Marine reserve monitoring in New Zealand: opportunities for citizen science?

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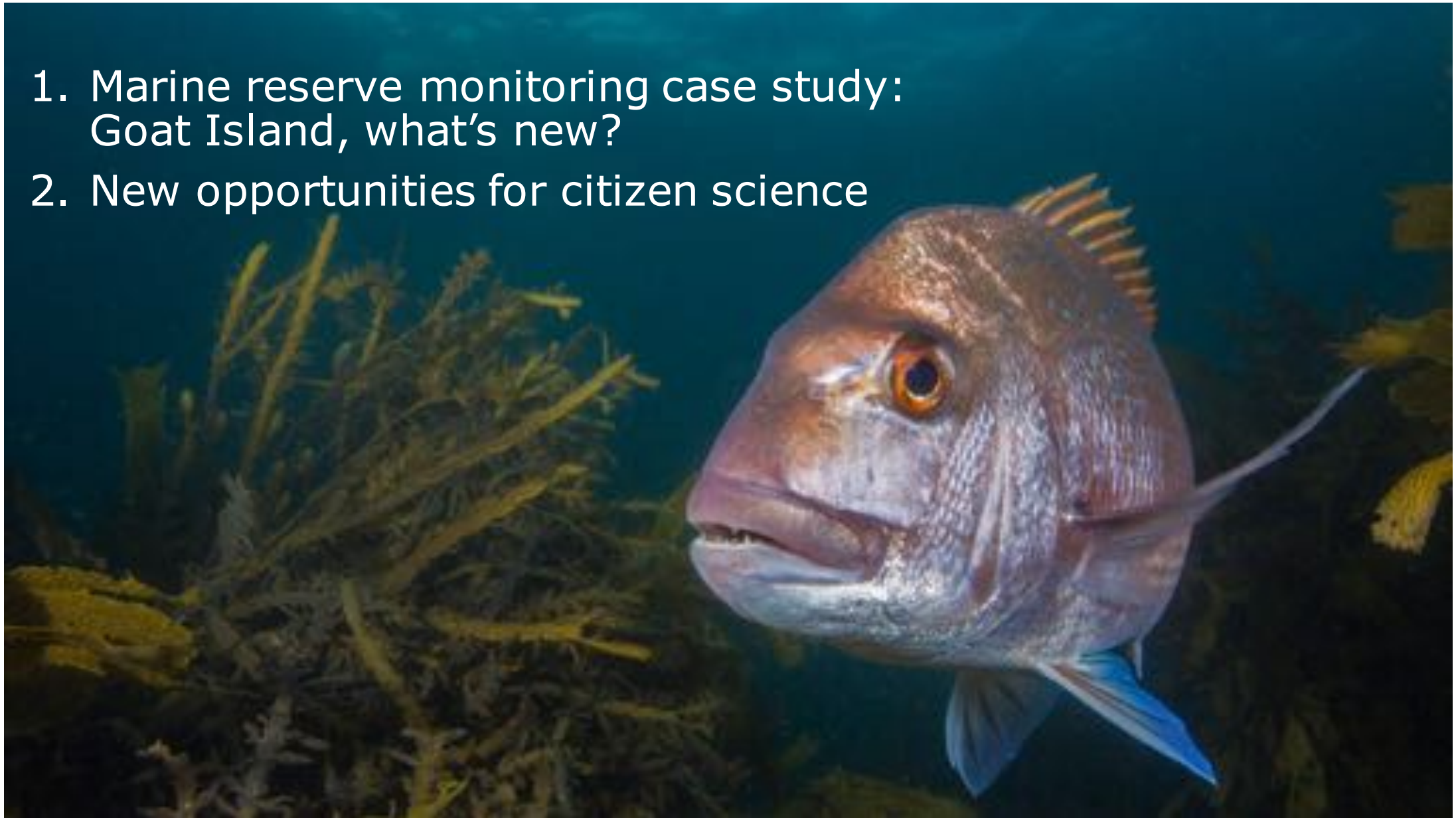
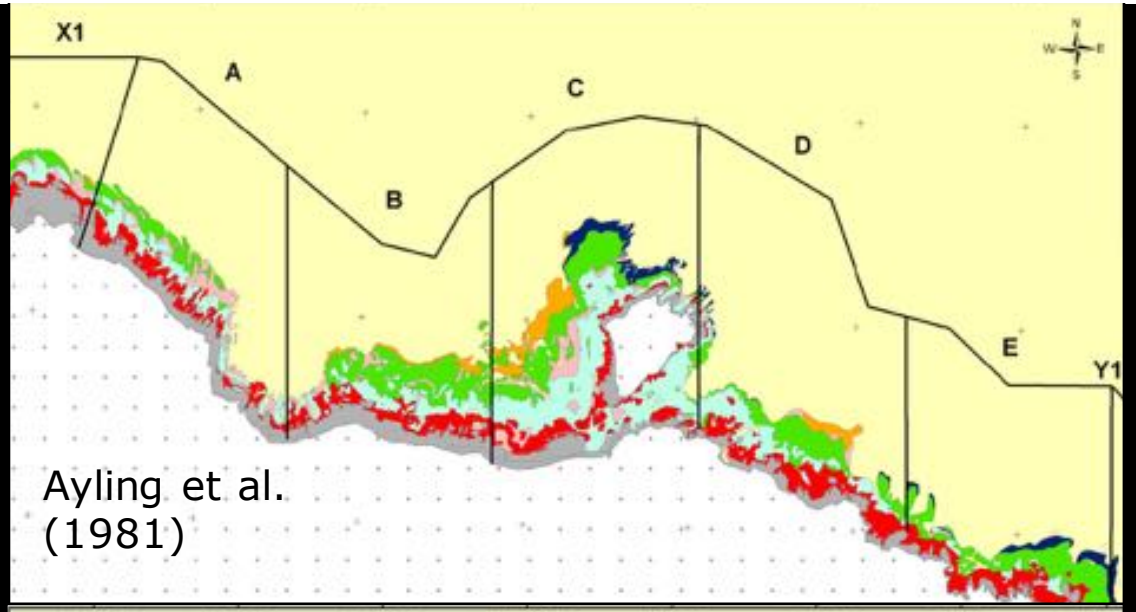

1. Marine reserve monitoring case study:
Goat Island, what's new?
2. New opportunities for citizen science

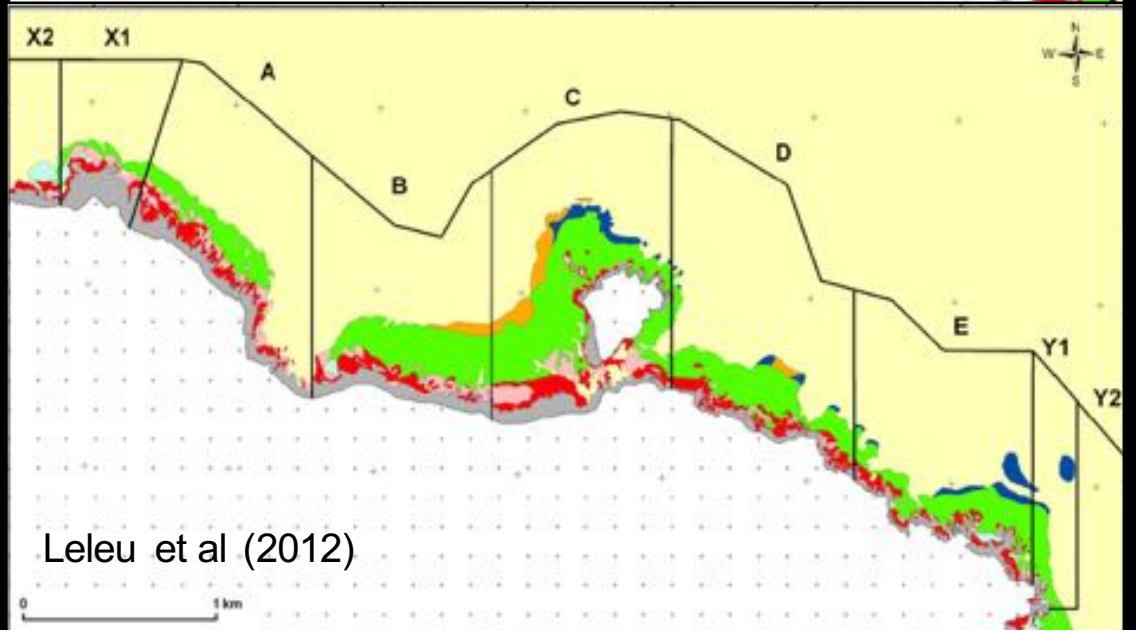

Goat Island or Leigh Marine Reserve (est. 1975)
Or Cape Rodney to Okakari Pt Marine Reserve
1km

