Redmap Australia

DAFF-SEAP Report, May 2012

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Australian Government
Department of Agriculture Fisheries and Forestry

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IMAS
INSTITUTE FOR MARINE AND ANTARCTIC STUDIES

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Redmap: Range Extension Database and Mapping project

Redmap was developed to ***involve, educate and inspire*** the Australian community. It promotes awareness and stimulates interest in Australian marine environment through engagement. Community members are invited to report information on how marine species are moving in Australian waters. This information is crucial for understanding patterns of species movement that may result from environmental changes (such as climate change) - but is often impossible to collect at the large scale which makes the data useful. The project also acts as an important warning system for new species being reported to an area they have not been found in before. The key is providing a way that the community can unite and collect this information, and the catch is finding an effective means to do this….

What we are

An exciting new initiative allowing Australians to provide crucial information on changes in the distribution of marine species

What we do

Inspire Australians through participation in science AND collect valuable data on the distribution of marine species.

Why it works!

Redmap Tasmania been a huge success...and there are now plans to extend the project nationally.

Over 4 million Australians go fishing, diving and boating each year. They see what's happening in the marine environment, but they do not always have a way of communicating this information to scientists. Redmap is a two-way knowledge exchange between our community and our scientists.

This report

This report details the activity conducted to add New South Wales, South Australia and Victoria on to the Redmap Australia grid, using funds kindly provided by DAFF, via the South East Australia program.

Contents

Context for the milestone progress detailed in this report

a) Overall project plan for Redmap Australia

i) Overview

Redmap engages citizens to help record and track range-shifts in marine species using an on-line website. Launched in December 2009 by Dr Gretta Pecl at the Institute for Marine and Antarctic Studies (IMAS) at the University of Tasmania, Redmap has logged more than 400 sightings of 70 marine species in Tasmania alone, and registered over 700 unique subscribers to the program. The success of the project as a highly effective engagement tool has been recognised with a number of prestigious awards including the University of Tasmania's Vice Chancellor's Award for Outstanding Community Engagement 2011 and the Royal Zoological Society of NSW 2010 Whitley Awards for outstanding publications dealing with the promotion and conservation of Australasian fauna.

Redmap is now being expanded to a national level and is expected to not only engage and educate, but also to promote awareness of local species and an early warning of species shifts from around Australia. The database that will emerge will be unique in Australia and an essential tool to effectively identify and monitor species distributional changes that may occur as a result of climate change. Thus Redmap will act as an early warning system for changes occurring in the marine environment, and has the potential to play a vital role in directing management decisions and actions.

ii) Objectives

Increase community engagement

To increase the capacity for national data gathering by providing an avenue through which community members can contribute to monitoring the marine environment with little or no training effort required; thereby harnessing the potential of non-trained community members to help identify climate change impacts

Promote climate change awareness and education

To engage, educate and communicate with the general public, schools and Australia's marine industries by creating greater awareness of climate change and our marine environment – communicating science and its benefits

Monitoring of the marine environment

To allow a system for monitoring distributional changes in species ranges by utilising community engagement and interest from a range of marine groups including fishers, boaters and divers.

Early warning system for management agencies of climate change impacts

Providing current and ongoing data for detecting marine species range shifts

Encourage collaboration of effort for managing climate change risks nationally

To encourage state level collaborative effort for common goals of increasing community understanding and awareness of climate change.

iii) Outcomes

Greater knowledge of Australia's biodiversity changes and impacts with climate change

Identification of regions or taxonomic groups with high frequency of range-shifts.

Increased community engagement and education of local biodiversity and the issues faced by the marine environment (e.g. in response to climate change)

Increase community awareness through effective communication of outcomes via the website and presentations to local groups/schools.

iv) Outputs

Website

An easy to use website that is designed to effectively capture data for users, ensure the workflow process, data verification, efficient and accurate reporting, feedback, and improved accessibility of information on current species range shifts.

Data

Metadata publicly available through the Institute for Marine and Antarctic Studies Geonetwork via the Australian National Data Service (ANDS), Australian Ocean Data Network (AODN) and Research Data Australia (RDA).

Data dissemination and availability via website (RDA and AODN once published).

Region-specific information "packs"

- Identification of species (including photos and distribution information)
- Identification of researchers/experts (by species if relevant, photos, bios)
- Identification of key stakeholder groups
- ID of principal organisation, collaborators and contacts
- Templates of promotional/educational material
- Regionalised information for website content

Quarterly newsletter

Web based quarterly newsletter sent to registered users. This will include overall and region specific information, including updates on species observed and data use.

Project manual

A project manual will be produced (by the core team) for implementation of the project in different regions. This manual will include information on website use, the species verification system, the appropriate use of the Redmap logo and involvement (including MOUs and Terms of reference material) as well as citing funding bodies and sponsors appropriately.

v) Operation

Strategic Development Plans

- Data management & Intellectual Property (IP) Policy
- Website Development
- Project Evaluation
- Science Integrity
- Community Engagement
- *Sustainability*

Steering Committee

Steering Committee Role	Appointee
Redmap Australia Chair	Dr Gretta Pecl
Technical Project Manager	Mr Peter Walsh
State Node representatives	VIC (Ms Dianne Bray) NT (Dr Karen Edyvane & Michael Hammer) NSW (Natalie Moltschaniwskyj) WA (Dr Gary Jackson) SA (Mr Keith Rowling) QLD (Marcus Sheaves)
Stakeholder representative	Russell Conway

Project Team

The Core Team will be responsible for the day-to-day management of the Redmap Australia project including coordination of the state level nodes. This team will consist of: 1. Project Chair, 2. Technical Advisor, 3. Project coordinator, 4. Administration support.

Advisory Groups

Roles and responsibilities of the two major advisory group committees of Redmap Australia: a. Science and Data; and b. Community Engagement.

Members	Roles/responsibilities
a. Science and Data Advisory Committee	
Prof Natalie Moltschaniwskyj (Chair) Mr Dallas D'Silva Mr Daniel Gledhill Dr Gretta Pecl Dr Amanda Bates Peter Walsh	- Science Plan – establish clear science objectives - National-scale data evaluation and analysis - Determine criteria for designating a range expansion - Qualitative report cards for stakeholders - Data modelling
b. Engagement Advisory Committee	
Dr Melissa Nursey-Bray (Chair) Mr Russell Conway Mr Neil Stump Mr Bill Sawynock Mr Steve Reynolds Ms Lowri Pryce Dr Gretta Pecl Ms Sam East Ms Yvette Barry	- Establish engagement and outreach goals - Determine metrics for evaluating project goals - Increase community engagement opportunities - Developing strategies for creating and maintaining project participation and retention

b) Key funders of Redmap Australia

The main players and sponsors who are bringing their financial, scientific and logistic support are listed below

The Institute for Marine and Antarctic Studies (IMAS) at the University of Tasmania has been created to encourage collaborative research in marine and Antarctic science between various parts of the University, CSIRO Marine and Atmospheric Research, the Australian Antarctic Division and other agencies. IMAS, in collaboration with the Government of Tasmania, delivers research and extension products for the betterment of Tasmania's aquaculture and fishing industries. IMAS is the host of Redmap Australia.

Redmap is supported by the Australian National Data Service (ANDS) through the National Collaborative Research Infrastructure Strategy Program and the Education Investment Fund (EIF) Super Science Initiative. Find out more at ands.org.au. ANDS funded the construction of the national Redmap website and database.

The Redmap initiative is supported in the south-east of Australia through the El Nemo – South Eastern Australia Program (SEAP). SEAP is supported by the Australian Government's Climate Change Research Program, the Victorian Department of Primary Industries, Primary Industries & Resources South Australia, Industry & Investment New South Wales, the Tasmanian Department of Primary Industries, Parks, Water & Environment, the Australian Fisheries Management Authority, the Fisheries Research and Development Corporation, CSIRO, and the South Australia Research and Development Institute.

This Inspiring Australia initiative is supported by the Australian Government through the Department of Industry, Innovation, Science, Research and Tertiary Education in partnership with the Institute for Marine and Antarctic Studies. Redmap has recently received an Inspiring Australia Grant to fund, "Eyes on the water: inspiring Australians through participation in science" which will further develop the Redmap citizen science project around Australia.

Building on the existing Tasmanian pilot project:

Redmap has received funding under round four of the ClimateConnect grants program for work that will increase reporting capacity in the detection of shifting marine species. The grant will also fund the development of a qualitative score card for resource managers. The Redmap project is an excellent example of collaborative and practical

action to help us understand changes in our marine environment. The ClimateConnect grants program provides funding to help Tasmanian communities and industries adapt to the opportunities and risks from climate change. The program is managed by the Tasmanian Climate Change Office in the Department of Premier and Cabinet. For further information on ClimateConnect, visit www.climatechange.tas.gov.au

Redmap is very grateful to our first sponsor: the Tasmanian Community Fund. IMAS obtained a TCF grant to initially develop Redmap's community-based ecological monitoring program in 2009. The Tasmanian Community Fund has provided grants to a broad range of not-for-profit organisations since 2000. The Fund was established from the sale proceeds of a community asset, the Trust Bank, to provide funds back to the community. The Fund has established itself as a significant part of the community landscape, with millions in grants allocated to Tasmanian projects.

Have you ever wondered where the money raised from the sale of recreational sea fishing licences goes? Revenue from the sale of sea fishing licences supports the Fishwise fund. This fund covers the management and administration of recreational fishing, including the licensing system, and provides funds to programs that support recreational fishing activities. Fishwise Community Grants provide funding for individuals and community groups to conduct projects that improve the management of marine resources or improve the awareness and knowledge of our fisheries. Fishwise funded Redmap signs at boat ramps around Tasmania.

The Mures family has been self-employed in the fish trade since 1965. They now are also well known providers of quality seafood and dining experiences. Mures provide two $50 Mures vouchers to Redmap members for joining Redmap each month.

c) Details of regional hosts for NSW, Vic and SA Redmap teams

The lead institutes hosting Redmap in NSW, SA and Vic are listed below

The University of Newcastle is the most research intensive university outside of an Australian capital city. Ranked ninth among Australia's universities for research, Newcastle's reputation is for innovation, excellence and research with impact.

PIRSA Fisheries and Aquaculture is the division of Primary Industries and Regions SA (PIRSA) that is responsible for the ecological sustainable development of South Australia's aquatic resources. The division provides effective administration of fisheries and aquaculture leasing and licensing, a partnership approach to policy development, ensures equitable allocation of access to aquatic resources and also has a strong compliance, education and awareness focus. Its purpose is to deliver a best practice, ecosystem-based approach to aquatic resource management that maximises the social and economic benefits to South Australian communities.

Museum Victoria is Australia's largest public museum organisation. As the State museum for Victoria, MV is responsible for looking after the State collection, conducting research and providing cultural and science programs for the people of Victoria and visitors from interstate and overseas. The major strength of Museum Victoria's research activity is its integral connection with collection holdings of more than 16 million objects and specimens. Dating back to the 1850s, the extensive natural history collections provide invaluable historical data on the biodiversity and distributions of Victorian and Australian animal life, and consequently can provide critical insights into the impacts of human activities on this fauna over more than 150 years.

Redmap Australia Steering Committee

Chair: Dr Gretta Pecl is a Fulbright Fellow and a Senior Research Fellow leading several projects within the Estuaries and Coasts Program at the Institute of Marine and Antarctic Studies (IMAS)**.** She is also the Research Fellow for the Marine and Biodiversity theme of the Adaptation Research Network for Marine Biodiversity and Resources (ARN-MBR). Gretta is a marine ecologist with many years of experience working on life history, fisheries ecology and population connectivity, and is particularly interested in assessing the role of movement and migration as key processes structuring marine populations.

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Professor Karen Edyvane is the leader (and Principal Scientist) of the newly established, Marine Biodiversity Branch of the Department of Natural Resources, Environment, the Arts and Sport, and also, is an adjunct Professor (Marine Conservation) with Charles Darwin University. Karen is primarily a marine habitat ecologist with specialist expertise and experience in coastal-marine biodiversity conservation, Marine Protected Area design and system planning, marine monitoring, and coastal-marine ecosystem-based planning.

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Dr Gary Jackson is a Principal Research Scientist with the WA Department of Fisheries. He has worked on range of projects focussed on the biology and dynamics of exploited finfish stocks, stock assessment and fishery management. Has been a member of ASFB since 1992, a state rep in both SA and WA and has been assisting the Exec as the national conference/workshop coordinator since 2005.

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Assoc Prof Natalie Moltschaniwskyj is a marine ecologist/biologist working at the University of Newcastle, she is part of the Marine Science group doing research and teaching at the Ourimbah campus on NSW Central Coast. She has

worked in a diversity of Australia's marine environments from the tropics to Antarctica. She carries out research on molluscs essentially and cephalopods.

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Keith Rowling is a Senior Research Officer in Marine Environment and Ecology at PIRSA- SARDI. His research has primarily been focussed in the field of ecology and benthic assessment methodology, particularly in the context of assessing environmental impacts in marine benthic systems and the impact and eradication of exotic marine pests. He has extensive experience in scientific diving and the operation of small boats for research purposes. He also has experience in habitat mapping using GIS based information software. Currently he is chief investigator of a project trialling the national Marine Pest Monitoring Manual, providing research support for the Adelaide Coastal Waters Project, aquaculture and dredging environmental assessment projects, and chief investigator of the Caulerpa eradication project.

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Dr Jemina Stuart-Smith is a young research fellow within the Estuaries and Coasts Program at IMAS. Her current position at IMAS involves research on two projects with Dr Gretta Pecl and Assoc Prof Stewart Frusher. She is involved in coordinating the development of Redmap Australia as well as providing research support for developing adaptation options in response to climate change for the South East Australia Program. She is interested in all aspects of ecology and appreciates community engagement as a valuable tool for allowing broadscale monitoring and generating interest in the marine environment.

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Peter Walsh is data manager at IMAS. His main interests include managing data integrity in large research datasets and managing data as part of a project lifecycle and communications protocols used for industrial site and equipment monitoring.

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DAFF milestones to be reported against

May 31st 2012 Milestones

1. Region specific resource material and information on NSW, Vic and SA 'Redmap' species (i.e. species suspected of shifting range) created on the Redmap website.
2. Assembly of a large scientific panel to verify observations from NSW, Vic and SA submitted to the website by fishers and community members, ensuring highest quality data and therefore longevity of the program.
3. A tested and fully functional NSW, Vic and SA component of the Redmap website by May 31st 2012 (to be deployed at a later date after additional training and testing as per Australian National Data Service agreement).
4. Design and framework for a quarterly newsletter, including release of a 'pre-launch' newsletter.
5. Templates of Redmap promotional materials (A4 flyers, leaflets, posters, banners and signage) for the NSW, Vic and SA teams to populate with region-specific information.

Region specific resource material for NSW, Vic and SA (milestone 1)

The following pages include examples of new general and region-specific resource materials that will be uploaded on the Redmap Australia website prior to the launch in October 2012.

Materials include:

- Redmap in South Australia - *It's a whaaaat? Spot and log uncommon fish along the South Australian coast*
- Ocean warming effects on the banded Mowong
- Land and sea species differ in climate change response
- Global movements (and we don't mean occupy Wall Street!)
- Redmap in New South Wales - *It's a whaaaat? Spot and log uncommon fish along the New South Wales coast*
- Marine turtles
- Photographing marine life
- Oceanographic influences in south east Australia (stills)
- Oceanographic influences in south east Australia (movies)
- Changes in the marine ecosystems Of south east Australia

Redmap in South Australia

By Yvette Barry

It's a whaaaat? Spot and log uncommon fish along the South Australian coast on www.redmap.org.au

Have you ever spotted a fish that doesn't usually live along your stretch of coastline in South Australia? Soon you'll be able to log your unusual sighting at *www.redmap.org.au.* In October 2012, all Australians will be able to log onto Redmap to share sightings and photos of marine life that seem out of place at their local fishing, diving or swimming spot. Redmap is keen for sightings of any uncommon marine life – not just fish but also turtles, sharks, rays, crayfish, corals, seaweed, urchins and prawns, to name a few.

Redmap was launched in Tasmania in December 2009 to track whether marine species could be 'moving house' further south along the Tassie coastline – a.k.a. 'a range shift'– as we experience marine changes such as warming seas. So far, Redmap's Tasmanian members have logged nearly more than 400 sightings including eastern rock lobster, yellowtail kingfish and luderick, many of which were spotted south of their usual home turf.

Keith Rowling is the program leader at the Community Based Fisheries section of PIRSA Fisheries and Aquaculture. He'll be driving the introduction of Redmap into South Australia in October. He says Redmap community sightings will help track if marine species are moving their homes further along the South Australian coast, possibly in search of cooler waters as the marine climate changes.

"At the moment there's very little research into range shifts in South Australian waters," Mr Rowling says.

South Australian has unique currents - cold water currents from the south east and the warmer Leeuwin current from the west - that are complicated by cooler Antarctic waters. So there are less obvious southerly range shifts such as those studied along the western and eastern seaboards.

Mr Rowling says he has his eye on a few species that could shift range if ocean temperatures warm, such as the blue swimmer crab. This crab is traditionally found in the upper gulfs of South Australia, but more and more divers and recreational fishers are reporting this species further south, outside the gulf areas. Yellowfin tuna is another fish Redmap will keep tabs on: it's rarely caught in South Australia, so any range shift would be noticeable if it moved into the state either from the east or west.

Over time, and with many sightings, Redmap's citizen science will help detect if marine species are really setting up shop elsewhere; or whether they are just one-off visitors or moving with seasonal variations along the coast. This information will help to focus research and management into those marine species – and range shift 'hotspots' along South Australia's vast coastline - that are most impacted by marine climate change. Redmap also engages people with climate change issues - by allowing Australians to collect and share their own data and photos on their local marine environment. And all whilst doing the things they love: diving, fishing and swimming!

If you want to know more about the Redmap in South Australia, please email enquiries@redmap.org.au or visit www.redmap.org.au or contact Keith Rowling at Keith.Rowling@sa.gov.au

Photo: Blue Swimmer Crab (*Portunus armatus*), male above female. Photo courtesy of SARDI Aquatic Sciences, South Australia.

The expansion of Redmap in around Australia was enthusiastically embraced and developed with the support of Redmap Australia's lead host, the Institute for Marine and Antarctic Studies (IMAS) at the University of Tasmania; and our main sponsors: the Australian National Data Service (ANDS), the Australian Government's *Inspiring Australia* initiative and the Australian Department of Agriculture, Fisheries and Forests (DAFF). Redmap will be hosted by institutions in every State and Territory (to find out who'll run Redmap in your region, see www.redmap.org.au)

Ocean warming effects on the banded Mowong

Scientific monitoring since 1944 by CSIRO at Maria Island show that surface water temperatures in the Tasman Sea have risen by nearly 2°C over the past 60 years. 'Generally, cold-blooded animals respond to warming conditions by increasing growth rates as temperatures rise,' said CSIRO marine ecologist Dr Ron Thresher, a co-author of the study. 'But theory and laboratory studies show that this has a limit.'

Banded Morwong (Cheilodactylus spectabilis) has a known range from Victor Habor, South Australia, around Tasmania and New Zealand and to Seal Rocks in New South Wales

'By examining growth across a range that species inhabit, we found evidence of both slowing growth and increased physiological stress as higher temperatures impose a higher metabolic cost on fish at the warm edge of the range,' Dr Thresher said. 'In this case, off northern New Zealand, ocean warming has pushed the banded morwong past the point where increasing temperatures are beneficial to growth.'

According to a co-author of the paper, IMAS researcher Dr Jeremy Lyle, banded morwong were used in the study because they can live for almost 100 years and, as adults, they stay in essentially the same area even if the water temperature shifts 'Growth rates of young adult banded morwong in SE Australia have increased significantly since 1910 at four sample sites,' Dr Lyle said. 'The team from CSIRO and IMAS compared these changes to temperature trends across the species' distribution. They observed increased growth for populations in the middle of the species' range in Australian waters where temperatures have increased, but are still relatively cool, but growth slowed with rising temperatures at the warmer northern edge of the species' range in New Zealand waters.'

Dr Lyle said the study showed that growth performance in banded morwong began to suffer above average annual water temperatures of about 17°C. The paper's other co-authors were a post-doctoral fellow with CSIRO who is now with Aarhus University in Denmark, Dr Anna Neuheimer, and, Dr Jayson Semmens from UTAS.

The research was conducted through CSIRO's Climate Adaptation Flagship, and IMAS, with funding from an Australian Government Endeavour Awards Fellowship and the Winifred Violet Scott Trust.

Land and sea species differ in climate change response

By Jennifer Sunday

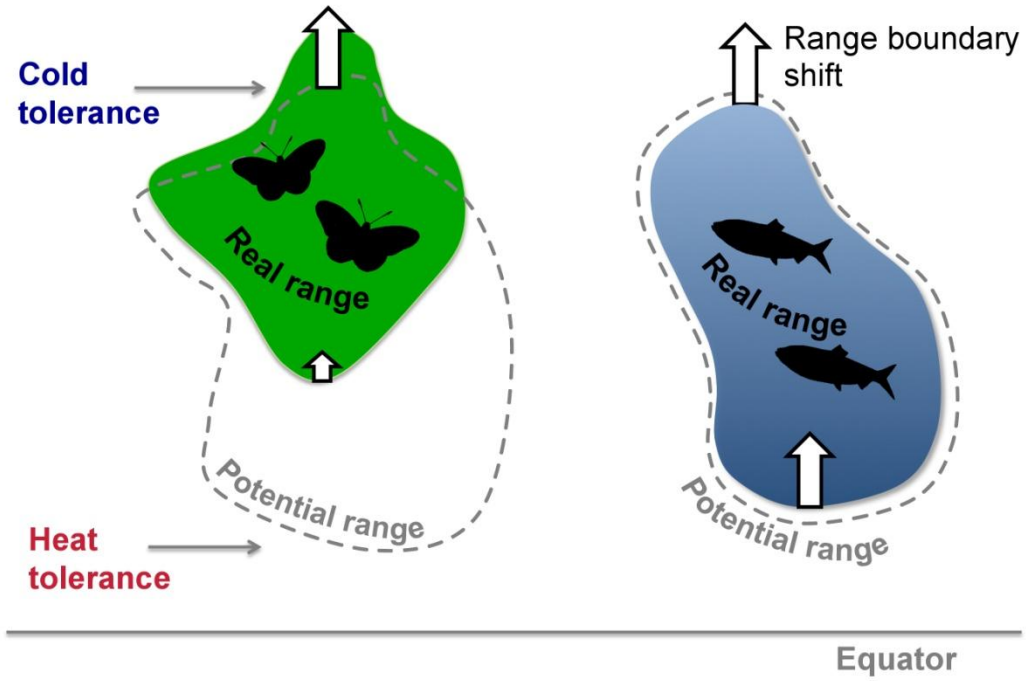
All animals occupy a piece of real estate on this earth, known as their geographic distributional range. Various factors probably contribute to determining a species' range, but temperature is thought to play a central role, particularly in setting how far north and south an animal can live. Because of this, we expect that animals will move towards the poles as the climate warms. In fact, this is generally what we are seeing – animals the world over are moving towards the poles - however, not all animals are moving to the same extent.

Thermal tolerance of 102 cold-blooded animals on land, such as this Australian skink, and 67 old-blooded marine animals, such as this Californian porcelain crab, was compiled in a global dataset. Photo: Jennifer Sunday.

In our work, we set out to test if animal ranges are set by their tolerance for warm and cold temperatures. To do this, we gathered published data from a century of experiments on animals' warm and cold functioning temperatures in cold-blooded animals such as marine snails, crustaceans, dragonflies, beetles, frogs, lizards and fishes.

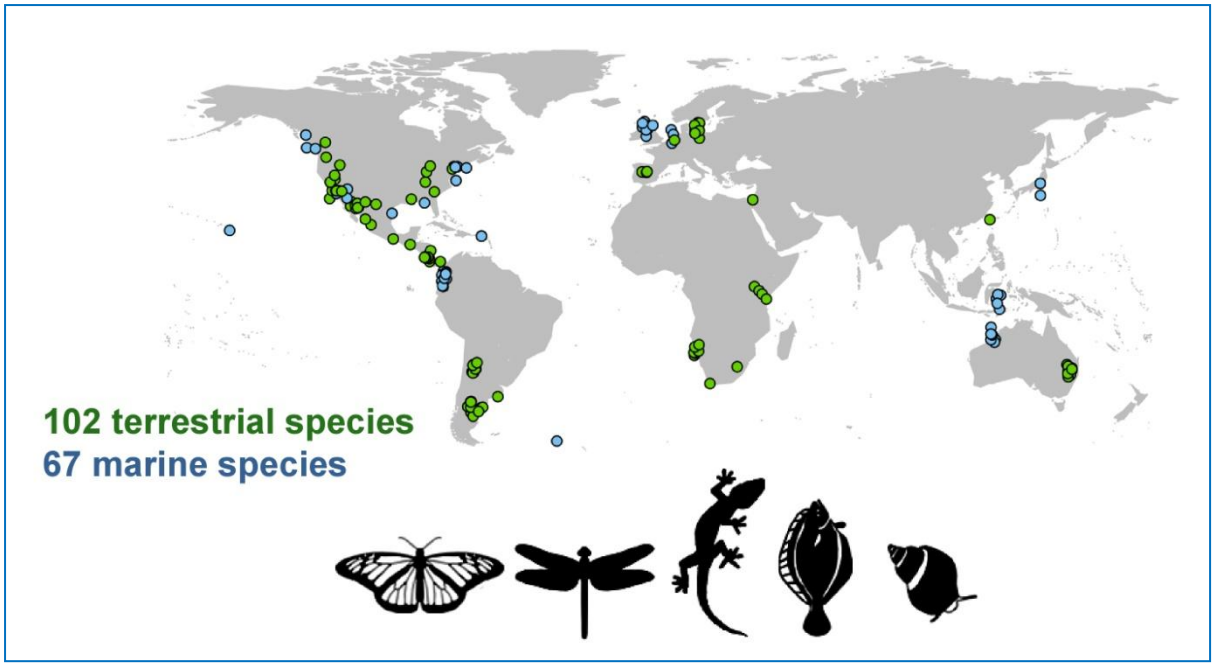
We then got out our maps to find the Northern and Southern edges of each species' range, and lined up the data for to compare where each species lived in relation to its temperature limits.

What we found was pretty surprising. We found a good match in the ocean - marine animals' Northern and Southern limits closely matched the distribution we expect based on their temperature tolerance. However, we found quite a different pattern on land. On land, there was a mismatch between where animals are found and where they can potentially live - most terrestrial species are not occupying the warmer ends of their potential real-estate. In other words, something other than heat is keeping terrestrial animals from living closer to the equator.



Cold-blooded animals use up their potential real-estate different on land and in the sea. On land, animals tend to occupy only the cooler ends of their ranges, even know we predict they could live closer to the equator based on their heat tolerance. In the ocean, animals tend to occupy their whole potential range. With climate warming, land animals are so far responding much more at their cold range boundaries, and responding much less at their warmer range boundaries. By contrast, in the ocean, animals are responding equally at both range boundaries. Jennifer Sunday

We next looked at how animals have been responding to recent climate warming, by compiling data sets from around the world. There are in fact lots of examples of animals shifting their ranges that have been attributed to climate change. We found marine species are responding to climate warming with equal sensitivity at their cold and warm range boundaries, but on land, animals are less sensitive at their warm range boundary. In other words, warm range boundaries on land are not contracting in response to warming as much as we expect them to.



To test how temperature tolerance relates to species' North-South distributions, we compiled data from scientific studies all around the world. We found data for 102 cold-blooded land animals (lizards, frogs, and insects - green dots) and 67 cold-blooded marine animals (snails, bivalves, crustaceans, and fish). Jennifer Sunday

Why are the warm boundaries of land species less sensitive to warming?

We think it's a combination of three things. First, species ranges aren't just set by temperature. On land where water is key, species may be hindered more by dryness, rather than being too hot at this range boundary. Second, it could that be rare heat waves are actually setting boundaries on where species can live. Finally, there are more species and much more ecological competition toward the tropics, which may be enough to exclude some species from living in the warmer end of their potential real estate.

One implication of this work is that we may have a better time predicting range shifts in the ocean comparted to those on land, because temperature plays a more general role. Understanding of the factors that set species' ranges, particularly on land, may help us to make better predictions for the future.

Global movements (and we don't mean occupy Wall Street!)

Research around the globe is showing creatures great and small are moving their homes further towards the poles in search of a 'better climate'. Redmap's Yvette Barry trawled a few publications and the media for some of these range extensions.

The well-armoured king crabs have a voracious appetite which may threaten Antarctic ecosystems (photo: Katrien Heirman/Ghent University, used with permission).

Invasion of king crabs in Antarctica?

King crabs have been excluded from Antarctic shelf waters for millions of years because it was just too cold for them – but that's changing, according to research published in the *Proceeding of the Royal Society B (Sept 2011)*. Dr Craig Smith and his researchers found 42 king crabs living at temperatures above 1.4 degrees off the western Antarctic Peninsula. The study predicted that as water temperatures rise in Antarctic shelf waters - at an estimated 0.01 degrees Celsius a year - so too will the number of king crabs over the next few decades. Why's this an issue? King crabs are voracious skeleton-crushing predators that feed on animals like sea urchins and starfish and the research showed there were very few of these species in areas patrolled by these crabs. As Antarctic seas warm, king crab numbers may threaten Antarctic biodiversity and even wipe out species.

The snake pipefish is hard to swallow for many seabirds in Europe (Photo: Rebecca Nason, www.rebeccanason.com, used with permission).

Fish in the North Sea

One of the more obvious changes in fish distributions in Europe has been the northern shift of the snake pipefish - and a massive increase in their numbers. According to a number of studies, the northward push of pipefish not only displaces other fish but also impacts the breeding of seabirds. Research published in *Marine Biology* showed that seabirds are struggling to eat the pipefishes' spiky, crunchy, long bodies; and chicks may choke to death trying to swallow them. Other research in northern European seas revealed iconic species like haddock shifting a whopping 216km further north; and fish like megrim, anglerfish, cod and saithe, all moving into deeper (and therefore cooler) waters than previously recorded. Of course, a range of factors could be at play here including changing water temperatures, water currents and ocean acidification, to name a few.

Birds shifting breeding areas towards the poles

In North America, birds have been recorded as shifting their breeding areas further north towards cooler regions and also retracting their southerly range edges. Birds on the move include the Nashville warbler, the pine siskin, red-bellied woodpecker, and the Carolina wren.

Much of the data that allowed this large-scale study came from the Breeding Bird Atlas census (www.pwrc.usgs.gov/birds.html), which engaged thousands of volunteers to observe and report the

birds they could identify. *Just goes to show how observations from everyday people can reveal important patterns!*

Winegrowers may have to head for the hills if the climate gets any warmer (Photo Y. Barry)

Spanish grapes

It's not just animals heading to cooler climes. *TIME Magazine* (Sept. 4, 2011) interviewed Spanish winemakers about the impacts of climate change on their grapes: average temperatures in Spain have risen one degree Celsius since 1880, and that means some farmers have to harvest their grapes as many as 25 days earlier in the season compared to even 25 years ago. Warming weather can change the taste of a wine, make sparkling wines flatter, reduce tannins in red wine and may leave the wine more susceptible to microbial infections, according to the article. One of the world's largest wine producers, Miguel Torres, told *TIME* he's buying hillside land "as a climate insurance" and will replant on higher ground as temperatures warm. Good news, then, for lovers of cooler-climate wine like pinot noir. But the article suggests other vintners may have to change the type of wines they produce, and increase shading and watering.

This eastern rock lobster was spotted by a Redmap member at Bicheno (Photo: E. Flukes).

Beetle battle

The *Washington Post* reported in December 2011 how swarms of bark beetles have killed some 30 billion conifers since the 1990s from Alaska to Mexico. And no, you didn't misread that sentence: an estimated 30 *billion* trees have died. Bark beetles are 5-mm insects that bury into the bark of pine trees, eventually killing the tree. To add insult to injury, some beetles also carry a fungus that clogs up the trees' water-conducting vessels. A century-old tree can be killed within a year of bark beetle infestation. *The Climate Institute* reported that the beetle battle was going on long before climate change entered the scene, but warmer weather over the last few decades now means beetle outbreaks in Northern America are moving further north and to higher elevations than previously recorded. Regions like Alaska, reports the Climate Institute, have experience a lot of warming and have been particularly affected: bark beetles have wiped out between 70-80% of the spruce trees in the Kenai Peninsula of Alaska. This means less water can be retained as snow pack and there's less food for wildlife dependant on the seeds or bark of spruce trees.

Sources (in order of topic):

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Redmap in New South Wales

By Yvette Barry

It's a whaaaat? Spot and log uncommon fish along the New South Wales coast on www.redmap.org.au

Have you ever spotted a fish that doesn't usually live along your stretch of coastline in New South Wales? Soon you'll be able to log your unusual sighting at *www.redmap.org.au.* In October 2012, all Australians will be able to log onto Redmap to share sightings and photos of marine life that seem out of place at their local fishing, diving or swimming spot.

Redmap is keen for sightings of any uncommon marine life – not just fish but also turtles, sharks, rays, crayfish, corals, seaweed, urchins and prawns, to name a few.

Redmap was launched in Tasmania in December 2009 to track whether marine species could be 'moving house' further south along the Tassie coastline – a.k.a. 'a range shift'– as we experience marine changes such as warming seas. So far, Redmap's Tasmanian members have logged more than 400 sightings including eastern rock lobster, yellowtail kingfish and luderick, many of which were spotted south of their usual home turf.

Professor Natalie Moltschaniwskyj from the University of Newcastle is keeping an eye out for tropical species that are starting to come down the NSW coast from Queensland.

"Anecdotally we are getting tropical species down in Sydney like damselfish and angelfish in the summer but they die off in the winter," says Professor Moltschaniwskyj, who will be driving the introduction of Redmap into New South Wales.

If more adult fish make it through a winter, it could mean they're starting to shift their usual home further south and could be there to stay.

Professor Moltschaniwskyj is not the only one excited that Redmap is coming to the state. The southern Coastal Management Authority has secured some funding for Redmap in southern NSW. And scientists, as well as DPI fisheries groups, have provided photos and information on the fish that may be shifting their ranges.

Already Professor Moltschaniwskyj and her team have compiled a list of about 60 species they want to track through the Redmap project, including butterfly fish, painted crayfish, cold trout and tropical wrasses.

Over time, and with many sightings, Redmap's citizen science will help detect if marine species are really setting up shop elsewhere; or whether they are just one-off visitors or moving with seasonal variations along the coast.

This information will help to focus research and management into those marine species – and range shift 'hotspots' along New South Wales' vast coastline - that are most impacted by marine climate change. Redmap also engages people with the marine environment and climate change issues – by allowing Australians to collect and share their own data and photos on their local seas. And all whilst doing the things they love: diving, fishing and swimming!

Marine turtles

By Belinda Bauer, Tasmanian Museum

Leatherbacks are known to make regular seasonal feeding excursions into Tasmanian and Victorian waters. Loggerheads, green turtles and hawksbill turtles are recorded as occasional visitors to southern states (loggerheads are the most common) and are usually associated with the seasonal impact of the East Australia Current or the Leeuwin Current.

Quite recently we recorded the first verified sightings of the tropical Olive Ridley turtle in Tasmania and this may reflect an extension in the known range of this species as a result of climate change. It also appears that there has been a general increase of all marine turtle occurrences around southern Australia.

Belinda Bauer at work measuring a beaked whale

The difficulty with marine turtle observations is that while it is easy to identify leatherbacks, the hard-shelled species (loggerheads, greens, hawksbills and Olive Ridleys) can be difficult to distinguish and often get mixed up – so a photo would be fantastic! This means we have few verified observations or specimens to give us a really good picture of which hard-shelled species are most common in southern Australia.

Projects like Redmap provide a really exciting opportunity to help add to our understanding of marine turtle distribution around Australia.

With the launch of Redmap Australia, you can now report turtle sightings all around Australia! We are particularly interested in sightings of turtles in the south east region of Australia.

Photographic marine life

By Adriaan van Huissteden

Position a point of interest along a lone of thirds and try to get at eye level.

Underwater photography is very rewarding, and with a camera, an underwater housing, a few tips and lots of practice, you can soon be sharing what you see with friends, family and of course, Redmap. Many cameras have underwater housings available, whether you have a simple point and shoot or a professional digital SLR camera. Often the camera is not the limiting factor to great shots, but rather the lighting system. Large amounts of light are required to show the true colour of your subject or scene.

Practise at home in a dimly lit room with the camera in the housing; get to know where all the buttons are, how to turn the flash on and off, and how to turn macro mode on and off. Make sure you are comfortable with your diving skills and buoyancy. Using a camera can be very distracting, and it can be easy to crash into the reef or another divers, or worse, float to the surface without knowing it.

Always ensure you follow the instructions on how to clean, seal and open your housing. It could save you from flooding your housing and wrecking your camera. If you ever experience a leak while under water, hold your camera with the lens pointing down and do a normal safe ascent. There are two basic types of underwater photography – macro and wide angle.

Macro

Use Macro for subjects generally within a metre and it is a good idea to have the flash set to ON so that it will fire with every shot you take. Water reduces colour, contrast, and sharpness. If the subject has eyes, make sure the eyes are in focus.

- Take your time if you can.
- Test the macro range with small objects and see how the pictures turn out. You might need to use a small torch to help your camera focus in low light or night-time conditions.
- Try not to centre your subject, rather fill the frame or position a point of interest along a line of thirds.

- Try not to use any zoom, as it affects how closely you can focus; rather, move the camera closer if you can without scaring your subject.
- Try to get low, at eye level.

Wide angle photos

Wide angled photography can be a bit more of a challenge. Unless you have a large underwater strobe or two, turn your flash off and use ambient light. Using the flash will result in what is called backscatter, where the light from your flash will light up all the particles in the water.

- Focus at the eyes.
- Try to get a photo of the subject facing you.
- Take several photos.
- An external flash (known as a strobe) reduces this by changing the angle of the reflection off the particles as it is extended away from the lens of the camera by a long arm. Your pictures may turn out with a blue tinge, but you can add some colour back at the computer. Alternatively, if your camera has a white balance setting, learn how to use it to get some colour back into your images.
- Use auto, aperture priority, or full manual mode, depending on your comfort level with camera settings.

A few general tips

- Night diving can be a great way to get close to subjects that would normally swim away from you.
- Join an underwater photography forum such as wetpixel.com and share your pictures with others to get tips and tricks.
- Dive with other underwater photographers.
- Having another diver in a scene can add to the depth of your image.
- Find a spot close to home with easy access to shore dive and practise.

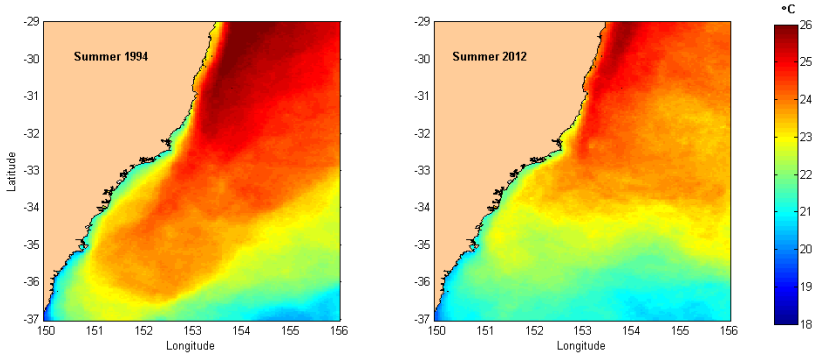
For more information: If you would like to contact me for a dive, or some more information, please email me at adriaanvh@gmail.com or give me a call on 0438 524 782. I have a website with gallery online at www.VizBiz.com.au or look for VizBiz on Facebook too.

Oceanographic influences in south east Australia (stills)

By Alistair Hobday (CSIRO)

New South Wales

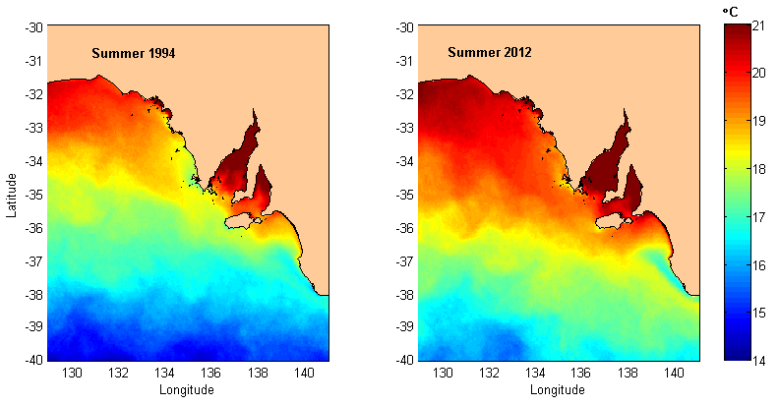
The temperature of offshore waters during the summer is related to the strength of the southward moving East Australia Current (EAC). Strong current flow results in warmer waters being carried southwards. A combination of northerly flow of cool water and coastal upwelling can result in very cool coastal water temperatures, even when offshore waters are warm (1994 and 2012). The contrast in temperature moving offshore can be dramatic, and result in very different fish communities.



Left image: A summer with a narrow current (1994). **Right**: A summer with a wide current (2012).

South Australia

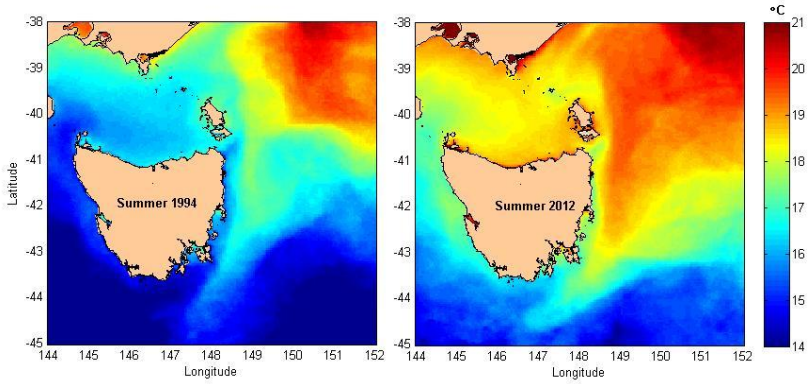
Offshore temperatures in summer are warmer when eastward moving water from the western Great Australia Bight is heated by the atmosphere, while in winter offshore temperatures in autumn and winter are warmer when the Leeuwin Current flows to the east along the edge of the continental shelf. Water temperature in the gulfs is related to atmospheric heating, so warm temperatures on land are associated with warmer waters in the gulfs. Cool coastal upwelling during summer in the south-east of the state, and along the western side of the Eyre Peninsula leads to cool waters close to land.



Left image: A relatively cool summer (1994). **Right**: A relatively warm summer (2012).

Tasmania

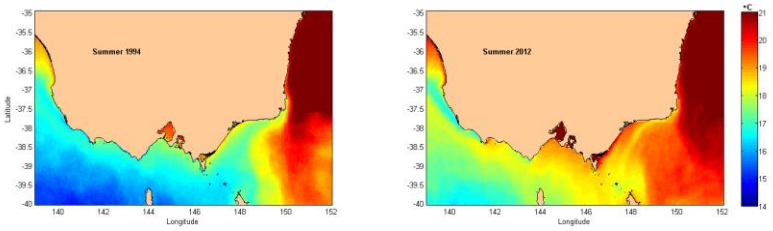
The water temperature in summer on the east coast of Tasmania is strongly influenced by the extent of the East Australia Current (EAC). In warm years (e.g. 2012), the EAC extends south, warming along the entire east coast, and bringing warm water species south. In weaker EAC years (e.g. 1994), sub-Antarctic waters from the south extend along the east coast resulting in cooler coastal temperatures. On the west coast of Tasmania, the extension of the Leeuwin Current can also bring relatively warm water to southern Tasmania in winter.



Left image: A relatively cool summer (1994). **Right**: A relatively warm summer (2012).

Victoria

Water temperatures in eastern Victoria are influenced by the East Australia Current, which flows south. This current does not penetrate in Bass Strait, as flow is generally from west to east. Western Victoria coastal temperatures are influenced by coastal upwelling, visible in Summer 2012, as cool water close to the coast. This wind-driven upwelling typically occurs from December to March. The temperature in the bays is mostly driven by atmospheric heating. When it is hot on land, the bays are also warmed. The Leeuwin Current flows from Western Australia along the edge of the continental shelf, and in strong years also leads to warmer waters in western Victoria.



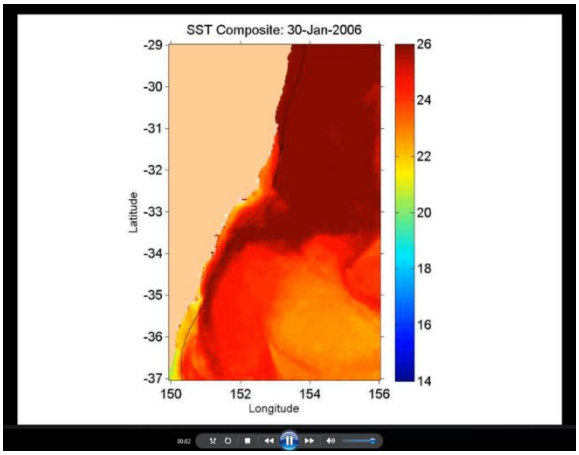
Left image: A relatively cool summer (1994). **Right**: A relatively warm summer (2012).

Oceanographic influences in south east Australia (movies)

By Alistair Hobday (CSIRO)

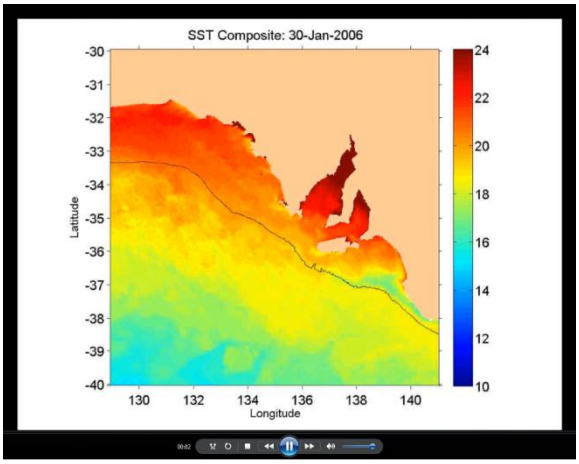
New South Wales

This animation shows surface water temperature every 6 days run from Jan 2006 to May 2012 (runtime of 3 minutes). The water temperatures offshore are dominated by the East Australia Current. This current can be wide and slow, or thin and fast. In summer it extends furthest south as a continuous band of warm water, or as a series of rotating eddies (circular features). Patches of cooler water can also drift in from the east or south. Close to the coast, filaments of cool water are common when the current is fast and narrow (Sept-Nov 2011).



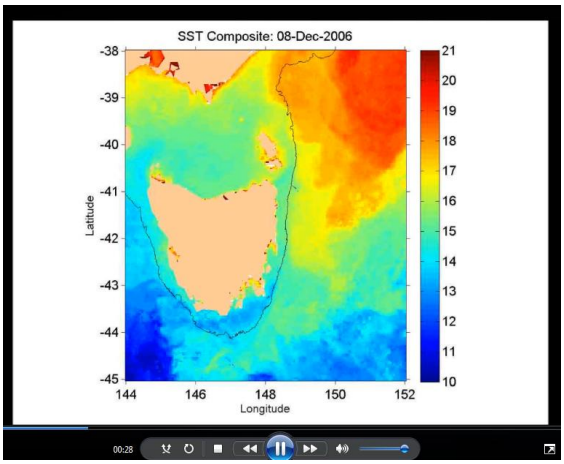
South Australia

This animation shows surface water temperature every 6 days run from Jan 2006 to May 2012 (runtime of 3 minutes). Relatively warmer waters in winter are visible offshore due to the flow of the wintertime Leeuwin Current. In summer, the warm water flows from west to east inshore of the 200 m depth (black line). Seasonal warming in summer and cooling in winter can be seen in both gulfs. Coastal upwelling in summer



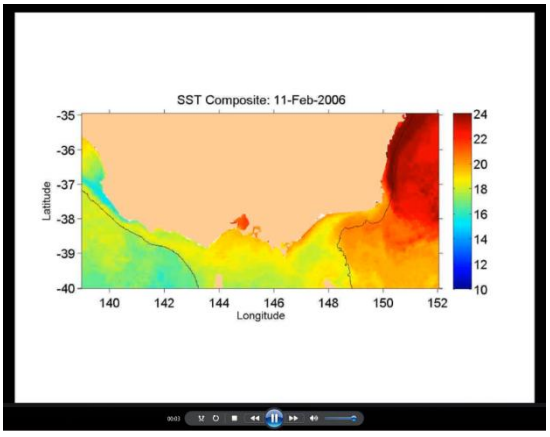
Tasmania

This animation shows surface water temperature every 6 days run from Jan 2006 to May 2012 (runtime of 3 minutes). The seasonal cycle of the East Australia Current (EAC) is visible as warm water pulses in summer, which tend be just east of the 200 m depth (black line), and then a retraction to the north in winter. Eddies (circles of warm water) from the north are also visible in some years). Coastal heating and cooling, related to atmospheric conditions, is often visible at many locations around Tasmania.



Victoria

This animation shows surface water temperature every 6 days run from Jan 2006 to May 2012 (runtime of 3 minutes). On the east coast, the seasonal cycle of the East Australia Current (EAC) is visible as warm water pulses in summer, which tend be just east of the 200 m depth (black line), and then a retraction of warm water to the north in winter. Upwelling in the summer months (e.g. Feb 2012) in western Victoria is visible as a cold water plume starting at the coast. The bays in central Victoria are warmer in summer and cooler in winter than adjacent Bass Strait waters.

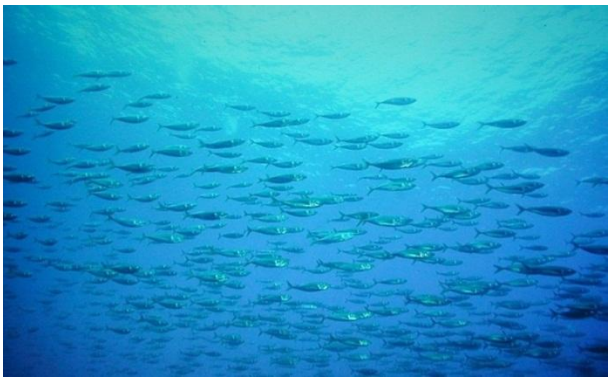


Acknowledgement: Data shown in these images represent the temperature of water at the surface and are collected by satellite, and processed at CSIRO by Chris Rathbone and colleagues. Further information is available at http://oceancurrent.imos.org.au/. Images and movies prepared by Alistair Hobday and Jason Hartog (CSIRO). *NOTE: screenshots of movies shown here for purposes of report, actual movies are 40-50MG each.*

Changes in the marine ecosystems of south east Australia

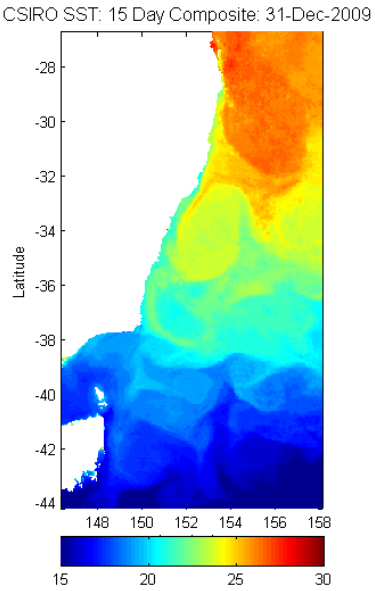
By Laura Purcell

Biodiversity is the number of different types of plant and animal life which exist in a particular place. The way all the different types and varieties of organisms work together in the environment is considered an ecosystem. Loss of one or more of these plants and animals, as a consequence of climate change, can disrupt function of the marine ecosystem. We rely on our marine environment for food, protection against coastal erosion, recycling of pollutants, climate regulation, and recreation. As the plants and animals exist together, loss of one variety can cause further changes in the ecosystem that result in the disappearance of even more varieties.



Fish community

Each marine species has a particular habitat preference which reflects the most suitable environment for them to thrive and defines their distribution. Suitable habitats can be characterised by specific water temperature and salinity, depth range, substrate, as well as the presence of adequate food.

