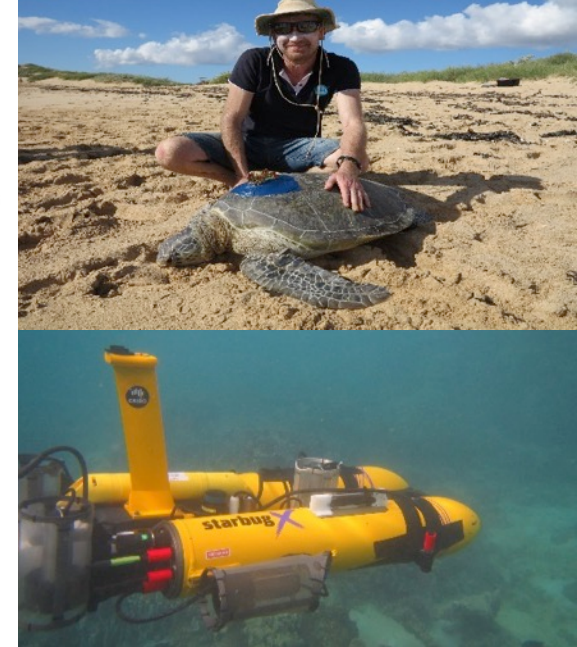




Theme 3 – Tagging turtles and sharks



ningaloo outlook



Satellites, syringes and students: using different approaches to understand large animal ecology

Mat Vanderklift

Richard Pillans, Jessica Stubbs, Sue Pillans & Tony Tucker

Ningaloo Outlook – A partnership between BHP Billiton and CSIRO

www.csiro.au



Ningaloo Outlook is a BHP Billiton-CSIRO Industry-Science Marine Research Partnership investing A\$5.4 million over five years to gather new knowledge on the Ningaloo reef and its important ecological values

Large animal ecology

Characteristics

Long-lived

Slow-growing

Low fecundity

Large home ranges



Targeted research

How many are there?

Where do they spend their time?

What food resources do they rely on?



Types of tags

Flipper tags



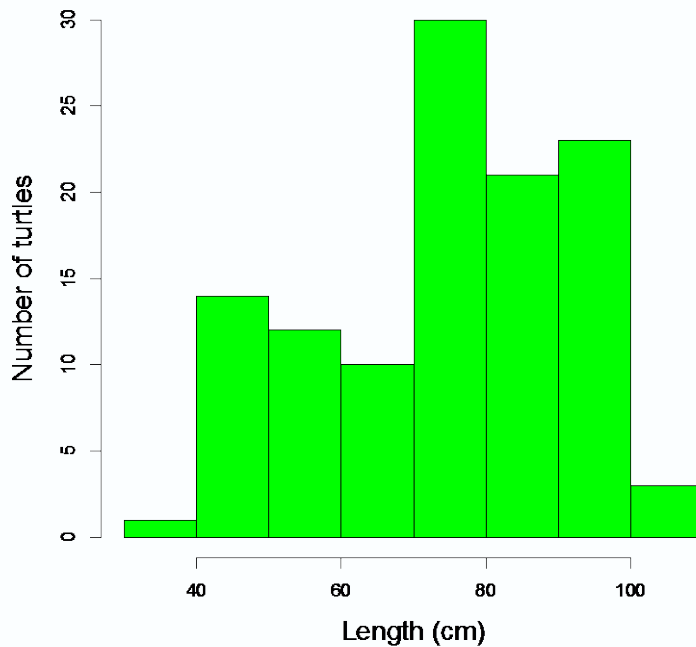
Satellite tags



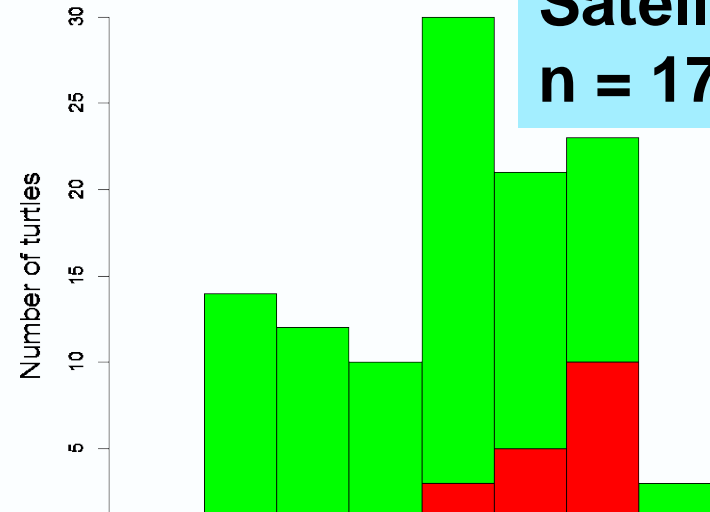
Acoustic tags



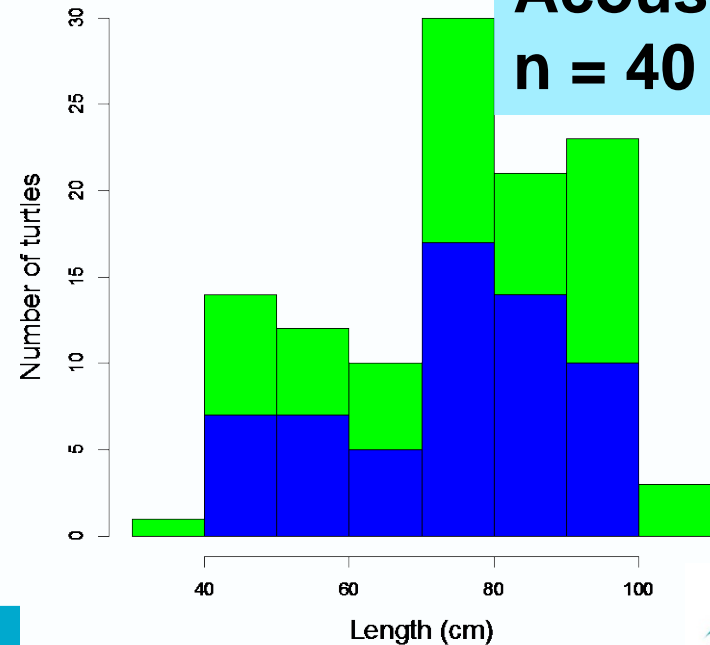
Flipper tags

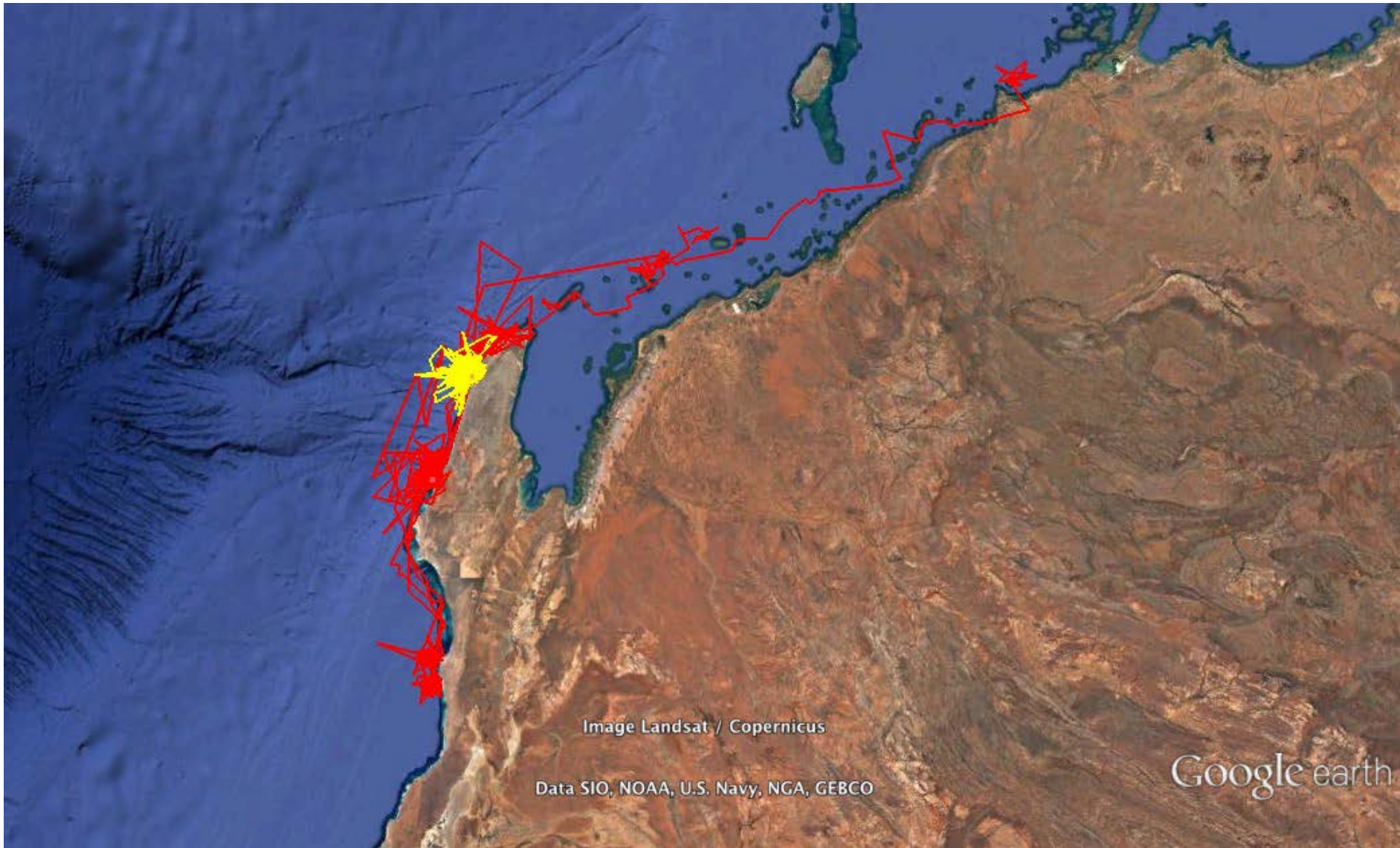


Satellite tags n = 17



Acoustic tags n = 40





Jurabi

- Tagged 26 January 2017 at 2:45AM
- Flipper tag first attached in 1992 – on the same beach!
- Grew 28 mm in 25 years 1992-2017



