

Glass Sponge Reefs: fragile habitats require further protection

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What is happening?

Glass sponge reefs only occur in B.C.'s Pacific coastal waters. Átl'ka7tsem/Txwnéwu7ts/Howe Sound has some of the best, most intact sponge reefs in all of B.C. The reefs in Átl'ka7tsem/Txwnéwu7ts/Howe Sound are the only ones that are shallow enough to reach by air diving; all other known reefs occur at much greater depths and require technical divingⁱ or use of a remotely operated vehicle (ROV) to access. This aspect alone makes these Átl'ka7tsem/Txwnéwu7ts/Howe Sound reefs extremely unique and comparatively accessible.



Research diver lighting up a sub-adult yellowtail rockfish over a glass sponge reef.
(Credit: Adam Taylor)

- i) Technical diving – all diving methods that exceed the limit for depth (> 40 m/ 130 ft) and/or time imposed for recreational scuba diving. Technical diving often requires the use of special gas mixtures other than compressed air, for breathing, as well as staged decompression stops when ascending.



A quillback rockfish on a glass sponge reef, Kw'émkw'em/Defense Islands. (Credit: Adam Taylor)

What is the current status?

Considerable advances in our knowledge of glass sponge reefs in Átl'ka7tsem/Txwnéwu7ts/Howe Sound have occurred. The Howe Sound Conservation and Research Team of Ocean Wise has spent decades monitoring the glass sponges in Átl'ka7tsem/Txwnéwu7ts/Howe Sound. One report examined changes over time at the inshore Nínich Kw'émkw'em/East Defence Island sponge reef (biohermⁱⁱ).¹ Over a decade of scuba diving at this bioherm led to a somewhat novel view of the dynamics of bioherm formation and persistence. Work documenting these reefs spanning decades had led to the opinion that cloud sponges (*Aphrocallistes vastus*), one species of glass sponge of which many genera exist, are very slow growing, and the geologic-

ally stable reef base includes many intact sponge skeletons. However, this study revealed a rapid collapse of dead skeletons and a geologic base largely consisting of skeletal fragments.¹

Additionally, the shallowest fringe of this reef has crept out over bedrock. Bioherms at this site have typically formed on glacial till (cobbles) because the Kw'émkw'em and Nínich Kw'émkw'em/Defence Islands protrude from the inner sill of Átl'ka7tsem/Txwnéwu7ts/Howe Sound, a glacial relic that consists of glacial till deposits. This reef is so close to the shore that it abuts the solid rock of ridges projecting from the island and has crept up onto that solid bedrock.

ii) Bioherm – ancient organic reef of mound-like form built by a variety of marine invertebrates and calcareous algae.

Furthermore, some rapid tissue collapse of particular sponges was observed when mortality occurred.¹ Encouragingly, restoration work using staked transplants (fragments of sponges that were damaged and broken loose from reefs by downrigger gear) illustrated relatively rapid (i.e., within months) growth and re-attachment to secure stakes. Similarly, the recovery of sponge growth from loose fragments with stabilized positions in debris driftsⁱⁱⁱ illustrates a living pattern, in effect, suggestive of tissue persistence. These sponge bushes are effectively single cells within a skeletal framework of silica (glass) spicules^{iv}. Fragments that include intact tubes or pumping units can resume growth under favorable conditions and with stable positioning, such as in debris drifts.

Because Átl'ka7tsem/Txwnéwu7ts/Howe Sound is so steep-sided and rugged, bottom trawling with chains and trawl doors attached to nets has not occurred where the sponge reefs exist. This is in stark contrast to the Strait of Georgia, where a half century of trawling for Pacific cod (*Gadus macrocephalus*) has left scoured remnants of the geologically stable reef bases, with some living reef structures.² These bases were protected in 2016 by bottom-contact fishing closures in case future settlement of planktonic propagules of glass sponges can facilitate the recovery of reefs at those locations.

How will climate change impact glass sponge reefs?