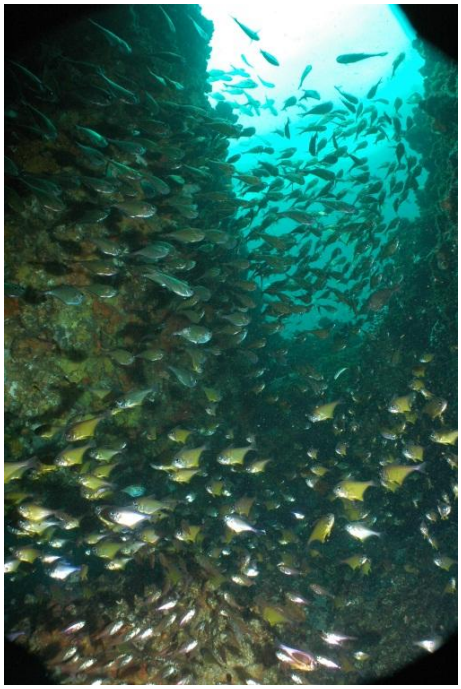


Sea Surface Temperature (SST) of the East Australian Current (EAC)

Changes in the climate are also altering the marine environment, in particular scientists have recorded increases in water temperature due to changes in ocean currents such as the East Australian Current, and seawater becoming more acidic due to more carbon dioxide (CO_2) being absorbed by the oceans. Increases in ocean temperature and/or acidification can push species to the limit of their physical functions which has a harmful effect on their growth, reproduction, foraging, immunity, behaviour, and competiveness.

New South Wales ecosystem changes

The waters off New South Wales coastline range from cool-temperate to subtropical. Ecologically, NSW's marine environment shares many similar fishery resources and habitats with the neighbouring states of Tasmania, South Australia and Victoria. On the north coast of NSW within the Solitary Islands region there is a rich and relatively undisturbed ecosystem of algae, corals, sponges and sea squirts. It's the ideal habitat for the sea creatures that dwell on the sea floor, fish which swim near the sea surface, grey nurse sharks and marine turtles.



Underwater cave, South West Solitary Region. Photo: Graham Edgar.

The East Australian Current (EAC) moves southward from the tropical waters of Queensland down along the east coast of Australia. It is responsible for transporting tropical larvae to NSW coastal waters. As a result of climate change, water temperatures of the south-west and south-east of Australia are warming faster than other regions. In the last 60 years the EAC has become stronger with warmer, saltier water now found 350 km further south. It is predicted that the Tasman Sea is expected to experience the greatest level of warming in the Australian region. This may lead to a variety of cool-temperate species migrating southwards, becoming extinct or being replaced by the

increased occurrence of sub-tropical and tropical species, including harmful species such as venomous jellyfish.

Australian Anchovy Engraulis australis *bait ball. South West Solitary region. Photo: Graham Edgar.*

Marine waters in south-eastern Australia are responsible for 50% of Australia's fisheries production, host a high level of endemic species, and offer no land mass further south for species that find themselves unable to cope with increasing water temperature or that are being displaced by species moving in from further north.

Common kelp, Ecklonia radiata*. Photo: Graham Edgar.*

Species which form habitats are also at risk from the warming waters. The *scleractinian* corals or stony corals of the Solitary Islands region may become vulnerable to more frequent bleaching events and coral disease leading to a loss of biodiversity and widespread changes in the composition of

coral reef fish communities. Kelp habitats (mostly *Ecklonia radiat*a) which dominate the warm temperate coasts of NSW may disappear from the northern reefs with associated reduction in the function of the rich and productive ecosystem. In South Australia and Tasmania kelp habitats are already moving southward, due to the increase in water temperature. As temperatures warm, less food is available for sub-tropical seabirds leading to a decline in breeding success.

Octopus tetricus*. Photo: Jorge Ramos.*

Cephalopods are invertebrates with a large head and tentacles such as octopus, squid or cuttlefish and are known to respond quickly to environmental changes. The Common Sydney Octopus *Octopus tetricus* is an abundant species and important fishery resource in eastern Australia. Until recently it was distributed from southern Queensland to NSW, but as waters have warmed, in the last few years it has been detected off Victoria and the northeast of Tasmania. In NSW it is possible that recreational and commercial important tropical species, such as Coral Trout could be become abundant enough to support small scale industries.

Coral trout. Photo: James Cook University.

Read more about NSW's changing ecosystem, in response to climate change:

- Marine Adaptation Network, Information Sheet #5. "Changes in community composition and distribution under climate change: New South Wales." http://arnmbr.org/content/images/uploads/Information_Sheet_5.pdf
- Marine Climate Change in Australia: Impacts & Adaptation Responses. 2009 Report Card. http://www.oceanclimatechange.org.au/content/index.php/site/welcome/
- NSW Department of Primary Industries. Threats to Fish Habitats: climate change. http://www.dpi.nsw.gov.au/fisheries/habitat/threats/climate-change
- Land Learn NSW. Climate change and fisheries. http://www.landlearnnsw.org.au/sustainability/climate-change/fisheries

South Australian ecosystem changes

The marine environment off the South Australian coast is diverse with kelp forests, deep water sponge gardens, rocky coasts, offshore islands, cliff and mangrove systems. These habitats support a rich ecosystem of thousands of invertebrates such as squid and rock lobsters, over a thousand varieties of algae, hundreds of different fish species, 33 mammal species, 16 breeding seabird species and 12 kinds of seagrass. Most of the red algae, fish species and seagrass in the South Australian marine waters are found nowhere else in the world.

Parapriacanthus*, Rapid Bay SA. Photo: Graham Edgar.*

Ecologically, South Australia's marine environment shares many similar fishery resources and habitats with the neighbouring states of Tasmania, Victoria and New South Wales. As a result of climate change, water temperatures of the south-west and south-east of Australia are warming faster than other regions. In the last 60 years the East Australian Current (EAC) is getting stronger pushing warmer saltier water further south and the Leeuwin Current is slowly getting weaker, which will have implications on the biodiversity of species in South Australia. These changes are leading to South Australia's marine ecosystem, suited to cool-temperate waters, to become less productive as they change their habitat or even become extinct.

Truncate Coralfish, Chelmonops truncatus*. Photo: Graham Edgar.*

South Australian marine life are 'feeling the heat' of changes in the ocean including: the Australian Sea Lion *Neophoca cinerea*, Leafy Sea Dragon *Phycodurus eques*, Southern Rock Lobster *Janus edwardsii* and varieties of kelp, such as the common kelp *Ecklonia radiata*, crazyweed *Phyllospora comosa* and giant kelp *Macocystis pyrifera*.

Australian SeaLions, Neophoca cinerea*. Photo: Alistair Hobday.*

Most of the Australian Sea Lion population is based in South Australia. They feed on squid, fish, rock lobster, seabirds and shark. As the ocean warms, it is expected the Australian Sea Lion's food supply will reduce, such as smaller adult sizes and less migration of Southern Rock Lobster, and the chance of disease spreading will increase.

Kelp, Ecklonia radiata*. Photo: Graham Edgar.*

Whilst the Australian Sea Lion prefers a particular habitat to breed and are not likely to migrate, certain varieties of kelp are moving south towards cooler waters, and are even disappearing from urban areas like Adelaide. Kelp forests are rich and productive ecosystems, so their migration is leaving behind some marine creatures without a home and food supply. When the kelp moves out, turf-forming algae moves in, which prevents the regrowth of kelp forests.

Leafy Sea Dragon, Phycodurus eques*, Rapid Bay SA. Photo:Graham Edgar.*

Leafy sea dragons, the emblem of South Australia, are very susceptible to environmental disturbances. As their habitat diminishes and the ocean warms they are more likely to suffer in storm events.

Read more about South Australia's changing ecosystem, in response to climate change:

- Marine Adaptation Network's Information Sheet #4. "Climate Change & the Marine Environment: South Australia."
- http://arnmbr.org/content/images/uploads/Information_Sheet_4.pdf
- Marine Climate Change in Australia: Impacts & Adaptation Responses. 2009 Report Card. http://arnmbr.org/content/images/uploads/Report_card_web.pdf
- Trend. Marine Ecosystems.
- http://www.trendsa.org.au/marine

Victorian ecosystem changes

Ecologically, Victoria's marine environment shares many similar fishery resources and habitats with the neighbouring states of Tasmania, South Australia and New South Wales. Victoria's coastal marine environment is influenced by Bass Strait, the East Australian Current (EAC) and the Leeuwin Current. An important feature of Victoria's coastal regions is the seasonal upwelling of cooler nutrient rich waters that stimulate the production of marine life, which is good for commercial and recreational fisheries.

Fish community. Top: Australian herring, Arripis georgianus*. Bottom: Yellowtail Scad,* Trachurus novaezelandiae*. Photo: Alistair Hobday.*

As a result of climate change, water temperatures of the south-west and south-east of Australia are warming faster than other regions. In the last 60 years the EAC has become stronger with warmer, saltier water now found 350 km further south. It is predicted that the Tasman Sea is expected to experience the greatest level of warming in the Australian region. This may lead to a variety of cool-temperate species shifting location southwards, becoming extinct or being replaced by the increased occurrence of sub-tropical and tropical species driven by warmer temperatures.

Seagrass, Posidonia australis. Photo: Graham Edgar.

King George whiting *Sillaginodes punctatus* spawn offshore from Victoria, where the larvae are transported hundreds of kilometres by currents to juvenile nursery areas. Port Phillip Bay is one such nursery and is also home to fish species such as black bream, snapper and sand flathead. Most of the fishing occurs in the sheltered bays and inlets. A pilot study using underwater stereo video showed that juvenile whiting were strongly associated with shallow seagrass beds. Climate change is expected to have a negative effect on seagrass through decreasing light and increased storm intensity and water temperature, reducing ideal habitat for the whiting. Although warming coastal waters may promote growth and survival of whiting larvae as they drift towards nursery areas, the weakening Leeuwin current may hinder the journey of larvae to nursery areas and reduce the population.

Sea Urchin, Centrostephanus rodgersii. Photo: Scott Ling.

It seems the sea urchin, *Centrostephanus rodgersii*, is favoured by these warmer conditions, as it has expanded its habitat and its devastation southwards. Without large fish and rock lobsters to keep their numbers down, the thriving sea urchins overgraze the sea bed leaving it barren of life. Their behaviour has been linked with the reduction of numbers of southern rock lobster *Jasus edwardsii*.

Squid, Sepioteuthis australis, a common cephalopod in the south east. Photo: Gretta Pecl.

Cephalopods are invertebrates with a large head and tentacles such as octopus, squid or cuttlefish and are known to respond quickly to environmental changes. The Common Sydney Octopus *Octopus*

tetricus is an abundant species and important fishery resource in eastern Australia. Until recently it was distributed from southern Queensland to NSW, but as waters have warmed, in the last few years it has been detected off Victoria and the northeast of Tasmania.

Black bream, juvenile. Photo: DPI Fisheries Victoria.

Climate change is also predicted to change rainfall patterns across south-eastern Australia with annual rainfall decreasing. This will influence the flow of freshwater into the estuaries and may reduce the abundance of estuarine species. Estuaries are highly-variable environments and many creatures inhabiting estuaries are capable of tolerating a wide range of physical and chemical conditions, however the spawning and survival success of black bream *Acanthopagrus butcheri* relies on specific estuarine conditions. It is unknown how the ecology of the estuaries will cope with changes in freshwater flows across the state, however research is underway.

To read more about Victoria's changing ecosystem, in response to climate change, read:

- Marine Adaptation Network's Information Sheet #4. "Climate Change, the Marine Environment and Fisheries Adaptation: Victoria."
- http://arnmbr.org/content/images/uploads/Information_Sheet_6.pdf
- Marine Climate Change in Australia: Impacts & Adaptation Responses. 2009 Report Card. http://arnmbr.org/content/images/uploads/Report_card_web.pdf

Information on NSW, Vic and SA 'Redmap' species to be listed on the Redmap Australia website (milestone 1)

a) New South Wales species information

Green Jobfish - *Aprion virescens*

Family: Lutjanidae
Size: Up to 100cm
Habitat: Outer reefs to 100m
Description: Cylindrical torpedo shaped body with distinctive elongated head and large canine-like teeth. Large diamond shaped scales are visible along the body but become smaller and less distinct on the head.
Colour varies between individuals but is generally an olive green to bluish-grey. The belly and lower portions of the caudal fin is a lighter shade of the colour found on the topside. The caudal fin is deeply forked and can have a yellow tinge. When erect, the dorsal fin may have dark spots along the base.
Photo: David Welch

Axilspot Hogfish or Coral Pigfish - *Bodianus axillaris*

Family: Labridae
Size: Up to 20cm
Habitat: Adults in clear shallow waters and lagoons to 10m. Juveniles found in caves and crevices to 25m.
Description: Juveniles are black with large white spots running along both the ventral and dorsal edges. Lips are an opaque white and fin edges are transparent. The eyes are a dark shade of red.
Adults are red-brown anteriorly which diagonally fades to a white posterior. There are three large black spots; one found at the base of the pectoral fin, one on the anal fin and one on the end of the dorsal fin. The fin rays are yellow on transparent fins, especially noticeable in the caudal fin.
Juveniles are commonly observed acting as cleaners to larger fish. Adults have infrequently been noted cleaning larger fish.
Photo: David Harasti

Threadfin Butterflyfish - *Chaetodon auriga*

Family: Chaetodontidae
Size: Up to 20cm
Habitat: Shallow protected reefs and outer reefs to 30m
Description: Common to most butterfly fish, this fish has a pointed mouth and the body is elongated on the dorsal edge forming a rounded rectangle-like shape.
Colouration is a white anterior section merging to yellow on the caudal fin and upper rear of the body. A prominent black band crosses the eyes vertically on both sides. The pattern on the body is composed of diagonally running black bands perpendicularly joining in the centre. Towards the rear of the fish, where yellow is the prominent background colour, the black bands become thicker.
The fish gets its common name from the threadlike yellow filament extending from the soft dorsal fin. This thread grows as the fish matures. Australian species have a black spot at the base of the yellow thread, whereas species from the Red Sea lack this black spot.
Photo: David Harasti

Klein's Butterflyfish - *Chaetodon kleinii*

Family: Chaetodontidae
Size: Up to 15cm
Habitat: Rocky reefs and slopes from 2-60m, but usually below 10m
Description: The body is yellowish brown with two white bars running vertically across the middle. A yellowish-brown bar is present in between the two white bars. The posterior section of the fish is a brighter yellow than the yellow-brown bar. A black bar crosses the eyes. Scales are tipped with light grey/white sections, which give the fish a white spotted look.
In adults a blue line becomes visible running along the edges of the rear section of the dorsal and anal fins. Adults also tend to show a blue tinge to the upper portion of the black band crossing the eyes. The caudal fin tips are transparent.
Photo: David Harasti

Doublesaddle Butterflyfish - *Chaetodon ulietensis*

Family: Chaetodontidae
Size: Up to 15cm
Habitat: Coral-rich lagoons and outer reef slopes to 30m
Description: Rounded rectangle shaped white body with bright yellow rear section. Two large black elongate spots are present on the upper portion of the body, which give rise to the common name of the fish. These black bars are overlaid by evenly spaced vertically running thin black lines. A dark black band crosses the eyes, which are entirely black.
Spines on the dorsal fin are yellow tipped. Caudal fin is transparent on the edges with a black spot at the base. Pectoral fins are also transparent. The anal fin in most individuals has a darker yellow band near the edge.
Commonly found in pairs or small aggregations.
Photo: David Harasti

Yellow-back Puller or Barrier Reef Chromis - *Chromis nitida*

Family: Pomacentridae
Size: Up to 9cm
Habitat: Rocky coastal rocky reefs to 25m
Description: White body with a diagonal black band running from the mouth, crossing the eye and ending at the last ray of the dorsal fin. Above this black band is a yellowish brown section, which gives the fish one of its common names – Yellow-back Puller. The caudal fin has black margins on the top and bottom. Anal fin is transparent with a black tinge towards the lower edge.
Females deposit eggs in the water column just above the substrate. The eggs have a sticky coating and adhere to rocks and coral structures directly below where the female lays them. Males aggressively guard eggs and frequently tend to them. Large aggregations of these fish may dominate an area during spawning cycles.
Photo: David Harasti

Helmet Gurnard or Purple Flying Gurnard - *Dactyloptena orientalis*

Family: Dactylopteridae
Size: Up to 35cm
Habitat: Sandy slopes near deep water. Occasionally found in estuaries in areas with flat sandy bottom. Often found in 10m, but can be up to 100m.
Description: Easily identifiable by the huge pectoral fins which, when outspread, are rounded and spiked. When retracted the pectoral fins sit alongside the body and extend slightly past the tail. The body shape is elongated and box-like. The dorsal fin has been shortened to form one elongated spine that extends from the brow ridge.
Juveniles have a creamy white body with distinct large brown spots. Adults have creamy-white body but brown spots are smaller, more numerous and partially join to form dark areas. In adults the edges of the pectoral fins have thin blue lines running along the margins and are seen when the fins are extended.
The large pectoral fins are used to startle predators or for bursts of speed when vacating areas. The gurnard also has specialised pelvic fins that it can use to 'walk' across the sandy substrate. The fish is active at night and can be found partially buried during the day.
Contrary to the common name, the Flying Gurnard cannot fly. Gurnards get their name from the French word 'gurnard', which means 'to grunt'. Gurnards produce a grunting sound from rubbing bones together in their jaw.
Photo: David Harasti

Bluespotted Maskray or Blue-spotted Stingray - *Dasyatis kuhlii*

Family: Dasyatidae
Size: Up to 200cm in length, 40cm in width
Habitat: Bottom dwelling in sandy areas, usually covered in sand to 20m.

Description: Oval shaped with tail longer than body. Dusky brown-grey in colour on the body. Blue spots adorn the upper body disc and follow no distinct pattern. In some individuals there is dark shading beneath the eyes and on the brow ridge. Tail is grey-white with white banding along the tip. Spines are found on the upper surface around the middle of the tail.
Usually encountered buried in the sand with only the eyes protruding. Easily startled if you come within their immediate vicinity.
Photo: David Harasti

Estuary Cod or Brown-spotted Grouper - *Epinephelus coioides*

Family: Serrandiae
Size: Up to 100cm
Habitat: Can tolerate brackish water. Juveniles reside in estuaries with a sandy/muddy bottom and mangroves. Adults prefer rocky reef to 100m.
Description: Creamy white body with large brown spots that roughly join to form irregular shaped bars that run almost vertical across body. Small orange to golden spots are present in the space between the brown bars. Fins are a semi-transparent brownish colour.
This species is commonly incorrectly identified as Epinephelus malabaricus and Epinephelus tauvina. There is also ambiguity with the species' common name.
Photo: David Harasti

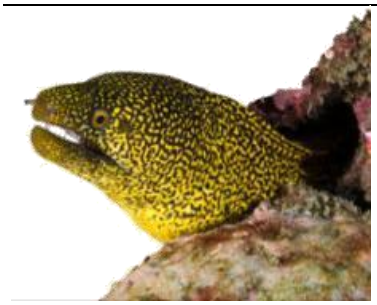
Queensland Grouper or Giant Grouper - *Epinephelus lanceolatus*

Family: Serrandiae
Size: Up to 300cm
Habitat: Shallow coral reefs, wrecks and caves. Occasionally found in estuaries and deep water to 100m.
Description: Juveniles are very secretive and rarely spotted. Reside in caves and crevices in shallow waters. Grey body with dark spots and faint black banding on upper surface covering the dorsal fin. Yellow tail and yellow tips on end of anal and dorsal fins. May also have faint yellow areas between dark banding.
Adults are recognisable by large size, very large mouth and relatively small eyes. Grey to brown dark spotted/speckled body. Adults continue to change colouration with growth through mottled greys, greens and browns.

This species was almost eliminated by heavy fishing pressure before protective measures were developed. Protected in New South Wales under Fisheries Management Act 1994. Listed as Vulnerable on the IUCN Redlist.
Photo: David Harasti

Potato Rockcod - *Epinephelus tukula*

Family: Serrandiae
Size: Up to 200cm
Habitat: Reef channels and seamounts. Also found in deep areas up to 150m. Juveniles inhabit tidal pools.
Description: Long-lived, large greyish brown fish with an elongated head and rounded tail. Large irregular shaped black spots adorn the body. Smaller spots and lines are found on the head and around the eyes. All fins are dark in colour with small dark spots. Older individuals may be almost completely black in colour.
Very inquisitive species and often interacts with divers. Will also accept food from divers hands. Due to their bold nature this fish is easily speared by spearfishermen. The Potato Cod is rarely found in areas where frequent fishing and spearfishing takes place. This species greatly benefits from areas that have some form of protection or legislation that limits fishing activities.
Photo: David Harasti



Abbott's Moray or Stout Moray - *Gymnothorax eurostus*

Family: Muraenidae
Size: Up to 55cm
Habitat: Shallow inshore reefs. Benthic species living in crevices.
Description: Irregular shaped yellow to white spots cover a dark brown body. Some individuals also have small black spots. The body colour gets darker further away from the head due to the presence of more markings. As with all moray species the Abbott's Moray can be found with the head slightly visible at the entrance to a crevice, mouth open showing rows of white pointed teeth and the remainder of the body tucked well inside.
Photo: David Harasti

Moses Perch or Russell's Snapper - *Lutjanus russelli*

Family: Lutjanidae
Size: Up to 45cm
Habitat: Juveniles in mangroves and estuaries. Adults on inner and outer reef and rocky areas to 80m.
Description: Grey-silver to a light brown with a pink tinge. Upper portion of head and back are usually slightly darker than rest of body. An elongated oval black spot is present below the rear of the dorsal fin. Sometimes this spot is quite faint. The pectoral, pelvic and anal fins have yellowish tinges. Juveniles have 4-6 brown horizontal lines running along the body.
Photo: David Harasti

Red emperor - *Lutjanus sebae*

Family: Lutjanidae
Size: Up to 45cm
Habitat: Juveniles in mangroves and estuaries. Adults on inner and outer reef and rocky areas to 80m.
Description: A fish easily identified in the juvenile and young adult stages by the striking markings on its body. Three dark red bands cross the body vertically. One runs from the front of the dorsal fin, through the eye and ends at the mouth. The second runs from the middle of the dorsal fin, crosses just behind the pectoral fin and ends on the pelvic fin (the pelvic fin is the same colour as the band). The third band originates at the rear of the dorsal fin and crosses diagonally to the lower corner of the tail. A small area on the upper tail is also marked with a band, or a spot in some individuals. In large adults the bands connect to become one, making the fish a bright red colour.
Photo: David Harasti

Ear-spot Filefish or Blackbar Filefish - *Pervagor janthinosoma*

Family: Monacanthidae
Size: Up to 15cm
Habitat: Commonly found hiding amongst rocks in lagoons and shallow reefs, to 20m.
Description: Body colouration varies between individuals. Blue frontal area and green rear is common, but light grey, brown and yellow may also be present. An elongated oval-shaped black spot is visible behind the eye. The tail is usually a bright orange or red with light striations and dark banding at the trailing edge. The skin is rough due to tiny scales with a raised, spike-like surface. The first dorsal fin has been altered to form a large spine. Pelvic fin is small. Mouth area is pointed with small lips.
Photo: David Harasti

Tailfin Batfish or Longfin Batfish - *Platax teira*

Family: Ephippidae
Size: Up to 70cm
Habitat: Juveniles underneath floating debris, usually clumps of seaweed. Adults inhabit wrecks and rocky areas in small schools, to 30m.
Description: Juveniles are very distinct boomerang shaped fish. The dorsal and anal fins are greatly extended and curve towards the tail. Pelvic fins are also elongated and extend well below the body. The body is striped with thick black and white vertical bands. One black band crosses directly through the eye.
Adults are light silver in colour. Dark vertical bands have faded from the juvenile stage but are still visible. Body has lengthened and the fish is less boomerang shaped and more triangular. Pelvic fins are yellow. In larger adults the head develops a hump above the eyes.
Photo: David Harasti

Blue Barred Parrotfish - *Scarus ghobban*

Family: Scaridae
Size: Up to 100cm
Habitat: Adults in lagoons and the edges of outcrops to 30m for females, 10m for males. Juveniles in small schools inhabit calm inshore areas.
Description: The Bluebarred Parrotfish undergoes colouration changes as it grows, matures and changes sex. It transitions through two phases – initial (females) and terminal (transition between female and male).
In the initial phase the fish are a yellow to light orange colour with five vertical blue bars. Large individual scales are blue or mottled blue, creating the uneven edged bars. The underside is lighter than the dorsal surface. The tail fin has blue edges on the upper and lower surface.
During the terminal phase males change to a greenish blue colour all over with a lighter area on the underside. Scales through the central region of the body have pinkish edges. Fins are bluish green with pink striped sections. In larger males the tail fin tips are noticeably elongated.
Juveniles are very light brown to off white with faint horizontal lines along the body. When nearing the end of the juvenile stage the five vertical bars start to form.
All parrotfish have fused teeth forming a beak like mouth. This is how the common name of the group was derived.
Photo: David Harasti

Jansen's Wrasse - *Thalassoma janseni*

Family: Labridae
Size: Up to 20cm
Habitat: Coastal and offshore shallow reefs, to 20m.
Description: Unlike many other wrasse species, the colouration of Jansen's Wrasse only undergoes slight changes throughout aging. The body of adults is mostly black with a thick white stripe running from the middle of the dorsal fin to the start of the anal fin. This vertical stripe is fringed in yellow. The base of the tail is white. Most individuals display another vertical white stripe at the rear edge of the pectoral fin. As the fish ages and changes sex into male the band completely rings the body. Larger males develop blue tinges along fin edges.
Photo: David Harasti

White tip reef shark - *Triaenodon obesus*

Family: Carcharhinidae
Size: Up to 215cm
Habitat: Semi-shallow reef areas with rocky caves and sand flats, over 300m - more commonly to 40m. Rests in caves during day. Hunts at night.
Description: The common name is derived from the white markings on the tip of the dorsal and caudal fins. The body is grey, which gradually changes to a white belly. The body has small semi-faded dark spots all over. Head is flattened and the snout is rounded. Eyes are large and grey-white in colour. Teeth are small and do not protrude from mouth. Considerably more active at night whilst hunting.
Photo: David Harasti

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b) South Australian species information

Western wirrah – *Acanthistus serratus*

Family: Serranidae
Size: length to 50cm
Habitat: shallow reefs to 50cm
Description: The Western Wirrah has a pale green-brown body with small spots that merge into lines on the head. They can be up to 50cm long and are commonly found in caves in southwest Australia

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Western Foxfish - *Bodianus frenchii*

Family: Labridae
Size: Up to 48cm
Habitat: coastal reefs 15m-30m deep
Description: Wrasse like, bright red to reddish above and white below with prominent yellow blotches on side, prefers deeper areas and occasionally caught on rod and line, black spots on juveniles.

