

# Dugong biology: the case for a CMS agreement

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## Conservation significance of dugongs

- Only member of family Dugongidae
- Only strictly marine herbivorous mammal
- Largest population size and range of extant Sirenia (dugong and manatees)
- Currently classified as vulnerable at global scale by IUCN



## Cultural importance of dugongs

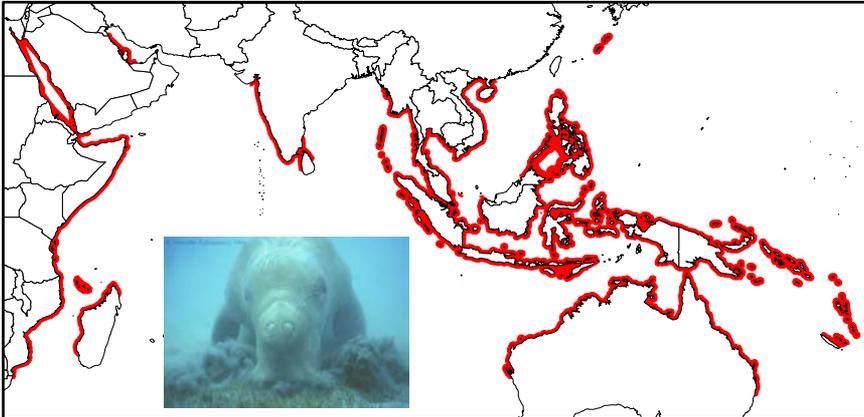
- High cultural value in many parts of range
- Valued source of food, medicine and artefacts in many countries
- Flagship species for coastal peoples



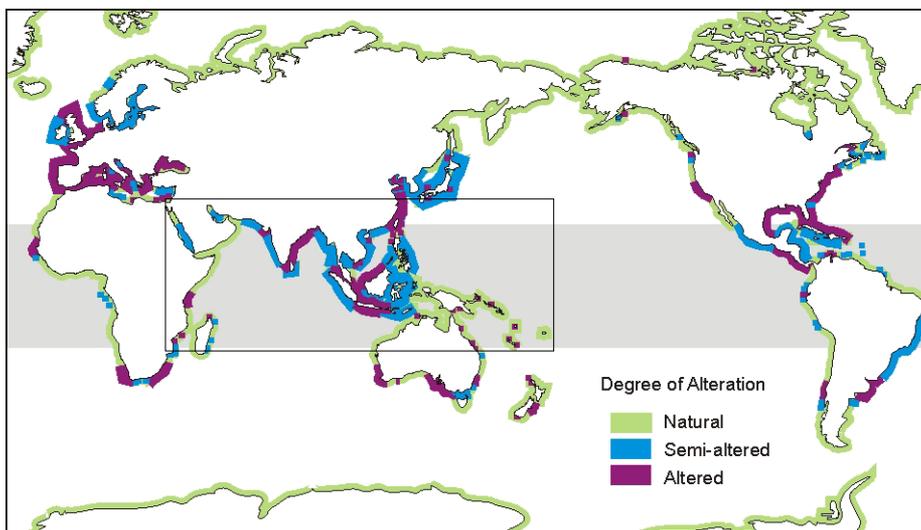
## Convention for conservation of migratory species

- Objective:
  - To conserve terrestrial, avian and marine species over the whole of their migratory range.
- Recognition of the need for countries to cooperate in conserving animals which migrate across national boundaries or between national territorial waters and the high seas.

# Extent of occurrence : 140,000 km of coastline across 48 countries

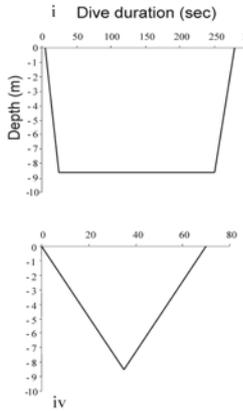


Still present at extreme ends of range but reduction in area of occupancy within range



from World Resource Institute

Dive computers show dugongs spend most of their time feeding in shallow water < 10m, 72% dives < 3m