The Nínich K̓w'ém̓k̓w'em/East Defence Island inshore bioherm study¹ included observation of mortalities associated with the El Niño climate events of 2009/2010 and 2015/2016. Tissue recovery and rapid growth ap-

peared correlated with La Niña events, so future study needs to include monitoring of climate patterns and recording of ocean water conditions.

iii) Debris drifts – stable piles of fallen sponges.

iv) Spicule – a minute, slender, sharp-pointed body, typically present in large numbers.

What has been done since 2017?

The table below reports on progress made on recommended actions from the previous 2017 article, where identified. Many of these require ongoing action.

2017 ACTION	ACTION TAKEN
INDIVIDUAL AND ORGANIZATION ACTIONS	
Install a safe and permanent moorage for dive boats at glass sponge reef sites.	The Marine Life Sanctuaries Society (MLSS) and partners have installed the base of what will be a permanent mooring buoy at the Halkett Marine Park sponge reef at Halkett Pinnacle. This will provide safe moorage and safe access for divers to the sponge garden on a ridge contiguous with the deeper sponge reef. Citizen science documentation of that garden and reef is anticipated, with the cooperation of commercial dive boat operators, and with web data reports and scientific assistance from Ocean Wise Research Institute, similar to the Annapolis Reef in Halkett Bay.
GOVERNMENT ACTIONS AND POLICY	
Implement full protection of glass sponge reefs throughout all of Átl'ka7tsem/Txwnéwu7ts/Howe Sound.	In March 2019, DFO announced the closure of the nine documented glass sponge reef complexes in Átl'ka7tsem/Txwnéwu7ts/Howe Sound to bottom-contact fishing. Furthermore, 21 additional possible reef sites in eight distinct areas in Átl'ka7tsem/Txwnéwu7ts/Howe Sound were mapped in the DFO report ³ that preceded the public review process. Those sites have since been surveyed in a DFO ROV research cruise in May 2019; publication of results is anticipated in 2020.

What can you do?

A detailed overview of recommended actions relating to climate change is included in *The path to zero carbon municipalities* (OWHS 2020). In some cases, no progress was identified on previous recommended actions; these remain listed below.



Individual and Organization Actions:

- Contribute to citizen science projects in order to monitor glass sponge growth at the inshore K̄w'ém̄kw'em/Defence Island sponge reef.
- Report illegal fishing and trapping to DFO within sponge closure areas.
- Take the padi course developed to teach safe diving practice around sponge reefs before diving around sponge reefs.
- Familiarize yourself and others with locations of sponge reefs throughout Átl'ka7tsem/Txwnéwu7ts/Howe Sound, specifically if bottom contact fishing or mooring your vessel.



Government Actions and Policy:

- Encourage local education and awareness of the importance of sponge reefs, and the risks they face.
- Advertise the uniqueness of the opportunity to dive a sponge reef using compressed air in Átl'ka7tsem/Txwnéwu7ts/Howe Sound.
- Support local citizen science projects, and formal studies aimed at understanding and monitoring glass sponge reefs.
- Restrict bottom contact fishing throughout all glass sponge reefs in Átl'ka7tsem/Txwnéwu7ts/Howe Sound.

Methods

The study by Marliave et al.¹ drew on more than a decade of scuba diving at the Nínich K̄w'ém̄kw'em/East Defence Island bioherm by the Howe Sound Conservation and Research Team of Ocean Wise. This research included the installation of bar-coded marker stakes

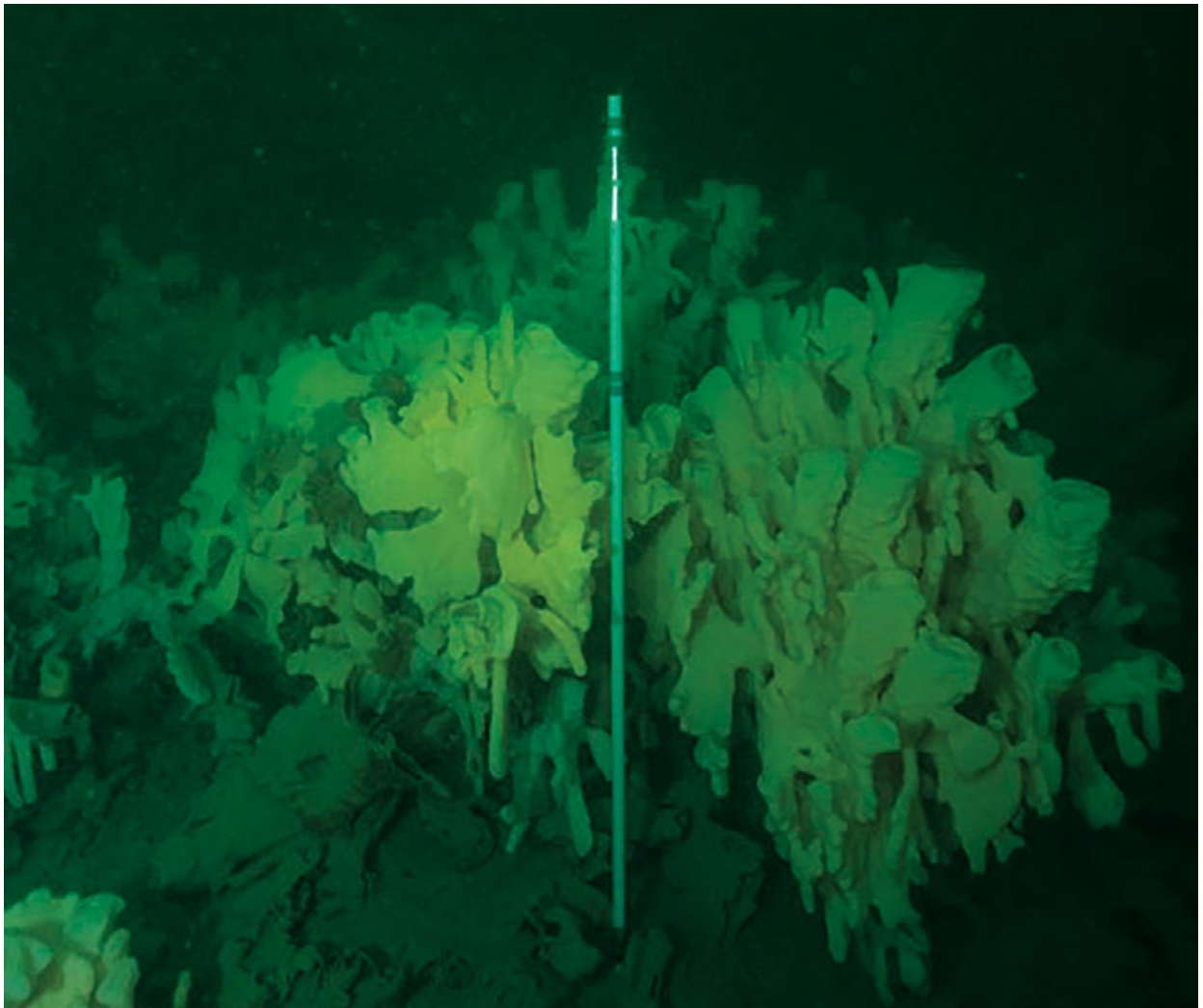
(i.e., multicoloured lines on the stakes to allow identification of each stake), transplants of loose fragments from fishing gear damage, and substrate depth survey transects with an avalanche probe.

References

¹ Marliave JB, Borden LA, Schultz JA, Gibbs DM, Dennison GJ. Formation, persistence and recovery of glass sponge reefs: a case study. 2018; Available from: <https://tinyurl.com/su6o6uz>

² Dunham A, Archer SK, Davies SC, Burke LA, Mossman J, Pegg JR, et al. Assessing condition and ecological role of deep-water biogenic habitats: Glass sponge reefs in the Salish Sea. *Mar Environ Res* [Internet]. 2018;141:88–99. Available from: <https://doi.org/10.1016/j.marenvres.2018.08.002>

³ Fisheries and Oceans Canada (DFO). Glass sponge aggregations in Howe Sound: locations, reef status, and ecological significance assessment [Internet]. 2018. [cited 2019 Dec 9]: DFO Canadian Science Advisory Secretariat Science Response 2018/032; Available from: http://www.dfo-mpo.gc.ca/csas-sccs/Publications/ScRS/2018/2018_032-eng.html



Glass sponge reef marked by a bar-coded stake. (Credit: Adam Taylor)