Life on the Bahamian Coral Reef

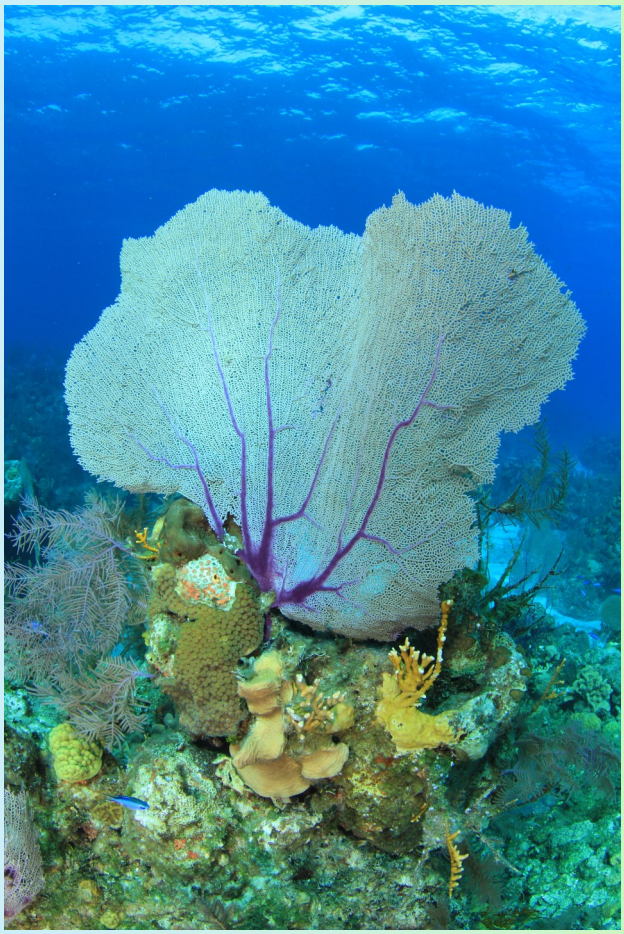
An Educator's Guide to the Virtual Coral Reef Field Trip

Bahamas Reef Environment Educational Foundation (BREEF)
www.breef.org

Bahamas Reef Environment Educational Foundation

The Bahamas Reef Environment Educational Foundation (BREEF) is a Bahamian non-profit foundation established in 1993. BREEF's mission is to promote the conservation of the Bahamian marine environment that sustains our way of life. BREEF informs the public about the importance of our marine environment, threats to our oceans and motivates people to get involved with protecting our critical marine resources.

Coral reefs play an important role in our tourism and fishing industries, providing food, recreation and shoreline protection for us all. The BREEF Virtual Coral Reef Field Trip toolkit includes a 25-min. film with interactive extras, this educator's guide and the 'Life on the Bahamian Coral Reef' poster. This important learning resource, developed by BREEF with funding from the Kerzner Marine Foundation's Blue Project, is designed for use in Bahamian high schools. It provides an enriching and engaging classroom experience for students learning about coral reef ecosystems.



Project Rationale

There can be challenges to taking students on an actual coral reef field trip. This tool kit will expose students to some of the wonders of the Bahamian coral reef while in their classroom. It will also lay the groundwork for further field studies on coral reefs and other ecosystems.

Through use of the tools provided in this kit, students will develop their scientific process skills and gain an appreciation for the need for conservation of coral reefs both locally and globally.

Kit Components

- Film — Virtual Coral Reef Field Trip
- Poster—Life on the Bahamian Coral Reef
- Educator's Guide

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Virtual Coral Reef Field Trip

Environmental Biology: Unit—Coral Reef Ecosystems

This engaging 25 minute high definition film targets a 10-12th grade student audience and is linked to the Ministry of Education—Department of Education Biology curriculum. It provides an up close look at Bahamian coral reefs with an emphasis on reef biodiversity. The film is supplemented by three short interactive extras: **Reef Creature ID** (non-fish species), **Reef Fish ID** and **Reef Survey Simulation** which may be used to reinforce concepts and assess student achievement of selected learner outcomes.

Main Film | **Sequence**

0-5 minutes: Location of coral reefs, abiotic factors required for corals to thrive.

5-7 minutes: Description of a coral reef, coral polyps, relationship between corals and zooxanthellae, types of corals.

7-15 minutes: Reef biodiversity, adaptations of common reef organisms: producers, herbivores and carnivores.

15-25 minutes: Benefits, threats and conservation of coral reefs.

Learner Outcomes:

- Identify the location of coral reefs around the world and in The Bahamas.
- Describe the relationship between the location of coral reefs and the abiotic factors needed for coral reefs to thrive.
- Observe a coral polyp.
- Distinguish between hard and soft corals.
- Observe and identify the organisms in a Bahamian coral reef ecosystem.
- Construct a coral reef food web.
- Observe the adaptations of reef organisms to their environment.
- Discuss ways humans impact the marine environment.
- Suggest ways coral reefs can be protected.

Did you know that reefs thrive in clear, shallow sunlit water because these conditions allow zooxanthellae to obtain light that is needed for photosynthesis?

CORAL REEF

Photo: French Grunts

What is a coral reef?

A coral reef is a massive limestone structure built by coral animals called polyps and cemented together by calcareous algae over many years. The reef forms the basis of the coral reef ecosystem, and supports great biodiversity. Although coral reefs cover less than 1% of the world's seafloor, they contain 25% of all marine species.

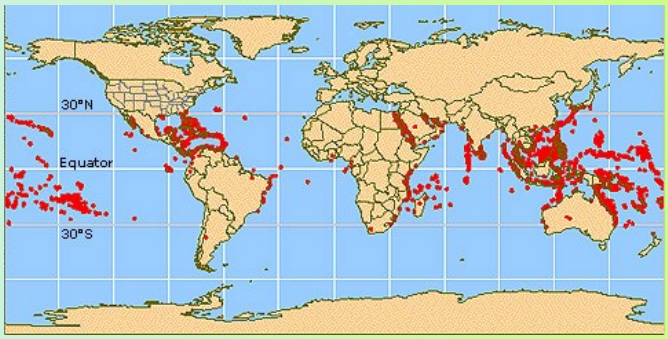


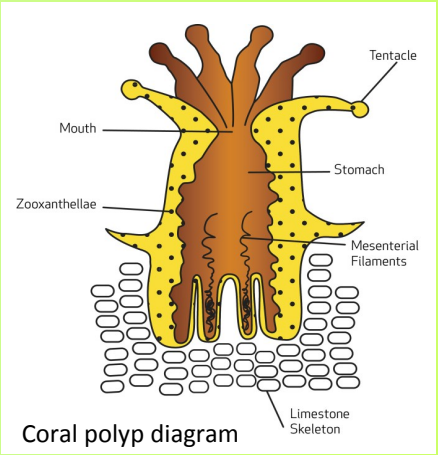
Image courtesy of NOAA National Ocean Service Communications and Education Division oceanservice.noaa.gov/education

Coral reefs - ●

The world's reefs are found in three major regions; the **Indo-Pacific,** the **Red Sea** and the **Western Atlantic Region**. These regions have tropical and subtropical climates in which reefs thrive. Coral reefs are found in these areas because corals require warm, sunlit, clear, clean and shallow saltwater to survive.

Corals are invertebrates that belong to the phylum Cnidaria. Organisms in this group have soft bodies and tentacles with stinging cells (nematocysts) that surround the only body opening. Other Cnidarians include jellyfish and sea anemones.

Corals are colonies of tiny animals called polyps, which secrete a calcium carbonate (limestone) skeleton that builds the structure of the reef.



Coral polyp diagram

Types of Corals

There are two groups of corals: **hard corals** or *hermatypes* are reef-building corals (e.g. brain or elkhorn coral) and **soft corals** or *ahermatypes* (e.g. seafans and sea whips).

Hard corals have microscopic algae called zooxanthellae living within their tissues in a mutualistic **symbiotic relationship**. Zooxanthellae supply corals with food and oxygen which they produce by photosynthesis. Corals protect the zooxanthellae and provide them with carbon dioxide. Since coral tissues are transparent, the zooxanthellae also give corals their colour. If corals become stressed due to environmental changes, e.g. high water temperatures, they expel their zooxanthellae and thus appear white. This is called **Coral Bleaching.** Bleached corals are highly susceptible to disease. If the stress is prolonged so that corals are unable to re-attract zooxanthellae, they may die.

Brain Coral
Pseudodiploria strigosa

Elkhorn Coral
Acropora palmata

Seafan
Gorgonia ventalina

Let's do our part to protect them 3

Reef Biodiversity

Coral Reefs are also known as the "Rainforest of the sea". They are home to a wide variety of organisms, from the tiniest plankton to the biggest of fish. The organisms that live on reefs have behavioral or physical adaptations that allow them to survive in their habitat (refer to page 10). All organisms play a role in keeping the ecosystem intact.

Marine macroalgae (seaweed), phytoplankton, seagrass and zooxanthellae are the producers in the coral reef ecosystem. They attract herbivores such as sea urchins, parrotfish, wrasses and damselfish. Grazing by herbivores controls the producers which compete with corals for space on the reef.

Herbivores attract carnivores like the Nassau grouper, snappers and sharks to the reef. These consumers control the populations of herbivores and other carnivores. Detritivores such as sea cucumbers and spiny lobster feed on the dead remains of animals and plants. This process cycles nutrients and ensures the health of the ecosystem.

Each organism has a particular niche and contributes to the ecological balance on the reef. Significant changes in species populations, due to activities such as overfishing, can alter the dynamics on the reef and may result in food chain disruptions.

Photos: Top to Bottom—sea grass (producer), long-spined urchin (herbivore), black grouper (carnivore)

Types of Reefs

A third of the Caribbean's coral reefs are located in The Bahamas. The most extensive reef systems are found along the northern and eastern coasts or the windward side of the islands. There are four main types of reefs:

Fringing Reefs - these run parallel to the shoreline, and are located closest to the shore.

Barrier Reefs - these reefs run parallel to the shoreline, but are much further from shore than a fringing reef. They form a barrier between the land and the ocean, protecting the land from erosion by waves. In The Bahamas, barrier reefs are usually found on the windward (northern or eastern) side of our Islands. The Andros Barrier Reef is the third longest barrier reef in the world and stretches for more than 140 miles along the east coast of Andros.

Photo: Hogsty Reef, Bahamas

Atolls - An atoll is a circular or U-shaped reef that encloses a distinct lagoon. They are commonly found in oceanic locations. They are formed when a volcanic island surrounded by a fringing reef subsides leaving a lagoon in its place. As the island sinks, the reef grows upward. Hogsty reef, located between Acklins and Inagua is considered to be a pseudo-atoll because it does not have a true volcanic origin. However, this 9 x 5 km reef has all of the features of a true atoll.

Patch Reefs— this type of reef is common in shallow water throughout The Bahamas. These small, isolated patches of reef are often referred to as coral heads.

Did you know that the world's longest barrier reef is Australia's Great Barrier Reef, which spans over 1600 miles? With a length of 700 miles, the 2nd longest is the Mesoamerican Barrier Reef System along the east coast of Mexico, Belize, Guatemala and Honduras.

Reef Threats

Corals require clear, shallow, sunlit, oxygenated, warm (79^0F-81^0F), salt water in order to thrive. Changes in these abiotic factors cause corals to become stressed, resulting in bleaching events. In recent times, these events have increased in frequency and severity due to increased water temperatures. This results in decreased live coral cover in reef ecosystems.

Threats can be classified as **natural** or **human-induced** (anthropogenic). Organisms are adapted to cope with the natural threats which have always occurred. However, humans have added additional stressors with which corals are not adapted to cope. As a result, approximately 75% of reefs worldwide are threatened.

Did you know that scientists have recently explored deep-water coral reefs in water below where light can penetrate? Deep-water corals grow very slowly because they do not have zooxanthellae to photosynthesize. They are particularly vulnerable to a destructive fishing practice called bottom trawling, and to oil and gas exploration.

