Welcome

Thank you for your work to help protect Washington’s shorelines! As a volunteer monitor, you will conduct two types of survey to monitor pocket estuaries in Puget Sound, the Strait of Juan de Fuca and the San Juan Islands for invasion by European green crab (*Carcinus maenas*): trapping and shoreline surveys. The Crab Team staff at Washington Sea Grant (WSG) has identified sites that are thought to be at highest risk of invasion based on habitat suitability. To increase the chances that we will detect green crab at the earliest possible stages of invasion into inland Washington waters, monitors will:

- work with a team of 3-5 monitors at an assigned site,
- conduct monthly surveys from April through September of each year,
- submit data to Crab Team *within a week* of completing surveys, and
- notify Crab Team immediately upon finding evidence of green crab presence.

We will increase monitoring at sites where green crab have been positively identified to determine whether crabs are successfully establishing at that site, and how they are affecting other organisms in the community.

**How were sites selected?**

Crab Team staff have created, and maintain, a map of shoreline sites in Washington’s Salish Sea categorized by habitat suitability ([www.tinyurl.com/wagreencrab](http://www.tinyurl.com/wagreencrab)). On the West Coast, European green crab have been observed to prefer habitats with the following characteristics:

- Low wave action
  - shallow beach slope or extensive tide flat
  - meandering channels or sloughs, with undercut or sloughing banks
  - isolated lagoons or artificial impoundments (e.g., culverts)
- Low freshwater input
- Marsh vegetation, like pickleweed (*Salicornia*) that crabs can use for shelter

Early detection monitoring is focused on these sites because green crab are likely to first be detectible in places where they do best. In addition, these are the types of habitats most likely to be impacted by green crab if they become abundant in our region. Other considerations that determine which sites are monitored include whether we can obtain legal access, geographic distribution, whether the site is large enough to accommodate the number of traps we use, and whether volunteers can safely navigate the terrain to conduct the protocols. Crab Team continues to refine this list by ground-truthing. Observations from trap catches and molt surveys will also help us tell if green crabs are likely to be able to live at a site based on the other species found in that habitat. To precisely and consistently target the best sampling locations within a habitat, sites will be delineated with semi-permanent markers (rebar stake) to provide a visual reference point for consistent sampling.
Volunteer Guidelines & Responsibilities

Your contribution of time is very important to us, and we do the best we can to make sure the data you collect will be valuable to science. In order to make this possible, sampling must be conducted consistently across all sites and over time. Therefore, we ask that you commit to participate in Crab Team only if you can be present for at least 75% of sampling days (at least 9 out of the 12 per year), and attend trainings. This is also a courtesy to your team members who rely on your participation. To be covered as a volunteer for the University of Washington, please record the actual times you worked, including preparation, travel, and clean up, on your data sheets each month for both survey types.

Safety & Stewardship

Please be aware that, despite their mild appearance, pocket estuaries can be hazardous areas to work in. If you think an area is potentially dangerous or are uneasy about accessing it, DON’T DO IT! Be mindful of the tides and always work with a partner on site. Always wear footwear that covers your entire foot, because the mud can hide sharp shells. Narrow-ankle boots or hip/chest waders make it much easier to get unstuck, and you can also use shovels or buckets for leverage in soft spots. The footing can change with the tide, so use care when traversing uneven ground, especially slippery surfaces such as wet rocks or seaweed. Don’t forget weather protection; being comfortable during surveying makes the work much more fun.

Please be mindful of your role as a steward of these natural areas, and minimize disturbance on the site as much as possible. The goal of the program is to contribute to the protection of Salish Sea shoreline habitats, so, as much as possible, handle all animals carefully to ensure they are in the best condition to survive upon release. This may include timing your trap set up and retrieval to avoid stressing animals. Respect the property rights of local landowners, the shared use of public spaces, and help maintain good relationships with neighbors and other site users. We rely on the goodwill of these groups to access monitoring sites.

The Washington Department of Fish and Wildlife (WDFW) classifies European green crab as a prohibited animal species under WAC 220-12-090. A permit is required to possess this species, even as a part of a WDFW monitoring and control program. Crab Team obtains a permit covering all monitors we train. However, you must be carrying a copy of the permit while you are trapping in order for it to be valid. The permit will be renewed annually, so we will provide a copy at the beginning of each sampling season.

Gear required and provided

In addition to your own boots, each group will need a digital camera for this project. We will ask you to submit images of your trap catches so that we can verify the species being trapped. This doesn’t need to be a fancy camera, your phone will most likely take adequate pictures. We will loan everything else you will need. We appreciate your help sustaining this project by taking good care of the gear, and returning it to us if you ever decide to end your participation. Please also let us know if any additional materials would be helpful, and we will see what we can do to make your job easier.

