

National Environmental Research Program

TROPICAL ECOSYSTEMS hub

A Synthesis of NERP Tropical Ecosystems Hub Torres Strait Outputs 2011-2014 Compiled by RRRC

Australia's Torres Strait region

The Torres Strait region is a group of 247 islands covering 48,000 km² located between the tip of Cape York and the southwest coast of Papua New Guinea (PNG) (image left). Only 18 islands are inhabited, supporting an estimated 7,000 people, and thus the Torres Strait retains a high degree of natural and wilderness value. In addition

to the many continental islands, the region has large areas of coral reefs, seagrass

meadows and mangroves. The region is protected from swell by the northern Great Barrier Reef (GBR), has strong tidal currents, an irregular seafloor and a narrow continental shelf.

Torres Strait is rich in biodiversity and cultural significance, and its ecosystems are amongst the most pristine in the world. The region provides a range of habitats for highly diverse Indo-Pacific marine plants and animals, including dugongs and marine turtles. Dugongs and turtles are of immense spiritual significance to the people of Torres Strait, and have a vital role in the region's ecology and cultural economy. Torres Strait has the largest continuous area of seagrass meadows in the world, significant areas of diverse coral reefs, extensive areas of coastal mangroves, and productive fisheries. The strategic location of the Torres Strait places it at risk from the downstream impacts of shipping, mining, resource over-exploitation, increasing tropical diseases and climate change.

A collection of Australian Government funded National Environmental Research Program (NERP) projects investigating the diversity and health of coral reefs, mangrove and freshwater habitats, and marine water quality have confirmed the importance of Torres Strait marine habitats from a regional perspective, as well as nationally and internationally. Participatory community projects have focused on ways to build resilient communities, and detecting tropical diseases. Torres Strait Islander communities continue to depend on the healthy functioning of their marine and coastal ecosystems for livelihoods and cultural practices. Central to the NERP science projects was the critical involvement of Torres Strait people and communities in research and monitoring, supporting communities and management agencies to develop future plans and policies to protect the natural and cultural values of the region.

apua New Guinea

Ecosystems of Torres Strait

The Torres Strait is where the Coral Sea and Arafura Sea meet, and marine and coastal ecosystems are shaped by local and regional water circulation as well as human activities. Massive freshwater and sediment inputs from coastal rivers in PNG, particularly the largest river in the region, the Fly River, can inundate the northeast Torres Strait with flood plumes transporting large quantities of sediment that pose a major threat to coral reefs and seagrass meadows. Water circulation in the region is driven by wind, tides, and ocean patterns in the nearby Coral Sea, northern Great Barrier Reef, Gulf of Papua, and Gulf of Carpentaria.

The strong physical drivers in the Torres Strait have influenced the formation and character of the 1,200 coral reefs, with an east-west elongation of reefs. Coral reefs dominate in the clear warm waters of the eastern Torres Strait and form the northern extension of the GBR, while seagrass habitats dominate in the more turbid and sediment-laden conditions in the west that are influenced by a number of small coastal rivers flowing from the Gulf of Papua. Whilst freshwater wetlands are rare, most Torres Strait islands have extensive coastal mangroves and several islands (particularly Saibai and Boigu) are made up of intertidal swamps. Torres Strait marine habitats support significant populations of dugongs, green and flatback turtles – species of conservation concern – as well as sharks, fish and invertebrate species, many of which are important for cultural practices, food security and livelihoods.

Coral reef surveys between 2012 and 2014 in the central and eastern Torres Strait indicate that the region may be a coral reef biodiversity hotspot. Surveys recorded 246 hard coral species of which 77 are new records for the Torres Strait and 6 are new records for Australia. Reef fish surveys documented 301 marine species, with many being new records for the region, and included species from the northern GBR and PNG. Coral and fish communities from central reefs differ from those in the east, reflecting the differences in turbidity and wave exposure. Torres Strait reefs are in good condition with high coral cover, the presence of major coral reef groups, and low incidence of coral disease. However there is evidence that reefs are at risk from crown-of-thorns starfish outbreaks and temperature stress.

The Torres Strait has the most extensive seagrass meadows in Australia and possibly the world, with 11 tropical species supporting globally significant populations of dugongs, green and flatback turtles. NERP-funded aerial surveys show that the dugong population in central and western Torres Strait is stable and estimated at more than 12,000 animals. This is the largest aggregation of dugongs globally, with animals moving between reef and non-reef areas, and using Australian and PNG waters. Aerial surveys also found a significant population of large juvenile and adult turtles in western Torres Strait (~600,000 animals).

The Mer island group has the most significant green turtle rookeries in the region, important to the future health and viability of the population. There are however long-term concerns for the future of the green turtle population due to chronic nesting failures at their major rookery, Raine Island, in the northern GBR. Islands in the north-western and southern Torres Strait are significant flatback turtle rookeries (e.g. Warul Kawa receives 100–200 nesting turtles each year), and adult females migrate large distances to forage in international waters.

There are 31,390 hectares of wetlands in Torres Strait, comprising 21 vegetation communities of which 3 are unique to the region. 83% of wetlands in Torres Strait are tidal (mostly mangrove communities), and Boigu and Saibai islands have the largest areas of wetlands. The region has very high mangrove biodiversity, with wetland surveys on 20 islands documenting 124 wetland species, including 35 mangrove species – more than 50% of the global total. The surveys identified 2 mangrove species new to Australia and 2 new species for Torres Strait. Mangrove species diversity was influenced by island size – smaller islands had fewer species (i.e. lower diversity) than larger islands. In freshwater habitats, 50 fish species were recorded on Torres Strait islands.

