

**Approved Conservation Advice for
Thrombolite (microbialite) Community of a Coastal Brackish Lake (Lake Clifton)**

(s266B of the *Environment Protection and Biodiversity Conservation Act 1999*)

This Conservation Advice has been developed based on the best available information at the time this Conservation Advice was approved; this includes existing plans, records or management prescriptions for this ecological community.

Description

Microbialites are discrete organosedimentary structures formed by the activities of specific microbial communities that occur at the bottom (benthic stratum) of certain aqueous ecosystems. Here, cyanobacteria and eukaryotic microalgae photosynthesise and precipitate calcium carbonate (limestone) from the surrounding water, leading to the formation of rock-like structures (Moore et al., 1983; Moore, 1990). Although microbialites have the appearance of rocks, they are in fact living ecosystems similar to coral reefs. Unlike corals, however, the hard carbonate structures of microbialites are not skeletal, but are instead the result of mineralisation in the biochemical environment. Microbialite construction is a passive process, unlike coral skeletal formation, which is an active and controlled precipitation of calcium carbonate by the coral tissues.

Thrombolites are a type of microbialite. They are distinguished from other microbialites, such as stromatolites, by the internal structure of their calcareous deposits. Stromatolites are finely layered, whereas thrombolites are not layered, and possess a clotted internal structure with fenestrae (Riding, 1999; Luu et al., 2004; Hale and Butcher, 2007). Thrombolites are formed by the interactions of a complex association of photosynthetic prokaryotes, eukaryotic microalgae and chemoautotrophic and chemoheterotrophic microbes (Moore, 1990). They require access to a carbonate-rich water supply and sunlight for their growth and survival. The photosynthetic action of the microbes causes the precipitation of calcium carbonate as aragonite from fresh groundwater seeping up from underground aquifers (Moore, 1990).

The dominant type of microbe present are generally photosynthetic cyanobacteria. Historically, the dominant microbe species for thrombolite formation is the cyanobacterium *Scytonema* sp., which grows in fresh to brackish waters with low nutrient levels (Moore, 1990; Luu et al., 2004).

Conservation Status

The Thrombolite (microbialite) Community of a Coastal Brackish Lake (Lake Clifton) is listed as **critically endangered**. This ecological community is eligible for listing as critically endangered under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) as, in 2009, the Minister considered the Threatened Species Scientific Committee's (TSSC) advice and amended the list under section 184 to include the Thrombolite (microbialite) Community of a Coastal Brackish Lake (Lake Clifton). The TSSC determined that this ecological community met criteria 2, 3, 4 and 5 because it has a very restricted geographic distribution coupled with demonstrable threat. Recent investigations indicate that *Scytonema*, a key cyanobacterium for thrombolite formation has gone from being a dominant species to no longer being found in Lake Clifton thrombolites (Alexander, pers. comm.). Community integrity has also been reduced, and the rate of continuing detrimental change is very severe.

The ecological community was also endorsed as a critically endangered ecological community in Western Australia in 2000 by the Western Australian Minister for the

Environment following assessment by the Western Australian Threatened Ecological Communities Scientific Committee. The Peel-Yalgorup Lakes System is listed as a Wetland of International Significance under the Ramsar Convention.

Distribution and Habitat

The Lake Clifton thrombolite community is restricted to Lake Clifton, which occurs within the South West Natural Resource Management Region. This ecological community is situated in the Swan Coastal Plain IBRA Bioregion of Western Australia. Lake Clifton is situated within the Yalgorup National Park, and is the northernmost lake in the Peel-Yalgorup Lakes System, which consists of several hypersaline and brackish lakes (Commander, 1988; Moore, 1990).

The Lake Clifton thrombolite community occurs on a relict foredune plain of Holocene age sands. The main known occurrence of the ecological community is a stretch, approximately 15 kilometres long and up to 15 metres wide, along the north-eastern shoreline of Lake Clifton. There are other small clusters of thrombolites within the Lake, also at the northern end. The thrombolites cover a total area of approximately four square kilometres (Moore, 1990). This structure is the largest known example of a living, non-marine microbialite reef in the southern hemisphere.

Threats

The main identified threats to the Lake Clifton thrombolite community are groundwater extraction and changes to surrounding vegetation, causing increased salinity levels, eutrophication and physical damage.

