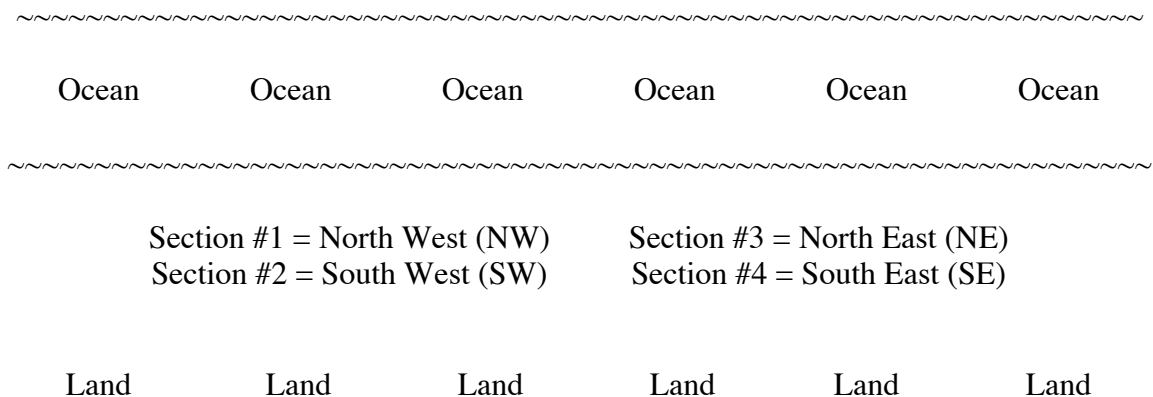


## Methodology for Random Quadrat Sampling of Intertidal Rocky Shoreline

1. Establish a fixed evaluation area by locating the largest and best suitable area of rocky or cobble habitat in a particular region.
2. Sample within one to three hours on either side of low tide depending on the sampling site.
3. Divide the area into four sections (quarter sections of the study sites, which we are sampling) by placing a first meter tape perpendicular to the start of the water's edge for a distance of hopefully 20 meters.
4. Place a second meter tape parallel to the waterline for a total distance of 20 meters so that it crosses the first tape at its mid-point (10 meters). Move the meter tape up or down so it crosses the first tape at its middle.

Placement of sections and their size is dependent on the slope and size of the sampling area. Therefore, it may be necessary to alter the distance, e.g. 30 meters along the water's edge and 10 meters parallel to it or shorten distances of sections on beaches with a smaller sampling sites (e.g. steep coasts or a small cobblestone patch). For example, consider this case: the meter tape that is perpendicular to the shore line has only a length of 15 meters from the water mark to the top of the intertidal or wrack line (stark line of seaweed and debris). Then the second tape meter, parallel to the ocean, should cross the first meter tape at 7.5 meters. Therefore creating a shape of four rectangle sections to sample. NOTE: I still need a better description of how to lay out the sections. To avoid possible confusion.



5. At the initial setup, map the area and key landmarks for repeatability. Ascertain the site coordinates (latitude and longitude) using a GPS or from a topographic map. If you do not have a GPS, please find your coordinates after your sampling because it takes time. Since low tide time is invaluable, so use it wisely.
6. Record the date, time, site name, time of low tide, weather conditions, air and water temperature, exposure (wave height), and salinity using a refractometer or salinometers. Also measure and record the distance from the water's edge to the high water mark. We will call this distance the sample intertidal length.
7. Split the citizen scientists into 4 or more groups. The groups should be composed of two or more people. If you have larger or younger groups, groups of 4 can be used but no more. Assign each group a number to each one: 1,2,3,4,... until you have numbered every group. When

breaking the citizen scientists into groups, please consider group dynamics. If for example, the class is not focused and too social, maybe you should split the friends into different groups.

8. Group one will sample a randomly chosen quadrat in the north west (NW) section #1, team #2 will sample section #2 (SW), team #3 will sample section #3 (NE), team #4 will sample section #4 (SE), and if there are more than 4 groups, they will be assigned to a section in the same fashion and pattern. For example, team #5 will sample a randomly placed quadrat in section #1 (NW), and so on!

9. Each group must determine the random placement of the quadrat in the section that they will be working in. To do this, select two random numbers between 1 and 10 (e.g., 3, 6). See Randomness page on our website for tables of randomly generated values, these will be calculated and on our website for your use. The numbers will be generated by a random number generator program that creates set of numbers of X, Y, which will not have repetition. This is done for you on the website, so all you have to do is just print out and bring to the field with you. There you have a list of random placements for quadrats. If by chance, the random generators puts two quadrats in overlapping spots in the same section, this is fine. Go to the next location via the next set of random generated numbers.