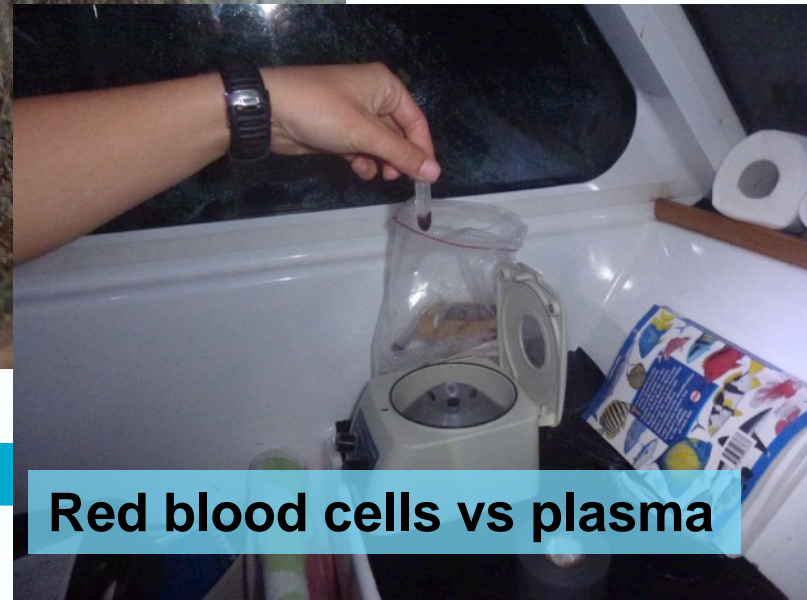
Biological measurements



Skin



Blood



Red blood cells vs plasma

Carbon

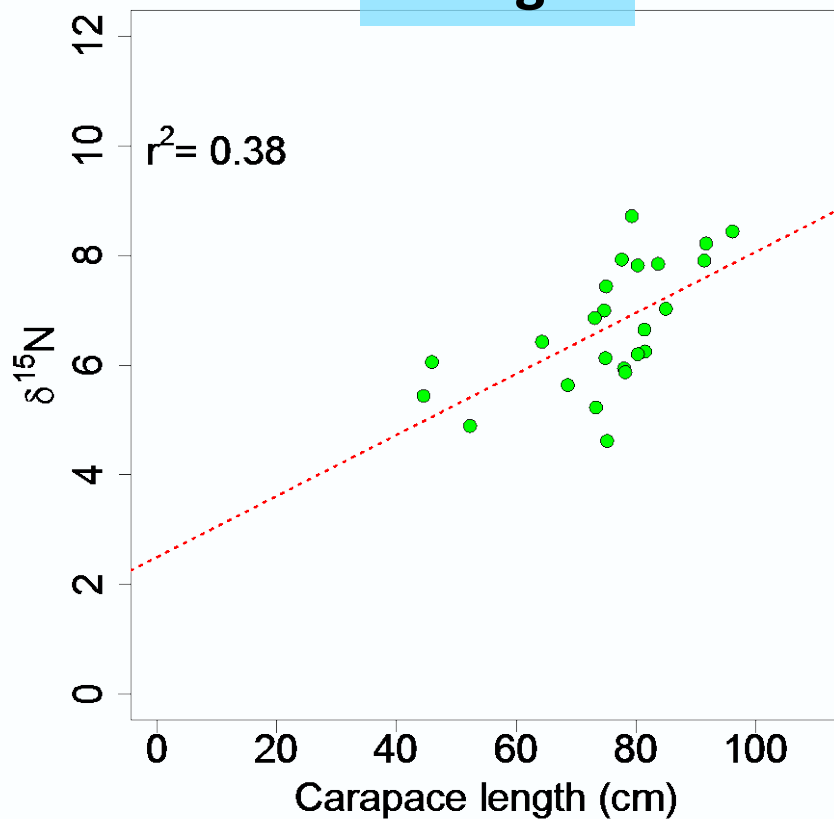


Nitrogen

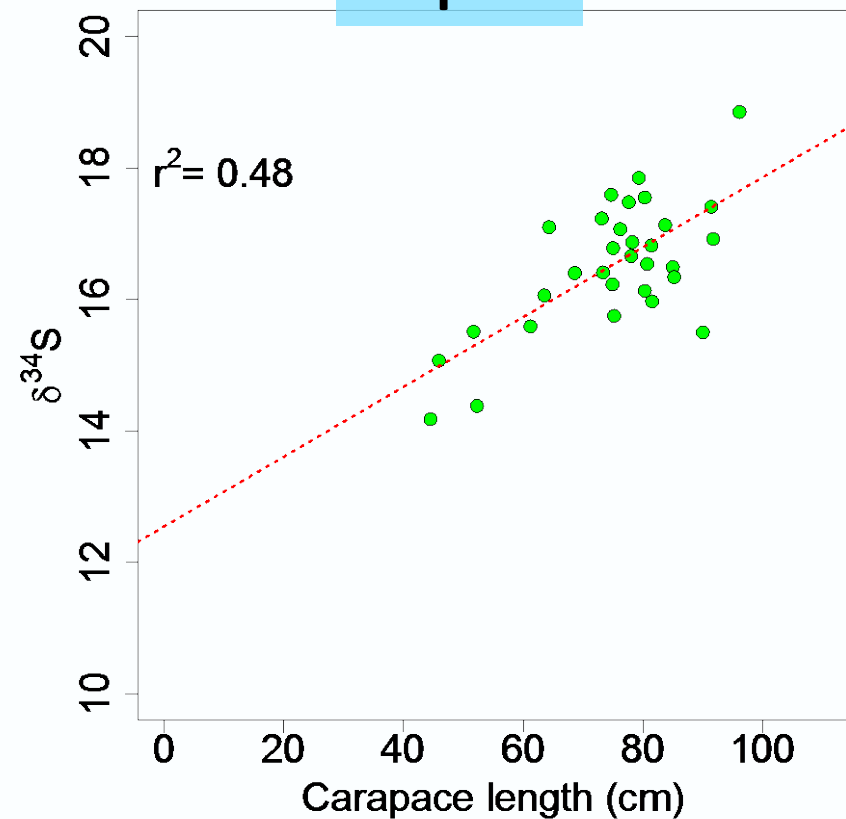


Sulphur

Nitrogen



Sulphur

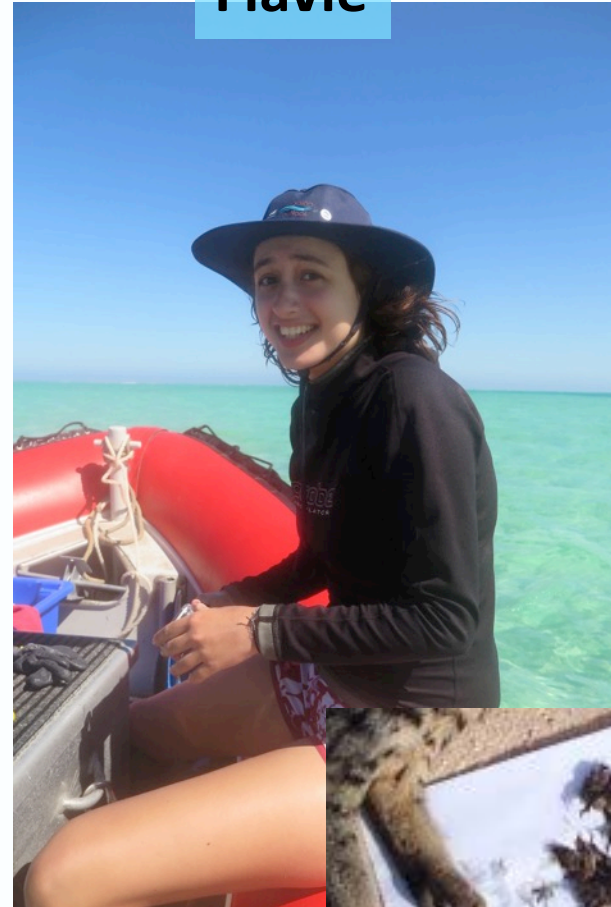


Students

Jessica



Flavie



Acknowledgements

- BHP Billiton-CSIRO Ningaloo Outlook Marine Research Partnership
- Claire Hall, Tim Cooper
- Exmouth District High School
- Exmouth community volunteers too numerous to mention
- Dwayne George, Anna Cresswell, Melanie Trapon
- Peter Barnes, Keely Markovina, Scott Whiting



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Sharks at Ningaloo Reef: acoustic and satellite telemetry

Richard Pillans, Mat Vanderklift, Russ Babcock, Mick Haywood, Douglas Bearham & Sue Pillans

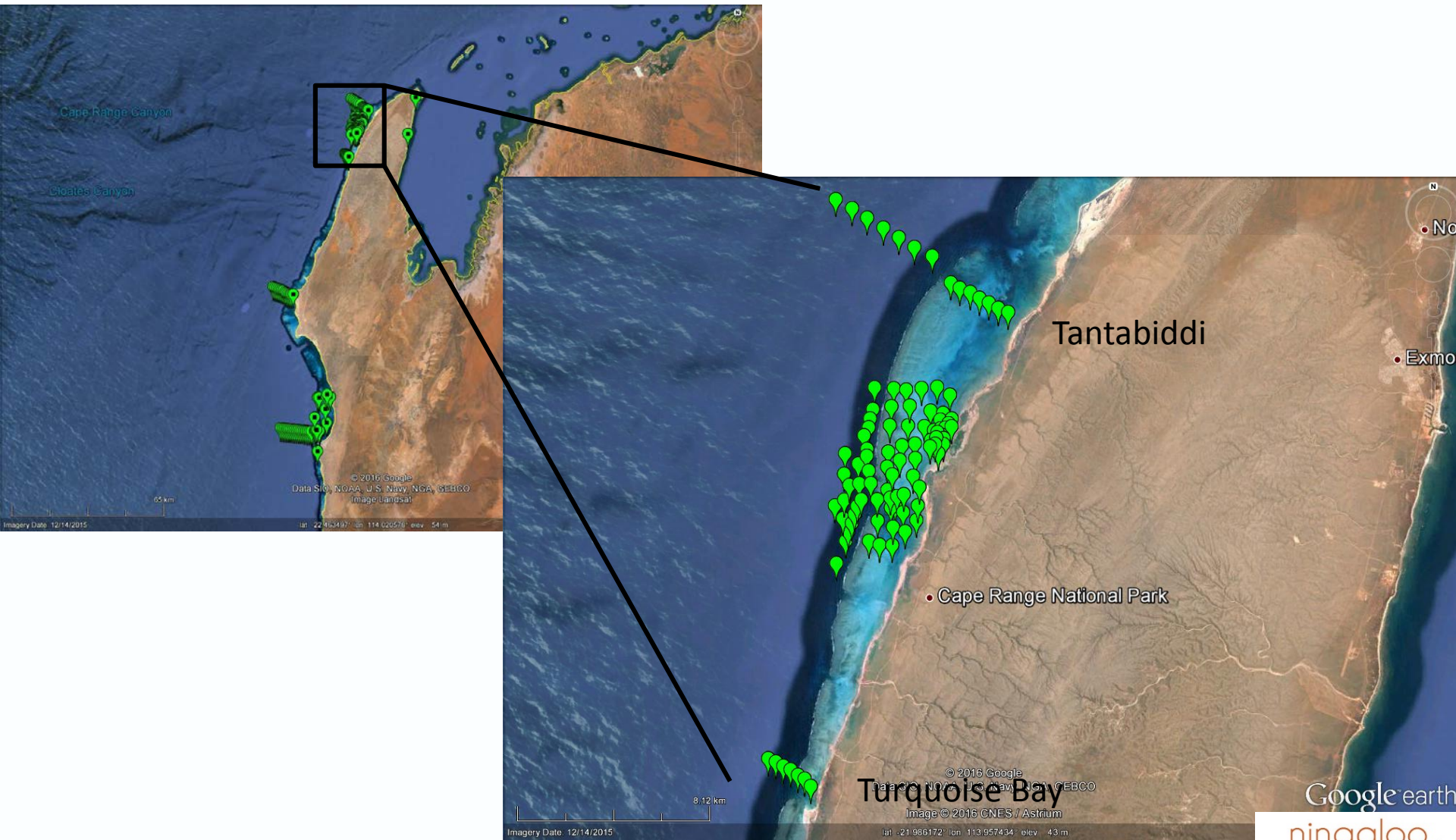
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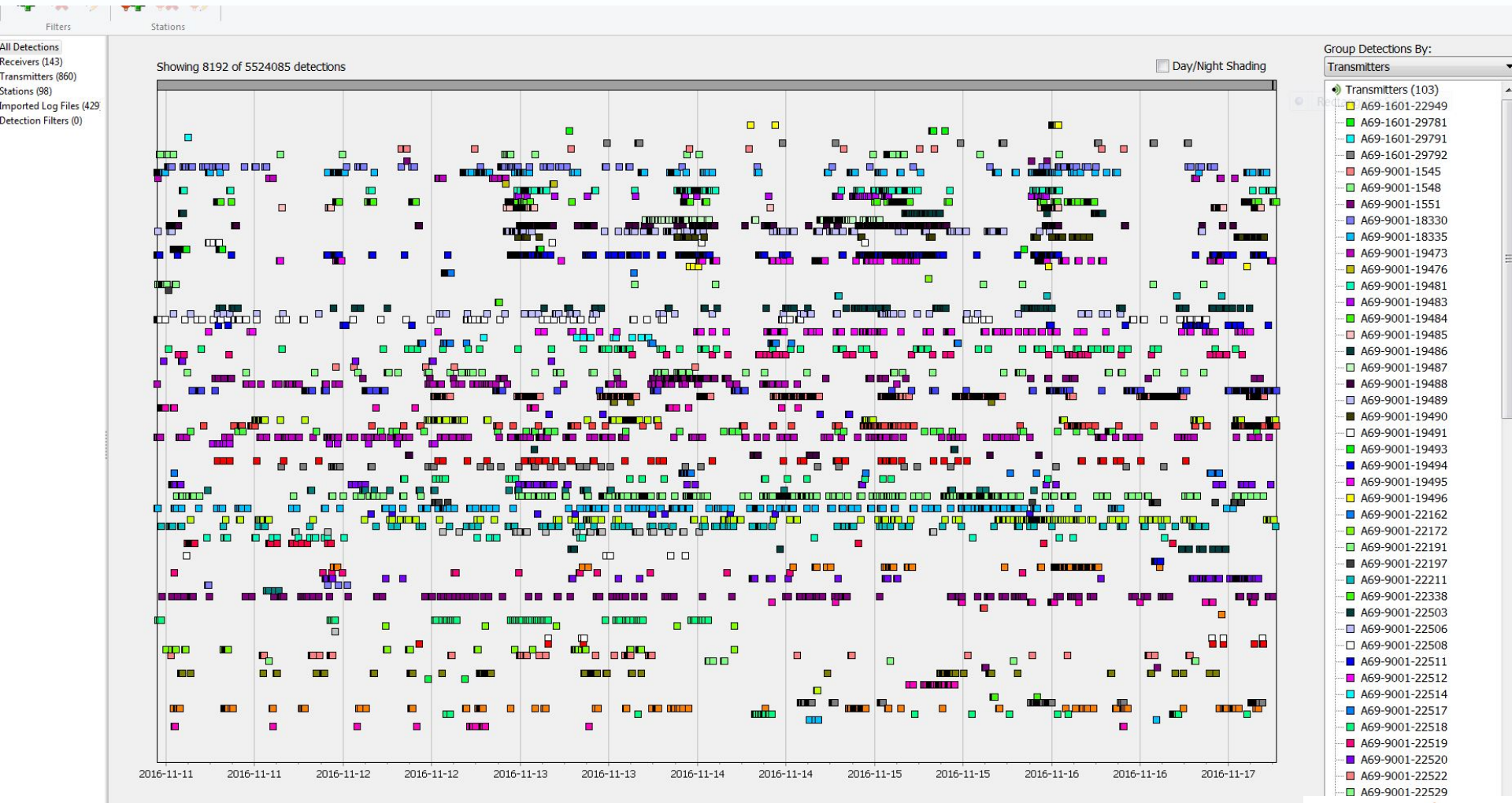
Ningaloo Reef acoustic array design



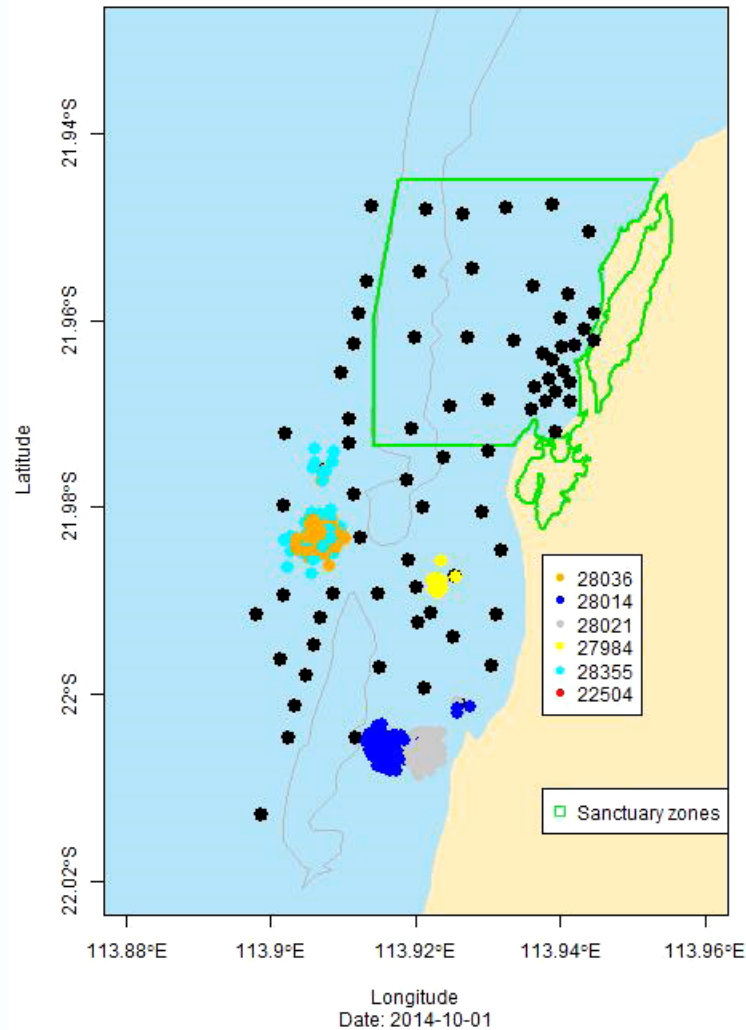
Results: Individuals tagged with acoustic tags

Species	TOTAL
Green Turtle	59
Grey Reef Shark	27
Blacktip Reef Shark	24
Lemon Shark	35
Australian Blacktip	11
Whitetip Reef Shark	3
Tiger Shark	7
Whale Shark	16

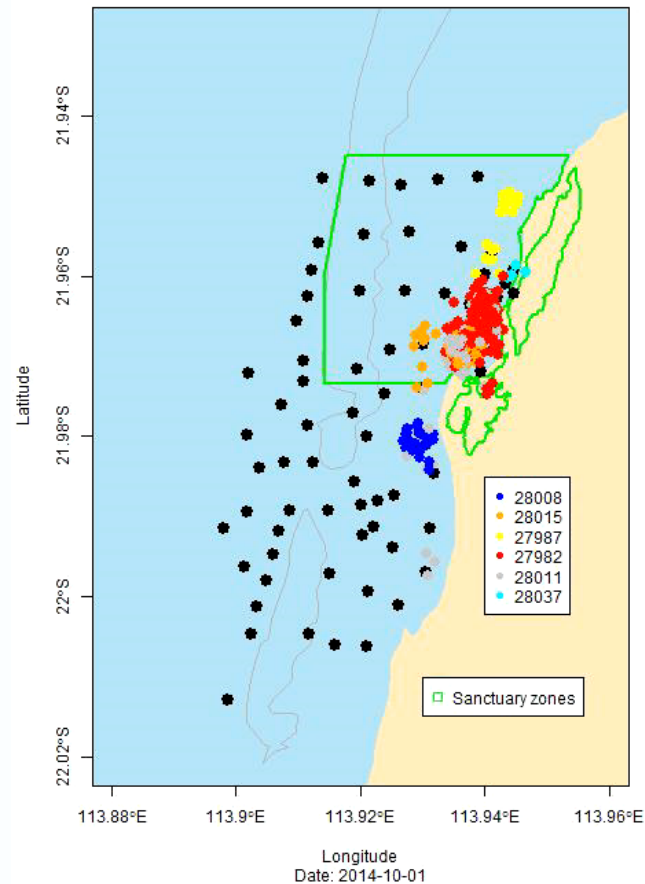
Acoustic Detections



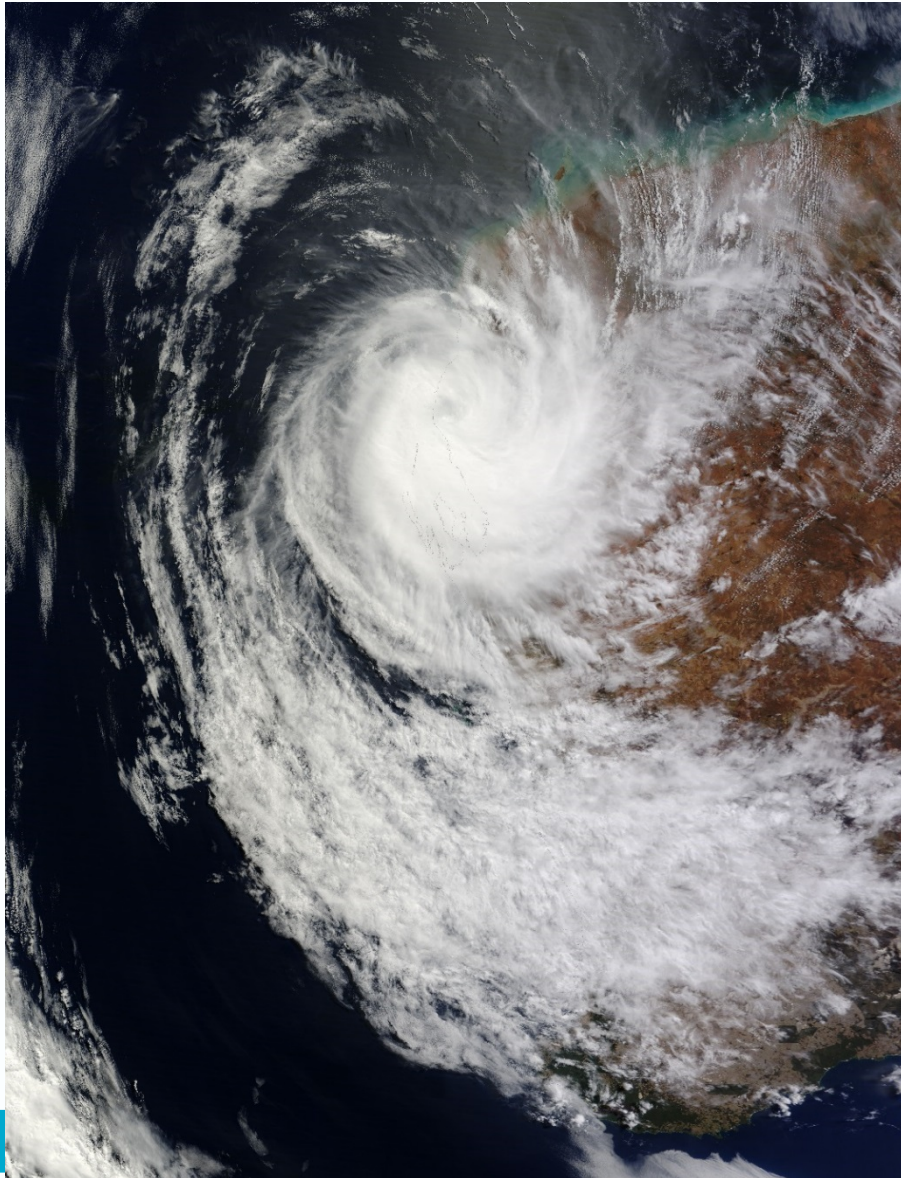
Movement patterns of Grey Reef sharks

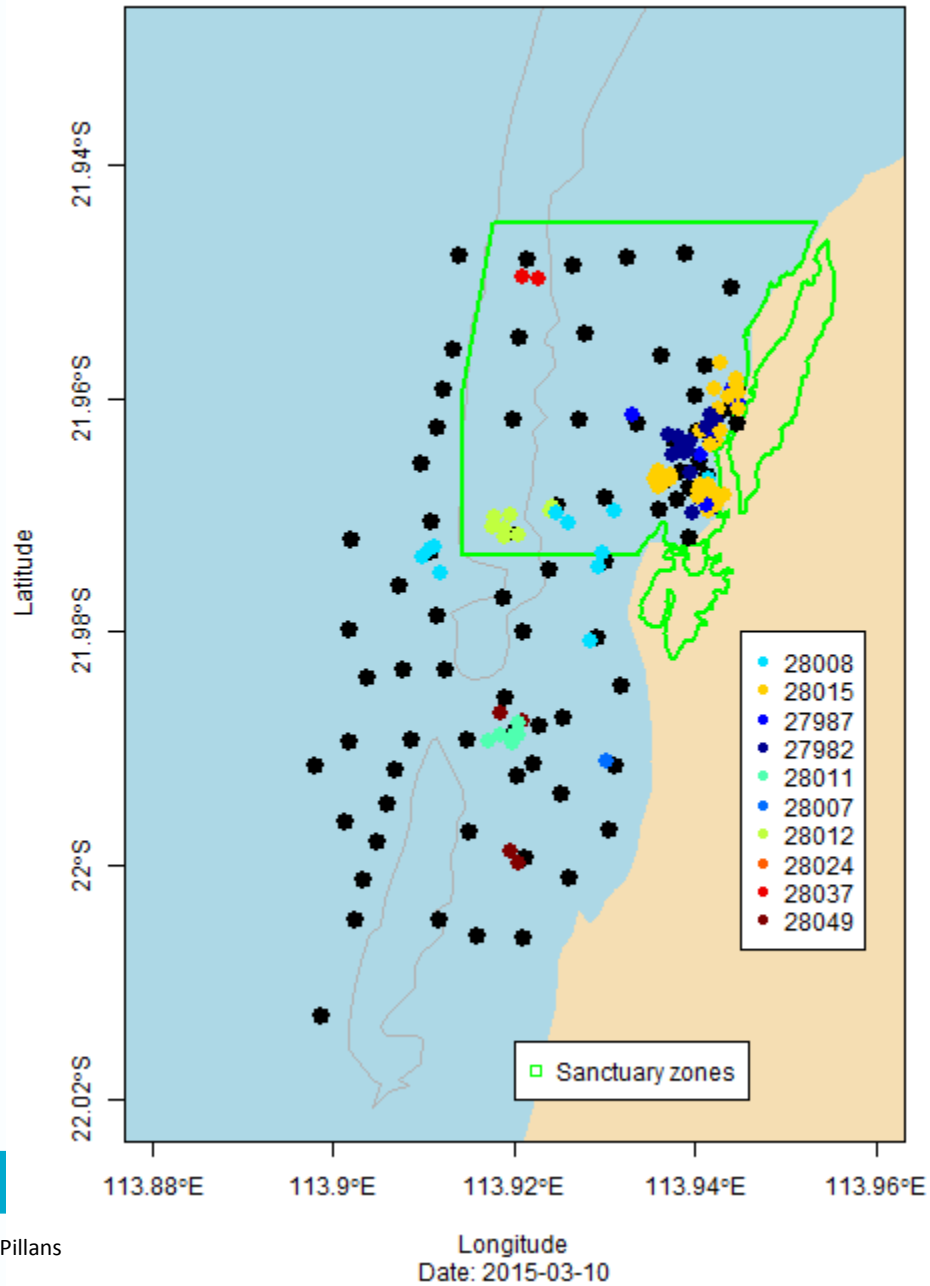


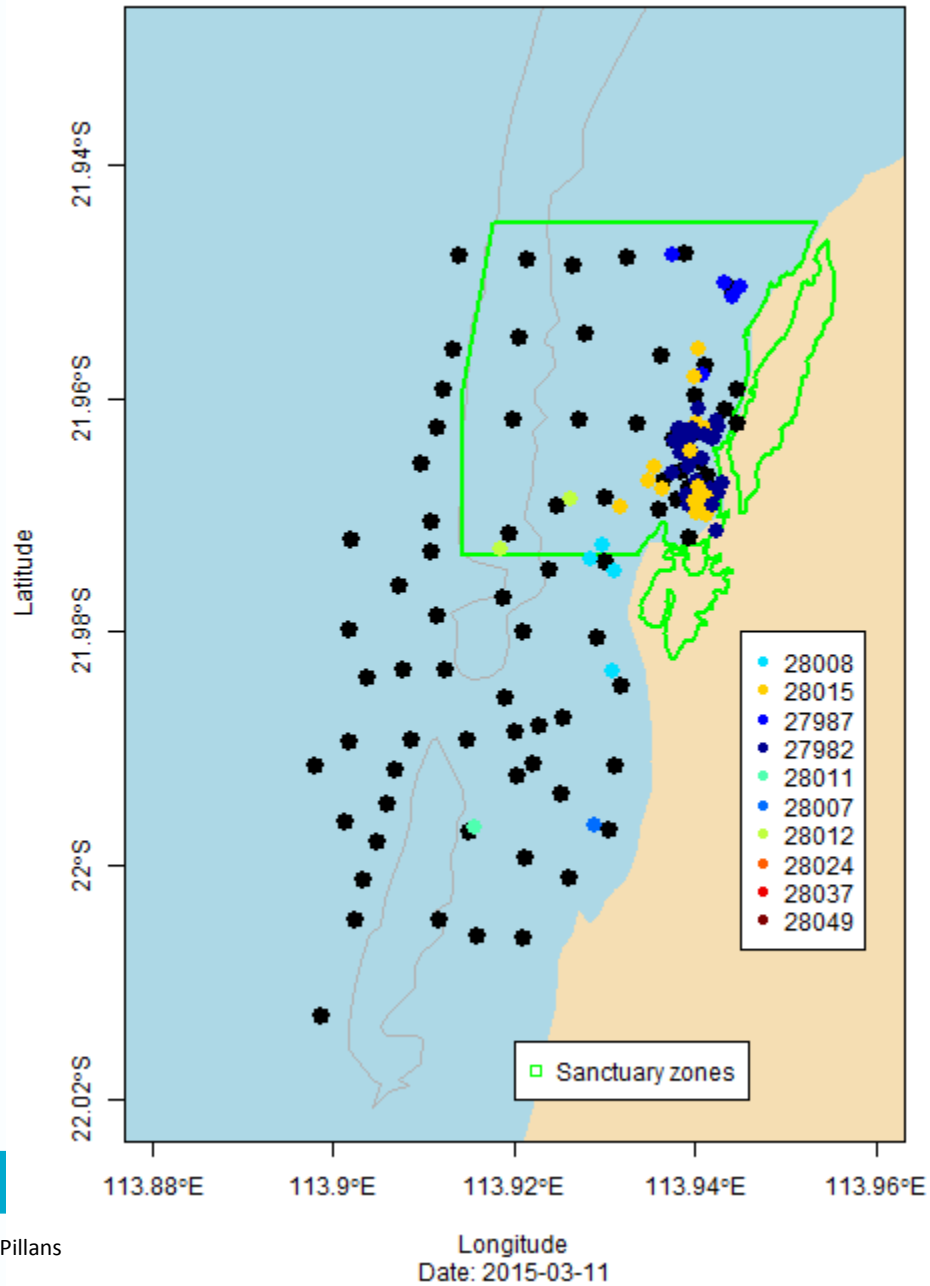
Movement patterns of Black Tip Reef sharks

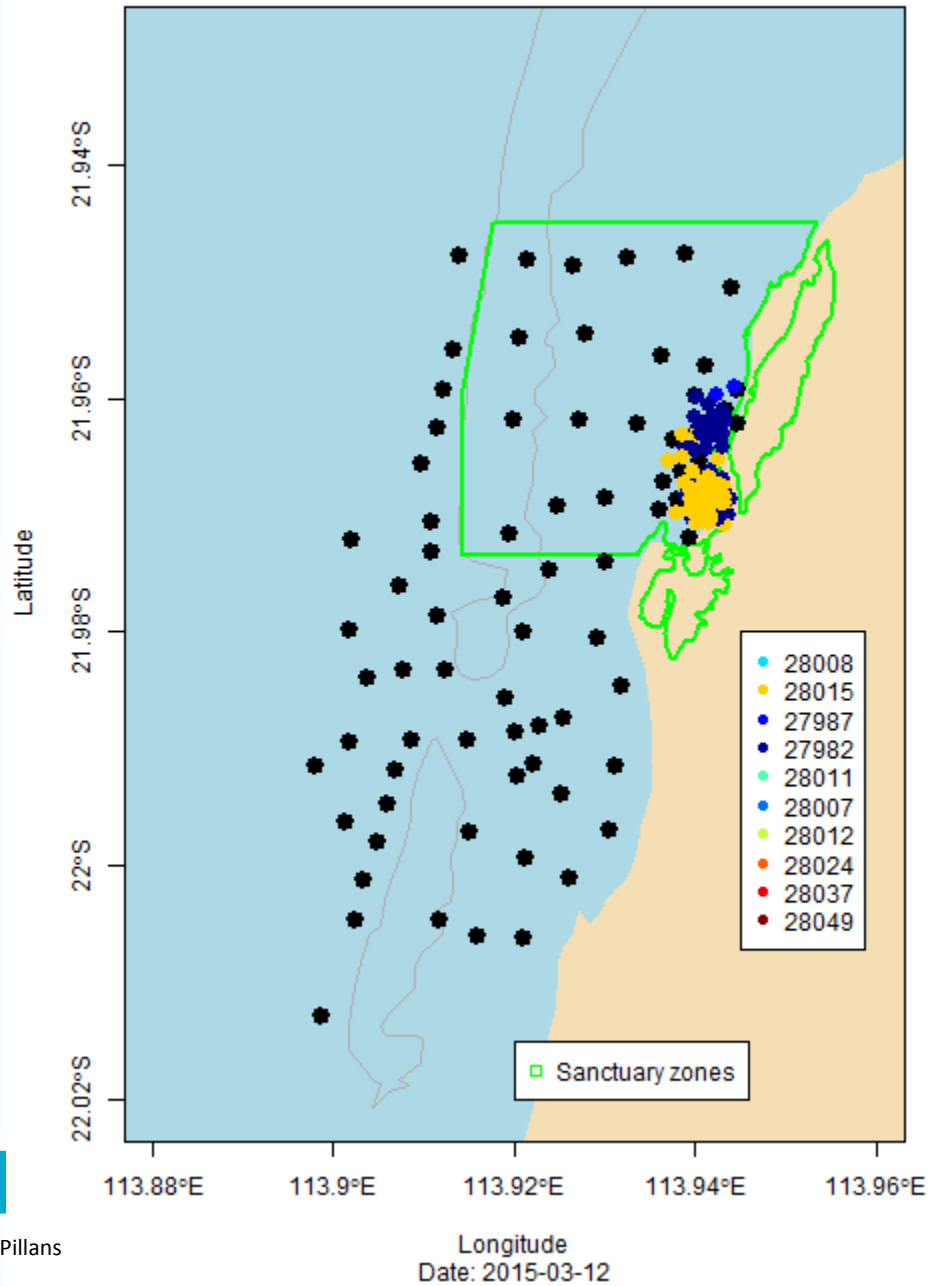


Influence of TC Olwyn on blacktip reef sharks



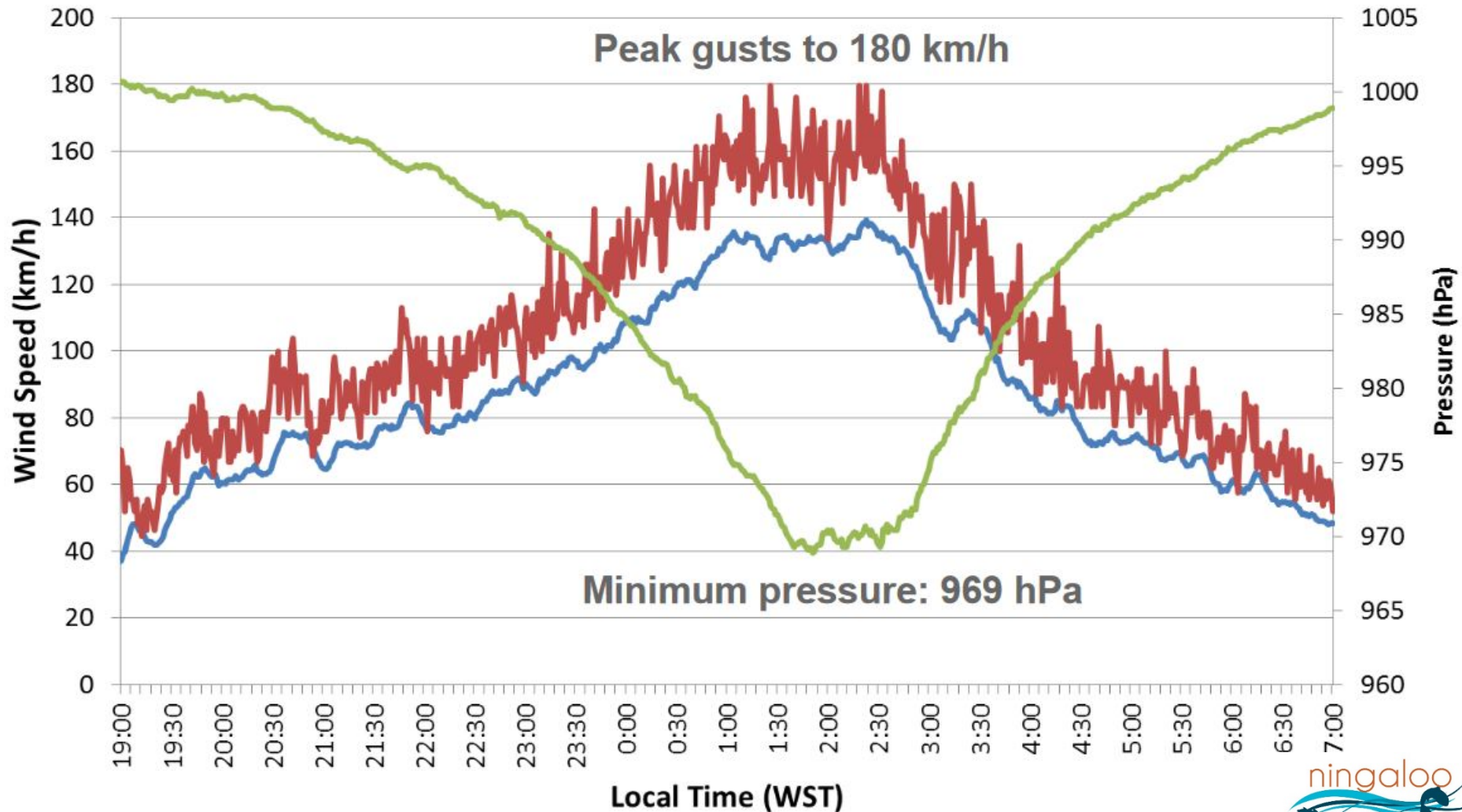


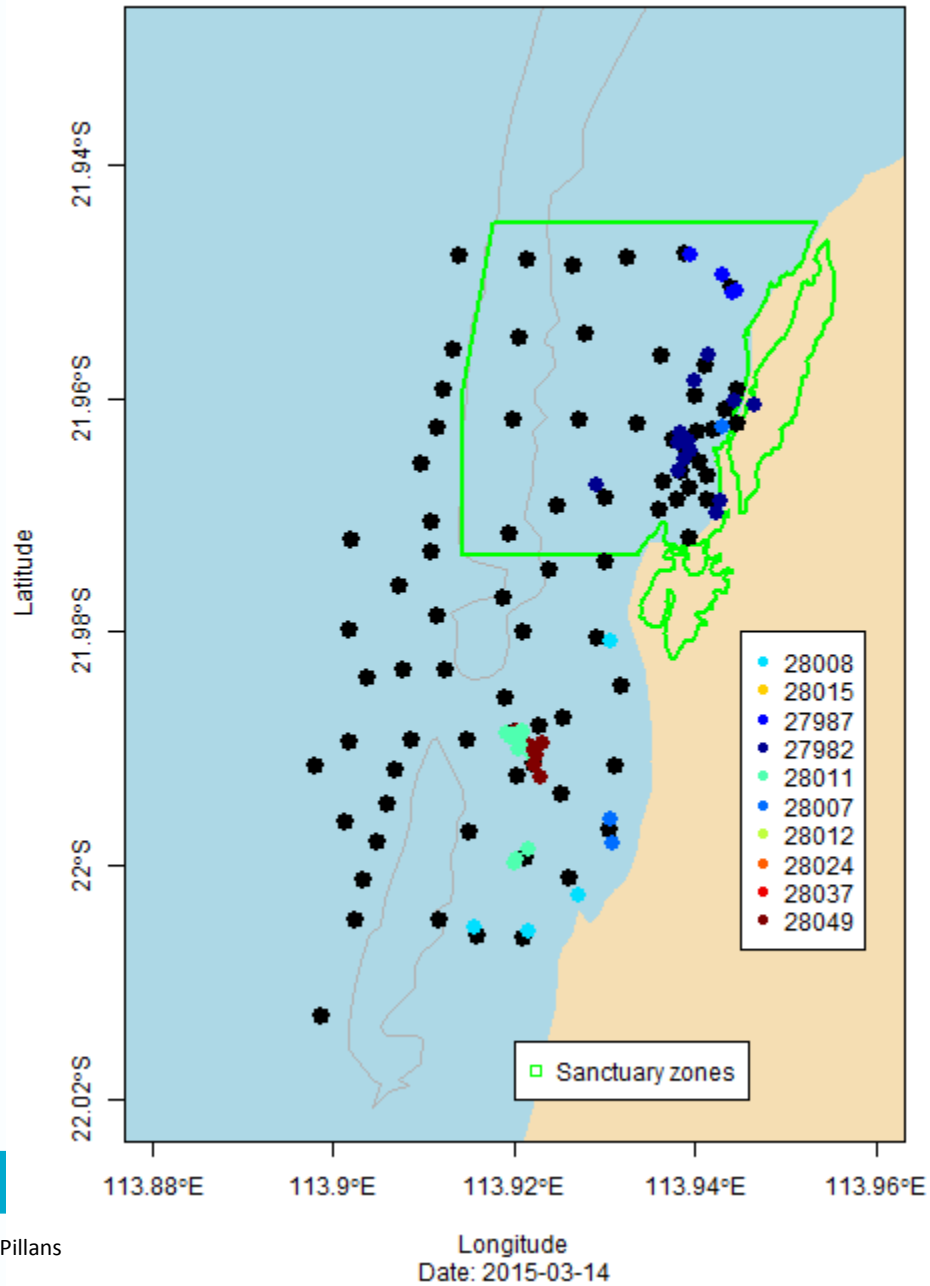


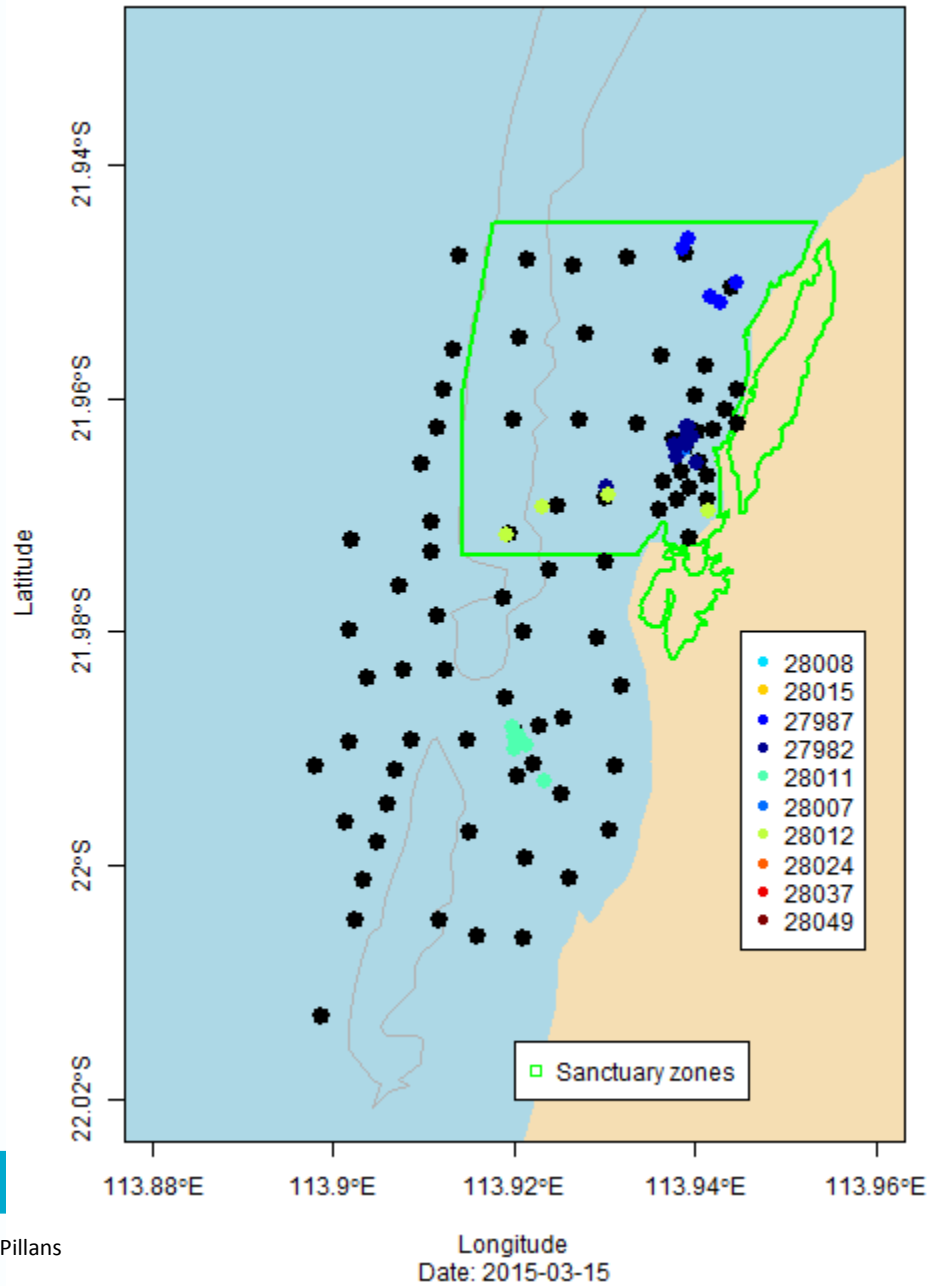


Weather Observations from Learmonth Airport 12-13 March 2015

— Wind Speed (km/h) — Wind Gust (km/h) — Pressure (hPa)