Loggerhead - *Caretta caretta*

Family: Reptilia
Size: Adult shell length averages 1m
Habitat: They are found in coral reefs and in bays and estuaries in all tropical and sub-tropical oceans in the Pacific and Indian oceans around Australia.
Description: Loggerhead turtles are named for their large head and powerful jaw.
Adults have a reddish brown shell often highlighted with light brown and olive, though this can be hard to see as they are often covered in algae. Their undersides are a contrasting yellow. Carapace is slightly heart-shaped.
Hatchlings have a dark brown carapace and light brown or cream coloured plastron (under part of shell).
Photo: David Harasti

Pineapple fish - *Celeidopus gloriamaris*

Family: Monocentridae
Size: length to 28cm
Habitat: In open estuaries and soft bottom coastal areas
Description: Pineapple fish have a distinctly rounded body covered with a mosaic of yellow plate like scales with black lines between them. They can be up to 28cm long and a occasionally found in caves.

Western hollow or Spined urchin - *Centrostephanus tenuispinus*

Family: Diadematidae
Size: Test diameter to 9 cm, primary spines to 7 cm
Habitat: Is found concealed in open reefs
Description: The urchin is slate grey in colour with thinner spines relative to their length than the closely related black urchin.

Green turtle - *Chelodina mydas*

Family: Reptilia
Size: Adult carapace length averages 1m
Habitat: Tropical and subtropical waters worldwide
Description: Adults have a smooth, high-domed shell that is an olive green colour with occasional brown, reddish-brown or black mottling. This is the largest of the hard-shelled sea turtles and the head is small compared to body size.
Hatchlings have a black carapace with white edges, white edges on their flippers and plastron (under part of shell).
Photo: Toni Cooper

Dolphin fish or Mahi Mahi - *Coryphaena hippurus*

Family: Coryphaenidae
Size: up to 2m in length
Habitat: Dolphin fish are pelagic. They are found in deep offshore waters.
Description: Adult dolphin fish are brightly coloured - metalic blue-green above and silvery-golden below and with flashing iridescent colours that change according to behavioural state. A single dorsal fin extends along the entire body and is dark green in colour. The caudal fin is strongly forked and the head is blunt. Displaying sexual dimorphic growth, mature males develop a prominent bony ridge at the front of the head.

Juveniles are small individuals and have well-defined alternating light and dark vertical bars on the sides of body that continue onto the dorsal and anal fins. Juvenile dolphinfish have white-tipped caudal fins.

Leatherback - *Dermochelys coriacea*

Family: Reptilia
Size: Up to 300cm
Habitat: Leatherback turtles are oceanic and are found in all the oceans of the world. They migrate great distances between cooler feeding grounds rich in jellyfish and tropical nesting beaches.
Description: Leatherback turtles are named for their soft leathery shell, and are the largest sea turtle. Their black shell has 5 ridges running along the length with light spots on it. Hatchlings are black with white markings along carapace ridges and undersides.
Photo: Graham Edgar

Hawksbill Turtle - *Eretmochelys imbricate*

Family: Reptilia
Size: Average carapace length of adults is 0.8 m
Habitat: This species inhabits tropical and some sub-tropical regions in the Atlantic, Pacific, and Indian Oceans.
Found in tidal and subtidal coral and rocky reefs in tropical and subtropical waters of all oceans of the world.
Description: Hawksbill turtles are named for their prominent bird-like beak.
Adults have a brown shell with brown and black patterns. Overlapping scales which is unique to this species. Their undersides are cream coloured with occasional black spots.
They have a distinctive beak-like mouth and narrow head. Hatchlings have a dark brown carapace and plastron.

Pacific Ridley Turtle - *Lepidochelys olivacea*

Family: Reptilia
Size: Adult shell length averages 60 cm
Habitat: Usually associated with the open ocean they may be found in coral reefs and in bays and estuaries in all tropical and sub-tropical oceans.
Description: Pacific ridleys, also known as Olive ridleys have as the name suggests have a pale green shell

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Estuary Perch - *Macquaria colonorum*

Family: Percichthyidae
Size: Up to 60cm
Habitat: Brackish coastal rivers and lakes
Description: Mostly silver, darker grey above, fins are grey except for whitish anal fin. Juveniles are slightly mottled or streaked on sides with dark spot high on operculum. Grow to 60cm and 10kg in weight.

Flatback turtle – *Natador depressus*

Family: Reptilia
Size: Adult carapace length averages 0.9 metre
Habitat: Flatbacks prefer subtidal coastal waters away from reefs. They feed mainly in shallow, murky bays inshore of the outer Great Barrier Reef, and similar habitats around northern Australia.
Description: Names for its flat shell with upturned edges. The carapace is olive green to grey and the flippers and head are grey. Underneath they are a creamy yellow colour. The soft skin covering the carapace is easily damaged and can show the scars of mating or collisions with boats.

Footballer sweep or Western footballer - *Neatypus obliquus*

Family: Microcanthidae
Size: to 24cm
Habitat: Occurs in large schools near offshore reefs between 5-200m deep
Description: White with six distinctive brown edged yellow stripes which occur obliquely across the body and yellow fins characterise this species.

Sand crab or Surf crab - *Ovalipes australiensis*

Family: Portunidae
Size: Carapace width to 105 mm
Habitat: Sandy beaches, to 60m
Description: The sand crab is readily recognised by the two red oval patches located towards the end of the light grey carapace and coarse granules near the front. Males, females and juveniles are similar in appearance.
Photo: PIRSA Fisheries and Aquaculture

Razorfish - *Pinna bicolor*

Family: Pinnidae
Size: Length to 50cm
Habitat: Sheltered sand, to 10m
Description: Mostly silver, darker grey above, fins are grey except for whitish anal fin. Juveniles are slightly mottled or streaked on sides with dark spot high on operculum. Grow to 60cm and 10kg in weight.
Photo: PIRSA Fisheries and Aquaculture

Tailor - *Pomatomus saltatrix*

Family: Pomatomidae
Size: Length to 1.2m
Habitat: Open coasts, estuaries
Description: Tailor are dark blue/green above and silvery to white below, have a yellow eye and broad forked tail. They are similar in appearance to West Australian Salmon and can grow up to 1.2m long.

Blue Swimmer Crab - *Portunus armatus*

Family: Portunidae
Size: Carapace width up to 21cm
Habitat: Sheltered sand, seagrass, to 60m
Description: Blue Swimmer Crabs are generally distinguished by the long spine projecting from each side of the carapace and the fact that their last pair of legs is modified as swimming paddles. Males are blue and have larger claws than females, which are green-brown in colour.
Photo: PIRSA Fisheries and Aquaculture

Banded Sweep - *Scorpis georgiana*

Family: Scorpididae
Size: to 46 cm
Habitat: Coastal with a preference for reefs, caves and ledges to 35m deep
Description: Grey to brownish grey above and silver below with two broad dark bands.

Yellowfin Whiting - *Sillago schomburgkii*

Family: Sillaginidae
Size: To 36cm in length
Habitat: This species is often found in shallow inshore sandy areas such as sand bars and spits.
Description: The body is sandy brown to sandy yellow in colour with yellow ventral fins. The body lacks striping in the adult as is characteristic in other whiting species. Juveniles often have dark blotches on the side.
Photo: PIRSA Fisheries and Aquaculture

Yellowfin Tuna - *Thunnus albacares*

Family: Scombridae
Size: Length to 2.1m
Habitat: Open water
Description: Yellowfin Tuna have yellow dorsal and anal fins which are scythe shaped in larger adults and no striations on the underside of the liver. Distribution crosses over with the Southern Bluefin Tuna and the Albacore.
Photo: PIRSA Fisheries and Aquaculture

Sea snakes

Family: Hydrophiinae
Size: Up to 2m in length
Habitat: can be found in shallow tropical waters
Description: Sea snakes are cold blooded reptiles. With their streamlined, boat-shaped body and flattened, paddle-like tail, sea snakes are well adapted to marine life. Sea snakes vary in size and colour and can reach up to 2m in length.

c) Victorian species information

Western Blue Groper - *Achoerodus gouldii*

Family: Labridae
Photo: Rudie Kuiter, Aquatic Photographics

Eastern Blue Groper - *Achoerodus viridis*

Family: Labridae
Size: Up to 100cm
Habitat: Exposed reef
Description: Males have fleshy lips and are a blue or blue-green colour. One male groper heads a larger school and if he is removed the dominant female changes gender and colour and becomes the new replacement male.
Females are brown with random light spotting/blotches.
Juveniles are grey with similar blotches.

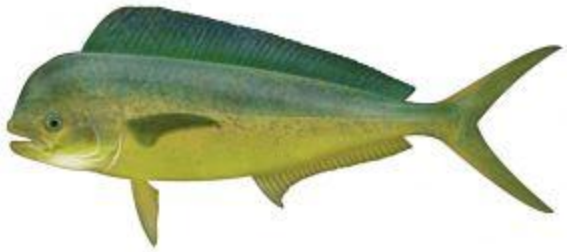
Loggerhead - *Caretta caretta*

Family: Reptilia
Size: Adult shell length averages 1m

Habitat: They are found in coral reefs and in bays and estuaries in all tropical and sub-tropical oceans in the Pacific and Indian oceans around Australia.
Description: Loggerhead turtles are named for their large head and powerful jaw.
Adults have a reddish brown shell often highlighted with light brown and olive, though this can be hard to see as they are often covered in algae. Their undersides are a contrasting yellow. Carapace is slightly heart-shaped.
Hatchlings have a dark brown carapace and light brown or cream coloured plastron (under part of shell).
Photo: David Harasti

Green turtle - *Chelodina mydas*

Family: Reptilia
Size: Adult carapace length averages 1m
Habitat: Tropical and subtropical waters worldwide
Description: Adults have a smooth, high-domed shell that is an olive green colour with occasional brown, reddish-brown or black mottling. This is the largest of the hard-shelled sea turtles and the head is small compared to body size.
Hatchlings have a black carapace with white edges, white edges on their flippers and plastron (under part of shell).
Photo: Toni Cooper



Mahi Mahi - *Coryphaena hippurus*

Family: Coryphaenidae
Size: Up to 2 metres
Habitat: Pelagic open ocean
Description: This species are very bright with colourful blues and yellows which fade quickly upon death. Older male fish have a steep forehead, like a lump (hump headed). They are not at all related to dolphins.

Leatherback - *Dermochelys coriacea*

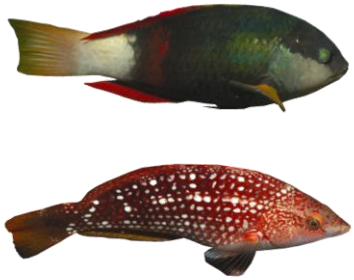
Family: Reptilia
Size: Up to 300cm
Habitat: Leatherback turtles are oceanic and are found in all the oceans of the world. They migrate great distances between cooler feeding grounds rich in jellyfish and tropical nesting beaches.
Description: Leatherback turtles are named for their soft leathery shell, and are the largest sea turtle. Their black shell has 5 ridges running along the length with light spots on it. Hatchlings are black with white markings along carapace ridges and undersides.
Photo: Graham Edgar

Green Moray - *Gymnothorax prasinus*

Family: Muraenidae
Size: Up to about 100cm
Habitat: Reef
Description: This green eel has a yellow brown humped head and green body
Photo: John Keane

Pacific Ridley Turtle - *Lepidochelys olivacea*

Family: Reptilia
Size: Adult shell length averages 60 cm
Habitat: Usually associated with the open ocean they may be found in coral reefs and in bays and estuaries in all tropical and sub-tropical oceans.
Description: Pacific ridleys, also known as Olive ridleys have as the name suggests have a pale green shell



Crimson-banded Wrasse - *Notolabrus gymnogenis*

Family: Labridae
Size: Up to about 50cm
Habitat: Exposed reef
Description: Males have a green body and white tail with the namesake red band across the body and red fins. The females are red to rust coloured with many rows of white dots horizontally along the body. Juveniles are green with white spots.
Photo: Graham Edgar

Gloomy octopus - *Octopus tetricus*

Family: Octopodidae
Size: Can reach an arm span of 2m
Habitat: Adult octopus live in reef environments
Description: You would really have to catch this octopus to easily identify it. Often octopus look like two eyes peering out from a rock crevice. If you are lucky enough to spot this up close, look for its white eyes, brown body and distinct orange underside.
Photo: Rick Stuart-Smith

Harlequinfish - *Othos dentex*

Family: Serranidae
Size: Up to 75cm, although most individuals are smaller.
Habitat: Coastal reefs with drop-offs and caves to about 30 m.
Description: Head large, eyes on top, mouth large with enormous canine teeth at the front of each jaw. Dorsal fin long-based, continuous with a low central notch, anal fin opposite the soft-rayed part of the dorsal fin, pectoral and tail fins rounded. Orange, brownish, greenish-grey or pinkish above, paler below, with large yellow to green blotches on lower sides, bright blue spots or dashes on head and upper side; a large red blotch behind the pectoral; fins yellow, orange or dusky coloured.
Photo: Rudie Kuiter, Aquatic Photographics

Spotted Grubfish - *Parapercis ramsayi*

Family: Pinguipedidae
Size: Up to 20cm
Habitat: In sheltered bays, estuaries and in deeper offshore waters, on sandy or muddy bottoms near reefs at 2-50m. Individuals are usually seen 'perching' on their pelvic fins or 'gliding' just above the bottom.
Description: Pale greyish to brown above, whitish below, with a series of small dark close-set spots forming a line along the upper side; large black spots or blotches along the lower side; upper side of tail base with a large black spot; front of dorsal fin with a dark area; caudal fin with a broad dark margin. Juveniles have yellowish to orange blotches along lower sides and a black spot surrounded by a white margin on the tail base.
Photo: Rudie Kuiter, Aquatic Photographics

Southern Blue Devil - *Paraplesiops meleagris*

Family: Plesiopidae
Size: Up to 33cm

Habitat: Coastal reefs, especially in deeper off shore areas, usually in caves or under ledges at 3-45m.
Description: Head bluntly rounded, dorsal and anal fins greatly elongated posteriorly, almost reaching end of large rounded tail. Pectoral fins large, rounded; pelvic fins elongate, produced at tips. Dark blue to bluish-grey with a dense covering of small brilliant blue spots, sometimes with faint dark bars on sides; edge of lower gill membrane brilliant blue, large adults with blue ring low on each operculum; anterior margin of pelvic fins and distal margins of dorsal, anal and caudal fins brilliant blue. Juveniles have large black areas posteriorly on dorsal, anal and caudal fins.

Leafy Seadragon - *Phycodurus eques*

Family: Syngnathidae
Size: Up to 35 cm
Habitat: Around rocky reefs amongst kelp and other macroalgae, and in sheltered bays amongst the seagrass Posidonia, in 5-40m.
Description: Body highly contorted and compressed, encased in bony plates and covered in many complex leaf-like appendages and broad stiff spines. Resemble floating seaweed, especially when swaying back and forth like kelp in the surge. Males brood the developing eggs on the underside of the tail just behind anal fin.
Photo: Graham Short

Cobia - *Rachycentron canadum*

Family: Rachycentridae
Size: Up to about 2m
Habitat: Often seen at or near the surface accompanying large rays and sharks; rarely in temperate waters; 0-200m.

Description: Slender fishes with a broad, flattened head without dorsal sucking disk and a protruding lower jaw; long-based dorsal fin preceded by short separated spines; anal fin similar with a slightly shorter base; front of soft dorsal and anal fins distinctly higher than rest of fin; caudal fin concave in adults with a longer upper lobe, fin rounded in juveniles. Dark brown above with two narrow white stripes along sides from head to tail base of tail, underside pale; large adults with a single stripe along the upper side.
Photo: Rudie Kuiter, Aquatic Photographics

Details of the membership of NSW, Vic and SA scientific panels that will validate observations submitted to the website (milestone 2)

a) New South Wales scientific panel

Assoc Prof Natalie Moltschaniwskyj is a marine ecologist/biologist working at the University of Newcastle, she is part of the Marine Science group doing research and teaching at the Ourimbah campus on NSW Central Coast. She decided that she was going to be a marine biologist the day she put a mask and snorkel on and put her head underwater. She is lucky enough to have worked in a diversity of Australia's marine environments from the tropics to Antarctica. Not only is she curious about where marine animals live and what they do, she loves learning about the processes that are responsible for what she sees underwater. She carries out research on a range of species, but usually the molluscs (mussels, oysters, abalone), and she has a passion for the cephalopods (squid, octopus and cuttlefish).

Dr Hamish Malcolm is a research scientist with the NSW Government, mainly working on marine biodiversity and marine parks. He's been based in the Solitary Islands Marine Park for the past decade, which is a very interesting place to work as there is an incredible mix of tropical, subtropical and temperature species due to the influence of the East Australian Current. He loves the latitudinal gradient there are in Australia, and has also worked as a marine scientist in Townsville and Tasmania. He's interested in all things to do with the sea, but particularly fishes and sharks and their ecology and conservation. He is very interested in changes to biodiversity associated with oceanographic and climatic changes.

Dr David Powter is a Senior Lecturer at the Central Coast Campus of the University of Newcastle with a background in marine ecology and biology. He has a long held fascination for the ocean and its organisms and this lead him to diving almost 30 years ago. A significant part of this is a strong interest sharks and rays in terms of understanding their life histories as well as their conservation and management needs. His research focuses mainly on coastal sharks and rays, with a particular emphasis on the Port Jackson shark.

David Welsh is a fisheries biologist and an avid spearfisher, who has spent many years living and working in the tropics and diving on the Great Barrier Reef. Through 20 years of fisheries work and 30 years of underwater fishing across Australia and overseas he has an intimate knowledge of many key fisheries species. Currently based near Coffs Harbour on the northern NSW coast he works as an independent scientist and spend many hours in the water. The northern NSW coastline represents an area where tropical and temperate fish species overlap seasonally. He is well placed to identify Redmap species of interest that appear from further north and he is looking forward to observing and reporting them himself.

Dave Harasti is a marine scientist in Australia working on threatened marine species (sharks, seahorses and fish) for the past 12 years. He currently works as Research Scientist for the Port Stephens-Great Lake Marine Park and in his spare time finishing a PhD on the biology, ecology and conservation of the White's Seahorse (*Hippocampus whitei*). He has been diving for 15 years and in that time he developed a passion for marine life and underwater photography. In particular he focuses on photography of unusual and rare marine species which has resulted in hundreds of images used in various fish and nudibranch identification guides. He has developed the Marine Species Database (www.speciesspotlight.com) and a website (www.daveharasti.com) to assist divers in identifying the marine species they may encounter on their dives.

Dave Jones is relatively new to the world of marine research. He has completed a Bachelor of Science degree double majoring in Marine Science and Sustainable Resource Management through the University of Newcastle. His honours project is looking at *Filicampus tigrus* (Tiger Pipefish) around the Port Stephens area. The Redmap project encompasses many of his interests, such as scuba diving, alternative information gathering methodologies, species identification and educating the community in aspects of marine science. He believes that initiatives like this are vital to engaging people in the science of climate change.

Dr Alan Jordan is a marine ecologist with NSW Department of Primary Industries that leads a research group examining the spatial and temporal patterns of biodiversity throughout NSW marine waters. His particular focus is on seabed habitat mapping and benthic biodiversity assessment using acoustics, and towed and autonomous video systems. These have been applied to a large range projects concerning environmental and marine resource assessment in

NSW. At present he is involved in a project specifically assessing the structure and biomass of fish assemblages on coastal reefs along the NSW coast using baited video systems.

Dr Mark Hamann is a senior lecturer at James Cook University, teaching into the Environmental Management degree. His research interests primarily relate to the biology and management of marine and freshwater turtles. He is currently involved in four main fields of research (1) assessing the vulnerability of marine turtles to climate change and coastal development (2) understanding the role of marine turtles in coastal environments (3) understanding mechanisms of turtle dispersal and distribution and (4) research associated with development of community-based projects for monitoring and management of marine turtles in Torres Strait. Most of his research involves working alongside Government agencies, Indigenous communities and NGOs to strengthen management options for marine turtles in Australia. He is a member of the IUCN Marine Turtle Specialist Group, serving as a Regional Vice Co-Chair for the Australasia region and a current member of the Scientific Advisory Committee for the IOSEA marine turtle MoU.

b) South Australia scientific panel

Paul Rogers, research scientist, has worked on a range of research projects over the past nine years including the population assessment of a range of pelagic fishes, seabirds and marine mammals. These projects have involved conducting research in offshore shelf waters of the Great Australian Bight (GAB). He also co-supervised a field program aimed at assessing benthic performance indicators for the GAB Marine Park's Benthic Protection Zone. His main area of expertise is in the life history and ecology of pelagic finfish and sharks. He has extensive experience in the analysis of spatially-related fishery and ecological data.

Assoc. Prof Tim Ward, science leader, has a range of interests including fish biology/ecology and stock assessment, especially of pelagic fishes, the ecological effects of fishing, especially by-catch and interactions with protected species. Other interests include conservation and sustainable use of benthic and pelagic ecosystems and research management and provision of policy advice to government.

Tim Ward is currently the Science Leader Fisheries Program within SARDI Aquatic Sciences. In this role, Assoc. Prof Ward leads and manages research on all of South Australia's fisheries and is the principal scientist for the Sardine Fishery

Dr Greg Ferguson, estuarine fisheries leader, has extensive experience conducting stock assessments of finfish and bivalve fisheries. Much of his work has been conducted in the Lakes and Coorong region of South Australia, specifically regarding gear interactions with non-target species in net fishery, abundance and distribution of pipis and development of a harvest plan for pipi.

Current and recent projects include the biology, ecology and stock structure of mulloway (*Argyrosomus japonicus*); gear interactions of non-target species in the Lakes and Coorong gill net Fishery and the development of survey methods to estimate abundance and distribution of pipis (*Donax deltoides*).

Dr Adrian Linnane has a wide range of skills and experience that have been developed working as a marine biologist and fisheries scientist. Since moving to SARDI, Dr Linnane's areas of active research centre around the development of stock assessment approaches for the South Australian rock lobster (*Jasus edwardsii*) and giant crab (*Pseudocarcinus gigas*) resources. He is responsible for delivering the annual stock assessment reports for these fisheries and also

directs the annual puerulus monitoring, voluntary catch sampling and fishery independent monitoring surveys. More recently, Dr. Linnane has worked closely with managers from PIRSA fisheries in developing the new Management Plans for both the Northern and Southern rock lobster fishery resources.

Dr Cameron Dixon is the Subprogram Leader of Inshore Crustacean fisheries research. He has led this research team since September 2004. Prior to this he had accumulated 11 years of experience in abalone research. Cameron has a wealth of experience in the design and conduct of sub-tidal and trawl fishery surveys in the temperate waters of Southern Australia. In particular he is knowledgeable in survey techniques used for fishery-independent abundance estimation, but also has vast experience in experimental design of novel research

c) Victorian scientific panel

Dianne Bray is a keen SCUBA diver and ichthyologist, she's been interested in the marine environment for most of my life – and love telling people about Australia's diverse and often unique fishes. As Senior Collections Manager at Museum Victoria, and previously at the Australian Museum, she has been fortunate to have surveyed fishes throughout much of Australia and elsewhere in the Southwest and Eastern Pacific. Along with Dr Martin Gomon and members of the OzFishNet consortium, she is currently working on *Fishes of Australia*, an online resource for anyone interested in Australian fishes. She is also updating information on the Australia's fish species for the Australian Faunal Directory, and is an author and editor of *Fishes of Australia's Southern Coast*, published in 2008.

Dr Martin Gomon's position as Senior Curator (Ichthyology) at Museum Victoria has allowed him to continue his lifelong interest in the marine environment. Over the years, his work has involved a number of diverse projects documenting and promoting Australia's diverse and often unique fish fauna. These studies have provided numerous opportunities to travel throughout Australia and to other parts of the world, cooperating with colleagues of many countries. He, along with other members of OzFishNet, is currently developing *Fishes of Australia*, an online resource for anyone interested in Australia's rich fish fauna. He is also Deputy Chair of the Australian Barcode of Life FISHBol Project, and is principle author and editor of *Fishes of Australia's Southern Coast*, published in 2008.

Dr Julian Finn is a Senior Curator of Marine Invertebrates at Museum Victoria. His primary research focus is the study of cephalopods - octopuses, squids, cuttlefishes and nautiluses. He is currently researching blue-ringed octopuses (genus *Hapalochlaena*), in a project funded by Museum Victoria and ABRS. Blue-ringed octopuses are among the most venomous marine creatures in the world, yet very little is known about them. While only four species are formally recognised worldwide, preliminary surveys indicate at least 15 species with half living in Australian waters. He is a keen SCUBA diver and underwater photographer, with a passion for macro (close-up) photography, and is involved diverse projects revealing and promoting Victoria's unique marine environment. Ongoing projects include documenting the biodiversity of Victoria's marine parks and authoring several guides to marine life published by Museum Victoria. Photo: Gary Cranitch

d) Turtle validating scientist (SA, NSW, Vic and Tas)

Dr Christine Fury first worked with dolphins, dugongs and whales but now embraced sea turtles and she has come to appreciate all marine life from small copepods to great white sharks and everything in-between. She is fascinated by how far turtles travel and how their time in the ocean between their birth on a beach to coming back to the same beach to breed is relatively unknown. She is hoping through the Redmap project to learn about some unexpected aspects to sea turtle distribution.

A description of the Redmap Australia website and database, including details of region-specific pages (milestone 3)

The development of an on-line system for Redmap Australia required considerable technical advances over the original Redmap (Tasmania). This was driven by six primary criteria:

1. Users must be able to readily access content and data specific to their local region without undue searching of the site.

2. Users must be able to readily access information (eg. species, map) specific to their region when they log a sighting.

3. Scientists who are verifying sightings must be able to do so quickly and effectively without undue workload.

4. Regional administrators must be able to work independently from other regional administrators with user and sighting data specific to their region.

5. Sighting validation workflow must be significantly automated.

6. Data services must be geographically capable (ie. Ability to serve map data and perform spatial queries).

Underpinning these criteria was the knowledge the system must be capable of working in a distributed manner (where web administrators and scientists will be contributing from most states of Australia) and with a potential 30x increase in the number of users (and therefore recorded sightings) that must be managed efficiently and effectively with minimal staff overhead.

Technically, this represented a significant departure from the capabilities of Redmap (Tasmania) and a decision was made to build Redmap Australia as a completely new system rather than attempt to reuse the existing code base.

The newly developed website utilises the following technologies:

- SQL Server 2008 R2 (chosen specifically for its spatial capabilities, performance characteristics and compatibility with other University systems).

- Django web framework (chosen for its ability to rapidly deploy database applications and its flexible and widely supported extensibility model).

- Geoserver (a Geospatial Consortium software for serving map tiles).

- Openlayers (a Geospatial Consortium software for presenting maps and associated data)

Functionally, the web site was built with the following features over and above those features available in Redmap (Tasmania):

- Redevelopment of the Content Management System to allow content to be "tagged" for specific regions and species groups and output to be filtered based on tagging. This allows a user, after selecting their local region, to predominantly receive only information of interest to them.

- Implementation of a semi-automated workflow to maximise efficiency of sighting validation by scientists and minimise the commitment required by scientists and administrators for working on the site. Expanding Redmap to a national audience represents a potential 3000% increase in sightings recorded requiring distributed management of data at significantly higher volumes than experienced in Tasmania. A semi-automated workflow is the only reliable method for ensuring none of the parties contributing to Redmap is unduly burdened with data management tasks.

- Development of a Decision Support Matrix to assist scientists and administrators to validate sightings in a consistent and timely manner. This tool operates by presenting the scientist with a number of questions that result in a determination of a valid or invalid sighting. This results the classification of the sighting as valid/invalid and provides a pre-written response to user. The scientist may override the outcome of the determination made by the Decision Support Matrix and may edit the email response before sending.

- The introduction of spatial analysis and mapping capabilities for: improved display of sightings and known species ranges; improved display of region specific data; automation of sightings logged that fall within known species distribution range and enabling preliminary analysis and reporting of sightings. All of these functions were managed manually in Redmap (Tasmania).

The following pages outline the *design* and *functionality* of the website including:

- Page layout design as it will be implemented in the final website (final look of website pages)

- Screen shots of the existing functional alpha test web site

- Database schema diagram (full schema available on request)

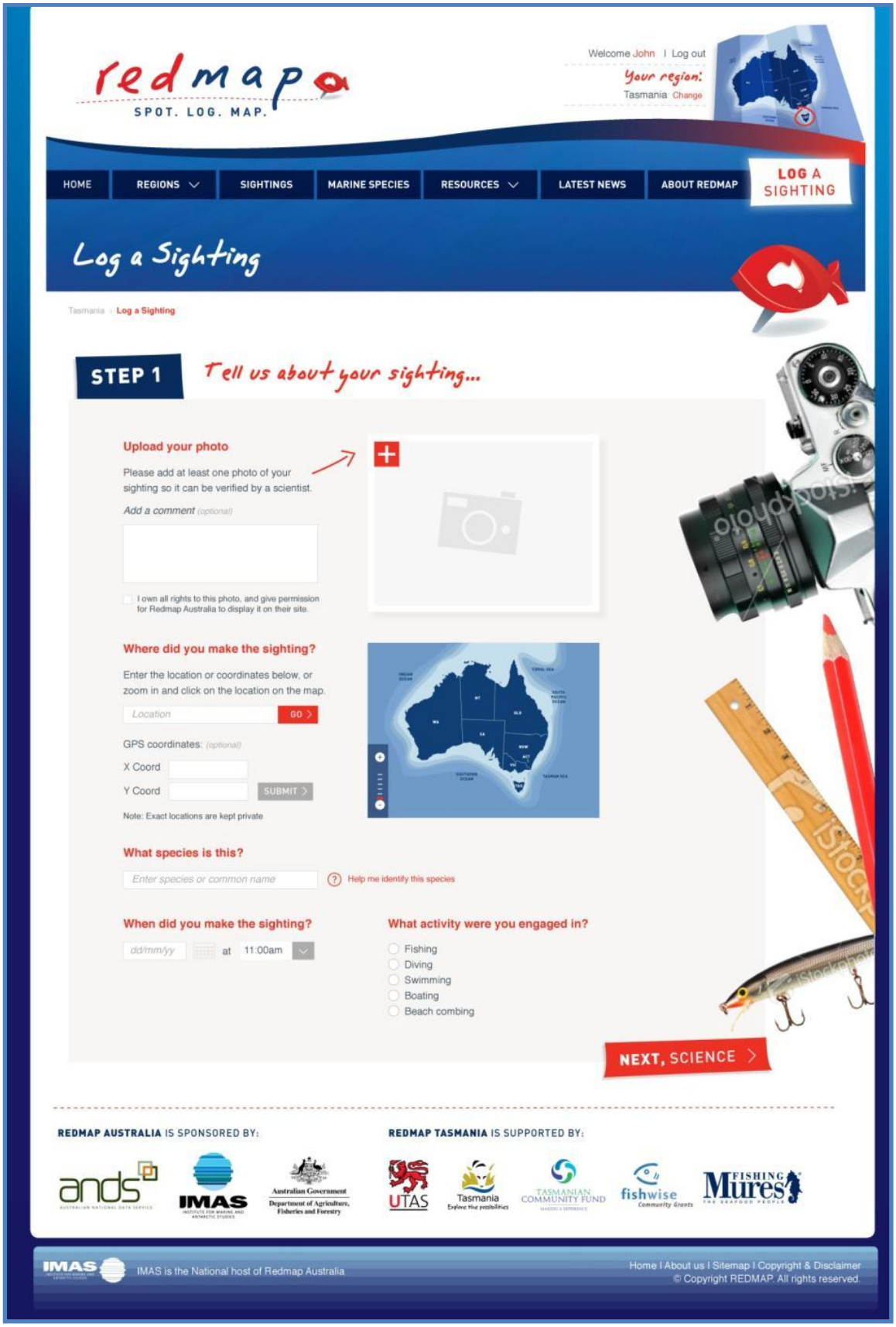
- Sighting validation workflow diagram

Page Layouts demonstarting final page design

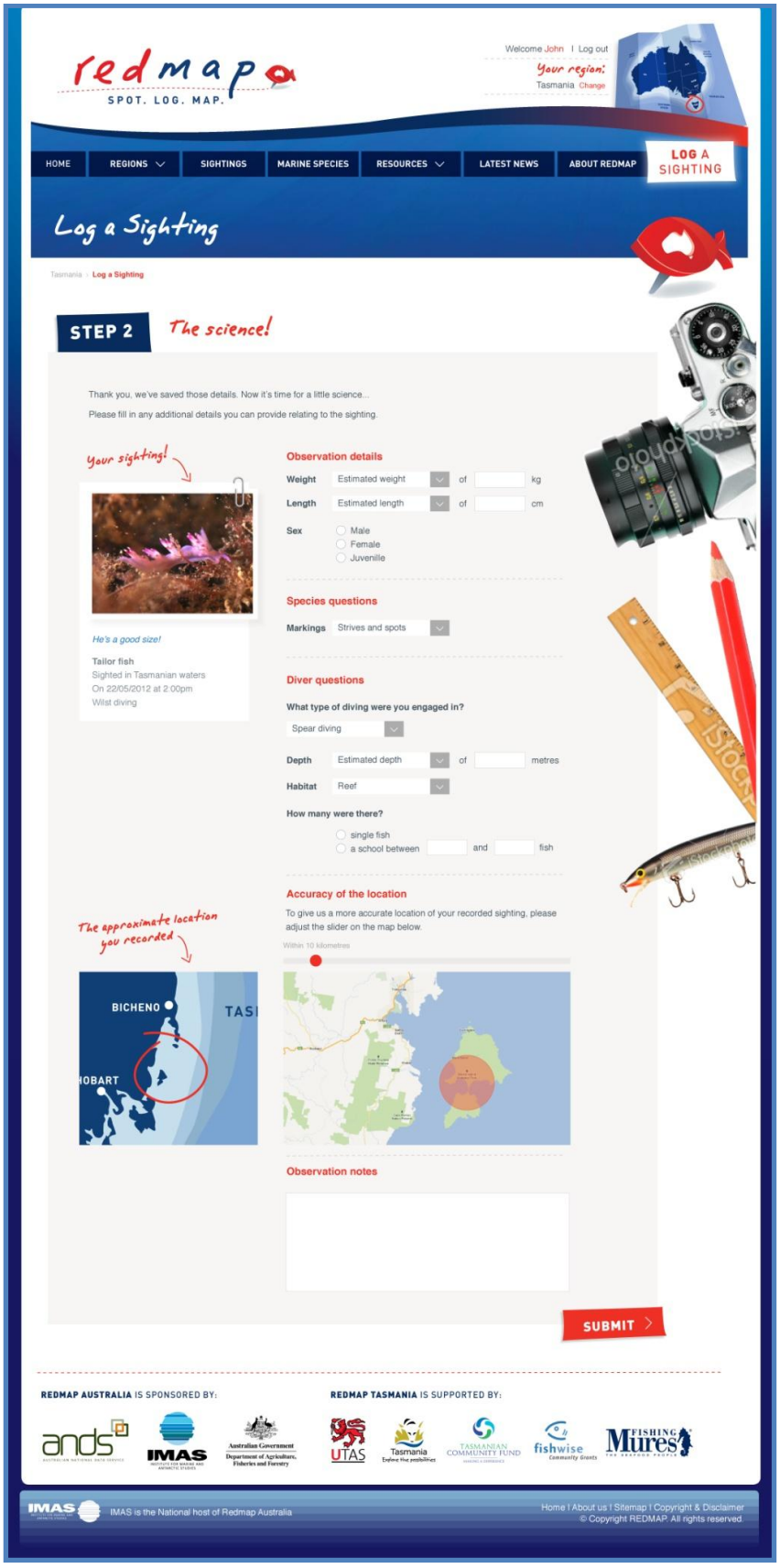
Website description – viewing sightings across the whole of Australia (data points)

Website description – viewing sightings across the whole of Australia (pictures)

Website description – logging pages example (1)

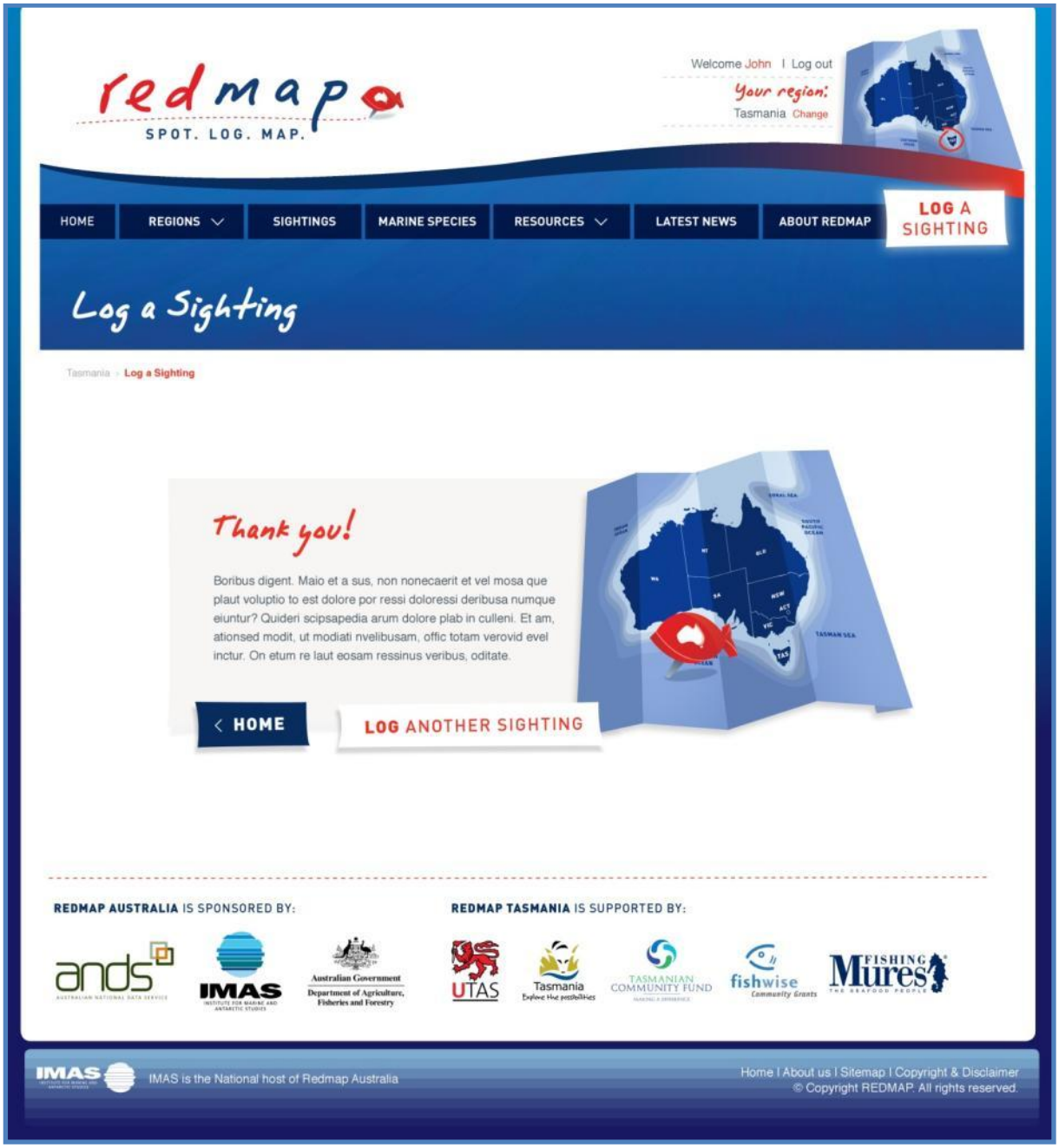


Website description – logging pages example (2)



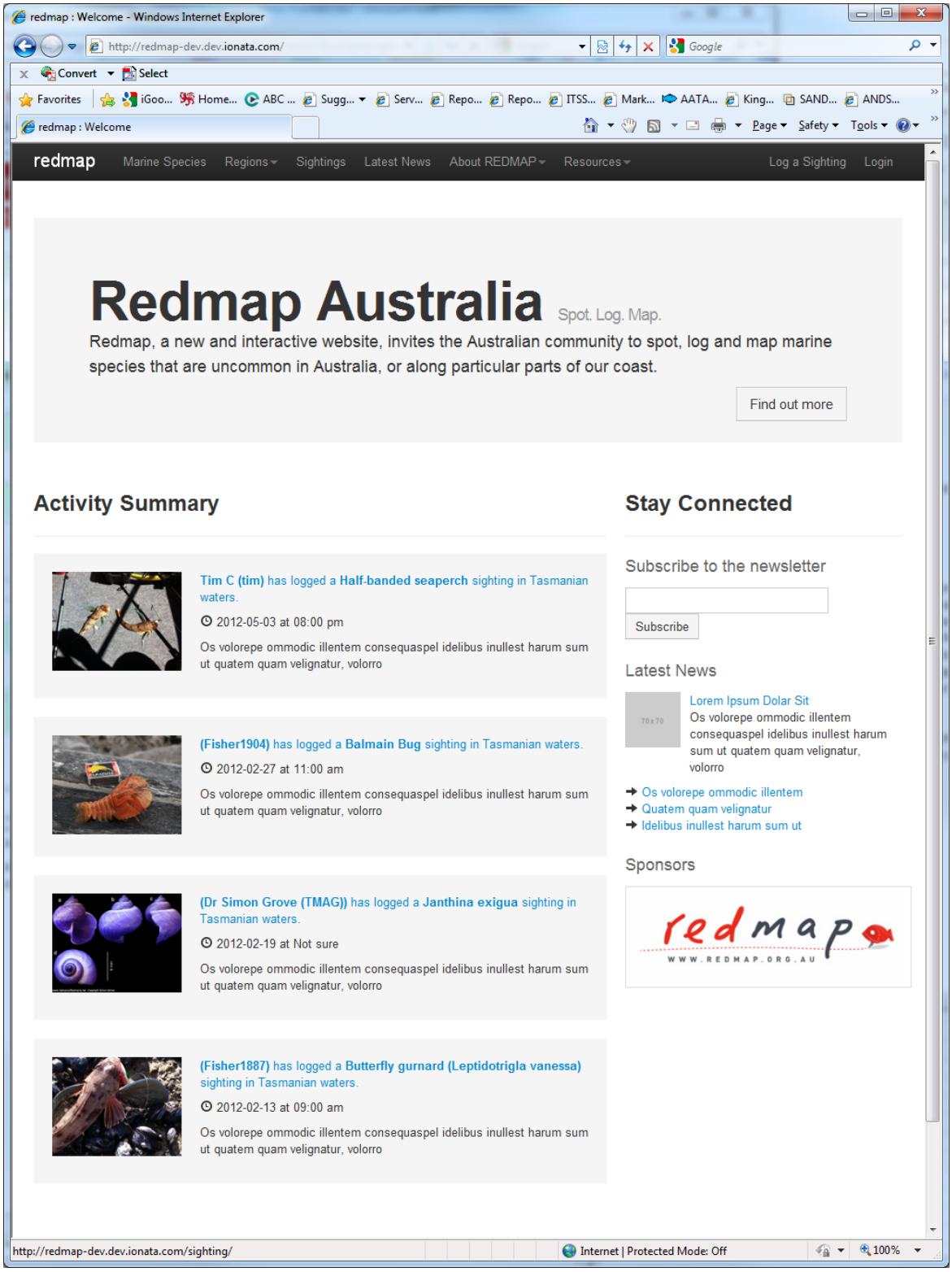
Regional landing page example (NSW)

Website description – acknowledegement of sighting submission

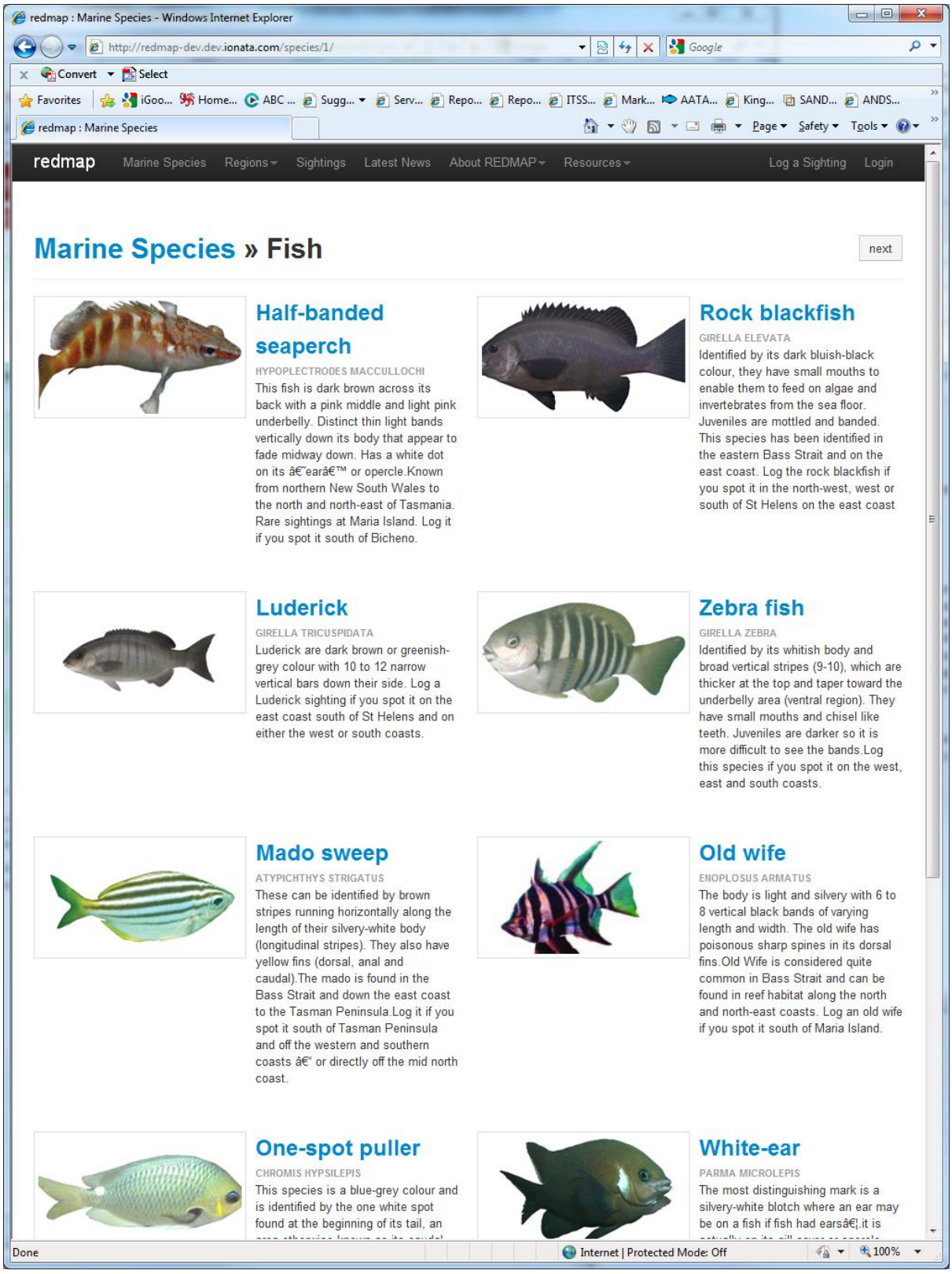


Screen shots of test website (design yet to be over laid on top of this structure)