Each team will be provided:

For trapping:
- 3 - Square Fukui traps
- 3 - Galvanized steel minnow traps
- Bait (frozen mackerel) & Bait Jars (6)
- 6 - Trap stakes
- 2 - Sets of calipers
- Photo ID cards and wax pencil
- 2 – Sorting bins

For shoreline surveys:
- 1 - 0.1 m² PVC quadrat
- 1 - 50 meter rope or tape

General gear provided:
- Gloves
- ID guide
- Clipboard
- Datasheets (on waterproof paper)
- Zip ties (trap repair, general use)
- Hand lens
TRAPPING

Set a total of 6 baited traps (3 square Fukui traps, and 3 minnow traps) for one nighttime high tide per month from April through September.

1. Timing

Traps should be deployed (“soaked”) for one overnight high tide, because that is when crabs are most actively looking for food. Depending on your site, and the tide, this could mean your traps are soaking for between 12 and 20 hours. The goal is to maximize the time that traps will be actively “fishing” but also ensure that any other organisms you catch will not be stranded out of the water when the tide drops, to avoid mortality of native critters. This will take a bit of planning with tide forecasts because the precise timing of tides varies depending on location. You can choose dates and times that are good for your site and team, and Crab Team staff is available to help.

This diagram shows a two-day tide forecast. Each 23 ½ hour tidal cycle has two high tides and two low tides—one higher, one lower, for each.

Set your traps on an afternoon or evening incoming tide, and retrieve them the next day, when the ebbing tide first drops low enough to reach your traps. This likely means you will not be targeting the lowest tides of either day.

To find the tide forecast for your site:
- www.tidesandcurrents.noaa.gov/tide_predictions.html
- App for iOS: Tide Graph

Example: Traps are typically set intertidally. A common trap elevation is +4ft (dotted line). At this height, traps will be submerged (fishing) any time the tide is predicted to be above +4ft (areas in green), but traps would be out of water if the tide height is below the trap elevation (red). Check tide charts to be sure traps remain under water during overnight low tides.

2. Preparation

A few days before setting traps, check that they are in good condition, clean and free of debris, and without holes in the mesh. Small holes can be repaired using zip ties. Each trap should have an orange tag with the WSG contact information attached.

If you need to notify a site owner of your sampling dates, contact them at least two business days before visiting the site.

An hour or so before you head out, remove the bait you will use from the freezer to allow it to thaw slightly. This will allow the bait to start attracting crabs to the traps more quickly. Gather the gear on your checklist, and make sure you’re prepared for the weather.
3. Setting Traps

You will set 3 square Fukui fish traps and 3 cylindrical minnow traps at each site.

a. **Time your trapping.** Plan to arrive at the site with enough time to set up traps on shore, and to still be able to walk out to the appropriate depth with your traps.

b. **Bait traps.** Load the bait into bait jars while still on the beach. The bait has been portioned out for you; you only need to empty one small bag into each of the 6 bait jars. Save the bags to dispose of used bait.

c. **Site the traps.** Generally, traps should be arrayed in a line parallel to the shore, starting adjacent to the stake marking your trapping location. Alternate the type of trap so that minnow and Fukui traps are interspersed and spaced approximately 10 meters apart (about 10 long paces).

All 6 traps should be at roughly the same tidal height. If water is retained at low tide, in a lagoon or slough, then your traps should be more than half submerged when you set them. If your site is on a sloped beach, set the traps deep enough so they won’t be exposed on the higher-low tide before you return to collect them. We want the organisms to be healthy when we release them. It is more important that the traps are placed in water than it is that they are precisely 10m apart, so it’s OK if you need to adjust slightly to find pools of water in a channel, for instance. It is preferable that the traps are slightly further than 10m apart, rather than closer together.

d. **Set up the traps.** Place one bait jar inside each trap. No need to attach jars to the trap. Close the Fukui trap by lifting the collapsible sides and clipping them together at the top. The two halves of each minnow trap clip together with the pin provided -- make sure each trap is clipped fully closed.

