REBUILDING AUSTRALIA'S LOST SHELLFISH REEFS

2022 Reef Builder Annual Report

Australian Government

The Nature Conservancy Australia

Contents

Version/Date	Issued as	Author/s	Approved
Version 1, December 2022	Draft	Oceans Program	Fiona Valesini

The Reef Builder Project is led by The Nature Conservancy (TNC), with generous grant funding from the Australian Government and co-contributions from public and private partners

Big-bellied Seahorse on the Gippsland Lakes Shellfish Reefs, Victoria. © Streamline Media

Executive Summary

Reef Builder, a partnership between the Australian Government and The Nature Conservancy (TNC), is Australia's largest marine restoration initiative. This program aims to rebuild and protect 13 shellfish reef ecosystems across Australia, working towards TNC's ambitious target of restoring 60 reefs nationally by 2030. Our goal is to recover 30% of this lost habitat, to bring shellfish reef ecosystems back from the brink of extinction for the benefit of both people and nature.

Shellfish reefs are created when millions of oysters and mussels settle onto each other, forming hard reef structures within the shallow waters of Australia's bays and estuaries. These vibrant reefs are natural solutions to some of our greatest conservation challenges. They improve water quality, boost fish stocks, provide homes for a diverse range of sea life, generate regional employment and protect Australia's coastal communities and shorelines from coastal erosion.

Vast shellfish reefs once stretched across Australia's southern coastline. Unfortunately, most have been decimated since the 1800s by years of commercial harvesting of wild shellfish, water pollution, introduced species and disease. Fewer than 8% of these habitats remain today.

To help reverse the decline of these vital habitats, TNC began an Australian-first initiative in 2014 to restore shellfish reefs at impactful scales in areas where people need them most – the populated bays and estuaries across southern Australia. After seven years of demonstrated success in Victoria, South Australia and Western Australia, Reef Builder was launched in partnership with the Australian Government to grow this critical restoration work to a national scale and accelerate the recovery of shellfish reef ecosystems.

Reef Builder is a $20 million program of work that commenced in January 2021 and will restore oyster and mussel reefs at 13 locations across Australia by June 30 2023. It aims to (1) protect and restore Australia's estuarine and coastal ecosystems through rebuilding a critically endangered marine ecosystem, improving local biodiversity and boosting fish populations, and; (2) provide economic stimulus to shellfish aquaculture, marine engineering, construction, monitoring and ecotourism businesses in coastal and regional communities.

This Annual Report outlines our progress throughout 2022, reporting on the four key Program objectives (below) and outlining our next steps for 2023.

Remnant native flat oyster bed at Georges Bay, Tasmania. © Streamline Media

What Reef Builder has achieved since 2021

30

Hectares of reef restored

98

Tonnes of recycled shells used

21

Million shellfish seeded on reefs

880

Hours of diving for restoration

256

Volunteers involved

2,684

Hours volunteered

422

Jobs created by Reef Builder

66

Small to medium enterprises engaged

Summary of progress against the four key Reef Builder objectives

Program Objective (2021-2023)	Status – January 1 2021 to December 30 20222
1. **Build new reefs** – Construct shellfish reefs at 13 locations, following established best practice project management, restoration and siting protocols.	60% Complete 8 sites restored totalling 30 ha of reefs
2. **Boost local employment** – Create up to 170 jobs through employing 120 local contractors from maritime construction, earthmoving, aquaculture, engineering and natural resource management businesses across resource procurement, reef construction and reef monitoring activities.	422 jobs (250% of overall target) 66 local contractors engaged (59% of overall target)
3. **Strengthen community engagement** – Harness community interest, support and participation by communicating project progress and success through media opportunities, an online project dashboard, interactive graphics and a project video, as well as creating community volunteering opportunities.	390 media opportunities with a combined reach of 170 million viewers 2684 hours of volunteering 256 volunteers
4. **Improve local biodiversity** – Establish oyster and mussel populations and enhance associated ecological communities compared to benchmark ecological targets at each of the 13 reef locations.	Shellfish populations established at 8 reef sites 21 million shellfish seeded to the reefs 880 hours SCUBA diving to construct, seed shellfish and monitor the establishment of the reefs

Background

Until the start of the 20th century, Australia was home to vast shellfish reefs, stretching across the southern half of the country, then up to the Great Barrier Reef, from Noosa in Queensland to north of Perth in Western Australia. These oyster and mussel reefs filtered the water, buffered waves reducing coastal erosion and were vital nursery grounds for fish and other marine life. After 200 years of wild commercial harvest, water pollution, introduced species and disease, our natural shellfish reefs have virtually disappeared – only 8% remain in Australia today, with similar trends observed globally.

Oysters and mussels are ecosystem engineers, settling onto each other to form hard reef structures similar to coral reefs. The disappearance of these reefs from most of Australia's bays and estuaries has changed how these coastal ecosystems function, with a host of negative flow-on effects such as reduced water quality, fish abundance and natural shoreline protection.

To reverse this decline, TNC has been leading shellfish reef restoration efforts in Australia since 2014, in partnership with the public and private sectors. This effort has built on 25 years of restoration experience in the United States and elsewhere and has been tailored to suit local conditions. Port Phillip Bay in Victoria was the first restored reef site established in Australia, followed by Windara on the Yorke Peninsula in South Australia and Oyster Harbour in Albany, Western Australia. After seven years of demonstrated restoration success, backed by the global track record of TNC, we know that shellfish reefs can be restored at scale and their social, economic and ecological benefits returned.

The Reef Builder partnership between TNC and the Australian Government is our nation's largest marine restoration program, rebuilding shellfish reefs at 13 locations across Australia. This major initiative is a bold step towards bringing our shellfish reef ecosystems back from near extinction for the benefit of both people and nature.

The Reef Builder Program (2021-23) will provide:

Economic stimulus in coastal and regional communities, including those impacted by COVID-19 and the 2019-20 bushfires. Key industry sectors benefitting from this initiative include aquaculture, marine engineering and construction, science, fisheries and tourism.

Healthier estuarine and coastal waters through the restoration of a critically-endangered marine ecosystem and improvements to local biodiversity and fish populations. This will assist in protecting and enhancing the resilience of Australia's coastal ecosystems.

Social and environmental benefits through job creation, community volunteering, improved social and cultural connections to coast, and boosting tourism opportunities.

We aim to achieve these outcomes through delivery of the following four key objectives:

1. Build new reefs – Construct shellfish reefs at 13 locations across Australia, following established best practice project management, restoration and siting protocols.

2. Boost local employment – Create up to 170 jobs through employing 120 local contractors from maritime construction, earthmoving, aquaculture, engineering and natural resource management businesses across resource procurement, reef construction and reef monitoring activities.

3. Strengthen community engagement – Harness community interest, support and participation by communicating project progress and success through media opportunities, an online project dashboard, interactive graphics and a project video, as well as creating community volunteering opportunities.

4. Improve local biodiversity – Establish oyster and mussel populations and enhance associated ecological communities compared to benchmark ecological targets at each of the 13 locations.

This Annual Report outlines our progress against the four key objectives in 2022.

Figure 1 Simon Branigan, Boze Hancock and Anita Nedosyko on Kangaroo Island during the project pre-planning phase. © The Nature Conservancy

Figure 2: The 13 Reef Builder locations

Figure 3 Aerial image of new constructed intertidal Sydney Rock Oyster Reefs in Noosa Estuary

Reef Builder progress in 2022

Objective 1: Build new reefs

Construct shellfish reefs at 13 locations, following established best practice project management, restoration and siting protocols.

Planning, permitting and on-ground (reconstruction and seeding) works for reef restoration follows best practice ecological restoration principles, including seven key delivery stages: (1) Project pre-planning; (2) Site selection and suitability; (3) Planning and permitting; (4) Procurement of materials and contractors; (5) Reef restoration; (6) Monitoring and evaluation; (7) Handover and closeout. The progress achieved in 2022 across each of the seven delivery stages is summarised below for all 13 sites.

This progress has been tracked and summarised via an online project management system (pmo365), which was tailored specifically to the delivery framework for Reef Builder and follows industry best-practice. The pmo365 system provides:

i. A consistent delivery framework across all 13 reef-building project locations

ii. Connectivity across projects

iii. Improved accountability and workflow approvals

iv. The ability to track and summarise the progress and implementation of all projects

This project management system is also complemented by a developing data management system (the Monitoring, Evaluation and Learning Data Hub - MELD Hub) to collate and visualise biological, social and economic data collected throughout Reef Builder (see 'Stage 6 - Monitoring & Evaluation' section below for more details).

Table 1: Summary of Reef Builder progress in 2021

STAGE 1 Project Pre-Planning: 100% complete	STAGE 2 Site Selection & Suitability: 100% complete	STAGE 3 Planning & Permitting: 70 % complete	STAGE 4 Procurement: 90 % complete	STAGE 5 Reef Restoration: 60 % complete	STAGE 6 Monitoring & Evaluation: 71 % complete	STAGE 7 Handover & Closeout
13 locations complete	13 locations complete	9 locations approved 4 locations submitted pending approval	12 locations contracts executed to preferred local contractors for on-ground works (construction and monitoring and evaluation) 1 location (Botany Bay) construction and hatchery contracts pending execution but preferred local contractors selected	8 locations restored 6 locations pending restoration but all scheduled to be completed by April 2023	13 locations baseline monitoring complete 2 locations post-construction monitoring complete 11 locations post-construction monitoring pending	Ongoing conversations with local and state government partners

Stage 1 – Project Pre-Planning – 100% complete

Project pre-planning was conducted in early 2021 with budget allocations and scheduling undertaken across all the 13 reef building locations. An overarching Project Management, and Monitoring and Evaluation Plans have been developed, as well as individual Communication, Stakeholder Engagement and Monitoring and Evaluation Plans for each of the 13 sites.

Stage 2 - Site Selection & Suitability – 100% complete

Restoration Suitability Modelling (RSM) is key decision-support framework that has guided decision making and site selection for each Reef Builder location. These quantitative models combine a library of spatial data layers to map areas that are most suitable for building shellfish reefs and are an important tool for engaging the local community in the decision-making process. These models are developed using three main components:

1. **Environmental suitability** - this model selects sites that are most likely to maximise shellfish survival and growth and is vital to the success of a restoration project. Parameters used in this model are water quality (e.g. salinity, temperature, dissolved oxygen) and seabed characteristics relative to the preference and tolerance of the species of oyster or mussel being restored.
2. **Restoration suitability** – this model ensures that conflict is limited within our highly-used estuaries and bays by selecting areas that have minimal conflicting human-uses. This model is established through consultation with the relevant regulatory agencies and other water-way users:
    - Navigational safety, i.e. sufficient vessel clearance over the top of reefs and avoidance of all navigational channels
    - Coastal infrastructure, e.g. marinas, jetties, navigation aids
    - Mooring areas
    - Gazetted human-use areas, e.g. sailing areas, water ski areas
    - Marine Protection Areas (MPAs)
    - Priority habitats, e.g. seagrass beds
3. **Stakeholder suitability** – this model ensures reef locations are situated in areas that are supported by stakeholders and community members.

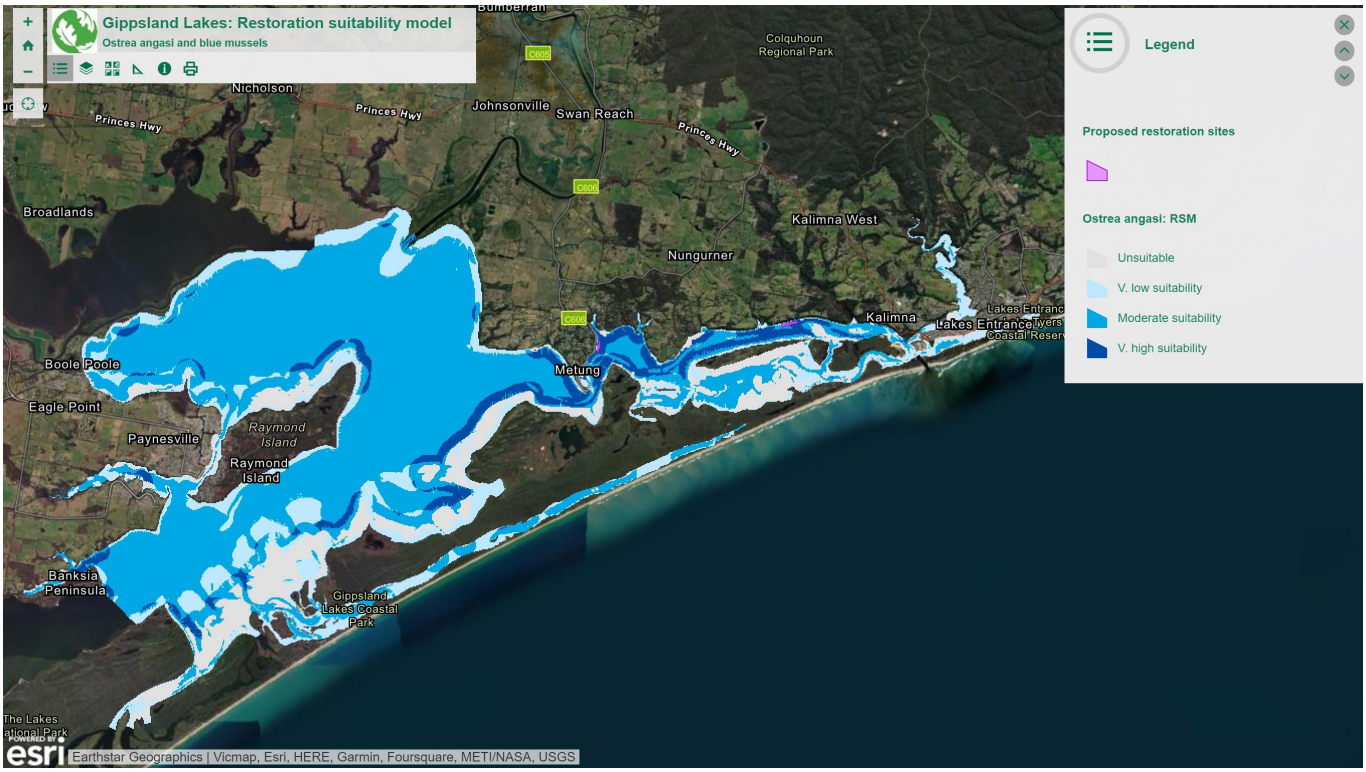


Figure 4 Gippsland Lakes Restoration Suitability Model

Stage 3 - Planning & Permitting – 70% complete (9 locations approved, 4 submitted and pending approval)

Restoration planning - reef specifications

Reef Builder projects are designing reefs that achieve a conservative balance between ecological and engineering principles, and minimising impacts to adjacent habitats and foreshores. Identifying the reef design and layout is an important step in providing regulators with the best available information to progress permitting for restoration works (Figure 4).

From a water movement and seabed perspective, the following principles are considered and assessed by coastal engineers to minimise the risk of reef structure instability, scour, and negative effects on other nearby structures and habitats:

1. For reefs located in areas with strong, well-defined seabed water flows, the long axis of the reef is aligned with the flow direction (to minimise barriers to sediment movement and edge scour).
2. For reefs with more inconsistent flow (strength and direction), a more flexible design approach can be adopted. However, individual reef units are arranged to optimally fit within the build envelope and align with seabed depth contours.
3. Reef layouts located on relatively flat areas of seabed are prioritised (to minimise risk of reef structure instability).

From an ecological perspective, the reefs are designed to increase biological gains and resilience for restored shellfish populations. Optimisation of edge effects, variability in reef height and creating a diversity of 3-dimensional space within reefs will cater to the needs of a wide range of plant and animal species, thereby boosting local biodiversity.

Permitting

A key stage of any restoration project is securing the relevant local and state government permits and approvals, which includes community consultation. The approval pathway differs from state to state, however a common element is the requirement for a Development Approval (DA). In many jurisdictions, shellfish reef restoration is considered the same as building grey infrastructure such as bridges, jetties and groynes, and undergoes a similar assessment and permitting process. The approval timeframe for DAs and associated consultation requirements, combined with other permit obligations (e.g. Crown Lands), can take up to a year for assessment. Other common permits/approvals required are biosecurity approvals (to ensure seeding of the reefs with shellfish does not introduce any new pests or diseases to the waterway), stock enhancement approvals and Aboriginal Heritage approvals.

The full suite of required permits has been obtained for nine of the reef building sites (i.e. Port Stephens, NSW; Noosa, Qld; Port Phillip Bay and Gippsland, VIC; Glenelg, Onkaparinga and Kangaroo Island SA; Derwent, TAS; and Swan-Canning, WA), with those for the remaining four sites pending approval.

Stage 4 - Procurement – 90% complete (12 locations fully procured and1 location pending contract execution)

The Nature Conservancy commits to sourcing materials and services required to design, construct and monitor the reefs from local suppliers wherever practical and financially feasible. This includes:

- Commitment to source at least 10% of all procurement by value from small and medium enterprises.
- All rock required to build the reef bases to be sourced from local quarries if logistically feasible.
- Local trucking companies to be hired to move the rock from the quarry to the load-out sites.
- All shellfish to be bred in local hatcheries or on local aquaculture farms, unless otherwise required by state government biosecurity protocols.
- Local research institutions, consultants, commercial divers and engineering firms to be identified and invited to tender for project work.
- Local shellfish farmers to be paid a fee if ongoing management of juvenile shellfish is required.
- All small vessels used for site visits to be hired locally.
- Interstate personnel to stay in the towns and cities where works are being undertaken contributing to the local economy.

Procurement for all materials and contractors has been completed at twelve of the Reef Builder locations with the execution of the contracts in Botany Bay for construction and hatchery work pending.

Stage 5 - Reef Restoration – 60% complete (reef reconstruction, seeding completed and natural ecological colonisation underway at 8 locations with restoration to be finished at the remaining 5 locations by April 2023)

Shellfish reef restoration follows a series of restoration steps, namely:

1. Deployment of a natural rock/rubble base to recreate a new reef
2. Seeding of the base with a native shellfish species
3. Natural ecological colonisation and development of the reef (‘maturation’), which typically takes ~5-7 years to become a fully established and self-sustaining ecosystem.

The reef restoration techniques are tailored to account for the difference in approach between subtidal and intertidal areas. However, both approaches involve reconstruction and seeding of this reef base with native shellfish species if the estuary or bay is recruitment-limited (i.e. natural remnant populations of native shellfish species are low).

This is an exciting stage where all the hard planning and preparation work comes to fruition. Barges and excavators are on the water, and local communities can see the restoration in action with rock being deployed and commercial divers seeding the reefs with shellfish.

Almost as soon as the reefs are reconstructed, fish and other marine animals start to make a home amongst the new habitat.

Following construction of the reef base, a key next step is to survey the reefs to ensure they have been constructed to design specifications. These post-construction surveys are undertaken by local hydrographic surveyors using multi-beam bathymetric echosound survey (MBES) technology, producing maps of the reefs which can be compared to the reef designs and layout plans (Figures 6, 7 and 8).

Figure 5: Shellfish reef base being deployed in Point Walter, at the Swan-Canning estuary in Western Australia, July 2022. © Overland Media.

Limestone Reef Base

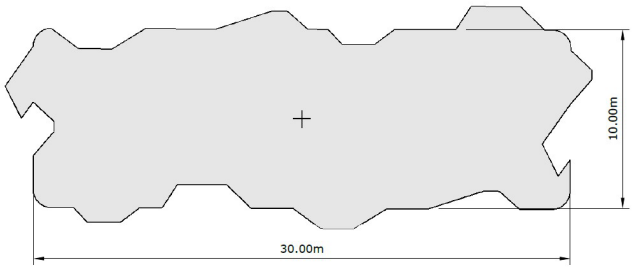
Across all sites Limestone substrate is to be deployed with an undulating finish height above the sea floor that ranges between 300mm and 500mm. The grade of the Limestone placed will range between 250mm & 600mm dia with the majority (70%) being 300-400mm dia.

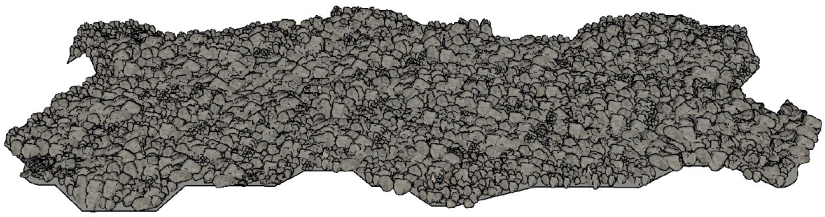
Each engineered footprint has been designed to allow maximum surface area and promote Naturally forming reef features.

Coverage for 30x10m Reef - 300m²
Coverage foe 15x10m Reef - 150m²

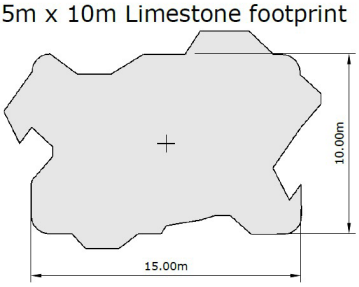
Cubic tonnage for 30x10m Reef 120m³
Cubic tonnage for 15x10m Reef 60m³

30m x 10m Limestone footprint





15m x 10m Limestone footprint



GIPPS- 09/21-003-1

Rev	Date	Description	By	APP
1	27/08/21	Initial Reef Design Limestone	SR	
2	01/09/21	Final Reef Design Limestone	SR	
2	05/01/22	No Change / Re issue only		

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Client: The Nature Conservancy Australia

Drawn: SR Date: 05/01/22
Engineered: Date:
Checked: Date:
Approved: Date:

POLARIS MARINE PTY LTD

Project: Gippsland Reefs-Feb/March 2022 Campaign

Title: Initial Reef Design Limestone.
30m x 10m Limestone Base.
15m x 10m Limestone Base.

Scale	Drawing No.	Sheet:	Rev:
NTS	GIPPS- 05/22-001-3	1	3

Figure 6: Reef design for the Nyerimilang Jetty Reef, Gippsland, Victoria.

Nyerimilang Jetty Reef

The orientation of the Nyerimilang reef plot is parallel to the shore line with the northern edge around 45m out from the bank. On the eastern side of the reef area is Nyerimilang Jetty with some existing natural muscle development below.
The total reef permit area is 31377m² (3.13Ha) with corner coordinates;

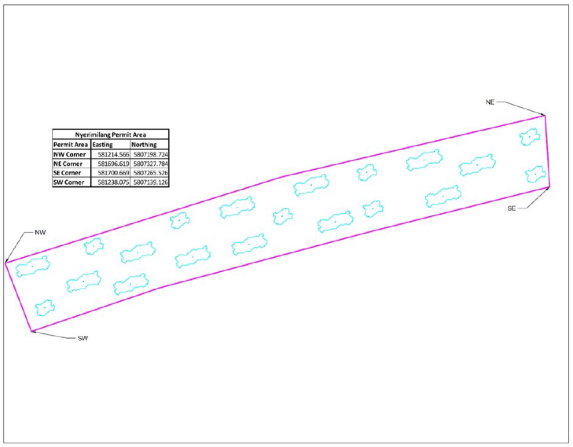
NW: 581214.5660 E, 5807198.7240 N
NE: 581696.6190 E, 5807327.7840 N
SE: 581700.6690 E, 5807265.5260 N
SW: 581238.0750 E, 5807139.1260 N

Reef Installation - Feb/Mar 2022.

The reefs in this location will be installed in a east west orientation to reduce any effects of scouring and provide longer edges with more shelter for recruitment of smaller species.

To be deployed in March 2022 are a total of 15 reefs.
9 reefs at 30m x 10m & 6 reefs at 15m x 10m

The coverage and new habitat area these reefs will provide is 3,600m²



Rev	Date	Description	By	APP
1	09/09/21	Initial Reef Design Layout.	SR	SR
2	14/09/21	Final Reef Design Layout.	SR	
2	22/02/22	Pilot reef ID removed.	SR	

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Client: The Nature Conservancy Australia

Drawn: SR Date: 22/02/22
Engineered: Date:
Checked: Date:
Approved: Date:

POLARIS MARINE PTY LTD

Project: Gippsland Reefs - Feb/March 2022 Campaign

Title: Nyerimilang Reef Design 2022 Reef Layout and permit area

Scale	Drawing No.	Sheet:	Rev:
NTS	GIPPS- 01/22-002-2	2	2

Figure 7: Reef design and layout for the Nyerimilang Jetty Reef, Gippsland Lakes, Victoria.

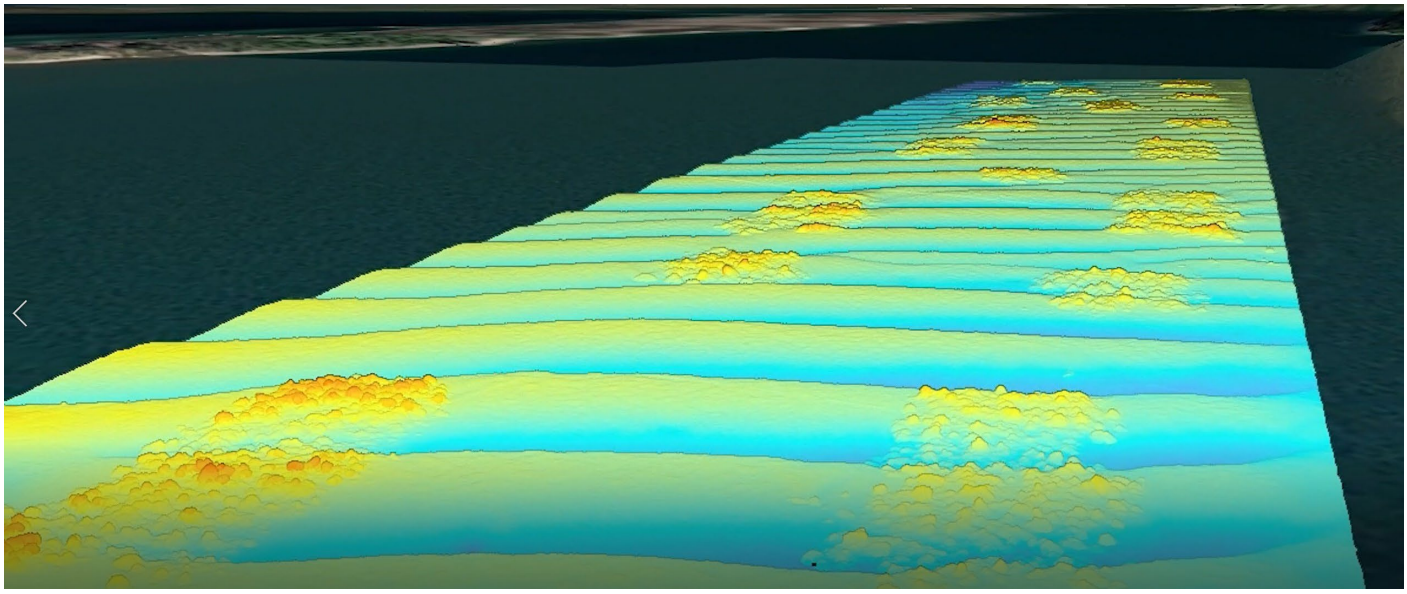


Figure 8: Animated Multibeam echosounder survey map of the Gippsland reef, showing the new reefs and seafloor profile.

