



National Environmental Science Programme

Characterising the values and connectivity of the northeast Australia seascape: Great Barrier Reef, Torres Strait, Coral Sea and Great Sandy Strait

Summary for Decision-Makers

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Photo: John Rainbird



Photo: Catherine Collier

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Project 3.3.3 Connectivity and interdependencies of values in the northeast Australian seascape:
Great Barrier Reef, Torres Strait, Coral Sea and Great Sandy Strait



This summary provides a brief synopsis of **NESP TWQ Hub Project 3.3.3: Connectivity and interdependencies of values in the northeast Australian seascape: Great Barrier Reef, Torres Strait, Coral Sea and Great Sandy Strait**. It provides a summary of key outputs so they are available for managers in the respective jurisdictions. The aim is to support efficient and effective cooperative discussion and management of the important values that make the northeast Australian seascape unique.

The northeast Australian seascape is a highly diverse ecosystem that includes: the Great Barrier Reef (GBR), Torres Strait, Coral Sea and Great Sandy Strait. These marine domains are ecologically, socially and culturally connected and contain values of national and international significance. The need to understand and manage for connections that cross boundaries has been recognised for decades. However, each domain is currently managed under different legislation with separate and largely independent management.

Understanding the values (natural, Indigenous, social and economic) of these connected systems and characterising the connectivity and inter-dependencies between them helps identify opportunities for and benefits of cross-jurisdictional policy and planning.

Defining values

Values have 'components' that are a feature of the system that is of significance for ecological function and/or society and people. Each component is made up of 'attributes' that are features that can be mapped and managed.

CHARACTERISING VALUES

Using a participatory process, the project identified **10 key components within four value groups** (Natural, Indigenous Heritage, Social/Historic and Economic) (see table below), comprised of attributes. A total of 62 attributes were characterised for their connectivity between marine jurisdictions (strength, direction and type), the threats that affect their condition and connections, the consistency of management across jurisdictions and therefore, their priority for cross-jurisdictional management.

VALUES	NATURAL HERITAGE							INDIGENOUS HERITAGE	SOCIAL & HISTORIC	ECONOMIC
COMPONENTS	Coral reefs	Mainland beaches & Islands/cays	Estuarine and tidal habitats	Seagrass meadows	Inter-reefal habitats	Mobile adults	Species with mobile larvae	Indigenous culture	Social & historic culture	Industry sectors
Attributes	Hard coral	Casuarina & Pandanus	Mangroves	Seagrass – <i>Zostera muelleri</i>	<i>Halimeda</i> banks	Dugong	Ornate rock lobster	Location of Sea Country	Location of historic shipwrecks	Location of tourism destinations
	Crustose coralline algae	<i>Pisonia grandis</i>	Saltmarsh	Seagrass – tropical spp. (<i>Thalassia</i> etc.)	Inter-reef gardens	Flatback turtle	Black teatfish	Tangible cultural resources	Places of social significance	Location of commercial fishing activity
	<i>Acropora</i> larvae	<i>Argusia argentia</i>		Seagrass – pan-regional	Upwelling	Green turtle	Sandfish	Intangible cultural resources	Location of place attachment	Recreational use areas
	Macroalgae			Seagrass – sub-tropical species		Narrow-barred mackerel	Crown-of-thorns starfish			

