

Kachemak Bay National Estuarine Research Reserve

European Green Crab Monitoring Protocol

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Importance

Non-native or invasive species have the potential to greatly alter an ecosystem by preying on, out-competing, or simply overwhelming native organisms. Globally, invasive species of both aquatic and terrestrial plants and animals cause billions of dollars of damage to industry and infrastructure each year, as well as untold and increasing impacts on native populations and ecosystems. Eradicating an invasive species once it is established can be very difficult, if not impossible. However, early detection of an invasive species in a newly invaded habitat may enable researchers to isolate a population and possibly control its growth by removing the non-natives from the habitat before they have a chance to become established. To identify non-native organisms and to judge their potential impact on native populations, it is vital to first have a detailed list of native species in a local ecosystem and to obtain information about distribution and abundance of native populations.

Volunteers can play an important role in the early detection of non-native species as well as in the monitoring of native species. Monitoring programs employing trained community members have been widely successful against a range of invasive species across both eastern and western seaboard of the United States (Ohrel and Register, 2000), including invasive crabs. We present here a protocol for volunteers to monitor crabs in Kachemak Bay. Their efforts will serve as an early detection for potential crab invasions and will help establish basic, baseline population information on native crab populations in Kachemak Bay. This information is vital to enable us to track any long-term changes in native crab and associated communities over time (with or without the influence of invasive species). This protocol is designed to be transferable to other regions of Alaska.

Species description

One non-native, invasive aquatic species of concern for Alaska is the European green crab, *Carcinus maenas* (Prince William Sound Regional Citizen's Advisory Council, 2005). Though these decapod crustaceans have not yet been found in Alaska waters, their populations have been spreading northward along the West Coast of the United States and Canada since the 1980s. These crabs are voracious predators that have displaced native species in invaded environments all over the world through predation and competition, and are considered potential threats to Alaska because of their ability to spread quickly throughout geographical regions and

disrupt native communities. They may impact shorebird populations because of their similar diets of clams and mussels (Prince William Sound Regional Citizen's Advisory Council, 2005) and can prey upon other crabs as large as themselves, thus having a potential impact on juvenile crab populations (WA Department of Fish and Wildlife, 2001). Green crabs have been found in a variety of habitats, including tidal marshes, sand flats, cobble beaches and protected rocky shores, all of which are found in Kachemak Bay. Laboratory experiments with this species suggest tolerance of wide ranges of salinity (4 - 54ppt) and temperature (0 - 33 °C) (Hines et. al, 2004), parameters well within those typically found throughout Kachemak Bay.

In spite of its name, the dorsal (top) shell of the European green crab can range in color from dark green to shades of brown interspersed with small yellow patches (Figure 1), while the ventral surface (underside) is green, orange and, during molting, red (Figure 2) (WA Dept. of Fish and Wildlife, 2001). The shape of the abdominal flap on the ventral carapace easily distinguishes the sex of the crab, with males having a pointed flap and females with a rounded flap (Figure 2). Distinctive features of the green crab include the presence of five spines lateral to and three bumps between the eyes (Figure 1). The size range of green crabs captured in Washington has been between 19mm (3/4") to 90mm (3 1/2") carapace width (CW, the distance across the dorsal shell at its widest point; WA Dept. of Fish and Wildlife, 2001).



Figure 1. Adult green crab with dark green dorsal shell and yellow spots, 5 spines lateral to each eye and 3 bumps between the eyes. Photo from <http://wdfw.wa.gov/fish/ans/greencrab.htm> .

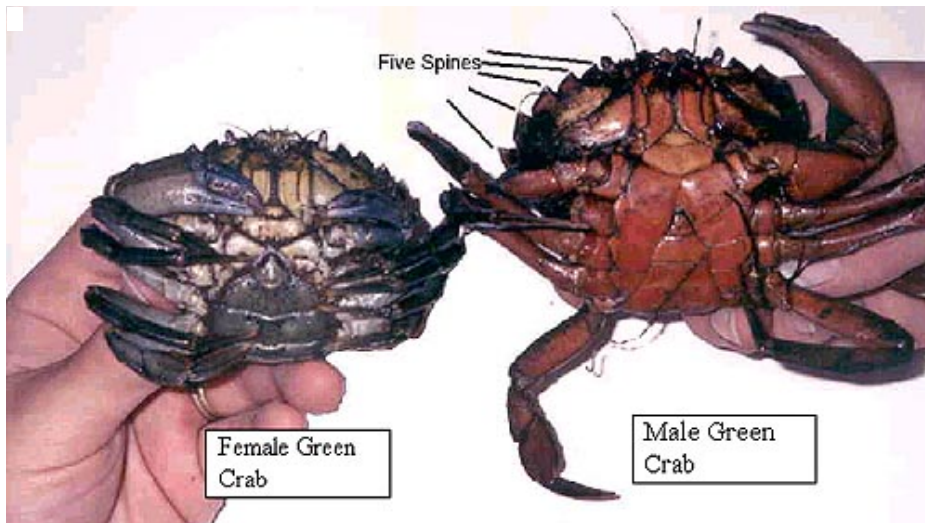


Figure 2. The abdominal flaps of female green crabs are rounded whereas those of male crabs are more pointed. Photo from <http://wdfw.wa.gov/fish/ans/greencrab.htm> .

Methods

Equipment required for this study includes:

- Map, tide book, and watch
- Wooden, numbered stakes for marking/tethering traps
- Traps, bait, and a Fish Resource Permit from ADFG
- Clipboards, data sheets, and pencils
- Bucket for temporarily holding crabs (one per trap)
- Tupperware container for suspected invasive crabs
- Crab identification cards
- Vernier calipers
- Disposable, waterproof camera
- Photo box and laminated photo numbers
- Appropriate clothing, boots, and rubber gloves

Sites to be sampled should be ecologically important, catalogued by GPS coordinates, identified as safe for the volunteers, and located in areas where equipment can be retrieved relatively easily. Three types of traps are used for crab monitoring: folding mesh traps, minnow traps, and “pit” traps (a 5-gallon bucket buried to its rim). We recommend using a combination of these, as the folding and minnow traps will capture crabs (generally larger and smaller crabs, respectively) actively foraging and the pit trap will capture crabs passively. All traps should be located at approximately -1.0 ft below MLLW. Pit traps must be removed or have tightly secured lids during non-sampling periods. Remove pit trap lids and bait the folding or minnow traps 24 hours prior to your scheduled sampling time. All traps should be numbered, and be sure to tether the folding and minnow traps.

Upon reaching a site on sampling day, find the wooden stakes and associated traps. Divide your observers into groups of about 5 that will each focus on a specific trap, and designate a record keeper. Next, have the record keeper fill out the top section of the data sheet. Be sure that all information about a particular trap is recorded under its stake number and trap type—for example, if a group finishes one trap and moves on to another, have them start a new data sheet for the new trap. Remove crabs from the trap and place them in the holding bucket: for folding traps, it may be easier to shake the crabs into the bucket rather than try to pry them loose from the mesh. Using the provided ID guides, identify all crabs captured in each trap, if possible, and measure the width of each crab’s carapace at the widest point. Any crab that is not easily identified *but is not an invasive crab* should be photographed in the provided photo box. Be sure to place a laminated photo number in the box with the crab, and record the photo number on the data sheet. **If you think you have captured a European green crab**, place it in the Tupperware container, secure the lid, and freeze it until KBRR personnel can pick it up. All crabs should be measured and recorded by species and sex. Please record and list information for all crabs *individually*—that is, if you find more than one individual of a particular species, list each individual separately. If more space is required, begin a new data sheet and be sure to number the pages. After sampling, all native crabs should be released alive. Note your finishing time on the data sheet. If you plan to sample the next 24-hour period, re-bait the folding and/or minnow traps. If not, remove the folding and minnow traps and tightly secure the pit trap lids.

The data sheet provided by the Reserve (see attached) should be filled out completely and returned to the Reserve to ensure data can be entered into the database for the project. Sampling date, personnel, site name and stake number, and the species names, numbers, sex, and sizes of all species encountered are the minimum information recorded for this project. Any other pertinent information can be included in the “Notes” section of the data sheet.

Literature cited

- Hines, A.H., G.M. Ruiz, N. G. Hitchcock, and C. deRiviera. 2004. Projecting range expansion of invasive European green crabs (*Carcinus maenas*) to Alaska: temperature and salinity tolerance of larvae. Research report submitted to Prince William Sound Regional Citizens’ Advisory Council, Anchorage, Alaska. 22pp.
- Ohrel, Jr. R. L. and K. M. Register. 2000. Volunteer Estuary Monitoring: A Methods Manual. Second edition. Report by the U.S. Environmental Protection Agency, Office of Wetlands, Oceans, and Watersheds to The Ocean Conservancy, Washington, D.C. 396 pp.

Web Sites

- Prince William Sound Regional Citizens’ Advisory Council. 2005. Nonindigenous Invasive Species. <http://www.pwsrca.org/projects/NIS/factsheets.html>
- Washington Department of Fish and Wildlife. 2001. Aquatic Nuisance Species: European Green Crab. <http://wdfw.wa.gov/fish/ans/greencrab.htm>

“How-To” Guide Invasive Green Crab Monitoring Project

1. Ensure you have all required equipment:
 - Map, tide book, and watch
 - Traps, bait, and a Fish Resource Permit from ADFG
 - Clipboards, data sheets, and pencils
 - Bucket for temporarily holding crabs (one per trap)
 - Tupperware container for suspected invasive crabs
 - Crab identification cards
 - Vernier calipers
 - Disposable, waterproof camera
 - Photo box and laminated photo numbers
 - Appropriate clothing, boots, and rubber gloves
2. Find the traps. Some sites may have more than one type: folding mesh, minnow, and/or “pit” (buried 5-gallon bucket) traps. Be sure to indicate on each data sheet which type you are sampling.
3. Divide into groups, each focusing on a specific trap. About 5 people per group is ideal.
4. Designate a record keeper who will record all observations.
 - a. Before observations begin, fill out the top of the data sheet in its entirety.
 - b. Record information for each crab individually: one crab per line.
 - c. Record any other pertinent information in the “Notes” section as needed.
 - d. If you run out of space, begin a new data sheet and indicate page numbers.
5. Place all captured organisms into the holding bucket.
 - If the trap is empty, write “Empty” in the “Notes” section and skip to step 9.
6. For each individual crab, record the following:
 - a. Species: use ID card, but if the crab is not easily identified, photograph it (see step 7).
 - b. Size: width in millimeters (mm) at widest part of carapace (“back” or “top” shell)
 - c. Sex: abdominal flap is pointed in males, rounded in females (Figure 2)
 - d. Photo number (if applicable; see step 7)
7. If a crab is not easily identified, *but you are certain* it is **not** an European green crab:
 - a. Place it in the provided photo box along with a laminated photo number (begin with “1,” and so on as necessary).
 - b. Frame the view with the box edges and take the photograph.
 - c. Record the photo number on the data sheet along with the crab’s size/sex info.
8. **If you suspect an European green crab**, place it in the Tupperware container, secure the lid, and either return it immediately to KBRR (226-4658) or place it in a freezer until it can be picked up by KBRR personnel. Release all other organisms.
9. If you plan to sample the following 24-hour period, re-bait the mesh and minnow traps. If not, close the pit traps by securing the lids tightly.
10. Return data sheets to KBRR (Judy Hamilton, 226-4658) at the Alaska Islands and Ocean Visitor Center, 95 Sterling Highway, Homer, AK 99603.

**Invasive Green Crab Monitoring Project
Data Sheet**

Date: _____ **Site name:** _____ **Stake number:** 1 2 3 4 5 6 7 8

Record keeper: _____ **Trap type:** Folding Minnow Pit

Observers: _____

Camera number: _____ **Number of photographs taken:** _____ **Start time:** _____ am / pm **End time:** _____ am / pm

Species	Size (mm)	Sex (F, M, U)	Photo Number
<i>Telmessus cheiragonus</i> , the helmet or horse crab			
<i>Cancer oregonensis</i> , the pygmy cancer crab			
<i>Cancer magister</i> , the Dungeness crab			

Notes: