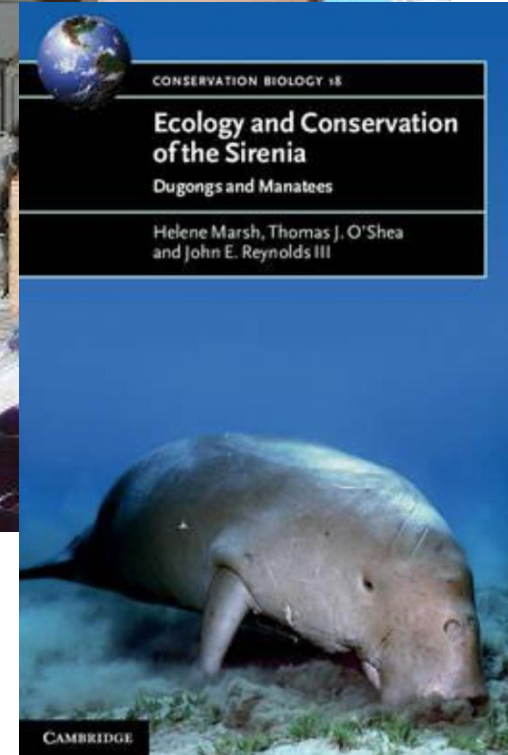# Key considerations for dugong aerial surveys

Christophe Cleguer & Helene Marsh

Key ingredients to a successful research project

Conduct a background search

- *Peer reviewed articles*
- *Books*
- *unpublished,*
  internal government or other
  organisation reports
- *Student theses*

Key ingredients to a successful research project

Determine what your research question is

Key ingredients to a successful research project

SUCCESS

Think of your constraints

Check List:
- ☐ What is my budget?
- ☐ What is my timeframe?
- ☐ What equipment is required?
- ☐ What expertise is required?
- ☐ Who can help me running this project?
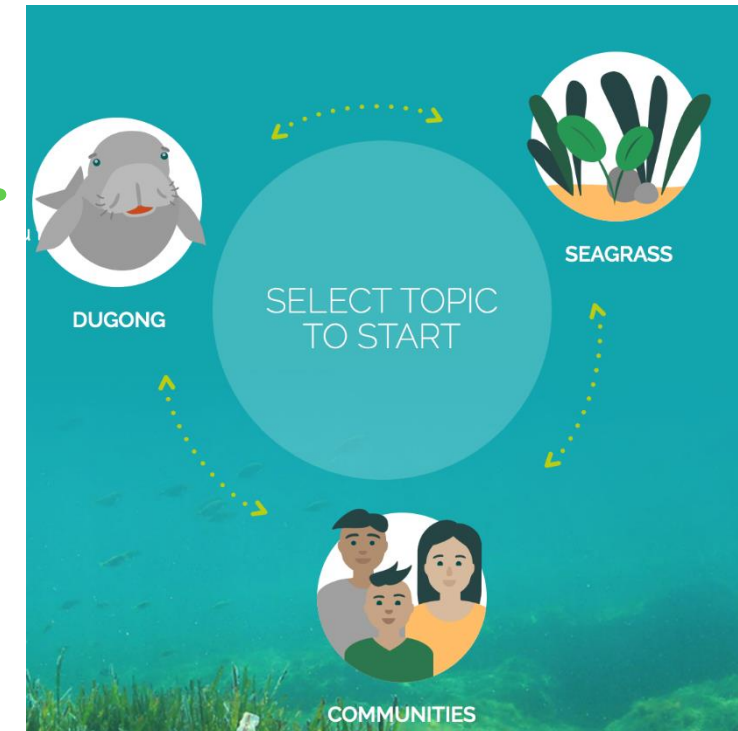- ☐ Does my project meet ethical standards?
- ☐

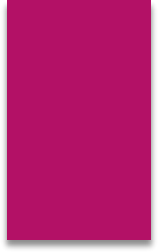# Key ingredients to a successful research project

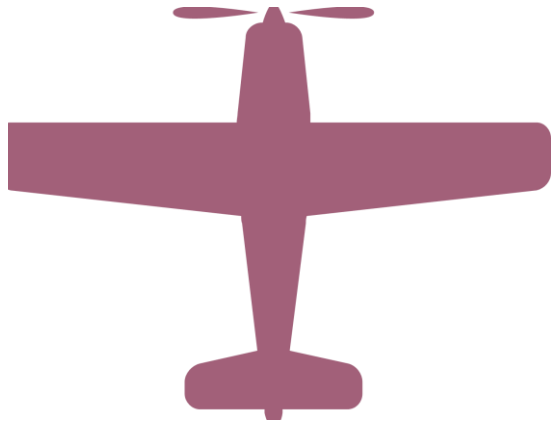Most appropriate technique to answer your research question

The dugong and seagrass research toolkit is now available to help you do this!

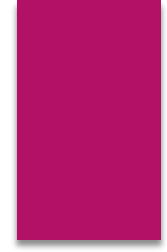# Dugong aerial surveys

Techniques

Tools

Tips on how to plan an aerial survey

Distribution versus **Abundance** surveys

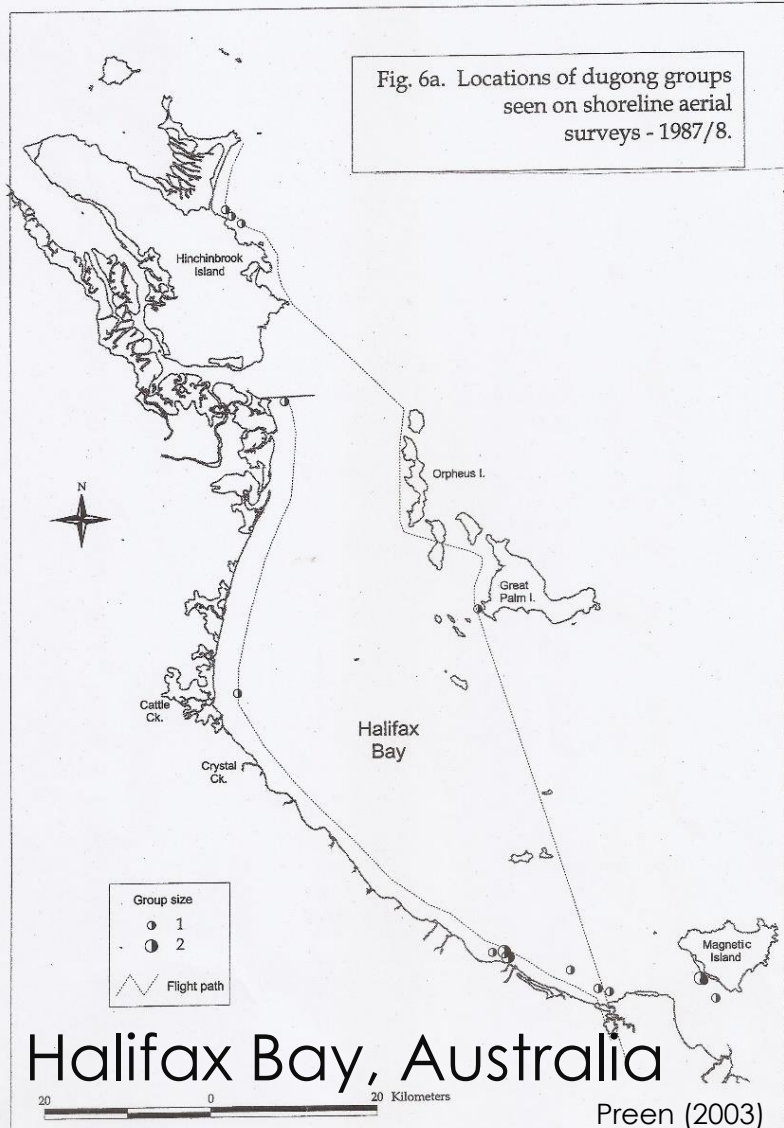## *Sampling design*

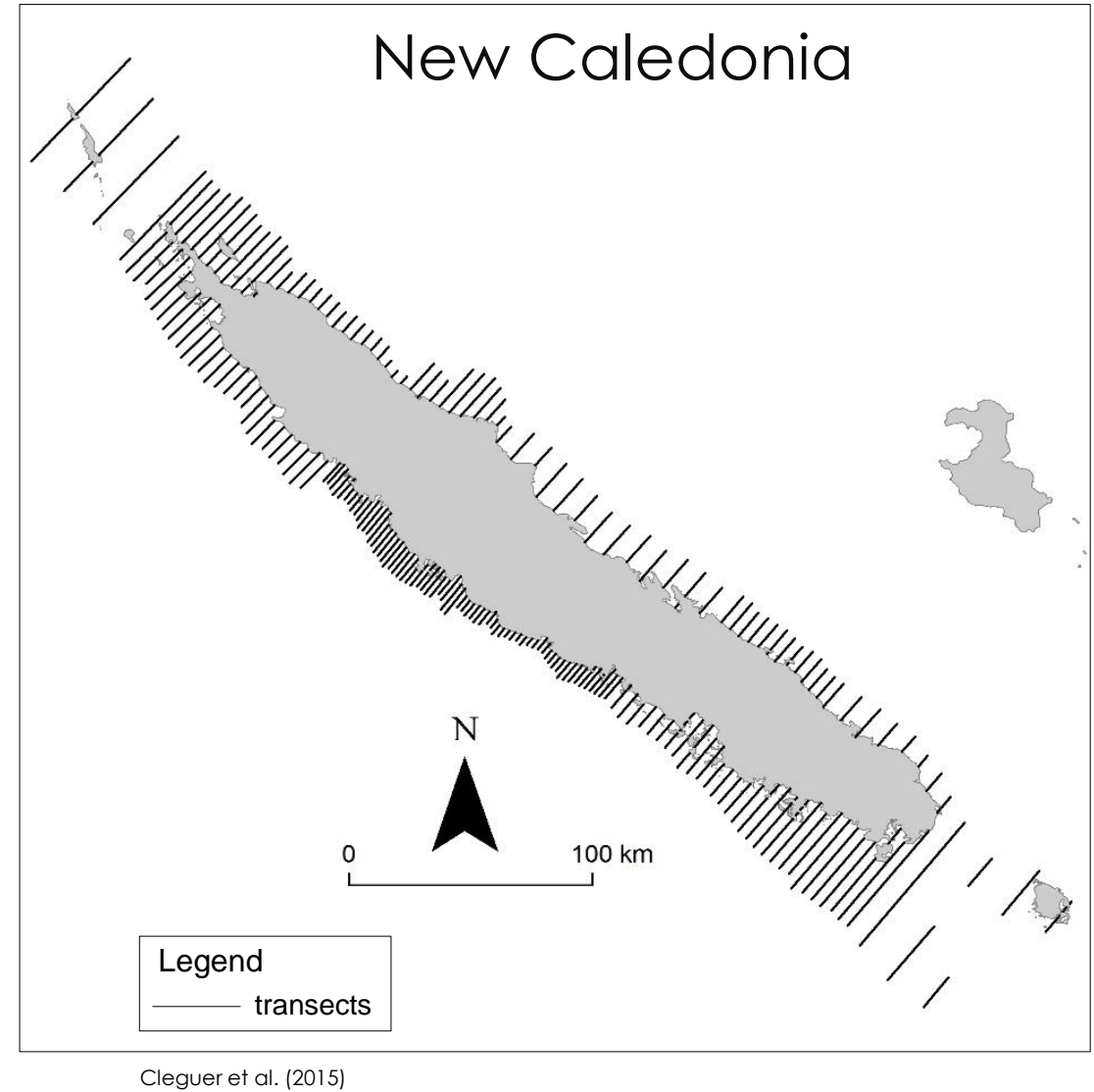| Distribution aerial survey	Abundance aerial survey
• Not necessarily systematic • Do not cover all habitats in the area of interest) • Often designed as shoreline transects	• Systematic • Strict sampling design covering all potential dugong habitats in the area of interest). • Transects going up to the 50m depth contours

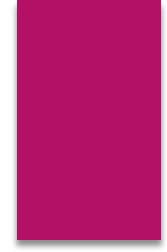# Examples of sampling designs

Distribution survey

Fig. 6a. Locations of dugong groups seen on shoreline aerial surveys - 1987/8.

Halifax Bay, Australia

Preen (2003)

Abundance survey

New Caledonia

Legend
——— transects

Cleguer et al. (2015)

Distribution versus **Abundance** surveys

Outputs

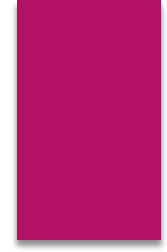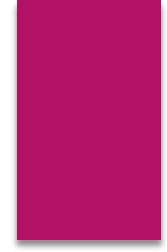| Distribution aerial survey	Abundance aerial survey
• Distribution of dugongs (+other marine megafauna species) • Unstable indices of relative abundance	• Distribution of dugongs (+other marine megafauna species) • Indices of absolute abundance • Can be used in PBR analysis

Distribution versus **Abundance** surveys

Outputs

Distribution aerial survey	Abundance aerial survey
• Distribution of dugongs (+other marine megafauna species) • Unstable indices of abundance	• Distribution of dugongs (+other marine megafauna species) • Indices of absolute abundance • Can be used in PBR analysis

Detecting trends in dugong populations is very difficult, if not impossible!