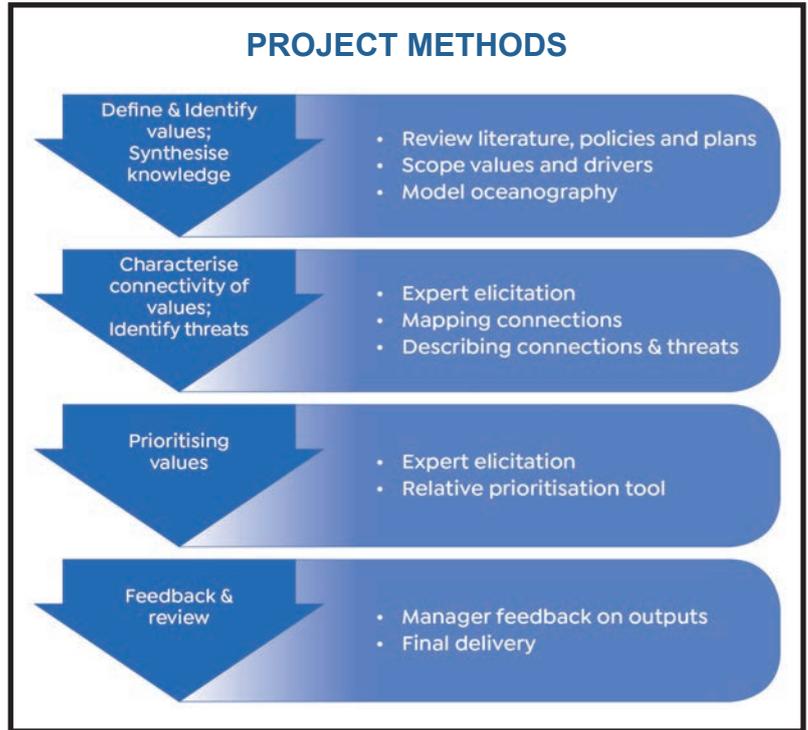
Loggerhead turtle, Hawksbill turtle, Yellowfin tuna, Spanish mackerel, Black marlin, pelagic foraging seabirds, inshore and offshore foraging seabirds, migratory shorebirds, Longfin & Shortfin eels, Tiger shark, Bull shark, White shark, Grey nurse shark, Humpback whale, Dogtooth tuna, Australian blacktip shark, Grey reef shark, Common blacktip shark, Scalloped hammerhead, Barramundi, Broad-barred mackerel, Coral trout (common), Coral trout (bluespot), Red throat emperor, Reef manta ray.

Red-spot king prawn, Brown tiger prawn, Eastern king prawn, Mud crab, Saucer scallop

DRIVERS THAT CONNECT VALUES

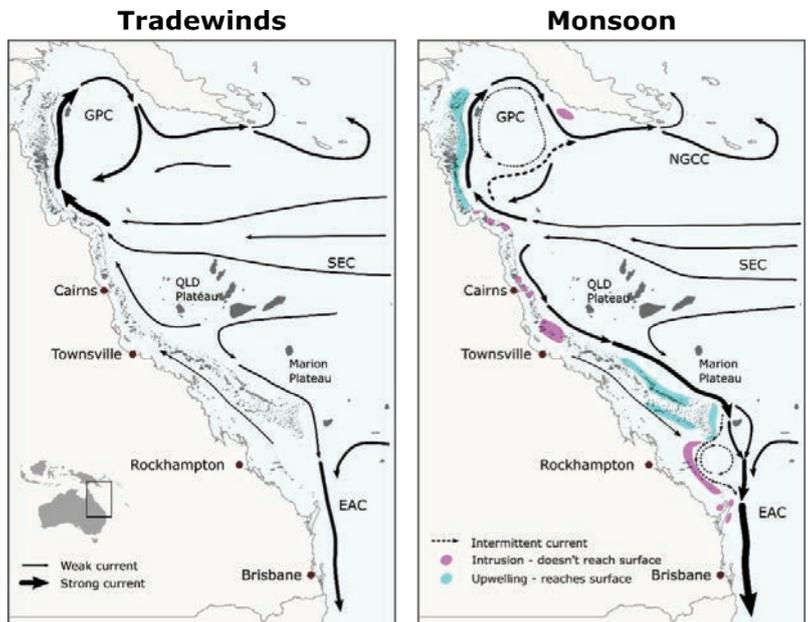
The project applied a hydrodynamic model for the northeast Australian seascape that combined earlier outputs to document physical drivers, including how ocean circulation influences connectivity and drives interactions between values. Ocean currents are the major mechanism that define and connect values across the entire seascape, for example by facilitating larval dispersal and transporting water properties from one region to another. During extreme events, such as marine heatwaves that can cause coral bleaching, some regions may be affected and linked with others by the movement of heat depending on the strength and direction of currents. Changes in ocean currents expected in the coming decades may impact connectivity of values.

Social and economic drivers can also connect marine values across boundaries through the networks between people, activities and culture across boundaries and the extent to which ecological values are shared.



CHARACTERISING CONNECTIVITY

Connectivity can vary in strength, direction and timing and describes the interactions between jurisdictions in the maintenance (or erosion) of a value in adjacent jurisdictions. Understanding these characteristics can help decision-makers to identify and prioritise the importance of another jurisdiction in achieving management goals for a particular value. It also helps to identify when management of a value is likely to affect goals in another jurisdiction.



