



**Submission to the NSW Department of Primary
Industries – Report on the Independent Scientific
Audit of Marine Parks in New South Wales**

prepared by

**EDO NSW
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Submitted to:

Petrina.Alcock@industry.nsw.gov.au

For further information on this submission, please contact:

Rachel Walmsley, Director – Policy and Law Reform, EDO NSW

T: 02 9262 6989

E: rachel.walmsley@edonsw.org.au

EDO NSW

ABN 72 002 880 864

Level 5, 263 Clarence Street

Sydney NSW 2000 AUSTRALIA

E: edonsw@edonsw.org.au

W: www.edonsw.org.au

T: + 61 2 9262 6989

F: + 61 2 9264 2412

Introduction

EDO NSW welcomes the opportunity to comment on the Report on the Independent Scientific Audit of Marine Parks in New South Wales (the **Report**).

EDO NSW submits that the management of the NSW marine estate should be guided by five key principles. These are:

1. *Recognition of the intrinsic value of the biophysical realm*

As noted in **Recommendation 11.2** and Appendix 7 of the Report, '[t]he benefits of interaction with nature, including direct contact with nature and simply seeing nature, are proved to be significant for not only individuals, but the broader community and environment as well.'¹ The intrinsic value of nature should therefore be taken into account when assessing the socio-economic dimensions of the NSW marine estate. This should in turn inform decision-making around the design of marine parks and management of fisheries.

2. *Decision-making to be informed by peer-reviewed science*

EDO NSW submits that the NSW marine estate should be first and foremost managed in accordance with the best available science. Those aspects of the marine environment that remain under-researched should be urgently prioritised for future research in order to maximise biodiversity conservation outcomes, including building resilience under climate change.² Research should further be managed by an independent and appropriately qualified scientific committee. This committee should also be empowered to make recommendations directly to the relevant consent authority in respect of decisions likely to have a significant impact on the marine environment.

3. *Ecosystem-based approach*

The ecosystem-based approach to biodiversity conservation and resource management has been formally endorsed by the Conference of the Parties for both the Convention on Biological Diversity (**Biodiversity Convention**)³ and Ramsar Convention.⁴ The ecosystem approach has also been supported by a plethora of peer-reviewed science emphasising its importance in building resilience under climate change.⁵

4. *Application of the precautionary principle*

Given the dearth of information regarding significant elements of the NSW marine environment,⁶ it is imperative that the precautionary principle be applied with a view to protecting the unique biodiversity of this region. This means that that if there are threats of

¹ Beeton RJS et al (2012), *Report of the Independent Scientific Audit of Marine Parks in New South Wales*. NSW Department of Primary Industries and Office of Environment and Heritage, NSW, page 109.

² For further details regarding information gaps see for example: Brewer, D et al, *Ecosystems of the East Marine Region* (2007), Report to the Department of Environment and Water Resources, CSIRO, Cleveland.

³ Biodiversity Convention, COP 5, Decision V/6.

⁴ Ramsar Convention, COP 9, Resolution IX.1 Annex A.

⁵ See for example: United Nations Environment Programme, *The Role of Ecosystem Management in Climate Change Adaptation and Disaster Risk Reduction*, *Copenhagen Discussion Series*, June 2009. Available online at http://www.unep.org/climatechange/Portals/5/documents/UNEP-DiscussionSeries_2.pdf.

⁶ For further details regarding information gaps see for example: Brewer, D et al, *Ecosystems of the East Marine Region* (2007), Report to the Department of Environment and Water Resources, CSIRO, Cleveland.

serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation.⁷

5. Network of strictly protected areas

While individual no-take (or sanctuary) zones contribute to meeting the specific needs of species or habitats, networks of connected reserves are widely considered to be the most effective means of achieving long-term ecosystem health in both protected and non-protected areas, particularly under climate change.⁸ Demonstrated benefits to non-protected areas include increased stocks in commercial and recreational fisheries.⁹ EDO NSW submits that connectivity between no-take (or sanctuary) zones marine parks should be further promoted by incorporating adequate buffer zones into network design.¹⁰

With these principles in mind, this submission focuses on **Principle Recommendation A** (in conjunction with associated recommendations). We then provide brief comment on **Principle Recommendation B** and associated recommendations, and other recommendations.

Principal Recommendation A

The Report recommends that:

The governance of the NSW Marine Estate be reorganised by bringing the entire estate under one legislative and administrative structure that is closely aligned with the five catchment management authorities covering the NSW coastal drainage systems.

Specifically:

R12 - *The Audit Panel recommends the replacement of the Marine Parks Authority, the Coastal Management Panel, NSW Fisheries and any other relevant bodies with a Coastal and Marine Management Authority. This Authority should be supported by a rationalisation of the plethora of legislation that currently overlays the NSW Marine Estate. This new Authority, to be effective, must be given concurrent rights on land use developments that have the potential to affect the NSW Marine Estate.*

EDO NSW does **not** support this proposal. We provide the following comment on the practical problems and inherent conflicts of the proposed administrative framework, and then make recommendations to improve the current legislative framework.

Administrative framework

While EDO NSW supports greater coordination of management of the marine environment, we cannot support the proposal to bring the entire NSW Marine Estate under one administrative structure. We believe that the proposed Coastal and Marine Management Authority (**proposed Authority**) would be inherently conflicted and structurally impractical in terms of local implementation.

⁷ See section 6(2) *Protection of the Environment Administration Act 1991*.

⁸ Coleman, Melinda. A. et al, *Connectivity within and among a Network of Temperate Marine Reserves*, *PLoS One*. 2011; 6(5):e20168. Epub 2011, page 1.

⁹ See for example: Roberts C.M. et al, *Effects of marine reserves on adjacent fisheries*, *Science*, 2001 Nov 30; 294(5548):1920-3.

¹⁰ See for example: Bennett, G. and K.J. Mulongoy (2006), *Review of experience with ecological networks, corridors and buffer zones*, Technical Series no. 23, Montreal: Secretariat of the Convention on Biological Diversity.

Conflicting mandates

A strong argument can be made in favour of maintaining separate government departments for resource management and biodiversity conservation respectively. Resource management is geared toward procuring consumable products from the natural environment, whereas biodiversity conservation seeks to protect, restore and maintain ecosystem health. While EDO NSW does support the sustainable use of biological diversity, we believe that the inherent conflict between these two domains and the pressure to minimise socio-economic impacts will invariably undermine environmental objectives if they are not promoted by an agency with a clear conservation mandate.

Previous departmental models in NSW that have attempted to amalgamate multiple planning, resource use and conservation roles have not achieved integrated decision-making and have been disbanded.¹¹

Good governance

The 'separation of powers' achieved by retaining separate conservation and resource agencies is more likely to give rise to good governance. This may be judged against the following criteria: capability; transparency; accountability; and inclusiveness.¹² A specialist biodiversity conservation agency is equipped with the necessary expertise to capably manage highly complex environmental matters. A lack of internal conflict (between resource management objectives and conservation goals) is more conducive to transparent and accountable decision-making. Finally, community concerns regarding the environment are more likely to be taken into account by a body whose mandate is focussed on protecting and restoring biodiversity. This in turn assists in building confidence between civil society and government.

CMA role

EDO NSW also submits that there is no logical reason for organising a superagency that links marine parks, fisheries management and planning around CMAs. While CMAs do play an important role in catchment management, they are not a consent authority for the purposes of the *Environmental Planning and Assessment Act 1979 (EPA Act)*; nor are they empowered to make decisions under the *Fisheries Management Act 1994 (FM Act)*. It is therefore difficult to envisage how state and local approval processes will fit into the proposed management structure, particularly as this information is not provided in the Report.

Additionally, catchments are defined by geographical boundaries that do not necessarily align with marine bioregions. In other words, CMAs reflect terrestrial landscapes, not marine ecosystems. As such, it would be contrary to the fundamental principles of ecosystem-based management to impose these artificial boundaries on the NSW marine estate.

Integrated decision-making framework

While EDO NSW believes that good environmental governance depends on the maintenance of separate agencies, we do support a strong framework for integrated decision-making in the marine environment that takes full account of scientific

¹¹ For example, the NSW Department of Infrastructure, Planning and Natural Resources (DIPNR) in NSW was broken down into separate functions.

¹² Lockwood, Michael et al, *Governance principles for natural resource management, Society and Natural Resources*, 23:1-16.

recommendations. This includes the impact of terrestrial management and decision making in coastal catchments. In this context we support **Recommendation 9.3**. We also support improved integration of biodiversity considerations into fisheries management and planning decisions. EDO NSW submits that instead of creating an impractical and conflicted proposed Authority, better integrated decision-making could be achieved by increased resourcing of specialist agencies and by legislative amendments as set out below.

Legislative framework

R14 - The Audit Panel recommends that new legislation consolidating all relevant Acts be drafted, and that this legislation give this authority real powers to coordinate with the activities of the Natural Resources Commission and work on a day-to-day basis with the catchment management authorities, terrestrial and marine park authorities, and local government (inasmuch as it relates to the coastal environment)

EDO NSW agrees that legislation relating to coastal and marine management could be clarified and strengthened, however, consistent with our comments about maintaining separate expert agencies, we do not agree with consolidating all existing legislation into a single Act.

The current state-level regulatory framework for the NSW marine estate comprises, amongst others, the following statutes and instruments:

- The *Marine Parks Act 1997 (MP Act)*;
- The FM Act;
- The *Threatened Species Conservation Act 1995 (TSC Act)*;
- The *Coastal Protection Act 1979 (CP Act)*;
- The EPA Act;
- Environmental Planning Instruments (EPIs), in particular *SEPP 71 - Coastal Protection* and *SEPP 14 – Coastal Wetlands*;

EDO NSW has seven key recommendations to make in respect of the current regulatory framework:

1. *Biodiversity conservation and resource management legislation to remain separate*

In keeping with our comments regarding the importance of maintaining separate resource management and environmental agencies, EDO NSW strongly opposes the creation of one, overarching regulatory framework designed to manage the entire NSW marine estate. We reiterate that the inherent conflicts between resource use and biodiversity conservation cannot be reconciled in a single piece of legislation. While we support ecologically sustainable resource use, experience indicates that good conservation outcomes cannot be achieved in the absence of biodiversity-focussed legislation or portfolio. We therefore recommend that the MP Act remain in force (supported by the amendments outlined below). We further recommend that the TSC Act be amended to ensure greater protection of threatened marine species, populations and ecological communities, as well as critical marine habitat (as discussed below).

2. *Strengthen the MP Act*

EDO NSW supports the maintenance of the MP Act and a strengthened Marine Park Authority. The primary objectives of conserving biodiversity and maintaining ecosystem integrity and function must remain the paramount consideration – as recognised in

Recommendation 4.5. We believe the following amendments will contribute to enhancing the long-term viability of ecosystems across the NSW network of marine parks:

- **Gaps to be filled** - EDO NSW strongly supports the proposition to fill the gaps in the current marine park network. In particular, we submit that the Act should be amended to include new marine parks in the Twofold Shelf and Hawkesbury marine bioregions (**Recommendation 2**).
- **Zoning** – It must be clear in legislation that zoning is based on ecological and biodiversity outcomes. EDO NSW does not support the list of other considerations listed in **Recommendation 6.3**.
- **Zoning plans to be included in the MP Act** - Any provision or provisions which are fundamental to the realisation of statutory objects should only be capable of amendment by Parliament. Accordingly, they should be included in the enabling legislation (that is, the statute) as opposed to a regulation. Zoning plans are arguably the most important tool for advancing the objects of the MP Act.¹³ EDO NSW therefore submits that they be removed from the regulations¹⁴ and incorporated into the Act.
- **Use to be consistent with objects of zones** - EDO NSW submits that all permissible uses within a given marine park zone must be consistent with the objects of that zone.
- **Approvals under EPA Act¹⁵ subject to more stringent controls** - While the MP Act does impose additional requirements with respect to planning approvals issued under Parts 4 and 5 of the EPA Act, EDO NSW submits that these could be strengthened in order to offer greater protection to marine parks and their ecosystems. Specifically, the Act should be amended to prohibit any Part 4 or Part 5 development within a marine park that is not consistent with the objects the zone within which it will take place.¹⁶ Furthermore, the opinion of the proposed scientific committee should be sought for all Part 5 development within a marine park before a final decision is made by the determining authority or Minister.
- **Mining activities** - The MP Act renders it ‘unlawful to prospect or mine for minerals in a marine park, *except as expressly authorised by an Act of Parliament* (emphasis added).’ EDO NSW submits that this section should be amended to prohibit prospecting and mining in marine parks without exception.¹⁷
- **Closures** - The Minister is given complete discretion under the MP Act to declare closures in marine parks ‘from time to time’.¹⁸ While we support this provision, we submit that it should be strengthened to *require* the Minister to exercise their power to declare a closure in certain circumstances. Specifically, the Minister should be compelled under the Act to declare a closure where a particular activity is inconsistent with the objects of the zone within which it is taking place.