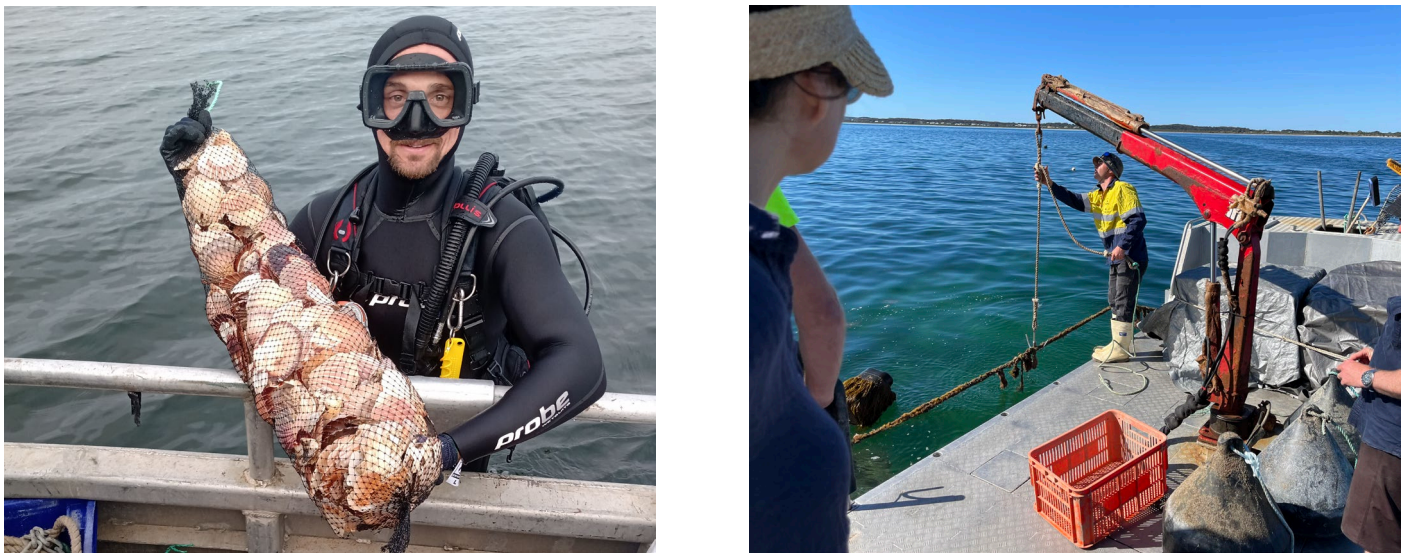


Figure 9: (left) Scott Breshkin, Gippsland's project coordinator deploying juvenile native flat oysters seeded onto shell at the newly restored shellfish reef at Nyerimilang, Gippsland Lakes, Victoria, Onkaparinga July 2022. (right) Contractors deploying juvenile native flat oysters for restoration into a shellfish farm in Kangaroo Island, SA © Boze Hancock

Since 2021, full-scale reefs have been constructed at 8 sites using rock and/or recycled shell, namely Noosa (1 ha), Port Stephens (5 ha), Port Phillip Bay (5 ha), Gippsland Lakes (3 ha), Sapphire Coast (1 ha), Glenelg (3 ha), Onkaparinga (5 ha) and Swan-Canning (8 ha) These completed construction works comprise 30 hectares of restored reefs using 33,000 tonnes of rock, 86 tonnes of recycled shells, and seven sites seeded with 21 million shellfish.

Stage 6 - Monitoring & Evaluation – 71 % complete (13 locations baseline monitoring complete, 2 locations post-construction monitoring complete, 11 locations pending start of post-construction monitoring)

Monitoring and evaluation for Reef Builder collects data to measure the environmental, economic and social outcomes of the Program. The Nature Conservancy and monitoring partners measure several key environmental indicators before and after reef construction, and at both reef and control sites, to assess how the reefs are developing against their predefined ecological baselines. Additionally, we measure social and economic indicators to inform on the benefits of shellfish restoration to people and the economy.

In 2022, baseline monitoring prior to reef construction was completed at all Reef Builder locations. Post-construction monitoring has taken place at Onkaparinga and Glenelg and will occur at the other locations in 2023.

Throughout 2022, the Reef Builder MELD Hub has been used to continuously collect monitored data. Monitoring partners and TNC are uploading biodiversity data, monitoring photos and annotating marine imagery using the MELD Hub. The Hub continues to undergo further development and refinement as feedback from monitoring partners and TNC users identifies improvements and as greater amounts of data becoming available as more reefs are constructed and monitored.

Additionally, we are testing the applicability of using artificial intelligence (AI) and machine learning to monitor the establishment and development of fish communities on

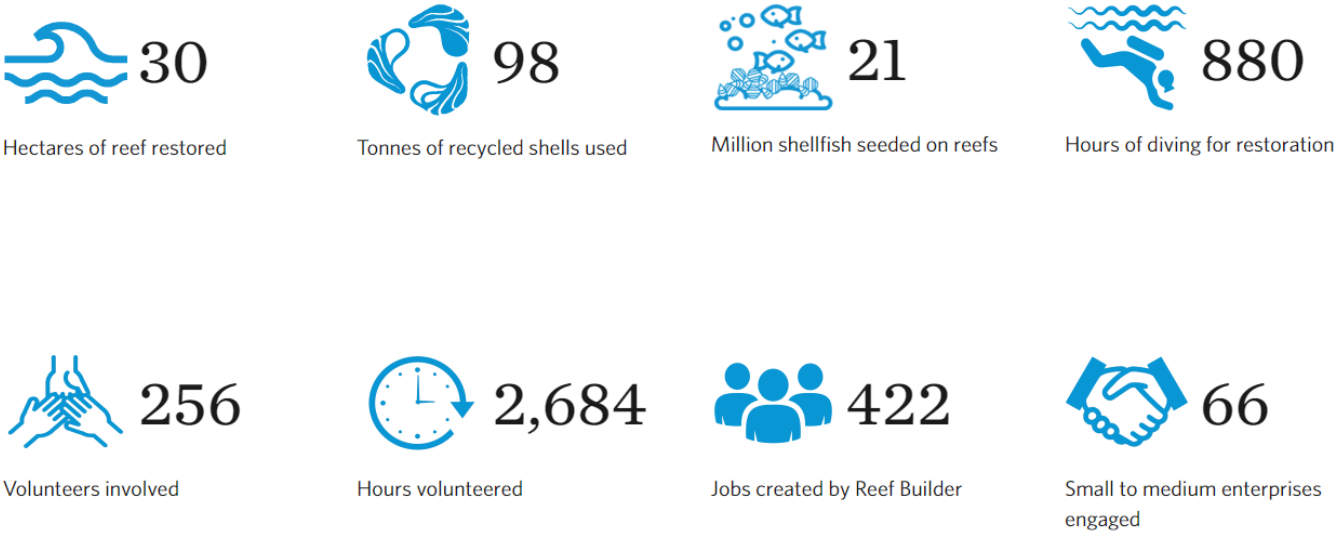
restored reefs. This project is a collaboration with the Global Wetlands Project (GLOW) and uses the Fish ID platform. Fish ID is an online platform using AI to automate the analysis of videos and images, making large volumes of data easier to process. A video of Fish ID in action can be seen here. In partnership with the University of Tasmania, we are also monitoring the nutrient cycling of shellfish reefs to understand some of the complimentary benefits of shellfish restoration to the environment, aside from biodiversity.

To fully account for social and economic benefits Reef Builder is collaborating with First Person Consulting to collect additional social data to understand the socio-cultural benefits from large-scale marine restoration. The team has also engaged EconSearch to undertake analysis and modelling to quantify the economic activity stimulated by Reef Builder.

Stage 7 - Handover & Closeout – In progress

For each of the 13 Reef Builder sites, ongoing management arrangements will be determined before the end of the funding timeframe.

What we've achieved since 2021



Objective 2: Boost local employment

Create up to 170 jobs through employing 120 local contractors from maritime construction, earthmoving, aquaculture, engineering and natural resource management businesses across resource procurement, reef construction and reef monitoring activities.

During 2022, Reef Builder created 422 jobs, which involved subcontracting 44 small to medium enterprises. This provided a much-needed direct economic stimulus for coastal and regional communities and businesses impacted by COVID-19 and bushfires.

Reef construction activities in Port Stephens, Port Phillip, Glenelg, Onkaparinga, Noosa, Swan-Canning and Sapphire Coast-Wagonga Inlet generated most of the jobs for both skilled and unskilled workers. These workers were employed in occupations such as engineers (e.g. designing the reefs), project managers (e.g. overseeing and leading project planning and implementation for TNC and contractors), machine and stationary plant operators (e.g. skippers and deckhands for boats and barges, long-reach excavator operators), farm managers and labourers (e.g. hatchery managers and support staff growing shellfish) and science technicians (e.g. environmental consultants, surveyors and scientific divers involved in monitoring the reefs). The industries involved in suppling this workforce came from a variety of sectors, including Aquaculture; Building & Construction; and Professional, Scientific and Technical Services.

Reef construction and monitoring works are scheduled to be completed for the majority of remaining project sites during 2023. Reef Builder is therefore on track to at least triple the projected 170 jobs, and meet the target of 120 local contractors engaged. This demonstrates that marine restoration at scale is beneficial for both nature and people and provides comparable (if not greater) economic benefits to traditional construction, such as road building and other grey infrastructure projects.

Figure 10. Contractors seeding restored reefs in Port Phillip Bay, Victoria, 2022. © Andrew Dunlop

Figure 11. Contractors at a quarry in the Gippsland region loading limestone rock for reef construction, Victoria, 2022. © Scott Breschkin

Objective 3: Strengthen community engagement

Harness community interest, support and participation by communicating project progress and success through media opportunities, an online project dashboard, interactive graphics and a project video, as well as creating community volunteering opportunities.

A key component in strengthening community engagement is the establishment and delivery of digital content and stories to provide partners and local communities with information on the program and local projects as they develop.

An online 'digital dashboard' has been established and is live on TNC Australia's Reef Builder webpage. (https://www.natureaustralia.org.au/what-we-do/our-priorities/oceans/ocean-stories/restoring-shellfish-reefs/). The dashboard provides a snapshot of current success against eight key metrics, including hectares of reef restored; tonnes of recycled shell used in reef restoration; numbers of shellfish seeded onto reefs; hours of diving for restoration; numbers of volunteers involved; number of hours volunteered; number of jobs created, and number of small to medium enterprises engaged (see '*What we've achieved since 2021*'.

Reef Builder digital content continues to be developed across various media platforms such as Facebook and Instagram, traditional media (print, TV, radio) and webinars. During 2022, the Reef Builder Program had 170 media events with a combined reach of 35 million viewers. Project-specific webpages (example: Noosa - https://www.natureaustralia.org.au/what-we-do/our-priorities/oceans/ocean-stories/restoring-shellfish-reefs/noosa-river/) have been developed to supplement the main Reef Builder webpage.

Project success stories were delivered to a broader community through the targeted media strategy. Highlights of these media events during 2022 included a segment about the Noosa project televised on National ABC morning show (repeated in the evening) to a combined audience of 2 million and Port Phillip Bay being featured on ABC's Landline.

Streamline media have made progress in producing videos for each of the 13 Reef Builder sites, with 7 completed and published online (latest update was the Noosa video) and the remaining in production. These will then be compiled into a national Reef Builder video featuring all of the sites, conveying how a restoration Program at this scale can be of huge benefit to nature and people. Another component of community engagement has been providing opportunities for community members to actively engage with the Program through the establishment of volunteering opportunities and stakeholder engagement events. Throughout 2022, 18 volunteers were engaged on local projects, contributing 165 hours to Reef Builder activities. Volunteer activities have mainly involved the cleaning and preparation of shell for hatchery seeding of shellfish. This is a critical step in the restoration process and enables shell to be recycled from seafood wholesalers and restaurants and used in reef building rather than going to landfill.

Information delivery to stakeholders and communities is another key element of Reef Builder. During 2022, Reef Builder staff engaged extensively with local community groups, schools, government agencies (local, state and Federal), citizen scientists, recreational fishing groups and Traditional Owners, holding 45 stakeholder engagement events (e.g. community forums) with 1395 attendees.

During 2022 there were three events jointly organised with Traditional Owners to celebrate the rebuilding of full scale reefs (images in Figure 8). In Port Stephens, our project partners NSW DPI Fisheries led a naming ceremony event of the Port Stephens reefs with Worimi nation elders. In Noosa there was a 'Shellebration' event with Kabi Kabi elders in the Noosa Estuary, Queensland and Derbarl Yerrigan smoking ceremony in the Swan-Canning estuary in Perth, Western Australia.

Figure 11: (left) Alison Rowe (centre), TNC Managing Director with (L) Frank Wilke (Noosa Council Deputy Mayor) and (R)Uncle Fred Palin (Kabi Kabi Elder) at the "Shellebration" event for the reef base deployment completion at Noosa, QLD, 2022 © K. Horner; (centre) Derbarl Yerrigan smoking ceremony for the restoration works at the Swan-Canning estuary, WA, 2022 © Fiona Valesini; (right) Smoking ceremony for the aboriginal shellfish reef restoration naming event in Port Stephens, NSW, 2022 © NSW DPI Fisheries.

Objective 4: Improve local biodiversity

Establish oyster and mussel populations and enhance associated ecological communities compared to benchmark ecological targets at each of the 13 locations.

In 2022, 20 million juvenile oysters and mussels were seeded onto the rebuilt reef. Monitoring in early 2023 will establish how the newly seeded and settled oyster and mussel populations are growing and surviving. The remaining Reef Builder locations will have oyster and mussel populations established in 2023 once reefs have been reconstructed.

Baseline ecological monitoring of restoration locations and other nearby 'control' habitats establishes benchmark understanding of local biodiversity prior to reef restoration. These baseline ecological surveys are critical for Reef Builder staff to measure changes in biodiversity following restoration, due to the establishment of marine animals and plants from nearby habitats (e.g. seagrass, rocky and remnant shellfish reefs). These monitoring surveys give insight into the marine species that will be early colonisers of the reconstructed reefs alongside the newly established oyster and mussel populations. Some examples of this monitoring works and biodiversity are shown in the surrounding images.

Western gobbleguts (Ostorhinchus rueppellii), stripey (Microcanthus strigatus) and toadfish at the newly deployed reefs in the Swan-Canning estuary, WA © Scott Breschkin

Fish community using the newly deployed Sydney rock oyster reef at Wagonga Inlet, NSW, as seen from the baited remote underwater cameras used for post-construction biodiversity monitoring surveys, 2022 © NSW DPI Fisheries

Divers performing quadrat monitoring surveys at restored reefs in Port Phillip Bay, Victoria, post construction surveys © Jarrod Boord

Next steps – plans for 2023

Reef Builder is on track for completion by the end of 2023, delivering each of the ambitious program objectives that were established in 2021. In the final year of this major restoration initiative, we will complete construction of the remaining 5 reefs and wrap up our extensive monitoring programs to evaluate the ecological, social and economic benefits of this work.

We look forward to sharing a final summary of Reef Builder's achievements and impact in the second half of 2023.

Monitoring works in Gippsland Lakes © Streamline Media

Restored shellfish reef at Wilsons Spit, Port Phillip Bay, Victoria © Streamline Media

FOR MORE INFORMATION

Alison Rowe, Managing Director |australia@tnc.org| 03 8346 8600

Suite 2-01, 60 Leicester Street, Carlton, VIC 3053

www.natureaustralia.org.au

The Nature Conservancy Australia