



pacificrockyintertidal.org

Sea Star Wasting Syndrome: detecting, tracking, and following the progression



Photo: Mélissa Miner





General Goals of MARINE Program

- To track natural changes within and between communities over a large spatial scale
- To assess impacts (e.g. oil spills, El Niño events, public access, disease, etc.)
- To develop a **long-term**, spatially extensive, **feasible** and funded program providing baseline data in areas typically having none

Two Part Approach

- Long-term “core” methods
 - Fixed plots that target “key” species
 - sampled annually or semi-annually = good temporal resolution
- Coastal Biodiversity Surveys (SWAT)
 - Large grid-style survey = good spatial resolution
 - Sampled infrequently (3-5 yr. cycle)

MARINe Sites

- Nearly 150 sites ranging from AK to Mexico

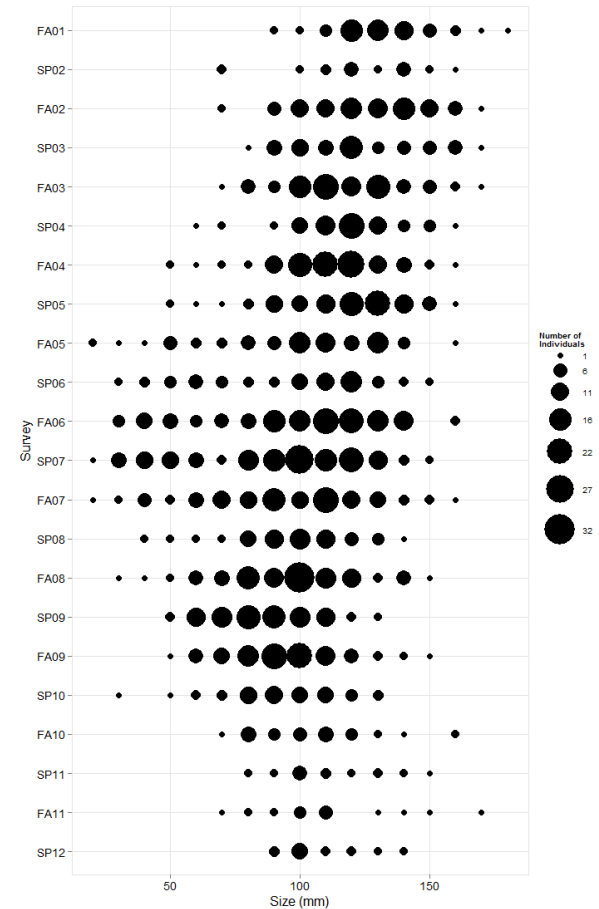
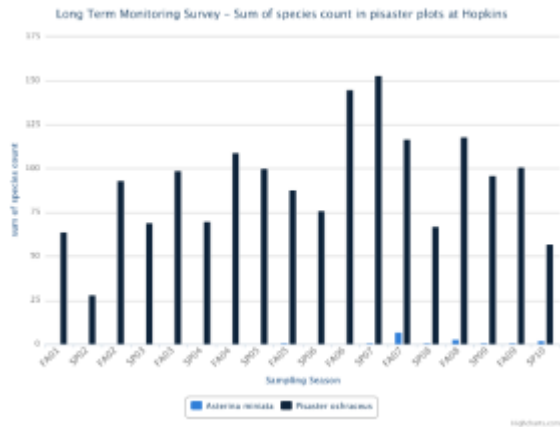
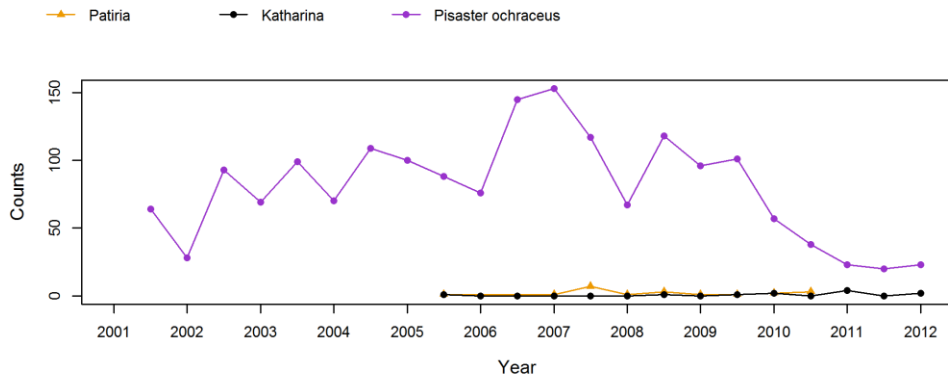




