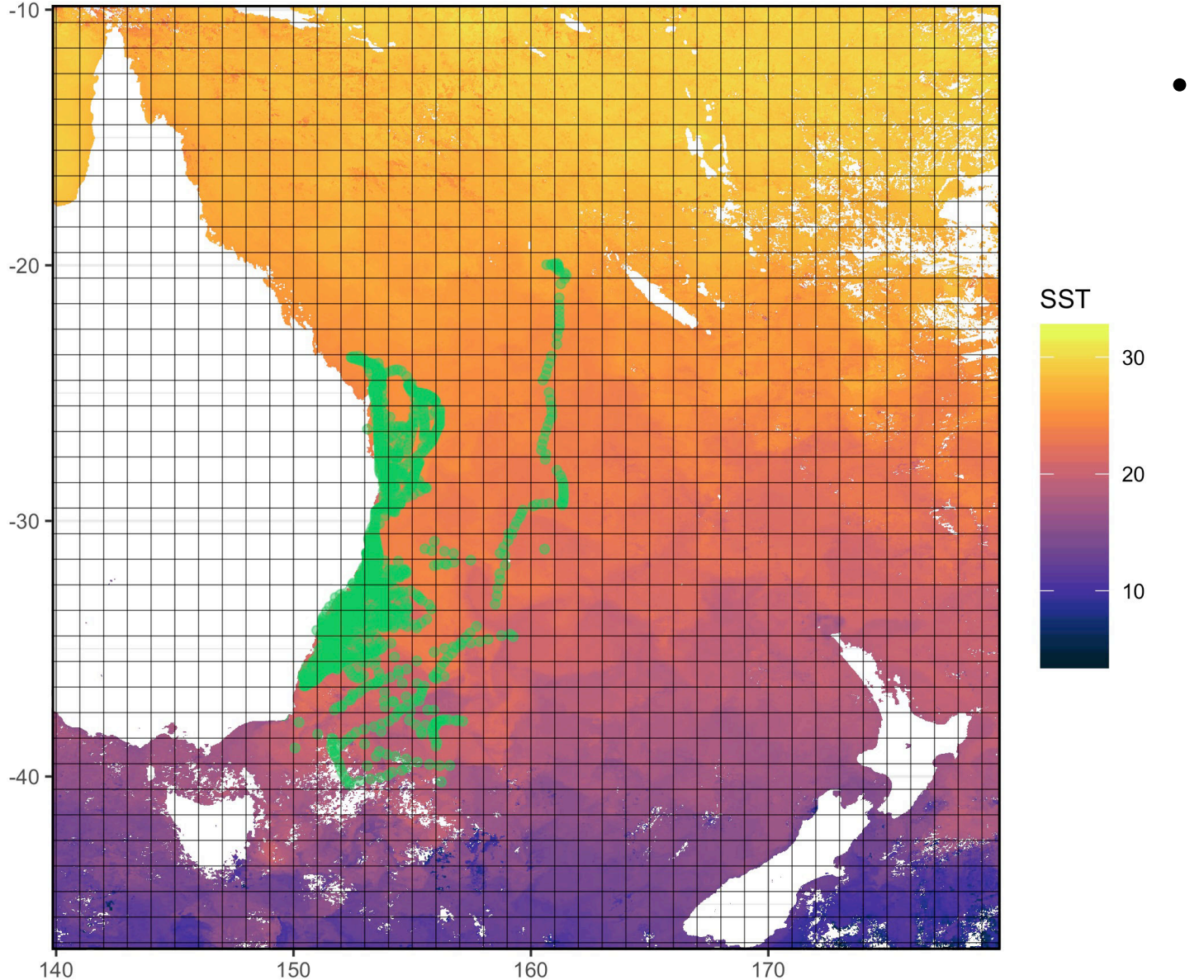
Resident



Migratory



Remote sensing data



- Space-usage models
Presence x absence

Grid:
1° Lat x 1° Lon

- Other variables:
- **Chlorophyll-a**
 - **Current speed**
 - **Thermocline depth**

3-D space usage
Time at depth
Temperature at depth



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Department of
Primary Industries

NSW Shark Management Strategy



Thank you!

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