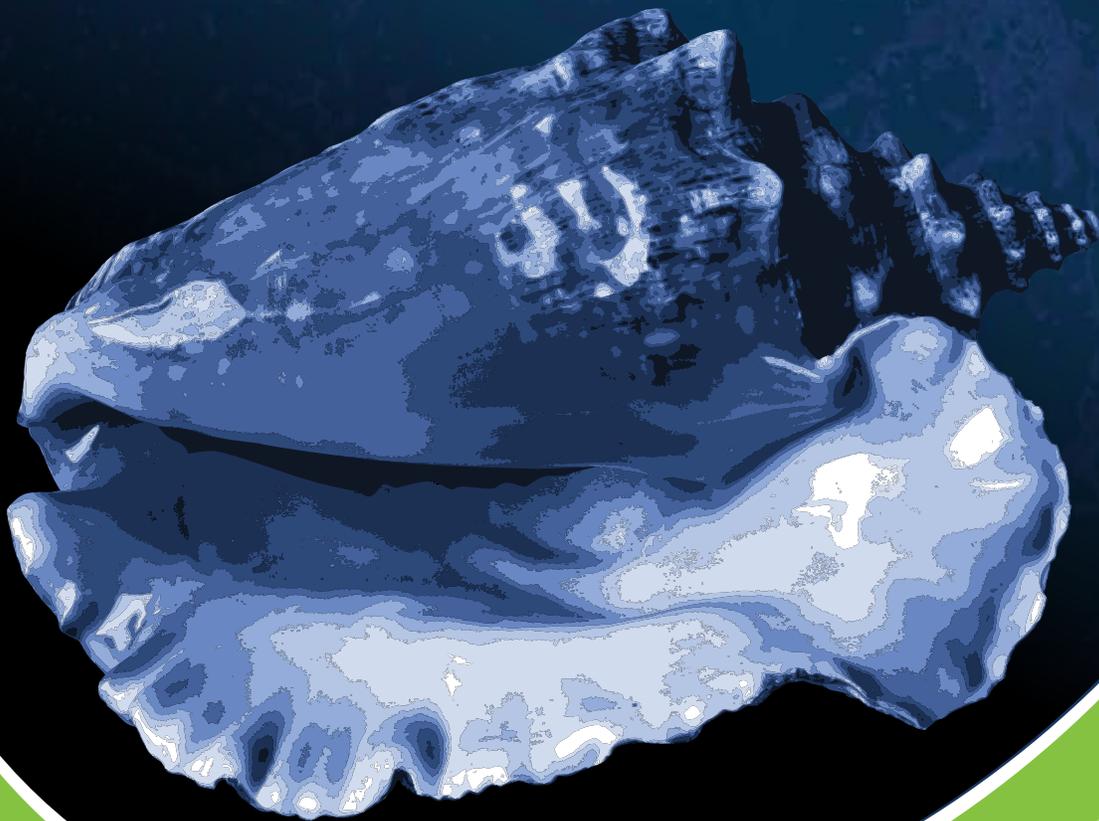


# THE Queen Conch

## True Bahamian Royalty

GUIDE FOR BAHAMIAN SCHOOLS



A Publication of The  
**Bahamas Reef Environment  
Educational Foundation**  
[www.breef.org](http://www.breef.org)

For Educational Use Only

**T**he Bahamas Reef Environment Educational Foundation (BREEF) is a Bahamian non-profit foundation established in 1993. Our mission is to promote the conservation of the Bahamian marine environment that sustains our way of life. BREEF informs the public about our marine environment and the threats to our oceans and coral reefs, motivating people to get involved with protecting our critical resources.

BREEF is committed to educating people about the marine environment and the role that it plays in our tourism and fishing industries, and in providing food, recreation and shoreline protection for us all. This important learning tool, developed by BREEF with funding from the Lyford Cay Foundation, is designed for use in Bahamian classrooms. It will help to provide enriching, engaging classroom experiences for science students throughout The Bahamas.

## Note to Teachers



This booklet was developed by BREEF to support the learner outcomes of the Science and Social Science curricula in The Bahamas. The information can be utilized to teach Environmental Biology units such as Biodiversity, Interdependence between Species and the Environment, Endangered Species, Protected Areas, Conservation and Environmental Stewardship, Fisheries Management. Discussion questions denoted by  have been included throughout.

Visit our website [www.breef.org](http://www.breef.org) for further information and resources. To schedule a classroom presentation or coastal field trips call 327-9000 or email [breef@breef.org](mailto:breef@breef.org). We look forward to your feedback so that we can better serve your marine education needs and promote environmental stewardship to all.

# Introduction



*Juvenile Conch*

## **The Queen Conch - An important part of our natural heritage**

The queen conch is important to Bahamian culture. It has been used for centuries for food, decoration, jewelry, bait for fishing and even as a musical instrument (conch horn). Its meat is a well loved delicacy enjoyed in a variety of ways including as fritters, salad, grilled, stewed or cracked (fried in batter).

Conch is an important part of the shallow water ecosystems of The Bahamas. The livelihoods of fishermen, vendors, restaurant owners, seafood wholesalers and processors depend on healthy conch populations. As a fishery resource, conch contributes over five million dollars to the economy annually.

We must use this resource in a sustainable way so that we will continue to benefit from it well into the future.

## Conch Classification

In the 18 century Carl Linnaeus developed the classification system for living things. He grouped organisms according to their similarities, making them easier to study and identify.

The first level, a Kingdom is the largest group, and the smallest and last group is the species. Organisms in a kingdom have basic features in common, but may be very different in appearance. Those that are of the same species are so alike, that they are able to successfully breed producing viable offspring.

The Queen Conch is classified as follows:

Kingdom	<b>Animal</b> – multicellular organisms that ingest their food
Phylum	<b>Mollusca</b> - invertebrate animals with muscular bodies
Class	<b>Gastropoda</b> - snails and slugs
Order	<b>Mesogastropoda</b> - snails
Family	<b>Strombidae</b> - conch
Genus	<b><i>Strombus</i></b>
Species	<b><i>gigas</i></b> – giant/large snail

The genus and species together make up the scientific name of an organism. This is referred to as the 'Binomial System' of naming species because each organism has two names. The scientific name of an organism is universally recognized. The scientific name of the Queen conch is ***Strombus gigas***, but it has different common names in different countries, including conch and lambie. There is some discussion among scientists about changing the genus to *Lobatus*.

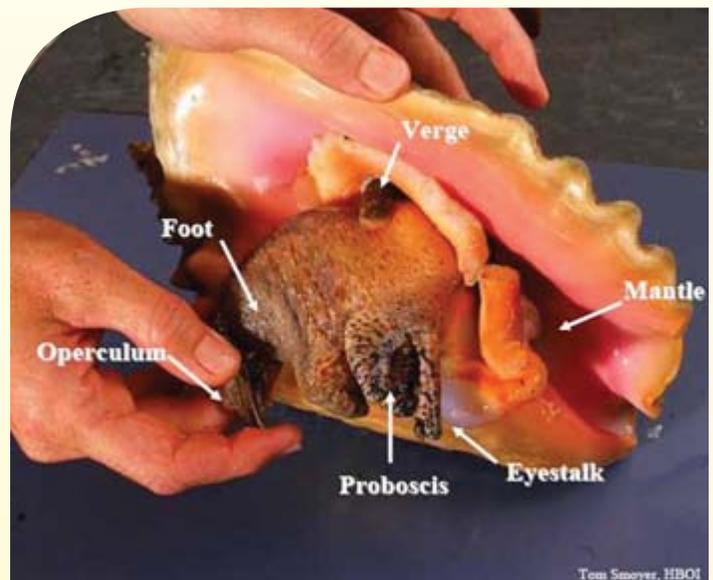
## Conch Anatomy- Form & Function

**Shell** - produced by the conch's mantle. Pale brown in color with a rosy-pink lip. The conch produces its shell by taking calcium and carbonate ions from sea water.

**Mantle** — orange-coloured tissue sometimes with dark spots. It is the outer body covering of the conch which produces the shell.

**Foot**— the muscular portion of the conch that is used for locomotion. This is the edible part of the conch.

**Operculum**—hard, sickle-shaped structure at the tip of the foot used for locomotion. The conch's



characteristic hopping motion is referred to as the ‘conch crawl or strombid leap’.

**Proboscis**—long, flexible, extensible snout. In its tip is a tongue-like structure called a radula which is used for scraping algae off sea grass blades as it feeds.

**Eye stalk**— two stalks extend from either side of the base of the proboscis. At their tips are the eye. Just before the eye is a small sensory tentacle which detects scent.

**Verge**— the reproductive organ of the male conch (shown). The female conch has a genital groove that runs down the side of its foot.

## Distribution and Habitat

The Queen conch, *Strombus gigas*, is found throughout the Caribbean Sea from Venezuela to Mexico, Southern Florida, The Bahamas, and the Lesser and Greater Antilles.

### Conch habitat

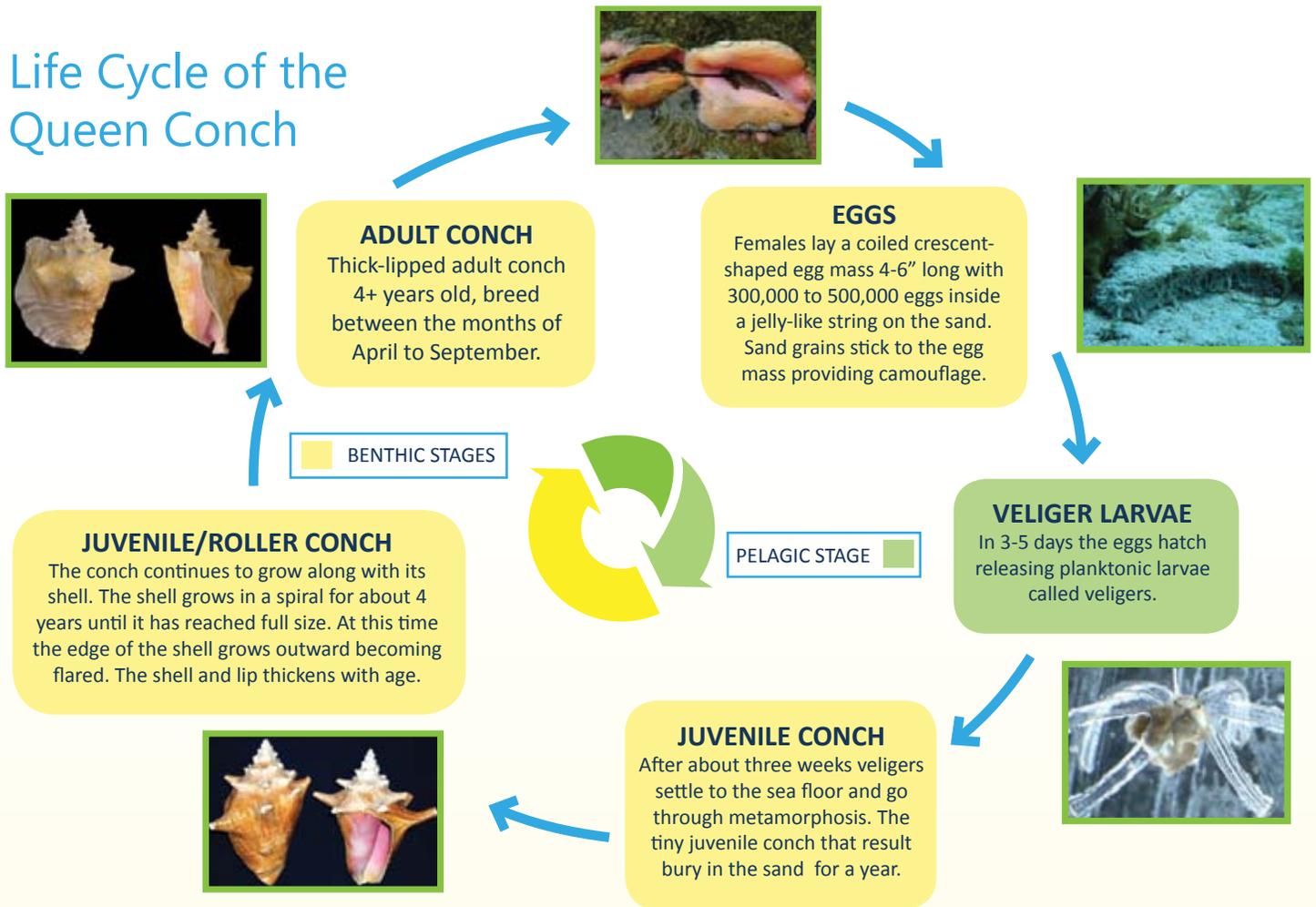
Conch depend on a variety of habitats during their life cycle. For example, conch larvae are planktonic, they float on water currents until they settle to the bottom in a suitable habitat. Juvenile conchs are found in the shallow waters of coastal wetlands and sea grass beds. Adult conch live in sea grass beds and on sand flats in depths of 2-30m where they feed on algae, detritus and diatoms (unicellular algae) found on the blades of sea grass (*Thalassia*). Conch is a shallow water species because these animals are herbivores. The algae they eat require sunlight for growth.



