Island Monitoring Task Force
Three-year Pilot Project 2004-2006

Methods Manual

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Island Monitoring Task Force
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METHODS MANUAL
Monitoring Recreation Impact on Islands

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Please Note: This document is to be used in conjunction with the *Island Monitoring Task Force Final Report.* Please refer to that document for an overview of the Island Monitoring Task Force's three year pilot project, including project background and recommendations for future monitoring. Please refer to each island's separate hard-copy binders and digital files for all field and GIS data, maps, and photos.

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Methods Manual Content

This document, *Methods Manual: Monitoring Recreation Impact on Islands* (hereafter referred to as *Methods Manual),* is a companion document to be used in conjunction with the *Island Monitoring Task Force Final Repor* (hereafter referred to as *Final Report).*

Please refer to the *Final Report* for an overview of the Island Monitoring Task Force's three year pilot project, including project background and recommendations for future monitoring.

Given that a monitoring program is basically obsolete without subsequent years of monitoring that can be compared to baseline data, the goal of this *Methods Manual* is to provide as much information as possible to replicate both field methods and GIS lab work.

Therefore this *Methods Manual* contains two major parts:

1. **Field Methods:** including hands-on descriptions for how to replicate the field methodologies used during the three year pilot phase.
2. **GIS Methods:** detailed descriptions on how field data were processed and loaded into a GIS database for the purpose of creating maps and analyzing data.

Please note that before the instructions and pathways contained in this manual are used, it is important that monitors read the *Final Report* and endeavor to address many of the recommendations related to improving future field methods. These can be found starting on page 16 of the *Final Report.*

Field Methods Overview

Please refer to the *Final Report* for an in depth discussion on methodological approach to this project, including information about baseline inventories in an island's terrestrial, shoreline and intertidal zones, and a discussion about the use of condition classes in the field. This information will help provide important context before venturing in the field for the purpose of monitoring recreational impact.

I) Methods included in this manual are the following:

- **Field Mapping and GPS:** Sketch maps (prepared ahead of time and used in the field) are an important component of every method outlined below. In addition, some line and point data can be collected with GPS, such as high and low tide lines (though accuracy will depend primarily on the GPS unit used).
- **Survey checklist:** This is an initial island-wide description of perimeter and shoreline attributes obtained by circumnavigating the island (or the extended use area if the island is too big, such as Long Island). Using a map, changes in the islands characteristics are noted as sections. Each section is categorized for a series of attributes such as landability, substrate/habitat type, dominant species, areas of concern, etc. Back in the lab, this data is incorporated into the GIS.
- **Campsite Monitoring:** This methodology has been adapted from (and heavily relies on) Jeff Marion's *Developing a Natural Resource Inventory and Monitoring Program for Visitor Impacts on Recreation Sites: a Procedural Manual."* Monitoring parameters include: measuring/mapping campsite boundary (radial transect method), fixed-point photography, areas of special concern, inventory indicators, and impact indicators including condition class, vegetative ground cover, exposed soil, tree canopy cover, tree damage, and root exposure.
- **Trails Monitoring:** Adapted in part from Acadia National Park's use of trail-based condition classes, and modified for the purpose of monitoring island trails, including mapping trail location and function, assigning a condition class to trails where they intersect with the high tide line (access points) and "in to three meters," and in some cases, interior trails as well.
- **Shoreline Monitoring:** With the mapping method initially adapted from Canada's Department of Fisheries and Oceans *Shorekeepers Guide*, this includes using a shoreline transect to systematically photograph and map shoreline use areas. Additionally, indicators such as root exposure and vegetation trampling, and condition class are also used.
- **Intertidal Monitoring:** Adapted from several sources including: Canada's Department of Fisheries and Oceans *Shorekeepers Guide*, Brosnan and Crumine's Intertidal Trampling studies, and Murray et al.'s *Methods for Performing Monitoring, Impact, and Ecological Studies on Rocky Shores*,, and other resources including recommendations by Maine-based and other intertidal experts. Focusing on use area, this method includes intertidal transects to systematically inventory percent cover of abundant species, rapid low-tide searches, assessing/mapping barnacle hummocks, and aging ascophyllum.
- **Photo Transect Method:** This method is used when there is simply a need for fixed-point photography as the only method for documenting an island's particular area or features. Though these photo points can be mapped, mapping and measuring are not specific objectives of this methodology.

II) Each method description includes four sections:

1. Introduction: The introduction describes what monitoring needs are being met by that method, how the Task Force came to use this particular method including sources, and any other background information that will make actually using the method more practical for the next round of monitoring.

2. How To: This section describes in a detailed, step by step format literally "how to" apply the method and its accompanying data sheet. The intent is to provide future monitors with all the information they need to actually conduct the field protocol.
3. Materials Needed: This is a list of all the materials needed to implement this method while in the field, basically a packing list specific to that method.
4. Method Data Sheet: Each of the seven monitoring methods has its own field monitoring data sheet (all of which are included as a group at the end of the field methods descriptions). Though these data sheets should be ready to photocopy as needed for future field work, they would benefit from a review before heading into the field; see reminder below. [Note: Over the course of the pilot phase, datasheets were constantly being improved from one field trip to the next. This explains why the data sheets found in the island's individual reports may slightly differ from the blanks included here.]

Reminder: **before the instructions contained in this manual are used, it is important that monitors read the *Final Report* and endeavor to address many of the recommendations related to improving future field methods. These can be found starting on page 16 of the *Final Report.***

III) A Note about "Leave No Trace" Monitoring

Visitors to Maine's islands are all encouraged to practice Leave No Trace, a well established series of ethics on how to leave the smallest possible impact on the places visited. Leave No Trace education has had a significant positive effect on the behavior of island users, the end result being decreased impact on island environments.

People involved in monitoring recreational impact on islands can themselves impact island environments. Field methods often require extensive amounts of time in small areas. For example, the campsite radial transect method requires a fair bit of foot traffic throughout the campsite area, thereby contributing to the potential trampling of that area. Or if the monitoring team needs to spend several nights camping on an island in order to complete field work, their own travel to and from the campsite can contribute to shoreline erosion or other impact issues.

It is safe to assume that island monitors, much like recreational island visitors, would choose to practice Leave No Trace as they are busy traveling throughout the island environment to monitor impacts, but not all involved in island monitoring have necessarily been exposed to the latest Leave No Trace ethics for the islands. For this reason, the seven principles of Leave No Trace are listed below with, in some instances, with a bit of commentary on how these might apply specifically to people involved in field work.

1. Plan ahead and prepare. Make a plan ahead of time for how you will achieve all of the monitoring goals for the island with minimal traffic throughout the island's environmental zones. For example, plan out how to deal with low tide constraints to achieve the most possible work in the shortest amount of time.
2. Travel and camp on durable surfaces. As you conduct your field work, be aware of where you step. Avoid unnecessarily trampling vegetation or repeated travel up and down shoreline banks. If you need to set up camp, keep your monitoring materials close at hand to minimize your traffic to and from camp.
3. Dispose of waste properly.
4. Leave what you find.
5. Minimize campfire impacts—kindle no fires.
6. Respect wildlife.
7. Be considerate of others. Be aware that your presence may be preventing other island visitors from using the island (particularly small islands). Plan your monitoring visits accordingly. If you

do encounter other visitors, do feel free to tell them what you are up to. We have found that island users are curious about the work and might even offer to help!

Finally, field monitors should be sure to photograph and list on the data sheets any impacts incurred while monitoring.

The north campsite on Bangs Island suffered a bit of vegetation trampling as a result of monitoring.

Field Mapping and GPS

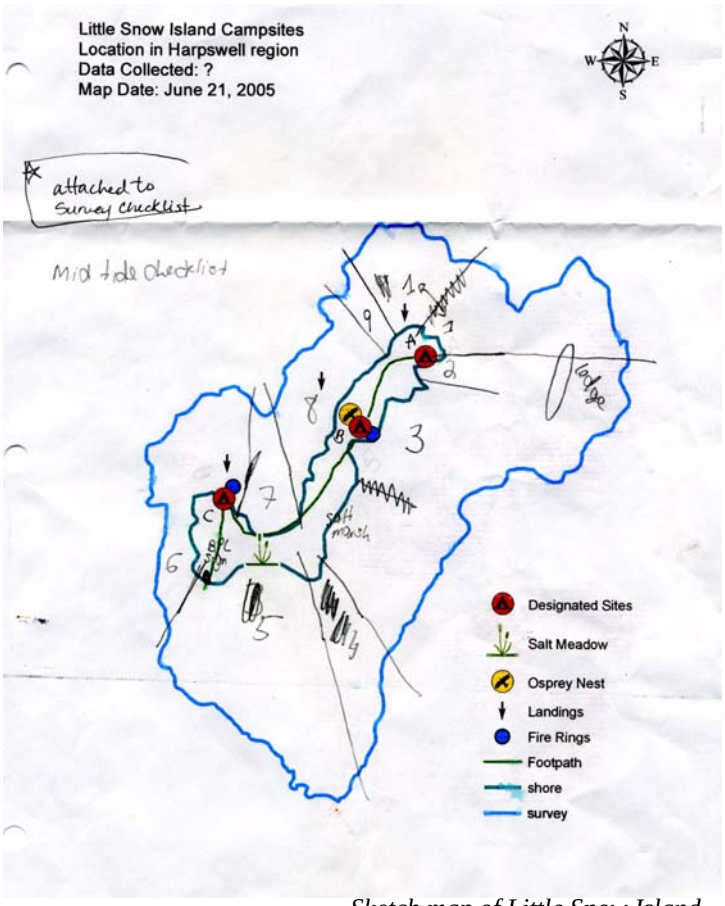
Introduction

Mapping is an important component of monitoring. Sketch maps and GPS are useful tools to rapidly track location data in the field, but each has its limitations. Sketch maps should be used consistently to keep track of where monitoring has been conducted as well as any other location data that might otherwise be missed. Information from sketch maps can be digitized to GIS maps to produce the most up to date layers about that island. For final maps to be accurate, however, they must be based on sketch maps that are complete and to scale. Similarly, GPS can collect location data such as points and lines, but there are limitations related to GPS accuracy that will be described below.

Preparing Sketch Maps for the Field

(Please refer to next section for technical GIS steps.)

Before traveling to any island for fieldwork, a basemap of the island should be created in GIS, using aerial photos and any other digital layers available. This base map will then be used for any sketch mapping conducted in the field. For the sake of accuracy and efficiency, it is important that this sketch map be printed from the digital base layers intended for all of the island's data processing, otherwise there is a risk of losing accuracy in transferring data from one to the other



Sketch map of Little Snow Island

This basemap should contain the following for the field sketch map:

- the island's low and high tide lines should be digitized using the aerial photos as a guide (in most cases, the high tide line serves as our primary island perimeter or outline);
- a north arrow;
- a scale;
- any features that are either designated or noted in the MITA *Handbook* (e.g. MITA campsite locations).

A printout of the base map is used in the field for multiple purposes as defined in several of the other methodologies in this report (such as ground-truthing the campsite location, and completing the low tide survey checklist). In addition, this basemap is a great place to add any location-specific information that should be documented but may not appear in any of the field methods, such as evidence of new campsite clearing or an osprey nest.

Global Positioning System (GPS)

GPS technology offers some great opportunities for gathering certain types of data such as points and lines. When a high end, professional mapping or survey-grade GPS system with sub-meter accuracy is

available (such as a Trimble with external antenna), a number of data can be reliably collected via GPS. However, at the time of this three-year project, such systems were beyond the budget of the project. Therefore, our protocol for using GPS is limited to hand held units which typically have 3-5 meter accuracy (we consistently used a *Garmin 76*).

[NOTE: Acadia National Park provided a high end Trimble and staff to use it for one day of field work on one island, Hell's Half Acre.]

Reliance on a hand held, recreation-grade GPS unit (like the Garmin 76) must be limited to features which do not depend on sub-meter accuracy, such as, for example when a meter makes a difference (which is the case for many of our methods). Do not depend on your hand held GPS for point-specific data, such as the center of a campsite, or the exact location of where an access trail enters the island from shore. Instead, limit the collection of point-specific data to that which will simply serve as a back up to your sketch map, or provide general information to help the GIS technician transfer data. That said there are certainly instances where GPS data is quite useful, such as described below, even if they are not within 3-5 meters.

Using GPS for Line Data

Any GPS data that is collected must be documented on the GIS Data Sheet. Start by filling out the general information, including: the date the GPS data are collected, the collectors name, which GPS unit is used (very important to determine accuracy), the island where field work is being conducted, cloud cover, and a specific description of what and where data are collected and their purpose (for example, is the area under a thick canopy cover). This last point can be expanded upon in the comment section for each data point or line. Before any GPS work is started, be sure to set your GPS unit to NAD 83 and UTM coordinates to maintain consistency with the baseline data.

Your sketch maps, as described above, should present high and low tide lines as drawn from aerial photos. The accuracy of those lines can be improved by walking the tide line with a GPS unit (set to collecting a line), then downloading the data and comparing the two versions. Usually, the GPS line will prove more accurate (even with a hand held unit) but the field worker and GIS technician should work together to make any judgment calls on final mapped island-perimeter lines.

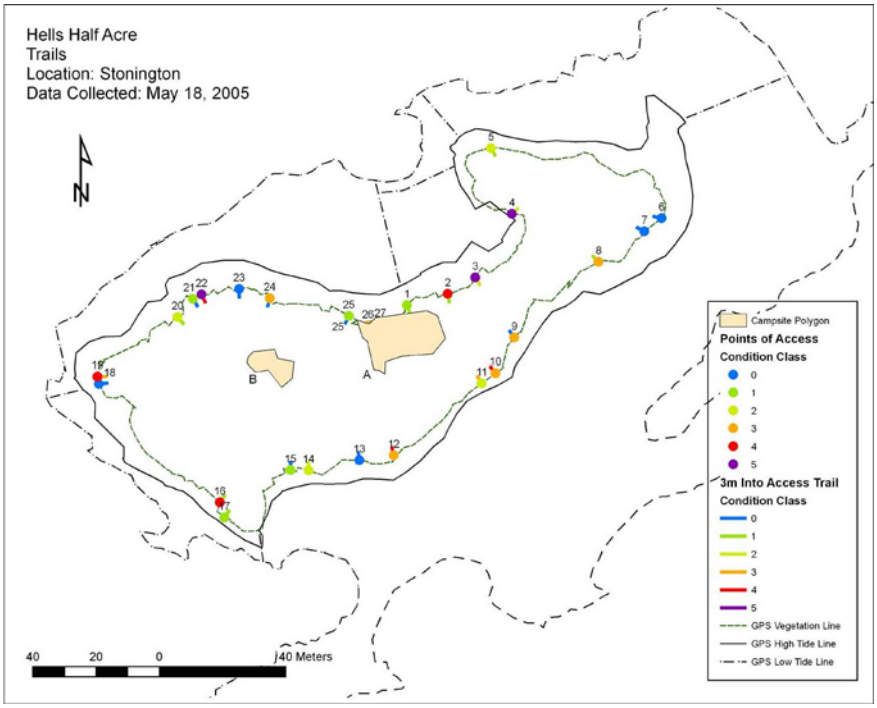
Start with the high and low tide lines first. If there is time, a mid-tide and vegetation line can be useful as well.

1. High tide: At the predicted time for mean high tide, walk along the water's edge with the GPS unit. Alternately, if you cannot be on the island exactly at high tide, walk the wrack line left behind by mean high tides (not the spring or higher high tide line). Back in the lab, this data can be entered into the GIS map and serve as the island's basic perimeter for any future mapping. Though this line is likely the most accurate perimeter that can be drawn for this island, it is important to remember that this is NOT a land-based vegetation line. This becomes important to note when mapping access trails (trails that enter the island's terrestrial zone from the shore). An access trail may cross the high tide line a good distance away from where it actually enters the terrestrial zone, lending some confusion to island maps that show trails crossing an island perimeter that is, in actuality, a high tide line. Where possible, surveyors should consider also walking an island's vegetation line.

2. Low tide: This line must be walked at low tide or it will get covered up by flooding water. While the surveyor walks this line with the GPS, he/she should also collect the final data on the survey checklist form (see next method), including the presence or absence of mussel beds, clam flats or eelgrass. This line is an important part of processing the intertidal data collected through that methodology.

3. Mid tide: If timing in the field permits, walk the water's edge at mid-tide. This will give the GIS mappers the line that was used during the survey checklist.

4. Vegetation line: As referenced above, a land-based vegetation line may prove useful for accurately mapping access trails and other terrestrial features on the shore. If it is possible collect this line using a GPS, but note that vegetation is constantly changing and affected by environmental factors. Also, remember that a recreation-grade GPS collects data with a 3-5 meter accuracy, so it is a judgment call on the part of the field surveyors as to whether the time spent collecting the vegetation line will provide data that are that much more useful than the high tide line. This may vary from one island to the next.



On Hell's Half Acre, GPS data (both line and point) was collected with a high end, sub-meter accuracy GPS unit, which is much more accurate than a hand-held.

5. Mapping trails: Some islands are criss-crossed with a network of trails that can, to some degree, be mapped using a recreation-grade GPS. Again, there is a judgment call to be made by the field workers. If the island is small, the downloaded trail data may be useless as it ends up all over the map and even off the map and in the water. For large islands, the hand held GPS may provide more useful island data. To make a decision, consider whether the trail network can more easily or accurately be drawn into the sketch map by hand, then digitized back in the lab (this is one instance where using the same base map in the field and in the lab will really help).

6. Other GPS Data: The GPS Data sheet provides space to document many other GPS points. You can use GPS to collect point data, such as a campsite center point, or transect line endpoints, but as mentioned above, the accuracy will depend on the unit used, thus it is up to the field staff's discretion to decide if this is worth the time.

Materials needed

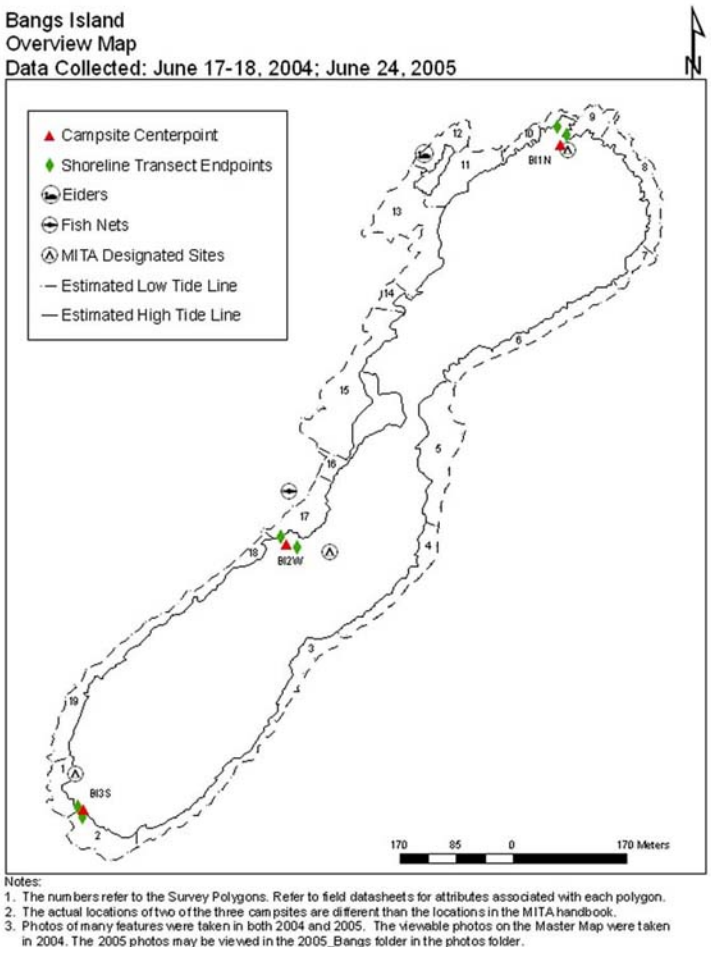
__ GPS set to NAD 83 and UTM coordinates (and extra batteries)
__ GPS Data Sheet
__ Survey checklist form (on "write in the rain" paper) for low-tide data
__ Paper copy of map or aerial photo prepared ahead of time (sketch map stapled to checklist)
__ Pencil, eraser and sharpener
__ Colored pencils
__ Clipboard

Initial Island-wide Survey

Introduction

The purpose of the "Survey Checklist" data sheet is to map the island's perimeter for dominant attributes (bedrock, ascophyllum, etc.), and areas of special concern (salt marsh plants, mussel beds, shoreline erosion, etc.). Surveyors are tracking island characteristics that can help managers determine both where most boats will land and what areas are most susceptible to human impact. This initial island-wide survey can help field staff prioritize monitoring while in the field, flag areas that need special attention (both for monitoring and management), and provide a baseline sketch of the character of the island from the water. This data is collected in such a format that it can then be transferred to a GIS database.

This survey is done at mid-tide based on the assumption that, on average, island visitors will be landing on the island sometime during the tide cycle between high and low tide (rather than exactly at high or low tide). Mid-tide provides the best average conditions on the shore that a visitor will seek to safely land a boat. Mid-tide also provides the surveyor with relative proximity to the bank area to note any shoreline and terrestrial concerns (for example, shoreline erosion). [Note: for some islands, you will find that the survey checklist was conducted at low tide before it became apparent that mid-tide would provide more reliable data representing average island users.]



Bangs Island survey sections. The numbered areas in the intertidal zone correspond to data collected using the "Survey Checklist."

While the majority of the rapid survey checklist should be done at mid-tide, there are, however, certain survey checklist features that can only be observed at or near low tide (such as mussel beds). These should be noted while the surveyor collects the low-tide GPS data.

How to:
This initial island-wide survey is a rapid assessment during which quick observations are documented on the "survey checklist" form and an accompanying field map or aerial photo. As much as possible given the tide, it should be one of the first things done by the island's surveyors.

Using a boat at mid-tide, circumnavigate the island (or the extended use area if the island is too big) while traveling slowly as close to shore as possible without hitting bottom. If a boat is not available, the mid-tide survey can be done on foot on an outgoing tide (avoid an incoming tide or you will lose some of the ground you are supposed to be assessing).

Visually delineate zones into substrate types (rocky, beach, marsh, mud flat). Label each stretch of substrate as a section on the attached map/aerial photo and assign it a section number, using the "survey checklist" form. Within each section, note presence, absence or details of the features defined on the form.

On the form, you will note that the columns on the far right are to be done at low tide only (or they will be covered with water and not visible). These columns should be completed separately while GPS data for low tide are collected.

Materials needed
__ Survey checklist form (on "write in the rain" paper)
__ Paper copy of map or aerial photo prepared ahead of time (sketch map stapled to checklist)
__ GPS set to NAD 83 and UTM coordinates (and extra batteries)
__ Pencil, eraser and sharpener
__ Clipboard
__ Boat

Campsite Monitoring

IMPORTANT NOTE: Our campsite monitoring methodology has been adapted from, and heavily relies on, methodology developed by Marion, Cole, Monz and others, but in particular, Dr. Jeffrey Marion's work through the USGS Patuxent Wildlife Research Center. Though Dr. Marion's methods were modified to fit the environment of Maine's islands, as well as the objectives of the island managers, the following reference served as the backbone of this work:

> Marion, Jeffrey L. 1991. *Developing a Natural Resource Inventory and Monitoring Program for Visitor Impacts on Recreation Sites: A Procedural Manual.* USDI, National Park Service, Natural Resources Report NPS/NRVT/NRR-91/06

This reference, hereafter referred to as the Marion manual, outlines much of the theory and practice behind monitoring campsite impact. The notes you find below apply the Marion methods to the island environment and outline the steps needed when using this project's campsite monitoring form. However, you should use these notes as a complement to the Marion manual or you will, in fact, lose much of the insight needed for field-based decisions.

Introduction

The location of an island's campsite(s) on the Maine Island Trail is usually, though not always, designated in the MITA *Handbook*. The exact shape, size and condition of that campsite, however, is subject to change over successive seasons of use. A campsite monitoring plan needs to effectively capture these details in order to document any changes that occur over time.

The list of potential human induced changes is long and could include: a growing campsite area, increased vegetation trampling, tree damage, fire scarring, and litter. For the purpose of the three year pilot project, the key indicators of campsite impact that were subject to monitoring were the ones described by island managers in the *Recreation Management Plan for the Public Islands on the Maine Island Trail, 2004-2014* (The Plan). These will be found in the methods overview below.

Our campsite monitoring methods combine three approaches to getting an overall picture of island conditions: fixed-point photography, standardized descriptions of indicators with rapid assessments (such as condition class and percent cover), and specific measurements.

How To

Bring the "Marion manual" with you to the field

The Campsite Monitoring Form that is included in this report and the descriptions below were created to apply the Marion methodology to the island environment; you will, therefore, find some details that are different than those in the Marion manual. That said, it is strongly recommended that you familiarize yourself with the Marion manual, and in fact, bring it in the field with you the first few times you monitor campsites as you will need to refer to it at several steps of the way. The amount of detail provided below is deliberately simplified, based on the assumption that you use Marion's manual for details.

Flagging the campsite boundary:

The first step in monitoring a campsite is to mark the boundaries of that site. This enables a quick visual reference for all remaining fieldwork such as photography and inventory descriptions, and provides specific boundaries needed for all site measurements. [The campsite monitoring method adopted for this project is known as the **Variable Radial Transect Method** and is described extensively in the Marion manual.]

The basic criterion for flagging the campsite boundary on an island is to judge where you believe that 90% or more of the users of this site will or have camped, as judged by evidence of campsite use and environmental conditions that lend themselves to camping (i.e. no rocks, reasonably flat etc). Walk the visual boundary of the camping area and place a flag at locations where the angle of the site boundary line changes. Using no more than 15 flags in creating the overall campsite boundary, you should end up with a polygon within which you estimate that more than 90% of the visitors will camp.

In the picture above, Campsite E on Steve's Island has flags marking its boundary. The white line in the center is the tape measure used to measure distance to each flag.

Using the "Campsite Monitoring Form"

I) General Campsite Information

Island Name:

Campsite Location: Where on the island is this campsite located, does the campsite have a specific name (For example: Campsite A)

Campsite tag #: Identify the spot you will be using as the campsite center point. (this will become the center of all your measurements in subsequent steps. It does not need to be exactly the center of the campsite). Write the campsite name (HHA site A, for Hell's Half Acre Campsite A) on the aluminum tag, attach it to the steel stake and place the stake into the soil at the center point, leaving it stick out so you can later attach the tape measure to it. When you are totally done monitoring this campsite, pound the stake with tag into the ground so it can be relocated in future years of monitoring.

Site Type: Record who owns and/or manages this site (for example, MITA, Acadia National Park etc)

Campsite Capacity: Record if there is a maximum capacity for numbers of campers (for example, campsite capacity: 8 people and/or 4 tents)

GPS Coordinates: of the campsite center point.

Date: Record month, date(s) and year campsite was monitored.

Inventoried by: include all involved.

II) Describe location of site so others could find it. Locate and label site on map.

III) Campsite Photos: Now that the campsite boundaries and center point have been flagged, take photos that will show the overall campsite and adjoining areas. Be sure to log bearings and distances from center point to photographer so that future photos may be taken from the same places with the same views. The purpose is to get overall visuals of the camping area, from several different angles. Be as descriptive as possible in the labeling of photos on the field form.

IV) Campsite Reference (Triangulation) Points: The goal is to identify three points that can be used in the future to re-locate the campsite center point through triangulation. Identify three prominent and reasonably permanent features in the area (for example, a large glacial erratic on the shore, a healthy spruce tree with a distinctive boil, or a distinctive geological feature such as basalt intrusions in a granite ledge). The features should be in opposing direction to enable triangulation, and need not be within the campsite boundary. Take a photo of each triangulation feature from the campsite center point. Take a compass bearing to each triangulation point from the center point and measure the distance to the feature

(for example, tallest part of largest boulder). In the case of trees or boulders, measure the approximate diameter of the feature, and describe it.

V) Center point information and photos: This is intended as additional information to help relocate the center point in the future. Describe the location of the center point in as much detail as possible (for example, 0.5 meters east of tallest spruce tree, or at northern base of solitary round granite boulder). Take photos of the center point from various angles and describe photos and photographer's location.

VI) Inventory Indicators

Composition of Shoreline use area: in the area where most people will land and head up towards the campsite, what is the composition of the substrate between mean high tide line and the vegetation line below the campsite ("the shoreline zone"). List as B=bedrock C=cobble Sh=shell S=sand M=mud.

Composition at access onto island's terrestrial zone: This is just above the shoreline area and crossing into the terrestrial vegetation zone. List as B=bedrock C=cobble Sh=Shell S=sand M=Mud.

Width of apparent shoreline disturbance: in the area where most people will land and head up towards the campsite (the shoreline or bank area) what is the width of apparent shoreline disturbance. For example, it may be a 16 inch access trail, or it may be an eroded bank a meter wide or more.

Distance from nearest mean high tide to center point. This is necessary to correlate campsite data with shoreline data. (0=none, 1=<10m, 2=11-20m, 3=21-40m, 4=41-60m, 5=>60m)

Site visibility from water: Can you see this campsite when you are traveling on the water? Y/N
Number of other campsites visible: From this campsite, can you see other campsites on the island? On other islands?

Distance to nearest other campsite: How far is the nearest other campsite on this same island. (0=none, 1=<10m, 2=11-20m, 3=21-40m, 4=41-60m, 5=>60m)

Existing site development: Describe anything built like platforms, MITA signs, steps, etc.

Potential for unmanaged site expansion (describe as needed): Low/ Medium/ High (L, M, H)
Given environmental conditions in the area (slope, rocks, vegetation etc) how likely is it that this site will expand over time, assuming no management actions are taken? This is purely to comment on whether the physical space would allow for any expansion.

Site Slope: (L = <5%, M = 5-10%, S = >10%) What is the slope of the campsite itself. Use the following to estimate: Less than 5%: over 10', rise less than 6"; 5% to 10%: Over 10', rise more than 6" but not more than 1'; Greater than 10%, over 10', rise more than 1'.

VII) Impact Indicators

Condition Class: Look at the overall condition of the area within the campsite boundary and assign it a campsite condition class using the following scale (for more details on what a condition class rating is, see the methods introduction. This condition class is from the Marion manual).

> **Condition Class 1:** Recreation site barely distinguishable; slight loss of vegetation cover and /or minimal disturbance of organic litter.
> **Condition Class 2:** Recreation site obvious; vegetation cover lost and/or organic litter pulverized in primary use areas.
> **Condition Class 3:** Vegetation cover lost and/or organic litter pulverized on much of the site, some bare soil exposed in primary use areas.