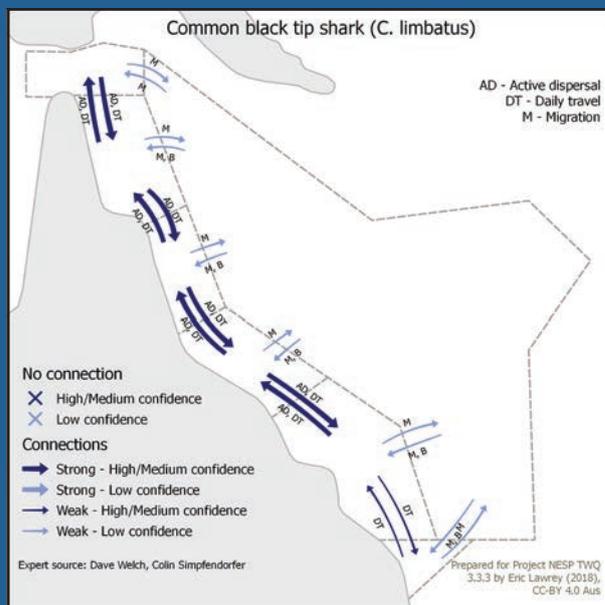
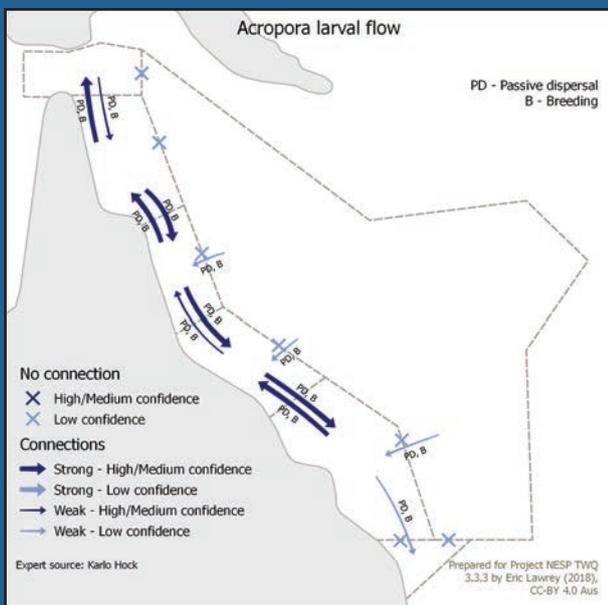
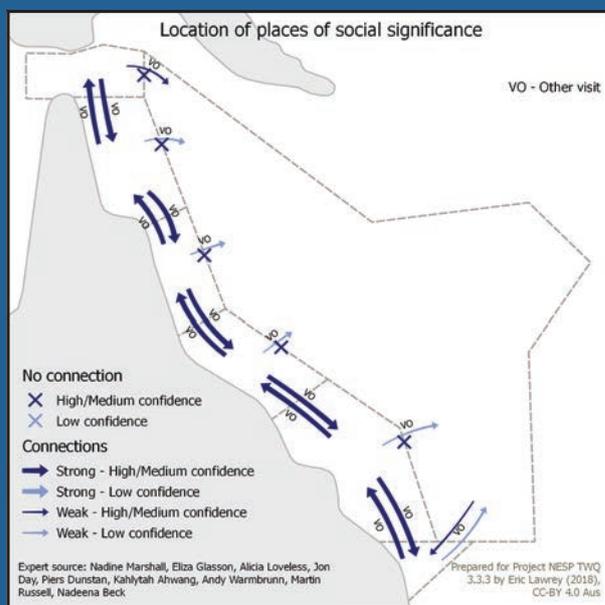
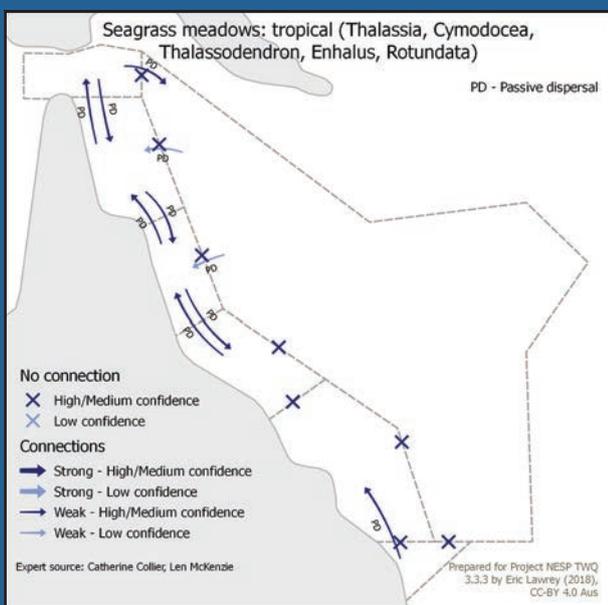
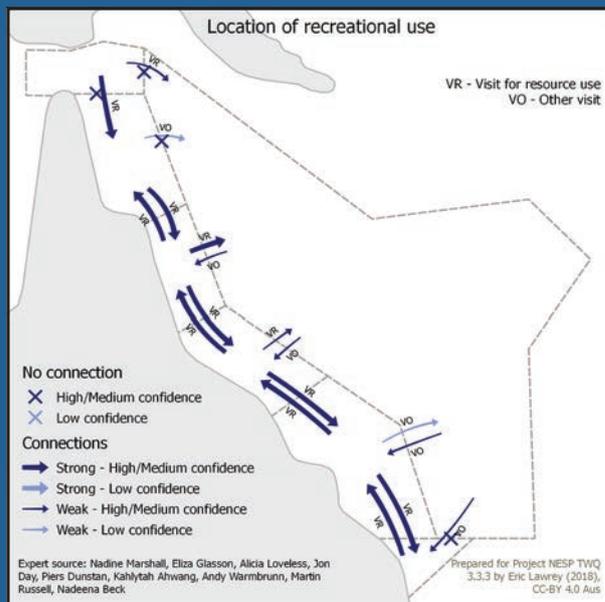
This map shows prevailing surface currents, which are dependant on winds. This does not show variations due to weather and eddies.
 GPC - Gulf of Papua Current, NGCC - New Guinea Coastal Current, SEC - South Equatorial Current, EAC - East Australian Current.
 Attribution: Craig Steinberg, Eric Lawrey, 2018