## Seagrass specialist



**Area of occupancy: shallow  
coastal waters**

**potentially > 125,800 km<sup>2</sup>**



**Critical habitat seagrass beds < 10m  
especially < 3m**

**Dugongs farm seagrass – when  
dugongs are lost from an area it  
may decline in habitat quality**



## Space age technology to study dugong movements and diving

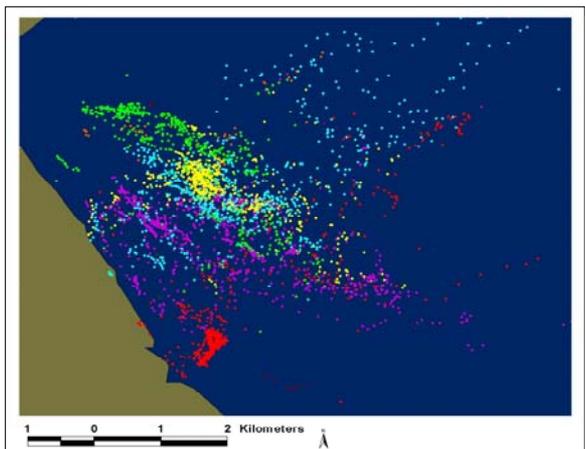


Acknowledgment James Sheppard

## Small-scale commuting movements

**Dugongs target specific areas with high biomass of preferred seagrass species**

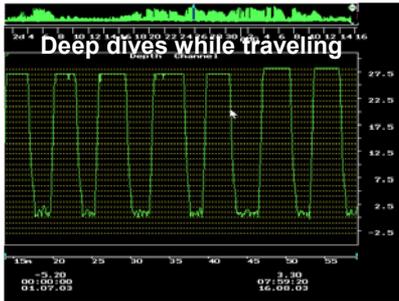
- Each colour an individual dugong
- Each dot a location fix



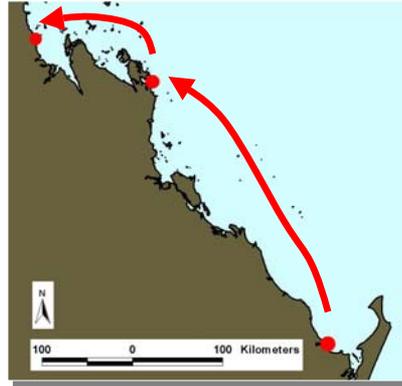
Acknowledgment  
James Sheppard

## Long distance movements:

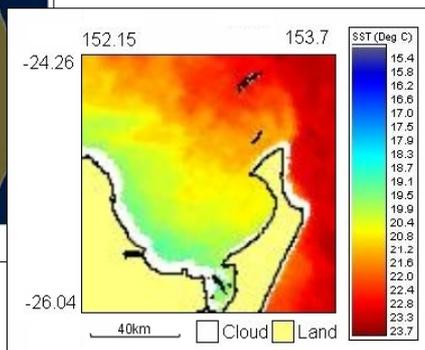
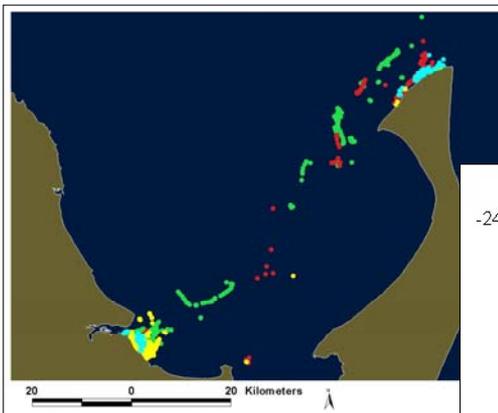
- Moves common yet unpredictable
- 44/72 >30km; 14>100km
- All size/age/sex classes make large-scale moves
- Moves up to 500km in 12 days
- Some make return trips



Acknowledgment James Sheppard



## Thermoregulatory movements at high latitude limits to range



Acknowledgment  
James Sheppard

Occasionally cross ocean trenches



Maximum age > 70 years



First breeds at age 6-17 years  
suckles young for up to 18 months



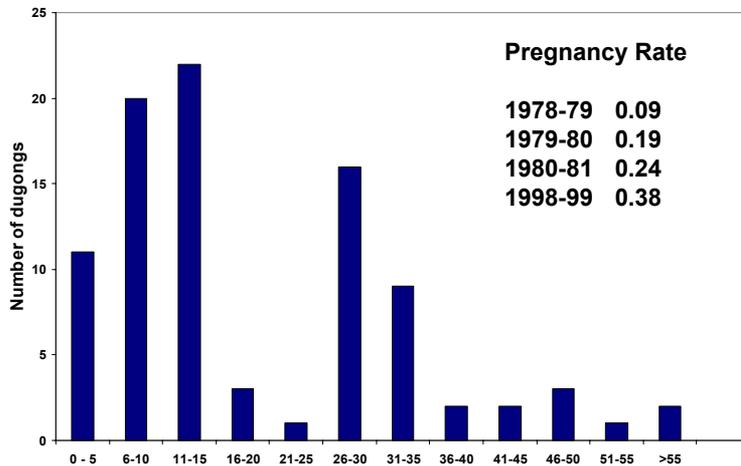
Acknowledgment  
Amanda Hodgson

One calf every 2.5 to 7 years  
depending on food supply



## If food supply is damaged dugongs postpone breeding and/or move

Impact of seagrass dieback 20- 25 years previous in age structure of sample



Acknowledgment Donna Kwan

Age Class (years)

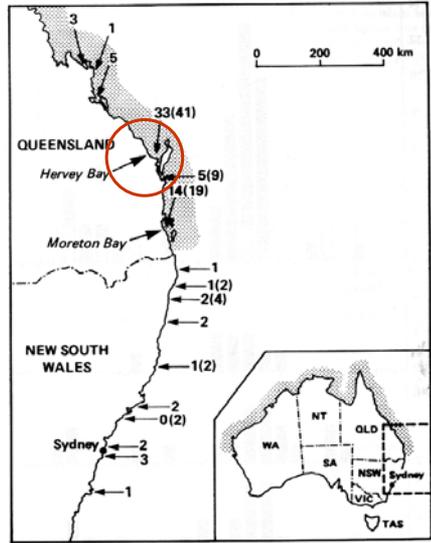
## Cause of 1992 decline (emigration + mortality): *Habitat loss, due to extreme weather*



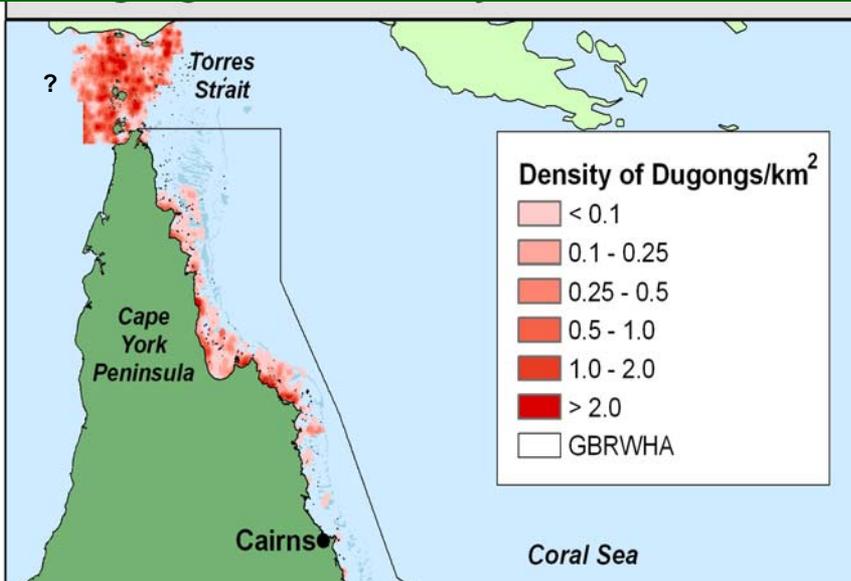
1000 km<sup>2</sup> of seagrass habitat were lost in Hervey Bay in 1992 after two floods and a cyclone

## After large scale seagrass loss dugongs move or delay breeding

Recovery of dugong  
carcasses after  
Hervey Bay seagrass  
loss

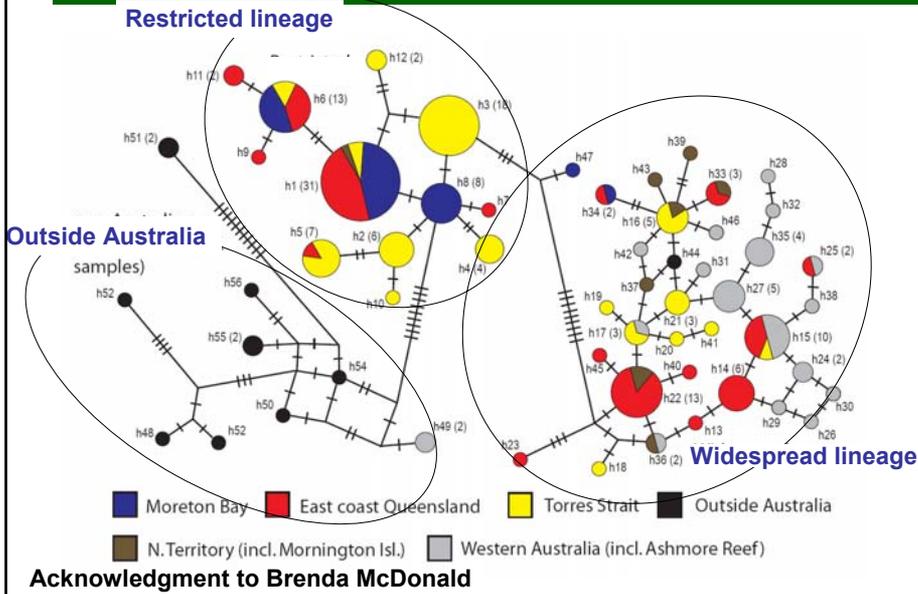


## Habitat extends across international boundaries

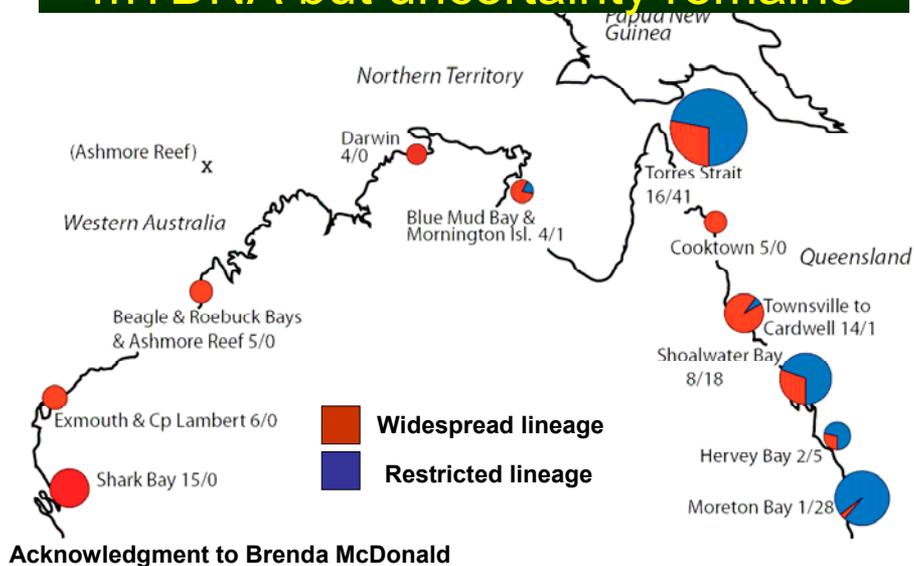


Acknowledgment  
Alana Grech

# Biological scale? Clues from mTDNA

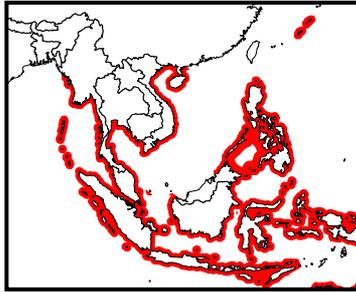


# Biological scale? Clues from mTDNA but uncertainty remains



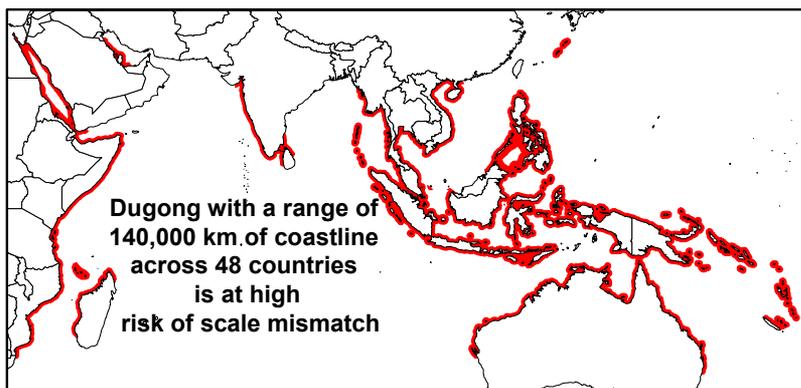
## Microsatellite markers

- Preliminary data from markers inherited from both parents consistent with isolation by distance at scale of hundreds of km



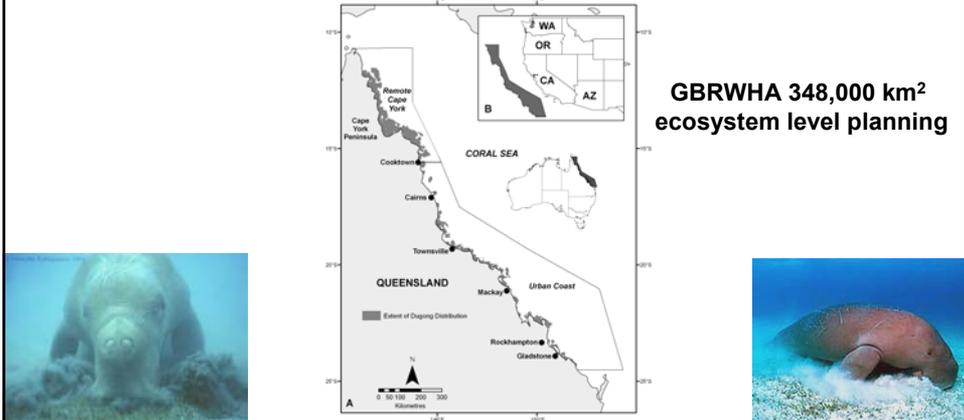
## Scale Mismatches

- Occur if mismatch between geo-political scale(s) at which resource managed and biological scale at which resource functions
- Major impediment to successful management



## Question?

Is there a scale mismatch between the scale at which risks to dugongs from anthropogenic impacts are managed in the Great Barrier Reef region and the scale at which dugong populations function?



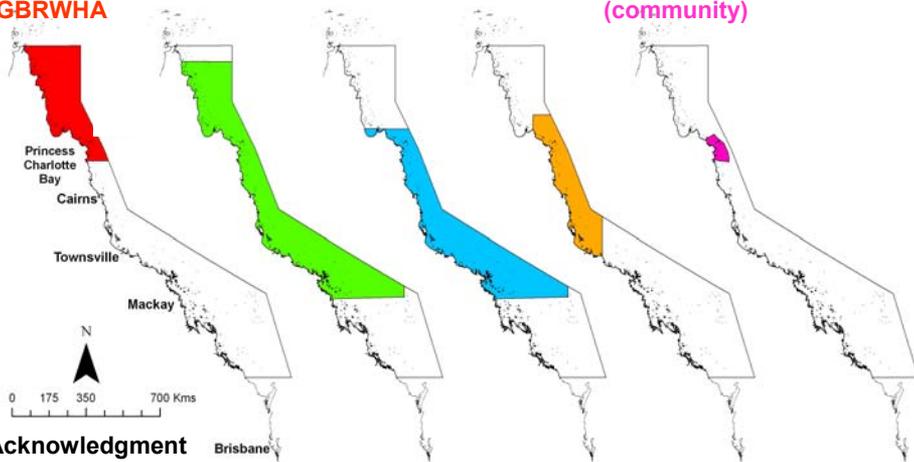
## 5 scales in Great Barrier Reef World Heritage Area

uncertainty

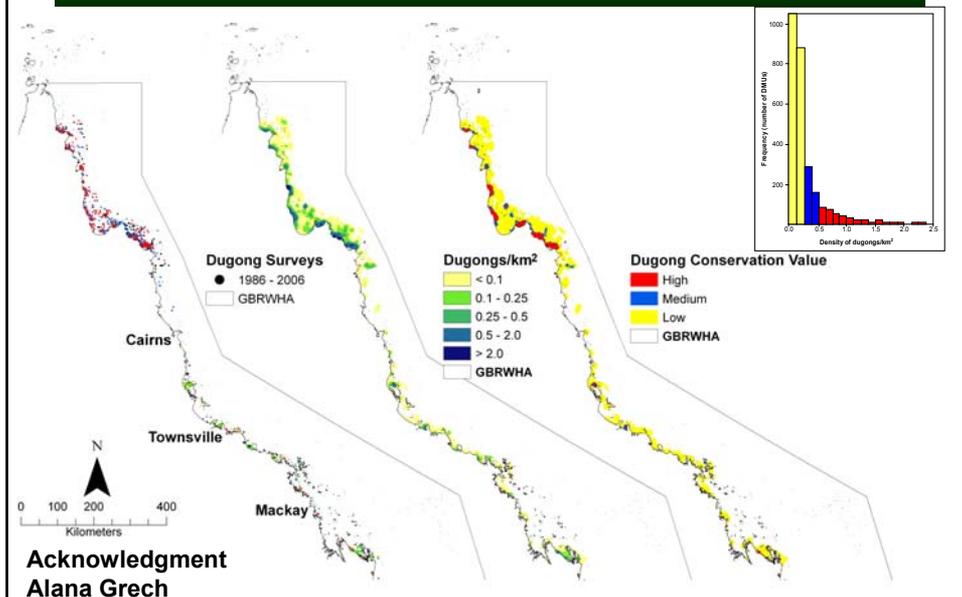
Geo-political Biological 1 Biological 2 Biological 3 Local

GBRWHA

(community)



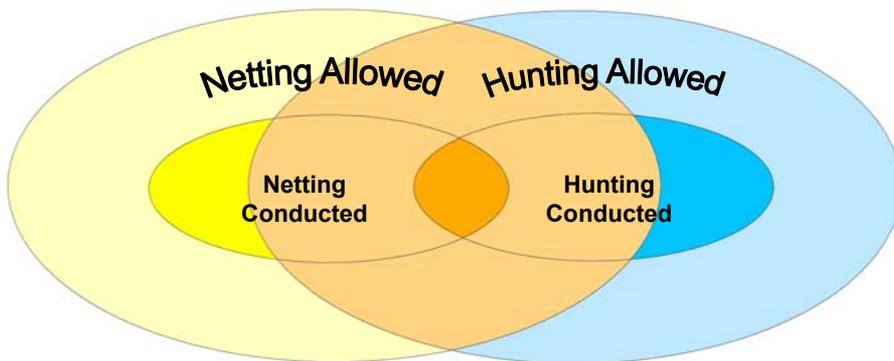
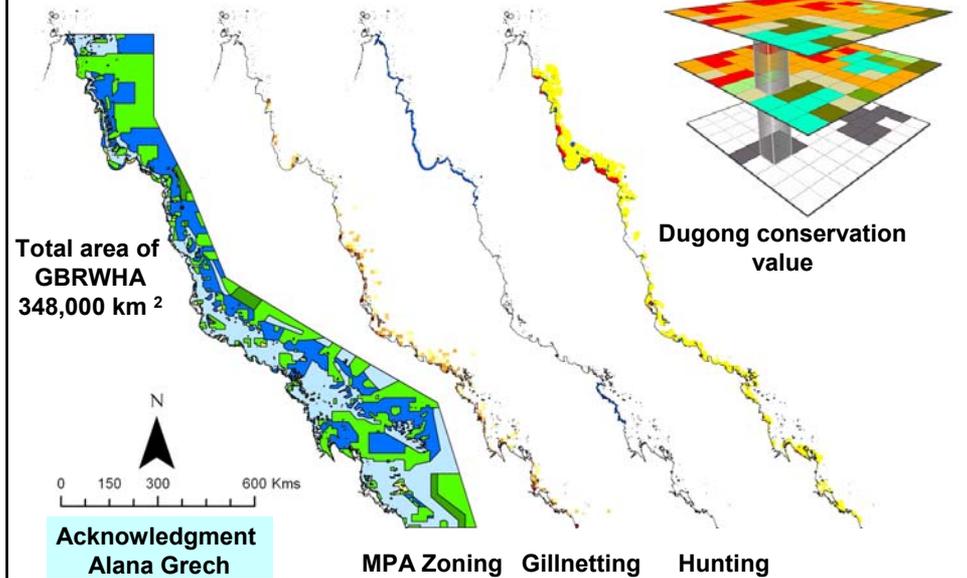
## Spatial model of dugong distribution and abundance based on 20 years of aerial surveys



## Two major sources of anthropogenic mortality



# Layers in 2x2 km grid



Acknowledgment Alana Grech

## % of area of high and medium Dugong Conservation Value

Scale	Netting Allowed	Netting Conducted	Hunting Allowed	Hunting Conducted	Netting and unting Allowed	Netting and Hunting Conducted
Geo-political	44	7	100	30	44	4
Biological 1	41	6	100	28	41	4
Biological 2	33	1	100	27	33	0
Biological 3	38	4	100	20	38	0
Local	38	9	100	23	38	1

**No evidence of scale mismatch because environmental planning in Great Barrier Reef region done at ecosystem scale**

Acknowledgment Alana Grech

## Conclusions

- Dugongs need to be managed at biological scales of hundreds of km
- Most geo-political scales are much smaller than this
- Spatial scale mismatch is a serious impediment to successful management
- Spatial scale mismatch can be prevented by ecosystem scale management planning
- CMS MOU is significant advance

Amanda Hodgson  
Donna Kwan  
Brenda McDonald  
Alana Grech  
Rob Coles  
James Sheppard

Thanks to:

