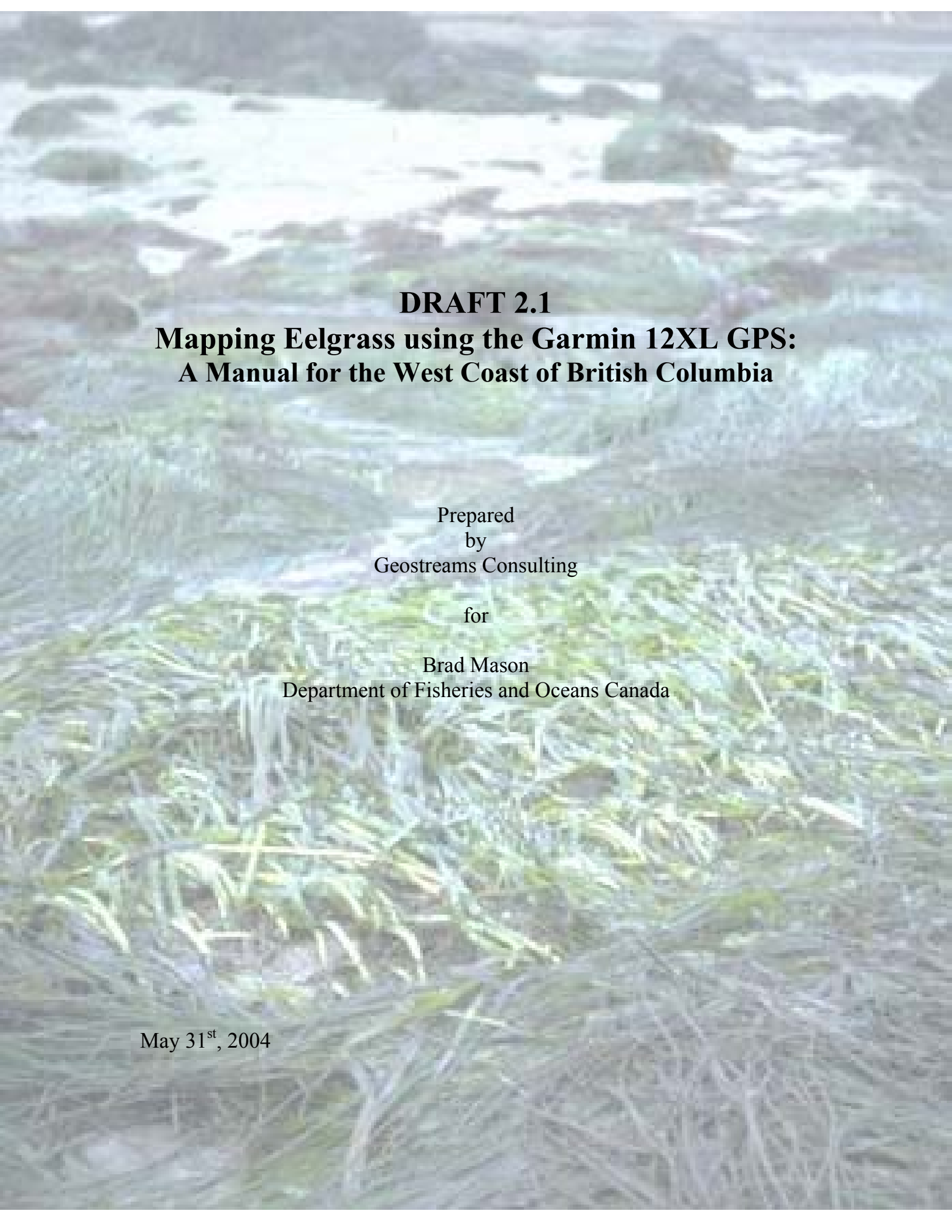

DRAFT 2.1
Mapping Eelgrass using the Garmin 12XL GPS:
A Manual for the West Coast of British Columbia

Prepared
by
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for

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1. Introduction

1.1. Purpose and Scope of Manual

This manual has been written to supplement the handbook "Methods for Mapping and Monitoring Eelgrass Habitat in British Columbia" (Precision Identification, 2002), a guide to field-based methodology for mapping and monitoring eelgrass in BC. This supplement presents information and tools for using Global Position Systems (GPS) to map eelgrass. These tools are intended for use by stewardship groups, communities, and volunteers to capture information on eelgrass beds along the BC coast.

Zostera marina spadices full of seeds from Waldron Island, Washington. Note sparse number of sterile ovaries. Photo by Ron Phillips.

The data collection method proposed in this manual utilizes a Garmin brand of GPS to capture eelgrass bed locations, and ESRI's ArcView Geographic Information System (GIS) software with Minnesota's Department of Natural Resources (DNR) Garmin extension to import, review, compile, update and export both spatial data and metadata. There are other compatible hardware and software systems that can be used to capture eelgrass bed locations and to review and update the data collected in the field. However, it is not the intention of this manual to endorse one system over another. Additionally, the methods proposed in this manual do not meet BC Provincial standards for data capture using GPS. However, this method will allow for initial identification of eelgrass bed locations until more sophisticated mapping techniques and/or funding for such undertakings becomes available.

1.2. GPS Unit

The manual contains an overview of data capture using the Garmin 12XL GPS unit. The Garmin 12XL unit is applied as an example of how a user can capture eelgrass data. The Garmin is employed in this manual because of its low-cost and ease of use, which enables stewardship and community groups to more easily access the GPS unit for field-base data capture. Other GPS units will perform similar tasks, however the scope of this manual does not encompass examples of other such units.

1.3. Flow chart for Eelgrass Mapping in BC

This manual has been designed to meet the needs of users who are not familiar with GPS mapping applications. Stewardship groups, non-profit and volunteer groups are the target users for whom this manual has been designed. However, government and contractors working in this area could also utilize this manual if so desired.

The flow model (Figure 1.0) outlines the approach we suggest for mapping eelgrass beds using GPS. This basic outline will enable each user to apply the procedures laid out in this manual more effectively. Please refer to this flow chart when you are mapping to ensure that each step has been considered and that the proper planning and knowledge base is in place before you begin your fieldwork.

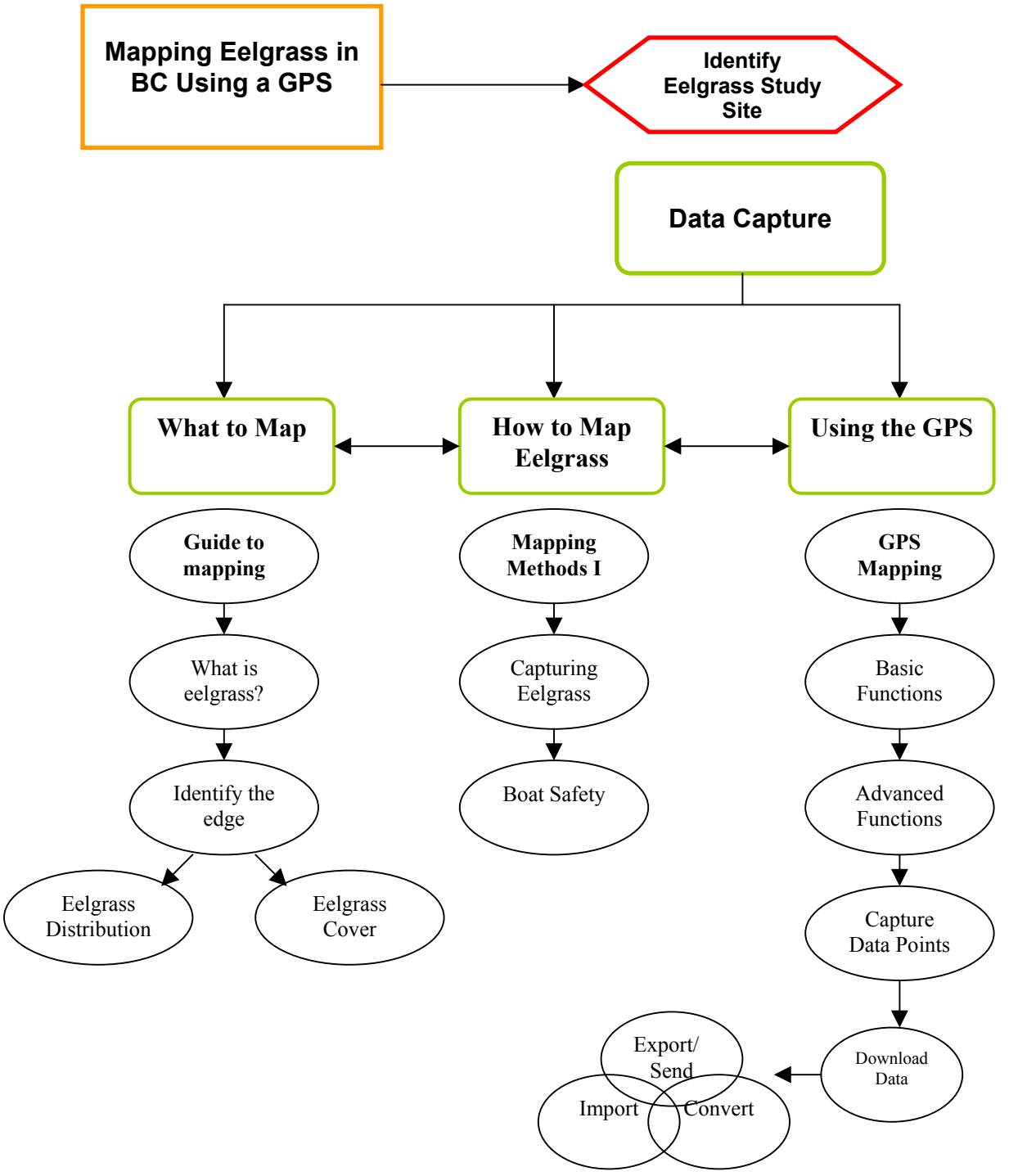
The flow chart outlines the initial stages of project development (orange box), including reference to the Methods for Mapping and Monitoring Eelgrass Habitat in British Columbia (Precision Identification, 2002), and identification of a field study site where an initial eelgrass survey has already been undertaken. This manual does not go into the processes or procedures required for identifying eelgrass bed locations along the BC Coast (red box). The techniques and approach used to initially identify eelgrass beds are outlined in detail in the Methods for Mapping and Monitoring Eelgrass Habitat in British Columbia (Precision Identification, 2002). This manual only describes the procedures to take after the initial site survey and identification of eelgrass beds has been made. If you are interested in undertaking mapping methods as described in this manual, but do not know of any eelgrass bed locations in your community or region, please refer to the contact information located at the back of this manual. These people will be able to assist you to find information on initial site survey and eelgrass bed locations in your area. Additionally, this manual assumes that you have a general idea of where the eelgrass beds are located in your area. It is recommended that a certified boat operator and field technician(s) are familiar with the area and tides and the general location of the eelgrass beds you are planning to map. Once you are familiar with the general location of the eelgrass bed in your area, you can begin to apply the tools and techniques offered by this manual.

This manual contains three main sections that outline what type of eelgrass beds to map, how to map eelgrass beds, and specifics on how to use the GPS to map your targeted eelgrass sites. In **'What to Map'**, data collection in the intertidal and nearshore environment is introduced. In this section, we ask and answer the question "What is eelgrass?". We determine how to find the edge of an eelgrass bed, and discuss eelgrass distribution and cover types, and eelgrass density. There are many pictures that will guide you through this section of the manual. In the next section, we discuss **'How to Map Eelgrass'**. This section introduces mapping methods. We explain the basics of how to go about capturing information on the location of an eelgrass bed. We also discuss boat safety and maneuvering around eelgrass beds. Finally, we briefly talk about other species of interest that you may want to map.

In **'Using the GPS'**, we are introduced to GPS mapping using a Garmin 12XL GPS unit. We review the basic operational functions of the Garmin 12XL, including the main tools that you will use to capture eelgrass location, bed shape and size, and other information. We then go into more depth on these functions. We talk specifically about how to map eelgrass beds using the GPS. We present three different ways that you could use to capture an eelgrass bed. Then, we show you how to capture data points using the Garmin 12XL GPS unit. We talk about downloading the data you have captured, importing it into ArcView GIS using the DNR Garmin extension, converting your points to polygons, and then exporting or sending the data out to web servers or eelgrass project stewards/data managers. We review an alternative way to convert your data to polygons and submit it using the Community Mapping Network (www.cmnbc.ca) web site tools.

We hope that this manual will be an effective tool to assist you with your GPS survey. Should you have any questions, please direct these concerns to the people listed at the back of this manual in the Contacts section. They will be able to assist you with any of your issues and help you to undertake a safe and successful GPS mapping survey.

Chart 1.0: Procedures and processed offered by this manual.



1.4. How to use this manual

The manual has been created for ease of use in learning to map eelgrass beds with a GPS. We want to help you as much as possible to easily pick up the concepts of GPS mapping! Therefore, we've created a style to present concepts, give you additional tips, review applications and procedures, remind you of what you need to do, and summarize each section you've just read.

Each of the icons below will be shown in this manual to illustrate a particular concept. For example, every time you see the first icon, it will mean that you are going to be presented with a tip to assist you with that task.

CONCEPT
This icon means that you are going to be presented with a new concept

TIP
This icon means that you are going to be presented with a new tip

REMINDER
This icon means that you are going to be presented with an important reminder or note

REVIEW
This icon means that you are going to be presented with review of a concept

SUMMARY
This icon means that you are at the end of the section and will now summarize what you have learned

2. Guidelines for mapping eelgrass

Mapping eelgrass involves identification of eelgrass beds, location and determination of the edge of the eelgrass bed and some understanding of eelgrass distribution and the kinds of eelgrass cover types that can occur.

2.1. Eelgrass Mapping

In almost every case, you will be using this manual to help with mapping the specific location of the eelgrass bed and not trying to generally locate the beds from maps or other data sources. For assistance with eelgrass bed location on the BC coast, please refer to Field Methods for Mapping and Monitoring Eelgrass Habitat in British Columbia (Precision Identification, 2002). If you are using this manual as a starting point for mapping eelgrass, you can use the contact page at the back of this manual to get in touch with local steward to determine if eelgrass beds are found in your area and the general locations of those beds.

In this section we will discuss identifying eelgrass beds, finding the edge of eelgrass beds and introduce different approaches to mapping the location of the eelgrass bed.

2.2. How to identify eelgrass and eelgrass beds?

Eelgrass is a grass-like plant whose shoots root in shallow intertidal and subtidal areas along the shoreline. The eelgrass plant has roots called a rhizome that grow and spread, one plant may form an entire eelgrass bed, with large root systems that develop underneath a sandy ocean bottom. The roots send up shoots that grow the leaves we see on the ocean floor. The leaves of an eelgrass shoot range in size from 25cm long (some intertidal populations) to 270cm (subtidal populations) long, and can vary from 2-20mm wide. However, leaf size in some populations can vary with season (Cynthia Durrance, pers. comm.). Eelgrass beds will develop in areas where favorable conditions exist for shoots to grow. The density of the shoots growing in a particular area defines what we call an eelgrass bed. Eelgrass beds will be found in water depths from 0m to –10m and can be found most often in quiescent, sandy mud substrate zones (Precision Identification, 2002) of the subtidal shoreline. However, eelgrass beds can also be found in areas where currents are stronger and/or in zones of mixed sand-mud-rock substrate.

Eelgrass development is dependent upon various factors and environmental requirements that are necessary for shoots to thrive. Eelgrass beds can move around depending on currents,

Zostera marina patch in meadow of *Phyllospadix scouleri* (a very unusual occurrence), Cape Arago, Oregon. Photo by Ron Phillips.

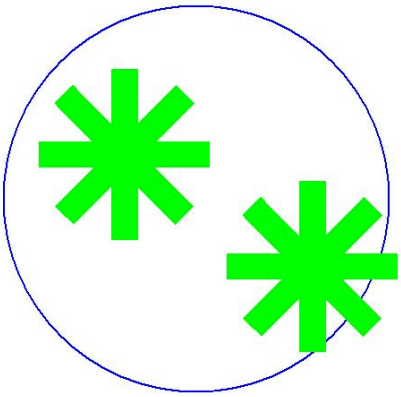
shifting sands or substrate/bed movement, and storms. Other reasons for eelgrass bed migration and/or expansion and contraction may be environmental or related to human impacts. During a survey, the eelgrass beds should not move greatly. However, if a large storm moves through the area during your survey, you may see some disruption in the eelgrass bed.

Zostera marina viewed from above. Aburatsubo Bay, South of Tokyo, Japan. Photo by Ron Phillips.

2.3. Identify the edge of Eelgrass Beds

The boundary of an eelgrass bed may be hard to distinguish. In some cases the bed may be quite distinct, but most often the bed will become more patchy and fragmented towards to edge.

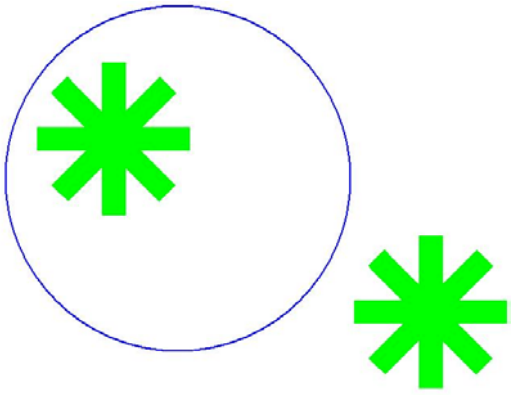
Edges of eelgrass beds are determined by measuring or estimating the **shoot density of eelgrass**. When the density declines to less than one shoot per m^2 ($1/m^2$) and continues to declines after that point that is considered the edge of the bed. The following images illustrate different densities and edges.



Imagine a hula-hoop. A standard Whammo Hula-Hoop has an interior diameter of 77 cm, which means the area inside the hula-hoop is just a bit under $1m^2$.

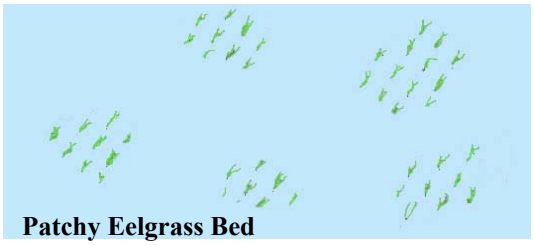
Now, try to imagine placing a hula-hoop over the shoots. Do one or more shoots fit inside the hula-hoop or almost touch its edges (as in the picture on the right)? If so, your shoot are dense enough to map and you should proceed with data capture.

If your shoots are growing less than 1 per m^2, as shown in the picture below, then you should not map the shoots. However, it is recommended that you at least take one point to mark the location of these sparse eelgrass shoots.



2.3.1. Eelgrass Distribution and Cover

The examples below show different distributions and cover types that may be found in eelgrass beds on the BC Coast. How would you go about mapping these eelgrass beds? Part of the difficulty in answering this question is the size of patches, and the size of the initial eelgrass bed. *Generally, eelgrass beds should be mapped at densities greater than 1 shoot for every square meter.*

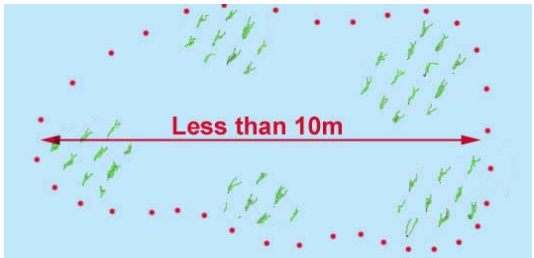


In the first two examples, the answer is pretty simple – map the perimeter of the entire eelgrass bed – even if there are bare un-vegetated areas within it.

In the third example, you would map the perimeter of the patches, unless there were very small patches (< 10m in diameter) and they were separated by a distance greater than 10m.

In the case where patches are larger than 10m in, you would map each patch as an individual bed. If you encounter a small patch (<10m in all directions) that you wish to document, this may be done using the protocol for beds <10m (by taking a single point in the center of each bed).

In the example where the patches are greater than 10m in diameter and the distance between them exceeds 10m, you can map each patch separately.

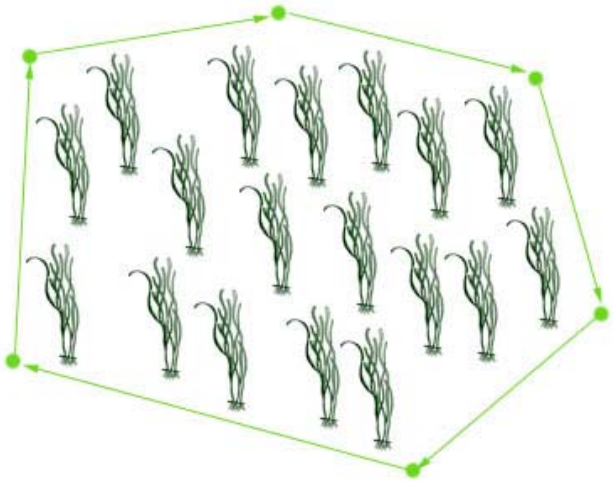


3. Introduction to mapping methods

There are several ways to capture the location of an eelgrass bed. One of the most important factors is determining the edge of an eelgrass bed. We discussed how to determine the edge of the eelgrass bed in Section 2.3 of the manual. All mapping methods introduced here involve using a Global Position System (GPS) to capture the specific location of the eelgrass bed.

The first and most basic method of capturing an eelgrass location is to capture a single point in the center of an eelgrass bed. This method only applies when the bed measures less than 10 m in all directions. When only one point is recorded you must use a metre tape to measure the length and width of the bed. The length is the distance along shore, or parallel to the shore. The width is the distance perpendicular to the shore.

The second method is to capture several points that can be used to define the edge of the eelgrass bed. This method is shown in the illustration below. In this case, the edge of the eelgrass bed was determined, and then the boat handlers and the GPS technician drove the perimeter of the eelgrass bed. The green lines show where the boat was driven and the green dots show the six data points that were captured using the GPS.



The third method involves using the GPS to manually track points as you maneuver a boat along the edge of an eelgrass bed. This method is recommended, as it is the most accurate and simple to process.

The last method is to use your GPS to capture a line or polygon that delineates the edge of the eelgrass bed. This fourth method is considered to be an advanced GPS function, and is not offered by the Garmin GPS 12XL unit. Therefore, this approach will not be discussed in this manual.

In the first three methods described above, GPS data points can be either written down using a pencil and a field survey book, or they can be transferred to a computer automatically using the connection and downloading procedures explained in this manual. If you chose to write down your data points, you will have to copy them into an email or send them to your co-ordinator after the survey is complete. If you download your data points, this will save you field time writing down all the coordinates. Plus, the pencil method could be difficult if you have a lot of data points, or many eelgrass beds to capture.

Once you are in the office, you may choose to load your data into a program such as ArcView. Garmin GPS has an ArcView extension called DNR Garmin. This extension can be used to transfer, convert and map your data points. The data points could be joined into lines and

converted to polygons. Then these polygons could be sent as ArcView shape files to your project co-ordinator.

Which method is right for you? The method you use will depend on your survey needs and the time (and energy) you have to devote to your survey.

3.1. Operating a boat in the inter-tidal zone

This manual has not been designed to address safety issues when operating boats in the open ocean/shoreline areas. Please refer to the Office of Boating Safety within the Canadian Coastguard (www.ccg-gcc.gc.ca/obs-bsn/main_e.htm) for more information on boat safety and boat operation requirements, including licensing. Do not undertake a survey without the proper training in small craft operation and the appropriate equipment to ensure your safety and the safety of all those assisting in the survey. Care and attention should be taken with regards to human safety above and beyond all else mentioned in this manual. You should use common sense when examining the shoots to determine shoot characteristics, environmental monitoring and/or shoot density and any other tasks that require movement around the boat. Wear a lifejacket at all times while in the boat and do not take it off for any reason, especially not to accommodate any issues that may arise in conjunction with performing the tasks outlined in this manual.

In general, care should be taken when working in and around eelgrass beds. The eelgrass shoots and beds are very sensitive and can be easily pulled up from its rooting position in the sand. Therefore, when operating a boat at low tide, avoid snagging eelgrass shoots on the prop and uprooting shoots as you drive in and around the eelgrass beds. Enroute or during your eelgrass survey, you may encounter sensitive areas and/or species that you should pay careful attention not to disturb or harm.

3.2. Other species of interest

Single points can be taken at specific features or important places to note near or within the survey area. Perhaps you may see a unique species of interest that you want to record for the database – you could take a single point here. Or perhaps you want to record useful benchmarks or land-based features to assist future mapping surveyors find their way back to the eelgrass bed. Capturing the location of submerged rocks could help keep future surveyors or GPS mapping technicians safe while navigating around eelgrass beds!

3.2.1. Examples of species/environments to note

Species/Environments	Who to Contact
Rocks/submerged features	Note these features in your survey report so repeat surveyors are warned of hazards in the field!
Benchmarks, such as a lighthouse, or buoy marker	Benchmarks can be valuable markers for other surveyors (or you). Note the location of lighthouses, or buoys in relation to the eelgrass bed for future field surveys.
Rare Species	Contact DFO to report rare or endangered species found in the field.

4. GPS Data Collection: Garmin 12XL

We are ready to start talking about GPS data collection! In this manual, we will use the Garmin 12XL GPS system as an example of how to collect GPS data points to define and delineate eelgrass beds. This system has been shown to work well for eelgrass bed mapping (Precision Identification, 2002). If you have other GPS systems that you use, and these have worked well for you in the past, please continue with these procedures. This mapping manual is designed for first-time users of both GPS systems, and the Garmin GPS 12XL system, in particular.

4.1. Introduction to the Garmin 12XL

Your Garmin 12XL has many different functions available for your use. This section briefly introduces the Garmin 12XL unit and its basic functionality.

4.1.1. Keypad Usage for Eelgrass data entry

Your Garmin has 8 main keypad functions that are important operational tools of the 12XL. These buttons you will use many times, so it is a good idea to get to know their uses and functions first.

On/Off

By pressing this button, the Garmin unit will be turned on and off. This button also activates screen backlighting.

Page

Scrolls through the main data pages in sequence and returns display from as submenu page to a primary page. Pages include: Satellite, Position, Map, Compass, and Menu.

Mark

Captures a position and displays the mark position page.

Goto

Displays GOTO page with the waypoint highlighted for GOTO operations.

Arrow keypads

Arrow keypads are used for ***ALL*** data entry.

Use the **Up/Down** arrows to select letters, numbers, and menu options.

Use the **Right/Left** arrow options to move the cursor forward or backward along the line.

Press **Enter** to confirm your data entry.

Enter

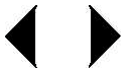
Confirms data entry. Allows data entry by activating highlighted fields.

Quit

Returns display to a previous page, or restores a data field's previous value.

Up/Down Arrows

Selects alphanumerical (A, B, C, D, etc.) characters and menu choices. Moves the field highlighter from field to field.



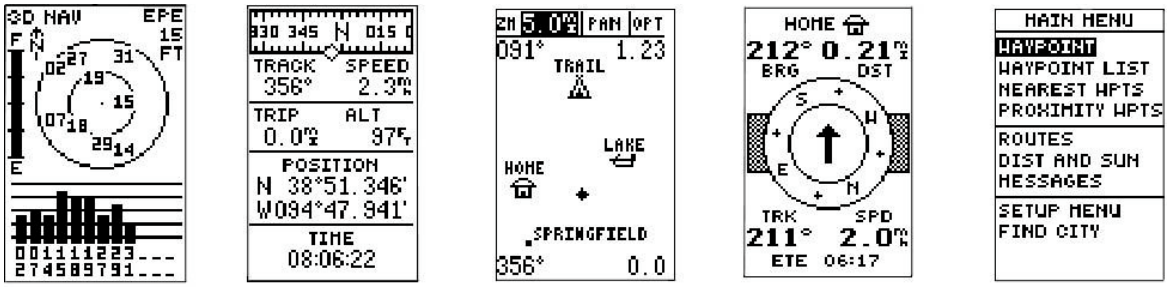
Left/Right Arrows

Moves the selected character field. Moves the field highlighter from field to field.

Zostera marina, new intertidal vegetative growth, Izembek Lagoon, Alaska. Photo by Ron Phillips.

4.1.2. Garmin GPS 12XL Pages

There are five primary page types in the Garmin GPS 12XL unit. To scroll between the pages, press the **Quit** or **Enter** buttons. These pages can be used to access all the menus and operate the GPS to allow you to map eelgrass beds.



Satellite | Position | Map | Compass | Main Menu

Satellite Page

The Satellite Page shows you what satellites the unit is receiving signals from, their positions and their signal strengths.

Position Page

This page shows you where you are, in what direction you are going and how fast you are going.

Map Page

The map page allows you to view the path that you have traveled over, the waypoints you collected along the way, and your current position.

Compass Page

The compass page shows you which direction to steer towards when navigating towards a waypoint.

Main Menu Page

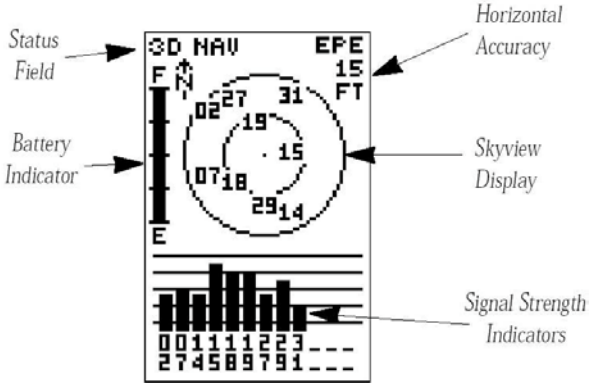
The main menu page gives the user access to the waypoint management, route, track log and setup features via a list of submenu options.

There are five different pages that you will use to access all of the menus and submenus in the GPS. It is good to know what each of the pages looks like and what they means. This will help you when using your Garmin GPS in the field!

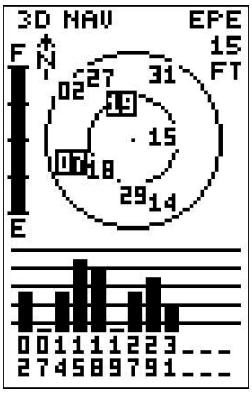
4.2. Garmin GPS 12XL Pages: In Depth

4.2.1. Satellite Page

The GPS 12XL Satellite Page displays the status of various receiver functions. The status information will tell you from what satellites the GPS is receiving signals and if the receiver has calculated a positional fix from those satellites.



Sky view and signal strength bars located on the Satellite Page indicate which satellites are visible to the receiver and whether they are being used to calculate a positional fix. The satellite view shows a birds-eye point-of-view of the position of each available satellite from which the GPS is receiving signals. The center of the bulls-eye is directly overhead and the outer circle is the horizon. The strength bars depict the strength of that signal.



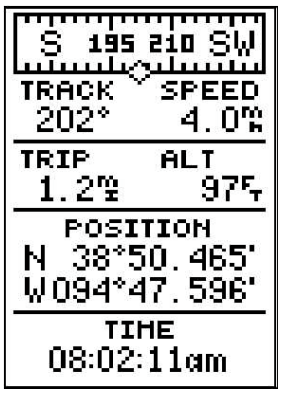
At the top of the Satellite Page, receiver status indicates the current GPS operational mode. The GPS mode includes the Searching, AutoLocate, Acquiring, 2D or 3D Nav (navigation), Poor Cvg (Poor GPS satellite coverage), Not Usable, or Simulator.

The EZInit option is also available at the Satellite Page. The EZInit allows you to re-initialize the unit. You may need to re-initialize if you have traveled over 800 kilometers with the GPS unit off, or in instances when you are having troubles getting the GPS to connect with the satellites.

The Satellite Page will display the satellites that are in your view, and are connected to the GPS. It also displays satellite signal strengths.

Use the satellite page to access the EZInit function, if you are having trouble initializing in the field.

The Satellite page is also the access to Screen Backlight, Screen Contrast, Battery Level Indicator and Emergency Erase function.



4.2.2. Positions Page

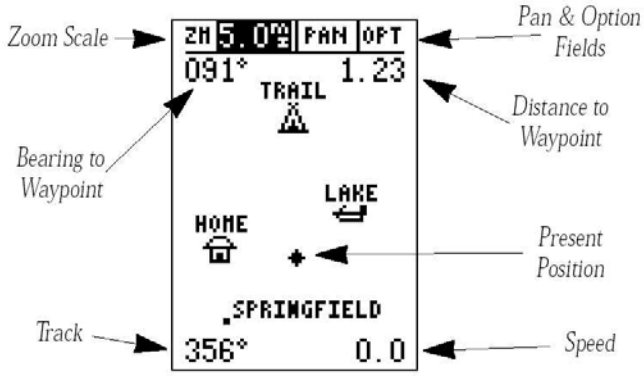
The GPS 12XL position page shows you where you are, what direction you are going, and how fast you are going. This is a useful page when you are not moving towards an active waypoint. You may want to use this page when starting out your survey on the way to the eelgrass bed site.

The top of the position page displays a compass indicating the direction you are moving in. Below this - **Track**, **Speed**, **Trip Odometer**, and **Altitude** fields show compass direction representing the distance you have traveled, the speed over ground you are going, the total distance traveled, and your current altitude. Below these fields, your current latitude and longitude is shown in the **Position** field. The **Time** field below this indicates the current time, set to 12 or 24-hour clock. The **Trip Odometer** and **Altitude** fields can be selected and customized as desired by the user.

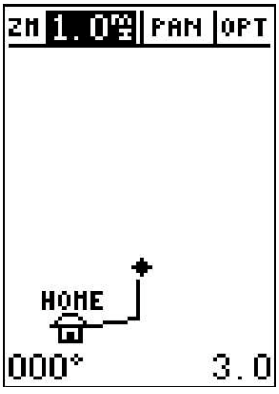
Use the Positions Page to see your position, speed, and altitude.

If you are using the Pencil and Pen Method of data capture, you will use the Position Page to mark down co-ordinates from the map page into your field notebook.

4.2.3. Map Page



The map page shows your position and any surrounding positions you have logged. It provides you with a target cursor that allows you to pan ahead to nearby waypoints, determine the distance and bearing to a map position, and mark new waypoints while you navigate.



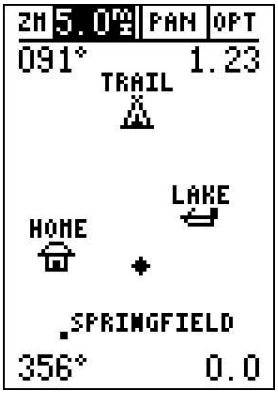
Zoom functions, **Pan**, and **Option** fields are located at the top of the map page screen.

The map page displays navigation information: the **bearing** and the **distance** to a destination waypoint and your **current track** and **speed over time**. The bearing and the distance to the destination waypoint refer to either: the active selected destination waypoint, a highlighted on-screen waypoint, or the panning target cross-hair. If you are not navigating to a destination waypoint, or using the cross-hair, the **Bearing to Waypoint** and **Distance to Waypoint** fields will not be displayed.

The **Track** feature that you will use to record points is available at the **OPT** function on the Map Page.

The map portion of the page displays your present location (with a diamond signal), and your track/route displayed as a solid line. Nearby waypoints are symbolized with their names shown adjacent to each waypoint symbol location.

