Sea star wasting – update!

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What's happening?

Starting in the spring of 2013, a widespread sea star mass mortality event spread up and down the west coast of North America in what might be the largest wildlife die-off event in recorded history.[1,2] At least 20 species are affected,[1] with trickle-down ecological effects at multiple levels of the food web.[3] Despite progress in understanding the causes and consequences of the outbreak,[4,5,6,7] many mysteries remain, and sea star wasting syndrome is ongoing.

Prior to October 2013, there were thousands of large sunflower stars, *Pycnopodia helianthoides*, at this site near Defence Island in Howe Sound. On April 3 2017, only six small individuals were found. (Photo: Neil McDaniel)

What is the current status?

The current status of sea stars varies widely by species and location. Although there are anecdotal reports of recovery, the frequency of sea star sightings continues to decline for many species (Figure 1A), and signs of wasting persist. At the same time, sea star distribution is increasingly patchy and abundance is quite variable (Figure 1B).

The sunflower star (*Pycnopodia helianthoides*) was the most severely depleted subtidal species overall, with declines of 90 percent or more in some areas.[3] Numbers remain extremely low compared to pre-mortality levels (Figure 1, bottom panel), and sightings are rare.

The purple star (*Pisaster ochraceus*) was also among the most severely affected, with populations disappearing from some sites, such as on Thetis Island (Andy Lamb, personal communication). However, the status of this species is highly variable from one location to the next. There are reports of this species returning to some areas, but not others.

Mottled stars (*Evasterias troschelii*) are similar to purple stars in that they were heavily impacted by sea star wasting overall but the severity and current status vary widely by location.

Predatory sun stars (*Solaster* spp.) were severely affected and remain a rare sighting throughout B.C. The striped sun star, *Solaster stimpsonii*, was more heavily impacted within B.C. than on other areas of the Pacific coast.

The leather star (*Dermasterias imbricata*) was not as severely affected as other species in the Strait of Georgia, and appeared to increase in some areas following the disease outbreak (Figure 1, bottom panel). However, leather stars were more severely affected near Port Hardy than in other areas.

(Photos: Lee Newman and Bernie Handby)

