IUCN Conservation Outlook Assessment 2017 **(archived)**
Finalised on 10 November 2017

Please note: this is an archived Conservation Outlook Assessment for Shark Bay, Western Australia. To access the most up-to-date Conservation Outlook Assessment for this site, please visit https://www.worldheritageoutlook.iucn.org.

Shark Bay, Western Australia

SITE INFORMATION

Country:
Australia
Inscribed in: 1991
Criteria:
(vii) (viii) (ix) (x)

Site description:
At the most westerly point of the Australian continent, Shark Bay, with its islands and the land surrounding it, has three exceptional natural features: its vast sea-grass beds, which are the largest (4,800 km2) and richest in the world; its dugong (‘sea cow’) population; and its stromatolites (colonies of algae which form hard, dome-shaped deposits and are among the oldest forms of life on earth). Shark Bay is also home to five species of endangered mammals. © UNESCO

SUMMARY

2017 Conservation Outlook

Good

The site has a good conservation outlook overall thanks to the robustness of its values in the face of anthropogenic impacts, its relative inaccessibility, the appropriateness of the boundaries of the area and overall effective management. The site's biodiversity values are maintained as outstanding, both in the marine and terrestrial environments. Human disturbance, including from recreational activities, continues to be a threat, although visitation levels remain low and this threat is appropriately managed. Risks from climate change and invasive species require special consideration, in order to minimize potential future damage.

Current state and trend of VALUES

Good
Trend: Stable

The site provides exceptional living examples of the earliest life forms on Earth in living stromatolites and microbialites, in a carbonate landscape and its hypersaline environments. These structures are in a good state and largely free of damage. Geographical isolation has provided areas where environmental circumstances have enabled species to survive after extinction in surrounding areas. The largest seagrass banks in the world also provide habitats for charismatic megafauna, especially dugongs, dolphins, turtles and sharks, as well as diverse genotypes in fish populations, sustainably managed. However, the seagrasses suffered a large scale dieback and defoliation during the summer of 2010/11 as a result of a marine heatwave event and this might result in cascade effects on the entire ecosystem. On land, the site includes transition zones in the flora, and examples of speciation, as well as high numbers of endemic species. There is some small risk to the terrestrial values of interaction between climate change, feral animals and sheep and goat grazing.

Overall THREATS

Low Threat

The site's World Heritage values are subject to only minimal threats. The robustness of its geological values and its effective management regime combine to minimize threats to its integrity. Similarly, the site's biodiversity values, which are more sensitive to anthropogenic impacts, are affected mainly by low threats, with the exception of ocean acidification, sea level rises, flooding and increasing temperatures in the marine environment. Human disturbance, including from recreational activities, continues to be a threat, although visitation levels remain low and this threat is appropriately managed. Spread of existing invasive species and potential introduction of new ones will continue to be a risk and therefore will require continued management responses and a consolidated strategy.

Overall PROTECTION and MANAGEMENT

Mostly Effective

The protection and management of the Shark Bay Word Heritage Property is overall effective. Management is supported by the Shark Bay World Heritage Advisory Committee and is based on a number of management and strategic plans. Key issues and threats appear to be adequately addressed; however, efforts in some areas need to be increased, for example with regards to invasive species eradication programmes.

FULL ASSESSMENT

Description of values

Values

World Heritage values

- **Most diverse and abundant examples of stromatolites – the oldest form of life on Earth**
  Criterion:(vii)

  One of the superlative natural phenomena present in this property is its stromatolites, which represent the oldest form of life on Earth and are comparable to living fossils(SoOUV, 2013). Analogous structures were the dominant benthic ecosystems on Earth for 3 000 million years. Their significance is due to their role in changing the earth’s atmosphere, by photosynthesis. The hypersaline environments of Shark Bay exclude many competitors, consumers and predators, enabling the survival of complex ecosystems in Hamelin Pool (Jahnert and Collins, 2012).

