



Science Unit: *Marine Critters and Communities*

Lesson 9: *Exploring Intertidal Biodiversity*

School Year: 2011/2012

Developed for: Tecumseh Elementary School, Vancouver School District

Developed by: Kathy Heise (scientist); Teresa Harris, Stephanie Pearce and Chuck McNicholl (teachers)

Grade level: Presented to grade 7; appropriate for grades 4 – 7 with age appropriate modifications

Duration of lesson: 1 ½ hours

Notes: This lesson prepares the students for two intertidal field trips. This lesson is modified from Lesson 3, Measuring Biodiversity, in the Biodiversity and Extreme Environments science unit, Scientist in Residence Program.

<http://scientistinresidence.ca/science-lesson-plans/biodiversity-and-extreme-environments/>

Objectives

1. Explore biodiversity and some of the different ways that scientists describe it.
2. Introduce students to the biological diversity of intertidal life that they may encounter on their field trips.
3. Practice using field guides to become comfortable using them.
4. Practice collecting species diversity data from a mock intertidal habitat.

Background Information

Much of the background information and vocabulary from the Lesson 3, Measuring Biodiversity, in the Biodiversity and Extreme Environments science unit applies to this unit, as do some of the worksheets. This unit on Exploring Intertidal Biodiversity is designed to prepare the students for two field trips: one to Jericho Beach, and the other to Stanley Park. Ultimately they will compare the Species Richness and Species Evenness of the two locations using data collected from 1m² circle plots.

Vocabulary

Circle plot: A circle with a known area (eg. 1m²) that can be used to subsample a community

Materials

- 2 Lego square bases with pieces of lego attached (see Activity 1)
- 14 copies of the Field Guide 'Explore the Rocky Shore at Stanley Park'
- Worksheet –Intertidal Life In Your Backyard
- Worksheets 1a, 1b etc., from Lesson 3 referenced in Notes above
- Selection of at least 7 other field guides to the marine intertidal
- 14 copies of 'Spring Beach Walk Field Guide' by the Vancouver Aquarium



In the Classroom

Introductory Discussion

1. Introduce the students to the concept that the intertidal zone is an extreme environment.
 - Ask the students to imagine being at the beach. Brainstorm the physical elements that animals in the intertidal zone are exposed to. Make a list- eg. salt water, fresh water, waves, air, heat, desiccation, cold, snow.
 - What adaptations might intertidal organisms have to cope with these extremes?
2. Using two Lego bases with different distributions of coloured pieces attached (see Activity 1) discuss measures of species evenness and richness. Compare the species evenness and richness of these two mock communities.
 - How would you decide which area would be most important to protect?
 - Can you think of an example when an area with relatively low species richness would merit protection?
3. Explain to the students that they will be going on two intertidal field trips, one to Jericho Beach, and one to Stanley Park, and that we are interested in comparing the biodiversity of the two locations. Students will learn some of the intertidal species that they may find by familiarizing themselves with the field guide to Stanley Park (Activity 2).
4. Allow some time at the end of the lesson for the students to explore the other field guides to intertidal life of the Pacific Northwest.

Science Activity 1

Activity: Discuss species richness versus species evenness

Purpose of Activity: To gain insight into different ways of measuring biodiversity

Instructions:

Set-up prior to activity: Obtain two identically shaped Lego bases, that are at least 25 cm by 25 cm. Both pieces will end up with an equal number of Lego pieces attached, but will differ in the distribution of colours of attached coloured pieces. On one base, attach an equal number of 5 different- coloured Lego pieces, so that there are at least (5x5) 25 pieces on the base (eg. 5 red, 5 blue, 5 yellow, 5 green, 5 white). On the other base, attach at least 20 of single colour pieces of Lego (eg. 20 white Lego). Then attach 5 more Lego pieces of different colours (eg. 2 yellow, 1 red, 1 blue, 1 green), so that there are an equal number of Lego pieces on both bases. Discussion questions are listed above.

Science Activity 2

Activity: Introduction to Intertidal Organisms

Purpose of Activity: To learn about the many different plant and animal species that can be found in the intertidal zone of the Pacific Northwest.

Instructions:

Students will work in pairs to complete the worksheet – Intertidal Life in Your Backyard using the field guide ‘Explore the Rocky Shore at Stanley Park’. The scientist will need to explain the acronyms that are used in the legend for the species descriptions, as well as the colour legend used for the pictures that



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show links between different groups of organisms (eg. marine algae are numbered in orange, annelids are numbered in red etc.)

Science Activity 3 (taken directly from Lesson 3, Measuring Biodiversity in Biodiversity and Extreme Environments science unit, Scientist in Residence Program;
<http://scientistinresidence.ca/science-lesson-plans/biodiversity-and-extreme-environments/>)

Activity Title: Measuring species diversity in a mock intertidal community

Purpose of Activity: To collect species diversity data from a mock intertidal community in order to prepare for lesson 4 and 5 (intertidal field trip).

Methods and Instructions:

Set-up prior to activity: Divide students into groups of 3 or 4. There are 4 versions of the mock intertidal community (see attached 'Worksheet 1a', 'Worksheet 1b' etc.) and each version has the quadrats located in different places. Print the mock intertidal zones on large paper (ideally about 1m by 0.6m) and give version 1 to two groups, version 2 to two groups, etc.

Demonstration: Begin activity with a 5-10 minute demonstration of how to collect and record the species data using one of the mock intertidal communities. [Note: each mock community drawing already has 3 quadrats superimposed on it.] Explain that students will record the number of individuals present (abundance) for some species (e.g. sea stars, mussels), while for other species (e.g. encrusting algae) and non-living substrates (eg. sand, rock), we record the percent cover occupied by that species/substrate.

1. In groups (3-4 students/group), students observe the species in their drawing of an intertidal community. They use their field guides to make a "Species Legend" (Worksheet #2) – they draw the animal or plant and assign the proper common name. Note that the animals and plants in the mock intertidal zone drawing are general types (e.g. barnacles, anemones etc.), so students need not worry about identifying down to species.
2. The mock intertidal zone has 3 sample quadrats superimposed on it. The following are the student roles and the sequence of collecting species diversity data within each quadrat (Worksheet #3):
 - i. The first student counts the number of individuals per species for the species being recorded with abundance data.
 - ii. The second student estimates the percent cover of the remaining species (e.g. encrusting algae) and substrates (e.g. rock, sand etc.).
 - iii. The third student is the "data recorder" and writes down all the observations on the data sheet (Worksheet #3).
 - iv. If there is a 4th student, then s/he helps the data collectors.
3. After all the data has been collected and the first two pages of Worksheet #3 are completed, then students work together in their groups to create a species accumulation group (third page of Worksheet #3). Note that students need to read the instructions carefully!!

Closure Discussion

1. Ask students to present their species accumulation curves to the class.
2. Explain to the students that for ease of transport, the study plots that they will be using for their intertidal field trips are circular, not square, but still have an area of 1m^2 . Review the formula for calculating the area ($A=\pi r^2$) and circumference ($C=2\pi r$) of a circle.
3. Review best practices for exploring the beach.



References

1. Sheldon, Ian. 1998. Seashore life of British Columbia. Lone Pine Publishing.
2. Sept, Duane J. 1999. The Beachcomber's Guide to Seashore Life in the Pacific Northwest. Harbour Publishing.
3. <http://naturevancouver.ca/sites/naturevancouver.ca/VNHS%20files/4/Nature_Vancouver_Intertidal_Pamphlet.pdf> Explore the Rocky Shore at Stanley Park. Nature Vancouver. Accessed May 30 2012.
4. Lamb, A. and B.P. Hanby. 2005. Marine Life of the Pacific Northwest, A Photographic Encyclopedia of Invertebrates, Seaweeds and Selected Fishes. Harbour Publishing.
5. Harbo, R. 2011. Whelks to Whales: Coastal Marine Life of the Pacific Northwest. Harbour Publishing.
6. Harbo, R. 1988. Guide to the Western Seashore: Introductory Marinelifelife Guide to the Pacific Coast. Harbour Publishing.

Spring Beach Walks—Quick Reference Identification Guide
 Explorations de la Plage au Printemps—Guide d'Identification Référence Rapide



Ribbed Limpet
 Une patelle lignée
Lottia digitalis



Shield Limpet
 Patelle bouclée
Lottia pelta



Keyhole Limpet
 Une patelle à trou de serure
Fissurellidae spp.