What is connectivity?

Connectivity, or connecting processes, are ecological and biophysical processes that link two or more realms and allow for the movement of species (i.e. biological connectivity) and the associated or independent transfer of energy and matter (i.e. geo-physical connectivity).

Beger et al. (2010)

Connectivity maps based on existing information and expert elicitation are available for 62 attributes through the eAtlas online tool: <http://eatlas.org.au/ne-aus-seascape-connectivity/>. The maps provide information on the strength and direction of connections, particularly focused on the borders between different marine jurisdictions, and the type of connection (e.g. passive dispersal, daily travel, human migration etc.). Example maps for each value category are provided below.



PRESSURES & THREATS

Assessing the main threats that influence the condition of values and connectivity also informs current management and where decision-making needs to focus on future threats.

Threats were rated based on the scope for management coordination. Six issues ranked highly for future cross-jurisdictional planning and management because there was considerable scope for threat reduction through improved coordination, and because improved management would benefit multiple shared attributes:

- Flood events (notably pollutants delivered via river discharges)
- Chemical/oil spills (especially associated with shipping incidents)
- Dredging (associated with port developments & maintenance)
- Fishing (includes recreational & commercial)
- Pathogens/disease outbreaks (including terrestrial & marine)
- Loss of food source (notably seagrasses & baitfish).