CORAL REEFS OF THE WORLD CLASSIFIED BY THREAT FROM LOCAL ACTIVITIES

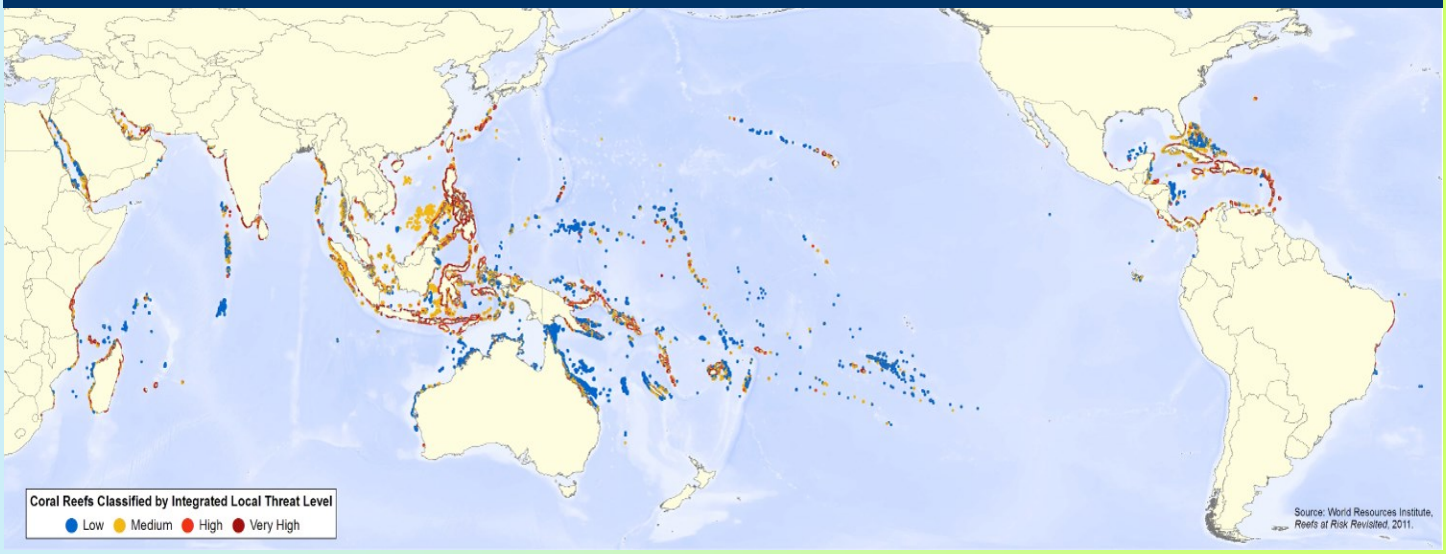


Image courtesy of World Resources Institute Reefs at Risk Revisited, 2011 http://www.wri.org

Disease
of corals and important reef species, e.g. urchins

Predation
of corals and reef species

Natural Threats

Hurricanes and Storms
wave action during storms, excessive rainfall may affect salinity

Did you know that coral polyps reproduce sexually to start new colonies and asexually (by budding) to expand a colony?

Overfishing
overharvesting, harvest of juveniles, destructive fishing practices

Human Induced Climate Change
warmer water causes coral bleaching, ocean acidification

Human Induced Threats

Pollution
marine debris, chemical pollutants: oil spills, fertilizers, sewage

Invasive Species
e.g. Lionfish compete with native species

Habitat Destruction
sediments from dredging and coastal developments, vessel grounding and anchoring

Reef Benefits and Conservation

As a coastal nation, The Bahamas relies heavily on the ecosystem services that coral reefs provide. Reefs provide a habitat for marine organisms, a supply of seafood (protein), shoreline protection, employment through fishing and tourism, recreation, opportunities for scientific research, medicinal and commercial products, and are a main source of sand for beaches. Protection of reefs with a variety of conservation tools will bring economic and ecological benefits.

Coral Reef Conservation Tools

Public Education — public and school campaigns are conducted by BREEF and other conservation partners. *"In the end we will conserve only what we love. We will love only what we understand. We will understand only what we are taught". Baba Dioum*

Protection of Connected Habitats — marine habitats are interdependent and are impacted by activities that take place both at sea and on land. Many marine species also use several habitats to complete their life cycle. Thus, protection of wetlands, beaches, seagrass, tidal flats and deep water habitats also protect coral reefs.

Scientific Research — is being conducted by scientists to collect data that will guide management efforts. Ongoing projects include coral reef surveys; a coral nursery programme; conch, grouper and crawfish population studies; invasive species (Lionfish) research and removal activities.

Legislation — Harvesting of coral, sea turtles, marine mammals and commercial fishing of sharks is prohibited in The Bahamas. Fishery regulations encompass a number of tools including closed seasons, size limits, gear restrictions, bag limits for sports fishing and restricted entry into the fishery to prevent overexploitation of resources. Enforcement of regulations helps to ensure that we will have these marine resources for the future.

Marine Protected Areas (MPAs) — As a signatory to the Caribbean Challenge Initiative, the government of The Bahamas has committed to effectively conserving and managing 20% of our marine and coastal environment by the year 2020. The Bahamas' system of marine parks and reserves protect critical habitats, including coral reefs. National Parks are currently managed by The Bahamas National Trust. Marine Reserves have been established specifically to support fishery replenishment and are managed by the Department of Marine Resources.

These Marine Protected Areas Protect Coral Reefs (2012)

1. Walker's Cay National Park
2. No Name Cay Marine Reserve
3. Fowl Cays National Park
4. Pelican Cays Land and Sea Park
5. North and South Andros Marine Parks
6. Exuma Cays Land and Sea Park
7. Moriah Harbour Cay National Park
8. The Exuma (Jewfish Cay) Marine Reserve
9. The Conception Island National Park
10. Little Inagua National Park
11. South Berry Islands Marine Reserve

Visit www.bahamasprotected.com for updates on new and proposed MPAs.

Extra 1— Interactive Reef Creature Identification & Trivia

This short film focuses on marine producers and non-fish animal species commonly found in the coral reef ecosystem. It highlights common species as well as species of ecological, cultural, and/or socioeconomic significance. Information is given about each species to allow students to gather information that could be used to develop a coral reef food web. Additional information is provided pertaining to their conservation status and significance.

Materials:

- VCRFT Film Extra 1 - Reef Creature ID
- Student Worksheet (page 16)

Reef Creature ID Quiz

Extra 1 includes a short organism identification quiz that consists of eight multiple choice questions. Before the film begins, ensure that students have the worksheet and a pen/pencil ready. The film has a built-in countdown to transition to the quiz, but you may PAUSE the film until you are ready to continue. The answers have also been provided on the film. Another countdown has been built-in so that you can ensure that the students are ready before the answers are reviewed.

1. [Halimeda] Halimeda is an example of :
A. Seaweed B. Sea fan C. Seagrass D. Sea cucumber

2. [Seagrass] This plant is not an algae, it is actually a flowering plant. What is it?
A. Zooxanthellae B. Seaweed C. Sea urchin **D. Seagrass**

3. [Long-spined urchin] In a food chain of marine organisms, this would be classified as:
A. Herbivore B. Omnivore C. Producer D. Carnivore

4. [Sea cucumber] This echinoderm is important to reef health because it cleans the sea floor by processing sand. What is it called?
A. Anemone B. Sea star **C. Sea cucumber** D. Queen conch

5. [Halimeda algae, Brain coral, Sponge and Sea fan] Which of these organisms is a plant?
A. Halimeda B. Brain coral C. Sponge D. Sea fan

6. [Adult conch with thick lip exposed labeled A and juvenile conch with no lip labeled B]. Which picture shows a conch that can be legally harvested in The Bahamas?
A. B.

7. [Spiny lobster/Crawfish] The closed season for crawfish is April 1st to July 31st . This suggests that crawfish mainly breed during which seasons?
A. Spring - Summer B Summer – Fall
C. Fall - Winter D. Winter - Spring

8. [Brain coral, Sea fan, Sea whip and Sponge]. Which of the following is a reef-building coral?
A. Brain coral B. Sea fan C. Sea whip D. Sponge

EXTRA 1
Answer Key

[on-screen image]

Correct Answer


Photo: Pillar coral

REEF BINGO!

Extra 1— Classroom Extension Activity

REEF BINGO

This activity will reinforce the concepts learned in Extra 1. The bingo cards also include organisms that students will observe during the main film.

Materials:

- Bingo Cards—one per team of up to three students
- Place Markers, e.g. foam pieces, beans etc. — 16 per team
- Bingo Caller Cards
- Prizes (optional)

Instructions:

- Make a set of bingo cards using the resources on pages 12-14, to provide a different card for each team of 2-3 students.
- Distribute one bingo card and 16 markers to each team.
- Call at random the clues for each organism. There are several clues for each. Call as many clues as you deem appropriate, and in accordance with the needs of your students. Feel free to create additional clues. Clues may feature adaptations (physical and behavioral characteristics), the importance of and threats to the species, regulations to protect the species, etc.
- Students will place the markers on an image that matches a called clue, if it is on their card.
- The winner must shout out the word 'BINGO'.
- Winners can be determined using an agreed bingo pattern (see table below).

BINGO Pattern	Description
BLACKOUT	All images marked
LINES	Must make a horizontal, vertical or diagonal line
'T'	Fill in the card in the shape of a right side up, upside down or sideways 'T ', e.g. top row and middle column
'U'	Fill in the card in the shape of an upside down or right side up 'U', e.g. left and right column and top or bottom row
SQUARES	Fill in the outer perimeter of the card

Photo: Flamingo Tongue on Sea Fan

Photo: Nassau Grouper

Extra 2— Interactive Fish Identification & Trivia

This short film focuses on reef fish species found in The Bahamas. The species that have been highlighted are of ecological, cultural, and/or socioeconomic significance. This section builds upon Extra 1 so that students will be able to construct a coral reef food web consisting of at least three interlinked food chains. Additional information is provided pertaining to their conservation status and significance.

Materials:

- VCRFT Film Extra 2—Reef Fish ID
- Student Worksheet (page 16)

Fish ID Quiz

Extra 2 includes a short organism identification quiz that consists of eight True/False questions. Before the film begins, ensure that students have the worksheet and a pen/pencil ready . The film has a built-in countdown to transition to the quiz, but you may PAUSE the film until you are ready to continue. The answers have also been provided on the film. Another countdown has been built-in so that you can ensure that the students are ready before the answers are reviewed.

1. **[Snapper]:** This fish is known as the Nassau grouper.
   True or **False**

2 .**[Grunt]** Quite popular with local fishermen, this is a snap shot of a bar jack.
   True or **False**

3. **[Nassau grouper]** The closed season for this fish takes place during the winter months to give them a chance to breed.
   True or False

4. **[Lionfish]** This fish, a native of the Indo-Pacific region, and an invasive species in The Bahamas, is safe to eat.
   True or False

5. **[Parrotfish]** This herbivorous fish has a beak-shaped mouth.
   True or False

6. **[Angelfish]** These fish, known as angelfish, help to control the amount of algae on the coral reef.
   True or False

7. **[Green Moray Eel]** The body shape of this fish indicates that it is usually seen lying flat on the seafloor.
   True or **False**

8. **[Caribbean Reef Shark]** Sharks are important species; they help to keep our oceans healthy.
   True or False

EXTRA 2
Answer Key

[on-screen image]

Correct Answer

Photos: Yellowtail Snapper (top), Queen Angelfish (bottom)

Extra 2 — Classroom Extension Activity

CONSTRUCT A FOOD WEB

A food web shows the feeding relationships between organisms by depicting how energy moves through a community of organisms. In this activity, students will construct a coral reef food web consisting of at least three interlinked food chains using the organisms from the word list below.

Materials:

- One set of student-selected organism cards per group
- Arrows/string/markers
- Poster board
- Glue/tape

Instructions:

- Review the organisms in the list below and classify them according to types of feeders (producer, herbivore, omnivore, carnivore, detritivore).
- Establish as many energy transfer/feeding relationships between the organisms as possible using the Virtual Coral Reef Field Trip film, books, Internet, etc. as resources.
- Select organisms from the list to create a food web of **at least** three interlinked food chains. Marks will be awarded according to the accuracy and complexity of your food web.
- Create organism cards using the word list or the images on page 14.
- Organize and affix the cards to a poster board to create a food web.
- Using a ruler, draw arrows to show the energy relationships between the organisms. The arrowhead should point to the animal that is consuming another.
- You are encouraged to use a legend, colour coding, labels, titles, etc. to effectively communicate ideas.
- Present your food web to the class. Use ecology terms to convey ideas — energy flow, producer, consumer, herbivore, omnivore, carnivore, detritivore, 1st, 2nd, 3rd, 4th trophic level, top predator, etc.