- **One of the world’s best examples of a living analogue for the study of the nature and evolution of the earth’s biosphere up until the early Cambrian**
  Criterion:(viii)

  Shark Bay contains, in the hypersaline Hamelin Pool, the most diverse and abundant examples of stromatolites (hard, dome-shaped structures formed by microbial mats) in the world. The stromatolites of Hamelin Pool were the first modern, living examples to be recognised that have a morphological diversity and abundance comparable to those that inhabited Proterozoic seas. As such, they are one of the world’s best examples of a living analogue for the study of the nature and evolution of the Earth’s biosphere up until the

early Cambrian (SoOUV, 2013).

► Seagrass banks of great geological interest
Criterion:(viii)

The Wooramel Seagrass Bank is also of great geological interest due to the extensive deposit of limestone sands associated with the bank, formed by the precipitation of calcium carbonate from hypersaline waters (SoOUV, 2013).

► Outstanding examples of processes of biological and geomorphic evolution taking place in a largely unmodified environment
Criterion:(ix)

Shark Bay provides outstanding examples of processes of biological and geomorphic evolution taking place in a largely unmodified environment. These include the evolution of the Bay's hydrological system, the hypersaline environment of Hamelin Pool and the biological processes of ongoing speciation, succession and the creation of refugia. One of the exceptional features of Shark Bay is the steep gradient in salinities, creating three biotic zones that have a marked effect on the distribution and abundance of marine organisms. Hypersaline conditions in Hamelin Pool have led to the development of a number of significant geological and biological features including the 'living fossil' stromatolites. The unusual features of Shark Bay have also created the Wooramel Seagrass Bank. Covering 103,000 ha, it is the largest structure of its type in the world. Seagrasses are aquatic flowering plants that form meadows in near-shore brackish or marine waters in temperate and tropical regions, producing one of the world's most productive aquatic ecosystems. Australia has one of the highest diversity of seagrasses globally, with 12 species occurring in the Bay (SoOUV, 2013).

► A range for many globally threatened species of plants and animals
Criterion:(x)

Shark Bay is a refuge for many globally threatened species of plants and animals. The property is located at the transition zone between two of Western Australia's main botanical provinces, the arid Eremaean, dominated by Acacia species and the temperate South West, dominated by Eucalyptus species, and thus contains a mixture of two biotas, many at the limit of their

southern or northern range. The property contains either the only or major populations of five globally threatened mammals, including the Burrowing Bettong (now classified as Near Threatened), Rufous Hare Wallaby, Banded Hare Wallaby, the Shark Bay Mouse and the Western Barred Bandicoot. A number of globally threatened plant and reptile species also occur in the terrestrial part of the property. Shark Bay's sheltered coves and lush seagrass beds are a haven for marine species, including Green Turtle (VU) and Loggerhead Turtle (EN) and the property provides one of Australia's most important nesting areas for this second species). Shark Bay is one of the world's most significant and secure strongholds for the protection of Dugong, with a population of around 11,000. Increasing numbers of Humpback Whales and Southern Right Whales use Shark Bay as a migratory staging post, and a famous population of Bottlenose Dolphin lives in the Bay. Large numbers of sharks and rays are readily observed, including the Manta Ray which is now considered globally threatened (SoOUV, 2013).

Other important biodiversity values

▶ **Important area for migratory birds**

Shark Bay as a significant site for migratory birds. Hundreds of species come through Shark Bay and this seems to be an important area for them. Much more research is needed in this field (IUCN Consultation, 2014).

Assessment information

Threats

Current Threats

Low Threat

The site's World Heritage values are subject to only minimal threats. The robustness of its geological values and its effective management regime combine to minimize threats to its integrity. Human disturbance, including from

recreational activities, continues to be a threat, although visitation levels remain low and this threat is appropriately managed. Climate change poses the largest threat to the site's World Heritage values and it is expected to significantly increase.

► Other

Very Low Threat
Outside site

Shark Bay Salt activities, potentially changing the salinity regime through bittern drainage and dredging (channel deepening). This occurs outside WH boundary, but marine ecosystems are highly connected.

