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Blue Crabs in the Chesapeake

An Introduction to the Blue Crab

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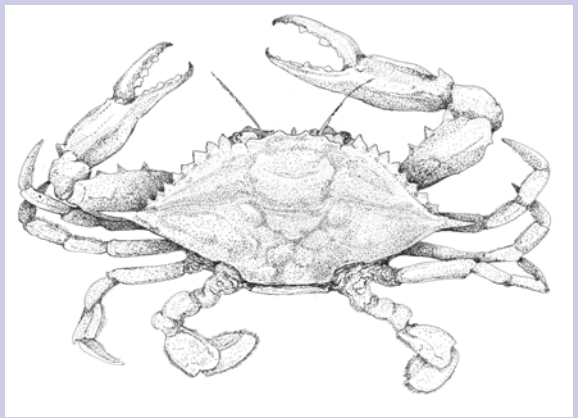
BLUE CRAB QUICK FACTS:

- Blue crabs are distributed throughout the U.S. Atlantic and Gulf coasts. By the mid 1900s blue crabs were found in European & African waters. It is likely that blue crabs were accidentally introduced to these areas by ocean-going ships.
- Adult blue crabs generally feed on thin-shelled clams, soft-shelled crabs, SAV, fishes, and oysters. Blue crabs are cannibalistic and up to 20% of an adult's diet can consist of juvenile crabs.
- Mating occurs from June to October in the mid-Bay regions. Although a female will mate only once in her life, she may produce two or more egg masses from this single mating. Fertilization occurs each time a new egg mass is produced by the ovaries until the sperm reserves are depleted.

The blue crab's elegant form, feisty behavior, complex life history, and tasty flesh have attracted the attention of scientists, fishers, artists, writers, and hungry diners. The earliest written accounts of culinary activity in the Chesapeake region, recorded in the early 17th century by European settlers, include descriptions of Native American crab feasts and soft-shell crab harvesting. Since that time, the blue crab's popularity as a food item has grown to make it the second largest crab fishery in the world.



Callinectes sapidus, the blue crab. Drawing by Kent Forrest

The blue crab is currently the most economically important shellfish in the Chesapeake Bay. Historically, the Chesapeake was the source of at least half of the United States' annual blue crab harvest. But recently the Bay's harvest of blue crabs has been in decline. Because of its importance to the Chesapeake economy, the blue crab has been the subject of much scientific study. Over the years, these studies have revealed fascinating details about the life history of the blue crab and its intimate connections with the physical, chemical, and biological cycles of the Chesapeake Bay.

The Blue Crab's Biological Pedigree

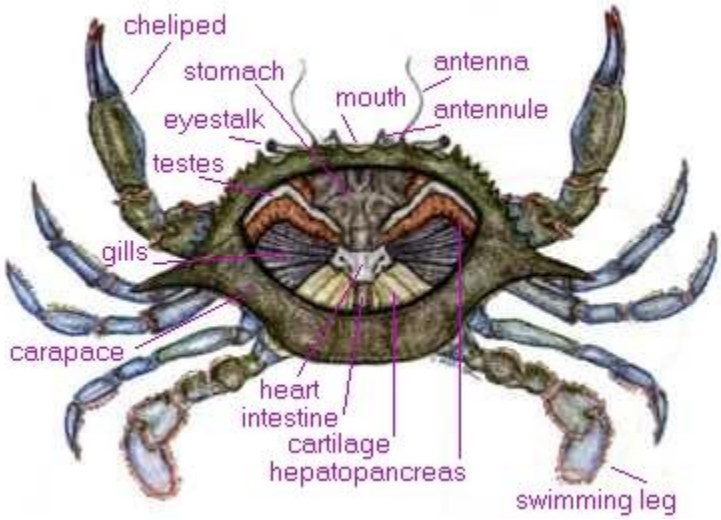
Eighty percent of all animal species on earth, including blue crabs, spiders, and insects, belong to the Phylum Arthropoda, a group whose members are characterized by external skeletons and jointed appendages. The blue crab's pedigree further reveals its kinship to familiar aquatic creatures such as shrimp, lobsters, and crayfish, all belonging to the Class Crustacea. These particular crustaceans have ten appendages, earning them membership in the Order Decapoda, meaning "ten feet." The blue crab's ten appendages are finely adapted for various functions. The first pair of legs has been modified into sharp and powerful claws, the second, third, and fourth pairs are walking legs, and the fifth pair, tipped with flexible paddles, is used for swimming. These paddle-like appendages and other special characteristics place the blue crab in the

Family Portunidae, the swimming crabs. It is the strong muscle in these swimming legs that provides the seafood market with the highly prized lump or backfin meat.

The blue crab's scientific name, *Callinectes sapidus*, is especially descriptive. The genus *Callinectes* refers to the creature's beauty (*calli-*) and its swimming ability (*-nectes*). The species name reflects its delicious flesh (*sapidus,* "savory" or "tasty"). Sixteen species of *Callinectes* crabs have been identified, most of them found in the Atlantic Ocean and Caribbean Sea. The earliest fossil record of this genus dates back 23 million years ago to the Miocene Epoch, during the Tertiary Period. The genus *Callinectes* appeared before the great ice ages of the Pleistocene and the Holocene, but many millions of years after the disappearance of the last dinosaurs. When rising sea level began to flood the Susquehanna River valley about 10,000 years ago, giving birth to the Chesapeake Bay, the blue crab was perfectly adapted to the variety of estuarine habitats that resulted.

Blue crab peeler. *NOAA Photo*

Blue Crab Anatomy



Drawing by Susanna Musick

Crab Anatomy Glossary

EXTERNAL FEATURES

Antenna (pl. antennae) The long segmented appendages located behind the eyestalks. These allow the crab to interact with its environment by touch and chemoreception.

Antennule (pl. antennules) Shorter segmented appendages located between and below the eyestalks, sensory organs; these also use chemoreception to "smell" and "taste."

Appendages Ten legs (five pairs) including a claw-bearing pair with spines used for feeding and defense, followed by three pairs of sharply pointed walking legs, and a pair modified as flat swimming paddles at the rear, swimming legs.

Apron Abdomen of a crab, which is folded under the body; male's is shaped like the Washington Monument or an inverted Y. An immature female's is triangular (pyramid shaped) and mature female's is semicircular, like the dome of the Capitol building.

Male apron.
Drawing by Kent Forrest

Female apron.
Drawing by Kent Forrest

Crab Anatomy Glossary continued

Carapace The shell covering the body that provides rigidity and protective covering. It is made of chitin and is the part of exoskeleton (hard outer covering) that covers the head and thorax (center) of the crab.

Cheliped (see appendages) The first pair of legs, carries the large claw which is used for defense and obtaining food. Male's claws are blue tipped with red; female's are red.

Eyes Visual organs mounted on the ends of eyestalks. The eyestalks contain cells that release hormones that inhibit molting.

Lateral spines Paired points on the widest outside edges of the carapace.

Mouth Opening to the digestive system, located between the antennae. The mouth contains jaws that hold and push food into the esophagus.

Sponge Egg masses. Numbers of eggs vary, some may contain as many as 8,000,000. They are attached to swimmerets.

Swimmerets (pleopods) Paired abdominal appendages under the apron of the female crab on which the eggs are carried until they hatch.

Walking legs (see appendages) Used for movement; crabs are capable of walking forward or diagonally, but usually they walk sideways.

INTERNAL FEATURES

Cartilage Encases muscles that aid in movement of the legs. The muscles are the edible portion of the crab.

Gills Place of respiration and filtration, consisting of many plume-like filaments arranged around a central axis. There are eight gills on each side of a blue crab's body.

Heart The pump of the circulatory system. It is broad in size and located in the lower center part of the body.

Hepatopancreas (midgut gland) Extremely large organ with several functions, including the secretion of digestive enzymes and absorption and storage of digested food. It fills most of the area around the stomach, depending on its contents of food reserves and water.

Intestine Portion of the digestive system through which digested food passes.

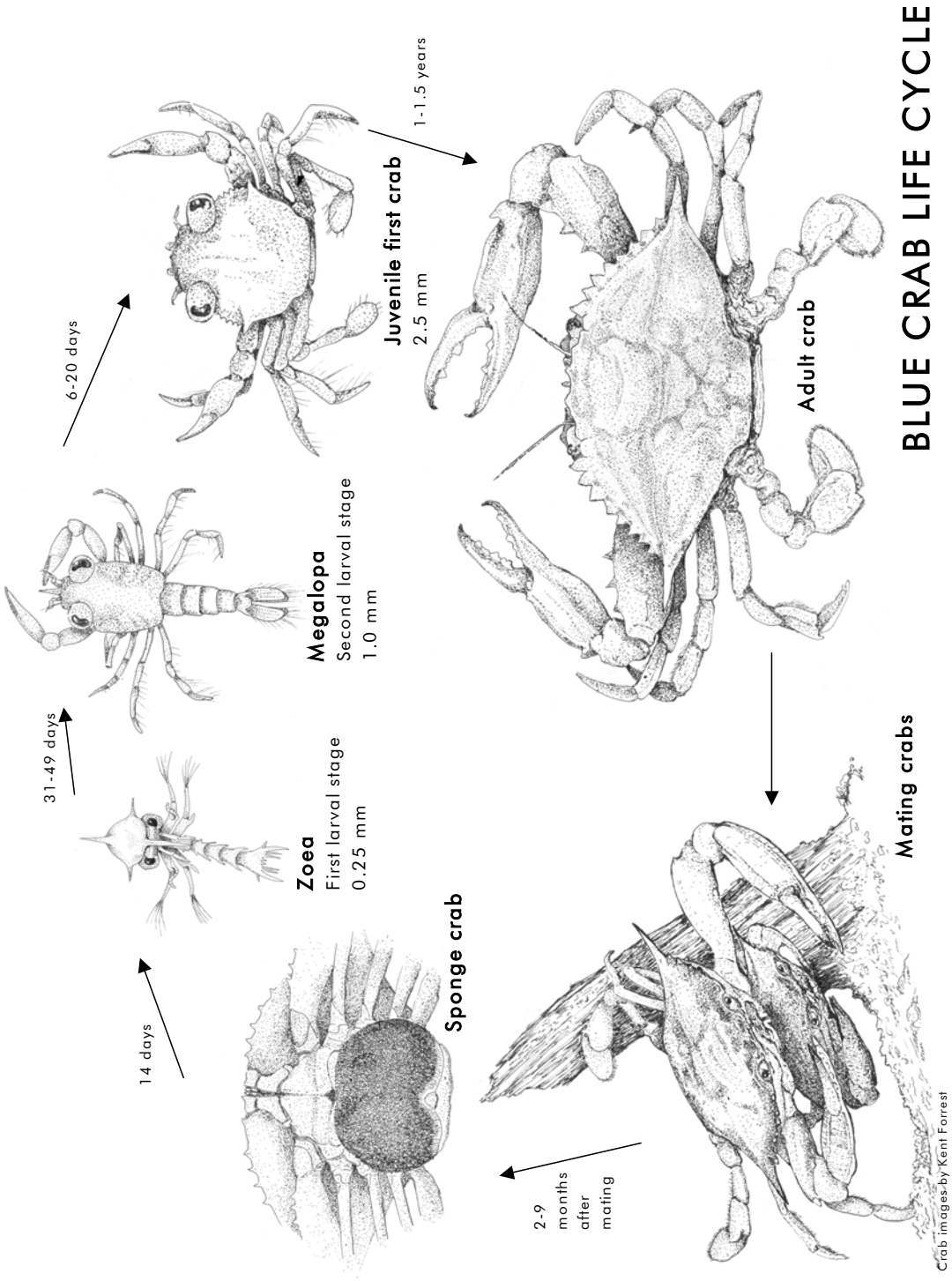
Stomach The organ of the digestive system that breaks down swallowed particles of food. It is lined with small hard plates and projections which aid digestion.

Testes Part of the male reproductive system , located on top of the hepatopancreas on either side of the stomach.

MORE BLUE CRAB FUN FACTS:

- Adults can grow up to 9 inches wide.
- Blue crabs have a brilliant blue color on their front claws (females have red-tipped claws) with a blue-green or olive carapace. They have a pair of paddle shaped legs that are specialized for swimming.
- A sponge or egg mass grows from orange to black in color as the developing larvae use up the yolk and develop large black eyes.
- Densities of juvenile crabs are ~10 X higher in seagrass beds than in nearby unvegetated areas.
- Blue crabs can regenerate lost limbs during successive molts.

LIFE CYCLE of *Callinectes sapidus*



BRIDGE Data Tip: The Blue Crab's Chesapeake Journey

Maine has its lobsters, Washington has its salmon, and in the U.S. mid-Atlantic, there is one animal that has historically symbolized the beauty, bounty, and energy of the Chesapeake Bay: the blue crab, Callinectes sapidus. This "beautiful swimmer" (the translation of its scientific name) is a very popular seafood species and supports the second largest commercial crab fishery in the world. It is also the target of a large recreational fishery.

The blue crab's native range extends along the Atlantic Coast from Nova Scotia through South America. Historically, the Chesapeake region was the source of at least half of the United States' annual blue crab catch. But recently the Chesapeake Bay's harvest of blue crabs has been in decline. Fisheries scientists and resource managers have been studying fluctuations in the blue crab's population, and according to the Chesapeake Bay Stock Assessment Committee's 2002 report, blue crab abundance is approaching the record low and has been declining in recent years. Changes in the fishing regulations for both the commercial and recreational crab fishery have been implemented, and more changes are under discussion.

In order to effectively monitor, manage, and conserve the blue crab in the Chesapeake Bay, we must understand the crab's life cycle and how it utilizes its habitat. The Bay is a large and variable aquatic environment, and animals that inhabit it must be adapted to near constant change. Along the Bay's north-south range, salinities can range from close to zero parts per thousand to full ocean salinity. Tides, storms, and droughts are a few of the natural occurrences that regularly alter the water chemistry and aquatic landscape. Some human activities have degraded the water quality and destroyed important habitat areas. But the blue crab is a hardy organism, and it is uniquely adapted to take advantage of the variety of habitats offered by estuaries such as the Chesapeake Bay.

NATIONAL SCIENCE EDUCATION STANDARDS CORRELATIONS

Science as Inquiry
- Ability to do scientific inquiry (5-8, 9-12)
- Understanding of scientific inquiry (5-8, 9-12)

Life Science
- Reproduction and heredity (5-8)
- Regulation and behavior (5-8)
- Populations and ecosystems (5-8)
- Behavior of organisms (9-12)

THE CYCLE OF LIFE

The blue crab's cycle of reproductive activity begins in early spring. All winter, the females have remained on the bottom of the Bay, the mature males have been buried in the sediments of the estuaries, and the juveniles have been sheltered in shallow-water habitats. With the arrival of warmer temperatures, the male and female crabs move away from their wintering grounds to look for food and seek out a mate. Male and female crabs mate in the greatest numbers from spring to summer in the mid-salinity areas of the Chesapeake Bay and its tributaries. A female will mate only once in her life, but from this single mating she may produce two or more fertilized egg masses over her 2 - 2.5 year reproductive lifetime.

LARVAL GROWTH AND DEVELOPMENT

After mating, the male blue crab remains in the middle to upper Bay or its tributaries and continues to mate with other females. The inseminated female leaves the male and moves toward higher salinity waters near the mouth of the Chesapeake Bay. As she migrates, her ovaries produce eggs that are eventually fertilized by the stored sperm forming an egg mass, the sponge, that may contain from 750,000 to as many as 8 million eggs. Only a tiny fraction of these eggs will result in a mature adult.

The larvae take about two weeks to develop inside the egg. During that time, the female completes her migration toward the high salinity waters at the mouth of the Chesapeake Bay. The eggs generally must hatch in water that is between 66 - 84 degrees Fahrenheit with a salinity of 23 to 35 parts per thou-

BRIDGE Data Tip: The Blue Crab's Chesapeake Journey

sand. The larval crabs, called zoeae, hatch out of their eggs during an ebb tide, and are swept away from the mouth of the Chesapeake out into the plankton-rich waters of the Atlantic Ocean's inner continental shelf. Here they spend about 45 days in this nursery area, drifting with the currents, feeding on zooplankton, and growing rapidly, molting seven to eight times. After its final molt, the zoea undergoes a dramatic metamorphosis and takes on a more crab-like shape. It is now called a megalopa. Blue crab megalopae are transported by currents, tides and their own movements back into the Chesapeake Bay primarily during late summer and early fall. Megalopae find their way to seagrass beds or other habitats that will provide food and shelter. Here the megalopae settle onto the bottom, and molt into the "first crab" stage. These juvenile crabs may molt 18 to 20 more times over 14 to 18 months before becoming mature adults. If they survive to maturity, they will seek out mates and begin the cycle of life again.

DATA ACTIVITY

The Virginia Institute of Marine Science (VIMS) has conducted a monthly trawl survey of finfish and blue crabs in 60 stations throughout the Chesapeake Bay since 1955. This activity uses blue crab data from 13 of the VIMS trawl stations. Students will determine which areas of the Chesapeake Bay are being used by blue crabs during different life stages.

Divide your class into four groups. Print out the four blue crab data sets and corresponding worksheets below and give each group one data set.

- Larval Blue Crab Survey Data and Worksheet
- Juvenile Blue Crab Survey Data and Worksheet
- Juvenile & Adult Blue Crab Survey Data and Worksheet
- Adult Female Blue Crab Survey Data and Worksheet

Access the map of the Chesapeake Bay. If possible, print a copy of the map on an overhead transparency for each group. Alternatively, give each group a paper copy of the map and then print one map on an overhead transparency to which all groups will transfer their answers later. Note that the map shows thirteen trawl survey stations.

Each data set has thirteen data tables, one for each of the thirteen trawl stations. The data tables record the temperature, salinity and the average number of crabs found at that station each season. Depending on the life stage of the data set, the data may be separated by size category and/or sex. Additional habitat information is provided in the juvenile survey data.

Using the worksheets, have your students analyze the thirteen tables in their data set to determine where in the Chesapeake Bay their life stage is most likely to be found. Have them indicate on the map which stations had the highest abundances of blue crabs. (Keep in mind that each individual data point should not be recorded, only the major trends.) Have them construct a hypothesis which relates the location of their crab life stage to a specific variable such as salinity, season, etc.

Special thanks to Jacques van Montfrans and the Crustacean Ecology Group at VIMS for providing data and information.

For related information and activities, check out the Bridge's Crustacean page <www.marine-ed.org/bridge/index_crustaceans.html>.

Blue crab data tables start on page 7...

LARVAL BLUE CRAB SURVEY DATA

Chesapeake Bay Field Survey for **Larval** *Callinectes sapidus*, one season
(mean number of crabs computed from monthly plankton sampling data)

Station #1 Mouth of Chesapeake Bay

	Water Temp. °F	Salinity (ppt)	Zoea Stage 1-2	Zoea Stage 3-7	Megalopae
Dec - March	41.43	29.71	0	0	0
April - May	56.65	27.44	1,500	0	0
June - August	73.49	28.47	1,200,000	0	400
Sept - Nov	65.12	29.94	15	0	1,500

Station #2 Mouth of James River

	Water Temp. °F	Salinity (ppt)	Zoea Stage 1-2	Zoea Stage 3-7	Megalopae
Dec - March	43.45	22.19	0	0	0
April - May	59.40	21.82	300	0	0
June - August	74.52	24.09	30	0	30
Sept - Nov	65.62	23.42	5	0	250

Station #3 James River at Hog Island

	Water Temp. °F	Salinity (ppt)	Zoea Stage 1-2	Zoea Stage 3-7	Megalopae
Dec - March	44.82	3.35	0	0	0
April - May	63.44	1.90	0	0	0
June - August	80.66	5.34	0	0	0
Sept - Nov	67.48	7.03	0	0	0

Station #4 Mouth of York River

	Water Temp. °F	Salinity (ppt)	Zoea Stage 1-2	Zoea Stage 3-7	Megalopae
Dec - March	43.56	20.74	0	0	0
April - May	59.02	18.46	0	0	0
June - August	76.81	20.89	0	0	8
Sept - Nov	66.82	22.04	0	0	30

BRIDGE Data Tip: The Blue Crab's Chesapeake Journey

LARVAL BLUE CRAB DATA

Station #5 Pamunkey River

	Water Temp. °F	Salinity (ppt)	Zoea Stage 1-2	Zoea Stage 3-7	Megalopae
Dec - March	44.45	2.25	0	0	0
April - May	63.83	1.65	0	0	0
June - August	80.19	4.30	0	0	0
Sept - Nov	66.07	6.45	0	0	0

Station #6 Mouth of Rappahannock River

	Water Temp. °F	Salinity (ppt)	Zoea Stage 1-2	Zoea Stage 3-7	Megalopae
Dec - March	42.40	17.09	0	0	0
April - May	59.36	14.35	0	0	0
June - August	78.12	16.26	0	0	1
Sept - Nov	65.43	18.65	0	0	0

Station #7 Bayside Eastern Shore

	Water Temp. °F	Salinity (ppt)	Zoea Stage 1-2	Zoea Stage 3-7	Megalopae
Dec - March	42.64	20.65	0	0	0
April - May	56.81	19.03	0	0	0
June - August	76.34	19.68	0	0	11
Sept - Nov	65.44	21.68	0	0	63

Station #8 Tangier Island

	Water Temp. °F	Salinity (ppt)	Zoea Stage 1-2	Zoea Stage 3-7	Megalopae
Dec - March	41.70	19.04	0	0	0
April - May	58.83	17.39	0	0	0
June - August	77.64	18.27	0	0	0
Sept - Nov	64.07	20.30	0	0	3

Station #9 Smith Island

	Water Temp. °F	Salinity (ppt)	Zoea Stage 1-2	Zoea Stage 3-7	Megalopae
Dec - March	41.51	17.76	0	0	0
April - May	58.22	16.48	0	0	0
June - August	78.29	16.88	0	0	0
Sept - Nov	64.73	18.84	0	0	1

BRIDGE Data Tip: The Blue Crab's Chesapeake Journey

LARVAL BLUE CRAB DATA

Station #10 Mouth of Potomac River

	Water Temp. °F	Salinity (ppt)	Zoea Stage 1-2	Zoea Stage 3-7	Megalopae
Dec - March	41.85	13.40	0	0	0
April - May	57.10	11.50	0	0	0
June - August	75.97	12.90	0	0	0
Sept - Nov	69.94	14.89	0	0	0

Station #11 Upriver Potomac

	Water Temp. °F	Salinity (ppt)	Zoea Stage 1-2	Zoea Stage 3-7	Megalopae
Dec - March	41.80	3.56	0	0	0
April - May	59.28	1.40	0	0	0
June - August	79.36	2.31	0	0	0
Sept - Nov	63.51	4.71	0	0	0

Station #12 Mouth of Choptank River

	Water Temp. °F	Salinity (ppt)	Zoea Stage 1-2	Zoea Stage 3-7	Megalopae
Dec - March	40.86	13.77	0	0	0
April - May	58.53	11.94	0	0	0
June - August	77.74	11.97	0	0	0
Sept - Nov	63.15	14.70	0	0	0

Station #13 Mouth of Severn River

	Water Temp. °F	Salinity (ppt)	Zoea Stage 1-2	Zoea Stage 3-7	Megalopae
Dec - March	41.38	14.50	0	0	0
April - May	53.15	11.99	0	0	0
June - August	73.79	13.00	0	0	0
Sept - Nov	65.90	15.55	0	0	0

JUVENILE BLUE CRAB SURVEY DATA

Chesapeake Bay Field Survey for **Juvenile** *Callinectes sapidus*, one season
(mean number of crabs computed from monthly suction sampling data).

Grass Bed Relative Abundance Scale: 0 = no grass beds; 4 = most extensive grass beds

Station #1 Mouth of Chesapeake Bay

	Water Temp. °F	Salinity (ppt)	Grassbed Rel. Abundance	Juveniles <15 mm male	Juveniles <15 mm female	Juveniles 15-60 mm female	Juveniles 15-60 mm male
Dec - March	41.43	29.71	0	0	0	2	1
April - May	56.65	27.44	0	0	0	1	0
June - August	73.49	28.47	0	0	0	0	2
Sept - Nov	65.12	29.94	0	0	0	4	4

Station #2 Mouth of James River

	Water Temp. °F	Salinity (ppt)	Grassbed Rel. Abundance	Juveniles <15 mm male	Juveniles <15 mm female	Juveniles 15-60 mm female	Juveniles 15-60 mm male
Dec - March	43.45	22.19	1	1	1	8	5
April - May	59.40	21.82	1	0	1	6	5
June - August	74.52	24.09	1	1	1	2	2
Sept - Nov	65.62	23.42	1	5	7	5	5

Station #3 James River at Hog Island

	Water Temp. °F	Salinity (ppt)	Grassbed Rel. Abundance	Juveniles <15 mm male	Juveniles <15 mm female	Juveniles 15-60 mm female	Juveniles 15-60 mm male
Dec - March	44.82	3.35	0	1	1	8	5
April - May	63.44	1.90	0	0	0	4	3
June - August	80.86	5.34	0	0	0	1	0
Sept - Nov	67.48	7.03	0	3	3	5	2

Station #4 Mouth of York River

	Water Temp. °F	Salinity (ppt)	Grassbed Rel. Abundance	Juveniles <15 mm male	Juveniles <15 mm female	Juveniles 15-60 mm female	Juveniles 15-60 mm male
Dec - March	43.56	20.74	4	7	6	13	13
April - May	59.02	18.46	4	3	3	18	21
June - August	76.81	20.89	4	1	0	9	13
Sept - Nov	66.82	22.04	4	30	33	5	2

BRIDGE Data Tip: The Blue Crab's Chesapeake Journey

JUVENILE BLUE CRAB DATA

Station #5 Pamunkey River

	Water Temp. °F	Salinity (ppt)	Grassbed Rel. Abundance	Juveniles <15 mm male	female	15-60 mm female	male
Dec - March	44.45	2.25	0	2	1	16	9
April - May	63.83	1.65	0	0	0	12	6
June - August	80.19	4.30	0	1	1	5	2
Sept - Nov	66.07	6.45	0	4	2	9	9

Station #6 Mouth of Rappahannock River

	Water Temp. °F	Salinity (ppt)	Grassbed Rel. Abundance	Juveniles <15 mm male	female	15-60 mm female	male
Dec - March	42.40	17.09	0	2	0	12	10
April - May	59.36	14.35	0	0	0	9	6
June - August	78.12	16.26	0	0	0	3	1
Sept - Nov	65.43	18.65	0	8	8	2	0

Station #7 Bayside Eastern Shore

	Water Temp. °F	Salinity (ppt)	Grassbed Rel. Abundance	Juveniles <15 mm male	female	15-60 mm female	male
Dec - March	42.64	20.65	3	8	11	17	21
April - May	56.81	19.03	3	3	3	22	22
June - August	76.34	19.68	3	2	4	13	7
Sept - Nov	65.44	21.68	3	39	38	2	5

Station #8 Tangier Island

	Water Temp. °F	Salnity (ppt)	Grassbed Rel. Abundance	Juveniles <15 mm male	female	15-60 mm female	male
Dec - March	41.70	19.04	4	16	19	21	20
April - May	58.83	17.39	4	10	11	23	22
June - August	77.64	18.27	3	7	10	6	7
Sept - Nov	64.07	20.30	4	33	39	6	5

Station #9 Smith Island

	Water Temp. °F	Salinity (ppt)	Grassbed Rel. Abundance	Juveniles <15 mm male	female	15-60 mm female	male
Dec - March	41.51	17.76	4	18	15	16	19
April - May	58.22	16.48	4	9	7	21	28
June - August	78.29	16.88	3	2	3	8	11
Sept - Nov	64.73	18.84	4	31	33	6	6

BRIDGE Data Tip: The Blue Crab's Chesapeake Journey

JUVENILE BLUE CRAB DATA

Station #10 Mouth of Potomac River

	Water Temp. °F	Salinity (ppt)	Grassbed Rel. Abundance	Juveniles <15 mm male	<15 mm female	15-60 mm male	15-60 mm female
Dec - March	41.85	13.40	0	1	2	9	6
April - May	57.10	11.50	0	0	0	11	7
June - August	75.97	12.90	0	1	0	4	1
Sept - Nov	64.94	14.89	0	5	4	6	5

Station #11 Upriver Potomac

	Water Temp. °F	Salinity (ppt)	Grassbed Rel. Abundance	Juveniles <15 mm male	<15 mm female	15-60 mm male	15-60 mm female
Dec - March	41.80	3.56	0	1	0	15	4
April - May	59.28	1.40	0	0	0	14	5
June - August	79.36	2.31	0	0	0	7	1
Sept - Nov	63.51	4.71	0	3	1	10	4

Station #12 Mouth of Choptank River

	Water Temp. °F	Salinity (ppt)	Grassbed Rel. Abundance	Juveniles <15 mm male	<15 mm female	15-60 mm male	15-60 mm female
Dec - March	40.86	13.77	0	0	0	17	7
April - May	58.53	11.94	0	0	0	19	9
June - August	77.74	11.97	0	0	0	10	5
Sept - Nov	63.15	14.70	0	1	1	14	5

Station #13 Mouth of Severn River

	Water Temp. °F	Salinity (ppt)	Grassbed Rel. Abundance	Juveniles <15 mm male	<15 mm female	15-60 mm male	15-60 mm female
Dec - March	41.38	14.50	0	0	0	12	3
April - May	53.15	11.99	0	0	0	13	3
June - August	73.79	13.00	0	0	0	9	2
Sept - Nov	65.90	15.55	0	0	0	13	4

JUVENILE & ADULT BLUE CRAB SURVEY DATA

Chesapeake Bay Field Survey for **Juvenile and Adult** *Callinectes sapidus*, one season
(mean number of crabs computed from monthly trawl survey data)

Station #1 Mouth of Chesapeake Bay

	Water Temp. °F	Salinity (ppt)	Males		Females	
			Juv.	Adult	Juv.	Adult
Dec - March	41.43	29.71	2	1	1	21
April - May	56.65	27.44	1	0	0	27
June - August	73.49	28.47	0	0	2	20
Sept - Nov	65.12	29.94	4	1	4	28

Station #2 Mouth of James River

	Water Temp. °F	Salinity (ppt)	Males		Females	
			Juv.	Adult	Juv.	Adult
Dec - March	43.45	22.19	9	4	6	13
April - May	59.40	21.82	6	4	6	10
June - August	74.52	24.09	3	3	3	15
Sept - Nov	65.62	23.42	10	1	12	15

Station #3 James River at Hog Island

	Water Temp. °F	Salinity (ppt)	Males		Females	
			Juv.	Adult	Juv.	Adult
Dec - March	44.82	3.35	6	12	4	4
April - May	63.44	1.90	4	8	3	3
June - August	80.86	5.34	1	6	0	3
Sept - Nov	67.48	7.03	8	6	5	0

Station #4 Mouth of York River

	Water Temp. °F	Salinity (ppt)	Males		Females	
			Juv.	Adult	Juv.	Adult
Dec - March	43.56	20.74	20	9	19	12
April - May	59.02	18.46	21	9	24	17
June - August	76.81	20.89	10	8	13	13
Sept - Nov	66.82	22.04	33	5	35	13

BRIDGE Data Tip: The Blue Crab's Chesapeake Journey

JUVENILE & ADULT BLUE CRAB DATA

Station #5 Pamunkey River

	Water Temp. °F	Salinity (ppt)	Males Juv.	Males Adult	Females Juv.	Females Adult
Dec - March	44.45	2.25	18	15	10	0
April - May	63.83	1.65	12	14	6	1
June - August	80.19	4.30	6	8	3	0
Sept - Nov	66.07	6.45	13	5	11	0

Station #6 Mouth of Rappahannock River

	Water Temp. °F	Salinity (ppt)	Males Juv.	Males Adult	Females Juv.	Females Adult
Dec - March	42.40	17.09	14	14	12	6
April - May	59.36	14.35	9	9	6	6
June - August	78.12	16.26	3	7	1	3
Sept - Nov	65.43	18.65	10	4	8	2

Station #7 Bayside of Eastern Shore

	Water Temp. °F	Salinity (ppt)	Males Juv.	Males Adult	Females Juv.	Females Adult
Dec - March	42.64	20.65	25	11	32	17
April - May	56.81	19.03	25	5	30	13
June - August	76.34	19.68	15	4	17	9
Sept - Nov	65.44	21.68	41	3	39	10

Station #8 Tangier Island

	Water Temp. °F	Salinity (ppt)	Males Juv.	Males Adult	Females Juv.	Females Adult
Dec - March	41.70	19.04	37	9	39	19
April - May	58.83	17.39	33	6	33	17
June - August	77.64	18.27	13	4	17	11
Sept - Nov	64.07	20.30	39	2	44	8

Station #9 Smith Island

	Water Temp. °F	Salinity (ppt)	Males Juv.	Males Adult	Females Juv.	Females Adult
Dec - March	41.51	17.76	34	6	34	15
April - May	58.22	16.48	30	6	35	17
June - August	78.29	16.88	10	5	14	8
Sept - Nov	64.73	18.84	37	3	39	9

BRIDGE Data Tip: The Blue Crab's Chesapeake Journey

JUVENILE & ADULT BLUE CRAB DATA

Station #10 Mouth of Potomac River

	Water Temp. °F	Salinity (ppt)	Males		Females	
			Juv.	Adult	Juv.	Adult
Dec - March	41.85	13.40	10	12	8	8
April - May	57.10	11.50	11	11	7	6
June - August	75.97	12.90	5	5	1	3
Sept - Nov	64.94	14.89	11	6	9	2

Station #11 Upriver Potomac

	Water Temp. °F	Salinity (ppt)	Males		Females	
			Juv.	Adult	Juv.	Adult
Dec - March	41.80	3.56	15	16	4	1
April - May	59.28	1.40	14	14	5	1
June - August	79.36	2.31	7	8	1	0
Sept - Nov	63.51	4.71	13	9	5	0

Station #12 Mouth of Choptank River

	Water Temp. °F	Salinity (ppt)	Males		Females	
			Juv.	Adult	Juv.	Adult
Dec - March	40.86	13.77	17	12	7	0
April - May	58.53	11.94	19	8	9	1
June - August	77.74	11.97	10	5	5	0
Sept - Nov	63.15	14.70	15	4	6	0

Station #13 Mouth of Severn River

	Water Temp. °F	Salinity (ppt)	Males		Females	
			Juv.	Adult	Juv.	Adult
Dec - March	41.38	14.50	12	10	3	0
April - May	53.15	11.99	13	9	3	0
June - August	73.79	13.00	9	5	2	0
Sept - Nov	65.90	15.55	13	5	4	0

BRIDGE Data Tip: The Blue Crab's Chesapeake Journey

ADULT FEMALE BLUE CRAB DATA

ADULT FEMALE BLUE CRAB SURVEY DATA

Chesapeake Bay Field Survey for **Adult Female** *Callinectes sapidus*, one season
(mean number of crabs computed from monthly trawl survey data)

Station #1 Mouth of Chesapeake Bay

	Water Temp.°F	Salinity (ppt)	Total crabs	orange sponge	black sponge
Dec-March	41.43	29.71	31	0	0
April-May	56.65	27.44	27	4	19
June-August	73.49	28.47	24	0	18
Sept-Nov	65.12	29.94	28	0	0

Station #2 Mouth of James River

	Water Temp. °F	Salinity (ppt)	Total crabs	orange sponge	black sponge
Dec-March	43.45	22.19	13	0	0
April-May	59.40	21.82	10	6	4
June-August	74.52	24.09	15	2	13
Sept-Nov	65.62	23.42	15	0	0

Station #3 James River at Hog Island

	Water Temp. °F	Salinity (ppt)	Total crabs	orange sponge	black sponge
Dec-March	44.82	3.35	4	0	0
April-May	63.44	1.90	3	2	0
June-August	80.86	5.34	3	0	0
Sept-Nov	67.48	7.03	0	0	0

Station #4 Mouth of York River

	Water Temp. °F	Salinity (ppt)	Total crabs	orange sponge	black sponge
Dec-March	43.56	20.74	12	0	0
April-May	59.02	18.46	17	14	0
June-August	76.81	20.89	13	6	2
Sept-Nov	66.82	22.04	13	1	0

BRIDGE Data Tip: The Blue Crab's Chesapeake Journey

ADULT FEMALE BLUE CRAB DATA

Station #5 Pamunkey River

	Water Temp. °F	Salinity (ppt)	Total crabs	orange sponge	black sponge
Dec-March	44.45	2.25	0	0	0
April-May	63.83	1.65	1	0	0
June-August	80.19	4.30	0	0	0
Sept-Nov	66.07	6.45	0	0	0

Station #6 Mouth of Rappahannock River

	Water Temp. °F	Salinity (ppt)	Total crabs	orange sponge	black sponge
Dec-March	42.40	17.09	6	0	0
April-May	59.36	14.35	6	3	0
June-August	78.12	16.26	3	0	0
Sept-Nov	65.43	18.65	2	0	0

Station #7 Bayside of Eastern Shore

	Water Temp. °F	Salinity (ppt)	Total crabs	orange sponge	black sponge
Dec-March	42.64	20.65	17	0	0
April-May	56.81	19.03	13	5	0
June-August	76.34	19.68	9	2	2
Sept-Nov	65.44	21.68	10	0	0

Station #8 Tangier Island

	Water Temp. °F	Salinity (ppt)	Total crabs	orange sponge	black sponge
Dec-March	41.70	19.04	19	0	0
April-May	58.83	17.39	17	3	0
June-August	77.64	18.27	11	2	1
Sept-Nov	64.07	20.30	8	0	0

Station #9 Smith Island

	Water Temp. °F	Salinity (ppt)	Total crabs	orange sponge	black sponge
Dec-March	41.51	17.76	15	0	0
April-May	58.22	16.48	17	3	0
June-August	78.29	16.88	8	0	0
Sept-Nov	64.73	18.84	9	0	0

ADULT FEMALE BLUE CRAB DATA

Station #10 Mouth of Potomac River

	Water Temp. °F	Salinity (ppt)	Total crabs	orange sponge	black sponge
Dec-March	41.85	13.40	8	0	0
April-May	57.10	11.50	6	1	1
June-August	75.97	12.90	3	0	0
Sept-Nov	64.94	14.89	0	0	0

Station #11 Upriver Potomac

	Water Temp. °F	Salinity (ppt)	Total crabs	orange sponge	black sponge
Dec-March	41.80	3.56	1	0	0
April-May	59.28	1.40	1	0	0
June-August	79.36	2.31	0	0	0
Sept-Nov	63.51	4.71	0	0	0

Station #12 Mouth of Choptank River

	Water Temp. °F	Salinity (ppt)	Total crabs	orange sponge	black sponge
Dec-March	40.86	13.77	0	0	0
April-May	58.53	11.94	1	0	0
June-August	77.74	11.97	0	0	0
Sept-Nov	63.15	14.70	0	0	0

Station #13 Mouth of Severn River

	Water Temp. °F	Salinity (ppt)	Total crabs	orange sponge	black sponge
Dec-March	41.38	14.50	0	0	0
April-May	53.15	11.99	0	0	0
June-August	73.79	13.00	0	0	0
Sept-Nov	65.90	15.55	0	0	0

Data Analysis Guide for Larval Blue Crab Survey

By analyzing data collected from the thirteen field stations throughout the year, you should be able to:

- state where in the Chesapeake Bay each of the three stages of larval crabs are most likely to be found during different seasons;
- construct hypotheses which explain the location of larval crabs based on factors such as water chemistry, currents, season, etc.

To help you develop your hypotheses, provide answers to the following items.

A. List the stations where the mean number of first and second stage zoea collected during each time period was:

0	5 - 500	>500

B. What information from the data charts might help account for the differences in the abundance of zoea among the stations you listed above?

C. List the stations where the mean number of megalopae collected during each time periods was:

0	10 - 250	>350

D. What other data from the charts might help you account for the differences in the location of megalopae?

E. What is notable about the data on zoea from stages 3 - 7?

F. The data show that Stage 1 - 2 zoea are present, as well as the more mature young crabs, the megalopae. What explanations might there be for the absence of later stage zoea in the Chesapeake Bay?

Data Analysis Guide for Juvenile Blue Crab Survey

By analyzing data collected from the thirteen field stations throughout the year, you should be able to:

- state where in the Chesapeake Bay juvenile crabs are most likely to be found;
- construct a hypothesis which relates the location of juvenile crabs to a specific variable, such as sex, salinity, season, etc.;
- construct a hypothesis which relates location of juvenile crabs to grassbed abundance.

To help you develop your hypotheses, provide answers to the following items.

A. List the stations where the mean number of juveniles (of both sexes) collected during each time period was:

<10 crabs 10 - 20 crabs >20 crabs

B. What information from the data charts might help account for the differences in the abundance of juveniles among the stations you listed above?

Data Analysis Guide for Juvenile and Adult Blue Crab Survey

By analyzing data collected from the thirteen field stations throughout the year, you should be able to:

- state where in the Chesapeake Bay juvenile and adult crabs are most likely to be found;
- construct a hypothesis which relates the location of juvenile and adult crabs to a specific variable, such as sex, salinity, season, etc.

To help you develop your hypotheses, provide answers to the following items.

A. List the stations where the mean number of juveniles and adults of each sex collected during each time period was:

<10 crabs 10 - 20 crabs >20 crabs

B. What information from the data charts might help account for the differences in the numbers of the different types of crabs found at the stations you listed above?

Data Analysis Guide for Adult Female/Sponge Crab Survey

By analyzing data collected from the thirteen field stations throughout the year, you should be able to:

- state where in the Chesapeake Bay mature female crabs are most likely to be found during different seasons;
- construct a hypothesis which relates the location of mature female crabs to other factors, such as water chemistry, season, etc.;
- construct a hypothesis which relates egg production to salinity.

To help you develop your hypotheses, provide answers to the following items.

