**Crayfish Project**

**Lake Roosevelt National Recreation Area**

**Field Study**

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**Subject:** Science

**Grade Level:** 9-12

**Purpose:** Students will have an opportunity for a place based educational field study in a National Recreation Area. By being part of a study that is within the boundaries of the park, as well as within their local community, it will provide a connection for students to “place”. Giving students the power of monitoring an invasive species will hopefully encourage them to be environmentally conscious in the future.

**Timeline:** 1-2 days

**Overarching question:** How are the invasive crayfish species affecting the population and habitat of the native crayfish?

**Materials:** Trap sampling protocol – run off for each group; traps, buoys, cat food, tool to punch holes in cat food can, and all other materials on protocol list; garbage bag

**Lesson Plans:** Take students on field trip to Lake Roosevelt National Recreation Area to collect traps, gather data. (Unless you are taking students to set the traps on one field trip then having a field trip the next day to collect the traps, you will need to set the traps the afternoon before you want the students to collect them. I usually get volunteers to help me set the traps after school, then have the class collect them the next day.)

I have attached a Crayfish Sampling Protocol that you should use to set and collect traps. This protocol is one that we use for our crayfish survey and not all parts may pertain to you and your situations. Use the parts that work best for you or are legal in your state. (If you haven’t already done so, you may want to check the fishing regulations in your state for crayfishing rules.)

Things to consider:

* Before you leave the school, you will want to have students in groups and prepared for their duties once you get to the park. (Depending on the number of students you are taking to the park, you will want to invite parents to help chaperone if possible.)
* Students have had practice measuring and recording data, but have not set or pulled the traps.

(Depending on when you choose to go into the field, you could practice setting and retrieving traps in the school yard if you feel the need to.)

* You will want to include a garbage bag for cat food cans and any other garbage you may find at the park

**Materials:** “Crayfish May Help Restore Dirty Streams” article – run off for students, Crayfish project assessment – run off for students, assessment key

**Unit Assessment:** Invasive Crayfish Unit Assessment

**Next Generation Science Standards:**

* HS-LS2-1, HS-LS2-2, HS-LS-6, HS-LS2-7, HS-ETS1-1, HS-ETS1-3

**Common Core State Standards Connections:**

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| --- |
| * ELA/Literacy –WHST.9-12.2, RST.11-12.7, RST.11-12.8, RST.11-12.9
* Mathematics – HSS-IC.A.1, MP.2, MP.4
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**Crayfish Project Assessment**

1. How would you divide the crayfish up into parts if you were going to explain a crayfish to someone who has never seen a crayfish before? Why did you divide it this way?

2. Explain how a crayfish’s needs and anatomy are adapted to its environment. (Give at least two examples.)

3. Compare and contrast swimmerets and walking legs.

4. After reading the attached article, explain what you think would happen to the environment in the cage if you introduced a non-native crayfish into the caged off section of the creek containing native crayfish:

 Short term:

 Long term:

5. Explain why you think the above changes would happen.

6. Your job is to redesign a crayfish, what would you change and why?

**Crayfish Project Assessment - Key**

1. How would you divide the crayfish up into parts if you were going to explain a crayfish to someone who has never seen a crayfish before? Why did you divide it this way?

 **Answers will vary; most will likely divide into carapace (thorax), abdomen and tail**

 **Or like an insect: head, thorax and abdomen**

 **Reason for division should relate to body organization.**

2. Explain how a crayfish’s needs and anatomy are adapted to its environment. (Give at least two examples.)

 **Answers will vary, examples may include: tail for quick movement to avoid predators;**

 **Carapace very tough for protection; large claws for grasping food and fighting;**

 **2 part mouth for chewing plants and organisms, chitinous teeth for breaking food**

 **down even further; etc.**

3. Compare and contrast swimmerets and walking legs.

 **Walking legs are for movement and swimmerets move water for respiration and sperm for reproduction.**

**Walking legs aid in protection and finding and eating food, swimmerets hold eggs (female) for protection or females (male) for reproduction**

4. After reading the attached article, explain what you think would happen to the environment in the cage if you introduced a non-native crayfish into the caged off section of the creek containing a native crayfish:

**Short term: Fighting would take place between the 2 species of crayfish for food and habitat, native would probably lose habitat and have to move; possible decrease or matting of plant life**

**Long term: Drastic reduction in numbers of native crayfish, increase in numbers of invasive species crayfish; big reduction in plant life and very few if any macro- invertebrates remain.**

5. Explain why you think the above changes would happen.

**Short term: competition for food and habitat, invasive crayfish usually are more aggressive and have greater metabolism so will need more food**

**Long term: invasives will eat more plants, all of the macroinvertebrates and if needed the native crayfish**

6. Your job is to redesign a crayfish, what would you change and why?

**Answers will vary, but the redesign should have a good reason for the change (stronger, easier to get or digest food, etc.)**

**Trap Sampling Protocol**

**Setting**

1. Ensure all equipment needed is loaded in vehicle being used.
2. A minimum of two people must be present during sampling.
3. Teacher listed on WDFW Scientific Collection Permit must be on site for trap setting and retrieval.
4. Be sure to check weather and be dress appropriately while out in the field.
5. Navigate by vehicle and by foot to survey sites.
6. Prior to setting the trap;
	1. Determine location where trap will be set.
	2. Punch several small holes in the bottom of seafood flavored canned cat food.
	3. Place punctured can into trap, secure can to bottom with zip tie or carabiner and lock door.
	4. Attached buoy/buoy line to trap.
	5. Record Site Name on Lake Roosevelt River Mile Crayfish Site Data Sheet.
	6. Record Names of Collectors on data sheet.
	7. Record Date Set on data sheet.
	8. Record water temperature (C) on data sheet.
	9. Record air temperature (C) on data sheet.
	10. Circle Y or N for precipitation? on data sheet.
	11. Record bank condition on data sheet.
	12. Record bank substrate on data sheet.
7. Setting Traps
	1. Toss baited trap into water, **BE SURE you have a hold of the end of the buoy line!**
	2. Secure buoy line to shore.
	3. Record buoy number on data sheet.
	4. Record Time Set on data sheet.
	5. Record waypoint and GPS coordinates on data sheet.
8. Traps will be set within the sample location, depending on available habitat and distance from other sample sites.
9. Choose a central location to set traps and record the following on the Weather/Bank Data Sheet
	1. Current Weather Conditions
	2. Lakeshore Bank Type
10. Traps will be fished overnight and collected within 24 hours of set.
11. After all traps are set be sure to collect all equipment not set and return to vehicle.

**Pulling**

1. Ensure all equipment needed is loaded in vehicle being used.
2. A minimum of two people must be present during sampling.
3. Teacher listed on collection permit must be on site during trap retrieval.
4. Be sure to check weather and dress appropriately while out in the field
5. Navigate by vehicle and by foot to survey sites.
6. Pulling a trap
	1. Designate a recorder and measurer
	2. Pull traps and record data one at a time in the order they were set.
	3. Record Date Pulled on River Mile Crayfish Survey Trap Data Sheet.
	4. Pull in trap slowly to ensure you don’t lose crayfish, the trap or cut the line by accident.
	5. Once trap is on shore record Time Pulled on data sheet.
7. Unhook buoy line from trap and neatly wind back up and place into mesh bag

***NOTE:*** *A trap may get stuck; try your best to get it unstuck without getting into the water. If you are unsuccessful in bringing in the trap or if a trap is lost tell the Adult Leader who will get a trap to replace the one stuck or missing.*

1. Take Measurement using River Mile Crayfish Biological Data Sheet
	1. One at a time pull crayfish from trap
	2. Identify the Species using the key provided and record the species
	3. Identify and Record Gender of Crayfish; Male (M), Female (F)
	4. Measure & Record Carapace Length in Millimeters (mm)
	5. Measure & Record Total Length in mm (ensure Uropods are together)
	6. Measure & Record Weight to the nearest gram by placing in mesh bag and hanging from digital scale. Be sure to zero scale each time with bag attached before weighing crayfish.
2. Take a picture of the crayfish and record picture number on the data sheet.
3. Once all measurements are taken if the crayfish is the native species (Signal) take a picture and immediately return it to the water. If it is a non-native species take a picture and then place into bucket.
4. Continue steps 8-10 until all crayfish in trap are accounted for.
5. Record total number of crayfish from that trap for corresponding buoy number on the River Mile Crayfish Survey Trap Data Sheet.
6. Repeat steps 6-14 until all traps are pulled in and all data is collected.
7. If you are unsure of a species take several pictures of the species for later identification.

***NOTE:*** *The more pictures the better! Take pictures of the traps, the crayfish in the trap, the site… take pictures of anything and everything!*

1. All non-native crayfish now in the bucket will be placed into a plastic bag and set on ice and/or placed into a freezer to euthanize
2. Once crayfish have been euthanized it is the responsibility of the teacher to properly dispose of the crayfish.

***IMPORTANT: At NO time can any of the crayfish collected be kept as pets, or to be consumed. It is against the law to transport live crayfish, and it would be a violation of our scientific collection permit to use these crayfish for anything other than what the permit states. If at any time these rules are broken the student/s involved will be immediately banded from the project.***

**Field Supplies and Equipment**

1. Crayfish traps
2. Canned Cat Food
3. GPS
4. Thermometer
5. Field maps
6. Field data forms
7. Pencils
8. Measuring board/ruler
9. Digital scale and mesh bag
10. Digital camera
11. Waders
12. Cooler/Ice
13. Bucket
14. Crayfish identification keys
15. Sampling permits
16. **Data Analyses and Reporting**

After data is collected from a site the electronic copies of the data sheets must be made and saved, they must also be emailed to the Lake Roosevelt Biologist (contact information provided below). Once electronic copies are made the original data sheets will be placed into the Lake Roosevelt National Recreation Area Crayfish Inventory & Monitoring Study binder.

You may want to report your findings to a local agency or post your information on iNaturalist website. <http://www.inaturalist.org/>

The website is easy to navigate and post your findings!

Adapted from document written by Meghan Lyons, NPS biologist and Janice Elvidge, NPS Educational Specialist

**Crayfish may help restore dirty streams**

**Crayfish may benefit insects, reduce sediment settling in impaired streams**

Date: April 21, 2016 Source: Stroud Water Research Center

While macroinvertebrates are a tasty food source for crayfish, a new study reveals a surprising finding: When crayfish were present in in-stream experimental enclosures, macroinvertebrate density was higher, not lower.

Stroud Water Research Center's lead fluvial geomorphologist Melinda Daniels, Ph.D., and Lindsey Albertson, Ph.D., a postdoctoral researcher and ecology professor from Montana State University, conducted the study in Valley Creek. The creek is an urbanized and degraded tributary of the Schuylkill River in King of Prussia -- a Philadelphia suburb.

The scientists placed wire-mesh enclosures, some with crayfish inside and some without, in the creek. At the conclusion of the 2-week experiment, populations of macroinvertebrates such as caddisflies, which can indicate better water quality, were higher in the crayfish enclosures despite being a food source for crayfish. The crayfish enclosures also featured reduced settling of fine sediment pollution on the surface of the streambed. As the crayfish disturbed the rock and gravel bottom with their claws, they agitated and increased suspension of fine sediments, presumably allowing more sediments to flow downstream.

"We were surprised," Albertson admitted. "We thought the crayfish would eat the macroinvertebrates and reduce their populations, but we found the opposite. Macroinvertebrate density was higher in the crayfish enclosures. So even if the crayfish were eating some of the macroinvertebrates, we think that all of the fine sediment that had been suspended and washed away created a more macroinvertebrate-friendly habitat."

Many macroinvertebrates don't like to live in streams with high sediment loads. It's a type of pollution that degrades freshwater streams and can be traced to land-use changes like agriculture and development.

Daniels said, "Crayfish show the potential to alleviate some of the problems seen in impaired streams. Every organism has its part in an ecosystem, and we're still learning what the individual roles are."

Stroud Water Research Center. "Crayfish may help restore dirty streams: Crayfish may benefit insects, reduce sediment settling in impaired streams." ScienceDaily. ScienceDaily, 21 April 2016. <www.sciencedaily.com/releases/2016/04/160421085228.htm>.