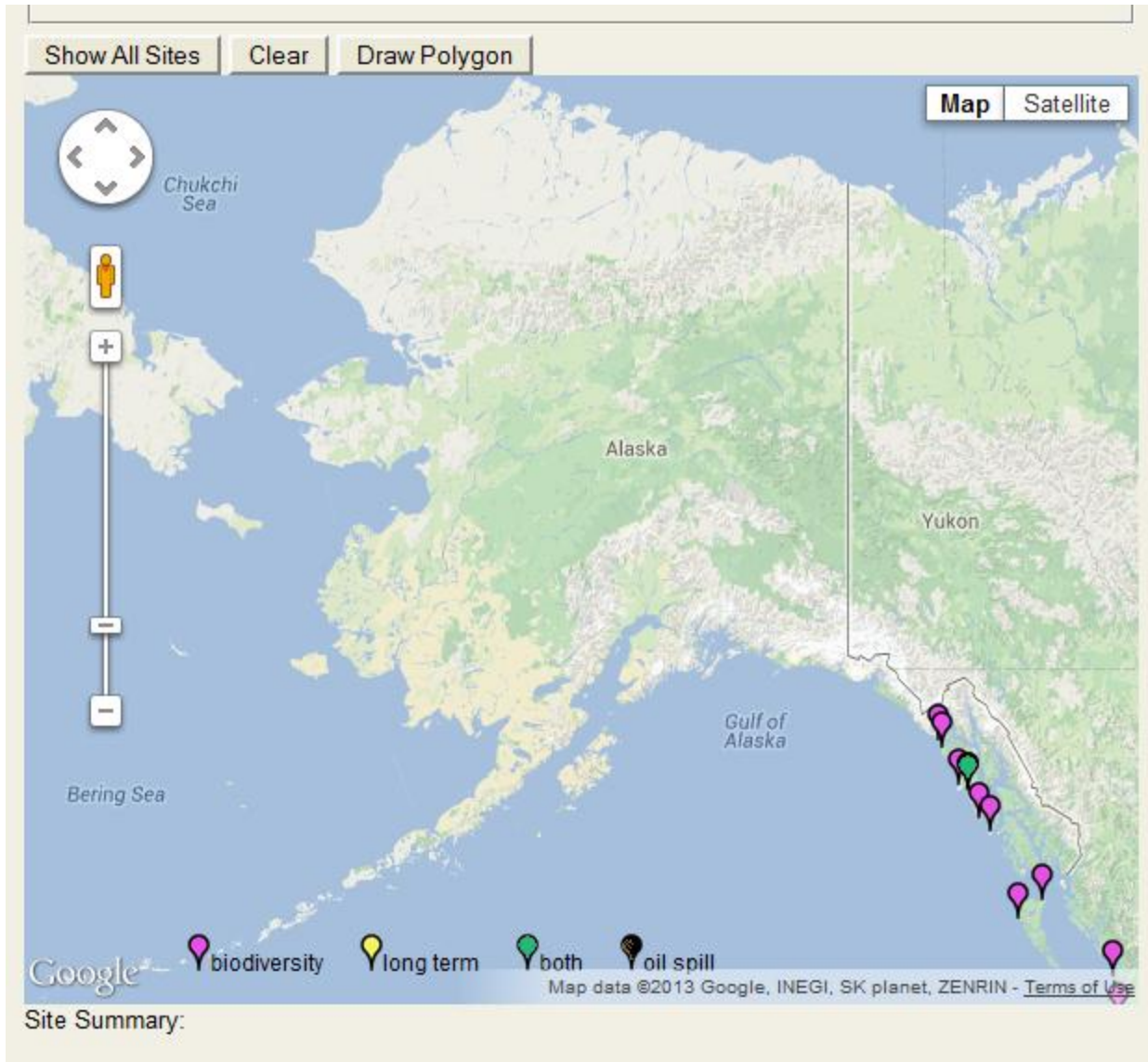


pacificrockyintertidal.org

➤ both static site graphs and user-generated graphs



Alaska MARINe Sites



Sea Star Wasting Syndrome: What is it?

- General description for a set of symptoms that are found in several species of sea stars
- Typically, lesions appear in the ectoderm followed by decay of tissue surrounding the lesions, leading to eventual fragmentation of the body and death
- Ultimate cause is not yet clear—working with microbiologists to isolate potential pathogen
- Historically associated with warmer than typical water temperatures (e.g. southern California 1983-1984 and 1997-98)



Species Affected

Pisaster ochraceus



Photo: Steve Fradkin

Patiria miniata



Photo: SIMoN

Leptasterias spp.



Photo: Steve Fradkin

Evasterias troschelii



Photo: Neil McDaniel

Dermasterias imbricata



Photo: Nate Fletcher

Species Affected

Pycnopodia helianthoides



Photo: Jeff Adams

Solaster dawsoni

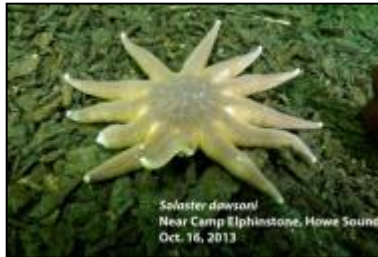


Photo: Neil McDaniel

Pisaster giganteus



Photo: Leanne Foster

Orthasterias koehleri



Photo: Feiro Marin Life Center

Pisaster brevispinus



Photo: Neil McDaniel

Sea Star Wasting Syndrome: How this event differs from previous

- Geographic extent of impact MUCH broader (most observations of past events confined to Southern CA)
- Not associated with major warm water event (e.g. El Nino), although at least some affected regions appear to have experienced temperature spikes in summer 2013
- Continuing well beyond November (when observations for ALL previous events stopped)



Surveys: Preliminary Results

- Wasting present at 40 of 74 long-term monitoring sites surveyed since Summer 2013
- Extent of impact appears to vary by region and can be patchy. Hardest hit areas include:
 - Monterey Bay
 - Seattle/Edmonds
 - Vancouver, BC (Howe Sound but not Sechelt Inlet)
- Clear progression of species mortality (*Pycnopodia*, *Orthasterias*, *P. brevispinus*, *P. giganteus*, *P. ochraceus*, *Evasterias*, *Patiria*)
- Infection may be more prevalent in larger individuals