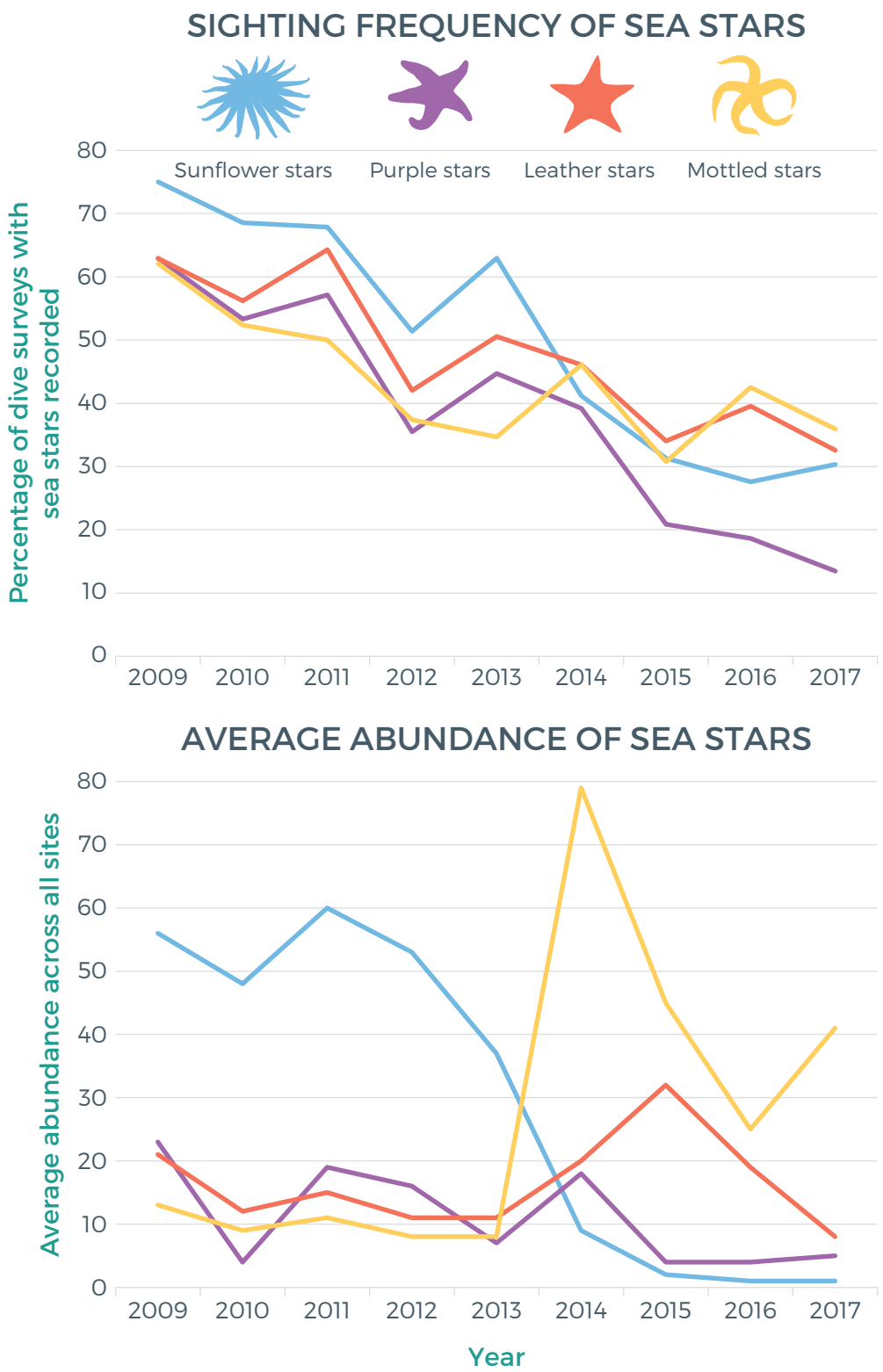


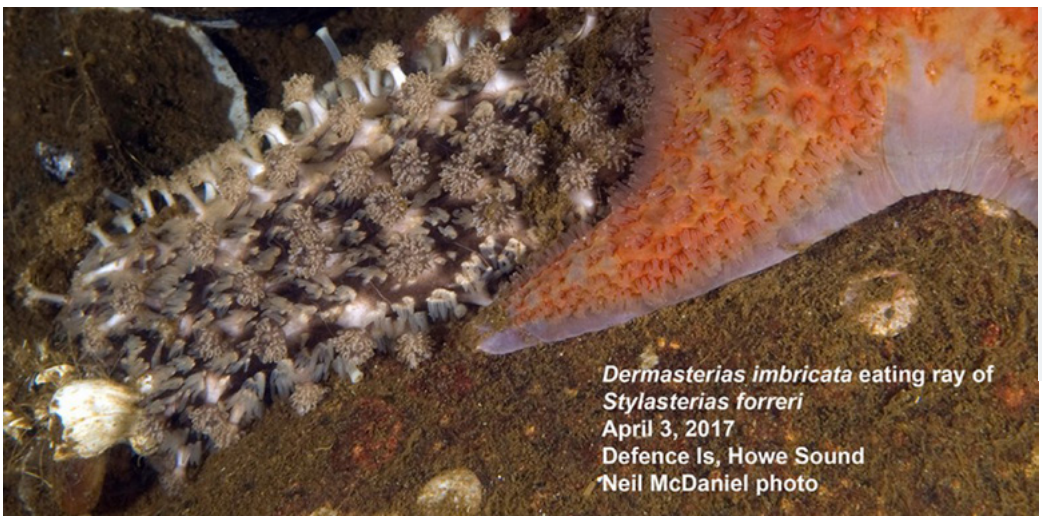
Figure 1. Between 2009 and 2017, the sighting frequency (i.e., the proportion of dive surveys where sea stars were recorded) of four common sea star species in the Strait of Georgia declined (top panel), but the average abundance for all sites surveyed in the Strait of Georgia (as estimated visually using roving dive surveys) was variable (bottom panel). Represented species include: sunflower stars (*Pycnopodia helianthoides*), purple stars (*Pisaster ochraceus*), leather stars (*Dermasterias imbricata*) and mottled stars (*Evasterias troschelii*). Data source: Pacific Marine Life Surveys Database of opportunistic SCUBA-based observations, accessed 15 Aug 2017.

Interestingly, there was an unusual boom in the abundance of juvenile sea stars of several species in 2014 and 2015. Juvenile sunflower stars, in particular, were extremely abundant at several locations in the Strait of Georgia, Puget Sound and elsewhere. Similarly, juvenile mottled stars (*Evasterias troschelii*) formed ultra-dense aggregations at some sites for a short period of time (see photo at end of article). Unfortunately the abundance was short-lived; the juveniles disappeared over a period of weeks to months, and no evidence of their abundance has so far been reflected in adult populations.

What is being done?

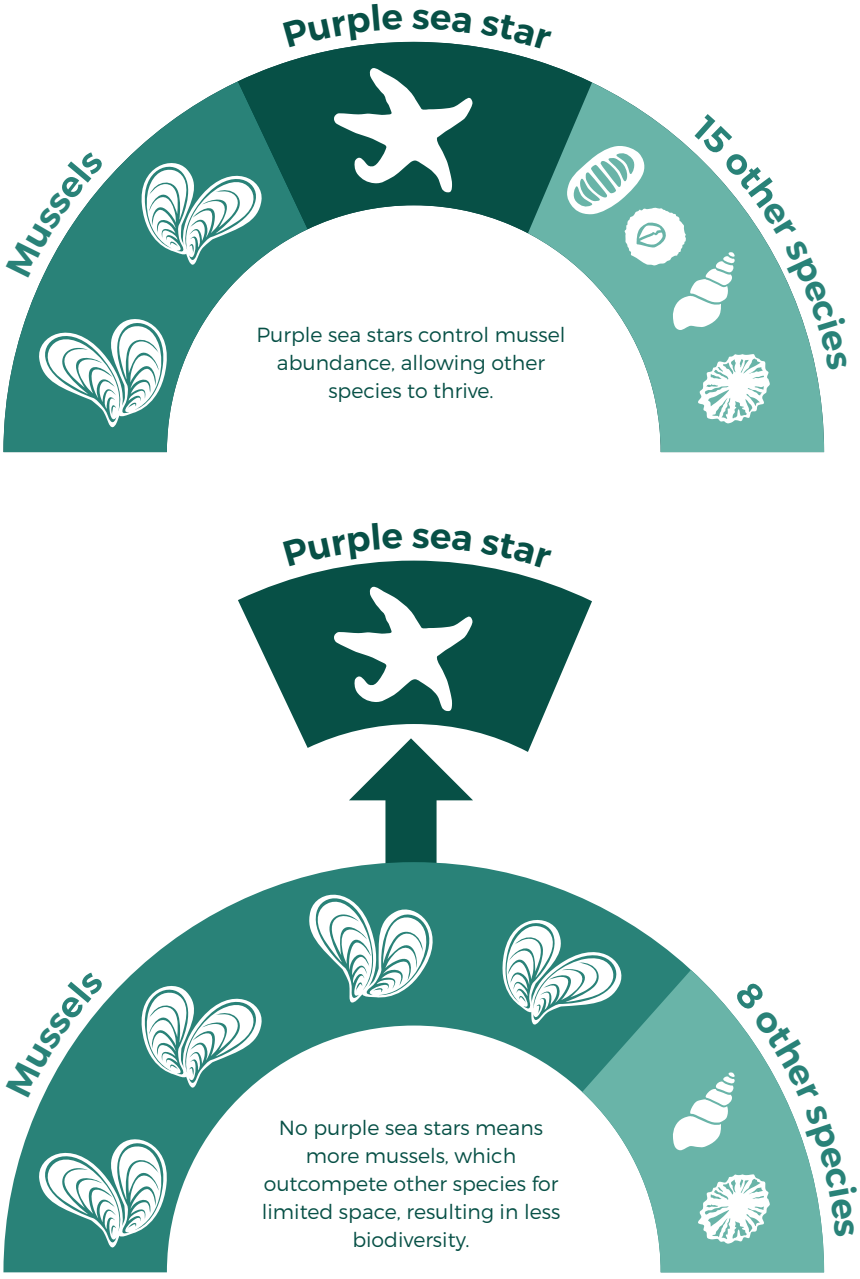
Research into the pathology (characterization), etiology (causes and origins), epidemiology (distribution and contributing factors), and ecology of the disease are ongoing at several institutions across North America. In British Columbia, monitoring efforts are ongoing at the Hakai Institute, Simon Fraser University, the University of B.C., the Coastal Ocean Research Institute, and elsewhere. A Sea Star Wasting Disease Task Force, coordinated by researchers at Oregon State University and the University of California, recently formed to develop a coordinated research strategy, consider mitigation and recovery approaches, and develop new legislation to improve disease response and management. Ongoing concern about the status of sunflower stars has led to initiatives to have sunflower stars assessed for listing under Canada's Species at Risk Act.

Sea star wasting continues to serve as a stark indicator of how much there is to learn about the complexity of ocean systems. Further research into the disease will help forward our understanding about wildlife mortality events, and how human actions and management might prevent or mitigate similar outbreaks in the future.



The leather star, *Dermasterias imbricata* (right), is a generalist opportunistic feeder, but it was unusual to see one eating the remains of a velcro star, *Stylasterias forreri* (left), that appeared to have died due to sea star wasting disease. (Photo: Neil McDaniel)

Purple sea star is a keystone predator



Hordes of mottled stars (*Evasterias troschelii*) sit with purple stars (*Pisaster ochraceus*) in Cates Bay, Bowen Island on July 17 2014. (Photo: Donna Gibbs)

Footnotes

[1] Stokstad, E. 2014. Death of the stars. Science 344, 464–7.

[2] Hewson, I. et al. 2014. Densovirus associated with sea-star wasting disease and mass mortality. Proc. Natl. Acad. Sci. U. S. A. 111, 17278–83.

[3] Schultz, J.A., Cloutier, R.N. & I.M. Côté. 2016. Evidence for a trophic cascade on rocky reefs following sea star mass mortality in British Columbia. PeerJ e1980. doi:10.7717/peerj.1980

[4] Eisenlord, M.E. et al. 2016. Ochre star mortality during the 2014 wasting disease epizootic: role of population size structure and temperature. Philos. Trans. R. Soc. Lond. B. Biol. Sci. 371, 20150212.

[5] Fuess, L.E. et al. 2015. Up in Arms: Immune and Nervous System Response to Sea Star Wasting Disease. PLoS One 10, e0133053.

[6] Kohl, W.T., McClure, T.I. & B.G. Miner. 2016. Decreased Temperature Facilitates Short-Term Sea Star Wasting Disease Survival in the Keystone Intertidal Sea Star *Pisaster ochraceus*. PLoS One 11, e0153670.

[7] Menge, B. A. et al. 2016. Sea Star Wasting Disease in the Keystone Predator *Pisaster ochraceus* in Oregon: Insights into Differential Population Impacts, Recovery, Predation Rate, and Temperature Effects from Long-Term Research. PLoS One 11, e0153994.

[8] Hildering, J. 2017. Wasted: What is happing to the sea stars of the NE Pacific Ocean? The Marine Detective. Accessed: 26th October 2017 Available at: https://themarinedetective.com/category/marine-invertebrates/sea-stars/