Sea Stars: wasting disease is ongoing

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What is happening?

Sea star wasting disease (SSWD) has been a serious issue along the entire Pacific Northwest coast, including in the waters of Átl'ka7tsem/Txwnéwu7ts/Howe Sound, since the major mortality event of 2013. One of the key issues caused by SSWD is the decrease in biodiversity (see Resources) in areas that are impacted.

Sun star, *Solaster stimpsoni*. (Credit: Lee Newman)

What is the current status?

Throughout Átl'ḵa7tsem/Txwnéwu7ts/Howe Sound, numbers for most sea star species remain low but stable. Sunflower stars (*Pycnopodia helianthoides*) and sun stars (*Solaster* spp.) continue to be very rare. When they are observed, they are small (approximately 10 cm across or smaller). Throughout their range, sunflower stars are not showing signs of recovery.[1–3] Initially, there was speculation that sunflower stars may have moved to deeper, colder water to escape the disease. Unfortunately, a 2019 survey found very low numbers in both shallow and deep habitats.[1]

The cascade effects of sea star wasting on other species within the community continue to persist. Green sea urchins are still extremely abundant compared to the years before SSWD (Figure 1). Without the high abundance of sunflower stars, their key predators, sea urchins are free to consume kelp, creating urchin barrens in areas where dense kelp beds previously existed.[4–6]

Dead seastars found on a shoreline. (Credit: Tracey Saxby)

SSWD is ongoing at low levels. In Átl'ḵa7tsem/Txwnéwu7ts/Howe Sound, there continue to be sightings of afflicted sea stars at low levels, particularly for the mottled star (*Evasterias troschelii*) which remains common. For most other sea star species, numbers are modest but stable. However, the leather star (*Dermasterias imbricate*) is very common; its numbers increased on many areas of the coast following wasting disease; however, it is not immune to wasting disease.

A virus is associated with SSWD in sunflower stars.[7] However, the disease is not associated with a virus in other sea star species.[8] Instead, there is likely a combination of factors that cause SSWD. These factors can differ from one species to another, and from one location to the next.[8] As a silver lining, surviving sea stars have demonstrated genetic adaptation, suggesting they may be able to evolve to cope with the disease.[9,10] However, with SSWD still present in the environment, it is not clear whether sea stars will ever fully recover, or whether populations will continue to be reinfected.