4.2.4. Zoom, and Pan Map Functions



Zooming, panning and pointing functions can be accessed from the map page.

To **Zoom**, you need to first select a zoom scale

- Highlight the **Zoom** field
- Press the **Enter** key
- Select a map scale, and press **Enter**.

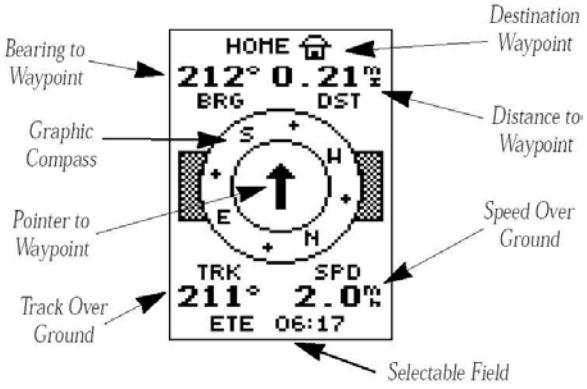
To activate the **Pan** function:

- Highlight the pan field
- Press the **Enter** key
- Use the arrow keys to move the map in any direction.
- To cancel the **Pan** function, press the **Quit** button.

You can also use the pan function and the cross-hair to add new waypoints as you navigate along. To perform this function, pan to the desired area of the map, and press **Mark**. Enter a name and a symbol for your new waypoint. Press **Enter**.

4.2.5. Compass Page

Whenever you select a **destination waypoint**, the compass page will appear to steer you in the direction of the waypoint. The compass ring in the middle of the page shows your course with a **pointer arrow** in the middle to direct you towards your destination waypoint. When the arrow is **pointing up** it means you are **moving directly towards** your target waypoint. The bearing and distance fields are displayed at the top of the screen and your current track and speed over ground are shown at the bottom of the page. The distance displayed is **the straight line distance** from your present location to the destination waypoint.



The **ETE** field defines your estimated time of arrival at the waypoint. The **ETE** field can display a number of different user-selected options to describe your navigation. These fields include: Estimated Time Enroute (**ETE**), Estimated Time of Arrival (**ETA**), Course to Steer (**CTS**), Crosstrack Error (**XTK**), Velocity Made Good (**VMG**), and Turn (**TRN**).

When you are close to arrival at your destination waypoint (<1min) the screen will flash. A message will appear to let you know you have arrived at your waypoint location.

4.2.6. Main Menu Page

The main menu page contains systems information, including system setup, navigation setup and waypoint pages.

4.2.6.1. System Setup

The setup menu contains options that allow you to configure your GPS to your preference. This includes System Setup Mode, Time Offset, Time format, Screen contrast, and Backlight Timeout.

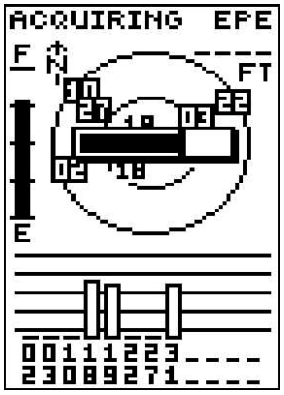
You should always be operating the System in **Normal Mode**. Simulator mode will not allow for data entry.

***Time offset**:* Date and Time offset should be set to local time. The GPS time is set to UTC (Greenwich Mean Time) time and you will have to either choose a value of either –7 or –8 depending on the time of year. Remember that in the Pacific Region, Daylight Savings time (UTC -7) is the first weekend in April until the last weekend in October, approximately. We operate on Pacific Standard Time (UTC -8) for the remainder of the year.

To enter **Time offset**, highlight **OFFSET** and press **Enter**. Enter the time offset and press **Enter**. To change the plus or minus sign, move the cursor to the left.

***Time format**:* Time format changes the time from 12 to the 24-hour time clock. Highlight hours and press Enter. Change the display format type to 12 or 24. Press **Enter**.

***Screen Contrast**:* To change the screen contrast, highlight contrast and press Enter. Adjust the scale bar to the desired contrast level. Press **Enter**.



***Backlighting timeout**:* Set the backlight timeout to 15 seconds - 240 seconds (4 minutes). Highlight the **Light** field and press **Enter**. Select the desired setting and press **Enter**. To turn lighting on and off, press the **Light** key.

4.2.6.2. Navigation Pages

The Navigation Setup page will allow you to change various default parameters including position formats, Map Datums, CDI scale (course deviation index), Units of measure, Heading reference, and Alarms.

Only the setup menus relative to this manual and operations for mapping eelgrass will be discussed below.

***Position Format**:* the Garmin GPS 12XL unit default positional format is latitude and longitude in degrees and minutes. You may want to change this to one of the following available positional output formats: latitude/longitude degrees, minutes, seconds; latitude/longitude decimal degrees; or UTM. Other formats are available, but are not applicable to this type of survey.

- Highlight the **POSITION FRMT** field and press **Enter**.
- Select the desired setting and press **Enter**.

Map Datum*:* The default Map Datum is WGS84. You can change this setting to NAD83, but it is not advisable to change this setting unless it has been altered in the past. In this case, re-set the map datum to WGS84 but selecting the MAP DATUM field and pressing Enter. Choose WGS84 and press Enter.

Units of Measure*:* The default measurement units for speed and distance readouts are 'statute'. You can change this setting to nautical or metric units of measure by highlighting the **UNITS** field and pressing **Enter**. Select the new units of measure and press **Enter**.

4.2.6.3. Waypoint Pages

Waypoint pages are also available from the main menu. Waypoint pages are discussed in section 4.5.1.

Zostera marina subtidal showing a mass of reproductive stalks in the center, Crab Bay, Evans Island, Prince William Sound, Alaska. Photo by Ron Phillips.

4.3. GPS Mapping: Basic functions

4.3.1. Turning the receiver on/off

Press and hold down the power button until the power turns on. This should take a few seconds. When the unit starts up, it will perform a self-test, and start searching for satellites. When enough satellites have been found for the unit to function, the **Position** page will display. You are ready to map!

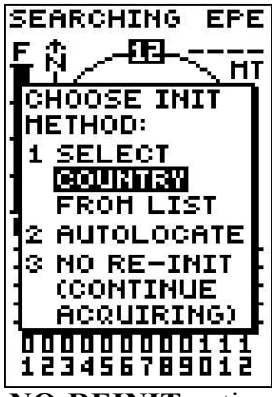
4.3.2. Initialization the Receiver

Initialization is generally not required, however, in the event of unit memory loss, or when the unit has traveled over 800 kilometers with the power off, you may need to re-initialize.

Turn the GPS unit on. The unit will conduct a self-test. Once the test is complete, the satellite page will display and the EZInit prompt may appear. If this occurs, select the following options:

Select **Country**: **Canada**. You may also need to select **Province**: **British Columbia**.

- Press the **Down Arrow** to highlight the **COUNTRY** option. Press the **Enter** key.
- Use the **Down** Arrow to scroll down the **Country** list until **Canada** appears.



- Use the **Up Arrow** to highlight the country/province/region Canada/British Columbia.
- Press **Enter**.

The GPS 12XL will start to search the sky for satellites. It will generally take under three minutes to initialize and get the first positional fix. Using autolocate, the unit should be able to find itself in three to five minutes.

If the EZInit prompt does not appear, press the **Enter** key from the Satellite page. If the EZInit page re-appears after initialization, select the **NO-REINIT** option and press **Enter**.

4.3.3. Screen Backlight

The satellite page also has a backlight option. If the light is dim or dark, you may want to use the screen backlight option. Press the **Light** button to activate the screen backlight.

The backlight will remain on for a period of time, and then will automatically shut off to conserve battery power.

4.3.4. Adjust Screen Contrast

You may want to adjust screen contrast on an especially sunny day.

- Press **Quit** or **Page** buttons to toggle between the page options and select the Satellite Page.

- Press the **Back/Forward** buttons to adjust the contrast level.

4.3.5. Battery Level indicator

The Satellite page has a battery level indicator option that allows you to view the battery power status of your batteries. When the battery level indicator is displaying close to **E** for **Empty**, replace the batteries with a fresh set.

This indicator is calibrated for use with **alkaline batteries**. Voltage differences between alkaline and Ni-Cad or lithium batteries will cause this indicator to ready differently for batteries of this type, and therefore may not read accurately for Ni-Cad batteries.

The GPS 12XL unit also has an **internal lithium battery** that will retain system memory when the receiver battery power is not operating, or unit is turned off. Your data, such as waypoints and routes, will not be deleted if the unit is to run out of power completely.

4.3.6. Emergency Erase

This function will allow you to completely purge all stored data on the Garmin 12XL unit, including waypoints, routes, and the track log. You may want to do this on the first day of your field survey to erase all previously collected data and information from the unit.

To do this, first start by turning the unit **off**. While holding down the **Mark** MARK button, turn the unit on by pressing the **On** button.

A warning message will appear and ask you to confirm the **Emergency Erase** action by selecting **Yes**. At this point you can **Cancel** the Erase operation, press the right arrow key, and select Enter. To erase ALL data on the unit, select **Enter** to confirm the operation.

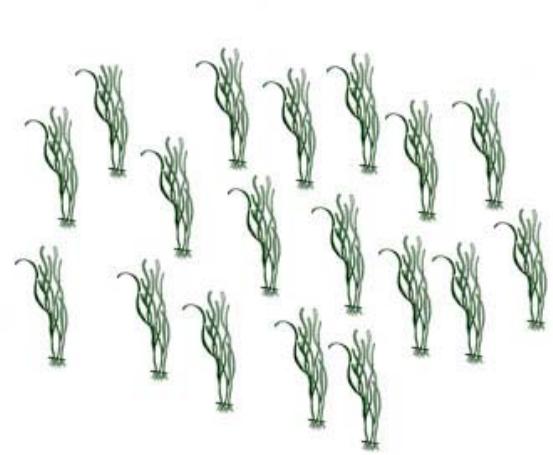
Warning: Emergency Erase will purge all data on the machine! Ensure that you have all your data downloaded before you use this function!

4.4. GPS Mapping: Advanced Functions

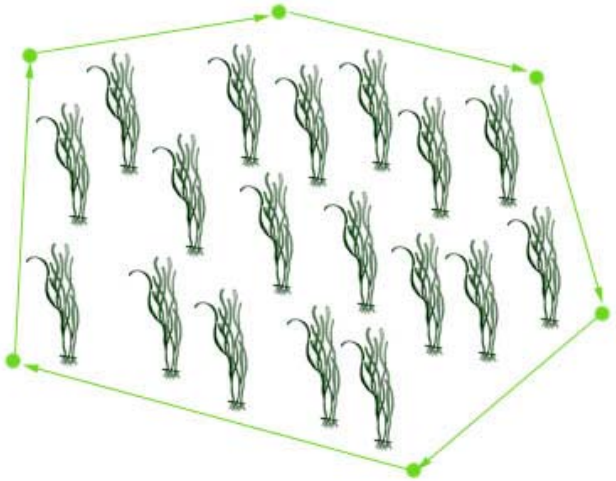
4.4.1. Detailed mapping methodology

When capturing eelgrass beds, you must first understand a little bit about the type of features that you are capturing and how they will eventually be integrating in a mapping system.

First of all, we are capturing eelgrass bed features and distributions of eelgrass beds along the coastline of British Columbia. Eelgrass beds can be found in many sizes, there are very large eelgrass beds, or small eelgrass beds. Eelgrass can be patchy, or continuous. Knowing what type of eelgrass bed you are capturing will help to determine how to map. Very small eelgrass beds, smaller than 10 m in size, are not to be mapped using this procedure. However, knowing where these beds are may be useful for some processes, and therefore if you come across an eelgrass bed that is smaller, it could be captured by taking a single GPS point at the site. This would allow resource managers to re-locate the bed and potentially examine why the bed is that size, if it is naturally small, and if not, what caused its size to decline, and if restoration is possible at that site.



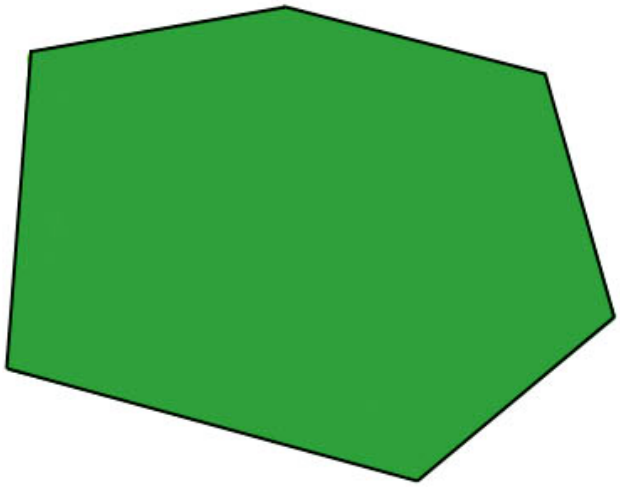
Larger beds can be captured using a series of GPS data points. We will discuss in the following sections how to capture data points using your GPS. The larger beds should be mapped in such a manner so that it is possible to re-create the shape of the bed from the data points collected. When you are out in the field, you will collect the edge of the eelgrass bed (see Section 2.3 for a definition of edge) as a series of data points. You will start collecting data at one point along the edge of the bed and continue collecting data points until the entire bed has been captured. You will end the data capture at the point where you originally started data collection, in a full circle from start to finish.



You may encounter long, linear beds that do not have a circular shape, and are less than 10m in width. These beds should be mapped by capturing point data down the center of the linear feature.

In the office, data technicians will be taking the series of data points and converting these points into **Lines** and **Polygons** in a **Geographic Information System**.

A **Geographic Information System** (GIS) is a tool that allows people to analyse spatial features (such as eelgrass) and assign attribute information to those spatial features. You have collected the eelgrass bed by capturing a series of data points along its edge. The data points you collected will be joined in the **GIS** by a series of connecting lines. The lines can be built into a polygon feature that will represent the spatial extent of that eelgrass bed.



The polygon will be assigned attribute information, such as an ID code, or a Feature Type. The attribute codes will contain valuable information that you collected while in the field, including possibly:

- Distribution (patchy vs. continuous)
- Density of Shoots
- Shoot length & width
- Species of Interest, etc…

The attributes may be entered directly into a pre-programmed GPS or recorded on hardcopy (paper) data sheets. A complete list of the attribute information that is required is listed on the datasheets in the Mapping & Monitoring Manual (Precision Identification, 2002). The minimum attribute data that must be recorded in the GPS is an identifier code that is unique to the data (bed, track or point) that is recorded.

The attribute information can be displayed in a table format (see below) or in spatial format in the GIS.

Polygon ID	**Eelgrass Type**	**Density of Shoots/m^2**	**Other Species of Interest?**
1004	Zostera marina	10	Crabs, and pipefish observed in bed.

4.4.2. Mapping Approaches

There is a few ways to approach eelgrass mapping. The flowchart (Chart 2.0) outlines the three approaches and how they could be applied.

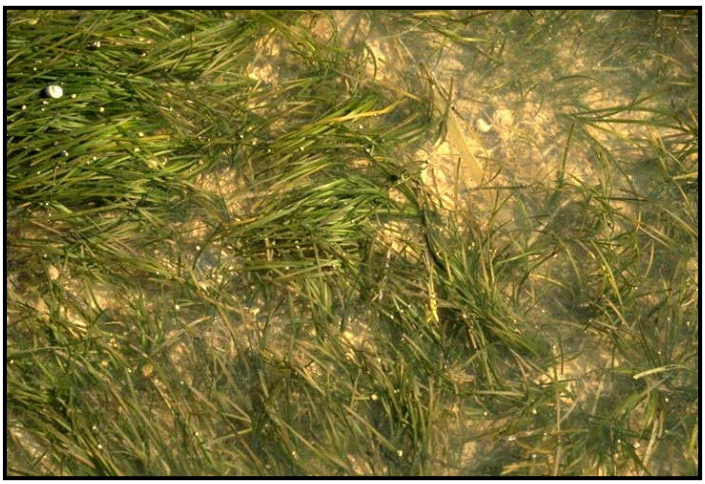
4.4.2.1. Paper and Pen Method

Field data points could be observed as the boat maneuvers along the edge of an eelgrass complex. Then those data points could be written down and e-mailed to the CMN contact. This is referred to in this manual as the paper and pen method.

4.4.2.2. Garmin GPS Method

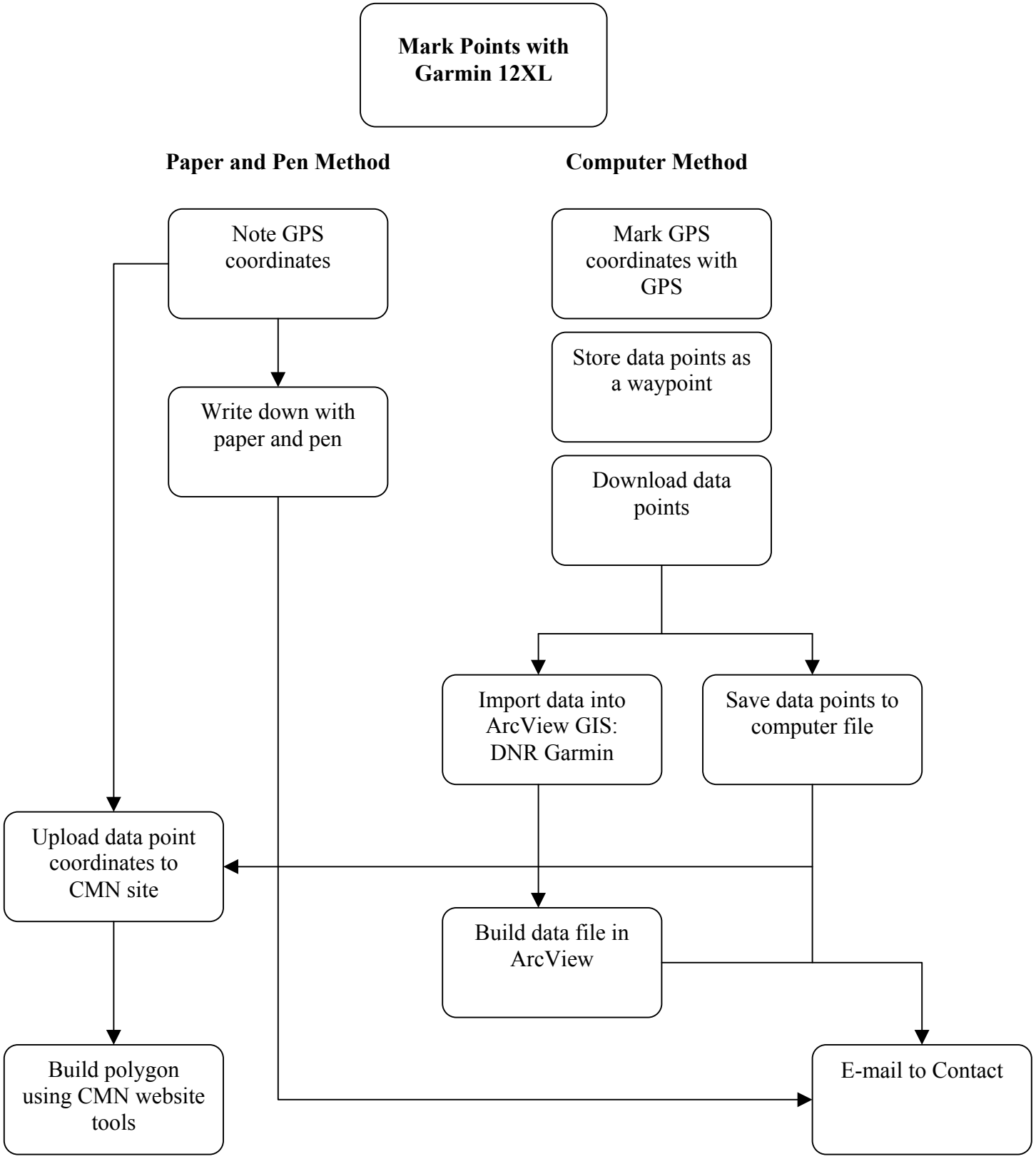
For more advanced users, field data points could be collected (the TRACK method is recommended) and stored in the Garmin GPS as waypoints. Those points could be downloaded from the unit and mailed to the CMN contact. The points could also be downloaded using the DNR Garmin extension and either edited using the DNR Garmin stand-alone mode, or imported into ArcView GIS. Once in ArcView, the user could build a polygon and then add attribute information to the polygon. Then the file could be sent to the CMN contact.

With data point locations, either from the Paper and Pen method, or from the Garmin GPS method, data from a file or data from a field book can be entered using the CMN web site data entry tool. This data entry tool is explained in detail in Section 8. The tool will allow users to enter the web site, upload add their eelgrass data field measurements, create polygons and add metadata.



Zostera mucronata from above, part of a vast field of plants, Cawley River, North of Adelaide, Australia. Photo by Ron Phillips.

Chart 2.0: GPS Mapping Approaches



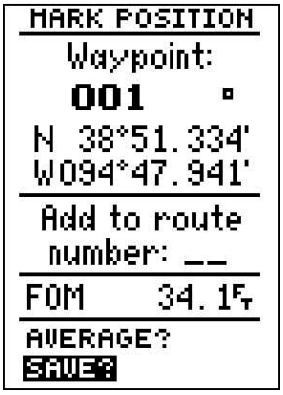
4.5. How to Capture Data Points using your Garmin 12XL

There are two ways to capture data points. At the edge of the eelgrass bed, you should mark positions approximately every 15 m or at half minute (30 seconds) intervals. In the case where the eelgrass bed is a complex shape, positions should be taken more frequently to accurately represent the form of the eelgrass bed.

If you use the track option to collect your data points, the data points will be logged automatically at specific intervals as you drive along. This will allow you collect data as you drive along the edge of the eelgrass bed.

4.5.1. Marking a position

A specific site location (for example, the edge of the eelgrass bed) captured by your Garmin 12XL is called a **waypoint**. In the picture shown on Page 20, six different waypoints were captured along the edge of the eelgrass bed.



Waypoints can be captured using the GPS in three ways:

(1) you can capture a waypoint position either by taking an instant 'electronic fix' at your site of interest;
(2) by manually entering point coordinates; or
(3) by using the bearing and distance to get to a known position.

You will only use the instantaneous electronic fix option to capture waypoints while driving the boat along the edge of the eelgrass bed. The other two methods are more advanced procedures that will not be dealt with in this manual.

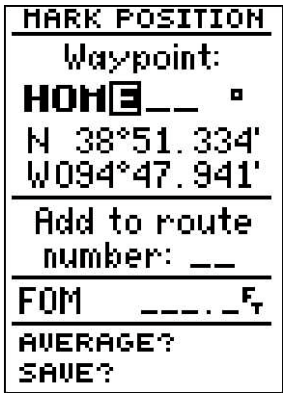
The Garmin 12XL GPS unit can hold up to 500 waypoints at any one time.

To capture a data point:

1. **Press the Mark** key. The Mark position page opens.

2. A default name and symbol for the point will be created automatically. You may wish to **Re-name the point**.

3. **Press Enter** to save the point.



To take a waypoint using the Garmin GPS:

- Press the **Mark** key.
- The mark position page will appear with your position location and a default three-digit name for the waypoint in the upper left side of the page.
- To save the default name and symbol, select **Enter** to confirm the "**Save**?" option.

To rename the waypoint:

- Highlight the waypoint name field, and press **Enter**.
- Enter a new waypoint name 'Edge'and press **Enter**. The waypoint symbol field will be highlighted.

You can change the waypoint symbol to a custom symbol type so you can easily recognize the symbol on your map.

- Highlight the waypoint symbol and press **Enter**
- Select a new symbol type and press **Enter**.
- Move the cursor to **Done**? and press **Enter**.

4.5.2. Position Averaging

The GPS 12XL averaging function will help to reduce errors ? selective availability has been eliminated now? the effects of the selective availability upon position error when marking a waypoint, providing more accurate saved positions.

After you have pressed the **Mark** key, highlight the **Average?** field and press **Enter**. The **Figure of Merit** (FOM) field will display a value reflecting estimated accuracy of the averaged position.

Note: as the GPS 12XL calculates FOM, it will rapidly change initially then begin to stabilize over time.

The unit will continue to average until you have highlighted **SAVE?** and press **Enter**.

To enter a different waypoint name, highlight the waypoint name field, and press **Enter**.

Input the new waypoint name and press Enter.

Averaging is a quick method to improve the accuracy of your GPS data points.

Remember the boat must be stable at each data point as you are averaging.

You must use your own discretion when deciding how long to stay at each data point. If you have a large eelgrass bed to map, you may only have 10 seconds or less over which to average. If you have a smaller eelgrass bed, you may be able to stay at each point for 30 seconds or longer. The longer you average, the more accurate and reliable your data points will be!

4.5.3. Way point pages

The GPS unit has three waypoint pages that let you quickly manage up to 500 waypoints. These pages, nearest waypoints, waypoint list and waypoint definition – can be accessed through the **Main Menu Page**.

4.5.3.1. Waypoints list page

The waypoint list pages, provides a complete list of all waypoints currently stored in the GPS 12XL and their respective waypoint symbols. The total number of empty and used waypoint locations in memory is also indicated. You can retrieve a waypoint definition, delete ALL user-defined waypoints, or review and select waypoints for navigation.

To delete all user-defined waypoints:

- Highlight **DELETE WPTS** and press **Enter**.
- Highlight **DELETE ALL** and press **Enter**
- Highlight **Yes** when prompted and press **Enter**.

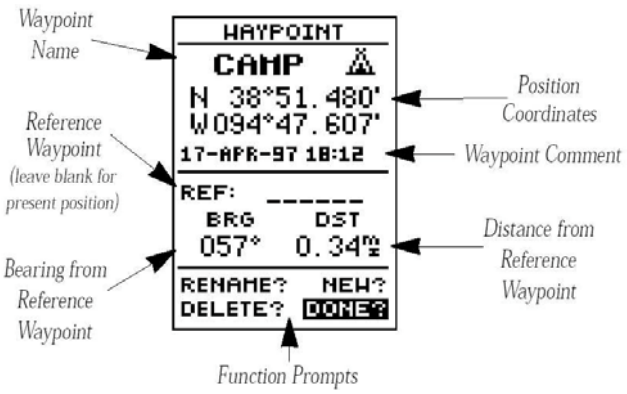
ALL waypoints will be deleted. ONLY perform this function after you have already downloaded and transferred your data from the GPS unit.

4.5.3.2. Waypoint Definition Page

The waypoint definition page lets you create new waypoints manually or review and edit an existing waypoint. Use this function if you have co-ordinate locations from a map or from another survey that you need to use.

To create a waypoint by entering coordinates:

- From the waypoint definition page, highlight **NEW**?, and press **Enter**.
- Enter a waypoint name and press **Enter**.
- Press enter to select a waypoint symbol, select the symbol of your choice and press **Enter**.
- Highlight the **DONE**? prompt and press **Enter** to return to the waypoint page.
- Highlight the position field, enter your position using the arrow keys, and press **Enter**.
- Press **Enter** to confirm the **DONE?** Prompt.



To delete a stored waypoint

- Highlight **DELETE** and press **Enter**.
- Highlight the **Yes**? prompt and press **Enter**.

4.5.4. Track Option

You can use the **Track** option to continuously record points along the edge of an eelgrass bed. This method is recommended as it is the most accurate of all the methods.

Highlight the **OPT** field on the **Map Page** and press **Enter**. Highlight **Track Setup** and press **Enter**. This will allow you to turn the track function on or off. Select **Record**, and then select a method to record. The options will be **Off**, **Fill** or **Wrap**. Select **Fill**.

You may want to clear the track log before you begin to record your initial track. From the **Map Page**, select **OPT**, press **Enter**. Highlight the **Track Setup** and press **Enter**. In the **Track Setup** page, select **Clear Log?** and highlight **Yes**. Press **Enter**.

Keep all the remaining fields in the auto or default settings.

To save a **Track** log route, copy Log Route 0 to an open storage route before starting another Track log.

5. GPS Data Download

To download data from the Garmin GPS you must connect the GPS 12XL to your PC computer using the interface cables provided.

5.1. Interface Setup

The Garmin GPS 12XL interface page allows you the select the format to connect the GPS 12XL to a PC computer. This will allow you to download waypoints from the GPS unit to your PC.

In the interface setup page, highlight the **I/O** (input/output) field and press **Enter**.

Select the **GRMN/GRMN** option. Press **Enter**.

Before downloading your GPS data, you can choose the option to download, install and start the Garmin GPS interface. This interface contains tools that will allow you to download and import your Garmin GPS data directly into ArcView.

If you are not utilizing ArcView to further process your data, use the methods above to download your data to a PC and then send the information to the appropriate data users.

5.2. Transfer Setup

The GRMN/GRMN will allow you to transfer the data to your computer. You must select the transfer name, Host.

- Highlight the transfer interface and press **Enter**.
- Select the HOST option. Press **Enter**.

5.3. Saving Data

When data is saved to your computer, save each data files using the following format.

5.3.1. Folder

<place>_<date>_eelgrass (i.e. saltspring_dec19_eelgrass)

5.3.2. Files

Waypoints_surveyname (i.e. Waypoints_boundarybay)

5.3.3. Where to send data?

Send data files to your GIS or mapping contact person within your organization. Or, send files to the CMN contact listed at the back of this manual.

1. Connect your Garmin to a PC.
2. From the Interface Setup, select the I/O field to equal GRMN/GRMN.
3. Select the Transfer Setup to equal Host.

You should now be able to download your data.

6. GPS Data Import: Garmin's DNR extension for ArcView

6.1. Introduction to Garmin's DNR extension

The Minnesota Department of Natural Resources created the DNR extension to allow users to transfer Waypoints, Tracks, and Routes from a Garmin GPS unit to ArcView and store them as Points, lines or polygons. Information can also be uploaded from ArcView graphics or shapefiles to the GPS and used as tracks or waypoints.

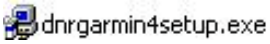
6.2. Obtain a copy of the DNR extension

To obtain a copy of the DNR extension, visit to following website:
http://www.dnr.state.mn.us/mis/gis/tools/arcview/extensions/DNRGarmin/DNRGarmin.html

Download a copy of the DNRGARMIN4.ZIP file.

Unzip the file in a local directory on your hard drive such as C: Temp.

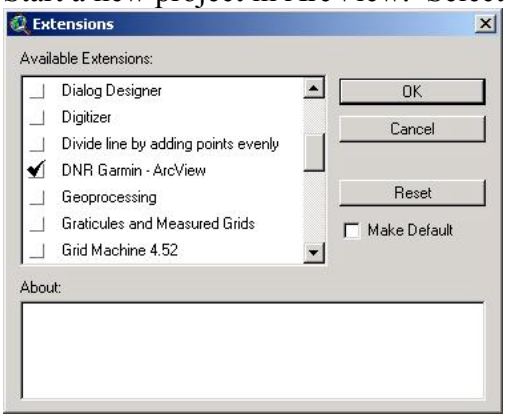
Double click on the dnrgarmin4setup.exe icon.



Follow the installation instructions.

6.3. Data Interpretation

Start a new project in ArcView. Select **File – Extensions,** select the DNR Garmin – ArcView extension by checking the box with your mouse. Press OK.



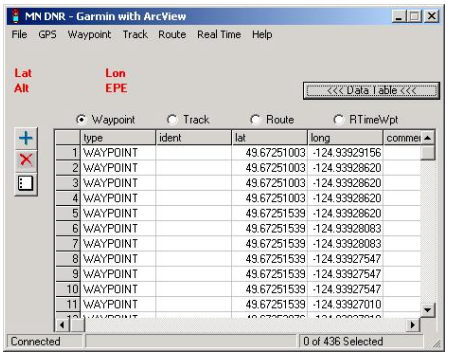
Open a new view in your ArcView project. You will see DNR Garmin pull down menu appear at the top left of the ArcView menu bar. Connect your GPS to your computer using a serial cable. Choose **Open Garmin GPS**. Ensure you have the right port selected by pulling down the **GPS** – **Assign Port** menu and choosing the port where the GPS is connected. If your Garmin is connected properly, you should see a message indicating the connection is successful.

If your Garmin is not connected properly, you will get this message.

You can use the MN DNR – Garmin with ArcView box to download the data directly from the Garmin 12XL unit. Select the **Waypoint**, **Track** or **Route** option, depending on what kind of data you have collected, and choose **Download**.

Ensure that your Garmin communication protocol is set to Garmin/Garmin in the Transfer Setup. This is explained in Section 4.0 of this manual

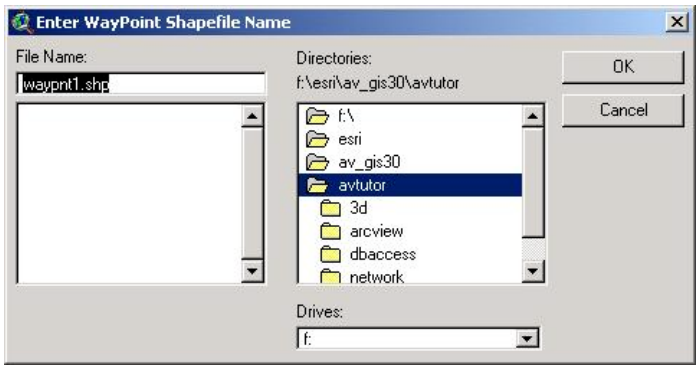
If you have already downloaded your data to the computer, you can select File – Load From, and choose File. You can then navigate to where you have your file saved.



Once the data has been downloaded, it will show up in the Table View of the MN DNR – Garmin with ArcView box. If the table is hidden, click on the Table button.

If necessary, you can edit your data in the Garmin Table View by double-clicking on the data fields and re-entering your data points.

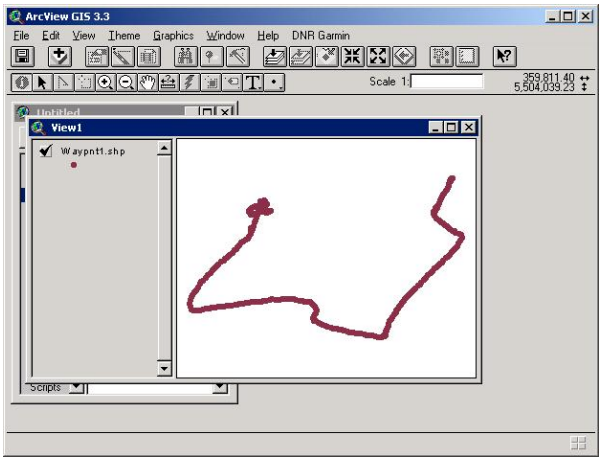
You can also add records or columns or delete records or columns by selecting either a row or a column and clicking the **+** or the **X** buttons. By selecting multiple rows or columns, more than one row or column can be deleted at one time.



6.4. Data export

You can then save your data points to ArcView shapefile format for import into ArcView.

From the File menu option, select Save To – ArcView - Shapefile. The Save box will appear, with the default name waypnt1.shp. You may Path to a new directory to save your file by browsing through directories, or by selecting a new drive. If you wish to change the default name of the file, highlight the **waypnts.shp** and type in a new file name. Press **OK**.