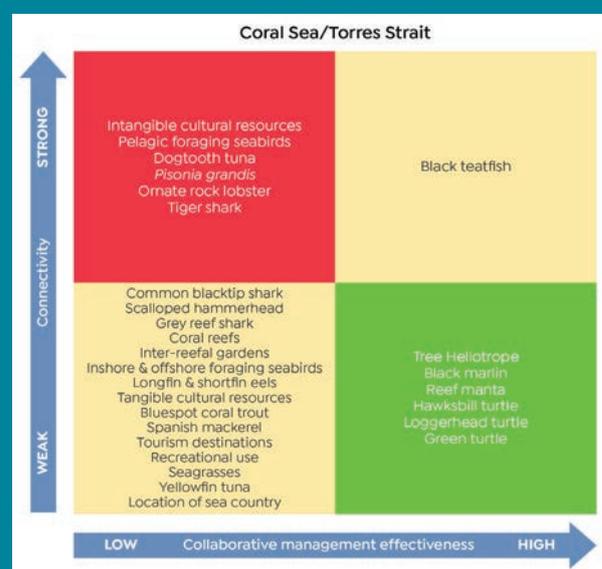
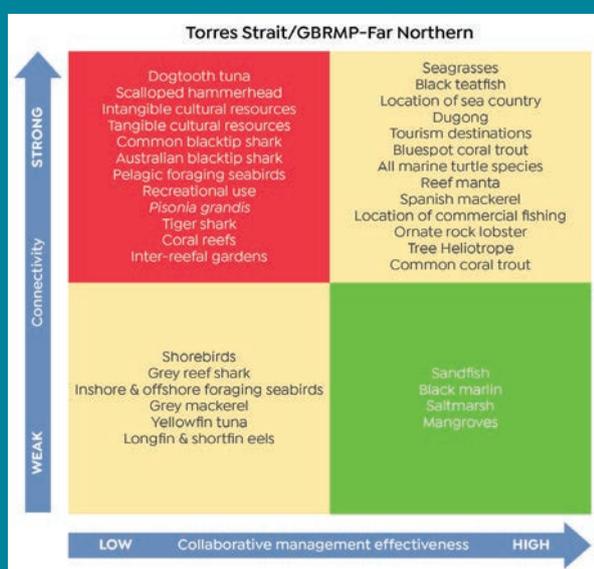
MANAGEMENT PRIORITIES

