Sea Star Wasting Syndrome Protocols for Subtidal Surveys

December 19, 2013

Value of Citizen Science Monitoring in the subtidal

Involving citizen scientists to survey the nearshore subtidal for evidence of sea star wasting syndrome will greatly improve our understanding of the spatial extent of the syndrome and track changes through time. Citizen science groups can collect subtidal sea star syndrome data using the standardized sampling methods described below, which have been modified from the approach used by the Multi-Agency Rocky Intertidal Network (MARINe) in the intertidal for counting and measuring sea stars and assessing condition in terms of wasting syndrome. In order to ensure repeatability of sampling effort within a group and standardize methods among groups, it is critical to collect data using the protocol described below. When possible, a researcher familiar with the protocol should accompany each citizen science group in the field to assist with site selection, data collection methods, and if appropriate, set-up of permanent transects/sampling areas. In addition, researchers can train citizen scientists in sea star species identification, proper measurement techniques and syndrome category designation.

Once the data have been collected, send scanned copies of data sheets to Rani Gaddam (gaddam@ucsc.edu, if in California) or Melissa Miner (cmminer@ucsc.edu, if in OR or WA) to be entered into the MARINe database. Data will be incorporated into the Sea Star Wasting Syndrome Map (http://data.piscoweb.org/marine1/seastardisease.html) to enable groups to track the occurrence of wasting syndrome on a local and coast-wide scale. We expect in mid-January to have an online data entry system, so please check the web site for updates (http://www.eeb.ucsc.edu/pacificrockyintertidal/data-products/sea-star-wasting/index.html).

Survey Methods

Because the cause of sea star wasting syndrome is still unknown, reasonable precautions against potential spread via sampling gear should be taken. Rinse diving and sampling gear with freshwater between surveys at different sites. At all long-term survey sites, sea stars should be counted within clearly defined areas using one of the survey options described below. For all sea stars encountered, the following information should be recorded:

1) species (or "unknown" if ID not possible)
2) size category (optional)
3) health category

If unhealthy individuals are encountered, representative photos should be taken (if possible) to document the various stages of syndrome symptoms.

<u>Required Gear (for both survey options)</u>
Dive slate (something to write on)
Pencil
Compass
Measuring device (in cm)
Dive light

<u>Optional Gear (but VERY useful)</u>
Meter tape or marked line
Data Sheet printed on UW paper
GPS handheld (for site coordinates)
UW Camera


Dive slate


Dive light


Meter tape

Survey Option 1a and 1b: Fixed Permanent Transects and Fixed Sampling Areas

Ideally, the exact same areas should be sampled over time, in order to compare how numbers and the condition of sea stars change within a specific, fixed area. Some options for how to establish permanent surveys of a fixed area include:

1a) **Counts Along Fixed Permanent Transects**—A meter tape or marked line can be attached to a fixed structure (e.g., pier piling in a harbor or a particular rock at your favorite dive site) and then stretched out to a set length (e.g., most transect tapes are 30 m) along a fixed compass bearing that traverses sea star habitat. Divers can swim along the transect line, counting and assessing disease categories for all sea stars encountered within 1 m of either side of transect (for a 2 m x 30 m wide swath). The distance from the middle of your chest to the end of one outstretched arm is often a good proxy for 1 m (measure to check this!), or a 1 m bar (piece of pcv pipe) can be used as a guide. One diver can accomplish the same task by first swimming along 1 side of the transect, then returning along the other side. Ideally, at least 3 replicate transects would be established in the area, but ensuring they do not overlap one another. An even better way to sample is to set the transect line first, anchoring both the 0 m end and the 30 m end at fixed points (ones that you can easily return to in the future) and once it is in place, then sample along the transect. The idea is to sample this same piece of benthic habitat several times in the future, each time covering the same amount of area to determine how sea star numbers and condition change over time.

1b) **Counts Within Fixed Sampling Areas**—Sampling the same exact (i.e. fixed) area repeatedly can also be accomplished by counting all sea stars on permanent underwater features, such as distinct rock outcroppings surrounded by sand, submerged docks, or harbor jetties (or well defined sub-sections of jetties). The key to this method is defining an area that can be counted completely during each survey. For example, it may not be possible to count all sea stars along the entire length of a jetty, but small, well defined/described subsections could be accurately and completely counted during repeated surveys.

Survey Option 2: Non-Permanent Transects Repeated Within Defined Sampling Areas

For sites where permanent underwater features cannot be used as transect start/end markers, or well-defined underwater features do not exist, sea stars can be counted along non-permanent (i.e. random) transects within a defined sampling area. The boundaries of the sampling are should be defined by GPS coordinates, which can be accomplished using a boat's GPS system, a handheld GPS, or Google Earth. Within these sampling boundaries, divers can swim random, non-overlapping transects at a consistent depth or along a depth profile for a set amount of time (e.g., swim 10 min along compass heading, then shift over 5 m and return along the opposite compass bearing). The goal is to try to cover approximately the same area during all subsequent surveys within the defined sampling area.

Collecting data

For both survey options 1 and 2, the entire sampled area should be searched carefully for all sea stars. While it is important to do a careful search, cobble and boulders should not be moved to ensure that sampling is non-destructive. Crevices should be searched with a dive light for cryptic or small sea stars. Sea star size class and disease category are recorded for all sea stars present (see size and disease class definitions below). **The "radius" of each sea star is measured with a metric ruler from the center of the disc to the tip of the longest ray (see photo below).** Often sizes must be estimated because sea stars are wedged in tight spots or the rays are curved. Sea stars should never be "straightened" or removed from the rock to make a measurement; please measure them in place.

Unusual observations should be recorded in the notes section at the bottom of the datasheet. These include "abnormal" sea star behavior such as "twisting" of multiple rays, and drooping or hanging off vertical surfaces. Signs of potential healing from wasting should also be recorded.

If diseased individuals are encountered, representative photos of all disease categories recorded should be taken if possible; these images will be used in our archives. The following photo naming approach should be used:

genus_species_diseasecategory_site_year_monthday_photographer

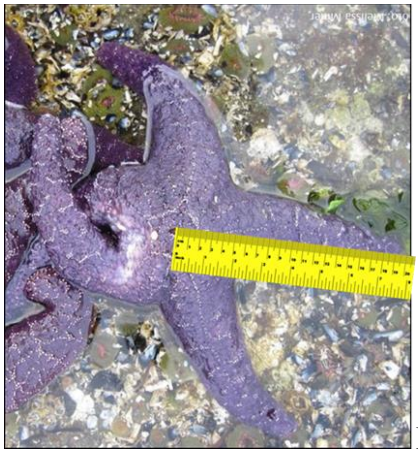
Genus can be abbreviated to the 1st letter so an example photo name would be:
p_brevispinus_mild_breakwater_2013_1113_dsteller

For sea star photos where disease category is unknown, use "catU":
p_miniata_catU_lobos_2013_1223_jnichols

Size Classes (optional but VERY useful!)

Sea stars of all species encountered should be recorded under the size classes listed below, determined by measuring the radius (center of the disc to the tip of the longest ray). Note that the data sheet has 5 cm bins on the side, so if you print on UW paper, you can use that as a ruler. It is always good to double check that this scale bar matches up with an actual ruler, as the size could change during printing/photocopying.

- <5 cm
- 6-10 cm
- 11-15 cm
- >15 cm



Method used for measuring sea star "radius"

Disease Classes

Two tiers can be used for assigning disease class:

Tier 1: Two sea star condition categories

- "Healthy" = no symptoms of disease
- "Diseased" = symptoms of disease present (lesions, arm loss, deflated, etc.)

Tier 2: Three sea star condition categories. The separation of disease severity will help us understand whether sea star wasting syndrome can persist at a low level within a community. Sea stars with mild signs may be able to recover.

- "Healthy" = no symptoms of disease
- "Mild" Symptoms = few lesions, deflated appearance, extreme twisting of rays
- "Severe" Wasting/Death = many lesions, arm loss, disintegration

Species Identification

It is import to identify sea stars to species. However, if separating species is not possible, focus on the species that you can confidently identify, and record other species as unidentified. Incorrectly identifying species will jeopardize analyses and conclusions.

Common name	Scientific name
Ochre star	*Pisaster ochraceus*
Giant-spined star	*Pisaster giganteus*
Short-spined (or Pink) star	*Pisaster brevispinus*
Northern Rainbow star	*Orthasterias koehleri*
Sunflower star	*Pycnopodia helianthoides*
Sun stars	*Solaster* spp.
Mottled/False ochre	*Evasterias troschelii*
Bat star	*Patiria miniata*
Leather star	*Dermasterias imbricata*
Velcro star	*Stylasterias forreri*

Others not apparently impacted (yet):

Blood star	*Henricia* spp.
Red star	*Mediaster aequalis*

Site:_____ Date:_____ Sampler Name:_____

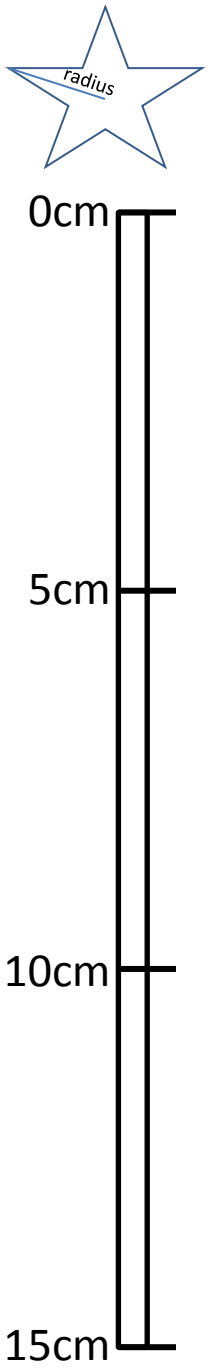
Healthy (no signs of disease)

Species	≤ 5cm	6-10cm	11-15cm	>15cm	not sized
Pynopodia (sunflower)					
Evasterias (mottled)					
Pisaster ochraceus (ochre)					
Pisaster brevispinus (giant pink)					
Pisaster giganteus (giant star)					
Dermasterias (leather)					
Patiria miniata (bat)					
Solaster spp. (sun)					
Orthasterias (rainbow)					
Unknown					

Diseased/Dead

Species	≤ 5cm	6-10cm	11-15cm	>15cm	not sized
Pynopodia (sunflower)					
Evasterias (mottled)					
Pisaster ochraceus (ochre)					
Pisaster brevispinus (giant pink)					
Pisaster giganteus (giant star)					
Dermasterias (leather)					
Patiria miniata (bat)					
Solaster spp. (sun)					
Orthasterias (rainbow)					
Unknown					

Notes:

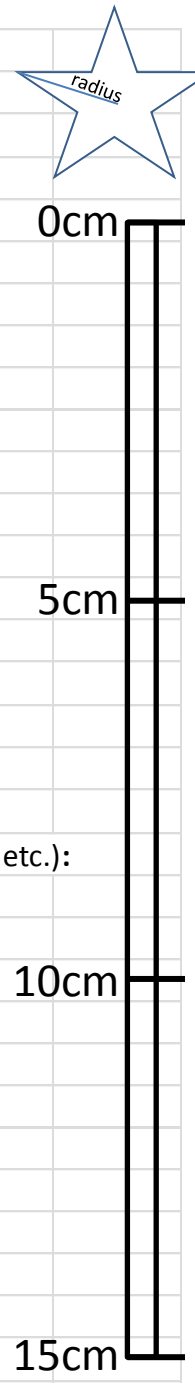


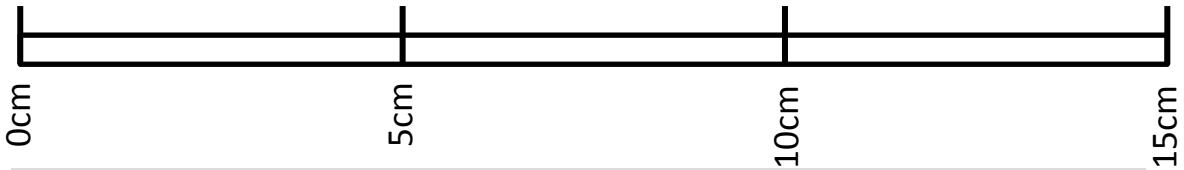
Site:_____ Date:_____ Sampler Name:_____

	Healthy (no signs of disease)				Mild Signs of Disease			
Species	≤ 5cm	6-10cm	11-15cm	>15cm	≤ 5cm	6-10cm	11-15cm	>15cm
Pynopodia (sunflower)								
Evasterias (mottled)								
Pisaster ochraceus (ochre)								
Pisaster brevispinus (giant pink)								
Pisaster giganteus (giant star)								
Dermasterias (leather)								
Patiria miniata (bat)								
Solaster spp. (sun)								
Orthasterias (rainbow)								
Unknown								

	Severe Signs of Disease/Death			
Species	≤ 5cm	6-10cm	11-15cm	>15cm
Pynopodia (sunflower)				
Evasterias (mottled)				
Pisaster ochraceus (ochre)				
Pisaster brevispinus (giant pink)				
Pisaster giganteus (giant star)				
Dermasterias (leather)				
Patiria miniata (bat)				
Solaster spp. (sun)				
Orthasterias (rainbow)				
Unknown				

Notes (e.g. arm regrowth, "abnormal" twisting, etc.):





	Healthy (no signs of disease)			
Species	≤ 5cm	6-10cm	11-15cm	>15cm
Pynopodia (sunflower)				
Evasterias (mottled)				
P. ochraceus (ochre)				
P. brevispinus (giant pink)				
P. giganteus (giant star)				
Dermasterias (leather)				
Patiria miniata (bat)				
Solaster spp. (sun)				
Orthasterias (rainbow)				
Unknown				

Site:_____

Date:_____

Sampler:_____

Notes (e.g. arm regrowth, abnormal twisting, etc.):

	Mild Signs of Disease			
Species	≤ 5cm	6-10cm	11-15cm	>15cm
Pynopodia (sunflower)				
Evasterias (mottled)				
P. ochraceus (ochre)				
P. brevispinus (giant pink)				
P. giganteus (giant star)				
Dermasterias (leather)				
Patiria miniata (bat)				
Solaster spp. (sun)				
Orthasterias (rainbow)				
Unknown				

	Severe Signs of Disease/Death			
Species	≤ 5cm	6-10cm	11-15cm	>15cm
Pynopodia (sunflower)				
Evasterias (mottled)				
P. ochraceus (ochre)				
P. brevispinus (giant pink)				
P. giganteus (giant star)				
Dermasterias (leather)				
Patiria miniata (bat)				
Solaster spp. (sun)				
Orthasterias (rainbow)				
Unknown				