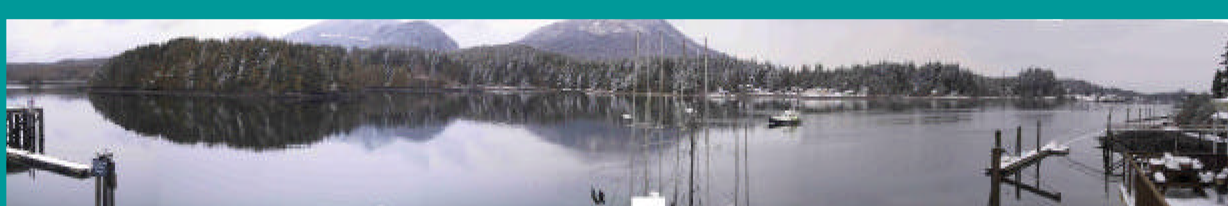
Ucluelet Harbour Project

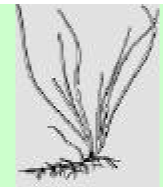
Report on the Biological Inventory of the Harbour:

Eelgrass Survey, District of Ucluelet Foreshore

Submitted to the Department of Fisheries and Oceans, in fulfillment of the requirements of the contract
 # F1103 -1-0029

March, 2002





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A. Suski
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Acknowledgements

The Ucluelet Harbour Project is a collaborative effort between communities around the harbour. However, several people require recognition and thanks for their contributions to the biological inventory:

Firstly, Gerry Schreiber has been the principal diver for the project. He has spent many cold hours snorkeling in the icy harbour waters this winter to map the boundaries of the eelgrass beds. Without his efforts and assistance this project would not have gotten off the ground (and into the water).

Ornella Cirella dedicated many hours conducting a literature search on eelgrass and inventory methodologies. She also conducted a SCUBA survey in the northern area of the harbour.

Leila Hanslitt assisted us with GPS field surveys. Mark Johannes (Northwest Ecosystems Institute) provided us with map base information and has been a valueable technical advisor.

I'd also like to thank Brad Mason, Cynthia Durrance and Nikki Wright for their efforts to map and conserve eelgrass habitat across the province.

Central Westcoast Forest Society: Len Dziamma and Adam Coronica did a great job of administering the DFO contribution dollars. As always, their skills and effort are much appreciated.

And finally, a big thank-you to Sean Mcconnachie for sitting as the DFO representative on the UHP Steering Committee and assisting us through support and funding with the initiation of this inventory!

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1.0 Introduction

Ucluelet Harbour Project (UHP):

The Ucluelet Harbour Project (UHP) represents a partnership of the communities and First Nations around the Ucluelet harbour. The vision of the UHP is to ensure "a healthy and sustainable working harbour". The project started with a "clean-up" that resulted in 280 tons of garbage being removed from the harbour. A biological inventory was initiated over the winter, the information collected on sensitive habitats and species will assist in planning and development around the harbour. This report presents the results of the first few months of this inventory and mapping work.

This inventory addresses the following objectives in the UHP Community Action Plan:

Goal 2: Improve and Protect Habitat Quality While Maintaining a Healthy and Sustainable Working Harbour

Objective 2A. Inventory and map shoreline and aquatic habitats and conditions.
Objective 2B. Identify, assess, and rate ecologically valued portions of the harbour.

Goal 5: Monitor Environmental Quality so That we May Guage Our Progress Towards a Healthy and Sustainable Working Harbour

Objective 5A. After Identifying the critical and/or important habitats within the harbour, implement a long term monitoring project for these areas.

(**Please refer to Appendix A for a list of the UHP Goals and Objectives*).

Location

The Harbour is located on the west coast of Vancouver Island, BC, and is in the traditional territories of the Ucluelet and Toquaht First Nations. The harbour is approximately 7 km long. At is mouth it is roughly a half a kilometer across, at the back it widens to ~1.5 km. There are over 20 km of shoreline in the harbour. Over one third is in the Municipal District of Ucluelet (pop ~1800), about one quarter is in Ucluelet First Nations reserve (Ittatsoo). The remainder of the shoreline is in Area C of the Regional District of Alberni Clayoquot (which includes the sub-divisions of Millstream and Port Albion) (Figure 1).

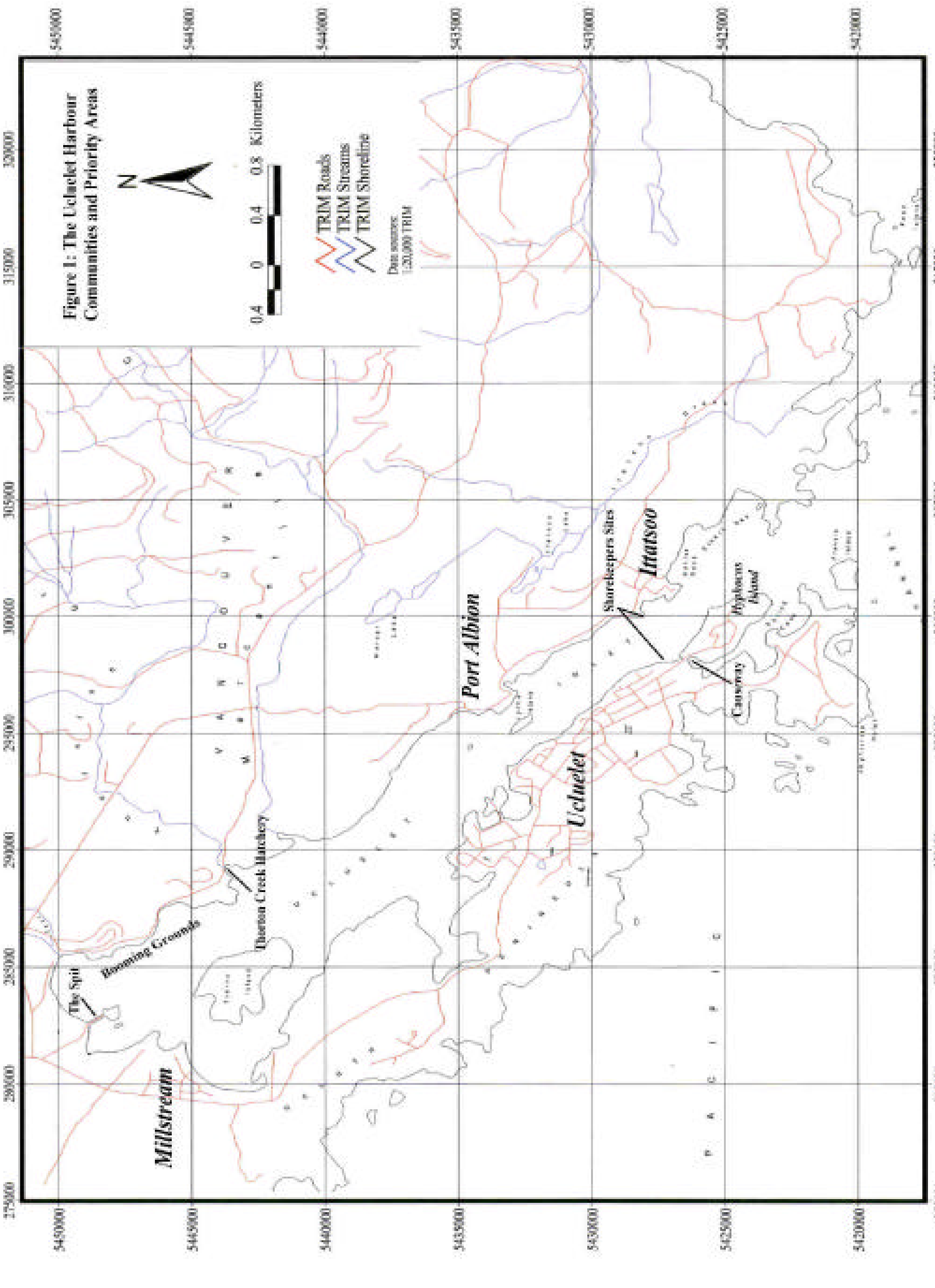
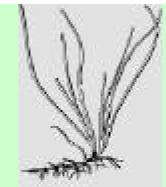


Figure 1: The Ucluelet Harbour Communities and Priority Areas
N
0.4 0 0.4 0.8 Kilometers
TRIM Roads
TRIM Streams
TRIM Shoreline
Millstream
The Spit
Booming Grounds
Thornton Creek Hatchery
Port Albion
Ucluelet
Itatsoo
Shorekeepers Sites
Causeway



Selecting Priorities for the Biological Inventory: Eelgrass

As a community project with limited funding we are restricted in the amount and scope of the work we can carry out. Therefore, in this initial stage of the inventory, we selected a cost effective strategy for conducting a biological inventory of our harbour. We focused our mapping efforts on critical habitats, the foremost of which are eelgrass beds. The funding contribution from DFO was instrumental in our being able to begin our biological inventory. We matched this contribution with in-kind donations of time, equipment and money (Appendix A).

Importance of Eelgrass

Eelgrass provides critical shelter and habitat for numerous species including: out-migrating juvenile salmon (*Oncorhynchus spp*.), Pacific Herring (*Clupes harengus*), Dungeness crab (*Cancer magister*), and black brant (*Branta bernicla*) (Norris & Wyllie-Echeverria, 2001). In addition, crustaceans use the eelgrass beds as protective nurseries and to hide from predators. Shedding crabs conceal themselves in the vegetation until their new shells have hardened. A variety of organisms [e.g., barnacles, bryozoans (a group of colonial invertebrates)] and eggs of many species attach directly to the leaves. Some research estimates that close to 70% of commercial fish species rely on eelgrass habitat at some stage in their life history (Durrance, pers comm. 2002).

Eelgrass habitat is of such importance to the sustainability of commercial (and non-commercial) fish stocks that it is protected under the Fisheries Act. The "No Net Loss" policy prohibits destruction of this important fish habitat.

Although only a few truly aquatic species consume the living plants (e.g., some species of fish), several types of waterfowl and small mammals rely on them as a major portion of their diet (e.g. Trumpeter swans). Even in death, the plants are a major estuary component. Eelgrass beds form huge quantities of decomposed matter as leaves die; several aquatic species use this detritus as a primary food source.

Research in Denmark discovered that detritus, primarily from eelgrass, was the basic source of nutrition for animals in coastal waters and that the historic abundance of fish in Denmark was mainly due to eelgrass (Phillips, 1983). The sheer bulk of the plants often buffers the shoreline and minimizes erosion by dampening the energy of incoming waves. Plant roots bind the sediments on the estuary bottom and retard water currents. By minimizing water movement, SAV allows suspended sediments to settle and water clarity is improved. The root –rhizome network forms an interlocking matrix, which binds sediments and restricts erosion (Phillips, 1983).

A study by Helfferich and McRoy in 1978 calculated that the U.S. dollar value of eelgrass meadows to be $12,325.00 per acre per year based on it contribution to commercial and recreations fishing and hunting.

The governments of many countries including the United States, Australia, South Africa and Britain have recognized the value of seagrass habitat and have implemented seagrass mapping and monitoring programs. These programs involve locating and mapping seagrass communities, usually through analysis of arial photos, followed by detailed monitoring of specific sites on the ground. The costs associated with these kinds of inventories is cost prohibitive in British Columbia at this time (Precision Identification, 2002).

Impacts on Eelgrass

Land use changes and development have led to the loss of eelgrass habitat in BC. Agriculture forestry, and dredging for commercial and residential development have all contributed to the loss. It is anticipated that the pressure to modify natural estuarine habitat for the development of commercial facilities and residential units within coastal areas will intensify in the near future. It is therefore necessary to identify, classify, quantify and develop a scientifically defensible management strategy for estuarine habitat in order to protect and maintain these valuable areas (Precision Identification, 2002).

In Chesapeake Bay, a submerged aquatic vegetation study identified a link between decreased productivity in the bay and degraded water quality caused by upland activities (shoreline development, agriculture etc.) (Orth and Moore, 1983). The data was used to enact legislation to restrict activities responsible for the impairment of water quality, which was successful in reversing the trend of vegetation loss (Dennison et. al., 1983).

We are unsure of the historical levels of eelgrass in the Ucluelet Harbour. Historical log booming, dredging, shoreline modification & development, and nutrient inputs (sewage and boat bilge) may have contributed to a decline from original levels. However, through identification and appropriate resource management we may be able to stabilize the amounts remaining.

Species

There are two species of eelgrass in in British Columbia; the native species *Zostera marina* and the introduced species *Zostera japonica*. It is believed that *Zostera japonica* was accidentally introduced with oysters from Japan to aquaculture sites in Washington State (Harrison, 1976).

The *japonica* is generally smaller (and thinner) than the native marina species. The introduced *Zostera japonica*, cannot out-compete the native marina species, but due to it ability to withstand exposure to air longer can coexist on the same beaches albeit in higher areas in the intertidal (Precision Identification, 2002).

The two can be easily distinguished in their mature form. The two species have two different kind of sheaths. *Z..marina* has an entire sheath; if the lower leaves are pulled in opposite directions the sheath will tear. The sheath of *Z. jaoponica* is composed of two overlapping flaps; thus the sheath parts rather than tears when stress is applied (precision Identification, 2002). In general, the blades of the *Zostera japonica* are much thinner that the *Z. marina* (2mm vs 10mm) (Harbo,1999).

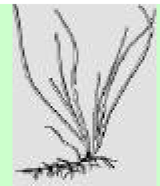
Eelgrass Ecology

Figure 2. Eelgrass, *Zostera marina*

Eelgrass is the dominant seagrass in the cooler temperate zones of the Atlantic and Pacific coasts. Beds of this plant survive in a wide range of salinities throughout these regions, but occur mainly in high salinity waters (18-30 parts per thousand-ppt) (Chesapeake Bay Program Web site). Flowing and elongate like an eel, the slender leaf blades grow up to several feet in length.

Eelgrass spreads by sending out runners that creep along the bottom and repeatedly send up shoots that grow into new plants. The species produces tiny, rather inconspicuous flowers and seeds that appear on large and easily distinguished branching stalks. New plants take several years to reach maturation. Once a bed becomes established, however, this species of seagrass is highly productive.

In this area, eelgrass beds are the primary component of the group of plants referred to as **submerged aquatic vegetation (SAV)**. SAV forms the critical link



between the physical habitat and the biological community. The plants require specific physical and chemical conditions to remain vigorous. In turn, they stabilize sediments and provide habitat, nourishment, and oxygen to other species in the estuary. A viable and self-sustaining SAV population is the hallmark of a healthy estuary/harbour (in estuaries/harbours that naturally support SAV).

SAV habitat requirements are as follows (adapted from Bergstrom, 1999):

Adequate Light Penetration: SAV can grow only in those portions of the estuary shallow enough and clear enough to receive sufficient sunlight for photosynthesis. The plants tend to grow in shallow water, but may grow in deeper areas where the water is particularly clear.

Water Inundation: SAV species primarily live in areas where the plants will remain submerged; however, some species can withstand exposure during low-water periods (e.g., *Zostera japonica* at low tide). A large tidal range may limit SAV growth (i.e., prolonged exposure during low tide and inundation by deep water during high tide, especially when the water is cloudy, can make for undesirable habitat conditions).

Suitable Salinity, Temperature, and Sediments: The salinity, temperature, and sediments of a particular estuarine location determine, to a large extent, which species can survive. While some species tolerate a fairly wide range of salinity, others are restricted to very specific levels.

Low to Moderate Wave Action: Heavy waves impede SAV roots from getting established. Some water circulation is desirable, however, to prevent SAV from becoming choked with algae.

In a balanced and healthy estuarine ecosystem, SAV species blanket the shallows with the composition of each bed attuned to controlling variables such as light availability, sediment, salinity, temperature, and depth. When an estuary/harbour is tipped out of balance, however, SAV beds usually suffer. The degradation or loss of these beds can set up a chain reaction of ill effects that ripples through the entire estuarine ecosystem.

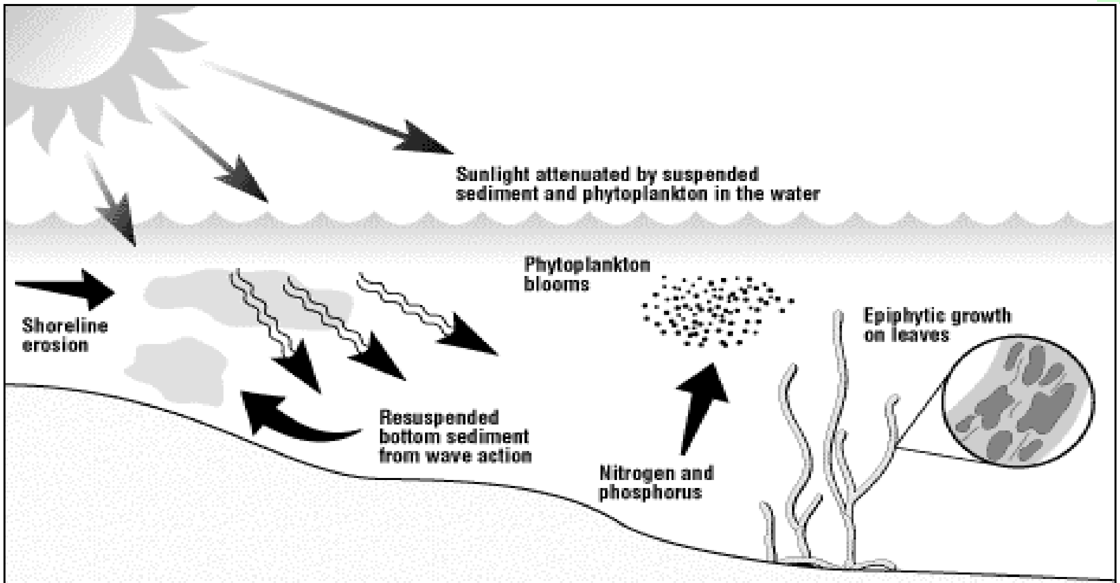
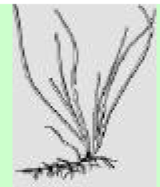


Figure 3. *Impacts on SAV. Sediments, nutrients (and accompanying algal blooms), and epiphytic growth can ultimately affect the amount of sunlight reaching the plants (adapted from Barth et al., 1989).*

Runoff from different land uses and dredging activities can cloud waters over acres of SAV beds with sediment. Agricultural and lawn herbicides may cause a loss of some species, while industrial pollutants and foraging animals may selectively kill off local beds. Areas frequently subject to improper shellfish harvesting, boat-generated waves, and boat propeller scarring may also lose their SAV beds.

By monitoring the occurrence of eelgrass beds and the changes in their distribution, density, and species composition, we can determine the health and status of SAV in our harbour.



2.0 Methods

Methods for Mapping Eelgrass in the Ucluelet Harbour

We tested several different methods for mapping eelgrass including: using SCUBA gear, snorkel gear, kayak surveys, and zodiac surveys. We found that snorkel surveys at low tide were the most efficient and effective method in the Ucluelet harbour, and yielded the best mapping data.

We focused our initial efforts on the foreshore areas of the District of Ucluelet.

The methods we used required a team of two people. One person walks along the upper edge of the eelgrass bed and collects GPS location readings at various points (we used a Garmin hand held unit, +- 5m accuracy). The second person snorkels in the water and measures the width of the eelgrass bed and the depth at the lowest point.

We collected the following information:

a) the location of the eelgrass beds (GPS survey of upper boundary with measurements to the lower boundary perpendicular to shore).
b) the distribution of eelgrass (the size of the beds, extent of shoreline covered)
c) the depths at which the eelgrass is growing (especially the lowest depth).

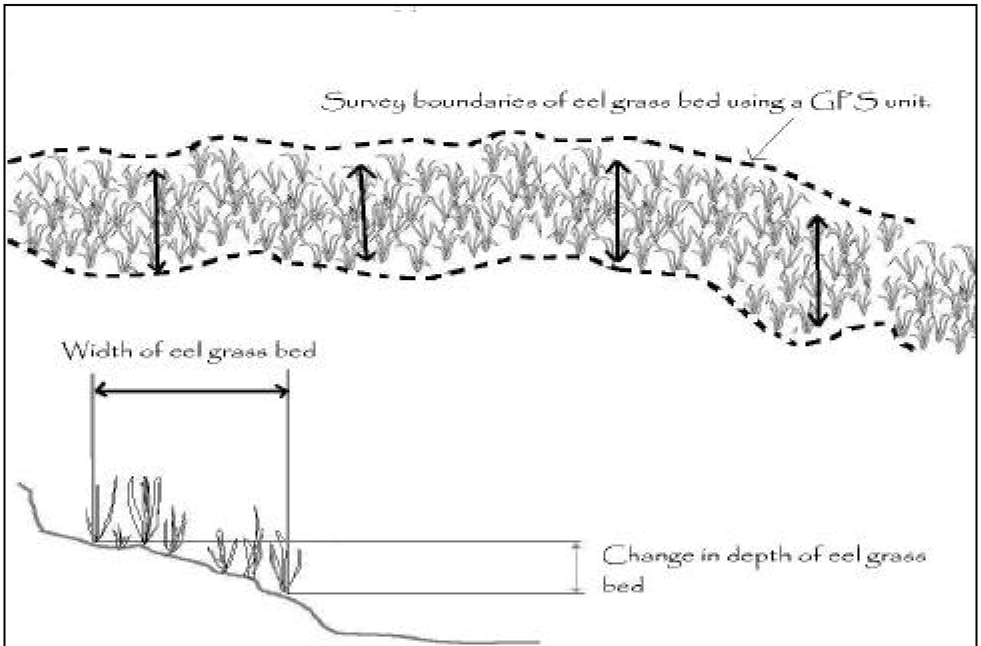


Figure 4. Features of Eelgrass beds that were mapped or

Figure 5.

An Eelgrass survey at low tide in the Ucluelet Harbour.

The surveyor in the water (wearing snorkelling gear) holds a measuring tape to determine the width (perpendicular distance from the shore) of the band of eelgrass, and uses a 5m measuring stick to determine the maximum depth of the lower edge.

The data was entered into database/spreadsheets (Excel) and mapped using Arcview 3.2a GIS software. The maps are available in digital format and in hard copy (as attached to this report).

3.0 Results

We collected data on eelgrass distribution for the foreshore of the District of Ucluelet (Figure 6). Detailed information on eelgrass distribution is presented in four larger scaled maps.

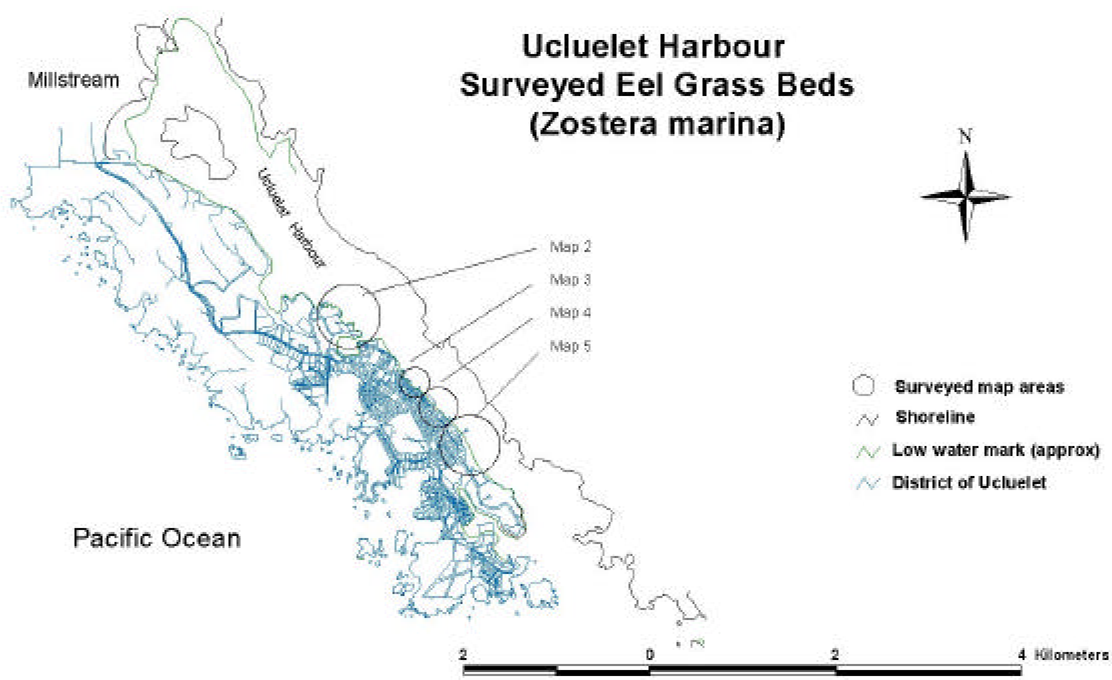


Figure 6. Locations of eelgrass surveys in the Ucluelet Harbour, Jan-Mar

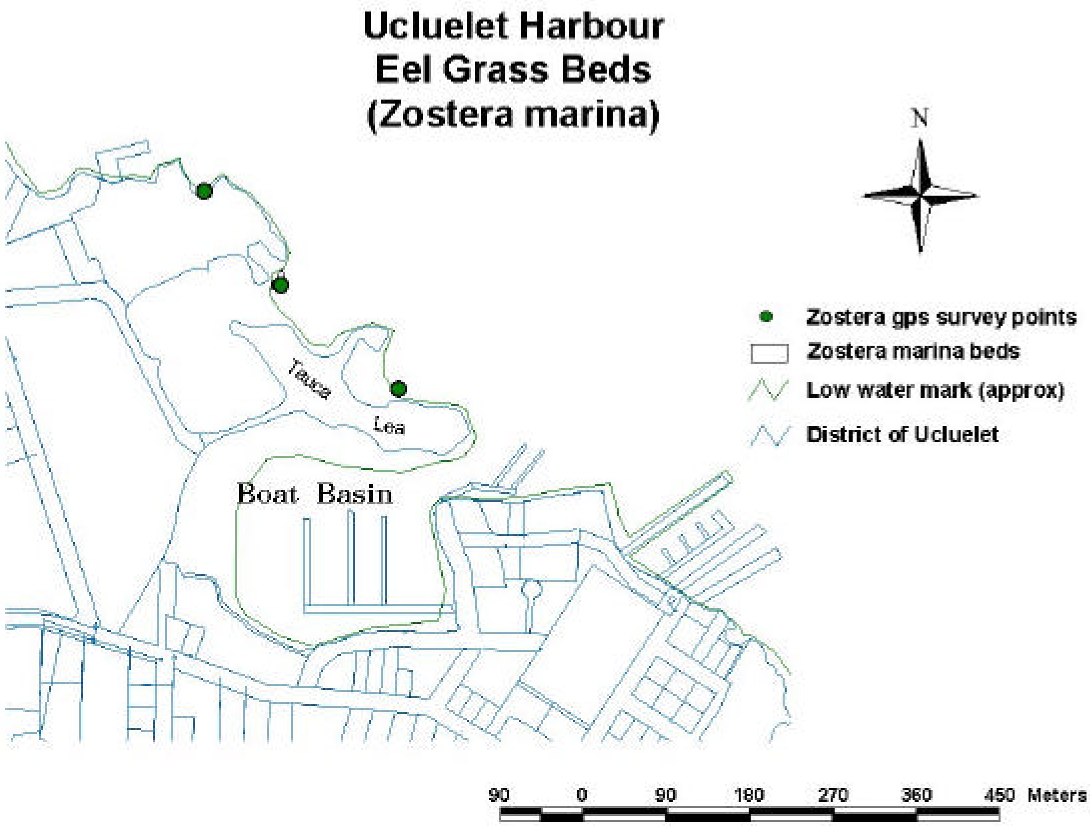


Figure 7. Map 2: Locations of eelgrass in the Boat Basin area of the District of Ucluelet foreshore. March 2002.

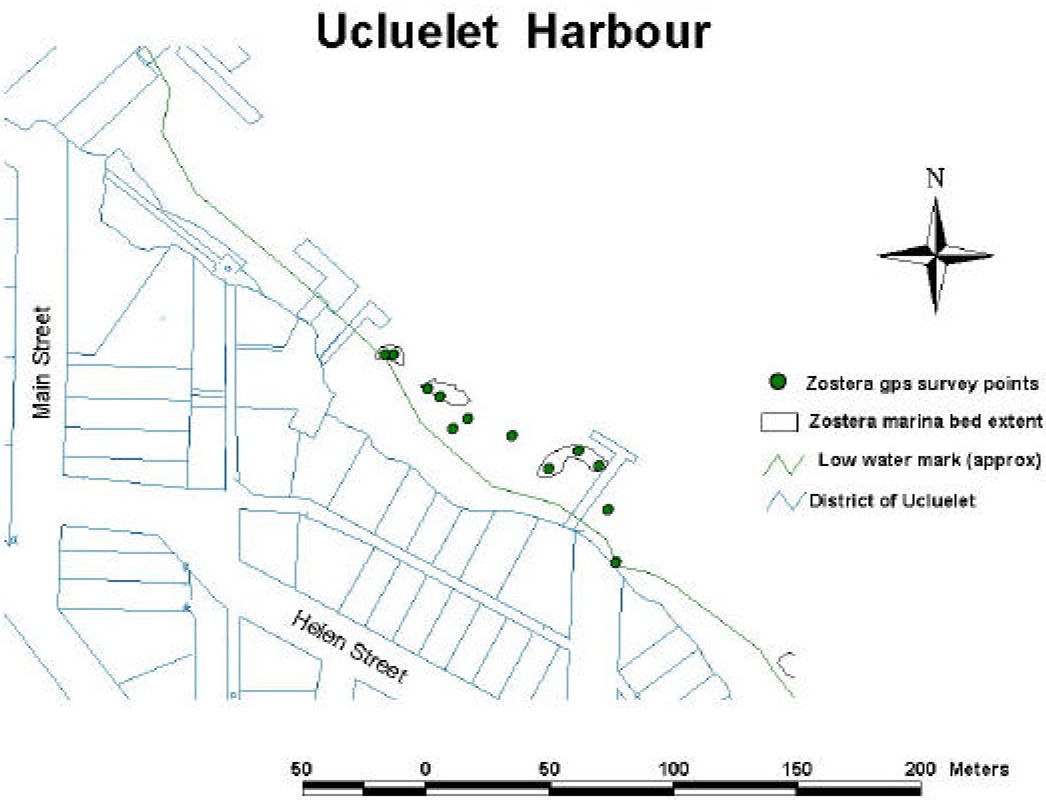


Figure 8. Map 3: Locations of eelgrass in the "Main dock/Whisky dock" area of the District of Ucluelet foreshore. March 2002.

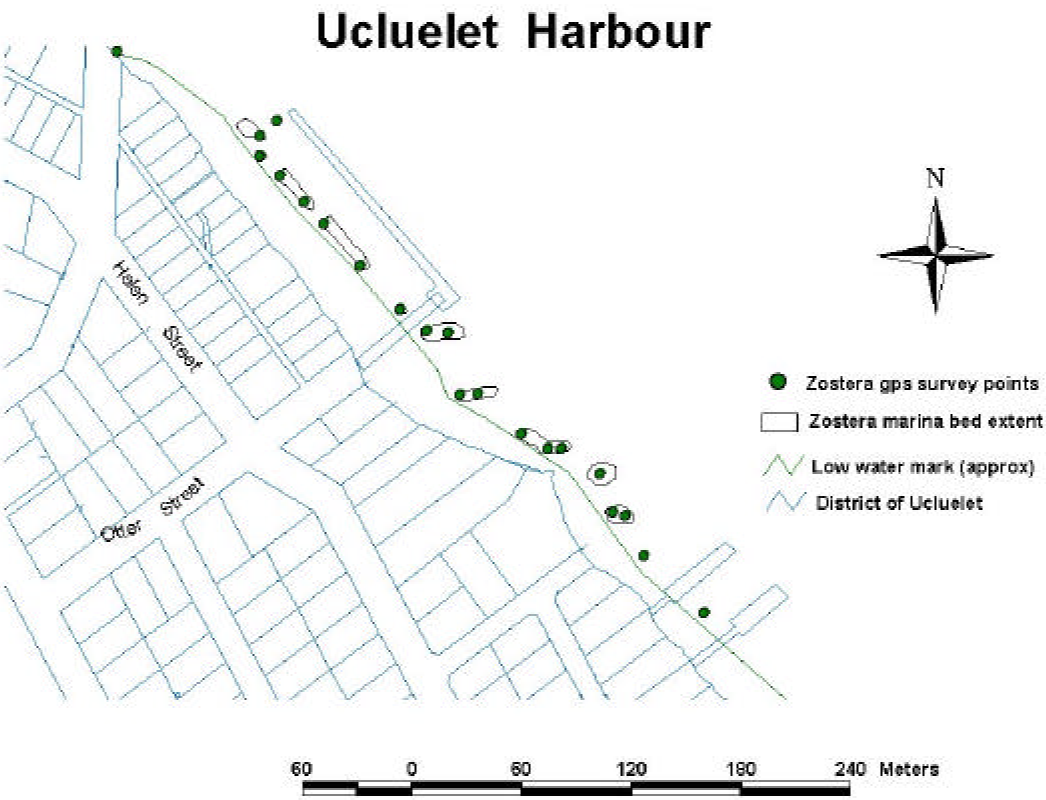


Figure 9. Map 4: Locations of eelgrass in the "52 Step dock" area of the District of Ucluelet foreshore. March 2002.

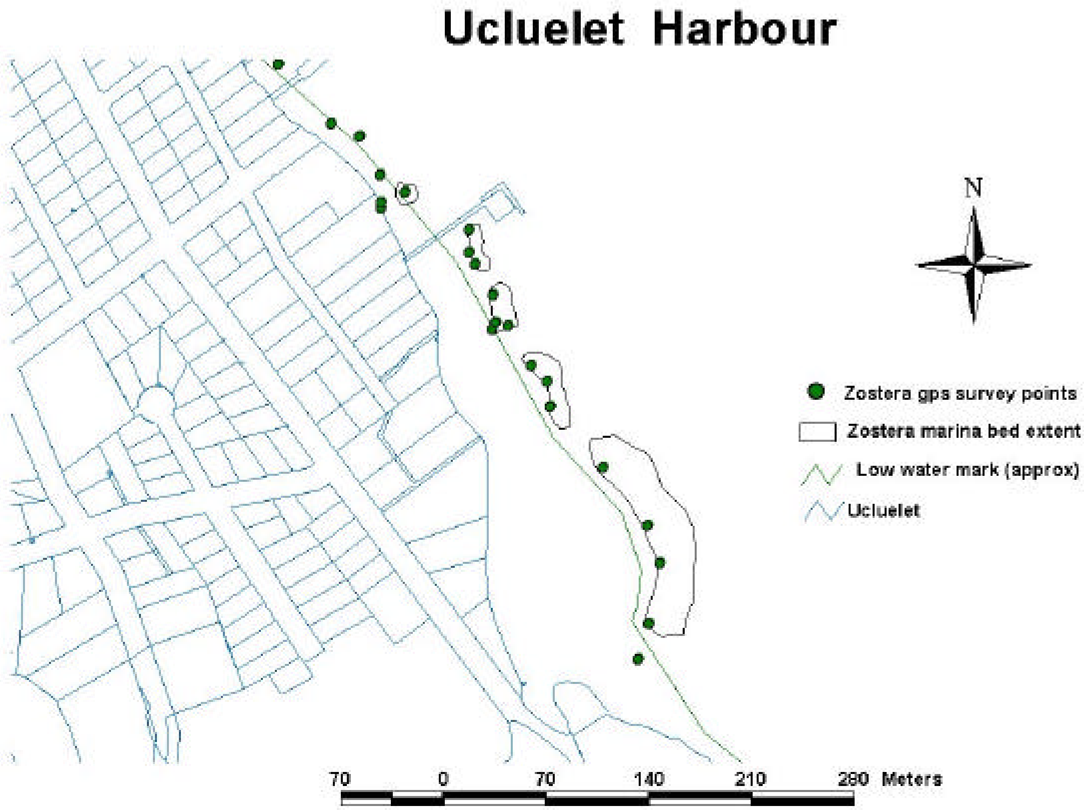
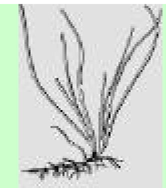


Figure 10. Map 5: Locations of eelgrass in the "PetroCan dock/Hyphocus causeway" area of the District of Ucluelet foreshore. March 2002.



Conclusions and Future Work

In the Ucluelet Harbour the most efficient and cost effective method of mapping eelgrass is conducting snorkel surveys at low tide. Some of the larger beds at the back end of the harbour may be more efficiently surveyed by kayak. However, the kayak method has two drawbacks; a) sunlight reflecting off the water makes it difficult to see into the water and thus to see eelgrass, and b) it is difficult to remain in exact position in a kayak thus making mapping of the eelgrass beds less accurate.

Our data from the foreshore of the District of Ucluelet indicates that there is still a considerable presence of eelgrass along the subtidal areas of the harbour. Towards the mouth of the harbour there are wide patches (60m +) where the slope is gradual. The eelgrass that is distributed among the docks, pilings, and developed areas of the District of Ucluelet shoreline tends to be in narrow bands (<15m) that are patchy and sparse. In these areas the majority of the patches are less than $10m^2$ in area. Many are less than $5m^2$. There are scattered patches of $\sim 1m^2$. The narrowness of the eelgrass beds can be explained by the steeper slope of the shoreline. The patchy-ness of the eelgrass may be due to shoreline modifications (dredging etc) or could be due to sediment disturbance from boat wakes (many large commercial fishing vessels come into the Ucluelet harbour to offload fish, and load up with ice and fuel).

The preliminary stem counts for eelgrass beds in the area of the “52 Steps” dock ranged from 20-40 stems per meter. This density is lower than in other estuaries on the east side of Vancouver Island where stem densities can be >100 stems per meter (Precision Identification, 2002). However, in the Ucluelet area stem counts may increase in the quieter parts of the harbour. We will be mapping these areas later this summer. At that time we can collect stem counts for comparisons.

Our current eelgrass maps will be sent to the District of Ucluelet municipal planning department and will assist in decision making for development around the harbour.

Having developed our eelgrass mapping methodology in accordance with the Eelgrass Conservation Working Group methodology we can also contribute the data we have collected to the provincial eelgrass mapping data base. This spring and summer we will continue to use this methodology to map the remaining areas of the harbour.

Our communities are thankful for the opportunity to have been able to initiate this inventory. The data will prove valuable in the future not only for local planning but also on a provincial level where we hope it will contribute to the broader understanding of eelgrass ecology in B.C.

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Appendix A

In-kind contributions to the eelgrass surveys:

Item	$ Value In-Kind
Volunteer Time: Coordinator A.Suski, Regional Aquatic Management Society (20 days @ $200.00/day)	$ 4000.00
Snorkel equipment (15 days @ $ 40.00/day)	$ 600.00
Scuba Diving Equipment (6 days @ 50.00/day)	$ 300.00
Kayak rental (plus all equipment) (2 @ $75.00/day)	$ 150.00
GPS use (15 days @ $25.00/day)	$ 375.00
Tape measures, compasses	$ 100.00
Digital camera use (4 days @ $50.00/day)	$ 200.00
Purchase of DO meter	$ 1200.00
Transportation to sites	$ 50.00
Office space (3 months @ $200/month)	$ 600.00
Computer use (3 months @ $100/month)	$ 300.00
Mapping base data (CSIM data, High water marks, etc., from Northwest Ecosystem Institute)	$ 2000.00
Total In-kind Contributions	$ 9875.00

Appendix B. Goals and Objectives of the Ucluelet Harbour Project

Goal 1: Promote Education and Awareness to ensure a Healthy and Sustainable Working Harbour

Objective 1A. Develop a communications plan and promote community awareness of the Ucluelet Harbour project.

Objective 1B. Act as the collection agency for information and as a distribution office to ensure that the communities have access to the best information on environmentally sound practices around their home businesses.

Objective 1C. Establish effective lines of communication and coordinate activities with community groups and main regulatory agencies.

Objective 1D. Promote environmental education activities in the harbour and promote wide community participation in the actions to clean up and protect the ecological integrity of the harbour.

Objective 1E. Prepare and promote stewardship guidelines for improved environmental quality.

Goal 2: Improve and Protect Habitat Quality While Maintaining a Healthy and Sustainable Working Harbour

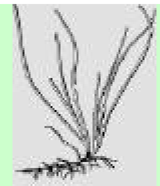
Objective 2A. Inventory and map shoreline and aquatic habitats and conditions.

Objective 2B. Identify, assess, and rate ecologically valued portions of the harbour.

Objective 2C. Identify habitat degrading activities.

Objective 2D. Assist the community with the development and implementation of alternatives that reduce or halt the input of deleterious substances into the harbour, and/or that reduce or halt actions that damage habitat in the harbour.

Objective 2E. Identify and implement habitat enhancement opportunities in the harbour



Goal 3: Decrease Contaminant Inputs into the Harbour.

Objective 3A. Inventory all point and non-point source discharges.

Objective 3B. Evaluate the quality, and the extent of existing point and non-point source discharges.

Objective 3C. Identify and/or develop remedial measures for identified contaminant inputs.

Objective 3D. Work in partnership with community members, community groups and other agencies to ir solutions to reduce the input of contaminants into the harbour.

Goal 4: Work in Partnership with Local Community Members, Organizatio and Businesses to Define, Fund, and Implement New Environmental Guidelines for a Healthy and Sustainable Working Harbour.

Objective 4A. Establish and maintain a steering committee for the harbour project on which sit people from a wide representation of organizations in the communities and appropriate agencies.

Objective 4B. Ensure that mechanisms for community input are available and functioning (examples inclu open houses, surveys etc).

Objective 4C. Work with people, community groups and local businesses to pursue funding for changes in operations or other improvements that will also serve to improve the quality of the harbour.

Objective 4D. Work with local and regional governments to develop land use plans and policies that protect the environmental quality of the harbour while promoting sustainable development and ensuring opportunity for a wide variety of uses of the harbour.

Objective 4E. The UHP should be proactive and participate in the project review and referral processes tc reduce the environmental impact of development.

Objective 4F. In partnership with the communities, resource decision making bodies and other groups define a water use/water zoning plan for all parts of the harbour.

Goal 5: Monitor Environmental Quality so That we May Guage Our Progress Towards a Healthy and Sustainable Working Harbour

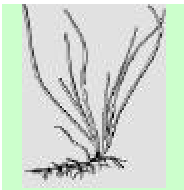
Objective 5A. After Identifying the critical and/or important habitats within the harbour, implement a long term monitoring project for these areas.

Objective 5B. Set objectives for water, sediment, habitat, and other environmental features of the harbour and implement a monitoring strategy for these parameters.

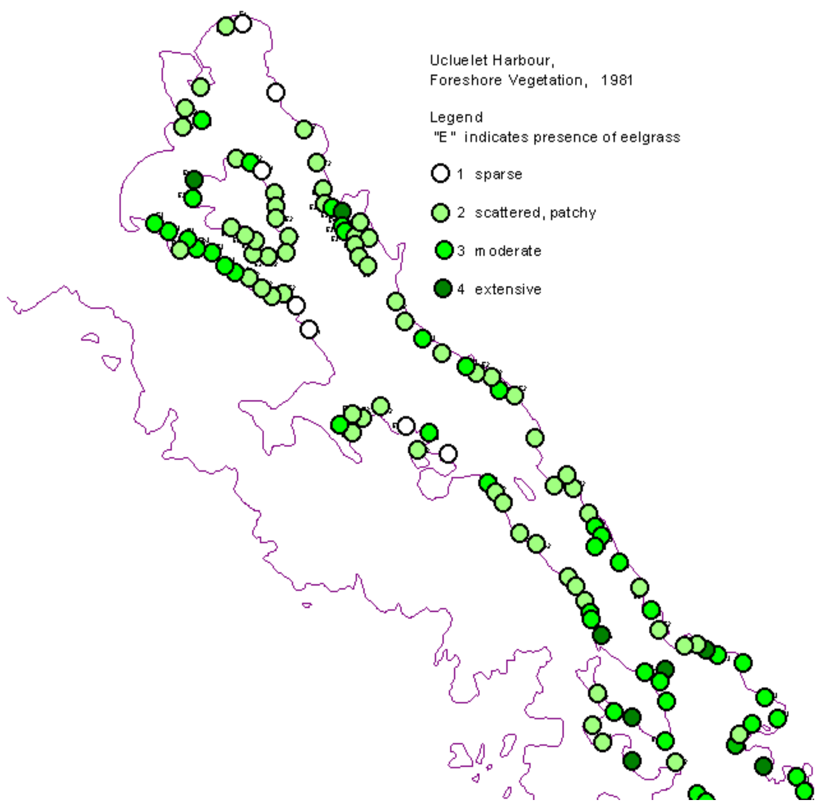
Objective 5C. Monitor the effectiveness of the education and awareness programs.

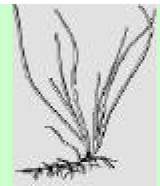
Objective 5D. Implement an adaptive management strategy to respond to the results of the monitoring programs.

Objective 5E. Report to the communities on the results of the monitoring programs and the progress of the Ucluelet Harbour Project.



Appendix C. Foreshore Vegetation Map. Results of foreshore vegetation survey conducted in 1981. Only the eelgrass survey data are presented here. Sites in the harbour were surveyed by boat. Eelgrass presence was assessed at selected points in the harbour. The extent of the beds were not measured nor mapped.





UCLUELET HARBOUR PROJECT- EELGRASS SURVEY *– MARCH 2002*