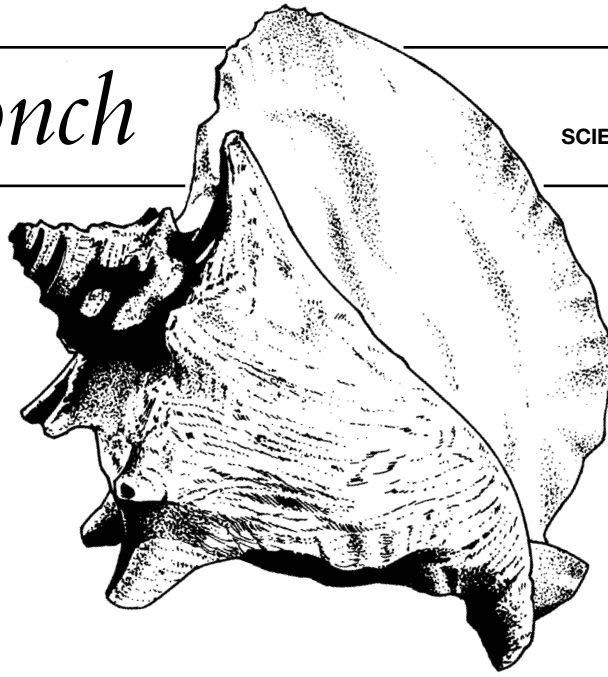


# Queen Conch

SCIENTIFIC NAME: *Strombus gigas*



<b>Kingdom</b>	Animalia
<b>Phylum</b>	Mollusca
<b>Class</b>	Gastropoda
<b>Order</b>	Sorbeoconcha
<b>Family</b>	Strombidae
<b>Genus</b>	<i>Strombus</i>
<b>Species</b>	<i>gigas</i>

## Description

The queen conch is one of the largest marine snails. It is a soft-bodied mollusk in a large, flared shell. Its scientific name *Strombus gigas* means “giant spiral shell.” This shell, covered with protective blunt spikes, has an orange hue on the exterior (though not always apparent because of algal growth), while the interior is a shiny, pink colour. The shell can grow to 30 cm (12 in.) in length.

The conch’s body consists of a black speckled “foot”; two sensitive tentacles; a “head” with two protruding stalks, each with an eye on the end; and a snout-like mouth (proboscis) with a rough, tongue-like radula that has thousands of tiny denticles (tooth-like protrusions). (See diagram on page 48.) The head and foot are covered by a thin layer of tissue called the mantle, which secretes the shell and also shelters the feathery gills that allow the conch to take in oxygen from the sea water.

The conch’s single foot ends with a “claw” called an operculum. It plants the operculum on the sandy seafloor to propel itself forward slowly, in a hopping motion. Like many other snails, the conch can pull its operculum tightly into the shell opening to defend against attacking predators. The foot is also useful as a lever for regaining an upright position if the shell is tipped, and it is the source of the meat used in many popular dishes.

## Range and Habitat

The queen conch’s range includes the warm, shallow waters off south Florida, Bermuda, The Bahamas, areas throughout the Caribbean, Central America, and south to Brazil. Queen conchs are rarely found at depths greater

than 21 m (70 ft.). Adults live around coral rubble, in the hard-bottom communities of soft corals and sponges, or on sandy bottoms and seagrass beds.

## Diet

The conch is a slow moving herbivore (plant eater) that is most active at night when it feeds on algae found on sand, seaweed, seagrass blades, and on floating organic debris.

## Reproduction and Life Cycle

Conchs breed throughout the year, except from November to January. During mating, the male sits directly behind the female and uses the sexual organ (the “verge”) on its right side to deposit sperm into the groove that runs down the right side of the female’s foot. Up to several weeks following internal fertilisation, the female releases an egg mass, which, although only five to 15 cm (two to six in.) long, can contain up to half a million fertilised eggs! This mass is actually a tightly folded egg-filled tube. From 21 to more than 36 m (70 – 120 ft.) of tube strands may be produced at a rate of about 1.5 m (five ft.) per hour. Sand grains soon adhere to the sticky mucus on the tube, hiding the eggs from predators.

After four to five days, the eggs hatch into tiny free-floating larvae, called “veligers.” These veligers are so small that 10 can fit into one drop of water. They do not look like conch at all. Their bodies have two round lobes rimmed with fine hairs that beat back and forth very fast, and help the conch swim and move food into its

mouth. Veligers drift in the sea feeding on tiny, one-celled organisms (phytoplankton).

After approximately four to six weeks, the conch settles to the seafloor and undergoes a metamorphosis. Its lobes disappear, and the foot and snout-like mouth develop. It develops a very fragile shell and finally begins to look like the conch that we know. For about a year, the juvenile conch buries itself in the sand and becomes nocturnal, only coming out to feed at night.

At a few months old the conch's shell is white, but by the time it is five or six months old the shell shows streaks of dark brown. Young conchs are called "rollers" because their shells do not yet have the stable, flared lip of the adults. When the juvenile is three to four years old, the shell stops growing in size and length, becomes thicker and heavier, the spiral gets bigger, and the flared lip develops. It is only when the lip is fully flared that the conch reaches sexual maturity. Few conchs survive to adulthood, instead becoming food for many ocean organisms. Those that do survive may live up to 25 years.

## Value

The conch is a source of food for many animals besides people. Juvenile conch are eaten by crawfish, crabs, hermit crabs, sea snails, hogfish, and queen triggerfish. Few animals can prey on an adult conch, but those that are able to crack its shell include loggerhead turtles, horse conchs, stingrays, and leopard rays. When abandoned, conch shells provide shelter for many sea creatures, such as hermit crabs and juvenile groupers.

The queen conch also has an important cultural and economic role in The Bahamas. It has been a staple food in the diet of Bahamians for hundreds of years, as well as an important fishery resource. The conch is a "cultural symbol" and popular food dishes include cracked conch, conch fritters, conch chowder, conch salad, and scorched conch. Shells have long been popular souvenirs, however

current regulations prohibit their export without the proper permit.

## Threats

The queen conch is vulnerable to overfishing because it matures slowly and populations are not replenished quickly. It is also slow-moving and easy to capture; the use of snorkelling gear has made harvesting even easier, considerably increasing the quantity caught (scuba is prohibited for fishing in The Bahamas). Reproduction may fail if conch populations fall below certain density thresholds. The queen conch has been a staple meat source throughout the Caribbean region for centuries, which has contributed to population declines of the queen conch in much of the wider Caribbean.

## Conservation

The queen conch is listed in Appendix II of the Convention on the International Trade in Endangered Species (CITES). This listing categorises the species as threatened and at risk of becoming endangered. All international trade of queen conch is strictly controlled among CITES signatory nations.

Conch populations in some areas of The Bahamas show evidence of overfishing. Where numbers are reduced, populations are at risk of collapse. Due to concern about the status of conch fisheries, the Bahamas Department of Marine Resources has prohibited the harvesting and possession of conch with a shell that does not have a well-formed lip and has limited the export of conch.

Researchers have observed that juvenile queen conchs typically live in aggregations, probably for protection against predation. Protection of key nursery areas would increase the chances of maintaining a sustainable conch fishery.

Queen conchs have been bred in captivity, but attempted reintroduction programmes have so far been unsuccessful.

## Sources

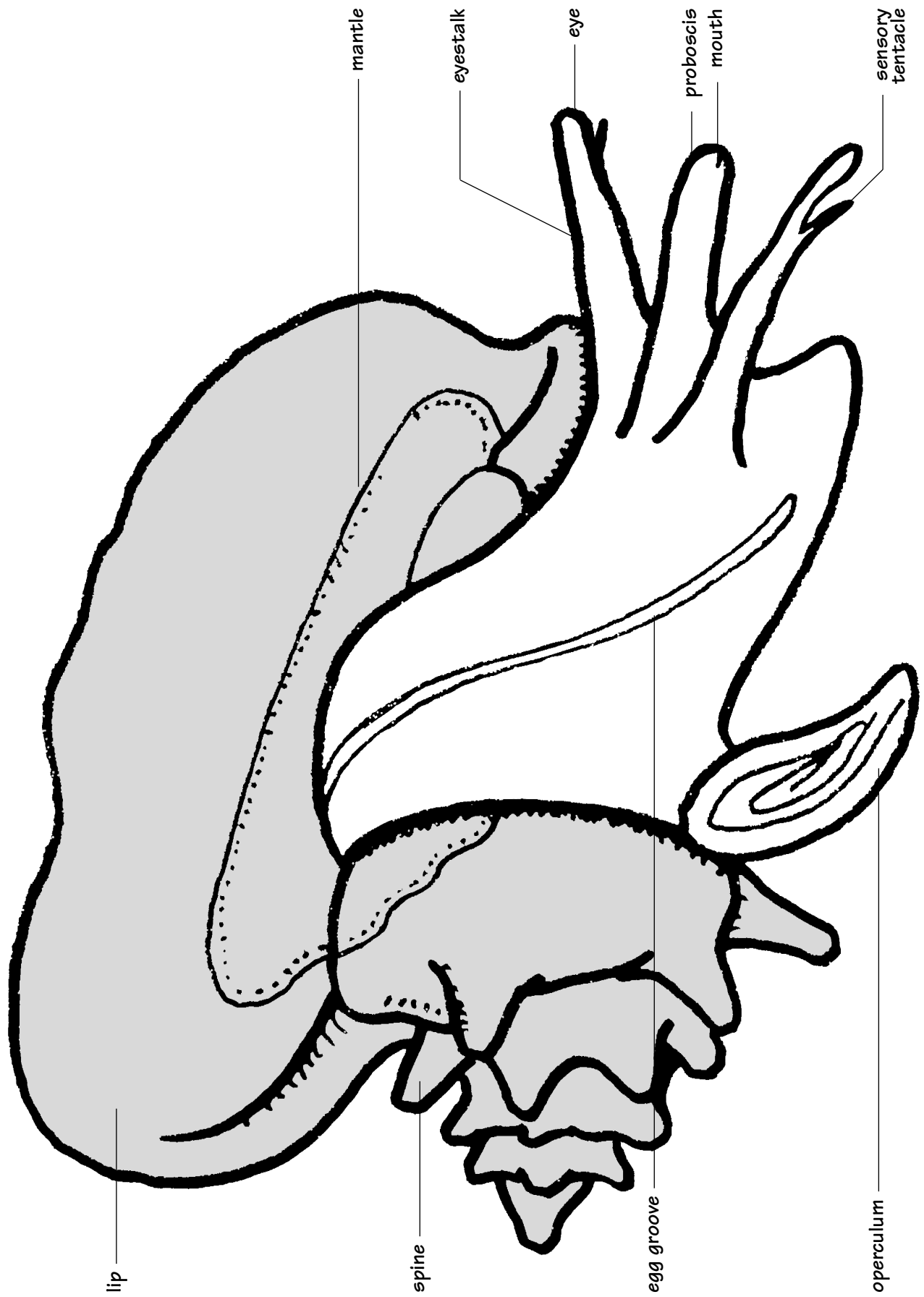
Bahamas National Trust. 2003. Queen Conch fact sheet.

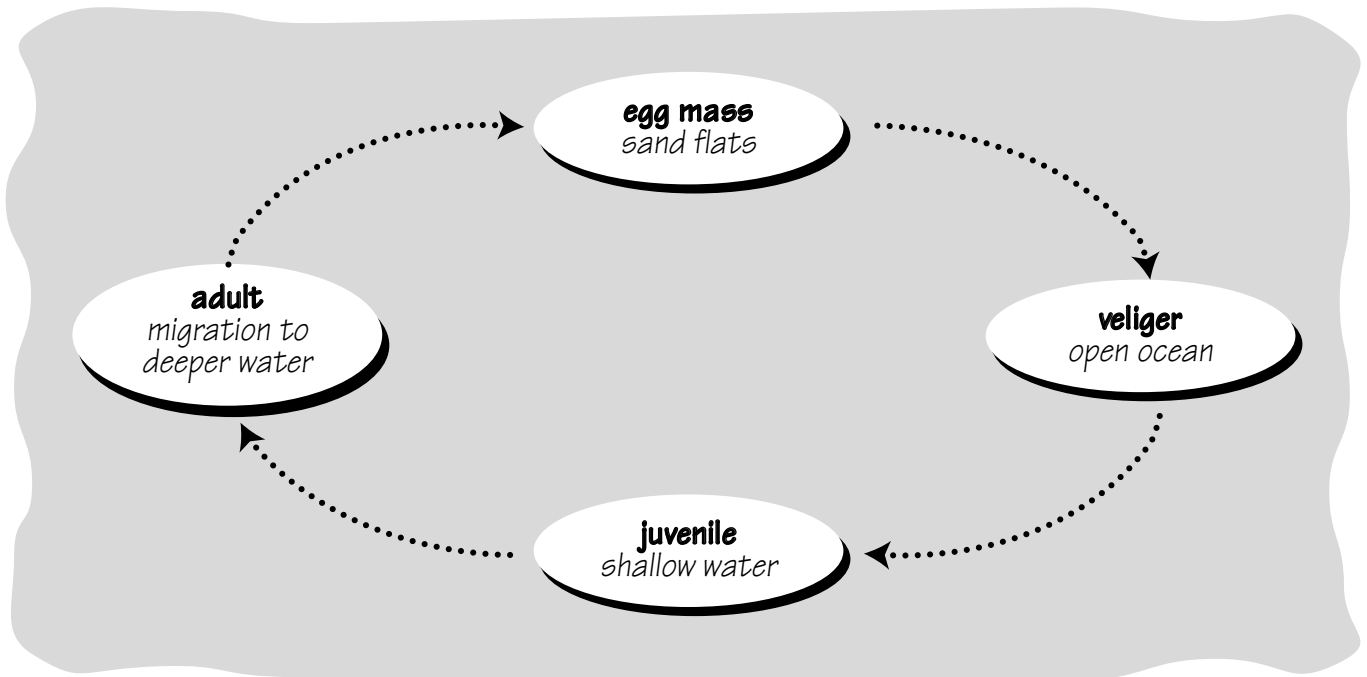
Florida Fish and Wildlife Conservation Commission, Fish and Wildlife Research Institute. Queen Conch Sea Stats. [research.myfwc.com/products/product\\_info.asp?id=1595](http://research.myfwc.com/products/product_info.asp?id=1595)

Gascoigne, Jo. 2002. Nassau Grouper and Queen Conch in The Bahamas: Status and Management Options. MacAlister Elliott & Partners Ltd., BREEF Perry Institute for Marine Science – Caribbean Marine Research Center. 2004. Poster series #1: Queen Conch. Jupiter, Florida. [www.perryinstitute.org](http://www.perryinstitute.org)

Sealey, Neil E. 2005. Primary Industries, Chapter 2 in *The Bahamas Today*, 2nd ed. Oxford: Macmillan Education.

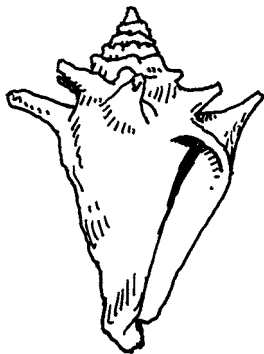
## Queen Conch



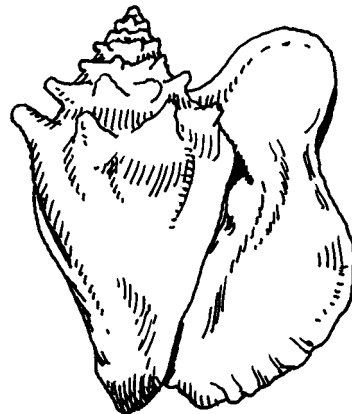


### Old Enough to be Eaten?

It's illegal to catch a conch with a short lip because it still has growing to do. This is a juvenile conch that has not reached maturity. We must allow conch to mature and reproduce in order to have conch in the future.



An adult conch has a flared lip. It's legal to catch adults, but we shouldn't take more than we need. Overfishing of conch has led to their commercial extinction (an insufficient population for harvest) in some places in the Caribbean.



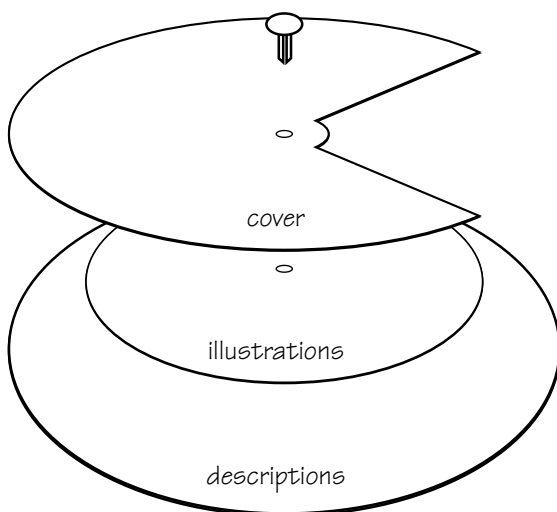
Adapted from Coastal Awareness Month supplement 2006.