3. Consolidate of threatened species provisions

EDO NSW submits that there are some opportunities to consolidate the existing legislation, for example in relation threatened species.

¹³ MP Act, section (3).

¹⁴ Zoning plans are currently provided for in the *Marine Parks (Zoning Plans) Regulation 1999*.

¹⁵ The EDO acknowledges that the NSW planning system is currently under review. References to Part 4 or Part of the EPA Act are therefore to be taken as references to the equivalent sections in any new regulatory regime.

¹⁶ Currently a consent or determining authority need only ‘take into consideration’ the objects of the relevant zone when determining a development application under Part 4 or Part 5 of the EPA Act. See MP Act, section 19 (1), (2) and (3).

¹⁷ MP Act, section 18.

¹⁸ MP Act, section 20A.

- **Listing** - EDO NSW has consistently argued that threatened marine species, populations and ecological communities should be listed under the TSC Act as opposed to the FM Act.¹⁹ Again, this is based on the inherent conflict between resource use (which is the focus of the FM Act) and biodiversity conservation. Furthermore, many other jurisdictions have a combined list for terrestrial, marine and freshwater biodiversity, including our federal jurisdiction.²⁰ We also submit that there is no compelling reason to maintain separate Scientific Committees for terrestrial and fish species as Committee members are not required to be expert in species or phyla, simply to assess the available information scientifically. This being the case, we submit that the Scientific Committee under the TSC Act should include a member with marine expertise. (Note: the role of this specialised Committee should not be subsumed by the more general policy oversight role of the Scientific Committee proposed in **Principle Recommendation B**).
- **Critical habitat** - Critical habitat provisions in the FM Act are currently underutilised. Critical habitat has only been declared for 1 of 23 eligible listings under the FM Act.²¹ These provisions should be transferred to the TSC Act and the Act should be strengthened in three ways. First, where a critically endangered species is listed, and that species has clearly identified critical habitat, that critical habitat should be automatically declared under the Act. Second, all critical habitat should be surrounded by an appropriate no-take (or sanctuary) zone. By way of example, a 1500m sanctuary zone around the 10 critical habitats identified for the grey nurse shark would greatly improve the effectiveness of shark conservation. Third, activities and development in, on or within an impactful distance of critical habitat should be prohibited.
- **Recovery and threat abatement planning and Priority Action Statement** - EDO NSW submits that recovery and threat abatement planning, together with the Priority Action Statement, should be transferred from the FM Act²² to the TSC Act. We further submit that the TSC Act should be strengthened to improve outcomes for listed marine species. In particular:
 - A framework for prioritisation between listed species should be developed under the TSC Act that covers both terrestrial, freshwater and marine listings;
 - A greater focus should be given operationally under the TSC Act to the more generic recovery strategies over recovery plans, as provided for in the Priorities Action Statement;
 - A greater focus should only be given operationally under the TSC Act to multi-species recovery plans over single-species plans where species can be appropriately grouped based on threat similarity using robust approaches;
 - Recovery plans under the TSC Act should facilitate adaptive management and be more flexible and responsive to change and uncertainty. This is of vital importance under climate change;

¹⁹ They are currently listed under Part 7A of the FM Act.

²⁰ See the *Environment Protection and Biodiversity Conservation Act 1999*.

²¹ In addition to the grey nurse shark declaration, we note there has been preliminary identification of habitat for a pygmy perch <http://www.dpi.nsw.gov.au/fisheries/species-protection/conservation/what/register/oxleyan-pygmy-perch-critical-habitat>

²² Threat abatement plans and recovery plans are currently provided for in Division 5 of the FM Act, while Priority Action Statements are provided for under Division 5A of the FM Act.

- A greater focus should be given operationally under the TSC Act to threat abatement planning over recovery planning; and
- Threat abatement efforts under the TSC Act should generally be focussed on sets of threats that overlap and interact to affect large numbers of species.

4. Ecologically sustainable development (ESD) and FM Act

While EDO NSW strongly supports maintenance of biodiversity conservation legislation, we acknowledge that appropriate protection of biodiversity also relies on resources being sustainably managed. This should involve an ecosystem based approach to management (as noted in our third guiding principles) underpinned by ESD. Given the prevalence of commercial and recreational fishing activities both within and outside marine parks, implementation of ESD is of vital importance if the estate's unique biodiversity is to be protected into the future. We therefore recommend that the FM Act should include a section imposing a duty on all individuals making decisions under the Act to implement (as opposed to consider) ESD. In addition, we submit that the Minister's discretion to declare a fishing closure 'from time to time'²³ should be strengthened to require the Minister to exercise their power to declare a closure if best-available science indicates that a fishery is not being managed sustainably.

5. Amend land use planning legislation

EDO NSW supports recommendation 9.3. We submit that the EP&A Act should be amended, and SEPP 71 strengthened to require a concurrence role for developments that may have impacts on the marine estate. Concurrence should be required from the Minister for the Environment and the Marine Parks Authority (where relevant). The New Scientific Committee should have a role in providing advice to relevant decision-makers.

6. NSW legislation should reflect international best practice.

The conclusion of **Recommendation 1** that "in the Audit Panel's opinion, the current arrangements pose no risk to the NSW Government that in regard to its management of marine parks it will be found in breach of international conventions" does not mean that NSW legislation can be inconsistent with Australia's international environmental obligations. The Report is correct in asserting that states and territories are not bound, in the absence of any specific agreement with the Commonwealth, to implement treaties to which Australia is signatory. Nevertheless, EDO NSW is of the opinion that given that environmental treaties often provide for implementation at national, state and local levels, the NSW Government should be striving to uphold those environmental treaties relevant to the NSW marine estate, in particular the Biodiversity Convention the Ramsar Convention, and relevant migratory species agreements. NSW should take a leadership role in enacting best-practice biodiversity conservation and resource management legislation. The obligations contained in environmental treaties, together with associated COP decisions, provide an excellent framework for realising this objective.

7. Miscellaneous legislative amendments

EDO NSW would also support new legislation to address problems associated with high risk marine pest species (**Recommendation 5.5**), and we would support an improved regulatory framework for managing storm water inputs (**Recommendation 5.7**).

²³ FM Act, section 8.

2. Principal recommendation B

Science for the NSW Marine Estate be reorganised under an independent Scientific Committee. The Audit Panel also makes recommendations about the organisational approach that this Committee should take and suggests a number of research priorities. In particular, these priorities call for greater emphasis on research in the social and economic sciences and the application of these findings to management.

EDO NSW supports the establishment of an independent scientific committee.

Committee membership, expertise and process

The Committee membership should be expertise based, and require at least one member to have appropriate qualifications in marine conservation ecology, in addition to expertise listed in **Recommendation 3**. The Committee should have a transparent process with research papers, meeting minutes and policy recommendations made public. We support the community consultation requirement in Recommendation 3.2. We submit that the role of the Committee should be formally recognised in legislation – for example, their role in advising relevant Ministers (Environment, Primary Industries, Planning etc) where appropriate.

Research priorities and triple bottom line assessment

Consistent with the primary objectives of the MP Act, research priorities must focus on investigating ways to better conserve biodiversity and maintain ecosystem integrity and function. The ecological health of the marine estate - and consequently all uses of that estate - depend on this. This approach is consistent with **Recommendation 4.5**. In this context, the ongoing need to undertake basic biophysical marine research to increase our understanding of the marine environment should be a research priority.

Many of the recommendations in the Report refer to a perceived need for additional assessment of socio-economic implications of marine parks (for example, **Recommendations 6, 7, 9.1, 9.2** etc). EDO NSW submits that any additional research or investigation of issues by the independent Committee must be based on a triple bottom line approach, whereby socio-economic considerations are balanced equally against environmental considerations. This is consistent with the implementation of ESD.

Further information should be made available about how non-economic values of the marine estate are assessed. This is consistent with recognising intrinsic value' as discussed above and noted in **Recommendation 11.2**.

Topics for Committee Research

- *Marine park design and climate change vulnerability*

Consistent with **Recommendations 4.3 and 4.4**, the Scientific Committee should prioritise research into optimal marine park design in the context of climate change vulnerability and the need to build species resilience. In their report to the former Department of Environment and Water Resources entitled *Ecosystems of the East Marine Planning Region*, the CSIRO outlined some of the possible impacts of climate change on the Temperate East Marine Region, which includes the NSW marine estate. These include 'strengthening southward flow of EAC resulting in less mixing of surface waters reducing nutrient input from deep

waters, and increased ocean acidity, clear biodiversity alterations.²⁴ In short, the CSIRO report indicates that the NSW marine estate is vulnerable to the impacts of climate change.

