



Dugongs in the Pacific

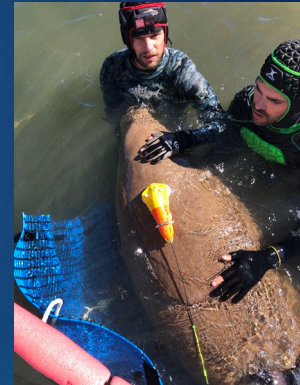
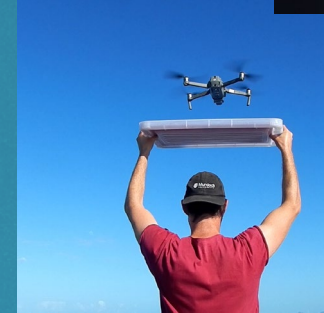
CHRISTOPHE CLEGUER

28TH JULY 2021



Quick self-introduction

- ▶ PhD on dugongs in New Caledonia (JCU-IRD)
- ▶ Research fellow at Murdoch University (Perth, Western Australia)
- ▶ Dugong researcher at James Cook University (Townsville, QLD) from October 2021
- ▶ Technical advisor to the UNEP-CMS Dugong MoU Secretaria
- ▶ Field of expertise
 - ▶ Dugong spatial ecology and population dynamics (aerial survey, animal tracking)
 - ▶ Community-based work
 - ▶ Development of cutting edge research tools to support the conservation of dugong

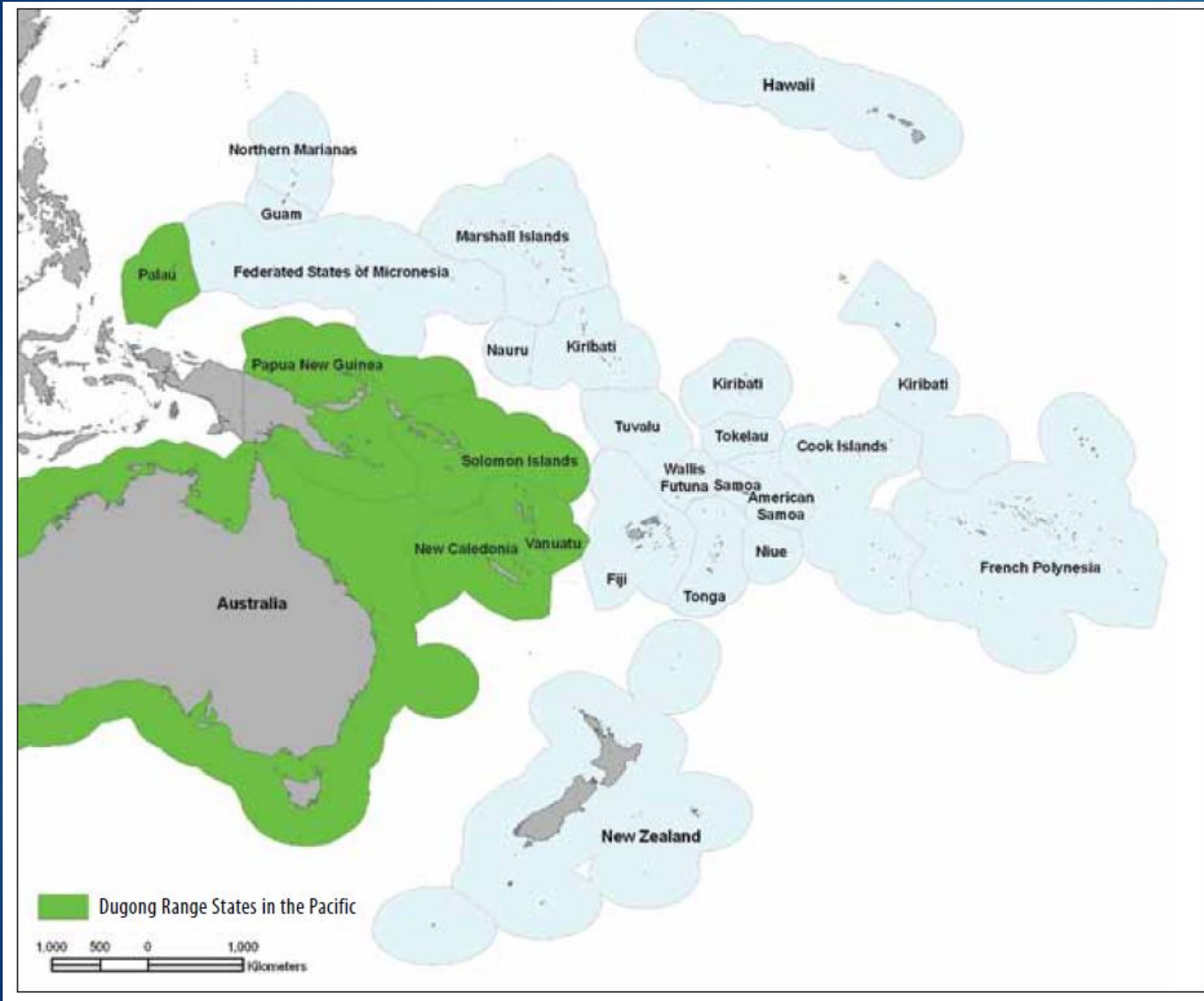


Presentation outline

- ▶ Dugong conservation status, estimated numbers and threats in the Pacific Basin
- ▶ Dugong movement and connectivity
- ▶ Advances in some key monitoring tools



Dugong range and numbers in the Pacific Basin



- ▶ Dugong range includes 46 range states in the Indian and Pacific ocean basins

6 range states are in the Pacific:

- ▶ Palau
- ▶ Papua New Guinea
- ▶ Solomon Islands
- ▶ Vanuatu
- ▶ New Caledonia
- ▶ Australia
- ▶ **Vulnerable to extinction at the global scale (IUCN Red List)**

Why are dugongs vulnerable

- ▶ Long-lived and slow to mature
- ▶ Geographical overlap between dugongs and people put the animals at risk from a range of activities
- ▶ Type and intensity of threat vary with location (across and within countries)

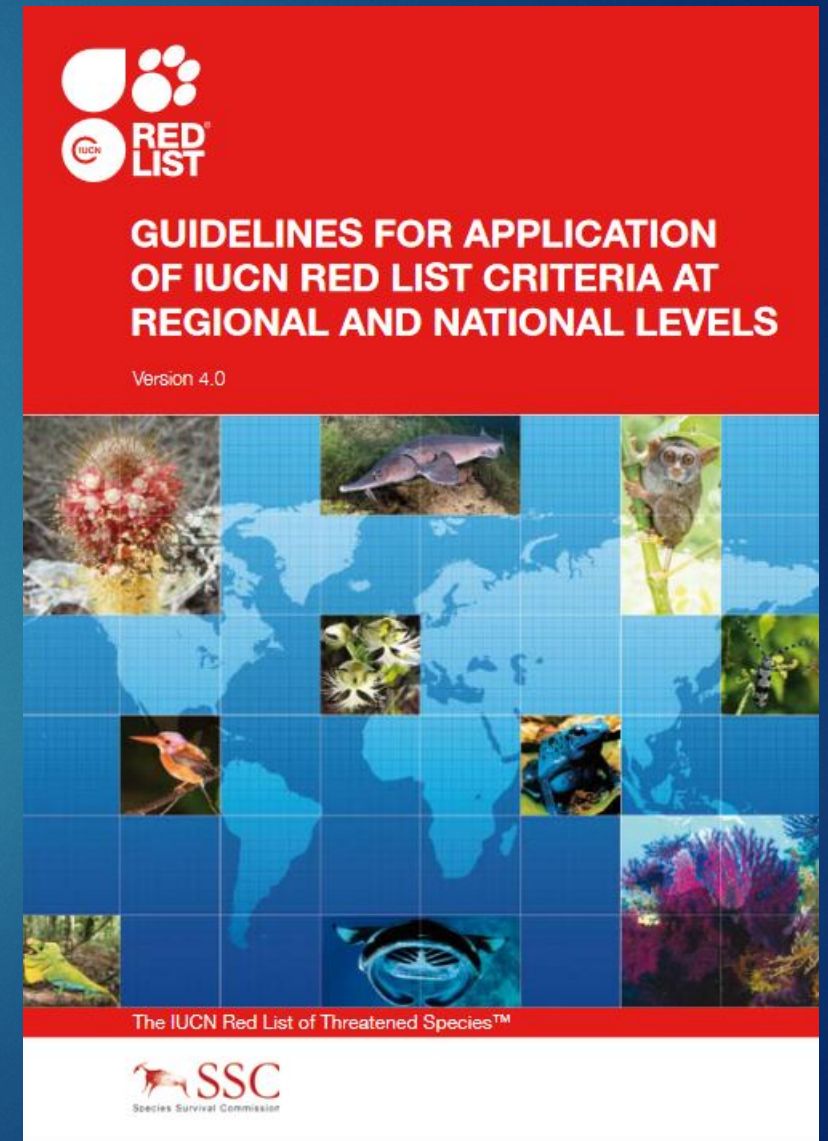
Protection

National laws protect dugongs in the Pacific range states, but enforcement is lacking.

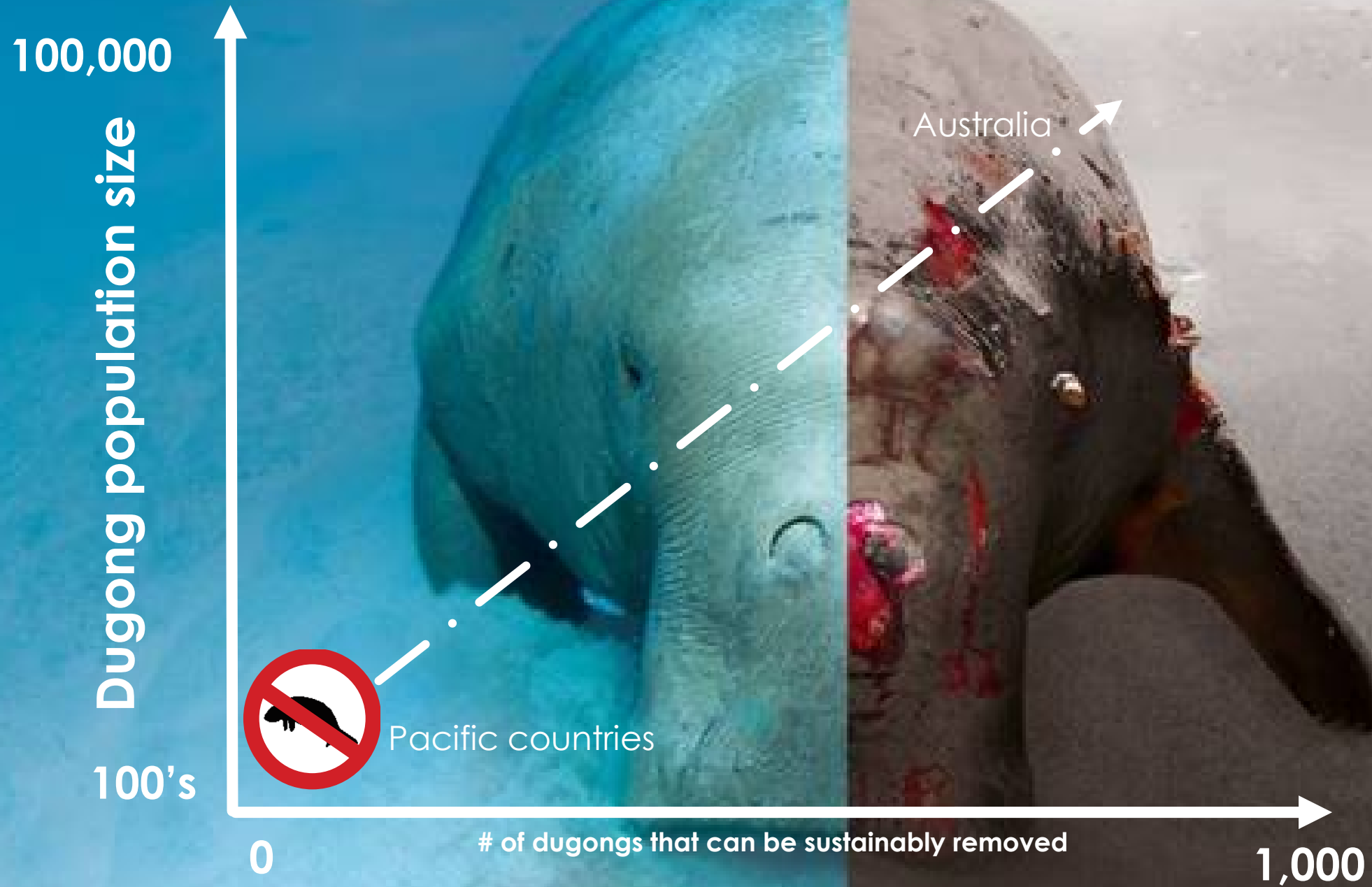


How are dugongs doing in the Pacific basin?

- ▶ Status remain mostly unknown (except Australia)
- ▶ Several countries lack baseline data + formal assessment hasn't really been conducted
- ▶ But, new data starting to emerge
- ▶ Opportunities to conduct IUCN regional assessments (IUCN Sirenia specialist group here to help)
- ▶ Need for evidence of decline in the population



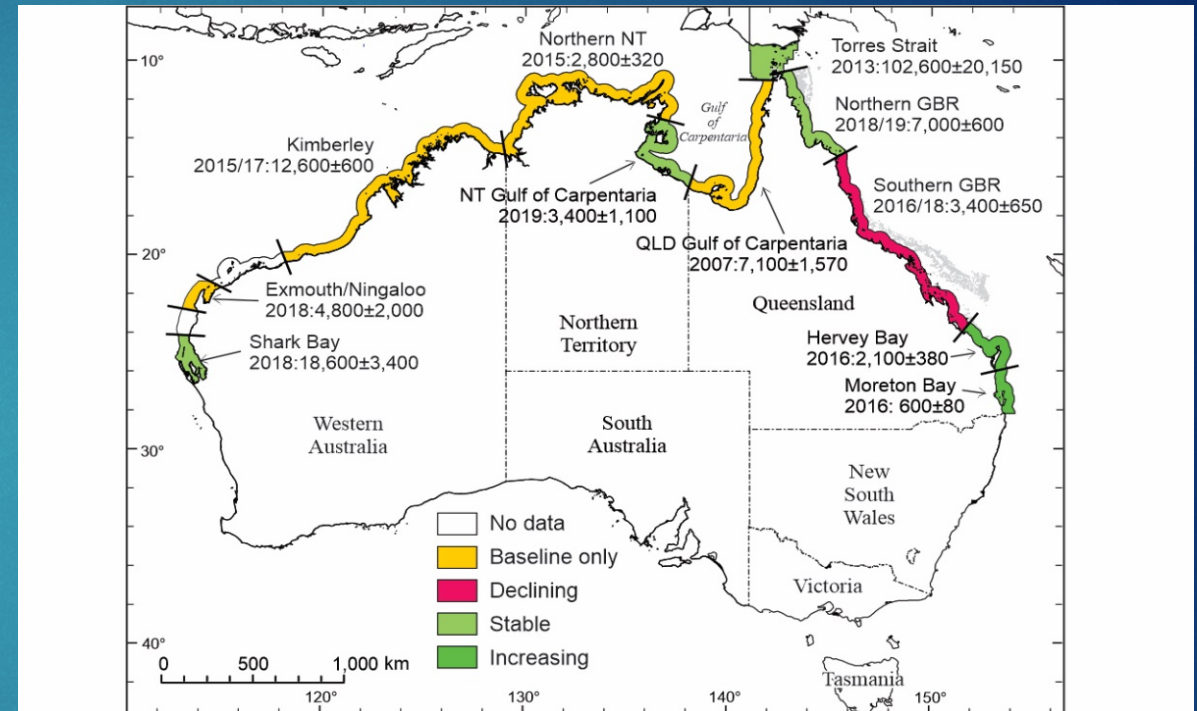
How many can we afford to lose ?



Australia



- ▶ > 150,000 dugongs
- ▶ Stable in some region, only baseline data available in others, declining in the Southern Great Barrier Reef
- ▶ Widespread and restricted lineages
- ▶ Ongoing population surveys, tracking studies and seagrass assessments



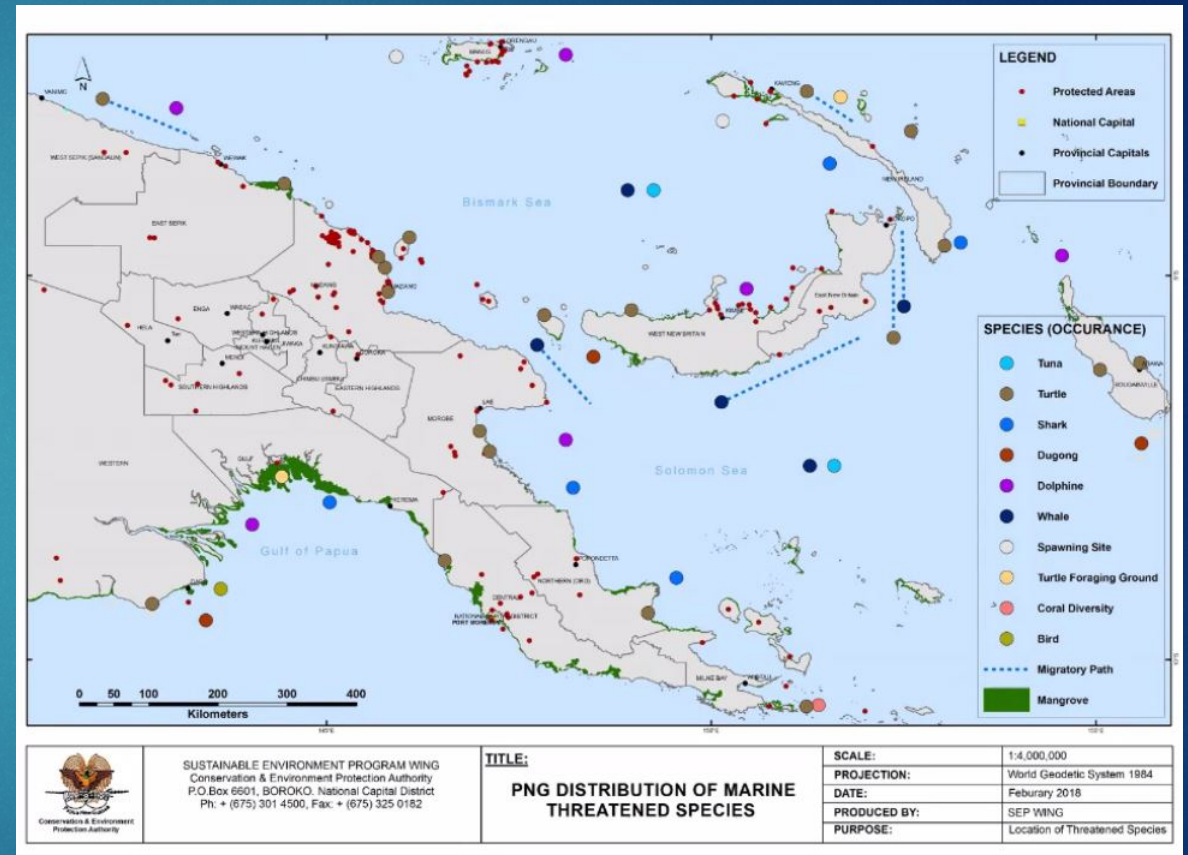
Review by Marsh (in press)

Papua New Guinea



- ▶ Estimated population size is unknown
- ▶ UNEP-CMS Dugong Questionnaire has been deployed (350 interviews to date?).
- ▶ Data was not collected in the UNEP-CMS standardised format. Questionnaire Upload sheet to be delivered.

Pilcher et al. 2016
<https://www.cms.int>



Palau



- ▶ Estimated population size is unknown
- ▶ No systematic aerial survey, but drone operations focusing on Ngederrak Reef suggest that there may be ~100 dugongs or more (groups of up to 59 dugongs were observed)
- ▶ Most geographically isolated population
- ▶ Insufficient regional samples to conduct genetic study

Coral Reef Research Foundation (2020)



Figure 2: Map showing the location and number of dugongs recorded. Bubble size represents dugong group size, where the smallest bubbles represent a single dugong and the largest bubble size shows the herd of 59 individuals.

Solomon islands



- ▶ Estimated population size is unknown
- ▶ UNEP-CMS Dugong Questionnaire has been deployed (109 interviews to date).
- ▶ Maps of dugong sightings, are available but not in the UNEP-CMS standardised format. Questionnaire Upload sheet to be delivered.

Pilcher et al. 2016

Reported by Pita Pisi, Dugong Survey, Marau Sound, 2010.

Report produced by Rose Babaua/Senior Conservation Officer/Environment & Conservation Division.



Dugong sightings in Marau, Guadalcanal Province

New Caledonia



Dugong relative density

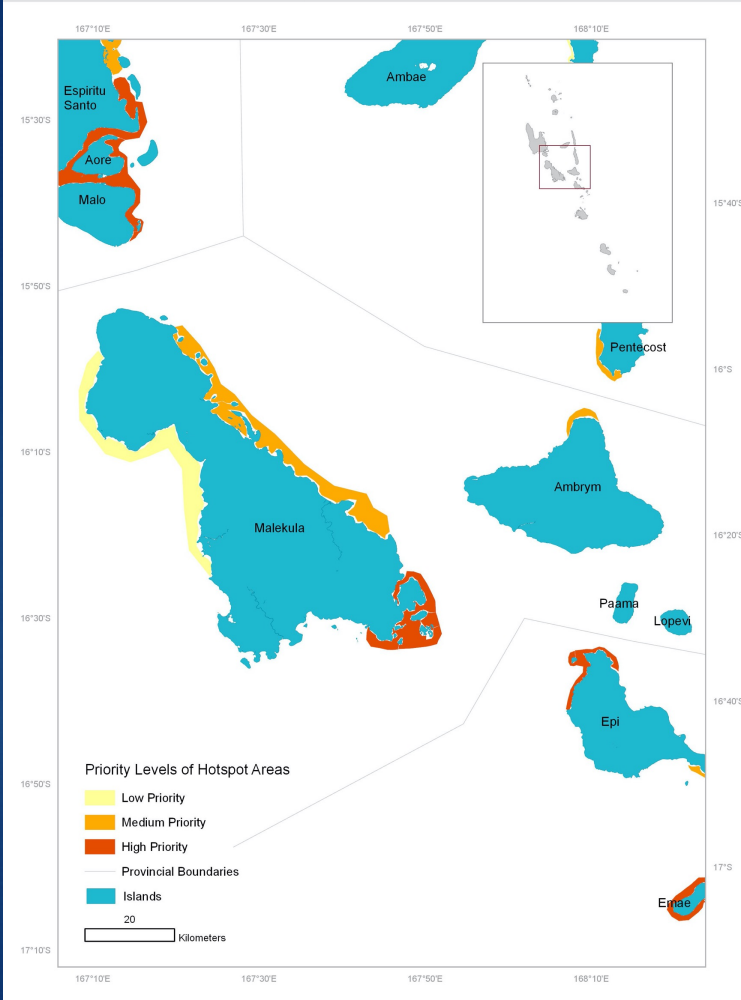
- Very High
- High
- Medium
- Low

- ▶ **< 1,000 dugongs** (time series of aerial surveys) located around the main island of New Caledonia ("Grande Terre") (Cleguer et al. 2017)
- ▶ MPAs not designed for dugongs (Cleguer et al. 2015)
- ▶ Lowest genetic diversity known worldwide. No genetic structure and genetically isolated from Australian populations (Garrigue et al. in prep)
- ▶ Dugong Action Plan 2010-2015 supported several scientific studies (aerial surveys, dugong tracking, genetic analysis) as well as education, awareness and management initiatives.
- ▶ Concerns about illegal take of dugongs (PAD 2010-2015)

Vanuatu



Hotspot Areas in Malampa Province



- Estimated population size is unknown.
- UNEP-CMS Dugong Questionnaire has been deployed (550 interviews to date).
- Dugongs are sighted throughout the archipelago in most of the major island groups in Vanuatu.
- Seagrass distributed throughout Vanuatu in small pockets.
- The general perception is that the number of dugongs is not decreasing.
- Concerns about by-catch in gill nets (particularly as many nets are left unattended, including at night).

Shaw pers. comm. (VESS)

A new book in the making

Opportunity to review and summarise dugong information for the Pacific Basin

Edited by Ellen Hines

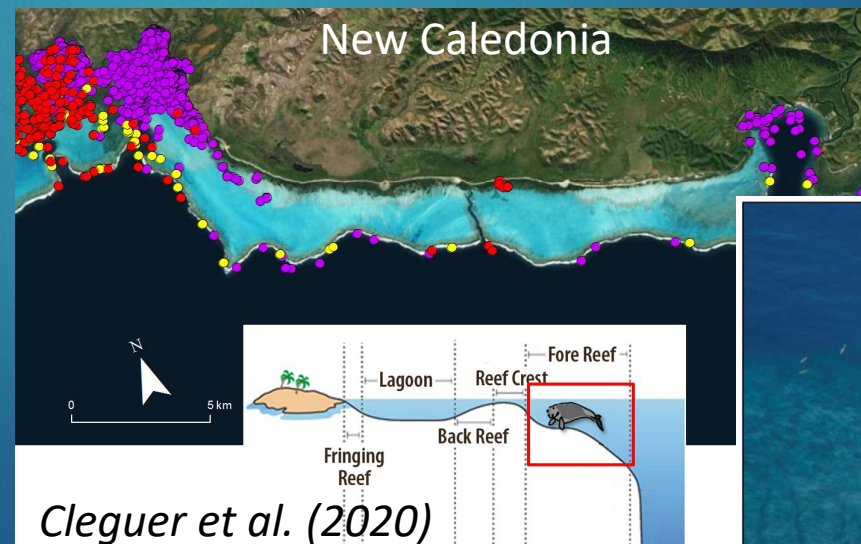
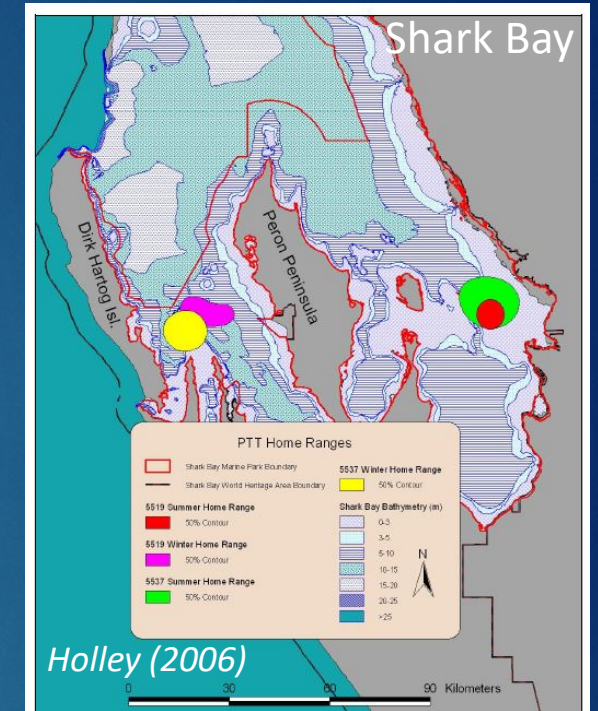
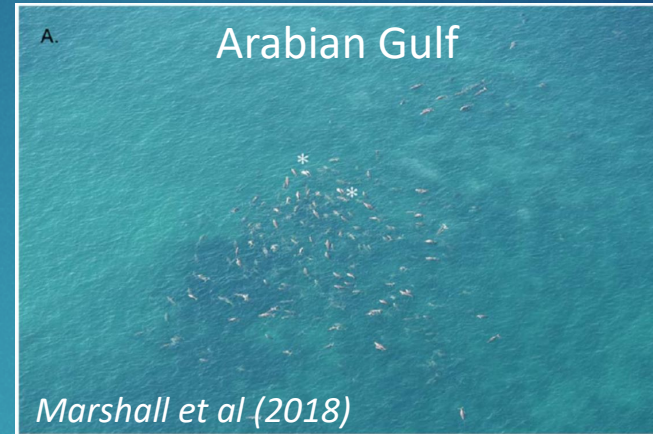


...v2

Dugong movements and connectivity



- ▶ Heterogeneous movements
- ▶ Possible long-range migratory patterns in some locations
- ▶ Mass movements more likely as response to climatic events
- ▶ Local-scale seasonal adjustments in habitat use in most locations
- ▶ Movement behaviour adjusted to small coral reef lagoon habitats



Dugong movements and connectivity



- ▶ Dugongs' long distance journeys have led to species range expansions, including “stepping-stone” colonization of islands.

First record of a dugong (*Dugong dugon* Müller, 1776) in Fiji

Renee Hill-Lewenilovo^A, Roko Vuiyasawa^A and Susanna Piovano^{ID A,B}



Fig. 1. The vagrant dugong found dead in Fiji on 20 May 2018 (photograph: Vilikesa Karalo).

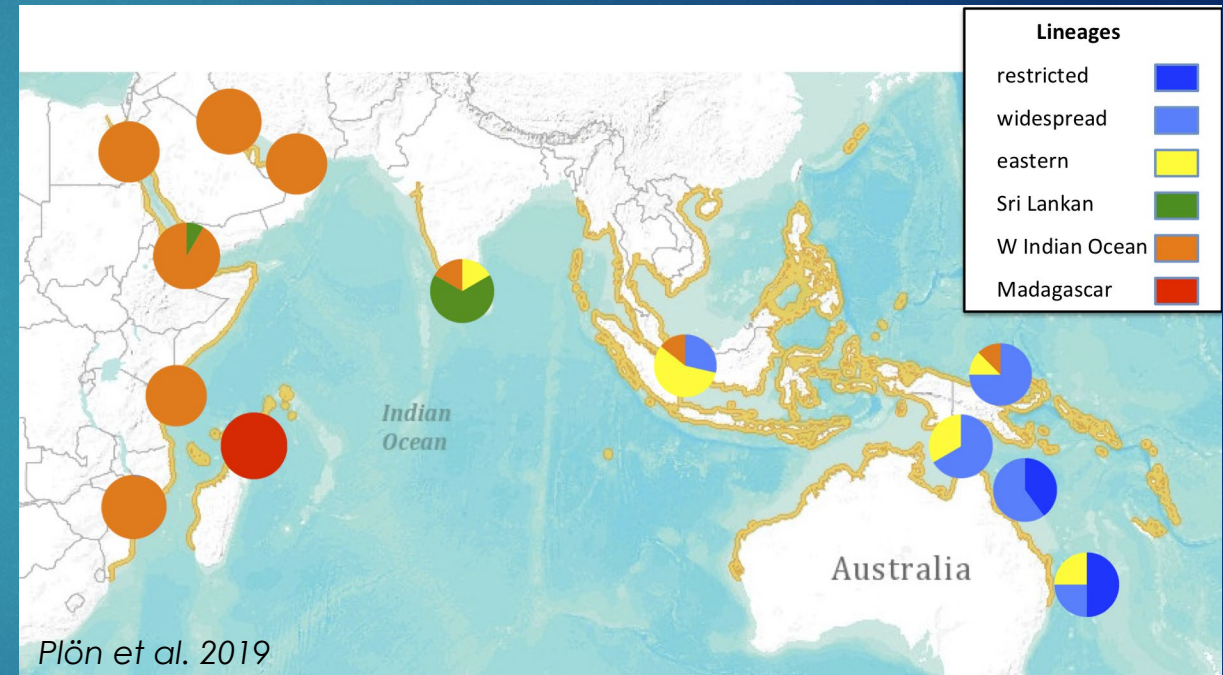
Phylogeography



- ▶ In the Indian Ocean (Plön et al. 2019):
 - ▶ New mtDNA lineages in the Western Indian Ocean and nearby Madagascar
 - ▶ Low levels of genetic diversity

Shows the importance and vulnerability of dugong populations in the Western Indian Ocean

- ▶ New genetic research from New Caledonia (Garrigue et al. in prep):
 - ▶ First information on dugongs from the Melanesian arc
 - ▶ Lowest genetic diversity known worldwide, and isolation from Australian populations
 - ▶ Limited number of samples from neighbouring dugong countries

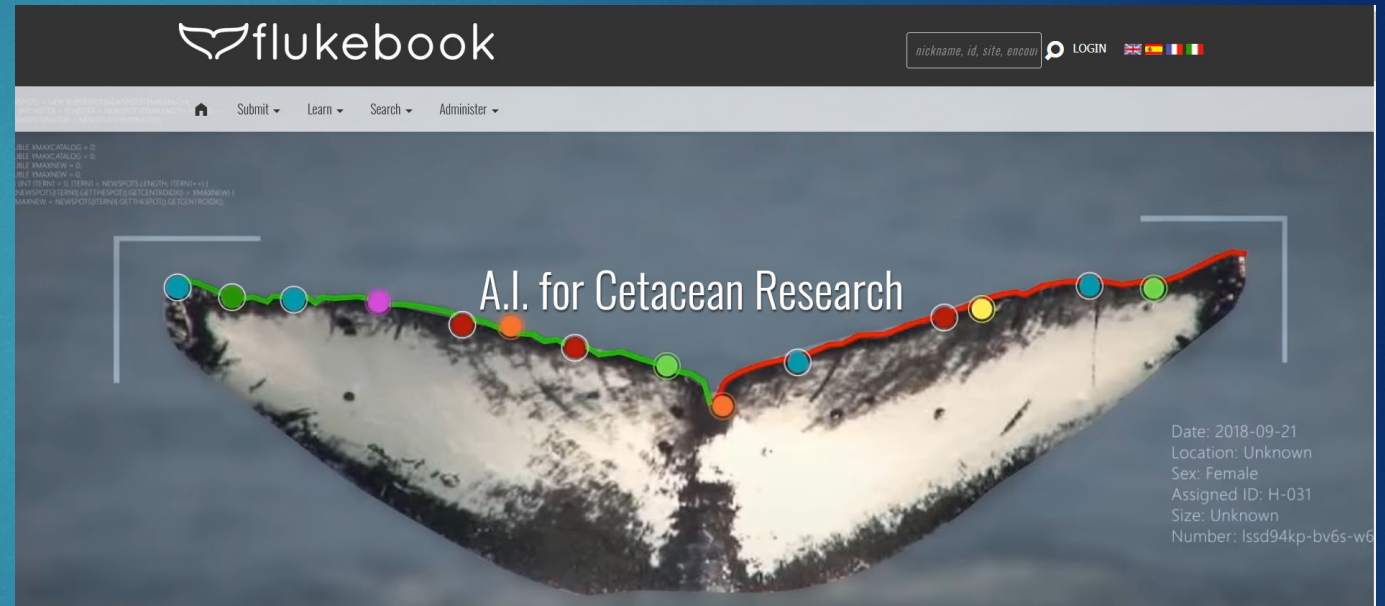


Dugongs in the Pacific Basin: a missing piece of the puzzle

Monitoring the living, yes...but what about the dead?

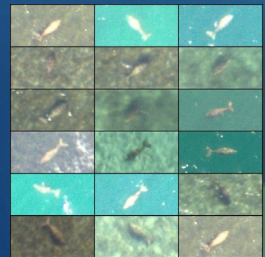
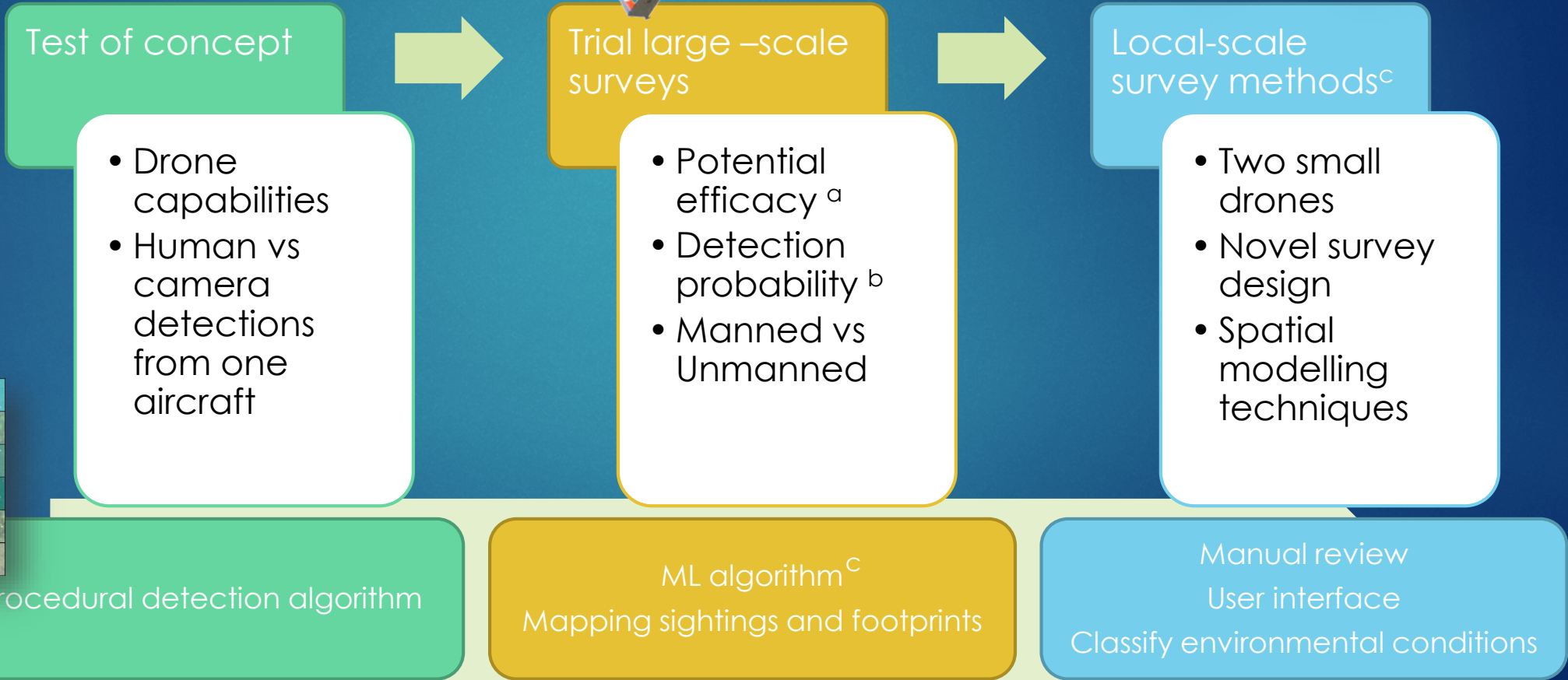


- ▶ Identify causes of illness, injuries or death
- ▶ Regional connectivity, genetic diversity
- ▶ Diet and hence habitat use analysis
- ▶ Help to increase effectiveness of management actions
- ▶ Collect, archive and **analyse** samples for genetic analysis



Advances in survey tools

From manned to unmanned surveys



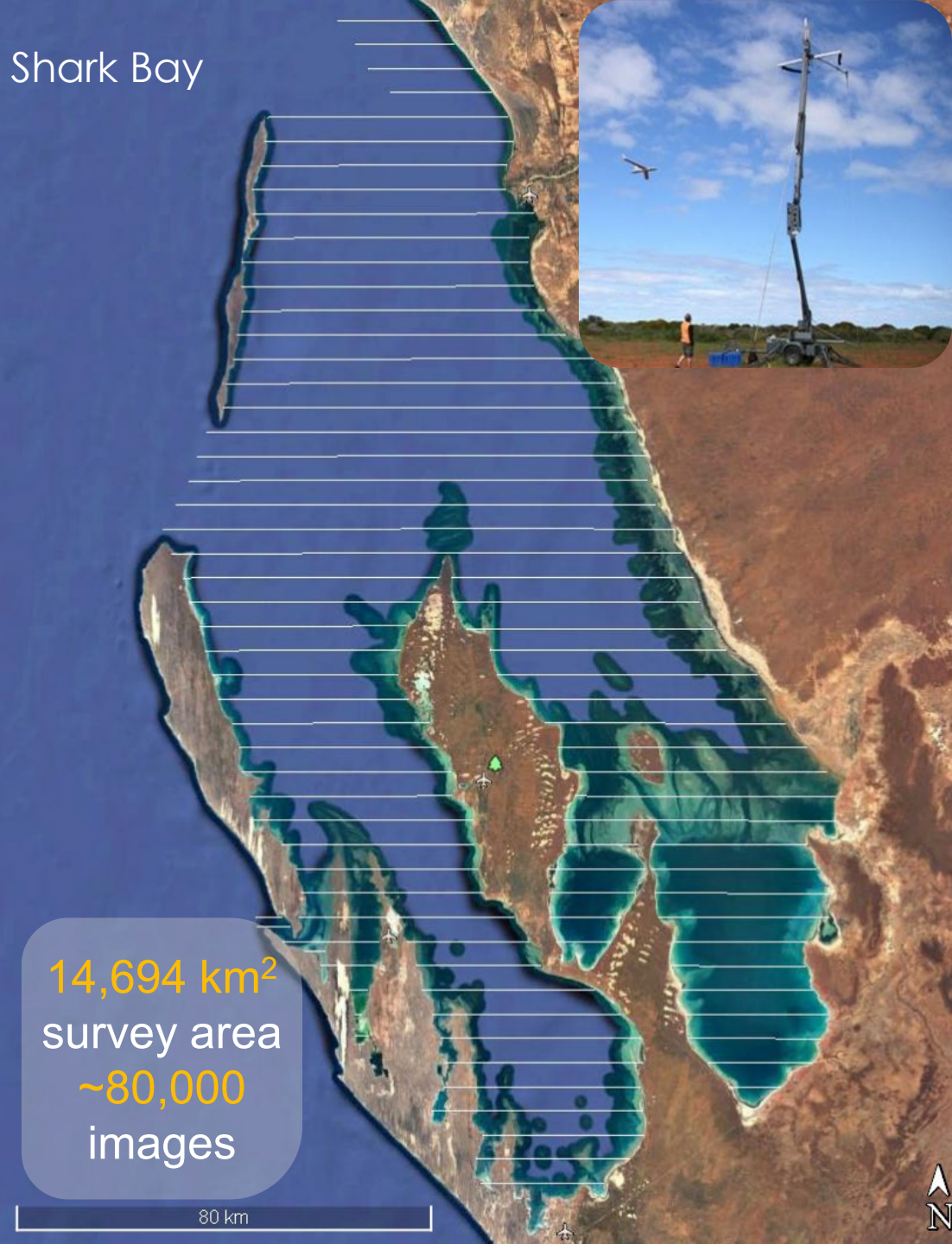
^a Hodgson et al. (2013)
^b Hodgson et al. (2017)
^c Maire et al. (2015)
^d Cleguer et al. (2021)

Large scale drone surveys are expensive and logistically challenging

- ▶ Affordable alternative to the ScanEagle?
- ▶ Permission to fly BVLOS and high altitude



Shark Bay

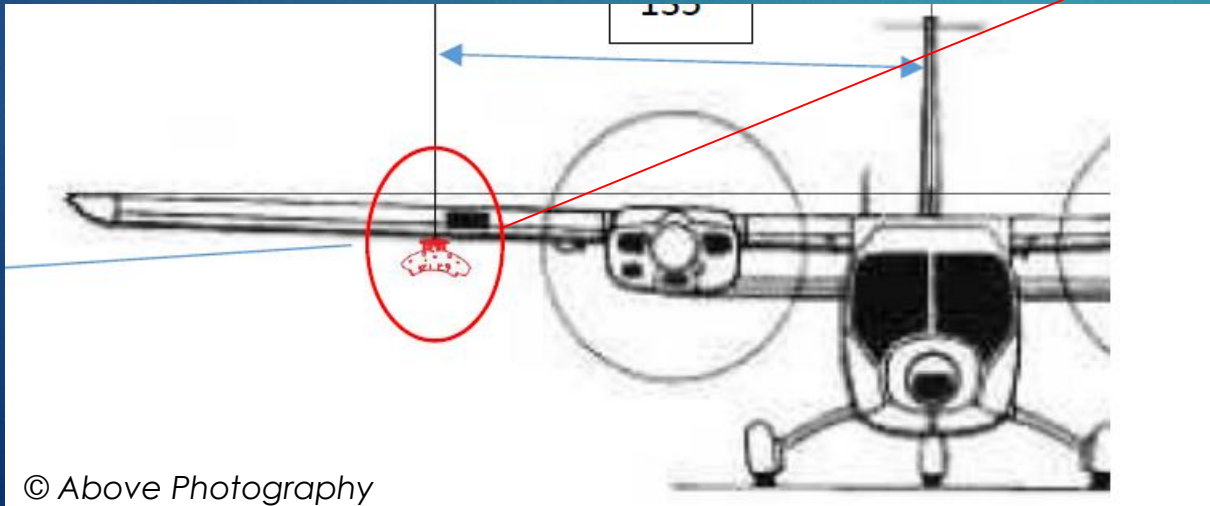


14,694 km²
survey area
~80,000
images

80 km

Uprise of camera-mounted manned planes

- ▶ Trialled in
 - ▶ Western Australia (dolphin survey; Raudino et al. in review)
 - ▶ Northern Territory (dugong vs snubfin dolphin survey)
 - ▶ New Caledonia (dugong population survey)
- ▶ Awaiting results/publications
- ▶ Need to carefully think of design and equipment to meet objectives



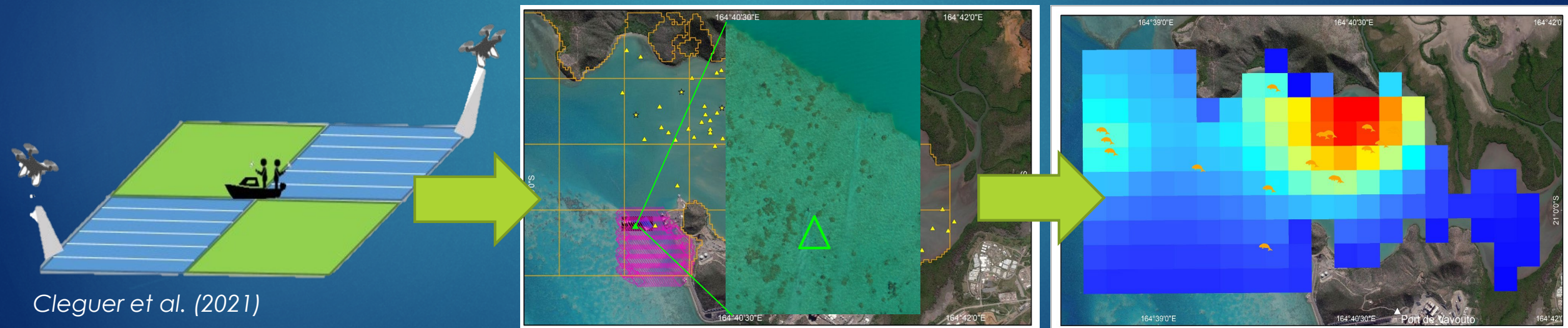
Small drone surveys: a cost-effective solution for high accuracy, intensive and repetitive local scale surveys



► Novel method

- Grid sampling design
- Two drones operated simultaneously
- First spatially-explicit density models based on imagery data
- Great for species occupancy and habitat use studies

Example of application: Baseline local survey of a mining port area in New Caledonia (Cleguer et al. 2020)



Method rolled out in communities in the Philippines, Indonesia, Thailand, Malaysia, and (perhaps) Timor-Leste

Advances in tracking tools

Miniaturisation and development of new dugong tracking equipment



- ▶ New insights into the long-term/range movements (GPS-sat tags) and short-term, fine scale dive profiles
- ▶ Require animal capture: logistically challenging if not impossible in low dugong density areas. Risky, and need to be culturally acceptable



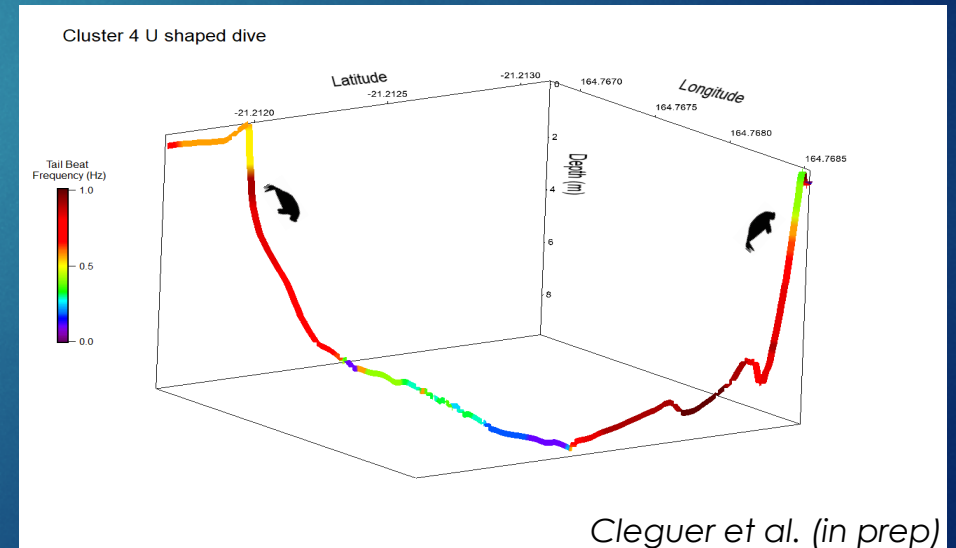
'Old' GPS-sat tag



'New' GPS-Iridium or sat tag



Diary and cam-diary tags



The UNEP-CMS questionnaire

A cost-effective solution

- ▶ Information on dugong distribution and density, seagrass, fishing activity. Serves to identify potential conservation 'hotspots'
- ▶ Simple to use (Excel and GIS Components) and training is available (talk to Nick!)
- ▶ Available in 11 languages
- ▶ Helps people to connect and share knowledge!
- ▶ 2016: 6153 surveys collected across 18 countries
- ▶ 2021: 9394 surveys collected across 20 countries
- ▶ No reporting or use of a 'variant' / shorter version of the questionnaire prevents data to be used the most effective way



Pilcher (2016), Pilcher et al (2017)

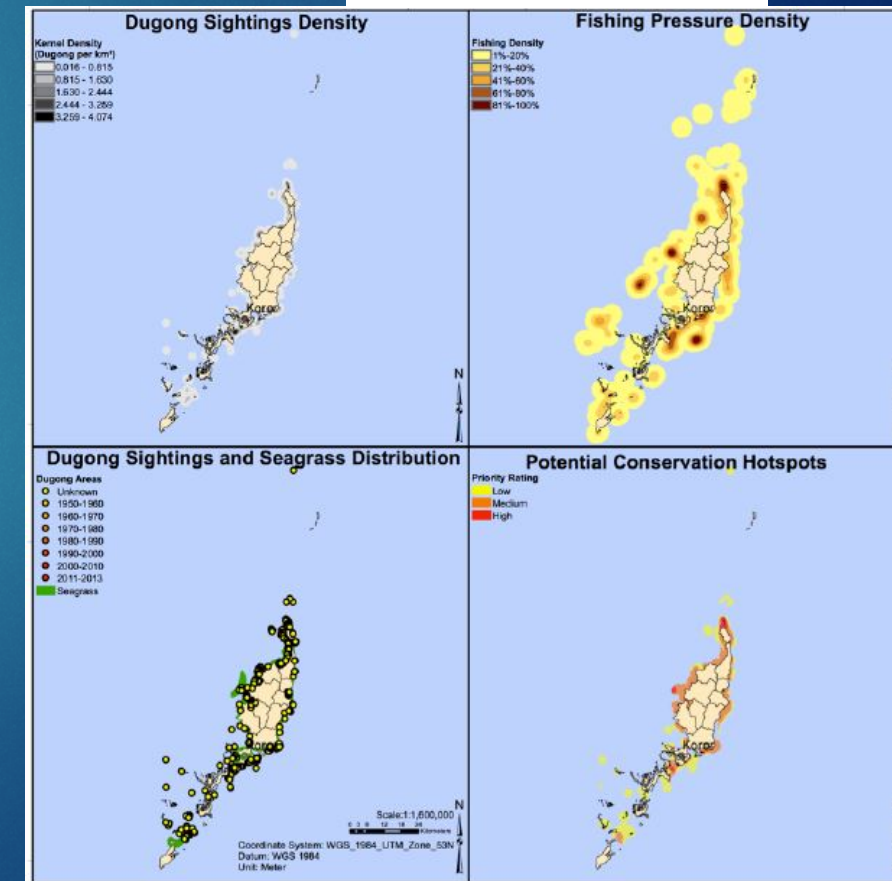
Dugong Questionnaire Survey

Project Manual



CMS-UNEP Abu Dhabi Office

June 2011

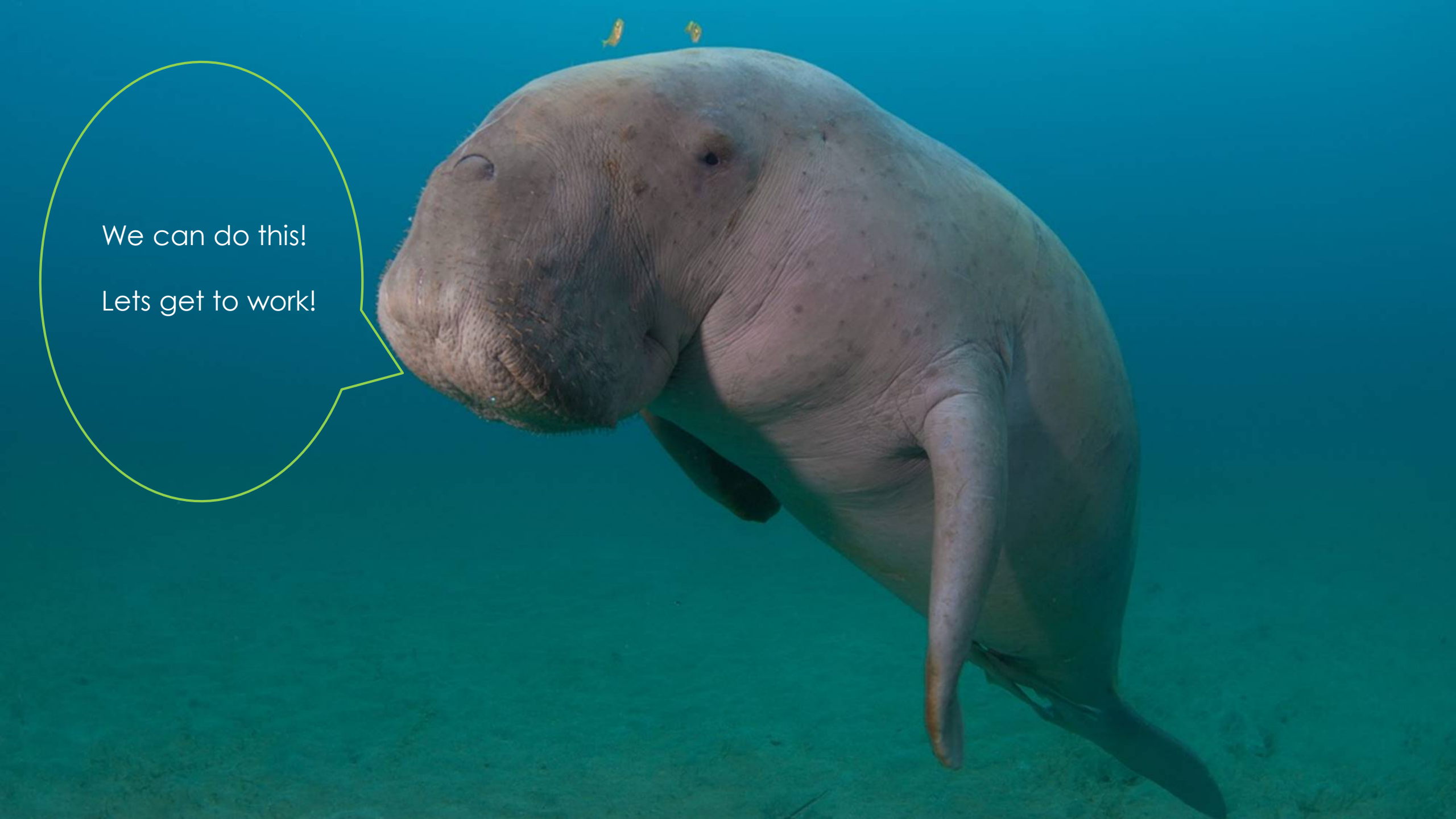


Dugong and Seagrass Research Toolkit

- Decision support tool for research into dugongs, seagrasses and associated human communities.
- Developed by Dugong Technical Group.
- Audience: marine natural resource managers, decision-makers (government and non-government) and researchers.
- Purpose:
 - to standardise data sets and methods across countries
 - allow for better comparison of global dugong and seagrass conservation status
 - to ensure that researchers consider the connectedness of dugongs, seagrasses and human communities.



www.conservation.tools

A photograph of a manatee swimming underwater. The manatee is the central focus, shown in profile from the side, facing left. It has a large, rounded head and a thick, wrinkled body. The water is a clear, deep blue. A yellow speech bubble is positioned to the left of the manatee's head, containing two lines of white text. The background is a uniform blue, suggesting an underwater environment.

We can do this!
Lets get to work!