

Synthesize and analyze sea-star wasting-disease field data

GOALS

The proposed summer research has three primary goals:

- Analyze data from the current mass mortality of sea stars due to sea-star wasting-disease
- Complete and submit manuscripts so the information is quickly available to other scientists and the public
- Sample subtidal sites in the Salish Sea for recovery of sea star populations

BACKGROUND INFORMATION

Sea-star wasting-disease is a general description of symptoms that are found in many species of sea stars. Lesions appear in the ectoderm, which are easily seen by closely inspecting an individual. Typically, these lesions rapidly expand, and eventually cause the body to fragment and the individuals to die. In some cases, individuals appear deflated before the above morphological signs of the disease are visible. Wasting disease can progress rapidly, leading to death after just a few days of initially observing lesions.

Very little is known about this disease. Past events were barely studied, and we have little information about nearly all aspects of disease. The proximal cause of the disease is unclear. Past pathological studies showed that a bacterium (*Vibrio* sp.) is typically associated with sick individuals and absent in healthy individuals (Staehli 2008). However, there is also evidence that the disease is caused by a virus or protist (Bates et al. 2009). Outbreaks of the disease are often associated with warmer than typical water temperatures—the outbreaks in California occurred during strong El Niño events (Eckert et al. 1999).

Recent outbreak of wasting disease along the west coast of North America (2013-2014)

The most recent outbreak of sea star wasting disease has resulted in the largest disease-related mortality events ever recorded in the oceans. Within the last year, mass mortality of many species of sea star has occurred from southern California to southern Alaska, but evidence of the disease is reported from the Baja peninsula in Mexico to Anchorage Alaska. Nearly twenty species are likely susceptible to the disease, while other related groups of echinoderms, like sea urchins and brittle stars, appear unaffected. Estimates of the numbers of individuals that have perished are in the millions.

The Salish Sea is the epicenter of the disease. In the summer of 2013, Dr. Steven Fradkin observed sick individuals of the ochre star, *Pisaster ochraceus*, at a site in the Olympic National Park (interestingly though populations of sea stars on the outer coast of WA are still healthy). Shortly thereafter, Dr. Jonathan Martin, a research associate at Simon Fraser University, reported a huge mortality event of the sunflower star, *Pycnopodia helianthoides*, in the waters off of British Columbia. He observed that individuals seemed to “waste away, deflate a little, and then just...disintegrate” (<http://echinoblog.blogspot.com/2013/09/mysterious-mass-starfish-die-off-in.html>). During the fall of 2013, mass mortality of sea stars was reported at locations around Seattle, WA and Vancouver, BC, and stars died in the Seattle and Vancouver aquariums.

The pattern of mortality from the disease is unusual and makes this disease event especially interesting. Mass mortality of stars occurred during the fall of 2013 in Vancouver, BC, Puget Sound, WA, and

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Monterey Bay, CA, though evidence of the disease was observed in a larger geographic area. Throughout the winter of this year the disease was present at several sites north of the Seattle, WA and near Vancouver, BC, and, populations in Southern California collapsed. In the spring, the disease wiped out stars in Oregon, and the remaining inland waters of WA (e.g., Hood Canal, San Juan Islands, Skagit and Whatcom counties, WA), and just last week sea stars in Sitka AK starting dying in large numbers.

INTENDED IMPACTS AND OUTCOMES OF PROPOSED RESEARCH

Unlike past outbreaks of sea star wasting disease (Dungan et al 1982, Eckert et al. 1999), this event is well documented, thanks to the coordinated effort of researchers and citizen scientists. There is a large and growing amount of data about changes in sea stars populations along the coast of North America due to the disease, and this is especially true for this region because the large effort from citizen scientists in WA. In collaboration with Dr. Raimondi's group at UC Santa Cruz, we have standardized protocols for sampling, and his group is entering and archiving data. We now need to analyze these data and publish the results. In particular, there are several very interesting observations that we would like to explore. Although nearly all the adults die during a mass mortality event, it appears that juveniles are less susceptible. In addition, at some sites the number of juveniles greatly increased when the adults die.

In addition to analyzing data and preparing manuscripts, I would like to monitor my regional subtidal sites in the Salish Sea to assess whether populations are recovering. I have some money remaining in a NSF grant that I can use to pay for the costs of sampling these sites.

The summer research grant would allow me to complete the following. The first two would be in collaboration with Dr. Raimondi's lab.

- Organize and analyze data from sites surveyed for sea star wasting disease.
- Write manuscripts based on the results of these analyses.
- Sample local subtidal sites for evidence of recovery.

Sea star wasting disease has caused the largest disease-related mortality event ever recorded in the ocean, and there is regional, national, and international interest in the current event. Much of the past coverage has highlighted WWU's role in studying the disease, and I would like this to continue. In addition, I expected the proposed research to greatly contribute to the dearth of information about sea star wasting disease and more generally marine diseases. Sea-star wasting-disease is a hot topic among scientists and the public, and the proposed research will benefit both groups.

LITERATURE CITED

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