



# *Shorekeepers' Guide for Monitoring Intertidal Habitats of Canada's Pacific Waters*



Developed by:

Glen S. Jamieson  
Colin D. Levings  
Brad C. Mason  
Brian D. Smiley

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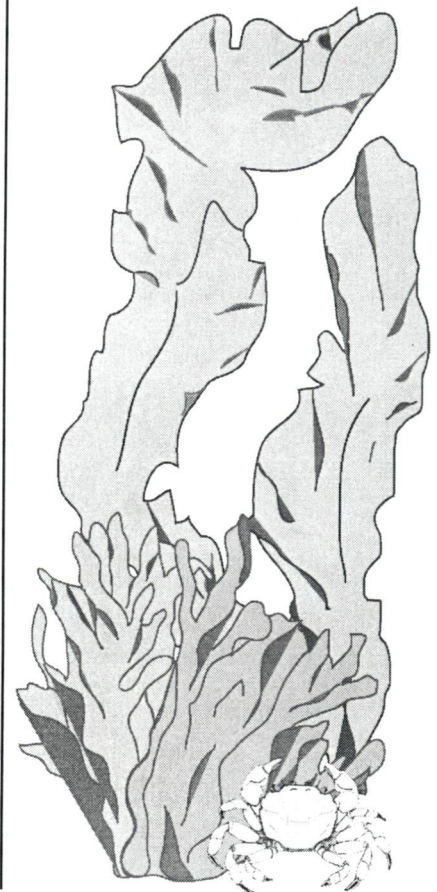
*Shorekeepers' Guide for  
Monitoring Intertidal Habitats  
in Canada's Pacific Waters*

*Introductory Sections*

# ABSTRACT

The Shorekeepers' Guide is a protocol for non-professionals to map and survey the intertidal zone, and to produce data of sufficient quantity and quality for use by resource managers, environmental biologists, and marine researchers who are monitoring and assessing long-term changes in marine communities. The goal is to enable interested non-professional individuals and community groups to obtain standardized, credible data over time from a specific physical site — and from these data, to document and evaluate the nature of change, if any, that is occurring. The protocol uses both physical substrate characteristics (e.g. sand, mud, and rock boulders) and biological features (e.g. rockweed and eelgrass beds) to define and map habitats, which are then sampled for species diversity and abundance. The protocol can be used on both soft and hard intertidal substrates, and includes a descriptive method for backshore surveying within 20 m of the intertidal zone.

The Guide is comprised of three modules: a mapping and survey procedure, a data management procedure, and a training curriculum to teach leaders about the survey protocol and data management procedures.

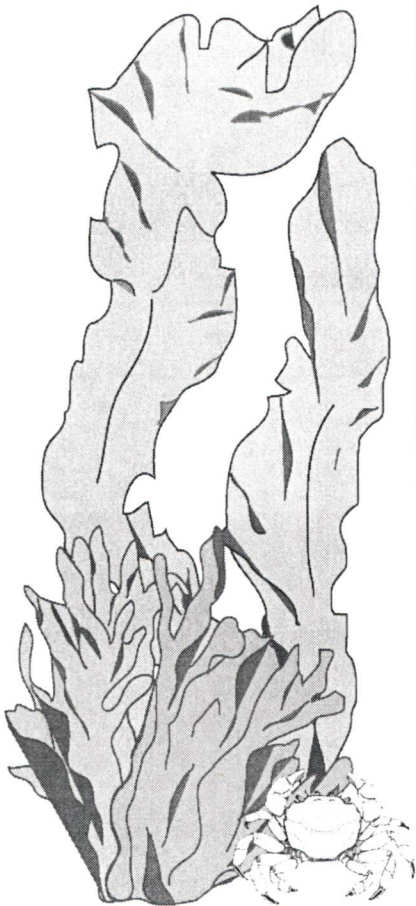




## RÉSUMÉ

Le Guide des Gardiens du littoral est un protocole destiné à aider les non-professionnels à faire des relevés et à cartographier la zone intertidale, en produisant des données dont la quantité et la qualité sont suffisantes pour qu'elles soient utiles aux gestionnaires des ressources, aux biologistes de l'environnement et aux chercheurs en biologie marine qui surveillent et évaluent les modifications à long terme des communautés marines. L'objectif est de donner à des personnes ou des groupes communautaires, qui ne sont pas des professionnels, le moyens de recueillir sur une période assez longue des données normalisées et fiables sur un site particulier – et, à partir de ces données, de documenter et d'évaluer la nature des modifications éventuelles qu'il subit. Le protocole utilise à la fois des caractéristiques du substrat physique (sable, vase, blocs de rocher, par exemple) et des caractéristiques biologiques (herbiers de fucus ou de zostère, par exemple) pour définir et cartographier les habitats, dont l'échantillonnage permet ensuite d'étudier la diversité et l'abondance. Le protocole peut servir pour les substrats intertidaux mous aussi bien que durs, et comporte une méthode descriptive pour faire le relevé de l'arrière-plage dans les 20 mètres de la zone intertidale.

Le Guide se compose de trois modules: procédure de cartographie et de relevé, procédure de collecte des données, et module de formation pour apprendre aux responsables à appliquer les procédures.



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# BACKGROUND AND INTRODUCTION

In January, 1997, Canada's Oceans Act was passed. This Act expanded the mandate of the Department of Fisheries and Oceans (DFO). In the past, the status of individual fish species has been largely monitored in isolation both from other species and their ecosystem. The Oceans Act now requires DFO to initiate an integrated and co-ordinated ecosystem-based approach to managing our ocean's resources, where species and habitat issues are evaluated in the context of their relation to other ecosystem components around them.

Such an approach will often require collecting data not just on managed species but rather on a wider variety of species that live in the same habitat and that may be connected ecologically to the managed species. More focus will now be directed on acquiring scientific knowledge about the natural relative abundance and spatial distribution of a variety of species that live in a habitat, and the impacts that human activities are having on them.

This demand for new information has come at a time when governments everywhere are reducing their expenditures, yet also at a time when local people and communities want greater involvement in decision-making processes. Decision-making implies assuming responsibility, and participation here is enhanced when the understanding of issues is obtained by direct involvement in field studies. Thus, there is now considerable opportunity and need for community groups and individuals to work with DFO's science staff to obtain new knowledge about our marine ecosystems.

It is the need for a new data acquisition approach that stimulated development of this Shorekeepers' Guide. The Guide has been modelled in part after the goals of the successful Streamkeepers' Program, a combined federal and provincial initiative designed to help non-professional community groups and individuals in British Columbia contribute significantly to preservation, protection, and enhancement of freshwater habitats. The methods used in the Shorekeepers' Guide are based loosely on the approach described in the DFO Coastal and Estuarine Fish Habitat Description and Assessment Manual, completed in 1993. However, the Guide differs from this Manual and most other regional approaches in that the Guide uses both physical substrate characteristics and

biological features such as rockweed and eelgrass beds to explicitly define habitats.

From 1996 to 1998, there were three major field testings of the Shorekeepers' methods and materials, with each leading to significant improvements or adjustments in the methodology described here in the Guide. Trials mostly occurred between Ladysmith and Denman Island, off south-eastern Vancouver Island, and thus the species listed in this Guide are those most likely to be found in Strait of Georgia marine communities. Additional lists, and in some cases even habitat types, for different geographical areas may be made available in the future; these will be added as new appendices.

There are a number of other intertidal monitoring protocols available to the public, but the goals and objectives of these protocols vary considerably. Many are focused more on education rather than the long-term provision of usable data. Groups interested in monitoring their marine environment should investigate all protocols before choosing an approach that they feel best suits their needs and monitoring capabilities. It is important to maintain familiarity with the available protocols, because their methods and materials may be modified over time as conditions change and new protocols may be developed.

If you choose this protocol, please stay in contact with your DFO representative so that any updates to this version of the Guide can be made available to you.

Some features of the Shorekeepers' Guide that set it apart from most other existing protocols are:

- Data credibility is high for use by resource management agencies;
- Procedures and systems are established for both data maintenance and accessibility by participating community groups; and
- Leader training procedures and technical support services are available to minimize problems.



# ORIENTATION TO THE GUIDE

## WHAT IS THE SHOREKEEPERS' GUIDE?

The Shorekeepers' Guide has been developed in response to growing concern about the impacts of human activities on marine life in British Columbia. Right now over 2 million people in BC live on the coast, and in the future this number is expected to grow faster than in the past. Surface runoff from urban areas and farms, human sewage, industrial discharges, logging, fishing, fish farms, clam digging, breakwaters, and even foot traffic on beaches can cause changes to the characteristics of intertidal communities.

Three modules comprise the Shorekeepers' Guide. The first two demonstrate how to set up and conduct surveys to monitor intertidal plant and animal communities, and how to organize and enter your data to the Shorekeepers' database. The third module is a two part curriculum to train volunteers both in how to conduct a survey and how to manage the data obtained.

## WHO CAN USE THIS GUIDE?

You may be concerned that a nearby industry is affecting the plants and animals on a particular shoreline; that the ecology of a particular shore is being affected by harvesting; or that the abundance of a few particular plants or animals appears to be changing. This Guide is intended for both professionals and non-professionals who would like to monitor the health of shores in their area and need a tool to do so. Participants may be volunteers, members of a community environmental group, or a senior high school class. Participants should be able to commit several full days each year to survey a site, be prepared to learn the survey techniques, which are rigorous and require some math. They should be interested and willing to learn how to accurately identify a large number of intertidal plant and animal species.

## **SURVEY TRAINING**

To make a Shorekeeper survey easier and its resulting data useful, participants are encouraged to take a training course. Module 3 presents a detailed course curriculum so that individuals with professional training in marine biology can develop a training course for non-professionals who wish to conduct Shorekeeper surveys in their area. If you are interested in taking the Shorekeeper course or in hosting a course, contact a DFO representative.

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## **WHERE DO THE DATA GO?**

Data collected from each Shorekeeper survey are first recorded on data sheets while in the field. They are then entered into the Shorekeepers' database. This is a multi-level computer database with explanatory screens that show how and where to input the data. Volunteers can receive summary reports of their data directly from the database. DFO representatives who maintain the database will analyze and report these, and other data, to look for long-term trends in intertidal habitat characteristics.

## **HOW TO USE THIS GUIDE**

Module 1 has been written in an easily understood step-by-step manner to guide a user through each step of a survey. First read through Module 1. Contact a DFO representative to discuss your interests and to obtain information about the status of Modules 2 and 3B. Module 1 will be your guide when you actually do a field survey. Module 2 will be your guide to data entry. If you plan to be an instructor for a Shorekeeper surveying and mapping course, then you will need Module 1 and Module 3, Part A. If you plan to be the instructor for a Shorekeeper data management course, then you will need Module 2 and Module 3, Part B.

# DESCRIPTION OF THE MODULES

## Module 1: Mapping and Surveying Intertidal Habitats

This Module describes in a step-by-step manner how to proceed from selection of a survey site through the entire process of mapping and surveying that site. You will document your concerns about the area and collect relevant maps or charts that encompass the area. You will assemble a survey team and select survey dates. You will map the habitats in your study area and take physical measurements of the slope and elevation. Then you will lay out quadrats within which you will identify and count or estimate each different species of plant and animal.

**Time commitment:** 2 days per year (minimum).

**No. of people required:** 5 or 6 per survey team.

**Time of year:** Spring or summer months when tides are low during the day.

**Training:** A Shorekeepers' surveying and mapping course should be completed by at least one member of the survey team (and preferably more) who will then act as leader to ensure that all aspects of the survey are completed correctly. Any team members who have not taken the course should be completely familiar with the survey methods in Module 1 before beginning the survey; they also should be able to identify the species of plants and animals likely to be encountered at the selected survey site.



## **MODULE 2: INFORMATION MANAGEMENT (in preparation)**

This Module describes the Shorekeepers' database. It provides a step-by-step guide to using the database, entering different types of data, and producing data summary reports about your survey.

**Time commitment:** 1 day per year.

**No. of people required:** 1 to 2 per survey team.

**Training:** To use the Shorekeeper database and complete the data entry, you should be familiar with Microsoft Access. If you are not familiar with Microsoft Access, then training may be necessary.

## **MODULE 3: TRAINING CURRICULUM FOR INSTRUCTORS**

### **Part A: Curriculum for Module 1: Mapping and Surveying Intertidal Habitats**

Part A of this Module is for individuals who intend to develop and offer a Shorekeeper surveying and mapping course. Such individuals should have professional knowledge about intertidal ecology and should have some experience surveying and mapping. The module describes the information that needs to be presented and learning outcomes, and also suggests how to present information.

**Course duration:** 24-hour instruction over 2 to 5 days.

## **MODULE 3: TRAINING CURRICULUM FOR INSTRUCTORS**

### **Part B: Curriculum for Module 2: Information Management (in preparation)**

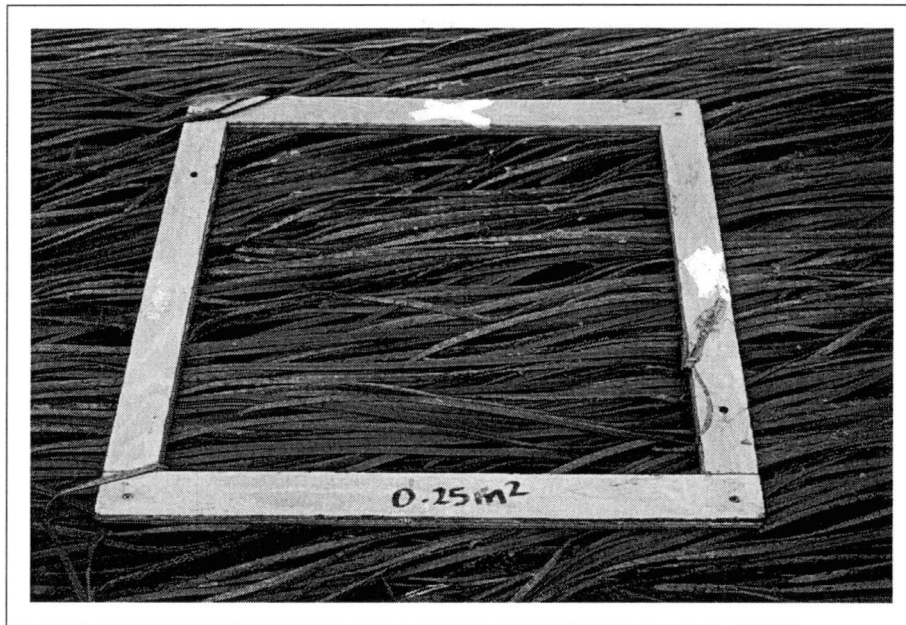
Part B of this Module is for individuals who intend to develop and offer a Shorekeeper data management course. Such individuals should have experience using Microsoft Access databases. The module describes the information that needs to be presented and learning outcomes, and also suggests how to present the information.

**Course duration:** 3 to 4 hours.

*Shorekeepers' Guide for  
Monitoring Intertidal Habitats  
in Canada's Pacific Waters*

*Module 1: Mapping and Surveying  
Intertidal Habitats*

# *Module 1: Mapping and Surveying Intertidal Habitats*



*Shorekeepers' Guide for Monitoring Intertidal Habitats of Canada's Pacific Waters*



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# *Module 1: Mapping and Surveying Intertidal Habitats*

April 1999

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# INTRODUCTION

WELCOME to the Shorekeepers' Guide, Module I: Mapping and Surveying Intertidal Habitats.

## WHAT IS A SHOREKEEPER SURVEY?

Surveying is mapping and documenting the plants and animals in these habitats. The intertidal zone – the area between the higher high water mark and the lower low water mark – is the Shorekeepers' area of interest. But the Shorekeepers' survey also includes a description of the backshore, the area from the higher high water mark away from the shore for 20 m. This backshore area may have significant influence on the intertidal zone, due to human impacts there such as modified water runoff.

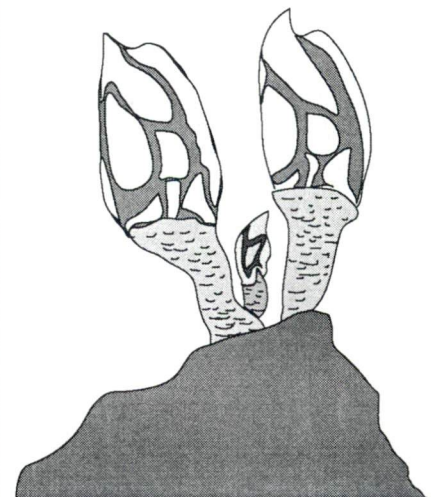
If a study area is surveyed once, it is inventoried, and a snapshot of its ecology is obtained. If a study area is surveyed at least twice, it is monitored, and changes in the ecosystem can be recorded and causal factors may be identified. For a good look at what is happening in an area, it should be surveyed every year at the same time for 3 to 5 years or longer, so that small year-to-year changes (which are to be expected) can be separated from longer term changes.

## WHEN SHOULD A SURVEY BE DONE?

In British Columbia, surveys are usually done between April and October. June, July, and August are the optimal months, because low tides occur during daylight. Just like on land, marine plant and animal abundance and diversity change with the season. If a study area is to be monitored over a number of years, then it should be surveyed at the same time each year so that organisms are at the same stage in their life cycles. In this way any changes that are seen on the shore may be attributed to something other than normal seasonal changes in plant and animal populations.

## HOW IS A STANDARDIZED SURVEY DONE?

A standardized survey should be done by a group of people working as a team. The Shorekeeper surveying and mapping



Time Commitment/Year: 2 Days  
No. of People: 5 to 6/Survey team  
Time of Year: Spring or summer  
Training/Study Area: Yes

course should be taken by at least one member of the survey team. This person should act as the leader to ensure that all aspects of the survey are completed correctly. Although we use words like “standardized” and “rigorous”, and although this manual may seem complicated, the survey process is broken down into easily understood steps that are grouped into logical tasks. There are 34 Steps. Listed below are the **seven tasks** in a survey.

## **PREPARATION**

Task 1: Getting Started

Task 2: Preparing for the Survey Day

## **CARRYING OUT THE SURVEY**

Task 3: Defining Study Area Boundaries and Components

Task 4: Mapping the Study Area

Task 5: Documenting Physical Features of Each Habitat

Task 6: Documenting Plants and Animals in Each Habitat

Task 7: Surveying the Backshore Zone

The standardized survey has four data forms that must be completed.

Form 1: Study Area Description

Form 2: Survey Description

Form 3: Habitat Unit Description

Form 4: Sketch Map

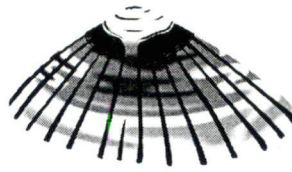
## **WHAT HAPPENS AFTER THE SURVEY IS DONE?**

When all data forms have been completed, the data must be entered into the Shorekeepers' Database and the data forms must be submitted to DFO. The DFO representative can advise you about entering the data yourself.

What follows in this module is the step-by-step procedure for doing a survey and completing the data forms.



# Getting Started



## STEP 1: CONTACT A DFO REPRESENTATIVE

A survey is done in cooperation with DFO and often other Shorekeepers on the coast. Therefore the first step is to contact one of the DFO people listed below. By working together, a local community and DFO can get useful information about a stretch of shoreline. This partnership begins long before any data are collected; it begins by choosing an appropriate study area that meets study objectives.

### DFO SHOREKEEPER REPRESENTATIVES IN BRITISH COLUMBIA

#### Vancouver Area and Sunshine Coast

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250-756-7223

### SHOREKEEPER TRAINING

Although the manual is presented in a clear and relatively simple format, at least one member of a survey team is required to take a Shorekeeper training course. The training is designed to ensure that scientific survey techniques are followed. DFO will provide you with details about planned Shorekeeper training courses.



## STEP 2: DEFINE GOALS AND CHOOSE A STUDY AREA

The survey team should first identify their key issues of interest or concern. For example:

- You may suspect that a nearby industry or fishing activity is affecting the plants and animals of a particular shoreline. If so, you might want to monitor the shore area you think is being affected, as well as a reference site at another location of a similar type that you believe is unaffected. By monitoring both study areas it will be possible to compare results. However, to establish a strong correlation between cause and effect, a number of sites in the two categories (affected and reference) will need to be monitored.
- You may want to describe the ecology in local intertidal habitats, or to document natural changes in community structure. For example, perhaps you are most interested in surveying a sandy beach or a rocky outcropping to describe the kinds of long-term change in habitats that may be occurring, and how species composition changes from year to year.
- You may be concerned mostly with a few particular plants or animals. If so, you will need to select a study area that contains the habitat in which those plants or animals occur.

A DFO representative will discuss with you your issues of concern, help you by identifying appropriate study areas, and assist in determining the number of study areas you should plan to survey. Study areas will each be registered and your team will be given a registration number for each area for long-term use. Put this registration number on all information related to a study area before submitting it to DFO. The DFO representative will also answer any questions about the steps involved in the surveying process.

*To be able to address most concerns, the team should plan to survey the same study area each year for 3 to 5 years to provide initial baseline data so that future changes can be documented.*

*Monitoring after that could be less frequent depending on what monitoring goals were established.*



## STEP 3: DECIDE ON THE SIZE OF THE STUDY AREA

Regardless of why a particular area is chosen, the study area length should be no less than 50 m and no more than 500 m along the shoreline. Realistically, the size of the study area will be limited by:

- the number of discrete habitat units that will be surveyed;
- the number of people on the survey team;
- the number of days available to do the survey.

A team of five to six people can probably survey no more than 50 m to 100 m of shoreline in 1 day. Such a survey takes 4 to 6 hours for the intertidal zone and an additional 1 to 2 hours for the backshore, depending on its complexity. Table 2 (page 35) provides an estimate of the time needed to complete each step. Remember, it is important to plan to survey a study area annually for 3 to 5 years. This is necessary to obtain baseline data against which to measure any long-term changes.



## STEP 4: RESEARCH THE STUDY AREA

Before collecting data in the field, try to find out if previous survey work has been done in and around the study area.

Notify the DFO field office in your area (Table 1 below) about your planned survey before you go into the field, so that they are aware of your activities. They can help you determine if the foreshore is part of an aquaculture lease or First Nations' territory, in which case you will need permission to do the survey.

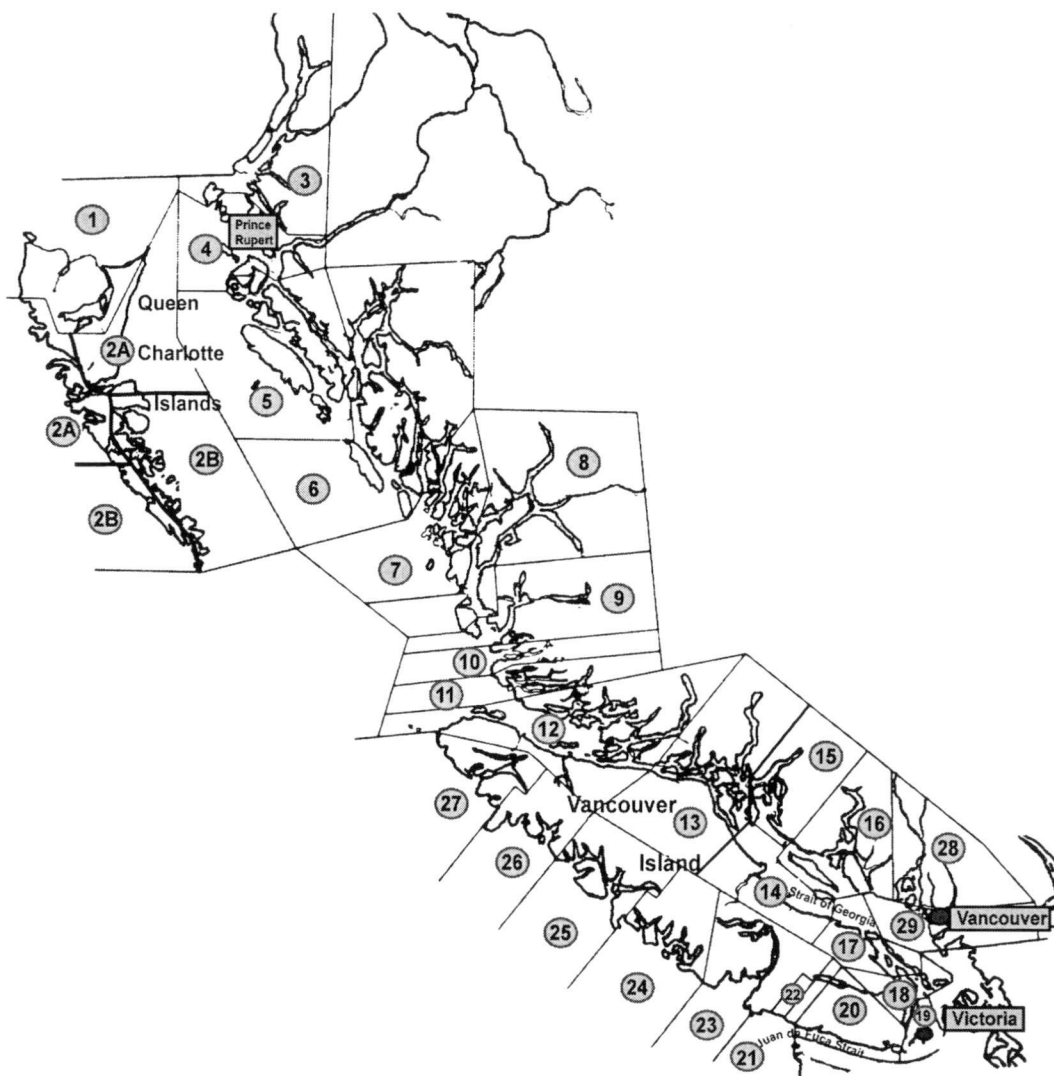
Table 1. Fisheries and Oceans Field Offices.

DFO Office	Phone	Fax	Fisheries Statistical Area of Jurisdiction*
Bella Bella	250-957-2363	250-957-2767	7
Bella Coola	250-799-5345	250-799-5540	8, 9, 10
Campbell River	250-287-2102	250-287-4899	13, 14N, 25, 26
Masset	250-626-3316	250-626-3253	1
Nanaimo	250-754-0235	250-754-0309	14S, 15, 16, 17
Port Alberni	250-724-0195	250-724-2555	21, 22, 23, 24
Port Hardy	250-949-6422	250-949-6755	11, 12, 27
Prince Rupert	250-627-3401	250-627-3188	3, 4, 5, 6
Queen Charlotte City	250-559-4413	250-559-4678	2W and 2E
Steveston	604-664-9521	604-664-9255	28, 29
Victoria	250-363-3252	250-363-0191	18, 19, 20

\*Coastal and offshore waters are divided into Fisheries Statistical Areas for management purposes. Figure 1 presents the location of each statistical area listed.



**Figure 1. Nearshore Fisheries Statistical Areas of British Columbia.**





If the study area is near the Strait of Georgia, check:

Lessard, J., C.D. Levings, M.S. North, and D. J. H. Nishimura.  
1996. Annotated Bibliography of Nearshore Fish Habitat  
Maps for the Strait of Georgia. Canadian Manuscript  
Report of Fisheries and Aquatic Sciences, No. 2350: 31 pp.

This bibliography gives brief descriptions of research that has been done in the Strait of Georgia, and gives addresses of where to get the original reports. Information from these reports may help orient your work, suggest areas that need further investigation and/or highlight important environmental issues in the area. To get a copy, contact a DFO representative or a DFO field office.



## STEP 5: DETERMINE HOW TO SURVEY THE BACKSHORE

If you have not already done so, find out if the backshore (the land away from the shore) is privately owned or owned by First Nations'. If it is private or is under First Nations' title, contact the landowner or First Nations Band Office and ask permission to map and survey the area. If it is not possible to access the land, or if the site is heavily developed with buildings, roads, and paving, then describe the backshore on **Form 2** in as much detail as possible by viewing it from the beach.



## STEP 6: PREPARE THE SURVEY TEAM

It is important to be well prepared before going into the field. You will need to know how to correctly identify relevant habitats and plant and animal species. The goals that you identified in **Step 2** will determine the type of intertidal study area (e.g. rocky shore, sandy shore, mudflat) you will be surveying, and hence the types of plants and animals with which you need to be most familiar. For example, if your particular concern is about clams, you would want to make sure that everyone on the team can identify all the species of clams that are likely to occur at the study area.

Also, when you survey the backshore, team members should be able to identify the major plants that occur there.

Obtain several plant and animal identification books to study and take into the field for references. There are a number of good field guides for identifying plants and animals. See the suggested reading list at the end of this Module. You may need to use several books at the same time. One guide may have a good description of a species giving both a common name and the scientific (Latin) name and a drawing of the animal, while another may have a very good photograph of it. In many cases, photographs are far more helpful than black and white drawings except perhaps photographs of an organism coated in an encrusting organism, giving it a misleading colour. Most guides give good information about the more common shoreline species, but many of the less common species are not mentioned at all. As a result, some species may be difficult to identify.

It is also a good idea to find resource people and organizations who can help identify specimens that you can not identify yourself. Contact colleges, universities, or museums to find resource people. The DFO representative can help with this. Make a reconnaissance trip to your study area. Familiarize yourself with its habitats and the general features. Try to identify as many plant and animal species as you can. In the intertidal

*Take the time to develop a list of contacts. Expert advice will be valuable along the way.*





area look on the surface, look under rocks, and dig down in the sand or mud. In the backshore, identify the major species of plants growing there. Take notes of the species you find and make sure that every member of your team can identify them. Take small samples or photographs of what you cannot identify and contact one or more of your resource people for assistance. Be cautious when making an identification. There may be many plants and animals that you cannot fully identify. Record the identification only to the taxonomic level you feel confident to identify. For example, if you see a barnacle, but you are not sure whether it is a brown barnacle or a common barnacle, then only record "barnacle," noting that it might be one of two species. Even this incomplete identification gives useful information.



## STEP 7: OBTAIN MAPS OF THE STUDY AREA

Obtain the hydrographic chart or topographic map that includes the study area. Maps and charts are used to locate the study area in geographic coordinates such as latitude and longitude. You can get the coordinates from maps or from charts, so you need obtain only one or the other. If aerial photographs are available for the area they may also be worth having. Generally, they are expensive to buy, but a local forestry company or the Ministry of Forests may have some that you can look at. Aerial photographs can be used to examine the general habitat characteristics of the study area and to orient the site in accordance to the surrounding landscape. For all types of maps, check local university and college libraries to see what they have. Often you can make large sized photocopies of their maps.

The following description of map types may help you decide which type(s) to get and where to get them.

### HYDROGRAPHIC CHARTS

Hydrographic charts are used for ocean navigation, and are produced by the Canadian Hydrographic Service. They are sold by marinas, sporting goods stores, dive shops, and boat/yacht outlets. Charts are available for the entire coast in many different scales, from very detailed (1:2,000) to very generalized (1:250,000). On most charts, important areas are shown in greater detail using a large-scale inset map. Choose the chart with the most detail of the study area.

The dotted lines on newer charts represent chart datum (see sidebar for definition) and give some indication of how the intertidal shore will look at the lowest low tides.

Every hydrographic chart has a four-number chart code in the corner. A typical chart code looks like "3527." A chart also has a name that is usually the closest port or major body of water (e.g. Baynes Sound).

#### Chart Depth Notation

Chart Datum = the lowest low level on the shore that the tide reaches. (Differs from U.S. Chart Datum which is mean lowest low water).

$3_2$  = 3.2 m below chart datum.

$\underline{1}_3$  = 1.3 m above chart datum and may be exposed during low tides (note the underlining).



If you use a hydrographic chart, record the chart code and the scale of the chart on **Form 2** under **Information Sources**.

## TOPOGRAPHIC MAPS

Topographic maps give little or no information about the coast. Instead, they are a map of the land, including names and locations of all major natural features such as lakes, rivers, and coastlines, as well as human-made features such as roads, buildings, docks, and lighthouses. Topographic maps also show land height as a series of contour lines.

The most common maps are the 1:50,000 and 1:250,000 National Topographic Series (NTS) maps. These maps are available for the entire west coast of British Columbia south of the Alaska Panhandle, including Vancouver Island, the Gulf Islands, and the Queen Charlotte Islands. It is best to use the 1:50,000 series maps because these show greater detail than the other series, and it will be easier to locate the study area.

NTS maps are available from the Geological Survey of Canada and many private retail outlets (see **Appendix A**).

Every topographic map has an NTS code on the corner of the map. A typical NTS map code looks like "92 F/10." The map also has a name, e.g. "Comox", that appears directly above the code.

If you use a topographic map, record the NTS code, the name of the map, and the scale of the map on **Form 2** under **Information Sources**.

## AERIAL PHOTOGRAPHS

Aerial photographs have been taken in Canada since the 1930s. Photos come in many scales that range from 1 km x 1 km ground area on a single 1:5,000 photo to 16 km x 16 km ground area on a single 1:70,000 photo. The most commonly sold photographs are the 1:15,000 to 1:20,000, which equals roughly 4 km x 4 km on the ground. Nearly all photos are taken with high contrast black and white film, but you can sometimes get colour photos. If you can get them, you may prefer to use colour photos because habitat features are easier to see.



Try to get a recent photo that was taken when the tide was low, so you can see the intertidal area. Use the largest scale you can get because it will give the most detail of your study area. Use the most recent photographs.

You can get photos from the Federal Government and the Provincial Government, but the Provincial Government has a bigger collection and their photos are easier to find. In either case, photos can be examined and purchased, but not loaned. You may be able to borrow a set from a local forestry office. Addresses and telephone numbers of these and other aerial photo dealers are given in **Appendix A**. Check with local dealers in B.C. first because they may have the photo that you want in stock.

Every aerial photo has a code along the edge of the photo. It looks like "BC 93099 - 43." On all provincial photos since 1977, the first two digits following the B.C. prefix show the year in which the photo was taken. For example, BC 89023 indicates that the photos were taken in 1989. Before 1977, only four-digit numbers were used.

If you use an aerial photograph, record the aerial photo code and the scale of the photo on **Form 2** under **Information Sources**.





## STEP 8: PREPARE DESCRIPTION OF THE STUDY AREA AND THE SURVEY

At this point, you have chosen the study area, defined the objectives of your study, and chosen the people who will do the field survey. Begin to fill out **Form 1: Study Area Description** and **Form 2: Survey Description** as much as you can. You will not be able to complete it until after the field survey is finished.

Following the examples of completed **Forms 1** and **Forms 2** (Figures 2 and 4) are descriptions of the headings (Figures 3 and 5) to clarify for the user the types of information required. Blank forms are in **Appendix B**.



Figure 2. Example of a Completed Form 1.

**FORM 1: Study Area Description**

Form Filled In By: Mary Smith  
 (First Name) (Last Name)

**PART 1 of 3: REFERENCE INFORMATION**

Study Area Name: Sunset Cove  
 DFO Registration No.: SK98-001  
 DFO registration No. for Control or Treatment Study Area: SK98-002

**APPLICANT CONTACT INFORMATION:**

Name: Allan Fry  
 (First Name) (Last Name)  
 Organisation: Seawatch Society  
 Address: 123 Road Street  
Parksville V3S 1Z7  
 (City/Town) (Postal Code)  
 Phone: (250) 444-4567 same  
 (Daytime) (Evening)  
 Fax: (250) 444-4566  
 Email: afry@connection.com

**DFO REPRESENTATIVE CONTACT INFORMATION:**

Name: Glen Jamieson  
 (First Name) (Last Name)  
 Address: Pacific Biological Station  
Hammond Bay Road  
Nanaimo V9R 5K6  
 (City/Town) (Postal Code)  
 Phone: (250) 756-7223  
 Fax: (250) 756-7206  
 Email: jamiesong@pac.dfo-mpo.gc.ca

**STUDY AREA OBJECTIVES:**

Overall Objective of the Study: urban development effects  
 Objective Notes: document diversity at site affected by heavy foot traffic  
 Reason for Choosing this Study Area: ease of access  
 Selection Notes: close to public access path



Figure 2 (continued). Example of a Completed Form 1.

DFO Reg. No.: SK98-001Study Area Name Sunset Cove

## FORM 1: Study Area Description

### PART 2 of 3: STUDY AREA LOCATION

#### GENERAL DIRECTIONS TO THE STUDY AREA:

Travel 2 km north of Parksville on highway. Turn right on Dennis Rd. follow to end. Study area ~ 30 m to the right as you face the sea.

#### DESCRIPTION AND LOCATIONS OF PERMANENT TRIANGULATION MARKERS:

Marker 1: Telephone pole with sign re: under sea cable. Measurement is from base of pole. Telephone pole is located at very end of Dennis Rd.

Marker 2: Base of fence corner post closest to end of Dennis Rd. on your right as you face the water. This is the fence that runs along the waterfront on 222 Seaview Street.

Marker 3: Base of fence corner post farthest along the shore from the end of Dennis Rd. This is the same fence as for marker 2.

Marker 4: Centre of bottom cement step leading from the beach to 224 Seaview Street.

Marker 5:

Marker 6:

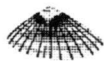


Figure 2 (continued). Example of a Completed Form 1.

DFO Reg. No.: SK98-001

Study Area Name Sunset Cove

## FORM 1: Study Area Description

### PART 3 of 3: STUDY AREA LOCATION (Cont.)

Study Area Aspect: NE

Baseline Length: 100 m

#### LOCATION OF BASELINE ENDPOINTS RELATIVE TO ABOVE MARKERS:

0-metre end of Baseline (to the left facing the backshore):

50 m to marker 1, 43 m to marker 2

Max-metre end of Baseline (to the right facing the backshore):

30 m to marker 3, 34 m to marker 4

#### ESTIMATED BASELINE ENDPOINT COORDINATES:

0-metre end of Baseline (to the left facing backshore):

                     mE                      mN 49.51 °N 124.54 °W  
(UTM East) (UTM North) Latitude (North) Longitude (West)

Max-metre end of Baseline (to the right facing backshore):

                     mE                      mN                      °N                      °W  
(UTM East) (UTM North) Latitude (North) Longitude (West)

UTM Zone: ☐ Zone 8 ☐ Zone 9 ☐ Zone 10

#### SOURCE OF BASELINE COORDINATES:

Map Type: Chart

Map Code: 3527

Map Name: Baynes Sound

Map Scale: 1: 40,000

Map Datum: ☐ NAD83 ☒ NAD27 ☐ WGS84

GPS: ☐

LUCO Shore Unit: 3801





**Figure 3. Description of Form 1 Contents by Heading.**

### PART 1 of 3: REFERENCE INFORMATION

Form Filled in By	Name of person completing the form.
Study Area Name	Common name of the study area.
DFO Registration No.	Assigned by DFO, unique to your study area.
DFO registration No. for Control or Treatment Study Area	If this study area is one of two or more sites being surveyed simultaneously by your organization as a comparison, either as a control site or as the treatment site, then record the DFO Registration Numbers of the other study area(s).
Applicant Contact Information	Name, affiliation, address, phone number, fax number and e-mail of person who applied for the DFO registration number.
DFO Representative Contact Information	Name, address, phone number, fax number, and e-mail of DFO contact.
Study Area Objectives	Give the objectives of your study. Beside <u>Overall Objective of the Study</u> , record one of the choices listed on the next page. Beside <u>Objective Notes</u> , you can give more specific objectives. Similarly beside <u>Reason for Choosing this Study Area</u> , record one of the choices listed below. Then beside <u>Selection Notes</u> , you can provide more specific details.

### HEADER on Parts 2 and 3

DFO Reg. No.	Assigned by DFO, unique to your study area.
Study Area Name	Common name of the study area.

### PART 2 of 3: STUDY AREA LOCATION

General Directions to the Study Area	Give a description of how to get to the site.
Description and Locations of Permanent Triangulation Markers	Describe each of the 4 (or more) permanent features (e.g. trees, corner of a fence, foundation or a marker that you have installed etc.) that you used to triangulate your baseline end points.

**Figure 3 (continued). Description of Form 1 Contents by Heading.**

**PART 3 of 3: STUDY AREA LOCATION (continued)**

Study Area Aspect	Record the seaward direction that the study area faces, using a magnetic compass.
Baseline Length	Record the length of the baseline. Note this is the length of your study area.
Location of Baseline End Points Relative to Above Markers	Record the distance in metres from each baseline end point to the two or more permanent features or markers that you used to triangulate the location of each baseline end point.
Estimated Baseline End Point Coordinates	Record UTM or latitude and longitude coordinates. Only one end of the baseline need be geo-referenced. If you record UTM coordinates you must also note the Zone.
Source of Baseline Coordinates	Record the following information about the map that you used to estimate your baseline coordinates: map type (chart or topo); map code; map name; map scale; map datum. If you used a GPS instead of a map and compass, then you need only tick off the GPS box.
LUCO Shore Unit	The provincial Land Use Coordination Office (LUCO) has classified the B.C. shoreline into discrete units. To obtain the shoreline unit code for the unit that includes your study area, contact your DFO representative.

Overall Objective of the Study

Urban Development Effects  
 Foreshore Development Effects  
 Agricultural Effects  
 Maricultural Effects  
 Transportation Development Effects  
 Waste Disposal Effects  
 Tourism and Recreational Effects  
 Forestry Effects  
 Fisheries Effects  
 Biodiversity Study  
 Species Study

Reason for Choosing this Study Area

Ease of Access  
 In or Near Human Impacted Area  
 Control Study Area  
 On-going Monitoring Area  
 Representative Shore-unit Area



Figure 4. Example of a Completed Form 2.

DFO Reg. No.: SK98-001 Study Area Name Sunset Cove

## FORM 2: Survey Description

Form Filled In By: Allan Fry  
(First Name) (Last Name)

### PART 1 of 3: BACKGROUND INFORMATION

Survey Year: First  
Survey Purpose: Establish 1<sup>st</sup> year of baseline data

#### SURVEY LEADER CONTACT INFORMATION:

Name: Allan Fry  
(First Name) (Last Name)

Leader Reg'n No: SK-001

Organisation: Seawatch Society

Address: 123 Road St.

Parksville V3S 4Z7  
(City/Town) (Postal Code)

Phone: (250)-444-4567 same  
(Daytime) (Evening)

Fax: (250)-444-4566

Email: afry@connection.com

#### SURVEY TEAM:

Names: Mary Smith, Jeff Fish, Rose Brown, Jane Fry

Team Affiliation: Seawatch Society

Team Experience: all members have completed a Shorekeeper mapping and surveying course.

#### SURVEY DATES:

	Visit Date	Start Time	End Time
First Day:	<u>06/03/98</u> (mm/dd/yy)	<u>07:30 AM</u> (hh:mm AM/PM)	<u>01:30 PM</u> (hh:mm AM/PM)
Second Day:	<u></u> (mm/dd/yy)	<u></u> (hh:mm AM/PM)	<u></u> (hh:mm AM/PM)
Third Day:	<u></u> (mm/dd/yy)	<u></u> (hh:mm AM/PM)	<u></u> (hh:mm AM/PM)
Fourth Day:	<u></u> (mm/dd/yy)	<u></u> (hh:mm AM/PM)	<u></u> (hh:mm AM/PM)

Sketch Map Completed ☒



Figure 4 (continued). Example of a Completed Form 2.

DFO Reg. No.: SK98-001 Study Area Name Sunset Cove  
 Survey Year: First (1998)

## FORM 2: Survey Description

### PART 2 of 3: REFERENCE INFORMATION

#### INFORMATION SOURCES:

Topographic Map: \_\_\_\_\_ 1: \_\_\_\_\_  
 (Code) (Name) (Scale)

Hydrographic Charts: 3527 Baynes Sound 1: 40,000  
 (Code) (Name) (Scale)

Aerial Photographs: \_\_\_\_\_ 1: \_\_\_\_\_  
 (Code) (Scale)

Species ID References: Kozloff: Seashore Life, Harbo: Shells & shellfish, Scugel: Common seaweeds.

Other Reference Materials: Spent 1 day with marine biologist who continues to assist with species identification.

#### MAXIMUM WIDTH OF THE STUDY AREA ON THE SURVEY DAY:

First Day:	<u>06/03/98</u>	<u>50</u> m	<u>.05</u> m	<u>9:30 AM</u> hr
	(Visit Date)	(Width)	(Low Tide Height)	(Low Tide Time)
Second Day:	_____	_____ m	_____ m	_____ hr
	(Visit Date)	(Width)	(Low Tide Height)	(Low Tide Time)
Third Day:	_____	_____ m	_____ m	_____ hr
	(Visit Date)	(Width)	(Low Tide Height)	(Low Tide Time)
Fourth Day:	_____	_____ m	_____ m	_____ hr
	(Visit Date)	(Width)	(Low Tide Height)	(Low Tide Time)

#### TIDE CALCULATION INFORMATION:

Primary Port: Pt. Atkinson Secondary Port: Nanaimo



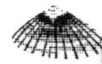


Figure 4 (continued). Example of a Completed Form 2.

DFO Reg. No.: SK98-001Study Area Name Sunset CoveSurvey Year: First (1998)**FORM 2: Survey Description****PART 3 of 3: AREA DESCRIPTION****BACKSHORE DESCRIPTION (Check as many as apply):****Backshore Development**

- ☒ Residential Building  
☐ Commercial Building  
☒ Landscaped  
☐ Cultivated  
☐ Pasture  
☐ Roadway  
☐ Paved  
☐ Gravel  
☐ Railway

**Backshore Vegetation**

- ☐ Meadow  
☐ Marsh  
☐ Deciduous Forest  
☐ Coniferous Forest  
☐ Mixed Forest  
☐ Shrubs  
☐ Sand  
☐ Soil  
☐ Cliff

Other (Please Describe):

Residential houses along water front. Land behind has recently  
been cleared for large subdivision.

SLOPE OF THE BACKSHORE ZONE:

- ☐  $\leq 2^\circ$    
 ☐  $3^\circ - 10^\circ$    
 ☒  $11^\circ - 20^\circ$    
 ☐  $21^\circ - 40^\circ$    
 ☐  $\geq 41^\circ$

GENERAL HUMAN ACTIVITY IN THE SURROUNDING AREA:

marina about 15 km north of study area.

RECENT SIGNIFICANT EVENTS AROUND THE STUDY AREA:

Residential area has recently switched from septic tank system to  
city sewer.

**Figure 5. Description of Form 2 Contents by Heading.****PART 1 of 3: BACKGROUND INFORMATION**

Form Filled in By	Name of person completing the form.
Survey Year	Record whether this is the first, second, third, etc. year.
Survey Purpose	List your main reason(s) for conducting this survey.
Survey Leader Contact Information	Name of leader, their registration number, affiliation, address, phone number, fax number and e-mail.
Survey Team	Names of team members, affiliation and their expertise, e.g. completion of Shorekeeper training, degree in biology or other science background.
Survey Dates	Record the date(s) of the survey (mm/dd/yy) and the start and stop time(s).
Sketch Map Completed	Check box if you have completed a sketch map of the study area.

**HEADER on Parts 1 to 3**

DFO Reg. No.	Assigned by DFO, unique to your study area.
Study Area Name	Common name of the study area.
* Survey Year	Record whether this is the first, second, third, etc. year.

\* Parts 2 and 3 only

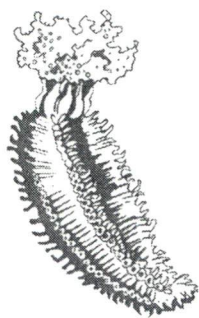
**PART 2 of 3: REFERENCE INFORMATION**

Information Sources	List the codes of topographic maps, hydrographic charts, or aerial photos used, as well as the scale. List the author and/or the title of any field guides you use to help identify plants and animals in the study area. List any other reference materials used.
Maximum Width of the Study Area on the Survey Day(s)	Record the measured width of the beach at low tide, the height of the tide and the time of low tide for each day of your survey.
Tide Calculation Information	Record the primary and secondary ports in the Tide Table book that you used to determine the tide time and height.

**PART 3 of 3: AREA DESCRIPTION**

Backshore Description	Check off as many of the backshore development and backshore vegetation items as apply to your study area. Record specific or unique details if necessary in the space provided.
Slope of the Backshore Zone	Select the slope category that best describes the backshore.
General Human Activity in the Surrounding Area	List any relevant, potentially impacting human activity you know of within 10 km of the study area. For example, agricultural, industrial, commercial, forestry, marine aquaculture, recreational, residential, or cultural. Especially important are commercial, recreational or Native fisheries; the type of fishing such as gill net, diving, or seine should be identified. Restrictions on resource use should be mentioned, such as shellfish harvesting closure. Also make note of middens indicating historic use of the site.
Recent Significant Events Around the Study Area	Record any personal observations about the study area that do not fit into one of the previous categories. For example, information noted here may include the fact that the adjacent land has been burnt by a recent fire or that there was an oil slick along the shore within the last five years.

# Preparing for the Survey Day



## STEP 9: ASSEMBLE SURVEY TEAM AND MATERIALS

Make sure that you complete and understand the following. At least one member of your team should:

- Complete a Shorekeepers' training course for surveying and mapping.
- Complete Preparation for the Survey (**Steps 1 to 8**).
- Look at a tide book and decide the best day(s) to do your survey. Look for a very low tide time that allows you several hours of daylight before and after low tide.
- Where options are given, decide which of the methods you will use for each of the steps on the following pages.
- Obtain all items from the **Materials Needed** headings in each Step and the list in **Appendix C**. Cost estimates of materials are provided in **Appendix D**. There are also a limited number of Shorekeeper Equipment Kits available to loan to community groups. Contact the DFO representatives.



### Materials Needed

- pen or marker
- pencil
- eraser
- clipboard
- watch
- notebook
- species identification
- books

### CONDUCTING THE SURVEY

- Get the team and materials to the study area several hours before low tide. It is important to survey a site on a day when the shore will be exposed the maximum amount of time during daylight hours. Go over each of the survey steps with your team and make sure that everyone understands each step. The best way to do this is to go through each step ahead of time on any beach at low tide.



*Remember despite these guidelines, what actually can be done in any given amount of time depends on the size and complexity of the study area, the size and skills of the study group, and the weather.*

- Timing on the beach is very important. There is a lot to do and the tide does not wait. In general, you should start your field survey with **Step 10** and work through to **Step 34**. However, you will find that there are many steps that must be started at the same time if you are to finish before the tide starts coming back in. Other steps can be done at home later. Do **Steps 10-14** right away with the whole team.

The remaining steps can be divided as follows:

- Two or three people can start taking measurements for the map (**Steps 15 to 17, Step 20, and Step 22**).
- Two other people can measure the slope and elevation of each habitat as they become exposed by the tide (**Steps 23 and 24**).
- By the time the map measurements are done, the map group will probably be able to decide on the placement of transects and quadrats in at least one habitat.
- The group that completed the slope and elevation measurements can lay out the first quadrat (**Step 25**) and start identifying and counting plants and animals.
- Other team members can join in as they complete their initial tasks.

The actual timing of survey activities should stick to the following general outline. Begin the survey at least 2 hours before low tide. In general, you may have to leave some of the steps that need to be done higher up the beach until later to ensure that the lowest habitats are sampled when the tide is lowest. When the tide begins to rise, do tasks that you missed when the tide was falling.

Only when you are finished surveying the tidal area should you collect data from the backshore — unless you have a large survey team that can be split into groups.

When the survey is done, or if it is getting dark, or the tide is too high to continue, collect all materials and people, making sure nothing or no one is missing.

If you have to go back the next day to finish, you will need to start with **Steps 10 and 11**.





## **BEACH SAFETY**

Your safety and your behaviour on the beach are very important.

Rocky beaches, boulders, surge channels, headlands, and mud flats can be dangerous. Even wide sandy beaches can catch you unawares. Some dangers to keep in mind: boulders can be slippery, especially when covered with algae; large waves can knock a person off of a rock – people drown this way every year; you may be working around a headland, and the tide may come in faster than you realize and cut you off from shore; bears are known to frequent the backshore area of a beach; fog can sweep in and obscure your vision, which may be a problem in isolated areas. So, follow these important rules:

- Never work alone.
- If your group is widely dispersed, check in and out with the group leader.
- Avoid sunstroke by wearing a hat and drinking plenty of water.
- Avoid being swept into the water by staying clear of the waves and slippery rocks.
- Keep an eye on the rising tide.
- Be careful not to get lost or stranded.
- Keep track of time.
- Be bear aware.
- Do not drink from creeks – beaver fever and fecal coliform contamination is widespread.
- Try to include one team member who has first aid certification.
- Carry a cellular telephone or a VHF radio in case of emergency.

## **BEACH ETIQUETTE**

How you behave while doing a survey is important to other people and to the animals and plants. The following rules may seem obvious, but make sure all team members obey them.

- Park your car safely on public access or on private property only with permission.
- Do not drive on the beach.
- Get permission to cross private property.



- Get permission to be on beaches that are part of First Nations' reserves.
- Leave your dog at home.
- Leave no trace behind except the permanent boundary markers.
- If you lift something to look underneath it, put it back in its original position.
- Fill in any holes you dig.
- Handle all animals and plants gently and put them back where you got them.

### GENERAL COMMENTS

Which form to use and where to record the data is listed at the beginning of each step.

- Complete **Part 2 of Form 1: Study Area Description** by recording data collected in **Steps 12, 15, 16, 20, and 21**.
- Complete **Form 2: Survey Description** at the end of the survey day.
- Use **Form 3: Habitat Unit Description** to record the information you collect in **Steps 10 to 14** and **Steps 22 to 33**.
- Use **Form 4: Sketch Map** to map your study area: **Steps 15 to 19**.

### WHEN TO RECORD YOUR DATA

Record your data while you are in the field, except for the final version of the sketch map. An example of a completed **Form 3** follows (Figure 6), as well as a description of each heading on **Form 3** (Figure 7). Blank sheets of **Form 1**, **Form 2**, **Form 3**, and **Form 4** are in **Appendix B**.



## ACCURACY OF FIELD WORK

Fill out data sheets with care. Make sure they are clear and legible. Keep detailed notes of what you do; include small sketches when you think they are helpful. (There are more instructions on keeping notes later in **Step 32**.) Use the same survey methods on each annual survey.

## KEEP ALL EXTRA NOTES OR SCRAPS OF PAPER YOU USE

Put the date and the name of your study area and your name on every piece of paper you use.

## USE THE STANDARD CODES GIVEN IN THIS GUIDE WHEN FILLING IN FORM 3 AND FORM 4

Standard codes are given throughout this Guide. They are given as bolded letters or bolded numbers in brackets, e.g. **(1)**, **(b)**. These codes allow you to record data quickly and make it easier for data to be entered into a computer system. An exception to this is species names. Write out the entire species name when filling in **Form 3**. A name is easier to remember than a code so you are less likely to make a mistake when recording what you find.

## HOW LONG WILL EACH STEP TAKE AND HOW MANY PEOPLE ARE REQUIRED?

Table 2 gives a summary of survey steps, an estimate of how long it should take to do each step and the minimum number of people needed to complete a step. Time estimates are rough, but you should be able to use this table to estimate how long it might take you to complete a survey of a particular size with a certain number of people.



Figure 6. Example of a Completed Form 3.

DFO Reg. No.: SK98-001 Study Area Name Sunset Cove  
Survey Date.: 06/03/98

### FORM 3: Habitat Unit Description

Form Filled In By: Jeff Fish  
(First Name) (Last Name)

#### PART 1 of 2: PHYSICAL DATA

##### HABITAT CLASSIFICATION:

Zone: ☒ Intertidal ☐ Backshore

Habitat Type cobble Habitat Unit ID: C1

Substrate: (Most Dominant) cobble  
pebble  
sand  
shell  
(Least Dominant) \_\_\_\_\_

##### HABITAT CHARACTERISTICS:

Habitat Area: 600 m<sup>2</sup> GPS Filename: \_\_\_\_\_

Slope Method Used: ☒ Clinometer ☐ Hand Level ☐ Horizon Method

First Slope: 3° 20 m  
(Slope) (Distance along baseline)

Second Slope: 5° 70 m  
(Slope) (Distance along baseline)

Third Slope: \_\_\_\_\_ m  
(Slope) (Distance along baseline)

Elevation Method Used: ☒ Hand Level ☐ Horizon Method ☐ Tide Time Method

Maximum Elevation: 1.2 m 8:30 hr  
(Elevation) (Tide Time)

Minimum Elevation: .5 m 8:30 hr  
(Elevation) (Tide Time)

##### SAMPLING DETAILS:

Quadrat Size: ☒ 25cm x 25cm ☐ 50cm x 50cm

Quadrat Depth: 10 cm Number of Quadrats: 9



DFO Reg. No.: SK98-001  
 Survey Date.: 06/03/98

Study Area Name Sunset Cove  
 Page 1 of 6

### FORM 3: Habitat Unit Description

Quadrat Size 25 cm  
 Quadrat Depth 10 cm

Zone: I  
 Habitat ID: C1

Habitat Comments: Numerous patches where the substrate has been disturbed by clam rakes.  
Freshwater seep runs across part of habitat.

#### PART 2 of 2: BIOLOGICAL DATA

Quad No.	Sub. Level	Mobility Code	Species Common Name	Latin Name	Count	Total	Cov. Code	Note
1.1	S	a	japanese weed	Sargassum			f	
1.1	S	d	sea lettuce	Ulva			C	
1.1	S	m	green shore crab	Hemigrapsus oregonensis	HTT 1	6		
1.1	B	m	" " "	" " "	HTT HTT HTT II	17		
1.1	W	m	japanese littleneck clam	Venerupis philippinarum	HTT HTT II	12		
1.1	W	m	native littleneck clam	Protothaca staminea	III	3		
1.1	W	m	mahogany clam	Nuttallia obscurata	HTT HTT HTT HTT I	21		
2.1	S	a	rock weed	Fucus			f	
2.1	S	a	common barnacle	Balanus glandula			f	
2.1	B	m	flatworm	Turbellaria		1		
2.1	B	m	gunnel	Pholidae		1		
2.1	W	m	mussel worm	Nereis vexillosa		1		
2.1	W	m	mahogany clam	Nuttallia obscurata	HTT HTT IIII	14		
2.1	W	m	bent-nose macoma	Macoma nasuta		2		
3.1	S	a	sea lettuce	Ulva			C	
3.1	S	a	common barnacle	Balanus glandula			C	
3.1	S	m	limpet	Patellacea	HTT HTT III	13		
3.1	B	m	sea star	Asteriidea	HTT III	8		1
3.1	B	m	mud nemertean	Paranemertes peregrina		1		
3.1	W	m	mussel worm	Nereis vexillosa		2		
3.1	W	m	native littleneck clam	Protothaca staminea	HTT II	7		
3.1	W	m	japanese littleneck clam	Venerupis philippinarum	III	3		

1. Sea stars are < 1cm in diameter, have 5 rays.

Figure 6 (continued). Example of a Completed Form 3.

Preparing for the Survey Day





Figure 6 (continued). Example of a Completed Form 3.

## Form 3 Picklist Values

## Habitat Type

## Backshore Habitat Types

## Rock Habitat (k)

at least 75% of the substrate is bedrock, boulders, cobble, and pebbles; less than 50% of substrate is covered by vegetation.

## Sand Habitat (d)

at least 75% of the substrate is sand; less than 50% of the substrate is covered by vegetation.

## Soil Habitat (l)

at least 75% of the substrate is soil; less than 50% of the substrate is covered by vegetation.

## Meadow Habitat (w)

at least 75% of the substrate is soil and/or sand; at least 50% of the substrate is covered by plants, many of which die to the ground every year; less than 50% of the substrate is covered by trees.

## Deciduous Forest Habitat (dt)

regardless of the substrate, at least 50% of the substrate is under a canopy of deciduous trees.

## Coniferous Forest Habitat (ct)

regardless of the substrate, at least 50% of the substrate is under a canopy of coniferous trees.

## Mixed Forest Habitat (mt)

regardless of the substrate, at least 50% of the substrate is under a canopy of a mixture of coniferous and deciduous trees that are mixed such that you can not readily define the two distinct habitats.

## Shrub Habitat (sb)

regardless of the substrate, at least 50% of the substrate is covered by shrubs.

## Marsh or Pond (h)

area composed of emergent vegetation that is infrequently covered by water, but may have areas of impounded water that permit establishment of typical marsh vegetation such as sedge, bulrush, and cattail.

## Intertidal Habitat Types

## Rock Habitat (r)

at least 75% of the substrate consists of bedrock and/or boulders; less than 50% of the substrate is covered by vegetation.

## Cobble/Shell Habitat (c)

at least 75% of the substrate consists of cobble, pebbles, and shell; less than 50% of the substrate is covered by vegetation.

## Sand Habitat (s)

at least 75% of the substrate consists of sand; less than 50% of the substrate is covered by vegetation.

## Mud Habitat (u)

at least 75% of the substrate is composed of mud; less than 50% of the substrate is covered by vegetation.

## Rockweed Habitat (fa)

regardless of substrate, at least 50% of the substrate is covered by rockweed (*Fucus gardneri*).

## Sea Lettuce Habitat (ua)

regardless of substrate, at least 50% of the substrate is covered by sea lettuce (*Ulva, Monostroma*)

## Kelp Habitat (ka)

regardless of the substrate, at least 50% of the substrate is covered by *Macrocystis*, *Nereocystis*, *Laminaria*, or other broad-bladed kelps. Specify the kelp species.

## Mixed or Other Macroalgae (oa)

regardless of substrate, at least 50% of the substrate is covered by other non-vascular intertidal vegetation or a mixture of non-vascular vegetation. Specify the species of algae that characterise this habitat.

## Eelgrass Habitat (e)

regardless of substrate, at least 50% of the substrate is covered by eelgrass, species include eelgrass (*Zostera japonica*) on sheltered cobble, pebbles, sand or silt in mid-intertidal, and native eelgrass (*Zostera marina*) on sheltered cobbles, pebbles, sand or silt in lower intertidal.

## Tidal Marsh Habitat (m)

area composed of emergent vascular vegetation that is regularly inundated by high tides (usually once or twice a day depending on elevation); contains typical marsh vegetation such as sedge, bulrush or pickleweed.

## Substrate Type

## Man-made

- t Metal
- e Concrete
- r Rubble
- l Logs
- u Lumber

## Natural

- k Bedrock
- b Boulder (>256 mm, dinner plate-sized)
- c Cobble (64-256 mm, apple to dinner plate-sized)
- p Pebble (2-64 mm, pea to apple-sized)
- s Sand (0.0625-2 mm, sugar granule-sized)
- m Mud
- h Shell
- o Soil

## Substrate Level within Quadrat

- S Surface to substrate
- B Beneath moveable objects
- W Within substrate

## Mobility Code

- a Attached (for plants and attached animals)
- m Mobile
- d Dead

## Coverage Code

- f Few - less than 25% cover
- c Common - 25 to 49% cover
- a Abundant - 50 to 75% cover
- d Dominant - more than 75% cover

**Figure 7. Description of Form 3 Contents by Heading.**

HEADER on Parts 1 and 2	
DFO Registration Number	Assigned by DFO, unique to your study area.
Study Area Name	Common name of the study area. Use the same name as on Form 1 and 2.
Survey Date	Date the data were collected.
<b>PART 1 of 2: PHYSICAL DATA</b>	
Form filled in by	Name of the person completing form.
Habitat Classification	Complete the following information to describe the habitat classification for a habitat unit.
Zone	Select the zone where this habitat was located (backshore or intertidal).
Habitat Type	Record the one or two letter code corresponding to the habitat type (see pick-list on back of Form 3).
Habitat Unit ID	Record the alpha-numeric code that identifies this habitat from others in your study area. See Step 13. The ID has a one or two letter code corresponding to the type of habitat followed by a number. For example, "E1" means the first eelgrass habitat that you have identified in the study area. "UA3" means the third sea lettuce habitat that you have identified in the study area. This ID code will tie all the physical and biological data you collect about a habitat unit to your sketch map.
Substrate	Check off up to five substrate types from the most to the least dominant. See Step 14.
Habitat Characteristics	Complete the following information to characterize the habitat.
Habitat Area	Record in square metres. See Step 22. If GPS was used to calculate area, record the GPS filename.
Slope	Check off the method you used. Record slope in degrees. Record more than one slope if the slope varies across the habitat. See Step 23.
Elevation	Check off the method you used. Record the elevation of the lower edge and of the upper edge of the habitat unit relative to the tide height and record the time. See Step 24.
Sampling Details	Record the size of the quadrat you used, 25- x 25-cm or 50- x 50-cm. Use the same size quadrat throughout a habitat unit. Record the depth to which you dug the quadrats in a habitat. You must be consistent and dig to the same depth in each quadrat in a habitat and in all other habitats that are the same type. Record the total number of quadrats surveyed in a habitat unit.



**Figure 7 (continued). Description of Form 3 Contents by Heading.**

**PART 2 of 2: BIOLOGICAL DATA**

Quadrat Size	See SAMPLING DETAILS, Form 3, Part 1 of 2.
Quadrat Depth	See SAMPLING DETAILS, Form 3, Part 1 of 2.
Zone	See HABITAT CLASSIFICATION Form 3, Part 1 of 2.
Habitat Unit ID	See HABITAT CLASSIFICATION Form 3, Part 1 of 2.
Habitat Comments	Record general comments about the habitat, e.g., evidence of recent clam digging in this habitat, or the rockweed is sparse compared to last year.
Quad. No.	Record the two-digit quadrat code (e.g. 1.1) See Step 28.
Sub. Level	Record the substrate level being sampled. See Step 29. Surface = "S"; Beneath = "B", a moveable object (e.g. log or rock); Within = "W".
Mobility Code	Record one of the following: attached = "A", motile = "M", dead = "D". See Step 30.
Species - Common Name	Record species identification to the taxonomic level for which you are confident, using common names. See Step 30.
Species - Latin Name	Record species identification to the taxonomic level for which you are confident, using Latin names wherever possible. See Step 30.
Count	Record the number of individuals of a species you find in a substrate level. Keep a field tally as you proceed. Sum up your tally and record the sum under <u>Total</u> . Remember to keep counts of dead organisms separate from counts of live organisms. See Steps 31 and 32.
Cov. Code	Record your estimate of percent coverage of attached animals or plants in the quadrat. Record a letter corresponding to one of the coverage categories. Remember to keep estimates of dead plants separate from counts of live ones. See Steps 31 and 32.
Note	Record notes about the quadrat on a separate piece of paper (unless they are very short). Number each note and record the reference number for each note here.

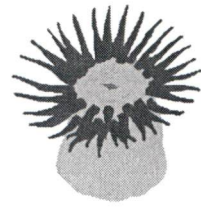


**Table 2. Time Estimates for Completing Steps 10 to 34 of a Field Survey.**

Step	Minimum Number of Team Members	Estimated Time Required (minutes)
10 Mark Study Area Borders	all	10
11 Identify Backshore and Intertidal Zone Boundaries	all	5
12 Set Up Baseline	all	10
13 Identify Habitats	all	5 per habitat
14 Identify Habitat Substrates	2	5 per habitat
15 Describe the Location of Baseline End Points	2	30
16 Install Permanent Baseline Triangulation Markers (optional)	2	30-45
17 Map the Features of the Study Area	3	1 hour/100 m of shoreline
18 Calculate Scale of the Sketch Map	1	5
19 Redraw the Rough Sketch Map to Scale on Sketch Map	1	30-40
20 Take Bearings from Baseline End Points	2	15
21 Determine the Geographic Coordinates of Baseline End Points	1	15
22 Determine Habitat Area	2	5 per habitat
23 Determine Habitat Slope		
• Clinometer	2	10 per habitat
• Horizon Method	2	10 per habitat
• Hand Level Method	2	10 per habitat
24 Determine Habitat Elevation		
• Tide Time Method	1	1 per habitat
• Horizon Method	2	10 per habitat
• Hand level Method	2	10 per habitat
25 Understand the Quadrat Survey Method	all	10
26 Choose a Quadrat Size	1	2
27 Layout Transects and Quadrats	2-3	10 per habitat
28 Assign Quadrat Numbers	1	2
29 Identify Substrate Level	1	2
30 Identify Plants and Animals	2	5-10 per habitat
31 Estimate Plant/Animal Abundance	2	5-10 per habitat
32 Notes	1	2
33 Surveying the Backshore	3	30 per habitat
34 Ensure all Data Forms are Completed	2	5-10



# Defining Study Area Boundaries and Components



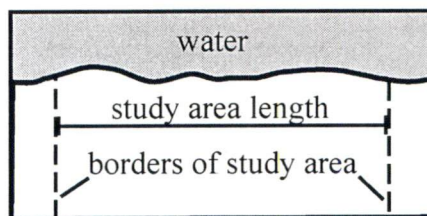
## Materials Needed

- two lengths of rope, at least 50 m each

## STEP 10: MARK STUDY AREA BORDERS

Mark the borders of the study area with rope. Place a length of rope down each side of your study area perpendicular to the shore. This ensures that all field participants work within the confines of the study area.

Keep in mind the safety of the team members. Make sure the boundaries are within a safe area and that everyone stays inside them.





## STEP 11: IDENTIFY BACKSHORE AND INTERTIDAL ZONE BOUNDARIES

### Where to Record Data

FORM	HEADING
3	Zone

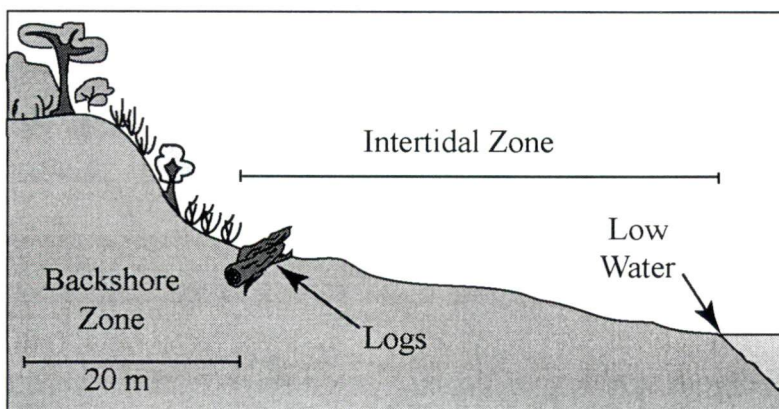
Every study area has two zones: **backshore** and **intertidal**.

**Backshore Zone (b):** this is the area from the higher high water line away from the water (landward) for 20 m including past the top of a coastal cliff or into the woods.

**Intertidal Zone (i):** this is the area between the higher high water line and the lower low water, i.e. chart datum.

All study team members should agree on where the boundaries are located by looking at the scene. The point where one zone stops and the other starts is not always obvious, but it should be clear enough to allow you to decide between the two.

On some shorelines the boundary may be up by the drift line where logs have been washed on shore. On other shores the boundary may be marked by the lower limits of the black lichens that cover the rocks.





## STEP 12: SET UP BASELINE

### Where to Record Data

FORM	HEADING
1: Part 2	Baseline length



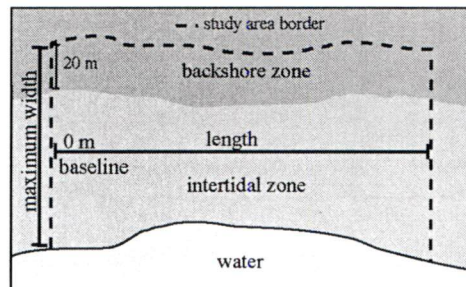
### Materials Needed

- baseline rope
- wooden stakes
- hammer
- a second baseline (optional)
- 6 to 10 stakes with flagging tape (optional)

*If you are surveying the backshore as well, you may need another baseline, perhaps along the line between the backshore and the intertidal zone.*

Stretch the baseline rope across the entire length of the study area. This is your baseline. You can place it at any distance from the water's edge, although through the middle of the width of your study area is probably a good idea. The flagging tape makes it easy to measure any point along the baseline. The 0 m end of the baseline should always be to your right as you face the water.

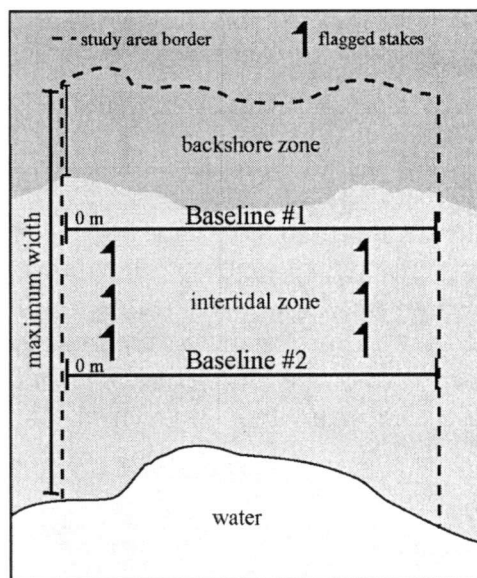
Tie the ends of the baseline at the borders of the study area. If the substrate allows, hammer in wooden stakes and tie the rope to the stakes. If the substrate is too hard, tie the rope to large rocks or logs. Do not stretch the rope or your measurements will be wrong.





## SETTING UP A SECOND BASELINE

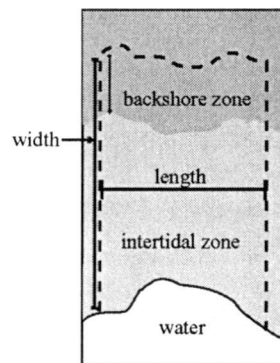
If the distance between the higher high water mark and low tide on the day of the survey is greater than 150 m, put in another baseline closer to the water's edge. Otherwise you will find it difficult to take the measurements for your map in **Step 17**. On very wide beaches, you can also use a series of flagged stakes that you can place at points between the two baselines to help ensure you are in fact taking measurements perpendicular to the baseline.



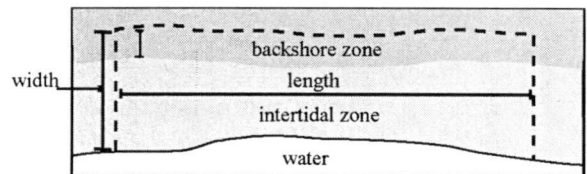


## LENGTH AND WIDTH

We talk about length and width. Length is the distance parallel to the water. Long Beach is long. Width is the distance from the boundary of the backshore down to the water. The width increases as the tide goes out and decreases as it comes in. Make sure the whole team is familiar with these terms.



A wide beach



A narrow beach

## HOW TO MAKE A BASELINE ROPE

This is a length of rope equal to the length of your study area, with surveyors' flagging tape woven into it at 2-metre intervals. Mark every 10 metres with a different colour flagging tape. Weave the first piece of flagging tape, marked with "0 m", into the rope 2 m from the end of the rope. This will leave you 2 m of spare rope to secure the baseline around a stake or rock.





## STEP 13: IDENTIFY HABITATS

Habitats characterized by observable features are the units with which we work. The whole Shorekeepers' method is about describing these units. You will record all the information you collect about each habitat unit on **Form 3**. Start a new **Form 3** data sheet for each habitat unit. Identify each habitat type and also record the alpha-numeric code for each unit.

### Where to Record Data

FORM	HEADING
3	Habitat Type Habitat ID

### WHAT DEFINES A HABITAT?

Habitats can be defined by physical and biological features including substrate, slope, elevation, temperature, humidity, vegetation and animals. For our purposes, 19 habitat types have been identified using substrate and vegetation. Those features integrate many of the variables mentioned above. If you are working outside of the Strait of Georgia and feel additional habitat types are needed, contact a DFO representative. The 19 habitat types are listed below. The descriptions are general, and are based on the intertidal or backshore zone in which they occur.

### MINIMUM SIZE OF A HABITAT

To be classified as a separate habitat an area must be at least 25 square metres, that is 5 m x 5 m, or 2 m x 12.5 m, or 3 m x 8.4 m, etc. There may be several separate units of the same habitat type in the study area, each of which is the required minimum size of 25 square metres. Treat each of these as a separate habitat unit. See below.

### HOW TO IDENTIFY THE HABITAT TYPE

This is simply a matter of looking at the study area and picking out all the different types of habitats. Each habitat unit is classified according to one of the 19 choices given. The most dominant feature is the one you will use. Once a type is selected, the boundaries of the habitat need to be determined. Everyone



on the team should help with this step; and everyone should agree on the habitat types, and be able to visually recognize each habitat and its borders. It is helpful to take photographs of your habitats to ensure consistency in identification from year to year.

As an example, if you have an area that is made of bedrock, but that is at least 50% covered in sea lettuce, you classify this as a sea lettuce habitat, not a rock habitat. An intertidal habitat composed of 75% bedrock and boulder, with little or no algae, is a rock habitat. Refer to the habitat substrates described on the next page to help with your habitat identifications. Estimate percent cover by assuming you are looking down on the habitat from above.



Each of the 19 habitats has its own code. The habitats are broken into two groups: backshore and intertidal.

### Backshore Zone Habitat Types:

rock habitat (k)	at least 75% of the backshore substrate is bedrock, boulders, cobble and pebbles; less than 50% of substrate is covered by vegetation.
sand habitat (d)	at least 75% of the backshore substrate is sand; less than 50% of the substrate is covered by vegetation.
soil habitat (l)	at least 75% of the substrate is soil; less than 50% of the substrate is covered by vegetation.
meadow habitat (w)	at least 75% of the backshore substrate is soil and/or sand; at least 50% of the substrate is covered by terrestrial plants, many of which die to the ground every year; less than 50% of the area is covered by trees.
deciduous forest habitat (dt)	regardless of the backshore substrate, at least 50% of the substrate is under a canopy of deciduous trees.
coniferous forest habitat (ct)	regardless of the backshore substrate, at least 50% of the substrate under a canopy of coniferous trees.
mixed forest habitat (mf)	regardless of the backshore substrate, at least 50% of the substrate under a canopy of deciduous and coniferous trees and shrubs.
shrub habitat (sb)	regardless of the backshore substrate, at least 50% of the substrate is covered by shrubs.
marsh or pond habitat (h)	backshore area composed of typical marsh vegetation such as sedge, bulrush, and cattail, and open water.

*The following habitat types describe habitats in the Strait of Georgia. Photographs of habitat types, along with the following descriptions are given in Appendix F.*



### Intertidal Zone Habitat Types:

rock habitat (r)	at least 75% of the habitat substrate is bedrock and/or boulders; less than 50% of substrate is covered by vegetation.
cobble/shell habitat (c)	at least 75% of the habitat substrate is cobble, pebbles, and shell – there may be patches of sand in this; less than 50% of the substrate is covered by vegetation.
sand habitat (s)	at least 75% of the substrate consists of sand; less than 50% of the substrate is covered by vegetation.
mud habitat (u)	at least 75% of the area is mud; less than 50% of the substrate is covered by vegetation.
rockweed habitat (fa)	regardless of the substrate, at least 50% of the area is covered by rockweed ( <i>Fucus</i> spp.)
sea lettuce habitat (ua)	regardless of the substrate, at least 50% of the area is covered by sea lettuce ( <i>Ulva</i> , <i>Monostroma</i> ).
kelp habitat (ka)	regardless of the substrate, at least 50% of the area is covered by <i>Macrocystis</i> , <i>Nereocystis</i> , <i>Costeria</i> , <i>Laminaria</i> or other broad-bladed large kelps. Specify the kelp species.
mixed or other macroalgae (seaweed) habitat (oa)	regardless of the substrate, at least 50% of the area is covered by non-vascular intertidal vegetation. This may be a mixture of algae species, or a 50% cover of one particular species other than rockweed or sea lettuce. Specify the species of algae that characterize this habitat.



eelgrass habitat (e)	regardless of the substrate, at least 50% of the area is covered by eelgrass; species include the introduced eelgrass ( <i>Zostera japonica</i> ) on sheltered cobble, pebbles, sand, or silt in mid-intertidal, and native eelgrass ( <i>Zostera marina</i> ) on sheltered cobble, pebbles, sand or silt in the lower intertidal.
tidal marsh habitat (m)	area composed of vascular vegetation that is regularly covered by high tides (usually once or twice a day depending on elevation); contains typical marsh vegetation such as sedge, bulrush, or pickleweed.

*Pay close attention when coding tidal marsh, as it can be easily confused with the code for the marsh habitat in the backshore.*

### WHY 25 SQUARE METRES?

It would take too long to conduct a survey if habitat units were defined as smaller, and hence more numerous units, because regardless of the size of a habitat, the same number of quadrats would need to be sampled for sufficiently accurate population size estimates. The 25-square metre minimum was set to balance scientific data collection requirements with the practicalities of conducting a field survey.

### WHAT TO DO IF THERE IS MORE THAN ONE PATCH OF THE SAME HABITAT TYPE

Study areas may contain several separate units of the same habitat type, each occupying 25 square metres. For example, there may be two distinct units of eelgrass habitat. To clarify which unit is being described, each is given a separate code. The first eelgrass habitat unit is recorded as E1. The next eelgrass habitat unit is recorded as E2. Do this until all habitats are given a location code. Enter the habitat location code beside **Habitat ID** on **Form 3**. This alpha-numeric code is unique to this habitat at your study area.





### **LABELLING HABITATS IN SUBSEQUENT YEARS**

When you resurvey next year, make sure you give habitat units the same ID number as previously used. Where a habitat unit is no longer there from the previous year but a new habitat of the same type has appeared somewhere else in the study area, use a new habitat ID number.

**Example:** In year 1, there was a S1 (sand 1 habitat) and an S2. In year 2, the S2 habitat is no longer there. In another part of the study area there is a new sand habitat. You label the new one S3, and the remaining old one stays S1.



## STEP 14: IDENTIFY HABITAT SUBSTRATES

### WHY RECORD THE SUBSTRATE TYPE?

Substrate is the material that forms the base material of the habitat. A boulder beach is a rock habitat (**r**) that has a boulder substrate (**b**). Each of the habitat units you identified in **Step 13** probably has more than one substrate, e.g. sand, pebbles, or boulder. Substrates provide surfaces upon, below, or within which plants and animals can live. The habitat type categories are quite general. For example, a rock habitat may consist of bedrock and/or boulders and/or some pebble and a bit of sand, or it may consist of just bedrock. Recording the substrate types makes it obvious what the differences are among rock habitats.

From the list provided, identify the substrates that best describe a habitat and record the codes beside **Substrate** on **Form 3**. Record up to five substrates for each habitat type, starting with the most prevalent to the least prevalent substrate type.

Choose the substrate(s) that best describe the habitat.

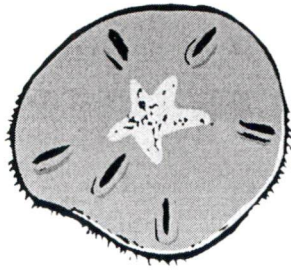
### Where to Record Data

FORM	HEADING
3	Substrate

**Table 3. Substrate Types.**

Human-made	Naturally occurring
metal (t)	bedrock (k)
concrete (e)	boulder (b) ( > 256 mm, i.e. dinner plate-sized rock or bigger)
rubble (r)	cobble (c) (64-256 mm, i.e. apple to dinner plate-sized rock)
logs* (l)	pebble (p) (2-64 mm, i.e. pea to apple-sized rock)
lumber (u)	sand (s) (2 mm, i.e. sugar-sized granules of rock)
	mud (m)
	shell (h)
	soil (o) (backshore only)

\* logs can occur naturally too



# Mapping The Study Area

While on the beach you will need to take some measurements to show where the study area is relative to the rest of the world and to show what is inside the study area. Once the measurements have been taken, you will be able to take a close look at the animals and plants in the study area.

## WHAT IS A SKETCH MAP?

A sketch of the study area provides a detailed view of the study area. When complete it shows the general lay of the land, and where features and habitats are located. The sketch map you make today will be important when the survey is done again. The sketch map will be scanned and stored as a computer file along with the rest of the data collected.

An example of a completed **Form 4: Sketch Map** form is included here (Figure 8). A blank **Form 4: Sketch Map** form is included in **Appendix B**.

Major features of the study area that need to be mapped are:

- the borders of the study area;
- the borders of habitats;
- the border between the Intertidal Zone and the Backshore Zone;
- the water's edge at low tide on the day of mapping;
- permanent features and/or installed markers used to triangulate the baseline end points.

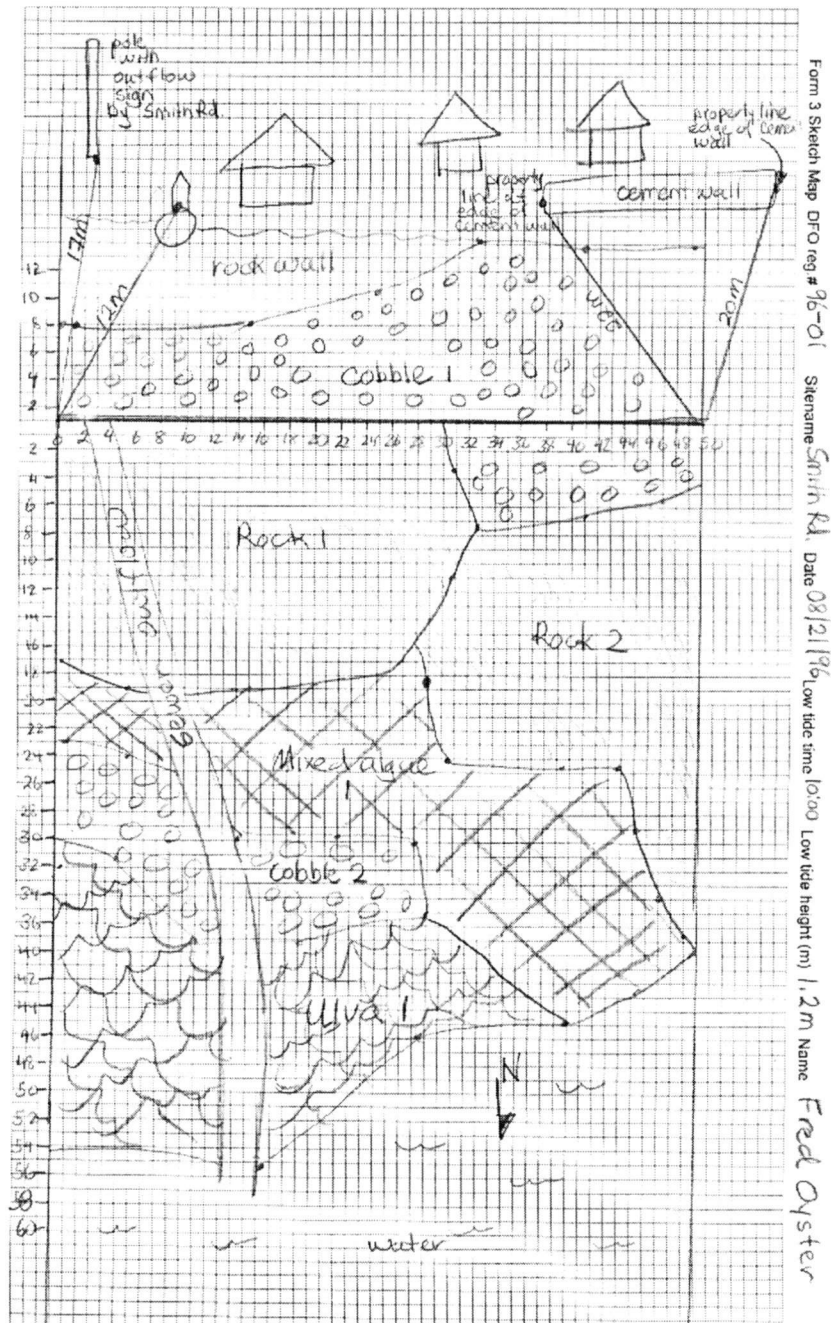
## RECORD YOUR SKETCH MAP MEASUREMENTS ON A ROUGH SKETCH MAP

The following steps show you how to develop the map. First, do a very rough sketch with all the measurements at the beach. Once all the necessary measurements are made on the rough sketch, carry on with the rest of the survey. The final copy of the map drawn to scale on **Form 4** can be done towards the end of your survey.

*If the backshore is not on private property you can survey it and measure its width. You need only go back 20 m. If it is private property, you may not be able to map it properly, so sketch what features you can see from the beach.*



Figure 8. Example of a Completed Form 4.







## STEP 15: DESCRIBE THE LOCATION OF BASELINE END POINTS

### Where to Record Data

FORM	HEADING
1	•Description and Locations of Permanent Triangulation Markers •Location of Baseline End Points Relative to Above Markers
4	Sketch Map



### Materials Needed

- long measuring tape or surveyor's hip chain or rangefinder
- calculator
- flagging tape
- compass

**Steps 15** and **20** deal specifically with the location of the baseline. In **Step 15** you are asked to locate both ends of the baseline relative to local features, say a large tree or rock. Later, **Step 20** requires you to locate at least one of the ends of the baseline relative to the rest of the world. The accuracy required in **Step 20** has to be good enough to lead a new Shorekeeper to the vicinity of the baseline end points, for example, we use longitude and latitude to locate the study area. The accuracy required in **Step 15** is much greater. It has to be good enough to get that stranger within a half a metre or so of the end of the baseline.

Record on **Form 1** a description of each of the three or four permanent features or markers under **Description and Locations of Permanent Triangulation Markers**. Record where they are in relation to the baseline end point under **Location of Baseline End Points Relative to Above Markers**.

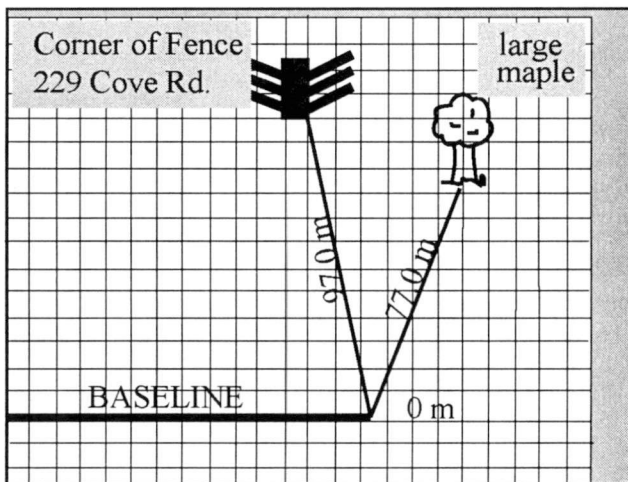
Record on your sketch map the location of each end of the baseline (for each baseline you are using) in relation to two major landmarks, such as boulders or large trees in stable locations, dock pilings, the corners of buildings, or a permanent marker you install. This is called triangulation. Make sure these features are not too close together; they should be about 90° apart. You will have to use two different pairs of landmarks for each end of the baseline. The landmarks themselves may be quite big (for example, a wharf or a boulder). You have to specify exactly where on the landmark is the reference point (e.g. northeast fence post at base) when making measurements.





Alternatively, if it is difficult to see two prominent features for each end of a baseline, you can use one feature with a compass bearing and a single distance measurement. Record these on your rough sketch map or install permanent markers, see **Step 16**.

On your rough sketch map draw in your baseline(s), the four permanent features, a description of them that allows another Shorekeeper to readily find them, and the distance from the end points to the permanent features. These measurements will allow you to use the same baseline next year.





## STEP 16: INSTALL PERMANENT BASELINE TRIANGULATION MARKERS (OPTIONAL)

### Where to Record Data

FORM	HEADING
1	•Description and Location of Permanent Triangulation Markers •Location of Baseline End Points Relative to the Above Markers

*Remember, it is important to get the consent of landowners, foreshore leasees, or First Nations before installing markers on their property. You should advise other local residents too, about your survey, so that if they find your survey markers while walking along the beach, they will not remove them or trip over them.*

If the study area has no suitable prominent features nearby with which to triangulate your end points, it may be necessary to install some permanent markers. You can do this at the end of the survey before you remove your baseline.

To make a permanent marker, build a small cairn with cement and stones or fill a crevice with concrete, then install a round-headed bolt, or some other length of steel that is not sharp. The bolt should be embedded in the cement with no more than 1 to 2 inches exposed for safety reasons. Your marker should be unobtrusive and placed above the high tide mark and preferably in the backshore. It should be somewhat sheltered from direct surf so that a big storm does not wash it away in the winter. Place the permanent marker as close as possible to prominent features that you can show on your sketch map. The permanent markers will help you or other survey teams to set up the same baseline next year. If possible, scratch in the DFO Shorekeepers' Study Area number and the date before the cement dries.



## STEP 17: MAP THE FEATURES OF THE STUDY AREA

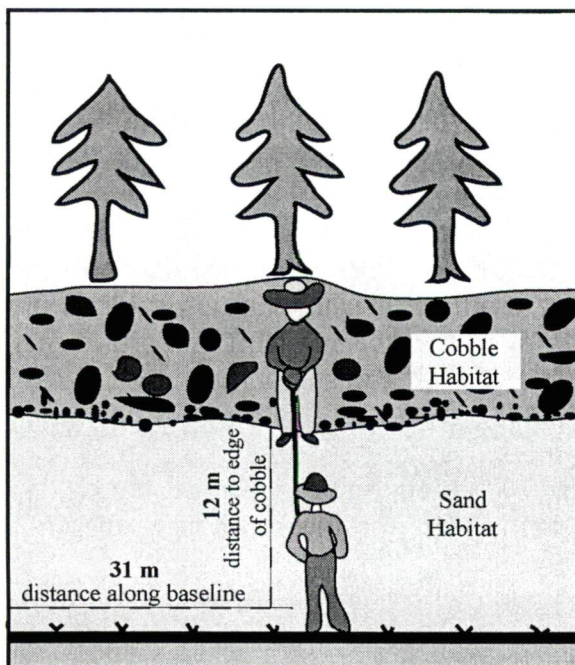
Mapping is very important and must be supervised by someone who has been trained in this task.

On your rough sketch map draw the following measurements as you make them, so as to keep track of your work.

**Backshore and Intertidal Zone:** Draw the line showing the boundary between the intertidal zone and the backshore zone. Measure the distance perpendicular from the baseline to the landward end of the intertidal zone at regular intervals along the baseline. Measure your distance along the baseline relative to the 0 m mark. This task is made easier by the marked flagging tape woven into the baseline rope. Record these measurements on the rough sketch, showing the points on the baseline from which you measured, and the width measurements you made.

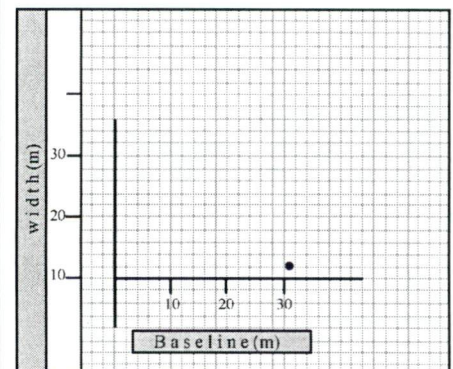
For every measurement there should be two numbers:

- the point along the baseline in metres from the 0-m end;
- the perpendicular distance to the feature or habitat boundary.



### Where to Record Data

FORM	HEADING
2	Maximum Width of Study Area on the Survey Day
3	Habitat Area GPS filename
4	Sketch Map





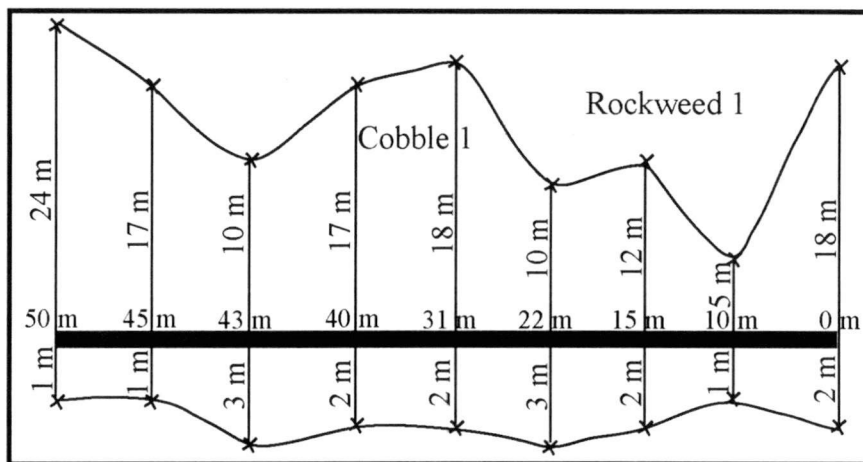
### Using Differential GPS

If you have a differential GPS, you can use it to more accurately map the boundaries of habitats in your study area. Record the GPS file name on Form 3 beside Habitat Area.

Even if you have Differential GPS, you must still make a sketch map as a visual record.

**Major features:** Follow the same procedure to map the major features in both zones.

**Habitats:** Habitat units are most often irregularly shaped. To map them you will need to take at least four or five sets of measurements to act as reference points around the edges of the unit (or more if the habitat is quite irregular). Then draw in the details as accurately as possible. Remember, the goal is to produce a reasonably accurate map of the habitat unit sizes, shapes, and locations within the study area, so that another Shorekeeper can accurately map a year to two later.



Record all the measurements on the rough sketch rather than just keeping a list of your measurements. The drawing will help to keep track of what measurements you have, and what measurements you still need to finish the sketch of the study area.

Be sure to label all features and habitat units on the rough sketch.





**Low tide mark:** You need to take two more measurements – the first of these is the width (the distance down to the water) of the study area at low tide on the day of the survey. You cannot get this measurement until the exact time of low tide.

When the tide is at its lowest, make several width measurements at various points along the baseline to the low tide mark and record these on the rough sketch.

**The Backshore Zone:** Your final measurement is the width of the backshore zone. From a work time perspective, it might be best to wait until the intertidal zone survey is complete before you actually make measurements. See **Step 33**.

*Remember that the maximum width of the study area is the combined widths of the backshore and the intertidal zones at low tide on the day of mapping.*





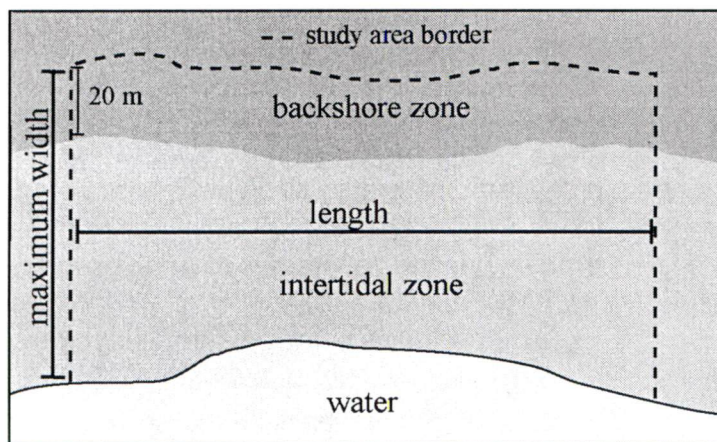
## STEP 18: CALCULATE THE SCALE OF THE SKETCH MAP

### Where to Record Data

FORM	HEADING
4	Sketch Map

The sketch map forms part of the data collected (it will be scanned into the central database by DFO), so it needs to be done as neatly and accurately as possible. This step describes how to calculate a proper scale for the sketch map. The scale will indicate how big objects are in real life.

The sketch map should show the entire study area, even the backshore. The maximum width of the study area is the combined widths of both the backshore and the intertidal zone on the day of mapping. The length of the study area is the distance these zones extend along the shore inside the study area borders. Draw the sketch map on **Form 4**. This form has grid lines, 100 x 60. Each square will represent a certain distance on the beach.



If your study area is 100 m by 60 m or less, you will be able to use a scale of 1 metre = 1 square. Try using this scale and see how it fits on **Form 4**.

If the paper is too small in either or both directions, you will have to use a smaller scale. Try using a scale of 2 metres = 1 square.

If the drawing fits on the paper, but it is very small and scrunched up, you will want to use a larger scale. Try using a scale of 1 metre = 2 squares.



**Example:** If the study area is 185 m long and 75 m wide, you would use a scale of  $2 \text{ m} = 1 \text{ square}$ . The sketch map would then be 93 squares long (half of 185) and 38 squares wide (half of 75).

**Example:** If the study area is 35 m long and 29 m wide, you would use a scale of  $1 \text{ m} = 2 \text{ squares}$ . The sketch map would then be 70 squares long (two times 35) and 58 squares wide (two times 29).

If the study area is wider than it is long, then turn the paper lengthwise and use a scale that works.

If you find this Step too difficult or confusing to complete properly, contact your DFO representative for assistance.

**Note:** You have to use the same scale in both directions.

*Remember to record the scale you are using on the map.*

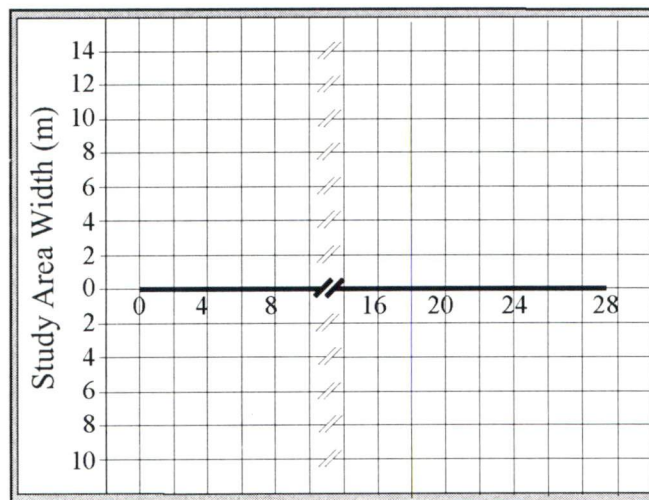


## STEP 19: REDRAW THE ROUGH SKETCH TO SCALE ON THE SKETCH MAP

### Where to Record Data

FORM	HEADING
4	Sketch Map

Draw a thick line representing the baseline, then draw a line along the left side of the page, perpendicular to the baseline. Label the perpendicular line, this represents the Study Area Width. Each square is equal to the scale you calculated in **Step 18** above. With the baseline being zero, label each square on either side of the baseline.



Draw in the lines to show the back boundary of the backshore zone and the low tide line. Draw in the lines to show the two side boundaries of the study area.

Put a North arrow on the map using a compass or a published map of the area. Make sure it is oriented properly, and indicate whether your arrow represents Magnetic North or True North, see **Step 21**.

*You are finished your sketch map when all the habitat boundaries and other features of your study area are mapped.*

Draw and label each feature and habitat unit. Write a one- or two-word label beside each feature you draw. Make sure the habitat units you map have the right location codes and correspond to the same habitat units described on **Form 3**.





## STEP 20: TAKE BEARINGS FROM BASELINE END POINTS

This Step, when combined with **Step 21**, will give accurate geographic coordinates for the study area. It actually gives coordinates for one of the end points of the baseline – this point is the reference location point for the study area. This point is particularly useful if the study area is in a remote area where you cannot document the location relative to access roads. Along with the permanent features you have marked on the sketch map, this will make it easier to find the study area in the future. Two methods for estimating the location of the study area are outlined below.

You can leave this step until the end of your survey, because it is not particularly constrained by the tide height, whereas mapping habitats and sampling quadrats are constrained.

*If you are using a GPS, then skip to Step 21 to determine the coordinates.*

### TAKING A COMPASS BEARING

This section describes how to use a compass to triangulate and pinpoint your study area on a map or chart. Once you have marked the site on the map or chart of the area, it is a simple step to determine the coordinates of that position in the next step.

### CHOOSE AT LEAST TWO, PREFERABLY THREE, PROMINENT FEATURES

Stand at one end of your baseline. Choose at least two, preferably three, large and obvious features that you can also find on your chart or topographic map. Points of land, lighthouses and other navigation markers are good if you are using a chart: buildings, heights of land, or radio towers are good if using a



### Materials Needed

- compass with sighting mirror
- parallel ruler



map. When choosing these features, keep the following points in mind:

- The nearer an object is to you, the more accurate the position of the bearing line.
- The three features should be approximately 90° apart from each other, if possible, for best accuracy.

### **TAKE COMPASS BEARINGS**

Training and practice in this beforehand is a must! Hold your compass level with the mirror tilted so that you can read from the compass while still holding it horizontal at eye level. Line up the sighting notch with the object. Adjust the compass plate so that the north arrow (free moving red end) lies directly over the red arrow etched on the base of the compass. Now you can read the bearing off the compass. This is the magnetic bearing to the object. Write it on a piece of paper. Repeat this procedure for the other two features.





## STEP 21: DETERMINE THE GEOGRAPHIC COORDINATES OF BASELINE END POINTS

Plot your bearings on a hydrographic chart or topographic map that you chose in **Step 7**.

**Plot bearings on a hydrographic chart:** Place your parallel ruler on the magnetic compass rose on the chart, and turn it so that the edge is along your compass bearing. Then work the parallel ruler across the chart until its edge is on the object. Draw a line from the object back towards shore. You were standing somewhere along this position line. Take your second bearing and do the same procedure to draw the bearing line on the chart. The point where the two bearing lines intersect should be your position. If you took a third bearing, plot this as well. It is unlikely that the three bearing lines will intersect at one point. It is more likely they will form a small triangle, with your position being somewhere in the triangle. If the triangle is large, or if the first two lines do not intersect, then you have made an error reading the bearing. Try again.

**Plot bearings on a topographic map:** Topographic maps use true north. So, on a topographical map you will have to change the magnetic reading from the compass into a true reading. True north is a fixed point at the north pole. Magnetic north is actually an area of magnetic fields deep inside the earth. The field is not located exactly at the north pole, rather it is about 2,092 km from true north and moves very slowly. A compass needle does not point to true north, it points to magnetic north.

In British Columbia a compass needle points approximately  $22^{\circ}$  east of true north. To correct your compass readings to true north, you need to add  $22^{\circ}$  to the compass reading. See the topographic map for the exact correction (declination) to use. It should be recorded along the bottom margin.

To plot your bearings, take your first bearing and add the declination.

### Where to Record Data

FORM	HEADING
1	•Estimated Baseline End Point Coordinates •Source of Baseline Coordinates



**Example:** Your magnetic bearing that you read from your compass is  $180^\circ$ . The declination you read off the bottom edge of the map is  $22^\circ$ . The corrected bearing from true north is  $180^\circ + 22^\circ = 202^\circ$ .

Now, place your parallel ruler on the corrected bearing on the map's compass rose. Then follow the same instructions for the topographic map, using the corrected bearing as you would on the hydrographic chart (described above) to locate your baseline reference point. Repeat this procedure for your second and third bearings. Don't forget to add the declination to each bearing.

You can determine your geographic coordinates later at home.

If you used GPS in **Step 20**, then skip this. If you have trouble with any part of this step, an individual who has completed power squadron, or a forester, surveyor or geography teacher will be able to help you. It should only take a few minutes.

**Hydrographic Chart (Estimated Latitude/Longitude):**

Hydrographic charts have a grid on them representing latitude and longitude. Latitude is measured parallel to the equator in degrees, from  $0^\circ$  at the equator to  $90^\circ$  at the north pole. Longitude is measured at right angles to the equator starting at  $0^\circ$  near London, England, and going  $180^\circ$  east and  $180^\circ$  west.

Latitude is read on the left and right sides of the chart. 1 minute of latitude equals about one nautical mile. Longitude is marked on the top and bottom of the chart. Lines of longitude converge at the north and south poles. As a result the distance between these lines varies with latitude. You cannot use longitude to measure distance.

Each degree of latitude and longitude is further divided into 60 minutes, which is marked on the sides of the chart at one-minute intervals ( $01'$ ,  $02'$ ,  $03'$ , etc.). Each minute block is further divided into 60 seconds. Seconds are spaced by dots into 10 equal parts, with each interval equalling 6 seconds ( $6''$ ,  $12''$ ,  $18''$ , etc.).

To estimate the coordinates of your location using a hydrographic chart, you will need to record a latitude value and



a longitude value for the reference point (one end of the baseline where you took your compass bearings) using the following procedures. The example used to illustrate the procedure is based on estimating the location of point 1 in Figure 9.

**Determine the latitude to the nearest second for the reference point:** Read the nearest number of degrees given below the point, followed by the minute block the point is in.

**Example:** If the point is in the 39<sup>th</sup> minute block above 49°, its latitude to the nearest minute is 49° 39'.

Determine the nearest second of the point, by measuring the ruler distance from the bottom of the nearest minute block to the point. Divide this value by the ruler distance for a minute of latitude.

**Example:** If there are 84 mm in each minute of latitude, and the location is 60 mm above the minute line, then it is at  $60 \div 84 = 0.72$  minutes.

Multiply this value by 60 to calculate the number of seconds. In the example given,  $0.72 \times 60 = 43.2$  seconds. The final latitude would be written as Lat. 49° 39' 43.2".

**Topographic Map (Estimated UTM):** Topographic maps have a grid of blue lines known as Universal Transverse Mercator (UTM) coordinates (see Figure 10). The grid lines are spaced every 2 cm in north-south and east-west directions. On 1:50,000 scale maps, this 2-cm spacing equals 1 km on the ground, and 1 mm equals 50 m on the ground. If the distance between any two points on the map is measured, then you can estimate the actual distance on the ground.



**Note:** If you use a topographic map or hydrographic chart to estimate UTM coordinates you **must** record the map number.

To estimate the location of your study area, record the UTM coordinates for the reference point by doing the following. You will need to record an “Easting” value and a “Northing” value for the point. The example used to illustrate the procedure is based on estimating the location of point 1 in Figure 10. Locations estimated using this method are accurate to within 50 m on the ground.

**Determine the six-digit Easting value for the point:**

Record the number of the closest grid line to the left of the point. Numbers are given at the top and bottom of the map sheet. In this example the number is 362000. To this value, add the number of metres represented by the distance between the grid line and the point.

**Example:** The point is located 6 mm to the right of the line, which equals  $6 \times 50 = 300$  m. The Easting value is therefore 362300.

**Determine the seven-digit Northing value for each point:**

Record the number of the blue grid line immediately below each point. These numbers are given on the left and right margins of the map sheet. In this example the number is 5502000. To this value add the number of metres represented by the distance between the grid line and the point.

**Example:** The point is located 10 mm above the line, which equals  $10 \times 50 = 500$  m. The Northing value is therefore 5502500.

**Example:** The study area marked on the map in Figure 10 is 7 mm long, which translates into 350 m at the actual site.

The UTM coordinates for the sample point is E 362300, N 5502500.



Figure 9. Example of a Study Area Marked on a Hydrographic Chart.

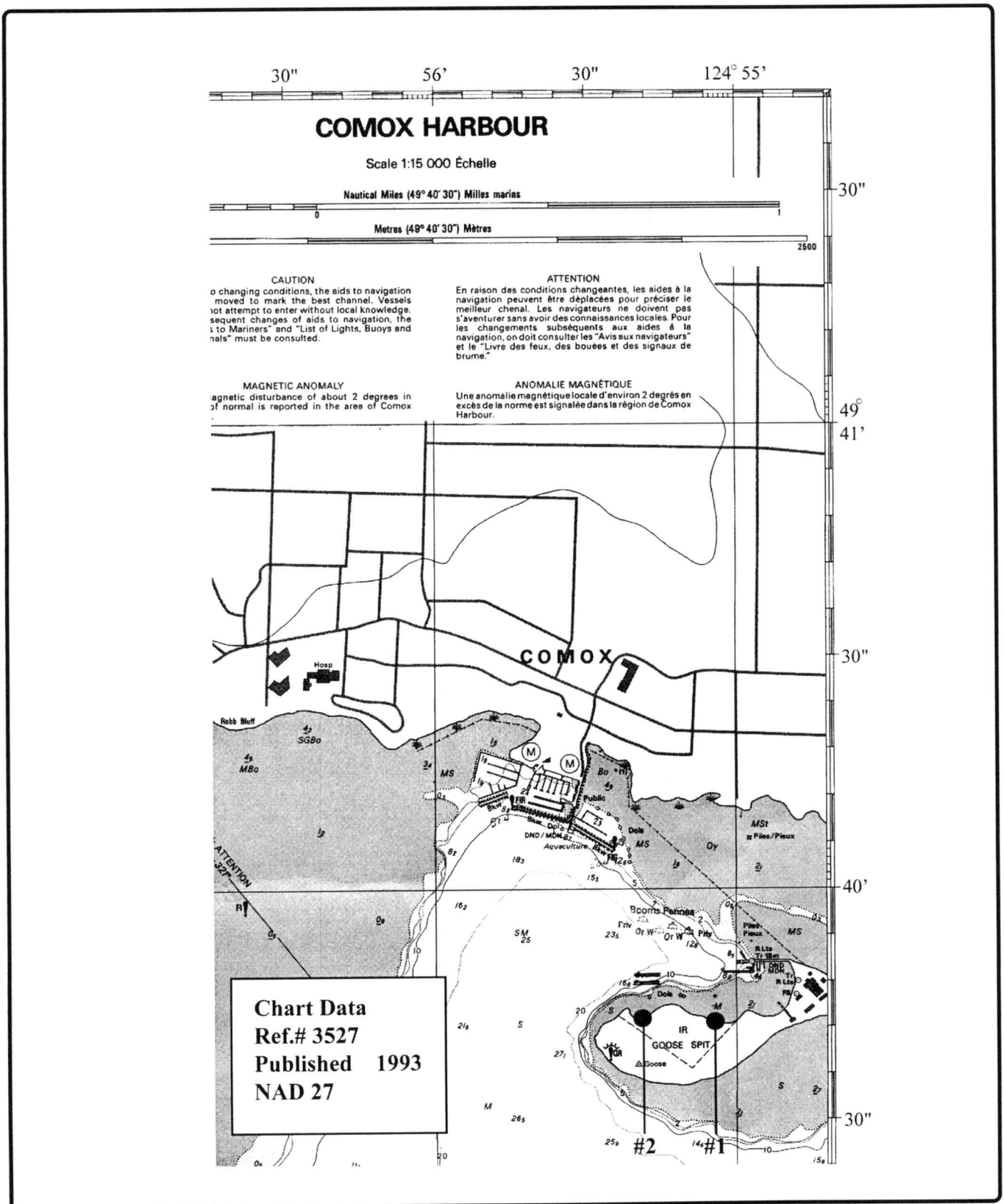
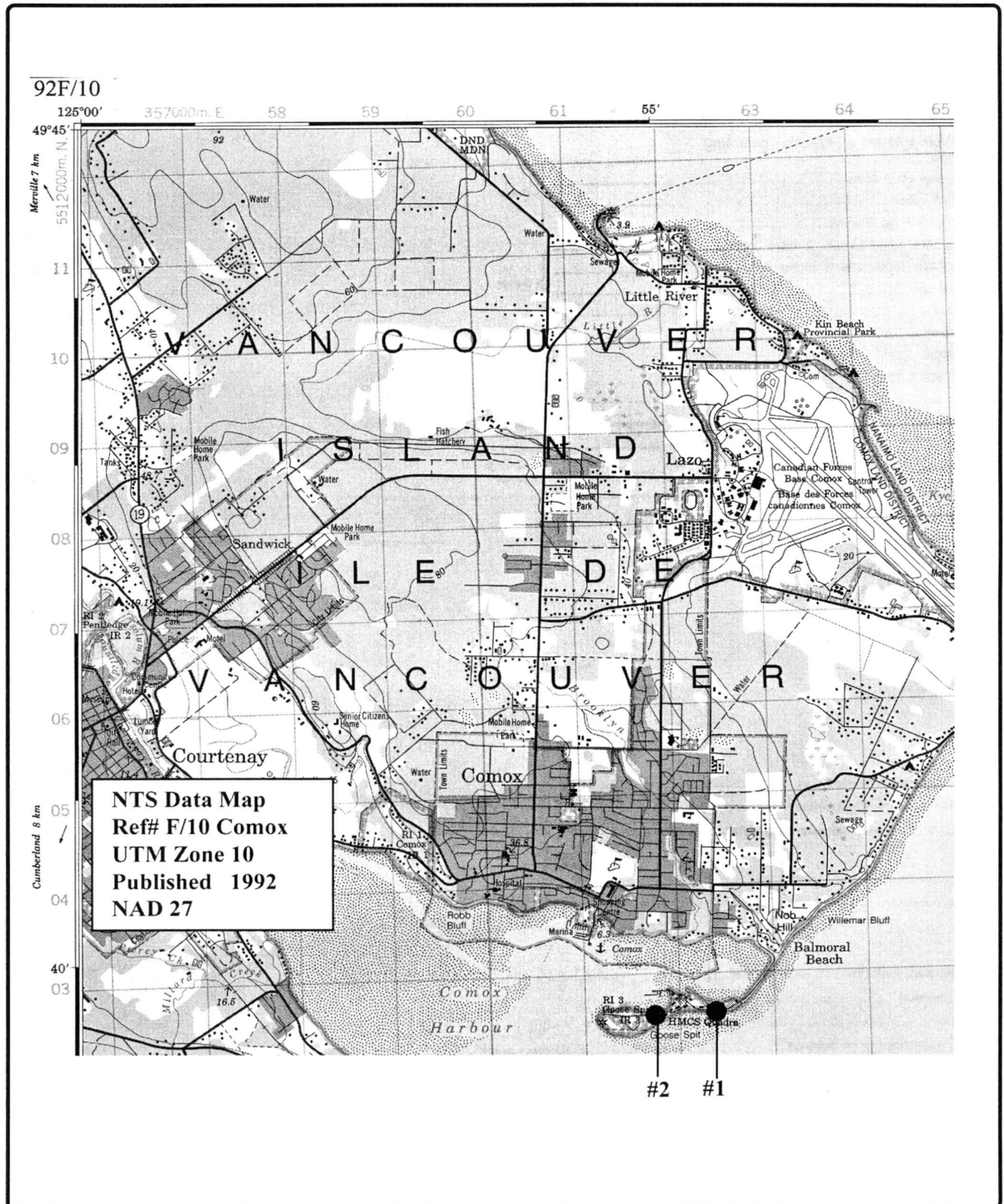


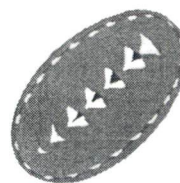




Figure 10. Example a Study Area Marked on a Topographic Map.



# Documenting Physical Features of Each Habitat



## STEP 22: DETERMINE HABITAT AREA

Choose the GPS method or the manual method to calculate the habitat area. Make one entry for each habitat unit.

### DIFFERENTIAL GPS METHOD

Measure the area of each habitat unit using GPS. Record the GPS file name on **Form 3**.

### MANUAL METHOD # 1

Measure the area in square metres. You can probably get the measurements you need from the person(s) given the task of mapping habitat units. Most habitats will be irregular shapes.

Take several width and length measurements for the habitat.

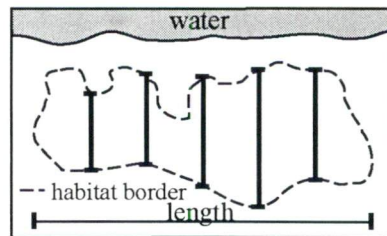
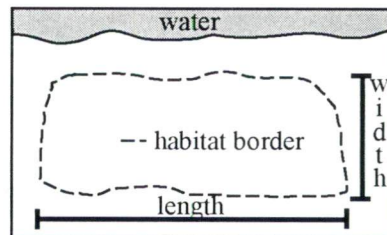
Calculate the average width of the habitat by adding up all widths and dividing by the number of width measurements. Do the same for the length measurements.

**Example:** There were five width measurements taken for this habitat. The sum of the five measurements is 45 m, then the average width is  $45 \div 5 = 9$  m.

Multiply the average length times the average width to compute square metres. Record this value on **Form 3**.

Where to Record Data

FORM	HEADING
3: Part 1	Habitat Area





## **MANUAL METHOD # 2**

This is probably the best of the two manual methods, unless your habitats are very regular shapes. You can do this later at home. Refer to the completed sketch map and count the number of squares and partial squares within each habitat and multiple them by the area that each square represents.



## STEP 23: DETERMINE HABITAT SLOPE

Slope is the steepness of a habitat and is measured in degrees from horizontal. You can measure the slope of a habitat using several different methods. The terrain of the habitat will determine which method is best. Often the slope within a habitat is clearly quite variable. Part of it may have a slope of less than  $3^\circ$ , while another part may be greater than  $10^\circ$ . You may decide to take more than one slope measurement. Make a note of where you took the measurement(s) in relation to your baseline.

There are numerous methods by which slope can be determined. During the development of the Shorekeepers' Guide, a number of different methods of determining slope were considered. The following three were found to be the easiest and most reliable.

- If you have a clinometer, use this method, as it is the easiest.
- If you have a hand level, use this method.
- If you have neither, use the Horizon Method.

Record which method you have used on **Form 3**.

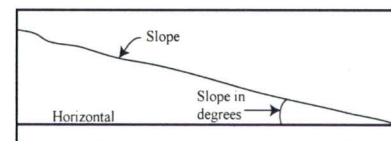
### CLINOMETER METHOD

There are a number of different clinometers on the market. Follow the instructions that come with yours. However, if you do not have instructions, they all work in the same way as described below.

Use a tape measure or the surveying stake to determine your height from your eyes to the ground. Mark your eye height on the stake.

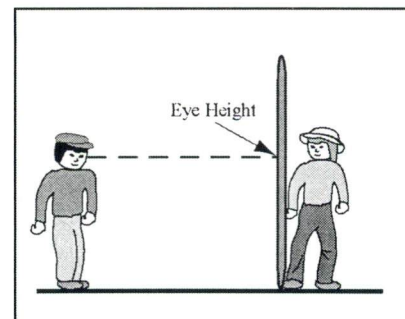
### Where to Record Data

FORM	HEADING
3:Part 1	Slope



### Materials Needed

- clinometer
- surveying stake – a 3.5- to 4-m stick, marked in hundredths of a metre

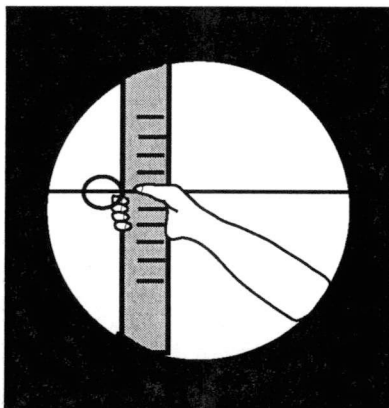




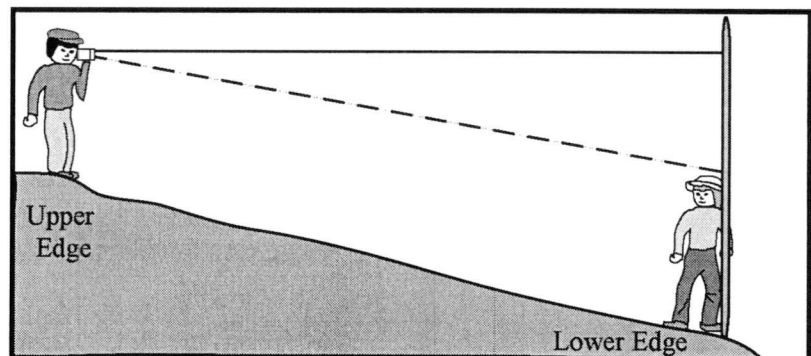


### Materials Needed

- hand level
- surveying stake – a 3.5- to 4-m stick, marked in hundredths of a metre
- long measuring tape
- calculator



One person stands at the lower edge of the habitat holding the stake. You stand at the upper edge of the habitat. Looking through the clinometer, line up the horizontal line with the height on the stake that you determined to be your eye height. Read the slope in degrees from the scale in the clinometer. Record this value on **Form 3**.



### HAND LEVEL METHOD

The following are the eight procedures of the Hand Level Method:

1. On level ground, measure the eye height of the person who will be sighting through the hand level. Use a tape measure or the surveying stake. Record their eye height on a piece of paper.
2. The person with the hand level stands near the top of the habitat.
3. Have a second person stand near the bottom of the habitat holding the surveying stake.
4. Look through the hand level. When the bubble is lined up with the horizontal line inside the hand level, read the height off the surveying stake or have the person place their finger at the appropriate height on the stake.





5. Subtract their eye height (**Procedure 1**) from this value. The resulting value is the change in elevation of the habitat.

**Example:** You have determined that your eye height is 152 cm or 1.52 m. You are now looking through the hand level at the stake being held at the lower edge of the habitat, and when you have the bubble lined up with the horizontal line inside, you read 2.26 m off the stake. The change in elevation is  $2.26 - 1.52 = 0.74$  m or 74 cm.

6. Measure the horizontal width of the habitat unit.
7. Calculate the slope fraction of the habitat unit by dividing the elevation change of the habitat unit determined in **Procedure 5** above, by the horizontal width of the habitat unit determined in **Procedure 6** above.

**Example:** If the elevation change is 0.74 m and the horizontal distance is 7 m the slope fraction is  $0.74 \div 7 = 0.1057$ .

8. Find the TAN number in Table 4 that is closest to the slope fraction calculated in **Procedure 7** above. The value in the column beside this TAN number is the slope of the habitat in degrees. Record this value on **Form 3** beside **Slope**.

If the habitat is quite steep, you will find you are looking over the top of the surveying stake, in which case you will not be able to do **Procedure 4** (read the height off the surveying stake when you have the bubble and the horizontal line inside the hand level lined up) in a single step. Instead, do several repeats of **Procedures 2 to 5** over shorter distances as necessary. Record each step separately and then add up the values to determine the total change in elevation of the habitat unit (see example on page 75, Horizon Method).

**Example:** The slope fraction is 0.1057. The closest TAN number is 0.1051, which means a slope of  $6^\circ$ .



**Table 4. Conversion of Slope Fraction to Slope in Degrees.**

TAN	Slope (°)	TAN	Slope (°)
0.0000	0	1.0000	45
0.0175	1	1.0355	46
0.0349	2	1.0724	47
0.0524	3	1.1106	48
0.0699	4	1.1504	49
0.0875	5	1.1918	50
0.1051	6	1.2349	51
0.1228	7	1.2799	52
0.1405	8	1.3270	53
0.1584	9	1.3764	54
0.1763	10	1.4281	55
0.1944	11	1.4826	56
0.2126	12	1.5399	57
0.2309	13	1.6003	58
0.2403	14	1.6643	59
0.2679	15	1.7321	60
0.2867	16	1.8040	61
0.3057	17	1.8807	62
0.3249	18	1.9626	63
0.3443	19	2.0503	64
0.3640	20	2.1445	65
0.3839	21	2.2460	66
0.4040	22	2.3559	67
0.4245	23	2.4751	68
0.4452	24	2.6051	69
0.4663	25	2.7475	70
0.4877	26	2.9042	71
0.5095	27	3.0777	72
0.5317	28	3.2709	73
0.5543	29	3.4874	74
0.5774	30	3.7321	75
0.6009	31	4.0108	76
0.6249	32	4.3315	77
0.6494	33	4.7046	78
0.6745	34	5.1446	79
0.7002	35	5.6713	80
0.7265	36	6.3138	81
0.7536	37	7.1154	82
0.7813	38	8.1443	83
0.8098	39	9.5144	84
0.8391	40	11.4430	85
0.8693	41	14.3010	86
0.9004	42	19.0810	87
0.9325	43	28.6360	88
0.9657	44	57.2900	89



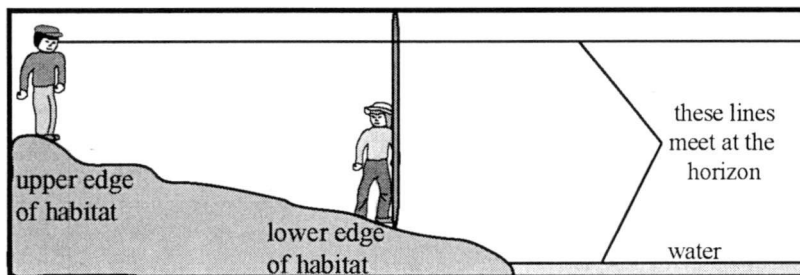
## HORIZON METHOD

The procedures to the Horizontal Method are essentially the same as for the Hand Level Method except that instead of sighting through a Hand level, you sight to the horizon. This requires a clear view of the horizon.

To use the Horizon Method the ocean view must recede into the distance far enough that it becomes the horizon. If something obstructs this view, such as an island or headland, you will need to use the clinometer or hand level method instead.

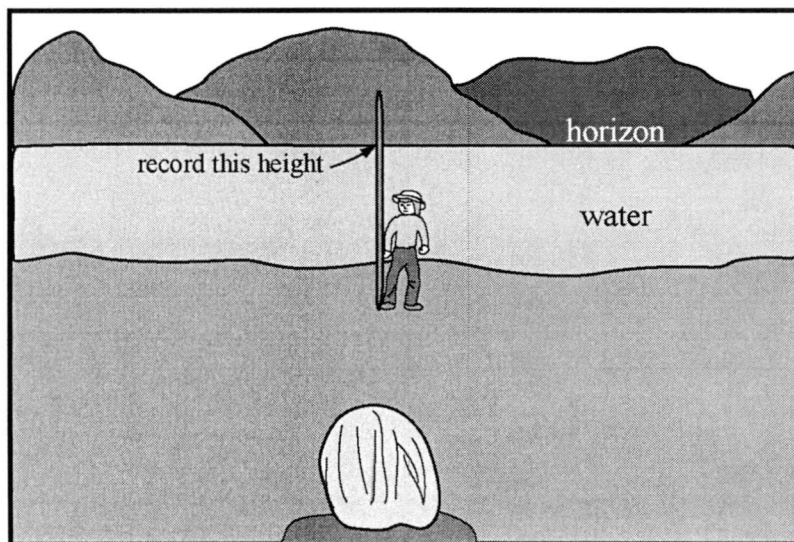
**The following are the nine procedures of the Horizon Method:**

1. Standing on level ground, measure the eye height of one person. Use a tape measure or the surveying stake. Record their eye height on a piece of paper.
2. Once their eye height has been measured, have this person stand near the upper edge of the habitat.
3. Position another person near the lower edge of the habitat with the surveying stake.
4. The person at the upper edge of the habitat indicates where the horizon intersects the surveying stake.



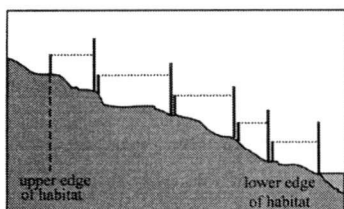
### Materials Needed

- surveying stake – a 3.5- to 4-m stick, marked in hundredths of a metre
- long measuring tape
- calculator



5. Read this height off the surveying stake where the horizon appears to intersect the stake.
6. Subtract from this value the eye height you marked down (see **Procedure 1**). The resulting value is the change in elevation of the habitat.

**Example:** The height measured on the surveying stake at the lower edge of the habitat is 2.1 m. Your eye height is 1.52 m. Thus  $2.1 - 1.52 = 0.58$  m. This is the change in the elevation.



If the change in elevation is great, you may find that you are looking over the top of the surveying stake. If this is the case, then it will be impossible to take the measurement in **Procedure 5** above (read the height off the surveying stake where the horizon appears to intersect this stake). In this case, do several repeats of **Procedures 4 to 6** over shorter distances. Record each step separately, and then add up the values to determine the total change in elevation of the habitat unit.

Alternatively, reduce the height that you need to subtract. Instead of your eye height when standing, try squatting down and sighting the horizon across an object of a known shorter height, e.g., a 1-m stick.



**Example:** If the habitat is too steep to calculate the change in elevation with one measurement, the person near the top of the habitat, moves closer to the person at the lower edge, until the horizon intersects the top of a 4-m surveying stake. Their eye height is 1.52m. Thus  $4 - 1.52 = 2.48$  m. Now the person at the lower edge of the habitat moves up to where the upper person is standing and the upper person moves to the upper edge of the habitat. This time the height measured on the surveying stake is 2 m. Again you subtract their eye height from this measure,  $2 - 1.52 \text{ m} = .48 \text{ m}$ . Now you add 0.48 m and 2.48 m to get 2.96 m. This is the total change in elevation.

7. Measure the horizontal width of the habitat unit. That is the distance between the person near the upper edge of the habitat and the person near the lower edge holding the surveying stake.
8. Calculate the slope fraction of the habitat unit by dividing the elevation change of the habitat unit (**Procedure 6**) by the horizontal width of the habitat unit (**Procedure 7**).

**Example:** If the elevation change is 1.1 m and the horizontal distance is 7 m, the slope fraction is  $1.1 \div 7 = 0.1571$ .

9. Find the TAN number in Table 4 that is closest to the slope fraction calculated in **Procedure 7** above. The value in the column beside this TAN number is the slope of the habitat in degrees. Record this value on **Form 3** beside **Slope**.

**Example:** The slope fraction is 0.1571. The closest TAN number is 0.1584, which means a slope of  $9^\circ$ .





## STEP 24: DETERMINE HABITAT ELEVATION

### Where to Record Data

FORM	HEADING
3: Part 1	Elevation

### WHAT IS THE ELEVATION?

Elevation is the height above the lowest low tide, also referred to as Chart Datum. If an object has an elevation of 2 metres, that means it is 2 m above chart datum. Elevation is important here because it determines the extent a given habitat unit is exposed to air at low tide. This, of course, affects the types of marine plants and animals that live there. Habitat units that are higher up the beach will be exposed to air longer, and so will contain animals and plants that can survive longer in air. Lower habitats will be exposed to air only at very low tides, and so will have plants and animals that cannot survive very much “air time.”

You will not measure actual elevation here, you will be measuring elevation relative to the tide at a specific time. By noting the time that you make the measurements, DFO staff will be able to make an estimate of the true elevation relative to chart datum by calculating the actual tide height at the time you recorded.

Record the elevation and time information for the lower and upper edge of each habitat unit. Record elevation values in metres using one of the following three methods.

The following are three alternative methods for estimating elevation:

- Time Tide Method;
- Horizon Method;
- Hand Level Method.

### TIDE TIME METHOD

The tide time method is the simplest method for finding the elevation of a habitat unit, but you have to pay close attention to the tide (and it also does not work if there are substantial



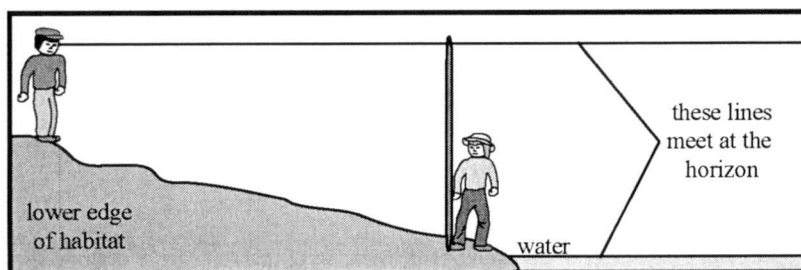
waves). Record the time when the tide reaches the lower and the upper edge of each habitat. With this method there are no height measurements to record, just the time. The tide times are used in a computer program that predicts tide heights. If you have a large study area and/or a lot of habitat units, you will probably not find this to be a practical method because it is difficult to keep track of the time of the tide at each habitat unit border when you have a lot of other tasks to do as well.

## HORIZON METHOD

You need an ocean view that recedes into the distance far enough that it becomes the horizon. If something obstructs this view, such as an island or headland, you must use one of the other methods.

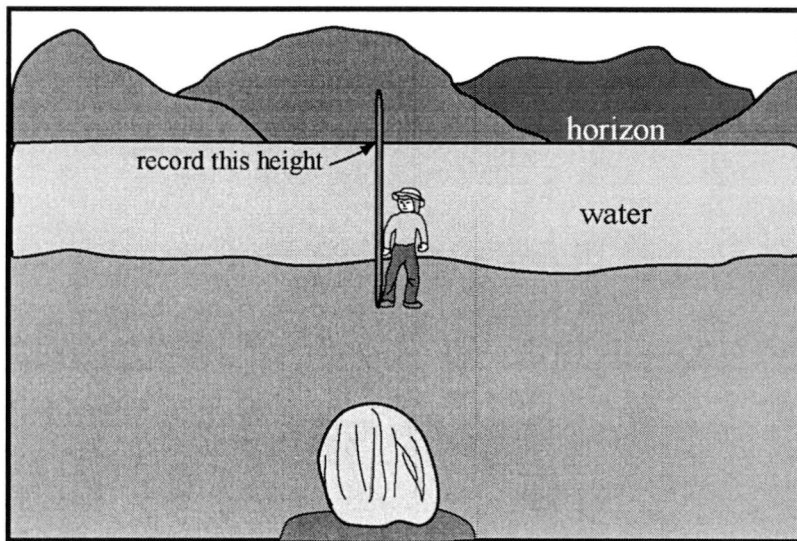
The procedures for determining elevation, using the Horizon Method, is the same as **Procedures 1 to 6** of the Horizon Method for calculating habitat slope, with **three** important differences. Read **Procedures 1 to 6** of the Horizon Method on pages 73-74 but make the following three changes.

1. You are measuring the elevation of the lower edge of the habitat relative to low tide and then the upper edge of the habitat relative to low tide, rather than the elevation change from top to bottom of the habitat. This means that the person whose eye height has been measured and who will be sighting past the surveying stake to the horizon, stands at the lower edge of the habitat (**Procedure 2**, page 73). The person holding the surveying stake stands at the water's edge (**Procedure 3**, page 73). Once you have completed the elevation calculation (**Procedure 6**, page 74), record this value on **Form 3** beside **Minimum Elevation**.



## Materials Needed

- surveying stake – a 3.5- to 4-m stick, marked in hundredths of a metre
- long measuring tape
- calculator



2. Now the person at the lower edge of the habitat moves to the upper edge of the habitat while the other person remains at the water's edge. Do **Procedures 4 to 6** as on pages 73-74. Record the elevation on **Form 3** beside **Maximum Elevation**.
3. You must record the time when you read the height off the surveying stake (**Procedure 5**, page 74) on **Form 3** under **Tide Time**.

**Example:** The height measured from the lowest edge of the habitat, on the surveying stake at the water's edge is 1.9 m. The eye height of the person is 1.5 m. Thus the elevation of the lower edge of the habitat is  $1.9 - 1.5 = 0.4$  m. Record this on **Form 3** beside **Minimum Elevation**. The time is 9:05 am.; record this as **Tide Time**. The person doing the sighting now moves to the upper edge of the habitat and sights past the surveying stake at the water's edge to the horizon. The height measured on the surveying stake at the water's edge is 2.5 m. The eye height of the person is 1.5 m. Thus the elevation of the upper edge of the habitat is  $2.5 - 1.5 = 1$  m. Record this on **Form 3** beside **Maximum Elevation**, and the time beside **Tide Time**.



If the change in elevation is great, you may find that you are looking over the top of the surveying stake. If this is the case, then it will be impossible to take the measurement described in **Procedure 5** on page 74. In this case do several repeats of **Procedures 2 to 6** as necessary, each over a smaller distance. Add up the values to determine the elevation of the lower and the upper edges of the habitat unit (see example on page 75).

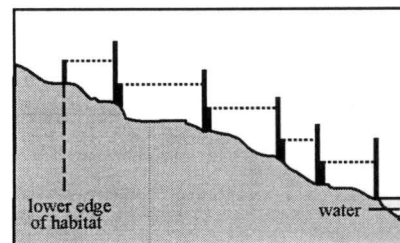
Alternatively, reduce the height that you need to subtract by squatting down and sighting across an object of a known shorter height, e.g. a 1-m stick, instead of using your full height.

## HAND LEVEL METHOD

The Hand Level Method for calculating elevation is the same as the Horizon Method for calculating elevation except that instead of sighting over a surveying stake to the horizon, you use a hand level to look directly at the surveying stake at the water's edge. This eliminates the need for a clear view of the horizon.

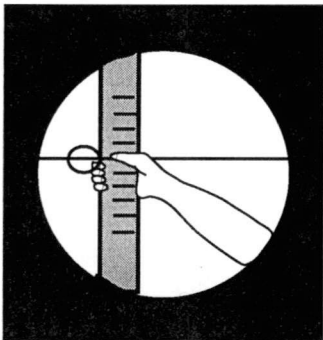
The procedure for determining elevation, using the Hand Level Method, are the same as **Procedures 1 to 5** of the Hand Level Method for calculating slope, with **three** important differences. Read **Procedures 1 to 5** of the Hand Level Method on page 70-71 but make the following three changes.

1. You are measuring the elevation of the lower edge of the habitat relative to low tide and then the upper edge of the habitat relative to low tide, rather than the elevation change from top to bottom of the habitat. This means the person whose eye height has been measured and who will be using the hand level stands at the lower edge of the habitat (**Procedure 2**, page 70). The person holding the surveying stake stands at the water's edge (**Procedure 3**, page 70). Once you have completed the elevation calculation (**Procedure 5**, page 71), record this value on **Form 3** beside **Minimum Elevation**.

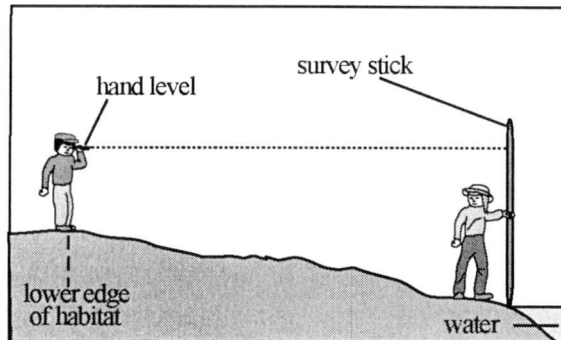


## Materials Needed

- surveying stake – a 3.5- to 4-m stick, marked in hundredths of a metre
- hand level
- calculator



*If the change in elevation is great, you may find that you are looking over the top of the surveying stake. If this is the case, then it will be impossible to take the measurement described in Procedure 4 on page 70 (line up the bubble with the horizontal line inside the hand level, read the height off the surveying stake or have the person place their finger at the appropriate height). In this case do parts 2 to 5 several times, each over a smaller distance. Add up the values to determine the elevation of the lower and the upper edges of the habitat unit (see example on page 75).*

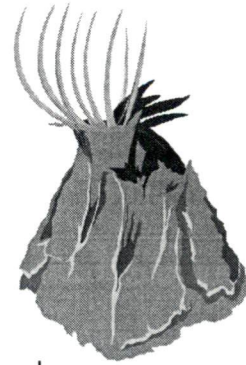


2. Now the person at the lower edge of the habitat moves to the upper edge of the habitat while the other person remains at the water's edge. Repeat **Procedures 4 and 5** pages 70-71. Record the elevation on **Form 3** beside **Maximum Elevation**.
3. You must record the time when you read the height off the surveying stake (**Procedure 5**, page 71) on **Form 3** under **Tide Time**.

**Example:** You have determined that your eye height is 152 cm or 1.52 m. You are standing at the lower edge of the habitat looking through the hand level at the surveying stake being held at the water's edge. When you have the bubble lined up with the horizontal line inside, you read 2.26 m off the stake. The elevation of the lower edge of the habitat is  $2.26 - 1.52 = 0.74$  m or 74 cm. Record this on **Form 3** beside **Minimum Elevation**. The time is 9:05 am; record this beside **Tide Time**. The person with the hand level now moves to the upper edge of the habitat and sights through the hand level to the surveying stake at the water's edge. The height measured on the surveying stake at the water's edge is 2.5 m. The eye height of the person is 1.52 m. Thus the elevation of the upper edge of the habitat is  $2.5 - 1.52 = 0.98$  m. Record this on **Form 3** beside **Maximum Elevation** and record the time beside **Tide Time**.



# *Documenting Plants & Animals in Each Habitat*



## STEP 25: UNDERSTAND THE QUADRAT SURVEY METHOD

It is not possible to count all the plants and animals in a habitat unit, since the habitat unit could be quite large and probably contains thousands (if not millions) of organisms. Therefore, we need to take samples of each habitat unit and identify and count only the most relevant organisms in these samples. From these samples, it is possible to make estimates of the number of relevant organisms in the whole habitat unit.

We use the quadrat survey method, which allows a small section of a habitat to be isolated and looked at more closely. A quadrat is a small area, in this case 25- x 25-cm square or 50- x 50-cm square. By looking closely at the organisms in a quadrat we are sampling, we are assuming that those plants and animals inside the quadrat are representative of (or much the same as) what is outside the quadrat. It is like sampling a piece of cake – you assume the rest of the cake is the same as the sample you tasted. In this step of the survey, you will look closely at a number of quadrats systematically located in each habitat.

It is important to follow the same procedure in all habitats of the same type. If you want the results to be comparable across years, you need to follow the same procedure on each sampling over time. This means sampling the same number of quadrats in all habitats of the same type in all survey years.

### HOW TO MAKE A QUADRAT

Quadrat square frames can be made by connecting four equal lengths of PVC pipe or wood, or by bending rigid wire. Check to make sure inner measurements are either 25 cm or 50 cm a side.



### Materials Needed

- long rope
- 50-m measuring tape
- quadrat markers that won't blow away, such as spray-painted rocks (use non-toxic water soluble paint) or blocks of wood
- one or more quadrats



### **HOW MANY QUADRATS SHOULD YOU SAMPLE PER HABITAT?**

Each quadrat is one sample. In general, the more quadrats you sample the more likely your data will be a true measure of the whole habitat. For statistical reasons, you should sample at least six quadrats in a habitat; but you need not sample more than 15 quadrats because there is little more accuracy to be gained from further sampling. When deciding on the number of quadrats to sample in a habitat, 15 obviously would be best, but you will need to consider how much time you have and the size of the study team. The advantage of sampling each habitat separately is that you can maximize your efforts in habitats with lots of life by sampling more quadrats (e.g., boulder, sand, mud, and any habitat near the low tide) and minimize your effort in habitats with little or few organisms (e.g., bare bedrock, sand, pebble, shell near the top of beaches). See Table 2 for an estimate of the amount of time required to sample one quadrat.



## STEP 26: CHOOSE A QUADRAT SIZE

Use the same quadrat size for all quadrats sampled within a habitat unit.

Record “25” if the quadrat is a 25- x 25-cm quadrat or “50” if it is a 50- x 50-cm quadrat.

The size of the quadrats will be determined by the type of substrate found within the habitat.

If the substrate is soft so that you can dig into it, use a 25- x 25-cm quadrat (inside dimensions). The small size of this quadrat reduces the area you will disturb when digging in the substrate; it also minimizes sorting time.

If the substrate is hard, it is only possible to look at the surface. Use a 50- x 50-cm quadrat (inside dimensions).

### WHY IS IT IMPORTANT TO RECORD QUADRAT SIZE ON FORM 3?

Quadrat size is needed to determine the number or density of plants or animals in a quadrat, and to estimate the number in the whole habitat unit. For example, if you find 10 purple shore crabs in a 25- x 25-cm quadrat, you could say that habitat has four times as many purple shore crabs than if there were 10 purple shore crabs in a 50- x 50-cm quadrat. A 50- x 50-cm quadrat is four times as big as a 25- x 25-cm quadrat, because it is twice as long and twice as wide. You must be consistent about the size of quadrat that you use in all habitats of the same type and in all subsequent surveys of the study area. If you don't, your data cannot be compared across years as readily.

Record quadrat sizes on **Form 3** beside **Quadrat Size**.

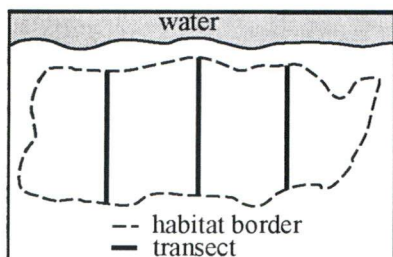
### Where to Record Data

FORM	HEADING
3	Quadrat Size





## STEP 27: LAY OUT TRANSECTS AND QUADRATS



You need to figure out where to place the quadrats in each habitat unit. Quadrats are laid out along straight lines called transects. These transect lines are laid out equal distances apart across a habitat unit, and then the quadrats are placed equal distances apart along each transect line.

If possible, avoid having transects run through tidepools. The sampling methods you are using are not ideally suited for sampling plants and animals in water. Do the best you can to avoid tidepools, but if you cannot avoid it, make notes of which quadrats end up in tidepools.

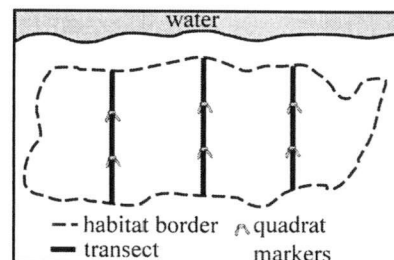
- Measure the habitat length.
- Divide the length by four to determine where to put three transect lines that will run the width of the habitat unit. (Divide the length by five to place four transect lines and so on). The transects should be spaced evenly from each other and from the borders of the habitat unit. Use the baseline to help line up transect lines. You don't have to lay out ropes for the actual transect lines. On the beach use the long tape measure as a transect line, and lay out the quadrat markers along it. Then move the tape measure to the next transect position and lay out the quadrats along it.

**Example:** You measure your sea lettuce habitat unit and determine that the maximum length is 50 m. To position the three transects, divide the 50 m by 4:  $50 \div 4 = 12.5$ . The first transect line will be 12.5 m from the border of the habitat, the next at 25 m and the third at 37.5 m.

- Decide the total number of quadrats you plan to sample, and space them equally along each transect. You must have the same number of quadrats on each transect.



**Example:** If you planned to sample six quadrats and you have three transects, then you will need to place two quadrats on each transect. Divide the width of each transect by three to determine the spacing of the quadrats. For example, if the transects were 12 m, 15 m, and 9 m wide, respectively, then you would place your quadrats roughly 4 m, 5 m, and 3 m apart on each of these transects.



- It takes two to three people to lay out the quadrats. Two people hold a long measuring tape (the transect line) while a third person places a painted rock or block of wood (or some other bright object) at each point along the transect line where sampling should occur.
- Position the centre of the quadrat within 30 cm of each spray-painted rock, block of wood, or small traffic cones. Make sure that quadrats do not overlap.
- Sketch the position of transects and quadrats onto your sketch map, **Form 4**. Record the number of quadrats that you sampled in each habitat unit on **Form 3** beside **Number of Quadrats**.

Lay each quadrat into position only when you are ready to start surveying within that quadrat. If you are working in a habitat unit by yourself, use only one quadrat. Place it in position, assess its contents, then put it at the next point, assess its contents, and so forth. If you have several people conducting the survey, individuals (or teams) can use different quadrats at different survey points at the same time. Be careful not to trample the study area, particularly the quadrat site location.





## STEP 28: ASSIGN QUADRAT NUMBERS

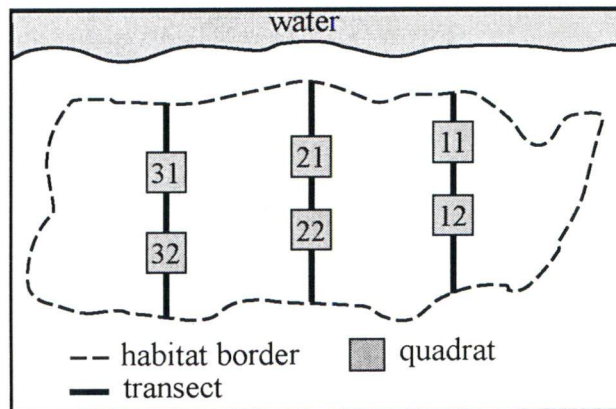
### Where to Record Data

FORM	HEADING
3: Part 2	Quadrat Number

Each quadrat needs its own number to indicate where it is located in the habitat unit. Each quadrat number has two digits.

The first digit indicates on which transect the quadrat is located. If you are facing the water, transect number 1 is the furthest transect to your right, the next one being number 2, etc.

The second digit indicates where along the transect the quadrat is located. The quadrat closest to the water is number 1, the next one up is number 2, etc. For example, quadrat number 22 is the second one up from the water on the second transect from the right.





## STEP 29: IDENTIFY SUBSTRATE LEVEL

There may be as many as three substrate levels that when you are sampling in a quadrat you will need to search through for plants and animals. These are:

- the surface of the substrate;
- beneath moveable objects;
- down within the substrate.

When you identify a species and estimate its abundance (how much or how many), you need to document how many were on the surface, beneath moveable objects, or within the sand or mud.

Identify and count the organisms on the surfaces of the substrate first, including those on all surfaces of algae. Then look under any moveable objects like rocks and boulders and pieces of wood. Finally, dig down into the substrate if it is loose enough to allow digging.

Respect that this is home to many animals and plants; leave as little trace of your work as possible. When you are finished, carefully replace any excavated materials and organisms back into the hole, smooth out the surface of the substrate, and replace all moveable objects and organisms back into their original positions.

### SUBSTRATE LEVELS

**On the surface of the substrate (S):** The surface of the substrate is all exposed surfaces of all materials that are exposed to sunlight in the quadrat. It includes the base substrate such as sand, mud, gravel, or rock, and the tops and sides of any objects that lie on top, including rocks, algal fronds that become suspended when underwater, and wood that was floating at high tide.

### Where to Record Data

FORM	HEADING
3: Part 2	Substrate Level



### Materials Needed

- dishpan
- pail
- garden trowel for loose substrates
- short measuring tape
- sieve; 20- x 20-cm with 5-mm (or 1/4") gauge screen, or a white plastic pasta strainer of a similar gauge for loose substrates



Explore all surfaces of all substrates. This includes carefully and gently searching through any vegetation, because many animals crawl on or hide below the fronds of algae.

**Beneath moveable objects (B):** Moveable objects include rocks and logs that are small enough to be moved easily by one person, but are heavy enough that they are not readily moved by recent wave action. These objects provide important habitat for many intertidal animals that are normally hidden.

Carefully raise the objects within the quadrat one by one.

Identify and count the animals beneath one object and then proceed to the next object. If an object lies partly in and partly out of the quadrat make sure you only identify and count organisms beneath that portion of the object lying inside the quadrat.

Replace the objects as quickly and carefully as you can.

**Within substrate (W):** If a substrate is loose, such as mud, sand, pebbles, or cobble, search down in the substrate for organisms.

Dig down to at least 10 cm across the whole quadrat using a small trowel. Use a measuring tape to make sure you dig to 10 cm. A depth of 10 cm will allow you to find most burrowing animals. Some species, however, such as ghost shrimp and some clams, are found much deeper than this. You may, therefore, choose to search deeper. Record the depth you plan to dig to on

**Form 3.**

You must be consistent and dig to the same depth in each quadrat in this habitat and in any other habitats in your study area that are of the same type. If you are not consistent, it may not be possible to compare your data with future survey data from your study area.

Gently sift through the excavated material using a sieve with a 5-mm (or ¼") gauge screen. The sieve will allow the substrate to pass through the screen while trapping objects 5 mm or larger. If you are digging in mud you may need to add water to help the mud percolate through the sieve.



Sort through the trapped material in search of animals such as clams and worms.

Identify and record the number of each species and then put the animals back as quickly as possible.

### HOW TO MAKE A SIEVE

You can make a sieve by attaching a length of 5-mm (or 1/4") gauge metal screening called hardware cloth (available at most hardware stores) to a 20- x 20-cm wooden frame. Make sure the steel is galvanized or it will rust out in a few weeks.

*It is important that the sieve mesh size you choose is consistent from year to year at your site.*





## STEP 30: IDENTIFY PLANTS AND ANIMALS

### Where to Record Data

FORM	HEADING
3: Part 2	Mobility Category

In this step you are going to classify what you find in your quadrat. Each organism will be classified by its **mobility** and then identified by **species**:

### IDENTIFY PLANT/ANIMAL MOBILITY CATEGORY

Record the mobility category to which a plant or animal belongs using the codes listed below.

**Mobility** is the degree of movement that an organism has.

**Animals:** attached to something (a), mobile (m), dead (d).

**Plants:** attached (a), dead (d).

**(m) mobile animals:** animals that can move. They can flee from predators, search for food, and roam from place to place.

**(a) attached plants and animals:** organisms that remain fixed to the substrate as adults. All plants are attached, as are animals such as barnacles, oysters, mussels, and anemones. While mussels and anemones are capable of moving from place to place, their movements are usually extremely slow and limited to a small area, resulting in their attached classification.

**(d) dead plants and animals:** For the purposes of this Guide, any unattached plant, be it a whole plant or a portion of a plant, is classified as a dead plant even though some algae species may frequently exist in an unattached state. Classifying living mats of unattached sea lettuce and rockweed as dead recognises that they do not form stable structural habitats for other intertidal plants and animals, and so distinguishes them from attached plants.

For a dead animal to be classified as such, at least half of its body must be found. For example, a dead starfish missing two of its arms would be classified as a dead animal, but an arm by itself would not. Empty crab shells are not classified as dead animals because these are often moult shells discarded by crabs as they grow, and empty snail





or clam shells persist for long periods and can be moved by the tides from where the animal actually lived. In the case of shells, these should only be recorded as dead animals if animal tissue is still attached to the shell indicating a recent death.

## IDENTIFY PLANT/ANIMAL SPECIES

**Species** is the term that indicates specifically what plant or animal you have located. Each plant and animal species has its own scientific and often a common name. You will find these names in your field guides. (If not, find a different field guide.) The species category indicates the detailed features of an organism such as size, shape, colour, etc., that distinguishes it from all other organisms. Individuals of a species are very similar to each other and typically can only breed successfully with members of their own species.

### Where to Record Data

FORM	HEADING
3: Part 2	<ul style="list-style-type: none"> <li>• Common Name</li> <li>• Latin Name</li> </ul>

## WHAT TO DO IF YOU CAN NOT IDENTIFY A PLANT OR ANIMAL IN THE FIELD

If you can not identify a plant or animal in the field, record an "x," followed by a temporary name (for example, black snail), and put one or two individuals into a plastic ziplock bag, freeze it, and keep it frozen until you can get it identified. Label the bag with the temporary name of the plant or animal, the name of the study area, the habitat unit, and the quadrat number. If you are later able to make a positive identification, replace the temporary name with the proper species name. If you cannot positively identify the species, replace the temporary name with the name of the species you think is closest to your sample, followed by a question mark. Since removing plants and animals from the shore usually kills them, you and your team should try your utmost to use all your field resources to identify organisms in the field.



### Materials Needed

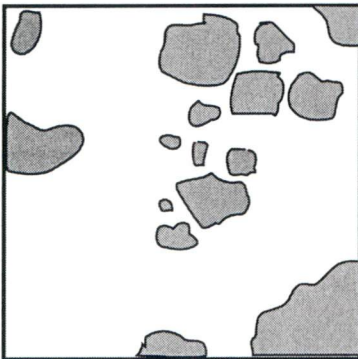
- field identification guide
- plastic ziplock bags



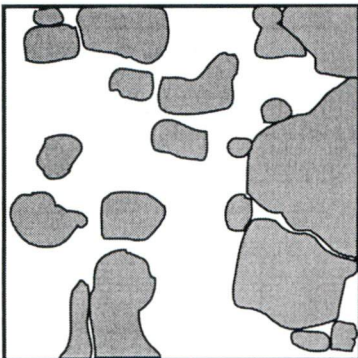
## Where to Record Data

FORM	HEADING
3: Part 2	<ul style="list-style-type: none"> <li>• Coverage Code</li> <li>• Count</li> </ul>

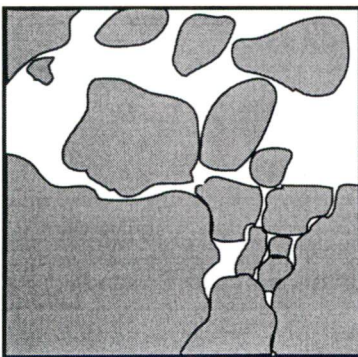
25 % cover



50% cover



75% cover



# STEP 31: ESTIMATE PLANT/ ANIMAL ABUNDANCE

Abundance is simply the number or amount of plants and animals present. The way you count or estimate the abundance of a plant or animal species depends on the Mobility Category it belongs to. If you have mobile or dead animals that would be mobile if alive, you count them. But, attached animals often occur in patches having thousands of individuals and plants spread out over the surface. In these cases counting is next to impossible, so we estimate the amount of space they take up inside the quadrat. This value is known as percent cover.

The following gives more details.

## HOW TO ESTIMATE PERCENT COVER

This covers attached plants, attached animals, if numerous, and dead plants.

Estimate the amount of space they occupy on the substrate using the chart below and diagrams beside. For example, any species within a quadrat that covers more substrate than that shown in the first illustration, but covers less substrate than that shown in the second illustration, would be between 25% and 49% cover, and we call that (c) common. Keep your estimates of percent cover to live plants or attached animals separate from estimates of dead ones.

The abundance categories are as follows:

Abundance	Category/Letter Code
less than 25% cover	few (f)
25% to 49% cover	common (c)
50% to 75% cover	abundant (a)
more than 75% cover	dominant (d)



Assess the percent cover of plants first. When this is complete, carefully move algal fronds so you can look under them for any attached animals. Estimate the percent cover of attached organisms you find underneath.

When you estimate percent cover of attached plants and animals look down on the quadrat from directly above it. If the quadrat is not lying flat, imagine a line that extends from the edge of the quadrat straight down to the ground. Include any portion of an attached species that occurs within the borders of the quadrat in percent cover estimations for that species.

## **HOW TO COUNT ANIMALS**

This is for animals that move around freely. This includes critters that scurry away, as well as slow animals, such as snails.

Count the number of individuals present. Keep your counts of mobile live animals separate from your count of dead animals of the same species.

Count and record the number of mobile and dead animals in each quadrat by counting and recording the number of live individuals of each species you find in each substrate level, and then the number of dead animals. Count and record the number of individuals of each species on the surface of the substrate first; remember to search all surfaces, including both sides of algae fronds. Then count and record the number of individuals of each species beneath moveable objects, and finally count and record the number of individuals of each species within the substrate. Record numbers, e.g. 1, 2, 3, or 4, on **Form 3** under **Count**.

As you identify plants and animals keep a tally on **Form 3** of the number you encounter in each substrate level. When you have finished surveying in the quadrat, tally your count and put the final number on **Form 3** under **Total**.



### **WHAT IF THERE ARE HUNDREDS OF INDIVIDUALS?**

If there are hundreds of individuals, e.g., periwinkles, you will not really be able to count them one at a time. In this case, count the number in one cluster and then estimate how many clusters there are and multiple by the number of animals in the first cluster.

Be careful not to double count individuals that were at the surface at the beginning of the survey, but scurried beneath objects after they were counted. Also be careful that you do not double count animals that crawled from one moveable object to another. Crabs have a tendency to move about during a survey, so put them in a bucket as you count them. Replace them when you are finished surveying the quadrat.

Look down on the quadrat from directly above it while you count. If the quadrat is not lying flat, imagine a line that extends from the edge of the quadrat straight down to the ground.

### **WHAT IF ONLY PART OF AN ANIMAL IS IN THE QUADRAT?**

Only count an animal if more than half of its body is in the quadrat. For example, a sea star with only one of its legs in the quadrat would not be included in the count. This is different from abundance calculations for attached species where any portion of an attached plant or animal that is within the quadrat is included in the estimation.





## STEP 32: NOTES

When you get to the beach you will find things that just don't fit into any of the instructions in this module. So, we provide a place for you to make notes. Notes help to clarify the data you record on **Form 3**. Make notes any time, but make them sparingly. Too many notes may confuse rather than help the data interpreter.

Each note should be numbered. Record the number on **Form 3** under **Notes**, and then write the details on a separate sheet of paper. It is best if you have a few sheets of paper specifically for this purpose. When you input your data to the DFO database, type in your notes in the space provided.

That's it for the intertidal zone. It's now time to take a look at the backshore zone.

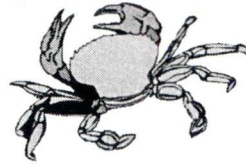
Remember, when you are planning any of this work, daylight hours, tides, and weather are all going to affect your schedule. You may plan on doing the intertidal zone on a particular day, and end up in the backshore zone instead because of 80-km/hour winds, or because suddenly there are 50 little kids from a day camp on the beach. Be flexible and enjoy whatever is happening.

### Where to Record Data

FORM	HEADING
3: Part 2	Notes



# Surveying the Backshore Zone



## STEP 33: SURVEYING THE BACKSHORE

### Where to Record Data

FORM	HEADING
3	<ul style="list-style-type: none"> <li>•Zone</li> <li>•Habitat ID</li> <li>•Habitat Type</li> <li>•Location</li> <li>•Area</li> <li>•Slope</li> <li>•Substrate</li> <li>•Species: <ul style="list-style-type: none"> <li>Common Name/</li> <li>Latin Name</li> </ul> </li> <li>•Coverage Code</li> <li>•Notes</li> </ul>

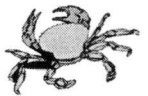
The backshore zone is of interest here because it affects the intertidal zone. Backshore plants can affect the intertidal zone through shading, by stopping erosion, and by holding water. As a result, you need to survey plants in the backshore zone. If you cannot get into the backshore zone because it is private property or a protected area, then make sure you give a good description of what you see from the beach, and record what you see on **Form 2**. If you can gain access, then complete the following instructions and record the results.