► Tourism/ visitors/ recreation, Other Activities

Low Threat
Inside site, scattered(5-15%)

Impacts from human activities, including coastal recreational use and access, continue to represent one of the main threats to the property. However, visitation rates remain low (IUCN Consultation, 2017). Impacts from human activities include trampling of sensitive environments, hardening of shorelines and 4WD traffic over soft sediments. Degraded recreational sites and disused tracks need to be identified and prioritised for rehabilitation (IUCN Consultation, 2017).

► Fire/ Fire Suppression

Low Threat
Inside site, extent of threat not known
Outside site

Fires represent an increasing threat, particularly to species highly restricted in their distribution (IUCN Consultation, 2017).

► Invasive Non-Native/ Alien Species

High Threat
Inside site, widespread(15-50%)
Outside site

The Department of Biodiversity Conservation and Attractions has established a conservation program to bring threatened native fauna species back from

the brink of extinction by controlling introduced predators – the feral fox and cat. Another programme -the Ecological Restoration Program (ERP), currently being carried out in Dirk Hartog Island National Park has almost eradicated introduced herbivores and feral cats. However, an eradication strategy for all introduced animals and pests threatening the values of the property is lacking (IUCN Consultation, 2017).

► Temperature extremes, Storms/Flooding

High Threat
Inside site, throughout(>50%)
Outside site

The Shark Bay area experienced an unprecedented warming event in the summer of 2010-2011, that caused a seagrass (Amphibolis antarctica) dieback of 90% in some areas across the Bay. Intense Leewin Current flows, extraordinary La Niña event and multi-decadal trends in the Pacific Ocean overlapped to drive mean monthly sea surface temperatures up to 2-4°C above normal for a period of four months, causing an extreme ocean heatwave (The Conversation, 2014). The occurrence of this extreme heatwave overlapped with three floodings from the Wooramel River, which delivered over 500 gigalitres of floodwater containing large amounts of sediment into Shark Bay significantly reducing light availability. This combination resulted in the widespread defoliation of the seagrass Amphibolis antarctica which is the most extensive canopy-forming seagrass in Shark Bay (ECOS magazine, 2013). Seagrasses have contributed to the creating of large banks and sills across Shark Bay which have led to a strong salinity gradient, and this in return has allowed the presence of one of the most diverse and abundant stromatolite populations in the world. Seagrass loss will impact the long-term stability of these banks and sills (The Conversation, 2014).

Potential Threats

Low Threat

Potential threats are mainly beyond the scope of management actions, including pollution, ocean acidification and increasing temperatures in the marine environment.

► Oil/ Gas exploration/development

Very Low Threat
Inside site
Outside site

Exploration permits exist but the area is classed as “not very prospective” (5)

► Water Pollution

Low Threat
Inside site, localised(<5%)
Outside site

A range of potential pollution sources exist which could impact on WH values. Most areas are under management and the site has extensive anti-pollution regulations. Potential pollution sources include land – littering and urban, industrial and agricultural pollution, groundwater pollution – seepage from septic drains, nutrients and chemicals, dust – mining and agricultural practices, marine pollution – sea dumping, bilge and ballast water, fuel, oil and chemical spills, hydrocarbon pollution, littering, sewage, dredging and discharge of bitterns, atmospheric pollution - vehicle, industrial emissions, carbon dioxide levels or bushfires, as well as noise pollution. (6)

► Fishing / Harvesting Aquatic Resources

Low Threat
Inside site, scattered(5-15%)
Outside site

Increasing pressure on managed fish stocks is occurring worldwide, but is managed sustainably in Shark Bay at present. Closures to increase snapper stocks have been very successful in allowing populations to reestablish (9). Pink snapper did increase under the fishing ban, but it has been widely reported (and possibly there are some data to support) that other species have declined (such as black snapper). (IUCN Consultation, 2014)

► Fire/ Fire Suppression

High Threat
Inside site, extent of threat not known
Outside site

Fire risks are forecast to increase. Fire represents a significant threat to

species that are highly restricted in their distribution, particularly populations which only survive on islands, where they could be severely affected or totally destroyed by a single large fire, especially from lightning strikes (Cowell, 2013). Appropriate management of fire is essential. Further knowledge of fire ecology and the requirements of species and communities is required (IUCN Consultation, 2017).