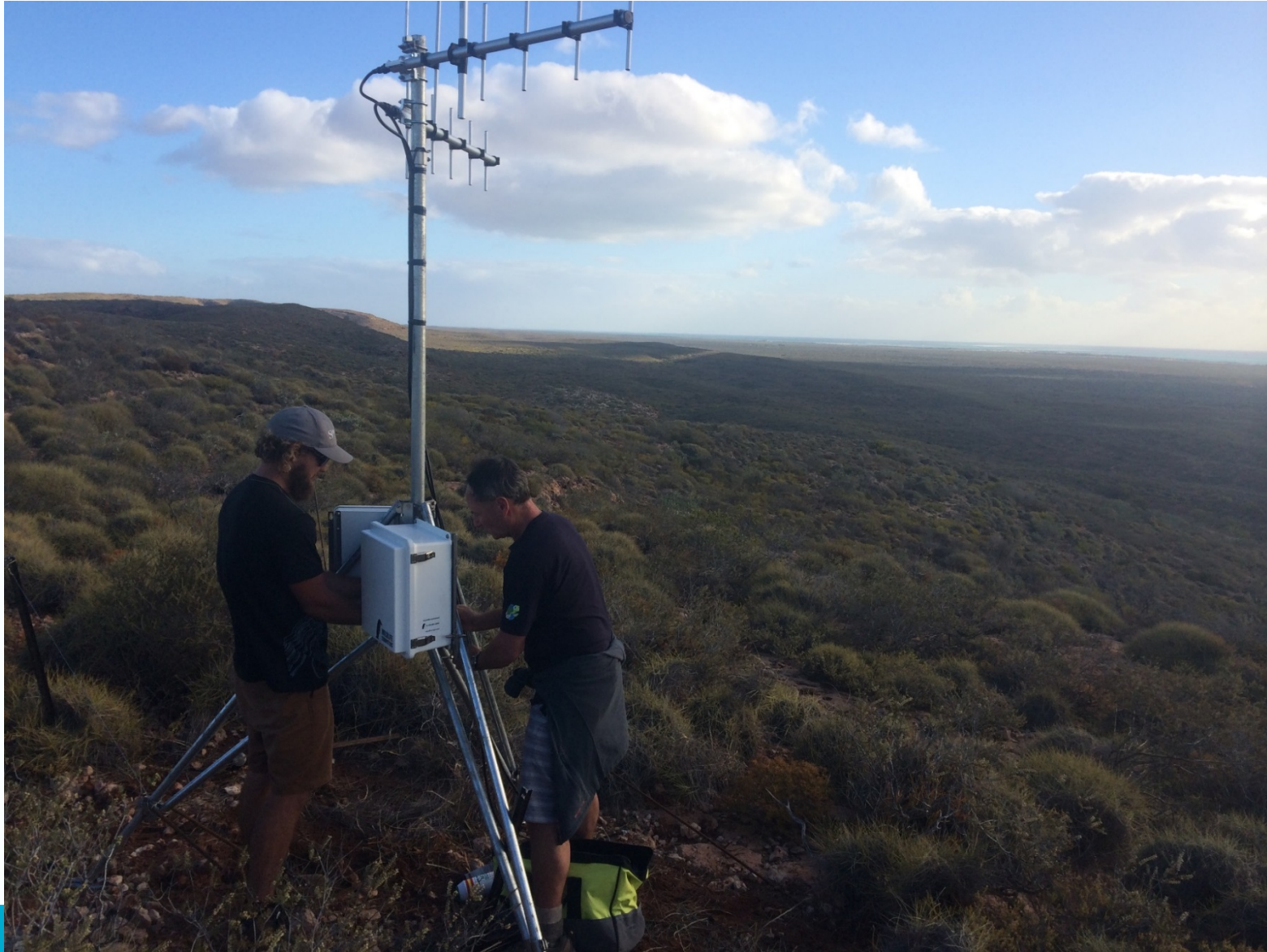




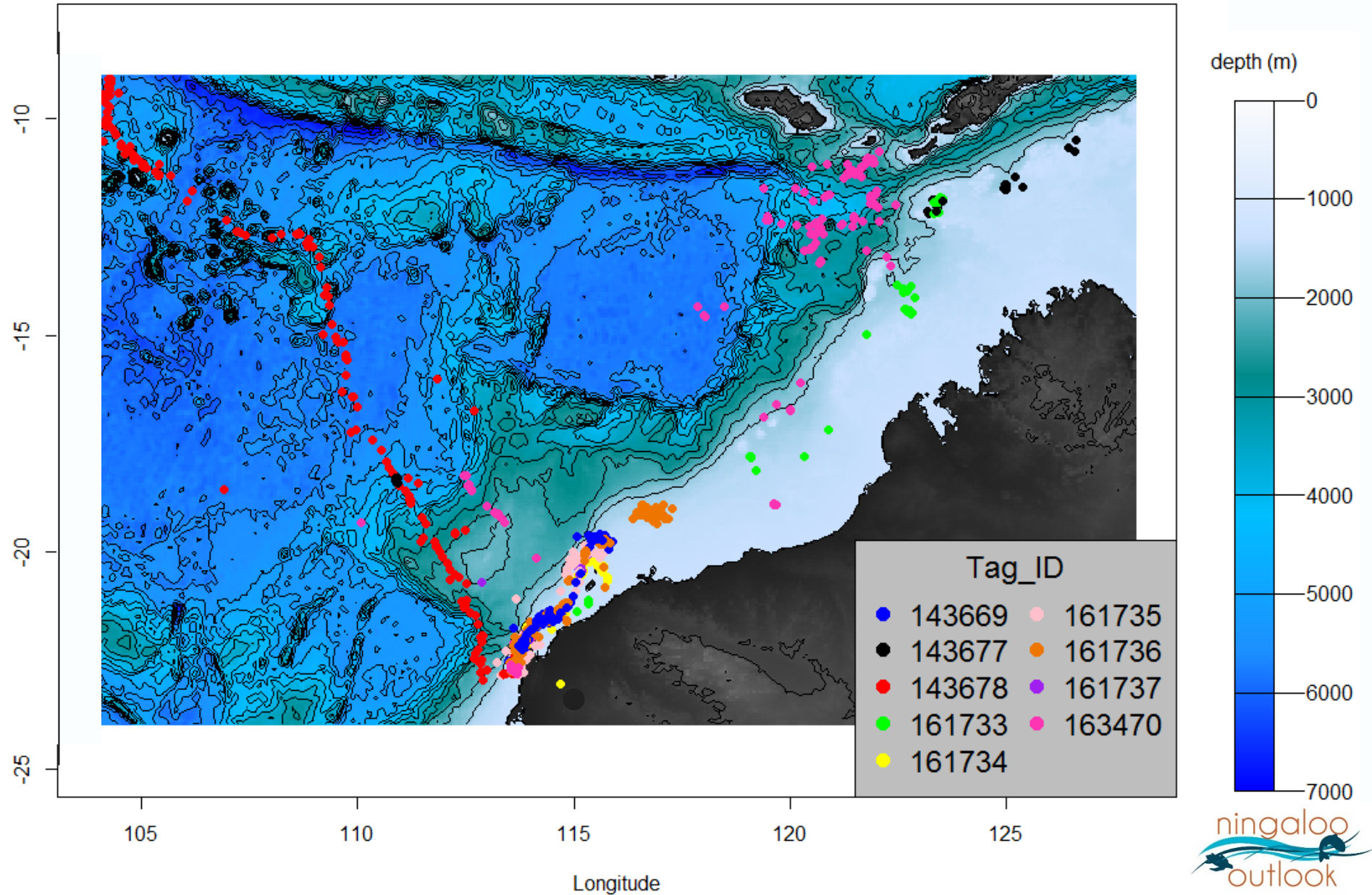
Satellite tags



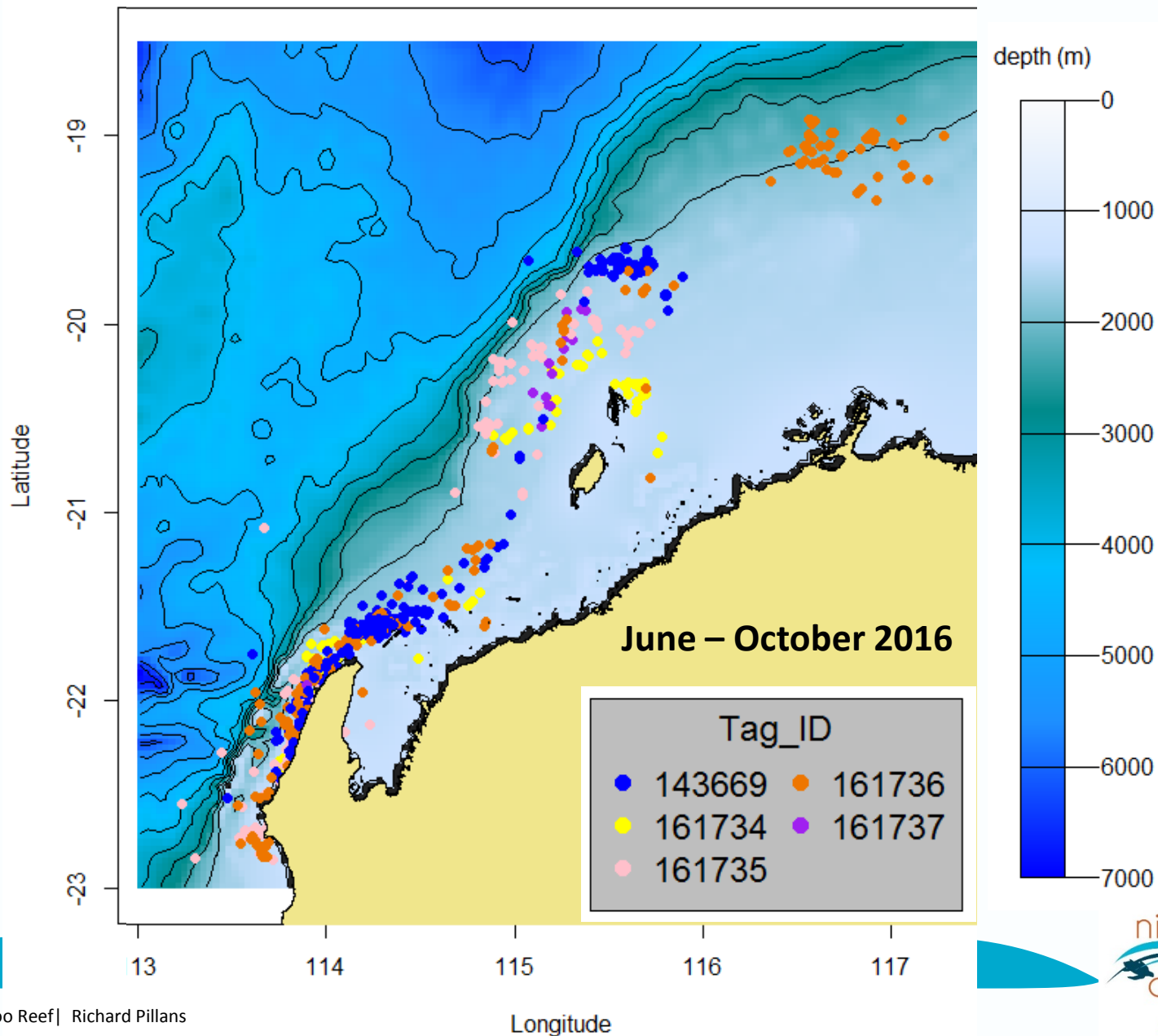
MOTE – ground based Argos receiving station

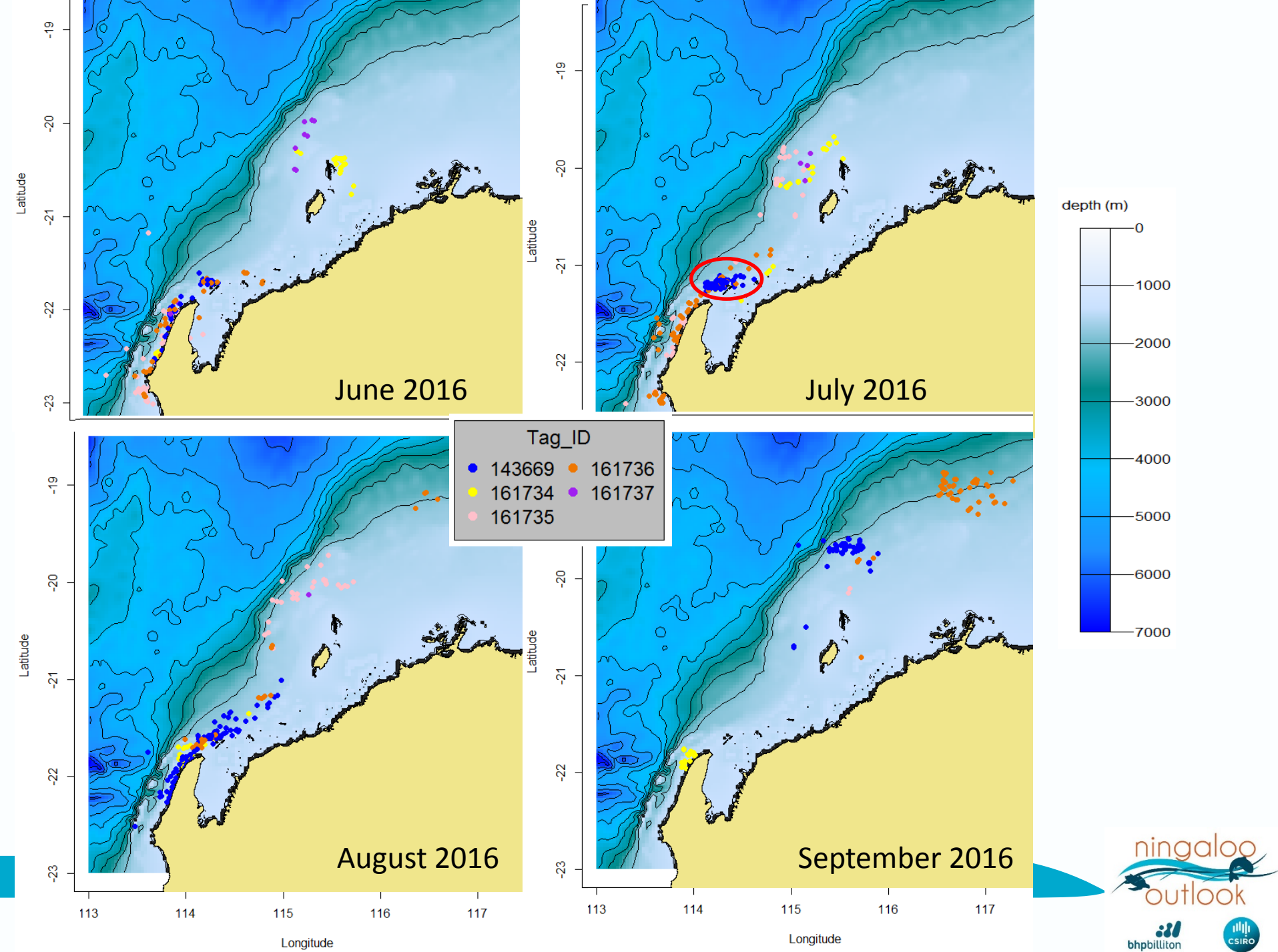


Whale Shark satellite tracks



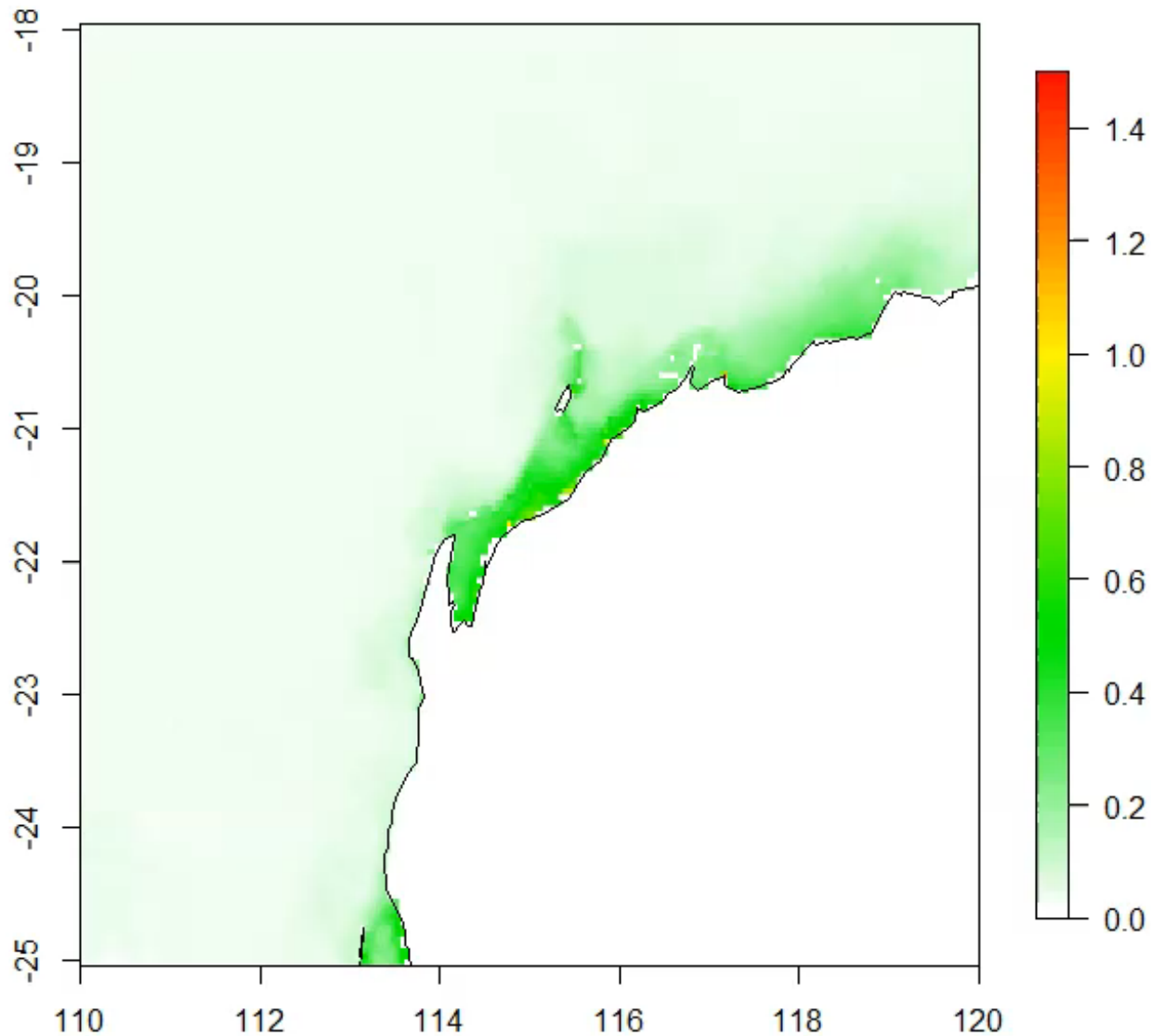
Synchronised movements?



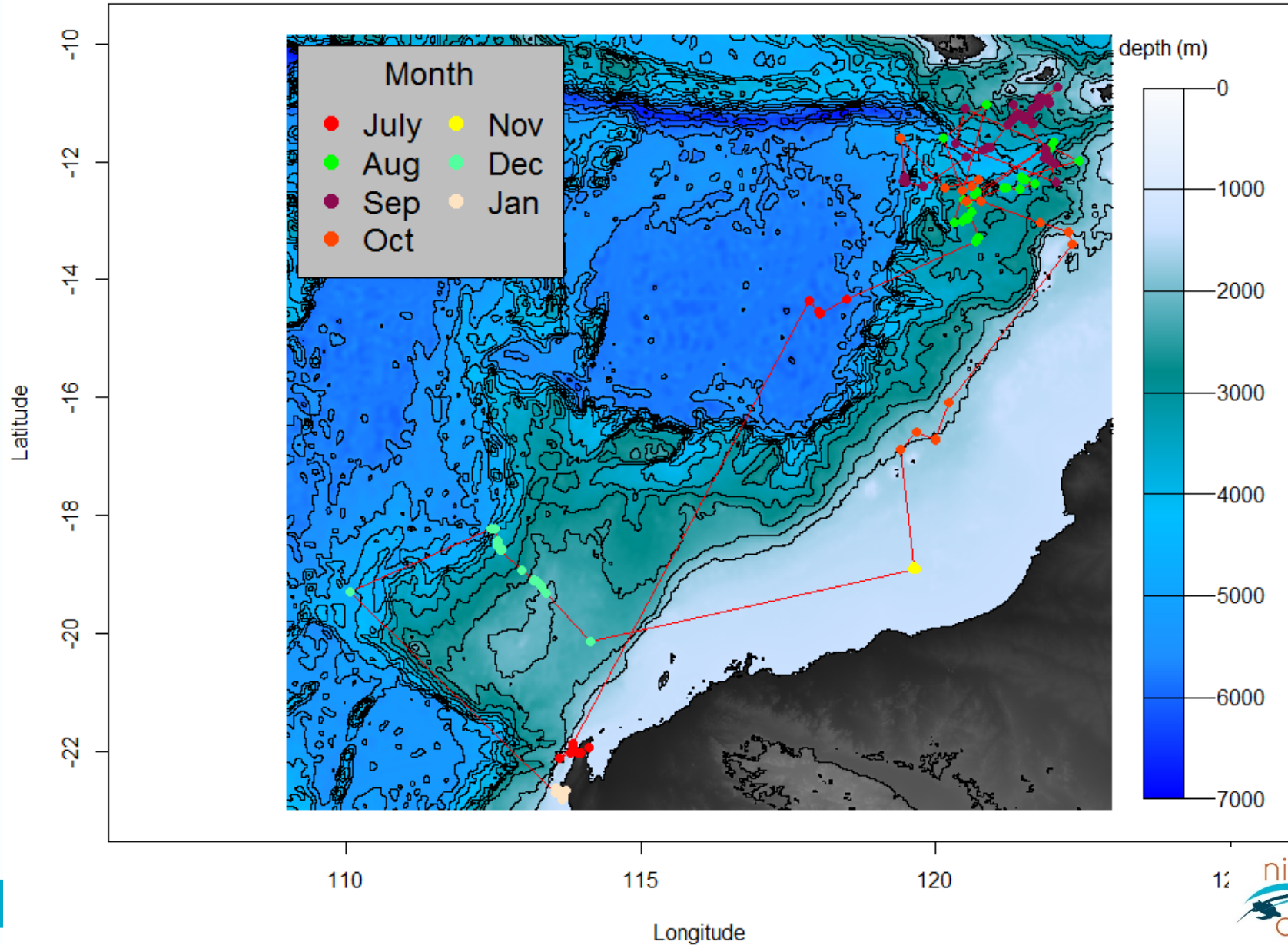


Relationship with Chlorophyll a

2015-03-17 12:00:00



Big Mumma – I still call Australia home!



Relevance and future directions

- Reef shark home range, habitat use, reproductive movements and residence relevant to marine park management
- Interactions between recreational fishers and shark are increasing
- Understanding of shark movement and residence important to better understand dynamics of these interactions
- Focus on data analysis and papers
- Timing, distance and routes of Whale Shark movement and migration relevant to Whale Shark management
- Focus on obtaining data required for robust estimates of Whale Shark population size and status over the next two years

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Acknowledgements

- BHP Billiton-CSIRO Ningaloo Outlook Marine Research Partnership
- DPAW Exmouth Office- Peter Barnes, Dani Rob
- Kevin Lay - Wildlife computers
- Anna Cresswell, Jessica Stubbs
- AATAMS
- Northwest Air
- Peter Grierson



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Foraging Ecology and Energetics of Ningaloo Green Turtles

Jessica Stubbs PhD Scholar

Supervisors: Dr Nicola Mitchell (UWA), Dr Mat Vanderklift (CSIRO), Dr Sabrina Fossette-Halot (UWA/DPaW)

Ningaloo Outlook – A partnership between BHP Billiton and CSIRO

WESTERN COASTAL/OCEAN & ATMOSPHERE
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Green Turtles at Ningaloo

- **Green turtles** common at Ningaloo
 - **Nesting** and **foraging** turtles
- Marine park management plan focusses on **nesting turtles**
 - **Little known** about **foraging turtles** in the area



Why is Foraging Ecology Important?

- Green turtles are primarily **herbivorous**
 - Foraging ground **specific diets**
 - Some **animal** matter
- Diet influences **energy budgets**
 - Growth and reproduction
 - **Future climates** may influence food availability



Diet

- **Stable isotope analysis**
 - **Nesting and foraging** turtles
 - Sample foraging turtles in **two seasons**
- **Skin and blood** samples
- Important **food sources**
- **Variation** with size, condition etc.?

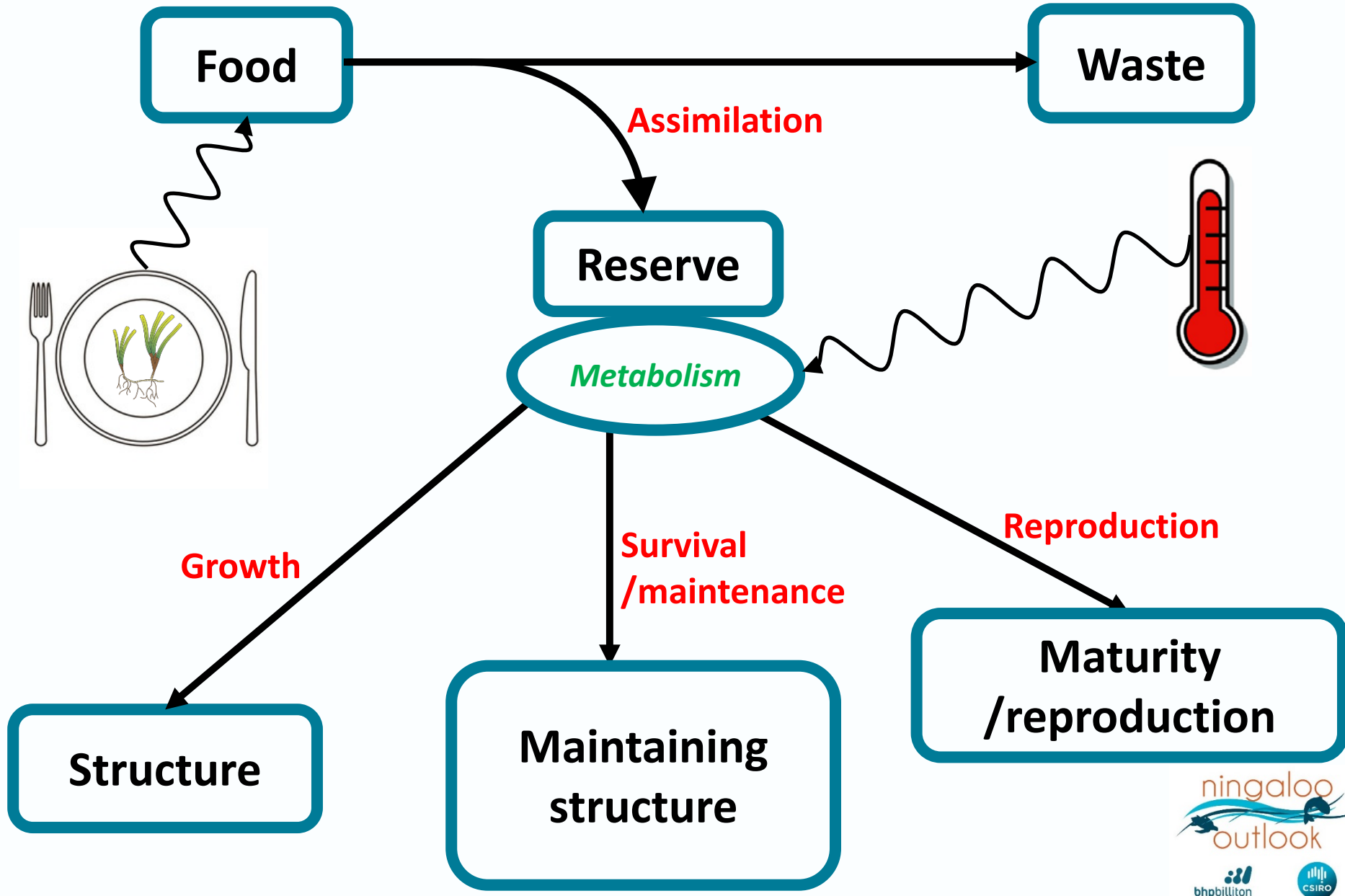


Foraging Behaviour

- **Satellite tagging**
 - Important feeding **areas**
 - **Variation** with size, condition etc.?
- **Habitat Surveys**
 - Identify areas with suitable **food sources** and **availability**



Energetics of Green Turtles - DEB Model

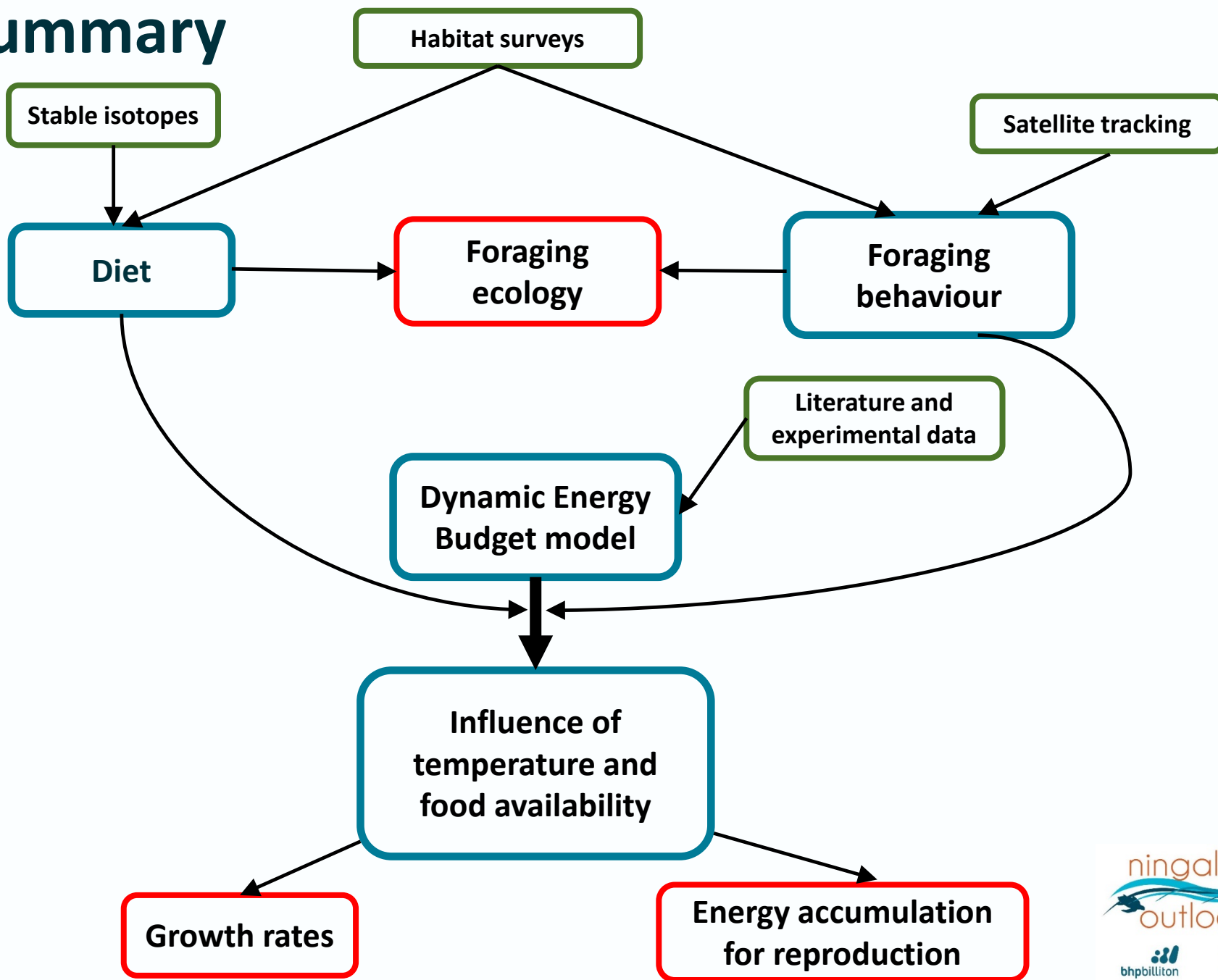


Influence of Temperature and Food Availability

- Model **growth rates** and **energy reserves**
 - Different scenarios of **temperature** and **food availability**
- Investigate **growth rates** and **processes**
 - e.g. **energy** accumulation for **reproduction**



Summary



Acknowledgements

- BHP Billiton-CSIRO Ningaloo Outlook Marine Research Partnership
- UWA School of Biological Sciences



THE UNIVERSITY OF
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Theme 3 Question Time





Symposium Closing Remarks