## What to Do

**1 Introduction.** Play the song “We Love We Conch So” by Phil Stubbs. Talk about the words of the song with your students. Use the “Queen Conch Fact Sheet” and poster to describe the life cycle of the conch. Pass around the conch shells and ask students to compare them. Which one is from a mature conch? How do students know?

**2 Make conch life cycle wheels.** Guide students through the following steps:

- Cut out the life cycle descriptions circle and glue it on a sheet of card stock. Carefully trim the card to the size of the circle.
- Cut out the illustrations circle, glue it on a sheet of card stock, and trim it to the size of the circle.
- Trace the wheel cover pattern onto a sheet of card stock and cut it out so that it looks like a pie with a wedge missing.
- Decorate the wheel cover with messages about the conch or information about its life cycle.
- Place the illustrations circle on top of the descriptions circle. Place the wheel cover on top.



- Teacher’s step: poke a pushpin or scissors point through the centre to make a small hole through all plates.
- Finish the wheel by inserting the fastener through the centre hole and securing it in the back.

**3 Show and tell.** Ask the students to show the different stages of the life cycle by adjusting their wheels.

## Assessment

Have students use the descriptions to write a story about the life cycle of the conch titled “How I Grow.” The story should include the four major stages in the development of the queen conch and where it lives at each stage.

Play the CYCLE game on page 88.

## Extensions

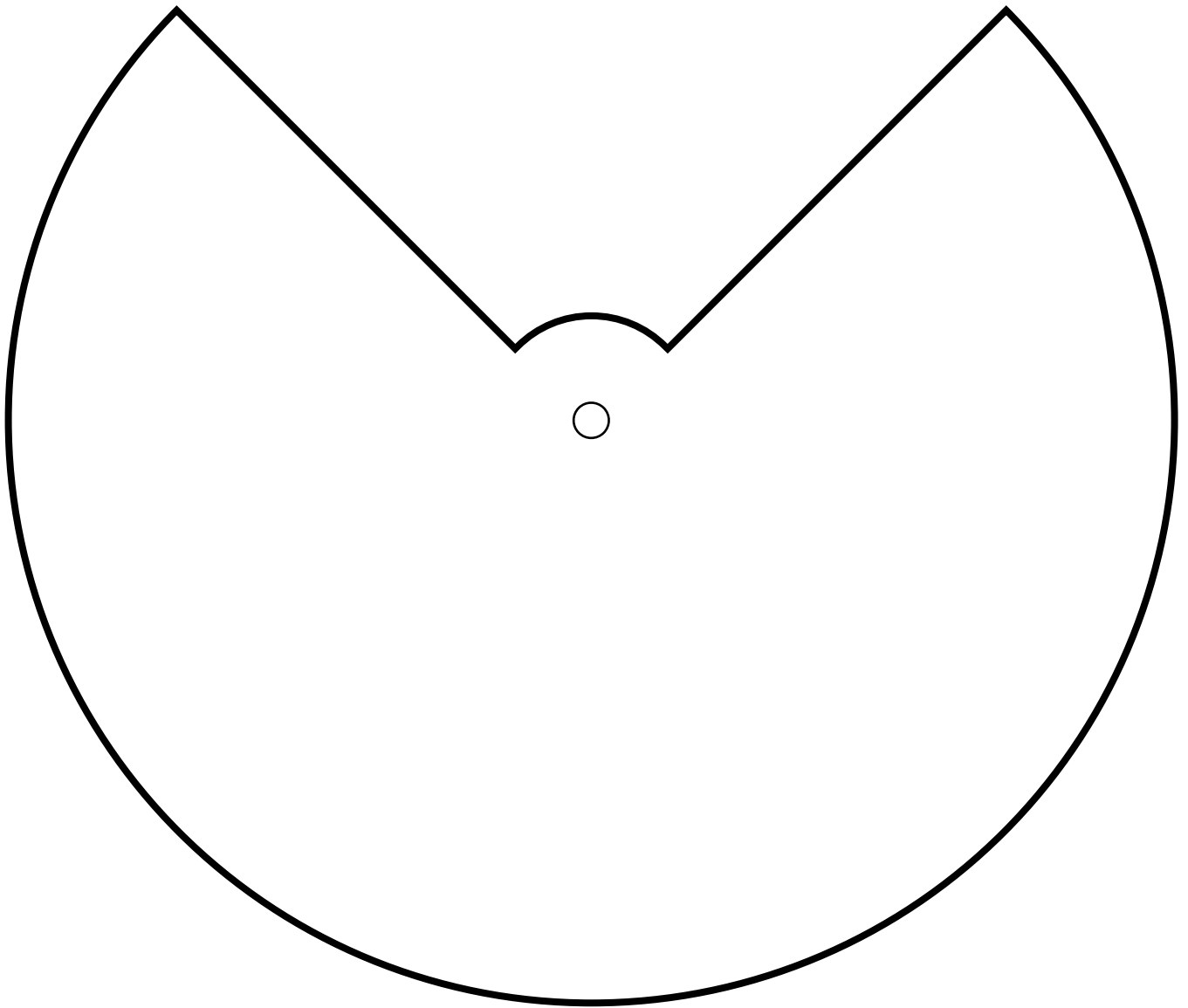
- Use math concepts to construct the wheel. Students can measure the diameter of the circles, calculate the circumference of the circles, divide the circle into four equal parts, and measure the angles.
- Students can create a survey sheet and interview other students about their knowledge of the conch life cycle. They can create graphs to illustrate the results.
- Investigate a conch midden to collect data on the number of juvenile and adult conch shells. Discuss implications for conch conservation. (See [treasures.amnh.org](http://treasures.amnh.org) for complete activity.)

## Resources

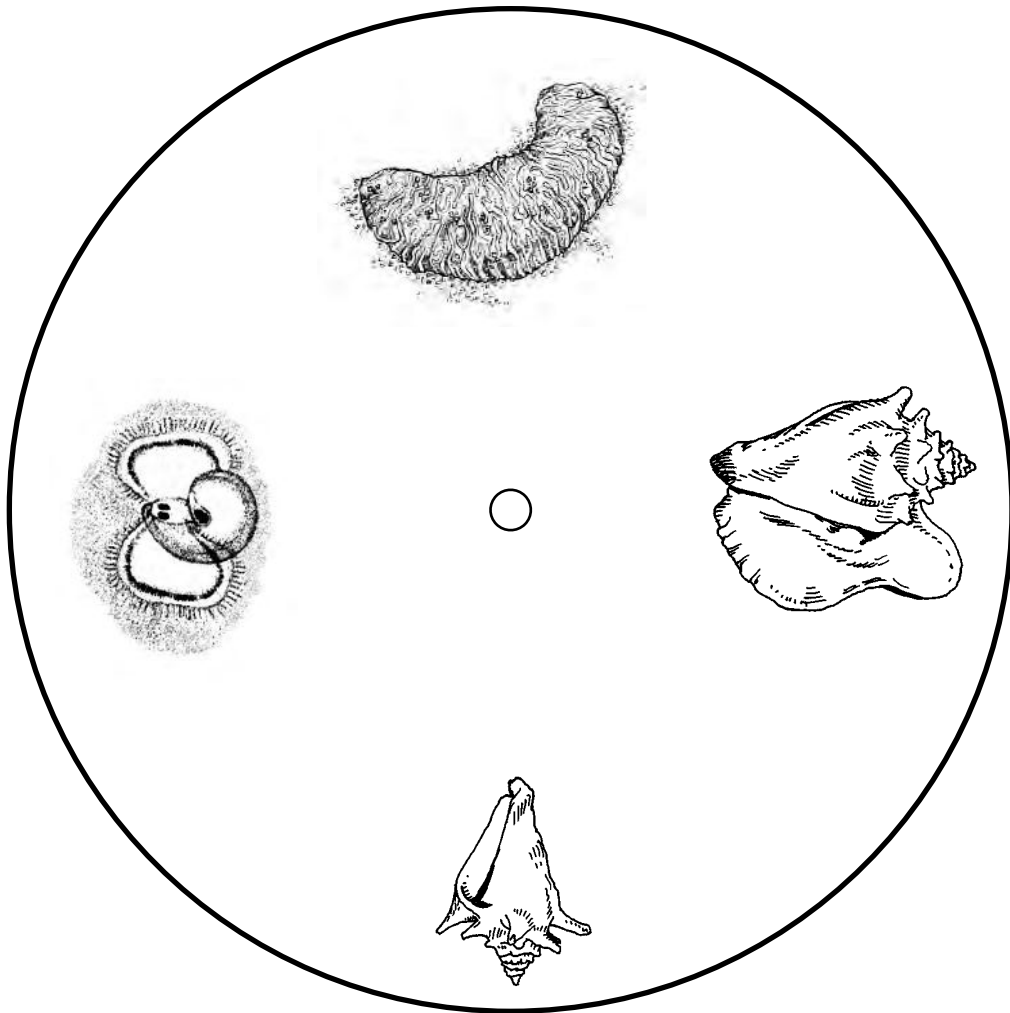
Perry Institute for Marine Science – Caribbean Marine Research Center. 2004. Poster series #1: Queen Conch. Jupiter, Florida. [www.perryinstitute.org](http://www.perryinstitute.org)

Adapted from “Wheel of Trouble,” an activity in *Ranger Rick’s NatureScope* (Endangered Species: Wild & Rare), 1989, with the permission of the publisher, the National Wildlife Federation®.

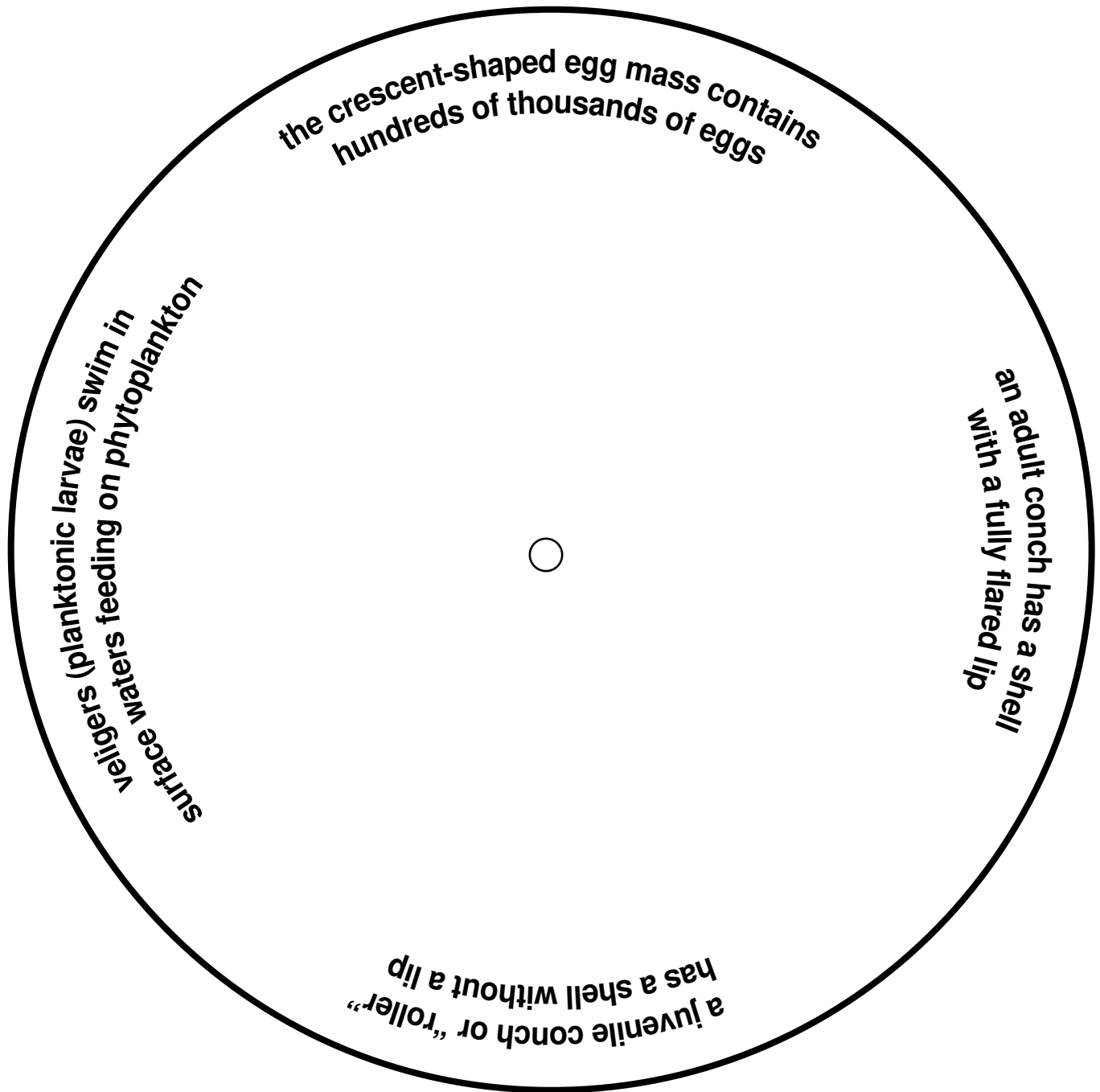
## Wheel Cover Pattern



## Conch Life Cycle Illustrations



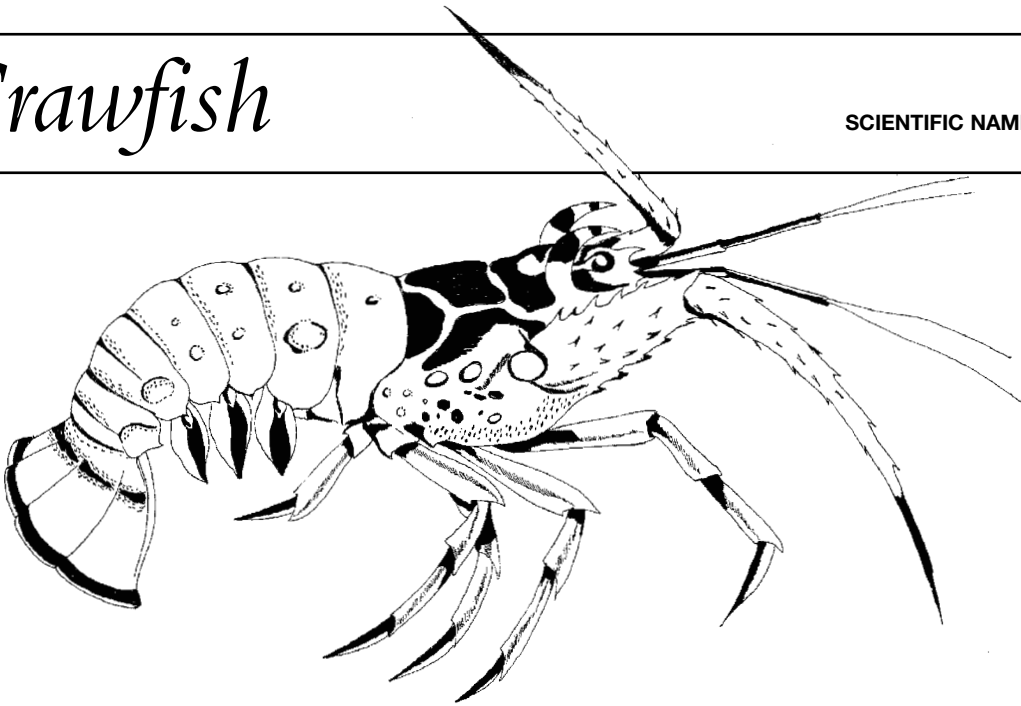
## Conch Life Cycle Descriptions





# Crawfish

SCIENTIFIC NAME: *Panulirus argus*



<b>Kingdom</b>	Animalia
<b>Phylum</b>	Arthropoda
<b>Subphylum</b>	Crustacea
<b>Class</b>	Malacostraca
<b>Order</b>	Decapoda
<b>Family</b>	Palinuridae
<b>Genus</b>	<i>Panulirus</i>
<b>Species</b>	<i>argus</i>

## Description

The crawfish, also known as the Caribbean spiny lobster, has a body comprised of a cephalothorax (the fused head and thorax) and an abdomen, which is segmented and flexible. The crawfish has a hard outer shell, or exoskeleton. The shell covering the cephalothorax is called the carapace. (See diagram on page 51.) The colour of the carapace varies from mottled greenish purple to reddish brown with a few dark spots, while the shell covering the abdomen is brown and tan with a few light spots on each segment.