**Which habitats should be included within the boundaries of Marine Protected Areas (MPAs) in order to protect the Queen conch fishery?**

**A-** Coastal wetlands, sand flats, seagrass and open water within our MPAs will help to protect our conch fishery.

## Life Cycle of the Queen Conch



## Life Cycle Vocabulary

**Adults** conch have a well formed (i.e. thick and flared) lip which continues to thicken as the conch ages. This means that the thicker the lip the older the conch. Studies have indicated that conch are sexually mature when their lip is 15mm thick. This is about the diameter of a penny. Conch can live for up to 30 years.

**Veligers** are microscopic planktonic conch larvae. They drift on ocean currents for up to three weeks. A newly hatched veliger has two lobes rimmed with short hairs called cilia. The cilia beat rhythmically back and forth to assist in locomotion and feeding. Veligers feed on microscopic plants (phytoplankton). During this stage, the baby conch are eaten by filter feeders such as corals and sponges, small fish and zooplankton. Veligers undergo changes as they develop, going from the newly hatched two lobed stage to a four lobed and then finally a six lobed stage.

**Metamorphosis** — After three weeks, the six lobed veliger settles to the bottom (benthos) and undergoes metamorphosis, during which its body changes form. Its lobes disappear, and it develops a long snout, foot and shell. At this stage they are approximately 1mm long.

**Juveniles** bury in the sand for up to a year to hide from predators, feeding on microscopic algae and growing larger. Initially the shell is white and later becomes streaked with brown. By about one year the shells are pinkish and about 60-80mm long. After this time they emerge from the sand and feed in sea grass beds. Conch take about over four years to reach sexual maturity. Their predators include the tulip snail, loggerhead turtle, stingray, octopus and of course, humans.

## Juvenile or Adult? It's easy to tell...

**Make your own Conch Tags:** Copy this page on card stock. Tie the tags on conch shells to share what you have learned with others.

### Juvenile Queen Conch



Conch eggs hatch, releasing microscopic larvae that float on ocean currents for three weeks before setting on the seafloor. The larvae then metamorphose into juvenile conch. Juveniles bury in sand feeding on algae for up to a year after which they move to seagrass beds to feed and grow. Conch make their own shells as they grow. A juvenile conch or 'roller' has a thin lip. The lip flares out and becomes thicker as they mature.

We must allow conch to mature and reproduce before we catch them. This will help us to have conch in the future.

Catching juvenile conch is illegal  
**Do not buy conch unless it has a thick flared lip**  
Encourage others to only catch or buy mature conch



[www.breef.org](http://www.breef.org)

### Adult Queen Conch



The Queen conch takes over 4 years to reach sexual maturity and reproduce. The shell of a mature conch has a well formed, thick, flared lip that gets thicker as it ages. During the summer, female conch lay egg masses with up to 400,000 eggs. However, most conch do not survive long enough to reach maturity.

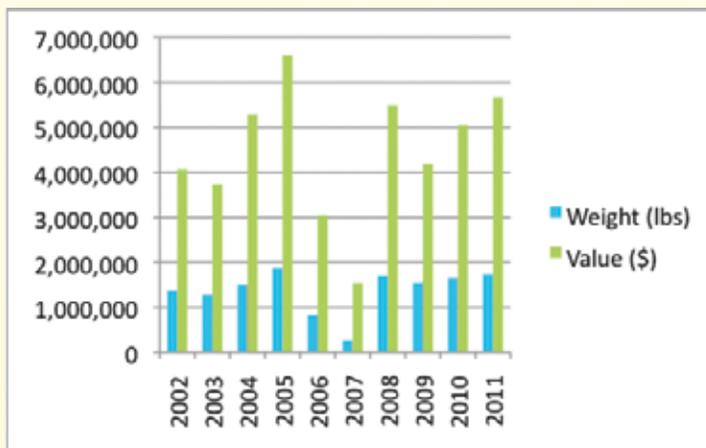
Overfishing of conch in Florida and the Caribbean has made them commercially extinct. We must take steps to ensure that this does not happen in The Bahamas

Buy only mature conch with a thick flared lip  
**Never take a conch from a Protected Area**  
Support fishers who obey our fisheries regulations

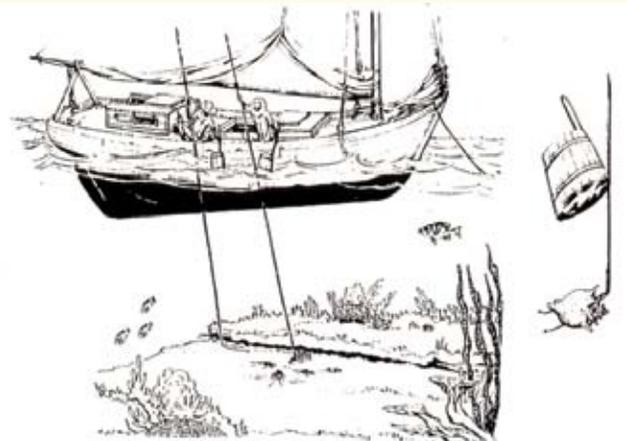


[www.breef.org](http://www.breef.org)

Queen conch has been fished traditionally in The Bahamas from the early days of the Lucayans. The meat was an important source of protein, the shell was used for trade and to make tools and ornaments. Today the conch fishery is an important part of the Bahamian economy. Annually conch fisheries contribute more than \$5 million to the economy.



Annual Queen Conch Landings: 2002-2011  
Source: Department of Marine Resources



Traditional Conchin' with water glass and conch hook

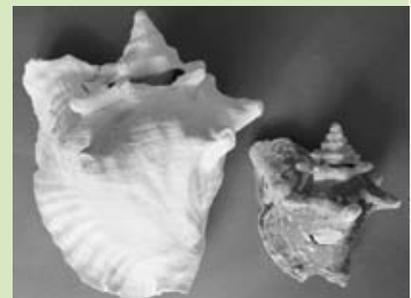
Traditionally in The Bahamas, conch was harvested by using a hooked pole to pull them out of the water. In many areas fishermen were also able to dive or wade in shallow water to collect them. Today conch is fished mainly by free diving. Fishers also often use compressor (hookah). By law, compressors must only be used under a permit issued by the Department of Marine Resources during the open season for crawfish: August 1st to March 31st between 30-60 feet of water.

Queen conch is in decline throughout the Caribbean and is listed on Appendix II of CITES (Convention on International Trade in Endangered Species) as commercially threatened. In the mid 1970's the conch fishery in the Caribbean and Florida showed signs of decline. Bermuda's conch fishery collapsed in 1975, commercial harvest was banned in the Florida Keys followed by a complete ban on both commercial and recreational harvest in all Florida and US territorial waters in 1986. Despite these measures the fisheries have not recovered. Countries throughout the region utilize a variety of measures to manage their conch fishery in order to prevent collapse.

## Threats

In The Bahamas, conch is heavily fished and is in danger of being overfished. Conch population densities in commercial fishing grounds are decreasing to levels below those required for reproduction. The threats to the conch fishery include:

- **Overharvest** – harvesting conch at a rate that is faster than they can be replenished by reproduction.
- **Harvest of juveniles** – taking thin lip (roller) conch before they are mature enough to reproduce.
- **Lack of enforcement of fishery regulations.**
- **Unregulated fishing** – due to the vastness and archipelagic nature of The Bahamas, it is difficult to monitor all potential landing sites for the enforcement of fishery infractions.
- **Loss of habitat** – conch require a variety of habitat types; wetlands, sea grass beds, sand flats, and open water to complete their life cycle. Loss of these habitats due to human activities, e.g. coastal construction and dredging, impact the conch fishery.
- **Subjective fishery regulations** – our regulations permit the harvest of conch with a well-formed lip. The term 'well-formed' is subject to interpretation. It is understood that it means flared and thick but does not quantify what this means by giving, for example, a minimum lip thickness.
- **Public misconceptions** – many people believe that the size of a conch's shell indicates that it is sexually mature. Like people, conch show genetic variation and mature conch can vary greatly in size. In the Bahamas, small thick-lipped Queen conch are often referred to as 'samba' conch. These, although small in size, are sexually mature and can be legally harvested. Surveys have shown that the density of samba conch have increased. This may be due to fishers selecting the larger sized conch for harvest, leaving the smaller ones behind. Smaller conch also produce less offspring than larger ones, contributing further to population declines.

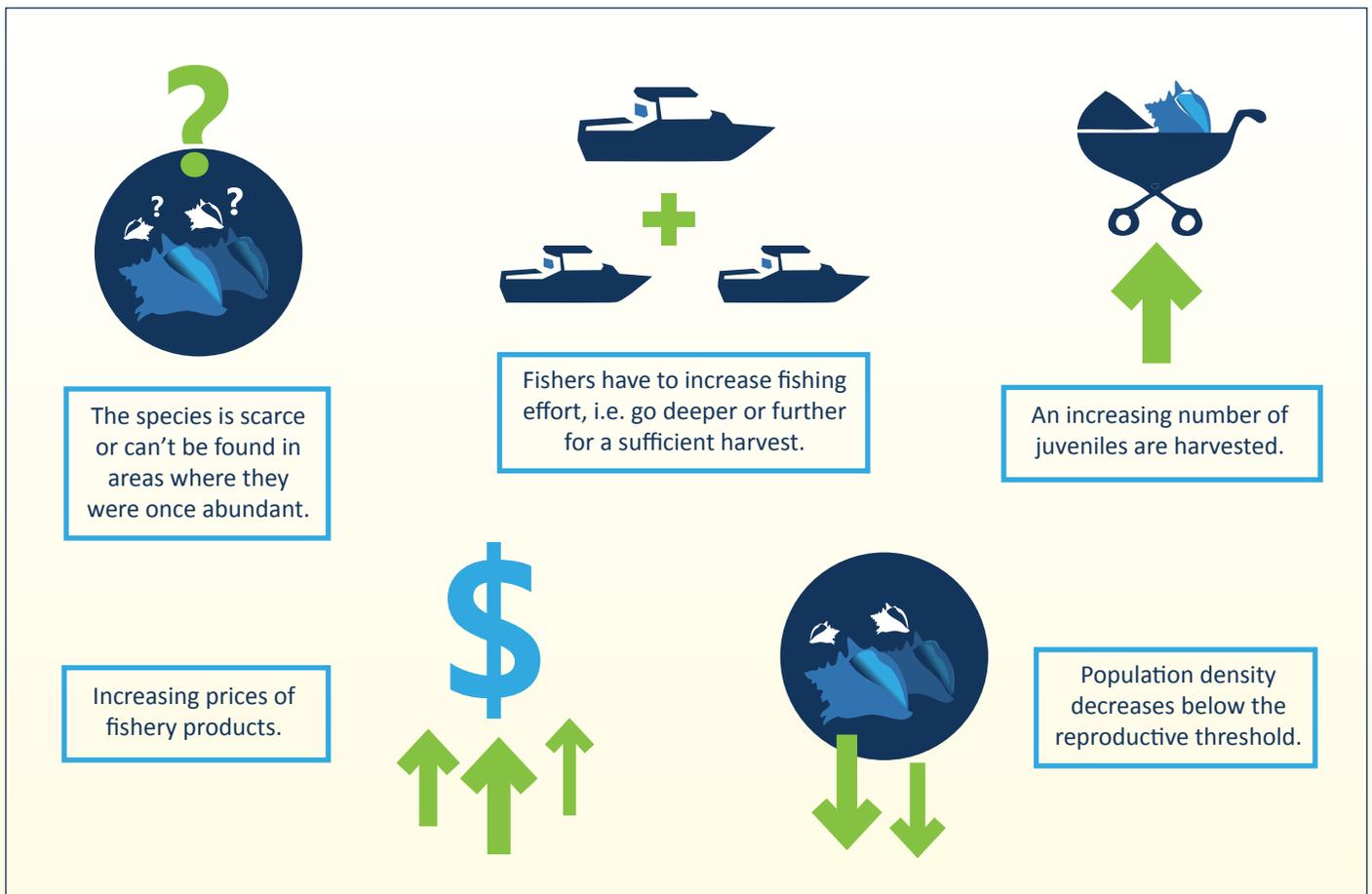


*Both of these conch are sexually mature because they each have a well-formed lip*

In 2013 a national 'Conchservation' campaign was launched to address concerns about declining conch populations in The Bahamas. The campaign is a partnership between Bahamian conservation agencies and sponsors with its ultimate goal being a sustainable conch fishery in The Bahamas. The campaign aims to reach out to all sectors of society to share research findings, engage the community in citizen science research, and get community input and recommendations for a sustainable conch fishery.



## Signs of a Declining Fishery



Conch are vulnerable to overfishing because they:

- are tasty and the global demand for seafood is increasing.
- are slow moving and therefore easy to catch.
- are slow growing, taking over four years to become sexually mature and reproduce. This characteristic results in the production of fewer offspring over a lifetime when compared to species that mature quickly. Some organisms reproduce within the first year of life.

- require an absolute minimum of 50 animals per hectare (ha) for breeding to occur. Fishery managers and scientists recommend a minimum of 100 animals/ha in order to support a sustainable fishery. Studies indicate that many areas of The Bahamas have conch populations below these thresholds.



Mating Conch



**Fishers have reported that they have to go out further and stay out to sea longer in order to harvest sufficient conch to maintain their livelihoods. What does this indicate about the conch fishery?**

*A – This indicates that conch populations are declining as less conch are found close to shore in shallow water than in the past.*



**How does this affect the cost of conch and seafood products?**

*A – This results in price increases because fishers have to use more gas and spend more time fishing than in the past.*

## How can we ensure that The Bahamas have conch in the future?

In order to safeguard the fishery, preemptive management strategies should be implemented. This involves taking action to manage our conch populations while we still have a viable fishery, i.e. before they are depleted.



- **Fisheries Regulations** help to prevent overexploitation of our marine resources by prohibiting the capture of immature/juvenile conch and by limiting the use of technology or the number of animals that can be caught in order to prevent overfishing. In 1986 the Fisheries Resources (Jurisdiction and Conservation) Regulations came into effect under the Fisheries Act. Since then, the Department of Marine Resources has issued several amendments, and updates. Fishing Regulations pertaining to the harvest of Queen conch in The Bahamas are:
  - i) The use of Self Contained Underwater Breathing Apparatus (SCUBA gear) in the capture of any marine product or resource is prohibited.
  - ii) The harvest and possession of conch with a shell that does not possess a well-formed (thick and flared) lip, is prohibited.
  - iii) A permit is required for sports-fishing and the harvest of conch by foreign sport-fishers is limited to 6 per vessel at any point in time.
- **Export control** - Queen conch (*S. gigas*) is listed in Appendix II of the Convention on International Trade in Endangered Species (CITES). This means that the CITES Secretariat considers the species to be endangered throughout its range and is in need of protection. Appendix II means that international trade (export) of the species



Conch Pearls

is restricted and is only allowed upon issue of a CITES Export Certificate by the local CITES Management Authority, and with proof that the export of the species is not detrimental to the survival of the species.

The Bahamas' recent commercial export quotas for conch meat has been approximately 550,000 lbs per year. Individuals are permitted 10 lbs upon the issue of an export permit from the Department of Marine Resources.

- **Enforcement and strengthening of regulations** for the Police Force, Defense Force and The Department of Marine Resources, in order to monitor fishing activity and enforce regulations. Bahamian fishers and the general public can also play a vital role by reporting infractions to these authorities. Our regulations can be strengthened to improve management of this important fishery.

## Queen Conch Management Strategies in the Caribbean

Countries in the region employ a variety of management strategies in an effort to prevent a collapse of the fishery.

Country	Lip Restriction	Minimum Shell Length	Closed Season	Limited # of Fishers	Gear Restrictions	Closed Areas e.g. MPAs	Harvest Quotas	Export Quota
Bahamas	Well Formed Lip				No SCUBA	Yes	For foreign fishers only - 6/vessel	Yes
Belize		7"	Proposed					
Grenada, Haiti	<i>All export suspended by Cites</i>							
Dominican Republic			1 Jul - 31 Oct					
Jamaica		9"	1 Jul - 30 Oct	Yes		Yes	Yes	Yes
Puerto Rico (US)	(9.5mm) 3/8"	9"	1 Jul - 30 Sept		No HOOKAH		Must be landed in shell 150 conch/day/ commercial 6/day/recreational fisher or 24/boat	
Turks & Caicos	Flared Lip	7"	15 Jul - 15 Oct		No SCUBA No HOOKAH	Yes	Yes	Yes

- **Establishing a Network of Marine Protected Areas (MPAs) in areas that are still productive conch nurseries and breeding areas BEFORE conch populations collapse.** Studies show that the Exuma Cays Land and Sea Park plays an important role as a replenishment area for species that are caught in surrounding waters. The concentration of conch inside this park has been estimated to be 31 times greater than outside the park. Movement of adult and larval conch provides conch for fishermen to harvest outside of the park boundaries each year. More recent studies show that although the Exuma Cays Land and Sea Park is providing a source of conch larvae to replenish adjacent fishing grounds, the park is not being effectively reseeded with larvae. To achieve this, we need a well-planned network of Marine Protected Areas that are connected to each other by the movement of larvae. This way MPAs can replenish each other, working together as self-sustaining units while also replenishing our fishing grounds. By 2013, seventeen MPAs were established in The Bahamas, four of which were established primarily to act as fishery replenishment zones. MPA authorities are actively working to protect additional areas in order to meet The Bahamas' conservation goals.



- **Scientific Research** provides essential information on the biology and status of Queen conch populations, so that we can make informed decisions about how to manage this resource. My Science, My Conch (MSMC) is one of the outreach and educational activities of The Bahamas

National Conchervation Campaign. MSMC project partners include Bahamas National Trust (BNT), Bahamas Reef Environment Educational Foundation (BREEF) and Community Conch. It is a hands-on experience for everyday people who want to learn more and help ensure that we will have Queen Conch for generations to come. Participants conduct surveys of conch middens (discarded conch shell piles) to collect shell length and lip thickness data that will be used to inform conch fishery management strategies for The Bahamas. Preliminary studies indicate that a large number of immature conch are being harvested.



Between 2009 and 2013, Community Conch, a non-profit community-based conservation organization conducted conch population surveys on the behalf of the Department of Marine Resources in order to assess the status of conch populations in The Bahamas. Their surveys of major fishing grounds indicate that:

- Overfishing has significantly reduced the density of conch populations.
  - Due to population declines, conch reproduction has also declined.
  - Female conch are not sexually mature until their shell lip thickness is 15mm on average.
- **Public Education Campaigns** - The National Conchervation Campaign seeks to get stakeholder input and to sensitize the public on ways to achieve a sustainable conch fishery. Conservation organizations like BREEF are also increasing awareness through their education and outreach programmes. Public education is important especially when enforcement is difficult. This is because an aware public that understands the importance of resources like the conch, is more likely to take action to protect it. As consumers of the resource, the public has the power to make a difference by buying only legally harvested conch (i.e. with a thick flared lip.)



### What can we the consumer do to protect the conch fishery?

*A – report illegal fishing activities, purchase legally harvested conch (meat from a shell with a thick, flared lip), support vendors and fishermen who obey fishery regulations, support the establishment of MPAs, educate others.*

## Aquaculture

Aquaculture is the rearing of aquatic organisms in a controlled environment. Today 40% of the fish eaten in the US is farm raised.

Conch farming began in the 1970's in an attempt to enhance wild populations and reduce fishing pressure. In 1984, the Caicos Conch Farm in the Turks & Caicos Islands began operations. Today it serves primarily a tourist attraction, rather than as a source of conch meat. In 2002 the Harbor Branch Oceanographic Institute in Florida began studies to improve conch farming techniques. While the potential for supplying seafood through fish farming is great, measures to conserve wild populations must be implemented to protect our culture, livelihoods and natural heritage. Aquaculture can pose many challenges; the success of farming aquatic organisms depends on several factors including: the type of organism (native vs. non-native species, herbivore vs. carnivore), ease of obtaining feed, cost of equipment, and the potential impact on the environment.

### Pros

- Reduces fishing pressure on wild fish/conch stocks.
- Creates jobs, revenue and provides opportunities for local investment.
- It increases scientific knowledge of the resource so that we can make informed decisions about their management.
- Farm raised organisms may be released into the wild to boost wild stocks. However this has not been successful because the farm raised conch lack the natural behaviours of wild conch which help them to avoid predation.



### Cons

- Construction of aquaculture facilities often negatively impacts natural nursery habitats such as wetlands.
- Puts pressure on wild stocks because they are caught to provide feed for farmed fish (this does not apply to conch because they are herbivores)
- Increases the risk of disease transmission and parasites from farmed to wild populations.
- By-products of the industry such as, chemicals used to treat parasites, excess nutrients in feed and waste may cause water pollution.
- Fish farms may threaten the livelihood of fishers.
- Farms are susceptible to weather, predators and disease so measures must be taken to counteract these. Such measures are often expensive.
- There is potential for the introduction of invasive species where non-native species are farmed. Invasive species grow and reproduce quickly making them attractive farming choices.
- High operational costs.



# Supporting Classroom Activities

## Conch 101

### Activity 1 - Conch Anatomy and Dissection

#### Objectives:

At the end of the lesson students will be able to:

- Identify the external features of the Queen conch.
- Indicate features used to determine sexual maturity.
- Label a diagram of the conch showing the Queen conch's external features, and describe the function of each part.
- Determine the sex of the conch.

#### MATERIALS NEEDED:

Live mature conch specimens (4 are advised to increase the probability of finding both sexes), unlabeled diagram of the external anatomy of the conch (page 14).

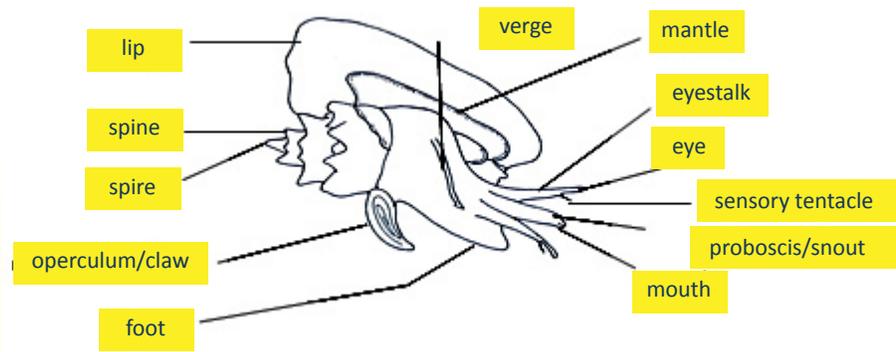
#### Method

1. Using a live conch, identify the parts of the conch shell: lip, spines, spire (pointy posterior end), spiral (anterior end where the eyes come out)



2. Discuss the significance of the lip with respect to sexual maturity, age of the conch and fisheries regulations. *Queen conch usually develop a flared lip by the time they are four years old. The lip thickens at a rate of approx. 5mm per year. On average, Queen conch are sexually mature when the lip is approximately 15mm thick. The older the conch the thicker the lip. Our fishery regulations prohibit the harvest of conch without a well-formed lip. The spines of the conch may become worn with age, but this does not indicate sexual maturity.*

3. Remove the conch from the shell. It is advisable to have them removed beforehand, but not cleaned, or to invite someone skilled at this task to the classroom. Show the conch's external anatomy - operculum, foot, mantle, eyestalk with sensory tentacle, and proboscis. Have students describe each part; colour, length etc. Discuss the function of the parts.



4. Determine the sex of the conch – males have a verge (penis) and females a genital groove.

5. Distribute an unlabeled diagram of the external anatomy of the Queen conch (page 14) and instruct students to label the diagram.

6. Students should also be able to briefly describe the function of the parts of the conch.

### EXTENSION ACTIVITIES:

#### Science

- Identify the internal organs of the conch: siphon, crystalline style, etc

#### Art/Music

- Make a conch horn: cut off the spire of an intact adult conch shell (that has not been cracked out), smooth opening with a file. A carving tool can be used to carve designs into the shell. Block any holes in the shell with hot glue.

#### Art & Craft

- Conch craft – using a few of the adult shells and opercula, have students make decorative or useful items.
- Visit a conch artisan to find out how conch shell jewelry is made.

#### Food & Nutrition

- Prepare conch dishes and investigate the nutritional value of conch.

#### Health Science

- Explore the nutrient composition of conch.
- Identify groups of people that have dietary restrictions that prohibit the eating of conch. Examine the factors that lead to conch poisoning.

#### Chemistry

- Conduct experiments using the calcium carbonate found in conch shells.
- Develop ways in which conch shells may be utilized in industry.

**ADDITIONAL RESOURCES:** DVD—The Conch's Life Story, Bahamian songs and literature, The Strombus gigas life story

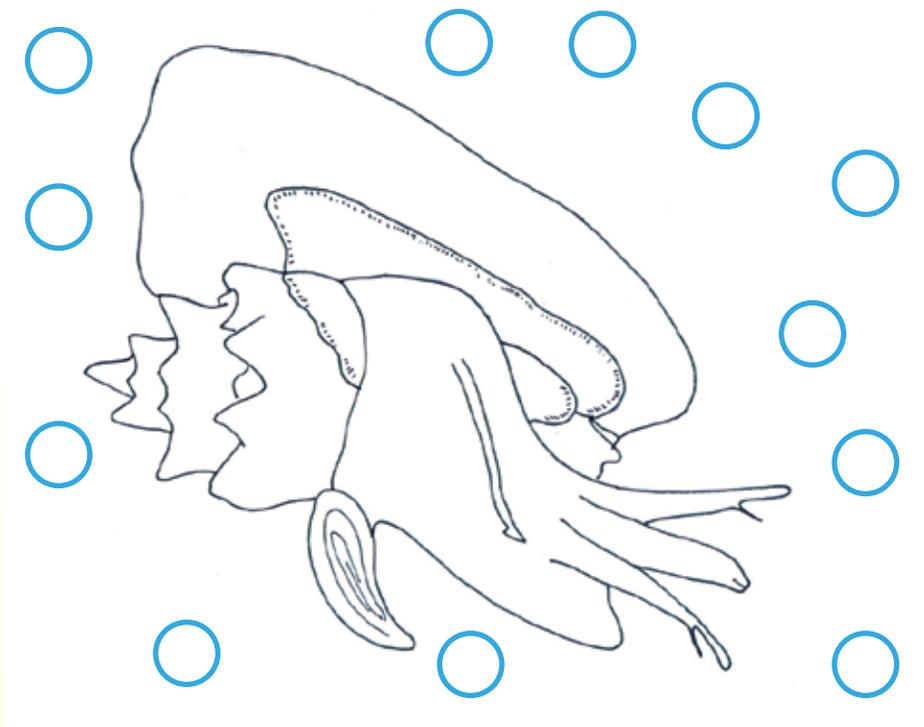
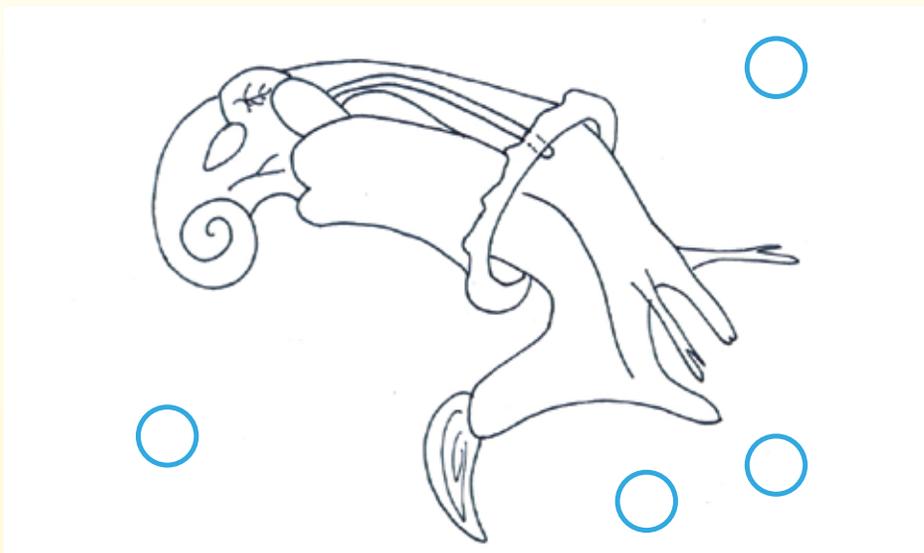
**STUDENT WORKSHEET** – External Anatomy of the Queen conch

Diagram of the external anatomy of the male Queen Conch (with shell on word list): label the following structures:

1. **Lip**
2. **Spines**
3. **Spire**
4. **Operculum**
5. **Foot**
6. **Mantle**
7. **Verge**
8. **Eyestalk**
9. **Eye**
10. **Sensory tentacle**
11. **Proboscis**
12. **Mouth**

Write the number corresponding to the body part in the list inside of the circle, and draw a line to corresponding structure

**EXTENSION ACTIVITY:** – Internal Anatomy of the Queen conch

Conduct research to label the internal anatomy of the Queen conch and state the function of each part. Word List

1. **Siphon**
2. **Crystalline style**
3. **Genital groove**
4. **Intestines**

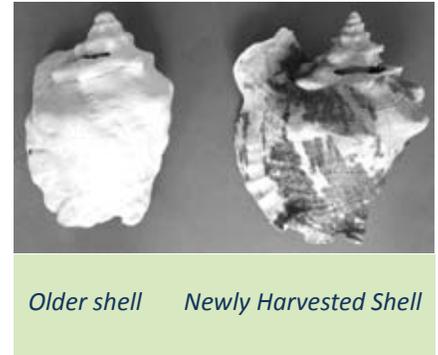
Describe the function of each part.

## Activity 2 - Hidden in the Midden

### Objectives:

At the end of the lesson students will be able to:

- Identify external features of a conch shell
- Distinguish between juvenile and adult conch
- State Bahamian fishery regulations for the Queen conch
- Predict the effects of overfishing and overharvesting of juveniles
- Discuss the status and threats to the queen conch fishery.



*Older shell      Newly Harvested Shell*

### PRE-TRIP ACTIVITY

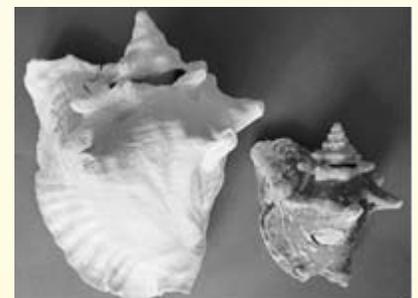
For teachers – Locate a suitable midden in your community. It should have at least 20 conch per group of 3-5 students. Ensure that students can identify the external features of the Queen conch. Distribute pictures or conch shells of adult and juvenile conch; discuss differences between juvenile and adult conch and laws pertaining to harvest of conch. Describe the activity that will be conducted in the field and explain how to use a tally system.

### MATERIALS NEEDED

BREEF's juvenile and adult conch ID cards (page 5), data sheet, clip board, pencils, one new Bahamian penny per group (slightly smaller than the old penny)

### FIELD ACTIVITY

1. Explain that a conch midden is a pile of discarded conch shells and that care should be taken to avoid injury when standing on a midden.
2. Use external features to distinguish between shells that have been discarded recently and those that have been discarded a long time ago. Recently discarded shells are pale brown with a flaky outer covering (peristracum), the inner surface is pink. Older shells are gray and weathered.
3. Review differences between adult and juvenile conch. Demonstrate that spire length (length of shell from tip to tip) does not determine maturity (some larger juveniles without a flared lip are bigger than some mature conch with a flared lip.)
4. Divide students into groups. Have them randomly select 20 shells per group. Ask students why the shells should be selected randomly (*Answer – to remove bias from the sample so that the shells selected are representative of the shells that are in the midden* ).
5. Students should observe each of the 20 conch shells to record the following in the table, using a tally system:
  - Was the shell harvested recently or a long time ago?
  - The edge of shell is called the lip. Does it have a flared or un-flared lip?
  - If it has a flared lip, is it as least as thick as a penny (15mm).



*Both are adult conch shells*

**Group Data Table:**

Shell Type	No. of Shells	No. with an un-flared lip	No. with a flared lip	No. with a lip at least as thick as a penny
Recently harvested shells				
Harvested a long time ago				
<b>Group totals</b>	20			

## 6. Compile results

Class data table: Compile data for the entire class

Shell Type	No. of Shells	No. with an un-flared lip	No. with a flared lip	No. with a lip at least as thick as a penny
Recently harvested shells	a	b	c	d
Number of shells harvested a long time ago	e	f	g	h
<b>Class Total</b>	i	j	k	l

## 7. Calculate the following:

- **The percentage of juvenile conch in midden =**  
 $\text{Class total for number of conch with a unflared lip (j)} / \text{Class total for number of shells (i)} \times 100$
- **The percentage of conch with a lip that are sexually mature =**  
 $\text{Class total for number of conch with a lip at least as thick as a penny (l)} / \text{Class total for number of conch with a lip (k)} \times 100$
- **The percentage of recently discarded shells that are sexually mature =**  
 $\text{Class total for recently harvested shells with a lip at least as thick as a penny (d)} / \text{Class total for number of recently harvested shells (a)} \times 100$
- **The percentage of shells discarded a long time ago that are sexually mature =**  
 $\text{Class total for shells harvested a long time ago with a lip at least as thick as a penny (h)} / \text{Class total for number of shells harvested a long time ago (e)} \times 100$

**FOLLOW UP QUESTIONS:**

- What information about our conch fishery is hidden in the midden?
- Compare percentages of sexually mature conch that were harvested recently with those harvested a longer time ago. Suggest reasons for these differences.
- Predict the effects of current harvesting practices on conch populations.
- Discuss the potential impacts of harvesting juvenile conch on our economy and culture.
- Suggest measures that can be implemented to prevent depletion of conch stocks.

NB: This activity can be simulated by bringing shell samples into the classroom. The limitation of this is that the sample size will be smaller so the data collected will be less valid and may not actually reflect what is occurring in the field.

**EXTENSION ACTIVITIES:**

**Social Science / Family Life** - Encourage students to share information with their friends and families.

**Art/ Science:** Develop posters or brochures to be displayed at school or in the community to increase awareness. Have students label samples of juvenile and adult conch shells to teach others the differences between them.

**Social Studies:** Interview fishermen about conch fishing in the Bahamas to determine how the conch fishery has changed over time.– questions may be asked about where conch are caught (historically vs. today), the ease of finding conch now as compared to the past, methods used to catch conch (traditional vs. current day), etc.

**Language:** Write a letter to the editor of the local newspaper discussing your findings and the significance to the sustainability of conch populations.

**Literature extension** – Write a poem or story about harvesting adult conch with a focus on conserving the Bahamian environment and culture. Read: “Shelly the Conch” by Katherine Orr.

**Music** – compose a song to encourage people to harvest adult conch sustainably.

**Biology** – As a juvenile conch matures, its shell length (spiral to spire) increases. Once a conch shell reaches its maximum length, its lip begins to flare, after which it thickens, at a rate of approx. 5mm per year. Just like people, adult conch grow to different sizes. Investigate the relationship between shell length (length of the shell from tip to tip) and lip thickness.



## Sources referenced for this guide include:

Bestor, UNEP-WCMC. 30 September, 2013. UNEP-WCMC Species Database: CITES-Listed Species

BREEF & MacAlister Elliot & Partners Ltd Fisheries Management Action Plan for the Bahamas Report to the Department of Fisheries, (1999)

Gascoigne J. Nassau grouper and Queen Conch in The Bahamas Status and Management Options MacAlister, Elliot & Partners Ltd (2002)

Little, Colin 1965. Notes on the Anatomy of The Queen Conch *Strombus gigas*, Bulletin of Marine Science. 15(2):338-358

Orr Katherine S. The Life story of the Queen Conch Marine Biological Laboratory, MA (1995)

Shawl, Amber. Conch Heritage Network [www.savetheconch.org](http://www.savetheconch.org)

Stoner, A et al: State of Knowledge of Conch Resources in The Bahamas and Management Considerations Technical Brief (2011)

Theile, S. (2001): Queen Conch fisheries and their management in the Caribbean. TRAFFIC Europe

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