Place traps in the water so that they are more than half-way submerged and can begin fishing immediately. Orient the minnow traps with the orange tag on top, so it can be easily read without moving the trap. Sink the stake all the way through the trap, from top to bottom, so that the bent portion of the stake is level with the top of the trap, pinning it down. The top of the stake should be covering the middle bars or rings of the trap, which are sturdiest. If the substrate is too hard to securely stake the trap, try angling the stake slightly, or moving the stake and trap around a bit. If you consistently find this to be a challenge, check with Crab Team staff. We might need to target a different part of the site, or weight traps with rebar to ensure they don’t get moved or lost.

e. **Record the time that your final trap was set,** so that we can track the “soak time”, or the amount of time that the traps were fishing for crabs.
4. Retrieving Traps

Check the traps the next time they will be out of water and **record the number and species of all organisms** in the trap. You will be sorting organisms and recording data at the same time, so it’s easiest to work with a partner or two: one person can record data, and the others can handle the traps and organisms.

a. **Timing.** Plan to return to your traps as the tide is dropping, i.e., before the low tide. This will ensure that any organisms in the trap will remain in water, and should survive upon release.

b. **Record trap retrieval time as the time the first trap was removed** from the water. Even though it might take you a while to get through the traps, it’s unlikely anything will climb into the traps once you are working at the site. Also, record the predominant weather condition (**select one**) that best describes the period during which the traps were soaking.

c. **Remove and record organisms in first trap.** Pull the stake, remove debris, and bring the trap back to shore. Carefully, to avoid losing any critters (data!) from inside the trap, empty the contents of the trap into the tub with the scale bar on the bottom. This is tricky with Fukui traps, and requires patience not to injure the critters. Note that it is OK if very small critters fall through the mesh of the trap before you open it, as you pull it from the water, because that means they are too small to be sampled.

d. **Take one photograph of entire trap catch** including the corresponding completed trap photo ID card. Try to get as many of the organisms as possible clearly visible in the photo, although this will not be possible if there is a great number. You will submit this with your trap data for data verification. Ensure reasonable resolution and avoid glare and shadows in the photos as much as possible.

e. **Record trap catch on data sheet. All species: Identify and record the number. Crabs: Measure the size of up to 10 of each sex (up to 20 total) - except hermit crabs. Fish should be counted and released first (but after photographing) because they are sensitive. Handle fish carefully, many species have defensive spines, and they can be easily injured. Use care when handling crabs as well, to avoid getting pinched or removing limbs, which take a while to regrow. Gloves will not protect you from large crab claws, but they can be helpful in guarding against pinches from the small shore crabs.

**On the data sheet, fill out a separate row for each species found in each trap.** Fill out the trap type (M: Minnow; F: Fukui) and number (1-3) that matches with the photo card. The order is not as important as matching the photo card to the data sheet. For each species, use the 4-letter code from the ID guide, and measure and tally the individuals of that species as described below. After counting an individual, move it to the second bin, the one without a scale bar, to avoid re-counting before releasing.
4. Retrieving Traps (continued)

f. For crab species only (except hermit crabs), count the total number of males and females of each species, and measure size for a subsample. To avoid size bias, select individuals haphazardly, without looking, until you have measured 10 males and 10 females. Measure the carapace width at the widest point (including spines) to the nearest millimeter using the calipers. If there are fewer than 10 males or 10 females of a crab species, take size measurements on all individuals present. Record the size of each crab in one of the 10 boxes in the row corresponding to the correct sex for that species. When you have filled the boxes for one of the sexes, you may simply count the remaining number of that sex to obtain a total for each sex of that crab species.

**Totals:** For crab species, record the total number of males and total number females on the appropriate sub-rows of the data sheet. For non-crabs and hermit crabs, record only the total (disregard sex).

g. If a trap is empty, clearly indicate that on the data sheet. Write “EMPTY” in the species column and submit a photo of an empty bin with the corresponding trap ID photo card. This allows us to be sure that no traps were skipped, and leaves a placeholder for all of the data.

h. Release all organisms in the water nearby, EXCEPT European green crabs (see below).

i. Repeat with each of the other traps one at a time.

If you catch a green crab, text a picture to Crab Team as soon as possible to verify ID. Photograph both top and underside of the crab with your calipers in the image for scale. Record the species data as with native species. Keep the crab alive (cool but not chilled, and damp, but not in standing water) until you receive instructions from Crab Team.

If you are unable to identify an organism, take several pictures from different angles with a size reference. If you are confident the organism is not a green crab, release it. Use a placeholder on your datasheet, such as “Unknown species A” until the organism can be identified. Email Crab Team as soon as possible so that we can ID the organism for you before you turn in your data sheet.

It is our goal to identify every organism in the traps. Take a lot of pictures and notes so we can identify the species for you.
5. Clean and store gear

Take the used bait home to discard. This avoids fouling the sites and creating an incentive for local raccoons to investigate traps in the future. If animals learn to come to the site looking for food, they may start trying to get bait from traps while traps are fishing.

