Conservation Ecology

Volunteer Training Manual

vancouver aquarium™

Program Summary

Grades 8-11

This Vancouver Aquarium school program is designed to meet the B.C. Ministry of Education's curriculum standards for grades 8-11. The overall goal of the program is to encourage students to look more closely at how humans are impacting marine ecosystems and consider their role in the importance of making small and large scale conservation efforts. Specifically, students will analyze three individual ecosystems; a rocky reef area found in B.C., a tropical coral reef, and a kelp forest. The program aims to teach students about the complexity of these ecosystems, their structure and interactions, as well as the actions we can take to promote healthier and more sustainable marine ecosystems.

This program takes place primarily in the Vancouver Aquarium galleries with the introduction and conclusion in a classroom. The program is 2 hours in duration, which breaks down approximately as such:

Introduction (10min) – Coordinator introduces program and some vocabulary terms, goes over short presentation on ecosystems and outlines program objectives. Students are divided into 3 groups and sent to galleries with a volunteer to lead the stations.

Rocky reef BC ecosystems (20min) - fish ID survey, fishing techniques demo-game, focus on rockfish conservation and sustainable seafood

Kelp forests ecosystems (20 min) - live urchin examination, focus on ecosystem interactions (food chain) and keystone species

Coral reef ecosystems (20 min) - examine live anemone polyp, focus on reef biology, human impacts on coral reefs and reef conservation

Classroom Activity (50min) - students are given models and components to build their own ecosystems, develop them, and then discuss and present what they've learned.

Materials

Rockfish station (Treasures of B.C. Coast Gallery)

- Fishing Game activity (add fresh water to fishing game)
- Clipboards with fish survey (fresh sheets)
- Illustration cards

Kelp forest station (Treasures of B.C. Coast Gallery)

- Sea otter pelt and illustration cards
- Live green sea urchins in glass bowls
- Food chain board w/ small animal images

Coral station (Tropic Zone Gallery)

- Live sea anemone
- Illustrations and question cards

- Coral skeletons
- Grab bag with items for conservation activity

Classroom

- Three tables with chairs
- Ecosystem models, components and scenarios
- A/V – Computer, projector, digital camera with link to computer

Time:

- Tuesdays October – April, 9:30 – 11:30 and 12:30 – 2:30
- Be there ½ hour before program start in order to help set-up. Your shift includes a ½ hour after the program to help with program take down.

Volunteering with Conservation Ecology

Your role:

Your job is to inspire students to care about marine animals and environments through observation and fun interactive activities. The Aquarium provides an amazing learning facility with the opportunity to view rich and diverse ecosystems and animals up close. Equipped with knowledge, props, accessories and an array of organized activities your role will be to give students the unique opportunity to learn in a creative, interactive and hands-on manner.

You will work as an informal educator, leading a group of students through three 20min ecosystem stations and then helping them in the 'build your own ecosystem' conclusion activity. At each station there is an outlined set of learning activities that you will facilitate and interpret. These activities will require you to be comfortable teaching biology, ecology and conservation concepts. Although there is specific information to be conveyed at each station, it will be up to you to develop your own teaching style, techniques and delivery. Don't worry – this takes some time to develop and the more you do the program, the more comfortable you will feel.

Shadowing:

Normally volunteers begin their training by shadowing a veteran volunteer in order to 'see how it's done'. Once you feel comfortable with the program content as well as the other responsibilities that come with leading a group, you can step up and take on a group of students yourself. Again, no worries – you, the other volunteers and the coordinator will work together to build on the program delivery and there will be lots of modifications and changes to be made along the way.

Volunteer Responsibilities during program:

1. *Meet your coordinator* in Aquaquest classroom 30min before program to aid with set up. **PLEASE BE ON-TIME FOR YOUR SHIFT!** It is difficult to coordinate program set-up and there may be important pre-program things to discuss with the volunteer team.
2. *Help set-up*. There are 3 ecosystem stations each requiring a cart and the appropriate teaching/activity props. Two of the stations also require live animals.

Prior to the program find the coordinator and find out how you can help setting various stations of the program.

3. *Help with class arrival*. The coordinator will greet the class and teacher and show them into the classroom. Volunteers will help the students find a place to put their coats, bags and valuables and then the students will take their seats.
4. *Guiding your group*. During the program you are responsible for the 8-10 students in your group and their safety. Please ensure that your group remains together as you travel through the busy galleries. Doing a second head-count once you arrive at your station is also recommended. See group management section for more details.
5. *Cover the program material*. Remember that the program is curriculum based, so it's important that each volunteer delivers the same educational content. That's what teachers are expecting.
6. *Be mindful of Aquarium guests.* We work with other groups in public galleries where there may be many other visitors, so please be considerate and patient. Feel free to let guests know who you are and what you're doing. Most of the time they will respect your teaching space.
7. *Respect the animals.* Students will be touching several live animals during this program. Please instruct them on the proper method of doing so (pinky finger rule. Stroke, don't poke!) This also applies to animals in the glass tanks. Knocking or banging on the glass is not acceptable behavior
8. *Please finish on time.* **WEAR A WATCH!** This program is very tight for time and each station must be completed in the time allotted to ensure the rotation and program wrap-up are on schedule.
9. *Help program take down.* After the program is finished, help the coordinator to clean up. If it is a morning program, help restore the stations for the afternoon session. If it is the afternoon program, help take down the station carts and return the props.
10. ***HAVE FUN!***

<u>Scheduling shifts and communication with coordinator:</u>

The program coordinator will be in contact with all the volunteers on a weekly basis (normally via e-mail) regarding program bookings, updates, and scheduling. Please do your best to respond to these e-mails promptly and remain in contact with your coordinator. Whether it be on a sign-up sheet or via email, ensure you and your coordinator know what shifts you are signed up for.