With this in mind, any new Scientific Committee should prioritise research into strengthening the design of NSW marine parks system to assist species and ecosystems adapt to changing climatic conditions. A plethora of peer-reviewed literature demonstrates that building resilience is fundamental to this process. This can be achieved by reducing stressors such as overfishing, water quality, mining and disease.²⁵ In particular, the Committee should prioritise work on creating a network of marine protected areas with an adequate proportion of the network must be afforded a sufficiently high level of protection (namely IUCN Categories 1a, 1b and 2).²⁶

This argument is supported by the *IUCN Guidelines*, which state that

*'protected areas will be able to play a role in mitigating climate change, by providing buffers against extreme climate events (Stolton et al. 2008) and a network of natural habitats to provide pathways for rapid migration and space for evolution and adaptation (Dudley Stolton 2003).'*²⁷

Based on the best available science, the Committee should determine exactly how much of the NSW marine estate should be afforded this level of protection. Consideration should be based around the principles of comprehensiveness (including full range of ecosystems at an appropriate scale), adequacy (the level of protection required to ensure the ecological viability and integrity of populations, species and communities) and representativeness (reflecting the biotic diversity of the marine ecosystems from which they derive).

To that end, various formulas have been developed, however the general principle to be extracted from each of these is the same: a representative percentage of the entire NSW marine estate must be protected from anthropogenic impacts. For example, the Ecology Centre at the University of Queensland released a scientifically robust guide to designing marine protected areas.²⁸ The guide, which was supported by many of Australia's leading marine scientists, recommends including at least thirty percent of

²⁴ Brewer, D.T et al, Ecosystems of the East Marine Planning Region, *CSIRO Marine Research*, October 2007, page 123. A report prepared for the former Department of Environment and Water Resource, page 123.

²⁵ Keller, B. and B. Causey, 'Linkages between the Florida Keys National Marine Sanctuary and the South Florida Ecosystem Restoration Initiative,' *Ocean & Coastal Management*, 48: 869-900, 2005; Hobday, A. J., T. A. Okey, et al., Impacts of climate change on Australian marine life: Part A, Executive Summary: Report to the Australian Greenhouse Office, Canberra, Australia, 2007; Johnson, J. E. and P. A. Marshall, Eds., Climate change and the Great Barrier Reef, *Great Barrier Reef Marine Park Authority and Australian Greenhouse Office*, 2007; Brander, K., 'Tackling the old familiar problems of pollution, habitat alteration and overfishing will help with adapting to climate change,' *Marine Pollution Bulletin* 56: 1957-1958, 2007.

²⁶ The International Union for Conservation of Nature (**IUCN**) has developed 6 different marine protected area categories (one of which is divided into two sub-categories i.e. 1a and 1b). For a full description of the nature of these categories, see Dudley, N. (Ed.), *Guidelines for Applying Protected Area Management Categories*, IUCN, Gland, Switzerland.

²⁷ Dudley, N. (Ed.), *Guidelines for Applying Protected Area Management Categories*, IUCN, Gland, Switzerland, page 45.

²⁸ The Ecology Centre, The University of Queensland, Scientific Principles for Design of Marine Protected Areas in Australia: A Guidance Statement. Available at http://www.ecology.uq.edu.au/docs/Scientific_Principles_MPA_s_c6.pdf

each bioregion in a given network of marine parks. They further recommended providing thirty percent of each conservation feature within a network with Marine National Zone Protection (IUCN Category 2).

Finally, we would like to note that use of the higher IUCN Categories has been associated with improved outcomes for fish stocks providing the opportunity for the Network to achieve multiple Commonwealth objectives. Specifically, they have been shown to:

- increase biomass and abundance of fish populations;
- increase size of and productivity of resident fish; and
- increase number and viability of species (and fish catches) in surrounding waters through a 'spillover effect'.²⁹

Based on best available science and international best practice, the Scientific Committee should advise on the design of a network of marine protected areas to build resilience. The design objectives should be reflected in legislation.

Other recommendations

EDO NSW supports **Recommendation 10** to involve local indigenous people in management of the marine estate, including establishing Aboriginal Liaison Officers and cadets.

For further information, please contact rachel.walmsley@edo.org.au or 02 9262 6989.

²⁹ Fisheries models predict maximum benefits with closures of 20–40% See *Gell, F.R. and C.M. Roberts (2003) Benefits beyond boundaries: the fishery effects of marine reserves and fishery closures. Trends in Ecology and Evolution 18: 448-455.*