Measure back 20 m from the line where the intertidal zone ends and the backshore zone begins. You will only survey the first 20 m of the backshore zone. If necessary, set up a new baseline parallel to your intertidal baseline. This is like **Step 12**. Locate the end points of this backshore baseline in comparison to the intertidal baseline. You can do this by taking a compass bearing.

**Example:** The zero end of the backshore baseline is 28.5 m distance and 243° bearing from the zero end of the intertidal baseline.

If the backshore is dense salal or forest, it will be difficult to actually string a rope. Do the best you can.

Map the features and different habitat units of the backshore. Walk along the baseline and measure where one habitat ends and another starts. In many cases there will be only one habitat, all of it fairly uniform. If there are several units, map their locations as carefully as you can. See **Step 17**.



Identify the various backshore habitats. See **Step 13**. Most likely there will be only one dominant type of habitat.

Measure the area for each habitat. See **Step 22**.

Measure the slope for each habitat. See **Step 23**.

Note the species of plants you see. Also, record the abundance of each species of plant. If you cannot readily identify the terrestrial plant species, then use the following species type categories:

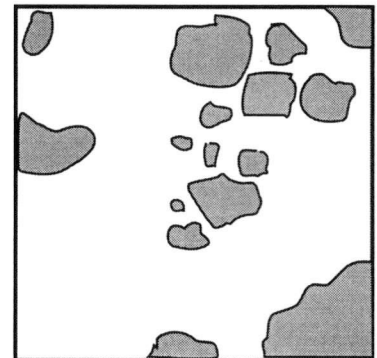
Type	Description
Coniferous trees	
Deciduous trees	> 7m tall
Tall shrubs	1.5 to 7m
Low shrubs	< 1.5m
Grasses (family Gramineae)	
Forbes	flowering plants
Rushes	stalks are round
Sedges	stalks have edges
Mosses and lichens	
Emergent vegetation	plants growing in water e.g., water lilies, water milfoil, duckweed, bulrushes, cattails

Adapted from:

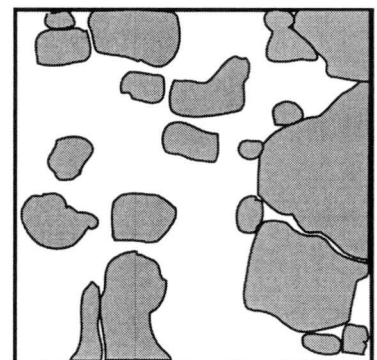
Southam, T., and E. A. Curran (eds.). 1996. The Wetlandkeepers Handbook: a practical guide to wetland care. B.C. Wildlife Federation, Surrey, B.C. and Environment Canada, Delta, B.C.

Estimate the percent cover of each species of plant attached to, or rooted in, the substrate. When estimating percent cover, assume you are looking down on the habitat from above, so that the widths of trees and the fullness of shrubs are included in your estimate. Only survey live plants.

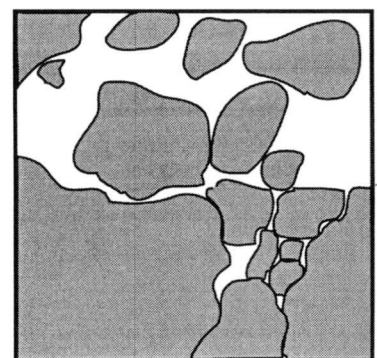
25% cover



50% cover



75% cover





Choose the best category from the list below.

Abundance	Category/Letter Code
less than 25% cover	few (f)
25% to 49% cover	common (c)
50% to 75% cover	abundant (a)
more than 75% cover	dominant (d)



## STEP 34: ENSURE ALL DATA FORMS ARE COMPLETED

### CONGRATULATIONS!

You have now completed the field portion of your survey! Now, make sure you have completed all your data forms. Go back through each form and make sure you have not left anything blank. Make sure the DFO registration number and the date are on all forms including notes and your rough sketch map. Don't throw any notes away. You may find that completion of all the paperwork is not as exciting and fun as being on the beach; but on the other hand, it may be a relief from sunburn or gale-force winds! But it is important. Without the proper reporting of all you have done, all of your data and time will have been wasted. If you have any trouble recording your data, contact your DFO representative. Please complete the paperwork and submit it as soon as possible, as you may forget some important details if you leave your field sheets incomplete for even a day or two.

Your work is very important to local communities and the health of our coastline. Your help is greatly appreciated and you should be proud of what you have done! You can obtain final copies of the data you and other shorekeeper groups have collected, contact a DFO representative. Finally, if you are particularly interested, you can assist DFO to analyse your data to look for trends. Contact your DFO representative about this.



## SUGGESTED READING LIST

Canada Hydrographic Service. Canadian tide and current tables. DFO, Ottawa.

Fisheries and Oceans Canada. Sailing directions for the British Columbia coast. South (coast) portion, Vol. 1, 1990. 15<sup>th</sup> Edition, Fs72-2/1990-1E. North (coast) portion, Vol. 2, 1991, 12<sup>th</sup>, Edition, Fs72-2/1991-2E.

Harbo, R.M. 1997. Shells & shellfish of the Pacific northwest: a field guide. Harbour Publishing, Madeira Park, B.C. 270 pp.

Kozloff, E.N. 1996. Seashore life of the northern Pacific coast. University of Washington Press, Seattle. 370 pp.

Lessard, J., C.D. Levings, M.S. North, and D.J.H. Nishimura. 1996. Annotated bibliography of nearshore fish habitat maps for the Strait of Georgia. Canadian Manuscript Report of Fisheries and Aquatic Sciences, No. 2350: 31 pp.

Pojar, J., and A. MacKinnon. 1994. Plants of coastal British Columbia, including Washington, Oregon & Alaska. Lone Pine Publishers, Edmonton, Alberta. 527 pp.

Scagel, R.F. 1971. Guide to common seaweeds of British Columbia. British Columbia Provincial Museum, Handbook No. 27. Victoria, B.C., 330 pp.

Snively, G. 1985. Exploring the seashore in British Columbia, Washington and Oregon: a guide to shorebirds and intertidal plants and animals. Gordon Soules Book Publishers, Vancouver, B.C.

Southam, T., and E. A. Curran. (eds.) 1996. The Wetlandkeepers Handbook: a practical guide to wetland care. B.C. Wildlife Federation, Surrey, B.C. and Environment Canada, Delta, B.C.

Yates, S. 1988. Marine wildlife of Puget Sound, the San Juans, and the Strait of Georgia. Globe Pequot Press, Chester, Connecticut. 262 pp.



# GLOSSARY

\*Definitions specific to this Guide.

**Abney level:** a device used to determine the slope, also known as a clinometer.

**attached plant/animal:** a plant or animal that remains fixed to the substrate as adults. For the purposes of this guide, all plants, barnacles, oysters, mussels and anemones are classified as attached.

**backshore zone:** area from the higher high water line landward, to 20 m past the top of a coastal cliff or limit of marine processes.

**biodiversity:** the variety and quantity of plants and animals in an area.

**chart datum:** in Canada, the point on the shore where the lowest low tides reach. In the United States, chart datum refers to mean lower low water, and can differ from Canadian chart datum by as much as 1.50 m.

**clinometer:** a device used to determine the slope of a site – also known as an Abney level.

**dead animal:** a dead animal with at least half of its body intact. Includes crab, snail, or clam shells if animal tissue is still attached, but does not include empty crab shells.

**dead plant:** a plant that is not attached to the substrate.

**ecology:** the relationship between organisms and their natural environment.

**elevation range:** change in height from the high to the low part of the beach. Values are given relative to chart datum.

**GPS:** Global Positioning System.

**habitat:** the place where organisms live and find food and shelter, defined by physical and biological attributes, including substrate, slope, elevation, temperature, humidity, vegetation. There are 19 habitat types identified by substrate and vegetation in this Guide.

**intertidal zone:** area between the higher high water line and the lower low water line (chart datum).

**inventory:** to survey a study area once to get a snapshot of its ecology.

**lower edge of habitat:** edge of habitat closest to the water's edge.

**monitor:** to track a parameter(s) over time at a study area using standard methods to evaluate change over time.

**mobile animal:** an animal that is capable of relatively noticeable motion.

**plant/animal mobility category:** a classification used to identify plant and animals based on their degree of mobility.

**quadrat:** a square frame used for sampling to isolate a small section of an area, so that plants and animals in it can be counted.

**slope:** steepness of a site, measured in degrees from horizontal.

**species:** a classification used to identify plants and animals, based on minute characteristics of their size, shape, colouration, etc. Indicates that individuals can generally only interbreed among themselves.

**survey:** an examination and gathering of ecological information about an area.

**transect:** a straight line along which samples are taken at regular intervals. Used extensively in surveys.

**upper edge of habitat:** edge of habitat furthest from the water's edge.

# APPENDIX A: OFFICES WITH MAPS, CHARTS, AND AIR PHOTOS

## TOPOGRAPHIC MAPS

Geological Survey of Canada  
Suite 101, 605 Robson Street  
Vancouver, BC, V6B 5J3  
Tel: 604-666-0271  
Fax: 604-666-1124

Canada Map Office  
615 Booth Street  
Ottawa, ON K1A 1E9  
Tel: 1-800-465-6277

## AERIAL PHOTOGRAPHS

### Federal Government

Canada Map Office  
615 Booth Street  
Ottawa, ON K1A 1E9  
Tel: 1-800-465-6277

### Provincial Government

Geographic Data-B.C.  
Ministry of Environment, Lands and Parks  
Tel: 250-356-5263  
or 250-387-3022

### University

Geographic Information Centre  
Department of Geography Library  
University of British Columbia  
Rm. 112, 1984 West Mall  
Vancouver, BC, V6T 1Z2  
Tel: 604-822-3048  
Fax: 604-822-6150

## HYDROGRAPHIC CHARTS

Hydrographic Chart Distribution Office  
Department of Fisheries and Oceans  
Institute of Ocean Sciences  
P.O. Box 6000  
9860 W. Saanich Road  
Sidney, BC, V8L 4B2  
Tel: 250-363-6358  
Fax: 250-363-6841



## APPENDIX B : DATA FORMS





# FORM 1: Study Area Description

Form Filled In By: \_\_\_\_\_

(First Name)

(Last Name)

## PART 1 of 3: REFERENCE INFORMATION

**Study Area Name:** \_\_\_\_\_

**DFO Registration No.:** \_\_\_\_\_

DFO registration No. for Control or Treatment Study Area: \_\_\_\_\_

### APPLICANT CONTACT INFORMATION:

**Name:**

(First Name)

(Last Name)

**Organisation:** \_\_\_\_\_

**Address:** \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

(City/Town)

(Postal Code)

**Phone:**

(Daytime)

(Evening)

**Fax:** \_\_\_\_\_

**Email:** \_\_\_\_\_

### DFO REPRESENTATIVE CONTACT INFORMATION:

**Name:**

(First Name)

(Last Name)

**Address:** \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

(City/Town)

(Postal Code)

**Phone:** \_\_\_\_\_

**Fax:** \_\_\_\_\_

**Email:** \_\_\_\_\_

### STUDY AREA OBJECTIVES:

**Overall Objective of the Study:** \_\_\_\_\_

**Objective Notes:** \_\_\_\_\_

**Reason for Choosing this Study Area:** \_\_\_\_\_

**Selection Notes:** \_\_\_\_\_



## FORM 1: Study Area Description

### PART 2 of 3: STUDY AREA LOCATION

**GENERAL DIRECTIONS TO THE STUDY AREA:**

---

---

---

**DESCRIPTION AND LOCATIONS OF PERMANENT TRIANGULATION MARKERS:**

**Marker 1:** \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

**Marker 2:** \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

**Marker 3:** \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

**Marker 4:** \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

**Marker 5:** \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

**Marker 6:** \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_





## FORM 1: Study Area Description

### PART 3 of 3: STUDY AREA LOCATION (Cont.)

Study Area Aspect: \_\_\_\_\_

Baseline Length: \_\_\_\_\_ m

**LOCATION OF BASELINE ENDPOINTS RELATIVE TO ABOVE MARKERS:**

0-metre end of Baseline (to the left facing the backshore):

\_\_\_\_\_  
\_\_\_\_\_

Max-metre end of Baseline (to the right facing the backshore):

\_\_\_\_\_  
\_\_\_\_\_**ESTIMATED BASELINE ENDPOINT COORDINATES:**

0-metre end of Baseline (to the left facing backshore):

\_\_\_\_ mE \_\_\_\_\_ mN \_\_\_\_\_ °N \_\_\_\_\_ °W  
(UTM East) (UTM North) Latitude (North) Longitude (West)

Max-metre end of Baseline (to the right facing backshore):

\_\_\_\_ mE \_\_\_\_\_ mN \_\_\_\_\_ °N \_\_\_\_\_ °W  
(UTM East) (UTM North) Latitude (North) Longitude (West)UTM Zone: ☐ Zone 8 ☐ Zone 9 ☐ Zone 10**SOURCE OF BASELINE COORDINATES:**

Map Type: \_\_\_\_\_

Map Code: \_\_\_\_\_

Map Name: \_\_\_\_\_

Map Scale: 1: \_\_\_\_\_

Map Datum: ☐ NAD83 ☐ NAD27 ☐ WGS84GPS: ☐

LUCO Shore Unit: \_\_\_\_\_



## FORM 2: Survey Description

Form Filled In By: \_\_\_\_\_

(First Name)

(Last Name)

### PART 1 of 3: BACKGROUND INFORMATION

Survey Year: \_\_\_\_\_

Survey Purpose: \_\_\_\_\_  
\_\_\_\_\_

#### SURVEY LEADER CONTACT INFORMATION:

Name: \_\_\_\_\_

(First Name)

(Last Name)

Leader Reg'n No: \_\_\_\_\_

Organisation: \_\_\_\_\_

Address: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

(City/Town)

(Postal Code)

Phone: \_\_\_\_\_

(Daytime)

(Evening)

Fax: \_\_\_\_\_

Email: \_\_\_\_\_

#### SURVEY TEAM:

Names: \_\_\_\_\_  
\_\_\_\_\_

Team Affiliation: \_\_\_\_\_

Team Experience: \_\_\_\_\_  
\_\_\_\_\_

#### SURVEY DATES:

	Visit Date	Start Time	End Time
First Day:	_____ (mm/dd/yy)	_____ (hh:mm AM/PM)	_____ (hh:mm AM/PM)
Second Day:	_____ (mm/dd/yy)	_____ (hh:mm AM/PM)	_____ (hh:mm AM/PM)
Third Day:	_____ (mm/dd/yy)	_____ (hh:mm AM/PM)	_____ (hh:mm AM/PM)
Fourth Day:	_____ (mm/dd/yy)	_____ (hh:mm AM/PM)	_____ (hh:mm AM/PM)

Sketch Map Completed

☐



DFO Reg. No.: \_\_\_\_\_

Study Area Name \_\_\_\_\_

Survey Year: \_\_\_\_\_

## FORM 2: Survey Description

### PART 2 of 3: REFERENCE INFORMATION

#### INFORMATION SOURCES:

Topographic Map: \_\_\_\_\_ 1: \_\_\_\_\_  
(Code) (Name) (Scale)

Hydrographic Charts: \_\_\_\_\_ 1: \_\_\_\_\_  
(Code) (Name) (Scale)

Aerial Photographs: \_\_\_\_\_ 1: \_\_\_\_\_  
(Code) (Scale)

Species ID References: \_\_\_\_\_  
\_\_\_\_\_

Other Reference Materials: \_\_\_\_\_  
\_\_\_\_\_

#### MAXIMUM WIDTH OF THE STUDY AREA ON THE SURVEY DAY:

First Day: \_\_\_\_\_ m \_\_\_\_\_ m \_\_\_\_\_ hr  
(Visit Date) (Width) (Low Tide Height) (Low Tide Time)

Second Day: \_\_\_\_\_ m \_\_\_\_\_ m \_\_\_\_\_ hr  
(Visit Date) (Width) (Low Tide Height) (Low Tide Time)

Third Day: \_\_\_\_\_ m \_\_\_\_\_ m \_\_\_\_\_ hr  
(Visit Date) (Width) (Low Tide Height) (Low Tide Time)

Fourth Day: \_\_\_\_\_ m \_\_\_\_\_ m \_\_\_\_\_ hr  
(Visit Date) (Width) (Low Tide Height) (Low Tide Time)

#### TIDE CALCULATION INFORMATION:

Primary Port: \_\_\_\_\_

Secondary Port: \_\_\_\_\_





DFO Reg. No.: \_\_\_\_\_

Study Area Name \_\_\_\_\_

Survey Year: \_\_\_\_\_

## FORM 2: Survey Description

### PART 3 of 3: AREA DESCRIPTION

#### BACKSHORE DESCRIPTION (Check as many as apply):

##### Backshore Development

- ☐ Residential Building
- ☐ Commercial Building
- ☐ Landscaped
- ☐ Cultivated
- ☐ Pasture
- ☐ Roadway
- ☐ Paved
- ☐ Gravel
- ☐ Railway

##### Backshore Vegetation

- ☐ Meadow
- ☐ Marsh
- ☐ Deciduous Forest
- ☐ Coniferous Forest
- ☐ Mixed Forest
- ☐ Shrubs
- ☐ Sand
- ☐ Soil
- ☐ Cliff

Other (Please Describe):

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SLOPE OF THE BACKSHORE ZONE:

- ☐  $\leq 2^\circ$     ☐  $3^\circ - 10^\circ$     ☐  $11^\circ - 20^\circ$     ☐  $21^\circ - 40^\circ$     ☐  $\geq 41^\circ$

GENERAL HUMAN ACTIVITY IN THE SURROUNDING AREA:

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RECENT SIGNIFICANT EVENTS AROUND THE STUDY AREA:

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DFO Reg. No.: \_\_\_\_\_

Study Area Name \_\_\_\_\_

Survey Date.: \_\_\_\_\_

## FORM 3: Habitat Unit Description

Form Filled In By: \_\_\_\_\_

(First Name)

(Last Name)

### PART 1 of 2: PHYSICAL DATA

#### HABITAT CLASSIFICATION:

Zone: ☐ Intertidal ☐ Backshore

Habitat Type \_\_\_\_\_

Habitat Unit ID: \_\_\_\_\_

Substrate: (Most Dominant) \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

(Least Dominant) \_\_\_\_\_

#### HABITAT CHARACTERISTICS:

Habitat Area: \_\_\_\_\_ m<sup>2</sup>

GPS Filename: \_\_\_\_\_

Slope Method Used: ☐ Clinometer ☐ Hand Level ☐ Horizon Method

First Slope: \_\_\_\_\_ °

(Slope)

\_\_\_\_\_ m

(Distance along baseline)

Second Slope: \_\_\_\_\_ °

(Slope)

\_\_\_\_\_ m

(Distance along baseline)

Third Slope: \_\_\_\_\_ °

(Slope)

\_\_\_\_\_ m

(Distance along baseline)

Elevation Method Used: ☐ Hand Level ☐ Horizon Method ☐ Tide Time Method

Maximum Elevation: \_\_\_\_\_ m

(Elevation)

\_\_\_\_\_ hr

(Tide Time)

Minimum Elevation: \_\_\_\_\_ m

(Elevation)

\_\_\_\_\_ hr

(Tide Time)

#### SAMPLING DETAILS:

Quadrat Size: ☐ 25cm x 25cm ☐ 50cm x 50cm

Quadrat Depth: \_\_\_\_\_ cm

Number of Quadrats: \_\_\_\_\_





Survey Date.: \_\_\_\_\_

Page \_\_\_\_\_ of \_\_\_\_\_

Quadrat Size \_\_\_\_\_ cm

Zone:

Quadrat Depth \_\_\_\_\_ cm

Habitat ID: \_\_\_\_\_

Habitat Comments: \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

[illegible]



## Form 3 Picklist Values

### Habitat Type

#### Backshore Habitat Types

##### Rock Habitat (k)

at least 75% of the substrate is bedrock, boulders, cobble, and pebbles; less than 50% of substrate is covered by vegetation.

##### Sand Habitat (d)

at least 75% of the substrate is sand; less than 50% of the substrate is covered by vegetation.

##### Soil Habitat (l)

at least 75% of the substrate is soil; less than 50% of the substrate is covered by vegetation.

##### Meadow Habitat (w)

at least 75% of the substrate is soil and/or sand; at least 50% of the substrate is covered by plants, many of which die to the ground every year; less than 50% of the substrate is covered by trees.

##### Deciduous Forest Habitat (dt)

regardless of the substrate, at least 50% of the substrate is under a canopy of deciduous trees.

##### Coniferous Forest Habitat (ct)

regardless of the substrate, at least 50% of the substrate is under a canopy of coniferous trees.

##### Mixed Forest Habitat (mt)

regardless of the substrate, at least 50% of the substrate is under a canopy of a mixture of coniferous and deciduous trees that are mixed such that you can not readily define the two distinct habitats.

##### Shrub Habitat (sb)

regardless of the substrate, at least 50% of the substrate is covered by shrubs.

##### Marsh or Pond (h)

area composed of emergent vegetation that is infrequently covered by water, but may have areas of impounded water that permit establishment of typical marsh vegetation such as sedge, bulrush, and cattail.

### Intertidal Habitat Types

##### Rock Habitat (r)

at least 75% of the substrate consists of bedrock and/or boulders; less than 50% of the substrate is covered by vegetation.

##### Cobble/Shell Habitat (c)

at least 75% of the substrate consists of cobble, pebbles, and shell; less than 50% of the substrate is covered by vegetation.

##### Sand Habitat (s)

at least 75% of the substrate consists of sand; less than 50% of the substrate is covered by vegetation.

##### Mud Habitat (u)

at least 75% of the substrate is composed of mud; less than 50% of the substrate is covered by vegetation.

##### Rockweed Habitat (fa)

regardless of substrate, at least 50% of the substrate is covered by rockweed (*Fucus gardneri*).

##### Sea Lettuce Habitat (ua)

regardless of substrate, at least 50% of the substrate is covered by sea lettuce (*Ulva*, *Monostroma*)

##### Kelp Habitat (ka)

regardless of the substrate, at least 50% of the substrate is covered by *Macrocystis*, *Nereocystis*, *Laminaria*, or other broad-bladed kelps. Specify the kelp species.

##### Mixed or Other Macroalgae (oa)

regardless of substrate, at least 50% of the substrate is covered by other non-vascular intertidal vegetation or a mixture of non-vascular vegetation. Specify the species of algae that characterise this habitat.

##### Eelgrass Habitat (e)

regardless of substrate, at least 50% of the substrate is covered by eelgrass, species include eelgrass (*Zostera japonica*) on sheltered cobble, pebbles, sand or silt in mid-intertidal, and native eelgrass (*Zostera marina*) on sheltered cobbles, pebbles, sand or silt in lower intertidal.

### Tidal Marsh Habitat (m)

area composed of emergent vascular vegetation that is regularly inundated by high tides (usually once or twice a day depending on elevation); contains typical marsh vegetation such as sedge, bulrush or pickleweed.

### Substrate Type

#### Man-made

- t Metal
- e Concrete
- r Rubble
- l Logs
- u Lumber

#### Natural

- k Bedrock
- b Boulder (>256 mm, dinner plate-sized)
- c Cobble (64-256 mm, apple to dinner plate-sized)
- p Pebble (2-64 mm, pea to apple-sized)
- s Sand (0.0625-2 mm, sugar granule-sized)
- m Mud
- h Shell
- o Soil

### Substrate Level within Quadrat

- S Surface to substrate
- B Beneath moveable objects
- W Within substrate

### Mobility Code

- a Attached (for plants and attached animals)
- m Mobile
- d Dead

### Coverage Code














- f Few - less than 25% cover
- c Common - 25 to 49% cover
- a Abundant - 50 to 75% cover
- d Dominant - more than 75% cover












A large grid of 30 columns and 30 rows for sketching a map. The grid is composed of small squares, suitable for drawing a detailed sketch map of a study area.













## LEGEND

-  **baseline**  
 **trail**  
 **road**  
 **railroad**  
 **water's edge at low tide on day of mapping**  
 **border between backshore zone and intertidal zone**  
**[backshore zone - area from the higher high water line landward to 20 m past the top of a coastal cliff or limit of marine processes]**  
**intertidal zone - area between the higher high water line and the lower low water line]**  
 **border of study area**  
 **permanent study area border marker**  
 **building**  
 **North Arrow**  
 **first patch of a habitat**  
 **second patch of a habitat**  
 **third patch of a habitat**

## Habitats in Backshore Zone

-  **rock habitat** - at least 75% of the substrate consists of bedrock, boulders, cobble, and pebbles; less than 50% of substrate is covered by vegetation.  
 **sand habitat** - at least 75% of the substrate consists of sand; less than 50% of substrate is covered by vegetation.  
 **soil habitat** - at least 75% of the substrate consists of soil; less than 50% of substrate is covered by vegetation.  
 **meadow habitat** - at least 75% of the substrate consists of soil and/or sand; at least 50% of substrate is covered by plants, many of which die to the ground every year; less than 50% of the area is covered by trees.  
 **coniferous forest habitat** - regardless of the substrate, at least 50% of the substrate is under a canopy of coniferous trees.  
 **deciduous forest habitat** - regardless of the substrate, at least 50% of the substrate is under a canopy deciduous trees.  
 **mixed forest habitat** - regardless of the substrate, at least 50% of the substrate is under a canopy of a mixture of coniferous and deciduous trees that are mixed such that you cannot readily define two distinct habitats.  
 **shrub habitat** - regardless of the substrate, at least 50% of the area is covered by shrubs.  
 **marsh habitat** - area composed of emergent vegetation that is infrequently covered by water, but may have areas of impounded water that permit establishment of typical marsh vegetation such as sedge, bulrush and cattail.

## Habitats in Intertidal Zone

-  **rock habitat** - at least 75% of the substrate consists of bedrock and boulders; less than 50% of substrate is covered by vegetation.  
 **cobble/shell habitat** - at least 75% of the substrate consists of cobble, pebbles, and shell; less than 50% of substrate is covered by vegetation.  
 **sand habitat** - at least 75% of the substrate consists of sand; less than 50% of substrate is covered by vegetation.  
 **mud habitat** - at least 75% of the substrate consists of mud; less than 50% of substrate is covered by vegetation.  
 **rockweed habitat** - regardless of substrate, at least 50% of the area is covered by rockweed (*Fucus gardneri*).  
 **sea lettuce habitat** - regardless of substrate, at least 50% of the area is covered by sea lettuce (*Ulva, Monostroma*).  
 **kelp** - regardless of substrate, at least 50% of the area is covered by *Macrocystis*, *Nereocystis*, *Laminaria*, or other broad-bladed large kelps. Specify the kelp species.  
 **mixed or other** - regardless of substrate, at least 50% of the area is covered by non-vascular intertidal vegetation or a mixture of non-vascular vegetation. Specify the species of algae that characterizes this habitat.  
 **eelgrass habitat** - regardless of substrate, at least 50% of the area is covered by eelgrass (*Zostera marina* and *Zostera japonica*).  
 **tidal marsh habitat** - area composed of emergent vegetation that is regularly inundated by high tides; contains typical marsh vegetation such as sedges, bulrush, or pickleweed.