Mossy Chiton
 Chiton à mousse
Mopalia muscosa



Lined Chiton
 Chiton lignée
Tonicella lineata



Gumboot Chiton
 Chiton à botte de caoutchouc
Cryptochiton stelleri



Butter Clam
 Palourde lisse
Saxidomus gigantea



Rough Piddock (siphons)
 Grande pholade rugueuse
Zirfaea pilsbryi



Nuttall's Heart Cockle
 Coque
Clinocardium nuttallii



Kennerley's Venus Clam
 Palourde venus
Humilaria kennerleyi



Manila Clam
 Palourde japonais
Venerupis philippinarum



Mahogany Clam
 Palourde d'acajou
Nuttallia obscurata

Mollusca - Mollusques

Spring Beach Walks—Quick Reference Identification Guide
 Explorations de la Plage au Printemps—Guide d'Identification Référence Rapide



Sand Fleas (Amphipods)
 Des amphipodes
Traskorchestia traskiana



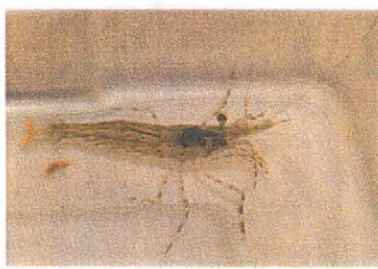
Giant Barnacle
 Balanes gigante
Balanus nubilus



Acorn Barnacle
 Une balane
Balanus glandula



Isopods
 Des isopods



Coonstripe Shrimp
 Une crevette de quais
Pandalus danae



Decorator Crab
 Un crabe décorateur
Oregonia gracilis



Green Shore Crab
 Un crabe vert commun
Hemigrapsus oregonensis



Dungeness edible crab
 Un crabe dormeur
Cancer magister



Red Rock Crab
 Une crabe à torteau rouge
Cancer productus



Northern Kelp Crab
 Un crabe du vareche du nord
Pugettia producta



Hermit Crab
 Un bernarde l'ermite
Paguridae spp.



Hermit Crab
 Un bernarde l'ermite
Paguridae spp.

Arthropods—Les Arthropodes

Spring Beach Walks—Quick Reference Identification Guide
 Explorations de la Plage au Printemps—Guide d'Identification Référence Rapid



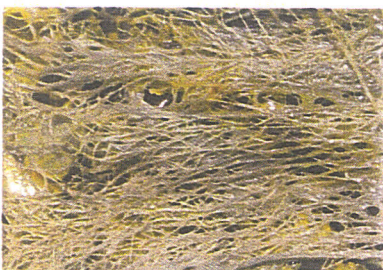
Coraline Algae
 Algue corallienne



Eelgrass
 L'eelgrass
Zostera marina



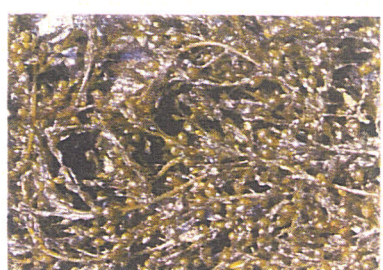
Sea Lettuce
 La laitue de mer
Ulva latuca



Acid Weed
Desmarestia spp.



Rockweed
 Le fucus
Fucus gardneri



Sargassum
 Sargasse japonaise
Sargassum muticum



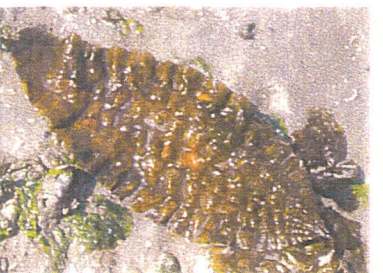
Laminarian
 La laminaire
Laminaria spp.



Bull Kelp
 Varech à flotteur
Mereocystis luetkeana



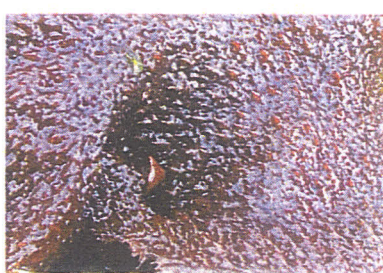
Feather Boa Kelp
Egregia laevigata



Seersucker Kelp
Costaria costata



Iridescent Algae
Mazzaella splendens



Turkish Towel
Gugarina exasperata

Seaweeds, Seagrasses & Kelp—Des Algues & Des Vareches

Spring Beach Walks—Quick Reference Identification Guide
 Explorations de la Plage au Printemps—Guide d'Identification Référence Rapid



Lewis's Moon Snail
 Une natic
Euspira lewisii



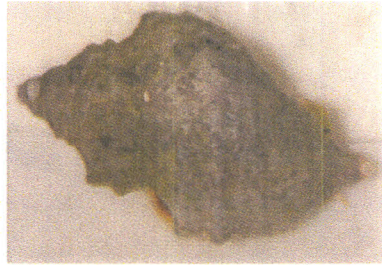
Periwinkles
 Des littorines
Littorina spp.



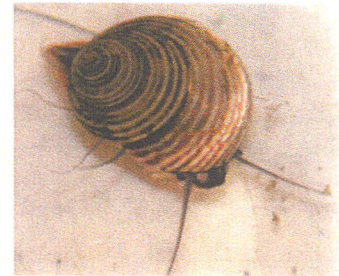
Oregon Triton
 Triton de l'orégon
Fusitriton oregonensis



Leafy Hornmouth
 Escargot feuilleté
Ceratostoma foliatum



Fringed Dogwinkle
 Coquillage plissé
Nucella lamellosa



Blue Topsnail
 Escargot bleu
Callistoma ligatum



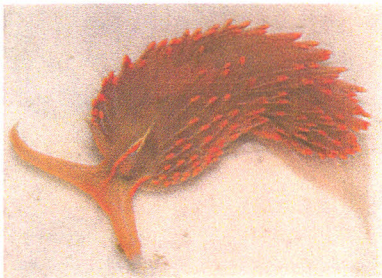
Blue Mussel
 Des moules bleues
Mytilus edulus



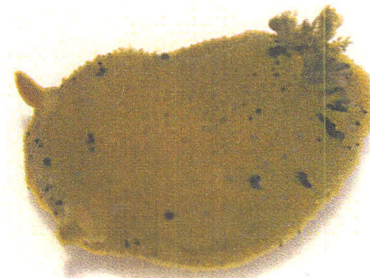
Barnacle Eating Nudibranch
 Nudibranch à mangeant balanes
Onchidoris bilamellata



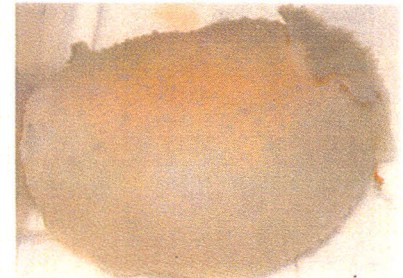
Shaggy Mouse Nudibranch
 Nudibranche à papilles
Aeolida papillosa



Opalescent Nudibranch
 Une nudibranche opalescent
Hermisenda crassicornis



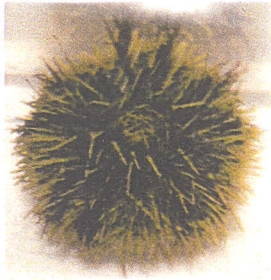
Sea Lemon
 Un citron de mer
Anisodoris nobilis



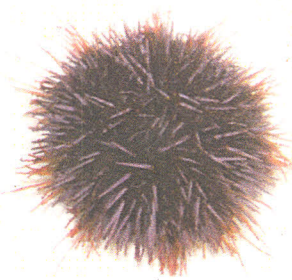
Giant White Dorid
 Une nudibranche blanche
Archidoris odhneri

Mollusca - Mollusques

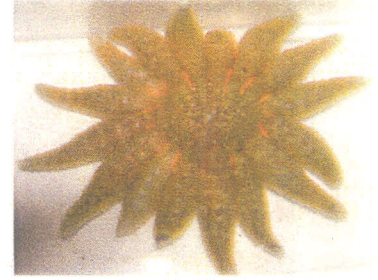
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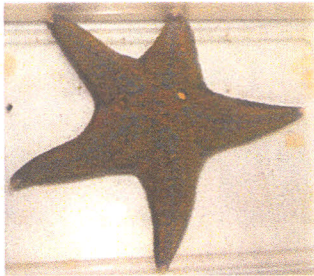
Green Sea Urchin
 Oursin de mer vert
Strongylocentrotus droebachiensis



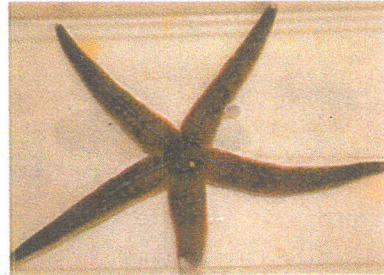
Purple Sea Urchin
 Oursin de mer mauve
Strongylocentrotus purpuratus



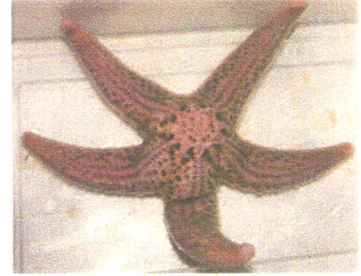
Sunflower Star
 Étoile de mer tournesol
Pycnopodia helianthoides



Leather Star
 Étoile de mer imbriquée
Dermasterias imbricata



Mottled Sea Star
 Étoile de mer tachetée
Evasterias troschelii



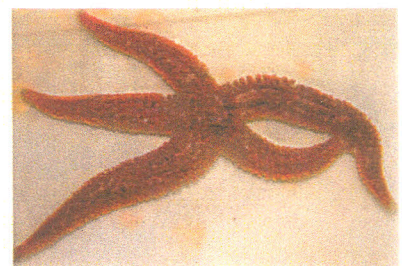
Giant Pink Sea Star
 Étoile de mer rose
Pisaster brevispinus



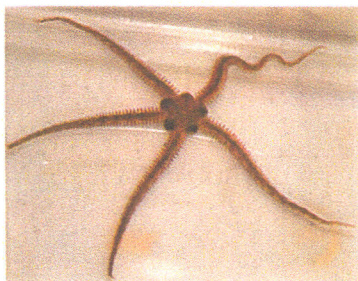
Purple/Common Sea Star
 Étoile de mer commune
Pisaster ochraceus



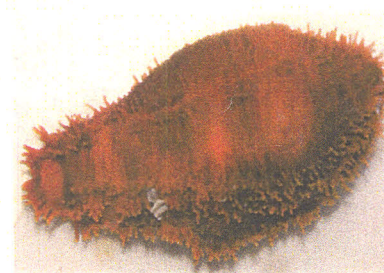
Common Sea Star
 Étoile de mer commune
Pisaster ochraceus



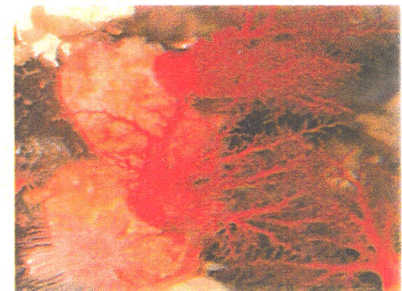
Rainbow/Painted Sea Star
 Étoile de mer peinte
Orthasterias koehleri



Brittle Star
 Une ophiure
Ophiopholis spp.



Orange Burrowing Cucumber
 Concombre de mer orange
Cucumaria miniata



Armoured Sea Cucumber
 Concombre de mer armé
Psolus chitonoides

Echinodermata - Échinodermes

INTERTIDAL LIFE IN YOUR BACKYARD					
Zone	Common Name	Scientific Name	Size (units)	Diet	Predators
	Banner Sea-nymph	<i>Nexis vexillosa</i>			
	Rockweed Isopod	<i>Idotea wosnesenskii</i>			
	Green Shore Crab	<i>Hemigrapsus oregonensis</i>			
	Thatched Acorn Barnacle	<i>Semibalanus cariosus</i>			
	Square-tooth Sea Flea	<i>Amphithoe valida</i>			
	Red Rock Crab	<i>Cancer productus</i>			
	Common Acorn Barnacle	<i>Balanus glandula</i>			
	Kelp-encrusting Bryzoan	<i>Membranipora serrilamella</i>			
	Mottled Star	<i>Evasterias troschelii</i>			
	Leather Star	<i>Dermasteris imbricata</i>			
	Orange or Red Sea Cucumber	<i>Cucumaria miniata</i>			
	Purple Star	<i>Pisaster ochraceus</i>			
	Wireweed	<i>Sargassum muticum</i>			
	Turkish Towel	<i>Chondracanthus exasperatus</i>			
	Sugar Wrack Kelp	<i>Saccharina latissima</i>			
	Iridescent Seaweed	<i>Mazzeolla splendens</i>			
	Bull Kelp	<i>Nereocystis luetkeana</i>			
	Rockweed	<i>Fucus gardneri</i>			
	Turkish Washcloth	<i>Mastocarpus papillatus</i>			
	Sea Moss	<i>Cladophora sp.</i>			
	Filamentous Red Seaweed	<i>Pterosiphonia bipinnata</i>			
	Sea Lettuce	<i>Ulva lactuca</i>			
	Pacific Blue Mussel	<i>Mytilus trossulus</i>			
	Barnacle-eating Nudibranch	<i>Onchidoris bimallata</i>			
	Pacific Littleneck Clam	<i>Protothaca staminea</i>			
	Nuttall's cockle	<i>Clinocardium nuttallii</i>			
	Washington Butter Clam	<i>Saxidomus gigantea</i>			
	Mossy Chiton	<i>Mopalia mucosa</i>			
	Mask Limpet	<i>Tectura persona</i>			
	Ribbed Limpet	<i>Lottia digitalis</i>			
	Checked Periwinkle	<i>Littorina scutulata</i>			
	Vancouver feather-duster	<i>Eudistylia vancouveri</i>			