Recovery of exploited species

Ecosystem changes



Ayling et al. (1981)

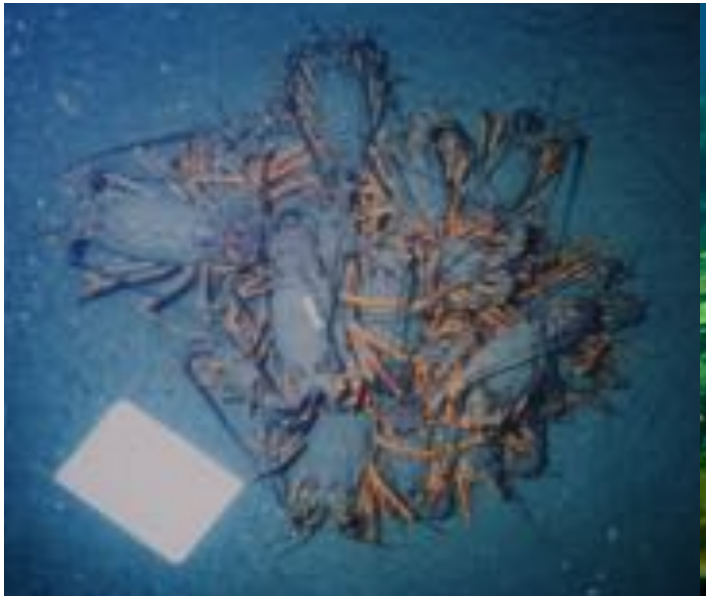


Leleu et al (2012)

What about outside reserves?

Similar patterns in other old marine reserves – Tawharanui and Hahei

Goat Island – So, what's new?

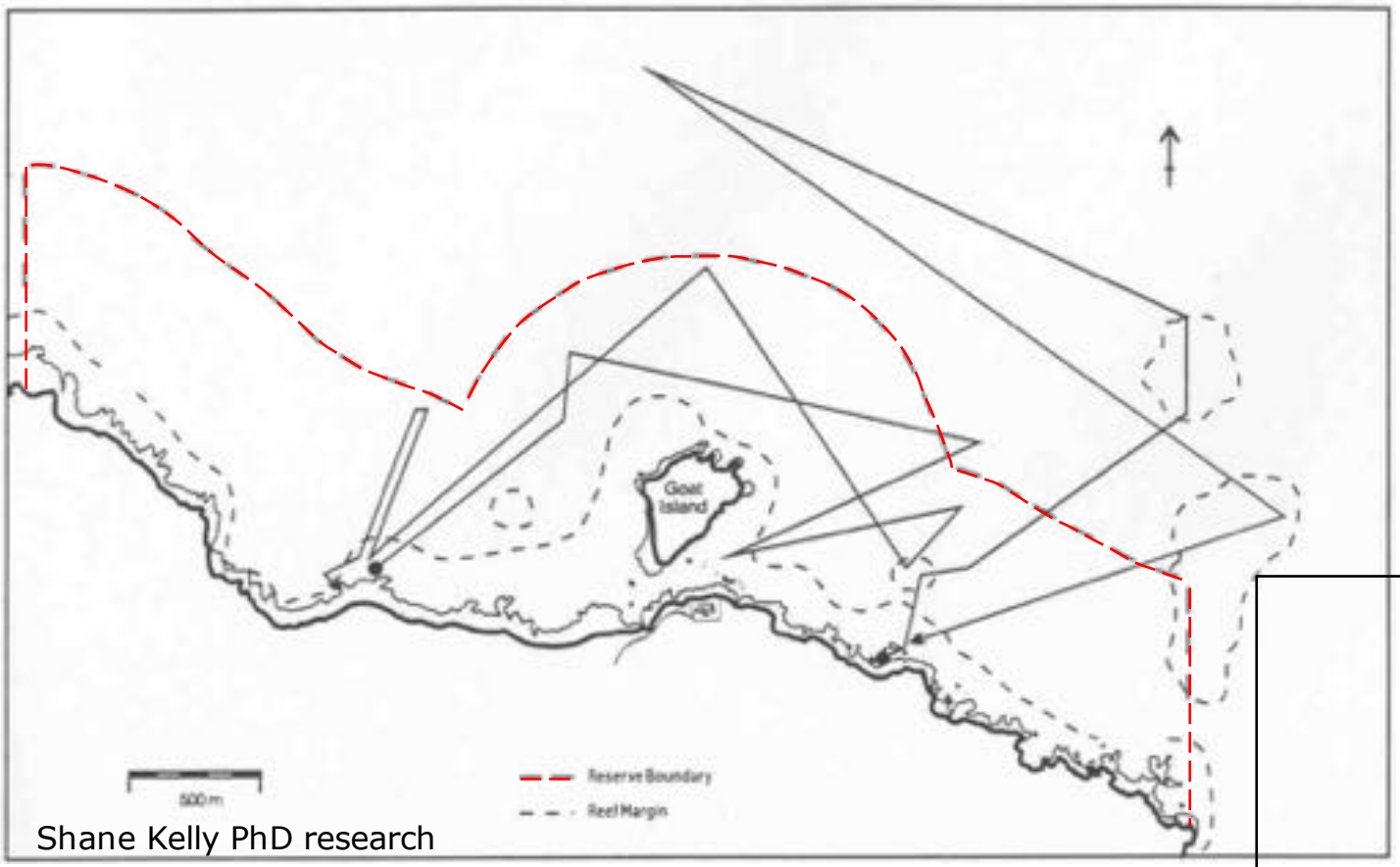


- Ever increasing pressure and stressors on marine ecosystems
- What's changing and how are we investigating these changes?
- Case studies:
  - Long-term trends in crayfish
  - How should we be monitoring snapper?
  - Mapping reef habitats from space

Long-term monitoring of crayfish in northeastern NZ marine reserves

- Declines in recent years across three reserves
- Biomass in fished areas <5% unfished levels
- Trends in reserve populations reflect wider fishery
- Need for management action

Why have crayfish declined?

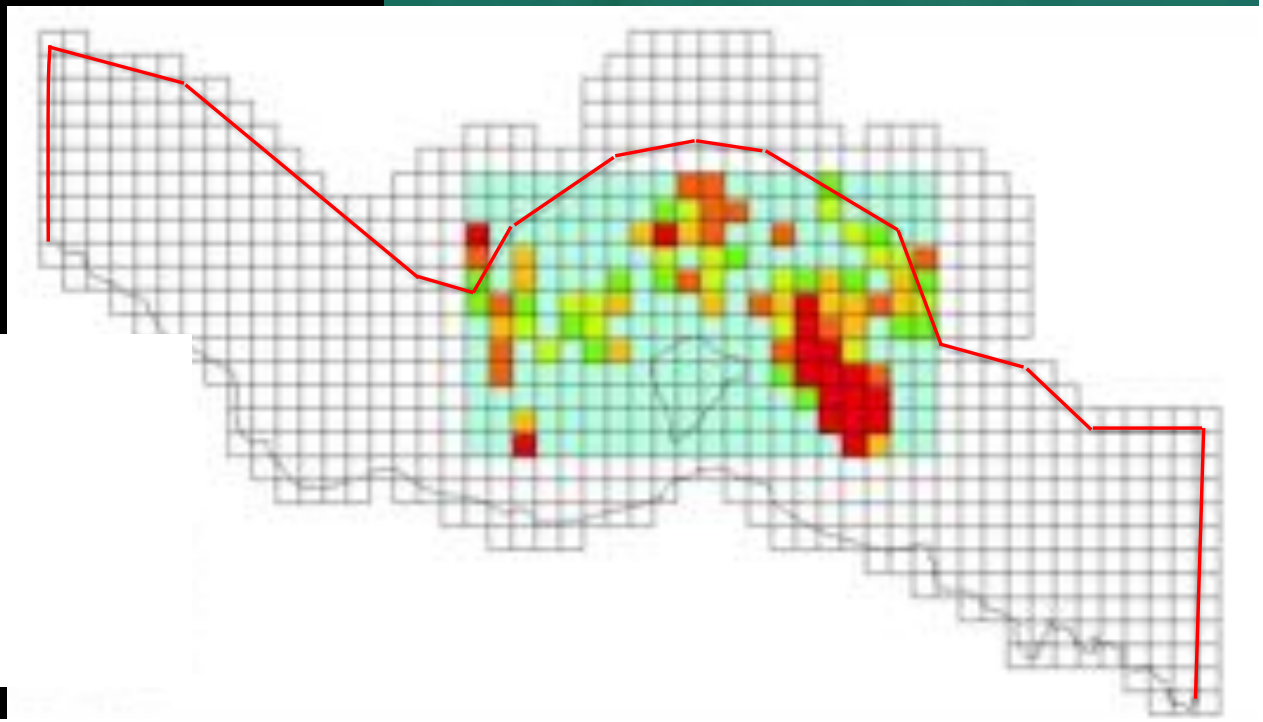


Shane Kelly PhD research

Small reserves not effective at fully protecting crayfish – populations vulnerable to overfishing