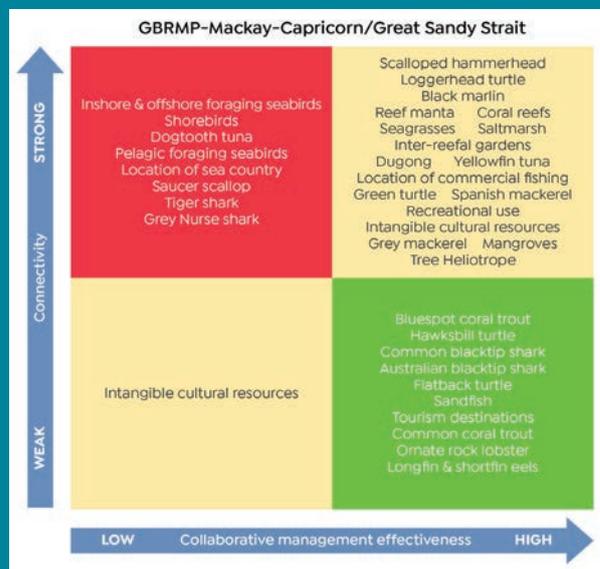
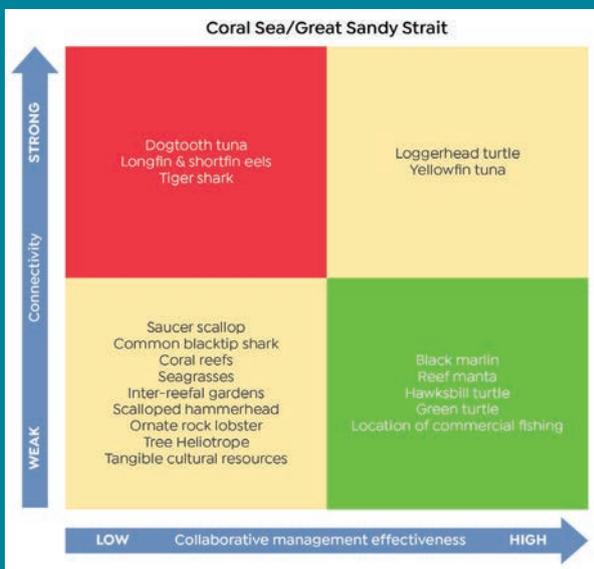
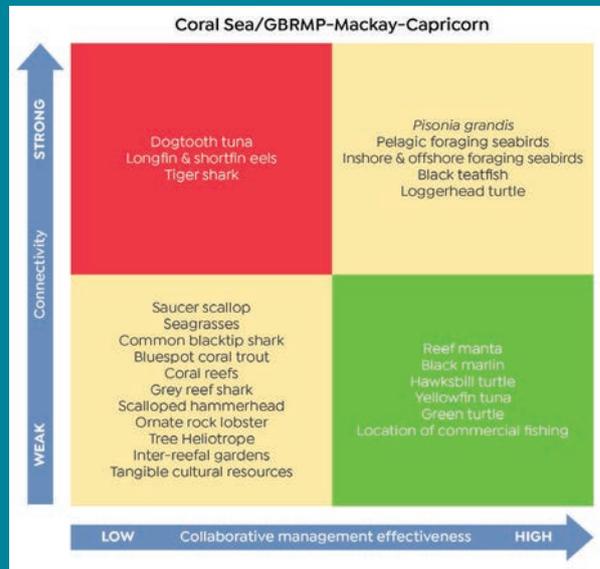
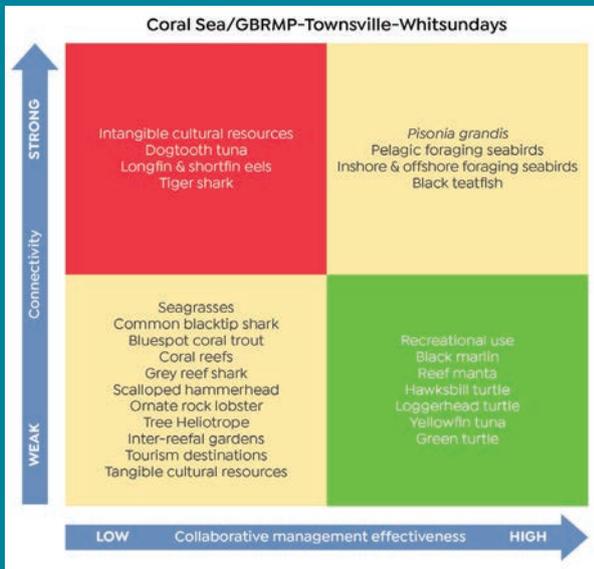
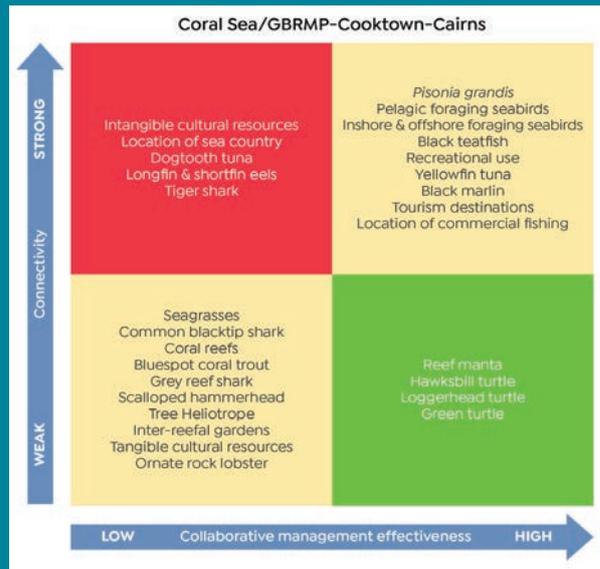
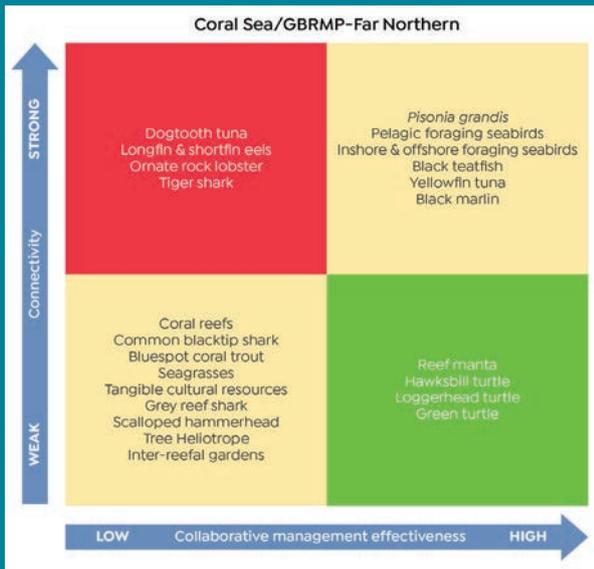
Due to the very large number of key value attributes identified, it was necessary to prioritise them for each respective jurisdictional boundary to focus management. Prioritisation was done through a participatory process with key stakeholders using expert elicitation and published information. A structured framework considered the strength of connectivity of an attribute across a boundary, and a series of criteria relating to current collaborative management effectiveness for that attribute in adjacent jurisdictions. For example, if an attribute was strongly connected and management effectiveness was assessed as low, that attribute rated a high priority for managers of marine jurisdictions that share that boundary.