Distribution versus **Abundance** surveys

Accounting for detection biases
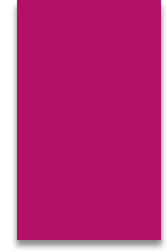
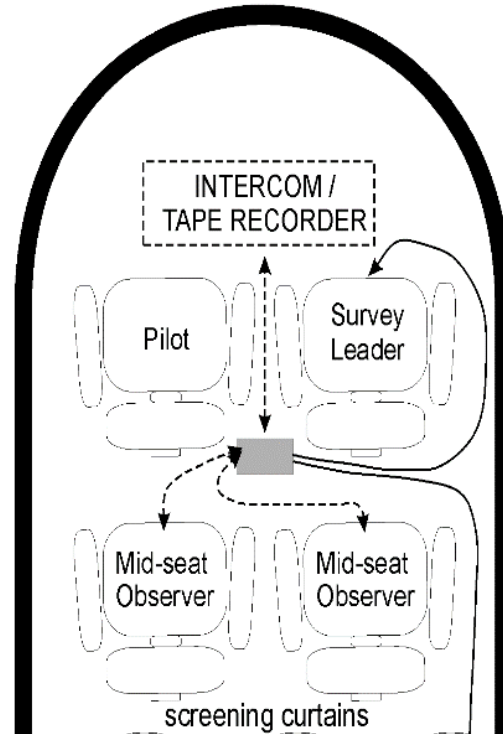| Distribution aerial survey	Abundance aerial survey
Does not account for animals missed by observers	Accounts for animals missed by observers
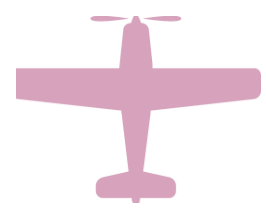
Accounting for detection biases

Distribution survey

- Variable number of observers

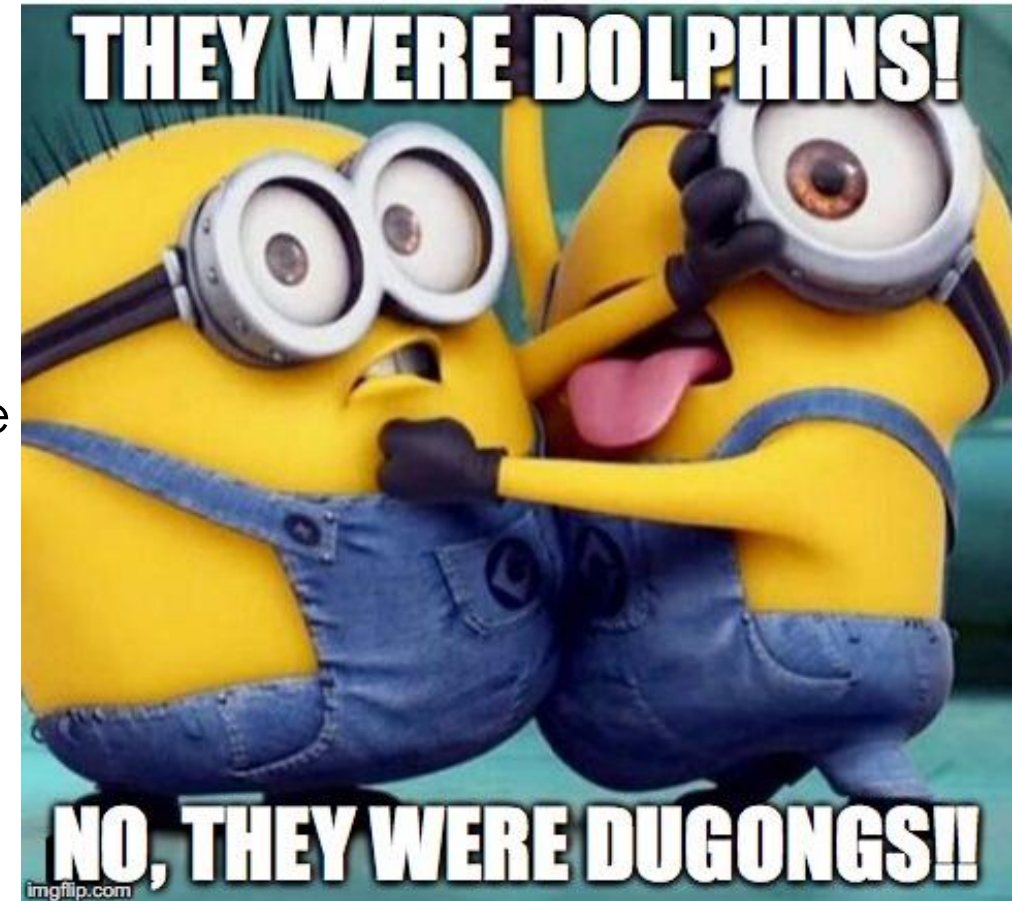*Schematic representation of a survey team in a plane*

INTERCOM / TAPE RECORDER

Pilot

Survey Leader

Mid-seat Observer

Mid-seat Observer

screening curtains

Abundance survey

- Fixed number of observers (generally 2 pairs of independent observers)
- Allows to estimate **perception bias**

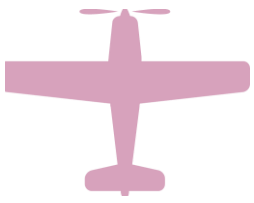# Detection biases: Lessons learned from turbid northern Australian waters (Dunshea et al. (in prep))

- Counting large groups (> 4-7 animals) is difficult

- Identification disagreement between observers
  - ~ 10% of dugong and dolphin observations had disagreement between dual observers.
  - 93% of these due to assignment of dolphin by one observer and dugong by the other.

- These issues may or may not apply to your area of interest
- High expertise in aerial observation of marine megafauna is critical!
- Following a comprehensive observer training program is essential!!!

# Detection biases: Lessons learned from turbid northern Australian waters (Dunshea et al. (in prep))

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Accounting for detection biases
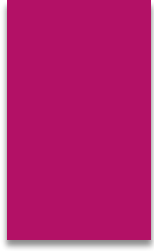
- **Abundance aerial surveys** also account for **availability biases** by assessing the environmental conditions that affect the dugongs' availability at the time of observation.
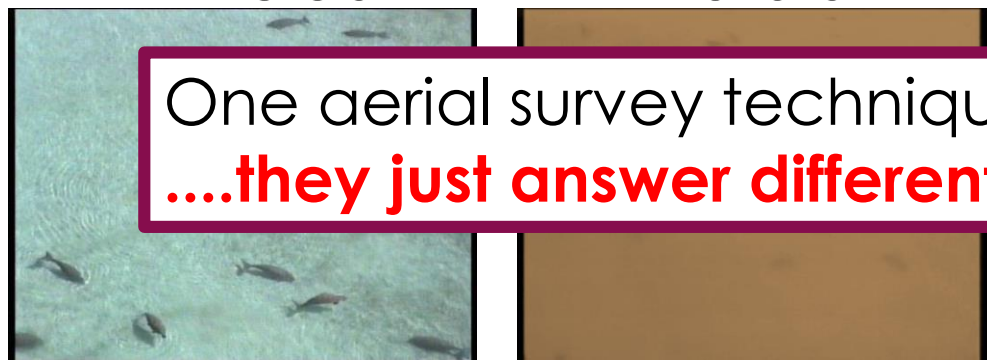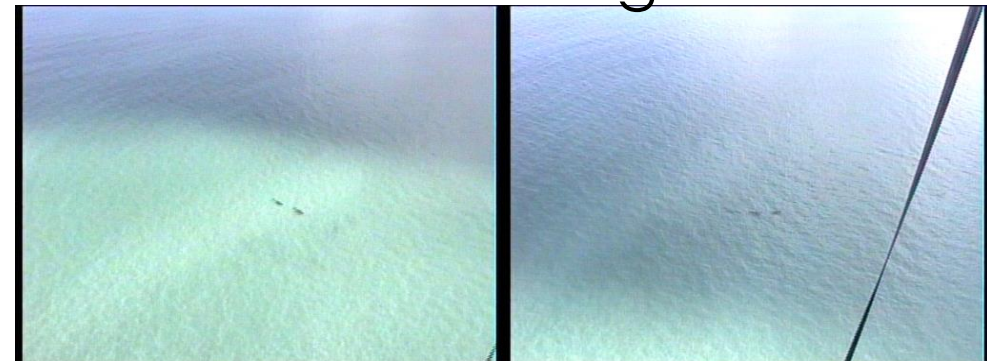
clear

turbid
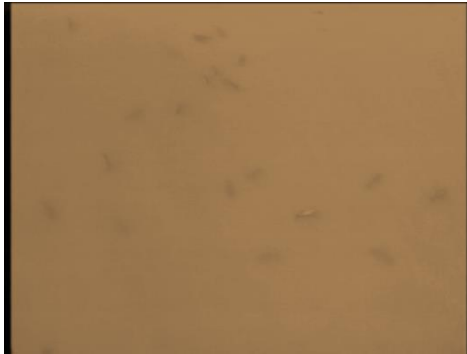
cloud moving across
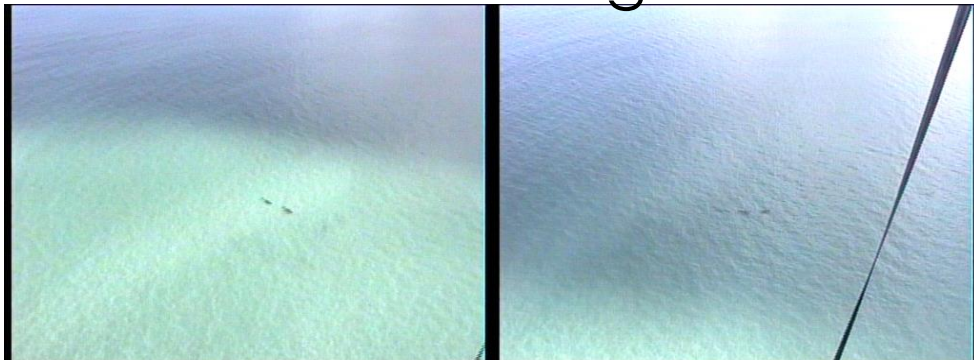
deep → shallow → glare

Accounting for detection biases

- **Abundance aerial surveys** also account for **availability biases** by assessing the environmental conditions that affect the dugongs' availability at the time of observation.

clear   turbid

One aerial survey technique is not better than the other....
....they just answer different questions!

cloud moving across

deep → shallow → glare

Dugong aerial surveys
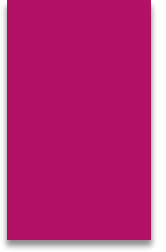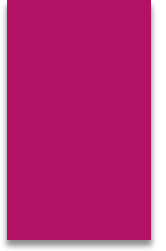
Techniques
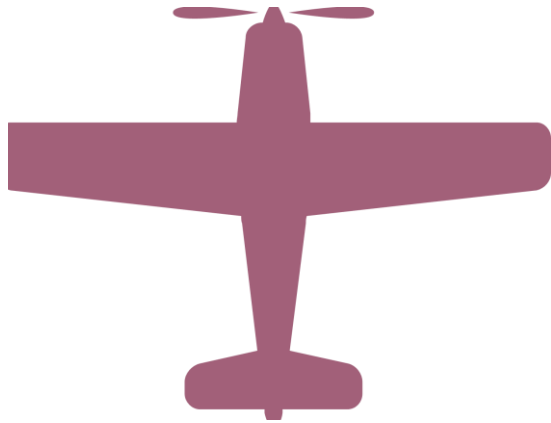
Tools

Tips on how to plan an aerial survey
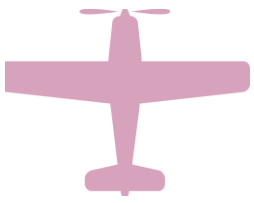
Manned aircrafts

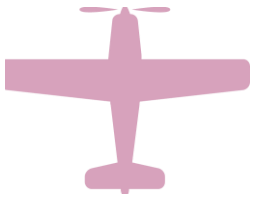## Fixed wing twin engine planes

Fixed wing mono engine planes

Helicopters

Manned aircrafts
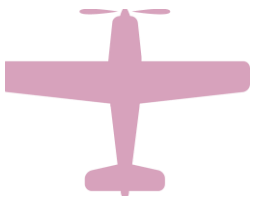
Fixed wing twin engine planes

Fixed wing mono engine planes

- Which platform to use depends on your research objectives and constraints (e.g. spatial scale of the study area, available equipment, budget)
- **Your safety should always come first!!!**

Helicopters

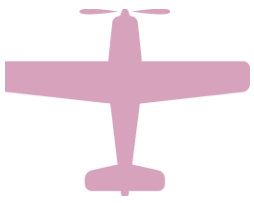# Unmanned aircrafts
(also called UASs, UAVs, Drones...)

- Fixed wings

Small   Size ~ spatial scale   Large
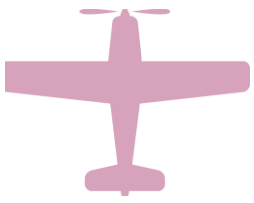
Unmanned aircrafts
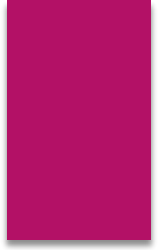## (also called UASs, UAVs, Drones…)

- Multirotors

…really?

Unmanned aircrafts
(also called UASs, UAVs, Drones…)

- Hybrid drones

Size ~ spatial scale

Unmanned aircrafts
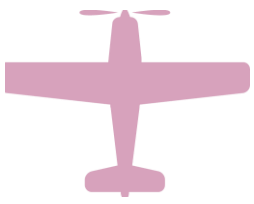## (also called UASs, UAVs, Drones…)

- Hybrid drones

- As in manned surveys, which UAV platform to use depends on your research objective and constraints (e.g. spatial scale of the study area, equipment available, budget)
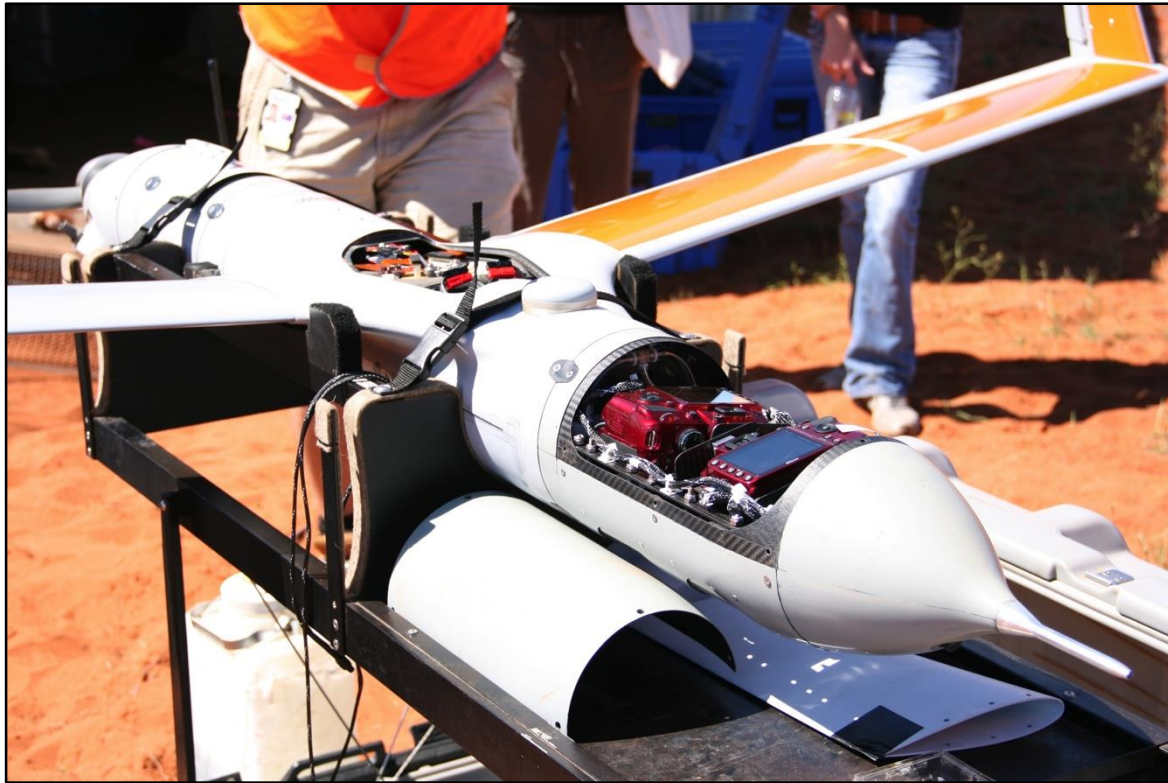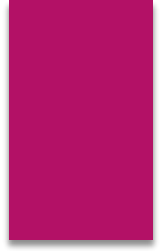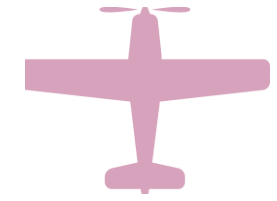
Small | Size ~ spatial scale | Large

