Intertidal Field Trip How-To Guide

Planning

Number of Field Trips

If at all possible, take your students on at least two trips. More than one trip also allows students to ease their way into surveying. Students need the first trip to become familiar with the environment, the sampling design and methodology, and be exposed to the species in the area. If the first trip is allowed to be more exploratory, on the second trip students will be in a position to take more accurate data. On the first trip, consider a species richness search (with organisms identification) or giving out a list of common species at the site with space for student to write in their identifications, descriptions, and to draw pictures to create their own personalized identification sheets. If you are unable to go on multiple field trips, plan to spend more time in the classroom practicing sampling techniques. If scheduling a trip during the week is prohibitive, consider offering an optional Saturday trip.

Choosing an Intertidal Site

Some general criteria:

- Is the site safe? Sites with steep drop-offs close to shore or big waves year round would be avoided. However, a site that is inappropriate in the winter due to high waves may calm and placid by spring.
- Is the site nearby? A site that is nearby may be more engaging to the students, since it is part of their local environment.
- Is the site accessible? There should be any long, arduous, steep treks from the bus to the intertidal (and bathrooms nearby are always nice!). Remember that some of the most accessible sites may be very popular, and thus may be degraded.
- Is the site a rocky area? Good intertidal sites to survey are dominated by rocks or a bench (but can have some sand too). Sandy beaches have less diversity in the intertidal because the shifting substrate does not allow much to adhere to the bottom. However, the site should not be composed of only huge boulders either or it will be very difficult to survey.
- How big is the site? The site should be wide enough to accommodate at least five transect groups spaced approximately 2 m apart (10 m wide). The site should also be at least 10 m long. Thus, a transect should extend at least 10m through the intertidal. The 10m mark should end in a still-shallow area (no deeper than knee-deep water). Of course, the shallow water can go on for much further than this.
- Is the site diverse? Are there different types of algae? Are there hiding places for organisms? A yes these questions means the site will be interesting. While less diverse sites are important to survey as well, just checking off "rock, sand, rock, sand, etc." on data sheets can get boring.

It is *very* important to check out the site on a similar low tide level as your field trip(s). Some great locations will be covered by water and missed if you only see them at high

tide. Take some pictures of the site to share with your students and look for organisms. Try to identify the most common species. Determine exactly where the transects will be laid and how long they should be, and anticipate any safety and logistical issues.

Field Trip Date(s)
Field trips need to be planned around low tides. Tidal level is determined mainly by the relative positions of the earth, sun, and moon, and is influenced by other factors like ocean floor topography. Tidal heights are written as negative and positive numbers indicating the magnitude of the tide. In Hawaii the difference between high and low tides is about 1 m (3 feet). We do not recommend scheduling field trip on low tides higher than 0.0. The more negative the tide, the better the field trip as more intertidal area will be exposed. However, large swells can make some sites inaccessible even at negative tidal heights. Most of the negative tidal heights during daylight hours occur in the spring in Hawaii.

To determine the best time to go into the intertidal, consult a tide table. Tidal calendars are sold at most drug stores (e.g. Longs) and stores than sell fishing supplies. The best tide website is NOAA's Tides and Current. Most tide tables have a section at the beginning explaining how to read them. Most of them write the tide in feet. Some tidal charts are for a particular site, like Honolulu, and thus a correction value is needed to determine the time of low tide for other areas, such as the North Shore. If no correction value is listed for your intertidal site, assume the tides will be similar to the closest given correction location or average the correction values given for two locations on either side of your site. Some websites allow you to choose locations around the island without having to factor in correction values.

You want to aim to schedule your field trip to straddle the low tide. Within an hour after low tide, a site can be covered by water. For instance, if the low tide is at 10am, you would ideally have a field trip from 9 to 11am. Using tide tables to plan for optimal times to go on a field trip is an important part of planning and one in which your students can take an active role. Determining the best time for a field trip can introduce or reinforce the concept of tides and chart reading skills.

Length of Field trip
The length of your field trip will depend on your goals, the amount of time you have to spend at the site, and the tide. In general, the time required to survey the intertidal is between an hour and a half and two hours. You will need to factor in time at the beginning and end of the trip to get situated, change shoes, and walk to the site. It is also helpful to debrief (with snacks!) at the site at the end of the trip. These tasks generally add approximately 15-30min to the field trips time, thus the total amount of time at the intertidal site should be about two and a half hours. Time travel to and from a site should also be considered. If your school's schedule limits the time you have for field trips, concentrate on surveying nearby sites.

Number of Students and chaperones

Avoid trampling the intertidal zone! Some research has shown that large groups of students in the intertidal zone can be harmful to the organisms. We recommend groups of 30 or less. The Hawaii state Department of Education requires a certain chaperone ratio based on the age of the students, check the requirements for your grade level.

Sampling Protocol

You can develop your own sampling protocol, your class can develop a sampling protocol (in groups or as a class), or you can follow standardized citizen science protocols. Following a standardized protocol, either a citizen science one or one you developed and have your class adhere to, allows comparisons to other sites and over time.

A combination of focused and open-ended activities is the best way to make the trip effective in terms of learning. You want the students to focus, and may have a specific data-collection goal, but ideally you also want students to make their own observations and discoveries and come up with their own questions.

Classroom Preparation

Spend the time to prepare your students for the field trip and make it meaningful. The trip should be part of your class objectives, building on prior activities and leading to future lessons.

Practice the sampling methods that will be used in the field. If possible, let your students practice many methods and then choose what method(s) they will use in the field based on their questions. Spend time on learning and identifying the most common organisms at your site before you go into the field.

Species Identification

You students will most likely to identifying species they are not familiar with. Species can be identified with field guides, online resources, and identification (ID) cards. Encourage students to use the scientific name when learning and recording the species. Keep in mind many of the species found at a site may not be on the ID cards or in books. Species that cannot be identified in the field should be richly described and photographed for later identification. Encourage groups to ask each other if they are unsure about a species' identification, pooling knowledge leads to much more accurate identifications.

The top of the data sheet…

The first thing students should do in their group is fill out the top of their data sheet(s) with their names and other identifying information, like their transect number and the field site. This is an important step that is often overlooked in the excitement of setting up.

Transect Lines

A common intertidal sampling scheme to capture zonation requires transect lines to be laid perpendicularly to the coastline. If student groups will be assigned a line to survey,

the students can lay out the transect lines themselves. Lay the lines as straight as possible and maintain equal spacing between groups (generally about 2 m). The "0" mark should be in the water. Common end points for intertidal sampling include the high tide level, coastal plants, or a set distance – e.g. 10 or 20 m, onto the coast. If you use the high tide mark as your endpoint, and because field trips are scheduled around low tides, you will have to help your students determine where the high tide level is by looking for pools of water, exposed intertidal organisms and algae, compacted sand, or a line of marine debris (e.g. drift algae, sticks, shells) that mark the highest point to which the ocean rises.

The total length of transect laid out will depend on the size of the intertidal site. The Hawaii state Department of Education does not allow public school students to get wet past their knees. Thus, your transects cannot extend into an area that is too deep. You are responsible to knowing how far the transect lines should extend into the water based on prior visits to the site. All the transect lines should extend the same length.

Work your way into or out of the water depending on the tide (e.g. if the tide is coming in, you'll want your class to start at the deepest point on the transect). Remember to check a tide chart so you know if the tide is rising or falling when you arrive at the site and so you can direct the direction in which your students sample.

Quadrats

The number of quadrats your students survey will depend on your protocol, which quadrat method(s) you are using, the time frame of your field trip, how well your students know the species at the site, and how quickly you think your students will be able to complete the data collection. If your students are using quadrats to sample biological abundance, 10 quadrats per transect is a good number to aim for. The more quadrat points, the larger an area of the intertidal will have been intensively monitored, and thus the more accurate the data. Quadrats should be placed along the transect at any standardized distance (e.g. every 1 m, 2 m, 5 m, etc.) depending on the size of your study site and your sampling scheme. When using quadrats, it is important to spot-check student data sheets to ensure students are adding up their percent cover or point count numbers. This should be stressed and practiced in the classroom before the field trip. This is an especially important data verification step in the field that students should perform on their own before moving onto the next quadrat.

Species Richness

If your students are performing a species richness search and you want to compare the number of species found between sites or over time, the search should be timed and the number of participants noted in order to allow comparisons of species richness between sites.

Safety

Having students come up with their own safety rules gets them thinking about potential safety issues, and should help with adherence. You can always bring up issues that

students might not think of themselves. For example, many classes routinely forget to bring up raincoats for inclement weather. Discuss as a class what consequences there should be for breaking safety rules. When students are involved in the planning process, discipline issues related to safety tend to be minimal. Students, co-teachers, and chaperones should know what the rules are and what the consequences will be for violating them.

In process of discussing safety issues, students may conduct background research on the hazards of visiting the intertidal ecosystem (e.g. wet slippery environment, waves), and the specific hazards presented by different organisms. Students can then be responsible for identifying items that need to be in the first-aid kit brought on the trip

Again, with student involvement, discuss appropriate clothing, sun protection, and the need for water. You and your students should also discuss conservation techniques to use in the field, such as handling organisms gently and returning organisms to where they were found, and turning rocks back to their original positions. On site, point out potential hazards and remind students of safety rules.

Sample Safety Guidelines (written by students at the University Lab School):

1. Algae and seawater make the rocks slippery. Be careful walking around. No running.
2. Watch the waves; be aware of your surroundings. Never turn your back on the ocean.
3. Do not go into the water more than knee deep. (*This is a DOE regulation for HI public schools*)
4. Be aware of the dangers presented by marine organisms:
    - Sponges, fireworms, hydroids and some zoanthids can sting and irritate skin – wear gloves or use nets when handling these animals.
    - Oysters, crabs, mantis shrimp, octopi, sea urchins and moray eels can cause injuries – do not stick your hand into a hole if you don't know what is there, and handle all marine organisms with caution.
5. If you turn over a rock, make sure you put it back the way that you found it.
6. Don't leave any trash behind. If you see trash that someone else has left, pick it up.
7. Respect your colleagues, and the environment.
8. Be prepared for our trip. This is what you'll need:
    - clothes that can get wet and dirty
    - sturdy, close-toed shoes for walking around on rocks (reefwalkers, tabis, or old sneakers)
    - sunscreen and a hat
    - snacks and a drink
    - a good attitude!

These safety guidelines can be incorporated into a student-generated field trip contract

encompassing safety issues and safety rules to be signed by the student and a parent or guardian. When getting parent permission, make sure to collect student emergency contact numbers and medication information. Remember to research where the nearest medical facility is located.

In the Field

Classroom Field Management

The best way to approach field classroom management is to prepare in your classroom.

- Have clearly defined goals for the field trip that are understood by your students.
- Plan on spending the class before the field trip reviewing details and logistics.
- Have you students be part of the planning process, from choosing the location, the date, and the data sheets.
- Have students generate safety guidelines
- Have the students prep field equipment as a class the day before the trip.

Dividing students into teams of 3-5 before the trip and assign agreed-on roles to each team member. In the field, be clear that each group is assigned a transect and must stay along their transect. This ensures students say within safe, designated areas. Be prepared for student groups to end at different times and have expectations for groups that end early as well as slower groups.

Conservation

It is important to make students aware of their impact on the intertidal. The goal is for your class to minimize their environmental footprint.
Intertidal Etiquette:

- Avoid stepping on invertebrates and algae whenever possible
- When holding organisms out of the water, keep them wet
- Replace rocks to *exactly* the same position as you found them
- Return animals to where you found them
- Limit the number of students you take on a field trip to approximately 30
- Do not leave any trash at the site

At the end of a field trip, it is important to have your students look back at the intertidal site and *see* their impact and the changes they have caused in the ecosystem. For instance, sand will now be compacted, rocks will have moved, and algae will have been compressed. Use this opportunity to tell your students to make this experience, and their inadvertent impacts to the intertidal, count.

Handling Intertidal Organisms

Many intertidal organisms are safe to handle. They can be held in your hand for a limited period of time (as intertidal organisms, they are used to being exposed to the air). It is important that the organisms stay wet and that you handle them gently. This entails holding organisms in the palm of your hand and not pinching, squeezing, or dangling them. Remind your students to treat the creatures with respect. Research and point out the hazardous ones students should not handle prior to the field trip.

If you have containers to temporarily place organisms in for the duration of the field trip, keep the organisms from overheating and the water from becoming anoxic by periodically having your students exchange the warmer container water for fresh ocean water and keeping the buckets in the shade (or covering them so they are shaded). When placing organisms back in the water, try to return them to their original location. Have your students return organisms to the same distance from shore as where they were captured (for instance, a crab found in knee-deep water should be returned to the same depth). Other organisms depend on the shade and protection given by rocks and should be returned to them if removed, for example brittle stars will appreciate being put back near, or under, a rock.

Extensions

Post-trip activities are a way for students to connect their direct experience into bigger topics and think of the field trip as an integral part of what they are learning, rather than as an add-ons that took away from classroom time. The following are examples of some extension activities.

- *Analyze data.* Have student analyze, infer, represent, and communicate their findings. Students can do this in traditional ways, such as a lab or oral report, but can also make posters, teach the intertidal ecosystem to younger students, or invite parents to a symposium (see other suggested assessments below).
- *Food web creation.* Students select an organism that they have seen in the intertidal zone and research what it eats and what eats it. They write this information on an index card color-coded by trophic level. The entire class constructs a food web by placing their organism on a bulletin board with string arrows indicating the direction of energy flows. By removing one or two organisms from the web, the class can see how drastically the rest of the organisms are affected.
- *Interaction web*. This is similar to the food web, but illustrates ecological interactions such as competition, predation, facilitation, commensalism, etc., between organisms. In this case, add pluses or minuses or zeros near the organism's name to the arrows to indicate whether organisms benefit or harm or neither harm nor benefit each other.
- *Threats to Biodiversity*. Referring back to your community food and interaction webs and hypothesize and model what would happen if one of the threats to biodiversity impacts even one of the organisms in your web. What will happen to the others?
- *Cultural Survey*. As a related social science project, students can create a questionnaire and ask friends, family members and neighbors about how coastal resources were used in the past. The questions can include what kind of organisms were collected, how, in what quantities and when, as well as how things may have changed over time in order to gauge human use and impacts. This can lead into investigations of cultural uses of different organisms that the students have examined within the scope of their project. They may wish to

investigate or debate issues such as harvesting or development facing an area or species.

- *Creative writing*. You can have your students read passages from fiction and non-fiction literary works that relate to the intertidal such as John Steinbeck's Cannery Row. They can then create their own descriptive paragraph about an organism they have studied. You can ask them specifically to use metaphors and similes to describe the appearance, movement and character of the plant or animal. You can also write poems, haikus, and creative stories (e.g. day-in-the-life journal article) about organisms. They may write newspaper articles or columns about their work, either for submission to a local paper or for their own class publication.
    - Some Literary Works about the Sea:
        - The Sea Around Us by Rachel Carson
        - Waiting for Aphrodite, by Sue Hubbel
        - American Sea Writing, edited by Nathanial Philbrick
        - The Log of the Sea of Cortez by John Steinbeck
        - Cannery Row by John Steinbeck
- *Visual art*. Students can document organisms they find by taking photographs. These photographs can be used as the basis for drawings, paintings, or sculpture that creatively explore the organism. Visual art of species can teach basic concepts of color and visual design within the context of the scientific project that the students are engaged in. To place artistic expression in a practical context students might produce graphically designed products like posters, brochures, or even websites. These projects also emphasize technologic and computer literacy skills.

Suggested Assessment

- *Scientific reports*. When writing scientific "lab" reports, students must practice their writing skills. Although content is often emphasized over style in scientific writing, this can still be a good opportunity for students to practice style, composition, spelling, and grammar. Students can compare data from different sites and from the same site over different years. Lab reports should include descriptive titles, an introduction (e.g. about Hawaiian intertidal ecosystem, intertidal organisms, adaptations, about sites, etc.), a hypothesis, materials and methods, data and observations (including graphs and graph interpretations), results discussion and conclusion (did results support your hypothesis? Why or why not? Include ideas for further research). Sources should be cited in a works cited page.
- *Poster or Webpage*. Have students design posters that summarize what they've done in the project. The posters should not only give an overview of the project and describe the goals, methods, and site(s) but also incorporate pictures, text, and drawings or other media, to make the poster eye-catching and visually pleasing. Encourage students to explain why they found what they did by analyzing the data and making a graph or chart. Students should also describe things that did and did not work, explain why they did or did not work, and make

suggestions for what you could do to improve this project were it to continue. In general, the poster should answer the question "Did you accomplish your goals?"

- *Creation of a field guide or brochure*. In small groups, students study existing field guides and identify what is useful and what is not. As a class, they discuss what they would like to put in a field guide. Each student thoroughly researches and writes about one or two organisms. You can make an online field guide as a class project or a lower-tech paper version, both of which can be used by next year's class and shared with the community.