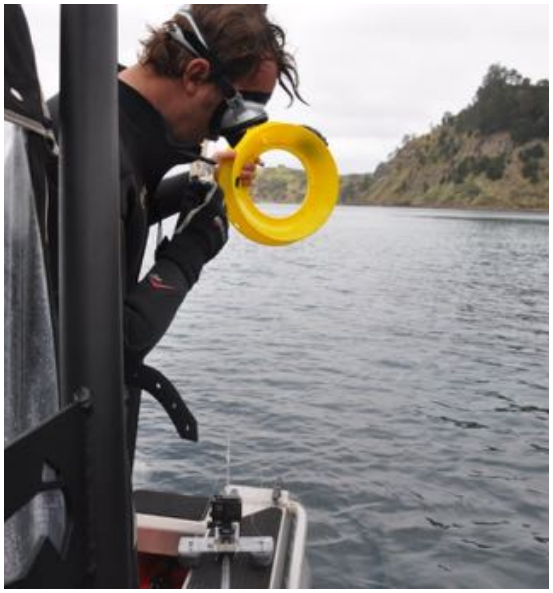
What about Snapper?

- Recent monitoring suggests declines
- Potentially reflects increasing pressure on Hauraki Gulf
- Concerns over BUV method

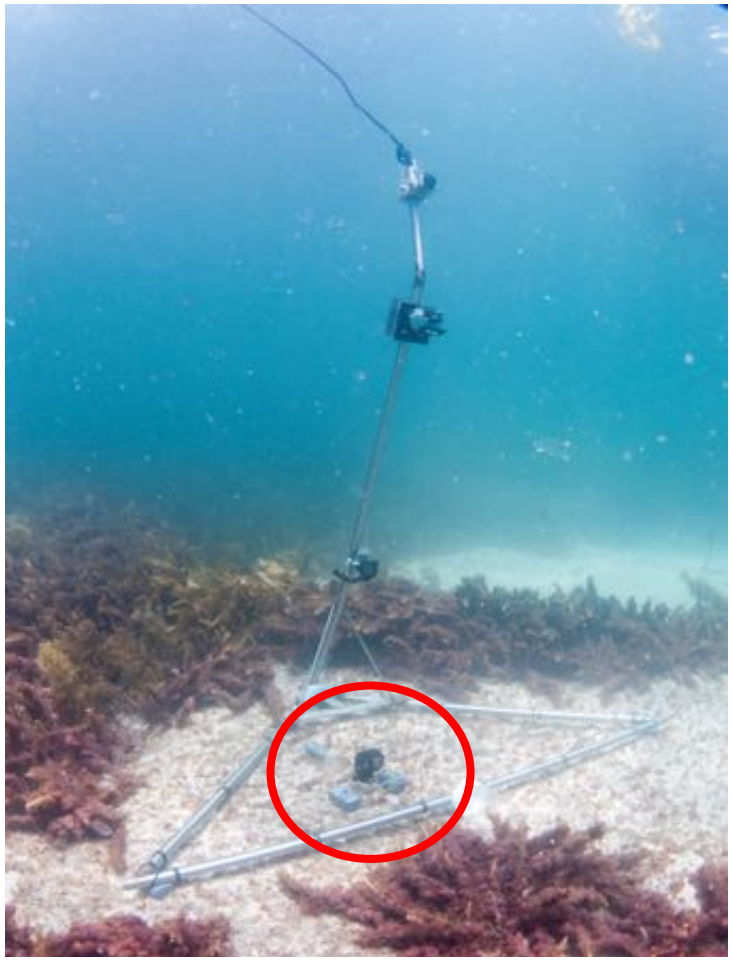


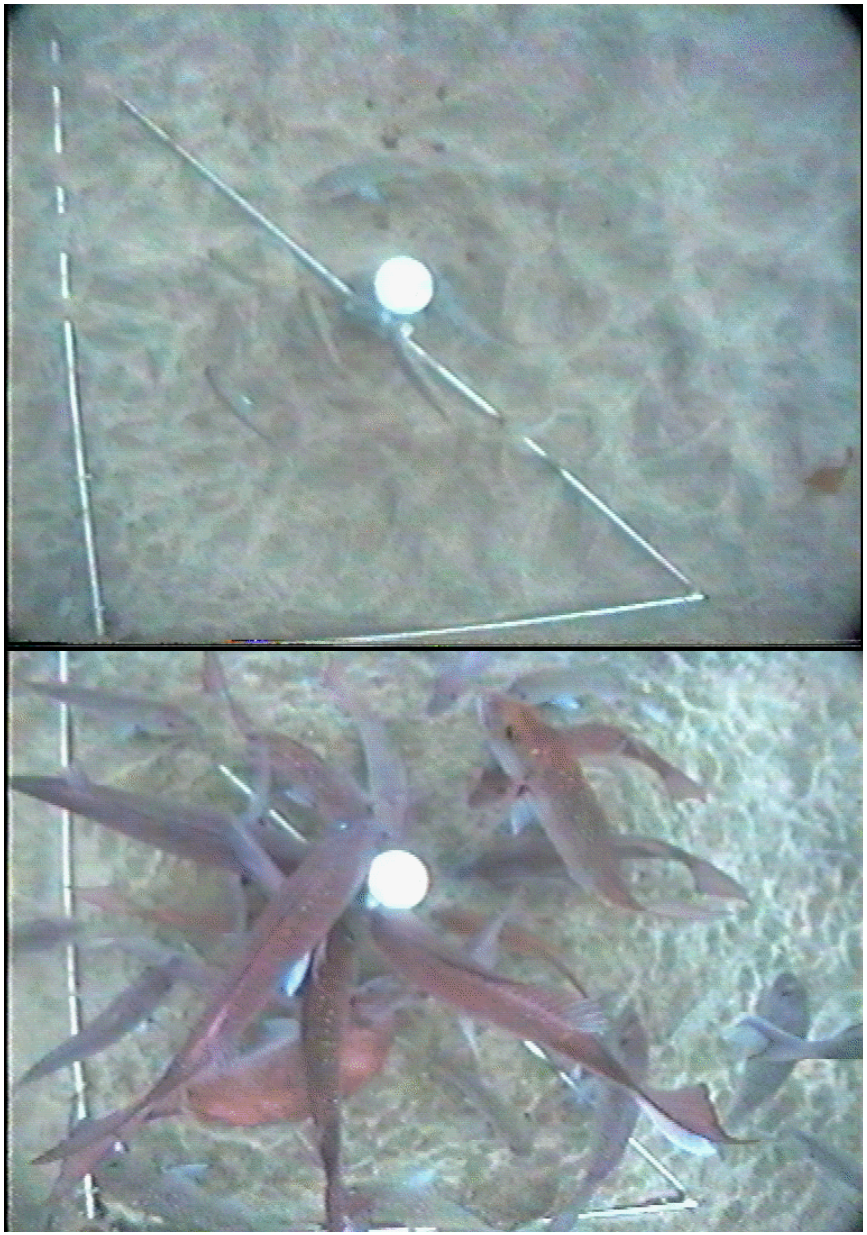
Measuring the effect of reserves on snapper

- Josh Richardson and Oliver Evans, MSc students (Supervisors: Taylor and Shears)
- Trialling new video methods



Baited Underwater Video (BUV)