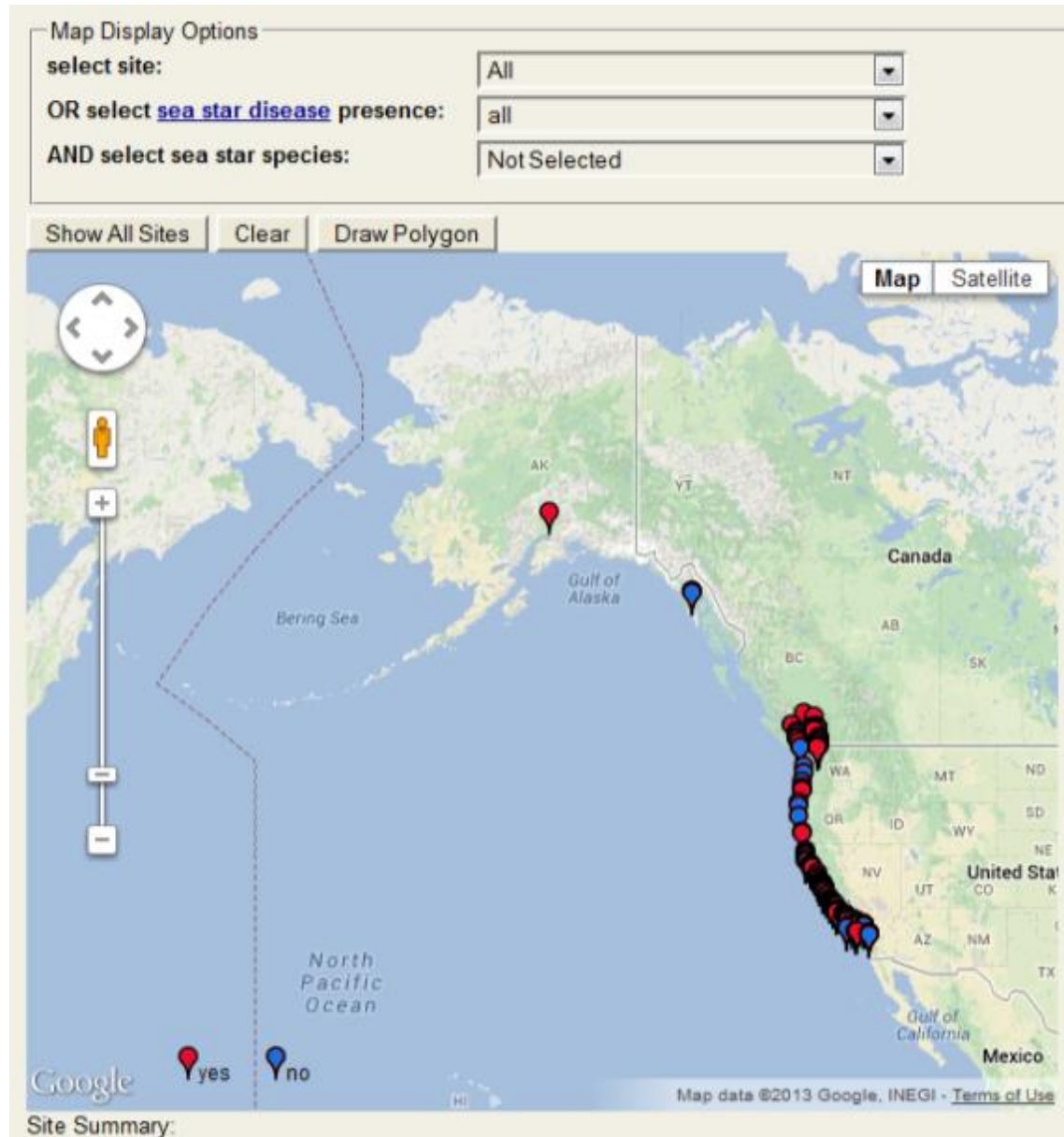
Pathogen Studies

- Analyses are still in early stages, so no potential culprits yet
 - Tissue samples are being sent to researchers at Cornell (Harvell & Hewson) for pathogen analysis
 - Other groups doing pathogen analyses include: Univ. of Rhode Island (Gomez), Brown (Wessel), Seattle Aquarium

Distribution of Wasting Syndrome

www.seastarwasting.org

- Wasting documented at long-term monitoring sites from Southeast AK to San Diego, CA (primarily *Pisaster ochraceus*)
- Other groups have documented wasting in many additional species at subtidal sites



Tracking Map

www.seastarwasting.org

The image shows a web-based tracking map interface. At the top, there are three buttons: "Show All Sites", "Clear", and "Draw Polygon". On the right side, there are two tabs: "Map" (selected) and "Satellite". The map displays the state of Alaska, with labels for "Chukchi Sea", "Alaska", "Yukon", "Gulf of Alaska", and "Bering Sea". A red pin is located in the central part of Alaska, and a blue pin is located in the southeastern part. On the left side, there is a navigation control with a compass icon, a person icon, a zoom-in (+) button, and a zoom-out (-) button. At the bottom left, there is a "Google" logo and two pins labeled "yes" (red) and "no" (blue). At the bottom right, there is a copyright notice: "Map data ©2013 Google, INEGI, SK planet, ZENRIN - Terms of Use". Below the map, the text "Site Summary:" is visible.

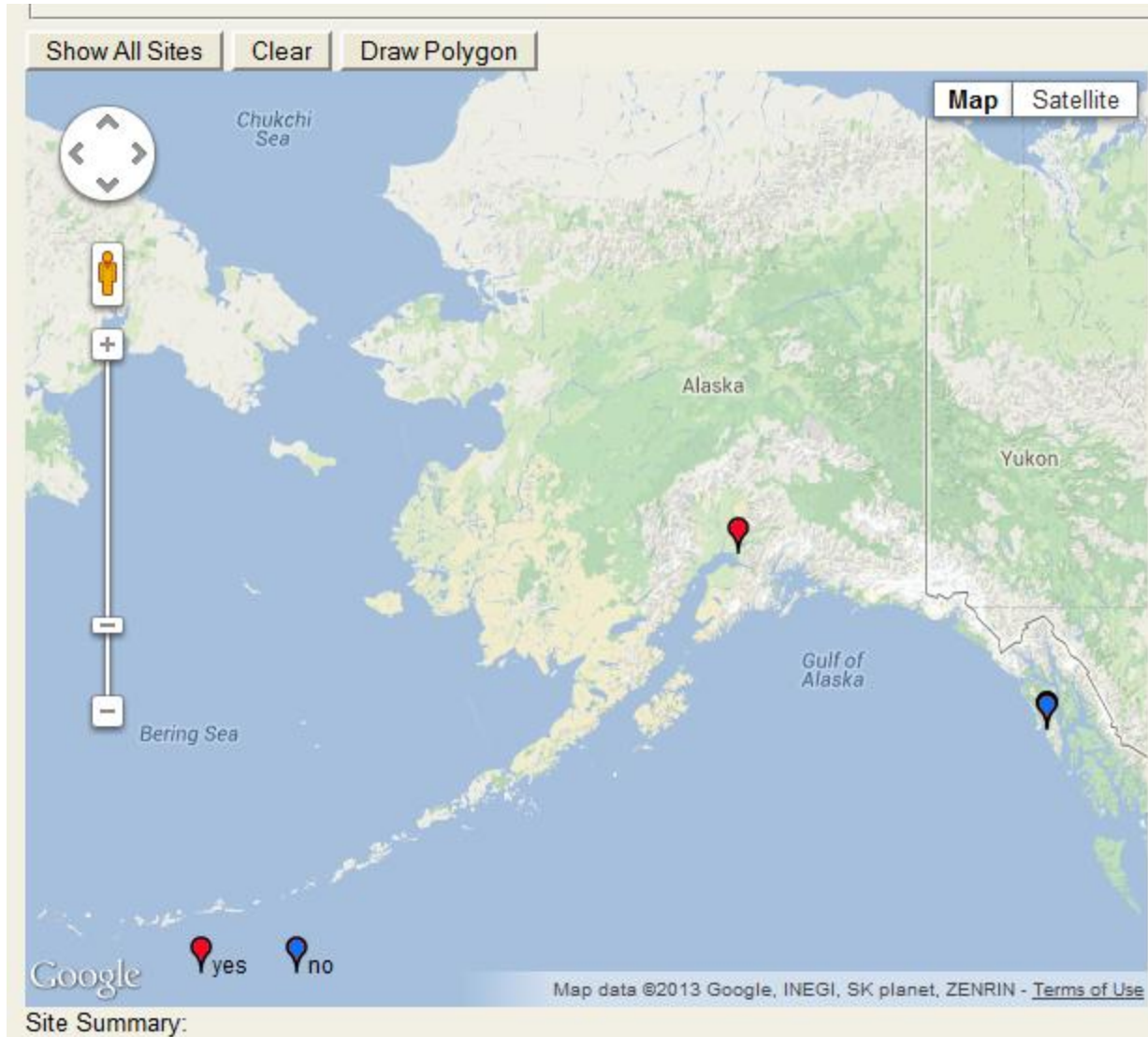
Citizen Science

- Involving Citizen Science groups will greatly expand our spatial coverage (particularly important outside of CA, where we have fewer long-term sites)
- Important even if no symptoms are present. Historic evidence suggest that wasting events are cyclical (perhaps in relation to temperature).
 - Data prior to impact is important for assessing effect on sea star populations

Citizen Science: Two Levels

- Tracking Logs (opportunistic)
- Permanent sites, monitored consistently and for long-term

Send us your data!



More information:



pacificrockyintertidal.org

Other Sea Star Wasting Resources:

- Vancouver Aquarium
 - vanaqua.org/act/research/sea-stars
- EchinoBlog
 - echinoblog.blogspot.com/2013/09/starfish-wasting-disease.html
- iNaturalist
 - inaturalist.org/projects/pisaster-disaster-tracking-starfish-wasting-disease
- <http://www.sickstarfish.com/>

Disease Severity Categories

- 0-4 based on Bates et al. 2009
- First adapted by Olympic National Park for intertidal sea star surveys in June 2013
- Incorporated into entire MARINe network for Fall 2013 surveys

Category 0

Healthy!



Photo: Melissa Miner

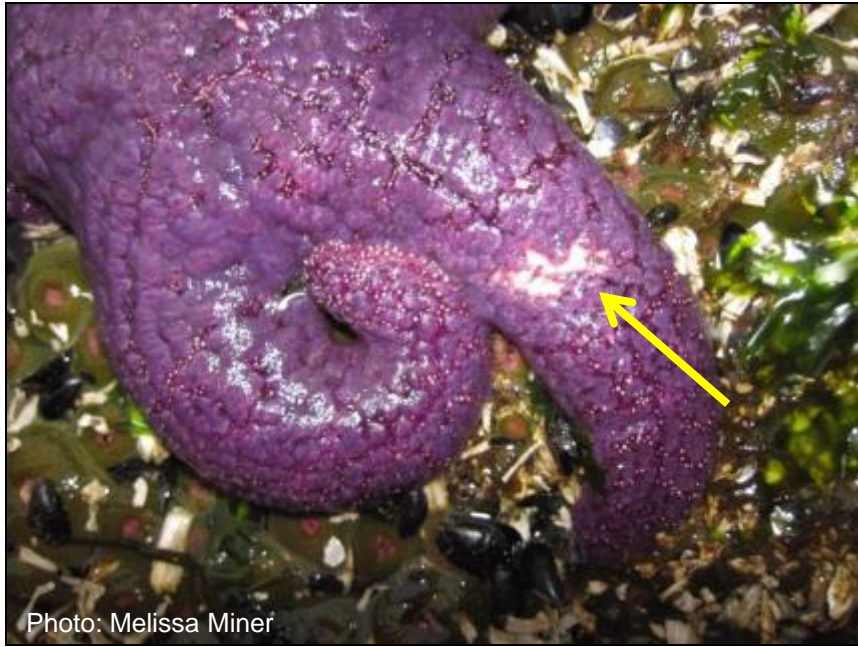
Category 1

lesion(s) on 1 arm or body

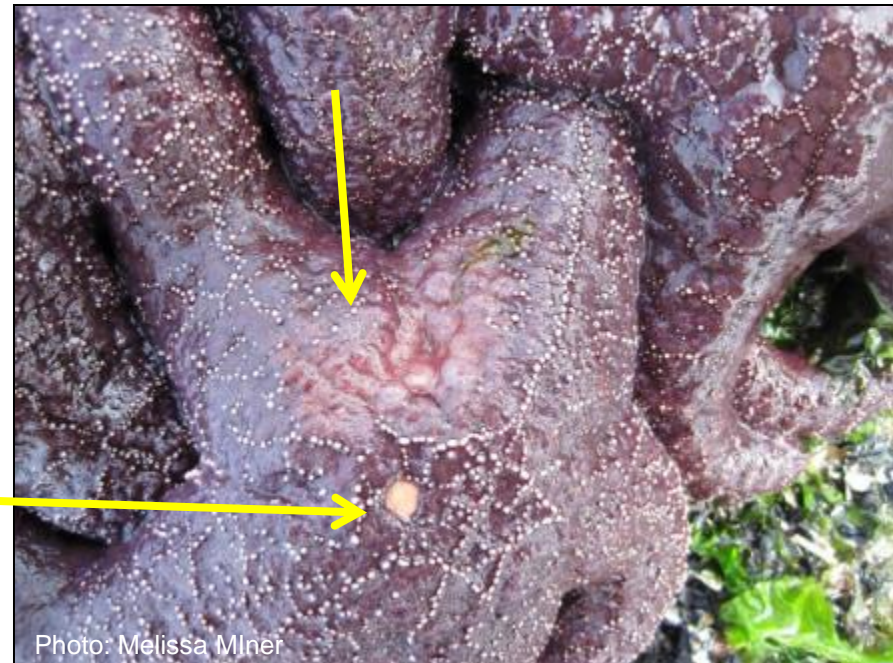
Tissue degradation in some of these photos may be the result of multiple lesions merging, but it is restricted to a single arm, or single location on the oral disk.



Category 1

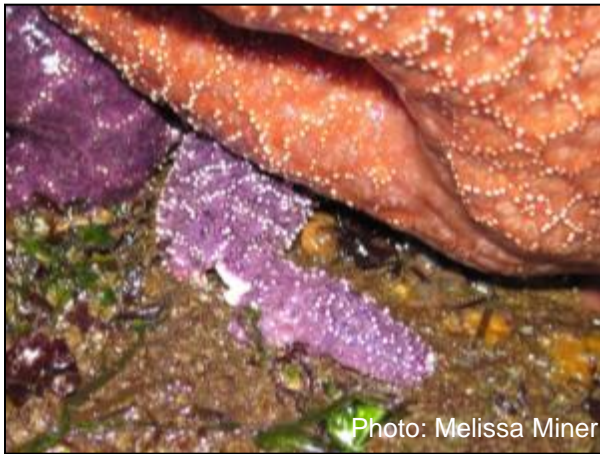


NOT a lesion
(madreporite)

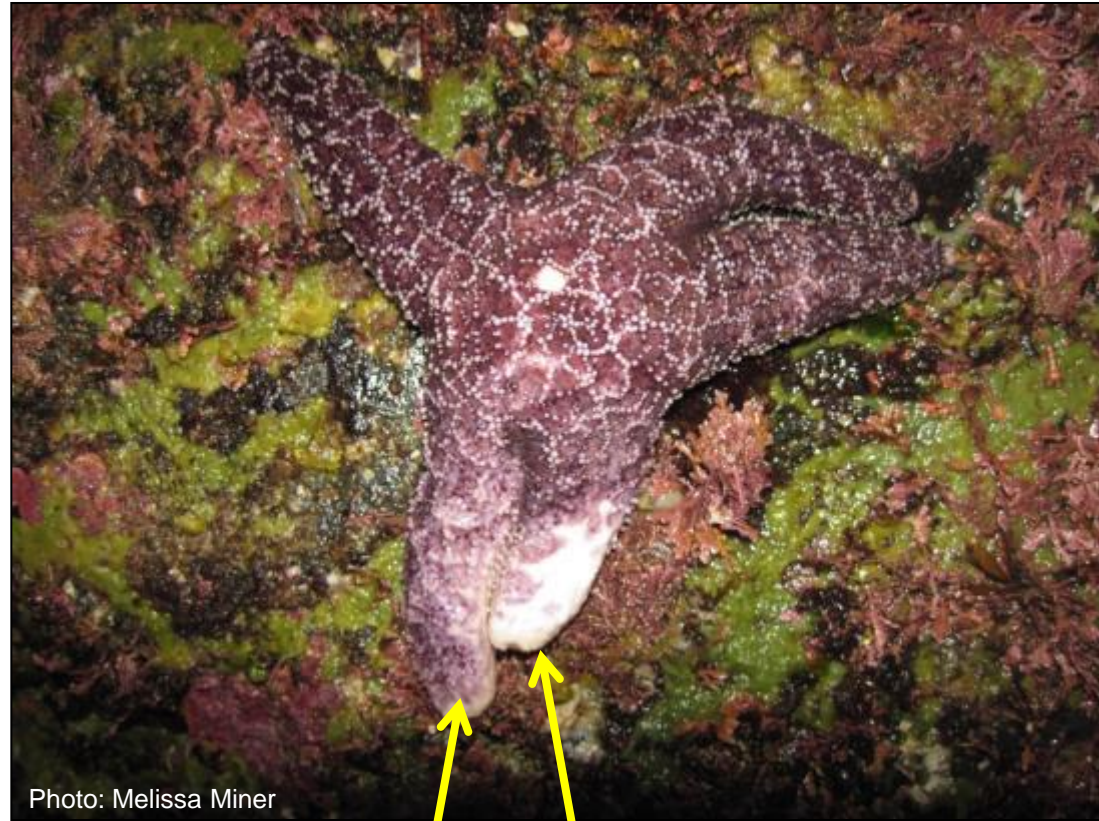


Category 2

lesions on 2 arms or 1 arm and body,
deteriorating arm(s)



Arm starting to separate



Tissue deteriorating on 2 arms

Category 3

lesions on most of body,
1-2 missing arms

Missing tips of 2
arms, lesion on 3rd



Photo: Steve Fradkin

Missing 1
arm

tissue
deterioration on
2nd arm

Missing 1 arm



Photo: Laura Anderson



Photo: Nathaniel Fletcher

Category 4

severe tissue
