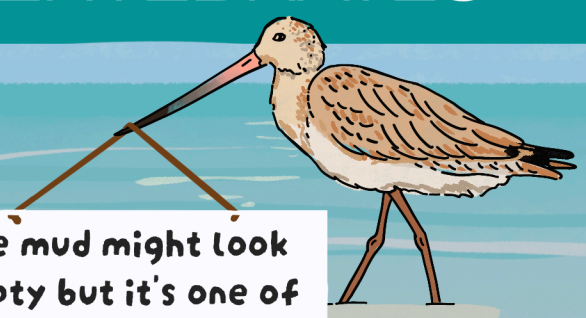
LIFE IN THE MUD

INTRODUCTION TO BENTHIC INVERTEBRATES



The mud might look empty but it's one of the most alive places on Earth!

WHAT EXACTLY IS A BENTHIC INVERTEBRATE?

Animals **without** a **backbone** that live on or within **marine sediments.**

GROUP	COMMON NAME	ROEBUCK BAY EXAMPLES & SPECIES COUNT
Polychaetes	Marine worms	Green Paddle Worm, Grey Tube Worm: 167 species
Crustaceans	Crabs, shrimps, barnacles	Hermit Crab: 74 species
Bivalves	Shellfish	Bloody Cockle: 59 species
Gastropods	Sea snails & slugs	Smooth Tusk Shell: 59 species
Echinoderms	Brittle stars, sea cucumbers	Long-armed Brittle Star: 35 species

WHY ROEBUCK BAY IS SPECIAL?

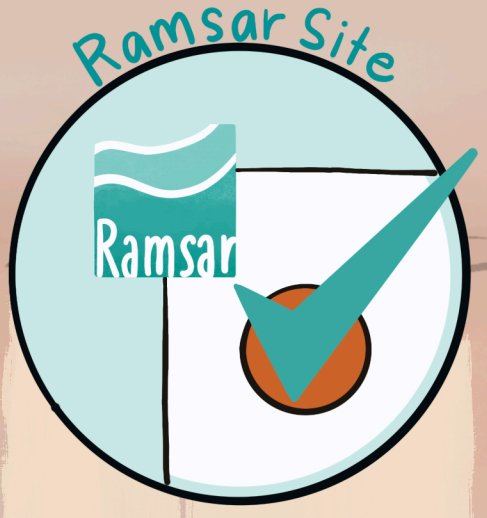
Shorebirds

100,000+ migratory shorebirds per year rely on the bay's benthic invertebrates to fuel migrations of up to 10,000 km making it one of Australia's most significant feeding and staging sites.

Megafauna

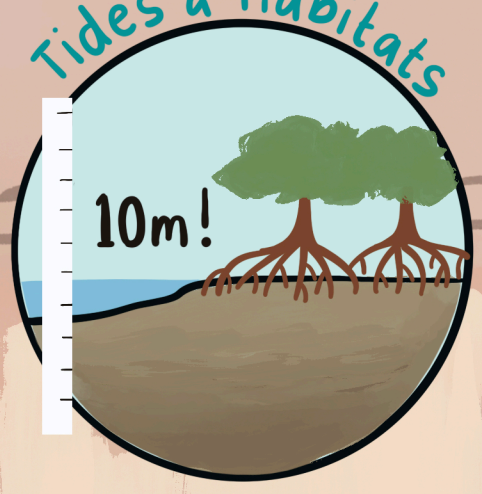
Home to a range of endangered or threatened marine species such as the iconic Australian snubfin dolphin, dugong, loggerhead, green and flatback turtles, and sawfish.

Ramsar Site



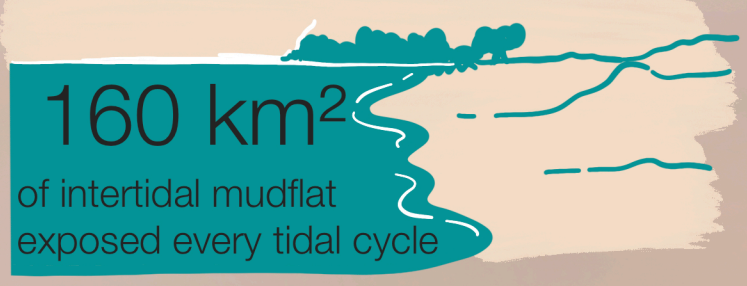
Designated a Wetland of International Importance in 1990. It is one of the world's most significant coastal wetlands because of exceptional biodiversity and critical role in supporting marine and bird life.

Tides & Habitats

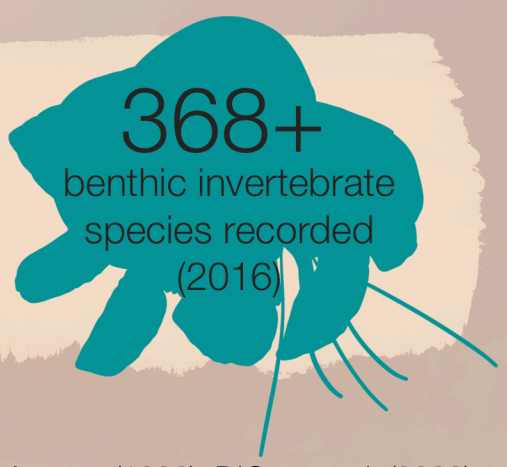


Tides up to 10 m expose expansive mudflats twice daily creating unique and diverse habitats such as firm sandy flats, deep soft mudflats, interspersed tidal creeks and mangroves and extensive intertidal seagrass meadows.

KEY STATISTICS



160 km²
of intertidal mudflat exposed every tidal cycle



368+
benthic invertebrate species recorded (2016)

100,000+
migratory shorebirds visit annually

Sources: Piersma et al. (2016); Australian Nature Conservation Agency (1996); D'Cruz et al. (2022).

This project is funded by the Australian Government Natural Heritage Trust and delivered by Rangelands NRM, a member of the Commonwealth Regional Delivery Partners panel.

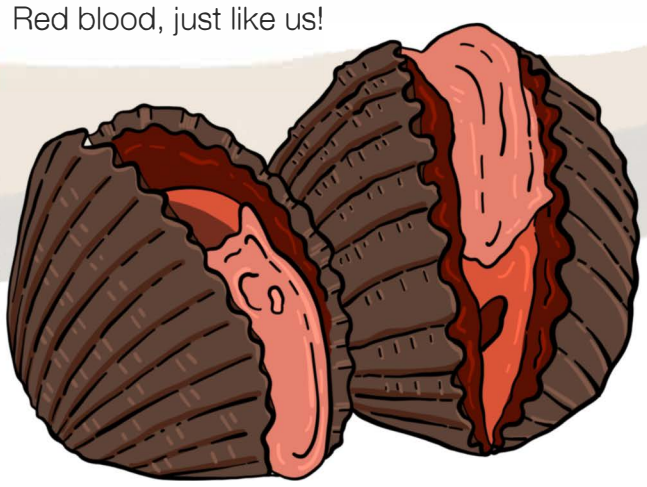
THE AMAZING CREATURES OF ROEBUCK BAY

MEET THE MUD CRITTERS

BLOODY COCKLE

Anadara granosa | Bivalve

Red blood, just like us!



Unique among shellfish: haemoglobin in its blood lets it survive in low-oxygen mud.

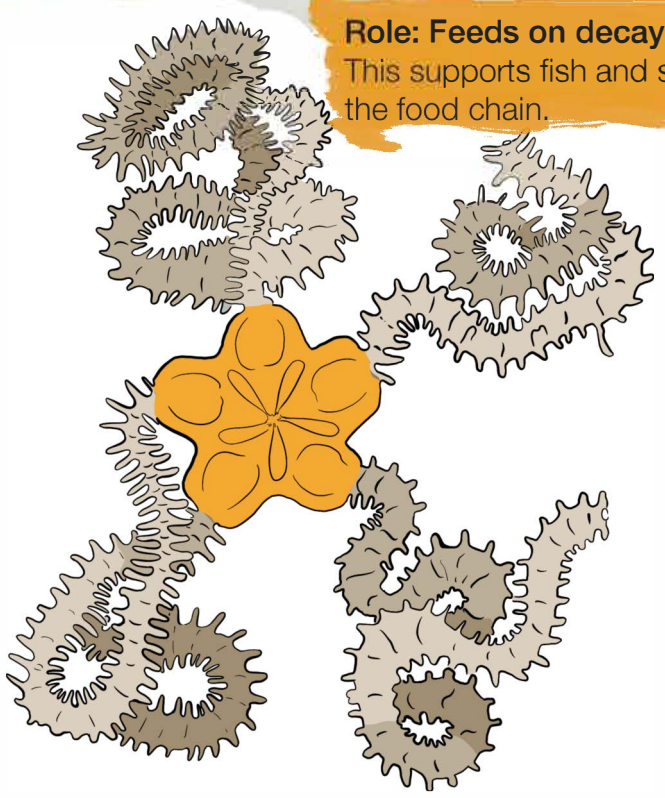
Role: Filter feeder
Removes excess nutrients, improving water quality.

Historically abundant at Dampier Flats and Crab Creek.
Now rare across much of Roebuck Bay.

LONG ARMED BRITTLE STAR

Amphiura sp. | Echinoderm

Role: Feeds on decaying material
This supports fish and shorebirds up the food chain.



To spot these critters you need to look for their arms at the surface, usually feeding. Their bodies are always buried.

Two closely related species (A. tenuis & A. catephes) coexist side by side. How they avoid outcompeting each other remains a mystery!

Widespread; most common in deep muddy areas

GREY TUBE WORM

Owenia mirrawa | Polychaete

Role: Filter feeder and sediment engineer
Improves water quality and maintains sediment health.

This worm spends its entire life inside a self-built tube of sand grains, shell fragments and mucus.

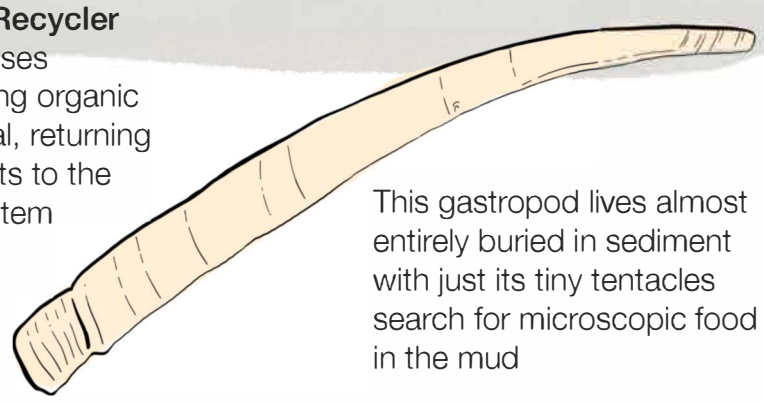
Dense colonies form **'worm cities'** that oxygenate sediments and support other species.

Most common around Crab Creek

SMOOTH TUSK SHELL

Laevidentalium lubricatum | Gastropod

Role: Recycler
Processes decaying organic material, returning nutrients to the ecosystem



This gastropod lives almost entirely buried in sediment with just its tiny tentacles search for microscopic food in the mud

Widespread: muddy and sandy sites across the Roebuck Bay

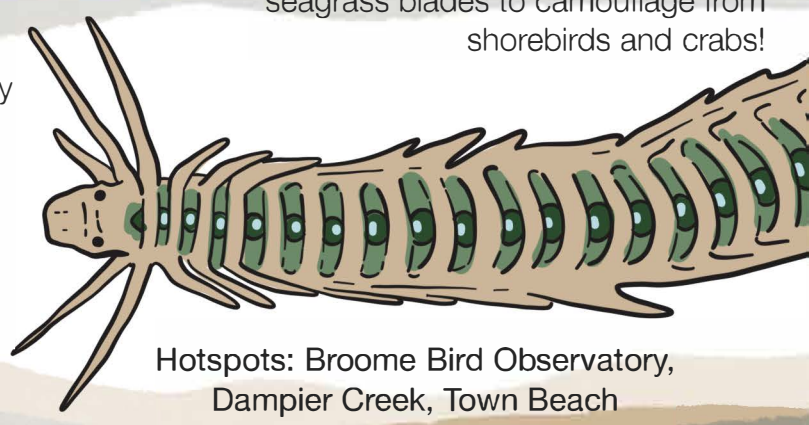
GREEN PADDLE WORM

Phyllodoce cf. novaehollandiae | Polychaete

Role: Mid-level predator
It links smaller prey to larger predators

Master of disguise
Green colour and slender body mimic seagrass blades to camouflage from shorebirds and crabs!