Condition Class 4: Nearly complete or total loss of vegetation cover and organic litter, bare soil widespread.
Condition Class 5: Soil erosion obvious, as indicated by exposed tree roots and rocks and/or gullying.

Vegetative Ground Cover On-Site (1 = 0-5% 2 = 6-25% 3 = 26-50% 4 = 51-75% 5 = 76-95% 6 = 96-100%). Estimate the percentage of ground cover within the campsite boundary that is covered with live, non-woody vegetation.

Vegetative Ground Cover Off-Site: (same values as above). For the sake of comparing the vegetation in the campsite and outside the use area, estimate the percentage of ground cover in an area near the campsite but that appears to be mostly undisturbed.

Exposed Soil: (same values as above). Estimate the percentage of area within the campsite boundary that is devoid of live vegetation and where litter (leaves, twigs etc) has been so pulverized, bare mineral soil is exposed.

Tree Canopy Cover: (same values as above).Estimate the percentage of tree canopy that covers the campsite area.

Tree Canopy Cover Off-site: (same values as above). For the sake of comparing the tree canopy cover in the campsite and outside the use area, estimate the percentage of tree canopy cover in an area near the campsite but that appears to be mostly undisturbed.

Tree Damage: Count each live tree (>1 in. diameter at 4.5 ft.) within or on campsite boundaries and tally how many of each fit into the following categories that describe damage:

None/Slight: No or slight damage such as broken or cut smaller branches, one nail, or a few superficial trunk scars.
Moderate: Numerous small trunk scars and/or nails or one moderate-sized scar.
Severe: Trunk scars numerous with many that are large and have penetrated to the inner wood; and complete girdling of tree (cutting through tree bark all the way around tree).

Tree stumps (#)/ Dead Trees (#): Within or on campsite boundaries, count each tree stump (> 1 in. diameter at ground and less than 4.5 feet tall), and each dead tree that remains standing. These should be tallied separately from the live trees.

Root Exposure:

Depending on the campsite, you can choose to do either both or one of the following root exposure assessments:

1. Per tree: Using the same total tree tally above, determine how many trees with roots that fit into the following categories:

None/Slight: No or slight root exposure such as is typical in adjacent offsite areas.
Moderate: Top half of many major roots exposed more than one foot from base of tree.
Severe: three-quarters or more of major roots exposed more than one foot from base of tree; soil erosion obvious.

2. Apply one of the same categories (none/slight, moderate, or severe) to the full campsite use area, unrelated to specific trees. This is especially useful when it is impossible to determine which roots belong to which tree.

Fire Sites (#): within campsite boundary, tally all active and inactive campfire site.

Access Trails (#): Count all the trails that enter/exit the campsite across the campsite boundary. Flag each trail using a different color flag than the boundary flags (you will map these trails later).

Human Waste (#) and/or Toilet paper: Both within the campsite and outside the boundary along the access trails or in the general vicinity of the site, count the number of instances you find human waste and/or used toilet paper.

Litter/Trash (None, some, much): Not including toilet paper, estimate the amount of litter and trash you find within the vicinity of the campsite.

VIII) Comments/Recommendations

Notes on monitoring priorities, management recommendations, field-decisions, etc.

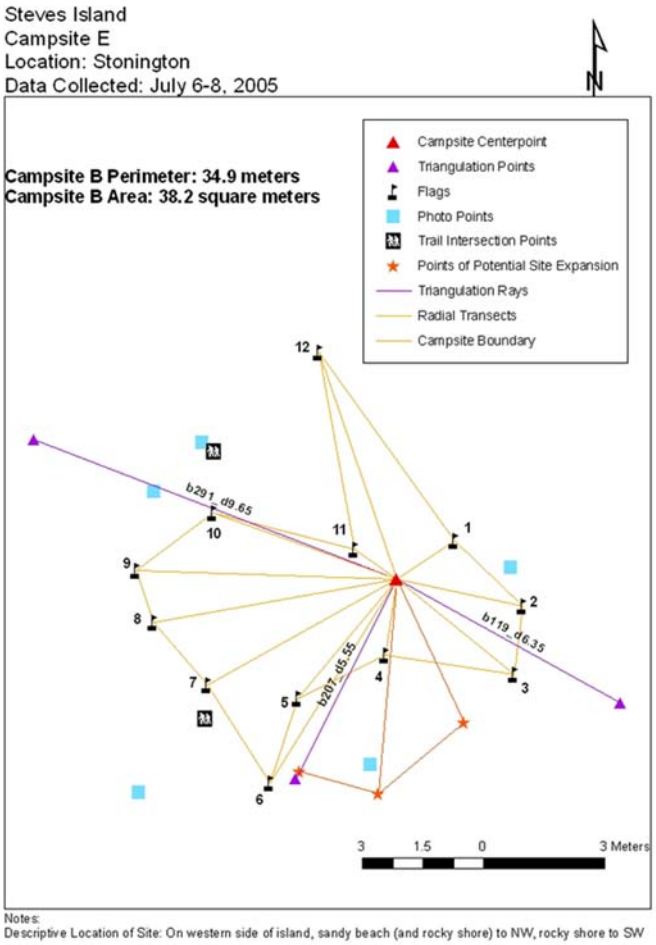
IV) Transect Data (see photo and map of Steve's Island above)

The remaining data will be collected using the radial transect method described in detail in the Marion manual. The purpose is to map the campsite boundary and all significant features of the campsite. This method produces data that can then be mapped using GIS (or even just with a protractor and engineer's ruler). The campsite's area can then be calculated and changes in boundary lines (campsite growth or shrinkage) can be tracked in subsequent years of monitoring.

You will need two people to easily accomplish this data collection system. One person takes compass bearings and photos from the center point while the other takes measurements to the flags around the campsite boundary. Start with the flag nearest to North and move in a clockwise direction. For each flag, a compass bearing, distance and photo number, all from the center point, are documented in the data sheet.

X) Trails intersecting site boundaries:

Using the same methodology as the transect data, take a compass bearing, distance measurement and photo, from the center point for each trail intersecting the campsite boundary that you previously counted and flagged. Leave the flag in place for the photo.



The map above shows how the radial transect method is used to map the campsite boundary (outside yellow line) as well as other features. This is Campsite E on Steve's Island, the same site as the picture above.

XI) Any other features of special concern: Again the same methodology is applied to any other features that should be mapped. This could include groover ("porta potty" system) sites near the campsite, platform corners, potential site expansion areas, specific trees, plants and/or fire pits, osprey nests, etc.

Materials needed

__ GPS set to NAD 83 and UTM coordinates (and extra batteries)
__ Campsite Monitoring Form (on "write in the rain" paper)
__This methodology description
__ A copy of: Marion, Jeffrey L. 1991. *Developing a Natural Resource Inventory and Monitoring Program for Visitor Impacts on Recreation Sites: A Procedural Manual.* USDI, National Park Service, Natural Resources Report NPS/NRVT/NRR-91/06
__ Paper copy of map or aerial photo prepared ahead of time (sketch map stapled to checklist)
__ Pencil, eraser and sharpener
__ Clipboard
__ Field tape measure wheel, in Meters
__ Two different color sets of 15-20 survey flags (12-18 inches tall). One set for campsite boundary and the other for intersecting trails. Bright colors turn up best in photos.
__ Peephole type (much more accurate than handheld compass and needed for survey work)
__ Large steel reference point stake (only need one per campsite)
__ Aluminum numbered tags (only need one per campsite)
__ Digital camera, with extra storage cards (capability to store 100 images at the camera's highest resolution), spare camera batteries

Additional Field Mapping Technique

While still in the field, you can draw a very accurate field map of your campsite once you have noted all the bearings and distances from the center point. This is especially useful for educational purposes when you (or your volunteers) are learning the methods. It is also useful to create a more accurate sketch map to aid in transferring data to a GIS. This in-the-field mapping technique was used on Bangs Island when the Task Force was assisted by students from nearby Chebeague Island.

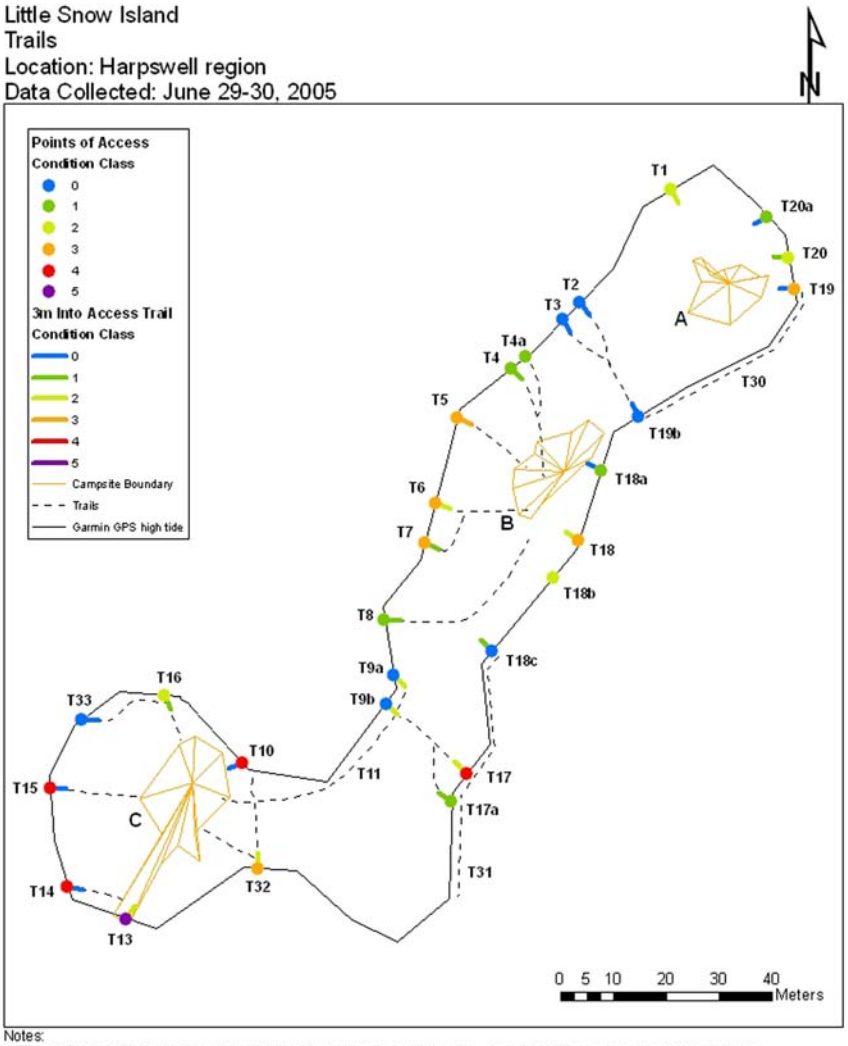
Use a protractor to draw all of your bearings (angles) from the center point, and use an engineer's ruler (chose the appropriate scale) to measure and draw the distances. Once you have marked the location of each flag radiating from the centerpoint, you can draw a line to connect the flags and create your campsite polygon. Additional features can also be added to your map using this method.

Materials needed for this methods (above and beyond what is already listed above)

__ Engineer's ruler (ruler with 6 different scales on three flat faces, triangle shaped. NOT architects' ruler, but engineers ruler, scales are different)
__ Protractor
__ Large format waterproof paper, 17x22 and surface to write/work on (plywood)
__ Masking tape
__ Colored pencils

Trail Monitoring

Introduction
Island trails (which are foot paths on an island, not to be confused with the Maine Island Trail) meet a variety of visitors' needs including: access trails from shore to camping area, island exploration trails, and trails linking island sites. Trails might be marked on a user's map (for example, trails that are mapped in the MITA handbook), or they might be social trails that island users have established over time. Some trails may be well established and obvious with significant soil erosion, deep treads, and growing width. Some trails may be emerging, or disappearing, or serving a use that is also met by other trails. The number, location, and condition of trails are important indicators of human-caused impact in all recreation zones.



Notes:
1. The perimeter of island is based on high tide line and not vegetation line, so trail locations on map may appear to be farther from campsites than they actually are.
2. The trails outside the island high tide line are in salt marsh.
3. Trail data were taken on two different dates; refer to the tables on the Field Datasheet.
4. Each trail has an affiliated photo; refer to Field Datasheets for photo numbers.
5. The field datasheets do not differentiate between Boundary Trails intersecting Campsite C and all Little Snow trails.

Mapping trails can help determine number and location of access and interior trails, as well as condition. However, before drawing conclusions about condition, it is important to correlate condition class with trail function (i.e. T13 on Little Snow Island above is an official trail with access steps up a bank, thus its higher level of impact is to be expected). A trail map may help managers decide what an island's optimal number of trails should be.

Conducting a baseline trail inventory on an island can help answer multiple questions, including

1. <u>How many access trails are there on the island?</u> Access trails enter the island interior or terrestrial zone from the shore, but are not necessarily limited to trails near the landing area. During the pilot project, documenting the number of access trails netted some of the most immediately useful data collected by the entire island monitoring project. On one island (Hell's Half Acre), 27 access trails link the shore to the terrestrial zone, many more than managers expected. It is important to note, however, that trail number alone without analysis about condition and function, does not supply managers with sufficient information (see more on this in #5 below).

2. How many other trails exist? (What is the total length of trail on this island?) This question is about documenting all the trails on an island and their cumulative length. Methodologies exist for measuring the length of trails, though this level of analysis was not deemed a priority for the pilot project.

3. Where are these trails? Mapping trails during an initial inventory (using either a sketch map or GPS) can provide an important baseline for future comparison. (Over time, is the location or number of trials changing?)

4. How is each trail used; what is its function? Documenting function can help managers prioritize trail management. For example, an established access trail into a primary campsite that is designated in the MITA handbook might need more proactive maintenance than a rarely used social trail whose purpose is already met by a parallel trail. In fact, managers may decide that the second trail in this scenario should be closed. [Note: MITA reports that the trails drawn on island maps in the MITA Handbook should not be technically considered "officially designated" as they are quite generalized and have never been ground-truthed. For the purpose of this project, we assumed that trail visitors would consider these trails as officially designated by MITA if they saw them on a MITA map.]

5. What is each trail's condition? Assessing trail condition helps prioritize management decisions. For example, of the 27 access trails mapped on Hell's Half Acre, only six of them are considered to exhibit a high level of impact. Of those six, at least three are either designated or serve a primary use where impact would (and arguably should) be concentrated. A rapid condition class assessment is used to determine overall condition and GIS provides a useful tool to comparatively show both condition and trail number as they relate to the trail's location. Other methodologies (including measuring trail width and depth) exist but were not utilized on the seven pilot islands.

6. What is the relationship between trails and campsites? Campsites are, by and large, located in the terrestrial zone and need to be accessed by some sort of trail. An assessment that covers the number of campsite trails, location, and condition can help in managing overall campsite use. Time available for field work and overall management goals should help field staff determine whether to prioritize assessment of campsite trails above and beyond that required on campsite monitoring form, which is now limited to number and location. Campsite trail condition can be assessed using the trail methodology described here.

The specific methodologies for trail monitoring on the seven pilot islands primarily focused on access trails from shore to terrestrial zone. Monitoring included mapping and photographing trail location, function, and condition via the assignment of condition class rating. On one island (Steve's Island), the width of the access trail was also measured and photographed. On some islands, interior trails were also monitored

As described in the methods introduction, condition class ratings are used in many recreation areas to classify a campsite or trail's condition on a scale of zero to five, with each number on that scale describing a different level of impact. As described in the methods introduction, using "Condition Class" provides a rapid survey method that standardizes the language used to describe impact.

For the trails, a condition class was assigned to access trails where they intersected with the high tide line (or the terrestrial vegetation line, whichever seemed more appropriate given the particular island). A second condition class assessment, using the same scale, was assigned to each trail in to three-meters.

Our condition class rating was provided by Acadia National Park, whose staff had adapted it from a trail condition class system designed by Jeff Marion (author of campsite monitoring methods) for use on Acadia's Little Moose Island (near Schoodic Point).

How To:
The following methods cover how to assess access trails, interior trails, and trails into campsites.

Assessing Access Trails
Note: Because you will need to be walking along the shore up close to the access trails in order to effectively document trail function and condition, you should NOT plan to conduct trail monitoring while conducting the survey checklist (you would be too far from the trails to assess them accurately).

First, by simply checking a few of the trails visually, determine whether the access trails enter the interior at the high tide line or at the vegetation line and make sure to note that in the comments section of your form. Whichever you choose is fine as long as you make every effort to be consistent and document your steps and decisions. Then, with the "Trails Monitoring Form" and island sketch map in hand, you and a partner should start your clockwise perimeter-walk around the island at the primary landing area. It is helpful to have two surveyors so you can discuss the condition class ratings and come to consensus.

Begin by filling in all the relevant header information (Island name, Date, your names, GPS unit used if applicable).

For each access trail that you come upon, regardless of level of impact, sketch its location on your sketch map and assign it a number. For each numbered trail, use the form to guide you in collecting all of the following data:

1. Photo number: take a photo of the access trail from shore and, if possible to include in the same photo, the stretch of trail in to three meters. Write the photo number in the appropriate column. The purpose of the photo is two-fold: to help future monitoring relocate the correct trail, and to determine any change in that trail by looking at the photo and comparing it to either a new photo or the trail itself. For the first photo, mark in the comments what kind of camera you are using and what distance from the access trail you are standing when taking your photo (attempt to maintain this same distance for each subsequent photo).
2. Assign a condition class (rating listed on the form and below) to the access trail at the point where it intersects with the vegetation line (or high tide line as per your decision above).
3. Assign a condition class (using the same rating) to the access trail for the first three meters into the island. In many cases, the two condition class ratings will be quite different as the soil composition often changes in just three meters.
4. Check all of the trail functions that apply. Descriptions of each trail function are listed on the form and below.
5. Note any relevant details (for example: stone steps have been constructed at this trail to prevent erosion; there is a Bureau of Parks and Lands sign at this trail; etc.)
6. Confirm in the checkbox that you sketched the trail onto the sketch map. Note if you also took a GPS coordinate (if so, note in the header information which GPS unit used).
7. Depending on monitoring and management goals for that island, you may opt to add one step: using two field marking flags, mark the width of the access trail at the intersection point and use a tape measure to measure that width. Take the picture in step 1 above when the flags and tape measure are still in place.

The final step will involve loading your data and map information into the GIS.

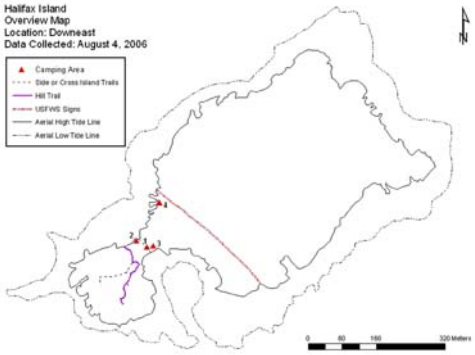
Assessing Interior Trails
If there is a need to assess trails over a longer distance, the steps are similar to those described above, with a few differences. Rather than assigning condition class ratings at the start and in to three meters from shore, the ratings are applied every 15 meters along the trail's length.

Use the same "Trails Monitoring Form" to guide you in collecting all of the following data (see Halifax Island image below for example):

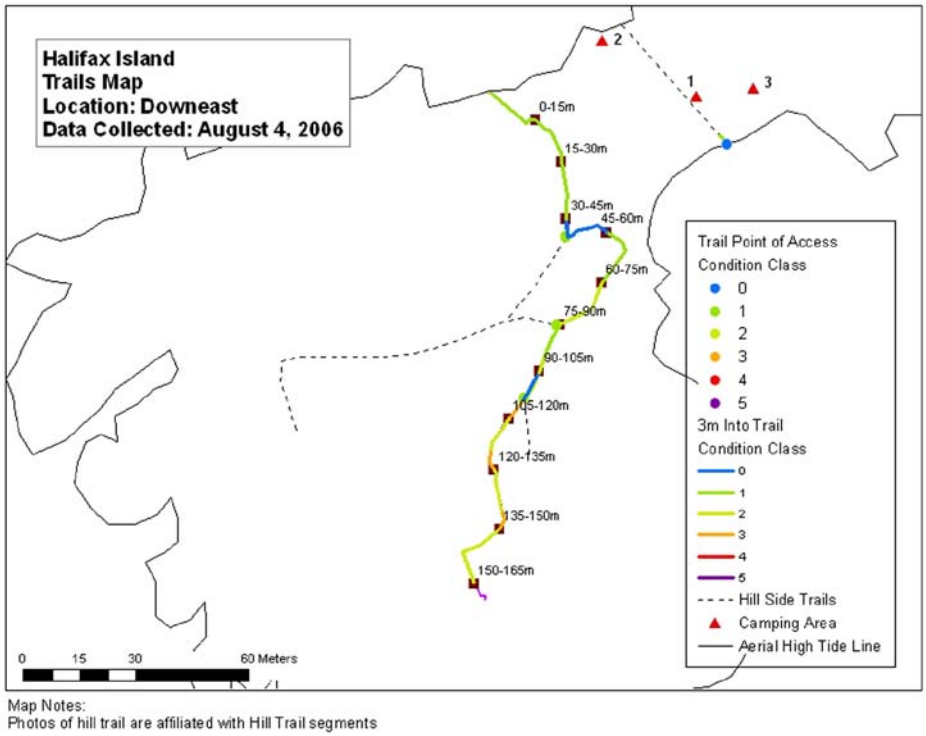
function.

1. In the Trail # column, enter 15 meter segment covered by that row of data (i.e. your first entry will be 0-15m; second will be 15-30m and so on)
2. Photo number: take your photo looking up the trail. The purpose of the photo is two-fold: to help future monitoring relocate the correct trail, and to determine any change in that trail by looking at the photo and comparing it to either a new photo or the trail itself. For the first photo, mark in the comments what kind of camera you are using.
3. Assign a condition class (rating listed on the form and below) to the 15 meter section. If it appears to differ significantly within that 15 meters, describe in the comments, and if you think an exact location should be documented, list the measurement (for example, at 67m, there is significantly worse soil compaction than elsewhere in this segment)
4. If any trails intersect this one, mark the point of intersection as you proceed along trail, and use comments to describe.
5. In the first row, check the Trail functions that apply. (Descriptions of each trail function are listed on the form and below). Chances are, the starting trail function will be the same for the whole length of the trail but in the event it changes, note that change in the appropriate segment.
6. Confirm in the checkbox that you sketched the trail onto the sketch map. Note if you also took GPS coordinate (if so, note in the header information which GPS unit used).

The final step will involve loading your data and map information into the GIS.



Halifax Island has a trail up the hill that managers wanted to monitor for impact. On the map above, that trail location is marked in purple (with a side trail in grey). On the map to the right, the condition of 15 meter trail segments has been assessed (and photographed).



Assessing trails into and out of campsites
If you are assessing trails into a campsite, then you should start by assessing the campsite using the "Campsite Monitoring Form," which will enable you to track the number and location of the trails. Among other impact indicators, it will ask you to list the number of access trails that enter the campsite. It will also provide you with methods for how to map those trails' location along the campsite boundary using the radial transect method.

If you chose to assess the condition of these trails, do so at this time. Use the same form as above and, with a couple exceptions, use the same method as "Assessing Access Trails." List the trail numbers in the Trail Monitoring Form according to how you listed them in the Campsite Monitoring Form. Assign the first condition class rating at the intersection of the trail with the campsite boundary, and the second rating to the 3 meter stretch from where the trail intersects the campsite OUT three meters. The rest is the same.

Again, the final step will involve loading your data and map information into the GIS.

Trail condition class rating
Condition Class 0: Trail barely distinguishable; no or minimal disturbance of vegetation or organic litter (typically applied to the undistinguishable sections of discontinuous trails).

Condition Class 1: Trail distinguishable; slight loss of vegetative cover and/or minimal disturbance of organic litter. Includes shrubby overgrown trails with obvious tread of bare soil that can no longer be seen because the shrub cover has overgrown the trail.

Condition Class 2: Trail obvious; vegetative cover lost or disturbed

Condition Class 3: Vegetative cover and organic litter lost in nearly all places, but little or no erosion.

Condition Class 4: Soil erosion or compaction in tread is beginning in some places.

Condition Class 5: Soil erosion or compaction is common; tread is obviously below ground surface.

Trail Function:
Check all that apply:

A. Trail designated by managers in guidebook or on island maps
B. Apparent primary use trail (whether or not it is specifically designated, this trail is obviously used by a large percentage of visitors)
C. Apparent informal trail (trail is not designated, is created by visitors but is not a primary use trail)
D. Access trail from shore into island
E. Trail into or out of a campsite (crossing campsite boundary defined by Radial Transect)
F. Connector trail between/for campsites or use areas
G. Island perimeter trail
H. Other (describe in comments)

Materials needed

__ GPS set to NAD 83 and UTM coordinates (and extra batteries)
__ Trails Monitoring Form (on "write in the rain" paper)
__ Paper copy of map or aerial photo prepared ahead of time (sketch map stapled to checklist)
__ Pencil, eraser and sharpener
__ Clipboard
__ Field tape measure in Meters
__ Survey flags (12-18 inches tall with colored flags)
__ Camera (and extra batteries)

Shoreline Monitoring

Introduction

The shoreline zone is the transition area above the mean high tide line and below the terrestrial zone. It is often considered the "bank" area where soil layers are visible above bedrock. Because the shoreline zone is the transition between the two other island zones, it is often difficult to determine exactly where it begins and ends, and often includes characteristics of both the intertidal and the land. Vegetation in the shoreline zone usually includes intertidal species at the upper reaches of their desiccation tolerance (such as blue-green algae) and/or terrestrial species that are particularly tolerant of salt spray (such as beach pea).

The plants in this zone are easily trampled by users entering and exiting camping areas or stashing boats and equipment for overnight storage. In addition, this area is often subject to erosion due to people repeatedly walking up and down the bank area. Island soils are, by nature, fairly thin and thus especially subject to erosion. In some instances, the erosion or trampling might be limited to the width of a trail. In others, it may spread over several meters, potentially indicating a large swath of the bank is used to enter and exit the terrestrial zone.

It is sometimes difficult, however, to discern if shoreline erosion is due to people or due to natural causes. The shoreline is subject to winter ice scraping, storm activity that throws damaging rocks and debris, and occasional extreme high tides that naturally erode bank soils. Over time, trees and vegetation growing along the shore may become threatened as their roots become exposed and liberated from the soil. And often, where one tree falls, many others are brought down alongside it. For the purpose of monitoring on our seven pilot islands, an assumption was made that shoreline erosion can and is indeed is a natural phenomenon, but it can be exacerbated by human caused impacts. Repeated trampling compacts soils and damages vegetation which renders the bank even weaker when that winter storm does hit.

The specific methodologies used for monitoring the shoreline included using a transect line to map and photograph the shoreline, and using rapid assessments for standardized descriptions of indicators (such as condition class and percent cover).

Considerations for shoreline composition: If you are working with a shoreline with little mineral soil (such as a cobble shore with beach pea and other shoreline vegetation, or the upper reaches of a sandy beach), you may determine that mapping cannot effectively provide an accurate assessment of that shore, especially given vegetation changes from one year to the next. In this case, consistent photography along the transect line, coupled with indicator descriptions may provide enough data. [See photo transect method for a similar approach.]

Our mapping methodology was adapted from Canada's Department of Fisheries and Ocean *Shorekeepers Guide for Monitoring Intertidal Habitats of Canada's Pacific Waters* (see Bibliography for full citing), a protocol for mapping and surveying both the intertidal and shoreline areas of a coastline.

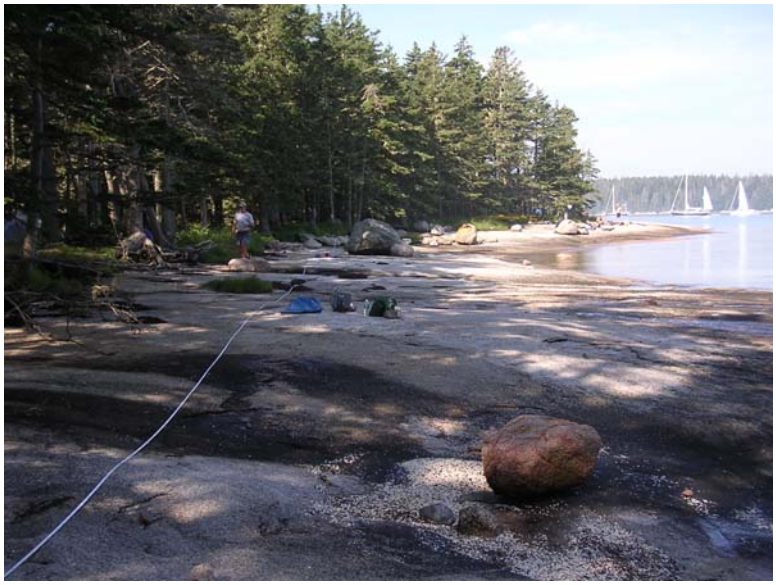
The rapid assessment systems were designed by Task Force members, adapting methods that appeared to work well in both our campsite and trails assessments.

How To

Step 1: Laying the transect line

The first step will be to determine what shoreline area needs to be inventoried and where to lay down your shoreline transect. Most island campsites are located near a landing area. In such a case, the

shoreline transect should be located along the bank area above the landing and below the campsite. In other instances, a stretch of shoreline that gets use may be away from either the landing or camping area, and be a separate spot used as a camp kitchen or for overnight boat storage. In any case, the decision on what stretch of shoreline to monitor should be based on management objectives, assumptions about use, and impact indicators.



The first step in shoreline monitoring is to lay down the transect line parallel to the shoreline, as is done here on Hell's Half Acre.

Once you have determined the shoreline area that needs monitoring, use your tape measure as a transect line that runs parallel to the shoreline, as close to the shoreline as possible without ever actually touching it. Though the shoreline will obviously be a wiggly, curved line, it is important that your transect line be straight, otherwise, the transect will never be replicable in future monitoring. Therefore, in some places, your transect line may be quite close to the actual shoreline itself, and in others, it might be several meters away. This variability will be mapped later. For now, if possible, lay the transect lines endpoints on or near a distinctive feature (such as a quartz intrusion into granite bedrock). This will facilitate future relocation of the transect line. For the rest of the shoreline monitoring exercise, it will be useful to have a name applied to each end of the transect line. When you are facing away from the water and towards the interior of the island, consider the left end of the transect Endpoint A, and the right end of the transect Endpoint B.

Using the "Shoreline Monitoring Form," begin by filling in all the relevant header information (Island name, Campsite/use area location, Date, Inventoried by…).

Step 2: Impact Indicators

Then use the form to assess the following impact indicators (if you have already monitored the campsite, some of these will be familiar. Use the same assessments but apply them to the shoreline rather than the campsite.)

1) Substrate of Landing Area (B=bedrock C=cobble Sh=shell S=sand M=mud):

2) Width of apparent shoreline disturbance

It is unlikely that the whole length of shoreline along your transect is disturbed. What is the width of apparent shoreline disturbance? For example, it may be only at a 16 inch-wide access trail, or it may be bank erosion a meter wide or more.

3) Distance from nearest mean high tide to center point in the campsite. If it is not close enough to measure (less than 50 meters), an estimate will suffice. This is necessary to correlate campsite data with shoreline data. (0=none, 1=<10m, 2=11-20m, 3=21-40m, 4=41-60m, 5=>60m)

4) Site visibility from water Y/N Is there a campsite affiliated with this shoreline that you can see when you are traveling on the water?

5) Shoreline condition class (0 to 5)
In this case, the condition class is assigned to the whole length of shoreline area as defined by the transect.
Condition Class 0: No apparent impact
Condition Class 1: slight shoreline and bank vegetation trampling but not appearing permanently damaged.
Condition Class 2: Some erosion areas and/or some exposed roots and/or some damaged vegetation.
Condition Class 3: 25% erosion and/or 25% exposed roots and/or 25% damaged vegetation.
Condition Class 4: 50% erosion and/or 50% exposed roots and/or 50% damaged vegetation.
Condition Class 5: more than 50% of shoreline/bank erosion, and/or exposed roots, and/or damaged vegetation.

6) Vegetative trampling (None/slight; Moderate; Severe)

7) Bank erosion (None/slight; Moderate; Severe)

8) Tree Damage (number of trees with None/slight; Moderate; Severe)
Count each live tree (>1 in. diameter at 4.5 ft.) on or near (within one meter) of shoreline and tally how many of each fit into the following categories that describe damage:

None/Slight: No or slight damage such as broken or cut smaller branches, one nail, or a few superficial trunk scars.
Moderate: Numerous small trunk scars and/or nails or one moderate-sized scar.
Severe: Trunk scars numerous with many that are large and have penetrated to the inner wood; and complete girdling of tree (cutting through tree bark all the way around tree).

9) Root exposure (number of trees with None/slight; Moderate; Severe)
Using the same total tree tally above, determine how many trees with roots fit into the following categories:

None/Slight: No or slight root exposure such as is typical in adjacent offsite areas.
Moderate: Top half of many major roots exposed more than one foot from base of tree.
Severe: Three-quarters or more of major roots exposed more than one foot from base of tree; soil erosion obvious.

10) Fire sites (#): Along the shoreline or nearby, tally all active and inactive campfire site.

11) Access Trails (#): Count all the trails that cross the shoreline.

12) Human Waste (#): Within the vicinity of the shoreline, count the number of instances you find human waste and/or used toilet paper.

13) Litter/trash (none, some, much): Not including toilet paper, estimate the amount of litter and trash you find within the vicinity of the shoreline.

Step 3: Management Comments/Recommendations:
Notes on monitoring priorities, management recommendations, field-decisions, etc.

Step 4: Measuring and mapping the shoreline
Shoreline transect data
In order to track changes along this shoreline in the future, the transect line will need to be relocated at exactly the same place. Some details about the position of this transect line and in relation to the campsite

center point will facilitate an overall understanding of its location. Specifically, use a compass to take a bearing from Endpoint A to B, and mark that distance. Also, take a bearing and distance from each transect endpoint to the campsite's center point (if it is too far, an estimate is useful).

Shoreline transect line end point triangulation

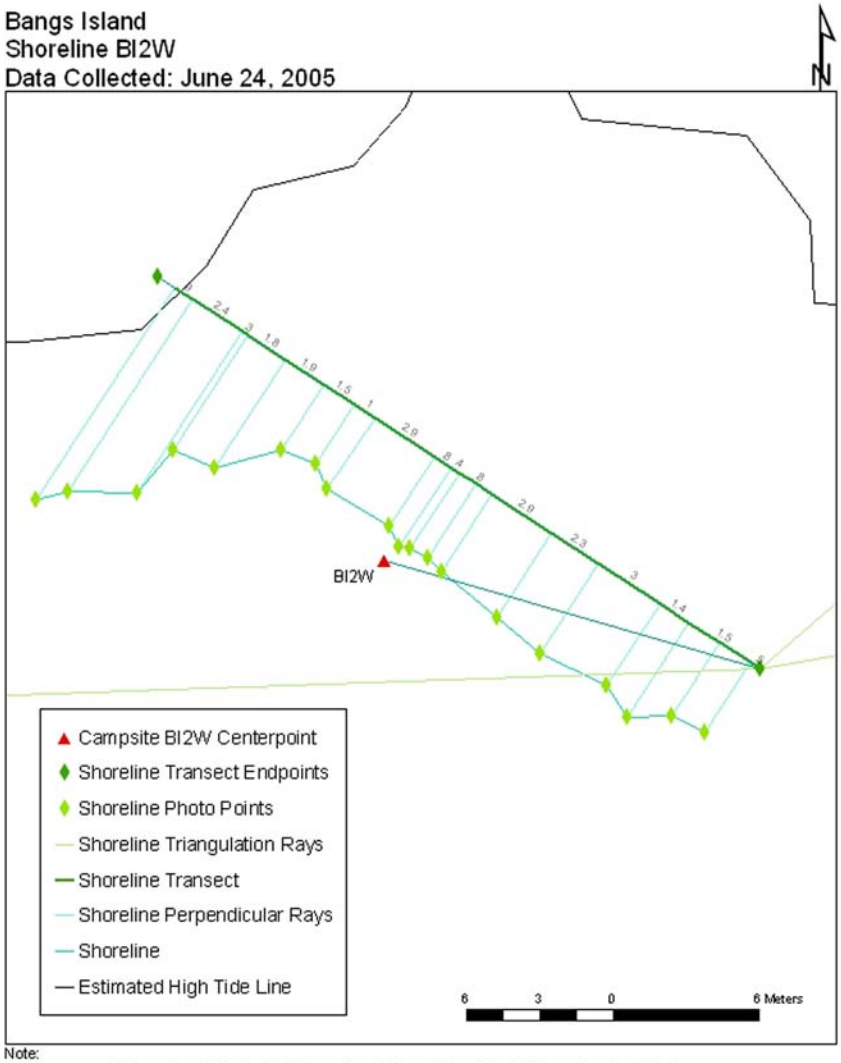
Providing triangulation points for each of the transect's endpoints enables exact relocation of the transect line in the future by using triangulation. Identify three prominent and reasonably permanent features in the area (for example, a large glacial erratic on the shore, a healthy spruce tree with a distinctive boil, or a distinctive geological feature such as basalt intrusions in a granite ledge). The features should be in opposing directions to enable triangulation, and need not be within the campsite boundary. Take a photo of each triangulation feature from the endpoint. Take a compass bearing to each triangulation point from the endpoint, measure the distance to the feature (for example, tallest part of largest boulder), and describe it. In the case of trees or boulders, measure the approximate diameter of the feature, and describe it. For the second endpoint, you can reuse the same triangulation points or different ones.

VI) Shoreline overview photos

To get an overall picture of the shoreline, take a series of generalized photos (for example west looking east, then east looking west). Note and photograph any particular features of special concern along the shoreline.

VII) Shoreline Transect Data

The goal here is to use the transect line to get the data needed to map the shoreline and to document any significant features anywhere along that shoreline. There are two ways to accomplish this and you will need to decide which method you choose. In the first method (more exact but more time-consuming), you would insert flags along the shoreline at any significant angle changes. Segments between your flags will vary in length. In the second method (less exact but more consistent for measurements and photos and less time consuming), you would simply insert flags along the shoreline every five



This image illustrates the mapped shoreline immediately adjacent to a Bangs Island Campsite.

meters. In both cases, Flag #1 should be inserted at the shoreline at transect endpoint A. [Note: we concluded that, in most cases, the second method was simpler and more advantageous than the first].

If any access trails cross the shoreline along the way, it is important to mark them exactly where they occur along the transect line and in order between the flags where they occur. In the Flag # column, mark FP if it is indeed a flag, and T if the data in that row refers to a Trail.

The distance from A refers to the distance that each subsequent flag is from endpoint A. If you chose the first method, that number will vary. If you chose the second method, that number should consistently be five meters more than the last (0, 5, 10 etc). Similarly, transect segment length will vary if you chose the first method, but should always be five meters in the second method.

In "distance from the transect line," the goal here is to map the shoreline (the measurement at each flag will be the same in both methods options). For each flag, use a second tape measure wheel to measure the distance from the transect line to the shoreline at that flag at a perpendicular angle. For mapping consistency when performing this measurement, the transect line and second tape measure should be laid at an exact right angle and it is worth using a handheld compass to ensure this (for that angle, subtract 90 degrees from the angle of the transect line that you noted in "IV Shoreline transect data" above). If shoreline erosion is an issue, extend the tape measure to where the soil is still intact (as opposed to where the vegetation mat ends, which may be farther into the shore).

For each flag, take a photo from the transect line up towards the shoreline and be sure to include the flag in the photo. In the second method, where a five meter distance is fixed, you should be able to construct a full photographic panorama of the whole shoreline.

List any additional details in the comments column.

Materials needed

__ GPS set to NAD 83 and UTM coordinates (and extra batteries)
__ Shoreline Monitoring Form (on "write in the rain" paper)
__ Paper copy of map or aerial photo prepared ahead of time (sketch map stapled to checklist)
__ Pencil, eraser and sharpener
__ Clipboard
__ Two field tape measures, both in Meters
__ Survey flags (12-18 inches tall with colored flags)
__ Camera (and extra batteries)
__ Peep hole and card compass

Intertidal Zone Monitoring

Introduction

The intertidal zone is the area below mean high water and above mean low water. It is the region where all life forms have adapted to being immersed in salt water for multiple and varying hours of the day/night. Its ecology is complex and altogether different than the terrestrial zone. The intertidal zone, even on one tiny island, is subject to tremendous variability. Depending on the tide, an island's best landing area could be a combination of sand beach, flat granite ledge, mud flat, boulder or cobble, or rockweed, barnacle or mussel mat.

Coastal *Leave No Trace* education programs recommend island visitors keep most island-based activities (e.g. camp kitchens) below the high tide line, thereby limiting or decreasing their travel through the island terrestrial zone while concentrating it in the intertidal regions. This educational approach is predicated on the fact that island terrestrial zones have been shown to be susceptible to recreational impact. However, little research has been conducted along Maine's shores to determine how the intertidal zone withstands repeated recreational use. There is compelling evidence from the Pacific Northwest (Brosnan 1994) and other areas that foot traffic can have significant impacts on intertidal communities.

In the absence of docks and piers, as is the case on all the pilot islands, the intertidal zone is, by necessity, the area where all boats accessing the island land and launch. Everyone who disembarks from a landed boat needs to travel through the intertidal zone, and if the group is camping, multiple trips through the intertidal are needed to transport gear. People stroll and explore, investigate live organisms, gather edibles such as mussels, collect empty shells and sometimes remove live creatures such as sand dollars and sea stars. Campers, as per LNT ethics, often build their kitchens in the intertidal, including fires.

On some islands, there has been anecdotal evidence of apparent change in species composition at landing areas. On Hell's Half Acre, for example, one member of the Task Force recalls a progression of change on the granite ledge landing area. This person recalls thick rockweed mats covering the majority of the granite ledge in the early 1990's, and at some point, a trail that ran through the rockweed from low tide. Now, that same granite ledge is host almost exclusively to tiny barnacles. Interestingly, not all members of the Task Force who are familiar with Hell's Half Acre have the same recollection of this change, which points to the need for standardized monitoring of the intertidal.

Many factors, including the composition of the intertidal zone, determine how susceptible it is to impact, particularly trampling. According to Murray, "Upright, canopy-forming algae, for example, are more susceptible to damage from human foot traffic than low-lying turfs or crusts and thus, as a functional group, constitute a strong indicator of trampling disturbance (Povey and Keough 1991, Brosnan and Crumrine 1994, but see Fletcher and Frid 1996)." Hard bottom substrates are surprisingly resilient, much more so than soft bottom (personal communication with Hess and Peterson). However, it is particularly difficult to discern if changes in the intertidal zone are due to people or due to natural causes, or some combination of the two. The intertidal, much like the shoreline, is subject to winter ice scouring that can decimate algal or invertebrate mat. Storm activity can throw damaging waves, rocks and debris.

Management decisions in the intertidal zone sometimes should be based more on local aesthetics rather than regional population ecology. Two species can serve to exemplify this fact: barnacles and blue green algae. Lets look first at barnacles (*Balanus balanoides*). In the Hell's Half Acre example above, tiny barnacles are currently the dominant species on the granite ledge where most boaters land on the

island. The barnacles are less susceptible to impact than the rockweed which appears to no longer be successfully colonizing the area. That these barnacles are tiny implies that larvae are recolonizing every year, but individuals are not reaching the larger mature phase of adult barnacles. Perhaps this is due to annual human trampling as this island receives a large amount of use, and perhaps the barnacles would grow in size if the trampling ceased. A lower-low tide assessment revealed the presence of some areas of barnacle hummocking. Barnacle hummocks are those rounded mounds of barnacles that occur when individuals outgrow the space available and start growing vertically sometimes one above the other. Barnacle hummocks are a sign of un-trampled areas, and they are rarely found in regions of high human foot traffic. On Hell's Half Acre, that barnacles in the landing zone are not reaching adult size, and certainly not hummocking, is a very localized issue. There is little fear among scientists that barnacle populations are threatened at the large scale, but is the loss of adult barnacles (or barnacle hummocks, or rockweed, or any other dominant species for that matter) a problem at the local level? This is a decision based on aesthetics and management objectives, and is in some ways better informed by an assessment of visitor's perceptions of the issue rather than population ecology of barnacles.

Barnacle hummocks occur in low-trampling zones. From afar, they look like rounded hummocks. This occurs as they compete for space and grow vertically.

Our second example looks at blue green algae, the slick, dark-to-black band covering most hard surface areas in the upper reaches of the intertidal zone and in the spray zone. A blue green algae mat is coated in a gelatinous sheath which keeps it moist during the majority of the hours when it is exposed to fresh air. It is a live algal organism, just like rockweed, but little attention has been paid to its resilience to impact. In the first year of monitoring in the intertidal zone, an interesting observation was made about the blue green algae. The algae mat was occasionally interspersed with scaring that appeared to have scrapped away all algae, leaving behind exposed granite in that one area. Upon close inspection, all the scars had a similar shape, like that of a liquid being dumped on a hard surface. Given that these scars were located only in areas of highly concentrated recreational use, where users are encouraged to concentrate their activity away from the terrestrial zone, one hypothesis is that the scars are the effects campers dumping their boiling pasta water or other kitchen liquids right where they have been instructed to do so by Leave No Trace ethics: on durable surfaces away from any soil. Much like the barnacle example, the coast of Maine is not at risk of losing its population of blue green algae. But do a dozen "boiling pasta scars" in the blue green algae in one area affect the recreational experience? Does it take away from that primitive wilderness feeling managers strive to achieve? In both the barnacle and blue

green algae examples, environmental monitoring can document that change is happening, but it is up to managers to decide what, if anything, to do about it.

Examples of the types of scarring visible in blue green algae on multiple islands that are used by campers.

Particular Challenges Posed by the Intertidal Zone

What is the nature and extent of recreational impacts in the intertidal zone on the seven pilot islands? Which species are impacted most by recreational use? How does species abundance change with number of visitors, management guidelines, and type of uses in the intertidal?

These were some of the important questions identified by the Task Force. But, monitoring and managing recreational impact in the intertidal zone is a completely new arena for MITA and the Bureau of Parks and Lands. Managers, as well as members of the Task Force realized early on that they knew less about the species composition, management options, and impacts in the intertidal than other island zones. This lack of experience and knowledge, coupled with the ecological complexity and diversity of this area and the question of whether impact is potentially compounded by the traditional LNT message described above, makes monitoring in the intertidal much more complicated. Thus, the Task Force enlisted the advice of several intertidal experts early on. In addition, Tracy Hart, then with Maine Sea Grant, headed the intertidal portion of the Task Force's work in its first year. To that end, Hart reviewed case studies and research from throughout the world to glean which might best meet the Task Force needs, a summary of which is Appendix E of the *Final Report*. Between Hart's research results and the advice of intertidal scientists, the Island Monitoring Task Force outlined initial goals for the intertidal monitoring:

- To develop a baseline assessment of natural resource conditions in the intertidal areas of recreation islands.

- To develop monitoring protocols that detect change in abundance and composition of target species associated with recreational island use.
- To identify the nature and extent of visitor impacts on the intertidal.
- To institute an early warning system for abnormal conditions or changes.
- To measure effectiveness of management actions.

To that end, the group outlined a preliminary plan of attack to achieve these goals:

The age of Ascophyllum nodosum *can be used as an indicator of trampling in the intertidal zone.*

- Start simple. Two pieces of information are needed: what communities are where (primary space holders)? What are the impacts?
- To address these questions in the first year, map substrate and habitat types (i.e. dominant, conspicuous space occupiers). Assessing this data and the methods for acquiring it after the first year of monitoring would help determine what monitoring is needed and do-able in subsequent years.
- Also look for presence/absence of barnacle hummocks (foot traffic will reduce/crush/eliminate hummocks) and count *Ascophyllum* bladders (trampling, as well as other factors like ice scouring & waves, causes breakage). These can be indicators of use and impact.
- Use GPS photopoints/photorecords, aerial photography, etc. to document sites.
- Add to existing GIS layers.

The purpose of the monitoring in these first years was to assess methodologies and acquire baseline data. If time and staffing were not an issue, advisors recommended monitoring both in the landing zone and in control areas on the same island, for comparison purposes. Such an approach leads more to an in depth study rather than baseline for a monitoring plan. Given the desire to keep it simple, and the realities of staffing shortages, all intertidal monitoring was limited to an island's most commonly used landing areas.

Evaluating and Rejecting Methods

Year 1: On Bangs Island, intertidal data were collected using two protocols: The first was developed for the Boston Harbor Islands National Park Area, and can be found in *Final Report, Inventory of Intertidal Habitats: Boston Harbor Islands, a National Park Area.* The second was the Canadian Department of Fisheries and Oceans *Shorekeepers' Guide for Monitoring Intertidal Habitats*. [Both can be found in the bibliography and will not be outlined in detail here.

Mapping is an important component of intertidal monitoring and both methods enabled baseline mapping and classifying of dominant space occupiers and substrates in the intertidal zone. The first (*Boston Harbor*) relies heavily on the use of GPS and the second (*Shorekeepers*) relies on transect

mapping. Both tools are valuable for in-depth mapping and analysis of intertidal zones but both had limitations for the purpose of this project, chief among which was the time required to carry out the field work.

Intertidal monitoring is limited to the hours immediately around low tide. Both methods took longer than one tide cycle to complete, and proportionally more time to achieve than all other methods combined (campsite, shoreline, etc.). In addition, the *Boston Harbor* protocol's reliance on a high-end GPS with sub-meter accuracy was an important limiting factor, since the Task Force did not have reliable access to such equipment. Though these methods are powerful and serve a valuable service in the regions where they have been employed, the Task Force needed to find simpler methods for mapping and classifying an island's landing area. An additional resource proved invaluable: *Methods for Performing Monitoring, Impact, and Ecological Studies on Rocky Shores*, 2002, by Murray, Ambrose and Dethier (recommended by Dr. Susan Brawley at the University of Maine's School for Marine Sciences). This document and others helped create the new plan for monitoring in the second field season.

[Note: a part of the "back beach" methods outlined in the *Shorekeepers Guide* is used in our shoreline monitoring approach.]

The Intertidal Monitoring Plan

Thanks to the hindsight provided by a summer of field work, additional consultation with experts and literature, the Task Force identified new priorities for intertidal monitoring. Specifically, **indicators** to be monitored would include the dominant species in landing zones, presence/absence of low-tide species and barnacle hummocks, and age-class of *Ascophyllum*. **Primary tools to collect baseline** information would include transect lines for large quadrat percent cover assessments, fixed point photography, rapid-timed searches, and simple observations. Used in tandem with the Survey Checklist method which looks at substrate and other parameters, all of this information would then be mapped using GIS, providing a useful snapshot of the intertidal landing area.

Dominant species assessment (abundance) using transect lines and percent cover: In order to develop a method that could be mapped using GIS, we modified "subjective scale" systems developed by various scientists (such as Kershaw whose 1973 method was adapted from the Braun-Blanquet approach, initially designed in the 1920's; Hawkins and Jones 1992; and Creese and Kingsford 1998. See Murray *et al* for details). Subjective scales are appropriate when you need a coarse-scale appraisal of an area, rather than an in-depth analysis. In our case, it was deemed sufficient to get an overall inventory of dominant species coverage and growth pattern in measured boxes along a transect line, rather than an exact tally of individual organisms. Another consideration is that this approach enables coarse-scale changes to be noted after subsequent years of monitoring. For example, a decrease in an algae's dominance from 6-25% down to 0-5% may not indicate a significant change (it might simply be subjectivity on the part of the surveyor or seasonal variation). On the other hand, when you skip two categories from one year to the next, such as noting 76-100% coverage down to 26-50%, this might be significant enough to warrant management actions.

Fixed-point photography: The transect approach also enabled replicable photography points, perhaps one of the most important portions of our intertidal methodology.

Presence/absence of low-tide species: A rapid 15-minute timed search conducted in the low tide region of the landing zone, right at the time of low tide, is a quick and simple way to document any species of special concern and significant invertebrate populations that might otherwise get missed in the dominant species assessment. It would be most comprehensive to conduct a timed search at mid-tide and high-tide as well, though the low-tide search would more effectively address species diversity.

Aging *Ascophyllum*: A bed of *Ascophyllum nodocum* may, to the naked eye, look perfectly normal. However, a passing storm may have weakened the algal stalks rendering them more easily broken off by trampling feet. Similarly, though repeated trampling may not visually appear to damage algae, it can weaken the stalk rendering it also more easily broken off by storm activity. A landing area composed of predominantly young *Ascophyllum* might very well point to repeated trampling. Counting air bladders along the *Ascophyllum*'s main stalk is a quick and easy way to assess its age. Though our methods focus on *Ascophyllum* aging, the same concept holds true for other species of foliose algae: they are susceptible to damage from trampling.

Presence/absence of barnacle hummocks
Barnacle hummocks, as described above, are good indicators of an area that gets very little human foot traffic, because they are so easy to crush or break apart.

Survey Checklist
The Survey Checklist is an important companion to a comprehensive intertidal monitoring plan. Parameters such as exposure to waves and weather, substrate type, and presence/absence of significant habitats such as clam flats are all covered in the survey checklist and provide important information that is useful in assessing intertidal conditions.

How To: Intertidal Zone Monitoring
NOTE: it is important to be familiar with the section above "The Intertidal Monitoring Plan" as it provides information needed for understanding the field work approach.

NOTE 2: be sure to mark your data sheet if it is neap or spring tide as this will affect the data.

All of the tasks are described in further detail below, along with instruction on how to use the "Intertidal Zone Monitoring Form." There are four major tasks:

1. Setting up the transect line,
2. Estimating abundance,
3. A low-tide timed search,
4. Aging *Ascophyllum* and noting barnacle hummocks.

You will need at least two people to complete this work. Begin this process at least an hour or more BEFORE low tide or you will not have enough time to completely gather all the data before tide covers up a significant portion of your landing zone. You will need to split up to achieve this work in just one low tide (once you have set up the transect line, one person can be noting its triangulation points while the other is conducting tasks 3 and 4). If you are unable to get all tasks completed due to the tide coming in, then plan on doing them at the next low tide. Waiting for several days or for a future field visit will skew your data.

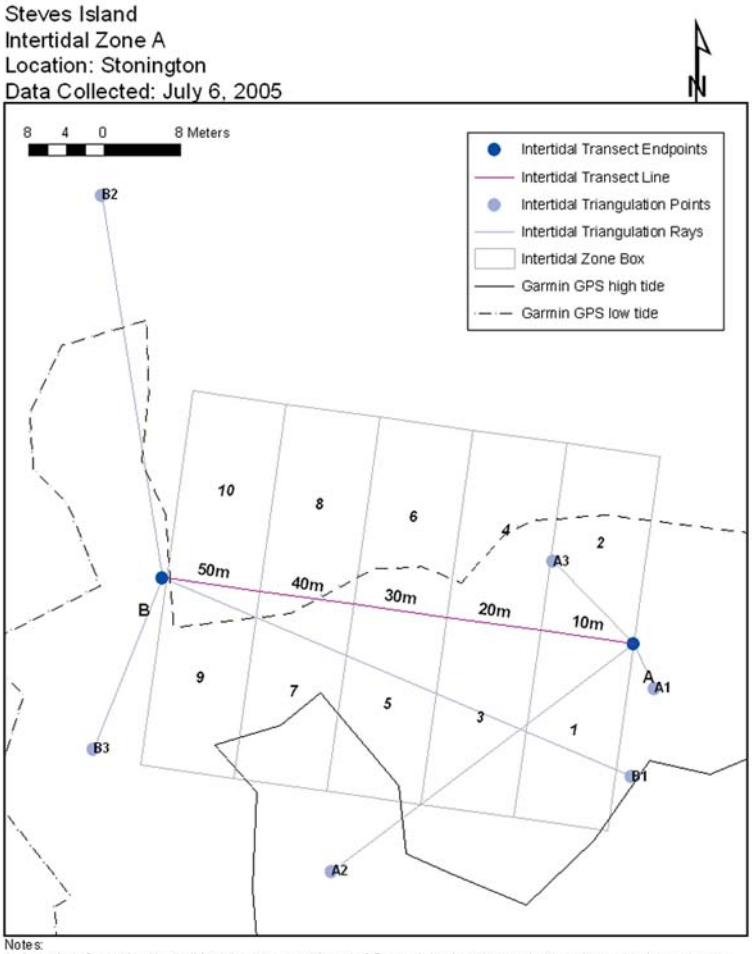
1. Setting up the transect line
The first step is to set up the intertidal transect line. Identify the general landing area for the island or for an island's particular campsite. Chose the area that you believe is used by the majority of boaters and campers, based on information in the MITA *Handbook*, or any other information source available. Eye-ball where the mid-tide line is likely to occur (based on species composition and the overall distance between low and high tide lines). Lay your transect line along that mid-tide line, with 0 (zero) located on the left, as you look up the beach (or right if you are facing the water). If possible, place your transect endpoints over a distinguishing feature such as a quartz intrusion within a granite ledge. Your line will likely rise and fall over rocks; attempt to keep it straight and taught, weighting down both ends with rocks. You may find that your 50 meter tape may be two short to cover the full width of the landing area, in which case, extend the line as needed with a second tape measure.

Now that you have identified your monitoring area, fill out the General Intertidal Zone Information and Use Area Description on the Intertidal Zone Monitoring Form.

Intertidal Zone Transect Data: In order to track changes along this intertidal zone in the future, the transect line will need to be relocated at exactly the same place. Describe the location of the transect as clearly as possible. Point A is at 0 meters (on the left, as you look up the beach or right as you face the water). Point B is the end of the first transect line. If you need a second transect line, B should be the point where the two lines meet and C is the end of the second line. Note the bearing along the transect line, starting at A.

For the purpose of locating the transect line in relation to a campsite that is also being monitored, you need to get a bearing and distance to A, B and C from the center point of that campsite (for information on how to define a campsite centerpoint, see Campsite Monitoring section.

Intertidal Zone Transect Line End Point Triangulation:
Providing triangulation points for each of the transect's endpoints enables exact relocation of the transect line in the future by using triangulation. Start by describing the location of Point A in as much detail as possible, then identify three prominent and reasonably permanent features in the area (for example, a large glacial erratic on the shore, a healthy spruce tree with a distinctive boil, or a distinctive geological feature such as basalt intrusions in a granite ledge). The features should be in opposing directions to enable triangulation. Take a photo of each triangulation feature from the endpoint. Take a compass bearing to each triangulation point from the endpoint, measure the distance to the feature (for example, tallest part of largest boulder), and describe it. In the case of trees or boulders, measure the approximate diameter of the feature, and describe it. For the second transect endpoint, you can reuse the same triangulation points or different ones. Repeat for the third endpoint, if you have one.



Abundance of dominant intertidal species can be estimated using in "boxes" that are delineated along a transect line.

2. Estimating Abundance
Use the transect line as the meter mark to visually create "boxes" or large

quadrats every 10 meters (0-10m is 1st box, 10-20m is 2nd box). Use the low tide line as the bottom of the boxes and the mean high tide line (the top of the blue green algae line, and/or the wrack line left by the last tide) as top of the boxes.

Number the first box in "Site #." Then, standing on the transect line at the middle of the box (i.e., for Box 1, at 5m; Box 2, at 15m etc), take two photos, one looking up and one down, to capture the entire area. Mark the photo numbers in the "Photo #s" box (use U for Up photos and D for Down photos). Ultimately, you cold use these photos to create a panoramic view up and down the intertidal zone from mid-tide.

Describe the location of each box as needed or use that space for any additional comments.

To determine abundance and growth pattern, it is easiest to complete a full box at a time. If you are concerned about time and incoming tide, focus on the "down" boxes (D) first to gather this data and photos before tide comes in. For each species abundance and growth patterns, use check marks or the letter Y for YES in the appropriate spaces on the form. For all other slots where NONE or N/A would apply, leave blank. D = Looking DOWN. U = Looking UP

For each species listed, look at the box you are describing and estimate abundance (number and cover) using the scale provided. For less that 5% cover, "sparse or very sparse" means that there are only a few isolated individuals; and "plentiful but cover small" means there area multiple individuals of that organism but they cover less than 5% of the overall area of the box.

For each species listed, look at the same box and identify that species' growth pattern, using the definitions provided.

- Growing singly, isolated individuals = there are isolated individuals scattered about, but they do not constitute any sort of grouping or aggregate.
- Growing grouped or in tufts = several individuals are growing together to form a tuft or small aggregate.
- Growing in small patches = enough individuals are growing together that they form a small mat of that species in one area.
- Growing in colonies of large patches = a larger mat or carpet of this species takes up a good portion of area.
- Growing in pure populations = the mat or carpet of this species is dominant and limits the growth of other species.

Repeat this same process for each box until you have reached the end of your transect line.

3. Low-tide timed search

At low tide at the landing area, take exactly 15 minutes to do a rapid survey of species occurring in the low tide region. The width of the search area should roughly run parallel to the mid-tide transect line that you set up to estimate abundance. If that is not possible, given rocks and such, then conduct the timed search specifically where you estimate that the majority of boats will land at low tide. Draw the location of your timed search on your sketch map.

Fifteen minutes goes by very quickly so before you officially begin, mentally delineate how long you can spend in each region (for example, 5 minutes along each third adds up to the full 15 minutes) and prepare to keep track of time as you proceed.

Start your search at one end of the landing area and work your way down to the other end. On the last page of the Intertidal Zone Monitoring Form, use hatch marks to note any species that you find during the search. If there are species you do not know, use the back side of your data sheet to rapidly draw or describe them, and immediately move on. Wait until your timed search is over to look them up in a field guide. If you have time later, use the same method to conduct searches in the mid and high tide regions.

4. Aging *Ascophyllum* and noting barnacle hummocks.

Aging *Ascophyllum* (bladder wrack)

Much like counting tree rings, the age of *Ascophyllum* can be determined by counting the number of air bladders growing along the main axis. *Ascophyllum* generally produce one air bladder per year. Lateral fronds form at different ages so air bladders should only be counted along the main axis (though once a lateral frond forms, it too will produce one air bladder per year).

Aging *Ascophyllum* should be done in the landing area in the lower, mid and high tide regions. Start in the low tide region. Randomly chose a clump of *Ascophyllum*, find its longest individual and measure that individual along the main axis. Again along the main axis, count the number of air bladders and mark both measurements on the data sheet (for example: 22 centimeters tall with 7 bladders = 22cm/7). Randomly sample two other individuals from two other clumps at the same elevation and wave exposure. Repeat this process of three samples each in the mid-tide region and in the upper tide region, and note all numbers on the date sheet.

Noting Barnacle Hummocks

Assess the landing area for any evidence of barnacle hummocks. If any occur, note them on the data sheet. One site number refers to the extent of a whole mat of barnacle hummocks. Take a photo of it, sketch it's location on your sketch map and describe its extent.

It is worth taking a walk around the island, or at least the intertidal areas adjoining the landing area, to survey for any other occurrences of barnacle hummocks. Mark these on the map and data sheet as well, and be sure to note if they are NOT in a landing zone. Barnacle hummocks can then be added to a GIS map layer and their presence/absence in the future can help determine the extent of trampling.

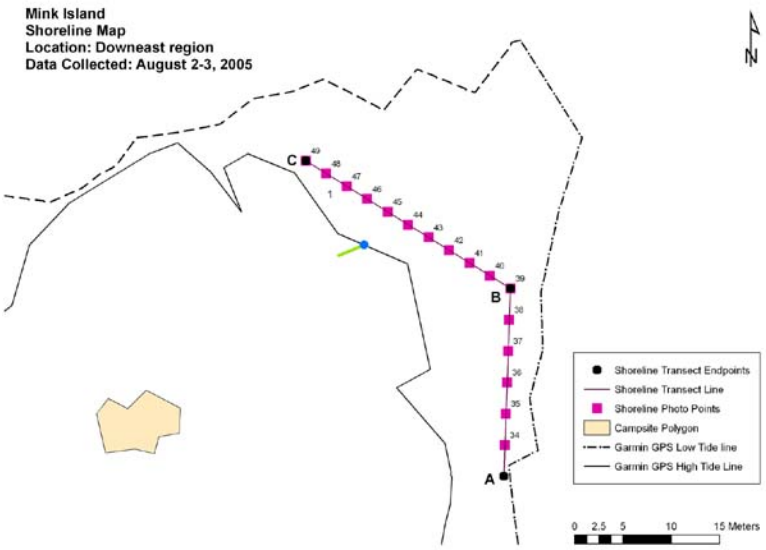
Materials needed

__ Intertidal Zone Monitoring Form (on "write in the rain" paper)
__ Paper copy of map or aerial photo prepared ahead of time (sketch stapled to checklist)
__ Pencil, eraser and sharpener
__ Clipboard
__ Two field tape measures, both in meters
__ Ruler (in centimeters)
__ Camera (and extra batteries)
__ Compass (peephole or card compass)
__ Intertidal field guides (for options, see the bibliography)

Photo Transect Method

Introduction

Through the course of the three year pilot project, the use of photography has emerged as perhaps the single most useful method in our toolbox for documenting change over time. In fixed-point photography, such as this photo transect method, photo points can be exactly relocated to achieve the exact same angle and perspective at different times. This enables concrete visual documentation of change.



The photo transect method was used to systematically collect photos of the shoreline on Mink Island. Each of the pink boxes corresponds to photos whose exact location can be replicated in future monitoring.

The photo transect method can be used when there is a need for fixed-point photographs of an area without added measurements or without the ultimate goal of mapping island features using GIS (though the photo points themselves CAN be mapped using GIS, as explained in the GIS methods section). The method establishes a photographic baseline of an area using a transect line that can be re-positioned in the future. As subsequent years of photos are taken at exactly the same locations, managers can assess changes visually. For example, by repeating a photo panorama of a shoreline every three to five years, changes such as erosion or shoreline vegetation damage can be noted.

Note: the photo transect method is quite similar to the way that transects are used for photography in both the intertidal and shoreline methodologies, minus the rest of those protocols. The photo transect method, as its name implies, is limited to photography, and can be used anytime a series of repeatable photos are necessary.

How To

<u>The Transect Line</u>

Once you have identified an area that needs a series of fixed-point photographs, the first step is to lay down the transect line. Using your tape measure as a transect line, extend the line parallel to the area you want to photograph (for example, parallel to the intertidal zone or a stretch of shoreline). If possible, lay the transect line endpoints on or near distinctive features (such as a quartz intrusion within granite bedrock), as this will facilitate future relocation of the transect line. Your line will likely rise and fall over rocks; attempt to keep it straight and taught, weighting down both ends with rocks.

It will be useful to have a name applied to each end of the transect line. When you are facing away from the water and towards the interior of the island, consider the left end of the transect Endpoint A, and the right end of the transect Endpoint B. You may find that your 50 meter tape may be too short to cover the full width of the landing area, in which case, extend the line as needed with a second tape measure. If you

need a second transect line, B should be the point where the two lines meet and C is the end of the second line.

Now that you have identified your targeted photography area, fill out the General Information (Island name, Campsite/use area location, Date, Inventoried by…) and Area Description on the Photo Transect Data Sheet. Also, mark the photo transect location on your sketch map.

Photo Transect Data

In order to track changes in the future, the transect line will need to be relocated at exactly the same place. Describe the location of the transect as clearly as possible. Note the bearing along the transect line, starting at A, and the length of that transect line in its entirety.

For the purpose of locating the transect line in relation to a campsite that is also being monitored, you need to get a bearing and distance to A, B and C from the center point of that campsite (for information on how to define a campsite centerpoint, see Campsite Monitoring section).

Transect line end point triangulation:

Providing triangulation points for each of the transect's endpoints enables exact relocation of the transect line in the future by using triangulation. Identify three prominent and reasonably permanent features in the area (for example, a large glacial erratic on the shore, a healthy spruce tree with a distinctive boil, or a distinctive geological feature such as basalt intrusions in a granite ledge). The features should be in opposing directions to enable triangulation, and need not be within the campsite boundary. Take a photo of each triangulation feature from the endpoint. Take a compass bearing to each triangulation point from the endpoint, measure the distance to the feature (for example, tallest part of largest boulder), and describe it. In the case of trees or boulders, measure the approximate diameter of the feature, and describe it. For the second endpoint, you can reuse the same triangulation points or different ones.

Photos every 10 meters from A to B (to C if needed)

Starting at 0, take a photo of the feature (say the shoreline). For ideal replicability, take the photo at a right angle from the transect line. In other words, if your transect line from A to B is at a bearing of 100 degrees, then use your hand held compass to take a photo at 10 degrees. Mark the photo number and a photo description on the form. It is good practice to also mark the tape measurement for each photo. Work your way down the transect lines taking photos every ten meters until you reach the end of your zone of interest.

Alternately, rather than taking the photos every 10 meters, you can take photos at whatever the distance from each other produces clear overlap. In other words, when taking the first photo at 0, mentally note what image the right edge of your photograph covers and move down the transect line only far enough that this part of the image now forms the left side of your second photograph. Make sure to list (in the description of photos) at what distance each photo was taken. Keep moving down the transect line ensuring that each photo can safely overlap the previous one so you end up with a composite of the full shoreline. The advantage of this system is that you are certain to get the full shoreline. The disadvantage is that it is nearly impossible to replicate the photos in future years.

Materials needed

__ Photo Transect Data Sheet (on "write in the rain" paper)
__ Paper copy of map or aerial photo prepared ahead of time (sketch map stapled to checklist)
__ Pencil, eraser and sharpener
__ Clipboard
__ Two field tape measures, both in meters
__ Survey flags (12-18 inches tall with colored flags)

__ Camera (and extra batteries)
__ Compass (peephole or card compass)

GPS Data

Date GPS data collected:				
Collected by:				
Island:				
Description of GPS data collected (location, purpose, canopy cover):				
Percent Cloud Cover:				
GPS unit used:				
GPS unit set to NAD 83 and UTM coordinates (yes/no?):				
Site	**Name Saved on GPS**	**Comments**	**Point or Line**	**Task Completed? Y/N**
High Tide Line				
Low Tide Line				
Mid Tide line				
Vegetation Line				
Trail 1				
Trail 2				
Trail 3				
Other:				
Other:				
Other:				
Other:				
Other:				
Other:				
Other:				
Other:				
Other:				
Other:				

Survey Checklist

Island Name: **Date:** **Time of Survey:**

Name of surveyor: **Hours before (-) or after (+) low tide:**

Section Surveyed (if not whole island):

Initial island-wide description of perimeter and shoreline attributes. This is a quick assessment. Method: Circumnavigate the island at mid-tide while visually delineating zones into substrate types (rocky, beach, marsh, mud flat). Label each stretch of substrate as a section on the attached map/aerial photo and assign it a section number. Within each section, note presence of following features in listed zone area. *The low tide survey (right columns) should be completed separately while GPS data for low tide is collected.

	Mid Tide Survey															Low Tide*		
	Landability		Substrate/Habitat Type															
	Rating	Slope	Bedrock	Loose Boulder s	Beach	Marsh	Mudflat	Dominant Species	Bank Erosion	Use Areas	Visible Impacts	Notable Changes	Exposure	Other		Mussel Bed	Clams/ Clam	Eelgrass
	Easy to reach by boat? Rate the likelihood that the area is used as landing spot: L=low; M=medium; H=high	Rate the slope of the landing: Flat=F, Medium=M, Steep=S		Are there boulders? Are they of rollable size? Y=yes; N=no	Cobble=C, Sand=S, Shell=L, or a mix =M	Note live saltmarsh plants (spartina, juncus..)=L or dead marsh grass stalks=D		A=Ascophyllum; F=Fucus; M=Mussel; B=Barnacle; 0=other (please list)	Areas of bank erosion. Any size/area Describe	What is the status of the use area? Designated=D; Undesignated=U; N/A	Natural or manmade, bare areas within populated zones, trash, fire, scars, objects, boiling pasta scars …		N, NE, E, SE, S, SW, W, NW?			Note clam holes & signs of clamming	Note presence. Estimated coverage
1																		
2																		
3																		
4																		
5																		
6																		
7																		
8																		
9																		
10																		

Survey Checklist

	Mid Tide Survey															Low Tide*		
	Landability		Substrate/Habitat Type															
	Rating	Slope	Bedrock	Loose Boulder s	Beach	Marsh	Mudflat	Dominant Species	Bank Erosion	Use Areas	Visible Impacts	Notable Changes	Exposure	Other		Mussel Bed	Clams/ Clam Flats	Eelgrass
	Easy to reach by boat? Rate the likelihood that the area is used as landing spot: L=low; M=medium; H=high	Rate the slope of the landing: Flat=F, Medium=M, Steep=S		Are there boulders? Are they of rollable size? Y=yes; N=no	Cobble=C, Sand=S, Shell=L, or a mix =M	Note live saltmarsh plants (spartina, juncus..)=L or dead marsh grass stalks=D		A=Ascophyllum; F=Fucus; M=Mussel; B=Barnacle; 0=other (please list)	Areas of bank erosion. Any size/area Describe	What is the status of the use area? Designated=D; Undesignated=U; N/A	Natural or manmade, bare areas within populated zones, trash, fire, scars, objects, boiling pasta scars …		N, NE, E, SE, S, SW, W, NW?			Note clam holes & signs of clamming	Note presence. Estimated coverage
11																		
12																		
13																		
14																		
15																		
16																		
17																		
18																		
19																		
20																		

Campsite Monitoring Form

I) General Campsite Information		*Comments*
1) Island name		
2) Campsite location		
3) Campsite tag #		
4) Site Type		
5) Campsite Capacity		
6) GPS Coordinates		
7) Date		
8) Inventoried by		

II) Describe Location of site so others could find it. Locate and label site on map and give GPS center point coordinates of campsite

III) Campsite photos

GOAL: The goal of this section is to capture images from the far edges to across the site and site access points/trails.

Photo number	Bearing from center point to photographer	Distance from center point to photographer	Description of photo (location of photographer, content of photo, etc).

IV) Campsite Reference (Triangulation) Point Information

Campsite Monitoring Form

Reference point number	photo number	bearing from center point	distance from center point	description

V) Center point Information and photos

description of center point location			
Photo #		Description of photo:	
Photo #		Description of photo:	
Photo #		Description of photo:	
Photo #		Description of photo:	

Campsite Monitoring Form

VI) Inventory Indicators	Data	Comments and tide level
Substrate of Shoreline use area between mean high tide line and vegetation area at campsite ("the shoreline zone" or the immediate access zone) (B=bedrock C=cobble Sh=Shell S=sand M=Mud):		
Composition at access onto island's terrestrial zone (consider several access pts) (B=bedrock C=cobble Sh=Shell S=sand M=Mud):		
Width of apparent shoreline disturbance :		
Distance from nearest mean high tide to center point (0=none, 1=<10m, 2=11-20m, 3=21-40m, 4=41-60m, 5=>60m)		
Site visibility from water Y/N		
Number of other campsites visible:		
Distance to nearest other campsite (0=none, 1=<10m, 2=11-20m, 3=21-40m, 4=41-60m, 5=>60m)		
Existing site development. Describe anything built like platforms, signs, steps.		
Potential for unmanaged site expansion and describe situation: Low/ Medium/ High (L, M, H)		
Site Slope (L = <5%, M = 5-10%, S = >10%)		

VII) Impact Indicators	Data	Comments
Condition Class: Look at the overall condition of the area within the campsite boundary and assign it one campsite condition class using the following scale: 1: Recreation site barely distinguishable; slight loss of vegetation cover and/or minimal disturbance of organic litter 2: Recreation site obvious; vegetation cover lost and/or organic litter pulverized in primary use areas 3: Vegetation cover lost and/or organic litter pulverized on much of the site, some bare soil exposed in primary use areas 4: Nearly complete or total loss of vegetation cover and organic litter, bare soil widespread 5: Soil erosion obvious, as indicated by exposed tree roots and rocks and/or gullying.		
Vegetative Ground Cover On-site (1=0-5% 2=6-25% 3=26-50% 4=51-75% 5=76-95% 6=96-100%)		
Vegetative Ground Cover Off-site (Use categories above)		
Exposed Soil (Use categories above)		
Tree Canopy Cover On-site		

(1=0-5% 2=6-25% 3=26-50% 4=51-75% 5=76-95% 6=96-100%)		
Tree Canopy Cover Off-site (1=0-5% 2=6-25% 3=26-50% 4=51-75% 5=76-95% 6=96-100%)		
Tree Damage (total number of each that are: None/Slight; Moderate; Severe)		
Tree stumps (#)/ Dead Trees (#)		
Root Exposure** (None/Slight; Moderate; Severe)		
Per tree:		
Full campsite use area (unrelated to specific trees):		
Fire Sites (#)		
Access Trails (#)		
Human Waste (#) and/or Toilet paper		
Litter/Trash: None, Some, Much (not including toilet paper)		

VIII) Comments/Recommendations:

Campsite Monitoring Form

IX) Transect Data

Flag #	Bearing	Distance	Photo #	Comments

X) Trails intersecting site boundaries

Flag #	Bearing	Distance	Photo #	Comments

XI) Any other features of special concern that should be mapped (groover sites, platform corners, potential site expansion areas, specific trees, plants and/or fire pits, osprey nests, etc.)

Flag #	Bearing	Distance	Photo #	Comments

TRAIL Monitoring Form

I) General Information

1) Island Name: 2) Date:

3) Inventoried by:

4) GPS Unit (Set to NAD 83 and UTM):

Trail Condition Class: Rating to be used specifically when monitoring trails that enter an island's terrestrial zone from the shore. Two conditions are assessed using this same rating. The first is where the trail intersects the island perimeter (or "high tide line" on our maps). The second is three meters in from that point.

0: Trail barely distinguishable; no or minimal disturbance of vegetation or organic litter (typically applied to the undistinguishable sections of discontinuous trails).

1: Trail distinguishable; slight loss of vegetative cover and/or minimal disturbance of organic litter. Includes shrubby overgrown trails with obvious tread of bare soil that can no longer be seen because the shrub cover has overgrown the trail.

2: Trail obvious; vegetative cover lost or disturbed

3: Vegetative cover and organic litter lost in nearly all places, but little or no erosion.

4: Soil erosion or compaction in tread is beginning in some places.

5: Soil erosion or compaction is common; tread is obviously below ground surface.

Trail Function:

A. Trail designated by managers in guidebook or on island maps

B. Apparent primary use trail (whether or not it is specifically designated, this trail is obviously used by a large percentage of visitors)

C. Apparent informal trail (trail is not designated, is created by visitors but is not a primary use trail)

D. Access trail from shore into island

E. Trail into or out of a campsite (crossing campsite boundary defined by Radial Transect)

F. Connector trail between/for campsites or use areas

G. Island perimeter trail

H. Other (describe in comments)

II) Trails Data (*See instruction sheet for how to fill this out.)

Trail #	Photo #	Condition Class			Trail Function, check all that apply								Comments or details	GPSed or Sketched?
		Access at shoreline	Inland to 3 meters	Width of trail (in meters) when trail C.C. is grtr than 0	A. Designated	B. Primary	C. Informal	D. Shore access	E. Into/Out of campsite	F. Connector	G. Perimeter	H Other (describe)		

II) Trails Data (*See instruction sheet for how to fill this out.)

TRAIL Monitoring Form

Trail #	Photo #	Condition Class			Trail Function, check all that apply								Comments or details	GPSed or Sketched?
		Access at shoreline	Inland to 3 meters	Width of trail (in meters) when trail C.C. is grtr than 0	A. Designated	B. Primary	C. Informal	D. Shore access	E. Into/Out of campsite	F. Connector	G. Perimeter	H Other (describe)		

Shoreline Monitoring Form

I) General Shoreline Information	
Island name	
Campsite/use area location	
Date	
Inventoried by	
Considerations and Methods to use: Measure up to the soil/vegetation line; Take care not to have the start of the tape measure next to the compass b/c the metal will affect your readings; Refer to attached condition class for data collection; collect a GPS High and Low tide line	

II) Impact Indicators	*Data*	*Comments*
1) Substrate of Landing Area (B=bedrock C=cobble Sh=Shell S=Sand M=Mud):		
2) Width of apparent shoreline disturbance		
3) Distance from mean high tide to center point (0=none, 1=<10m, 2=11-20m, 3=21-40m, 4=41-60m, 5=>60m)		
4) Site visibility from water Y/N		
5) Shoreline condition class: This condition class is assigned to the whole length of shoreline area as defined by the transect: 0: No apparent impact 1: slight shoreline and bank vegetation trampling but not apparently permanently damaged 2: Some erosion areas and/or some exposed roots and/or some damaged vegetation 3: 25% erosion and/or 25% exposed roots and/or 25% damaged vegetation 4:50% erosion and/or 50% exposed roots and/or 50% damaged vegetation 5: more than 50% of shoreline/bank erosion, and/or exposed roots, and/or damaged vegetation.		
6) Vegetative trampling (None/slight; Moderate; Severe)		
7) Bank erosion (None/slight; Moderate; Severe)		
8) Tree Damage		
(number of trees with None/slight; Moderate; Severe)		
9) Root exposure		
(number of trees with None/slight; Moderate; Severe)		
10) Fire sites (#)		
11) Access Trails (#)		
12) Human Waste (#)		
13) Litter/trash (none, some, much)		

III) Management Comments/Recommendations:

IV) Shoreline transect data

Shoreline Transect Location Description	
Bearing along transect line (A to B)	
Length of transect line (Distance A to B)	
Bearing and distance from campsite center point to A	
Bearing and distance from campsite center point to B	

V) Shoreline transect line end point triangulation

Transect line point A description:	

Photo number A:

Photo numbers	bearing from A	distance from A	description
A1			
A2			
A3			

Transect line point B description:	

Photo number B:

Photo numbers	bearing from B	distance from B	description
B1			
B2			
B3			

VI) Shoreline overview photos

Photo #		Description of photo:	

Photo #		Description of photo:	
Photo #		Description of photo:	
Photo #		Description of photo:	
Photo #		Description of photo:	

VII) Shoreline Transect Data

Considerations: Take the transect line bearing and subtract 90 from the bearing. This second bearing is the one to set the compass at before beginning to collect data.

Flag #	Distance from A	Transect segment length	Distance from Transect line	Photo #	Comments (Specify FP for flag point, T for trail or any other feature. They should all be on this same line).

Intertidal Zone Monitoring Form

I) General intertidal zone information	
Island name	
Campsite/use area location	
Date	
Inventoried by	
Tide level at start (best to start BEFORE low tide): Hours before (-) or after (+) low	
Phase of the moon (for tide range info)	
Comments	

II) Intertidal zone use area description

III) Intertidal zone transect data		
Intertidal Transect Location Description		
Bearing along transect line (A to B, B to C)		
Length of transect line (Distance A to B, B to C or total)		
Bearing and distance from campsite center point to A		
Bearing and distance from campsite center point to B		
Bearing and distance from campsite center point to C		

IV) Intertidal zone transect line end point triangulation

Transect line point A description (on right when facing water):				
	photo number	bearing from A	distance from A	description
A1				
A2				
A3				

Intertidal Zone Monitoring Form

Transect line point B description (on left when facing water):				
	photo number	bearing from B	distance from B	description
B1				
B2				
B3				

Transect line point C (if needed) description:				
	photo number	bearing from C	distance from C	description
C1				
C2				
C3				

Intertidal Zone Monitoring Form

Subjective Observation of Abundance

Create a 10m box using the transect line as the meter marker (ie: 0-10m is 1st box, 10-20m is 2nd box); use Y for YES; for all other slots where NONE or N/A would apply, leave blank; measure below the transect line first (looking DOWN=D) to catch the low areas before tide comes in (looking UP =U); measure what is seen up to the top of the blue green algae or wrack line; take photos at every 5m mark, looking DOWN and UP (ie: at 5m in the 0-10m box, @15m in the 10-20m box)

Site #	**Photo #s**	**Number and cover**												**growth pattern**									
		sparse or very sparse		plentiful but cover small		cover at least 5%		25-50%		50-75%		75-100%		growing singly, isolated indiv.		growing grouped or in tufts		growing in small patches		growing in colonies or large patches		growing in pure populations	
Location description:																							
		U	D	**U**	D	**U**	D	**U**	D	**U**	D	**U**	D	**U**	D	**U**	D	**U**	D	**U**	D	**U**	D
Blue Green Algae																							
Semibalanus																							
Ascophyllum																							
Fucus																							
Red foliose algae																							
Kelp																							
Mytilus edulis																							
Littorina littorea																							
Other																							

Intertidal Zone Monitoring Form

Site #	Photo #s	Number and cover												growth pattern											
		sparse or very sparse		plentiful but cover small		cover at least 5%		25-50%		50-75%		75-100%		growing singly, isolated indiv.		growing grouped or in tufts		growing in small patches		growing in colonies or large patches		growing in pure populations	
Location description:																									
		U	D	**U**	D	**U**	D	**U**	D	**U**	D	**U**	D	**U**	D	**U**	D	**U**	D	**U**	D	**U**	D	**U**	D
Blue Green Algae																									
Semibalanus																									
Ascophyllum																									
Fucus																									
Red foliose algae																									
Kelp																									
Mytilus edulis																									
Littorina littorea																									
Other																									

Site #	Photo #s	Number and cover												growth pattern											
		sparse or very sparse		plentiful but cover small		cover at least 5%		25-50%		50-75%		75-100%		growing singly, isolated indiv.		growing grouped or in tufts		growing in small patches		growing in colonies or large patches		growing in pure populations	
Location description:																									
		U	D	**U**	D	**U**	D	**U**	D	**U**	D	**U**	D	**U**	D	**U**	D	**U**	D	**U**	D	**U**	D	**U**	D
Blue Green Algae																									
Semibalanus																									
Ascophyllum																									
Fucus																									
Red foliose algae																									
Kelp																									
Mytilus edulis																									
Littorina littorea																									
Other																									

Intertidal Zone Monitoring Form

Site #	Photo #s	Number and cover												growth pattern											
		sparse or very sparse		plentiful but cover small		cover at least 5%		25-50%		50-75%		75-100%		growing singly, isolated indiv.		growing grouped or in tufts		growing in small patches		growing in colonies or large patches		growing in pure populations	
Location description:																									
		U	D	**U**	D	**U**	D	**U**	D	**U**	D	**U**	D	**U**	D	**U**	D	**U**	D	**U**	D	**U**	D	**U**	D
Blue Green Algae																									
Semibalanus																									
Ascophyllum																									
Fucus																									
Red foliose algae																									
Kelp																									
Mytilus edulis																									
Littorina littorea																									
Other																									

Site #	Photo #s	Number and cover												growth pattern											
		sparse or very sparse		plentiful but cover small		cover at least 5%		25-50%		50-75%		75-100%		growing singly, isolated indiv.		growing grouped or in tufts		growing in small patches		growing in colonies or large patches		growing in pure populations	
Location description:																									
		U	D	**U**	D	**U**	D	**U**	D	**U**	D	**U**	D	**U**	D	**U**	D	**U**	D	**U**	D	**U**	D	**U**	D
Blue Green Algae																									
Semibalanus																									
Ascophyllum																									
Fucus																									
Red foliose algae																									
Kelp																									
Mytilus edulis																									
Littorina littorea																									
Other																									

Intertidal Zone Monitoring Form

Site #	Photo #s	Number and cover												growth pattern											
		sparse or very sparse		plentiful but cover small		cover at least 5%		25-50%		50-75%		75-100%		growing singly, isolated indiv.		growing grouped or in tufts		growing in small patches		growing in colonies or large patches		growing in pure populations	
Location description:																									
		U	D	**U**	D	**U**	D	**U**	D	**U**	D	**U**	D	**U**	D	**U**	D	**U**	D	**U**	D	**U**	D	**U**	D
Blue Green Algae																									
Semibalanus																									
Ascophyllum																									
Fucus																									
Red foliose algae																									
Kelp																									
Mytilus edulis																									
Littorina littorea																									
Other																									

Site #	Photo #s	Number and cover												growth pattern											
		sparse or very sparse		plentiful but cover small		cover at least 5%		25-50%		50-75%		75-100%		growing singly, isolated indiv.		growing grouped or in tufts		growing in small patches		growing in colonies or large patches		growing in pure populations	
Location description:																									
		U	D	**U**	D	**U**	D	**U**	D	**U**	D	**U**	D	**U**	D	**U**	D	**U**	D	**U**	D	**U**	D	**U**	D
Blue Green Algae																									
Semibalanus																									
Ascophyllum																									
Fucus																									
Red foliose algae																									
Kelp																									
Mytilus edulis																									
Littorina littorea																									
Other																									

Intertidal Zone Monitoring Form

Timed Search				
Island Name:			**Name of Surveyors**:	
Date:			**Amount of Time Allocated to Search**:	
15 minute timed search at low tide landing area. The width of the search area should match the transect line. If that is not possible, given rocks and such, then conduct the timed search specifically where 90% of the boats will land at low tide. Draw the location of your times search on your sketch map. In the box below, check off species using hatch marks to count.				
Low zone (define where):				
Blue Green Algae			Other:	
Semibalanus				
Ascophyllum				
Fucus				
Red foliose algae				
Kelp				
Mytilus edulis				
Littorina littorea				
Seastars				
Urchin				
Mid zone (define where) If you have time, repeat timed search in this zone too.				
High zone (define where) If you have time, repeat timed search in this zone too.				

Ascophyllum Aging		Note the length of the longest frond in randomly chosen clump, and count how many air bladders along that line (for example: 17 inches tall with 7 bladders = 17/7) Describe location.		
	Lower Intertidal	Mid Intertidal	Upper Intertidal	Comments
Sample 1				
2				
3				

Barnacle Hummocks		Note any instances in the landing zone. If hummocks are noted anywhere else (ie not in the landing zone) it it worth noting here too.	
Site #	Photo number	Sketched on sketch map?	Description of location, extent, and other comments

Photo Transect Data Sheet

I) General information	
Island name	
Campsite/use area location	
Date	
Inventoried by	

II) Area description

III) Photo transect data		
Transect Location Description		
Bearing along transect line (A to B, B to C)		
Length of transect line (Distance A to B, B to C or total)		
Bearing and distance from campsite center point to A		
Bearing and distance from campsite center point to B		
Bearing and distance from campsite center point to C		

IV) Transect line end point triangulation

Transect line point A description:				
	photo number	bearing from A	distance from A	description
A1				
A2				
A3				

Transect line point B description:				
	photo number	bearing from B	distance from B	description
B1				
B2				
B3				

Photo Transect Data Sheet

Transect line point C (if needed) description:				
	photo number	bearing from C	distance from C	description
C1				
C2				
C3				

VI) Photos every 10 meters from A to B (to C if needed)			
Photo #		Description of photo:	
Photo #		Description of photo:	
Photo #		Description of photo:	
Photo #		Description of photo:	
Photo #		Description of photo:	
Photo #		Description of photo:	
Photo #		Description of photo:	
Photo #		Description of photo:	
Photo #		Description of photo:	
Photo #		Description of photo:	
Photo #		Description of photo:	
Photo #		Description of photo:	
Photo #		Description of photo:	