



WESTERN AUSTRALIA REPORT CARD

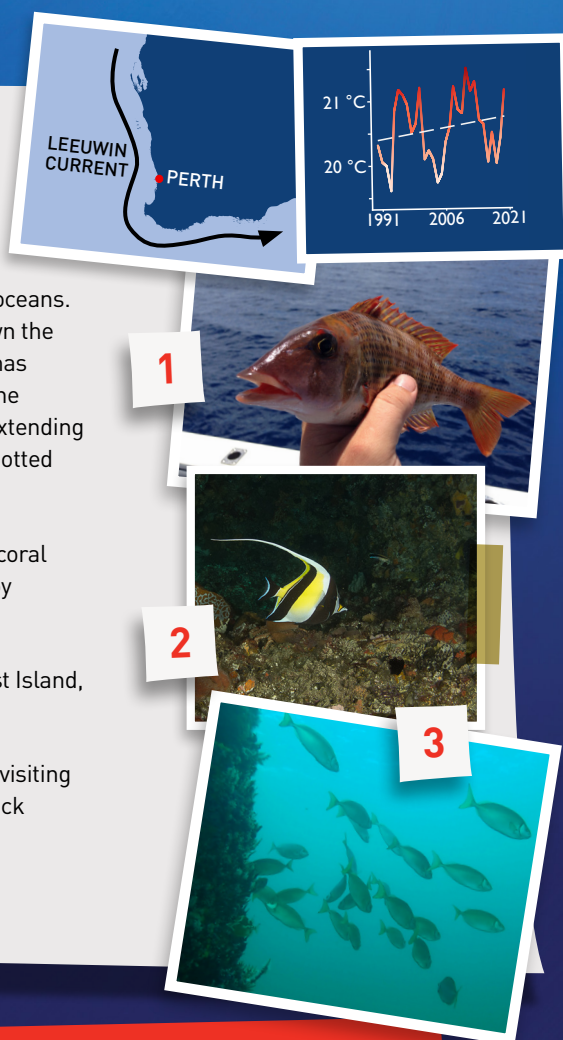
Over the past decade (2012–2022), Redmap (Range Extension Database & Mapping Project) has recorded out-of-range marine species with the help of observant citizen scientists across the state.

Marine species are moving further south

South-western Australia is one of the fastest warming regions of the world's oceans. The Leeuwin Current, which transports warm, tropical water southwards down the coast of Western Australia and eastwards across the Great Australian Bight, has experienced significant variations over recent decades, including strong marine heatwaves and cold spell events. In response, some marine species may be extending their ranges south. In recent years, the Western Australian community has spotted many marine species south of their usual ranges, for example:

- 1 Redthroat Emperor (*Lethrinus miniatus*) are usually found near tropical coral reefs, so Western Australia's recreational fishers have been surprised by catches as far south as Hamelin Bay.
- 2 SCUBA divers have spotted a number of new tropical species at Rottnest Island, just 20 km from Perth, like this Moorish Idol (*Zanclus cornutus*).
- 3 Several out-of-range fish species have been spotted by keen observers visiting the Busselton Underwater Observatory in Geographe Bay, including Black Rabbitfish (*Siganus fuscescens*).

Image credits: [1] J. Marshall; [2] M. Lee; [3] S. Teede, Busselton Jetty Inc.






CITIZEN SCIENCE HELPS DETECT SPECIES RANGE SHIFTS

Thank you to Western Australian citizen scientists (divers, fishers, beachcombers, and boaters), who since 2012 have been logging 'out-of-range' species sightings like those above with Redmap. These observations can provide an early indication of how species distributions are changing, improving our ability to predict and prepare for the challenges and opportunities range extending species may deliver. By contributing to citizen science programs like Redmap, anyone with a camera can become an 'ecological detective', helping to uncover which species are on the move and how their local region may be changing in response to ocean warming.

WHAT SPECIES ARE ON THE MOVE IN WESTERN AUSTRALIA?

How confident are we that a species' range is shifting?

HIGH 
MEDIUM 
LOW 

Confidence that a species' range is shifting was assessed as 'High', 'Medium' or 'Low' by combining the strength of evidence provided by citizen scientists' observations with our confidence in each species' known southern range limit.

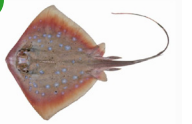



















Number of sightings by:


**SNORKELERS/
DIVERS**


FISHERS


**SPEAR-
FISHERS**

Central West Coast

- | | | |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1

Bluespotted Maskray
<i>(Neotrygon australiae)</i>
 1  | 2

Pacific Bonefish
<i>(Albula argentea)</i>
 1  | 3

Green Jobfish
<i>(Aprion virescens)</i>
 6  1  |
| 4

Mangrove Jack
<i>(Lutjanus argentimaculatus)</i>
 2  | 5

Yellowedge Coronation Trout
<i>(Variola louti)</i>
 2  1  | 6

Keyhole Angelfish
<i>(Centropyge tibicen)</i>
 2  |

Leeuwin-Naturaliste

- | | | |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 7

Stout Moray
<i>(Gymnothorax eurostus)</i>
 1  | 8

Barred Soapfish
<i>(Diploprion bifasciatum)</i>
 4  | 9

Moorish Idol
<i>(Zanclus cornutus)</i>
 3  |
| 10

Yellowtail Angelfish
<i>(Chaetodontoplus personifer)</i>
 1  | 11

Ocellate Butterflyfish
<i>(Parachaetodon ocellatus)</i>
 2  | 12

Giant Mud Crab
<i>(Scylla serrata)</i>
 1  3  |
| 13

Red Emperor
<i>(Lutjanus sebae)</i>
 1  6  | 14

Longnose Trevally
<i>(Platycaranx chrysophrys)</i>
 1  | 15

Rankin Cod
<i>(Epinephelus multinotatus)</i>
 4  |
| 16

Threadfin Butterflyfish
<i>(Chaetodon auriga)</i>
 2  | 17

Indo-Pacific Sergeant
<i>(Abudefduf vaigiensis)</i>
 3  | 18






Redspot Wrasse
<i>(Stethojulis bandanensis)</i>
 1  |
| 19




Black Rabbitfish
<i>(Siganus fuscescens)</i>
 6*  1  | 20

Common Lionfish
<i>(Pterois volitans)</i>
 10*  1  | 21

Redthroat Emperor
<i>(Lethrinus miniatus)</i>
 1  13  |

South Coast

- | | | |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 22

Shark Mackerel
<i>(Grammatorcynus bicarinatus)</i>
 4  1  | 23

Blacksaddle Goatfish
<i>(Parupeneus spilurus)</i>
 6  | 24

Common Dart
<i>(Trachinotus botla)</i>
 1  3  |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

*2 sightings recorded at the Busselton Jetty underwater observatory

Image credits: 1,2,14,15,22,24 CSIRO Australian National Fish Collection CC BY-NC-SA; 3,5(bottom) Mark Rosenstein CC BY; 4 Jean-Lou Justine CC BY-SA; 5(top),18,21 Ian Shaw; 6 Rickard Zerpe CC-BY; 7,9,13,16 Dave Harasti; 8 John Sear; 10 Glen Whisson CC BY-NC; 11 Brian R Mayes CC BY-NC; 12 Paul Butcher NSW DPI Fisheries; 17 Richard Ling CC BY-NC; 19 Rick Stuart-Smith CC BY; 20 Sara Nguyen; 23 Gina Mascord



HOW DO WE DETERMINE IF SPECIES ARE SPOTTED OUT-OF-RANGE?

Sightings logged by citizen scientists are reviewed by species experts for verification. Then, the location of sightings are compared to each species' distribution limits (established from scientific sources as of 2012) to identify which species were spotted beyond their known range boundaries over the past decade. Here is a summary of this information across Western Australia's southern marine bioregions.

113

CITIZEN SCIENTISTS
logged unusual or out-
of-range species sightings

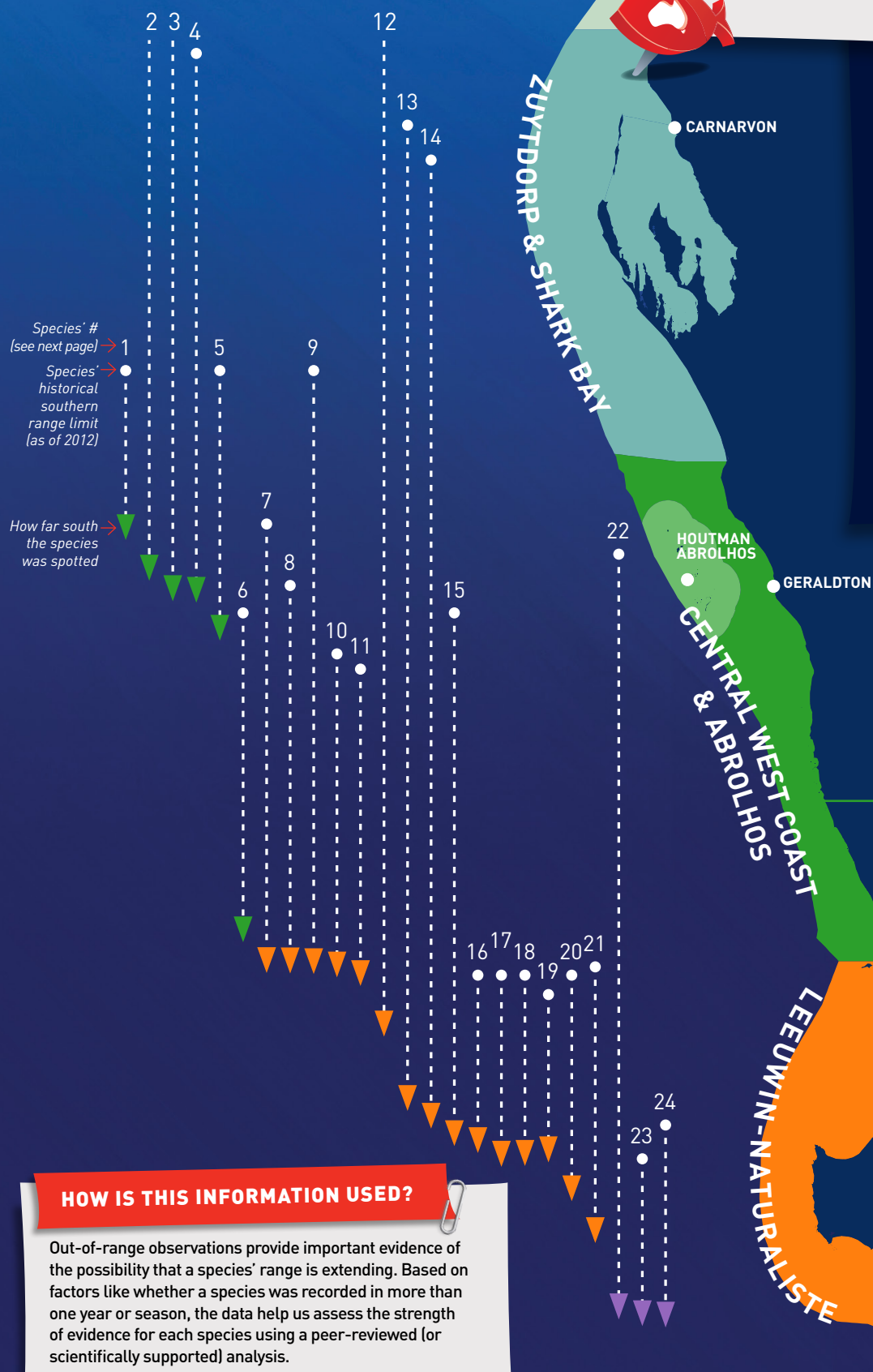
3

CITIZEN SCIENCE PROGRAMS providing
out-of-range species observations
(see final page for more info)

redmap
SPOT. LOG. MAP.

iNaturalist
Australasian
Fishes Project

RLS
REEF LIFE
SURVEY



214

Out-of-range or
unusual SPECIES
REPORTS

115

MARINE SPECIES
tracked for out-of-
range sightings

54

SCIENTISTS
involved in
verifying species
identifications

HOW IS THIS INFORMATION USED?

Out-of-range observations provide important evidence of the possibility that a species' range is extending. Based on factors like whether a species was recorded in more than one year or season, the data help us assess the strength of evidence for each species using a peer-reviewed (or scientifically supported) analysis.

What is Redmap?

Redmap (Range Extension Database and Mapping Project) invites members of the community to spot marine species that are outside of their usual range around Australia and log photos on our website or smartphone app.

GET INVOLVED

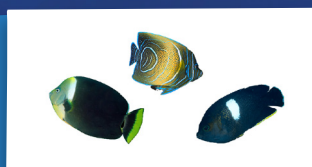
— WE'RE RELYING ON YOU!

Even though we have 'High' confidence that some species have been extending their range south along the coast of Western Australia, it is **your** observations as citizen scientists that are helping to assess how far beyond their known ranges these species are found. **Your** continued efforts will help to determine if these 'out-of-range' observations represent long-term patterns, and whether 'Medium' or 'Low' confidence species are more likely to undergo a range shift in the future. For more info and how to get involved - visit redmap.org.au

HAVE YOU SPOTTED AND PHOTOGRAPHED THESE SPECIES?



SOUTH OF HOUTMAN ABROLHOS?



Angelfishes
(*Pomacanthidae* spp.)



Common Coral Trout
(*Plectropomus leopardus*)

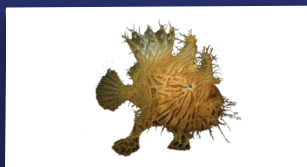


Parrotfishes
(*Scarinae* spp.)

SOUTH OF MANDURAH?



Emperors
(*Lethrinus* spp.)



Striate Anglerfish
(*Antennarius striatus*)



Sergeant-majors
(*Abudefduf* spp.)

Image credits: top row: Glen Whisson, Alexandra Hoschke, Rick Stuart-Smith Reef Life Survey; janetsclough/iNaturalist CC BY-NC; John Turnbull CC BY-NC-SA; bottom row: Jean-Lou Justine CC BY-SA; Malcolm Roberts; Gerry Allen WAM, Antonia Cooper; background (above): John Turnbull

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More ways to be a citizen scientist



iNaturalist is an online social network where people can share, identify, and learn about species sightings (not just out-of-range or marine species), and help generate biodiversity data for scientists along the way. www.inaturalist.org

Reef Life Survey is a citizen science initiative in which trained volunteer SCUBA divers conduct standardised underwater surveys of biodiversity on rocky and coral reefs around Australia (and the world). www.reeflifesurvey.com

WWW.REDMAP.ORG.AU



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CENTRE FOR MARINE SOCIOECOLOGY



JAMES COOK
UNIVERSITY
AUSTRALIA



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