Organism List: *Butterflyfish, Coral, Damselfish, Green Turtle, Hawksbill Turtle, Lionfish, Marine Algae (Seaweed), Nassau Grouper, Parrotfish, Phytoplankton, Queen Conch, Sea Cucumber, Seagrass, Sea Urchin, Shark, Silversides, Snapper, Southern Ray, Spiny Lobster, Sponge, Zooplankton, Zooxanthellae.* (*You may add additional organisms if you wish*)

FOOD WEB RUBRIC (sample web on page 15)

Criteria	Level 1	Level 2	Level 3	Level 4
Organisms	• Less than 10 • Less than 3 interconnected food chains	• 11-15 • 3 interconnected food chains	• 16-20 • 3-5 interconnected food chains	• 21 + • More than 5 interconnected food chains
Energy Flow	• Many missing arrows • Arrows backwards • Energy flow difficult to follow	• Few missing arrows • Few arrows backwards • Energy flow sometimes clear and easy to follow	• Accurate use of arrows • Energy flow is usually clear and easy to follow	• Extensive use of arrows • Energy flow is always accurate and clear
Knowledge	• Limited understanding of organism roles • Consistently inaccurate use of terminology	• Moderate understanding of organism roles • Moderate use of terminology	• Clear understanding of organism roles • Accurate use of terminology	• Excellent understanding of organism roles • Extensive and accurate use of terminology
Organization	• Limited use of legend, colour coding, title, labels, neatness	• Moderate	• Well-organized	• Extensively organized

FISH ADAPTATIONS

Extra 2— Classroom Extension Activity—Fish Adaptations

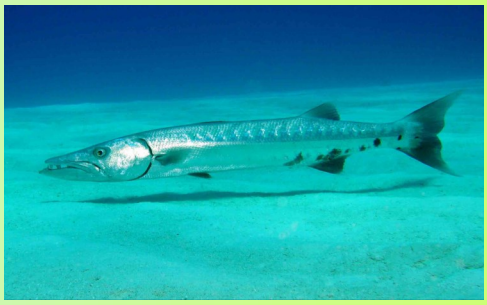
Students can use two organisms of their choice to show how they are adapted for life on the coral reef . They should be able to use the observable features of a fish to answer the following questions:

What does the fish eat? Is it a herbivore or carnivore? Where in the water column does it feed (i.e. on the seafloor, in the water column, at the surface)? Is it a fast or slow swimmer? Is it an ambush predator?

BACKGROUND INFORMATION

Adaptation is a process that takes place over multiple generations in which a species becomes better suited to survive in its environment. Adaptations may be **physical** or **behavioral**. **Physical** adaptations are the physical features of an organism (e.g. shape, body covering). **Behavioral** adaptations are instincts and/or the ability to learn (e.g. schooling, mating in spawning aggregations, feeding at night).

Body shape - Fish that are fast swimmers have a **fusiform** or streamlined shape: cylindrical and tapered (e.g. barracuda). **Compressed**: flattened side-to-side body shapes navigate easier in dense cover or reefs (e.g. angelfish, butterflyfish). **Depressed:** flattened top-to-bottom, is common on bottom-dwelling fish (e.g. stingray). The **Elongated:** ribbon-like shape of eels allow them to wriggle into small crevices.



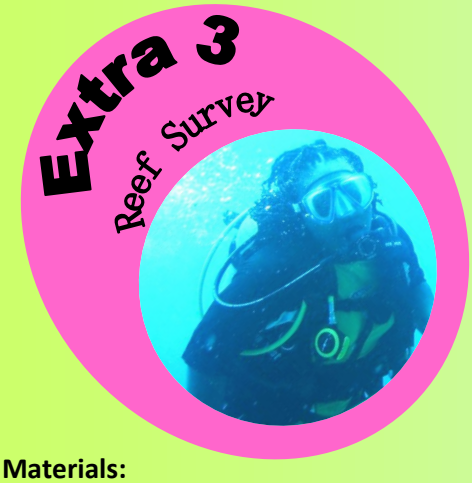
Tail shape – Faster swimmers have **lunate** moon/sickle-shaped tails (e.g. marlin), **forked** tails (e.g. bonefish, grunt) or **rounded** tails (e.g. grouper). Slower swimmers tend to have **tapered** tails (e.g. eels).

Coloration and markings - Some fish (e.g. flounder and scorpion fish) can camouflage in order to ambush prey and/or escape predation. Since predators often swallow prey head first, butterflyfish have a line through the eye to make it less noticeable to predators. They may also have markings on the tail called ocellated spots that resemble a false eye. Sharks exhibit countershading - dark back, light belly - so they blend in with the dark bottom when viewed from above and with the well-lit water surface from below. Lionfish use bright colors to warn predators that they are venomous.

Mouth location and size - Usually carnivores have large mouths for swallowing whole fish (e.g. Groupers, Sharks). **Small** mouths are used for nibbling on plants and small animals (e.g. parrotfish, damselfish). A **dorsal** or upturned mouth is used for eating near the surface (e.g. barracuda). **Anterior** or front-facing mouths are used for eating in the water column (e.g. snapper). **Ventral** mouths turn downwards or are on the underside of the fish. They are used for eating near or on the seafloor (e.g. stingray).

Photos (clockwise from top left): Southern Stingray, Great Barracuda, Banded Butterflyfish, Stoplight Parrotfish

I AM A MARINE BIOLOGIST



Materials:

- VCRFT Film Extra 3— Reef Survey Simulation
- Student Worksheet (page 16)

Extra 3 — Reef Survey Simulation

Marine biologists conduct reef surveys to assess reef systems. These scientists are trained to identify fish, coral and other benthic species such as algae and invertebrates. The data collected may be used to develop conservation management strategies.

Extra 3 is a short film clip showing a variety of common reef organisms found on Bahamian reefs. The activity simulates a reef survey. Students will be required to complete the Reef Survey worksheet to identify as many of the organisms in the film as they can.

Reef Survey

Ensure that students have their supplies ready before viewing the film and that they fully understand how to complete the survey sheet BEFORE the film begins. **The film clip will play twice.** During the first showing, students should focus on the identification of individual organisms. They should tick the box next to each organism that they observe, as the film plays. During the second showing, students should also pay attention to the organism abundance. After the second showing, PAUSE the film to give students sufficient time to estimate and record the abundance of each observed organism. Abundances should be recorded by circling the letter that applies according to the following key:

S—Single 1 **F—Few 2-10** **M– Many 11-100** **Abundant — > 100**

Press PLAY when you are ready to review the answers. The film clip will play again with the answers so that students can check their responses. The name of each species will be indicated as they appear on the screen. Students should compare and discuss the abundances that they have recorded and explain why their responses vary.

Follow up questions:

1. **What skills do scientists need in order to conduct coral reef surveys?**

A—swimming and snorkeling, SCUBA certification, strong observation skills, accurate data recording and input, species ID skills

2. **What challenges do scientists face when collecting accurate fish population data?**

A—fish move so they are difficult to count, large number of organisms to remember, large area of ocean to cover

3. **How can they overcome these challenges?**

A—conduct multiple surveys, practice, specialize in certain species groups, collect data from a representative area using a transect or quadrat

Photo (foreground): Mustard Hill Coral

R	E	E	F

Instructions:

1. Make a copy of pages 12-14.

2. Cut out the BINGO Card Template—Copy as many as you need to provide a card for each student/group of students. Two cards can fit on a 8½" x 11" sheet.