## APPENDIX C: MATERIALS LIST

STEP	MATERIALS NEEDED	DESCRIPTION OR NOTES
10	two lengths of rope	at least 50 m each
12	baseline rope wooden stakes hammer a second baseline (optional) 6 to 10 stakes with flagging tape	length of rope equal to the length of your study area with surveyor's flagging tape woven in 2-m intervals; mark every 10 m with a another colour of flagging tape. Weave the first piece of flagging tape marked with 0 m into the rope 2 m from the end so it can be tied to something.
15 to 18	50- to 100-m measuring tape or surveyor's hip chain calculator flagging tape	longer if possible
20 23	compass with sighting mirror 3.5- to 4-m survey stake clinometer* hand level* flagging tape measuring tape	unless you have a differential GPS survey stake should be marked off in hundredth of a metre
24	3.5- to 4-m surveying stake flagging tape measuring tape hand level*	marked off in hundredths of a metre
27	50-m measuring tape or surveyor's hip chain flagging tape spray-painted rocks, blocks of wood, or small traffic cones quadrat(s)	enough to mark quadrat positions in at least one habitat  at least one
29	garden trowel(s) dishpan(s) short measuring tape sieve: 20- x 20-cm, with 5-mm (or 1/4") gauge screen or white plastic pasta strainer of the same mesh size	for digging in loose substrate to capture sediment and water that runs through the sieve
30	field identification guide(s) plastic ziplock bags	

\* If this is the method that you choose





## APPENDIX D: COST ESTIMATES OF SURVEY MATERIALS

Survey materials are listed below in alphabetical order. Cost estimates are given in the standard unit of sale for the item, resulting in a mixture of metric and imperial values.

Item	Estimated Cost	Where To Purchase
clinometer	\$135	surveyor's store
calculator	\$6 - 20	stationery store
field identification guide	\$20 - 40	book store
flagging tape	\$3 for 150-ft roll	hardware store
garden trowel	\$5	hardware store
hand level	\$135	surveyor's store
50- to 100-m long measuring tapes	\$50 - \$100	surveyor's store
compass with sighting mirror	\$50	outdoor store
nylon rope – for baseline and study area boundaries	\$5 for 70-m roll	hardware store
pail	\$10	hardware store
dishpan	\$10	hardware store
plastic ziplock bags	\$3 for box of 30	grocery store
quadrat (at least one)	\$5 each to make	hardware store
spray paint	\$10	hardware store
small traffic cones	\$20	hardware store
sieve: 20- x 20-cm with 5-mm (or 1/4") gauge screen	\$5 to make; \$45 to purchase	hardware store; mining shop
pasta strainer with 1/4"-gauge screen	\$10	hardware store
cement	\$8	hardware store
round headed bolts	\$3	hardware store
stakes	free	forest, shore





## APPENDIX E: SPECIES

The following species list is drawn largely from those likely to be encountered in the Strait of Georgia. If you are working in another area, contact the DFO representative to get additional species. Where different plants have the same common name be certain to record the Latin name, so as to indicate which of the species you have identified.

### INTERTIDAL PLANTS

#### Brown Algae

COMMON NAME	LATIN NAME	TAXA LEVEL
Brown Algae	Phaeophyta	phylum
Sargassum/Japanese Weed	<i>Sargassum muticum</i>	species
Bladderwrack/Rock weed	<i>Fucus</i>	genus
Rock Weed	<i>Fucus gardneri</i>	species
Sea or Tan Cauliflower	<i>Leathesia difformis</i>	species
Ralfsia	<i>Ralfsia</i>	genus
Sausage Links	<i>Scytosiphon lomentaria</i>	species
Acid Kelp	<i>Desmarestia ligulata</i>	species
Bull Kelp	<i>Nereocystis luetkeana</i>	species
Sugar Kelp	<i>Laminaria saccharina</i>	species
One-Rib Ribbon Kelp or Alaria	<i>Alaria marginata</i>	species

#### Red Algae

COMMON NAME	LATIN NAME	TAXA LEVEL
Red Algae	Rhodophyta	phylum
<i>Gracilaria</i>	<i>Gracilaria sjoestedtii</i>	species
Black Pine/Sea Pine	<i>Rhodomela larix</i>	species
Sea Brush	<i>Odonthalia floccosa</i>	species
Crisp Leather	<i>Mastocarpus papillata</i>	species
Shiny Blade	<i>Iridaea cordata</i>	species
Turkish Towel	<i>Gigartina exasperata</i>	species
<i>Plocamium</i>	<i>Plocamium</i>	genus
<i>Gelidium</i>	<i>Gelidium</i>	genus
<i>Petrocelis</i>	<i>Petrocelis franciscana</i>	species
Sea Sac	<i>Halosaccion glandiforme</i>	species
<i>Hildenbrandia</i>	<i>Hildenbrandia</i>	genus
Jointed Pink Weed	<i>Bossiella</i>	genus
Pink Crust	<i>Lithophyllum</i>	genus
Pink Crust	<i>Lithothamnium</i>	genus
Jointed Pink Weed	<i>Calliarthron</i>	genus

## Red Algae

COMMON NAME	LATIN NAME	TAXA LEVEL
Jointed Pink Weed	<i>Corallina</i>	genus
Red Tufted Algae	<i>Endocladia muricata</i>	species
Iodine Kelp/Railroad Strap	<i>Prionitis lanceolata</i>	species
Red Laver/Nori/Dulse	<i>Porphyra</i>	genus
Bald Sea Hair	<i>Bangia fuscopurpurea</i>	species

## Green Algae

COMMON NAME	LATIN NAME	TAXA LEVEL
Green Algae	Chlorophyta	phylum
Green Filament	<i>Ulothrix</i>	genus
Green Moss	<i>Cladophora</i>	genus
Sea Lettuce	<i>Ulva</i>	genus
Sea Lettuce	<i>Monostroma</i>	genus
Sea Hair/Sea Confetti	<i>Enteromorpha</i>	genus

## Submerged Flowering Plants

COMMON NAME	LATIN NAME	TAXA LEVEL
Surf Grass	<i>Phyllospadix</i>	genus
Eelgrass	<i>Zostera</i>	genus
Native Eelgrass	<i>Zostera marina</i>	species
Introduced Eelgrass	<i>Zostera japonica</i>	species
Common Mare's Tails	<i>Hippuris vulgaris</i>	species

## Spray Zone Flowering Plants

COMMON NAME	LATIN NAME	TAXA LEVEL
Sea Arrow-grass	<i>Triglochin maritimum</i>	species
Thrift	<i>Armeria maritima</i>	species
Seaside Plantain	<i>Plantago maritima</i>	species
Coastal Strawberry	<i>Fragaria chiloensis</i>	species
Orache	<i>Atriplex patula</i>	species
Pickleweed/American Glasswort	<i>Salicornia virginica</i>	species
Sea Milk-wort	<i>Glaux maritima</i>	species

## BACKSHORE

### Grasses, Rushes, and Sedges

COMMON NAME	LATIN NAME	TAXA LEVEL
Ditch-Grass	<i>Ruppia maritima</i>	species
Arctic Rush	<i>Juncus arcticus</i>	species
Toad Rush	<i>Juncus bufonius</i>	species
Common Rush	<i>Juncus effusus</i>	species
Sickle-leaved Rush	<i>Juncus falcatus</i>	species
Brewer's Rush	<i>Juncus leseuerii</i>	species
Lyngby's Sedge	<i>Carex lyngbyei</i>	species
Large-headed Sedge	<i>Carex macrocephala</i>	species
Spike Bentgrass	<i>Agrostis exarata</i>	species
European Beachgrass	<i>Ammophila arenaria</i>	species
Nootka Reedgrass	<i>Calamagrostis nutkaensis</i>	species
Seashore Saltgrass	<i>Distichlis spicata</i>	species
Dunegrass	<i>Elymus mollis</i>	species
Meadow Barley	<i>Hordeum brachyantherum</i>	species
Seacoast Bulrush	<i>Scirpus maritimus</i>	species
Tule	<i>Scirpus lacustris</i>	species

### Other Flowering Plants

COMMON NAME	LATIN NAME	TAXA LEVEL
California Poppy	<i>Eschscholzia californica</i>	species
Canadian Sand-spurry	<i>Spergularia canadensis</i>	species
Beach Sand-spurry	<i>Spergularia macrotheca</i>	species
Goosefoot Family	Chenopodiaceae	family
Knotweed Family	Polygonaceae	family
Black Knotweed	<i>Polygonum paronychia</i>	species
Willow Dock	<i>Rumex salicifolius</i>	species
Pea Family	Leguminosae	family
Beach Pea	<i>Lathyrus japonicus</i>	species
Gray Beach Peavine	<i>Lathyrus littoralis</i>	species
Nootka Lupine	<i>Lupinus nootkatensis</i>	species
Small-flowered Lotus	<i>Lotus microanthus</i>	species
Seashore Lupine	<i>Lupinus littoralis</i>	species
Salt Marsh Dodder	<i>Cuscuta salina</i>	species
Borage Family	Boraginaceae	family
Aster Family	Asteraceae	family
Silver Burweed	<i>Artemisia norvegica</i>	species
Fleshy Jaumea	<i>Jaumea carnosa</i>	species
Brass Buttons	<i>Cotula coronopifolia</i>	species

## Other Flowering Plants (continued)

COMMON NAME	LATIN NAME	TAXA LEVEL
Dune Tansy	<i>Tanacetum douglasi</i>	species
Contorted-pod Evening Primrose	<i>Camissonia contorta</i>	species
Carrot Family	Umbelliferae	family
Beach Carrot	<i>Glebnia littoralis</i>	species
American Searocket	<i>Cakile edentula</i>	species
Black Twinberry	<i>Lonicera involucrata</i>	species
Twinflower	<i>Linnaea borealis</i>	species
Scurvy Grass	<i>Cochlearia officinalis</i>	species

## Ferns & Horsetails

COMMON NAME	LATIN NAME	TAXA LEVEL
Scouring Rush	<i>Equisetum hyemale</i>	species
Bracken Fern	<i>Pteridium aquilinum</i>	species
Licorice Fern	<i>Polypodium glycyrrhiza</i>	species
Maidenhair Fern	<i>Adiantum pedatum</i>	species
Lady Fern	<i>Athyrium filix-femina</i>	species
Sword Fern	<i>Polystichum</i>	genus

## Coniferous Trees

COMMON NAME	LATIN NAME	TAXA LEVEL
Conifer	Coniferales	order
Spruce	<i>Picea</i>	genus
Pine	<i>Pinus</i>	genus
Western Hemlock	<i>Tsuga heterophylla</i>	species
Douglas-fir	<i>Pseudotsuga menziesii</i>	species
Grand Fir	<i>Abies grandis</i>	species
Sitka Spruce	<i>Picea sitchensis</i>	species
Shore Pine	<i>Pinus contorta</i>	species
Western White Pine	<i>Pinus monticola</i>	species
Western Yew	<i>Taxus brevifolia</i>	species
Western Redcedar	<i>Thuja plicata</i>	species

## Deciduous Trees

COMMON NAME	LATIN NAME	TAXA LEVEL
Garry Oak	<i>Quercus garryana</i>	species
Red Alder	<i>Alnus rubra</i>	species
Black Cottonwood	<i>Populus balsamifera</i>	species
Douglas Maple	<i>Acer glabrum</i>	species
Bigleaf Maple	<i>Acer macrophyllum</i>	species
Western Flowering Dogwood	<i>Cornus nuttallii</i>	species
Cascara	<i>Rhamnus purshiana</i>	species
Vine Maple	<i>Acer circinatum</i>	species
Arbutus	<i>Arbutus menziesii</i>	species

## Shrubs and Woody Plants

COMMON NAME	LATIN NAME	TAXA LEVEL
Hooker's Willow	<i>Salix hookeriana</i>	species
Pacific Willow	<i>Salix lucida</i>	species
Hairy Manzanita	<i>Arctostaphylos columbiana</i>	species
Kinnikinnick	<i>Arctostaphylos ulva-ursi</i>	species
Evergreen Huckleberry	<i>Vaccinium ovatum</i>	species
Red Huckleberry	<i>Vaccinium parvifolium</i>	species
Salal	<i>Gaultheria shallon</i>	species
False Azalea	<i>Menziesia ferruginea</i>	species
Stink Currant	<i>Ribes bracteosum</i>	species
Black Hawthorn	<i>Crataegus douglasii</i>	species
Common Hawthorn	<i>Crataegus monogyna</i>	species
Bitter Cherry	<i>Prunus emarginata</i>	species
Baldhip Rose	<i>Rosa gymnocarpa</i>	species
Nootka Rose	<i>Rosa nutkana</i>	species
Himalayan Blackberry	<i>Rubus discolor</i>	species
(Common Blackberry)		
Evergreen Blackberry	<i>Rubus laciniatus</i>	species
Saskatoon	<i>Amelanchier alnifolia</i>	species
Oceanspray	<i>Holodiscus discolor</i>	species
Pacific Ninebark	<i>Physocarpus capitatus</i>	species
Introduced Mountain-ash	<i>Sorbus aucuparia</i>	species
Thimbleberry	<i>Rubus parviflorus</i>	species
Salmonberry	<i>Rubus spectabilis</i>	species
Trailing Blackberry	<i>Rubus ursinus</i>	species
Gorse	<i>Ulex europaeus</i>	species
Scotch Broom	<i>Cytiscus scoparius</i>	species
Red Elderberry	<i>Sambucus racemosa</i>	species
Common Snowberry	<i>Symphoricarpos albus</i>	species



## Shrubs and Woody Plants (continued)

COMMON NAME	LATIN NAME	TAXA LEVEL
Devil's Club	<i>Oplopanax horridus</i>	species
Oregon Grape	<i>Mahonia</i>	genus
Highbush-Cranberry	<i>Viburnum edule</i>	species
Western Trumpet Honeysuckle	<i>Lonicera ciliosa</i>	species

## Mosses

COMMON NAME	LATIN NAME	TAXA LEVEL
Mosses	Bryophyta	phylum

## INTERTIDAL INVERTEBRATES

### Amphipods

COMMON NAME	LATIN NAME	TAXA LEVEL
Small Beach Hopper	<i>Traskorchestia traskiana</i>	species
Kelp Flea (Gammarid amphipods)	Gammaridea	class

### Barnacles

COMMON NAME	LATIN NAME	TAXA LEVEL
Thatched Barnacle	<i>Semibalanus cariosus</i>	species
Brown Barnacle	<i>Chthamalus dalli</i>	species
Common Barnacle	<i>Balanus glandula</i>	species

### Bivalves

COMMON NAME	LATIN NAME	TAXA LEVEL
Butter Clam	<i>Saxidomus gigantea</i>	species
Pacific Littleneck Clam	<i>Protothaca staminea</i>	species
Japanese Littleneck Clam	<i>Venerupis philippinarum</i>	species
Green False-jingle	<i>Pododesmus cepio</i>	species
Dark Mahogany Clam	<i>Nuttallia obscurata</i>	species
Pacific Blue Mussel	<i>Mytilus edulis</i> complex	species
Softshell Clam	<i>Mya arenaria</i>	species

## Bivalves (continued)

COMMON NAME	LATIN NAME	TAXA LEVEL
Macoma Clam	<i>Macoma</i>	genus
Baltic Macoma	<i>Macoma balthica</i>	species
Bent-nose Macoma	<i>Macoma nasuta</i>	species
Pointed Macoma	<i>Macoma inquinata</i>	species
White Sand Macoma	<i>Macoma secta</i>	species
Plain Tellin	<i>Tellina modesta</i>	species
Heart Cockle	<i>Clinocardium nuttallii</i>	species
Olympia Oyster	<i>Ostrea conchaphila</i>	species
Pacific Oyster	<i>Crassostrea gigas</i>	species
Pacific Geoduck	<i>Panopea generosa</i>	species
Fat Gaper (Horse Clam)	<i>Tresus capax</i>	species
Pacific Gaper (Horse Clam)	<i>Tresus nuttallii</i>	species
Rock Entodesma	<i>Entodesma saxicola</i>	species
Arctic Hiatella	<i>Hiatella arctica</i>	species

## Bryozoans

COMMON NAME	LATIN NAME	TAXA LEVEL
Marine Bryozoan	Marine bryozoan	class
Orange Bryozoan Crust	<i>Schizoporella unicornis</i>	species
Leafy Soft Bryozoans	<i>Dendrobeatia lichenoides</i>	species

## Chitons

COMMON NAME	LATIN NAME	TAXA LEVEL
Chiton	Polyplacophora	class
Woody Chiton	<i>Mopalia lignosa</i>	species
Lined Chiton	<i>Tonicella lineata</i>	species
Mossy Chiton	<i>Mopalia muscosa</i>	species
Black Katy Chiton	<i>Katharina tunicata</i>	species

## Crabs

COMMON NAME	LATIN NAME	TAXA LEVEL
Decorator Crab	<i>Oregonia gracilis</i>	species
Kelp Crab	<i>Pugettia producta</i>	species
Porcelain Crab	<i>Petrolisthes eriomereus</i>	species
Cancer Crab	<i>Cancer</i>	genus
Red Rock Crab	<i>Cancer productus</i>	species
Graceful Crab	<i>Cancer gracilis</i>	species

## Crabs (continued)

COMMON NAME	LATIN NAME	TAXA LEVEL
Dungeness Crab	<i>Cancer magister</i>	species
Shore Crab	<i>Hemigrapsus</i>	genus
Purple Shore Crab	<i>Hemigrapsus nudus</i>	species
Green Shore Crab	<i>Hemigrapsus oregonensis</i>	species
Black Clawed Crab	<i>Lophopanopeus bellus</i>	species
Hermit Crab	<i>Pagurus</i>	genus
Pea Crab	<i>Pinnixa faba</i>	species

## Diatoms

COMMON NAME	LATIN NAME	TAXA LEVEL
Brown Grunge	Bacillariophyta	phylum

## Snails, Nudibranchs, and Limpets

COMMON NAME	LATIN NAME	TAXA LEVEL
Keyhole Limpets	Fissurellacea	superfamily
True Limpets (no key holes)	Patellacea	superfamily
Ribbed Limpet	<i>Lottia digitalis</i>	species
Shield Limpet	<i>Lottia pelta</i>	species
Whitecap Limpet	<i>Acmaea mitra</i>	species
Plate Limpet	<i>Tectura scutum</i>	species
Mask Limpet	<i>Tectura persona</i>	species
Screw Shell	<i>Batillaria cumingi</i>	species
Dire Whelk	<i>Lirabuccinum dirum</i>	species
Frilled Dogwinkle	<i>Nucella lamellosa</i>	species
Striped Dogwinkle	<i>Nucella emarginata</i>	species
Periwinkle	<i>Littorina</i>	genus
Sitka Periwinkle	<i>Littorina sitkana</i>	species
Checkered Periwinkle	<i>Littorina scutulata</i>	species
Lewis's Moon Snail	<i>Polinices lewisii</i>	species
Green Bubble Shell	<i>Haminoea virescens</i>	species
Dove Shells	<i>Amphissa</i>	genus
Leafy Hornmouth	<i>Ceratostoma foliatum</i>	species
Northern Compact Worm Snail	<i>Petalconchus compactus</i>	species
Blue-top Snail	<i>Calliostoma ligatum</i>	species
Ringed Nudibranch	<i>Discodoris sandiegensis</i>	species
Yellow Sea Slug	<i>Archidoris montereyensis</i>	species
Brown Sea Slug	<i>Onchidoris bilamellata</i>	species

## Isopods

COMMON NAME	LATIN NAME	TAXA LEVEL
Isopods	Isopoda	order
Sphere Pill Bug	<i>Gnorimosphaeroma</i>	genus
Seaweed Isopod	<i>Idotea</i>	genus
Eelgrass Isopod	<i>Idotea resicata</i>	species
Speckled Pill Bug	<i>Cirolana harfordi</i>	species

## Worms and Worm-Like Animals

COMMON NAME	LATIN NAME	TAXA LEVEL
Free-swimming Flatworm	Turbellaria	class
Type of Flatworm	<i>Leptoplana</i>	genus
Type of Flatworm	<i>Notoplana</i>	genus
Ribbon Worms (Proboscis Worms)	Nemertea	phylum
Orange Nemertean	<i>Tubulanus polymorphus</i>	species
Mud Nemertean	<i>Paranemertes peregrina</i>	species
Green Ribbon Worm	<i>Emplectonema gracile</i>	species
Pale Ribbon Worm	<i>Amphiporus</i>	genus
Sand Worm/Mussel Worm	<i>Nereis vexillosa</i>	species
Lugworm	<i>Abarenicola pacifica</i>	species
Thread Worm	<i>Notomastus tenuis</i>	species
Sand Worm	<i>Nereis brandti</i>	species
Calcareous Tube Worm	<i>Serpula vermicularis</i>	species
Bamboo Worm	<i>Axiobella rubrocincta</i>	species
Tiny Tube Worm	<i>Spirorbis</i>	genus
Leather Tubeworm	<i>Eudistylia vancouveri</i>	species
Scale Worm	Polynoidae	family
Peanut Worm*	<i>Phascolosoma agassizi</i>	species

\* belongs to phylum Sipuncula

## Sea Anemones

COMMON NAME	LATIN NAME	TAXA LEVEL
Anemones	Anthozoa	class
Burrowing Anemone	<i>Anthopleura artemisia</i>	species
Red Green Anemone	<i>Urticina crassicornis</i>	species
Aggregate Anemone/ Green Anemone	<i>Anthopleura elegantissima</i>	species
Plumose Or White/ Tan Anemone	<i>Metridium senile</i>	species
Hydroids	Hydrozoa	class
Beard Hydroid	<i>Obelia</i>	genus

## Sea Cucumbers

COMMON NAME	LATIN NAME	TAXA LEVEL
Sea Cucumbers	Holothuroidea	class
Burrowing Sea Cucumber	<i>Leptosynapta clarki</i>	species
Orange Sea Cucumber	<i>Cucumaria miniata</i>	species
Ivory Bristly Cucumber	<i>Eupentacta quinquesemita</i>	species
Orange Chiton Cucumber	<i>Psolus chitinoides</i>	species

## Ascidians/ Sea Squirts

COMMON NAME	LATIN NAME	TAXA LEVEL
Sea Squirts	Ascidacea	class
Red Sea Squirt	<i>Cnemidocarpa finmarkiensis</i>	species
Warty Sea Squirt	<i>Pyura haustor</i>	species

## Sea Stars

COMMON NAME	LATIN NAME	TAXA LEVEL
Sea Stars	Asteroidea	class
Leather Star	<i>Dermasterias imbricata</i>	species
Mottled Star	<i>Evasterias troschelii</i>	species
Purple Star	<i>Pisaster ochraceus</i>	species
Blood Star	<i>Henricia leviuscula</i>	species
Sunflower Star	<i>Pycnopodia helianthoides</i>	species
Six-Armed Star	<i>Leptasterias hexactis</i>	species
Brittle Stars	Ophuroidea	class
Daisy Brittle Star	<i>Ophiopholis aculeata</i>	species

## Sea Urchins & Sand Dollars

COMMON NAME	LATIN NAME	TAXA LEVEL
Red, Purple, or Green Urchins	<i>Strongylocentrotus</i>	genus
Green Urchin	<i>Strongylocentrotus droebachiensis</i>	species
Sand Dollar	<i>Dendaster excentricus</i>	species



## Shrimp

COMMON NAME	LATIN NAME	TAXA LEVEL
Crangon Shrimp	<i>Crangon</i>	genus
Broken Back Shrimp	<i>Heptacarpus</i>	genus
Mud Shrimp	<i>Upogebia pugettensis</i>	species
Ghost Shrimp	<i>Callinassa californiensis</i>	species

## Sponge

COMMON NAME	LATIN NAME	TAXA LEVEL
Sponges	Porifera	phylum
Yellow/Tan Sponge	<i>Halichondria</i>	genus
Red/Purple Sponge	<i>Haliclona</i>	genus
Purple Sponge	<i>Haliclona permollis</i>	species
Orange/Red Sponge	<i>Ophlitaspongia pennata</i>	species
Yellow Sponge	<i>Halichondria bowerbanki</i>	species

## VERTEBRATES

### Fish

COMMON NAME	LATIN NAME	TAXA LEVEL
Gunnel	Pholidae	family
Penpoint Gunnel	<i>Apodichthys flavidus</i>	species
Crescent Gunnel	<i>Pholis laeta</i>	species
High Cockscomb	<i>Anoplarchus purpureus</i>	species
Sculpins	Cottidae	family
Staghorn Sculpin	<i>Leptocottus armatus</i>	species
Tidepool Sculpin	<i>Oligocottus maculosus</i>	species
Sand Sole	<i>Psettichthys melanostictus</i>	species
Northern Clingfish	<i>Gobiesox maeandricus</i>	species



## APPENDIX F: HABITAT TYPES



# Backshore Zone Habitat Types

## rock habitat (k):

at least 75% of the backshore substrate is bedrock, boulders, cobble, and pebbles; less than 50% of the substrate is covered by vegetation.



## sand habitat (d):

at least 75% of the backshore substrate is sand; less than 50% is covered by vegetation.





**soil habitat (I):**

at least 75% of the substrate is soil; less than 50% of the substrate is covered by vegetation.



**meadow habitat (w):**

at least 75% of the backshore substrate is soil and/or sand; at least 50% of the substrate is covered by terrestrial plants, many of which die to the ground every year; less than 50% of the area is covered by trees.



**deciduous forest habitat (dt):**

regardless of the backshore substrate, at least 50% of the substrate is under a canopy of deciduous trees.





coniferous forest habitat (ct):  
regardless of the backshore  
substrate, at least 50% of  
the substrate is under a  
canopy of coniferous trees.



mixed forest habitat (mf):  
regardless of the backshore  
substrate, at least 50% of  
the substrate is under a  
canopy of deciduous and  
coniferous trees and shrubs.





**shrub habitat (sb):**

regardless of the backshore substrate, at least 50% of the substrate is covered by shrubs.



**marsh or pond habitat (h):**

backshore area composed of typical marsh vegetation such as sedge, bulrush, and cattail, and open water.





# Intertidal Zone Habitat Types

## rock habitat (r):

at least 75% of the habitat substrate is bedrock and/or boulders; less than 50% of substrate is covered by vegetation.



## rock habitat (r): (continued)



## cobble/shell habitat (c):

at least 75% of the habitat is cobble, pebbles, and shells - there may be patches of sand in this; less than 50% of the substrate is covered by vegetation.





cobble/shell habitat (c):  
(continued)



sand habitat (s):  
at least 75% of the  
substrate consists of sand;  
less than 50% of the  
substrate is covered by  
vegetation.



mud habitat (u):  
at least 75% of the area is  
mud; less than 50% of the  
substrate is covered by  
vegetation.





rockweed habitat (**fa**):

regardless of the substrate,  
at least 50% of the area is  
covered by rockweed  
(*Fucus* spp.).



sea lettuce habitat (**ua**):

regardless of the substrate,  
at least 50% of the area  
is covered by sea lettuce  
(e.g. *Ulva*, *Monostroma*)



kelp habitat (**ka**):

regardless of the substrate,  
at least 50% of the area is  
covered by *Macrocystis*,  
*Nereocystis*, *Costeria*,  
*Laminaria*, or other  
broad-bladed large kelps.  
Specify the kelp species.





mixed or other macroalgae  
(seaweed) habitat (oa):

regardless of the substrate, at least 50% of the area is covered by non-vascular intertidal vegetation. This may be a mixture of algae species, or 50% cover of one particular species other than rockweed or sea lettuce. Specify the species of algae that characterize this habitat.



eelgrass habitat (e):

regardless of substrate, at least 50% of the area is covered by eelgrass; species include the introduced eelgrass (*Zostera japonica*) on sheltered cobbles, pebbles, sand, or silt in mid-intertidal, and native eelgrass (*Zostera marina*) on sheltered cobble, pebbles, sand, or silt in the lower intertidal.



tidal marsh habitat (m):

area composed of vascular vegetation that is regularly covered by high tides (usually once or twice a day depending on elevation); contains typical marsh vegetation such as sedge, bulrush, or pickleweed.