*** **If you are unable to make a shift for ANY reason, please give your coordinator at least 24 hours notice so she can find a replacement*****

Coordinators:
Jenn Burt, 604.659.3492, jenn.burt@vanaqua.org

Teaching in School Programs

Managing your group:
Group management can be one of the most challenging parts of your job as a volunteer educator, especially when you are trying to lead a group of 10 energetic (or non-energetic) high school students through busy Aquarium galleries. Here are a list of tips you may find helpful in managing your group and teaching the program content.

1. *From the start, be assertive and enthusiastic*. Introduce yourself and make it clear that you are the leader and their teacher for the next 2 hours. If you respect them and treat them as adults, they should do the same to you.
2. *Communicate to the group* that they are to stick with you for the whole program. If they need anything, such as a bathroom break, they need to let you know. Let them know you are approachable and appreciate questions at anytime – try to encourage their participation.
3. *Be approachable*. Encourage students to ask questions during the program. If it's disrupting your blurb, just say 'I'll answer that in a moment'.
4. *Keep track of everyone.* You have about 2 minutes to move from station to station. During this time keep an eye on your group, make sure they know where you are going and can see you. They are not little kids, so you are less concerned about 'loosing' them as you are them 'wandering off'.
5. *Work as a team*. You may find it easier (and more fun) to teach in a team-like dynamic. Less "I am the teacher, this is what I have to teach" and more "We are working as a team to learn some new things about ecosystems – we have an amazing facility and great exhibits to explore – so if you help by cooperating we'll get to see it all and I can tell you all the super cool things I know".
6. *Communicate clearly and audibly*. The galleries are a loud and very distracting place. At each station, get your group gathered around you close enough so that everyone can see and hear – you want to avoid any students feeling left out or cut off. Speak loudly and confidently.
7. *Deal with behavior issues appropriately*. Frame requests for acceptable behavior in a positive way: say "*Please walk*" instead of "*Don't run.*" Give information about *why* you are requesting a particular behavior: "Fish are disturbed by loud noises. Tapping on the glass upsets them." Try to distract disruptive behavior by moving the student to a new situation or by giving a task.

*** If you have any difficulties during the program, feel free to radio the program coordinator who can come to help with any situation. If the coordinator is leading a group, try to find them during station rotations if you need to communicate something. After each program, discuss how your session went with the other volunteers and the coordinator – this way everyone will learn from different program situations***

Important Information

- You are not permitted to take any photos during the program. Especially do not take any photos of the children.

- Students are allowed to go to the washroom at any time. Just ensure that they tell you and you point them to the closest washroom.

- Never verbally discipline a student. If a behavior problem persists after you have tried various strategies, calmly and quietly contact the program coordinator or the teacher for assistance.

- Child protection: For your own protection, and the comfort of all involved, avoid physical contact with the students in your group. All volunteers must protect the children in their care from physical and/or sexual abuse or harm. If you become aware of questionable behavior on the part of staff, volunteers or visitors, bring it to the attention of the Duty Manager, Manager of Volunteer Services or a staff person immediately.

- The Aquarium, by nature, is a facility with multiple cautionary areas. Please be advised that certain areas of the facility may have wet floors on an on-going basis and as such all volunteers are reminded to use due care when moving around the building, and when leading groups of students around the building. The behind the scenes areas of the Aquarium can be sensitive and therefore are off-limits to people other than approved staff

- You are not permitted to enter any construction zones, therefore avoid construction areas for your own safety and that of the children in your care. Follow all signs and directions from the construction crew.

- Take reasonable steps to remove any threat of personal endangerment to yourself, fellow volunteers or children in your care. This can be as simple as asking students to hold onto railings as they move down stairs, to go around wet spots on the floor or the stand back from doors that open outwards.

- Lost student. If you loose a student from your group **remain calm**, remember you have other students in your care. Look around the vicinity you are in to see if you can locate the student, if not take your group with you to the nearest staff member and **have this staff member radio your coordinator. Do not leave your group!** If necessary, staff on radio will initiate our search procedure in an effort to locate the student. The police are called if the child is not located by our search procedure within 5 minutes.

- If a panicked parent or group leader approaches you in the galleries looking for a lost child, try to calm them and reassure them that we will do all we can to find the child and bring them immediately up to Admissions. The Admissions staff will take over from there.