3. Retain one copy of the BINGO clues for the BINGO caller.

4. *Make several copies of page 14. Cut out the images and stick them on the blank BINGO cards so that each card has a different combination of images (*25 images have been provided and there are 16 spaces on each card).*

5. You are now ready to play REEF BINGO.

** or allow students to create the cards to develop their scientific process skills.*

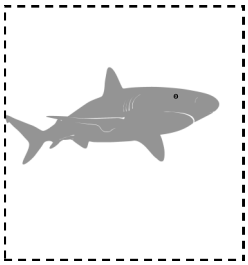
REEF BINGO CLUES—CALLER CARDS

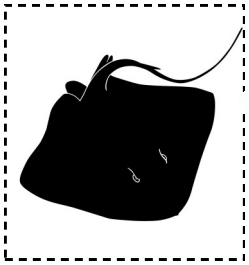
• I am very important to ocean health. • I am a carnivorous fish with a skeleton made of cartilage. • I have a dark back and a lighter belly so that I can be less visible to prey. • I cannot be commercially harvested in The Bahamas. **I am a Shark**	• I am a carnivorous fish with a skeleton made of cartilage. • I am often seen lying partially buried on the seafloor. • I use the barb on my tail for protection against predators. **I am a Southern Ray**	• I am a silvery fish. • My streamlined body makes me a fast swimmer, which is important for a top predator. • My large mouth indicates that I am carnivore. **I am a Barracuda**
• I am a favourite food fish. • You cannot catch me during the closed season which takes place during the winter so that I can reproduce. • I have five wide vertical markings on my body, and a black saddle-shaped spot on the base of my tail. **I am a Nassau Grouper**	• I am a ribbon-shaped fish. • This shape allows me to fit into the crevices in the reef. • I am a carnivore. **I am an Eel**	• I am a marine invasive species. • I am a native of the Indo-Pacific region. • Although my spines are venomous, my meat is safe to eat. • I am a threat to the fishing industry because I compete with native fish for prey. **I am a Lionfish**

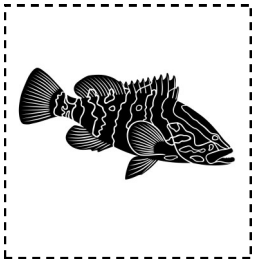
REEF BINGO CLUES—CALLER CARDS

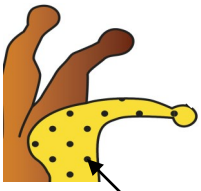
• I am a microscopic unicellular organism. • My cells contain chlorophyll. • I live inside coral polyps and supply them with food. • I give corals their colour. • Corals expel me when they are stressed. **I am Zooxanthellae**	• I am a simple plant with no true roots, stems or leaves. • I compete with corals for space on the reef. • Parrotfish and sea urchins feed on me. • There are many different types of my kind, one example is Halimeda. **I am a Marine Algae/Seaweed**	• I am a marine mollusc. • I produce my own shell. • I live in the seagrass that surrounds the reef. • I must have a thick, flared lip in order to be harvested. **I am a Queen Conch**
• I am microscopic algae. I float in the water column. • Filter feeders such as sponges feed on me. • Coral polyps capture me from the water column with their tentacles. **I am Marine Phytoplankton**	• I consist of microscopic animals that float in the water column. • Coral polyps and filter feeders such as sponges eat me. • I am a life cycle stage of many commercially important species, e.g. conch, crawfish, grouper. **I am Marine Zooplankton**	• I am a flowering plant. Queen conch, starfish, sea urchins live in my habitat. • Queen conch feed on the algae that grows on my leaves. Green turtles eat me. • My roots help to stabilize the sand on the seafloor. **I am Seagrass: e.g. Turtle grass**
• I am a colonial animal. • I have a ring of tentacles surrounding a central mouth. • Algae live symbiotically within my tissues. • I secrete a calcium carbonate/limestone skeleton that builds the reef. **I am a Coral Polyp**	• I am an echinoderm with long spines. • I am a herbivore. • I feed on the algae that grows on the reef, which helps to keep the reef healthy. **I am a Sea Urchin**	• I am a carnivorous echinoderm. • I feed on small molluscs. • People often collect me to use for decoration, but this threatens my species. **I am a Sea star/Starfish**
• I am an echinoderm. • I live on the sandy seafloor. • I process sand by feeding on the dead remains of animals and plants (detritus). **I am a Sea Cucumber**	• I am an important fishery resource that lives under reef ledges. • I cannot be harvested from April 1-July 31st. My season opens on August 1st. • You cannot harvest me if I am carrying eggs, and if my tail is less that 5 ½" long. **I am a Spiny Lobster/Crawfish**	• I am a protected species that cannot be harvested in The Bahamas. • I am a hard boulder shaped coral that is common on reefs. • I resemble an important organ that is part of the central nervous system. **I am a Brain Coral**
• I am an endangered species that cannot be harvested in The Bahamas. • I am a hard, branching coral. • I resemble deer antlers. • I feed on zooplankton. **I am an Elkhorn Coral**	• I am a protected species that cannot be harvested in The Bahamas. • I am a soft coral. I sway back and forth with the water current. • I feed on zooplankton. **I am a Seafan**	• I am a marine reptile that is fully protected in The Bahamas. • The only time that I come on land is to lay my eggs on a beach. • I can be hurt by discarded plastic bags which I may mistake for jellyfish, my favourite food. **I am a Sea Turtle**
• I am very important to reef health. • I am a herbivorous fish with a beak-like mouth. • I control the algae on the reef by scraping it from rocks as I feed. • The rock particles that I ingest are then egested as sand. **I am a Parrotfish**	• I am a herbivorous fish. • I feed on algae. • My actions help to control the rate of algal growth, which helps to make space for corals to grow. **I am a Damselfish or Angelfish**	• I am a favorite food fish. • I eat smaller fish and crustaceans. • My body is silver to white, with a yellow stripe that runs from my eye to my tail. • My tail fin is yellow. **I am a Yellowtail Snapper**

Use the images below to create your own unique set of BINGO cards.
These images may also be used for the food web activity.



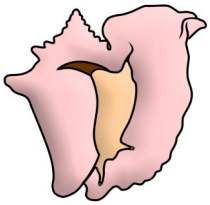


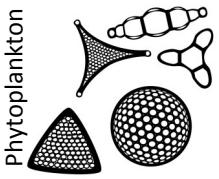




Zooxanthellae

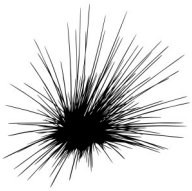
Marine Algae

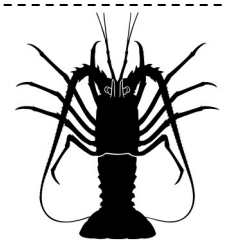


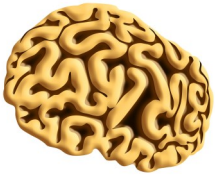


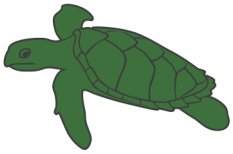
Phytoplankton

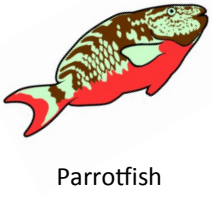
Zooplankton



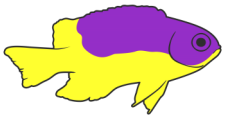




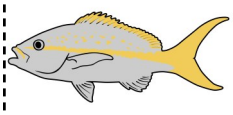




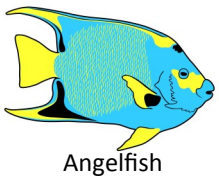
Parrotfish



Damselfish



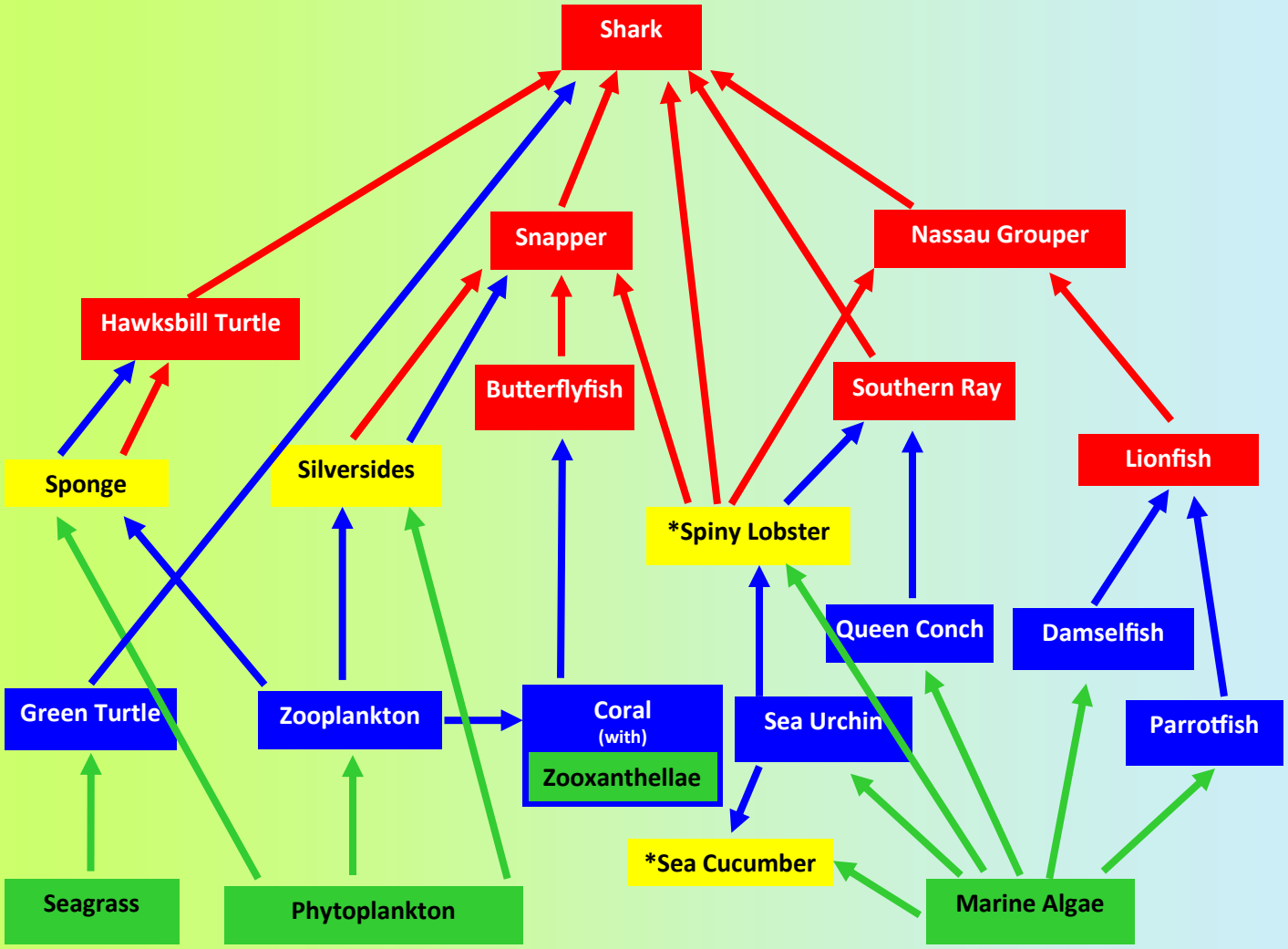
Yellow Tail Snapper



Angelfish

Image list L-R—Shark, Southern Ray, Barracuda, Nassau Grouper, Moray Eel, Lionfish, Zooxanthellae, Marine Algae, Queen Conch, Phytoplankton, Zooplankton, Sea Grass, Coral Polyp, Sea Urchin, Sea Star, Sea Cucumber, Spiny Lobster, Brain Coral, Elkhorn Coral, Sea Fan, Sea Turtle, Parrotfish, Damselfish, Yellow-tail Snapper, Angelfish.

This sample food web illustrates some of the potential feeding relationships between organisms on a coral reef.



KEY **Feeder Type**

- Producer
- Herbivore
- Carnivore
- Omnivore

* Detritivores feed on the dead remains of animals and plants

Feeding Relationship

- Producer to primary consumer
- Primary to secondary consumer
- Secondary to tertiary consumer or Tertiary to quaternary consumer

VIRTUAL CORAL REEF FIELD TRIP FILM WORKSHEET

NAME _____ **Date** _____

Circle your answer for each question.