These priorities present key targets for cross-jurisdictional management. Importantly, the results provide detail on which jurisdictions need to consult on managing specific attributes.

Ultimately, this information can be used to develop aligned and collaborative agreements. Further, the framework can be adopted by managers in future planning whereby priority values can be reviewed and updated periodically. The key outcomes of the prioritisation are presented below.

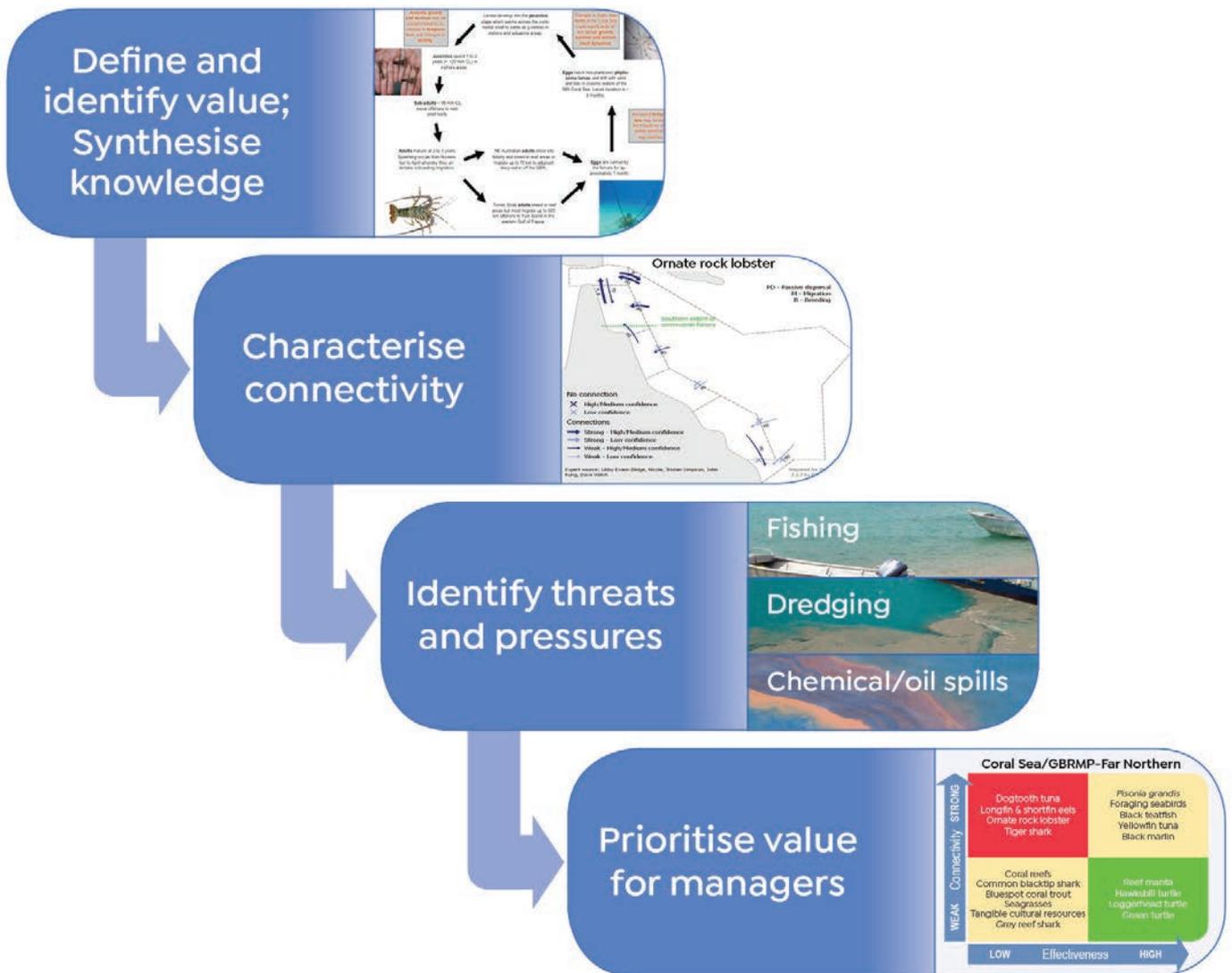
Results of the management prioritisation for attributes that are connected between marine jurisdictions. Red = attributes that are highest priority due to strong connectivity and low collaborative management effectiveness; Yellow = attributes that are moderate priority due to either weak connectivity and low collaborative management effectiveness or strong connectivity and high management effectiveness; Green = attributes that are lowest priority due to weak connectivity and high management effectiveness.





CASE STUDY

Using the information about connectivity, threats and priority for cross-jurisdictional management, below is an example for ornate rock lobster and how the information can provide a focus for collaborative management.



RECOMMENDATIONS

The results of this study provide targets for management, in terms of what species, habitats, resources or human activities should be the focus of cooperation between jurisdictions, and where these values and attributes have the strongest connectivity.

Opportunities for improved cross-jurisdictional management include attributes that are highest priority (in the 'red zone') across all jurisdictions (e.g. dogtooth tuna and tiger sharks), and attributes that are highest priority (in the 'red zone') at specific boundaries (e.g. recreational use and cultural resources in the Far Northern GBR and Torres Strait). There are also some general recommendations about how these results can inform collaboration and governance between jurisdictions in the future.

1. **Develop collaborative agreements** for cross-jurisdictional management of high priority values and attributes.
2. Identify mechanisms to **improve alignment of existing management** (e.g. zoning, policy and planning) with adjacent marine areas through participation in more regular coordination meetings.
3. **Periodically update connectivity information and the prioritisation assessment** using expert elicitation and the automated prioritisation tool. The methods developed in the project should be re-applied to update the maps and prioritisation every 2-3 years to build on the results, improve confidence in the data and help support improved alignment.

FUTURE WORK

There is a need to focus on addressing critical knowledge gaps relating to connectivity of high priority values, and how the information can be best communicated to inform cooperative management. This will in part, entail utilising the results and tools developed by the project to explicitly include priority values and attributes into relevant management plans and policy decisions.

A strategic assessment of how changing pressures, such as climate change, increasing coastal development and population growth, are expected to influence connectivity of key values would supplement the connectivity maps and information on cross-jurisdictional management priorities.

Importantly, extending the results on connectivity and the prioritisation for management to support the first meeting of a Northeast Australia Coordination Working Group could deliver effective cooperative management and joint agreements for policy and planning in the northeast Australian seascape.

KEY RESOURCES

For full details of the project results there are the following resources:

1. Connectivity maps and supporting information about values and attributes: <http://eatlas.org.au/ne-aus-seascape-connectivity/>
2. NESP Tropical Water Quality Hub technical report provides details on all methods and results.
3. Supporting synthesis report that documents values and published information relevant to their spatial and temporal connectivity.

SUPPORTING PUBLICATIONS

Johnson, J.E., Welch, D.J., Marshall, P.A., Day, J., Marshall, N., Steinberg, C.R., Benthuysen, J.A., Sun, C., Brodie, J., Marsh, H., Hamann, M., Simpfendorfer, C. (2018) Characterising the values and connectivity of the northeast Australia seascape: Great Barrier Reef, Torres Strait, Coral Sea and Great Sandy Strait. Report to the National Environmental Science Program. Reef and Rainforest Research Centre Limited, Cairns (81 pp).

Johnson, J.E., Welch, D.J., Marshall, P.A., Day, J., Marshall, N., Steinberg, C.R., Benthuysen, J.A., Sun, C., Brodie, J., Marsh, H., Hamann, M., Simpfendorfer, C. (2018) Supplementary Synthesis Report: Connectivity and inter-dependencies of values in the northeast Australia seascape. Report to the National Environmental Science Program. Reef and Rainforest Research Centre Limited, Cairns (67 pp.).



Photo: Dave Welch



Photo: Dave Welch