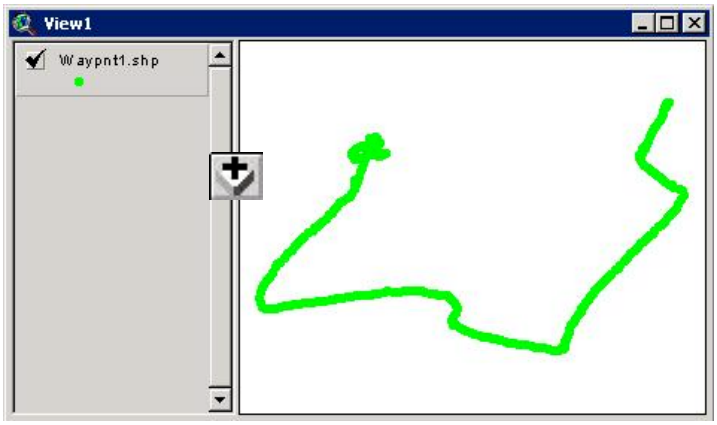


The file will automatically load into the ArcView Project View.

7. Eelgrass Mapping in ArcView

There are several important functions to know when mapping eelgrass data in ArcView. ArcView contains various tools that can assist you to review and edit your eelgrass data. Once the data has been cleaned, verified, converted and attributed, it is ready to send to your eelgrass contact.

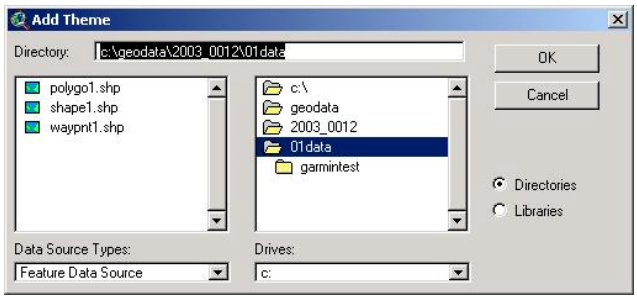
7.1. Importing/Uploading your data



Your **waypnt1.shp** file will be loaded automatically using the DNR Garmin extension tool. If it hasn't loaded automatically, click the **Add Theme**

tool, or under the **View** menu, select **Add Theme**.

Browse to where your waypoints file has been stored, and click to add it into the project view.

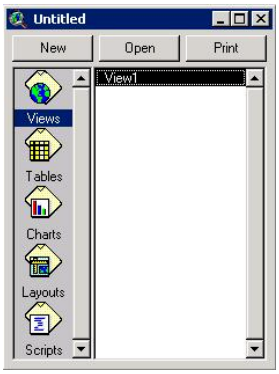


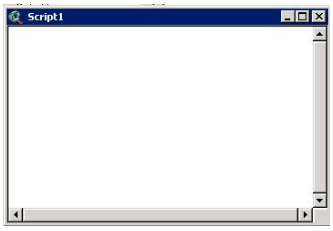
Now, turn the layer on.

The data points you collected should display.

7.2. Creating a Polygon from your data points

The next step is to create a polygon from your data points. First, you have to number your data points so that the **Create** polygon tool will know the order of your data set.

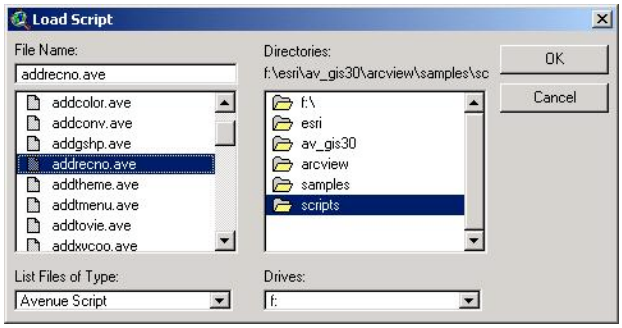




To number your data points, click from the **View** screen to the **Scripts** screen. Select **New** to open a new script editor. A blank script page will open. Click on **the Load Text** File button on the bar at the top of the script page.

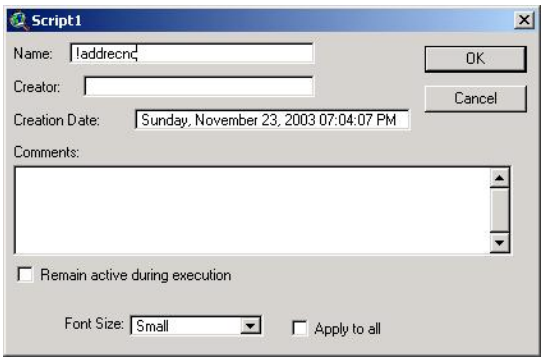
The **Load Text** File button looks like a little folder  opening.

Once you have the **Load Script** prompt box open, navigate to your ESRI/AV_GIS30/ ARCVIEW/ SAMPLES/SCRIPTS folder. Find the script called **addrecno.ave**. Add this script by selecting it and press **OK**.



7.2.1. Rename the Script

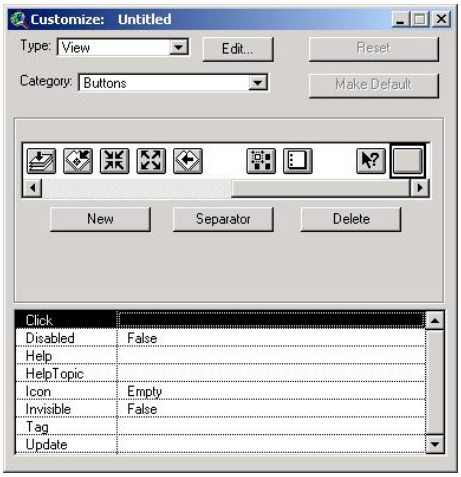
Under the **Script** pull down menu select **Properties** and in the **Name** box, rename the **Script** starting with an exclamation mark. For example, you could rename the script **!addrecno**.



Compile the script by clicking on the compiler button, the check mark.

7.2.2. Add the Script to Project

Select the **Customize** window option by double-clicking on the button bar. The **Customize** window will appear.

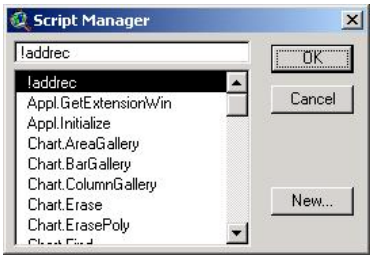


Under the **Category** pull down menu, select **Buttons**.

The buttons will appear in the window with a slider bar underneath.

Slide the slider bar over and highlight the last button in the menu bar. Then select **New**. A new button will be added.

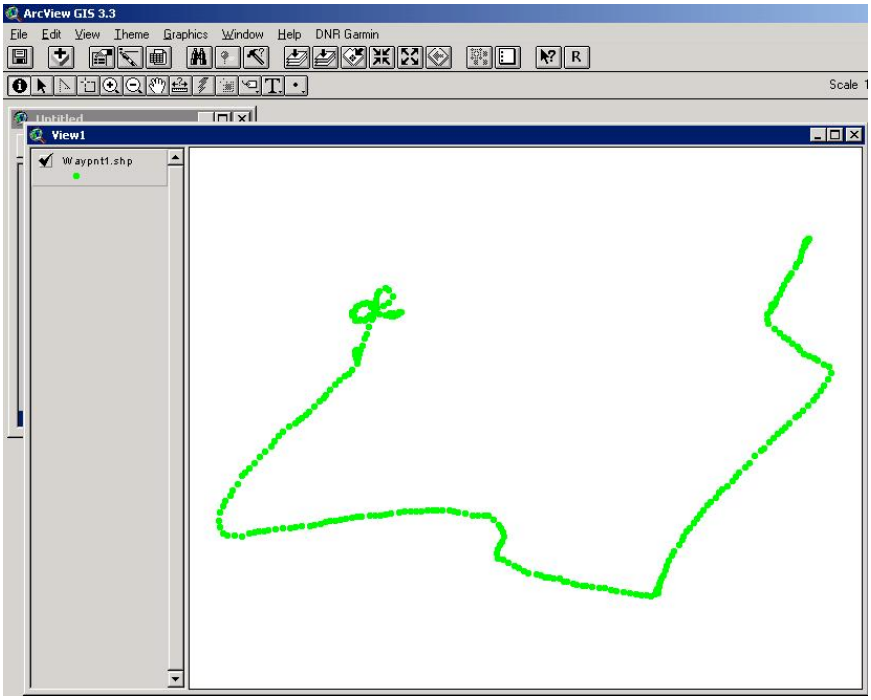
In the **Button Properties** definition box below, double-click on the **Click** option. A window of scripts will open.



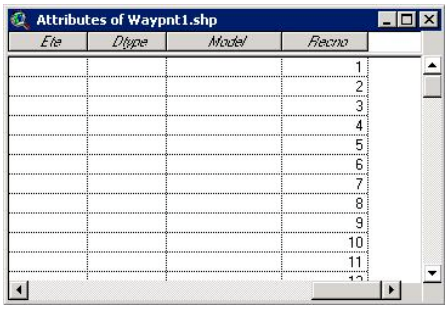
Select your script. It should be the very top script if you named it starting with an exclamation point. If you wish, assign an icon to your button by double clicking on **Icon**, and choosing an icon from the **Icon Manager** box.

When complete, close the **Customize** window. Your icon should display at the end of the button bar.

Now you are ready to run the **Add Record** number to your waypoints data file. With the Waypoints shapefile active (click on it, when it appears raised, it is Active), click on **the Add Record** number button you just created. The **Query** box will appear. You will be prompted "Add record number attribute to waypoint.shp?". Select the **Yes** option.

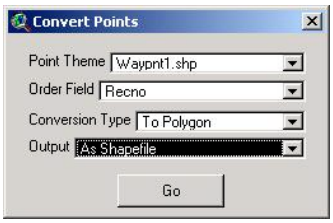


Open your data table, the recno attribute field will be added with numbers 1, 2, 3, 4…and so on to your data table.



7.2.3. Create a polygon from data points

You can now create a polygon from your numbered data points. Under the DNR Garmin pull down menu, select **Convert Points**. Make sure the Waypoints.shp file is active.



In the box, select **Order Field** equal to **Recno**, **Conversion Type** equal to **Polygon**, and **Output as Shapefile**. Click **Go**.

Save the new theme to a directory where you are storing your files.

Name the file as eelgrass_polygon.shp.

Close the **Convert Points** box.

The new theme will be automatically loaded into the project. Turn the new theme on.

7.2.4. Edit the new theme

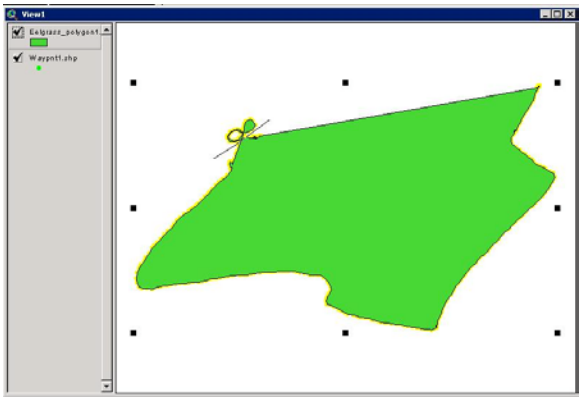
You may want to create a back-up your polygon data file before you start editing!

Depending on your data points, you may need to edit the polygon file. Under the **Theme** menu, select **Start Editing**. Now you can use your edit tools to cut the polygon shape, or use the node edit tool to adjust nodes.

7.2.4.1. Cut tool

In the picture below, the cut tool has been used to edit polygons, which are not part of the eelgrass bed. In this example, the boat handler was idling around while the GPS had already started collecting waypoints. To minimize editing time, try to collect waypoints only when you are on the eelgrass bed.

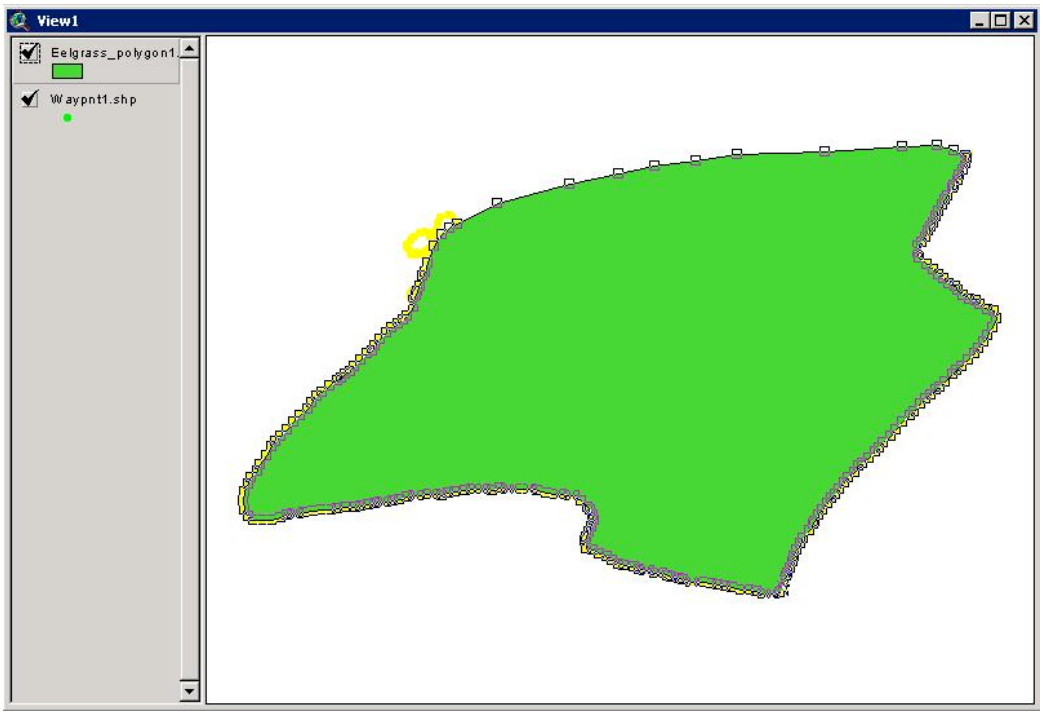
- Select the cut tool from the pull down editing tool bar (see right).
- Select the polygon that you wish to edit using the cut tool.



- Using the cut tool click at each point where you want to cut the polygon. Start and end the cut function outside of the polygon. Double-click to finish.
- Now both polygons are selected.
- Select the polygon you wish to delete.
- Press the delete key.

7.2.4.2. Node edit

Using the node edit tool, select the polygon you wish to edit. The nodes will appear (see figure below).



Select the node you wish to edit by hovering the mouse over the node. The node tool will turn to a cross-hair over each node.

Click and drag the node to its new location.

To delete nodes, hold the mouse over top of them (until you see the cross-hair). Press the delete key while holding down the mouse.

To delete sliver polygons, simply 'cut' them out using the cut tool. Delete the polygon that contains the sliver. Re-build features using the node edit tool.

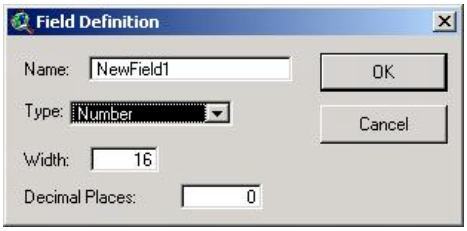
7.3. Editing your attribute table

Adding metadata to your polygon's attribute table will provide information about who collected the data, when it was collected, eelgrass type, and more.

You may want to save your edits during this process. Under the **Theme** menu, select, **Save** your edits throughout the process.

7.3.1. Add fields for metadata

In the table view, you should open the table for your polygon. Under the **Theme** menu, select **Start Editing**.



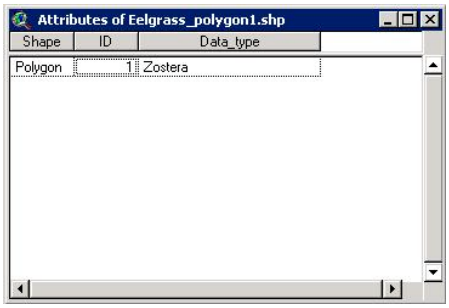
You will only have two fields in your attribute table, Shape and ID. Under the **Edit** menu, select **Add Field**.

Add the following fields (in blue) to your attribute table. The other fields in the table below are for your information, and not to be added to your attribute table. Information in the table can be provided in abbreviated format. Full names must be used in the readme file to accompany field data.

Field Name	Description	Example	Field Type	Width	Decimal Places
Data_type	Eelgrass Type	*Zostera*	String	50	--
Field_coll	Field collector (person and/or organization)	*K. Bennett*	String	50	--
Date	Date field data collection	*12-06-2003*	Date	20	--
Location	General location of survey	*Boundary Bay*	String	50	--
GPS Type	Type of GPS used	*Garmin 12XL*	String	30	--
Technician	Technician who processed the data	*K. Bennett*	String		--
Process_date	Date of data processing	*12-09-2003*	Date	20	--

7.3.2. Fill attribute fields

Once you have created all the necessary fields, fill in your data fields with the pertinent information. To input data, use the text edit tool.



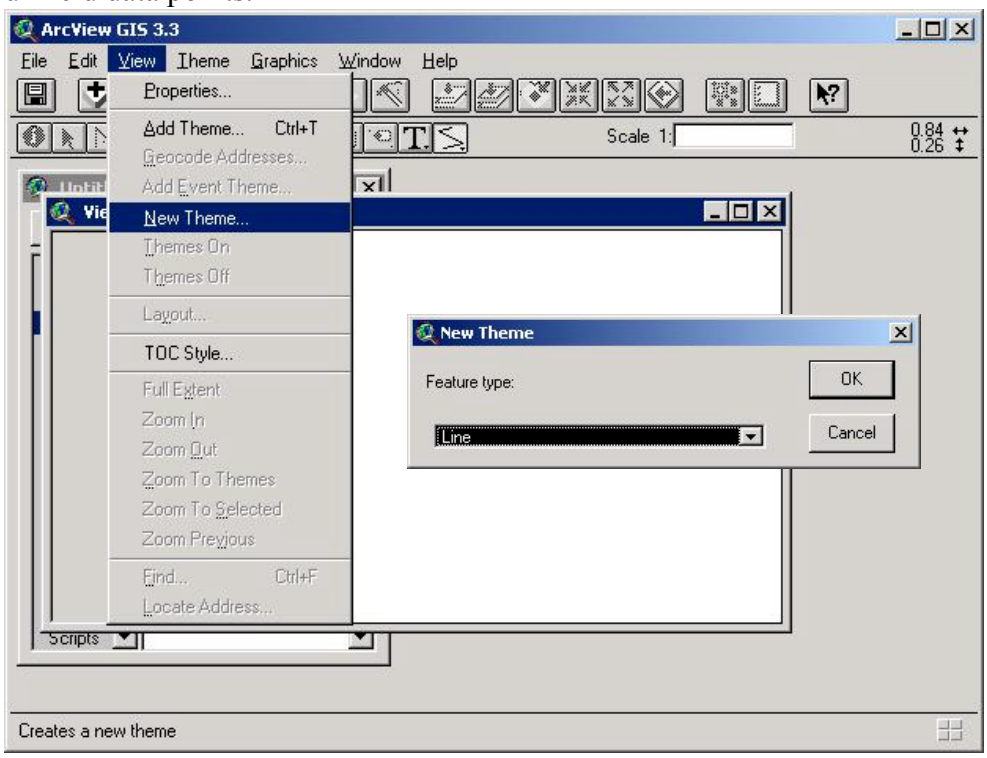
To use this tool, select it. Once it is selected, it will appear depressed.

Once you have the text edit tool selected, you will be able to enter text information into your attribute table. Use the mouse and click in the attribute box. You will see a text cursor appear. You may now type metadata into this box.

Once you are finished, select **Stop Editing**. Save your edits.

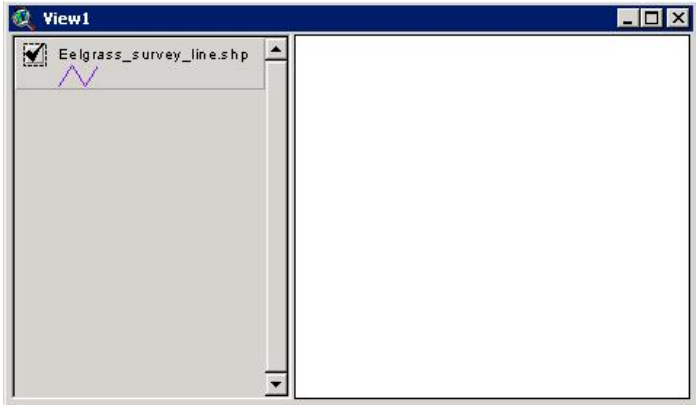
7.4. Creating a new line or polygon in ArcView

You may want to create a new shapefile line or polygon to depict your eelgrass beds or other features you have you captured during your survey. Import the data you have collected in the field (Section 6.0), and follow the instructions below to simply trace a new line or polygon over top of your field data points.



In ArcView, under the **View** pull-down menu, select the **New Theme** menu option. You will be prompted to select either a new point, line or polygon theme.

Select the theme type you wish to create. Save the theme in folder to a unique name. The theme will be added to the project view and will be ready to start editing.



Use the line tool or the polygon tool to create the new line/polygon feature. When you have finished drawing the new feature, double click to end the editing of that line segment. Continue adding lines until you have finished adding all the elements of your feature.

Under the **Theme** menu, select **Stop Editing**. Save your edits.

8. CMN website: Eelgrass Bed Mapping Atlas

You can use the eelgrass bed mapping atlas available at www.cmnbc.ca to map out data point, creates lines and polygons for your single points, or upload data from ArcView and add to the Atlas.

There are several ways to add data, however we will primarily use the add GPS data points function. After you have added your data points, you can proceed to creating lines or polygons based on the GPS data points you collected in the field.

First, you will require a password to log into the CMN website and use the eelgrass mapping tools. Contact the CMN representative listed in the Contacts section of this manual.

Once you are at the CMN website, select the Eelgrass Bed Mapping Atlas. Log in using your user name and password.

For first time users, we recommend that you read the help pages "How to use the Eelgrass bed mapping application". These help pages are available from the main menu under the Help button.

Zoom into the area of the coast where you were mapping using the zoom tool. Click and drag over the area you wish to zoom into and release. The map will zoom in.

Select the **Data Entry** button. A suite of tools will pop up. Use the pull down menu **Select Feature Type to Digitize** and choose **GPS Point**.

You will be able to enter coordinates based on your field collected GPS data points.

Once you have entered all your data points, then you can proceed with connecting the data points to make a polygon. Use the eelgrass bed function to create a **Polygon** from your data points.

In the case where you have captured eelgrass along a shoreline, you could select the **Shoreline** (line) option to digitize the shoreline where the eelgrass was mapped along.

In the case where the eelgrass was found in small patches less than 10m by 10m, you may have just captured one data point. Just leave these data points as point data.

Where you have found eelgrass in linear patches, use the line tool to connect the data points that you mapped.

Once you have completed your data entry, you can use the **Add Attributes** or **Source** buttons to fill out fields that contain information on eelgrass bed attributes, information and metadata to complete your eelgrass survey report.

Note that the data entry tool is in UTM coordinates system. Therefore, if you have not collected your data in UTM, you will have to convert your data points into a UTM system.

You can also choose to add an ArcView shapefile, point or line file directly to the Eelgrass Mapping Atlas. Stay tuned for directions on this feature!

9. Contacts

Community Mapping Network Contact:

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