Clean gear before leaving the site. Remove seaweed or other debris that has collected on or in the traps and other gear, and rinse mud off in the water of the receding tide. Cleaning as much material as possible at the site will not only make your job easier at home, but it will also reduce the possibility that you could transport organisms on the gear to a new location.

Rinse all your gear well with fresh water and allow to dry completely. Because loaned trapping gear is not deployed at any other site, further decontamination is not required.

Store gear in a dry, covered space, out of direct sunlight. If any of your traps have lost their tags, request replacements from WSG so we can get them to you before the next sampling. Do not use your Crab Team gear at any other site, or for any purpose other than this sampling.
**1. Delineate the transect**

a. **Find the habitat boundary.** On a low tide (typically +3 ft or lower), identify the line at which the bare ground (mud/sand) of the subtidal environment interfaces with the lowest observed intertidal habitat. Sites fall into two categories: vegetation or riprap, and this survey will focus on the deepest edge of the “structured” habitat, either plants or rocks respectively.

b. **Set the transect line.** Starting adjacent to your site marker, string the 50m measuring tape or rope along the deep boundary of the vegetation or riprap zone. You don’t need to be extremely precise in following all the contours- the goal of the line is only to gauge the distance at which measurements will be taken. Small, sparse patches of vegetation, discontinuous with the main area, do not need to be included. Connect gaps larger than 5m.

c. **Determine distances at which observations will be made.** Each month you will use a new set of distances (1-50) for your quadrat sampling locations using the table to the right. These numbers change annually. For instance, in April 2021, you will survey quadrats at the 8, 10, 12…and so on, meter marks along your rope or tape.

<table>
<thead>
<tr>
<th>Month</th>
<th>2021 Randomly Sampled Distances (meters)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Apr</td>
<td>8 10 12 15 26 35 36 37 45 47</td>
</tr>
<tr>
<td>May</td>
<td>1 2 5 8 10 19 26 27 31 35</td>
</tr>
<tr>
<td>Jun</td>
<td>7 8 13 17 19 30 36 39 44 48</td>
</tr>
<tr>
<td>Jul</td>
<td>10 11 12 13 16 28 34 40 43 50</td>
</tr>
<tr>
<td>Aug</td>
<td>2 6 9 12 17 22 25 26 40 41</td>
</tr>
<tr>
<td>Sep</td>
<td>4 6 22 25 26 28 29 43 44 46</td>
</tr>
</tbody>
</table>

Conduct one habitat transect survey each month from April through September to characterize the shoreline habitat, vegetation, substrate, and wrack.
2. Record cover at each replicate quadrat

d. Place quadrat in the habitat zone at appropriate distance. Find distance corresponding to assigned random number for sampling month, place the deepest edge of the quadrat along the deepest edge of the stems (for vegetation transects) or rocks (for rip-rap transects). Do not place quadrat based on location of overhanging vegetation (with no stems or roots directly underneath), but move upslope to find where the vegetation is rooted at its deepest point on the shore. The entire quadrat should be oriented so it generally falls within the habitat zone.

The quadrat is on the *landward* side of the rope, *positive* relative to the meter mark.

Place the quadrat so that the deepest edge aligns with the deepest rooted vegetation stems. Don’t include “overhang” in quadrat

e. Box 1: Visually estimate percent cover of wrack. Round to the nearest 5%. Cover 2.5% or greater is rounded up to 5%, anything less is recorded as 0%. Assess only the top layer of wrack material, as if it were a flat photo. Record the following categories of wrack, should total 0-100%:

- **Eelgrass**
- **Seaweed** (macroalgae)
- **Trash** (any object or debris of human origin, plastic, etc.)
- **Terrestrial vegetation** (leaves, sticks, pine cones, logs)

f. Box 2a: Remove wrack, and estimate percent cover of attached algae. This category typically includes wooly filamentous green algae, but can include any attached algae such as Fucus, or ulvoid sea lettuce. This can range from 0-100%, independent of other categories. This category can grow directly on sediment, loosely attached, or on the stems of rooted vegetation or surface of rocks. However, if it is *not* attached, but clearly washed it, it should be recorded as wrack in Box 1- seaweed. Estimate to nearest 5% as above.

Examples of “attached algae” are filamentous greens (left) and fucoid macroalgae (right). Though very different categories of organism, they fill a similar ecological role in our transects.

Attached algae can grow loosely secured directly to the substrate, but is not stabilizing the sediment like pickleweed which is considered rooted vegetation and counted in step 2b.
2. Record cover at each replicate quadrat (cont.)

g. **Box 2b:** Estimate percent cover of habitat categories to nearest 5%. These three categories should always total exactly 100%, independent of the total percent cover of wrack or filamentous green algae.
   - **Rooted vegetation:** e.g., pickleweed, marsh grass, estimate the area of the sediment in the quadrat that is stabilized by roots underground. Rooted vegetation does not have to be “live” and sometimes it can be difficult to distinguish between dormant and dead pickleweed. So focus primarily on the estimated root area.
   - **Live epifauna:** animals living at that spot, e.g. barnacles, mussels, snails, but not crabs - anything that can’t move out of the quadrat faster than you can estimate its cover. Don’t include, crabs of any kind, dead organisms, or empty shells.
   - **Bare substrate:** all remaining space else to total exactly 100%.

h. **Box 3:** Record the dominant sediment type in the quadrat as one of the categories below. If it is a combination, choose the one that takes up the most space.

i. Repeat steps d-g for remaining 9 quadrats.
1. Collect all crustacean molts

The goal of the molt search is to collect as many molts as possible with a standardized amount of effort.

a. **Start with all participants standing at the site marker.** Walking time is included in the search. Target the areas you think will have the greatest density of molts. Spotty patches of beach wrack are a great place to look, as is the base of vegetation, or below large beach logs.

b. **Collect molts for a total of 20 person-minutes** (for 2 people: 10m each; for 3 people: 6:40 each, etc.). Use a timer with an alarm - it’s easy to lose track of time molt hunting. When you start the timer, participants may then walk to any spots you’ve targeted, and start collecting as many molts as possible. Note that you are looking for any crustacean molt, not only European green crabs, so use a broad search image. Collect molts from any crustaceans, including amphipods, shrimps, hermit crabs. Many molts are small, especially shore crabs. Don’t try to ID molts as you collect them. This could throw your rate of collection.

c. **You can search anywhere on your site, but stay on the site.** That is, if your site is an enclosed lagoon or marsh, don’t search or collect on open portions of the beaches that are on the other side of the berm from your enclosed area. Check with staff if you aren’t sure about how to define your search.

d. **Place molts into a bait jar or cup, by hand, one at a time.** Avoid sweeping piles of molts into your cup. Doing so makes it difficult to standardize effort across sites, and can crush the molts (which makes it hard to identify them). Small molts can also be blown away by the wind, so placing them in a small cup offers some protection and keeps your hand free for picking up more.

2. Count and identify all molts collected

a. **Count and identify each molt.** After you have finished collecting, sort through all of the molts collected, and identify each to species/taxon. You can take molts off site with you to do the sorting at home where it can be more comfortable.
2. Count and identify all molts collected (cont.)

b. Only count molts for which you have found at least half of the carapace. If you find only a claw or small portion of the shell, this does not get included in your total – even if you are able to identify the species of the crab it came from. This enables us to avoid potentially double-counting individual crabs for which the molts have broken into multiple pieces.

c. Record number of molts and any dead crabs you find. No information about sex or size is needed (except for green crab, see below), but you should record dead crabs separately from molts. Dead crabs are distinguishable from molts because the flesh is still in the shell, making it heavier and much stinkier. Sometimes a dead crab turns gray rather than a pink or reddish brown of an aged molt. If it is not clear that the crab is a full dead specimen, record as a molt. Record these categories separately on the data sheet.

d. Dispose of molts. Dump molts on beach and crush or throw away in trash.

3. What to do if you find...

...a green crab molt?
Contact Crab Team as soon as possible. Text a photo to 360-358-3561 with your survey information (site), and an indication of scale (e.g., your calipers, or scale bar in the bin) next to the molt.

Record the sex and size of up to 10 haphazardly selected green crab (CAMA) molts. If you manage green crab molts, select up to 10 haphazardly to measure. In the Notes column, record the sex (if the abdomen is present) and carapace width, measured at the outside of the widest point of the back shell (including the spines) to the nearest mm. If you don’t have a full carapace, for instance if one edge is slightly broken, estimate the full size of the carapace by measuring the carapace to the centerline from the intact portion, and doubling that measurement and note that the carapace width is estimated for that molt.

...a molt you can’t identify?
Because molts are the shells of the crustaceans, it’s OK to take them home with you for follow up identification by Crab Team staff. It’s our goal to identify molts as carefully as possible, even if they are tiny. If you can’t ID the molt because less than half the shell remains, you don’t need to record it at all. Email a few pictures with clear indication of scale (e.g., the calipers, or scale bar in the bin) next to the molt. You can use a temporary species placeholder on your datasheet (e.g., Unknown species A) until the organism can be identified. Provide as much detail as you can in the description to the Crab team along with the pictures. If we cannot identify the crabs from the pictures, we might ask you to send them to us. Please wait to submit data sheets until species ID has been completed.
Submit data from monthly surveys electronically within a week of sampling, and mail the hard copies to Crab Team HQ at the end of the season.

1. Submit monthly survey data electronically

Each month, you will submit all of your data to Crab Team HQ as images or scans via email within one week of trapping.

a. Verify data sheets are complete. Check that site data and volunteer names and hours are complete. Ensure each row of data is clearly totaled in the correct column. If you have questions about species identification, please get these answered before you submit your data sheets, so the data submission is fully complete. We might ask you to revise your data and resubmit electronic copies.

b. Scan or take a photograph of data sheets. Your phone is often adequate for this, but quality can often be improved (and file size decreased) by using a scanner, or a scanning app on your phone (like Scanner For Me). Open all the photographs on your desktop computer (not just your phone) before sending to be sure they are sufficient resolution. Can you see the hairs on the shore crab legs?

c. Rename all files according to the convention. This likely requires transferring files to your computer, as not all phones allow you to rename image files. All file names should follow the basic format, with each element separated by a period:

- Trap photo
- Data sheet
- Shoreline Transect Data sheet
- Molt Hunt Data sheet

d. Email all images to crabteam@uw.edu. You will submit a minimum of 9 photographs each month: one for each of the 6 traps (including empty traps) and at least 3 for the data sheets. Multiple emails are fine if necessary. File sharing websites like Google Drive or Dropbox also work for us. Make sure that if you have the chance to select the file size for photographs, that you choose at least “Large”. Selecting Medium or Small will send pictures that are too low resolution to see details necessary for species identification.

2. Mail Data Sheets to WSG

At the end of the sampling season, mail hard copies to Crab Team HQ. You should have received your blank data sheets in a pre-addressed envelope at the beginning of the season. After the last month’s data sheets have been approved as finalized, mail them back in that envelope to Crab Team HQ for archiving. If you did not receive or cannot find the envelope, use the WSG Address here:

Crab Team
Washington Sea Grant
3716 Brooklyn Ave NE
Seattle, WA 98105-6716
**Don't measure fish**

**Don't measure hermit crabs**

**Clearly record empty traps**

**Hours include travel time, data submission etc**

**Pro Tip: Use X's for 10 in tallies to save space when you have a lot of one species**

**Including gravid and dead in species totals**

**Record ALL mortalities**

**Include gravid or dead in species totals**

**Track females w/ eggs**

**ONLY one weather**

**Use multiple rows for tallies if you need space**
**WSG Crab Team**

**Transect Data Sheet**

**Date:** 6/11/18  
**Site #:** 402  
**Volunteers:** Captain Swaddle  
**Participating:** Cheerleader

### Quadrat Survey

**Circle One: Riprap-Substrate**  
**Vegetation-Substrate**

#### Set 10 quadrats at assigned distances along transect. Estimate percent cover (nearest 5%) in each.

<table>
<thead>
<tr>
<th>Quadrat 1</th>
<th>Random Distance (m): 7</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Estimate wrack, then remove:</td>
<td></td>
</tr>
<tr>
<td>Wrack (dislodged floating material)</td>
<td></td>
</tr>
</tbody>
</table>
| Eelgrass (dead or live) | 25  
| Terrestrial veg (dead) | 15  
| Seaweed | 0  
| Trash | 0  |
| 2a. Filamentous green algae | 100  
| 2b. Live epifauna | 0  
| 3b. Sediment and substrate | Mud | Sand | Gravel |
| (circle 1) | Bedrock | Riprap | Cobble |

<table>
<thead>
<tr>
<th>Quadrat 2</th>
<th>Random Distance (m): 8</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Estimate wrack, then remove:</td>
<td></td>
</tr>
<tr>
<td>Wrack (dislodged floating material)</td>
<td></td>
</tr>
</tbody>
</table>
| Eelgrass (dead or live) | 0  
| Terrestrial veg (dead) | 0  
| Seaweed | 0  
| Trash | 0  |
| 2a. Filamentous green algae | 95  
| 2b. Live epifauna | 5  
| 3b. Sediment and substrate | Mud | Sand | Gravel |
| (circle 1) | Bedrock | Riprap | Cobble |