The main potential threats to the Lake Clifton thrombolite community include introduced fish species and climate change.

Research Priorities

Research priorities that would inform future regional and local priority actions include:

- Implementation of suitable monitoring programs which would support and enhance any existing projects.
- Undertake further research into the biology, distribution and ecological requirements of the thrombolite community, including groundwater influx, and the relative impacts of threatening processes.
- Determine the range of 'normal' fluctuations for hydrological regimes, including groundwater flow, and ways to maintain them within that range.
- Development and implementation of a Water Quality Improvement Plan.

Regional Priority Actions

The following regional priority recovery and threat abatement actions can be done to support the recovery of the Thrombolite (microbialite) Community of a Coastal Brackish Lake (Lake Clifton):

Habitat Loss, Disturbance and Modification

- Ensure that any development activities (including those which involve groundwater) within the Lake Clifton catchment do not adversely impact on the Thrombolite (microbialite) Community of a Coastal Brackish Lake (Lake Clifton).
- Manage any changes to hydrology that may result in changes to water table levels and/or increased run-off, salinity, algal blooms, sedimentation or pollution.
- Minimise and manage any disruptions to the groundwater aquifer.
- Create and protect a suitable native vegetation buffer around Lake Clifton.

- Investigate formal conservation arrangements, management agreements and covenants for adjoining private land.
- Investigate inclusion of private and crown land in reserve tenure (Yalgorup National Park) if possible.
- Monitor the progress of recovery, including the effectiveness of management actions and the need to adapt them if necessary.

Trampling

- Implement practical methods of preventing physical damage to the thrombolite structures, such as the construction of more boardwalks and viewing platforms to limit human access and foot traffic.
- Ensure adequate fencing to prevent domestic stock and feral animals from gaining access to the lake shore.

Animal Predation or Competition

- Develop and implement a management plan for the control and eradication of Black Bream (*Acanthopagrus butcheri*) in Lake Clifton.

Conservation Information

- Raise awareness of the Thrombolite (microbialite) Community of a Coastal Brackish Lake (Lake Clifton) within the local community. There are several community groups associated with Lake Clifton already active in the area, including Friends of the Ramsar Action Group for the Yalgorup Lakes Environment (FRAGYLE), the Peel Preservation Group Inc. and the Lake Clifton Herron Progress and Sporting Association, all of whom support further protection of this ecological community.

This list does not necessarily encompass all actions that may be of benefit to the Thrombolite (microbialite) Community of a Coastal Brackish Lake (Lake Clifton), but highlights those that are considered to be of highest priority at the time of preparing the Conservation Advice.

Existing Plans/Management Prescriptions that are Relevant to the Species

There is an existing Interim Recovery Plan in place in Western Australia for this ecological community called “Thrombolite (stromatolite-like microbialite) Community of a Coastal Brackish Lake (Lake Clifton), which sets out priority actions for its ongoing management and recovery (Luu et al., 2004).

These prescriptions were current at the time of publishing; please refer to the relevant agency’s website for any updated versions.

Information Sources:

Alexander J. Curtin University of Technology, personal communications, March to September 2009.

Commander DP (1988). Geology and hydrogeology of the superficial formations and coastal lakes between Harvey and Leschenault inlets (Lake Clifton Project). Western Australian Geological Survey Professional Papers. Report No. 23, 37-50.

Hale J and Butcher R (2007). Ecological Character Description of the Peel-Yalgorup Ramsar Site – A report to the Department of Environment and Conservation and the Peel-Harvey Catchment Council. Perth.

Moore LS (1990). Lake Clifton – An Internationally Significant Wetland in need of Management, Land and Water Research News,8:37-41, Water Authority of Western Australia, Leederville.

- Moore L, Knot B and Stanley N (1983). The Stromatolites of Lake Clifton, Western Australia – Living Structures Representing the Origins of Life. *Search* 14:11-12 309-314.
- Luu R, Mitchell D and Blyth J (2004). Thrombolite (stromatolite-like microbialite) Community of a Coastal Brackish Lake (Lake Clifton), Interim Recovery Plan No. 153, 2004-2009, Western Australian Department of Conservation and Land Management, Perth.
- Riding R (1999). The term stromatolite: towards an essential definition. *Lethaia* 32:4 321-330.