An integrated study of the Gladstone Marine System

Long term movement of Green Turtles, *Chelonia mydas,* in Gladstone Harbour: advantages of acoustic telemetry

Richard Pillans   **11–12 August 2015**
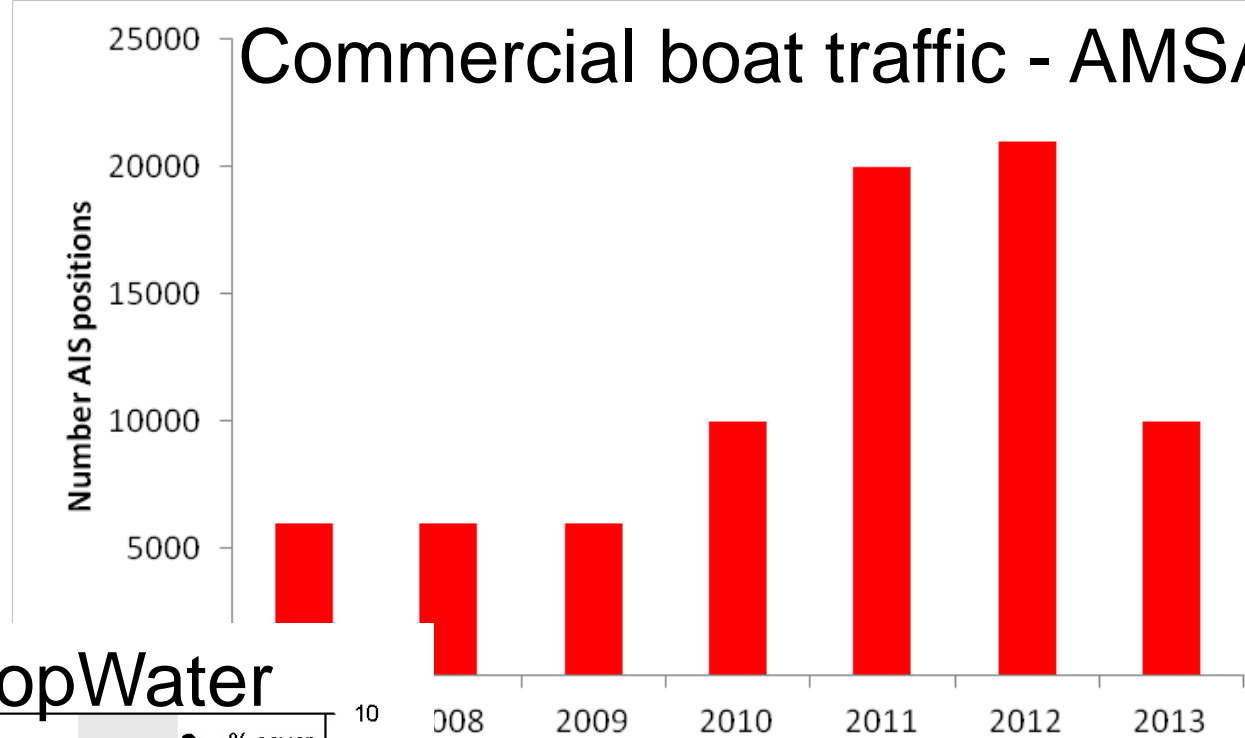
GISERA & development in Gladstone Harbour

- **Increasing LNG developments**

- **But, a long history of Port development & other impacts**

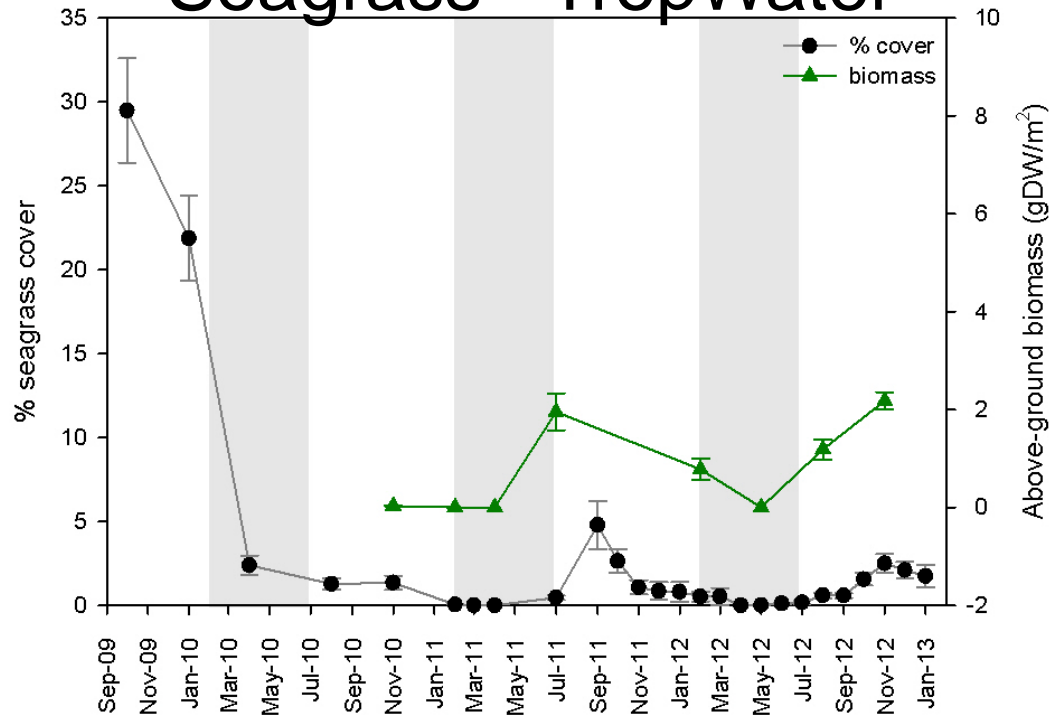- **Lessons & insights from Gladstone are relevant to many other areas of coastal Australia**

Background

Commercial boat traffic - AMSA

Seagrass - TropWater

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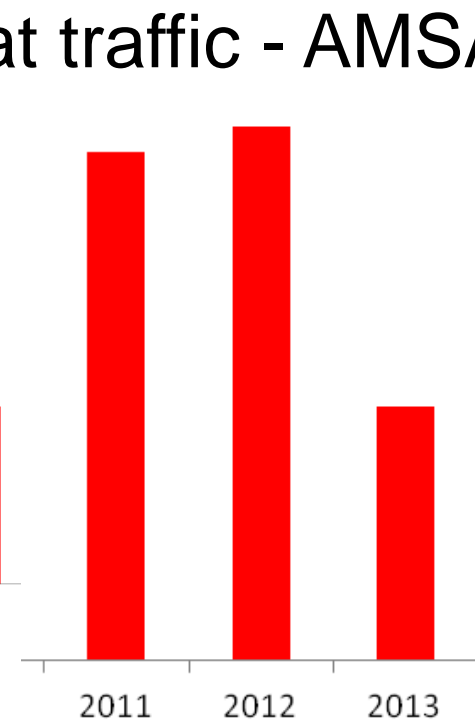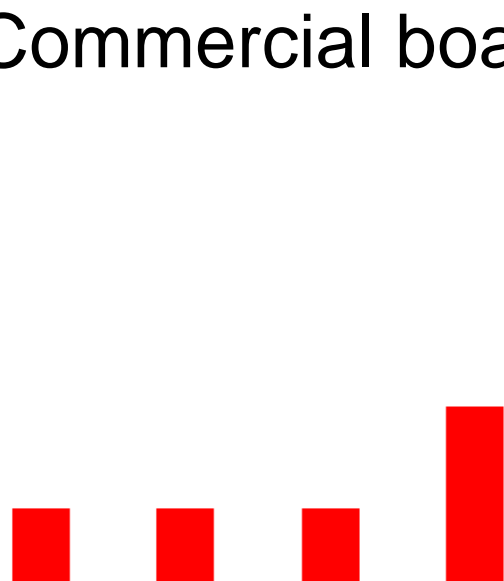**Background**

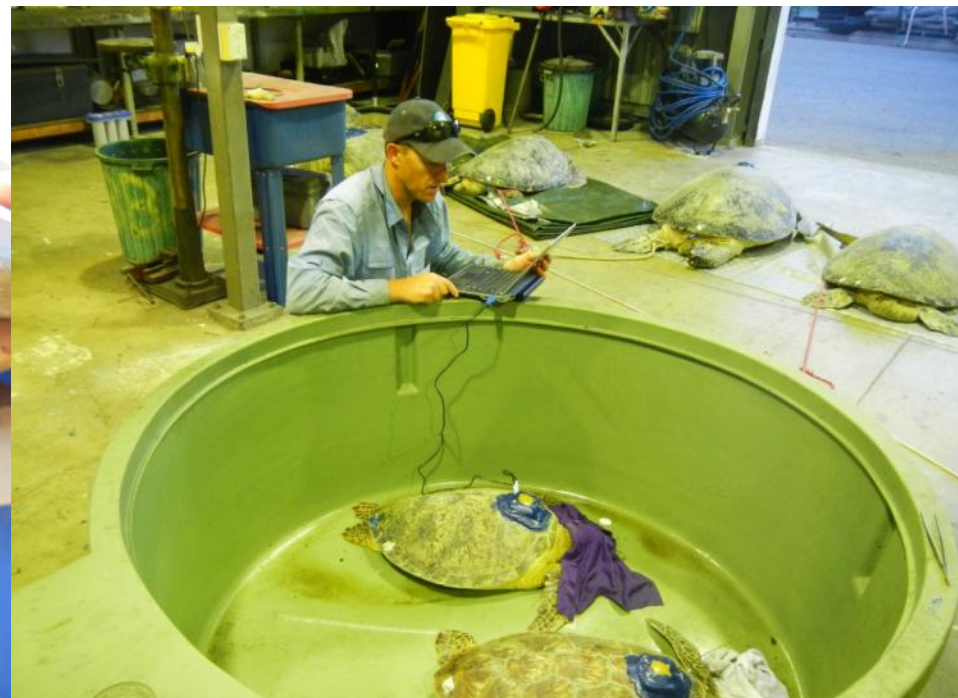Commercial boat traffic - AMSA

Turtles killed by vessels
DEHP 2011
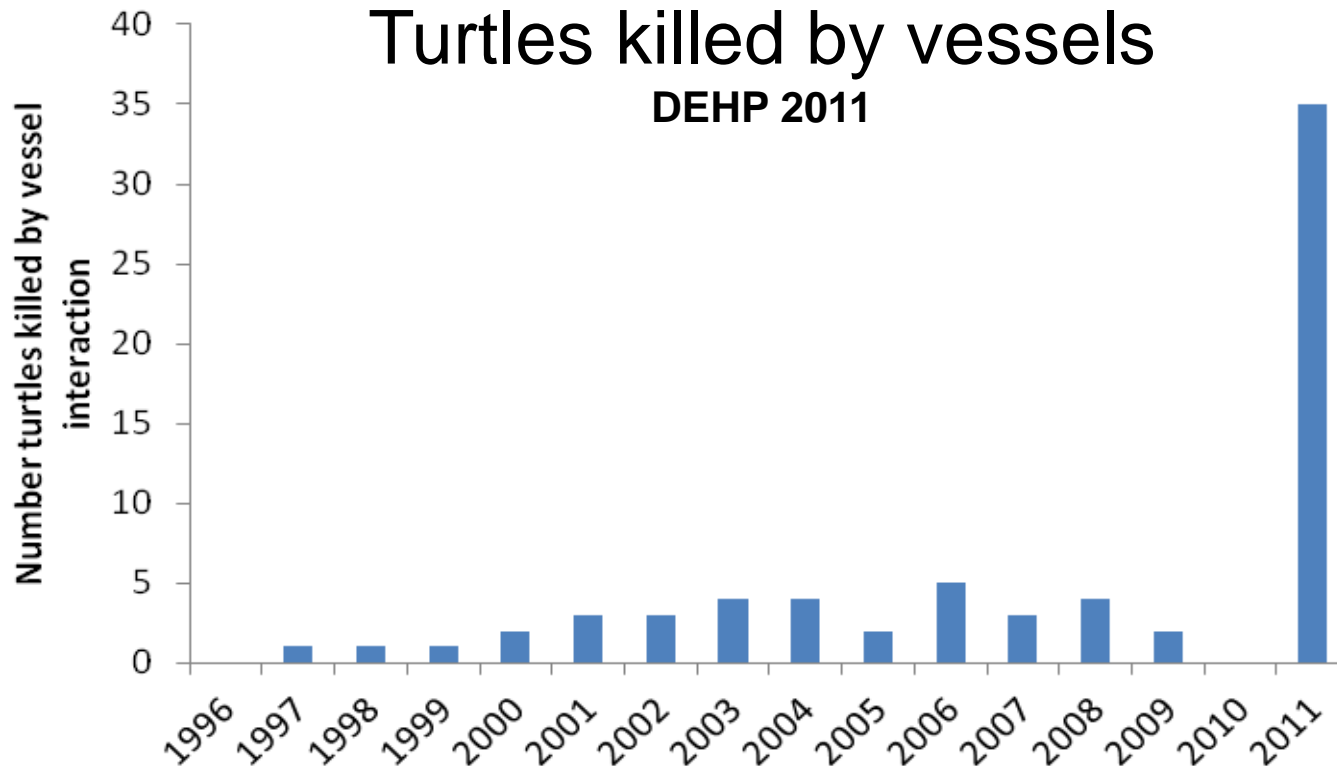
Questions