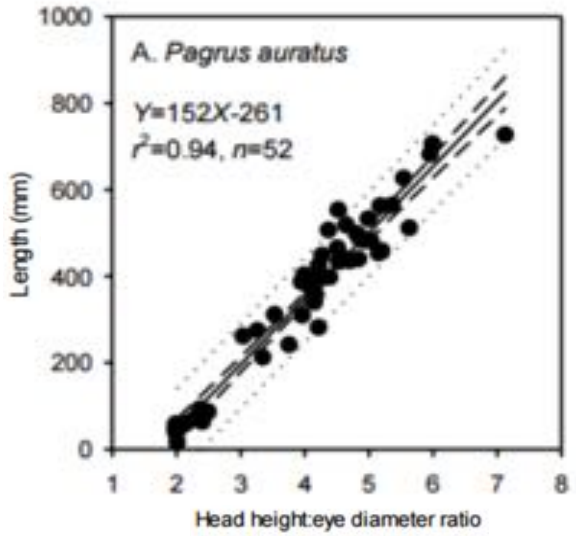




Unbaited underwater video (UUV)

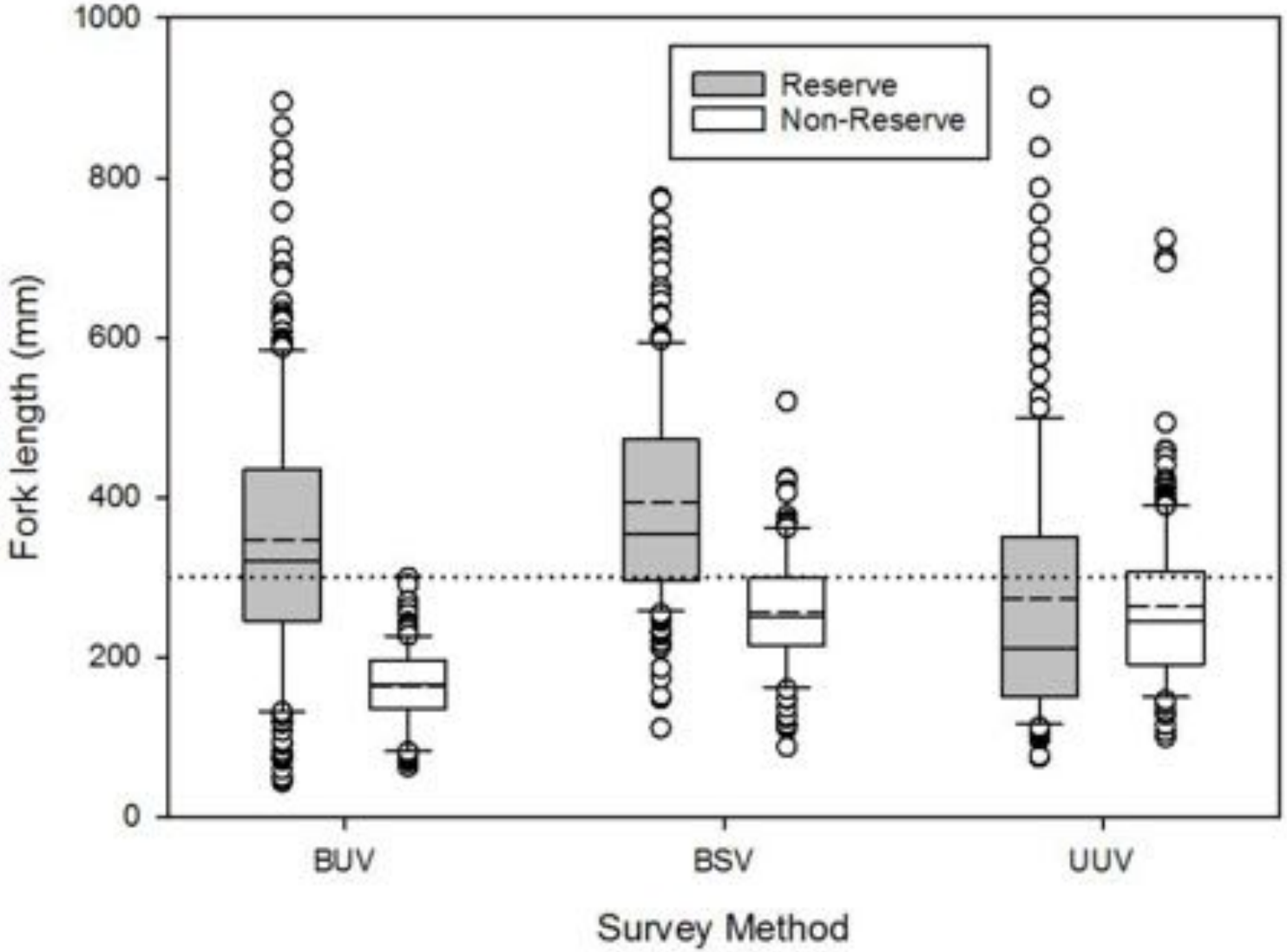
UUV: size estimation

- Relative eye size used to estimate length of fish from a single image.

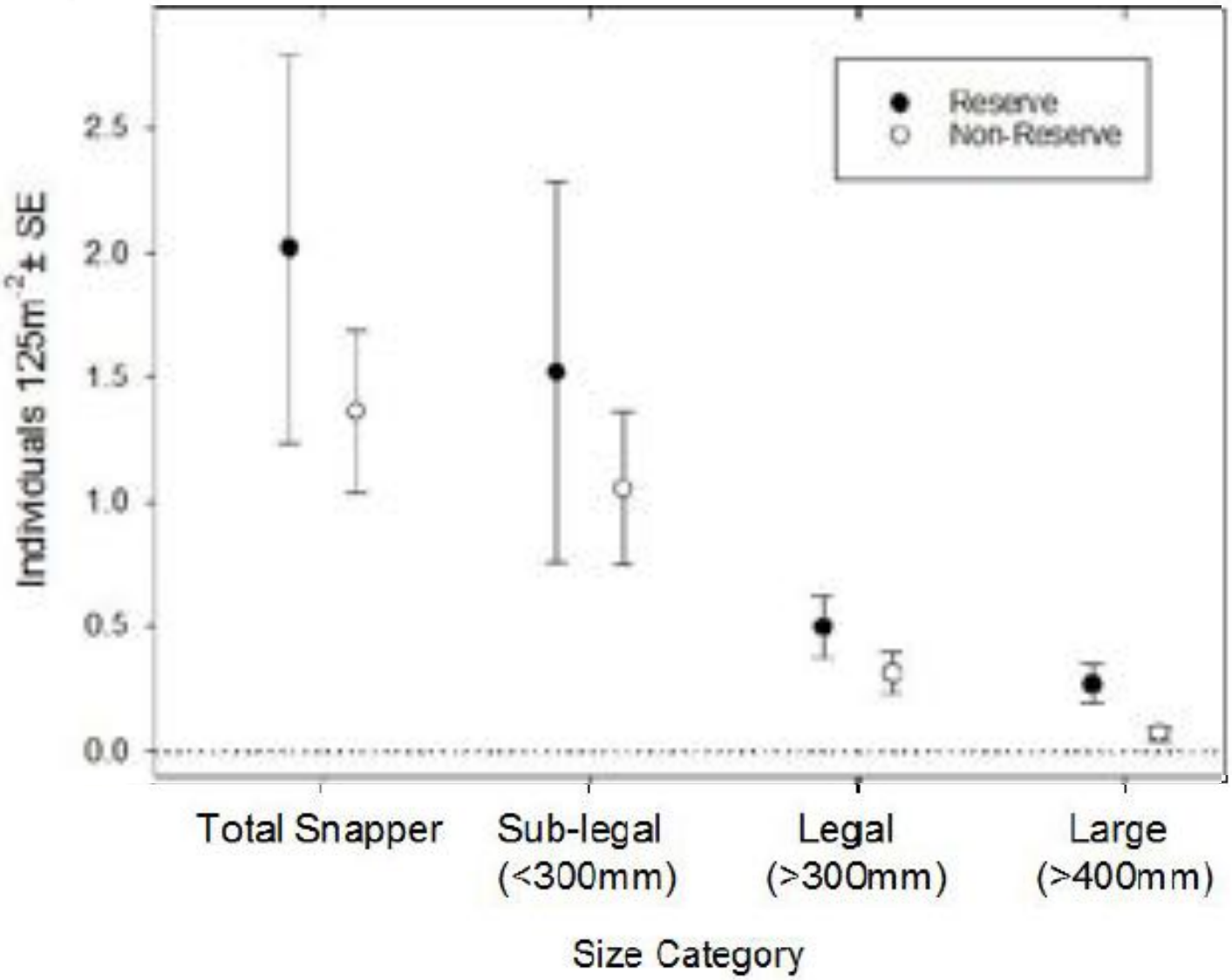


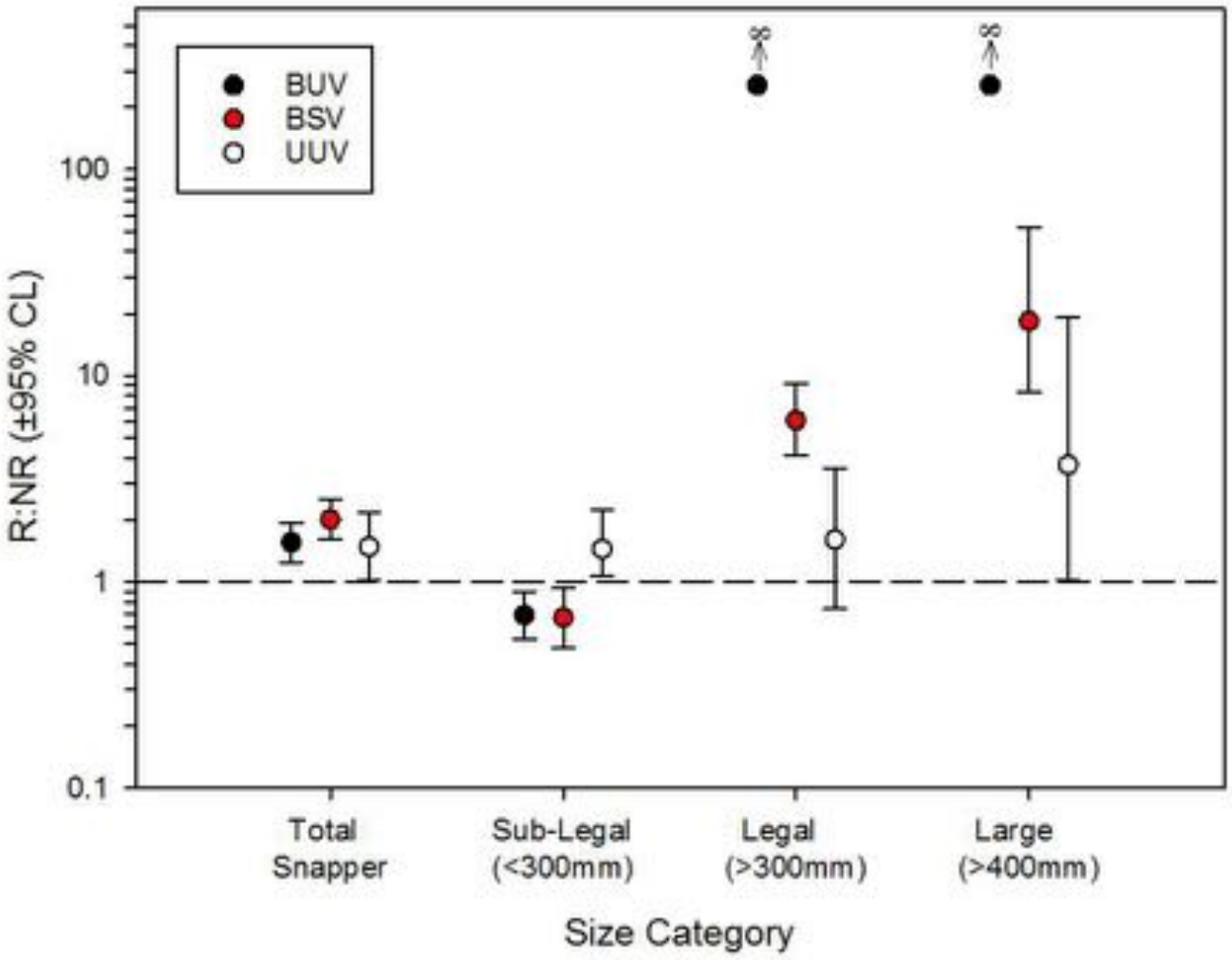
Richardson et al. (2015) *MEPS*

Baited Stealth Video (BSV)


1000
800
600
400
200
0
Fork length (mm)
Reserve
Non-Reserve
BUV
BSV
UUV
Survey Method

UUV


Reserve
Non-Reserve
Individuals 125m^{-2} ± SE
2.5
2.0
1.5
1.0
0.5
0.0
Total Snapper
Sub-legal (<300mm)
Legal (>300mm)
Large (>400mm)
Size Category



- BUV greatly overestimates reserve effect on snapper due to behavioural effects
- UUV suggests limited effect of reserve on legal-sized snapper!?
- More research needed to understand variability in UUV
- Reserve not big enough to adequately protect snapper

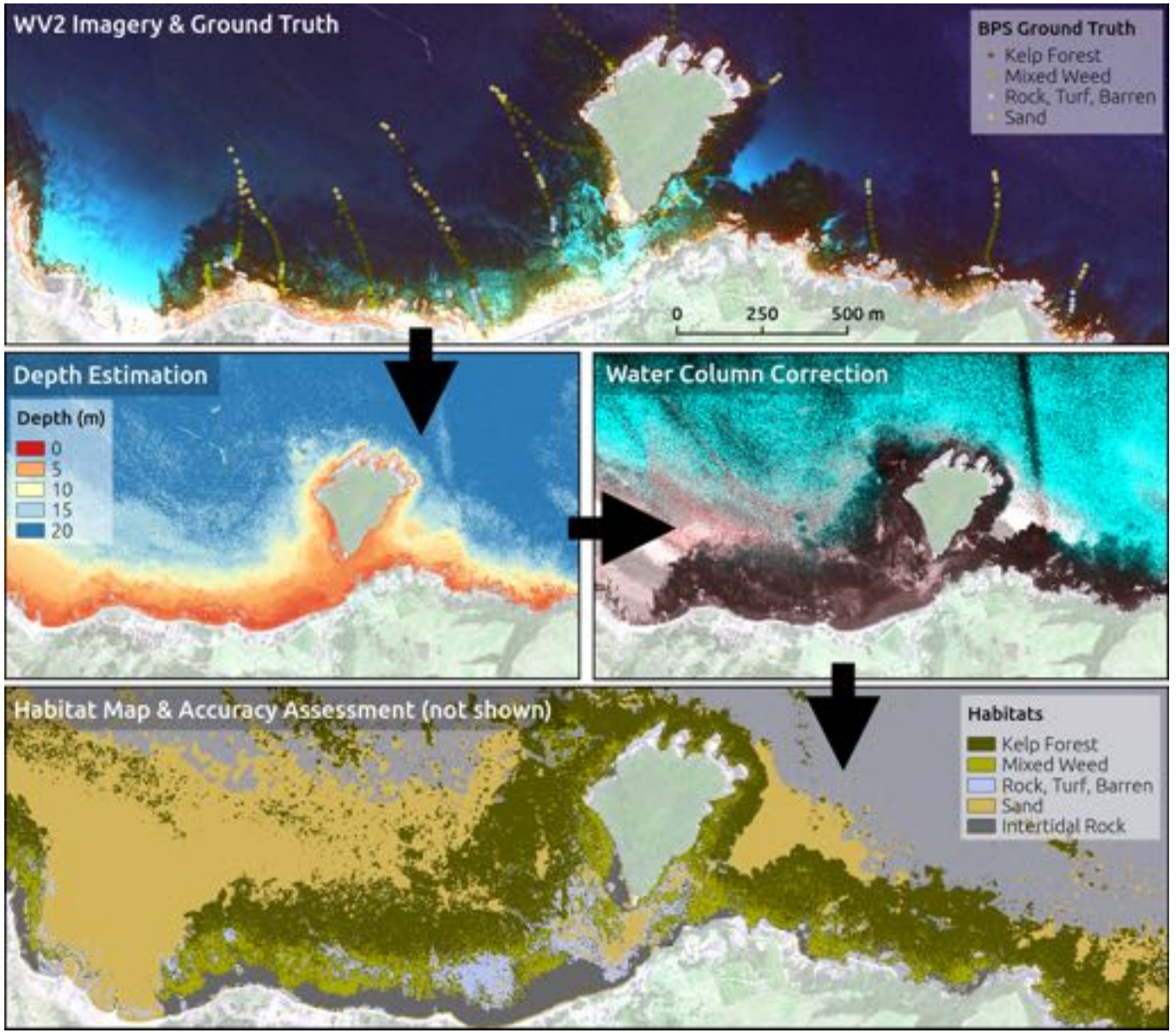
Mapping reef habitats from Space

Jared Kibele

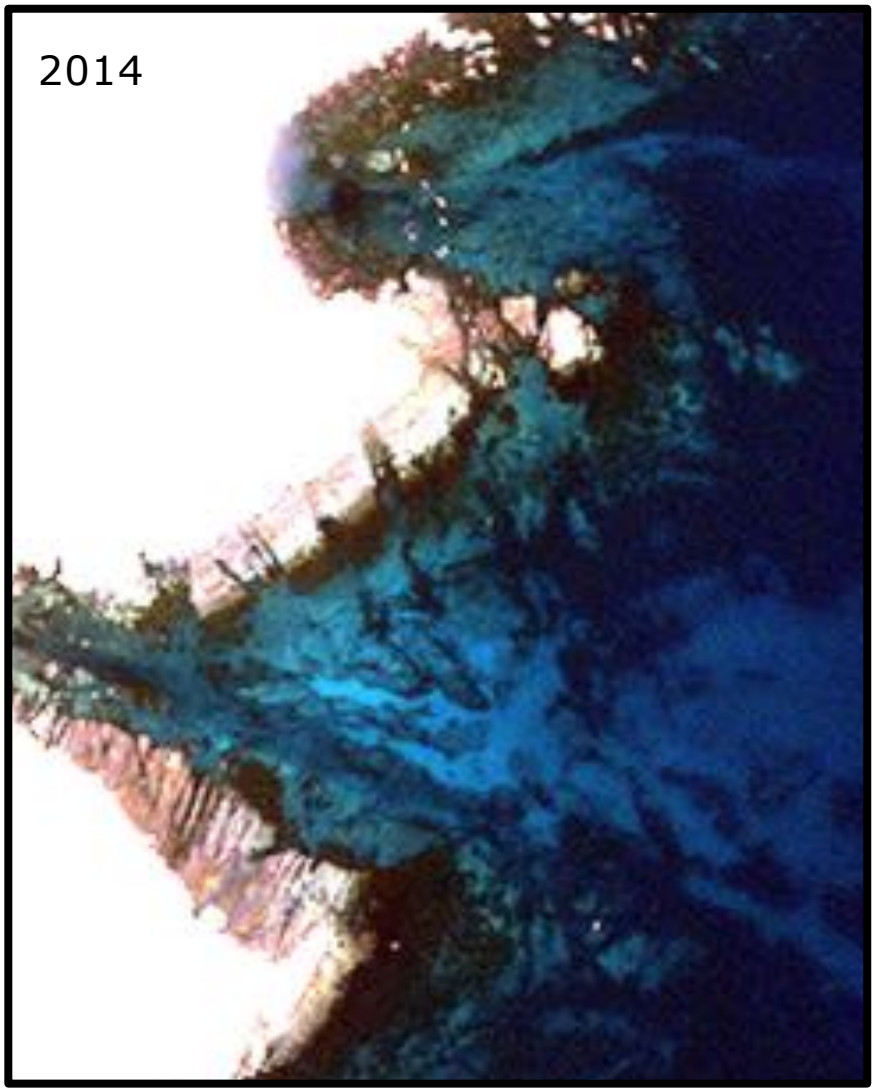
Image source: DigitalGlobe Foundation

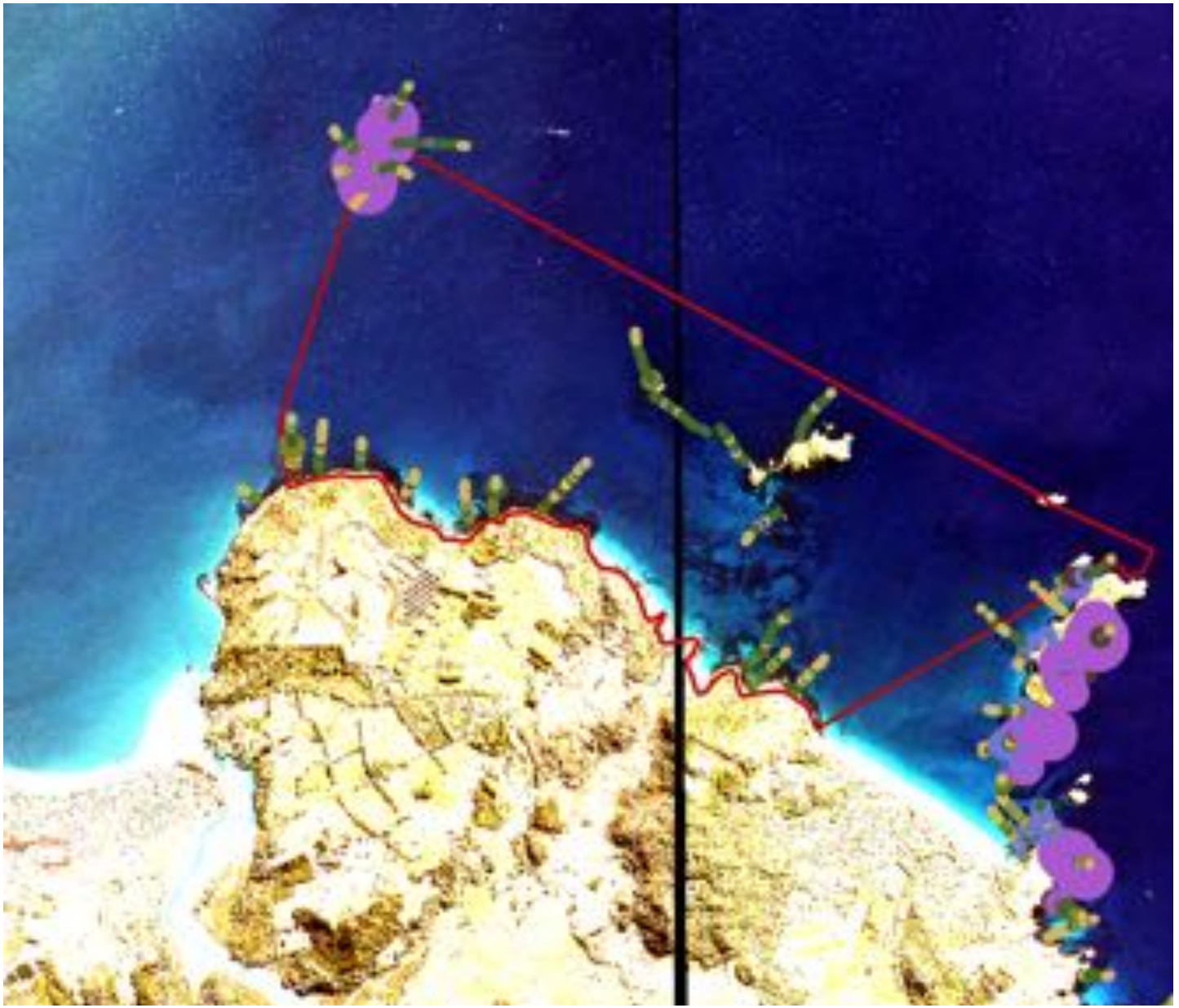
"MORE-MAPS"

- **M**arine **O**ptical **R**emote s**E**nsing **M**ap and **A**ssessment **P**roduction **S**ystem
- A complete and low cost system for mapping marine habitats from satellite imagery
- Drop camera surveys to collect ground truth photos and depth info
- Used to classify habitats in satellite image



Mapping changes in reef habitats





Opportunities for citizen science

- Surveys – variable levels of training required, generally small-scale
- Observations – "no" training, large spatial scales
- Online analysis/classification, e.g. Zooniverse

RLS REEF LIFE SURVEY

Mm2 Mm2.net.nz

seawatchers

NatureWatchNZ

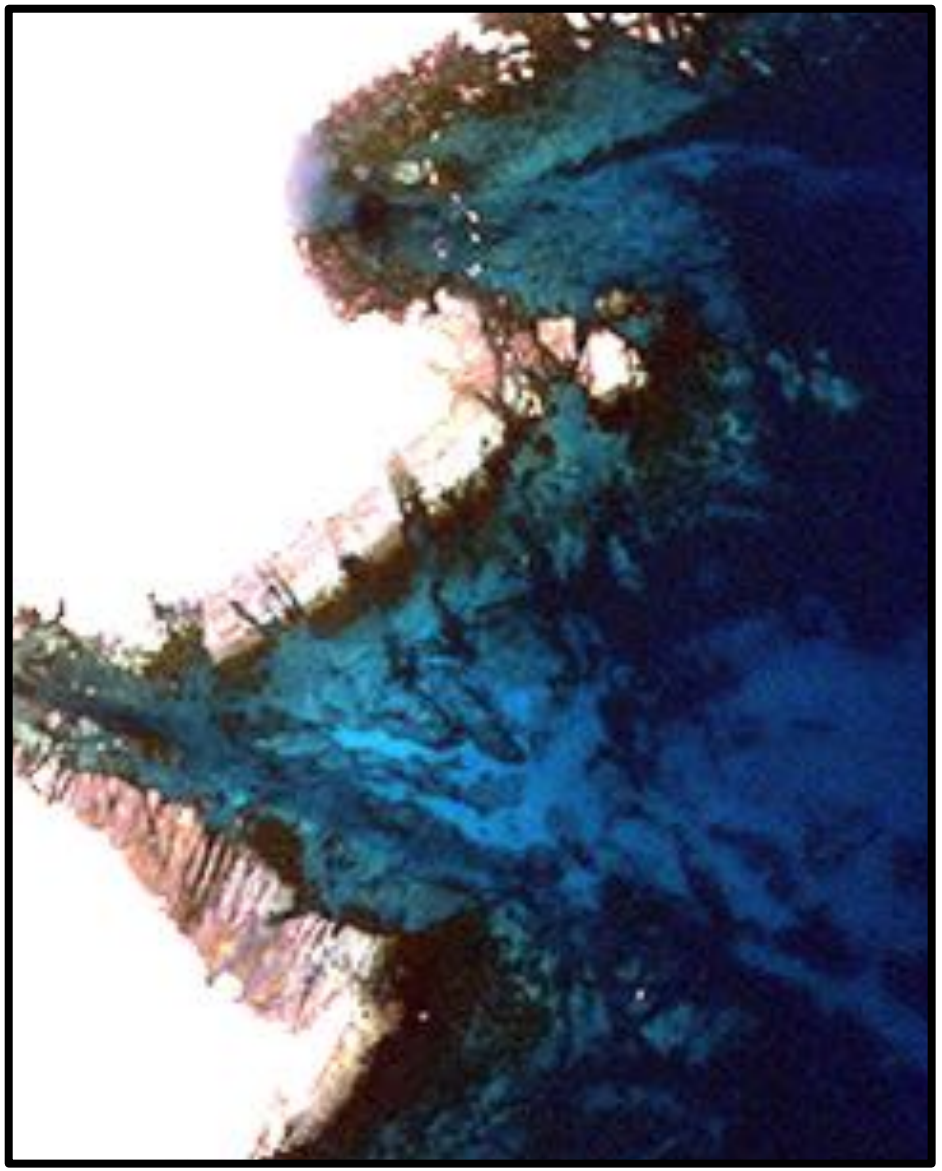

HERO4
GoPro

Geo-referenced underwater photos (and potentially video)

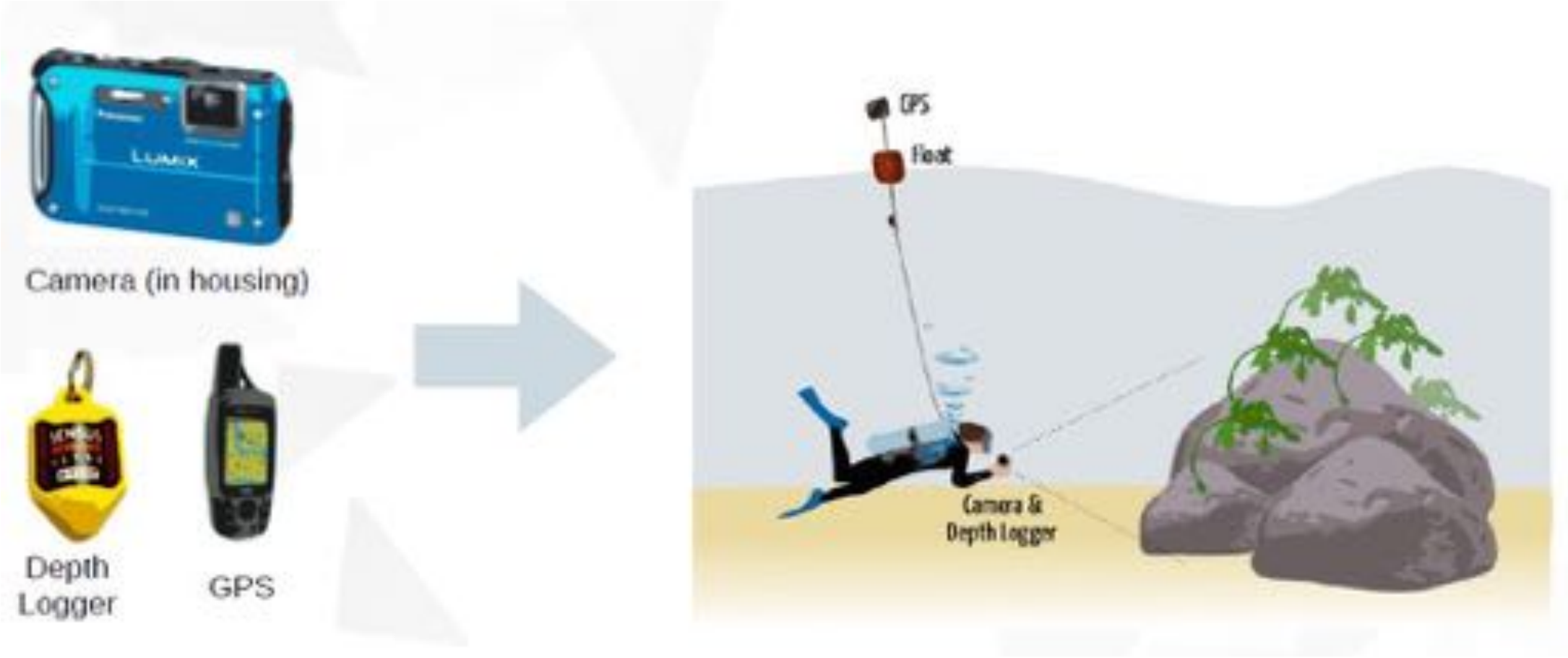
- Mapping spread of invasive species
- Changing species distribution with climate change
- Documenting the occurrence of new underwater phenomena, e.g. disease, harmful algal blooms
- Collecting ground-truth images for habitat mapping
- Potentially quantification of species abundance, habitat covers etc

Case study: Collecting ground-truth images for habitat mapping

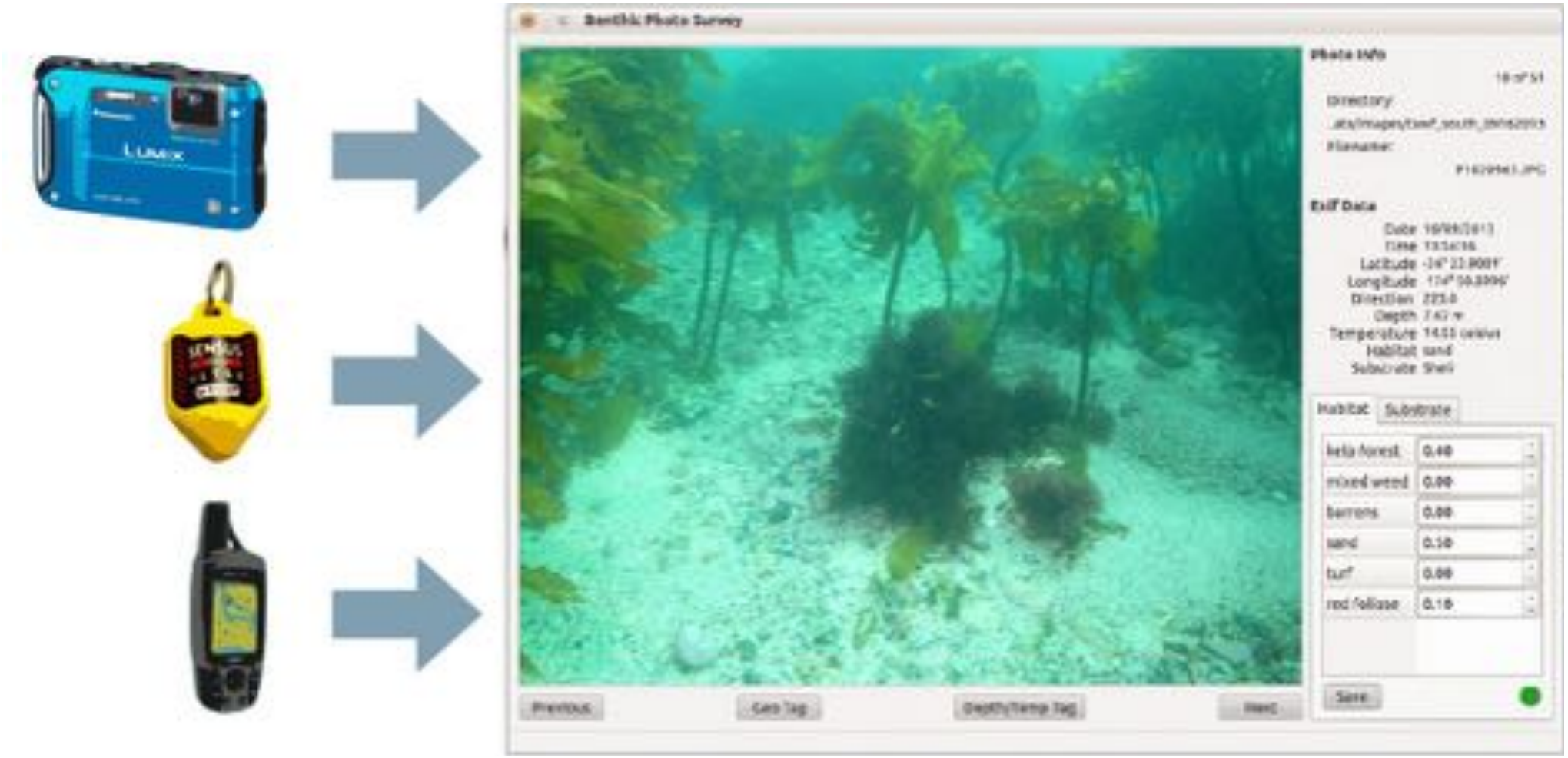
- Essential for habitat mapping and accuracy assessment
- Easy to take photos (diving, snorkelling, from boat)
- Uses Benthic Photo Survey software



Geo-referenced photos – field work



Classification of images in Benthic Photo Survey Software

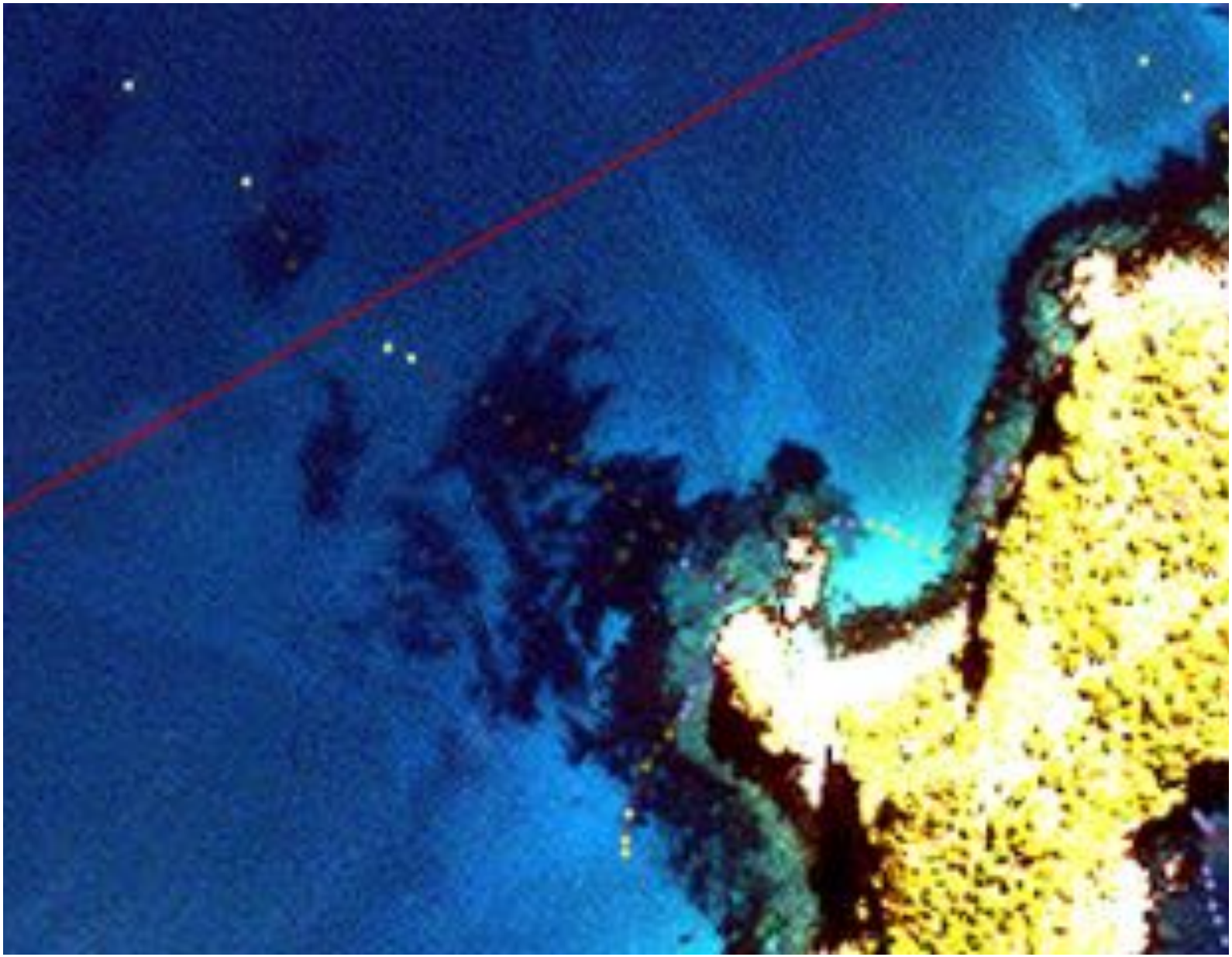


Export shape file

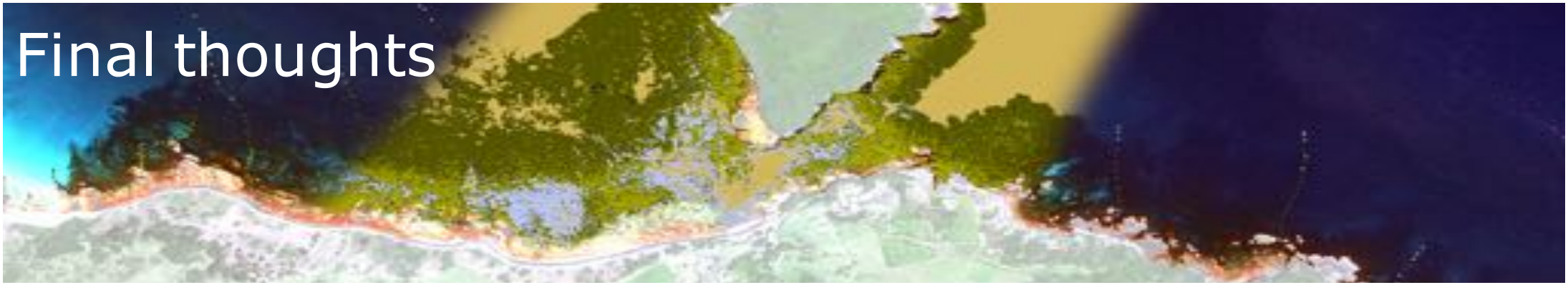
View in GIS software

Used in mapping process

Need to develop web application so users can click on points and view photos



Final thoughts



- Huge opportunity for CS in marine environment beyond reserves
- New technology creating new opportunities for citizen science
- Increasing costs and H&S requirements mean that citizen-science increasingly important
- Work needed on developing a national citizen-science platform for marine environment, e.g. for hosting, classification of georeferenced images