Rows of spines on its carapace earn the crawfish the common name spiny lobster. These spines as well as two sharp horns over its eyes, and a pair of long, conical antennae, often called whips, are used for defense against predators. A second pair of antennae, called antennules, are used for sensory perception and are folded alongside the body when not in use. The stalked eyes of the crawfish are compound (or multi-faceted), providing a mosaic of images that enable the crawfish to detect movement well. Male crawfish have an opening at the base of each of the fifth pair of walking legs. The fifth pair of a female's walking legs has hook-like "spurs" at the tips. While the male has a single set of four pairs of leaf-like swimmerets (or pleopods) under the tail, each of the female's swimmerets has two lobes (one flat and one like a small pincers). The end of the tail is fan-like, with two lobes on each side of a centre lobe. When disturbed, a crawfish flips this fan to make a hasty backwards retreat.

## Range and Habitat

Crawfish are found throughout the tropical and subtropical waters of the Atlantic Ocean, Caribbean Sea, and Gulf of Mexico, occurring from South Florida, The Bahamas, and Bermuda to the West Indies. They require several types of habitats over the course of their life cycle. As larvae, crawfish drift in the open ocean. In the post-larval stage, they settle in the vegetation of nearshore benthic (bottom) habitats. As they develop, juveniles seek shelter in crevices of rocks, sponges, and corals. Maturing crawfish move to deeper reef habitats. Adults live in small groups in protective recesses in reefs during the day and forage in the open at night.

## Diet

Examination of the contents of crawfish stomachs has revealed that they feed on sea urchins, hermit crabs, sea stars, small mollusks (such as young conch and clams), and worms. Crawfish are scavengers and will feed on almost any animal matter that they come across while foraging. They are able to detect food at some distance using special sensors on their antennae.

## Reproduction and Life Cycle

Crawfish reach sexual maturity at about three years old, when the carapace measures nearly eight cm (over three inches). They spawn when the ocean is warm during the spring and summer. The male places a sticky fluid on the underside of the female. This hardens into a black patch (called a “tar spot”), containing thousands of sperm. The female scratches the spot with the hook on her leg to release the sperm as she discharges eggs. The fertilised eggs attach to hairs on the pincer-like lobes of the swimmerets under her tail for two to three weeks, until they turn from orange to dark brown and are ready to hatch. A female with an eight-cm carapace can produce about 250,000 eggs, while a female with a carapace greater than 10 cm (four in.) can produce over a million eggs, though as few as one individual may survive to become an adult. Large crawfish may spawn two or three times during the mating season; smaller crawfish spawn only once.

A female carrying eggs (in “berry”) usually stays on the deeper edges of a reef, so when the eggs hatch the larvae are released into the open sea. The transparent, flat, spider-like larva, called a phyllosome, looks nothing like its parents. It drifts in the ocean feeding on other plankton, moulting 11 times over six – 12 months. At approximately nine months, the phyllosome undergoes a metamorphosis in which its body takes on the shape of a small crawfish. The still transparent post-larval crawfish swims towards shore to settle in nursery areas like mangroves, algal and grass beds, or shallow reefs. Juveniles also hide on boat bottoms, anchor ropes, and dock pilings. Soon after they settle, juveniles take on striped and banded yellow and dark brown patterns that help them hide in the vegetation. Sub-adults move to coral reefs and crevices. Crawfish continue to grow larger throughout their lives, with some reaching nearly a meter (more than three feet) long from head to tail. Because they frequently moult and grow a new shell, it is difficult to accurately determine an adult lobster’s age, so scientists do not yet know the maximum age a wild crawfish can reach.

## Sources

Bahamas National Trust. 2003. Spiny Lobster fact sheet.

Bahamas Reef Environment Educational Foundation. Our Marine Resources. [www.breef.org](http://www.breef.org).

Department of Fisheries. 2003. Crawfish brochure.

Florida Fish and Wildlife Conservation Commission, Fish and Wildlife Research Institute. Spiny Lobster Sea Stats. [research.myfwc.com/products/product\\_info.asp?id=3720](http://research.myfwc.com/products/product_info.asp?id=3720)

Perry Institute for Marine Science – Caribbean Marine Research Center. 2004. Poster series #2: Spiny Lobster. Jupiter, Florida. [www.perryinstitute.org](http://www.perryinstitute.org).

## Value

Crawfish is an important food source for large groupers, loggerhead turtles, octopus, sharks, and people. Crawfish are “reef cleaners” and play a vital role in keeping our coral reefs healthy. They also have significant economic value. Fishing of crawfish is a multimillion-dollar industry in The Bahamas. On average, crawfish represent 60% of total fishery product landings and more than 85% of the value of landings annually.

## Threats

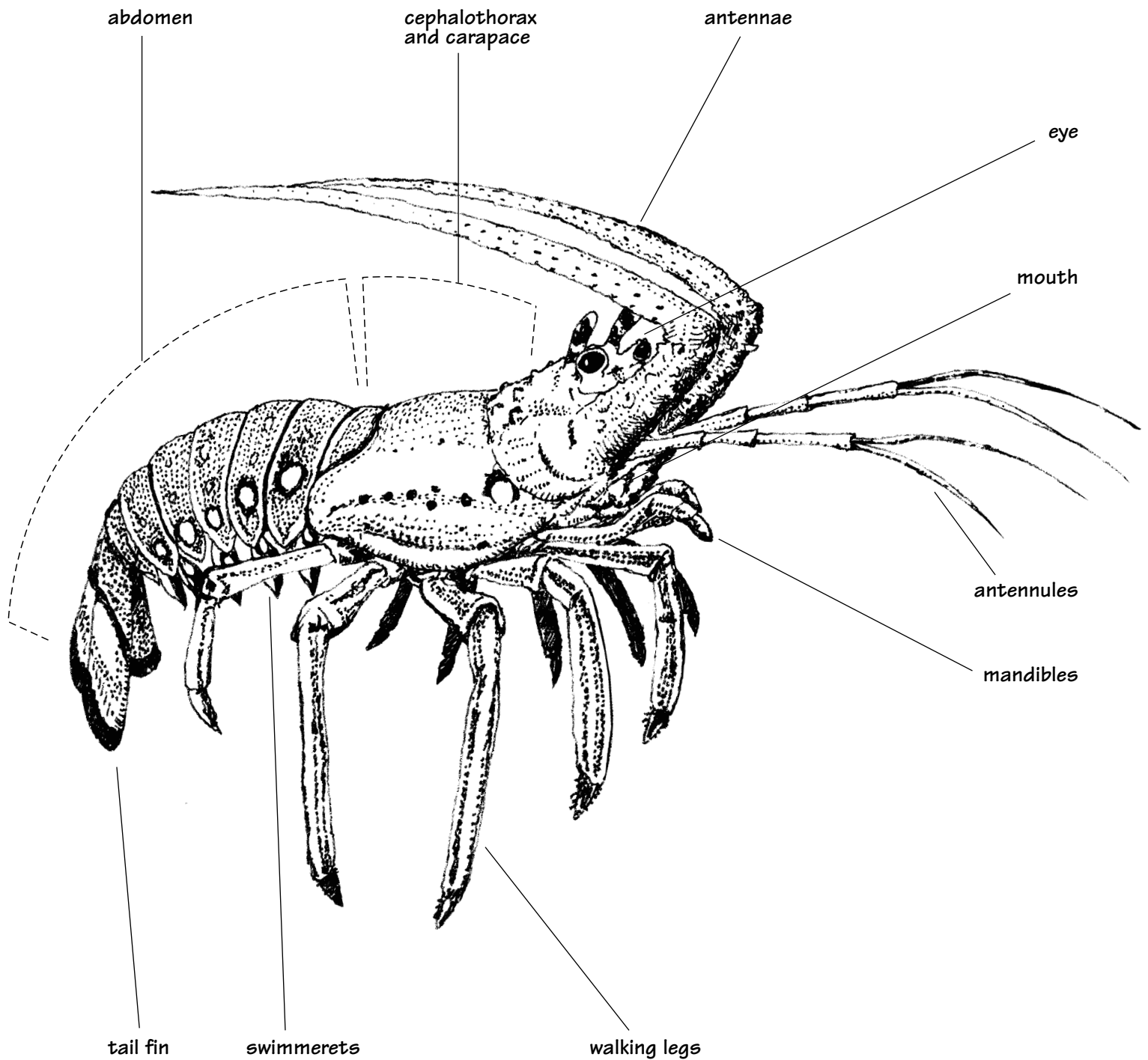
Crawfish are heavily fished throughout their range. In The Bahamas, crawfish are considered generally abundant, with localised depletions near major population centres. The continued success of the commercial fishery depends upon use of responsible fishing methods and respect for fishing regulations.

## Conservation

To produce enough larvae to sustain harvest levels, crawfish must be allowed to reproduce undisturbed. Conservation of crawfish habitat is an important part of this. The Bahamas Department of Marine Resources has put in place the following regulations:

- An annual closed season from April 1 through July 31
- A minimum harvestable size of 8.25 cm (3.25 in.) carapace length or 14 cm (5.5 in.) tail length
- Possession of an egg-bearing female is prohibited as is removing the eggs from a berried (egg-bearing) female
- Use or possession of bleach or other noxious or poisonous substances is prohibited without a permit
- Crawfish traps are limited to wooden slat traps no more than .9 m (3 ft.) long and .6 m (2 ft.) wide, with slats at least 2.5 cm (1 in.) apart

## Crawfish (Spiny Lobster)



# CRAWFISH COLOURING PAGE

Name: \_\_\_\_\_

Date: \_\_\_\_\_

Colour the crawfish and label it with the words listed here.

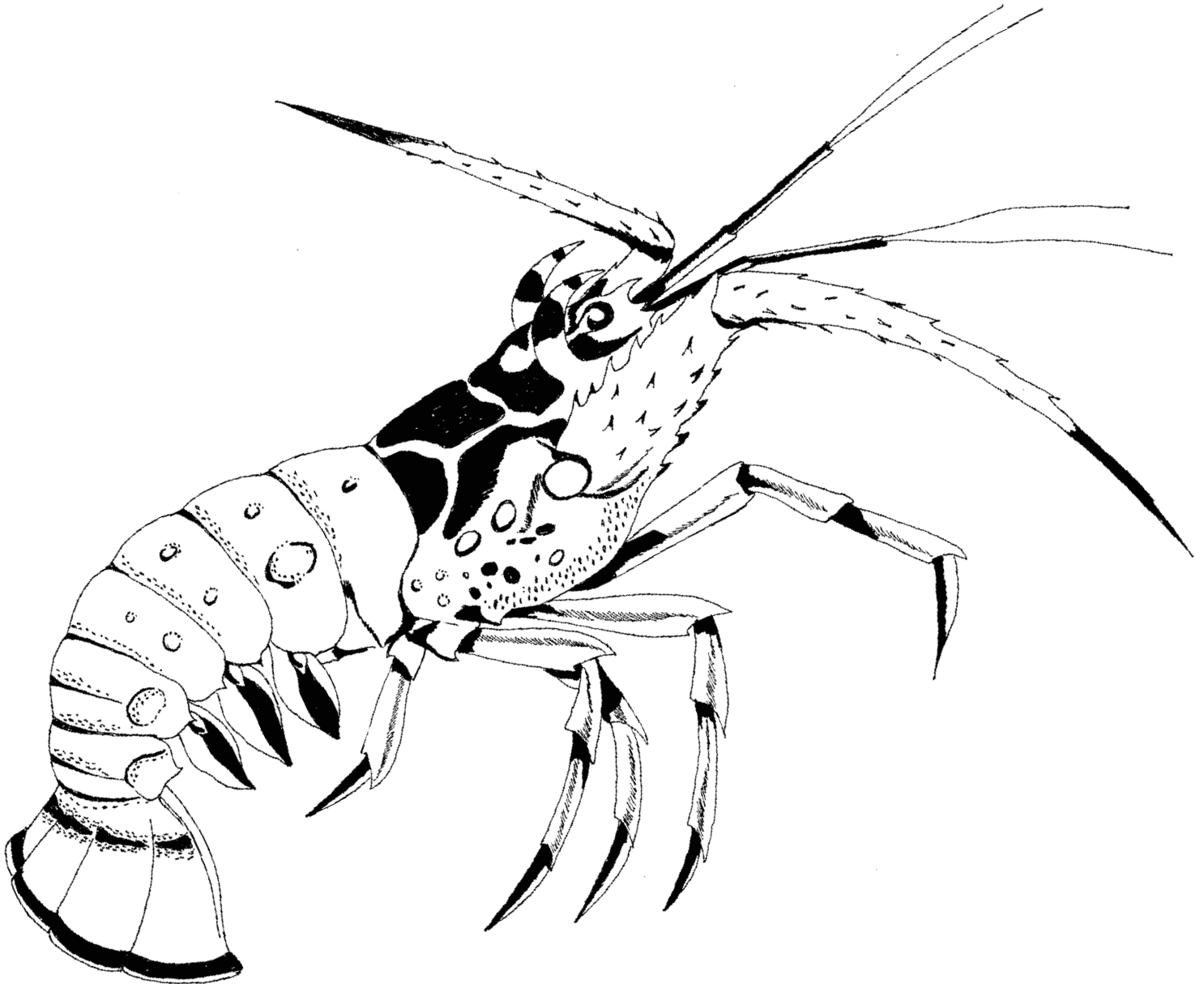
antennae

carapace

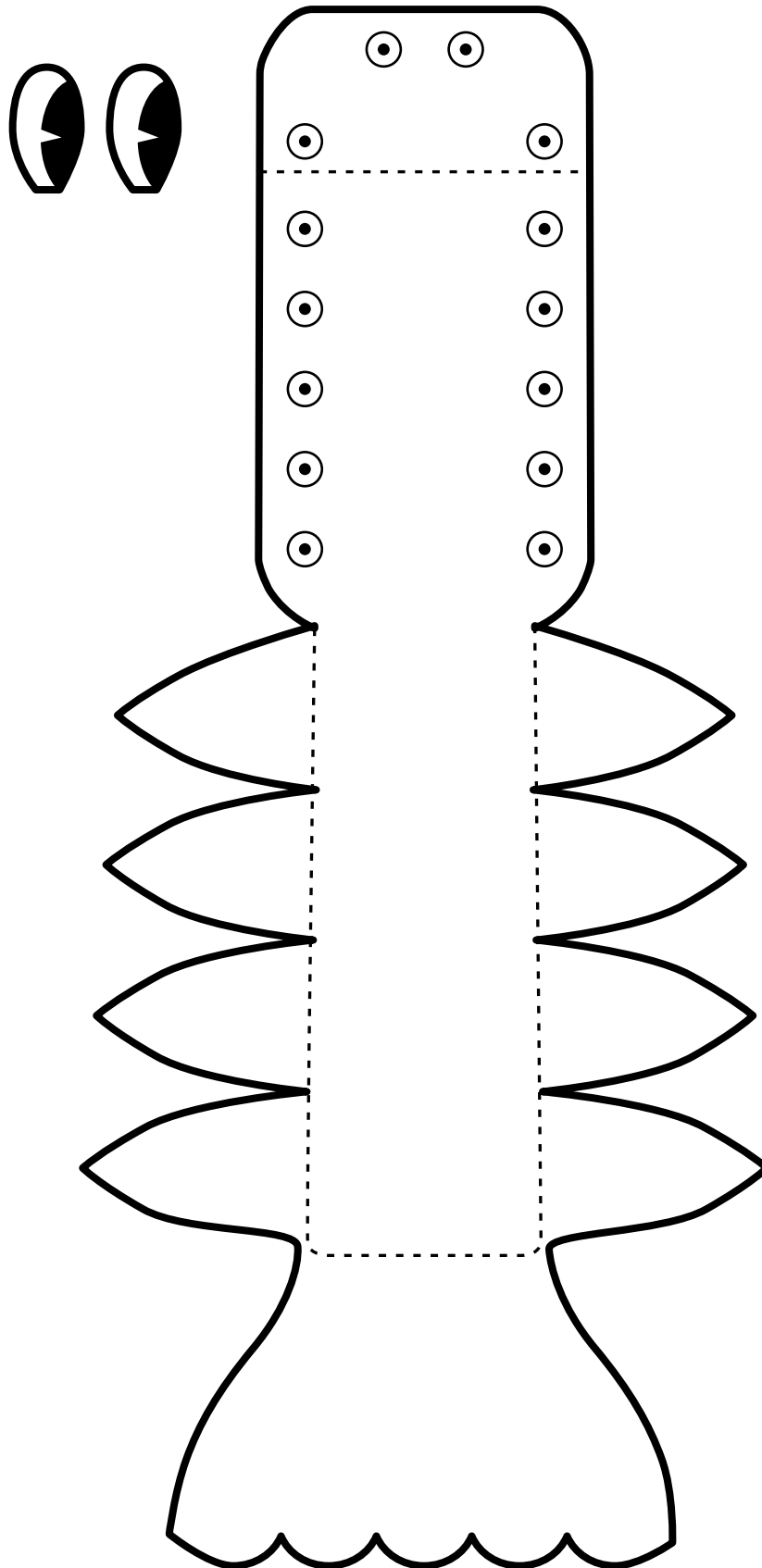
abdomen

swimmerets

walking legs



## Crawfish Pattern



# CRAWFISH FORM AND FUNCTION

Name: \_\_\_\_\_

Date: \_\_\_\_\_

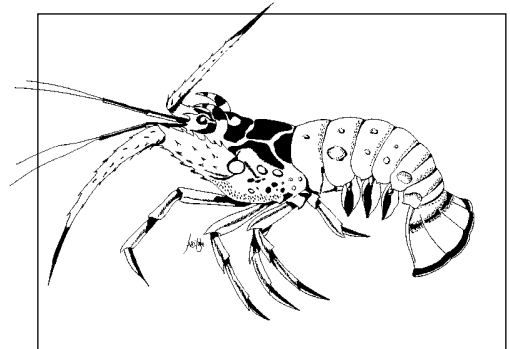
Use the diagram or poster of the crawfish to answer the questions below.

1. What are the three main body parts of the crawfish?

a. \_\_\_\_\_

b. \_\_\_\_\_

c. \_\_\_\_\_



2. The fused head and the thorax, commonly known as the “body” of the crawfish, is also called the \_\_\_\_\_.

3. Find the crawfish’s mouth. What other parts would help the crawfish to eat?

4. The crawfish has no claws. How many legs does it have?

5. Can you find the crawfish’s eyes? What is special about these eyes?

6. Fill in the blanks: The crawfish’s protection is its hard, s\_\_\_\_i\_\_\_\_y shell.

7. What part of its mouth does the crawfish use for crushing and eating food?

8. What does the crawfish use to sense its surroundings?

# 2

# Crawfish Mobile

Students create a mobile of the crawfish life cycle that illustrates its development from egg to mature crawfish.

## Learning Objectives

- Describe the major stages in the development of a crawfish
- Illustrate the habitats of the crawfish at different stages of its development

## Grades

5 – 6

## Subjects

Science, Art

## Skills

organising (sequencing, drawing, manipulating materials), analysing (identifying components and relationships among components)

## Vocabulary

juvenile, **metamorphosis**, **moult**, phyllosome

## Time

45 – 60 minutes

## Materials

For each student: card stock (or construction paper), scissors, a wire hanger, 5 pieces of string, a copy of “Crawfish Life Cycle” (page 83)

For the class: glue, hole punch, spiny lobster poster (Perry Institute for Marine Science – CMRC), stapler or thumb tacks

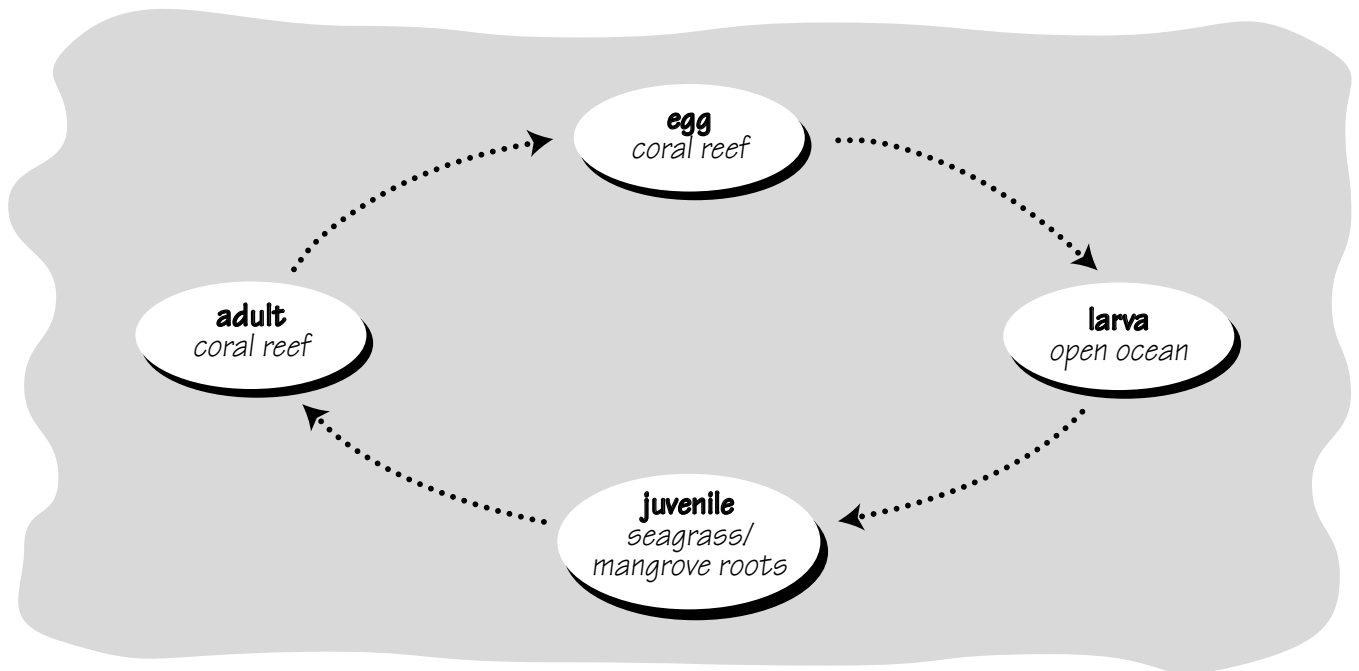
It takes about three years for a crawfish to go from egg to mature adult. From one of thousands of orange-coloured eggs (or millions, in the case of a large female), it becomes a transparent, spider-like larva, called a phyllosome, and drifts for several months in ocean currents. It moults several times before undergoing a metamorphosis, or complete change in appearance — now with the shape of a tiny, but still transparent crawfish. This juvenile crawfish swims towards shore to settle in nursery areas like mangroves, grass beds, or shallow reefs. Its body becomes coloured, marked with yellow and dark brown. As it matures, it moves to coral reefs and crevices. It will continue to grow throughout its life, moulting and growing a new shell. See the “Crawfish Fact Sheet” on page 18 for more information.



## How do Crawfish Grow?

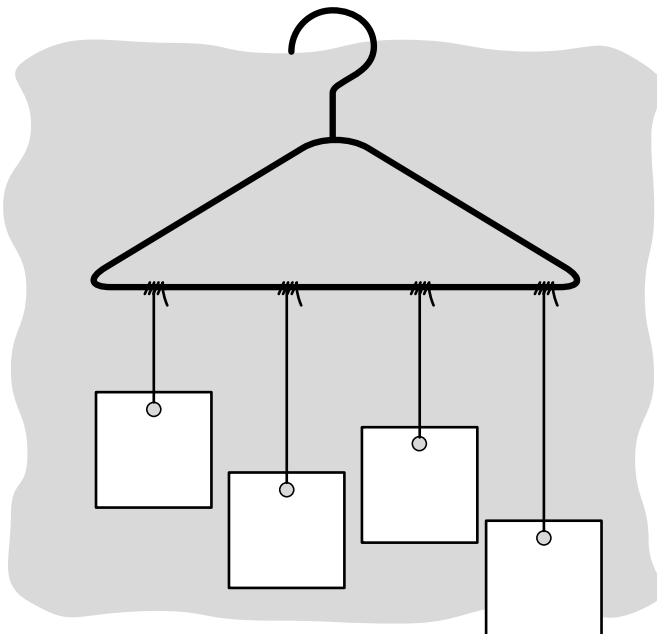
A crawfish moults, or sheds, its outer shell as it grows. Before moulting, a crawfish grows a soft shell — like a second skin — underneath its hard shell. Then it splits its hard shell open where the tail joins the body and backs out of the shell through this opening. The crawfish now has only its soft skin-like shell and is especially vulnerable to predators until the soft shell swells to a larger size and slowly hardens. The crawfish has room to grow in this new shell until it is time to moult again.

Spiny Lobster fact sheet (Bahamas National Trust, 2003).



### Before You Begin

The day before, ask students to bring a wire hanger to school. Each child needs a wire hanger to do this craft. Make a copy of “Crawfish Life Cycle” (page 83) for each student. Cut five pieces of string for each student; these can be of equal length or of varied lengths for added interest.



### What to Do

**1 Introduce the crawfish life cycle.** Begin the activity by showing the students the poster of the crawfish. Point out the different stages of its life cycle and discuss habitats it uses at each stage. Tell the students that they will be creating a life cycle mobile. Distribute a copy of the “Crawfish Life Cycle” to each student.

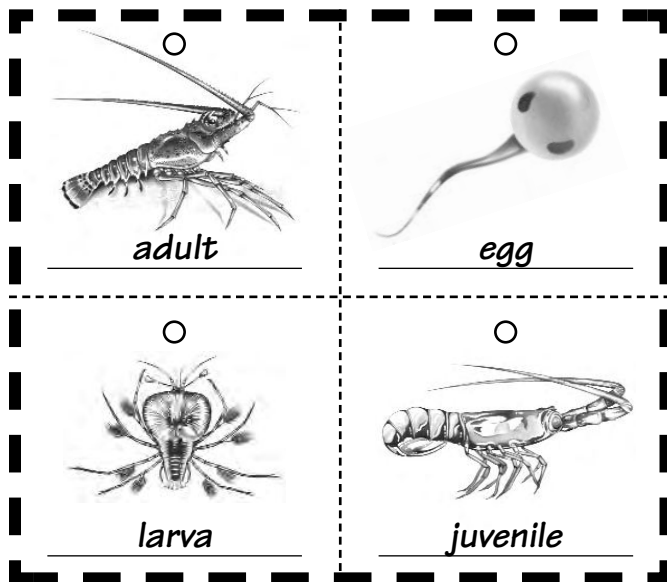
**2 Make the mobile.** Read the instructions on the “Crawfish Life Cycle” sheet with the students. Assist students in making the craft. Alternatives include: decorating hangers by wrapping them with yarn, ribbon, or raffia, or making a mobile without a hanger by linking pictures in a chain. When they are finished, a piece of string can be tied to the top of the hanger to hang it. A thumbtack or stapler can be used to hang the mobiles from the ceiling.

**3 Wrap-up.** Review the stages by pointing to each one of the pictures on the “Crawfish Life Cycle” mobiles and asking students to name each developmental stage.



**Assessment**

Exhibit the mobiles and have students vote on them based on categories such as most colourful, complete, or creative, as appropriate. All mobiles should have the correctly labelled stages of development and illustrate the habitat utilised by the crawfish at each stage.



Play the CYCLE game on page 88.

**Extensions**

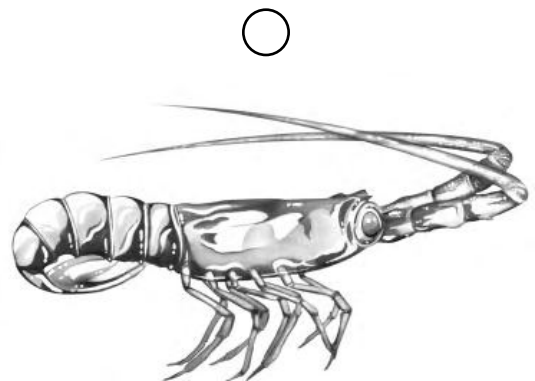
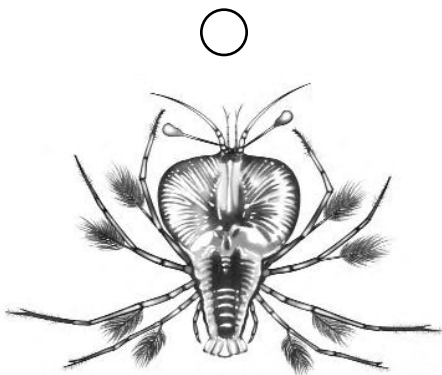
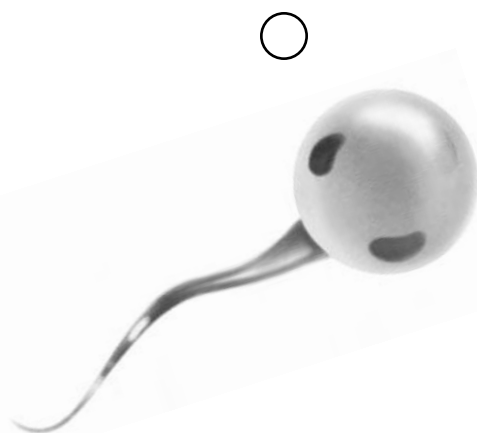
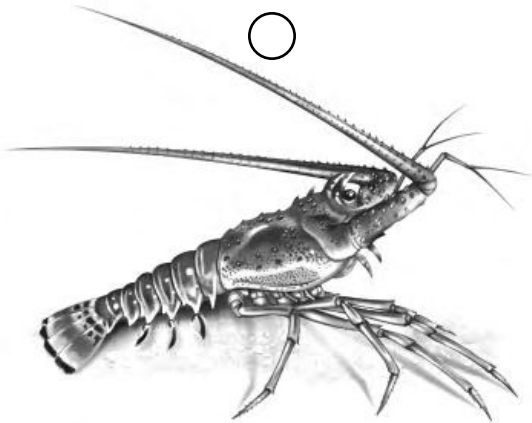
- Invite other students or members of the community to an exhibit of the mobiles.
- Investigate the food sources of the crawfish at the various stages.
- On the back of the squares in their mobiles, have students draw or write threats to the crawfish in each stage.

**Resources**

Perry Institute for Marine Science – Caribbean Marine Research Center. 2004. Poster series #2: Spiny Lobster. Jupiter, Florida. [www.perryinstitute.org](http://www.perryinstitute.org)

# CRAWFISH LIFE CYCLE

1. Label each of the four stages of the crawfish life cycle on the line under each picture.
2. Colour the pictures and draw the habitat where the crawfish lives during each of the stages.
3. Cut out the large square with all four pictures in it along the thick dashed line.
4. Glue this whole square with all the pictures onto heavy paper and trim it.
5. Cut along the remaining dashed lines to separate the pictures of the four stages in the crawfish's life cycle.
6. Punch a hole at the top of each picture as marked.
7. Thread string through the holes and secure the pictures to a hanger in the order of the stages of the crawfish life cycle.



# Nassau Grouper

SCIENTIFIC NAME: *Epinephelus striatus*



<b>Kingdom</b>	Animalia
<b>Phylum</b>	Chordata
<b>Class</b>	Actinopterygii
<b>Order</b>	Perciformes
<b>Family</b>	Serranidae
<b>Genus</b>	<i>Epinephelus</i>
<b>Species</b>	<i>striatus</i>

## Description

The Nassau grouper is an important part of the coral reef community and a valuable fisheries resource. Nassau groupers often rest on the seafloor under ledges, around caves, and in crevices and cracks in the reef. The Nassau grouper belongs to the seabass family of fishes which tend to have strong, stout bodies and large mouths. Five dark brown bars (vertical markings), a dark band (diagonal marking) running from the snout through the eye to the forward side of the dorsal fin, and a dark saddle-like spot on the base of the tail fin are markings that distinguish the Nassau grouper from other groupers. Its broad, fan-shaped tail makes it a slow long-distance swimmer, but enables it to accelerate quickly and make short, quick movements to catch prey. (See diagram on page 59.) A Nassau grouper will change its colour and patterns when it is threatened or to hide from prey. Groupers are among the largest fish on the reef, reaching a maximum length of 1.2 m (4 ft.) and weight of more than 23 kg (50 lbs), but averaging 0.3 – 0.6 m (one to two ft.) long and 4.5 – 9 kg (10 – 20 lbs). They have an average life span of 16 years, but may live for more than 20 years in the wild.

## Range and Habitat

Nassau groupers are found in the tropical western Atlantic Ocean and the Caribbean Sea from Bermuda, The Bahamas and southern Florida to Central America and northern South America. Adult Nassau groupers inhabit shallow waters to depths of approximately 100 m (328 ft.) and prefer areas associated with reefs or rocks where they can hide under ledges, in caves, crevices, and cracks. Young groupers

are often seen in shallow water near the shore where they settle in algal and seagrass beds, mangroves, and patch reefs.

## Diet

Nassau groupers, like most seabass, are predators. They sit camouflaged outside the openings of caves and wait to ambush prey such as crabs, crawfish, reef fish, and octopus. They see well without much light, and often hunt at dawn and dusk when other fish are looking for shelter or feeding. As groupers grow, their diet changes. Juveniles feed mainly on crustaceans, while adults will eat both invertebrates and fish.

## Reproduction and Life Cycle

During the full moon from late November through February when water temperatures are cool, Nassau groupers migrate up to hundreds of kilometres to gather in large groups around certain bank locations to spawn (a form of reproduction in which eggs and sperm are released into the water). Groupers are one of only a few species that form these large spawning aggregations, now numbering in the hundreds, but were once commonly made up of thousands to tens of thousands fish. At these aggregation sites, returning fish undergo various colour phases as spawning approaches. Groupers will rise quickly to the surface in small groups, releasing eggs and sperm into the open sea. Males are often seen nudging the bellies of females to trigger the release of eggs. Spawning continues for several days following the occurrence of the full moon.

The clear, fertilised eggs, measuring less than one millimetre in diameter, are carried away from the reef

by the wind and tide. Larvae hatch from these tiny eggs within approximately 20 to 40 hours. After 35 – 50 days at sea, currents return the larvae to coastal areas where they settle in nursery areas such as algal beds. At about 10 – 12 months, juveniles move to patch reefs in shallow waters where they remain for several years. As they reach adulthood, Nassau groupers move to deeper reefs where they continue growing until they reach sexual maturity, between four to eight years of age. Of the million or so eggs released by each female, less than 1% survives to adulthood.

An interesting aspect of the life cycle of many species of grouper is that they can change sex from female to male, however evidence for this is weak in Nassau groupers, indicating that it is not typical for the species.

### Value

Nassau groupers play a key role in reef communities. They are a food source for sharks, and small groupers are eaten by barracudas, lizard fish, and dolphins. They also participate in symbiotic relationships, for example visiting “cleaning stations” where small fish and shrimp remove parasites from their exterior and the inside of their mouths. Decreases in Nassau grouper populations have community-wide impacts.

Named after The Bahamas’ capital, the Nassau grouper has high social value and is popular in traditional dishes such as boiled fish and grouper fingers. It has been The Bahamas’ most economically valuable finfish in recent years. According to the Department of Marine Resources, in 2003 recorded landings of grouper totaled 421,880 kg (930,087 lbs) and were valued at over \$2.7 million. The Nassau grouper is also a favourite of snorkellers for its size, inquisitiveness, and photogenic appearance.

### Threats

Humans are the predators that have had the biggest impact on grouper populations. In addition to maturing slowly,

Nassau groupers are exceptionally vulnerable to over-exploitation because of their spawning aggregations, which form in predictable areas and at predictable times, and from which fish can be caught prior to reproduction. Where spawning aggregations have disappeared due to overfishing, they do not form again. Direct threats to groupers include uncontrolled fishing on spawning aggregations, spearfishing, and the capture of juveniles in small mesh traps. Other threats include habitat destruction, coral breakage by divers, siltation from construction, runoff, dredging, sewage, and other contaminants that harm both coral reefs where adult Nassau groupers live, as well as algal beds in nearshore nursery areas. The Nassau grouper occupies only a fraction of its previous range and is classified as endangered according to the World Conservation Union (IUCN). This classification signifies that the Nassau grouper has suffered a rapid population decline — it has declined by about 60% over the last three decades — and is at risk of extinction. It is commercially extinct in most of the Caribbean region. Since the 1990s, spawning aggregations have not occurred in Puerto Rico, Bermuda, or the United States Virgin Islands. The Bahamas is one of the few countries where stocks remain commercially viable, though they are much less abundant than in previous decades.

### Conservation

Signs of decline in the Nassau grouper population have prompted the Bahamas Department of Marine Resources to establish an annual closed season from the beginning of December to the end of February. This closed season protects Nassau groupers when they gather in spawning aggregations and are the most vulnerable. Other management measures that would help protect the Nassau grouper include:

- Marine parks and reserves where the fishing of grouper is prohibited
- Enforcement of the minimum legal harvest size of three pounds

### Sources

Bahamas National Trust. 2003. Nassau Grouper fact sheet.  
 Department of Fisheries. 2003. The Nassau Grouper brochure.  
 Gascoigne, Jo. 2002. Nassau Grouper and Queen Conch in The Bahamas: Status and Management Options. MacAlister Elliott & Partners Ltd., BREEF.  
 IUCN. 2006. *2006 IUCN Red List of Threatened Species*. [www.iucnredlist.org](http://www.iucnredlist.org)  
 Perry Institute for Marine Science – Caribbean Marine Research Center. 2004. Poster series #3: Nassau Grouper. Jupiter, Florida. [www.perryinstitute.org](http://www.perryinstitute.org)  
 Ray, G. Carleton. and Jerry McCormick-Ray. 2004. *Coastal-Marine Conservation: Science and Policy*. Malden, Massachusetts: Blackwell Science.  
 Sadovy, Yvonne and Anne-Marie Eklund. 1999. Synopsis of Biological Data on the Nassau Grouper, *Epinephelus striatus* (Bloch, 1792), and the Jewfish, *E. itajara* (Lichtenstein, 1822). *NOAA Technical Report NMFS 146*. US Department of Commerce, Seattle, Washington.

# 3

# Grouper MISSING

Students learn about Nassau grouper form and function by making “MISSING” posters and doing worksheet activities. The concept of adaptations is introduced with a poem.

## Learning Objectives

- Identify the parts of the Nassau grouper
- State the main functions of Nassau grouper parts
- Describe some adaptations that enable fish to live in water

## Grades

3 – 6

## Subjects

Science, Language Arts, Art

## Skills

gathering (observing, listening), organising (matching, drawing), analysing (discussing, identifying components and relationships among components, comparing and contrasting)

## Vocabulary

raspers, vertebrate

## Time

1½ hours

## Materials

copies of “MISSING” (page 63), “Fish Body Parts and Functions” (page 64), “Grouper Adaptations” (page 65); cassette tape and tape player; fish backbone in a zippered baggie; Nassau Grouper transparency (page 62); overhead projector

The Nassau grouper is one of the largest fish on the reef, growing to a maximum of 1.2 m (4 ft.) and weighing over 22.7 kg (50 lbs). It’s a heavy-bodied fish with a characteristically large mouth. Its markings distinguish it from other groupers: five dark brown bars (vertical markings) on the body, a dark band (diagonal marking) running from the snout through the eye to the forward side of the dorsal fin, and a dark saddle-like spot on the base of the tail fin.

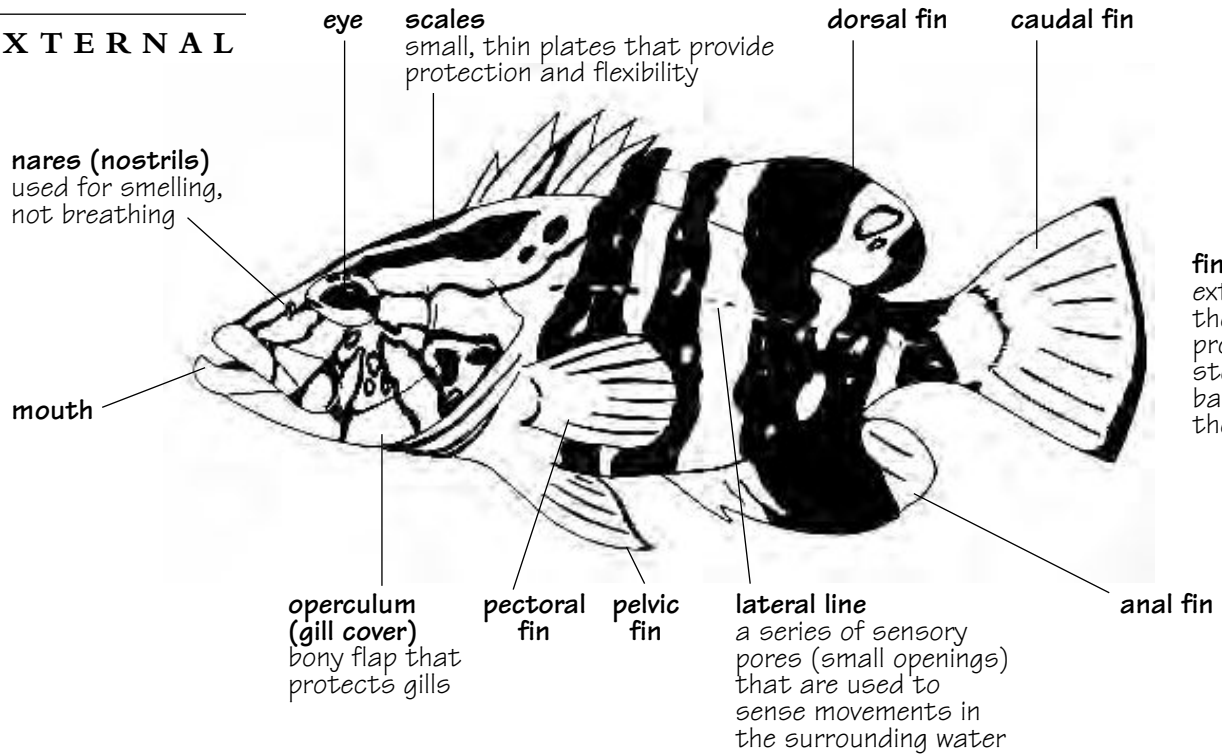
While its broad, fan-shaped tail makes it a slow swimmer, it is able to accelerate quickly and make short, quick movements to catch prey. The Nassau grouper’s colour and pattern go through various phases as it develops from a juvenile to an adult. It can also change colour and pattern when moving from one environment to another, and when it is surprised or afraid. This colour-changing ability helps it blend into its surroundings so it can ambush fish to eat. Groupers have several sets of strong, slender, rasper-like teeth. While these are similar to a shark’s teeth, groupers do not use them to tear flesh, but to prevent small fish from escaping their mouths. Read more about the Nassau grouper’s anatomy in the “Nassau Grouper Fact Sheet” on page 20.



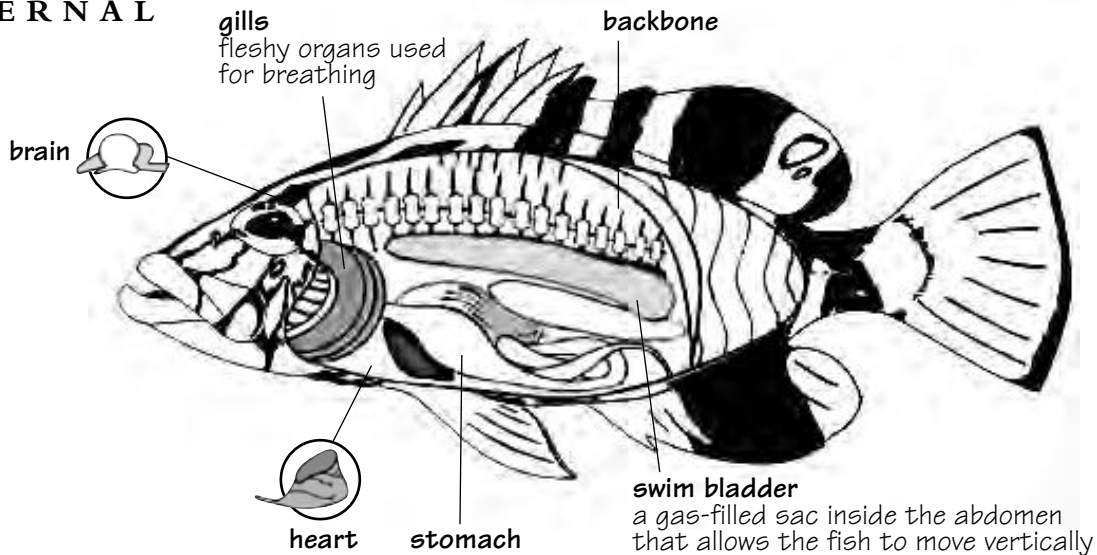
## What Makes a Fish a Fish?

Fish are vertebrates — they have backbones — like amphibians, reptiles, birds, and mammals. They have scales, fins, and gills that make them well-adapted to the marine environment. Most fish are cold-blooded, which means they cannot control their body temperature, but rely on the temperature of their surroundings. While they don’t need hair or fur to insulate their bodies the way warm-blooded animals do, some fish are adapted to warm water and others are adapted to cold.

## EXTERNAL



## INTERNAL



### Before You Begin

Make the recording of the “Grouper News Bulletin” (on page 60) or have a student do it. Use music and a “reporter voice” to make the recording more realistic. Make a transparency of the Nassau grouper on page 62. Make copies of the worksheets on pages 63 – 65 for each student. Clean a fish backbone and put it in a zippered baggie.

### What to Do

**1 Play the recording of the news bulletin.** Ask the students whom they think the news bulletin is about. (*A grouper fish.*) Explain that when someone or something is missing, posters with a drawing and description are often posted around the community so people can be on the lookout.

**2 Create the poster.** Distribute copies of “MISSING.” Explain to students that they are going to create their own MISSING poster of the grouper fish, first labeling some of its key features. Project the Nassau grouper transparency. As each part is identified, describe it and instruct students to label the grouper on their posters, using the appropriate part from the list provided. Point out the backbone on the transparency and show the fish backbone. *Warning – handle with care, these are very sharp bones!* Students can write a title or text on their posters to make it a MISSING poster, for example, “MISSING! Nassau grouper last seen at...”

**3 Discuss grouper parts and functions.** Distribute “Fish Body Parts and Functions” and have students do the activity in groups or individually. When they are finished, ask questions to reinforce what they have learned. What parts of the fish help it to breathe? (*gills*), move in water? (*fins*), or eat? (*mouth*), and so forth.

**4 Discuss adaptations.** Explain that groupers and other fish have adaptations (special tools or characteristics) that enable them to survive, such as fins for swimming and gills for breathing. Ask a student to read the poem “The Fish Had a Wish.” Have students complete the “Grouper Adaptations” worksheet and draw the parts identified onto the fish drawing. Alternatively, for younger students you can prepare “puzzle” pieces for them to paste onto the drawing by copying the illustration on page 63 and cutting out the parts that correspond to the statements on the worksheet.

## Grouper News Bulletin

This just in! A very important fish is missing! The disappearance of this fish causes grave concern among humans and marine life alike. All citizens are asked to be on the lookout for an oblong, large fish with large eyes and coarse, spiny fins. It is average size for its kind, estimated to be about two feet long and weighing 20 pounds. It is a light, buff colour with five irregular dark brown vertical bars on each side. The third and fourth vertical bars form a W-shape above the lateral line. Black dots are located around its eyes. This fish can change colour patterns from light to dark brown very quickly, depending upon its mood and the surrounding environment. The public is advised to concentrate search efforts in areas where parrotfish, wrasses, damselfish, squirrelfish, snappers, and grunts reside. This fish should be hungry and will likely be seeking out these fish as prey. Report all sightings to the fisheries officer in your area. We are holding out hope that this fish will return to its home unharmed.



## The Fish Had a Wish

by Lynn Gape

The fish had a wish  
that he could walk on  
the land

But his fins could not  
get a grip in the sand.

The fish had a wish  
that he could soar like  
the birds

But he needed some  
wings with feathers  
he heard.

The fish had a wish  
that he could leap  
into trees

But out of the water he  
just could not breathe.

The fish had a wish  
that he could swim far  
and wide

And he traveled the  
oceans following the  
tides.

**Assessment**

Have students work in pairs, acting as “detectives” to identify any differences between their posters and then discuss them. (*Did students interpret the facts from the news bulletin the same way? Did they label the fish features correctly?*) Discuss the conclusions of this peer review as a class.

Grade the worksheets, using the following answers as a guide:

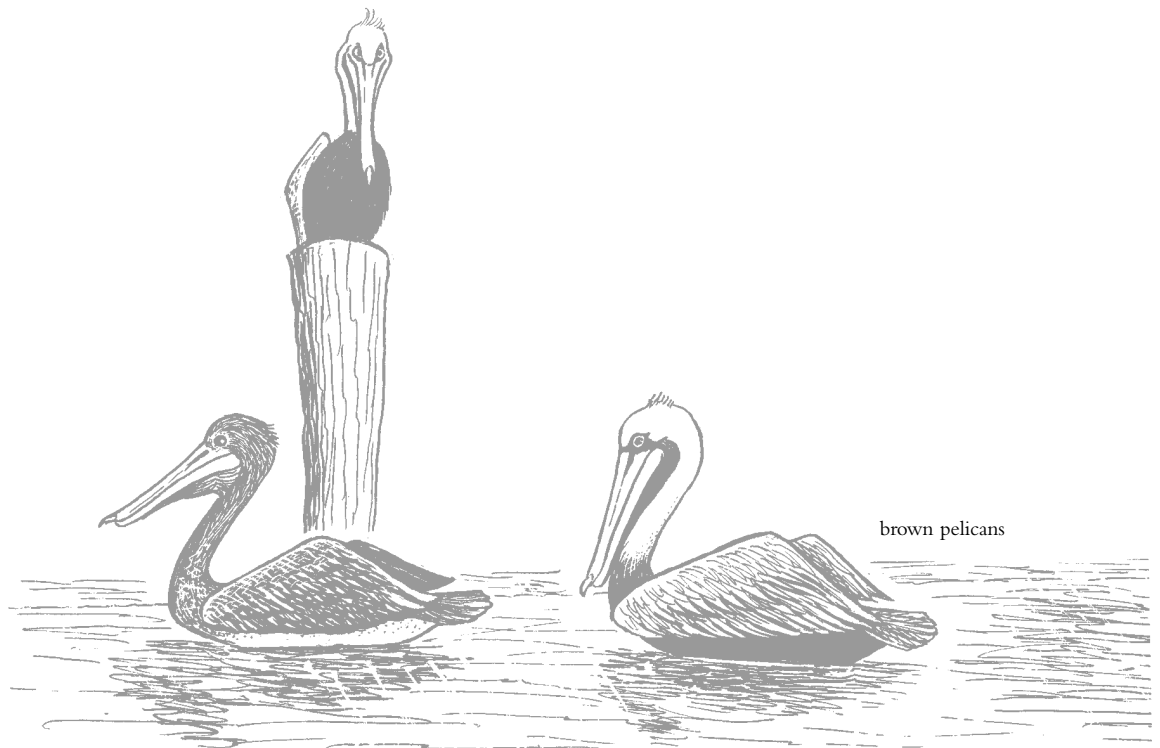
Fish Body Parts and Functions 1 c, 2 d, 3 e, 4 f, 5 a, 6 g, 7 h, 8 b

Grouper Adaptations 1 fins, 2 mouth, 3 gills, 4 operculum, 5 scales, 6 nares, 7 lateral line, 8 caudal fin

The “Pass the Part” activity on page 66 is a great way to review grouper body parts and functions.

**Extensions**

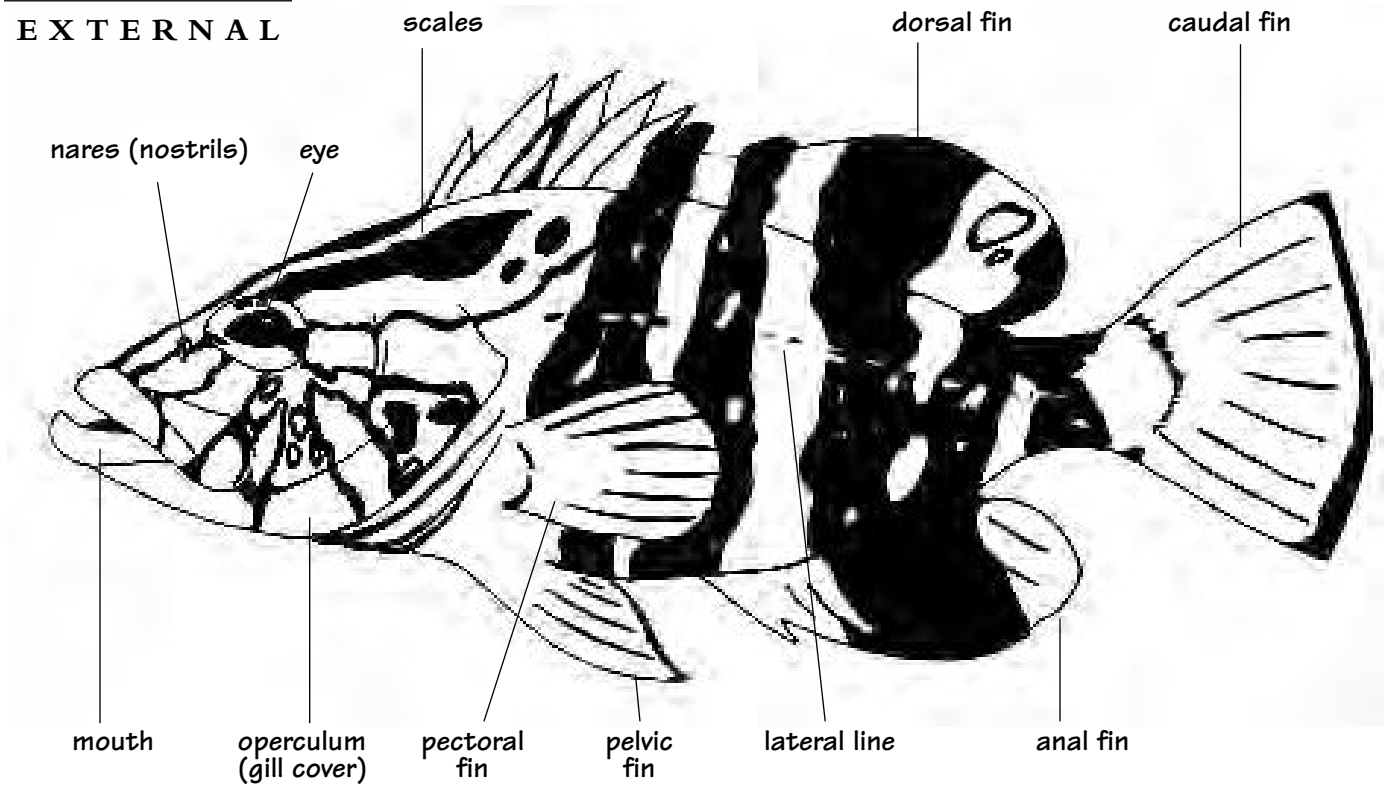
- Instead of a radio news bulletin, students can do a skit of a television news alert complete with a panel of “expert analysts” to talk about the Nassau grouper.
- Students can dissect a fish and compare what they find to the Nassau grouper illustration.
- Read the poem “The Nassau Grouper” by Telcine Turner-Rolle. Have the students write their own poems about the Nassau grouper.



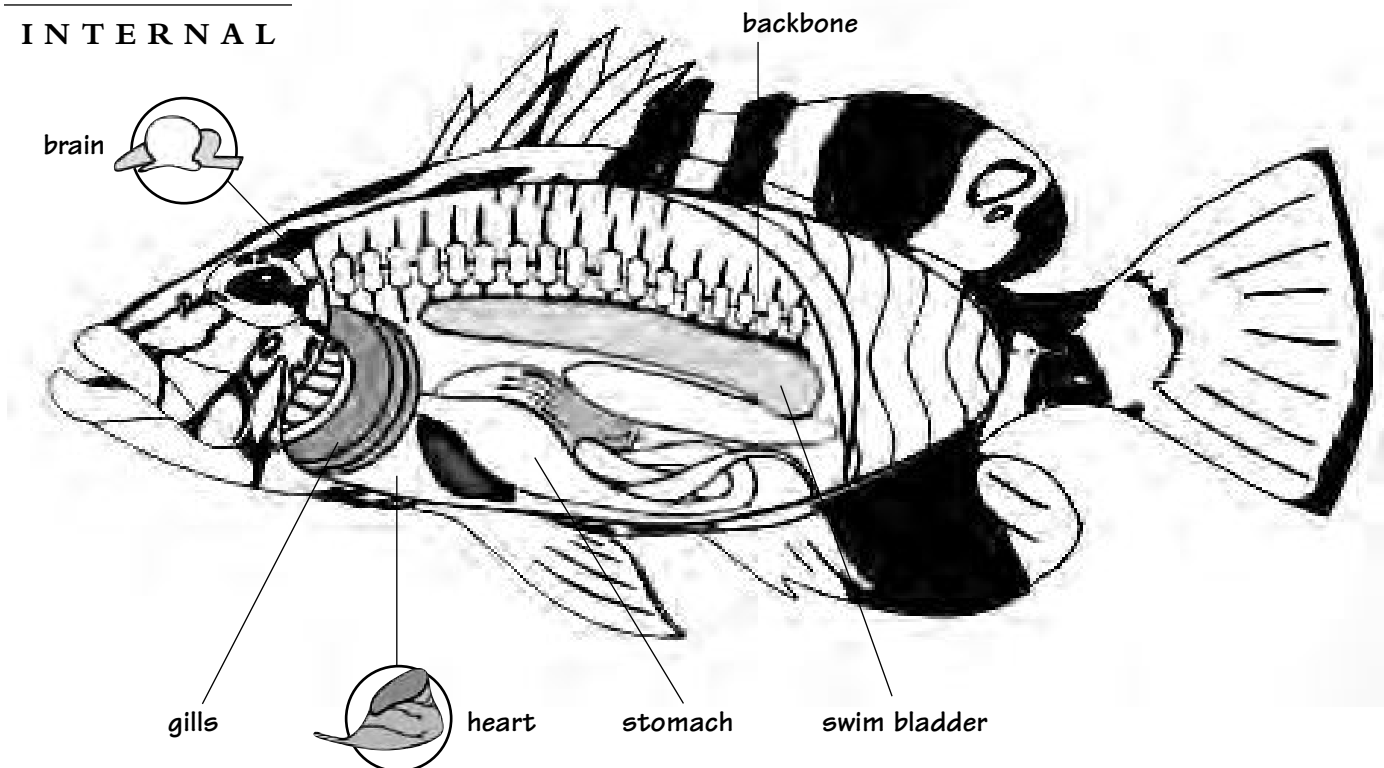


# Nassau Grouper

## EXTERNAL

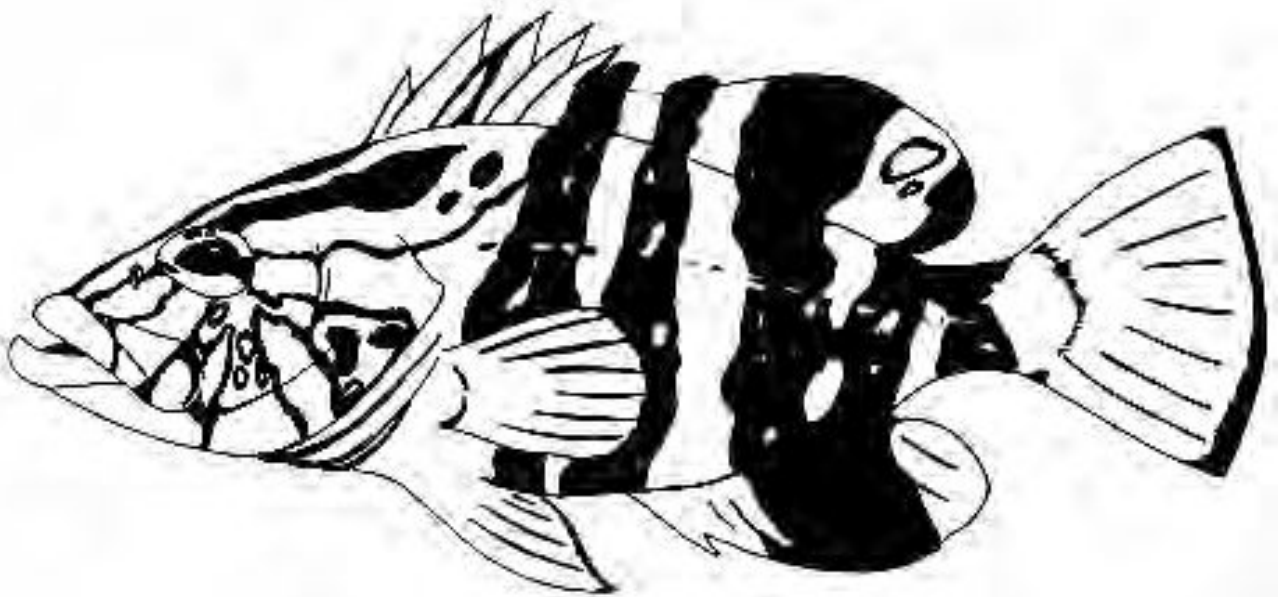


## INTERNAL



Name: \_\_\_\_\_ Date: \_\_\_\_\_

# MISSING



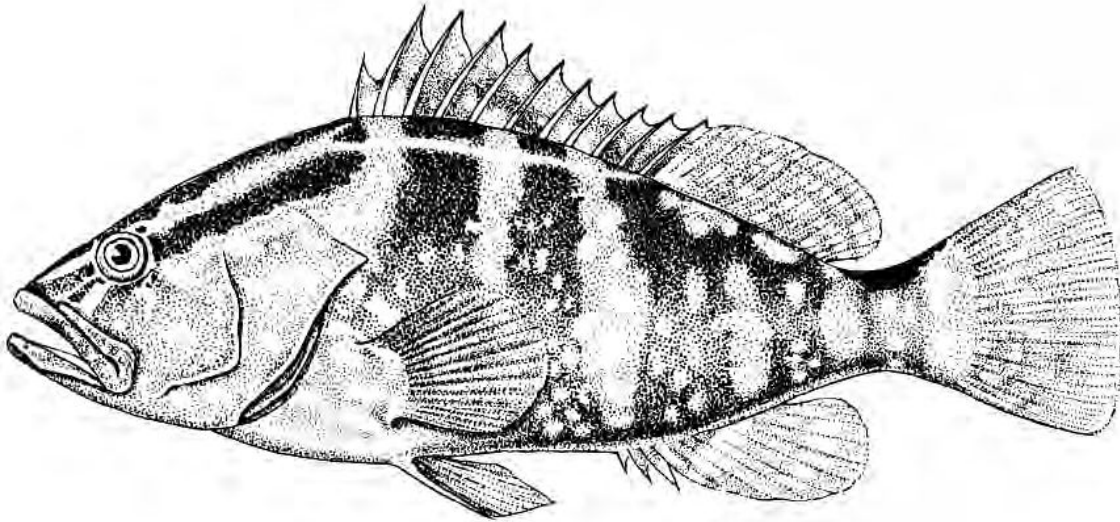
Use the words below to label the parts of the grouper.

anal fin	dorsal fin	gills	mouth	pelvic fin	
eye	lateral line	pectoral fin	caudal fin	nares	operculum

# FISH BODY PARTS AND FUNCTIONS

Name: \_\_\_\_\_

Date: \_\_\_\_\_



Write the letter of the part that matches each function below.

## Function

- \_\_\_\_\_ 1. the part of the body that the fish uses to catch food, located in the front of the body
- \_\_\_\_\_ 2. sight organs located on the head
- \_\_\_\_\_ 3. fleshy organs that are used for breathing and are located on the side of the head
- \_\_\_\_\_ 4. a series of pores (small openings) that are located along the sides of fish to sense vibrations in the water
- \_\_\_\_\_ 5. body parts used for propelling, steering, or balancing in the water
- \_\_\_\_\_ 6. the flap that protects and covers the gills
- \_\_\_\_\_ 7. a gas-filled sac inside the abdomen that allows the fish to move vertically
- \_\_\_\_\_ 8. small, thin plates that provide fish with protection and flexibility

## Part

- a. fins
- b. scales
- c. mouth
- d. eyes
- e. gills
- f. lateral line
- g. operculum
- h. swim bladder

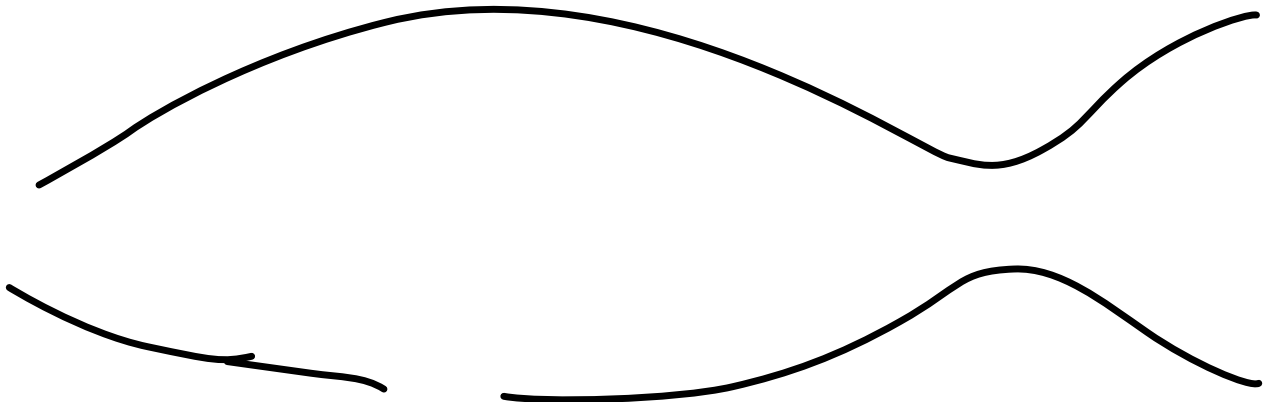
# GROUPE ADAPTATIONS

Name: \_\_\_\_\_

Date: \_\_\_\_\_

Adaptations are the special features of an organism that help it to survive in its environment. In this activity we learned about the parts that fish have, and some that are specific to Nassau groupers that make them well-adapted to life in the sea. Fill in the answers below and identify the part by drawing it onto the fish.

1. Fish don't have any legs. What do they use to move around? They swim with \_\_\_\_\_.
2. The large, fleshy body part that groupers use to capture their prey is: \_\_\_\_\_.
3. People breathe by using their lungs to take in oxygen from the air. Fish need oxygen, too, but they do not have lungs. They breathe with \_\_\_\_\_.
4. The \_\_\_\_\_ is a structure that protects the fish's gills from the environment.
5. A fish is covered in small plates called \_\_\_\_\_ that protect it and allow it to move freely.
6. We use our nostrils to breathe and to smell. A fish's nostrils are called \_\_\_\_\_, and they are only used for smelling.
7. A fish senses movements or disturbances in the water with its \_\_\_\_\_.
8. The grouper's large tail, or \_\_\_\_\_, is used for steering and accelerating quickly.



# 4

# Pass the Part

Students play a straw relay game to review queen conch, crawfish, and Nassau grouper characteristics.

## Learning Objectives

- Demonstrate knowledge of queen conch, crawfish, and Nassau grouper form and function by matching function clues with corresponding parts

## Grades

3 – 6

## Subjects

Science, Physical Education

## Skills

organising (matching, manipulating materials), analysing (identifying components and relationships among components), citizenship (working in a group)

## Vocabulary

adaptation, anatomy, relay

## Time

1 hour

## Materials

play chart(s) — large illustrations of conch, crawfish, and grouper (pages 70 – 72); paper to make circles about 7.5 cm (3 in.) in diameter; photocopy of “Pass the Part Clues” (page 69); 8½-x-11 inch sheet of card stock or poster board; scissors; glue; masking tape; one straw for each student

A relay game is a competition between teams in which all the team members work together. This straw relay not only requires knowledge of anatomy and adaptations, but also involves physical skill and competition. It is a good culminating activity to follow “Conch Ain’t Got No Bone,” “Crawfish Critters,” and “Grouper MISSING.”

## Before You Begin

Decide if you want to review the form and function of one, two, or all three of the animals on the game pages (70 – 72). Take these pages to a copy centre to enlarge them to about 90-x-60 cm (36-x-24 in.) or draw the outlines and title them to create play charts. Cut out paper circles to fit the circle outlines on the enlarged game page(s). Label the cut-out circles as follows:

Conch: mantle, eyestalk, operculum, foot, radula, denticles

Crawfish: abdomen, antennae, mandibles, spiny shell, cephalothorax, walking legs

Grouper: caudal fin, nares, scales, swim bladder, gills, lateral line

Cut out the clue boxes and mount them on poster board. The day before the activity, instruct students to review the parts and functions of the marine animals as homework.



# 3 Grouper Race for Survival

Students play a board game to learn about the life cycle of the grouper and its survival needs at various stages of the cycle.

## Learning Objectives

- Describe the major stages in the life cycle of a Nassau grouper
- Name one challenge that the Nassau grouper faces at each stage in its development

## Grades

3 – 6

## Subjects

Science, Language Arts

## Skills

organising (sequencing, manipulating materials), analysing (discussing), interpreting (identifying cause and effect), citizenship (working in a group)

## Vocabulary

juvenile, larva, overexploited, pelagic, predator, prey, spawning aggregation

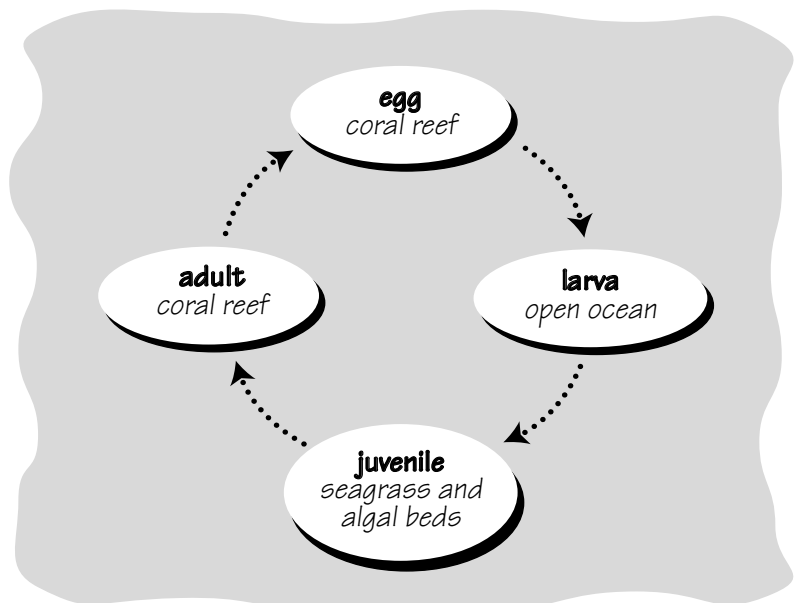
## Time

1 hour

## Materials

For each pair of students: card stock to mount game board and a set of game cards (pages 86 – 87), 1 die, 2 playing pieces  
For the class: Nassau grouper poster (Perry Institute for Marine Science – CMRC)

A life cycle is the series of stages an organism passes through during its lifetime. The Nassau grouper faces many challenges in completing the cycle from egg to adulthood. Most fish, including the Nassau grouper, develop from eggs outside the mother's body. The parents usually do not protect the soft eggs. Many eggs are produced so that enough young survive to continue the species — for the Nassau grouper that may mean a million or more eggs! Less than 1% of these eggs will survive through the life cycle. The tiny larvae that emerge may be eaten by big fish. Those that survive to the juvenile stage settle in seagrass or clumps of coral where they feed on crustaceans. Ten to 12 months later, these juveniles are carried by currents to the reef. It takes about seven years for a Nassau grouper to reach adulthood, the final stage in the life cycle. Adults live in caves and cracks in the reef. These are ideal places from which to ambush prey such as crawfish, parrotfish, red snapper, and other reef fish. The dark bars on Nassau grouper's body help it to blend into dark recesses. The adult Nassau grouper must avoid predators such as reef sharks, barracudas, and humans.



## Top Predator with a Sixth Sense

The Caribbean reef shark (*Carcharhinus perezi*) is one of the top predators in the Bahamian marine environment. It spends most of its time on the edges of reefs and preys on reef-dwelling fish, including the Nassau grouper. Reef sharks are most active in the morning and evening hours when their prey

is most likely to be feeding. They use six keen senses to locate prey: smell, sight, hearing, touch (including receptors which run along each side of the shark's body to detect water vibrations), taste, and electroreception (using small pores under the skin on its head and snout to detect weak electric fields).

When groupers gather to spawn they are especially vulnerable to overfishing. To protect them and ensure there will continue to be Nassau groupers in Bahamian waters, there is a closed season from December to February and Nassau groupers must be at least 1.36 kg (three lbs.) to be fished, purchased, or sold.



Bahamas Reef Environment Educational Foundation.

### Before You Begin

Make one copy of the game board (page 87) and the game card sheet (page 86) for each pair of students, and cut the cards apart. For durability, mount the board and cards on card stock or copy them directly onto card stock, and laminate them. Make or collect playing pieces, such as fish-shaped erasers, or fish-shaped cardboard cut-outs — be creative! Remember, the playing pieces must be different so that each player can identify his or her playing piece.

### What to Do

**1 Introduce the life cycle of the Nassau grouper.** Use the introductory information, the “Nassau Grouper Fact Sheet” (page 20), and the grouper poster to illustrate and explain its life cycle.

**2 Play the “Grouper Race for Survival” game.** Tell the students that they are going to play a game in which they pretend to be grouper eggs struggling to become adult groupers. Divide students into pairs or ask them to find partners. Pass out a game set to each pair of students. Explain the rules and play the game.

**3 Discuss what students learned from playing the game.** Ask questions like: Was it easy to go from an egg to becoming an adult fish? What were some of the dangers you encountered? What are some of the events that helped you to advance more quickly?

### Assessment

Have students write sentences about what they experienced as “groupers.” Students should name the stages in the grouper life cycle and one challenge groupers face at each stage.

Play the CYCLE game on page 88.

## Extensions

- Have students write an essay (or a cartoon story) about a grouper's adventures throughout its life cycle, or how the life cycle could be easier if there were not so many dangerous situations.
- Students can make playing pieces for the board game by creating models of the grouper at various stages. Students can also add more cards to the game.
- Play a life-sized version of the game. Simply recreate the game board on pavement with sidewalk chalk. Use numbers to indicate the challenges and instructions that are written on the game board. Use a star or other symbol for the spaces where

players must pick a card. The students can play in teams, with one student from each team assigned to be the "playing piece," another to roll the die, others to take turns selecting and reading the cards, and the whole group to work cooperatively and to cheer on the team. The same rules of the game apply.

## Resources

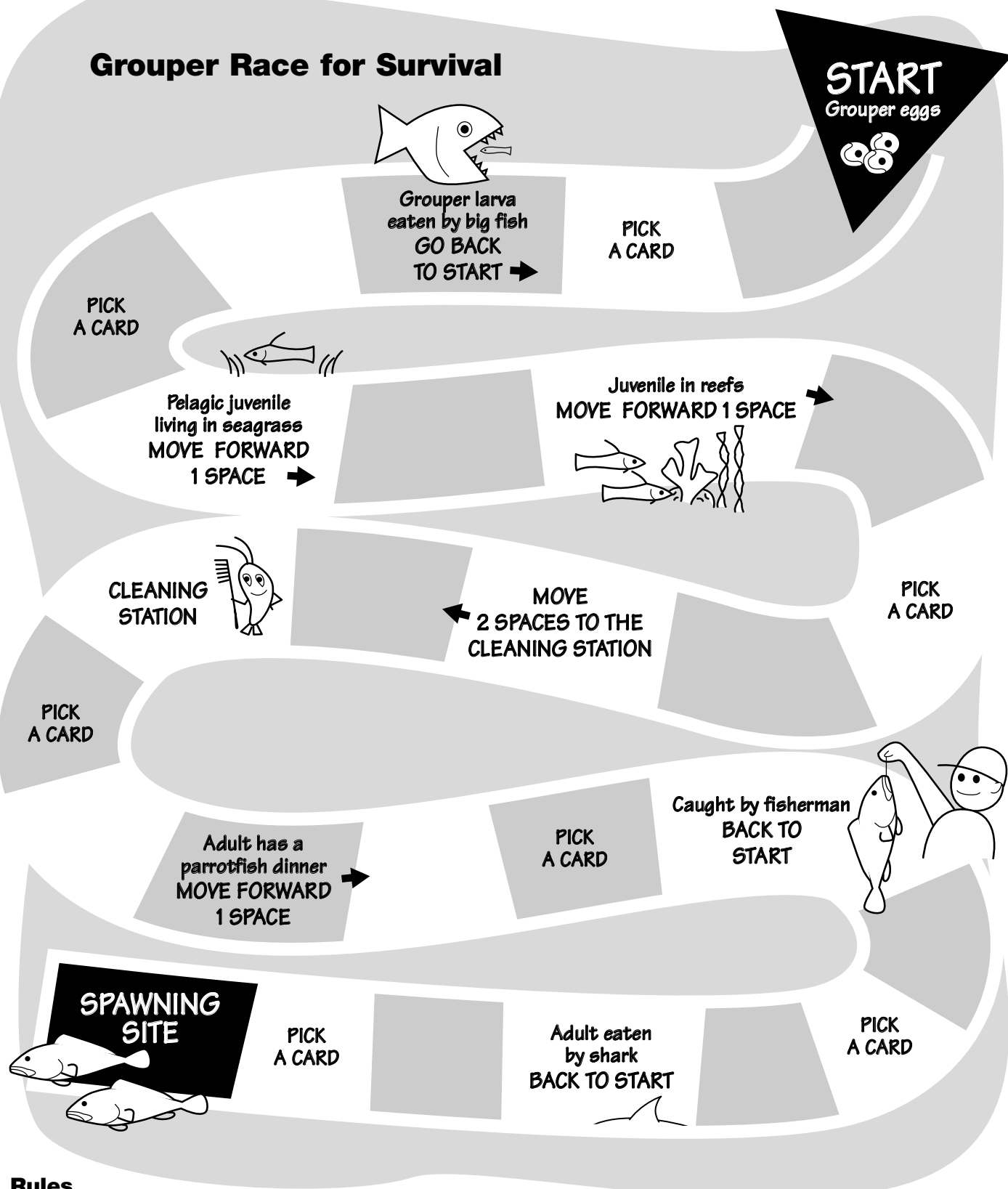
Perry Institute for Marine Science – Caribbean Marine Research Center. 2004. Poster series #3: Nassau Grouper. Jupiter, Florida. [www.perryinstitute.org](http://www.perryinstitute.org)

## Grouper Race for Survival Game Cards

<p><i>Welcome to the fish buffet!</i> Abundant food supply</p> <p><b>move ahead 1 space</b></p>	<p><i>I'm starving!</i> Food shortage</p> <p><b>move back 1 space</b></p>	<p><i>Whew! That was close!</i> Undersized grouper caught, but returned to the sea</p> <p><b>move ahead 1 space</b></p>
<p><i>Who wrecked my place?</i> <i>I'm moving!</i> Reef damage</p> <p><b>move back 2 spaces</b></p>	<p><i>Protection perfection!</i> Fishing laws enforced</p> <p><b>move ahead 2 spaces</b></p>	<p><i>We had 452,000 girls and 563,000 boys!</i> Spawning sites protected</p> <p><b>move ahead 2 spaces</b></p>
<p><i>Eat beef!</i> Overfishing of groupers</p> <p><b>move back 2 spaces</b></p>	<p><i>I can't take this heat!</i> Increasing water temperature</p> <p><b>move back 1 space</b></p>	<p><i>Swim for your life ...!</i> Hurricane</p> <p><b>move back 2 spaces</b></p>
<p><i>Do you smell bleach?</i> Illegal fishing practices</p> <p><b>move back 1 space</b></p>	<p><i>The camera loves me!</i> Divers take pictures not fish</p> <p><b>move ahead 1 space</b></p>	<p><i>A place to call my own!</i> National park created</p> <p><b>move ahead 1 space</b></p>



# Grouper Race for Survival



## Rules

1. Shuffle the game cards and place them face down.
2. Each player rolls the die. The one who rolls the highest number plays first. (For additional rounds between the same players, the winner plays first.)
3. Place playing piece on the start space.
4. Roll the die and move the playing piece ahead the number of spaces indicated on the die.
5. If a player lands on a space with instructions, that player must move his or her playing piece accordingly. If the player lands on a PICK A CARD space, that player must take the top card, read it aloud and follow the instructions. Afterwards, the card should be placed face down at the bottom of the stack.
6. The first player to arrive at the spawning site is the winner!

# Caribbean Fish Cards

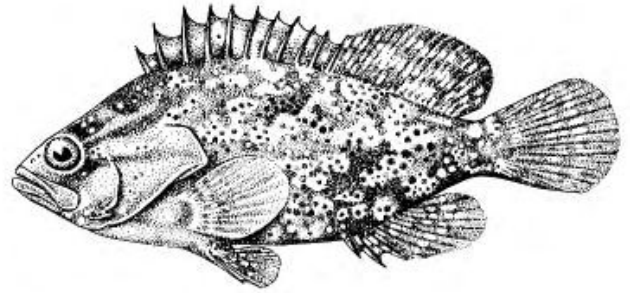
You may wish to enlarge illustrations for classroom use. Note that they are not to scale.

1

## Mutton hamlet

(*Alphestes afer*)

This is a small colourful grouper with brownish or orange scales, orange spots, and darker brown spots forming vertical lines. It may let you come close to observe — if you are able to find it. It camouflages well in the colourful reef rubble and grassy beds that it prefers.

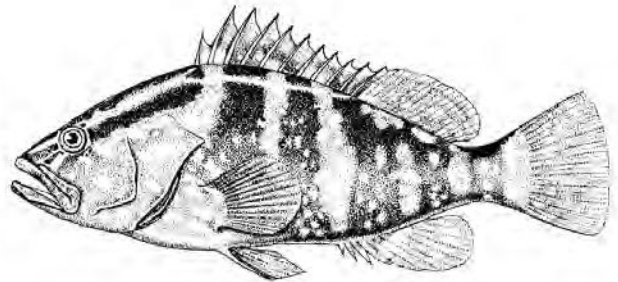


2

## Nassau grouper

(*Epinephelus striatus*)

This fish has a black saddle spot on the base of its tail and five irregular, olive-brown bars over a light background. But a grouper can change to almost black when it needs to blend with its surroundings. It stays in shallow areas, resting on the bottom near rocks, corals, and grasses.

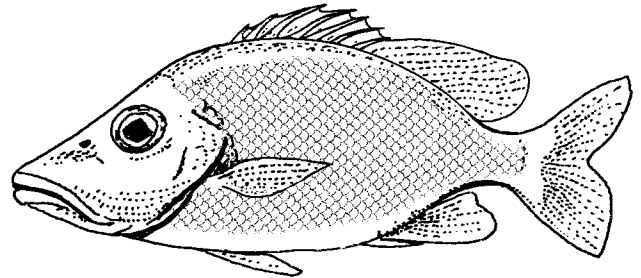


3

## Schoolmaster

(*Lutjanus apodus*)

This is a common fish throughout the Caribbean. Schoolmasters like to drift (in schools) in shallow waters near coral reefs feeding on smaller fish and invertebrates. Younger fish usually grow in the lagoons, hiding in the roots of trees.

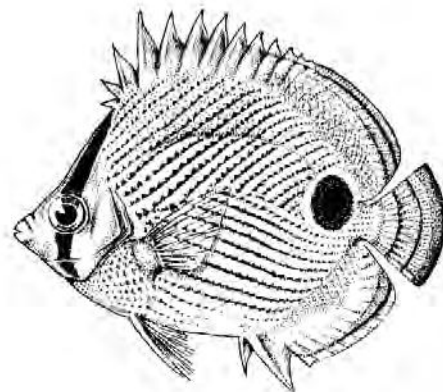


4

## Foureye butterflyfish

(*Chaetodon capistratus*)

This is a round fish with a large spot on each side near its tail. These are called false eye spots and they fool bigger fish, like the barracudas, into thinking the tail is the head so they attack from the wrong end, giving the butterflyfish a better chance of escape. The butterflyfish feeds on zooplankton, soft coral polyps, and various worms.

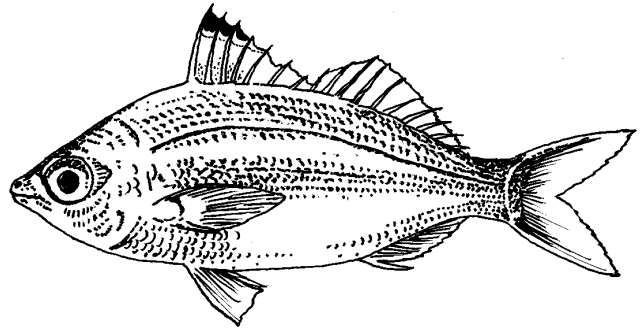


## Caribbean Fish Cards

5

### Flagfin mojarra (*Eucinostomus melanopterus*)

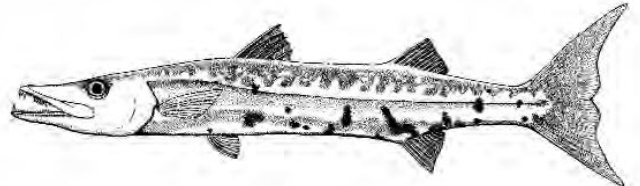
This is a slender, bright, silvery fish, locally known as pilcher. It hovers over sand and grass beds, moves quickly from place to place, stopping to feed, occasionally raising its fins for a split second. It also moves through tree roots in brackish waters (where fresh water and salt water meet).



6

### Great barracuda (*Sphyraena barracuda*)

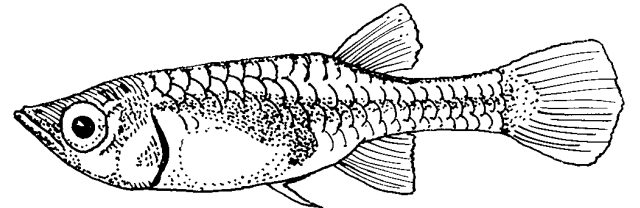
This is a quick swimmer, with a long smooth body and very sharp teeth that may look scary, but are harmless to humans. It spends all of its growing years among tree roots searching for small fish. When it becomes an adult, the barracuda moves to waters with grassy vegetation or corals to feed on small fish such as foureye butterflyfish and parrotfish.



7

### Bahama gambusia (*Gambusia manni*)

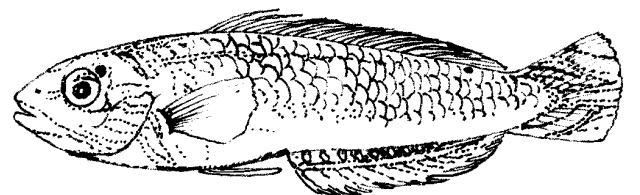
A small fish with a translucent grayish body that lives in brackish waters (where fresh water and salt water meet), looking for food among tree roots and in lagoons. It is popularly known as the mosquito fish because it feeds on mosquito larvae.



8

### Blackear wrasse (*Halichoeres poeyi*)

This is a colourful fish that ranges from shades of green to a brown that can quickly pale or darken to blend with the background. It can also display or conceal a black spot between the eye and the gill cover. It is common throughout the Caribbean where it can be found constantly swimming among turtle grass and sometimes on reefs.

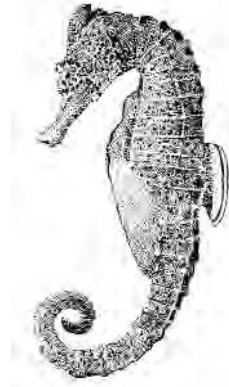


## Caribbean Fish Cards

9

### Longsnout seahorse (*Hippocampus reidi*)

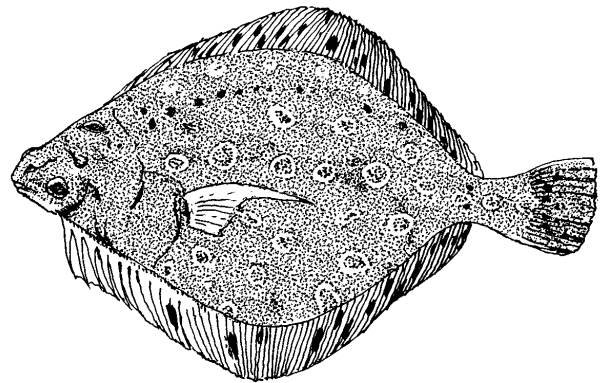
Seahorses are fish, too. Though not common in The Bahamas, the longsnout seahorse is occasionally seen here. It varies greatly in colour, from yellow to reddish orange, brown, or even black, and may even display two tones. It is usually found with its tail curled around branches of corals or grasses. The males protect the eggs in a brood pouch.



10

### Eyed flounder (*Bothus ocellatus*)

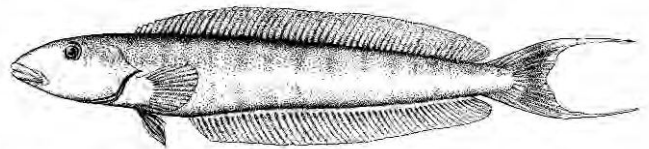
This is a flat fish that lies on the sandy bottom near grassy areas or coral rubble. To find it you have to look very carefully because it usually rests motionless on the bottom, blending with the background. When moving, it glides over the bottom in a wave-like motion.



11

### Sand tilefish (*Malacanthus plumieri*)

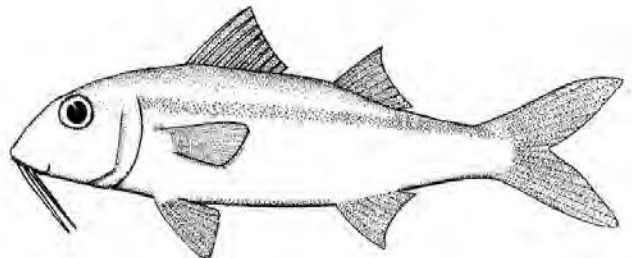
This is a small fish that builds a burrow in sand and rubble and hovers near its entrance, undulating its fins and searching for food. When threatened it will quickly go back into its burrow.



12

### Yellow goatfish (*Mulloidichthys martinicus*)

This fish is mainly white, but has a yellow tail and midbody stripe. It also has two barbels under the tip of its chin that it uses to dig in the sand to look for food. Yellow goatfish are abundant in the Caribbean, often swimming in large schools.



## Caribbean Fish Cards

13

### Southern stingray (*Dasyatis americana*)

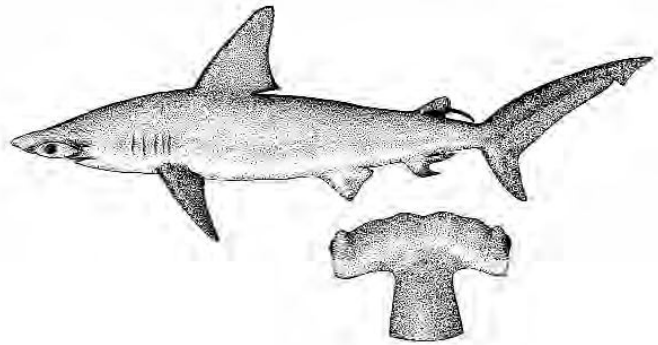
Only found in the Caribbean, this fish spends most of its time buried in the sandy ocean floor, leaving only its eyes and tail visible. When not buried, it will look for snails, crabs, and clams to eat. This ray has a flat body with a whip-like tail that has one or two venomous spines. Be careful where you step in the sand so you won't get a painful sting!



14

### Hammerhead shark (*Sphyrna lewini*)

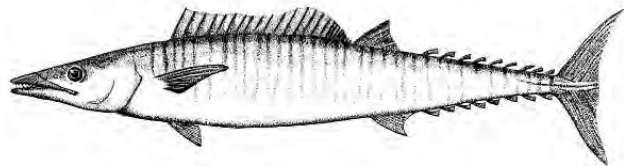
You won't have any trouble identifying a hammerhead — its head is shaped like a wide rectangle or hammer, with eyes at either end. It is a voracious eater, making a meal of rays, smaller sharks, and other fish that it finds around deep waters.



15

### Wahoo (*Acanthocybium solandri*)

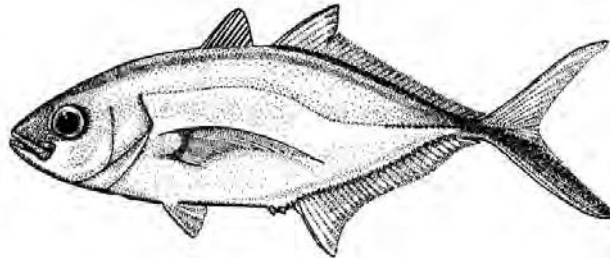
You may have seen this fish on your plate. This is a large fish, appreciated for its delicious taste. Its bluish-green colour shades to silvery white towards its belly. It is commonly fished in deep waters, but may also swim over deep reefs.



16

### Bar jack (*Caranx ruber*)

This silvery fish can darken almost to black, especially when feeding near the bottom. It prefers swimming in open waters in small to large schools. It will often follow goatfish and stingrays as they dig in the sand for prey and snatch their food away.

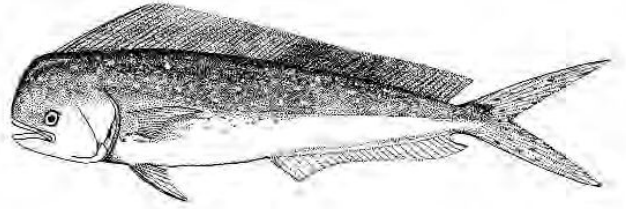


## Caribbean Fish Cards

17

### Dolphinfish (*Coryphaena hippurus*)

This is a brilliant silver fish, common throughout the Caribbean, where it is sought after for its taste. Dolphinfish, also known as mahi-mahi, are rapid swimmers in the open waters and are often seen in small groups of one or two males with several females.

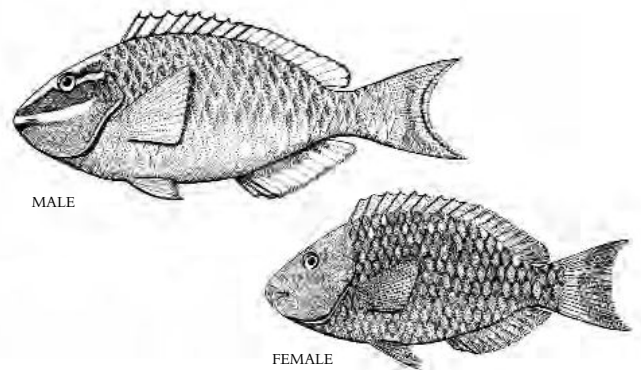


18

### Stoplight parrotfish (*Sparisoma viride*)

Male (blue/green, yellow, pink); Female (red belly and tail, brown body, white spots)

One of the largest fish in its habitat, this brightly coloured fish shows dramatically different colours between sexes and in different stages of development. Its mouth looks like the beak of a bird, pecking at the algae that grow on dead coral and inside coral polyps.



19

### Trumpetfish (*Aulostomus maculatus*)

A fish that is an expert in disguise — it can change colour and position its body to blend with the background. Its long, thin, trumpet-like body can mimic the colours of nearby corals, from brown to reddish, or blue to gray and even bright yellow.

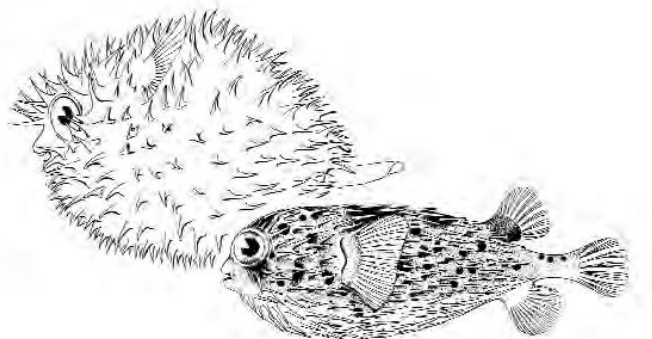


20

### Balloonfish

also popularly known as spotted spiny puffer  
(*Diodon holocanthus*)

This olive- to brown-coloured fish has small, dark spots and spines over its entire body. It is a shy fish that lurks in or near openings in the reef or in the roots of trees and will retreat into them if approached. If bothered, this fish inflates so predators cannot eat it. The swelling is a response to stress and usually the fish has difficulty deflating.



## Caribbean Fish Cards

21

### Spotted moray eel (*Gymnothorax moringa*)

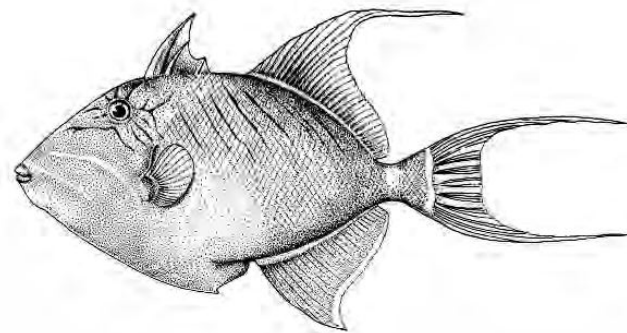
Long and snakelike, the eel likes to hide during the day in crevices on the reef. Its mouth is constantly moving, which makes the eel look like it may want to bite you. In truth, it needs to move its mouth all the time to push water across its gills to extract the oxygen it needs to breathe.



22

### Queen triggerfish (*Balistes vetula*)

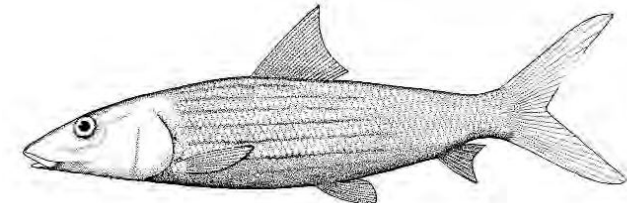
Commonly called “Old Wife,” this is one of the most spectacular fish on the reef. It can change colour at will from brilliant to pale in just seconds. Queen triggerfish eat many invertebrates, such as sea urchins.



23

### Bonefish (*Albula vulpes*)

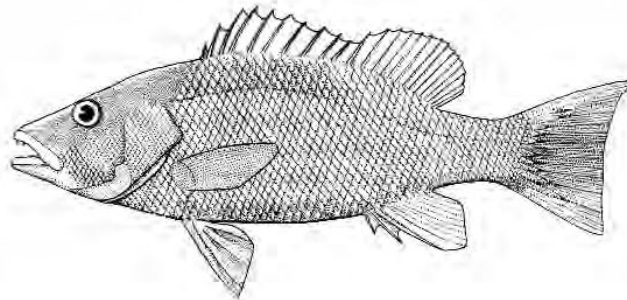
This elongated and silvery fish is one of the most important sportfish in warm waters worldwide, and particularly in The Bahamas and the rest of the Caribbean. Sportfishermen find bonefish on sandy flats near creeks or mangrove areas where these fish hunt for worms, crustaceans, and mollusks.



24

### Gray snapper (*Lutjanus griseus*)

Found throughout The Bahamas, the gray snapper has a mouth with thick lips, similar to a grouper. Its body is grayish with tints of red throughout. Young snappers may be found around trees in brackish waters (where fresh water and salt water meet). As an adult the gray snapper likes to frequent areas around ledges and rocks, but also around reefs, where it hunts for other fish, shrimp, and crabs.



# SCAVENGER HUNT CLUES

Name: \_\_\_\_\_

Date: \_\_\_\_\_

As you walk around, try to find:

1. an animal that blends into its surroundings
2. a very flat fish
3. an animal that lives in a shell
4. an animal that's attached to something else
5. an animal that eats other animals
6. an animal that looks like a plant
7. an animal that spends most of its time on the bottom of the ocean
8. a type of seaweed
9. an animal that escapes its enemies by swimming very quickly
10. an animal or plant that drifts near the surface of the water
11. an animal with tentacles (long, flexible body parts with suckers at the tips)
12. an animal that spends part of its time in the water and part of its time on land
13. an animal or plant that lives on the shore
14. an animal that's smaller than an apple
15. an animal that escapes its enemies by hiding in the sand
16. an animal that escapes its enemies by hiding between rocks
17. a marine ecosystem that is sometimes submerged by water and sometimes not
18. a marine ecosystem where a lot of plants grow
19. a symbiotic relationship (two animals or plants that depend on each other)
20. an animal that produces light
21. an animal that's bigger than you are
22. an animal that must go up to the water surface to breathe air