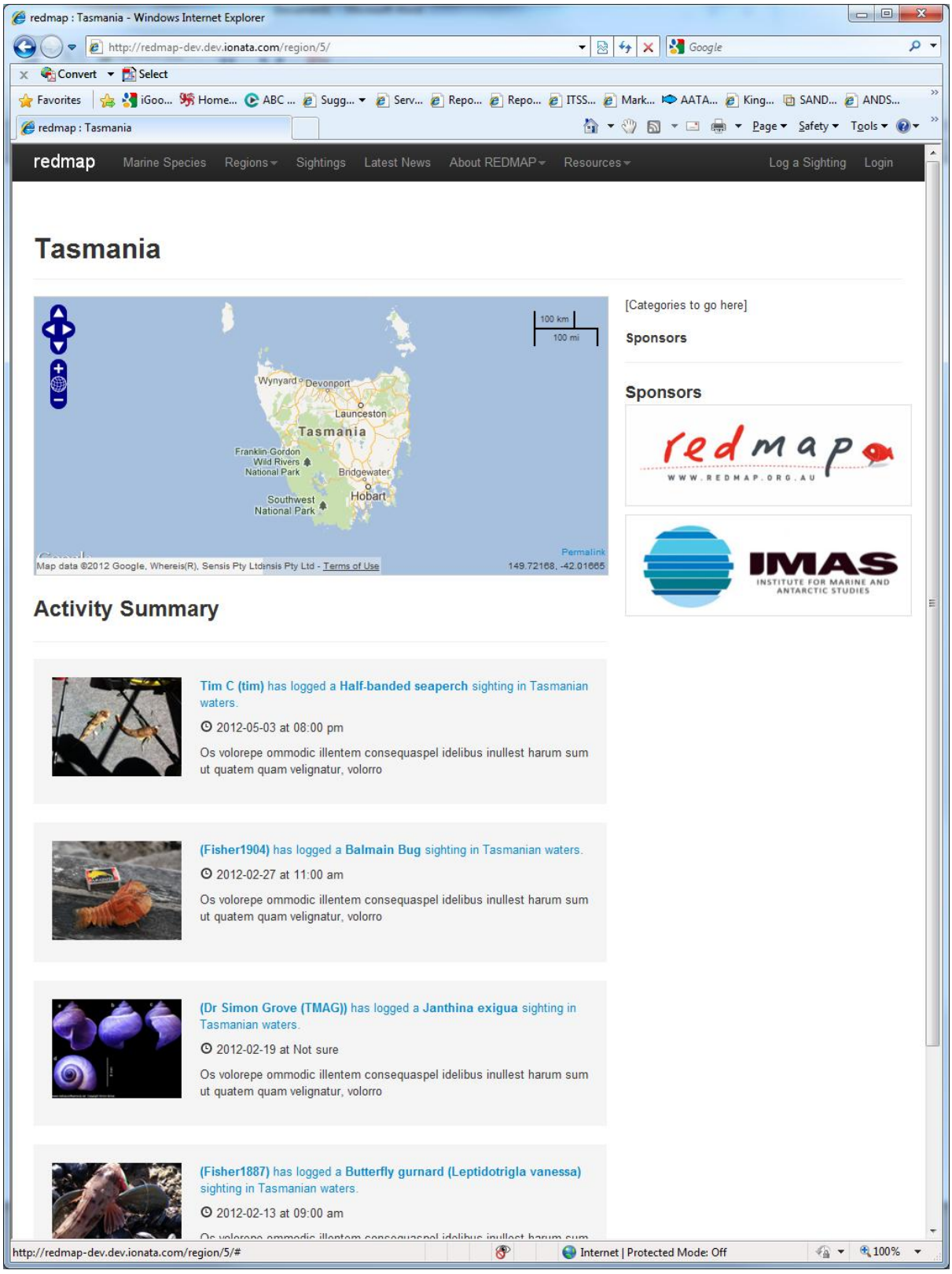
Home Page



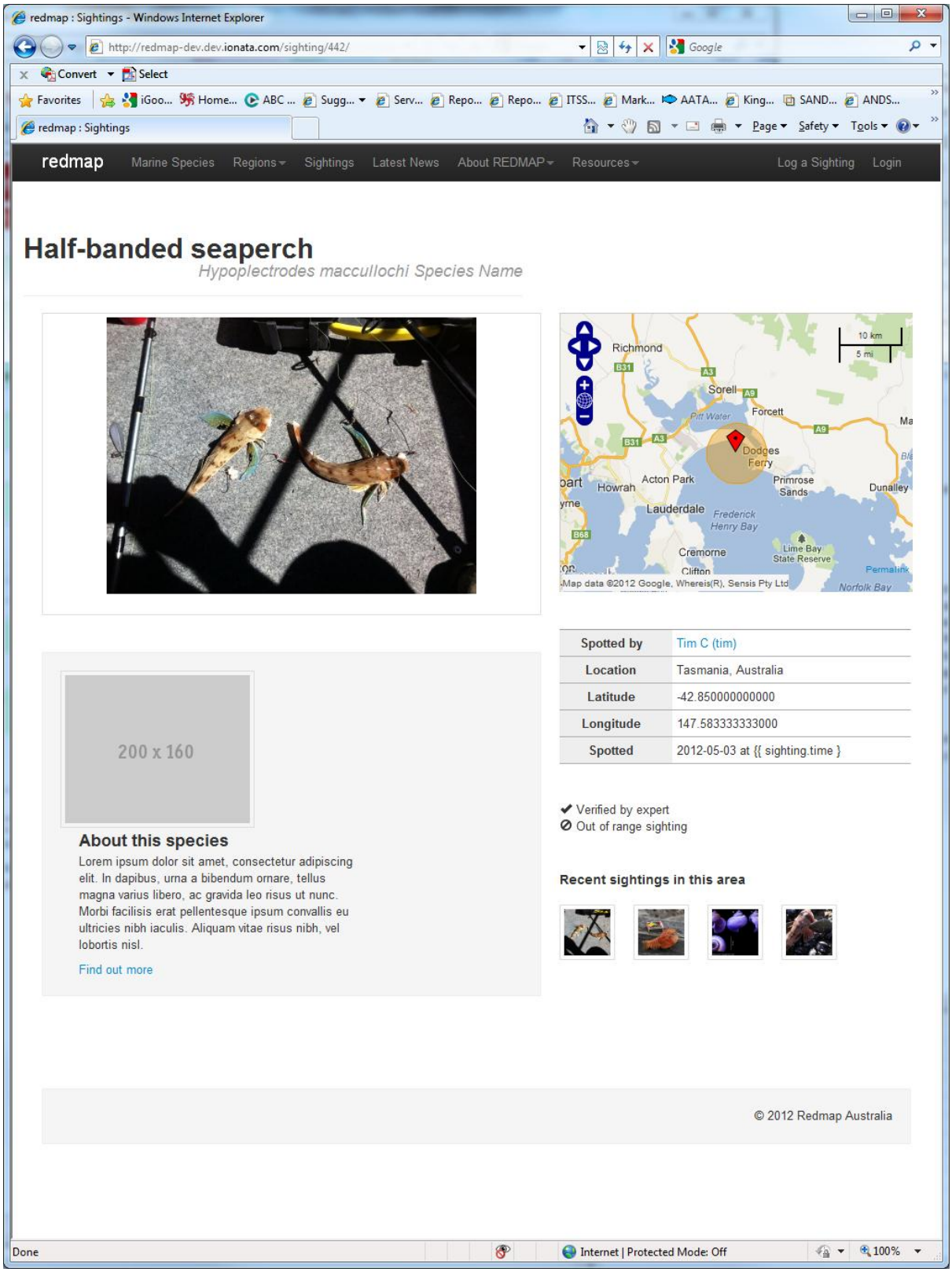
Marine Species of Interest



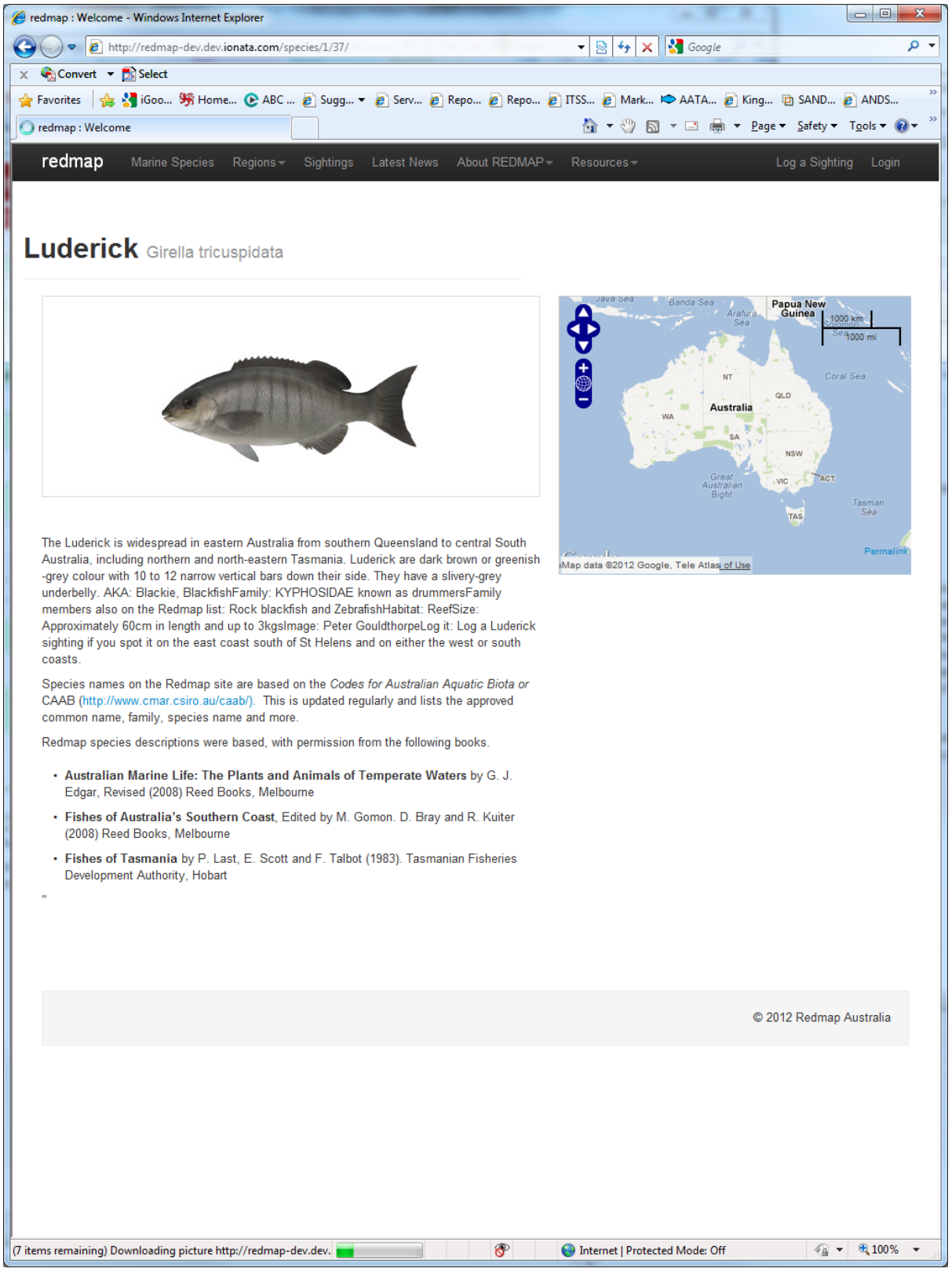
Regional Landing Page Example



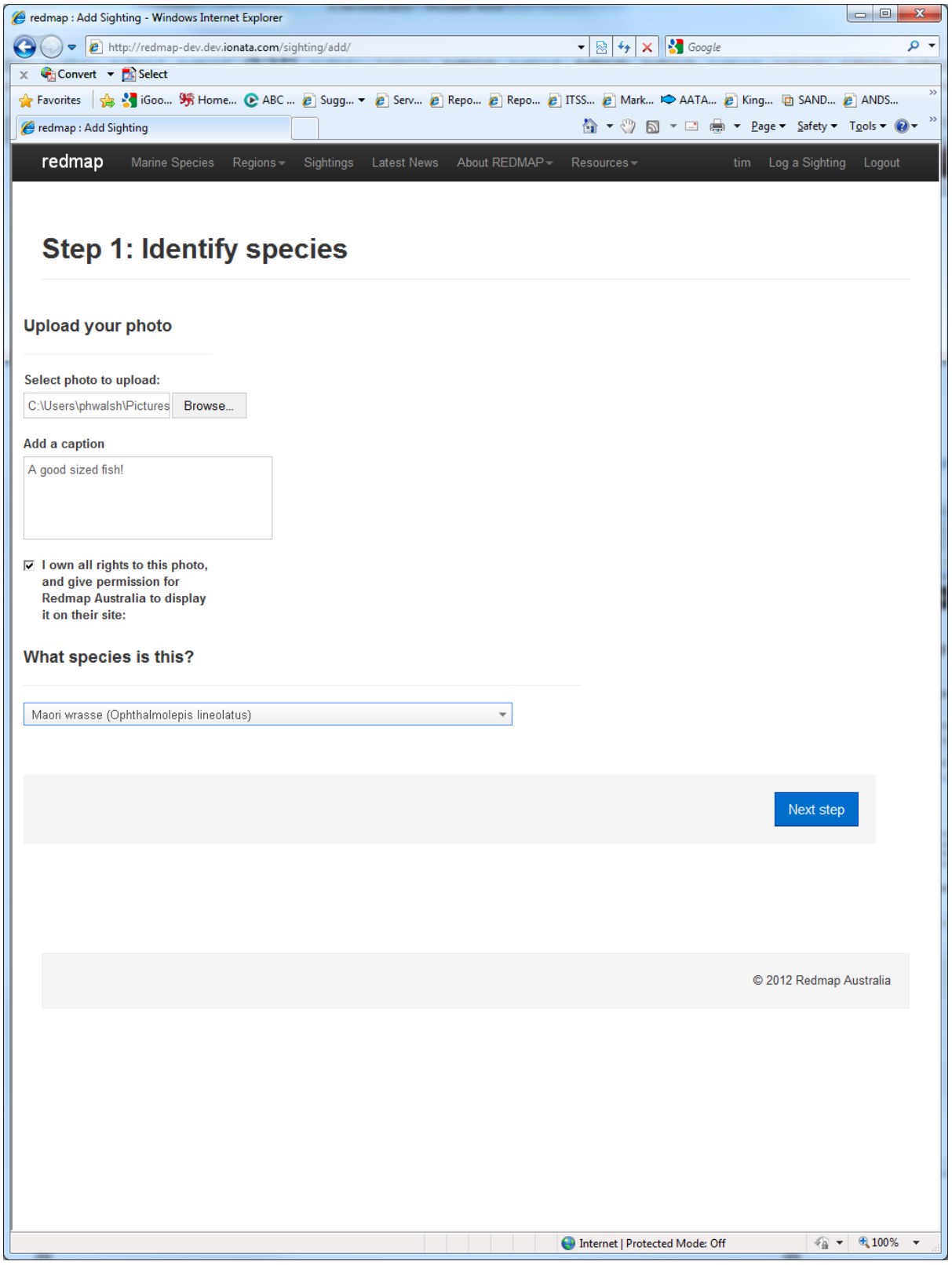
Sighting detail



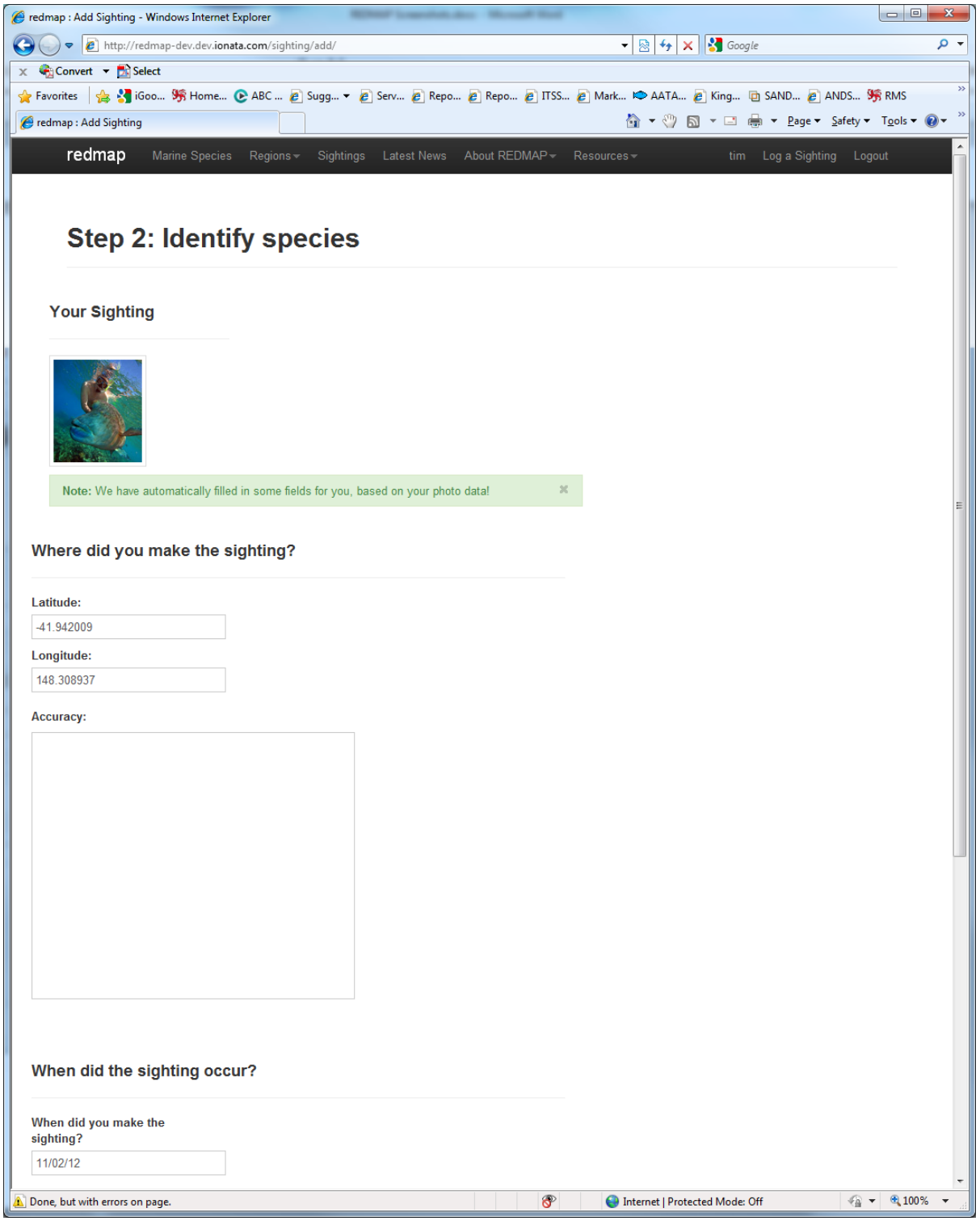
Species Information Example



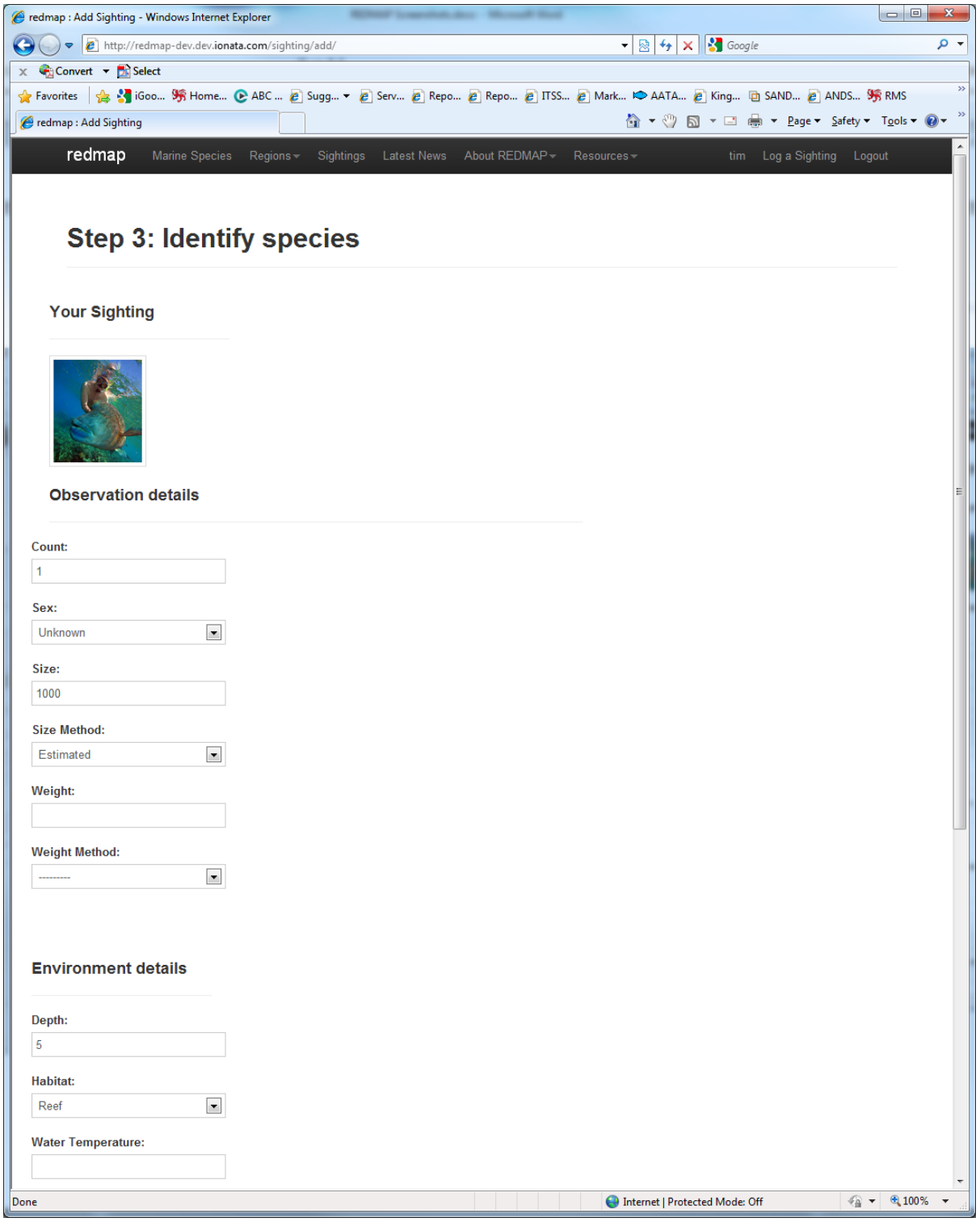
Log a Sighting – Step 1



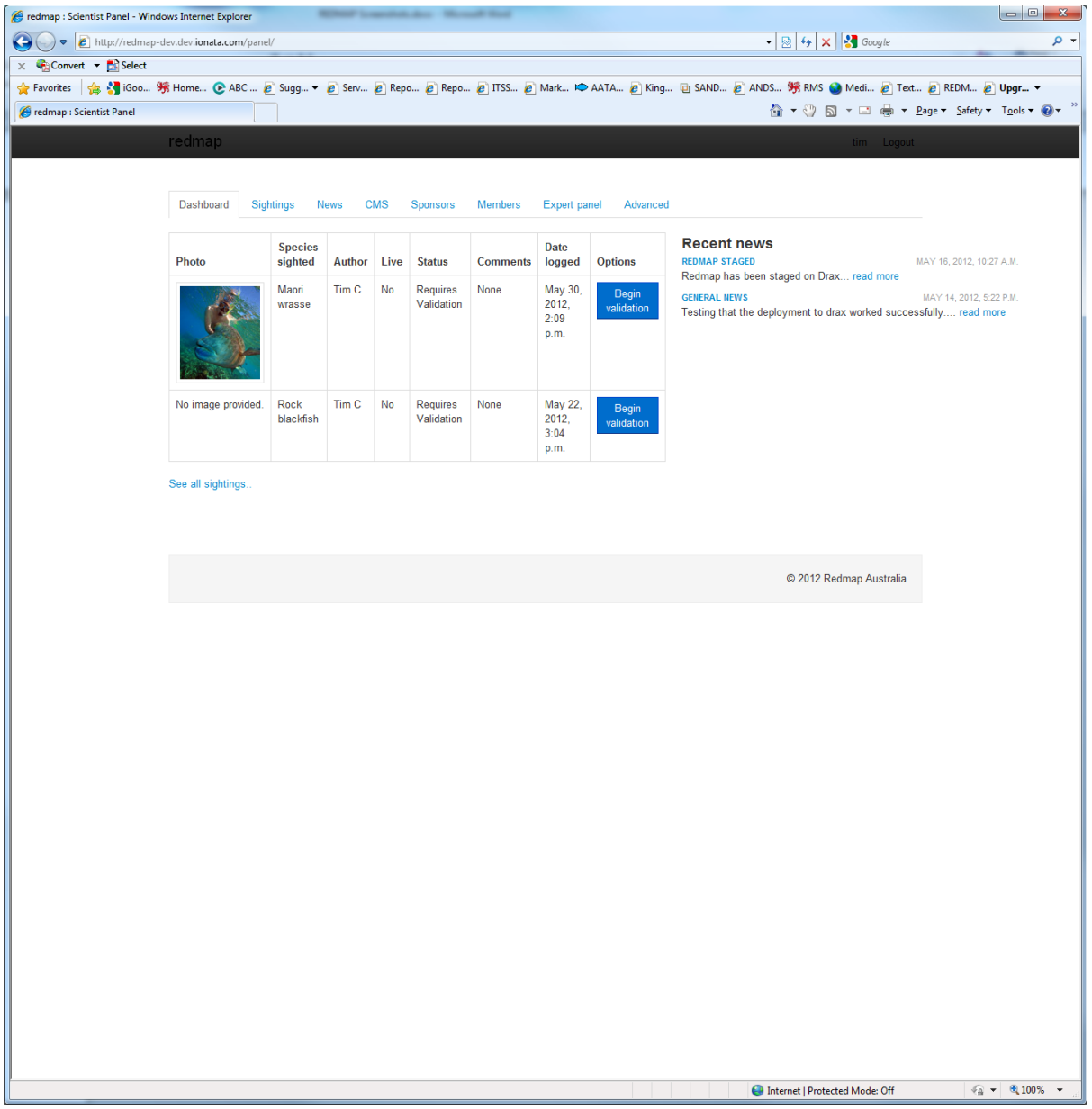
Log a Sighting – Step 2



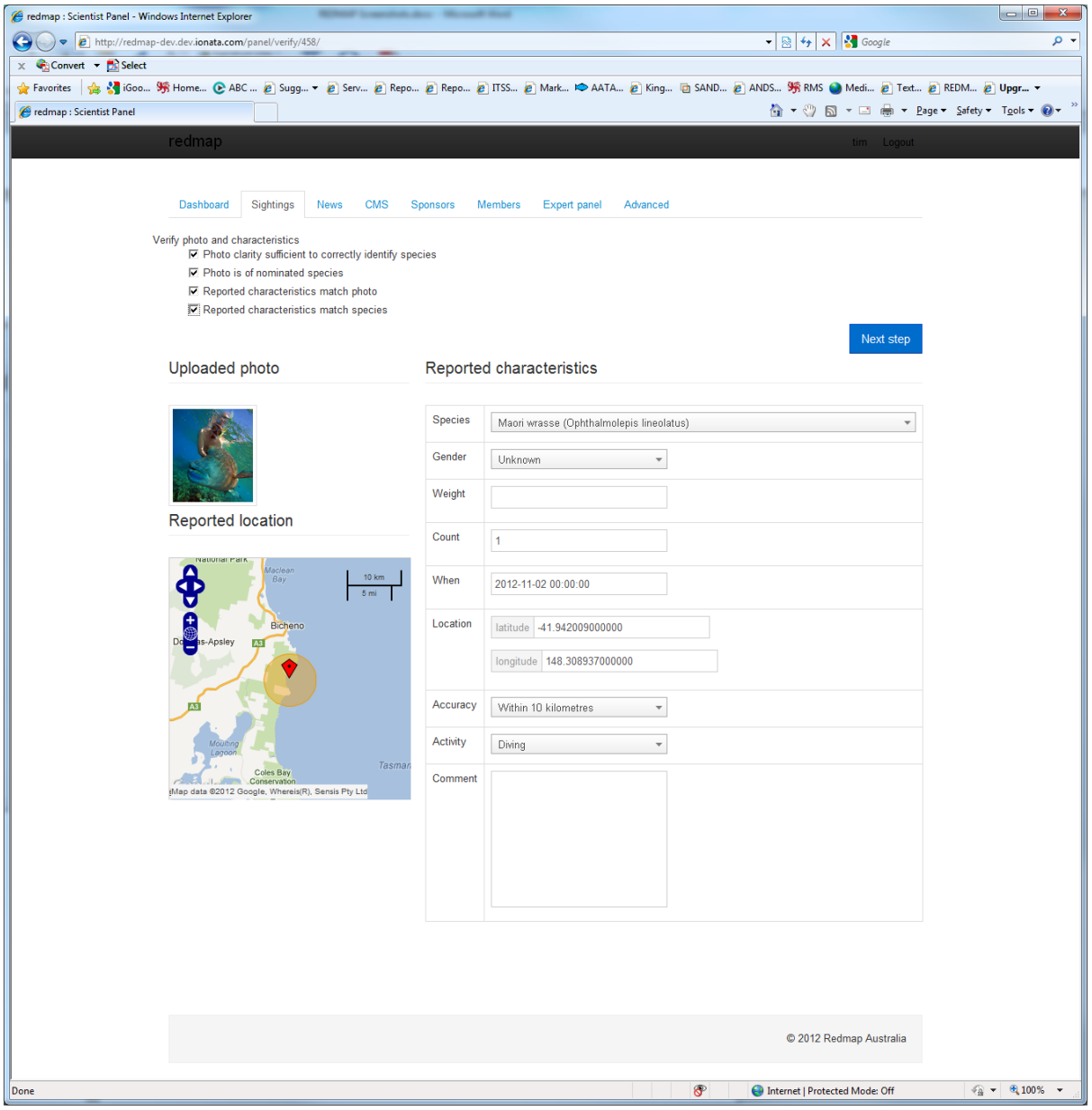
Log a Sighting – Step 3



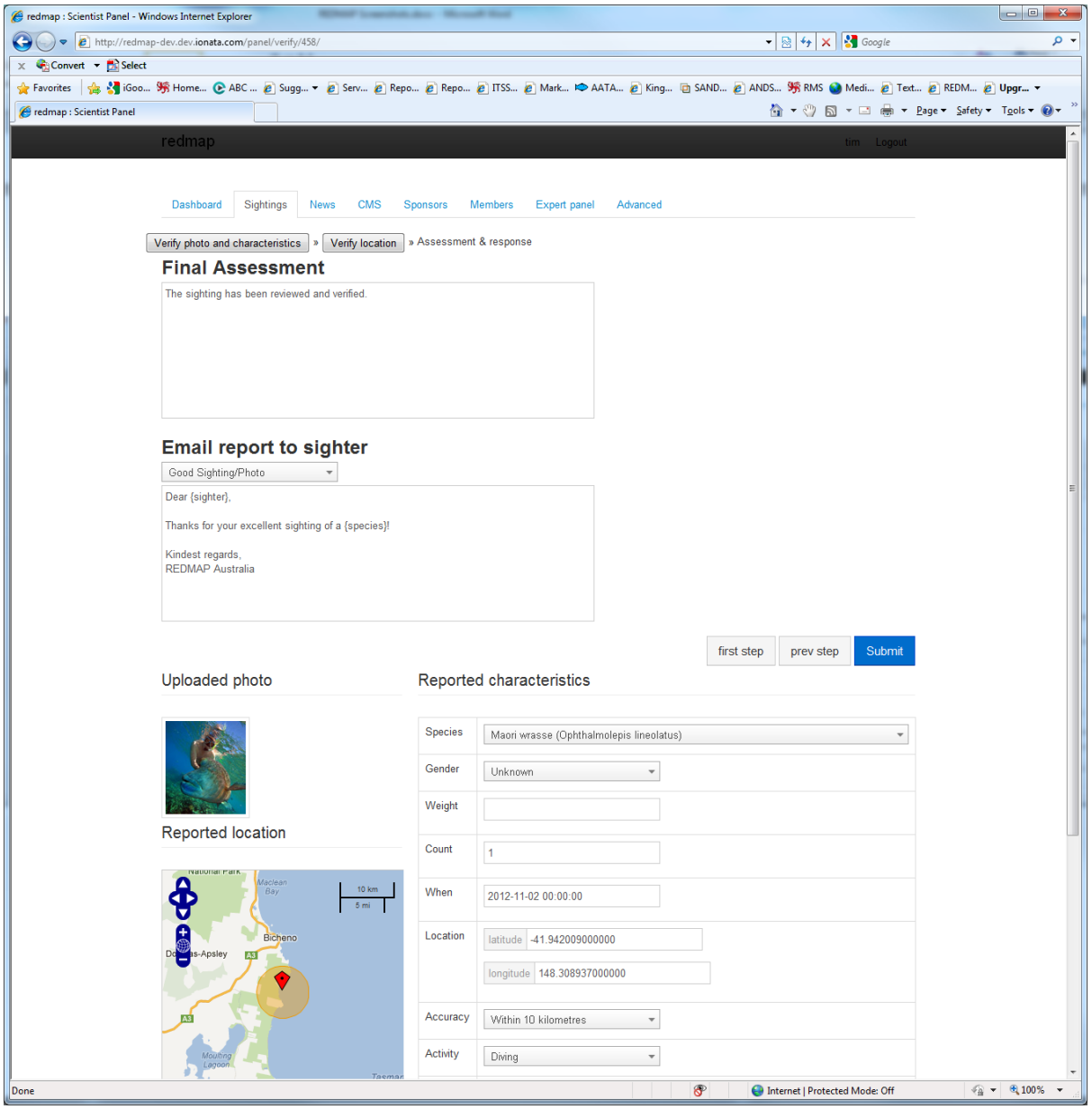
Sighting Management Dashboard – Un-validated Sightings List



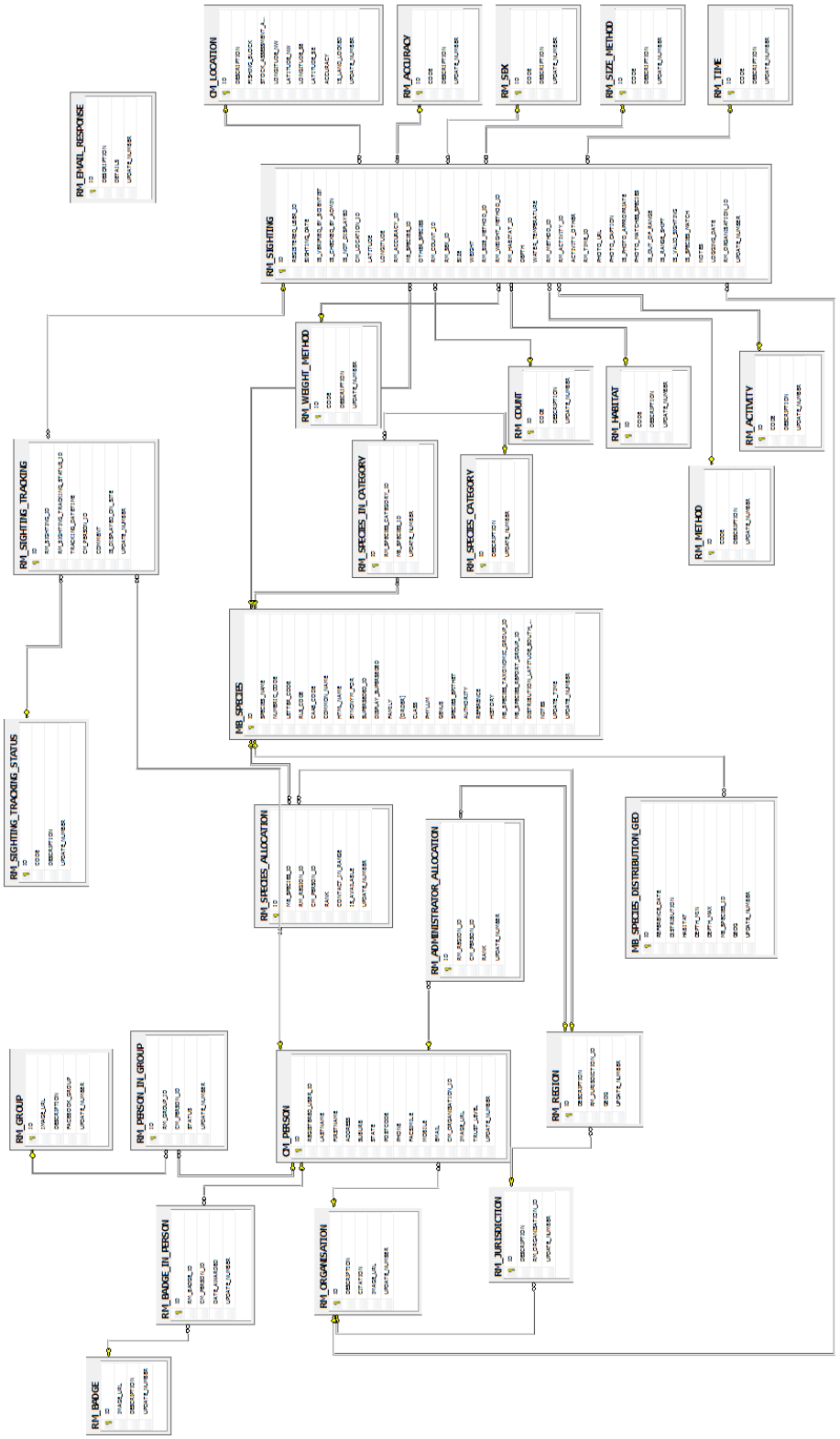
Sighting Management Dashboard – Sighting Validation Wizard 1



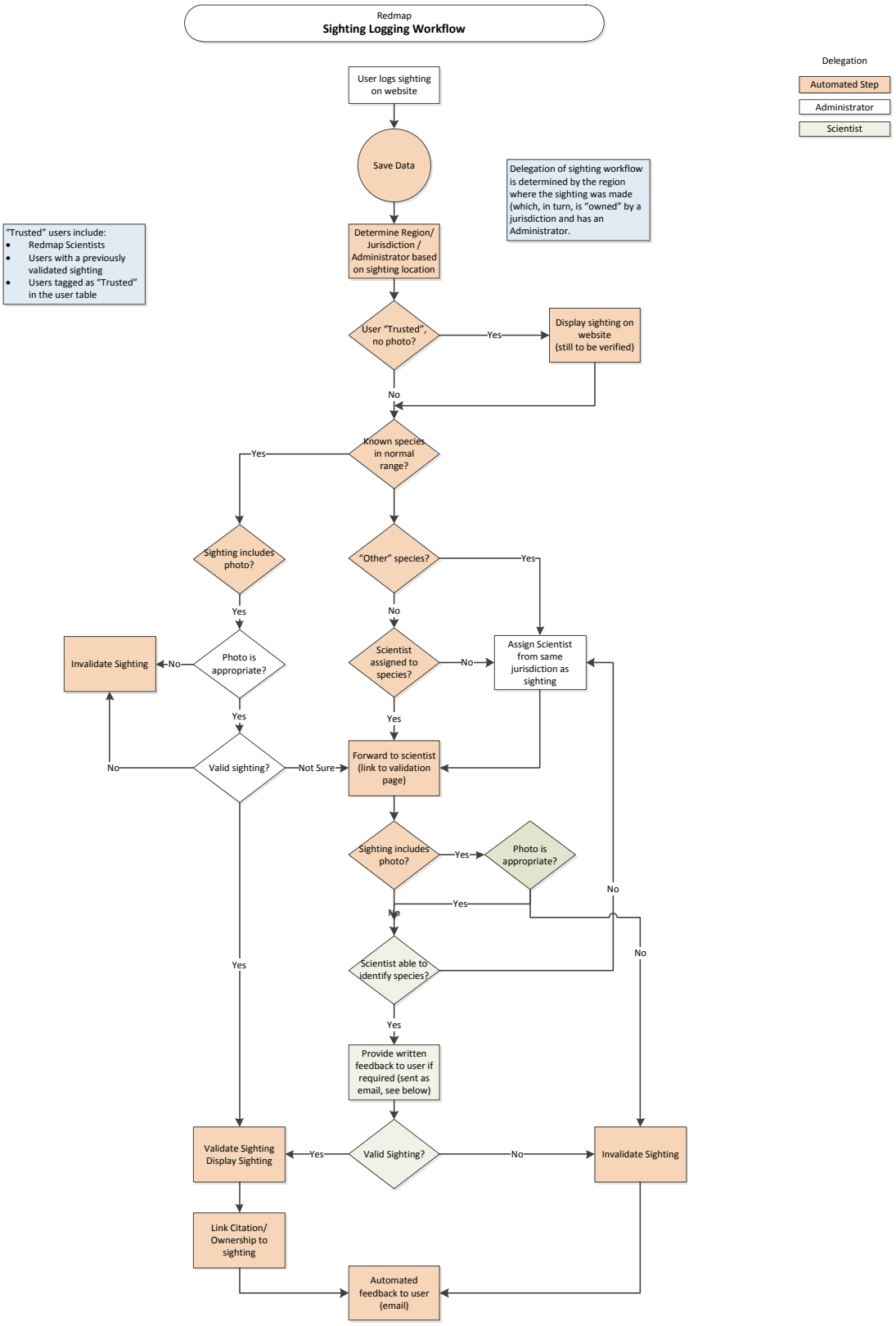
Sighting Management Dashboard – Sighting Validation Wizard 2



Database Schema Diagram



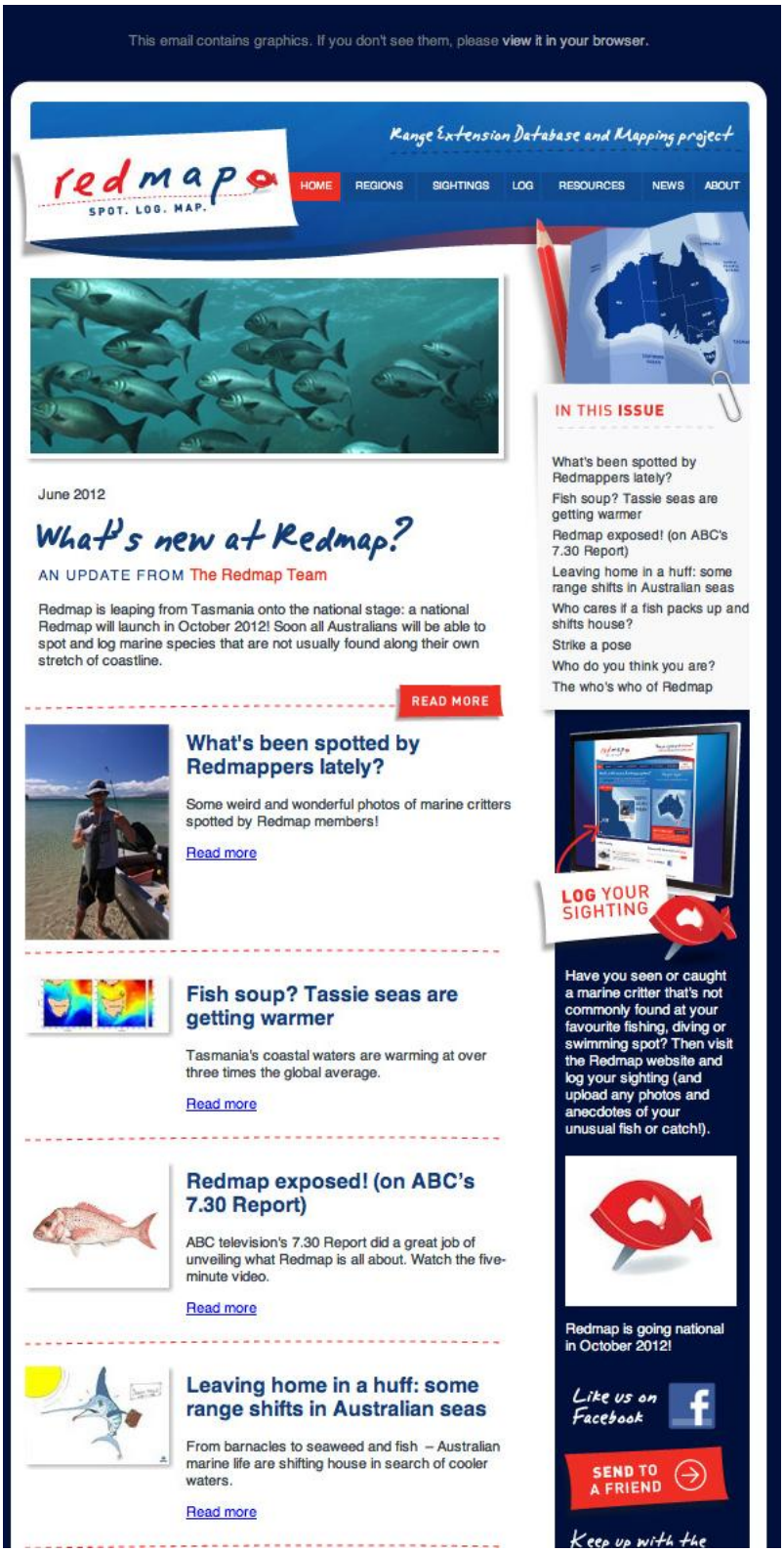
Sighting Validation Workflow



Redmap Australia ‘pre-launch’ quarterly electronic newsletter (milestone 4)

Redmap Newsletter to be released now on June 12 to coincide with the Inspiring Australia announcement

Newsletter design



latest at Redmap

Email JOIN

Who cares if a fish packs up and shifts house?

Marine range shifts can bring new opportunities - as well as a few issues - for recreational and commercial fishers, marine ecosystems and human health.

Read more

Strike a pose

Diver and underwater photographer Adriaan van Huissteden reveals some of his secrets for taking a great shot for Redmap (hint: fish can't say 'cheese').

Read more

Who do you think you are?

What do a student, a professional diver, and a draftsperson have in common? Redmap! We profiled some of the citizen scientists behind the Redmap project.

Read more

The who's who of Redmap

The main players and sponsors behind a national Redmap.

Read more

WHAT IS REDMAP.ORG.AU?

The Redmap website invites you to share sightings of fish and marine critters that you think are 'uncommon' and do not usually live along your coastline. Over time, Redmap will use your 'citizen science' data and photos to sketch a picture of Australian fish and marine species that may be extending their distribution range – a.k.a shifting house - in response to changes in the marine environment, such as warming seas.

Redmap allows Australians to collect their own marine data, share stories and upload photos of 'unusual' sightings. Redmap is science created by the people for the people.

WWW.REDMAP.ORG.AU

REDMAP AUSTRALIA IS SPONSORED BY:

ands AUSTRALIAN NATIONAL DATA SERVICE

IMAS INSTITUTE FOR MARINE AND ANTARCTIC STUDIES

An Australian Government Initiative

Inspiring AUSTRALIA

Australian Government Department of Agriculture, Fisheries and Forestry

REDMAP AUSTRALIA IS HOSTED AROUND AUSTRALIA BY:

JAMES COOK UNIVERSITY AUSTRALIA · Northern Territory Government · Government of South Australia · el arenal · Tasmanian Community Fund · The University of Newcastle Australia · Government of Western Australia Department of Fisheries · NW

CONTACT REDMAP call (03) 6227 7277, or email enquiries@redmap.org.au

IMAS IMAS is the National host of Redmap Australia

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Newsletter articles

These articles will be formatted nicely on the website with photos – and delivered via the electronic newsletter format also attached. But they are in Word format here for reporting purposes:

What's new at Redmap: Redmap is flying the coop!

What's been spotted by Redmappers lately?

Redmap exposed! (ABC 7.30 report on Redmap)

Leaving home in a huff: unusual range shifts in Australian seas

Fish soup? Tassie seas are getting warmer

Who cares if a fish packs up and shifts house?

Strike a pose: photographing fish and marine life for Redmap

Who do you think you are?

The who's who of Redmap Australia

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These articles are detailed in the following pages.

What's new at Redmap: Redmap is flying the coop!

By the Redmap Team

Redmap is leaping from Tasmania onto the national stage: Redmap Australia will launch in October 2012! Soon all Australians will be able to spot and log marine species that are not usually found along their own stretch of coastline.

For more than two years, many Tasmanians have taken up a new marine sport: spotting uncommon fish and critters for Redmap!

And the main goal? Exploring which species are on the move in Tasmanian seas.

And now Redmap is on the move: by October 2012, Redmap will be launched around Australia. Soon all Australians will be able to log onto www.redmap.org.au to share sightings and photos of marine species that are not usually found at their local fishing, diving or swimming spot. Redmap Australia is keen for sightings of any marine life you consider uncommon along your coastline – and not just fish but also turtles, sharks, rays, crayfish, corals, seaweed, urchins and prawns, to name a few.

From little projects big ones grow…

Redmap was launched as a Tasmanian pilot project in December 2009. The community sightings are mapped on the website, often with photos and information about the sighting and species. Over time, Redmap will sketch a picture of which species may be 'moving house', or extending their usual range, as we experience changes in the marine environment such as warming seas.

So far Redmap members have logged more than 400 sightings of 70+ marine species including eastern rock lobster, yellowtail kingfish, Maori wrasse and zebra fish – all spotted further south than usual. We have 700+ subscribers to the Tasmanian Redmap newsletter and our community sightings have been included in three scientific papers. And we've scored a few awards along the way (including a Whitely Award and the Vice Chancellor Award at UTas for Outstanding Community Engagement).

So why super-size Redmap?

With such a positive response, Redmap was destined for the national limelight. Redmap Australia will still be found at www.redmap.org.au but with a revamped look and sections for each State and Territory. Redmap members will help monitor Australia's vast coastline, providing an early indication of marine 'range shifts'. The citizen science data will also highlight regions and species that appear to be experiencing more range shifts, so that research can be focused into these areas.

Redmap Australia will still be asking: are marine critters shifting their range as the marine environment changes? We hope Australian fishers, divers, swimmers and boaters will help answer this question.

This newsletter is dedicated to exploring what a range shift is; what's been spotted by 'Redmappers' lately and introducing you to some of Tasmania's 'citizen scientists'.

If you have any queries about Redmap please don't hesitate to contact us on enquiries@redmap.org.au.

Happy fishing, boating and diving,

The Redmap Team

Ps The expansion of Redmap around Australia was enthusiastically embraced and developed with the support of Redmap Australia's lead host, the Institute for Marine and Antarctic Studies (IMAS) at the University of Tasmania; and our main sponsors: the Australian National Data Service (ANDS), the Australian Government's Inspiring Australia initiative and the Australian Department of Agriculture, Fisheries and Forests (DAFF). Redmap will be hosted by institutions in every State and Territory (to find out who'll run Redmap in your region, read The who's who of Redmap Australia).

What's been spotted by Redmappers lately?

By Yvette Barry

Some weird and wonderful photos of marine critters spotted by Redmap members!

WHAT'S BEEN SPOTTED BY REMAPPERS LATELY?

Since December 2009, Tasmanian anglers, fishers, divers and the public have logged more than 400 marine critters on *redmap.com.au*— here are a few beauties.

A yellowtail kingfish (*Seriola lalandi*) caught off Bruny Island, Tasmania. This may be a common fish on the mainland, but most Tasmanian sightings south of Maria Island are considered out of range (Photo: anon).

This juvenile green turtle (*Chelonia mydas*) was spotted on Rag Island, east of Wilson's Promontory in Victoria. Redmap is going national in October but we're already receiving sightings from around Australia. Keep them coming! This turtle, usually found in more tropical waters, was reported to Victorian fisheries. (Photo: Grant Leeworthy).

A pair of "Old Wives" (*Enoplosus armatus)* spotted at a diving site near Cape Huay, Tasman Peninsula. The known range of this species extends to Maria Island—so this pair is considered out of range here.
(Photo: John Silberberg).

Stunning photography by Warren Judges of a red velvetfish (*Gnathanacanthus goetzeei*) at Fortescue Bay. This fish is common in Tasmania —but we love such photos, so send them in to *redmap.org.au*

Redmap member Tom King caught this striped marlin (*Tetrapturus audax*) off the Tasman Peninsula on the east coast of Tasmania. While this majestic fish is not uncommon here, they usually only show up in years with a strong - and correspondingly warm - East Australian Current (Photo: Tom King).

Redmap exposed!

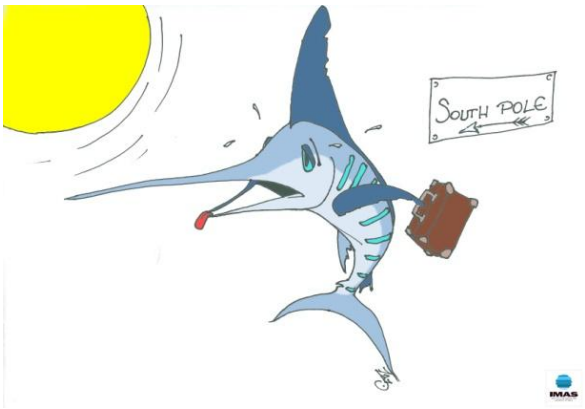
ABC television's 7.30 Report did a great job of explaining what Redmap is all about. Watch the five-minute video.

Article title and photo links directly to: http://www.abc.net.au/news/2012-03-09/rare-finds/3881022

Leaving home in a huff: some range shifts in Australian seas

By Yvette Barry

From barnacles to seaweed and fish – Australian marine life are shifting house in search of cooler waters.



Striped marlin (*Tetrapturus audax*) are being spotted and caught more often by fishers in southern Tasmanian waters – but it's not yet clear whether they are shifting their range further south. Picture drawn by Elsa Gärtner (IMAS)

From barnacles to seaweed and fish –Australian marine life are shifting house in search of cooler waters.

Most fish just want to live the comfy life. Each has a range of conditions, such as water temperatures, in which they want to live. So it's no surprise when studies show some fish are packing up shop and migrating towards the poles – to cooler waters – in response to warming oceans.

What is surprising: there's still a lot we don't know about the impacts of climate change on marine ecosystems. Yet Australia's oceans have been slowly warming since the mid-1900s. For example, the Tasman Sea in southeast Australia is about 2 degrees warmer than it was 60 years ago. (1) That doesn't sound like much, but for marine life it's like always leaving the heater on. Even in the summer.

What the available research is showing – along with observations from fishers and divers – is that some marine species are extending their distributions into cooler waters; while others simply disappear from a region when things get too hot at home.

One such study showed 55% of the invertebrates surveyed on Tasmania's east coast – a known 'hotspot' for ocean warming - were found further south in 2007/2008 than in a 1950's study. Barnacles and gastropods showed the greatest range extensions over the 60 or so years, according to the joint University of Tasmania and CSIRO study. The giant rock barnacle, Austromegabalanus nigrescens, is now recorded widely along the Tasmanian east coast, but it was absent in the 1950's study. (2)

Another study looked at the changes in Australian seaweed communities since the 1940s. Dr Wernberg from the University of Western Australia and his associates found many seaweed species have shifted south along Australia's east and west coasts. But it's not just one or two species leaving in huff: in some regions, whole seaweed communities have shifted to cooler climes.

So why care about the movement of few slimy seaweeds? This 2011 study warns that increasing water temperatures may "force many retreating species beyond the limits of available habitat at the southern margins". If the oceans warm further, seaweed may keep shifting south until there's nowhere suitable left to move to. This may lead to extinctions and flow-on effects because seaweeds are a unique habitat for many fish and invertebrates. (3)

Anecdotal evidence from fishers, divers and scientists also points to marine shifts.

It was during a marine 'heat wave' two summers ago, where ocean temperatures were several degrees higher than usual for a few months, that Dr Gary Jackson from the Department of Fisheries in Western Australia started getting a wave of calls from fishers reporting uncommon species along the WA coastline. Reports included subtropical species like Spanish mackerel, whale sharks, emperor species, and damsel fish species spotted further south along the WA coast than they're usually found.

"It was obvious something was going on," Dr Jackson says.

He hopes more sightings from fishers and divers will help track any southern shifts along such a large coastline.

"There are a lot of people out there on the water or under water or walking on beaches seeing things which would be of interest to us about how the ocean are changing and what the consequences are going to be for fish and fisheries in WA," he says.

In New South Wales, Professor Natalie Moltschaniwskyj from the University of Newcastle is keeping an eye out for tropical species that are starting to come down the coast from Queensland.

"Anecdotally we are getting tropical species down in Sydney like damselfish and angelfish in the summer but they die off in the winter," Prof Moltschaniwskyj says.

If more adult fish make it through a winter, it could mean they're starting to shift their home turf and could be there to stay.

Already Professor Moltschaniwskyj and her team have compiled a list of about 60 species they want to track through the Redmap project, including butterfly fish, painted crayfish and tropical wrasses.

While NSW fishers may welcome hooking more crayfish species, there are other less desirable visitors such as the relatively new arrival of long-spine urchins (*Centrostephanus rodgersii*) into Tasmanian waters. Thriving urchin populations tend to overgraze the seabed and leave them barren of life. A 2009 study by Ling and Co. at the University of Tasmania suggested the southern movement of the urchin was related to a strengthening of the East Australian Current (EAC) south and coastal warming in eastern Tasmania. Urchins have already formed barrens along much of Tassie's east coast and may continue further down the coast if marine warming forecasts are realised. Not good news for Tasmania's kelp forests and marine biodiversity. (3)

And yet, other potential shifts into Tasmania are more welcomed. And tasty too! Fishers and divers have been reporting to Redmap more eastern rock lobster, yellowtail kingfish, tailor, striped marlin and King George whiting further south than usual.

But it's not easy to pinpoint how warming waters impact fish along huge coastlines.

There are very few studies of range shifts in South Australian seas according to Keith Rowling, program leader at the Community Based Fisheries section of PIRSA Fisheries and Aquaculture. That's because South Australia has unique currents that are complicated by cooler Antarctic waters: so they don't see the more obvious southerly range shifts like those along the western and eastern seaboards.

"We have a fairly unique coastline in that we have cold water coming from the south-east and the warmer Leeuwin currents coming from the west and there's generally a solid divide there about where the gulf starts," Mr Rowling says.

But he is keeping track of blue swimmer crab (*Portunus pelagicus*) sightings. This crab is traditionally found in the upper gulfs of South Australia, but more and more divers and recreational fishers are seeing this species further south, outside the gulf areas. Yellowfin tuna (*Thunnus albacares*) is another fish he'll keep tabs on: it's rarely caught in this state, so any range shift would be noticeable if it moved into SA with potentially warmer waters from the east or west.

But marine critters aren't just influenced by water temperature. Things like food, predators, acidification, currents, and fishing activity are also thrown into the mix. Additionally, it's not uncommon for marine animals to swim far from home (considered 'vagrants'), but they don't necessarily set up shop there. The normal distribution of a fish is sometimes hard to establish, or not known at all.

That's where a national Redmap will come into play after October 2012. Over time, and with many sightings, Redmap's community sightings will help uncover if marine species are really extending their range along Australia's vast coastline, especially as the marine climate warms; or if they are just random visitors or only moving with seasonal variations.

If you want to know more about the Redmap project in your region, please email enquiries@redmap.org.au or visit www.redmap.org.au

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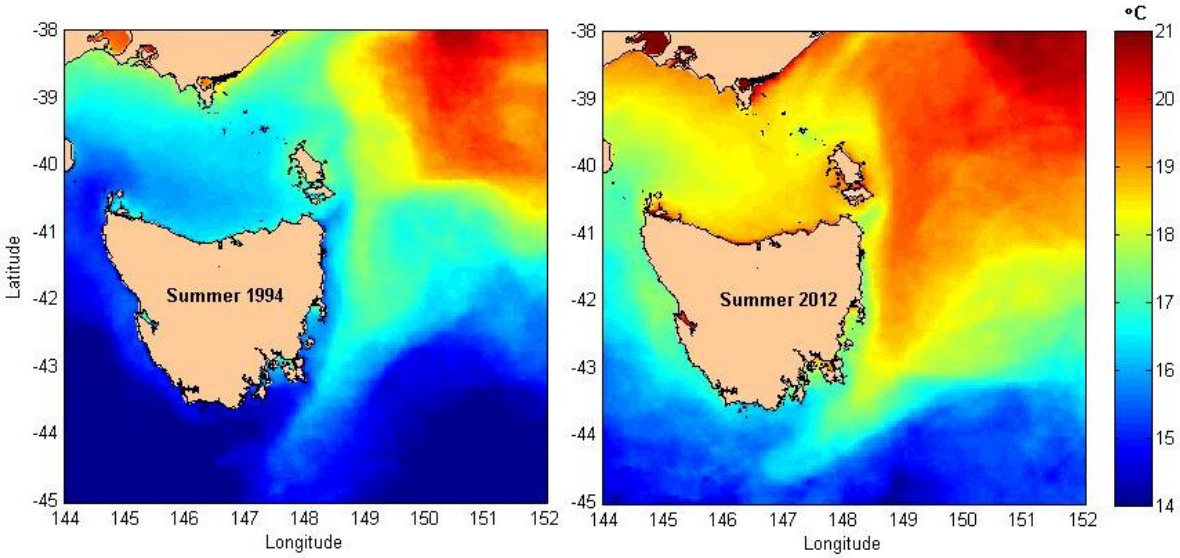
Fish soup? Tassie seas are getting warmer

By Yvette Barry

Tasmania's coastal waters are warming at over three times the global average.

The heat is on: water temperature monitoring is showing Tasmania's coastal waters are warming up.

A stark example of warming seas is shown in the satellite data below, which compares sea surface temperatures in the summers of 1994 and 2012. CSIRO marine scientist Dr Alistair Hobday says the warmer seas in 2012 were mainly caused by the extension and increased strength of the East Australian Current (EAC), bringing down warmer water from the north.

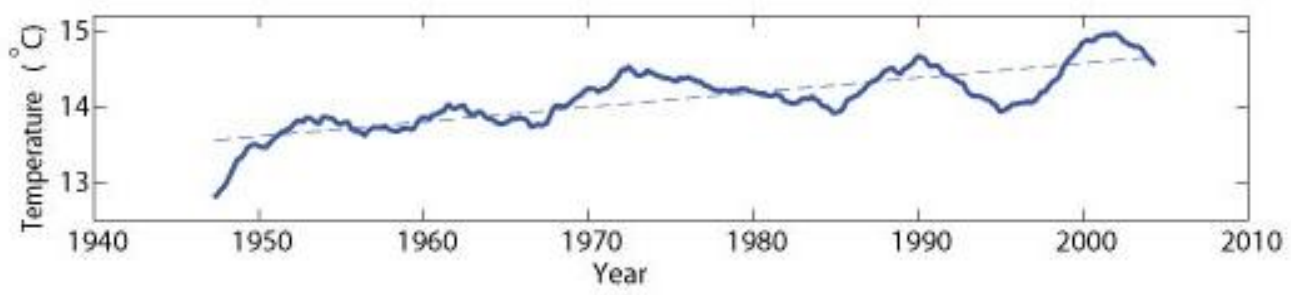


Average summer sea surface temperatures, 1994 vesus 2012. It's important to remember though that current strength does vary from year to year, and warming trends may not be continuous. (Dr. Alistair Hobday, CSIRO Climate Adaptation Flagship, Marine and Atmospheric Research).

And it appears Tasmania is also a global hotspot for marine warming. Sea temperature data collected off Maria Island for more than 50 years has shown Tasmanian waters are warming at three times the global average. Dr Katy Hill, a scientific officer for the Integrated Marine Observing System (imos.org.au) in Hobart, analysed the monthly data collected since 1944. Crunching the numbers revealed Tassie waters are warming at 2.28 degrees Celsius per century (as shown in the graph below).

Tasmanian water temperatures tend to vary from an average of 12 degrees Celsius in late winter, to an average of about 18 degrees Celsius in late summer (wetsuit, anyone?). Of course there are greater fluctuations from year to year, and in sheltered coastal areas and estuaries. A few degrees rise in water temperature doesn't sound like much, and if you've ever swum at a Tasmanian beach it sounds quite nice! But for marine ecosystems, small temperature changes have a significant impact on the distribution and physiology of marine species.

It’s no wonder more and more marine animals are being spotted further south of their usual range on Tasmania’s coastline – in search of cooler waters?

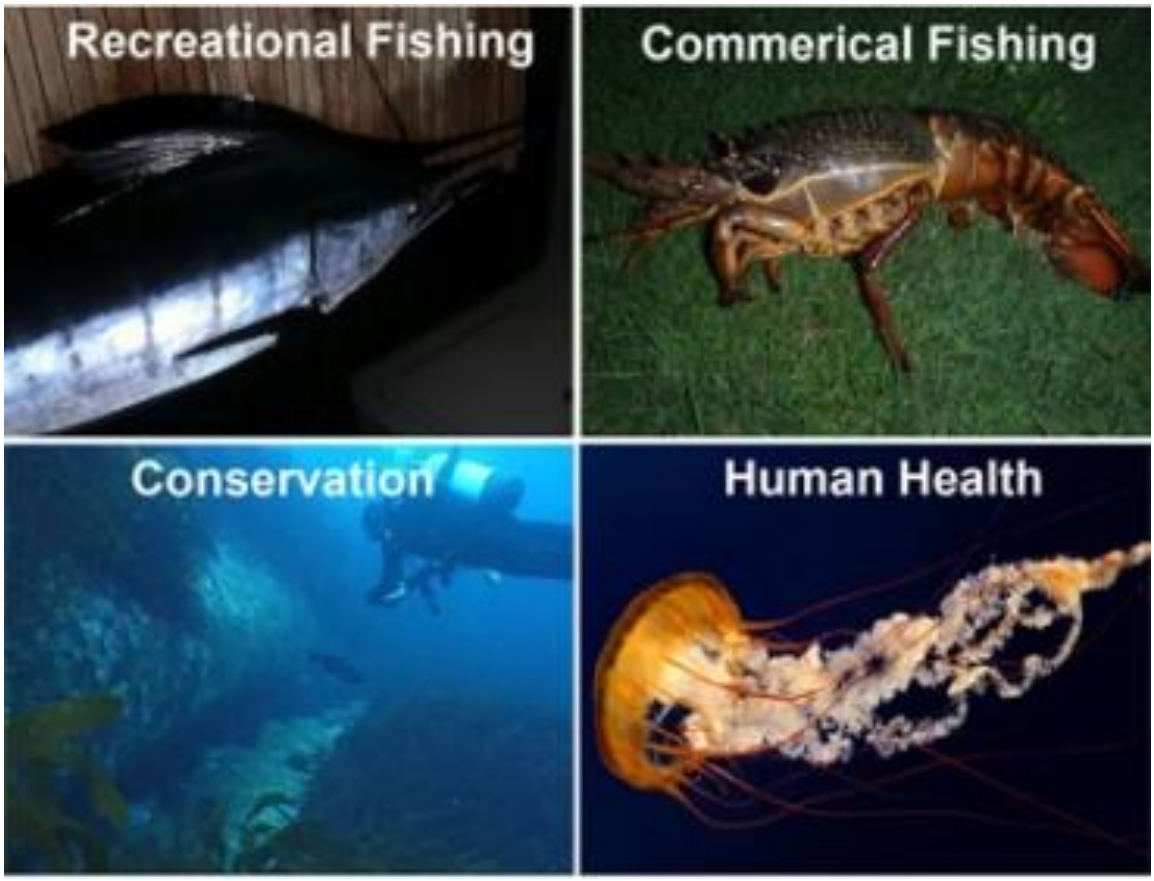


A trend of gradually increasing water temperatures off Maria Island since 1944 (IMOS, Dr Katy Hill)

Who cares if a fish packs up and shifts house?

By Dr Amanda Bates and Yvette Barry

Marine range shifts can bring new opportunities - as well as a few issues - for recreational and commercial fishers, marine ecosystems and human health.



Marine range shifts can bring new opportunities- as well as a few issues - for recreational and commercial fishers, marine ecosystems and human health.

One of the most commonly observed responses to recent marine warming is the shift in the geographic location of where a species lives, known as a "range shift". While some species may adapt to the balmy new conditions, others tend to shift house – extending their range - to stay within their preferred marine climate. In fact, sightings of warm-water species are on the rise around Tasmania where the East Australia Current is pushing southwards. These range expansions can result in exciting opportunities, such as the arrival of more yellowfin tuna (*Thunnus albacares*) and King George whiting (*Sillaginodes punctata*) into Tasmanian waters – a tasty surprise on the end of a hook!

However, there are also some impacts of range shifts that are less than ideal. One example includes the expansion of venomous warm-water species such as the Portuguese Man-of-War (*Physalia physalis*) into waters that have been considered temperate: not the type of species you want around at swimming beaches! Other less welcome range shifts include the increase in the long-spine urchin (*Centrostephanus rodgersii*) along the east coast of Tasmania; and the decline of cold-water species such as the giant kelp (genus Macrocystis). It's important to understand the consequences of marine warming and range shifts; and how the redistribution of species will impact the balance of marine food webs that support

productive fishing grounds. Certainly some marine life will win as waters warm, others will decline, and the ocean will also keep some ace-cards up her sleeve.

Early detection of range shifts will allow recreational and commercial fishers to both take advantage of the arrival of new fish, and minimise the risks for those fisheries that will suffer in a warmer ocean.

With the launch of Redmap Australia in October 2012, potentially thousands of Australians will become 'citizen scientists', sketching a picture of marine range shifts around Australia.

This information will help arm recreational and commercial fishers with information on how climate change is impacting their coastline.

"Redmap community sightings may become the canary in the coalmine: highlighting those marine species and particular regions along Australia's vast coastline that are strongly impacted by climate change," says Dr Gretta Pecl, Redmap's Principal Investigator (and the brains behind the original Redmap project at the Institute for Marine and Antarctic Studies in Hobart).

"Redmap will help us to focus Australian research and provide relevant up to date information for marine management for these areas."

Redmap also aims to engage people with climate change issues – without any preaching – by allowing Australians to collect and share their own data and photos on their local marine environment. And all whilst doing the things they love: diving, fishing and swimming!

[Photo caption]: Range shifts bring new species for recreational and commercial fishing. However, range shifts also bring pest species like the long-spine urchin which forms barrens devoid of life; or poisonous jelly fish. (Photo Credits (from left to right): Striped Marlin (Tom King), Eastern Rock Lobster (Redmap member "Diver333"), Urchin Barrens (Scott Ling), Jellyfish (Thomas Bird).

Strike a pose: photographing fish and marine life for Redmap

By Adriaan Van Huissteden

Diver and underwater photographer Adriaan van Huissteden reveals some of his secrets for taking a great shot for Redmap (hint: fish can't say 'cheese').

The best way to save a record of your special critter on www.redmap.org.au is to include a photograph. This will help the Redmap team to confirm your sighting, and it's also added to the website for all to ogle at!

Here are some ideas on photographing for Redmap:

Kiss the fish with your camera— no, not really. But make sure you get a picture as close as you can of the whole catch. Pay special attention to markings and colours.

Size (it really does matter sometimes!) – have a reference object in the photo showing the whole critter. A good example is a full-length shot of a fish on the beach with a shoe next to it, a knife, or a ruler. The classic trophy shot of you holding up an unusual catch is welcome too.

Location, location – note the location you found or caught your Redmap sighting and include it when you log on to the website. What bait did you use if you were fishing? If you have any GPS info, or water temperature info, or any other interesting observations, include them too. Redmap uses these titbits to gather a better picture of if and how species are shifting their range over time.

Free photography information and a gallery of images can be found on www.VizBiz.com.au

Adriaan G Van Huissteden: avh@vizbiz.com.au

*** A snook (*Centropomus undecimalis*) and tailor (*Pomatomus saltatrix*) caught off Freycinet — Redmap loves these trophy shots showing the full fish (Photo: Finisterre).**

*** The ruler in this photo gives Redmap the perfect scale (Photo: anon Redmap member)**

*** These luderick (*Girella tricuspidata*) were easy to ID with this close-up photo. There were 22 luderick logged on this day in the D'Entrecasteaux Channel—which is further south than their usual known range. This information is useful to sketch a picture over time of which species are being found further south than "usual" (Photo: S.Ibbott).**

*** A 15cm Balmain bug (*Ibacus peronii*) caught off the Tasman Peninsula. This looks exotic for Tasmania but it's not uncommon—albeit not often seen as it burrows into the sand. But Redmap likes all unusual sightings! (Photo: Jak Britten).**

Who do you think you are?

By Yvette Barry

What do a student, a professional diver, and a draftsperson have in common? Redmap! We profiled some of the citizen scientists behind the Redmap project.

What do a student, a professional diver, and a draftsperson have in common? Redmap! We profiled some of the citizen scientists behind the Redmap project.

For over two years Tasmanians have reported to Redmap some 400 sightings of fish and marine animals they thought were unusual along their coastline. Some of these sightings were schools of up to 100 fish, so the actual number of individuals reported is in the thousands. Divers logged about half these Redmap sightings; while anglers reported 43 per cent of the sightings. The rest were reported by Redmappers who considered themselves swimmers, boaters or beachcombers.

We asked four of these Redmap 'statistics' to tell us a bit about themselves.

1. Q&A with uni student and angler Rhiannon

Occupation: Biology Student at the University of Tasmania.

Favourite coastal or marine spot in Tassie: Fortescue Bay for its beautiful location and rich biodiversity.

Favourite fish: Wrasse.

Favourite marine anecdote: Being completely beside myself with terror as several considerably sized stingrays swam around me whilst swimming on holiday. All the while, my family sat wetting themselves on the beach nearby.

What marine critters have you logged on the Redmap website? An oarfish in Adventure Bay, Bruny Island, Tasmania.

2. Q&A with career diver Mick Baron

Occupation: Operating a scuba diving business on the Tasman Peninsula.

Favourite fish to eat: Deep-sea trevalla and Tasmanian striped trumpeter.

Favourite marine spot in Tassie: The Tasman Peninsula for the tremendous variety of diving spots, but especially Waterfall Bay for the marine cave system – the best labyrinth of tunnels in the sea in Australia.

Amusing marine anecdote: A dive buddy collapsed into our small dinghy after exploring the ship wreck, the Lake Illawarra, under the Tasman Bridge in Hobart. Although he was a very experienced diver (only those with half a clue do this dive) he was expleting unmentionables and I seriously thought there was a problem. It took a minute for him to settle while I was getting more worried. Turns out the sheer experience of diving the wreck had absolutely blown his mind. Quote: "I've done some diving, but that was just b....y mind-blowing out there man."

What marine critters have you logged on the Redmap website? The southern fiddler ray (*Trygonorrhina dumerilli*, pictured left) from Pirates Bay at 5 metres. And also an Exocoetid (flying fish).

Have you seen many changes in marine life over the years you've been diving? Blimey - where do I start! From spending half my life underwater (I've been scuba diving for 40 years), I've noticed a change in the distributions of flying fish, old wife, magpie perch, herring cale, mado and yellowtail kingfish. The big one I've also noticed is the disappearance of the giant kelp (*Macrocystis pyrifera*) from most of my diving spots along the east coast of Tasmania (although I've noticed healthy growth in the more southern regions where the temperatures are cooler and the East Australian Current (EAC) seems not to have penetrated). From what I've read, the EAC has strengthened over the past 20 to 30 years and winter water temperatures have risen by 1-2 degrees, which allows the larvae of the long-spined sea urchin (Centrostephanus rodgersii) to survive through the Tassie winters and take over the kelp habitat.

3. Q&A with research assistant Sarah-Jane Pyke (pictured left holding a giant crab)

Interest in the sea: Science and diving

Occupation: IMAS- Aquaculture Support

Favourite fish to eat: Striped trumpeter

Amusing marine anecdote: A thresher shark breaching right next to the boat in the Philippines – it almost jumped in.

What marine critters have you logged on the Redmap website? Yes, an eastern rock lobster caught potting in Marion Bay.

4. Q & A with draftsperson and Redmap member Juanita (her kids are pictured left at Bruny Island)

Interest in the sea: A mix of fishing, boating and diving

Occupation: Architectural draftsperson

Favourite coastal or marine spot in Tassie: Bruny Island and Bicheno - crystal clear, clean waters and fun water activities.

Favourite fish: Blue marlin to look at and watch - not to eat!

Favourite marine anecdote: Fondest memory of the sea is living at a manned lighthouse whilst growing up and watching the dolphins & whales frolic in the surf.

Have you logged a fish or marine critter on the Redmap website? Not yet but I need to get my act together!

Redmap member Juanita was stoked to win the Tasmanian MURES $50 prize voucher for joining up in December, as she loves "going to Mures Lowerdeck for a feed of fish and chips with the kids!". Left is a recent photo of Juanita's 7-year olds about to go for a snorkel off a tropical-looking Bruny Island!

Rhiannon, Sarah and Juanita won a MURES Fishing prize for joining up to Redmap in Tasmania.

FISHING Mures®
THE SEAFOOD PEOPLE

Each month Redmap Tasmania sponsor Mures Fishing kindly donates two $50 vouchers for those Tasmanians joining up to Redmap! The Mures voucher can be used on anything in the lower deck – fresh fish, goodies in the shop, a meal in the Bistro or a yummy snack in the Polar Parlour (Note: we're on the hunt for similar sponsors in other regions of Australia so that when we go national, everyone can go in the draw for monthly prizes).

The who's who of Redmap Australia

By Elsa Gärtner

The main players and sponsors behind Redmap Australia.

Drum roll, please…. In October 2012, Redmap will expand from a Tasmanian pilot project into Redmap Australia. The move towards a national Redmap began in November last year when researchers and representatives from around Australia traveled to Hobart to begin setting up the national Redmap website and initiative. Now we have the support of lead institutes in each state and territory. But what does this all mean for Redmap? Soon all Australian fishers, boaters, divers and scientists – from Hobart to Broome to Townsville to Sydney to Melbourne— will be able to log onto redmap.org.au and report any uncommon fish and marine life they don't usually see along their stretch of coastline. This community data will help highlight marine range shifts around Australia as the marine environment changes, including warming seas, so that anagement and research can be directed into hotspots or particular species along Australia's coastline. By encouraging Australians to collect and share information about their local seas, Redmap also aims to engage many people with marine climate change – and become citizen scientists in the process.

But a national Redmap couldn't have happened without the financial, scientific and logistic support of the partners and institutes listed below.

Our funding partners:

The Institute for Marine and Antarctic Studies (IMAS) at the University of Tasmania has been created to encourage collaborative research in marine and Antarctic science between various parts of the University, CSIRO Marine and Atmospheric Research, the Australian Antarctic Division and other agencies. IMAS, in collaboration with the Government of Tasmania, delivers research and extension products for the betterment of Tasmania's aquaculture and fishing industries. IMAS is the host of Redmap Australia.

Redmap is supported by the Australian National Data Service (ANDS) through the National Collaborative Research Infrastructure Strategy Program and the Education Investment Fund (EIF) Super Science Initiative. Find out more at ands.org.au. ANDS funded the construction of the national Redmap website and database.

The Redmap initiative is supported in the south-east of Australia through the El Nemo – South Eastern Australia Program (SEAP). SEAP is supported by the Australian Government's Climate Change Research Program, the Victorian Department of Primary Industries, Primary Industries & Resources South Australia, Industry & Investment New South Wales, the Tasmanian Department of Primary Industries, Parks, Water & Environment, the Australian Fisheries Management Authority, the Fisheries Research and Development Corporation, CSIRO, and the South Australia Research and Development Institute.

This Inspiring Australia initiative is supported by the Australian Government through the Department of Industry, Innovation, Science, Research and Tertiary Education in partnership with the Institute for Marine and Antarctic Studies. Redmap has recently received an Inspiring Australia Grant to fund, "Eyes on the water: inspiring Australians through participation in science" which will further develop the Redmap citizen science project around Australia.

Redmap has received funding under round four of the ClimateConnect grants program for work that will increase reporting capacity in the detection of shifting marine species. The grant will also fund the development of a qualitative score card for resource managers. The Redmap project is an excellent example of collaborative and practical action to help us understand changes in our marine environment.

The ClimateConnect grants program provides funding to help Tasmanian communities and industries adapt to the opportunities and risks from climate change. The program is managed by the Tasmanian Climate Change Office in the Department of Premier and Cabinet. For further information on ClimateConnect, visit www.climatechange.tas.gov.au

Redmap is very grateful to our first sponsor: the Tasmanian Community Fund. IMAS obtained a TCF grant to initially develop Redmap's community-based ecological monitoring program in 2009. The Tasmanian Community Fund has provided grants to a broad range of not-for-profit organisations since 2000. The Fund was established from the sale proceeds of a community asset, the Trust Bank, to provide funds back to the community. The Fund has established itself as a significant part of the community landscape, with millions in grants allocated to Tasmanian projects.

The lead institutes hosting Redmap around Australia:

PIRSA Fisheries and Aquaculture is the division of Primary Industries and Regions SA (PIRSA) that is responsible for the ecological sustainable development of South Australia's aquatic resources. The division provides effective administration of fisheries and aquaculture leasing and licensing, a partnership approach to policy development, ensures equitable allocation of access to aquatic resources and also has a strong compliance, education and awareness focus. Its purpose is to deliver a best practice, ecosystem-based approach to aquatic resource management that maximises the social and economic benefits to South Australian communities.

The Western Australian Department of Fisheries is responsible for the sustainable management of the State's aquatic resources and their ecosystems. The Department employs a bioregional, Ecosystem-Based Fisheries Management (EBFM) approach to achieve this. The Departments' Research Division, based at the WA Fisheries and Marine Research Laboratories, Hillarys, undertakes a broad range of monitoring and research programmes to provide the scientific basis for EBFM.

James Cook University is ranked in the top five percent of the world's tertiary institutions by the respected Academic Ranking of World Universities. The University conducts nationally significant and internationally recognised research in areas such as marine sciences, biodiversity, tropical ecology and environments, global warming, tourism, and tropical medicine and public health care in under-served populations.

Museum Victoria is Australia's largest public museum organisation. As the State museum for Victoria, MV is responsible for looking after the State collection, conducting research and providing cultural and science programs for the people of Victoria and visitors from interstate and overseas. The major strength of Museum Victoria's research activity is its integral connection with collection holdings of more than 16 million objects and specimens. Dating back to the 1850s, the extensive natural history collections provide invaluable historical data on the biodiversity and distributions of Victorian and Australian animal life, and consequently can provide critical insights into the impacts of human activities on this fauna over more than 150 years.

The University of Newcastle is the most research intensive university outside of an Australian capital city. Ranked ninth among Australia's universities for research, Newcastle's reputation is for innovation, excellence and research with impact.

Our original Redmap Tasmanian sponsors are:

IMAS obtained a grant from the Tasmanian Community Fund to develop the original Redmap community-based ecological monitoring program. The Tasmanian Community Fund has provided grants to a broad range of not-for-profit organisations since 2000. The Fund was established from the sale proceeds of a community asset, the Trust Bank, to provide funds back to the community. The Fund has established itself as a significant part of the community landscape over the years, with millions in grants allocated to Tasmanian community projects.

The Mures family has been self-employed in the fish trade since 1965. They now are also well known providers of quality seafood and dining experiences. Mures provide two $50 Mures vouchers to Redmap members for joining Redmap each month.

Have you ever wondered where the money raised from the sale of recreational sea fishing licences goes? Revenue from the sale of sea fishing licences supports the Fishwise fund. This fund covers the management and administration of recreational fishing, including the licensing system, and provides funds to programs that support recreational fishing activities.

Fishwise Community Grants provide funding for individuals and community groups to conduct projects that improve the management of marine resources or improve the awareness and knowledge of our fisheries. Fishwise funded Redmap signs at boat ramps around Tasmania.

Templates of Redmap promotional materials for the NSW, Vic and SA teams to populate with region-specific information (milestone 5)

Regional A4 sheet


What's on the move in NSW waters?
Insert common name
Insert scientific name
IDENTIFYING FEATURES
Insert text here
SIZE
Insert text here
HABITAT
Insert text here
SPECIES IMAGE INSERTED HERE
LOG IT
Insert log location here
Insert common name
Insert scientific name
IDENTIFYING FEATURES
Insert text here
SIZE
Insert text here
HABITAT
Insert text here
SPECIES IMAGE INSERTED HERE
LOG IT
Insert log location here
Check out the website for photos and more info
To register your sighting visit: redmap.org.au
or contact the Redmap Team on (00) 0000 0000
or email enquiriesNSW@redmap.org.au
IMAS
INSTITUTE FOR MARINE AND ANTARCTIC STUDIES
IMAS is the host of Redmap Australia
email enquiriesAustralia@redmap.org.au

National A2 poster

National and regional A1 banner

National powerpoint template

Regional powerpoint template

Regional DL postcard

Acknowledgements

We thank the Institute for Marine and Antarctic Studies and the Department of Agriculture, Fisheries and Forestry for their financial and logistical support. We thank Holly Webber for the designs and Ionata for the website. We also thank Nicholas Jones, Laura Purcell, Alistair Hobday, Jason Hartog, Steven Reynolds, Jennifer Sunday and Dallas D'Silva for their substantial assistance.

Redmap Australia launches October 2012

IMAS
INSTITUTE FOR MARINE AND ANTARCTIC STUDIES

Australian Government
Department of Agriculture, Fisheries and Forestry

ands
AUSTRALIAN NATIONAL DATA SERVICE

Photo credit: J. Stuart-Smith