► Invasive Non-Native/ Alien Species

High Threat
Inside site, widespread(15-50%)
Outside site

Potential Introduction of new invasive species will remain a risk and therefore requires constant monitoring and active management (Fourqurean et al. 2012). A weed management strategy is required to prevent the introduction of new invasive plants and manage the spread of existing plants (IUCN Consultation, 2017).

► Habitat Shifting/ Alteration, Ocean acidification, Temperature extremes, Storms/Flooding

High Threat
Inside site, throughout(>50%)
Outside site

Effects of climate change will likely result in impacts on the property' habitats, and ecosystems, as well as changes in salinity and nutrient levels which will directly affect Hamelin Pool and the stromatolites. Local conditions such as wind, erosion, cyclones and extreme tides will need to be monitored as they are likely to increase due to climate change. The Shark Bay area is in the transition zone between tropical and sub-tropical zones for many species of terrestrial and marine fauna and therefore vulnerable species and ecosystems are expected to experience significant effects, many of them detrimental (IUCN Consultation, 2017).
Stromatolites are also becoming increasingly threatened as stomatolite growth is vulnerable to rising sea level and
extreme climate events (Suosaari et al., 2016).

Protection and management

Assessing Protection and Management

▶ Relationships with local people

Mostly Effective

The Shark Bay World Heritage Property Strategic Plan 2008-2020 was prepared to develop a partnership between governments and the community (World Heritage Committee, 2013).

▶ Legal framework

Highly Effective

The relevant legislation includes the Environment Protection Biodiversity Conservation Act 1999 (EPBC) which provides a legal framework to protect and manage nationally and internationally important heritage places, including World Heritage sites (http://www.environment.gov.au/epbc). In Western Australia environmental impact assessments under the Environmental Protection Act 1986 (WA) is the main method of considering the environmental impacts of major developments which may affect World Heritage values (IUCN Consultation, 2017).

▶ Enforcement

Highly Effective

Enforcement of the relevant legislation is considered effective.

▶ Integration into regional and national planning systems

Data Deficient

Data deficient

▶ Management system

Highly Effective

The Department of Parks and Wildlife is the lead State Government agency responsible for the management of the property. The Shark Bay World Heritage Advisory Committee is in place and provides advice to the State and Commonwealth Governments with regards to the management of the

property, research priorities and scientific basis of management principles and practices (IUCN Consultation, 2017). The Shark Bay World Heritage Advisory Committee replaced the two previous Scientific Advisory and Community Consultative committees with a new committee consisting of community, scientific and Indigenous representatives (World Heritage Committee, 2013). Several plans are in place, including Shark Bay Terrestrial Reserves and Proposed Reserve Additions (Department of Environment and Conservation, 2012) and the Shark Bay World Heritage Property Strategic Plan 2008-2020. The Shark Bay World Heritage Property Strategic Plan 2008-2020 (DEC 2008a) provides direction for the management of resources across the Property (DEC, 2012).

► Management effectiveness

Mostly Effective

Overall, management effectiveness is high. Advisory committees are in place, and management is supported by largely up to date management plans.

► Implementation of Committee decisions and recommendations

Highly Effective

No recent Decisions have been taken by the World Heritage Committee on this property.

► Boundaries

Mostly Effective

Since inscription, Francois Peron National Park (52,586 hectares), Shell Beach Conservation Park (517 hectares), Monkey Mia Reserve (446 hectares), Monkey Mia Conservation Park (5 hectares), Zuytdorp Nature Reserve (additional 58,850 hectares), Nanga pastoral lease (176,407 hectares), part Tamala pastoral lease (56,343 hectares), South Peron (53,408 hectares), part Carrarang pastoral lease (18,772 hectares), Bernier, Dorre and Koks Islands Nature Reserves (9,722 hectares) and Dirk Hartog Island National Park (61,243 hectares) have been added to the conservation estate. With the designation of the Shark Bay Marine Park (748,725 hectares) in 1990, incorporating the Hamelin Pool Marine Nature Reserve, the total formal conservation area of the World Heritage property is approximately 1.24

million hectares. In addition, the coastal portion of the Yaringa pastoral lease (19,396 hectares), part of Nerren Nerren pastoral lease (104,351 hectares) and part of Murchison House pastoral lease (37,578 hectares) have been added as a buffer. (World Heritage Committee, 2013).

► Sustainable finance

Data Deficient

No recent information is available.

► Staff training and development

Data Deficient

No recent information is available.

► Sustainable use

Mostly Effective

Acceptable levels of usage are in place (8, 3)

► Education and interpretation programs

Mostly Effective

Good signage and pamplets are in place (8, 3). But interpretation materials could be updated substantially to reflect the most recent research findings (IUCN Consultation, 2014).

► Tourism and visitation management

Mostly Effective

The Shark Bay Terrestrial Reserves and Proposed Reserve Additions Management Plan 2012 addresses visitor access issues with the objective of providing a range of access types that do not adversely impact on key values of the property (Dept. of Environment and Conservation, 2012).

► Monitoring

Highly Effective

Effective monitoring of Shark Bay is in place for the marine reserves (3) and

Project Eden (8)

▶ Research

Highly Effective

High levels of research have been taking place in Shark Bay through WAMSI, DPAW/DEC (3, 8). The profile of Shark Bay has been substantially raised by international research. In addition to a dedicated community of Australian scientists, there have been long-term research projects underway even before Shark Bay achieved World Heritage status. There are hundreds of scientific papers published on this site in the last 15 years. New scientific articles continue to be published on stromatolites (see for example, Collins and Jahnert, 2014; Suosaari et al., 2016).

Overall assessment of protection and management

Mostly Effective

The protection and management of the Shark Bay Word Heritage Property is overall effective. Management is supported by the Shark Bay World Heritage Advisory Committee and is based on a number of management and strategic plans. Key issues and threats appear to be adequately addressed; however, efforts in some areas need to be increased, for example with regards to invasive species eradication programmes.

▶ Assessment of the effectiveness of protection and management in addressing threats outside the site

Mostly Effective

Due to its inaccessibility and the appropriateness of its boundaries, the site is not subject to significant threats originating from outside its boundaries, with the exception of climate change and rising sea levels.

▶ Best practice examples

Feral cat and introduced herbivore eradication programs on Dirk Hartog Island.

State and trend of values

Assessing the current state and trend of values

World Heritage values

▶ **Most diverse and abundant examples of stromatolites – the oldest form of life on Earth**

Low Concern
Trend:Stable

These structures are in a good state and largely free of damage. Stromatolites are largely stable geological structures, with many more subtidal habitats than were listed in the nomination document (2). Sediment flows in 2011 (9) were of concern (La Nina events) with increased sediment runoff due to overgrazing in the surrounding catchments.
Concerns about ocean acidification are largely beyond the scope of management, but Shark Bay will represent a stable natural laboratory for comparative purposes, strengthening its significance. (9)

▶ **One of the world’s best examples of a living analogue for the study of the nature and evolution of the earth’s biosphere up until the early Cambrian**

Low Concern
Trend:Stable

Stromatolites continue to be in a good state and largely free of damage. Stromatolites are largely stable geological structures, with many more subtidal habitats than were listed in the nomination document (2). Sediment flows in 2011 (9) were of concern (La Nina events) with increased sediment runoff due to overgrazing in the surrounding catchments.
Concerns about ocean acidification are largely beyond the scope of management, but Shark Bay will represent a stable natural laboratory for comparative purposes, strengthening its significance. (9)

► Seagrass banks of great geological interest

Good
Trend:Stable

Reserves are in generally good to excellent condition and are well managed (3, 6). The La Niña event in 2011 raised temperatures and increased sediment run-off resulting in a reduction in seagrass leaf density and cover (10), especially at the mouth of the Wooramel delta. Risks of increasing frequency of such events with changes in global climate are still unknown (6).