deterioration/death,
≥3 missing arms

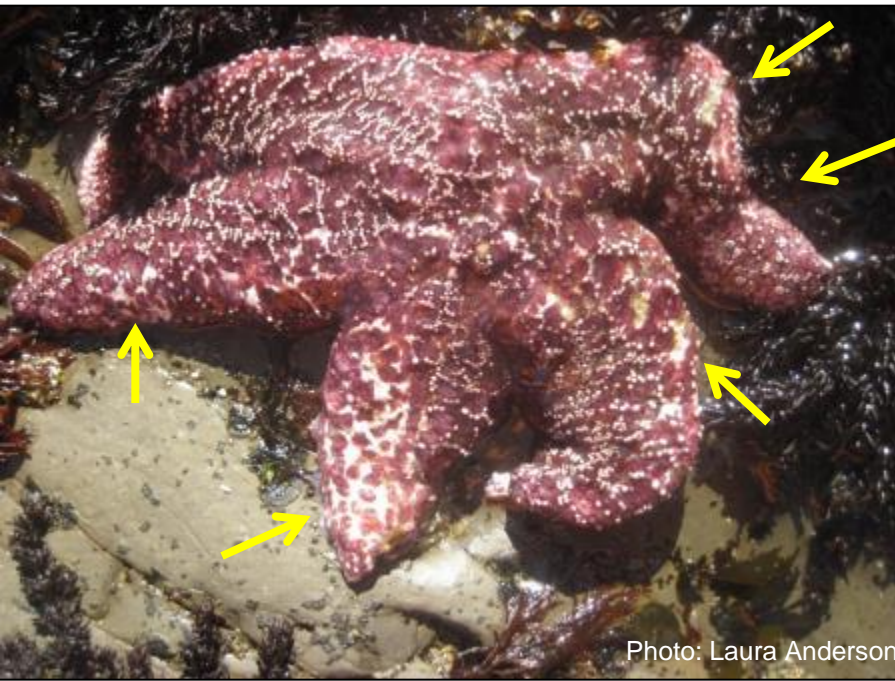
Missing most arms

Missing tips
of all arms



Missing most arms

Category 4



Recovery

- Arm regrowth, healing of lesions, population increase*





pacificrockyintertidal.org

Primary Funding for MARINE comes from:



The Bureau of Ocean Energy Management



The National Park Service



Partnership for Interdisciplinary
Studies of Coastal Oceans



California Sea Grant