EXTRA 1 — Creature ID

Question				
1	A	B	C	D
2	A	B	C	D
3	A	B	C	D
4	A	B	C	D
5	A	B	C	D
6	A	B		
7	A	B	C	D
8	A	B	C	D
Score				

EXTRA 2 — Fish ID

Question	True	False
1	T	F
2	T	F
3	T	F
4	T	F
5	T	F
6	T	F
7	T	F
8	T	F
Score		

Extra 3—VIRTUAL CORAL REEF SURVEY

Tick the box next each species that you observe.

After the film, record the abundance of each observed species by circling the letter that best applies.

INVERTEBRATES

Brain Coral	☐	S	F	M A
Elkhorn Coral	☐	S	F	M A
Queen Conch	☐	S	F	M A
Sea Cucumber	☐	S	F	M A
Seafan	☐	S	F	M A
Sea Star	☐	S	F	M A
Sea Urchin	☐	S	F	M A
Sponge	☐	S	F	M A
Spiny Lobster	☐	S	F	M A

VERTEBRATES

Angelfish	☐	S	F	M A
Bar Jack	☐	S	F	M A
Barracuda	☐	S	F	M A
Black Grouper	☐	S	F	M A
Bluehead Wrasse	☐	S	F	M A
Bluestriped Grunt	☐	S	F	M A
Blue Tang	☐	S	F	M A
Butterflyfish	☐	S	F	M A
Caribbean Reef Shark	☐	S	F	M A
Green Moray Eel	☐	S	F	M A
Lionfish	☐	S	F	M A
Nassau Grouper	☐	S	F	M A
Parrotfish	☐	S	F	M A
Sea Turtle	☐	S	F	M A
Sergeant Major	☐	S	F	M A
Silversides	☐	S	F	M A
Southern Ray	☐	S	F	M A
Yellowtail Snapper	☐	S	F	M A

VIRTUAL CORAL REEF FIELD TRIP POSTER WORKSHEET

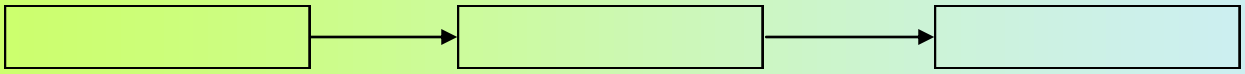
NAME _____ **Date** _____

Refer to the Coral Reef poster 'Life on the Bahamian Coral Reef' to complete this worksheet.

1. List 2 organisms for each of the following types of feeders:

Producer	Herbivore	Carnivore	Detritivore
_____	_____	_____	_____
_____	_____	_____	_____

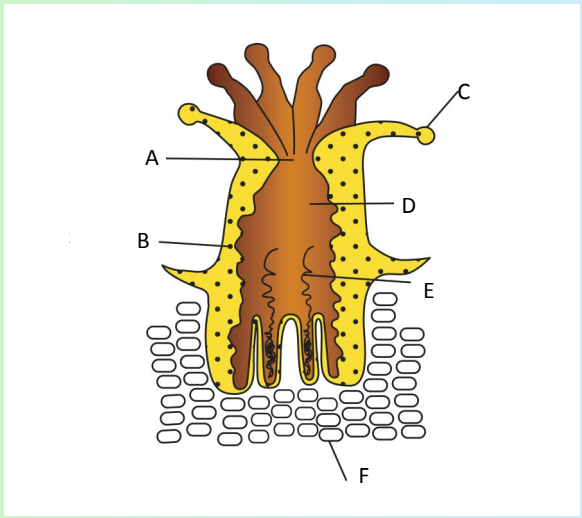
2. Use the organisms on the poster to construct a food chain with THREE organisms.



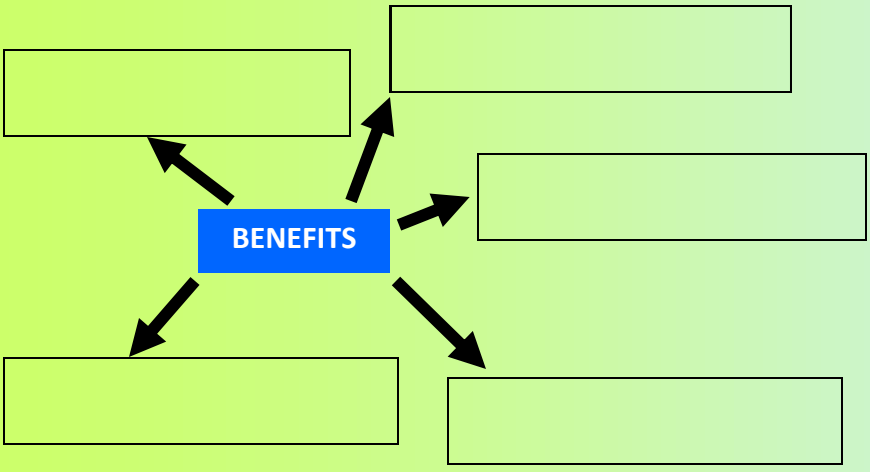
3. Organisms are adapted to survive in their environment. Carefully observe the Green Moray Eel. What is the advantage of its elongated body shape for life on the reef?

_____

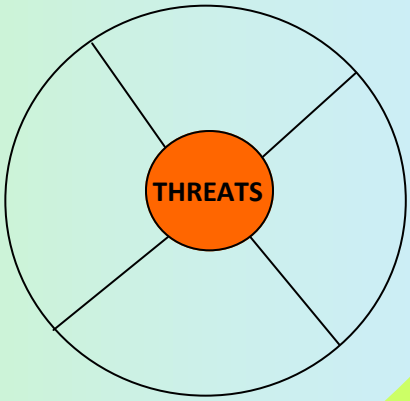
4. Label the diagram of the coral polyp.



5. Complete the following chart to show 5 benefits of coral reefs.



6. Complete the wheel to suggest FOUR threats to coral reefs.



7. Give ONE action that each of the following groups can take to protect coral reefs:

The Government _____

Fishermen _____

Conservation agencies like BREEF _____

You _____

Acknowledgements

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Sources referenced for this guide include:

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Caves Village, West Bay St., P.O. Box CB11005, Nassau, The Bahamas.
Tel: 327-9000 Fax 327-9002
email: breef@breef.org website: www.breef.org