A. List the stations where the mean number of mature females (disregarding sponge) collected during each time period was:

<10 crabs 10 - 20 crabs >20 crabs

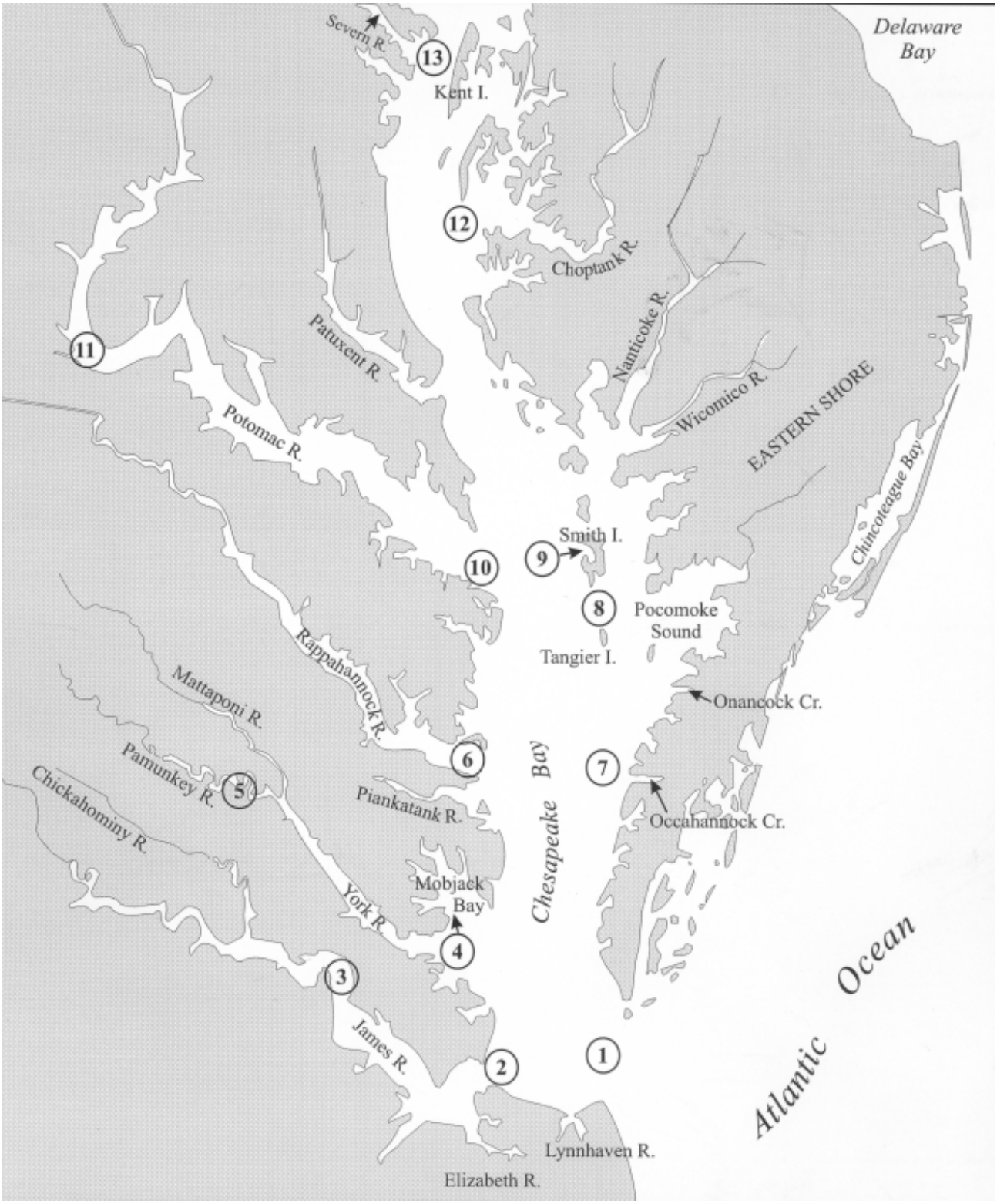
B. What other information from the data charts might help account for the differences in the abundance of mature females among the stations you listed above?

C. Group the stations according to sponge crab data:

No sponge crabs Orange sponge crabs Black sponge crabs

D. What other data from the charts might help you account for the differences in the location of female crabs in various stages of egg development?

Chesapeake Bay Blue Crab Research Stations



Blue Crab Websites

Virginia Institute of Marine Science: The Blue Crab
www.vims.edu/adv/ed/crab/

Maryland Sea Grant: Blue Crabs in the Chesapeake
www.mdsg.umd.edu/crabs/index.html

Chesapeake Bay Program: Blue Crab
www.chesapeakebay.net/blue_crab.htm

South Carolina Department of Natural Resources: Blue Crabs
water.dnr.state.sc.us/marine/pub/seascience/bluecrab.html

The Blue Crab in Delaware & Maryland
www.beach-net.com/Crab.html

Texas Parks & Wildlife: The Blue Crab
www.tpwd.state.tx.us/fish/specinfo/crab/crabbro.htm

VIMS Fisheries Blue Crab Trawl Survey
139.70.40.46/trawlseine/mainpage.htm

Blue Crab Archives
www.blue-crab.org/

Virginia and Maryland Standards Correlations

Virginia Science Standards of Learning

6.2 Scientific Reasoning and Logic
(ideas are investigated by asking for and actively seeking information; conclusions are based on scientific evidence obtained from a variety of sources)
6.8 , LS.4 Life Processes
(energy transformation, growth, response, reproduction, etc.)
6.9, LS.7 Living Systems
(ecological concepts: food webs/pyramids, nutrient cycles, etc.)
LS.5 Classification of Organisms
(classification based on external and internal structures, locomotion, feeding, reproduction)
LS.9 Interactions among populations in a biological community
(predator/prey)
LS.10 Adaptation of organisms to biotic and abiotic factors within a biome
LS.11 Dynamic nature of populations and organisms
BIO.5 Life functions of organisms
(body structures, metabolic activities, environmental responses, observations of local organisms)
BIO.9 Dynamic equilibria within populations, communities and ecosystems
(limiting factors, analysis of local ecosystems)

Maryland Science Standards

Scientific Inquiry (Grades 9-12)

- Use observations, research, and select appropriate scientific information to form predictions and hypotheses.
- Analyze appropriate data to identify trends to form conclusions and apply what has been learned to evaluate the hypothesis.

Critical Thinking (Grades 9-12)

- Provide supporting evidence when forming conclusions, devising a plan or solving a practical problem.
- Analyze and extend patterns.
- Analyze conclusions and modify ideas based on new information from developmentally appropriate readings, data, and the ideas of others.
- Describe to others how scientific information was used.

Applications of Science (Grades 9-12)

- Apply scientific principles and/or concepts to understand a new situation.

Ecology (Grades 9-12)

- Analyze the interdependence of diverse living organisms and their interactions with the components of the biosphere.

NOTES: