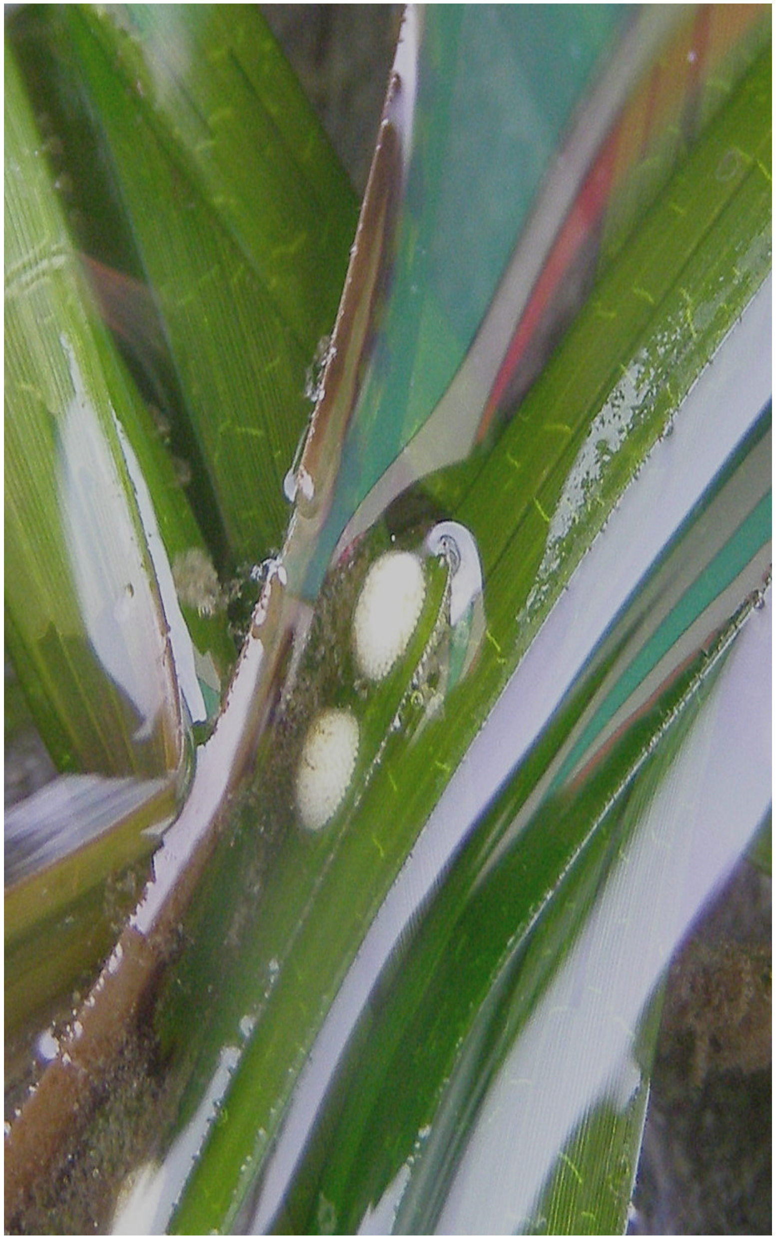


Eelgrass Mapping & Monitoring Volunteer Pocket Guide

Draft April 2007

Friends of Semiahmoo Bay Society

Prepared by:
Eileen Kaarsemaker
& Ramona de Graaf

INTRODUCTION Continued

Difference between Z. *marina* & Z. *japonica*

BOTH species:
Leaf length and width vary with depth:
As depth increases, leaf length and width increases.

DEEPER: LONGER, WIDER blades

Note: Intertidal *Z marina* is often within the length / width range of *Z japonica*, so the **best distinguishing factor is not size, but the SHEATH** (see opposite page).

See Illustration opposite

Note: Zostera marina and Zostera japonica are often intermixed at higher inter-tidal elevations**.**

(Reference: p. 2 Reproduction)

6th Page of Data Sheet, (p. 27) continued

Re: Turbidity Level 3 & 4 and Salinity, TSS, and Chlorophyll A Level 4:

This level of survey is not currently being carried out, so is not covered by this pocket guide.

(Reference: p. 12 Turbidity & Salinity, TSS, Chlorophyll A)

Additional: Data management

· Enter data into an Excel data sheet so that you:
have the data organized,
are prepared for doing calculations of the average.

Later, present the data so it is prepared for metadata entry onto the Community Mapping Network, Georgia Basin Habitat Atlas: Boundary Bay
www.georgiabasin.net

Z. marina Native	***Z. japonica*** Introduced
Generally larger	Generally smaller
- Found in lower intertidal, and sub-tidal zones	- Found in the intertidal and shallow subtidal, but not in the subtidal zone. -Better tolerates low tide exposure
Sheath: - Has an entire sheath, which is CLOSED at the base. - When lower leaves are slowly pulled in opposite directions, the sheath will tear. It is like two pieces of paper glued together; no overlap in lip.	**Sheath**: - It is OPEN at the base. - When stress is applied, the sheath parts rather than tears.

Cynthia Durance

Cynthia Durance

INTRODUCTION Continued

Ecotypes

There are three **ecotypes** of *Z. marina*, primarily recognized by depth:

1. Narrow leaf: mostly intertidal, calm conditions
2. Medium leaf size: tide line to 4 m depth, moderate current
3. Large leaf: 5 to 10 m. depth, strongest current conditions

Note: Smaller intertidal plants usually grow at greater density. Larger, sub-tidal plants usually grow less densely. (But the total "biomass" is usually greater)

(Reference: p. 2 – 3 Species & Ecotypes)

Eelgrass reproduces in two ways

1. Sexually (seeds). **Flowers** are produced on **reproductive shoots**. Once the seeds have developed, the shoot begins to senesce (grow old), breaks free from the rhizome, and floats away.

2. Asexually or **vegetative (branching)**
New shoots form at the base of the parent shoot. The rhizome branches, allowing the new shoot to grow away from the parent.
Counting the number of reproductive (flowering or with seed pods) shoots over the years is important for answering the question: "Is eelgrass reproduction changing?"

Note: It is very rare that we see/count shoots with flowers. We usually count shoots with tougher, brown blades and/or with seed pods.

6th Page Field Data Sheet, (p. 27)

Leaf Area Index (LAI) — Level 3 & 4

The **Leaf Area Index** is an estimate of the productivity of the amount of habitat available

Note: *As in the previous section, the measurements should be collected at the same time as the shoot densities for each quadrat.*

Measurements:

To ensure random sampling of leaves / to avoid measuring just big shoots:

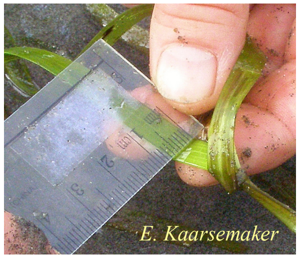
· Measure the shoot located nearest to the upper right corner of the quadrat and the lower left corner
· Take measurements from **3** plants:

Measure leaf length from *sheath to tip* of the 2nd oldest leaf (* 2nd blade in from the outside of sheath).

- **Record in cm**

Measure **leaf width**: near *middle* of the leaf.

- **Record in mm**



(Reference: p. 12
Leaf Area Index (LAI)

5th Page Field Data Sheet **4B Patchy Eelgrass** continued

2. Establish Location & Number of Quadrats and **lay them out.**

If area of patch < $1m^2$: Use **one quadrat** to determine density:

· Note the *total number* of shoots and the number of *reproductive* shoots rooted within the $.25m^2$ quadrat.

Remember: Avoid the edges of patch

If area of patch > $6m^2$: Use **2 Quadrats** within the patch. Sample as randomly as possible.

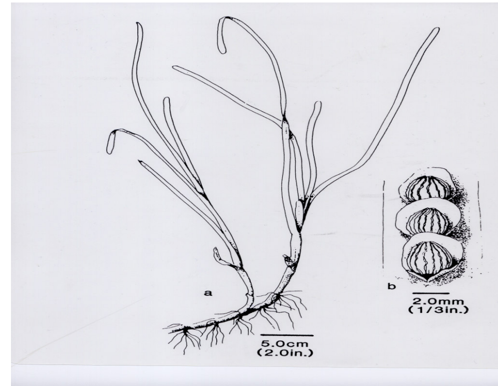
3. Record Shoot Density for each Quadrat & **Calculate** averages

· **Record**: The total number of shoots rooted in each Quadrat ($0.25m^2$) on the **Field Data Sheet** in the margins.

Calculations are basically the same as **4A**:
The Mean (average) number of shoots per 0.25 Quadrat within the patch

Note: The **Method** for counting and recording Vegetative and Reproductive shoots is the same as for **Continuous Beds 4A** described (p. 20-22 of this guide).

As noted in 4A: Before moving on to your next Quadrat, note the length and width of the shoots as described in the next section – LEAF AREA INDEX.



Z. marina: Shoots, rhizomes and seed pods

Eelgrass (*Zostera marina*) showing rhizomes

Seed Pods

Blades with flowers

Mapping and Monitoring

Introduction

Goals

(1) Protect and conserve; (2) Assess changes over time; (3) Track ecosystem health

Take PHOTOS of the exposed bed during the survey. Include:

- A site view
- Several close-ups of the eelgrass.
  Include an object (penny, meter stick) in each close-up for scale reference.

Note: Take photos from similar locations in subsequent surveys.

Re: Level of Survey

A strategy was developed to enable all those interested to participate in mapping. Each level has its own goals and its own needed resources.

Level 1: Location & overview of Intertidal habitat:

Action: Map *intertidal* section
Goal: Conservation of *intertidal* eelgrass habitat
Required: Locate & characterize INTERTIDAL area of Bed

Level 2: As above + Overview of *subtidal* bed + Delineate *whole* bed

Action: Map BOTH intertidal and subtidal sections
Goal: Conservation of *intertidal* AND *subtidal* Eelgrass habitat
Required: Locate, delineate & characterize ENTIRE area of Bed

5th Page Field Data Sheet **4B PATCHY** Eelgrass (p. 26)

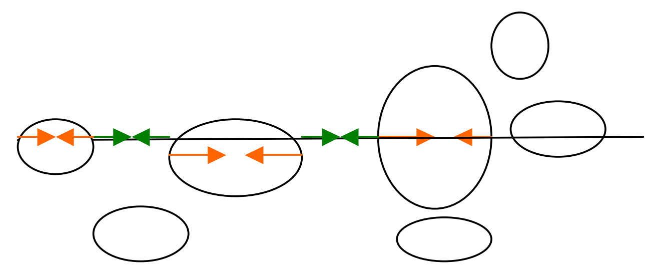
Note: Complete one form for each zone.

Note: There isn't much difference between the methods for continuous v. patchy. The main difference is that for Patchy, you measure distances between patches and you count fewer quadrats.

Establish a temporary transect line parallel to shore and **record** its location (GPS - start and end) at the top of the data sheet page. (*Same as for Continuous – 4A*)

- Start at 0-metre mark.
- Record the length along your transect that is occupied by the 1st patch *under* the transect line.
  That is "Patch #1".
  Refer to ***Field Data Sheet - Column "Distance across eelgrass patch"***

- Continue along transect and **record:**
  (1) Distance ***over* each patch** (See Illustration below)
  (2) Distance ***between* each patch** (See Illustration below)
  Refer to: ***Field Data Form – Column*** *"Distance to next eelgrass patch"*



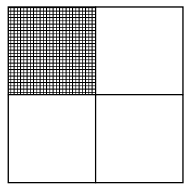
Cynthia Durance

(Reference: p. 11-12)

4th Page Field Data Sheet **4A CONTINUOUS** Eelgrass continued (p. 25)

* **METHOD TO COUNT SHOOTS** *continued*:

Note: If there are too many* shoots to count in your 0.25m2 quadrat (50 cm by 50 cm), then sub-sample the **upper left ¼** of the quadrat.



See Il-

* Use this sub-sampling method only if you feel there are more than 100 shoots in your quadrat

lustration below

· Record that number. Then multiply it by 4 to get the required 0.25 m 2.

Note that you "sub-sampled" a quarter, so you multiply by 4 when you enter data into spreadsheet for that quadrat.

Important: Before moving on to your next Quadrat: Note down the length & width of the shoots as described in the next section – LEAF AREA INDEX.

3. Calculate:

(1) The Mean (average) number of shoots per Transect:

Divide Total number of shoots in all 30 Quadrats by 30 (*if you did 30 quadrats*)

(2) The Mean (average) number of reproductive (flowering) shoots

Level 3: As above + Max/Min Depth, Degree of Patchiness, Shoot Density, LAI, & turbidity

Action: Include density counts/length & width for LAI
Goal: Conservation of eelgrass habitat + identify habitat loss / degradation
Required: Locate, delineate, characterize + monitor Eelgrass bed to note changes + monitor water quality in entire area of bed

Level 4: As above + salinity, TSS (Total Suspended Solids), Chlorophyll A

Note: We are not currently involved at Level 4.

(Reference: p. 6 – 7 Strategy & Levels 1-4)

FILLING IN THE FIELD DATA SHEET, p. 22

Note: *All* questions to be answered. Notes below to clarify selected points:

Introduction to Location & Delineation **ALL LEVELS**

Bed Delineation
The boundary / edge of an eelgrass bed is the point where the density is less than 1 shoot per square meter.

Why Location and Delineation are important:

· DFO's "no net loss" policy: "Development may not impact known eelgrass habitat without compensation"
· Delineation enables us to detect increases or decreases in eelgrass area over time.

(Reference: p. 4 Location and Delineation)

1st Page, Field Data Sheet (p. 22)

Background

Re: Location — ALL LEVELS

· Identify the location of the eelgrass bed:

Sources of information: Herring Spawn maps, air or ortho photos, Community Mapping Network: www.shim.bc.ca/maps.

Note: land-based surveyors can survey intertidal beds during the lowest daytime tides of the year. Divers, underwater cameras must locate subtidal beds.

(Reference: p. 4 Location)

Re: Bed Delineation — LEVELS 2, 3, 4

Note: ***The subtidal edge*** *can be delineated with a variety of methods:*

· Use a GPS * to geo-reference the boundaries of the bed and create a polygon.

You can determine the boundaries by using:

a) An aqua viewer: Can be used successfully if turbid-ity and depth range is not too great.

b) A diver with weighted floats (Appendix 8)

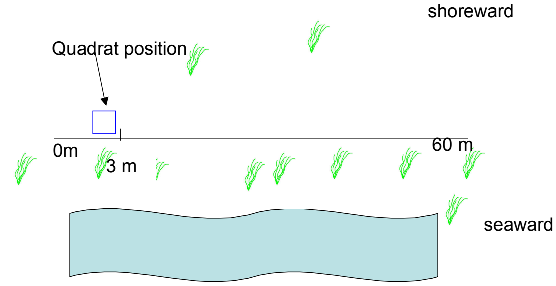
c) An underwater camera – on sunny days with clear visibility - by boat

· Record the readings about every 15 metres around the perimeter of the bed.

(References: p. 10 Bed Delineation + *Mapping Eelgrass using Garmin 12XL GPS: (See last page of this Guide)*

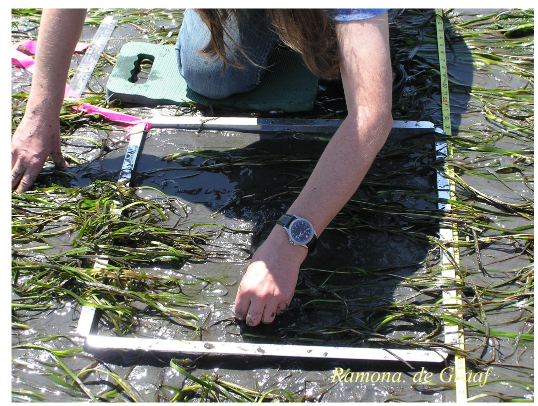
* METHOD TO COUNT SHOOTS:

Illustration A



Ramona. de Graaf

Illustration B



4th Page Field Data Sheet (p. 25) Continued

Continuous Eelgrass

Record the Shoot Density for each Quadrat AND Calculate averages

· **Record:**
The *total number* of shoots rooted in each Quadrat (See * **Method** below)

The total number of *reproductive* (with flowers or seed-pods) shoots in each Quadrat

The total number of *vegetative* (non-flowering, branching) shoots in each Quadrat:

· **Calculate**: *Total number* of shoots *minus* total number of *reproductive* shoots

*** METHOD TO COUNT SHOOTS:**

Use a standard 50 cm by 50 cm quadrat (0.25 m^2).
Reminder: Lay down quadrat - shoreward of the transect tape – with the LOWER RIGHT hand corner touching the metre mark on the tape.

See Illustration A opposite

Sweep all of the blades upward or to the right
Visually divide the quadrat left to right in thirds or quarters.
Start in at top and work down your first 1/3 or 1/4 of the area
Lay the blades over to the left as you go, so that the counted blades are sweeping to the left and the uncounted blades are as you started.

See Illustration B opposite

- Write the Quadrat number in the left margin of the Field Data Sheet 4A. *….Continued…*

1st Page, Field Data Sheet (p. 22) continued

Re: Tide Height start & finish **ALL LEVELS**

· Note the tide height when you start your survey and the tide height when you finish your survey.
Maximum and Minimum Depth
Note the time and check the Tide Chart

Re: Reference used to determine tide height

- Note the source of your tide height data

Re: Geographic (Lat/Long) or Projection **ALL LEVELS**

· Note the specifics of Projection UTM, etc
Use a Compass and / or GPS:

Note: **Knowing your GPS and accurately mapping is the most important past of the entire process.**

There is a guide for using the GPS, which you should review:

(Reference: *Mapping Eelgrass using Garmin 12XL GPS: A Manual for the West Coast of BC*) (See last page of this Guide)

2nd Page, Field Data Sheet (p. 23)

Overview of Intertidal Habitat **ALL LEVELS**

Fields and Categories to describe the features of each bed:

Re: Form

There are 2 basic forms of eelgrass beds in the Pacific Northwest: Fringing and Expansive (flat)

Fringing beds are narrow bands / on gentle slope

Expansive (Flat) beds are large areas (e.g. tidal flats)

(Reference: p. 9 Overview Intertidal Habitat)

Re: Distribution within the bed **ALL LEVELS**

Note: This is important because the integrity of eelgrass meadows is threatened by fragmentation.

- Record as either **Continuous OR Patchy**

See Diagram opposite page

Note: More detail will be required on the 4th or 5th page (page 25 or 26 in the Manual) of the Data Form.

Note:
- A bed with a few bare patches is **Continuous.**
- Quiet, calmer water tends to have homogeneous / **Continuous**
- Stronger current tends to have **Patchy** beds

(Reference: p. 9 + Appendix 6, p. 33-34 Patchy vs. Continuous Eelgrass Distribution)

Layout transect parallel to shore in each zone

M. Cuthbert

Lay out quadrats along either side of transect

4th Page Field Data Sheet, (p. 25)

4A Continuous Eelgrass

***Note**: Complete one form for each zone.

Re: Length of Transect

· Lay out a transect, parallel to shore with a metre-tape or a marked line in each zone.
- The length should equal about 60% of bed.
- If you don't know the length of the bed, do as many 60-metre transect lines as feasible.
- **Center the transect in the bed to avoid edge-effects of the transition areas.**
- Stay away from edges where transitions zone occur

· **At the top of the data sheet page, record the location of your transect with a GPS at the start and end of the transect line.**

Note: There is no specific notation on the data sheet for GPS location points, but it is very important information; data can then be deciphered and entered into the atlas.

2. Establish and lay out Quadrats:

· Use predetermined random numbers to establish the location of QUADRATS along either side of the transect.
You can use a sheet of random #s, OR just pick your favorite numbers between 1-30 and place a quadrat at each number:

· ***Lay it down with LOWER RIGHT corner touching the metre mark on the transect tape, always on same side.***
Initially, 30 Quadrats per 60-metre transect

Note: Do more than one transect (and quadrats) in a zone if you can. Lay parallel to beach as you just did.
(Reference: p. 11)

2nd Page, Field Data Sheet *(p. 23) continued*

Distribution: CONTINUOUS and PATCHY

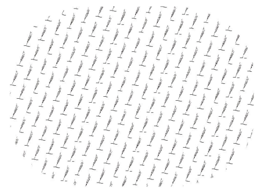


Figure 1. Continous Cover

Continuous Cover

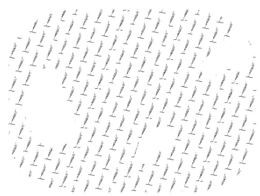


Figure 2. Continous cover with bare patches

Continuous Cover with bare patches

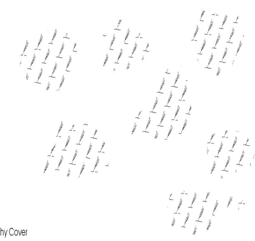


Figure 3. Patchy Cover

Patchy Cover

Cynthia Durance

2nd Page, Field Data Sheet, (p. 23) continued

Re: Percent cover / density **ALL LEVELS**

Percent Cover / Density of intertidal eelgrass at low tide

Note 1:
If the cover varies significantly, then the **Primary, Secondary, &** (if necessary) **Tertiary densities** should be recorded.

Note 2:
This is a very important part of the mapping and must be done well. But it is quite difficult to do in real life, even with experienced field people.

Your Team leaders will guide you with this task. It is important to follow the manual very carefully.

Categories:
1-10%,
11-25%,
26-50%,
51-75%,
>75%,
100%

To get an idea what each percentage range looks like:
See diagrams opposite page
(More examples in Manual p. 37)

Note: Primary + (optional) Secondary, Tertiary

(Reference: p. 9 + Appendix 7: p.35-37 Percent Cover)

· Classify the zones by number:
Start with the uppermost zone. (Zone 1) Typically,

Zone 1
Where? The most shoreward
(In Semiahmoo Bay, it is found between 0.5 & 0.1 metre tidal mark)
Blades? Has the shortest and narrowest blades

Zone 2
Where? More seaward than Zone 1
Blades? Medium length & width, and higher densities than Zone 1

Zone 3
Where? The most seaward (Subtidal)
Blades? Very long, wide blades & lower densities than Zone 2

Shore
Zone 1 *Smallest blades*
Zone 2
Zone 3 *Largest blades*
~~~ Sea ~~~

Reminders:
· Sample and quantify shoot density within each zone individually

· Sample *outside* transition areas.

(Reference: p. 10 – 11 Zonation)

4th or 5th Page Field Data Sheet (p. 25 or 26)

Re: Number of Zones

Introduction:

The density and leaf size of eelgrass may be consistent throughout the bed, or it may vary with depth.

There are usually 2 – 3 zones within a bed (with transition zones where one zone blends into the next)

Since the density and size of the shoots is very different between zones, each zone must be sampled individually.

Interesting note:
Subtidal ecotype is longer (up to 2 m!) and wider than intertidal, but the density (*number of shoots/0.25m²*) decreases due to the mere size of the plants.

As plant size increases,
Density decreases.

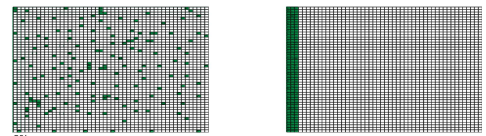
You can almost find what zone you are in by the length and width measurements.

Why do we need to note the number of zones?

You need to determine the number of zones within a bed in order to establish the location and number of transects to be sampled (next section)

Re: Percent cover / density

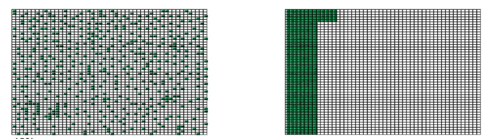
Note: Random on Left. Visualize as grouped on Right



6%

Figure 7.1 Six percent of the squares are shaded. The squares are randomly located in the first diagram (a) and are grouped in the second (b). This represents an area that would be classified as 1-10% cover on the datasheet.

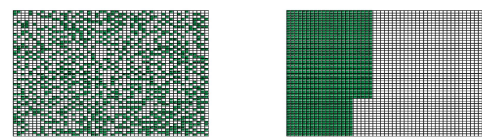
Category 10%
Example is 6% cover



18%

Figure 7.2 Eighteen percent of the squares are shaded. The squares are randomly located in the first diagram (a) and are grouped in the second (b). This represents an area that would be classified as 11-25% cover on the datasheet.

Category 11-25%
Example is 18%



41%

Figure 7.3 Forty-one percent of the squares are shaded. The squares are randomly located in the first diagram (a) and are grouped in the second (b). This represents an area that would be classified as 26-50% cover on the datasheet.

Category 26 – 50%
Example is 41% cover

Cynthia Durance

2nd Page, Field Data Sheet, (p. 23) continued

Re: Substrate Type — ALL LEVELS

· Record the Order of dominance: Primary
+ (optional):Secondary, Tertiary substrates

Note: IF more than 1% cover class or substrate type is present, the % that is occupied by EACH type should be recorded according to the categories on the data sheet.

Substrate Types:

Mud	Smooth
Mud / sand	Sand: gritty
Gravel	< kiwi size
Cobble	Between kiwi & grapefruit
Boulder	> grapefruit
Bedrock	Solid (continuous) rock

(Reference: p. 9)

2. Overview of SUBTIDAL Habitat — Level 2, 3, 4

This is Sub-tidal and is done with the help of divers and underwater viewing equipment.

It is not covered by this pocket guide.

3rd Page, Field Data Sheet (p. 24)

Re: Depth — Level 3, 4

This is Sub-tidal and is done with the help of divers, depth gage and other measuring equipment.

It is not covered by this pocket guide.

Re: Distribution & Density — Level 3 & 4

Distribution: Continuous or Patchy?

Note: These decision(s) will have already been made on 2nd page of Field Data Sheet

If it is **Continuous:**
Fill in Field Data Sheet, # 4A (p. 25)

If it is **Patchy:**
Fill in Field Data Sheet, # 4B (p. 26)