- **What are turtle home range sizes?**

- **How does turtle habitat use vary with habitat, tide and time of day?**

- **How comparable are satellite and acoustic tagging results?**

- **How can turtle habitat utilisation be used to better manage turtle interactions in Gladstone Harbour?**
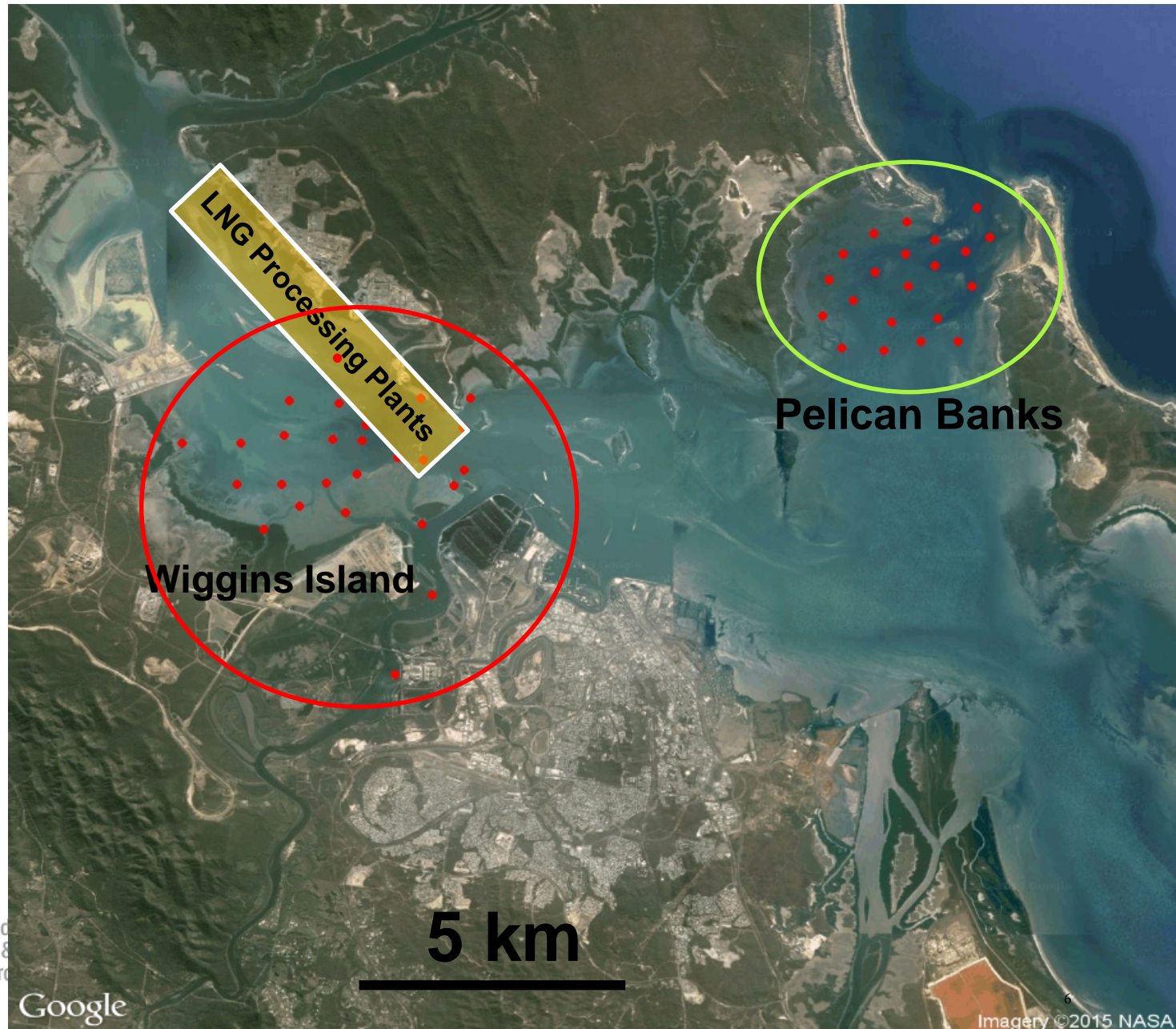
Gladstone Harbour Acoustic Tracking Array

44 acoustic receivers

24 at Wiggins Island:

- no seagrass
- high commercial traffic
- large scale development

20 at Pelican Banks:

- high seagrass cover
- low commercial traffic

LNG Processing Plants

Pelican Banks

Wiggins Island

5 km

GISERA Gas Ind Social & Research

Google

Imagery ©2015 NASA
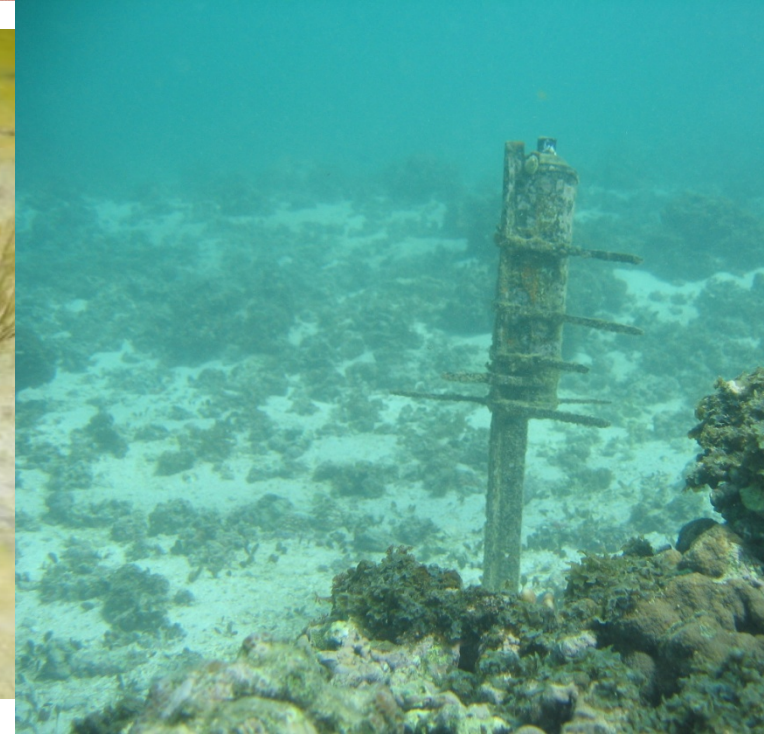
6

Turtle capture and tagging

- **Capture**

Vemco acoustic tags & receivers

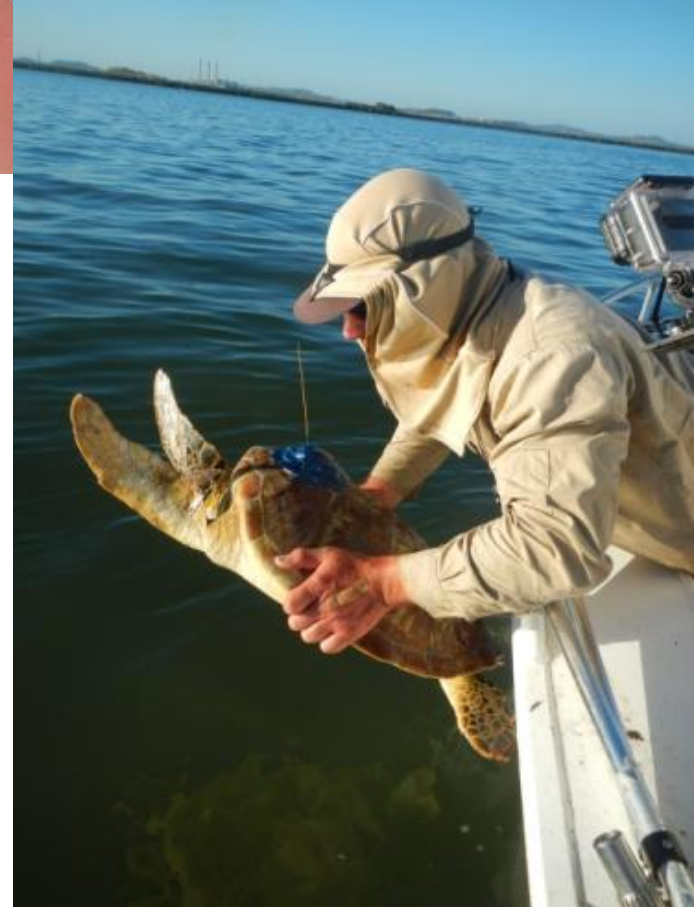**Wildlife Computer SPLASH10-F-296A fastloc GPS tags**

Turtle capture and tagging

- **Capture**
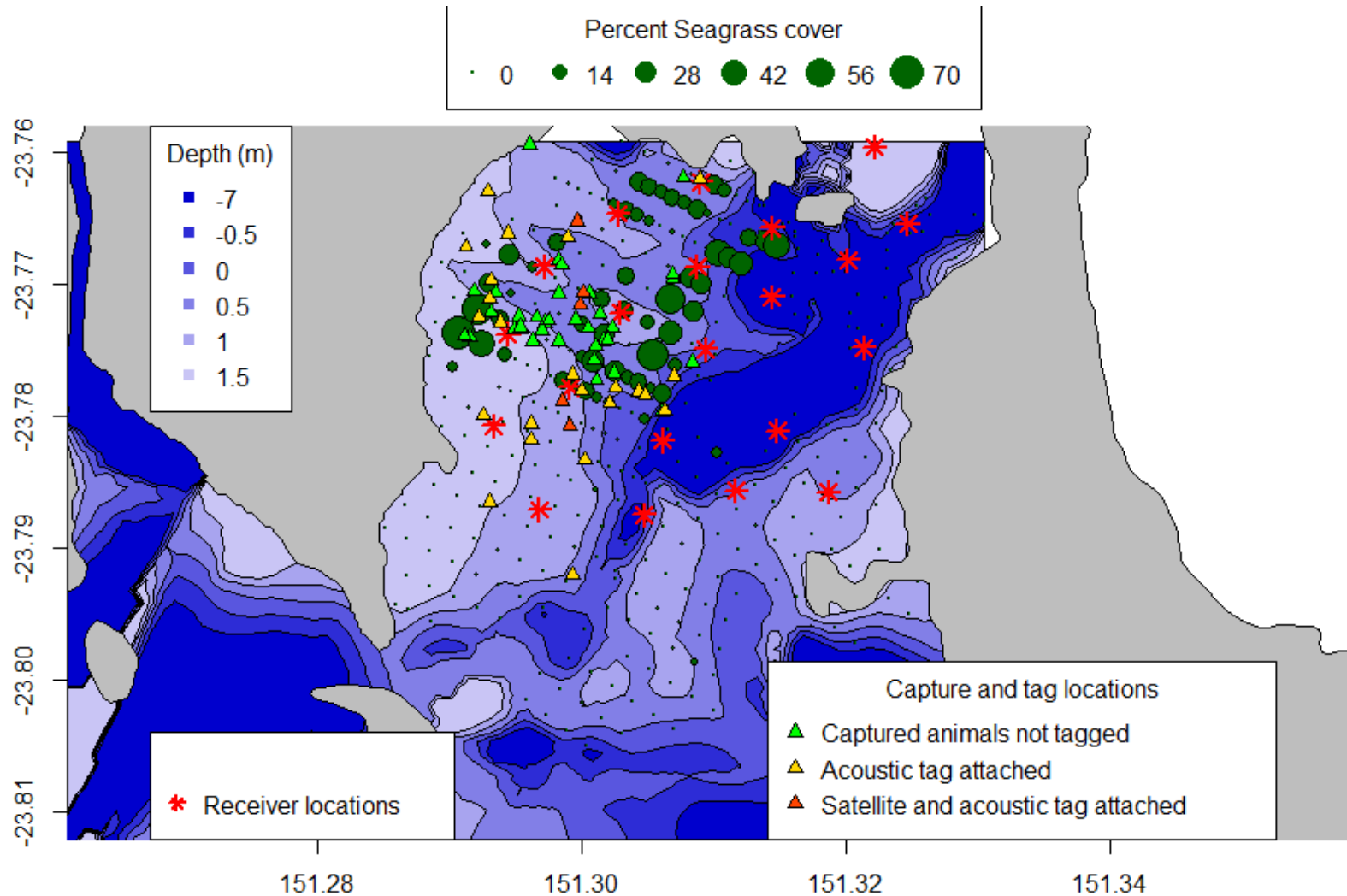
Vemco acoustic tags & receivers

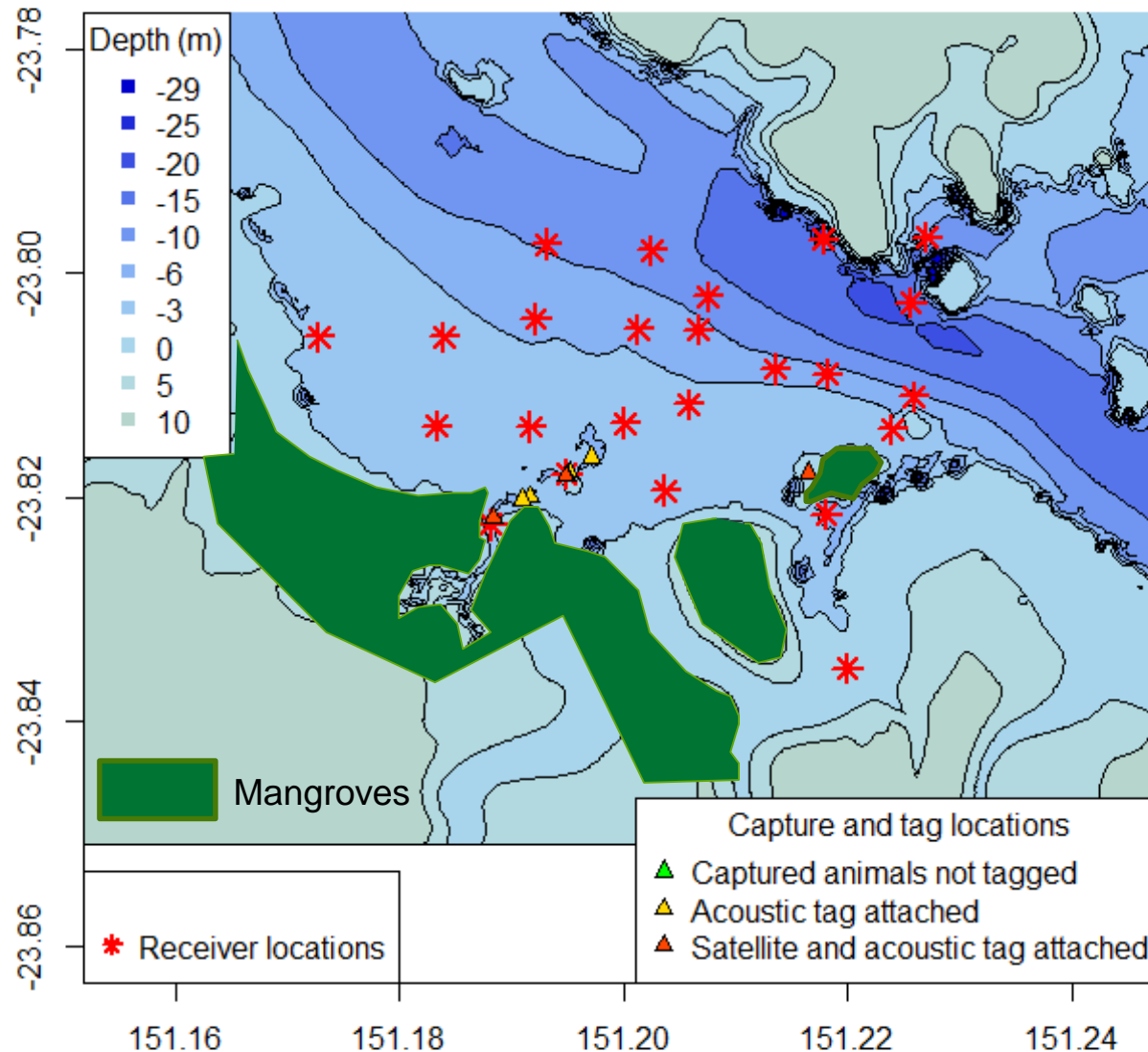**Wildlife Computer SPLASH10-F-296A fastloc GPS tags**

Turtle tagging – Pelican Banks

- **33 tagged with acoustic tags at Pelican Banks**
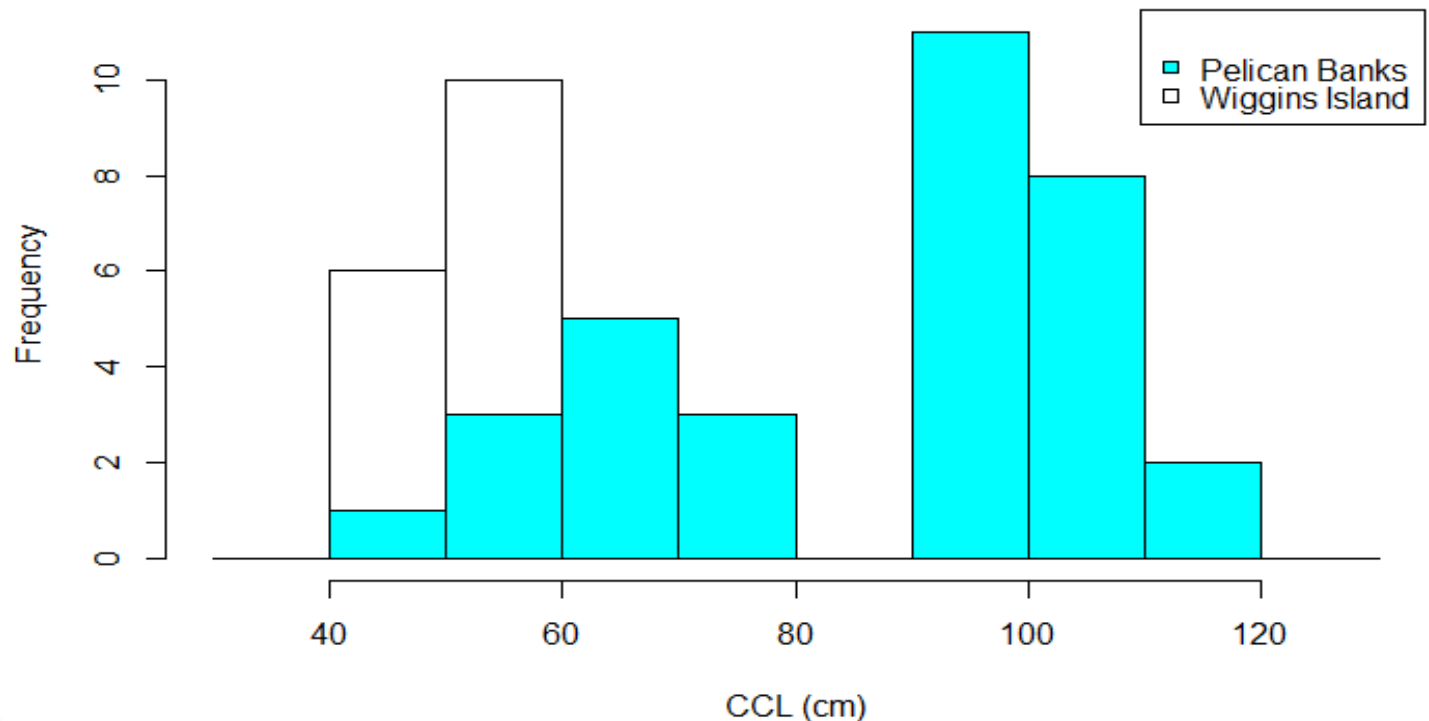- **5 tagged with both satellite and acoustic tags**

Turtle tagging – Wiggins Island

- **16 turtles tagged with acoustic tags at Wiggins Island**
- **5 tagged with both satellite and acoustic tags**

Results – Population structure

- **Wiggins Island mainly juveniles**
- **Pelican Banks mainly adults and sub-adults**

Home range estimation

- **Acoustic tags** - 1.4 million detections May 2013 – September 2014 (49 tags)

- **Satellite tags** – 8400 Fastloc detections May 2013 – September 2014 (10 tags)

- Home range estimates for acoustic and satellite data obtained using Kernel Utilisation Distribution (adehabitatHR – R)

- Acoustic detections randomly assigned to a 200 m buffer around each receiver

- HREF smoothing parameter most realistic given array configuration

- BOM tide and sunrise/sunset data

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Results – Home range estimates for all turtles at Pelican Banks

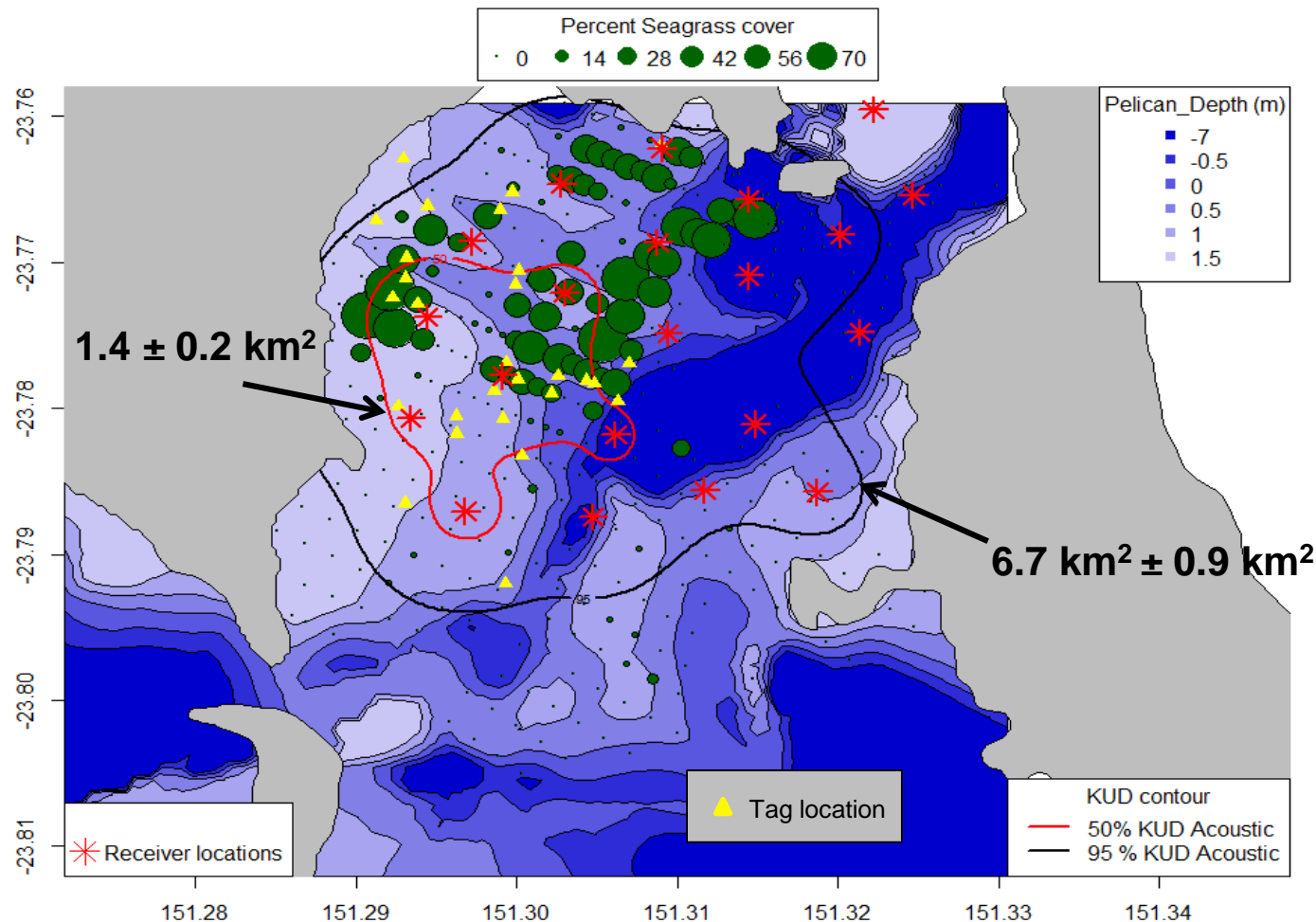## - cumulative kernel density utilisation for the population

• 50 and 95 % KUD contours for 33 Green Turtles at Pelican Banks
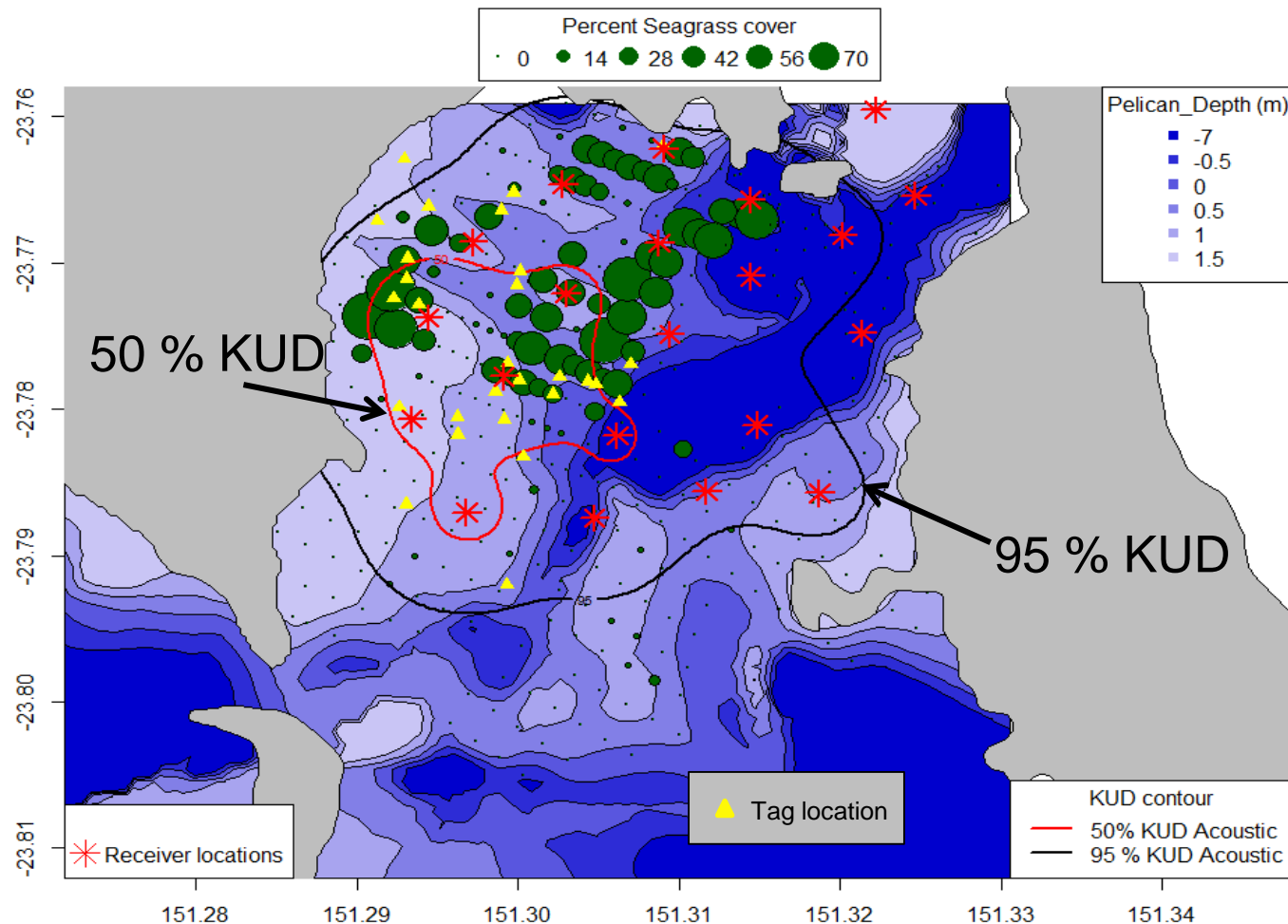
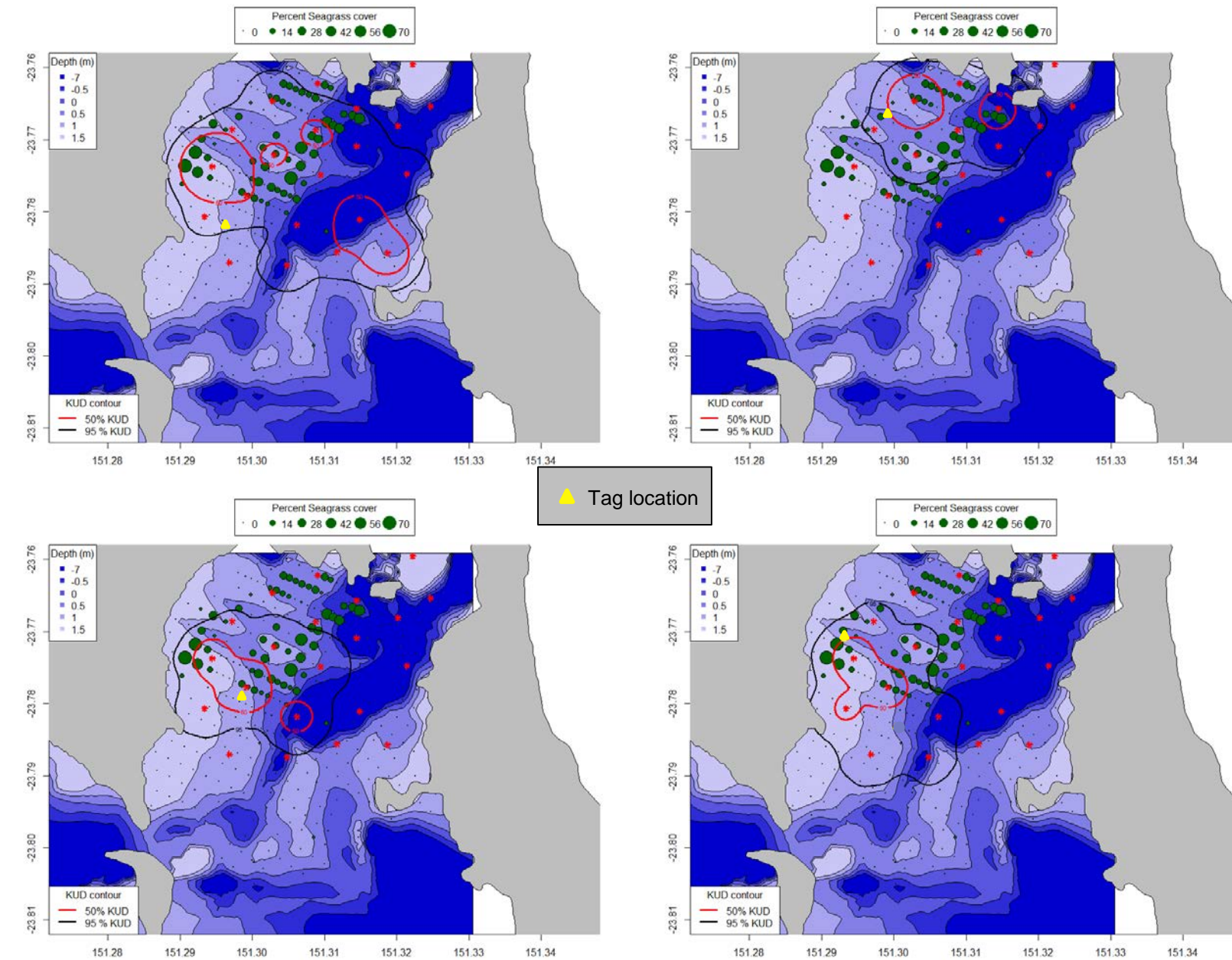# Results – Home range estimates for all turtles at Pelican Banks

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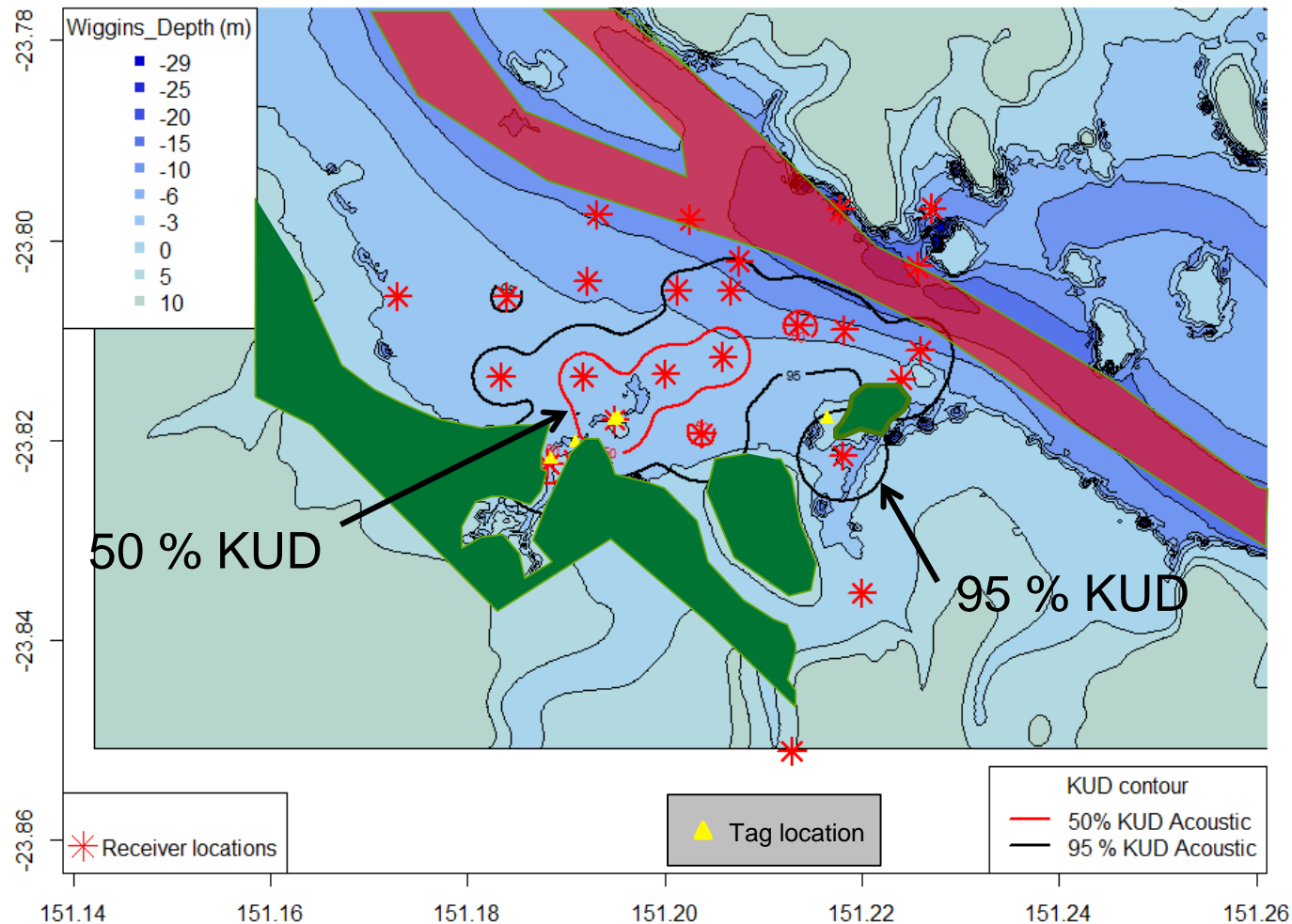
Results – Pelican Banks: individual variation

• high degree of overlap with seagrass coverage with individual variation

Results – Wiggins Island
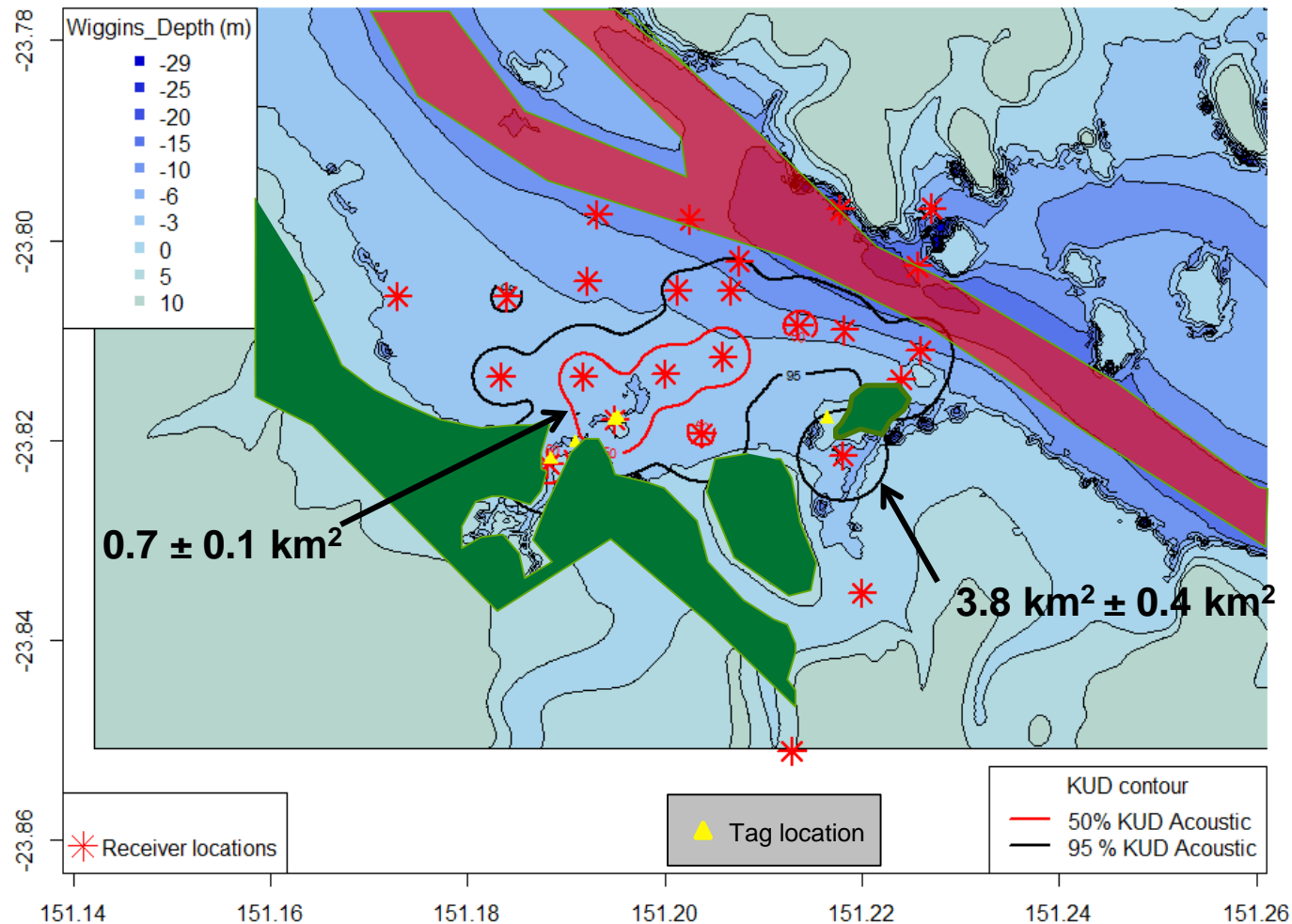## - cumulative kernel density utilisation for the population

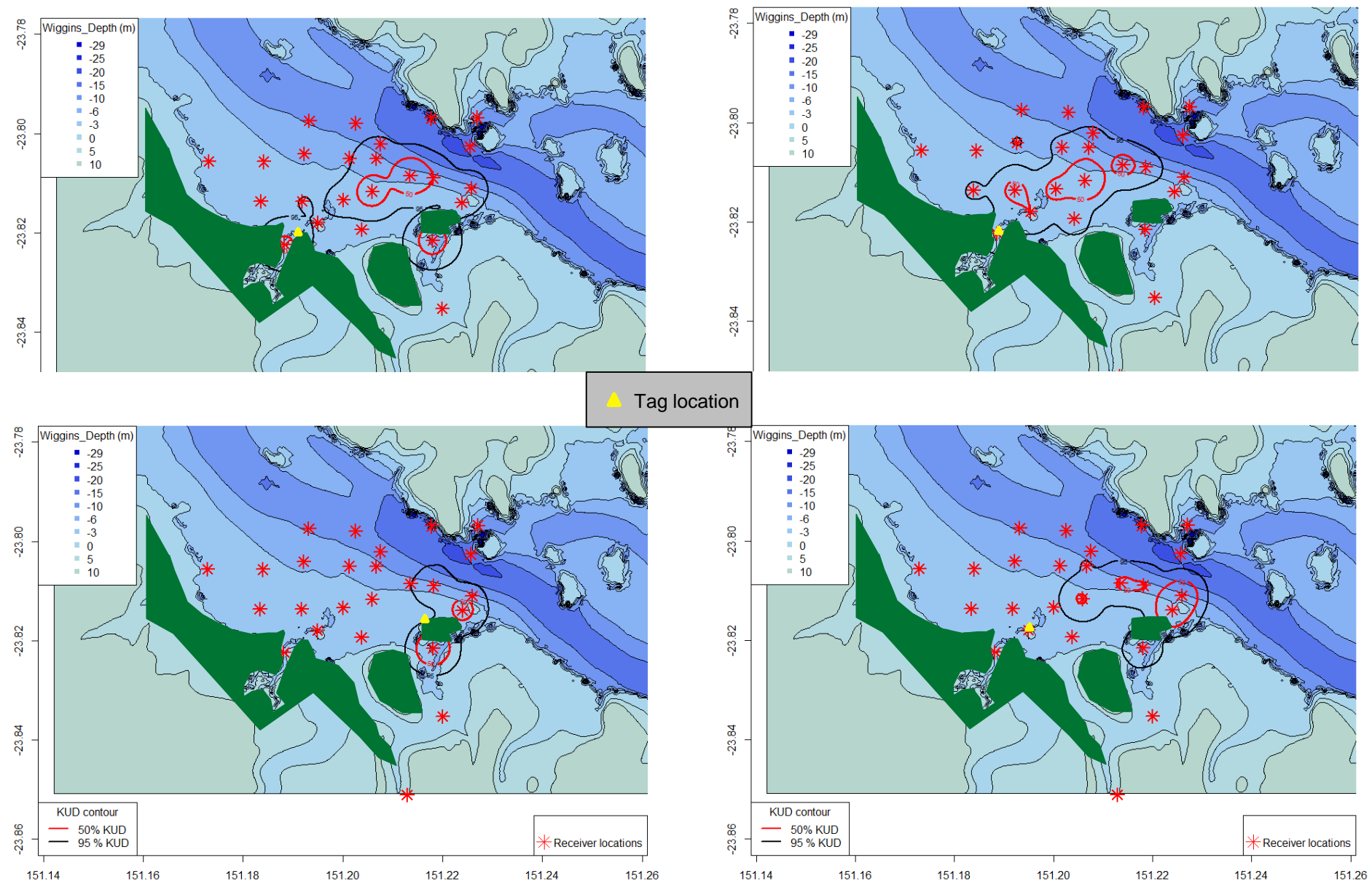• **50 and 95 % KUD contours for 16 Green Turtles**

Results – Wiggins Island
- cumulative kernel density utilisation for the population

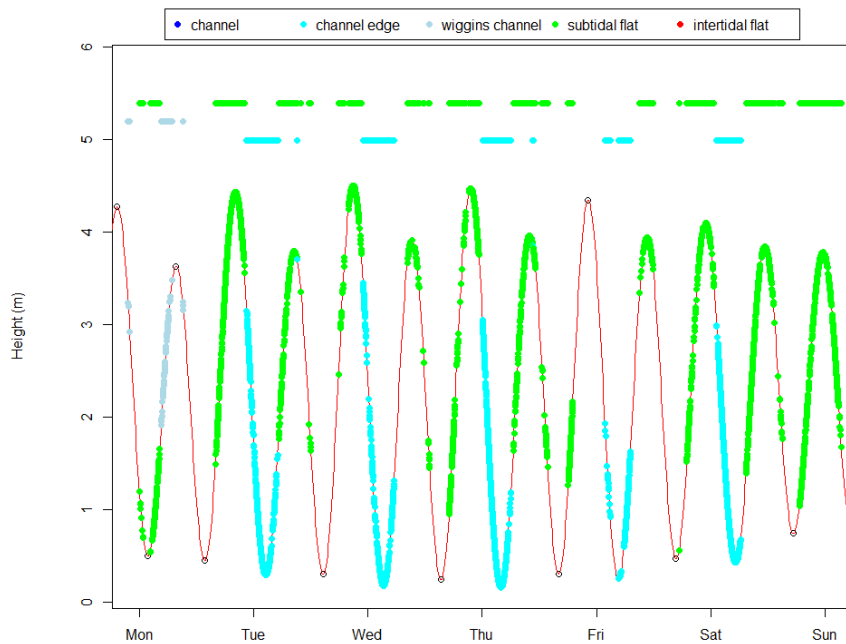• 50 and 95 % KUD contours for 16 Green Turtles

Results – Wiggins Island: high degree of overlap with intertidal mud flats and mangrove lined drains and shoreline with individual variation
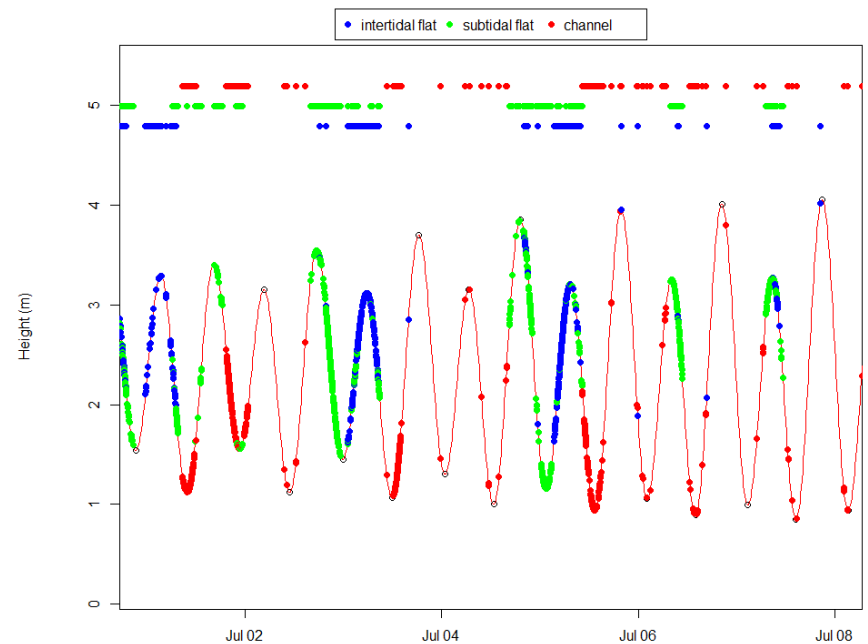
Results – influence of tide

- Greater use of flats during mid-high tide
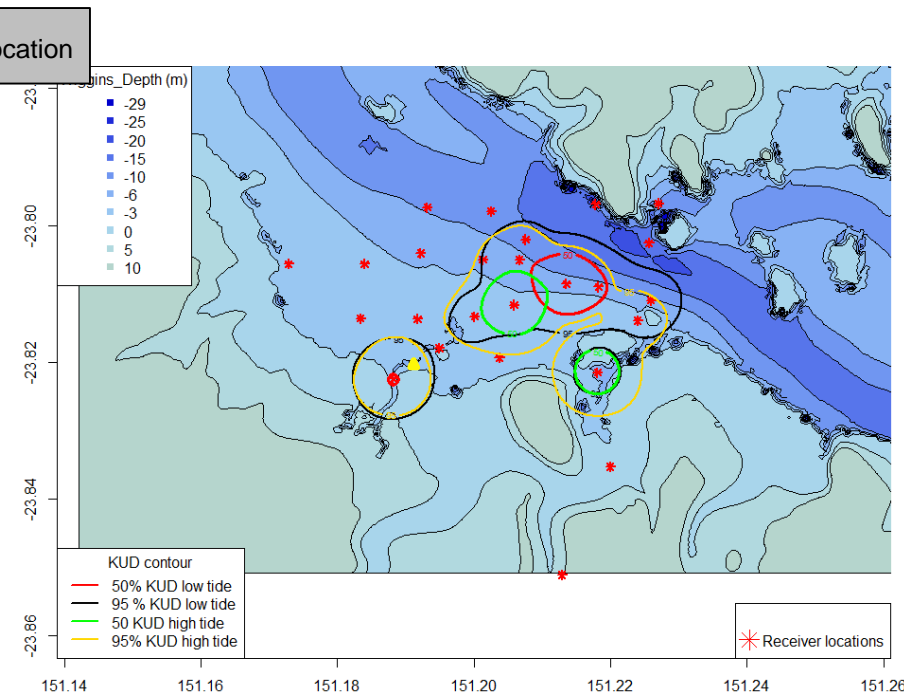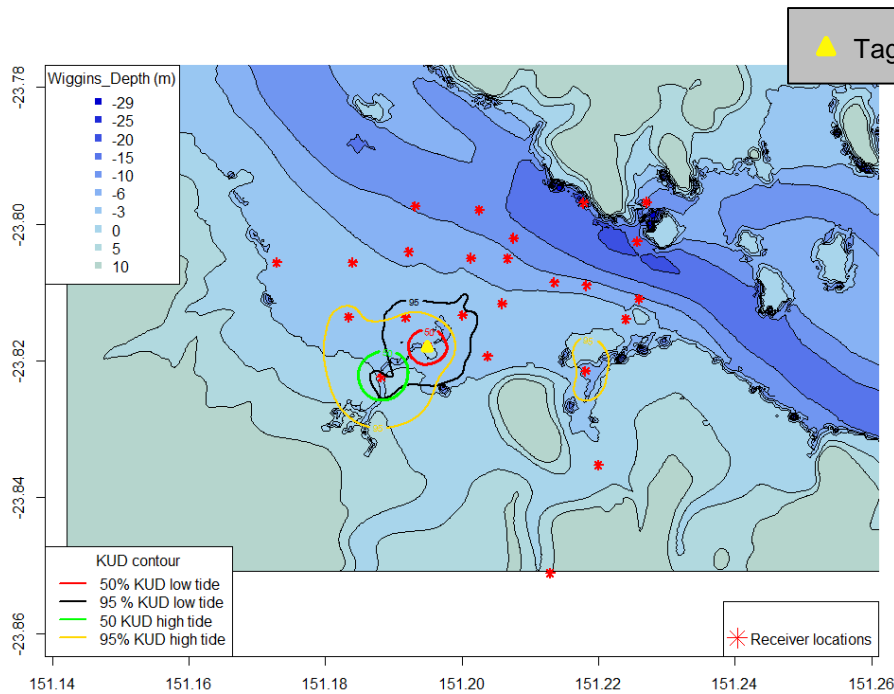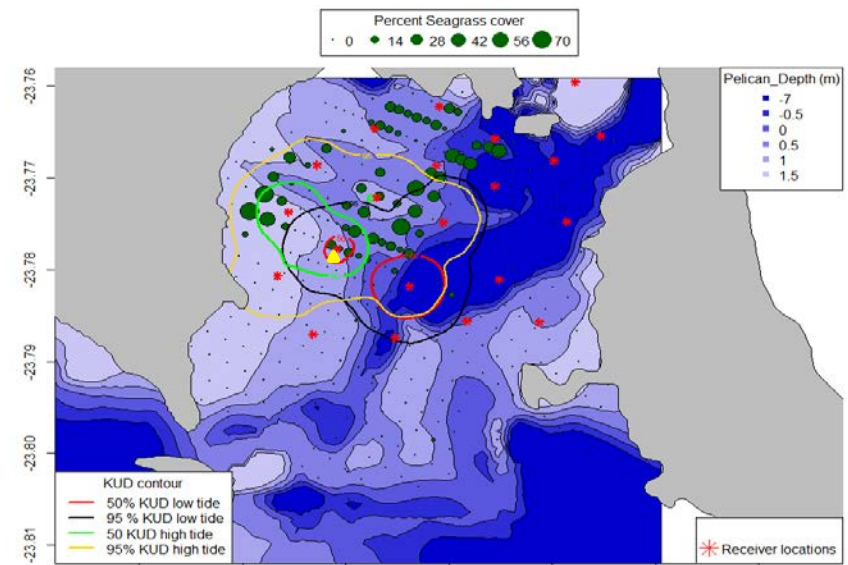- Greater use of channels at low tides

Wiggins Island
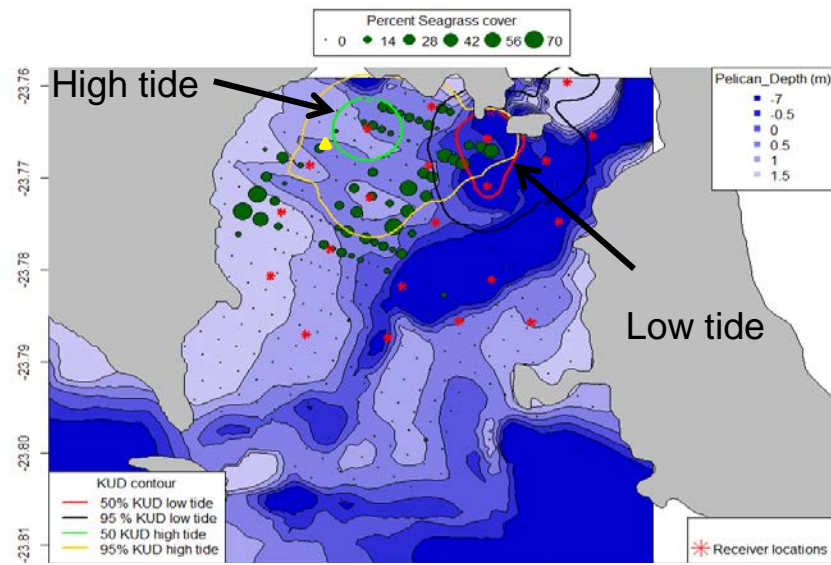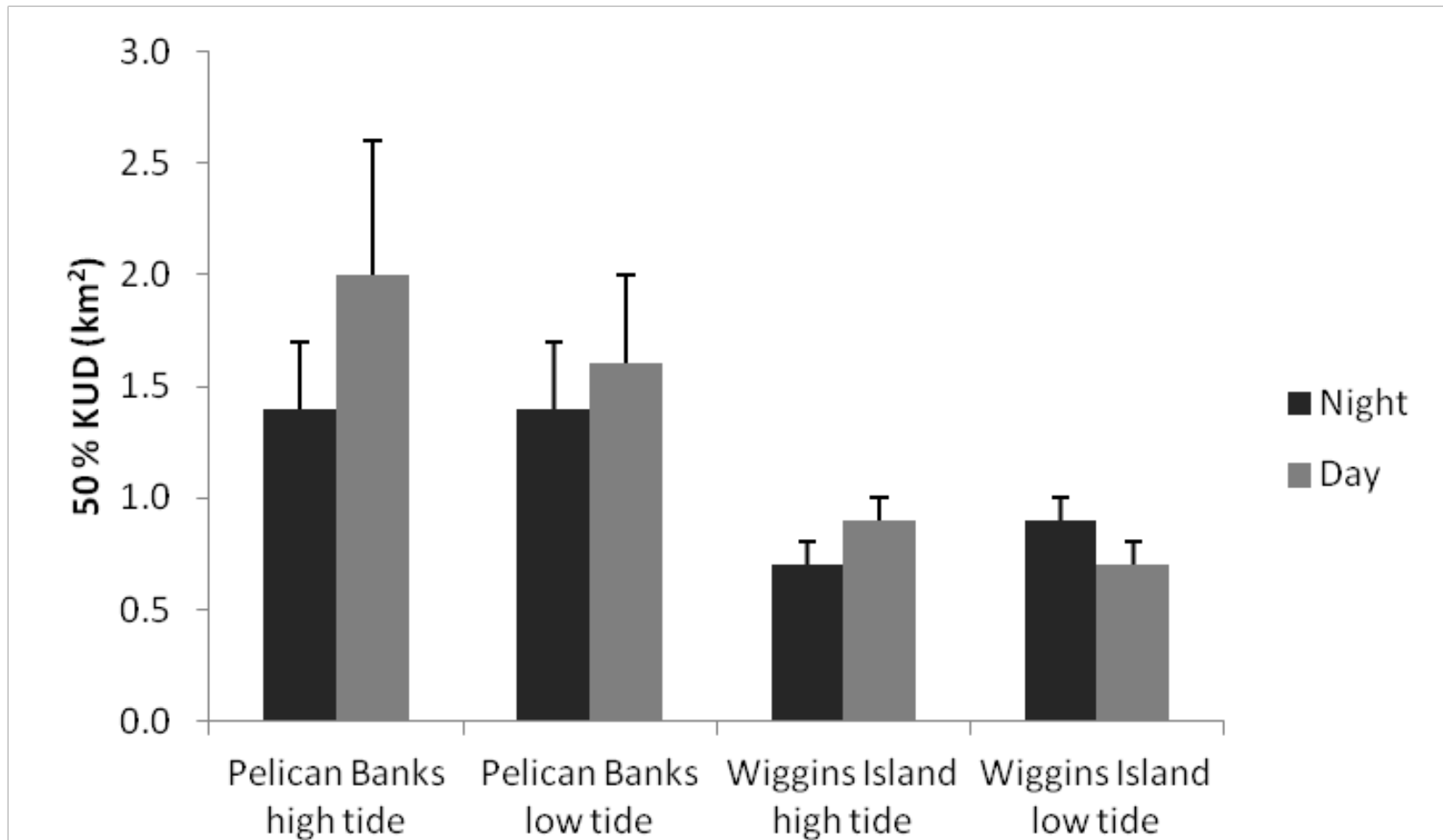
Pelican Banks

Results – strong influence of tide on movement

Habitat use – Day vs Night

• **no difference in size of home range at high and low tide between day and night**

Pelican Banks – Satellite tags
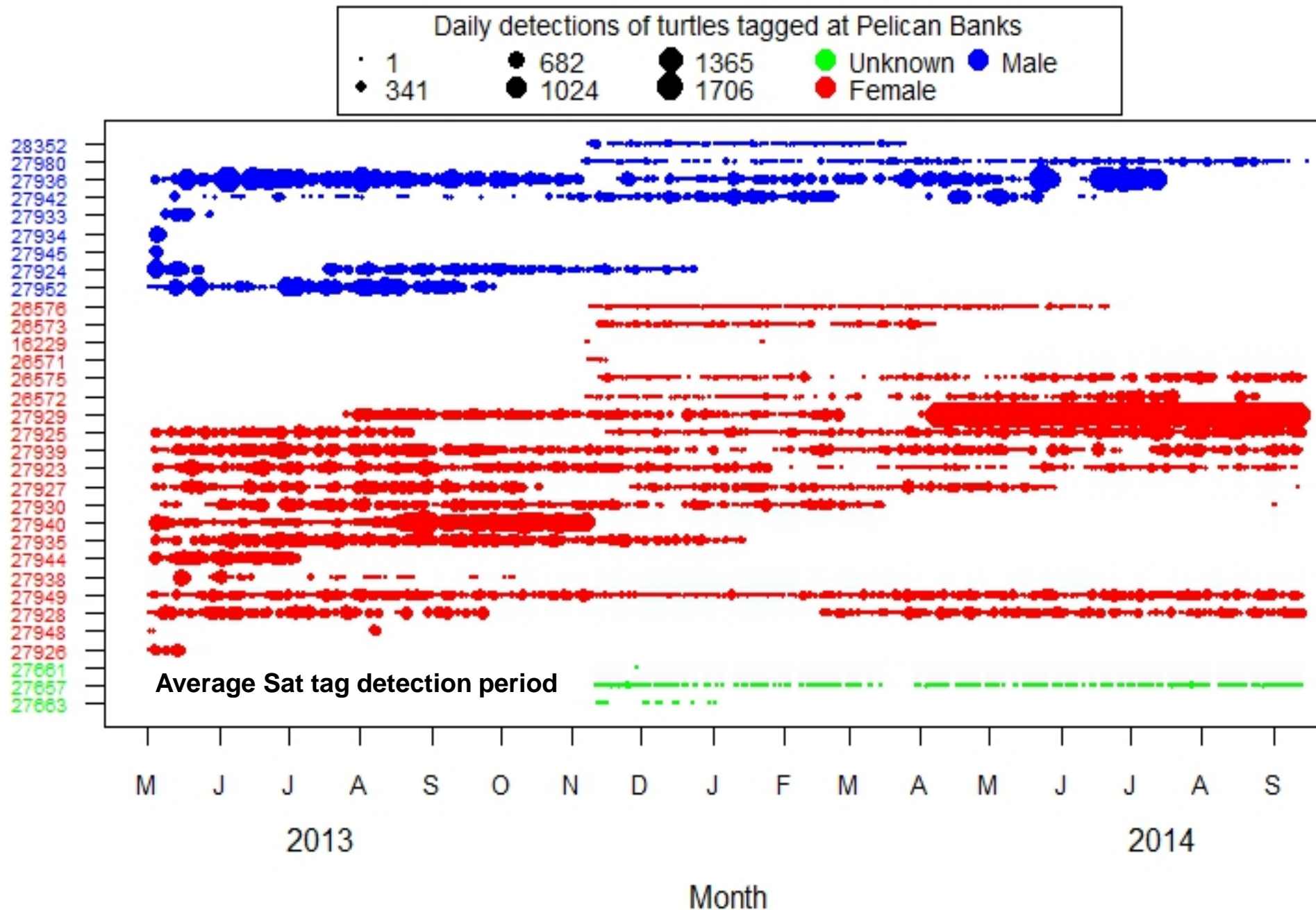
Daily detections of turtles tagged at Pelican Banks

- · 1
- ♦ 341
- ● 682
- ● 1024
- ● 1365
- ● 1706
- ● Unknown
- ● Female
- ● Male

Average Sat tag detection period

Month

Pelican Banks – Satellite tags

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Pelican Banks – Satellite tags

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Average Sat tag detection period

M J J A S O N D J F M A M J J A S

2013   2014

Month

Pelican Banks – Satellite tags

31
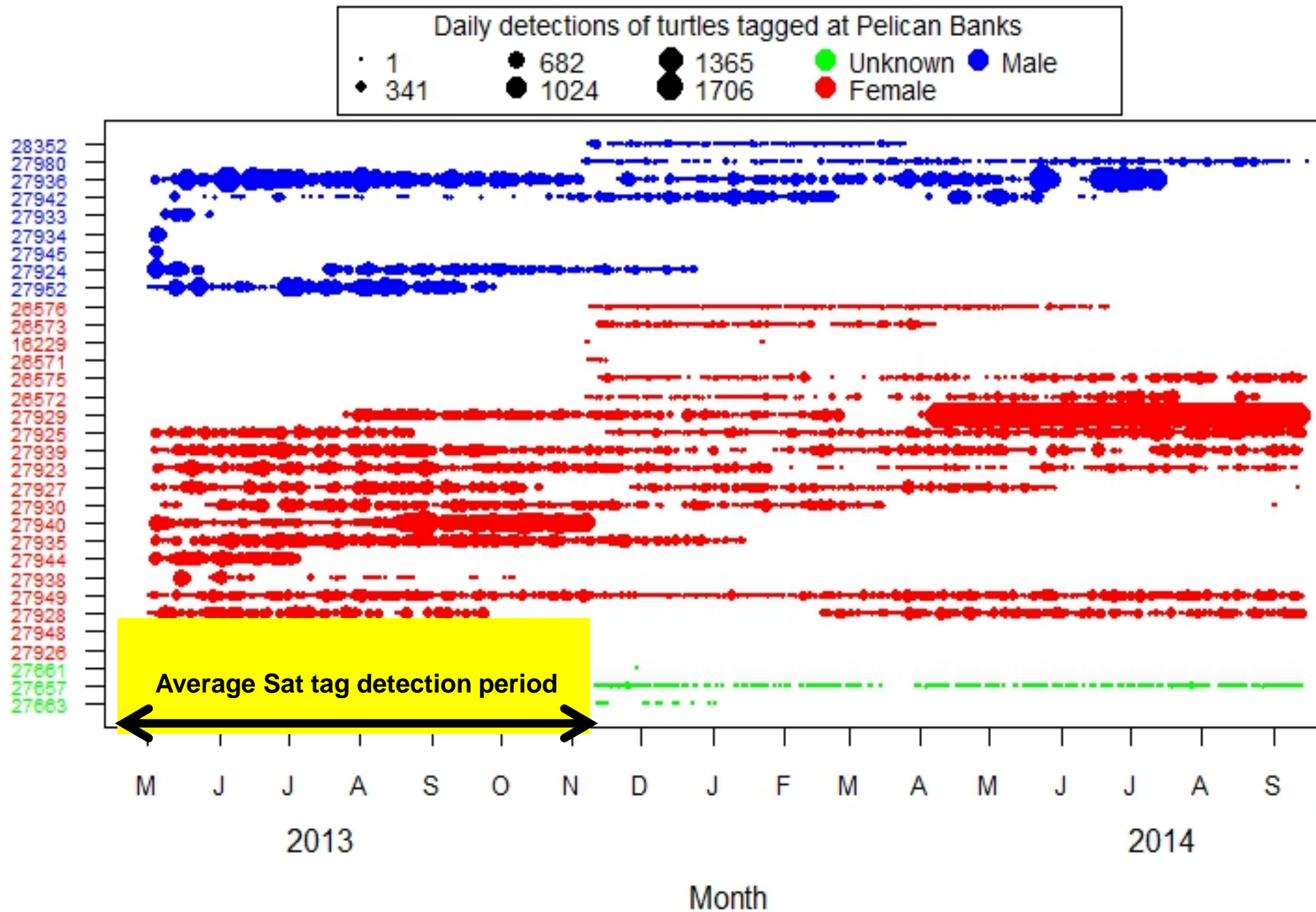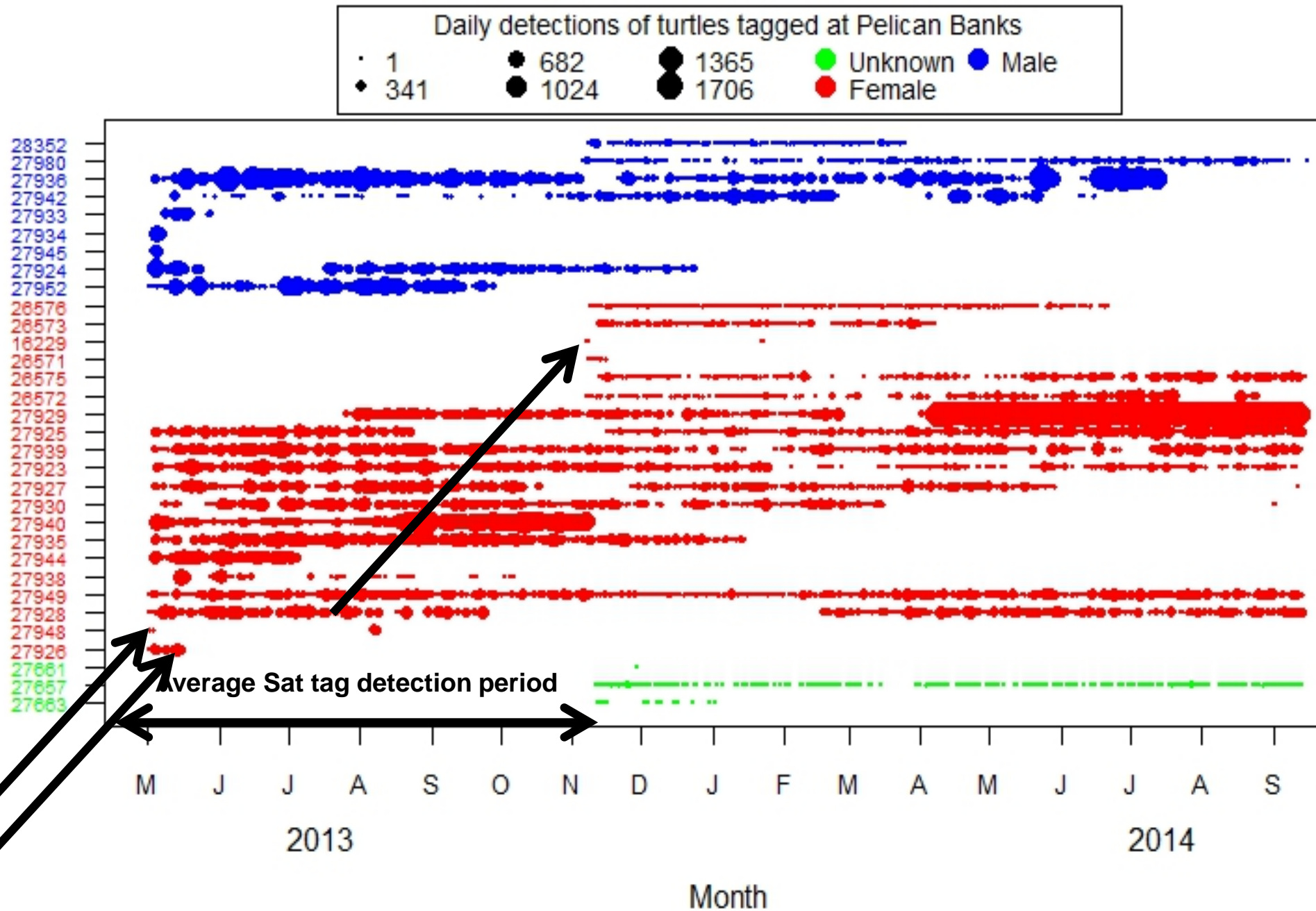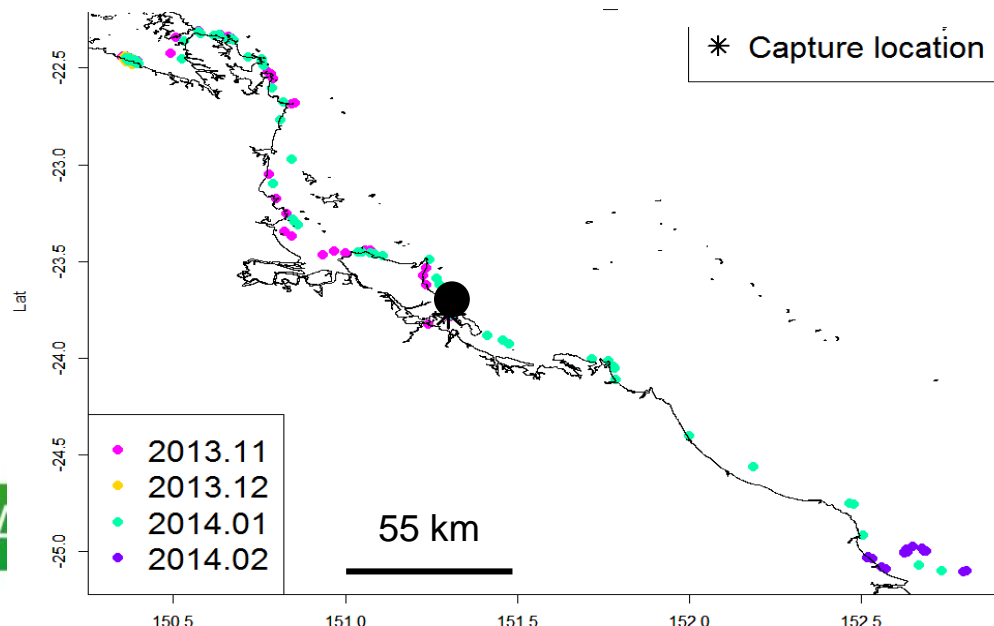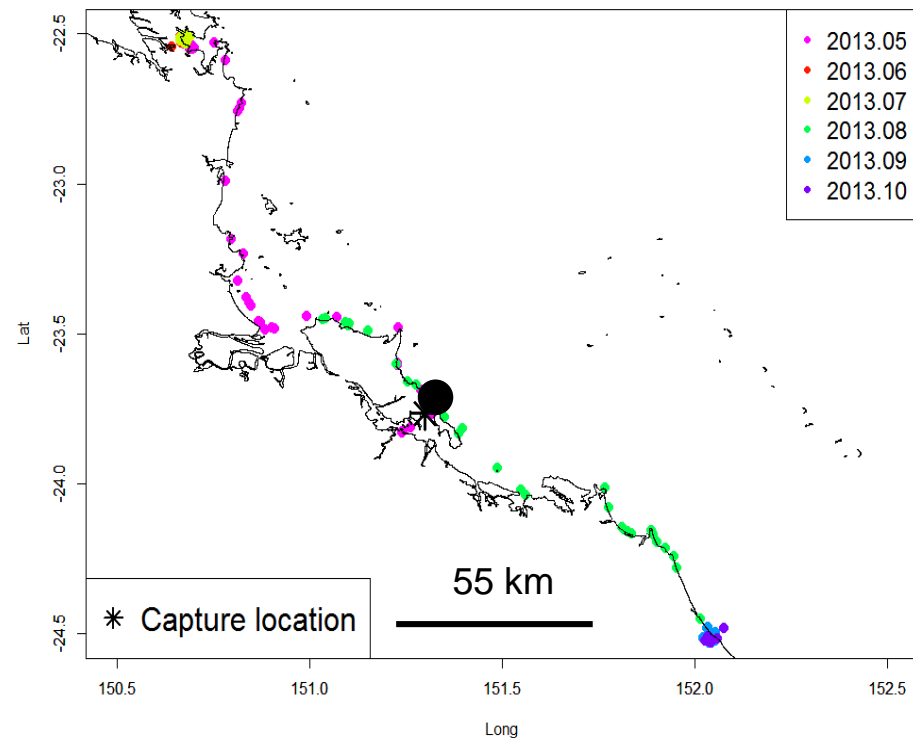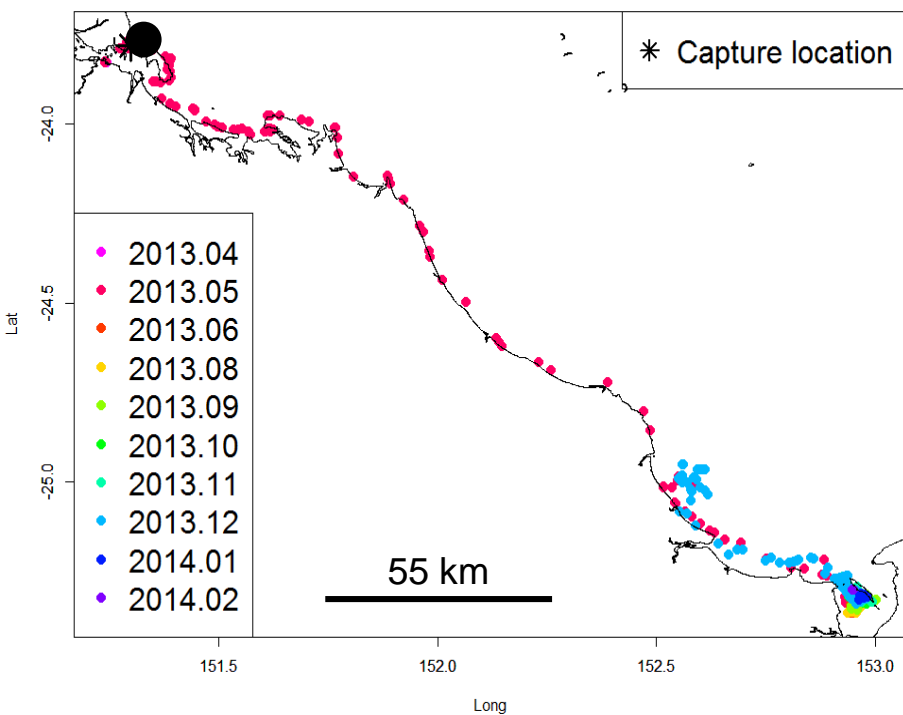
Satellite tags – resident animal - limitations

Tag location

Acoustic tag detections

Satellite tag detections

For all double tagged turtles - **60 times** more detections from acoustic tags
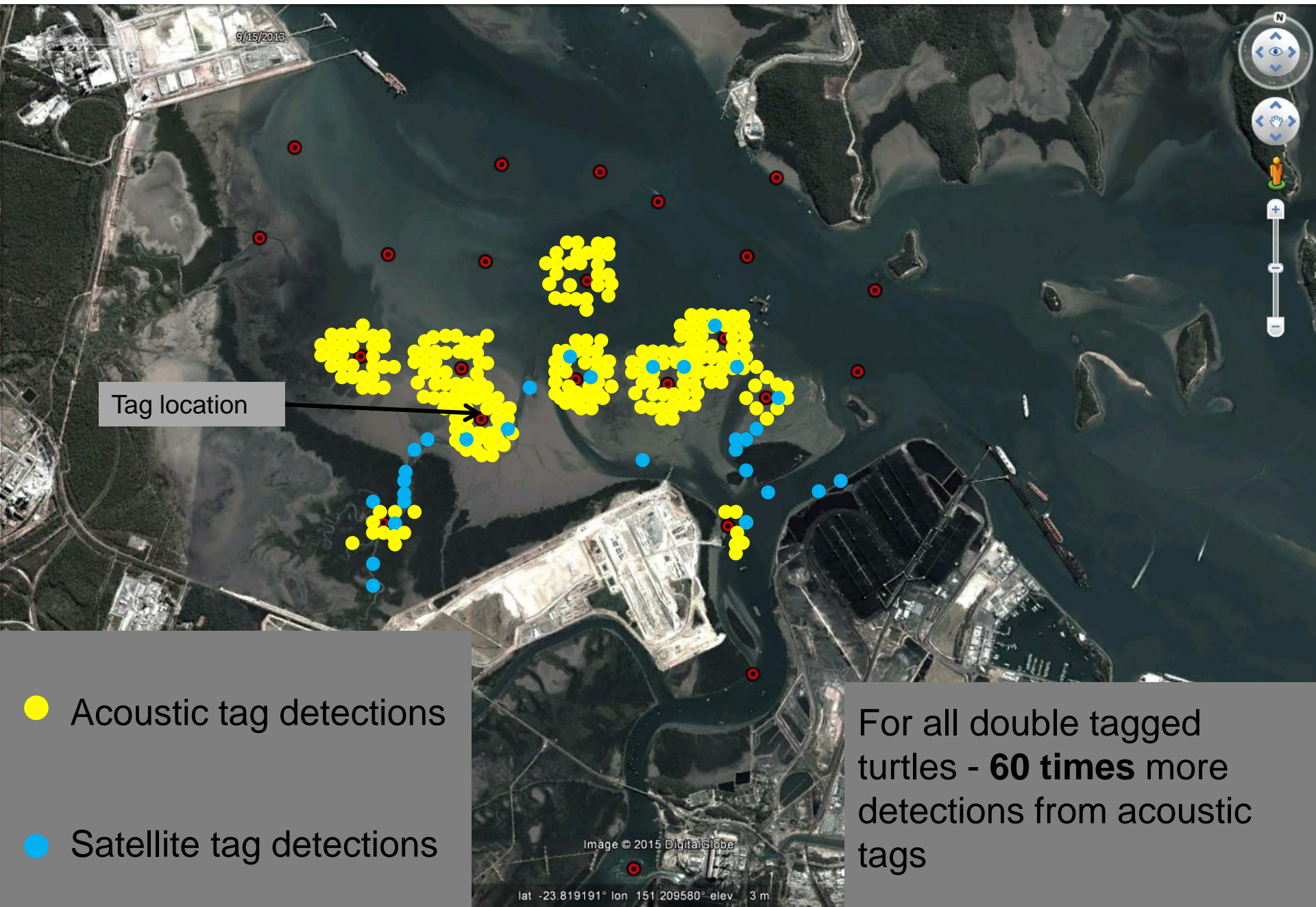
# Pelican Banks – Satellite and acoustic tags
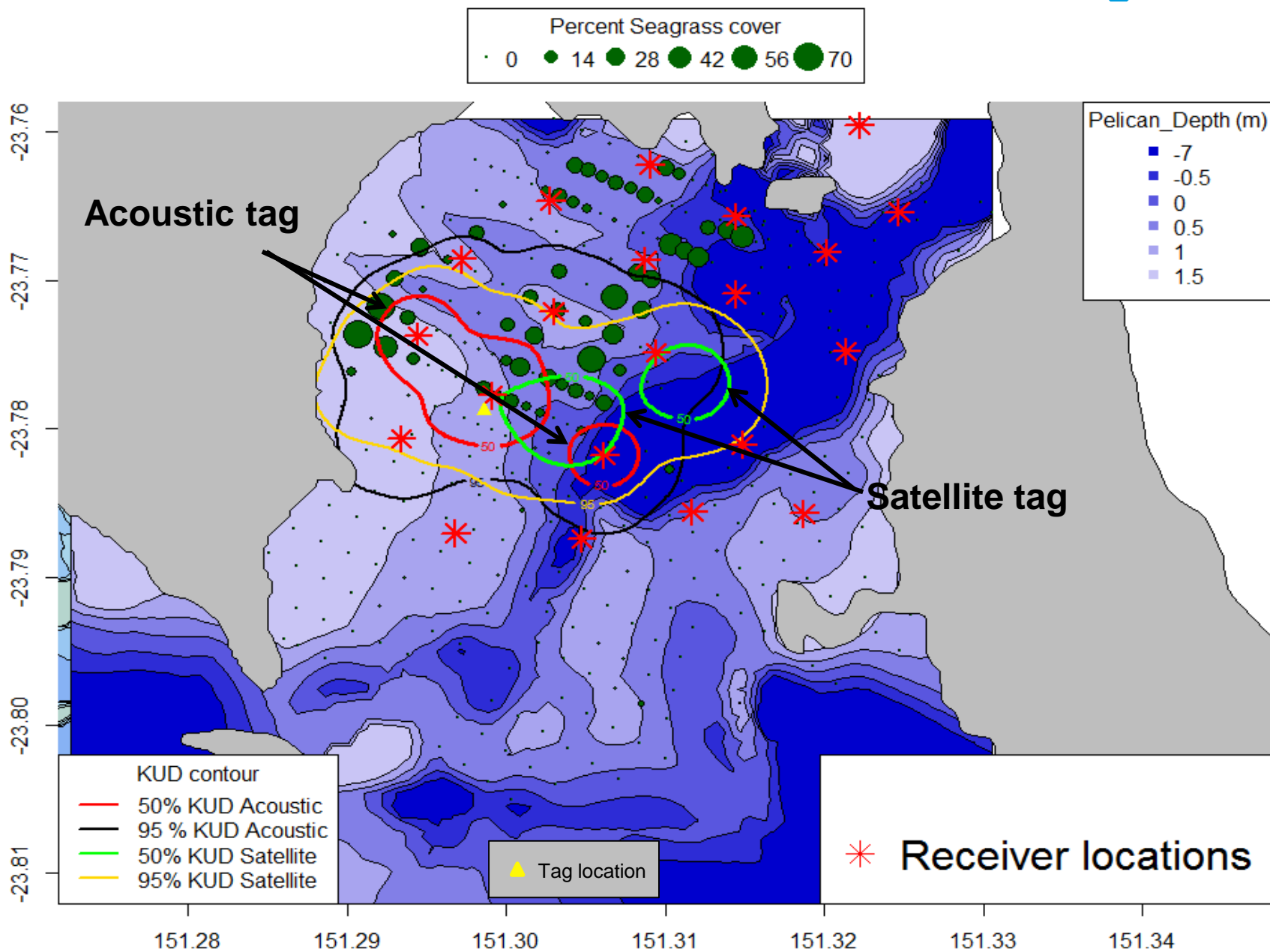
Satellite and acoustic tags

- **$60000 – Acoustic telemetry = 45 tags, 30 receivers + deployment**

- **$60000 – Satellite telemetry = 10 tags + deployment**

- **Satellite tags underestimate home range of resident turtles**

- **Acoustic tags generated 1000 – 7000 detections per month**

- **Satellite tags generated 20 – 250 detections per month**

- **Acoustic tags stay on much longer (years vs months for Sat tags)**

- **For resident animals, acoustic tags provide better data for estimating fine and broad-scale movement patterns and habitat use**

- **Acoustic tags better for investigating localised impacts (e.g. Port Development)**

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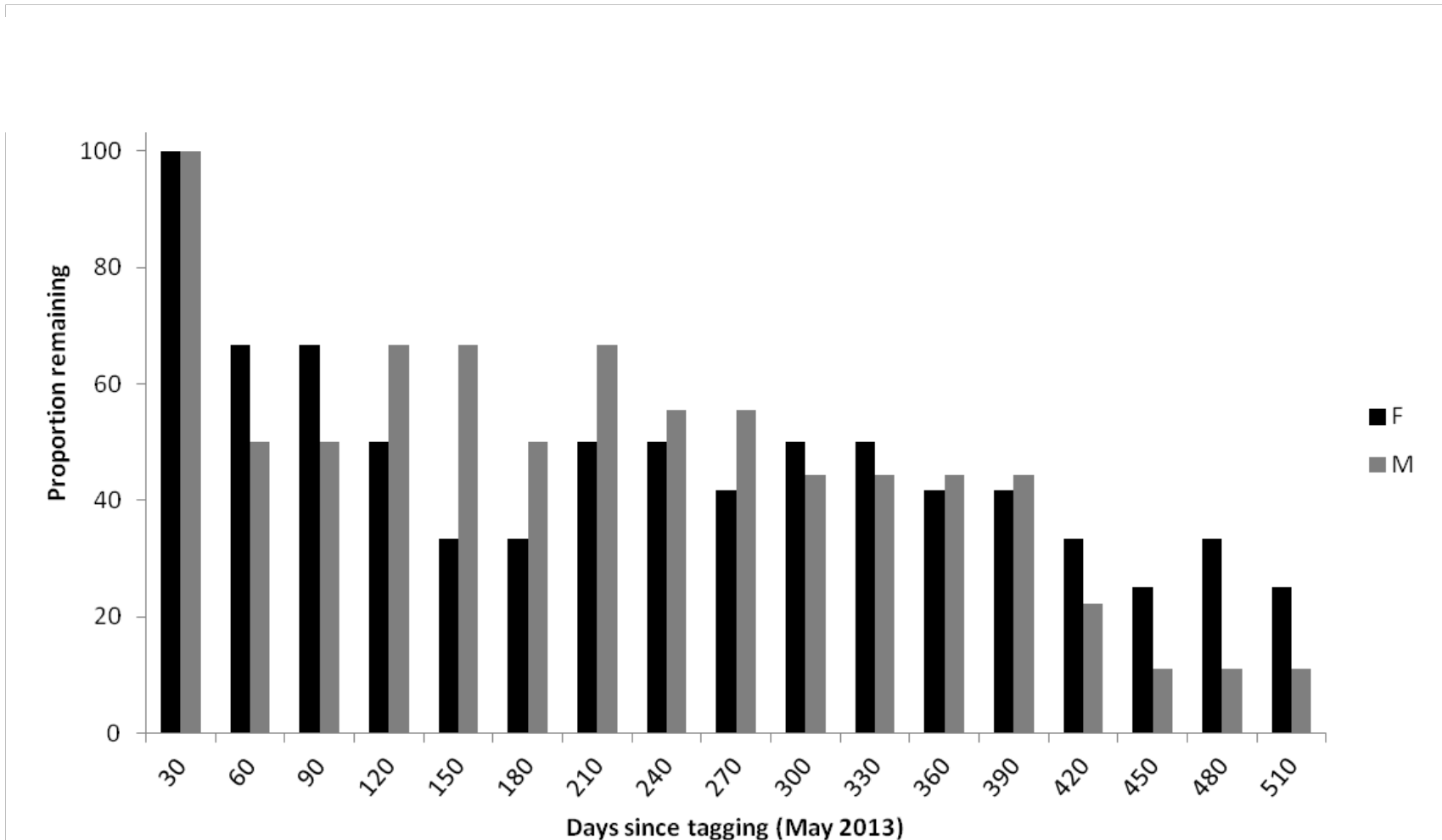# Long term benefits of acoustic tags

- **Monthly home range is small and stable (but is it really?)**
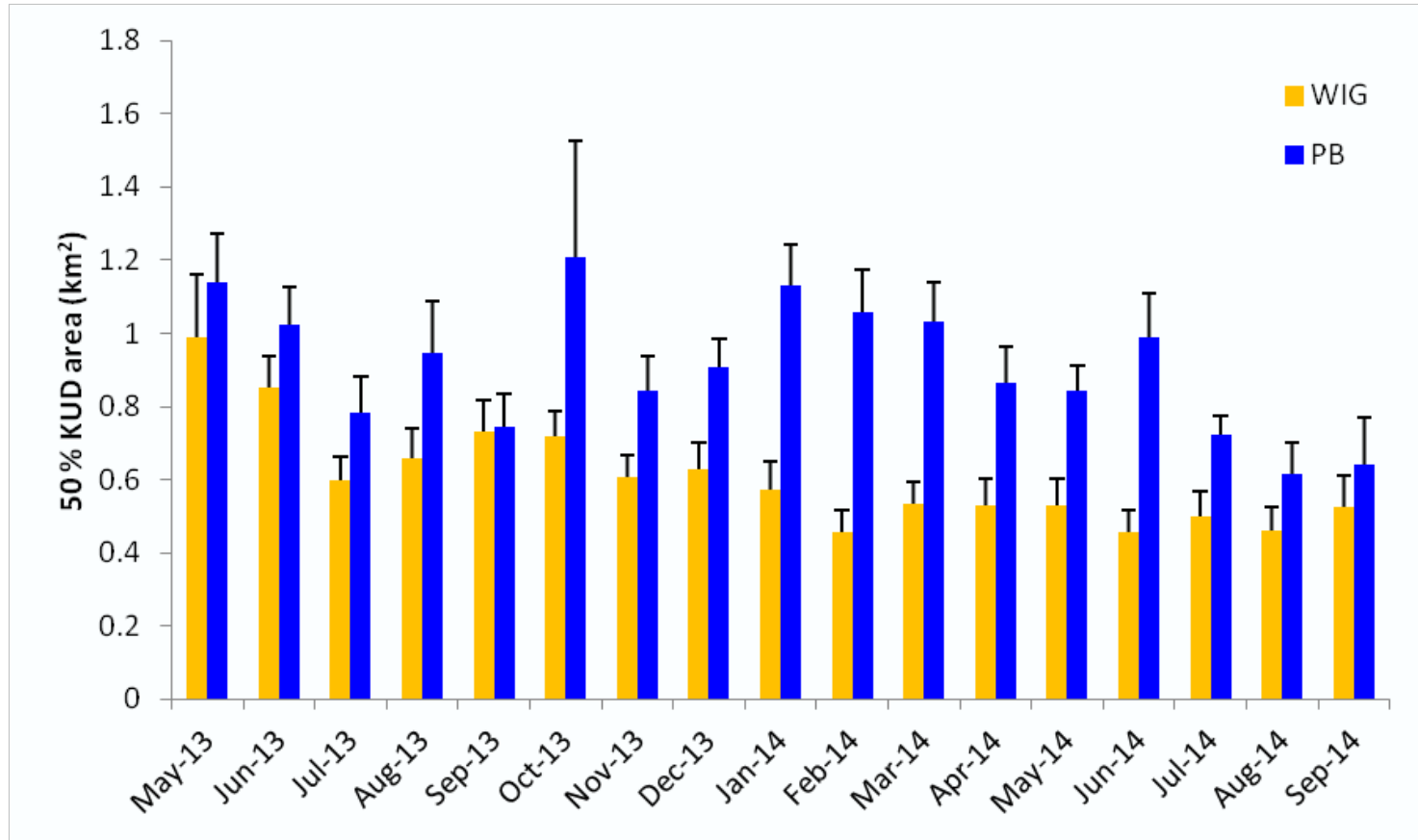
Long term benefits of acoustic tags

Adults (96 – 114 cm CCL)

- **Despite small home range, > 50 % move beyond established HR and don't return**

Implications for management

- **How can we use turtle habitat use to better manage turtle interactions in Gladstone Harbour?**

Shipping movements

Habitat modelling

Implications for management

- **How can we use turtle habitat use to better manage turtle interactions in Gladstone Harbour?**

Recreational craft
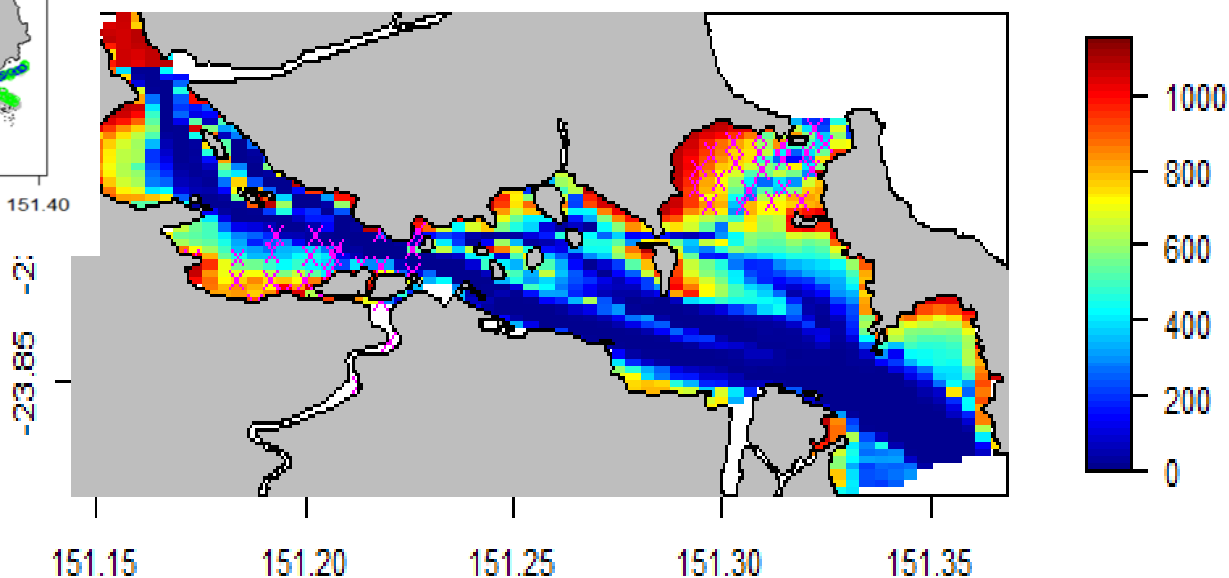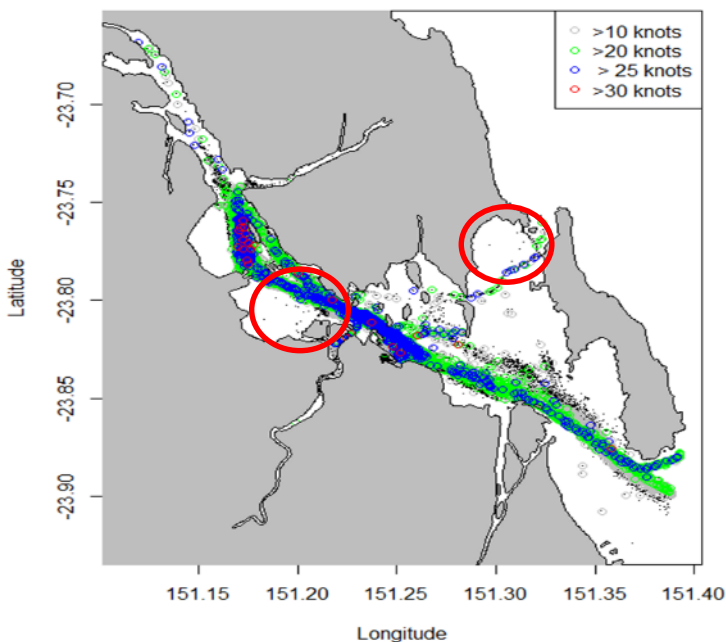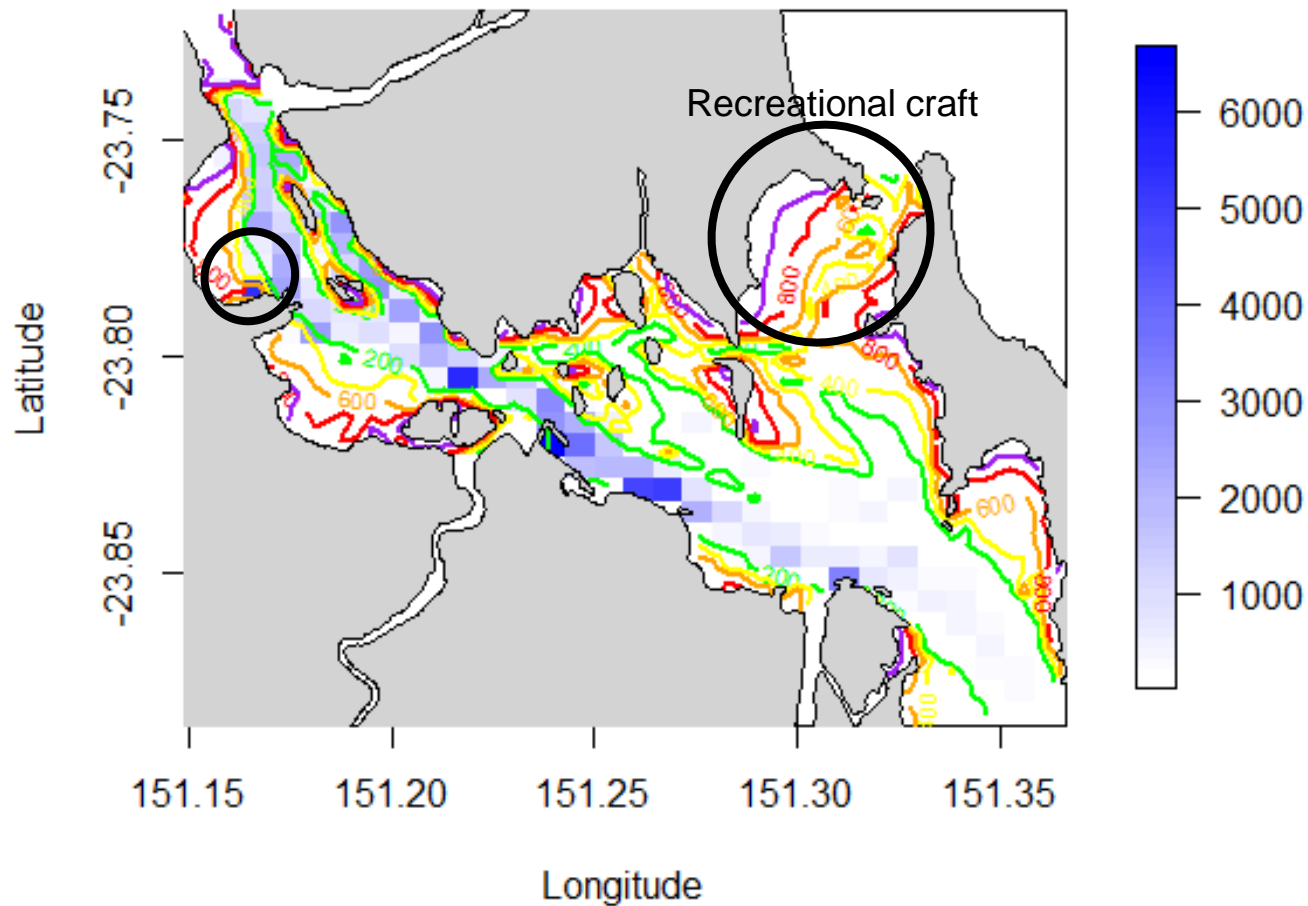
**Model of habitat preference and shipping activity**

Conclusions: effectiveness of acoustic arrays for green turtles

- Satellite and acoustic tags highly complimentary

- Satellite tags best for long distance movements (reproduction)

- Satellite tags underestimate home range for resident turtles

- Acoustic tags provide 60 times more positions for residents within array

- Acoustic tags better for investigating tide and diurnal behaviour

- Acoustic tags providing insights into proportion of resident individuals

- Acoustic tags enable a pool of pre-tagged animals to provide baseline in case of unexpected events

- Methods for permanent attachment of acoustic tags need to be developed

Thank you

Average depth of a turtle at Wiggins Island

- No evidence of channel use from depth data

ID: 126275
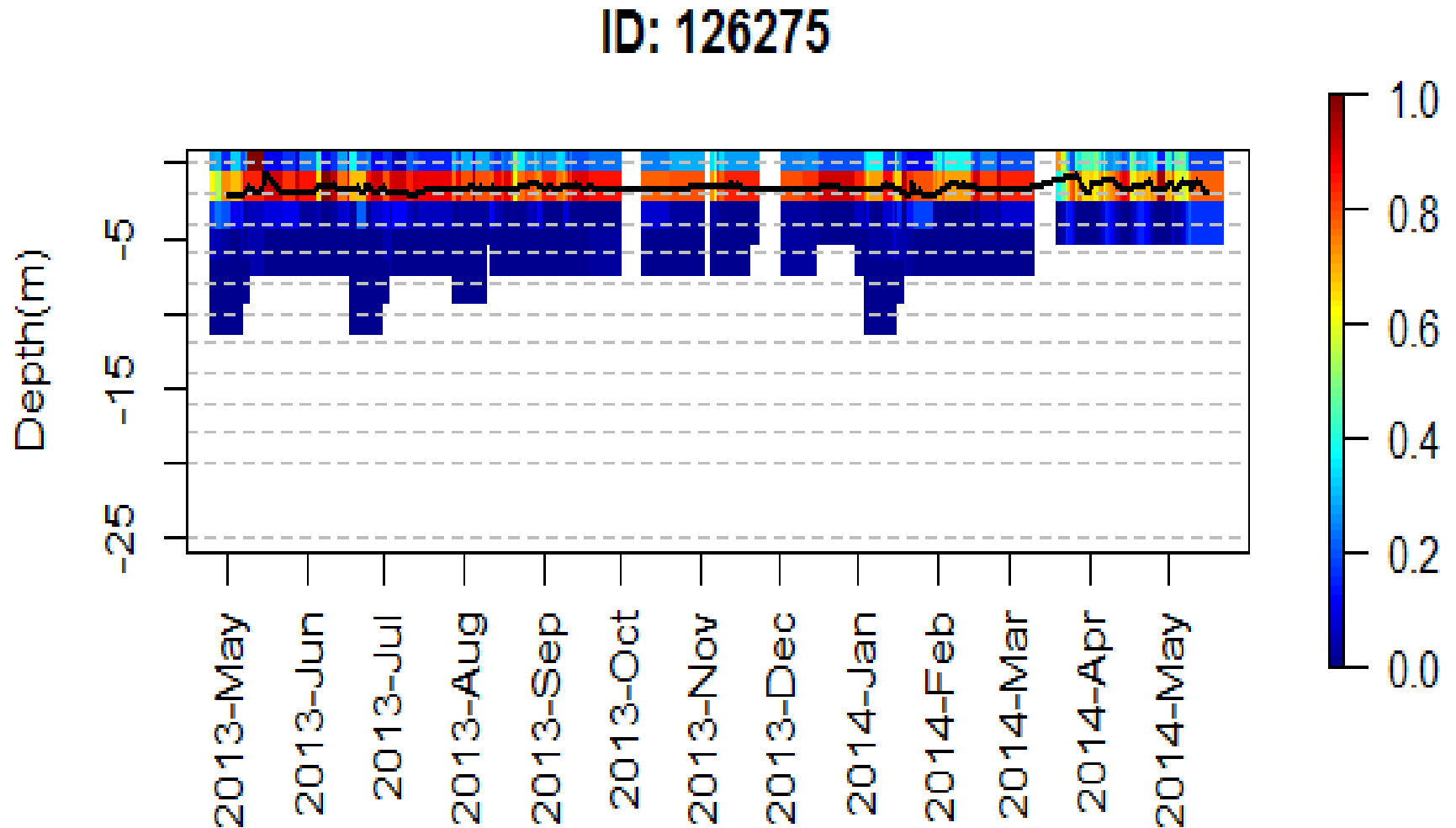
Satellite tags – Fastloc data only