<table>
<thead>
<tr>
<th>Quadrat 3</th>
<th>Random Distance (m): 9</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Estimate wrack, then remove:</td>
<td></td>
</tr>
<tr>
<td>Wrack (dislodged floating material)</td>
<td></td>
</tr>
</tbody>
</table>
| Eelgrass (dead or live) | 0  
| Terrestrial veg (dead) | 0  
| Seaweed | 0  
| Trash | 0  |
| 2a. Filamentous green algae | 100  
| 2b. Live epifauna | 0  
| 3b. Sediment and substrate | Mud | Sand | Gravel |
| (circle 1) | Bedrock | Riprap | Cobble |

<table>
<thead>
<tr>
<th>Quadrat 4</th>
<th>Random Distance (m): 10</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Estimate wrack, then remove:</td>
<td></td>
</tr>
<tr>
<td>Wrack (dislodged floating material)</td>
<td></td>
</tr>
</tbody>
</table>
| Eelgrass (dead or live) | 0  
| Terrestrial veg (dead) | 0  
| Seaweed | 0  
| Trash | 0  |
| 2a. Filamentous green algae | 0  
| 2b. Live epifauna | 0  
| 3b. Sediment and substrate | Mud | Sand | Gravel |
| (circle 1) | Bedrock | Riprap | Cobble |

<table>
<thead>
<tr>
<th>Quadrat 5</th>
<th>Random Distance (m): 11</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Estimate wrack, then remove:</td>
<td></td>
</tr>
<tr>
<td>Wrack (dislodged floating material)</td>
<td></td>
</tr>
</tbody>
</table>
| Eelgrass (dead or live) | 0  
| Terrestrial veg (dead) | 0  
| Seaweed | 0  
| Trash | 0  |
| 2a. Filamentous green algae | 0  
| 2b. Live epifauna | 0  
| 3b. Sediment and substrate | Mud | Sand | Gravel |
| (circle 1) | Bedrock | Riprap | Cobble |

<table>
<thead>
<tr>
<th>Quadrat 6</th>
<th>Random Distance (m): 12</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Estimate wrack, then remove:</td>
<td></td>
</tr>
<tr>
<td>Wrack (dislodged floating material)</td>
<td></td>
</tr>
</tbody>
</table>
| Eelgrass (dead or live) | 0  
| Terrestrial veg (dead) | 0  
| Seaweed | 0  
| Trash | 0  |
| 2a. Filamentous green algae | 0  
| 2b. Live epifauna | 0  
| 3b. Sediment and substrate | Mud | Sand | Gravel |
| (circle 1) | Bedrock | Riprap | Cobble |

<table>
<thead>
<tr>
<th>Quadrat 7</th>
<th>Random Distance (m): 13</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Estimate wrack, then remove:</td>
<td></td>
</tr>
<tr>
<td>Wrack (dislodged floating material)</td>
<td></td>
</tr>
</tbody>
</table>
| Eelgrass (dead or live) | 0  
| Terrestrial veg (dead) | 0  
| Seaweed | 0  
| Trash | 0  |
| 2a. Filamentous green algae | 0  
| 2b. Live epifauna | 0  
| 3b. Sediment and substrate | Mud | Sand | Gravel |
| (circle 1) | Bedrock | Riprap | Cobble |

<table>
<thead>
<tr>
<th>Quadrat 8</th>
<th>Random Distance (m): 14</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Estimate wrack, then remove:</td>
<td></td>
</tr>
<tr>
<td>Wrack (dislodged floating material)</td>
<td></td>
</tr>
</tbody>
</table>
| Eelgrass (dead or live) | 0  
| Terrestrial veg (dead) | 0  
| Seaweed | 0  
| Trash | 0  |
| 2a. Filamentous green algae | 0  
| 2b. Live epifauna | 0  
| 3b. Sediment and substrate | Mud | Sand | Gravel |
| (circle 1) | Bedrock | Riprap | Cobble |

<table>
<thead>
<tr>
<th>Quadrat 9</th>
<th>Random Distance (m): 15</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Estimate wrack, then remove:</td>
<td></td>
</tr>
<tr>
<td>Wrack (dislodged floating material)</td>
<td></td>
</tr>
</tbody>
</table>
| Eelgrass (dead or live) | 0  
| Terrestrial veg (dead) | 0  
| Seaweed | 0  
| Trash | 0  |
| 2a. Filamentous green algae | 0  
| 2b. Live epifauna | 0  
| 3b. Sediment and substrate | Mud | Sand | Gravel |
| (circle 1) | Bedrock | Riprap | Cobble |