People & Communities

The Torres Strait is a region rich in natural and cultural values, with strong links between the environment and the livelihoods of local people. The region has one of the highest proportions of Indigenous people in Australia with the Torres Strait Islanders being of Melanesian origin. The Torres Strait is the only region in Australia that shares international borders with PNG and Indonesia. The Torres Strait Treaty between PNG and Australia established the Torres Strait Protected Zone and other mechanisms for shared governance of the region, including access to and management of marine resources. The Treaty aims to protect island community livelihoods, and improve them through sustainable economic development. As Australia's northern border however, the region is undergoing unprecedented change.

> Torres Strait is under increasing pressure from a range of factors, and island communities have been working to pro-actively plan for the future to address these threats to their islands, their culture, way of life and livelihoods. A new participatory approach to support communities

make decisions in the face of change was trialled and identified some key actions for the future to build resilient and sustainable Torres Strait communities. Resilient communities are able to cope with and continue after unexpected shocks. Priority issues identified by communities included: cultural renewal, improved garden food production for food security and health, enhanced community communication, improved marine resource management especially for green turtles and dugongs, and developing sustainable industries, including ecotourism and aquaculture.

> The Torres Strait has long been recognised as a biological bridge to mainland Australia, including for emerging infectious diseases, and there is concern regarding its potential to enable disease movement to the mainland. Infectious diseases represent serious threats to human health, agriculture and biodiversity. A NERP-funded project provided preliminary information on how diseases move across the Torres Strait and what methods are best for early detection of disease to inform management of outbreaks within the region. A novel method for sampling disease vectors (mosquitos) in remote tropical regions that is more robust, efficient and cheaper was encouraging. Results show that although natural vegetation supports three times more mosquitos, the diseasecarrying mosquitos are almost exclusively found in villages, with implications for the spread and containment of infectious diseases in Torres Strait. Management of vector breeding habitats in villages is the highest priority for managing future disease outbreaks in the region.

Pressures & Threats

The Torres Strait is under increasing pressure from a range of regional factors – PNG population growth, resource demand, mining and development impacts, increased shipping, and climate change – as well as local factors – resource exploitation, emerging tropical diseases and poor waste management. A study of potential water quality issues identified:

- 1. Local island waste management, including sewage and solid waste disposal.
- 2. Shipping, commercial vessels and marine infrastructure.
- 3. Regional pollution from developments in PNG (e.g. discharge of sediments, metals, (and other) pollutants from the Fly River associated with mining, the port at Daru, other mines in PNG, and land clearing).

Crown-of-thorns starfish (COTS; coral eating starfish native to the Indo-Pacific region) have been found in Torres Strait for a long time with COTS recorded at Mer in 1913. CSIRO surveys in 2011 suggest that numbers have been increasing in recent years. Although COTS are naturally found on healthy coral reefs, the population can increase to a point where predation exceeds coral growth and recovery, dramatically impacting on reef condition. Any future increase or spread of COTS in Torres Strait poses significant risks to coral cover, and would be a major driver of declining reef condition. Declining reef conditions will in turn affect the sustainable livelihoods of Torres Strait Islanders.

Climate change poses a significant threat to communities and natural ecosystems around the world, and the Torres Strait is no exception. Consistent with the global situation for coral reefs, Torres Strait reefs are threatened by a variety of local and global climate change pressures, particularly temperature stress that can cause coral bleaching and increase coral disease. Widespread coral bleaching was recorded for the first time in the Torres Strait in 2010 and reef surveys at Mer recorded a reduced abundance of temperature-sensitive corals, which could be due to this bleaching event. The projected increase in sea temperatures in Torres Strait of +1.65 to $+3.01^{\circ}$ C by 2070 will likely result in more bleaching events that can impact on the structure and function of coral reefs. Effects may be seen as early as 2030, when sea temperatures are projected to be +0.62 to $+1.27^{\circ}$ C warmer.

Turtle nesting and hatchling monitoring has identified climate change issues for rookery beaches in Torres Strait, including increasing sand temperatures and sea level rise. For example, results indicate that Dauar Island will produce hatchlings with a female bias possibly as early as 2030.

There are many forces driving changes in wetlands (e.g. erosion, storm damage, feral animals, ghost nets) and these vary considerably between Torres Strait islands. The biggest future threats to mangroves include sea level rise, nutrients, chemical pollution and uncontrolled wood harvesting. The location of mangroves at the shoreline places them in the direct line of climate change impacts, particularly more severe and frequent storm events, sea level rise and altered rainfall patterns. Fortunately, current assessments of wetland habitats on Torres Strait islands documented increases in area and regrowth, with a 2% annual increase on Buru, Sassie, Zagai, lama and Tudu Islands. Mangrove expansion is a sign of the limited direct human pressures on mangrove habitats in Torres Strait at present.

Further Reading

Johnson, J.E., Marsh, H., Hamann, M., Duke, N., Burrows, D., Bainbridge, S., Sweatman, H., Brodie, J., Bohensky, E., Butler, J. and Laurance, S. (2015) Tropical Research in Australia's Torres Strait region. Report to the National Environmental Research Program. Reef and Rainforest Research Centre Limited, Cairns (33pp.).