► Outstanding examples of processes of biological and geomorphic evolution taking place in a largely unmodified environment

Low Concern
Trend:Stable

The site’s internationally and nationally important biodiversity values, which are more sensitive to anthropogenic impacts, are affected mainly by very low threats (Fourqurean et al. 2012). The exception may be the seagrass banks which suffered a large scale dieback and defoliation during the summer of 2010/11 as a result of a marine heatwave event. Methods to restore the meadows are being explored, but have been unsuccessful to date (IUCN Consultation, 2017). The dieback was estimated to be very significant (>90%) in several regions of Shark Bay. This reduction in habitat quality resulted in impacts on the entire ecosystem, including a decline in the health status of largely herbivorous green turtles (Chelonia mydas) in the 2 years following the heat wave (Thomson et al., 2014).

► A range for many globally threatened species of plants and animals

Good
Trend:Stable

Marine populations (e.g. dugongs and turtles) are all under Western Australian legislation for the protection of wildlife, as well as Marine Park status (3), diminishing the risks to World Heritage values. The isolation of fauna habitats on islands and peninsulas increase the likelihood of survival of marsupial species, such as the Shark Bay Mouse, Banded Hare Wallaby, Rufous Hare Wallaby, Western Barred Bandicoot, the Bilby and Bernier Island subspecies of Ash-grey mouse (6). Reserves are in generally good to

excellent condition (6, 8).

Summary of the Values

► **Assessment of the current state and trend of World Heritage values**
Good
Trend: Stable

The site provides exceptional living examples of the earliest life forms on Earth in living stromatolites and microbialites, in a carbonate landscape and its hypersaline environments. These structures are in a good state and largely free of damage. Geographical isolation has provided areas where environmental circumstances have enabled species to survive after extinction in surrounding areas. The largest seagrass banks in the world also provide habitats for charismatic megafauna, especially dugongs, dolphins, turtles and sharks, as well as diverse genotypes in fish populations, sustainably managed. However, the seagrasses suffered a large scale dieback and defoliation during the summer of 2010/11 as a result of a marine heatwave event and this might result in cascade effects on the entire ecosystem. On land, the site includes transition zones in the flora, and examples of speciation, as well as high numbers of endemic species. There is some small risk to the terrestrial values of interaction between climate change, feral animals and sheep and goat grazing.

Additional information

Benefits

Understanding Benefits

► **Carbon sequestration**

The blue carbon stored as soil carbon under Shark Bay’s seagrass meadows is recognised on a global scale as a carbon hot spot (IUCN Consultation,

2017).

▶ **Tourism-related income, Provision of jobs**

Although visitation numbers are relatively low, tourism represents an important activity for the local economy.

▶ **Importance for research**

The site is an Important area for research, both marine and terrestrial, as well as archaeological.

▶ **Sacred natural sites or landscapes**

Sacred Aboriginal Heritage Sites are located within the WH site.

▶ **Fishing areas and conservation of fish stocks**

The World Heritage site is contributing to maintaining fish productivity by providing breeding, spawning and feeding areas.

▶ **Outdoor recreation and tourism**

Although visitor numbers are relatively low, Shark Bay is an important tourism destination providing some unique features.

Projects

Compilation of active conservation projects

№	Organization/ individuals	Project duration	Brief description of Active Projects
1	Department of Biodiversity, Conservation and Attractions, Parks and Wildlife Service	From: 2017 To: 2017	Plant and animal research, particularly Project Eden, and plant genetics. Hartog Island Ecological Restoration Project – eradication of feral animals and pastoral herbivores and reintroduction of native mammals.