<table>
<thead>
<tr>
<th>Quadrat 10</th>
<th>Random Distance (m): 16</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Estimate wrack, then remove:</td>
<td></td>
</tr>
<tr>
<td>Wrack (dislodged floating material)</td>
<td></td>
</tr>
</tbody>
</table>
| Eelgrass (dead or live) | 0  
| Terrestrial veg (dead) | 0  
| Seaweed | 0  
| Trash | 0  |
| 2a. Filamentous green algae | 0  
| 2b. Live epifauna | 0  
| 3b. Sediment and substrate | Mud | Sand | Gravel |
| (circle 1) | Bedrock | Riprap | Cobble |

**Ensure complete site data**

**Habitat type won’t change**

**Epifauna, rooted veg and bare must total exactly 100%**

**Don’t forget sediment type in every quadrat**

**Wrack does not need to total 100% (0-100)**

**Filamentous green is estimated 0-100% independent of the rest of step 2.**
Use a placeholder when you can’t ID a molt. Keep molt and send description and photos to Crab Team before submitting the data sheet.

Hermit crabs aren’t recorded by species in the molt hunt – just HERM

Collect any crustaceans – even amphipods (AMPH) shed their shells

Pro Tip: Use X’s for 10 to save space when you have a lot of one species

### WSG Crab Team
#### Molt Hunt Data Sheet

<table>
<thead>
<tr>
<th>Species Code</th>
<th>&quot;Scratch Space&quot;</th>
<th># Molts</th>
<th># Dead</th>
<th>#Total</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>HEOR</td>
<td>XXX 11</td>
<td>32</td>
<td>3</td>
<td>35</td>
<td></td>
</tr>
<tr>
<td>MEGR</td>
<td>#12</td>
<td>13</td>
<td></td>
<td>13</td>
<td></td>
</tr>
<tr>
<td>HENU</td>
<td>#1</td>
<td>4</td>
<td></td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>UNKA-PEAS</td>
<td>#1</td>
<td>1</td>
<td></td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>HERM</td>
<td></td>
<td>1</td>
<td></td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>AMPH</td>
<td></td>
<td>2</td>
<td></td>
<td>2</td>
<td></td>
</tr>
</tbody>
</table>
CRAB TEAM PROTOCOL CHEAT SHEET

Before you go:

- Gather your equipment:
  - Bins
  - Datasheets/clipboard
  - Camera
  - Gloves
  - Traps (3 Fukui, 3 Minnow)
  - Measuring rope
  - Copy of permit
  - Quadrat
  - Bait (6 bags) & bait jars
  - Stakes (6)
  - Calipers
  - ID Guide
- Schedule arrival as tide is rising, before water reaches the height you will set the traps.
- Remove 6 bait bags (1 large bag) from the freezer and allow to thaw slightly.

Setting traps:

- Prepare bait on shore, adding 1 small bag of frozen mackerel to each bait jar, one jar to each trap.
- Set traps more than half submerged, 10 meters apart, alternating type, in a line parallel to shore.
- Stake traps all the way through, securing with bent metal rod, trap tag on top.
- Record the time at which the last trap was deployed.

Retrieving traps:

- Record the time at which the first trap was removed from water.
- Pull traps out and record catch one trap at a time.
  - Photograph each trap catch in bin (with trap id photo card in image).
  - For fish: Record total number of each species, ignore sex/size, release back into water.
  - For crab species (except hermit crabs): Record carapace width of first 10 male and first 10 female crabs selected haphazardly; record total by sex (total # males, total # females)
  - For all other species: Record total number, ignore sex and size.
  - Release all native crabs back into water.
- Take pictures and descriptions of any unknown organisms. Email to crabteam@uw.edu.
- Keep any suspected European green crabs alive and contact Crab Team immediately with photos.
- Dispose of bait at home (please don’t reuse or dump at the site).

Transect survey:

- Set the 50-meter rope along the riprap-substrate or vegetation-substrate habitat boundary.
- Place 10 quadrats at assigned distances based on the table of randomly-generated numbers for the corresponding month, and record percent cover of wrack, cover, and substrate type in each.

Molt hunt:

- Starting at site marker, collect as many crustacean shells within the site in 20 person minutes as possible
- Record the total number of each species of molt or dead crab collected after the end of the search.
- Record sex and carapace width of up to 10 haphazardly selected green crab molts. Contact Crab Team with photos.

After returning home:

- Clean, repair, and store traps. Dispose of used bait in trash or compost.
- Decontaminate gear to avoid transporting species.
- Contact Crab Team for help IDing any unknown species.
- Submit completed data to crabteam@uw.edu within one week of sampling.