Releases sticky mucus as a defence when threatened!

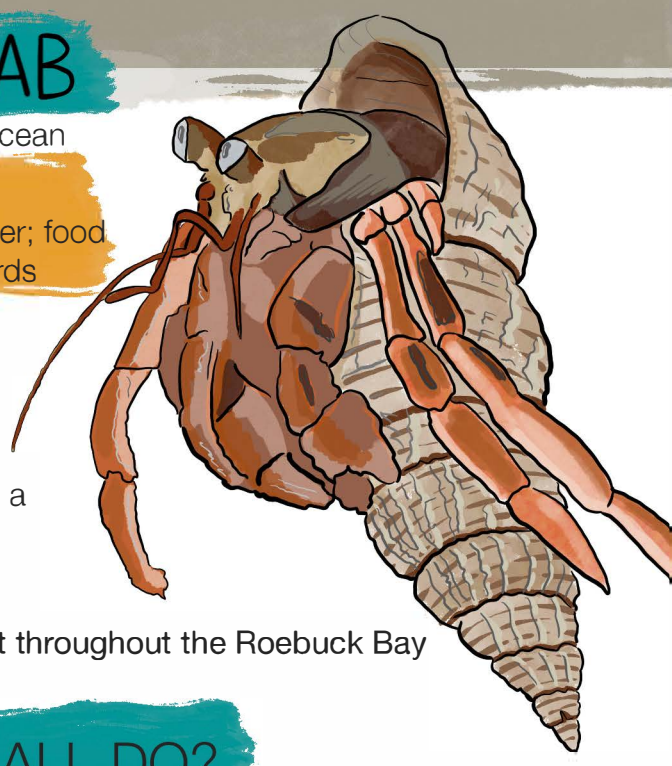


Hotspots: Broome Bird Observatory, Dampier Creek, Town Beach

HERMIT CRAB

Paguroidea sp. | Crustacean

Role: Recycler
Breaks down organic matter; food for fish, crabs and shorebirds



Hermit crabs cannot grow their own shells and form **'vacancy chains'**: when a larger shell appears, crabs queue and swap homes in a domino effect, biggest to smallest!

Widespread and abundant throughout the Roebuck Bay

WHAT DO THEY ALL DO?

FILTER	RECYCLE	BUILD	FEED
Cockles and tube worms remove excess nutrients cleaning the water	Hermit crabs and tusk shells break down dead matter returning nutrients to the bay	Tube worm 'cities' oxygenate the sediment supporting life below the surface	All six species are food for fish, crabs, turtles and 100,000+ migratory shorebirds

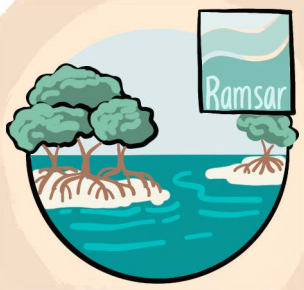
Sources: Piersma et al. (2016); He et al. (2024); Drent et al. (2006); Pepping et al. (1999); Pleijel (1991).

DECADES OF DISCOVERY

RESEARCH HISTORY AND COMMUNITY GROUPS

Four major benthic surveys since 1997 have built one of Australia's longest-running intertidal datasets, drawing together scientists, government agencies, universities and local volunteers from around the world.

1990
RAMSAR LISTING



Roebuck Bay recognised as a Wetland of International Importance, driving the first systematic benthic monitoring programs.

1997
FIRST SURVEY

First comprehensive benthic survey. Only 10% of species found could be confidently named — the bay's true biodiversity had barely been scratched.

2002
SECOND SURVEY

Survey Expands South
Coverage extended to nearly the entire bay. 60 previously unrecorded species found. Featured in National Geographic; filmed for Channel Nine's 'Postcards'.

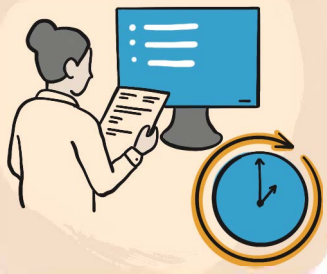
2006
REPEAT NORTHERN SURVEY

28 new species found. Some shellfish populations in almost identical locations to surveys a decade earlier, evidence of remarkable ecosystem stability.

2016
SURVEY + MARINE PARK ESTABLISHED

368 species identified. Marine Park formally established. Yawuru Traditional Owners and Country Managers contributed directly to fieldwork.

2026
ECU SURVEY CONTINUING THE RECORD



Rangelands NRM supporting Edith Cowan University to implement an updated long-term monitoring program.

SURVEY SPOTLIGHTS

ROEBIM-97 1997
Key finding: Established the first detailed baseline. Only 10% of species identifiable — the start of the story.
Organisations: NIOZ, CALM/DBCA, Curtin University, Broome Bird Observatory.
30 community volunteers

SROEBIM-02 2002
Key finding: 60 new species. International headlines — National Geographic and Channel Nine.
Organisations: NIOZ, CALM/DBCA, University of Sydney, Charles Sturt University, WA Museum.
65 community volunteers

ROEBIM-06 2006
Key finding: 28 new species. Shellfish found in near-identical locations to surveys a decade earlier.
Organisations: NIOZ, CALM/DBCA, University of Groningen, Flinders University, Charles Sturt University, WA Museum.
38 community volunteers

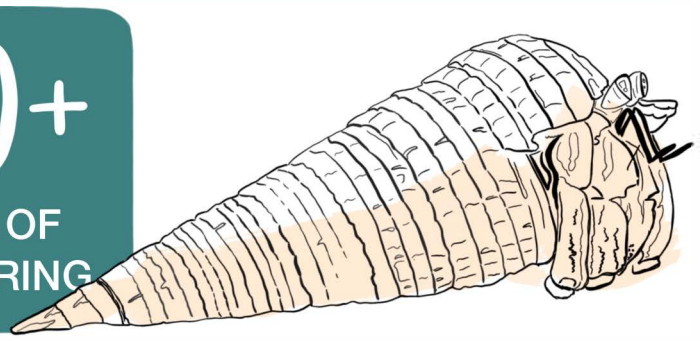
AnnRoeBIM-16 2016
Key finding: 368 species — most detailed dataset ever produced. First Yawuru Country Manager involvement in fieldwork and species identification.
Organisations: NIOZ, DBCA, ECU, University of Groningen, Wetlands Research & Management, Yawuru Traditional Owners.
100+ community volunteers

4 MAJOR SURVEYS

200+ COMMUNITY VOLUNTEERS

368 SPECIES IDENTIFIED

30+ YEARS OF MONITORING



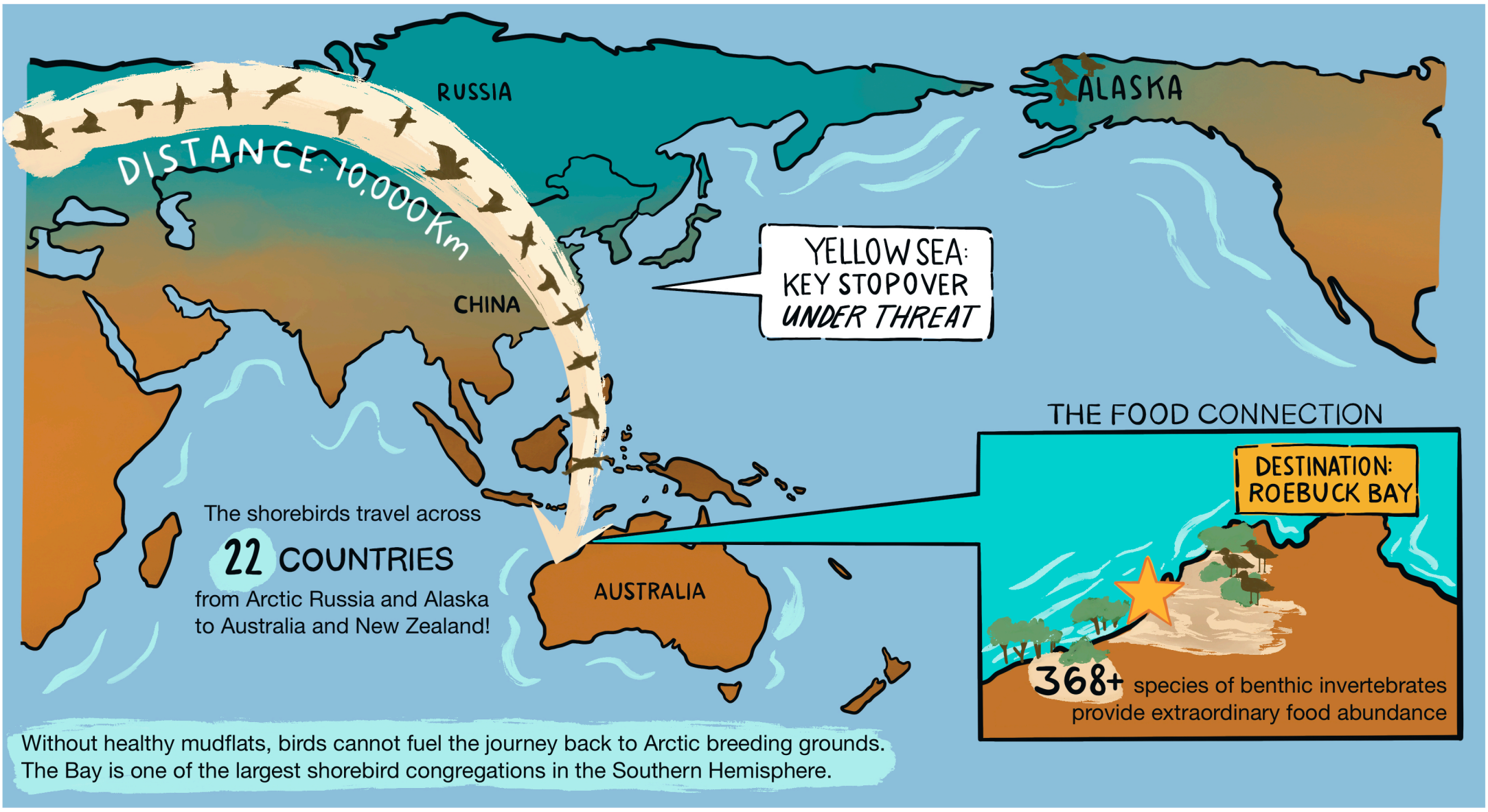
Sources: Piersma et al. (2016); Tulp et al. (1994); Chan et al. (2022); Marchant & Higgins (1993); Pepping et al. (1999). | Roebuck Bay lies within Yawuru Country — Yawuru Nagulagun. | Rangelands NRM.

THE LONG WAY HOME

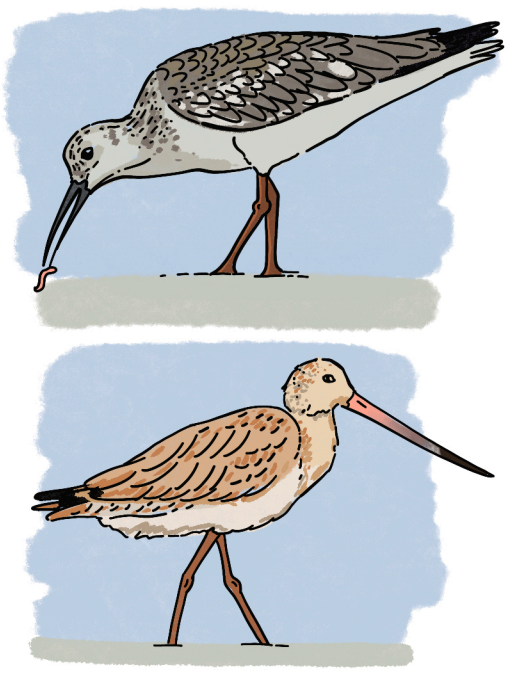
SHOREBIRDS AND THE MUD THEY DEPEND ON

Each year, 100,000+ shorebirds fly up to 10,000 km from the Arctic to Roebuck Bay to eat what's hidden in the mud at Roebuck Bay. The Bay is one of the most critical non-breeding staging site for the magnificent shorebirds.

THE EAST ASIAN AUSTRALIA FLYWAY



PRIORITY SPECIES



GREAT KNOT — *Calidris tenuirostris*
NEAR THREATENED GLOBALLY

Feeding: Shellfish specialist
Swallows bivalves whole and crushes shells in a powerful muscular gizzard.
Targets thin-shelled cockles: maximum energy for minimum shell.

First migration leg from Roebuck Bay can exceed 5,500–6,000 km non-stop!

Why Roebuck Bay?
A significant proportion of the global Great Knot population relies on Roebuck Bay's shellfish-rich mudflats to fuel migration to north-eastern Siberia.

BAR-TAILED GODWIT — *Limosa lapponica*
CRITICALLY ENDANGERED GLOBALLY

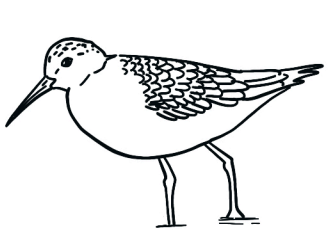
Feeding: Deep prober
Specialised nerve endings in bill tip detect worms and shellfish buried centimetres below the surface.

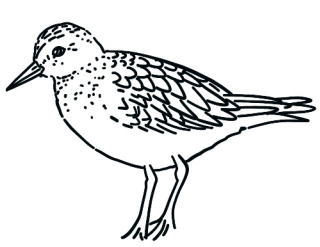
Some individuals fly 10,000+ km non-stop from Alaska to Australia!

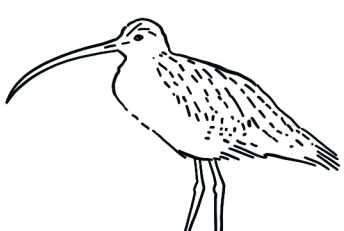
Why Roebuck Bay?
After one of the longest non-stop migrations on Earth, Bar-tailed Godwits depend on Roebuck Bay's worms, shellfish and crustaceans to restore energy reserves for the return migration north.

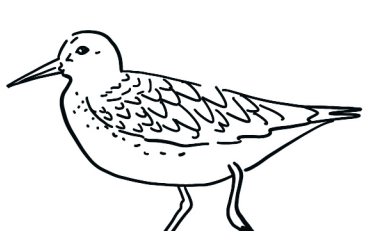
HOW FIVE SPECIES SHARE ONE MUDFLAT

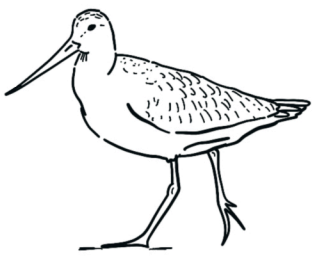
Different feeding strategies allow many species to share one mudflat without competing and the benthic community supports them all.











	CURLEW SANDPIPER	RED-NECKED STINT	EASTERN CURLEW	BAR-TAILED GODWIT	GREAT KNOT
Feeding Technique	Rapid 'sewing-machine' pecking at tidal edge	Surface picking tiny prey directly from the mud	Long curved bill reaches crab burrows and mud cracks	Deep probing detects buried prey by touch	Swallows bivalves whole; crushes shells in gizzard
Primary Prey	Small surface invertebrates	Tiny crustaceans and worms	Large worms, crabs, shrimp	Worms, shellfish, crustaceans	Cockles and thin-shelled bivalves

Sources: Piersma et al. (2016); Tulp et al. (1994); Chan et al. (2022); Marchant & Higgins (1993); Pepping et al. (1999). | Roebuck Bay lies within Yawuru Country — Yawuru Nagulagun. | Rangelands NRM.