Our changing marine environment: Redmap and the contributions of citizen science

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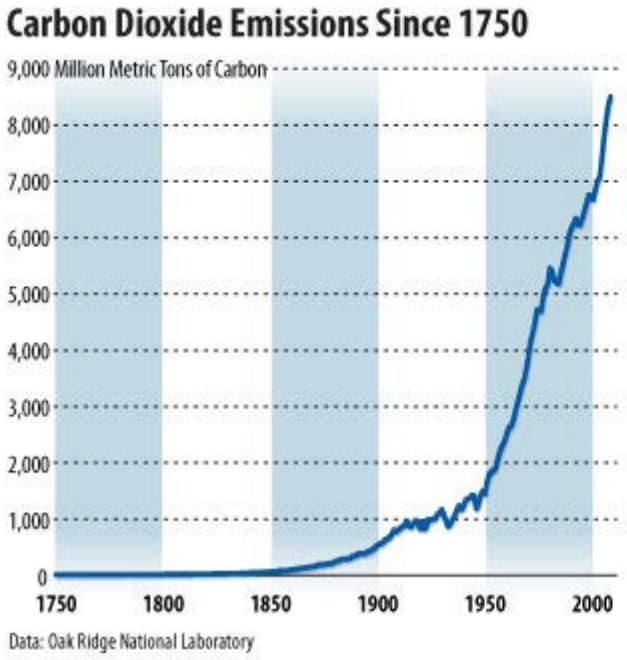
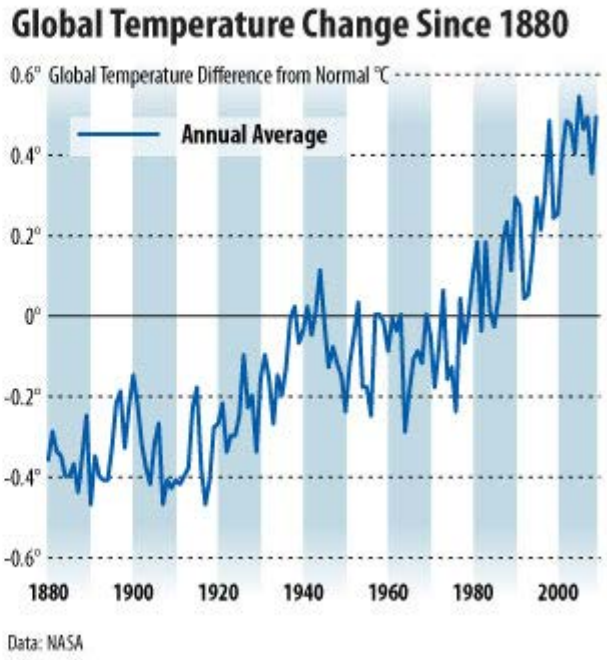
translatingnatureintoknowledge

Our changing climate

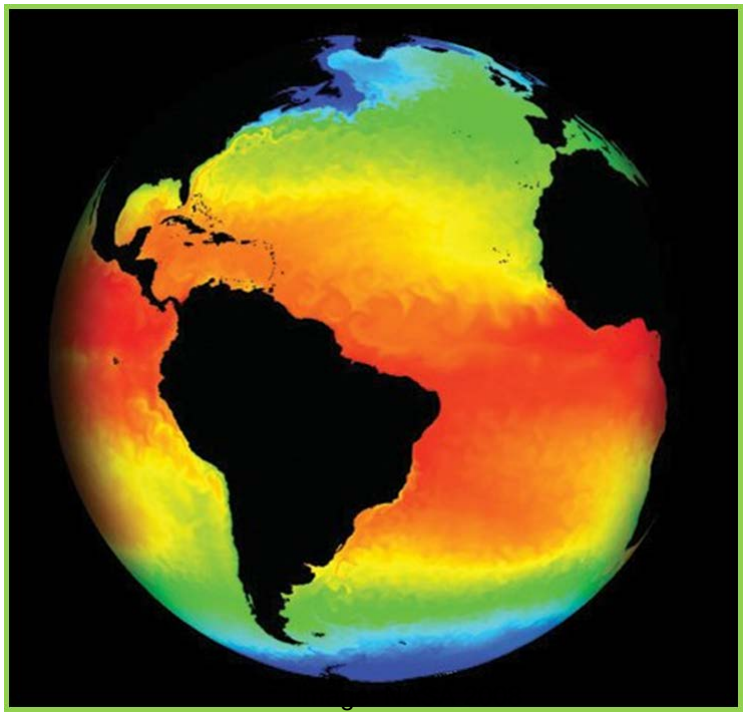
- Climate has always been changing!
- BUT…pace of current changes is more rapid than in the past





Global marine changes

- Increased water temperature
  - *80% heat absorbed by ocean*
- Ocean acidification
  - *50% of the atmospheric carbon emitted is absorbed by ocean*
  - *Ocean already 30% more acidic*
- Changes in ocean currents, winds, productivity (nutrients) and rainfall
- Increases in frequency and/or intensity of extreme events
- Sea level rise
- Regional differences in changes & sensitivity to change



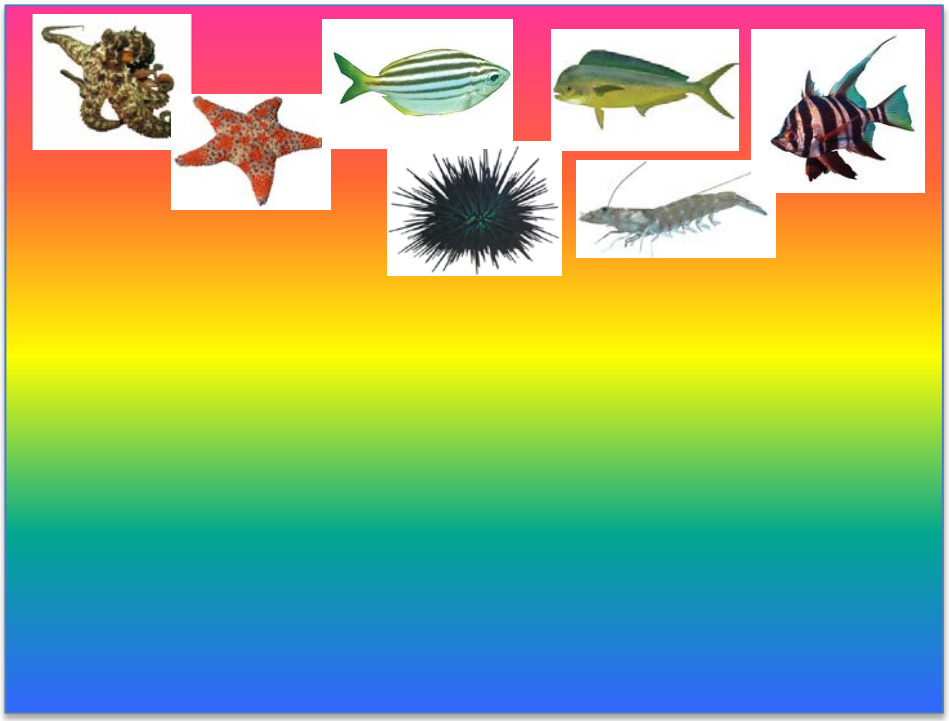
Species on the move

- Rearrangement of what lives where – on land and in the ocean
- Species have a preferred range of temperatures they like to live in
- Species' distributions shifting polewards
- Changes in distribution are, and will continue to be, extensive
- Some of the largest shifts in species ranges have come from the ocean
- 'Range shifts' greatest where climate has warmed the most

Variation in timing & pace of species shifts

- Not all species can/will shift
- Species will shift at different rates

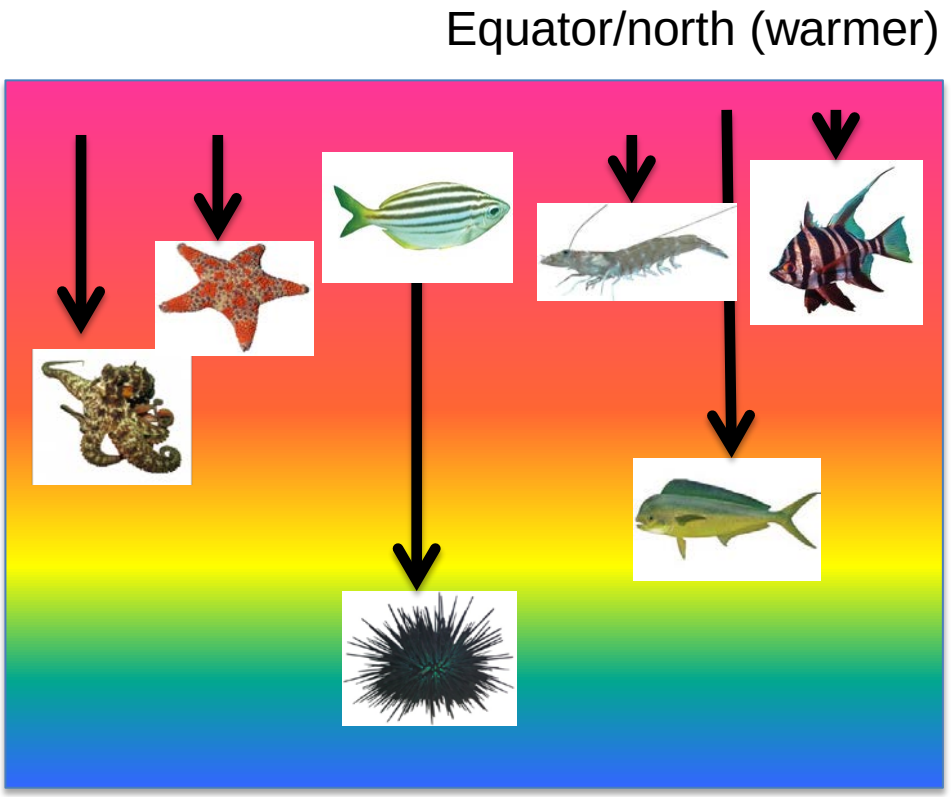
Equator/north (warmer)



Polewards/south (cooler)

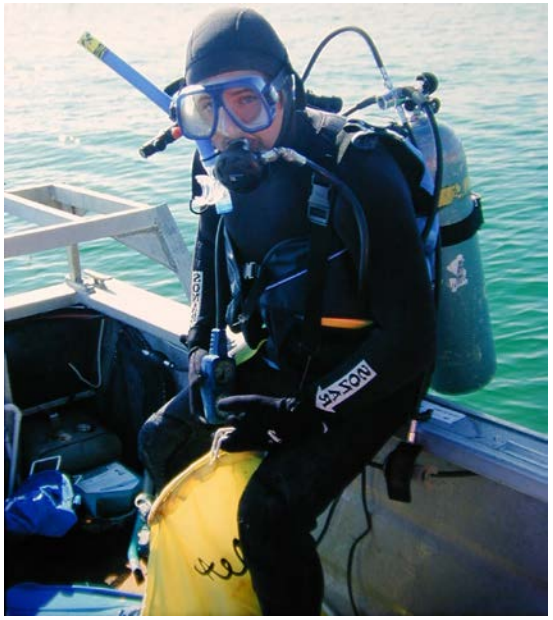
Variation in timing & pace of species shifts

- Not all species can/will shift
- Species will shift at different rates
- General poleward movement - but lots of variation
- Species can also change where they live for many reasons
- Some changes harder to detect than others – species detectability
- Overall – very complicated!!

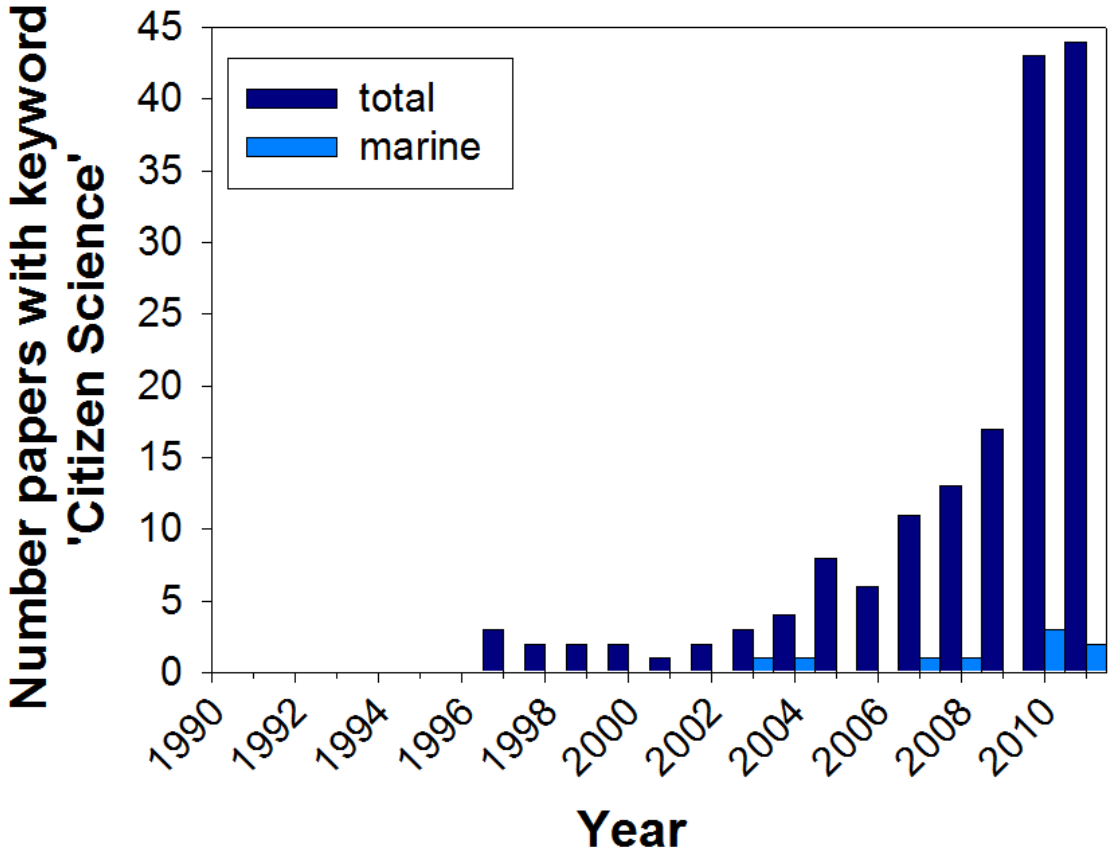


Understanding a changing environment

- Requires many observations over time & space.
- Monitoring is expensive and difficult to sustain over large areas or for prolonged periods.
- Observations made by the countless men and women spending time in their environment are rarely recorded & potential coverage is vast.
- Advances in our technological capacity have also radically improved the precision & accuracy with which many types of community information can now be recorded.



Emergence of citizen science



- Exponential increase
- More momentum in land based systems
- Marine systems lagging

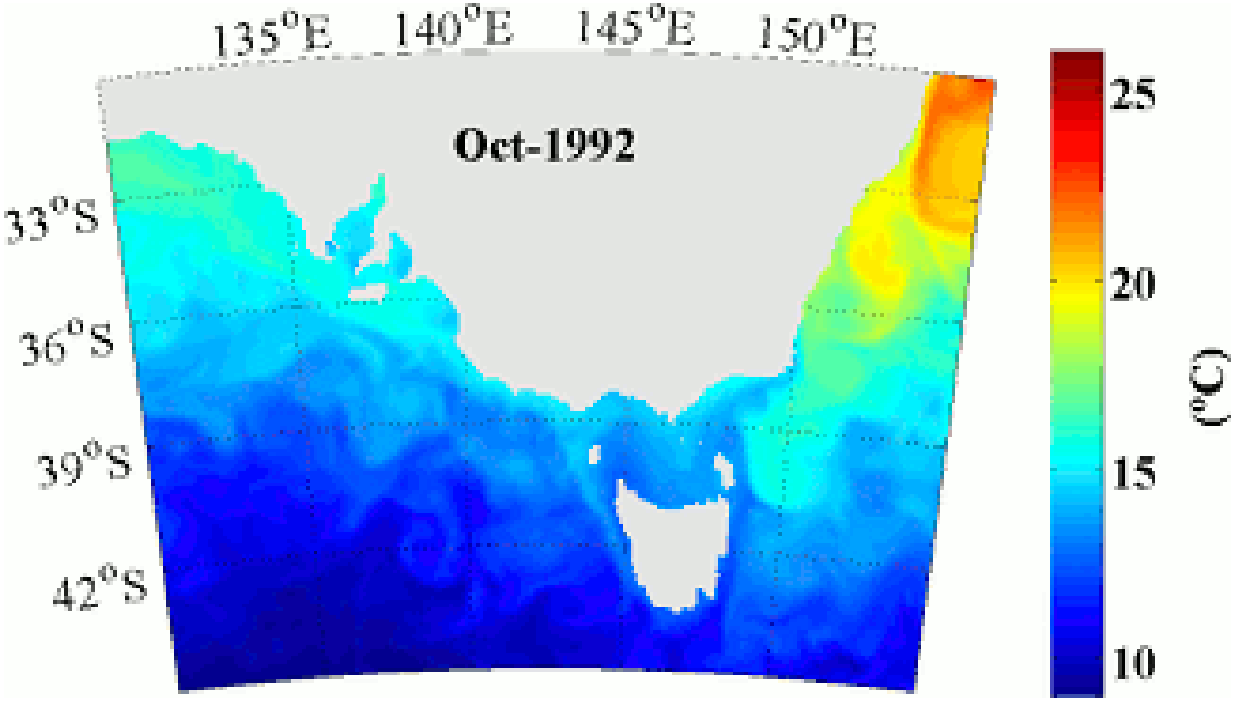

Imagine...
NT
QLD
SA
NSW
ACT
VIC
OCEAN

Turning observations and pictures from the community into data……

Mick Baron

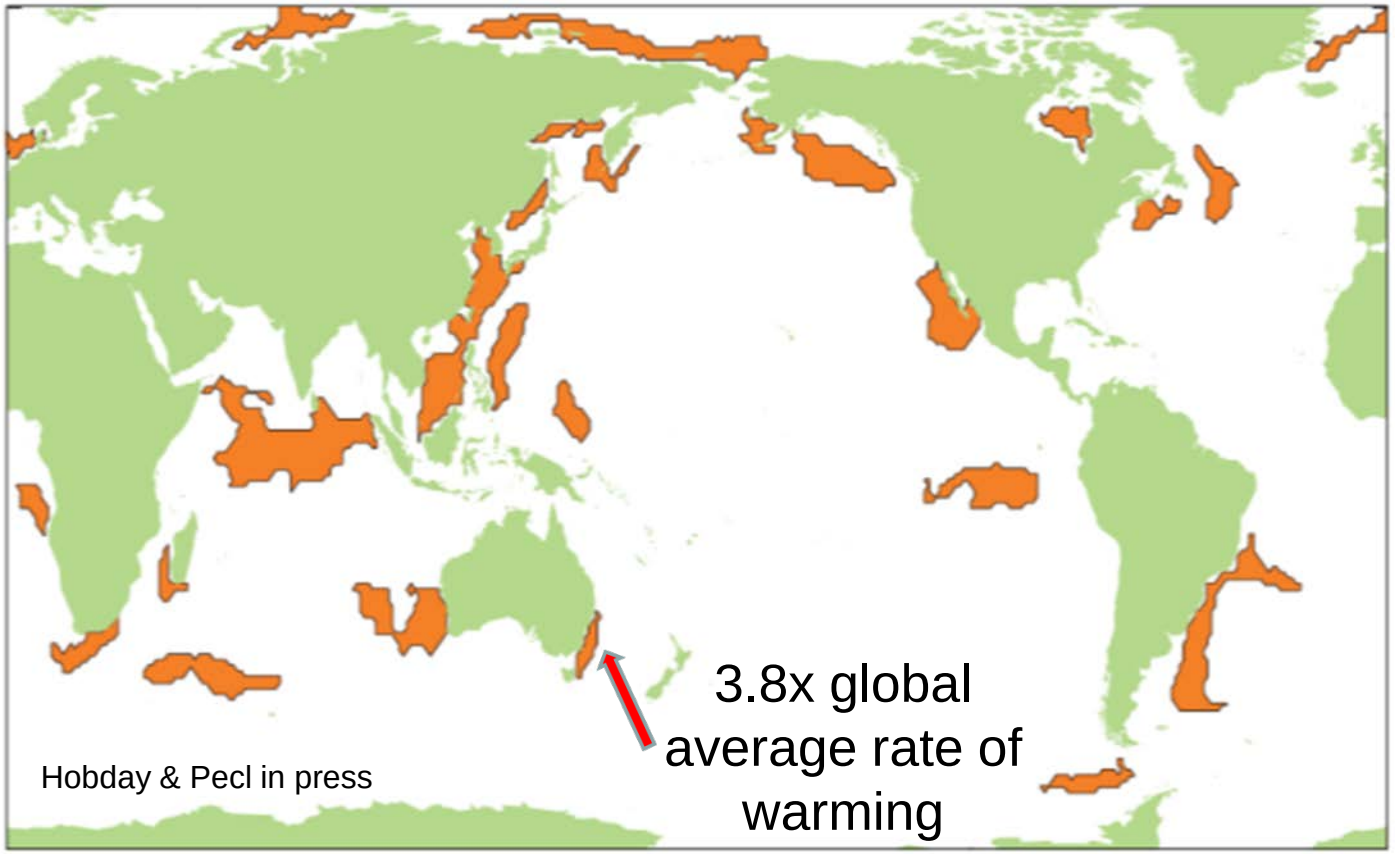
- Range Extension Database & Mapping Project
- Record ‘out-of-range’ species
- Hosted by IMAS in collaboration with many institutes
- Winner of multiple awards
- Launched Australia-wide 6 months ago
- Pilot project in Tasmania, started Dec 2009

East Australian Current pushing further south & persisting for longer



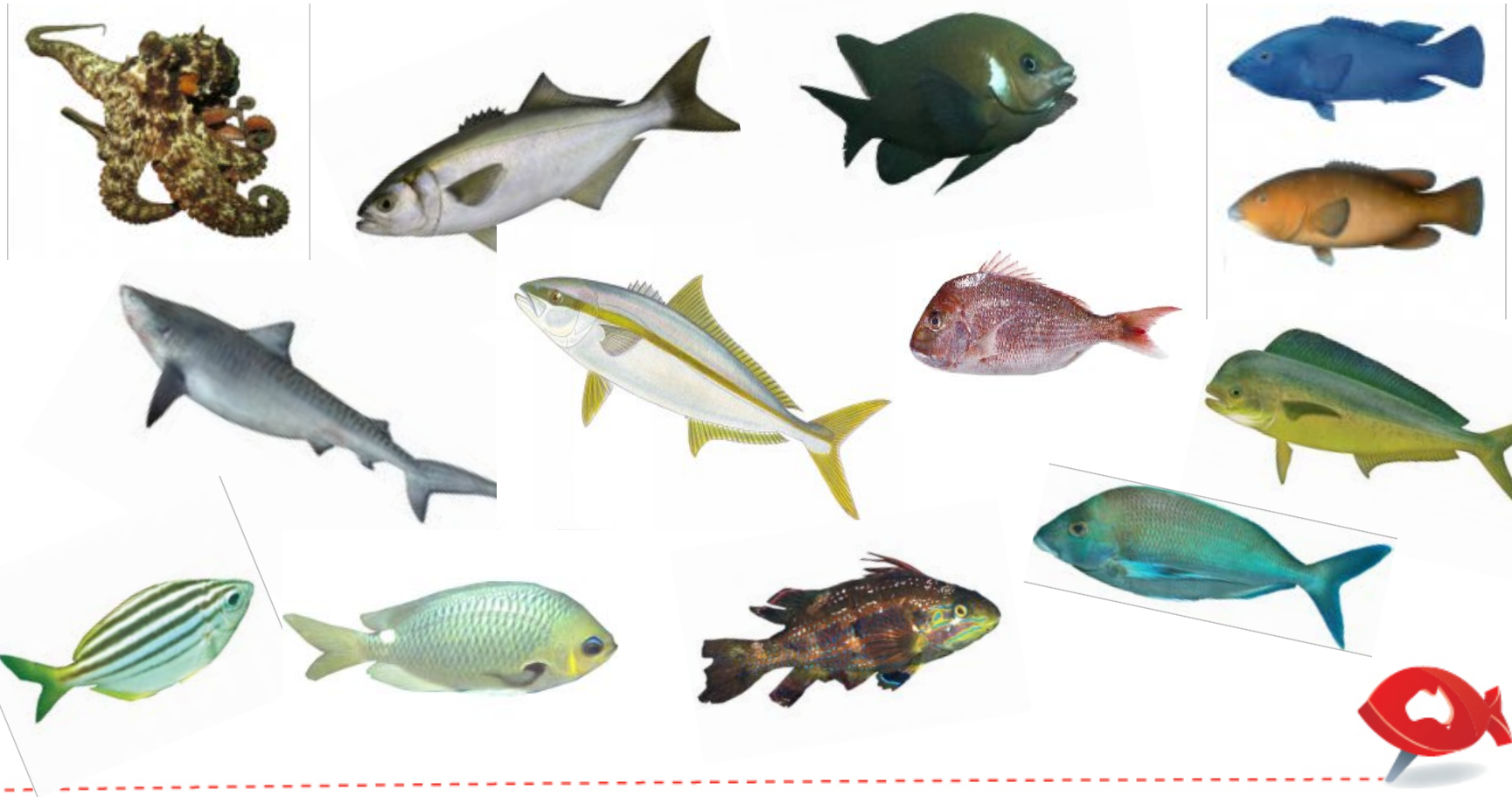
Animation courtesy of CSIRO

Ocean warming hotspots (■) areas in the top 10% for measured rate of warming



Several dozen new and range-extending species in Tasmania (since 1970)

Last et al. 2010



Importance of marine environment to Tasmania

- Highest value of seafood nationally
- Seafood contributes 1/3 value of agricultural production
- High participation rate (29.3%) in recreational fishing
- Most diverse communities of temperate marine life
- Considered a region of potential biodiversity decline

Redmap: Capturing & maximising local knowledge

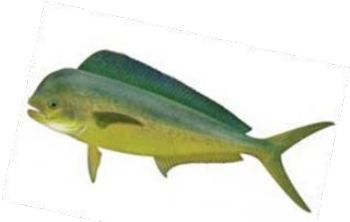
Two broad aims:

1. Monitoring for ecological change (we have a long coastline & large-scale/long-term monitoring programs are under-funded)!

2. Engage, informs and educate our marine communities (using their *own* data)

Two-way knowledge exchange:
gaps in knowledge being addressed *in partnership*





Ecological aims of Redmap

- What ‘new’ or ‘uncommon’ species, usually observed only in warmer waters, are fishers and divers seeing?

- Observed over cooler months/years, or only warmer months/years?
  - Over winter or in large numbers?

- Is there evidence of a shift in distribution?
  - EARLY INDICATION of ‘new’ species - qualitative report card
  - Impact of shift, e.g. qualitative modelling
  - Evaluate shift, e.g. presence only SDM’s
  - Manage new species proactively to maximise benefits/minimise impacts

Marine Species

Jump to a region | Jump to species

Bony Fishes

Invertebrates

Shark & Rays

Reptiles

Algae & Plants

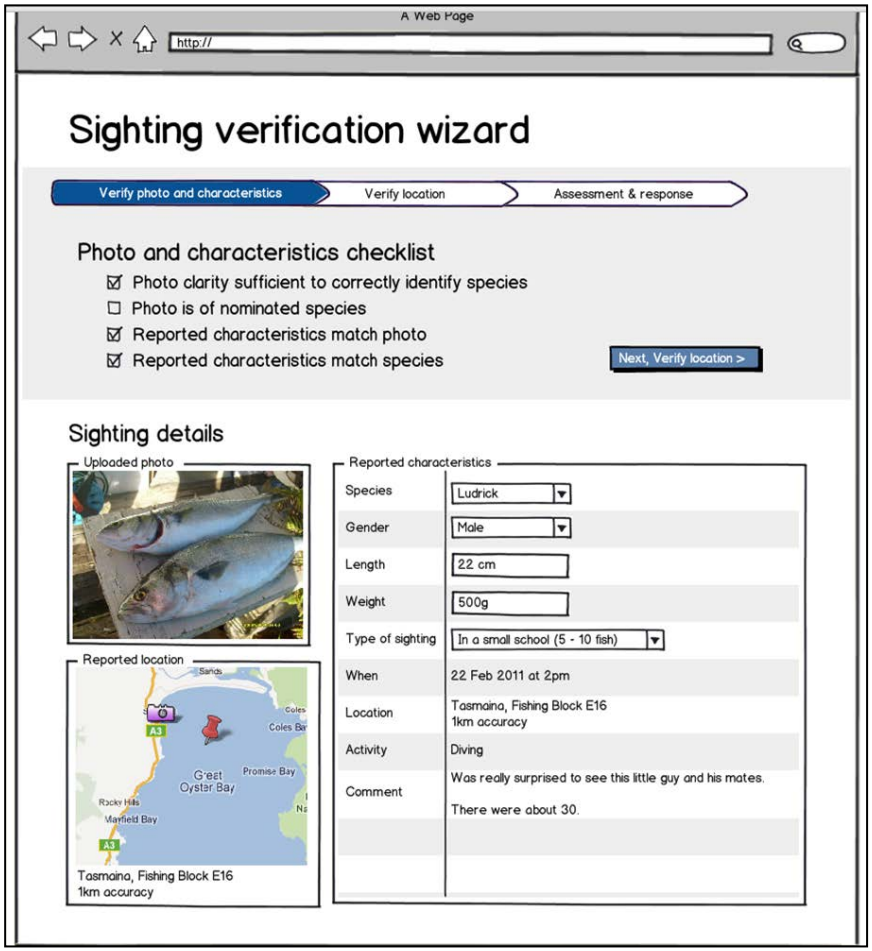
Mammals

Quality photos submitted to verify sightings

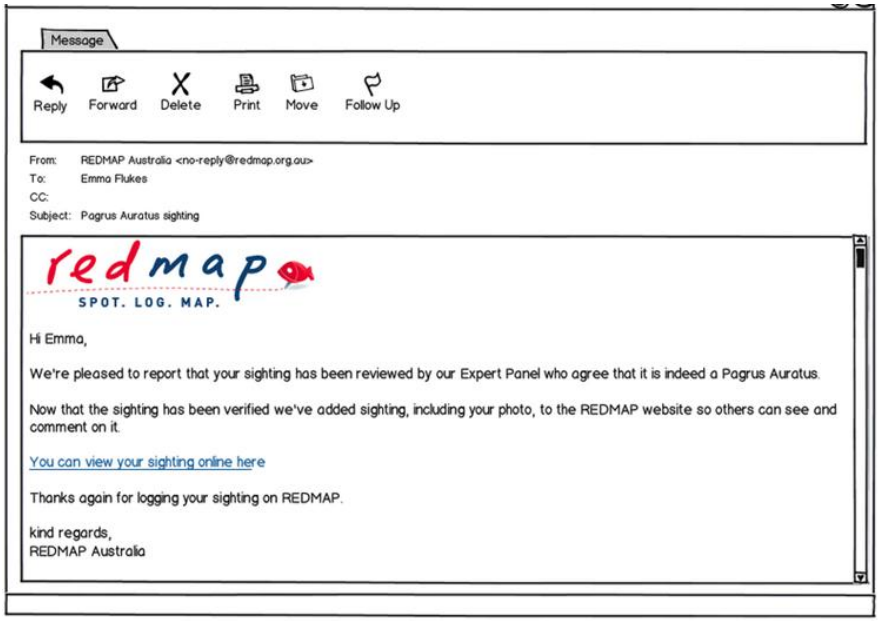
Up to 475 km further polewards than expected

Photos are ID'ed by many scientists – thanks to Rick Stuart-Smith, Graham Edgar, Neville Barrett, Peter Last & Daniel Gledhill in particular

For the scientist: validating species ID & verification of sighting details is simple



Providing feedback to the observer (fisher or diver) is easy - sent an automatic acknowledgement



Sightings from
Emma Flukes

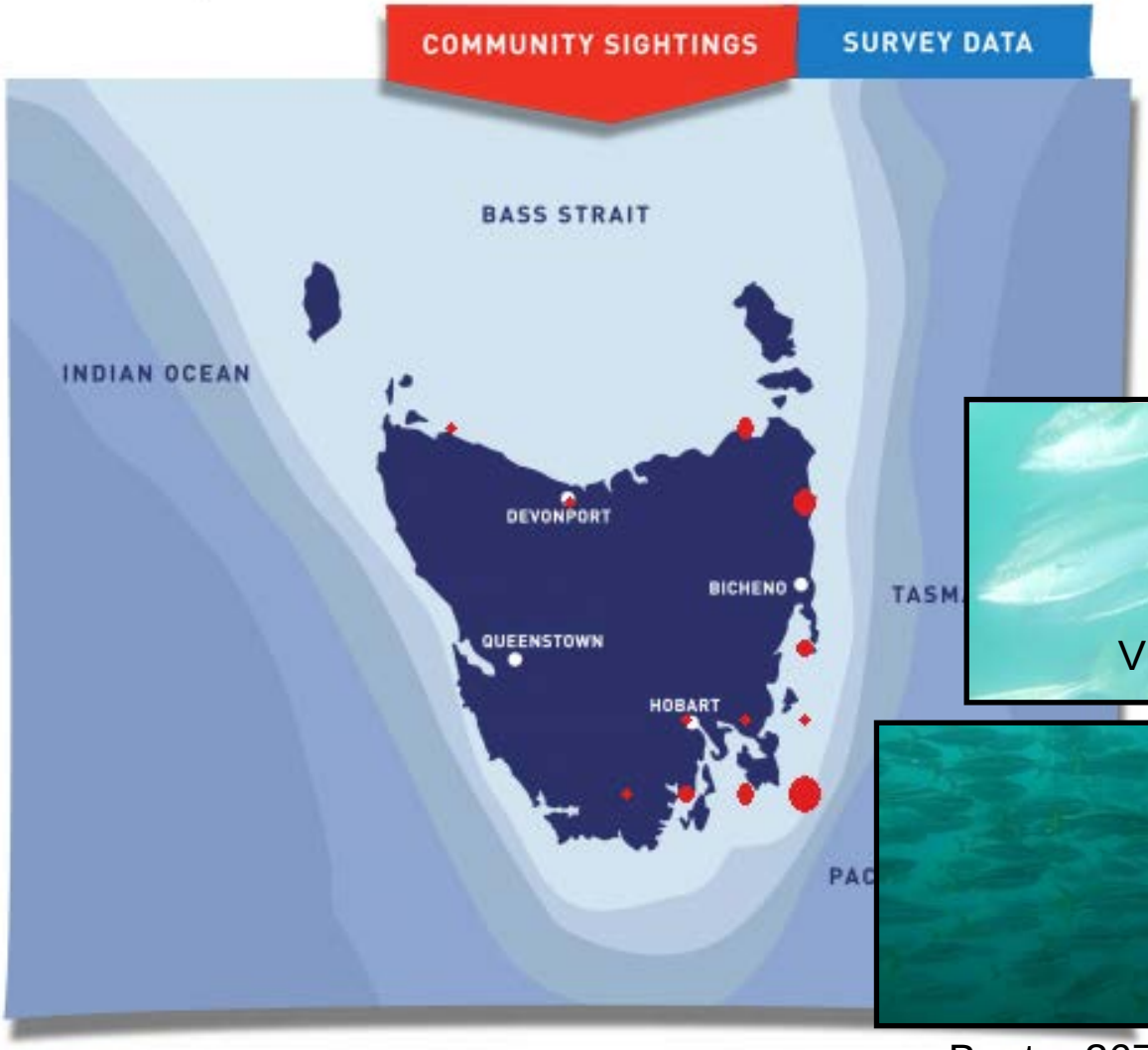
Sighting activity: 49.8% divers, 42.7% fishers

Very few ‘dodgy’ sightings submitted….

Information generated:
Old wife (*Enoplosus armatus*)

- Found in shallow reefs Sth QLD to WA
- Common on north coast of Tasmania
- Poisonous spines & makes a ‘grating’ sound when stressed
- Redmappers are spotting it in south Tasmania

Information generated, e.g. Yelowtail Kingfish



- Previously only recorded occasionally along north of Tasmania
- Redmap - multiple sightings of large schools, down south, in cool winter months

VizBiz

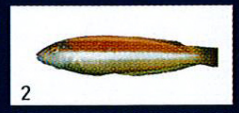
Mick Baron

Boater 367

Qualitative report card

- Led by Lucy Robinson
- Decision tree approach
- Assesses strength of evidence of a potential shift in distribution (strong, moderate, weak)
  - Detectability (fishers vs divers)
  - Migratory?
  - Observations in winter?
  - Seen in multiple years?
- Also assesses confidence in baseline range estimate (high, medium, low)
- Available on line with supporting info on methods

1 Spotted South of Bass Strait

	SPECIES	MOSTLY SEEN BY	REFERENCE POINT CONFIDENCE	EVIDENCE OF RANGE SHIFT	OVERALL CONFIDENCE
 1	**Gloomy octopus** *(Octopus tetricus)*	1			
 1	**Crimsonband wrasse** *(Notolabrus gymnogenis)*	2			
 6	**Rock cale** *(Aplodactylus lophodon)*	3			
 2	**Southern Maori wrasse** *(Ophthalmolepis lineolatus)*	4			
 2	**Onespot puller** *(Chromis hypsilepis)*	5			
 3	**Eastern rock lobster** *(Sagmariasus verreauxi)*	1			
 4	**Grey morwong** *(Nemadactylus douglasii)*	2			
 5	**Frigate mackerel** *(Auxis thazard)*	1			
 7	**Eastern blue groper** *(Achoerodus viridis)*	2			
 6	**Snakeskin wrasse** *(Eupetrichthys angustipes)*	3			

The Redmap Top Ten for Tassie

1. 
   Eastern rock lobster (*Jasus verreauxi*)
2. 
   Yellowtail kingfish (*Seriola lalandi*)
3. 
   Luderick (*Girella tricuspidata*)
4. 
   Maori wrasse (*Ophthalmolepis lineolatus*)
5. 
   Zebra fish (*Girella zebra*)
6. 
   White-ear (*Parma microlepis*)
7. 
   Herring cale (Odax cyanomelas)
8. 
   Tailor (*Pomatomus saltatrix*)
9. 
   Halfbanded seaperch (*Hypoplectrodes maccullochi*)
10. 
    Gloomy octopus (*Octopus tetricus*)

Early days – but getting good participation!

Success so far….

- ≈700 sightings (some are large schools, so thousands of individuals), of 198 species from 200+ people
- Identify new research projects
- Over 100,000 discrete visits (hits) on the site
- 220,000 website page downloads
- Visits from 174 countries
- >1000 newsletter subscribers
- Radio, tv, print media
- Many emails requesting more stuff!
- Invitations to present at industry forums
- *Climate change & marine species – 3rd most visited section of site*
- Data used in 3 journal publications so far

DiveH

Global Ecology and Biogeography, (Global Ecol. Biogeogr.) (2011) **20**, 58–72

RESEARCH PAPER

Long-term shifts in abundance and distribution of a temperate fish fauna: a response to climate change and fishing practices

Peter R. Last[1,2]*, William T. White[1,2], Daniel C. Gledhill[1,2], Alistair J. Hobday[1,2], Rebecca Brown[3], Graham J. Edgar[3] and Gretta Pecl[3]

Documentation of range shifts

Journal of Experimental Marine Biology and Ecology 400 (2011) 17–32

Contents lists available at ScienceDirect

Journal of Experimental Marine Biology and Ecology

journal homepage: www.elsevier.com/locate/jembe

Climate change cascades: Shifts in oceanography, species ranges and subtidal marine community dynamics in eastern Tasmania

Craig R. Johnson [a,*], Sam C. Banks [b], Neville S. Barrett [c], Fabienne Cazassus [d], Piers K. Dunstan [d], Graham J. Edgar [c], Stewart D. Frusher [c], Caleb Gardner [c], Malcolm Haddon [e], Fay Helidoniotis [a,e], Katy L. Hill [e], Neil J. Holbrook [f], Graham W. Hosie [g], Peter R. Last [e], Scott D. Ling [a], Jessica Melbourne-Thomas [a], Karen Miller [a], Gretta T. Pecl [c], Anthony J. Richardson [h], Ken R. Ridgway [e], Stephen R. Rintoul [e], David A. Ritz [d], D. Jeff Ross [c], J. Craig Sanderson [a], Scoresby A. Shepherd [i], Anita Slotwinski [c], Kerrie M. Swadling [c], Nyan Taw [d]

Synthesis to understand marine ecosystem changes

Contents lists available at SciVerse ScienceDirect

Global Environmental Change

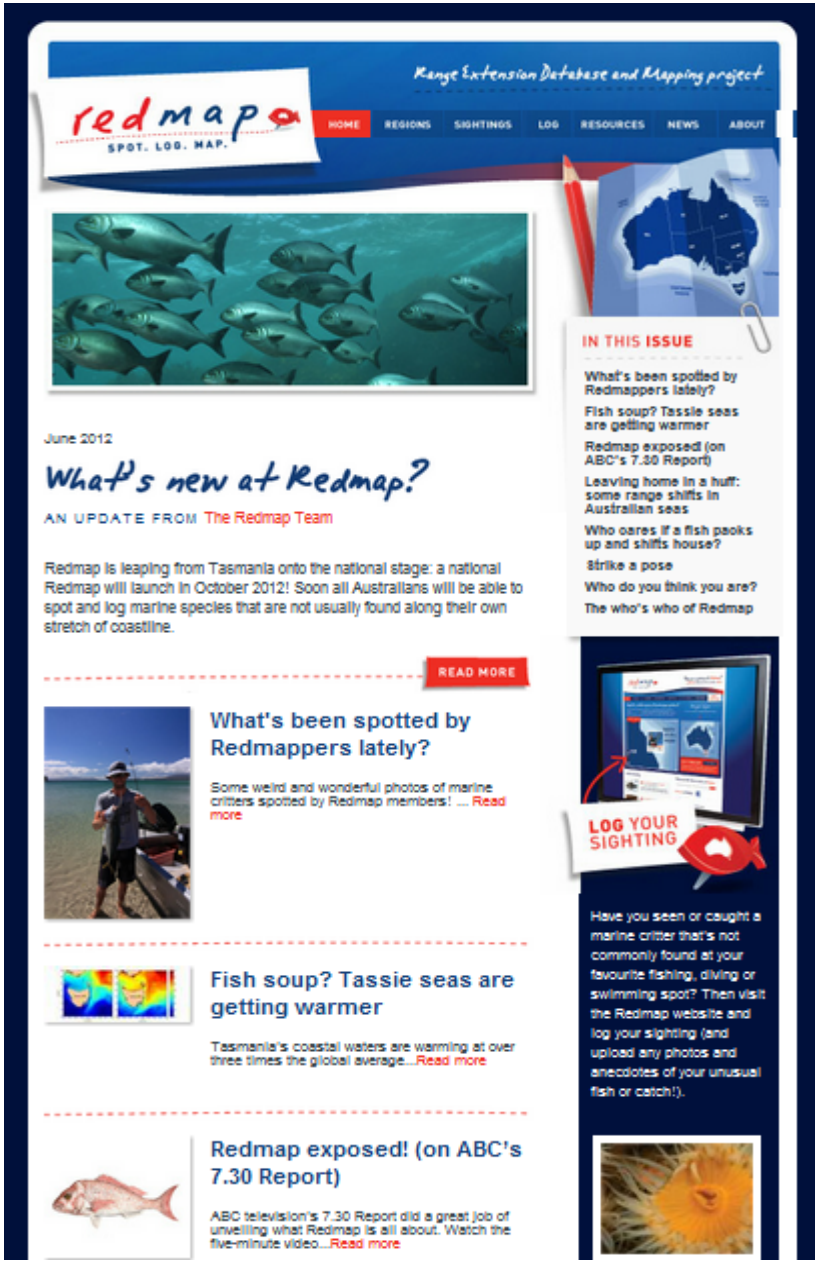
journal homepage: www.elsevier.com/locate/gloenvcha

ELSEVIER

Socio-economic and management implications of range-shifting species in marine systems

Elizabeth M.P. Madin [a,*], Natalie C. Ban [b], Zoë A. Doubleday [c,d], Thomas H. Holmes [e], Gretta T. Pecl [c,f], Franz Smith [g]

Management/Policy responses



Newsletter communication

- Light hearted tone
- Mix of science & people
- Released quarterly
- Very well received!

Email from Redmap member “G”, a commercial cray fisher:

“Really interesting articles about the science that’s going on. Been wanting to know more and finally someone made sense of it to me.”

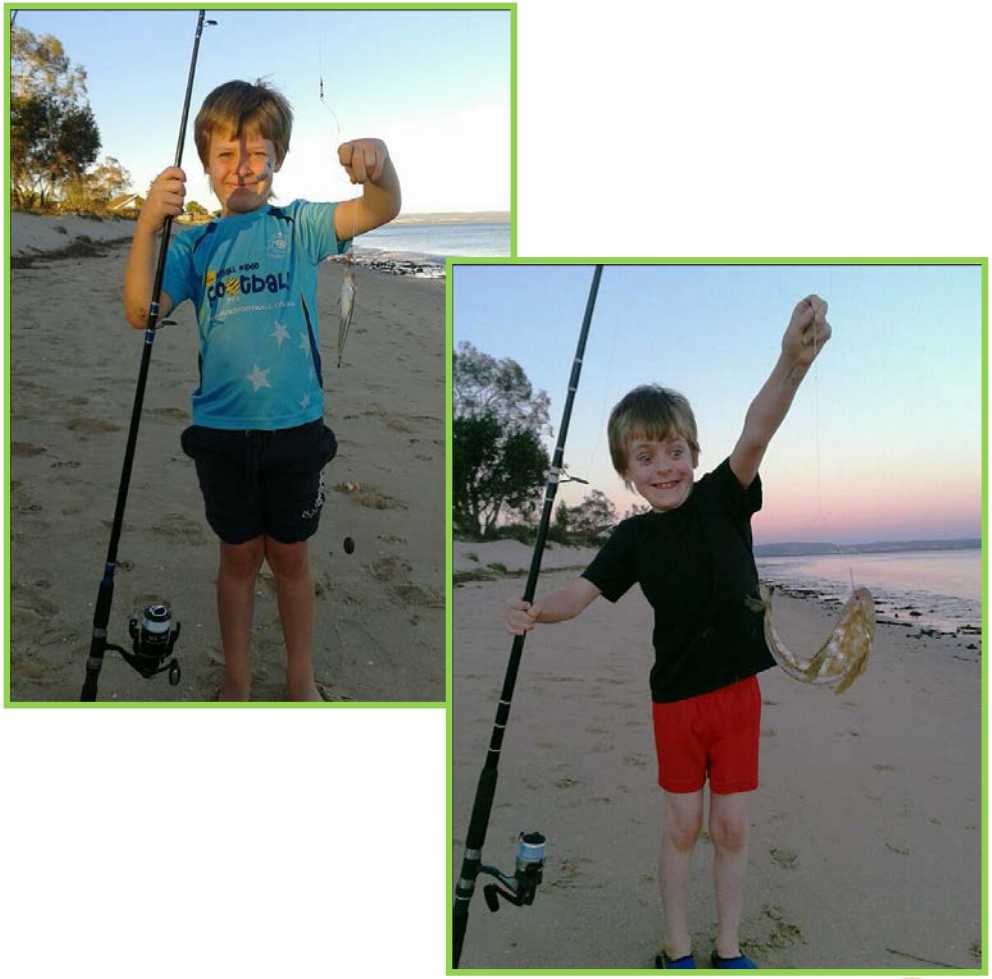
Why does Redmap work?

- Engaging website with clear project branding
- Immediate display of most community & fisher reported data
- Individual feedback provided for sightings with photos
- Recognition of contributions on website & in project newsletters
- Clear acknowledgement & valuing of industry & community knowledge
- Involving people in *discovery*…something NEW to report all the time
- Fishers love talking about what they caught & divers love taking photos

Redmappers: Peter, Sam, Lawfish, Diver263

Long-term benefits of Redmap

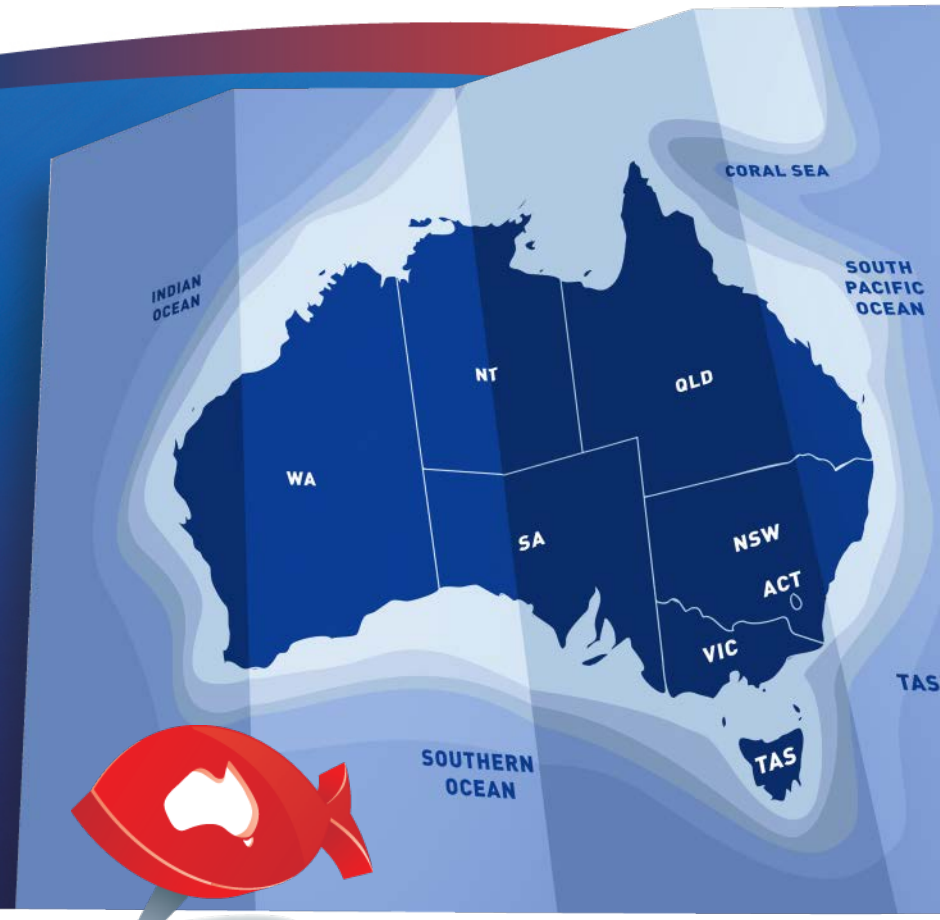
- Ecological monitoring - species ranges
- Effective way to identify where research could be targeted
- Promoting awareness within the general community
- Involving & engaging industry - acknowledge & values contribution
- Gives industry and community ownership of some of the knowledge



redmap

SPOT. LOG. MAP.

- 60,000 km coastline
- 3-4 million fishers
- 2 million dives per year
- 1000’s of naturalists / beach combers
- 200+ species being monitored
- 60+ scientists
- 10+ institutes



8.6 million
smartphone users in Australia

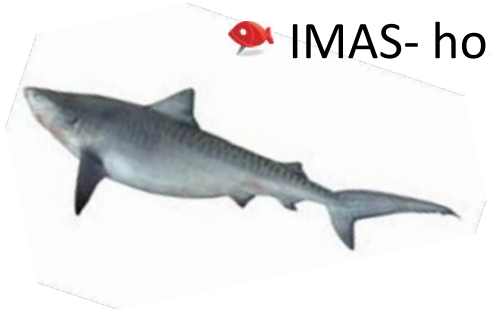
11.7 million
Facebook users in Australia

Out of range
Pacific glass squid
Rob de Little
Submitted 30/8/2012

Synthesising observations from the community…….and showing how one person can make a difference, contributing as a citizen scientist & helping the scientific community unravel the mysteries of how our ecosystems are changing

Keep up to date with what's on the move around Australia via our quarterly electronic newsletter: sign up at www.redmap.org.au

Join us on Facebook



Many thanks to:

- Fishers & SCUBA divers
- Scientific validation panel
- Contributing author scientists
- Community & industry groups that support Redmap
- Our funders!!
- Regional lead institutes
- IMAS- host of Redmap Australia

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THANKS to the many supporters

TASMANIA Mures

CLIMATE CONNECT

TASMANIAN COMMUNITY FUND
MAKING A DIFFERENCE

fishwise
Community Grants

BRUNY ISLAND CRUISES
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tas uni dive club

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Peter Johnston
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TSIC
Tasmanian Seafood Industry Council

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