№	Organization/ individuals	Project duration	Brief description of Active Projects
2	Research organisations, e.g. UWA, CSIRO, WAMSI, Curtin University, Florida International University	From: 2017 To: 2017	Ecosystem processes Shark research
3	George Town University	From: 2017 To: 2017	Dolphin research
4	Australian Wildlife Conservancy	From: 2017 To: 2017	Mammal re-introductions
5	Curtin University	From: 2017 To: 2017	Stromatolites

Compilation of potential site needs

№	Site need title	Brief description of potential site needs	Support needed for following years
1	Climate change mitigation research	Resources for all projects are hard to obtain.	From: 2017 To: 2017

REFERENCES

№	References
1	Considine, Mary-Lou (2013). ‘Is Shark Bay shifting from temperate to tropical’? ECOS Magazine. http://www.ecosmagazine.com/?paper=EC13084 Accessed 25 October 2017
2	Cowell C 2013 Shark Bay World Heritage Threats and risks analysis. DPAW
3	E. P. Suosaari, R. P. Reid, P. E. Playford, J. S. Foster, J. F. Stolz, G. Casaburi, P. D. Hagan, V. Chirayath, I. G. Macintyre, N. J. Planavsky & G. P. Eberli (2016). New multi-scale perspectives on the stromatolites of Shark Bay, Western Australia. Scientific Reports | 6:20557 | DOI: 10.1038/srep20557
4	Fourqurean et al. 2012 Science for the Management of Subtropical Embayments: Examples from Shark Bay and Florida Bay. Marine and Freshwater Research, 2012, 63:11, 941-1199
5	Fourqurean, J. W., Duarte, C. M., Kennedy, H., Marba`, N., Holmer, M., Mateo, M. A., Apostolaki, E. T., Kendrick, G. A., Krause-Jensen, D., McGlathery, K. J., and Serrano, O. (2012). Seagrass ecosystems as a globally significant carbon stock. Nature Geoscience 5, 505–509.
6	Fraser et al. 2014 (submitted) Extreme climate events lower resilience of foundation seagrass at edge of biogeographical range. Journal of Ecology
7	Fraser, M.,Kendrick, G., Statton, J.,Thomson, J. and Heithaus, M. (2014). ‘Climate change threatens Western Australia’s iconic Shark Bay’. The Conversation. https://theconversation.com/climate-change-threatens-wester… Accessed 25 October 2017
8	Jahnert, R.J. and Collins, L.B. (2012) Characteristics, distribution and morphogenesis of subtidal microbial systems in Shark Bay, Australia. Mar. Geol., 303–306, 115–136.
9	MPRA 10-year Audit and Review of Shark Bay Marine Reserves April 2010
10	McCluskey P (2008) Shark Bay Strategic Plan 2008-2020 DEC
11	Periodic Report 2003
12	Retrospective Statement of Outstanding Universal Value (2013).

№	References
13	Suosaari, E.P., Pamela Reid, R., Abreu Araujo, T.A., Playford, P.E., Holley, D.K., Mcnamara, K.J. and Eberli, G.P. (2016). Environmental pressures influencing living stromatolites in Hamelin Pool, Shark Bay, Western Australia. Palaios, v. 31, 483–496.
14	Thomson, J.A., Burkholder, D.A., Heithaus, M.R., Fourqueran, J.W., Fraser, M.W., Statton, J., Kendrick, G.A. (2015). Extreme temperatures, foundation species, and abrupt ecosystem change: An example from an iconic seagrass ecosystem. Global Change Biology, Volume 21, Issue 4 April 2015. Pages 1463–1474 DOI: 10.1111/gcb.12694
15	WA EPA 2001 Assessment of Potential Petroleum Industry Impacts Study (Section 16E report)
16	Walker, D.I. 1989 Seagrass in Shark Bay - the foundations of an ecosystem (In : Biology of Seagrasses : A Treatise on the Biology of Seagrasses with special reference to the Australian Region. (Ed. A W D Larkum, A J McComb and S. A. Shepherd) Elsevier/North Holland. pp182-210.