- A sick student can be treated as an emergency situation. Call first aid (get the Coordinator or staff member to do this). Stay with the sick student and keep your group with you as well. Your Coordinator will then take over and will deal with the first aid attendant and sick child. Do not leave the sick child until the coordinator is on the scene. Remain confident and calm.

- **First Aid Procedure**: In any emergency first aid or security situation, go directly to a staff member with a radio. They will be able to contact the first aid attendant and/or security and contact emergency services if necessary. Radios are always kept at Admissions and your coordinator should have a radio. If you are carrying a radio, you can contact the first aid attendant or security guard directly on **Channel 3**. If you have no radio, you can call admissions (3594). You need to communicate three things:

1. Who the situation concerns: Staff First Aid or Guest First Aid
2. The situation code: **Code 1** (minor scratches, scrapes or bumps),
   Code 2 (bleeding cuts, animal bites or insect stings)
   Code 3 (broken bones, life threatening, unconscious etc.)
3. Where you are: location in Aquarium

Stay on the radio on channel 3 and wait with the person until help arrives.

- **Fire or Evacuation:**
  All volunteers should be familiar with the fire exits in the galleries. If you see a fire or smoke, walk to the nearest exit AWAY FROM THE SMOKE, set off the fire alarm by using the pull station and leave the building with your group, if you have one. If you are unsure what a pull station is, please ask.

  If a fire alarm sounds - 2 stages: 1st stage get ready, 2nd stage evacuation - walk the group to the nearest fire exit and leave the building. **Assembly will be at the killer whale statue near the main entrance.** A head count will take place there. If anyone is missing, DO NOT RE-ENTER THE BUILDING. Inform the program coordinator or another staff member. Wait until further instructions are received. Do not return to the building until the alarm has stopped ringing and you have been given the all clear by engineering dept.

- **Earthquake**
  In the event of an earthquake, take cover under a desk, table or bench or against an inside wall, doorway or hallway. After the earthquake, evacuate the building and meet at the emergency meeting location (outside Door #6 in the open field or outside Admissions). Do not call 9-911 or use the telephone unless life threatening injury or fire has resulted. Do not re-enter the building until instructed to do so.

  ***Detailed information is available in emergency protocol binders, located in the Volunteer Services Office) ***

Program Specific Info

Program Set up:

Rockfish station (Treasures of B.C.-Botanical Beach)

- 1 props cart with Fishing Game activity (add fresh water to fishing game)
- clipboards with fish survey (fresh sheets)
- illustration cards
- oceanwise brochures

Kelp forest station (Treasures of B.C.-)

- 1 props cart with lg. flat Tupperware box containing pelt and illustrations
- get 3 urchins from the Wet Lab and place them in bowls inside a large bucket on top of the cart
- Food chain board w/ small animal images

Coral station (Tropic Zone- right of large exhibit)

- 1 props cart just beside the large exhibit in Tropical Gallery
- large bucket with 1 giant anemone from the Wet Lab
- illustrations and pink question cards
- lg. Tupperware bucket with coral samples
- just *outside of tropical gallery* - conservation activity Tupperware

Classroom

- 3 tables with chairs enough for the number of students you expect
- take out ecosystem activity buckets and corresponding activity materials
- Camera with link to computer

Animal handling:

- Touch animals with pinky finger only.
- Program participants are not to handle animals without the supervision of staff or volunteers
- Stroke animal lightly (to feel texture). Never poke it.
- Do not use injured animals. Remove and replace stressed or injured animals.
- Don't pick up animals that are firmly attached to substrate (surface).
- Please do not allow students to tease or taunt the animals.
- Animals that should be kept in the water as much as possible. Urchins are kept in glass bowls within the larger holding containers which allows students to get a closer look with out harming or stressing the animal.
- Water temperature needs to remain cold. This may involve needing to switch the bucket water in between programs.

Introduction (10 min)

What is an ecosystem?

An ecological unit that includes both living and non-living components

- Living examples-fish, birds, plants
- Non-living examples-water, light, substrate

Vocabulary

- Ecosystem
- Biotic
- Abiotic

Rocky Reefs in British Columbia (20 min)

Learning objectives of this station:

- Identify fish species living in rocky reefs using species photo ID cards
- Identify interactions between fish species and their habitat components
- Discuss human fishing practices and their impacts on ecosystems and fish populations
- Introduce concept of sustainable seafood and provide students with tools to make educated decisions on seafood purchasing

Vocabulary

- Overfishing
- Marine Protected Areas (MPA's)
- By-catch
- Sustainable

Station Introduction: (few minutes)

Welcome to British Columbia! BC is full of amazing underwater ecosystems and incredible biodiversity. Each of the exhibits in this gallery represents a different ecosystem and has been modeled after actual places in BC. If you look at them you'll notice some are very different: there are sandy bottom ecosystems, rocky reef ecosystems, ones with more current or less current, more light, or less light. In each of these ecosystems you will find different types of animals!

Today we will begin by focusing our efforts on understanding one ecosystem: rocky reefs. These reefs are excellent habitats for many different fish species.