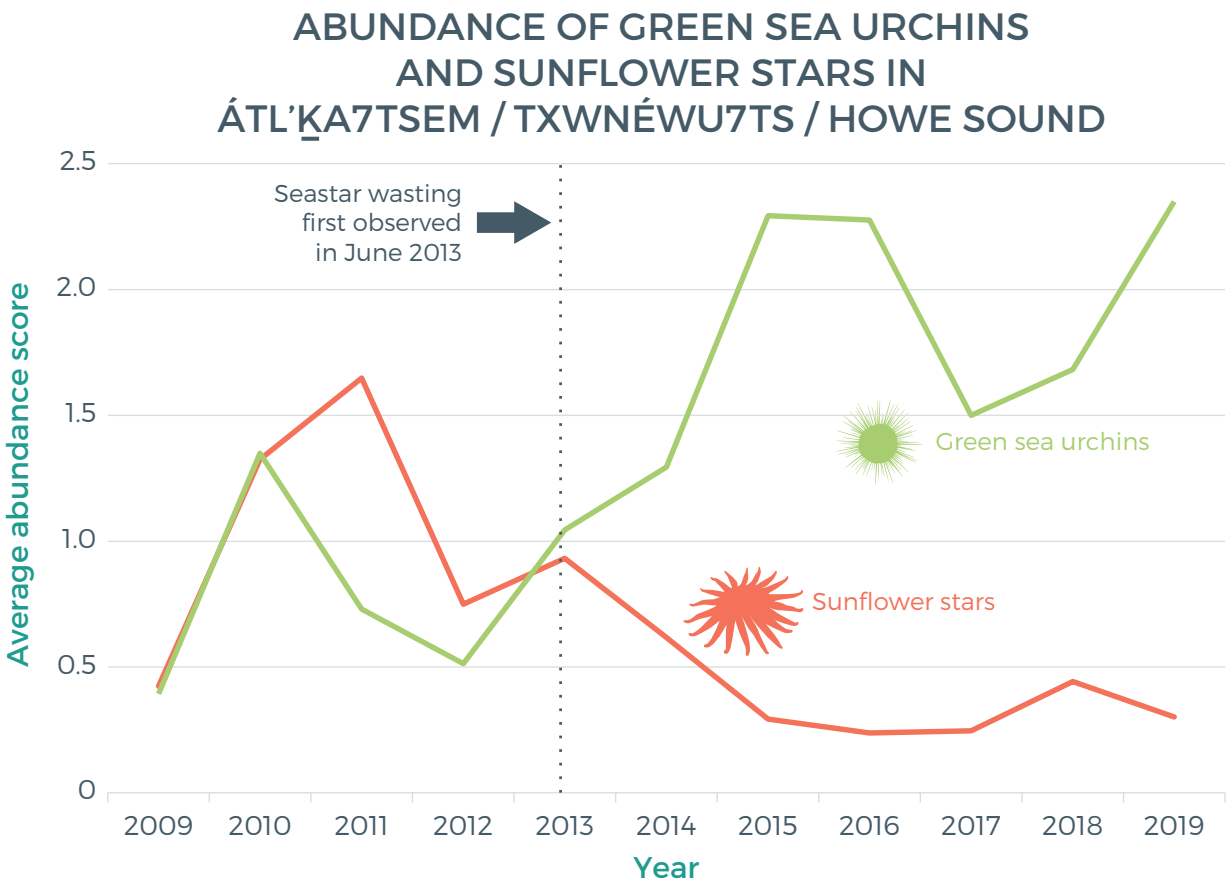
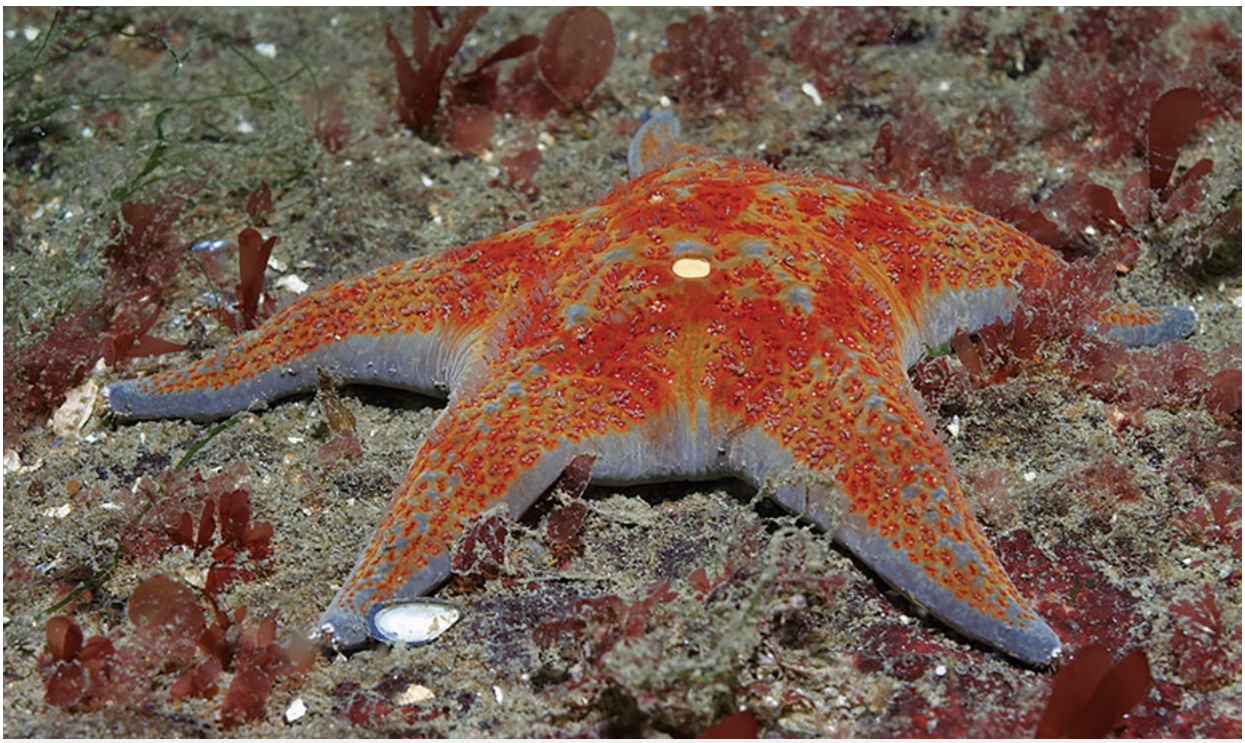


Figure 1. Following the outbreak of sea star wasting disease in 2013 (indicated by the red dashed line), the abundance of sunflower stars declined while the abundance of green sea urchins increased drastically. These data are from roving dive surveys at 116 sites in Átl'ḵa7tsem/Txwnéwu7ts/Howe Sound during which abundance was scored using the following scale: 0 = none; 1 = 1–9 individuals; 2 = 10–24 individuals; 3 = 25–49 individuals; 4 = 50–99 individuals; 5 = 100–999 individuals; 6 = >1000. n = 992 surveys. (In the 2017 Sea Stars article, the dataset used covered the entire B.C. coast. Here, we use Átl'ḵa7tsem/Txwnéwu7ts/Howe Sound specific data).

What are the potential impacts of climate change on sea stars?

There is growing evidence that SSWD is related to warming ocean temperatures. Unusually warm temperatures in 2014 and 2015 are linked with peak declines in sunflower stars[1] and some populations of purple stars (*Pisaster ochraceus*).[11] In both species, increased temperature intensifies and accelerates the progression of the disease.[1,11–13] Initial observations of SSWD occurred in the same year (2013) as the *Blob*[i] appeared in the Pacific Ocean, which was followed by the warmest El Niño on record.[6,14] However, the timing and severity of SSWD outbreaks are not always predictable based on temperature,[11] and interactions between wildlife diseases and climate change are complex.[15] In general, marine diseases are likely to become more frequent and less predictable in a warming ocean.



Echinoderm. (Credit: Lee Newman)

i) The Blob - a marine heatwave that occurred in the North Pacific Ocean, starting in late 2013. See Resources for further information.

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	
If you see a sick or dying sea star, please submit your observations to the UC Santa Cruz monitoring site (see Resources). Your observations can help researchers track disease spread and understand the potential causes and consequences of sea star wasting. If applicable to your organization, encourage company-wide participation in this citizen science project.	Almost 50 observations have been submitted to the above monitoring site from Átl'ka7tsem/ Txwnéwu7ts/Howe Sound alone.
GOVERNMENT ACTIONS AND POLICY	
Increase public education about sea star wasting disease to encourage participation in citizen science projects, and personal actions to help decrease overfishing, pollution, habitat damage and stressors.	The previous Ocean Watch Howe Sound Edition (2017) increased public awareness throughout the Sound, although this was not a government action.
If studies reflect the need, classify sea stars as Imperiled Species by the *Species at Risk Act*.	In Canada and the USA, discussions continue regarding whether to list sunflower stars as endangered. Thus far, they have not been given this official designation. Researchers and conservationists continue to work on a sea star recovery and monitoring strategy, but because of the complexity of factors causing the outbreak, defining a specific approach remains a challenge.

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. Additional actions marked as NEW also follow.

Individual and Organization Actions:

- NEW Actions to mitigate climate change will promote sea star recovery and decrease the probability of other wildlife disease outbreaks in the future.

Government Actions and Policy:

- Financially support ongoing research projects and assess the need for additional research. Support further studies specifically on the cause(s) of sea star wasting disease.
- NEW List sunflower stars as endangered in Canada and the USA, at provincial, federal or international levels.
- NEW Support and fund researchers and conservationists in Canada and the USA to continue to work on a sea star recovery and monitoring strategy.

Methods

Data presented in Figure 1 were collected from 992 roving dive surveys conducted by the Howe Sound Conservation and Research Team at 116 sites in Átl'ḵa7tsem/Txwnéwu7ts/Howe Sound between 2009 and 2019. The abundance of all fish, invertebrates and algae encountered were scored (0 = none; 1 = 1–9 individuals; 2 = 10–24 individuals; 3 = 25–49 individuals; 4 = 50–99 individuals; 5 = 100–999 individuals; 6 = >1000). Sea stars with signs of wasting were noted, and the diameter of sunflower stars was measured whenever possible. Data are managed using the Pacific Marine Life Surveys database.

A literature scan using the terms "sea star wasting syndrome" and "sea star wasting disease" was carried out. We also considered our own personal observations, as well as anecdotal evidence shared with us by Neil McDaniel, Andy Lamb, Marc Chamberlain and Jan Kocian.

Acknowledgements

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Resources

This list is not intended to be exhaustive. Omission of a resource does not preclude it from having value.

The Blob
El Niño patterns contributed to long-lived marine heatwave in North Pacific. 2016.
Available at: https://swfsc.noaa.gov/news.aspx?ParentMenuId=54&id=21991 Accessed August 9th 2019.

Ocean heat waves like the Pacific's deadly "Blob" could become the new normal. 2019. Available at: https://www.sciencemag.org/news/2019/01/ocean-heat-waves-pacific-s-deadly-blob-could-become-new-normal Accessed August 12th 2019.

UC Santa Cruz monitoring
https://marine.ucsc.edu/data-products/sea-star-wasting/index.html

Decreased biodiversity causes changes in keystone species.
https://oceanwatch.ca/howesound/wp-content/uploads/sites/2/2016/11/diagram-keystone-predation-BRANDED.png

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