10. Starting in the center of the plot, walk parallel to the water, marking off on the x axis the first random number (3 meters); then walk towards the water and mark off on the y axis at half the distance of the sample intertidal length (6 meters, in feet is acceptable).

11. Place the left bottom corner of a 1-meter<sup>2</sup> or 2-meter<sup>2</sup> quadrat at the intersection of these two measurements (x, y). NOTE: shouldn't they all use the same size quadrats?

12. The group should find all the crabs in the quadrat by visual inspection. Every crab should be put in a bucket. Then turnover all the rocks and pebbles and search the sea weed for crabs. The rocks should be turned over one rock at a time, then removing that rock from the quadrat into another bucket, so it does not change the surrounding area that might also be sampled, until the entire quadrat has been searched. All crabs should be placed in another container (not the ones with rocks that could be removed). The best way to pick up a crab is using just your thumb and pointer finger and place them on the back end of the crab or right behind the big pinchers. Visual representations of these two techniques can be found at the bottom of the "Photo" page of the invasive tracers (MIS CSI) website. If done properly, due to their structure, they will not be able to bite you. A net is not required.

13. One person should be data keeper while the others should be crab measurer. The measurer will take one crab, identify its species (European green, Asian shore, Jonah, rock, etc. ). If not sure, ask the other group members. If there is not a unanimous consensus, then ask the group leader or consult labeled crab molts and/or field guides to answer these questions. Then the sex of the crab can be determined by flipping the crab over and examining the underside of the crab's carapace (exoskeleton or "suit of armor") determined by the shape of the abdomen (tail flap). The male has a tail flap that looks like a light house or a thin triangle or a Washington monument, while, the female has a larger and rounded tail flap.

Then the crab's carapace will be measured at its widest section (the 5th spine, the one furthest from the eye to the other corresponding 5th spine). The data keeper records this information for each crab. Do this for each crab, until all crabs have been counted. Record, on the data sheet, the time it took to sample that quadrat. Do not worry, it is not a race, please do a thorough and meticulous job. We need this information for analysis of efficiency of various monitoring

techniques. Also do not worry if you find few or no crabs, these data are also very important to my research.

Species	Sex	Size
European Green Crab	Male	45 mm
Asian shore Crab	Female	22.5 mm
<i>Carcinus maenas</i>	Female	35 mm
<i>Hemigrapsus sanguineus</i>	Male	20 mm
Hemi	Female	10 mm
Rock Crab	Male	55 mm
Green Crab	Female	57 mm

All are correct documentation since all names are clear, even if abbreviated. Since there are no other crabs in the genus of Hemigrapsus, so Hemigrapsus or Hemi is acceptable. Please be careful that you label all the measurements, for example, the size was 10? 10 cm? 10 mm? Scientists must pay close attention to details like this, so other scientists can understand their field data and can incorporate into the larger sets of scientific standardized sets of data.

Totals:

Species	Green	Asian	Rock	Jonah	Blue
Total # in this quadrat	3	3	1	0	0
# of Males /# of females	1/2	1/2	M	N/A	N/A

14. Rare invaders or unusual observations should be photographed. Samples of unknown species should be collected for verification by taxonomic specialist offsite. They can be well preserved by putting them in a container filled with ethanol.

15. Now the rocks and crabs can be released in the same area as collected unless they are needed for further activities. So ask the group leader before releasing the crabs. If crabs are kept, please add new water every hour so it does not heat up and hurt the crabs by the water becoming warm and oxygen depleted. Even though the intertidal zone experiences regular disturbances from wave exposure, temperature and other human and animal presence, care should be taken to avoid creating disturbances or undue stress that may affect settlement and/or life processes of the organisms.

16. After one quadrat is sampled and a data sheet has recorded it, hand the sheet to the group leader and get a new data sheet and two new random numbers to place your next quadrat. This time you will rotate to a new section. The next section you sample will be the number section you sampled before + 1, except those who sampled Section #4. For example, the group that sampled in section #1 will now sample a quadrat, with the NEW set of random numbers, in Section #2. Those who sampled in section #4, will sample next in sample a quadrat in Section #1 (Should I use capital "Q" for sections to separate it from quadrats? Yes. Or should the whole section be called sections to reduce chance for confusion between Quadrats and and quandrants)?! Section would probably be better.

17. Repeat the process for all the quadrats that are possible to sample during the sampling time.

Record the names of all volunteer monitors, their ages, and level of education on the back of your data sheets.

18. Please document the site with pictures of the sections, so I can compare it to other sites and for finding the site in case I want to sample it.

19. Please send all the data sheets and pictures to:

david.delaney@elf.mcgill.ca

Or by snail mail at:

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