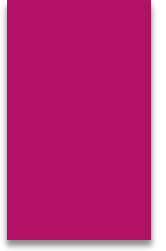# Replacing humans' eyes with high resolution cameras and neural network algorithms
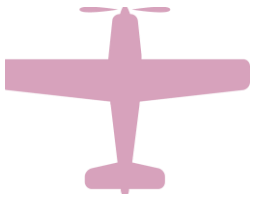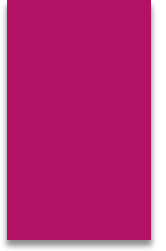

(Hodgson et al. 2013)

But humans' eyes remain essential
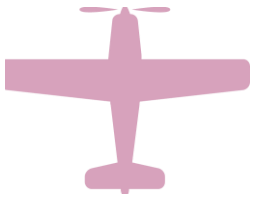

(Hodgson et al. 2013)

# From manned to unmanned platforms: What are the main improvements

- Improved human safety
- Improved dugong detectability *(assuming use of correct survey design, equipment, and expertise in data analysis) (Hodgson et al. in prep)*
- Improved positioning of dugong sightings
- Improved counts of large groups of dugongs?
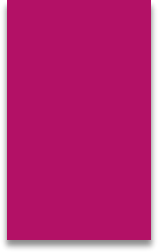- Images collected with drones can be archived

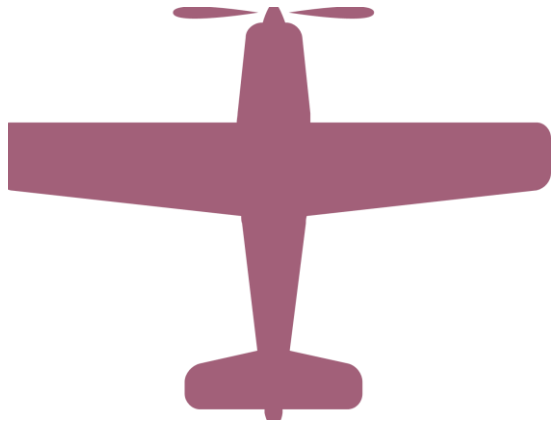# From manned to unmanned platforms: What needs to be improved
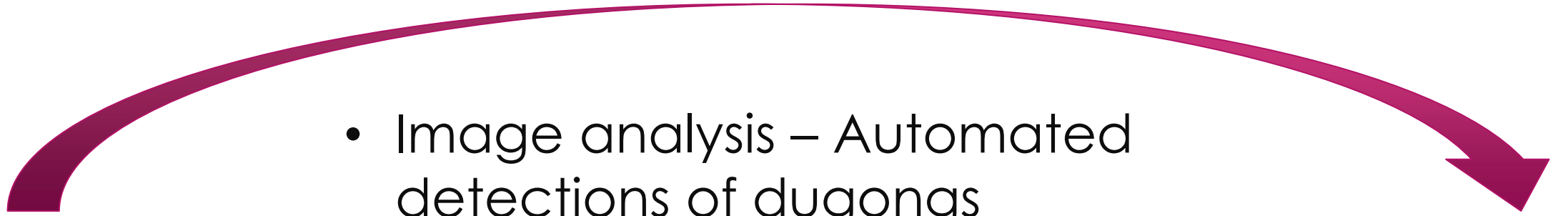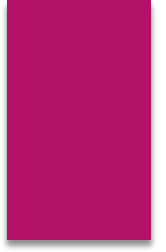
- Image analysis – Automated detections of dugongs

- Availability biases

- Species identification

- High performance surveying at variable spatial scales

- Cost

Dugong aerial surveys

Techniques

Tools

Tips on how to plan an aerial survey

10 point plan to implement an aerial survey

1 Frame your research question

2 Define your objectives

3 Choose which technique suits your objectives best

4 Choose your aerial survey platform

5 Organise logistics

6 Collect the data

7 Process the data

8 Analyse the data

9 Write up the report

10 Promote your results

Thank you