Take a close look at the animals and habitats of this ecosystem. While we are here, you are going to become field biologists and conduct a fish species survey.

Observation Activity: Fish survey (7min)

Divide the students into 3 groups and give each small group a clipboard. Send 2 groups to different exhibits and tell them to identify as many of the fishes as they can using their ID tags. Once they ID a fish ask them to make specific notes about the abiotic features in their habitat and also how the fish appears to be interacting in their

environment (Hiding in rock? Hiding in kelp? Camouflaged on bottom? Eating kelp? Encourage them to make as many observations and notes as possible!

Discussion + Fishing demo

Okay let's compare notes and find out what types of fish each group found?
Did anyone find perch, geenlings, Cabazon or rockfish?
What species of rockfish did you find? (tiger, china, black, vermillion, copper, boccaccio)

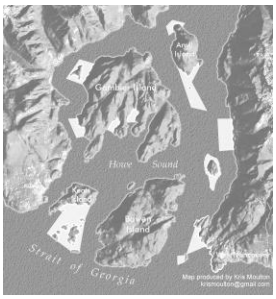
Rockfish belong to the scorpion fish family! They have spines with venom. BC rockfish don't have very strong venom. But the spines could give you a good poke! Their species name is Sebastes. "Sebast" in Latin means "majestic". Do they look majestic?

Rockfish live to be super old!! The oldest rockfish (rougheye, found in Alaska) was aged at 205 years; the yelloweye around 120yrs, quillback and tiger 100 yrs, china 80 yrs, black and copper 50 yrs. That's a long time when you consider that most other fish live between 2-8 years (pink salmon 2yrs, surf perch 6yrs, herring 7-8yrs,). Imagine, some of the fish you are looking at have been around before you, your parents, or even your grandparents!

How did you find the fish interacting with their habitat? What were they doing?

Not a lot. Rockfish don't move around much – mostly they just find their little rock and hang out (hence their name). Unfortunately, this puts them at risk from being fished quite easily. If they don't move a lot, then they can be "fished out" quickly, especially if enough people fish in the same place (consider how long it takes them to reproduce too). Look at this picture (man fishing next to no fishing sign). This is at Lighthouse Park on the North Shore. All of the Burrard Inlet and Howe Sound used to be filled with rockfish, but due to local and commercial fishing – they are all almost totally gone.

What can we do?
One way we can help protect rockfish is to conserve the areas they live in…and that is just what we are doing. If you drive from here to Whistler near Howe Sound, you can see there are lots of ROCKFISH CONSERVATION AREAS or RCA's. Hopefully, we will see the populations increase in these areas (we'll have to monitor them).



What else can we do? What do you think is the biggest way humans impact fish populations?

FISHING! We eat fish and harvest it in huge quantities all over the world! Many of the fish techniques we use are actually the cause of major ecosystem destruction and fish population decrease.

Fishing techniques demo

First, let's look at one method called Trawling. Let's trawl for rockfish – these little pink chips hanging out on the bottom of our ecosystem. Can I get a volunteer to trawl this ecosystem here…….Did you catch lots? (yes). Did you catch other things? (yes). This is called "by catch". Many commercial species are caught with a lot of by-catch which harms their populations – dolphins, turtles, other fish. How does the ecosystem look? (ruined). Now there are no more places or rocks or kelp for the fish to live in. No habitat, no fish. This is a problem.

Let's try to improve this technique using something called a BRD or By catch Reduction Device. This slightly improved Trawling method uses a grill guard or grate to keep out some of the by catch. Get another student to try. So now we caught much less by-catch, but how is our ecosystem? (Still destroyed).

So we see that trawling, and trawling using a BRD, are not super great methods to ecosystems. Maybe we don't have to catch quite so many at a time. What if we just used the old fashion hook and line technique. Try……. Now we have the fish we want and we didn't damage the ecosystem.

But we aren't the fishermen. We don't really have as much control on the different techniques being used…but what we DO have control over is the fish we BUY. We can know what it is, where it comes from, and if it's a "sustainable seafood" choice.

Be informed and make smart seafood choices.

We want to eat and buy seafood that isn't caught using harmful techniques and have populations that are healthy and not threatened to be extinct. We can use these Seafood choice guides where the fish are categorized into three groups based on how they are fished and how stable their populations are. When you go to restaurants or

markets you can avoid the red zone fishes…like "red snapper" which is actually yelloweye rockfish!

Support Restaurants that make smart seafood choices

The Aquarium also has a program that supports sustainable seafood choices. It's called Ocean Wise. How many of you guys have been or like going to the Cactus Club? That's an example of an "Ocean Wise" restaurant…so when you go there and you see this little logo on the menu, you know you are making a sustainable seafood choice. There's lots of restaurants involved, so you can find out where the best restaurants to take your date and impress them with you sustainable seafood knowledge!!

Kelp Forests in British Columbia (20 min)

Learning objectives of this station:

- Examine the functional roles of animals in kelp forest ecosystems
- Discuss the connectivity between kelp, sea urchins and sea otters
  in relation to ecosystem balance (FOOD WEB)
- Examine live sea urchins
- Discuss the concept of 'keystone species' and the importance of
  ecosystem interconnectivity and balance

Vocabulary

- Keystone species
- Photosynthesis
- Food chain

Introduction:

Welcome to a very exciting and important ecosystem.
Just like we have amazing forests on land that you all have probably been in and explored before…not many people know, but we have incredible forests under the sea – they're called KELP FORESTS.

Show illustration of temperate forest w/ kelp forest.
Kelp forests are actually a lot like land forests – they have a similar structure:

Canopy level: at the top where all the kelp blades float around near the surface creating – like the tops of trees – that shade all the area beneath it letting some light through here and there.

Understory level: in the middle, a bit more open where fish can swim about, less places to hide but can move more freely.

Ocean floor: where the kelp is attached to the rocky bottom. Here you find some shorter seaweed species (like the bushes and plants of a forest) and lots of little animals crawling around, hiding and eating.

Kelp forests are a vital part of the ecosystem for several reasons. One of these reasons is that kelp forests are often referred to as 'the ocean's nursery'. Many different species of fish as well as octopus and squid, lay their eggs on the large broad blades of kelp. There, the babies will hatch and have many safe places to hide until they are big enough to fend for themselves.

Another place where kelp comes in handy is in the food chain. (Use visual aid) Does anyone know what kelp is…? Is it a plant? (NO) Kelp is actually made of photosynthetic algae- algae that rely on the sun's energy to make their own food. In the food chain we refer to them as Primary Producers. (Place kelp on Food Web board)

Because kelp is at the bottom of the food chain, kelp is bound to be consumed. Can you name any marine species that eat kelp? (snails, abalone, urchins, kelp crabs–place images on board) Animals that eat producers are called consumers.

Urchins are one of the biggest kelp consumers in the ocean. Let's take a closer look at these unique animals. (Urchin observation)

- Show urchin diagram, external/internal components
- Spikes, mouth, teeth-to munch on kelp, gonads=UNI (sushi)
- Students are permitted to hold urchins if supervised.
-

Are ocean animals the only ones that eat kelp? No, humans eat kelp too. Have any of you ever eaten sushi? Sushi chefs use dried kelp to wrap fish and rice.

Also, alginate, a commercial product made from kelp is used as a thickening agent in many items we use on a daily basis. How many of you brushed your teeth this morning? If you did, you may have consumed some alginate-it's a main ingredient in tooth paste! Alginate is also used in foods such as ice cream, salad dressings, sauces and low-fat spreads.(Complete/review Interactions-human and animal on food web board)

The top spot in this food web is reserved for the animal that eats the consumers, but is not consumed- we know these animals as top predators! Can anyone think of an animal that eats consumers and lives at the surface of kelp forests? (Sea otters)

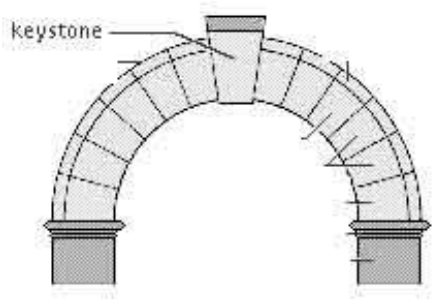
One could argue that sea otters are not the ultimate predator in this situation. Can anyone think of another animal that actively sought out sea otters for many years? HUMANS! Over a period of 200 years (1600's-1800's) sea otters of our Pacific coast were hunted and killed to the verge of extinction! And for what, all for the sake of fashion! (show sea otter pelt-have them touch it). Pelts like this one were

processed and turned into garments such as fur coats, hats, mittens, etc… and everyone-especially in Europe and Asia, wanted one.

Today, sea otters are a protected species and their numbers are slowly increasing. Families of sea otters that survived the fur trade were eventually taken and transplanted back into areas such as California and B.C., off the west coast of Vancouver Island.

Looking at our food web, how do you think the disappearance of sea otters affected the balance of this ecosystem? What happened to the sea urchin population? (It grew!) What then happened to the kelp forests? (They disappeared!) What happened to all the animals that were hiding amongst the kelp? (They were eaten)

Because sea otters are such an important part of this ecosystem, we refer to them as a "keystone species" (show image of arch/keystone) Look at this image, the keystone is the piece in the center that holds everything together. What happens to the arch if you remove the keystone? (It collapses just like the ecosystem)



Take home message: Ecosystems are complex and balanced by a large number of interconnections between species. We must be careful about how we impact these species because when even one component of an ecosystem is altered, it can have large (and catastrophic) effects on the entire ecosystem!

Primary Producers:
The organisms responsible for primary production are known as primary producers or autotrophs, and form the base of the food chain. In terrestrial ecosystems, these organisms are mainly plants, while in aquatic ecosystems the primary producers are algae and phytoplankton. They convert energy from the sun (in addition to taking carbon dioxide dissolved in the water) into oxygen and carbohydrates which allow them to grow.
Note: Algae are NOT plants – they have no roots, stems, leaves, and vascular transport as do what we often think of as Vascular plants. Algae falls under Kingdom Chromista (not Plantae) and the three major phylums are: Phaeophya (brown algea like kelps), Chrysophyta (green algae), Rhodophyta (red algae).

Grazers: Herbivore animals that feed on the living and growing herbage, attached algea, or phytoplankton. For example, many mollusques and crustaceans live right on the kelp stipes, holdfasts, or fronds, and munch away at it. Most grazers will themselves be eaten by higher predaters such as fishes. Fish can also graze. On land the forest grazers are things that eat the plants – deer, rabbits…etc.

Bottom feeders : Animals that feed from the lower ocean floor layer.

Scavengers: Scavenge their food from the ocean floor. Often eat dead remains of animals.

Decomposers and Detrivores: Get their energy from eating scarps of plants and animals (basically the muck on the bottom). They help break down dead matter in the oceans and recycle the nutrients back into the ecosystem. A wellknown terestrial decomposer is the earthworm. Marine worms, sea cucumbers, bat stars, lobsters, crabs help do this in the ocean.

Filter feeders: capture food that is suspended in the water by creating a current within them for the water to flow through. Prey is captured as the current passes through the animal; the prey is filtered from the water as the water passes through the animal

Suspension feeders: Catch food or organic material from the water using tentacles or spiny arms. They do not create a current like filter feeders yet just let the food come to them and then attach onto it with their tentacles or arms. Some examples of suspension feeders are the anemone, coral, hydroids and brittle stars.

Predaters: Predators actively seek out their prey items. This includes carnivores and also omnivores. There can be multiple level of predation in the oceans. Primary predaters eat the lower levels in the food web such as the grazers, or certain
bottom feeders. Secondary predaters eat the primary predaters and so on.

Coral Reefs in the Tropics (20 min)

Learning objectives of this station:
- Discuss the ecological significance of coral reef ecosystems
- Examine an anemone polyp and learn basic coral biology and reef building
- Identify abiotic conditions necessary for coral survival
- Discuss how corals respond to changes/stresses in their environment
- Identify multiple human causes of reef destruction and corresponding ways to reduce these impacts

Vocabulary
- Zooxanthellae
- Biodiversity
- Natural and Anthropogenic Impacts

Introduction (1-2 min)

While looking at the large exhibit, ask the students if coral is a plant, animal or rock? In a way, they're all three. Technically, they're classified as animals.

Corals are alive!! They are giant connected colonies of tiny animals living together that can cover *kilometers* of ocean. Corals are the largest living structures on earth. Think Great Barrier Reef. Not an elephant. Not a blue whale.

Coral reefs are one of the oldest ecosystems on our planet. They have existed for millions years. Look at all the shapes, sizes and colors of coral! Look at all the types of fish living within them! (How do they differ from BC ocean ecosystems?)

Coral reef systems are considered one of the most biodiverse ecosystems on earth. They are often referred to as "rainforests of the sea".

Coral cart (10 min)- True or False Activity

Ask a student to pick up and read the first T/F question cards to begin the station:

> 1. T or F. Corals are in the same scientific grouping (Phylum) as jellies and sea anemones?

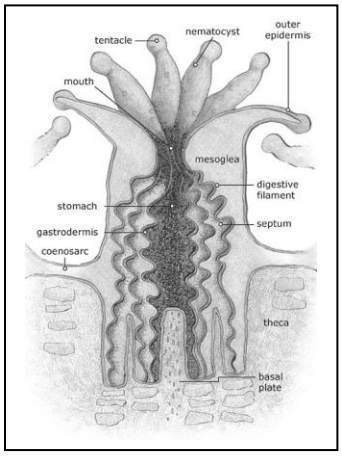
True. The phylum is called Cnidaria. Coral actually have a same structure as a sea anemone. Corals are made of colonies of polyps – each one that looks just like a mini sea anemone.

Touch the anemone and tell me what happens?

The tentacles stick to your fingers because they have stinging cells called Cnidocytes. When you touch them they send little harpoons into your fingers injecting poison trying to capture you and bring you to their mouths (in the center). We don't feel a sting or prick because we have very thick skin and the 'harpoons' aren't able to pierce it. **The corals use their tentacles to capture food**.

So that's one coral polyp? But how do we get a reef?

Whiteboard – Mr. Polyp: Point out the basic polyp structure. All corals are made of polyps. Some are soft – just like the anemone – and they don't grow into big reefs. Reef building corals are hard because they secrete a calcium carbonate casing (for protection). Polyps form the casing and then reproduce asexually (cloning) right on top of each other to build the familiar coral structures we know. Pass the students some sample of dead coral and tell them to use their magnifying glasses to see the holes where the polyps used to live. You can really see the structure of their skeletons!



> 2. T or F. Corals need ocean current to grow?

True. We just saw that polyps have tentacles to catch food, so the polyps need current to bring them food. Write 'current' on whiteboard in abiotic factors corner. Some corals, however, rely on something else and do not have the same requirements for ocean current.

3. T or F. Coral reefs grow at the same rate as kelp forests?

False. Kelp are annuals – that means they grow super big, super fast, and then die off for the winter and then grow again next year. In comparison to corals, plants grow fast... but they don't have to produce a hard skeleton. **Corals only grow about 1 to 10cm in a year!** Just imagine, the creation of coral reefs can take hundreds, even thousands, of years!

Imagine when you break off a piece of coral like the ones we we're holding. It's like breaking off 50 years of building effort. AND, more importantly, it will take 50 years for that piece to grow back again. This is a big problem because currently, **some coral reefs are being destroyed faster then they are able to grow back**.

4. T or F. There are *more* nutrients in the warm oceans for coral reefs than in the cold oceans of BC?

False. There are not a lot of nutrients or food particles in the waters where coral reefs live. This means there is not a lot of food for corals to trap with their tentacles – they need another way to acquire energy. They incorporate zooxanthellae, which are like a plant, to photosynthesize and produce energy from the sun. Waste from the zooxanthellae are used by the coral for nutrients. What do plants need to live? (Light) So this means corals need light. What kind of water do corals need to live in then? (shallow waters, access to light – write on board)

What do you think happens when as global water temperatures rise? Does it stress out the corals?

5. Fact: Most coral reefs are in warm water.

T or F? Corals will die if the water is *too warm*?

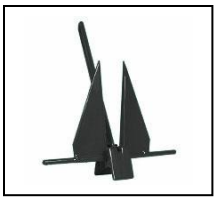
True. Corals release their zooxanthellae when water temperatures rise above their normal threshold. This phenomenon is called coral bleaching.
It has nothing to do with bleach the chemical…but what happens when you bleach something? (It turns white) This is what happens to the corals when they become 'stressed'.

Ask the students if they have ever felt stressed?
Does your body feel the same when you're stressed? (No. I break out in lots of zits, I often get sick because I am tired and my immune system is down…)
Corals are the same. When the conditions in the environment change, like an increase in water temperature, the corals become stressed. When they are stressed, they release their photosynthetic algae. Why is this bad?
(No algae = lose their color = not photosynthesizing = no food = dead)

People are very concerned about corals reacting to climate change. Scientists predict that if the ocean temperatures continue to increase, even by a few degrees, it will cause coral bleaching on most reefs (which has occurred in the recent past). If there are no coral reefs, it is a huge loss of habitat for a HUGE number of animals that rely on the reefs to survive. Scientists are actually studying coral to help them know how the ocean temperature is changing. Corals are like an ocean indicator of temperature conditions.

Conservation Activity (5 mins)

So now we know lots about coral reefs, we want to get a better understanding of the things that are damaging them and how. Ask a student to reach into the bag and select an item. Ask the group to brainstorm how they think this item might be related to causing coral reef damage. Items in bag:



<u>Boat w/ anchor</u>

Boat anchors can destroy coral reefs when they are lowered and raised. Boaters must be really careful about knowing where they can drop anchor in reef covered seas.

<u>Container with water, dead coral and sand</u>

→ Siltation: When muddy or sandy sediments get washed over coral and cover them. This can be due to many factors. Show picture of clear cutting that caused land erosion and run-off into streams that empty into coral reef areas.
→ Bottom trawlers stir up sediments that can cover coral.
→ Why does siltation cause coral polyps to die? (recall what corals need –light)

<u>Golf ball w/ fertilizer</u>

→ What keeps that grass so green? Fertilizer!! If the course is close to the ocean, with rain the fertilizer oozes through the ground and into the ocean or a nearby stream that feeds the ocean. This can throw the nutrient balance out of whack.
→ This also applies to farmland or peoples private homes that use lots of chemical fertilizers.

<u>Hotel</u>

There are environmental impacts associated with building developments.
→ What might be the problems of building a lot of beach front resorts?

Construction projects cause a lot of pollution from material byproducts and waste. Land clearing for construction sites can increase silt in estuaries.
Tourism booms can cause sudden increases in garbage, sewage, and emissions. When a resort or facility is built, where does all the human waste go? How do supplies get there? Are there tourist activities?

Dead coral souvenir ornament

Habitats are destroyed through illegal removal of corals as souvenirs. Recall how long it takes for coral to grow!! What could be a solution to this problem?

Stick of dynamite

In some places a very destructive technique called dynamite fishing is used to harvest commercial fish. They throw explosives into the water and harvest all the dead fish that float to the top. There is much more than just the desired fish species that is blown up and damaged.

Toy car

Think Pollution, carbon emissions, and climate change. Corals are very sensitive to temperature changes and they get stressed when the temperature goes out of their normal range. When coral is stressed they eject their photosynthetic algae and therefore cannot produce energy (food) for themselves. They become bleached and the reef dies. This has major implications for all the animals living in the reef.
→ We can act to help change by doing a number of small actions that reduce carbon emissions (drive less, save energy, purchase less packaging or local food…)

Flipper

Divers and snorkelers can have a direct impact on coral reefs by standing on or touching the corals with their bodies. In many areas, people stand on corals so they can keep their head above water while they adjust their equipment or have their photo taken. Divers and snorkelers can also influence the behavior of coral reef animals when they feed them.

Classroom Activity (50 min)

Build an Ecosystem

This is a fun activity where students get to put their heads together, be creative and apply the things they learned in their gallery activities. The goal of this activity is for the students start thinking about the connectivity of ecosystem components and the impacts that human developments have on the environment.

Sitting around tables in their existing groups, coordinator will briefly introduce the activity and hand out the materials.

Each group will receive a different ecosystem bucket and a clipboard worksheet. The worksheet describes a scenario for the specific ecosystem and gives instructions for what their 'environmental impact team' must do. They will have around ½ hour to do the actual model building and then the last 10-15 minutes of the program will be each group giving a short environmental news report. The role of the Volunteer will be to supervise and oversee this activity without being too involved in it – this is a creative time for the students to apply their knowledge.

The students may need help in constructing the various models, or have questions regarding certain 'development decisions' that you will be able to help with. If they seem confused or off-track, try asking leading questions to help focus their building process:

Ex: How will you ship your products? Need cargo ships? What is the impact of having lots of cargo/tanker traffic in your waters? Perhaps oils spills? How might that impact local wildlife?

Ex: Recall our station in the tropics…do you remember when we discussed coral reef damage…how might building many big hotels close to the shoreline affect the offshore corals?

It is a fun activity with lots of little props, so it may be easy for students to get carried away or silly – try to keep your group on task and focused. Remind them they have to present their work to the class!

Below are the ecosystem worksheets for the different group buckets. Following that is an example photo of the different models the students are asked to build. These photos are simply guidelines to help you in the appropriate direction. The little text boxes briefly describe the conversation topic around each model. Take a look at these and think up some ideas of your own.

Have fun!

Rocky Reef

Welcome to the area named "Fishmania" – a rocky reef ecosystem located on BC's remote northern coastline. This area is famous for the HUGE number of fish species and high invertebrate life. MANY species of rockfish reside along rocky bottom, schools of herring feed in the nutrient rich waters, huge halibut cruise through the waters, salmon migrate in all the streams and the inshore areas are full of different shellfish (crabs, oysters, scallops). Due to these supreme conditions, the fishing industry is starting to exploit this area, but local residents are concerned the ecosystem will be changed forever. As a result, the Department of Fisheries and Oceans has decided to hire a team of professional consultants to offer two proposals: one that maximizes commercial use of the area and generates the most revenue and one that balances the needs of local residents, fishermen and the environment. Mrs. Hookenline, your government contact, has hired your team for this job. Please complete the following steps so you can be present them at the next community meeting. The future of Fishmania rests in your hands...

1. Create a model of the Fishmania ecosystem prior to use by humans. Briefly describe the ecosystem and list below the natural features of the area:

2. You and your classmates own Fishmania. Develop it any way you want. You'll need to show and explain the outcome of any of your developments.

Kelp Forest

Welcome to "Kelpana" – a small island ecosystem off the West Coast of BC with a sad and tragic history. Today, the Kelpana Island ecosystem is in bad shape. The island has been cleared of trees, the rivers are full of dirt and mud, the shorelines are slicked with oil, the ocean floor is a carpet of sea urchins and there are no sea otters, kelp or other marine life to be found. Scientists guess this was not always the case. Old reports say that before the 18th century, the Kelpana Island ecosystem was an extremely rich ecosystem with massive trees, healthy rivers and one of the world's largest kelp forests packed with hundreds of fish species and marine mammals (especially sea otters). The BC government has funded a project to try to restore the ecosystem to its once healthy condition and they have hired your environmental impact team to research this process and suggest how it could be done. Please complete the following steps so they can be presented to the class for review. The future of Kelpana rests in your hands...

1. Create a model showing Kelpana Island ecosystem after major human impacts. Include all human activities and natural parts of the environment. Briefly note how each human activity in the model impacted the natural environment and contributed to the change of the Kelpana Island ecosystem:

2. Create a model showing what can be done to help remediate (re-build) a healthy ecosystem and community in this area. Briefly note how each remediation contributes to the restoration of the Kelpana Island ecosystem:

Coral Reef

Welcome to the area named ReefoRama – a very beautiful and unique tropical ecosystem. This area has wonderful weather year round, miles of untouched golden sand beaches and is famous for its huge number of beautiful coral reefs *FULL* of amazing marine life and biodiversity. Recently, the island was voted the best place in the world for a relaxing vacation. As a result, entrepreneurs have decided to invest a lot of money in developing the island for tourism. Local residents have raised concern about too much development, so the development contractor, Mr. Buildalot, has hired your team to present two proposals: one that maximizes profits for investors and another that balances the needs of the local community, environment and investors.

Your job is to show how the developments will impact the ecosystem. Please complete the following steps so they can be presented to the class for review. The future of Reeforama rests in your hands...

1. Create a model of the ReefoRama natural ecosystem that has not been influenced by human development. Briefly describe the ecosystem and list below the natural features of the area:

3. You and your classmates own ReefoRama. Develop it any way you want. You'll need to show and explain the outcome of any of your developments.