

Marine Invaders

Extra! Extra!

Read all About it!

Asian Shore Crabs on the loose!

Multiplying by the thousands!!!

Destroying our habitat!!

Are we doomed?!!

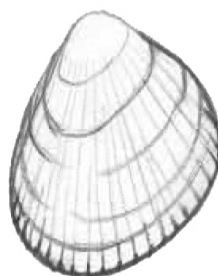
Or can we do something to stop them?

*Help National Park Scientists learn
more about these invaders
and stop this epidemic!*



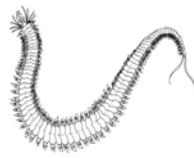
TABLE OF CONTENTS

I. Letter to teacher	1
II. Curriculum Standards – State of New York.....	2
III. Job Descriptions.....	3
IV. Outline of Program.....	4-5
V. The So What behind the Program.....	6
VI. Materials Needed.....	7
VII. Sample Worksheets.....	8-10
VIII. Actual Worksheets.....	11-19





Chinese Mitten crab



Marine Invaders



Chinese Mitten crab

To the Teacher:

Under the rocks, along the shores of Jamaica Bay, you will find hundreds of an unusual species of crabs, a species of crabs that wasn't always there. Where did these crabs come from? What are they eating? How will they affect our ecosystem? With your help, we can solve these questions and many more. Have your class become citizen scientists for the National Park Services and help scientists understand more about this unusual species of crabs.

By participating in this program, students will learn about the Asian Shore Crabs and how they are invading the shores of Jamaica Bay. They will learn where these crabs are coming from, how they are getting here from their original homeland and things they can do to help the situation. They will also understand what invasive species are, why they are bad for our ecosystem and what makes these crabs invasive.

Inside this package, you will find answers to why your students should participate in this program, pre and post assignments for the program, and a list of job titles for the students and a general outline of the program along with contact information in case you ever need help with the program or the materials.

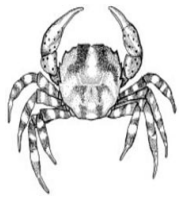
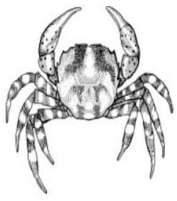
Also enclosed in this package is a list that has the State of New York Curriculum Standards and NYC Scope & Sequence Guidelines that support this program. This program will cover the concepts of Human Impacts on the Environment, Definitions of Species, Ecosystems, Measurements, Relationships among Organisms, Factors Affecting Population Growths and more.

This program should be conducted four times throughout the year during low tides. The first time will be led by a Park Ranger so that the teacher, who will lead the program the last three times, will gain an understanding on how the program should be conducted. During the first trip to Jamaica Bay, a Park Ranger will explain how the bay works as an ecosystem and discuss crabs and their life cycles. He/ she will demonstrate seining (fishing with a fishing net that hangs vertically in water) to find what lives in the ecosystem. The Park Ranger will also go over basic scientific study protocols for the program.

Jamaica Bay is one of the three units of Gateway National Park. It is located in the boroughs of Brooklyn and Queens. Jamaica Bay consists of 12,000 acres of water and shores. This includes Floyd Bennett Field, Canarsie Pier, Jamaica Bay Wildlife Refuge, and Plum Beach.

The National Park Service (NPS) has had jurisdiction over Jamaica Bay since 1972, but it has been around for decades before that. Today, NPS works to restore Jamaica Bay. Jamaica Bay is home to over 300 species of birds such as the Green Heron and the Herring Gull and many other organisms





CURRICULUM STANDARDS – STATE OF NEW YORK

STANDARD

GRADE

Science, Unit 4, Interdependence

6

Global Warming and human impact

LE 7.2d, PS2.2r, ICT 1.4, 2.1-3, 4.1, 5.1-2, 6.1-2, IPS 1.3

Populations & definition of species

LE 1.1h, 7.1a

Ecosystems

LE 7.1a, 7.2a-b, ICT 1.2

Factors affecting population growth

LE 7.1b

Relationships among organisms

LE 3.2a, 7.1c-d, 7.2c

Effects, environmental changes

LE 7.2a-d, 7.1e, ICT 5.2

Living Environment Standard 4

High School

Using science to study the living environment
& physical setting

Mathematics, Science & Technology

High School

Measurement 3.5

Uncertainty 3.6

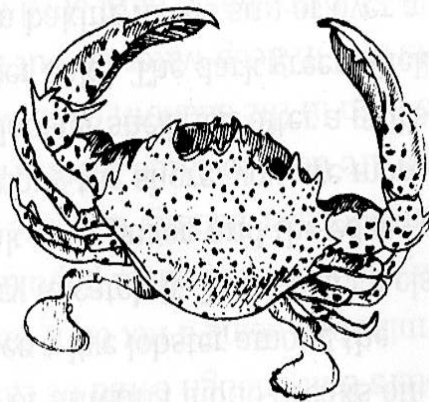
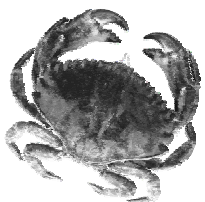
Patterns & Functions 3.7

Impacts of Technology 5.6

English Language Arts

High School

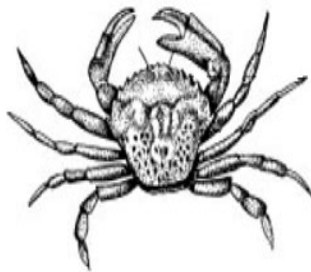
Standards 1 & 3



Job Descriptions

Class should be split into two groups, each containing the following jobs:

1. **Tossers:** -tosses the bean bag over his/her shoulder so it lands on a random section of the rocky sea shore.
 - places four meter sticks on the grid around the bean bag creating a quadrant.
2. **Observers:** -Observer chooses three “large” rocks within the quadrant for sampling
 - observer places 3 CDs provided on 3 sampling spots.
 - observer measures the dimensions of the footprint or the rock and calls out measurements to recorder
 - collects samples of organisms found in the footprint or the rock and places them in the sampling jar
3. **Flipper/Grabber-** flips a rock to reveal sand under rock.
 - replaces crabs under rocks once photographer has taken picture
4. **Recorders:** records information about crab gender and size. Recorders enter all information on data sheets.
5. **Photographer:** takes a picture of crabs in basin and organisms in the trays



Outline of Program:

Protocol – purpose: to find out how many of these crabs are on a rocky beach in a given month. What is the relationship between males and females? What does it mean to have one large male and dozens of small female crabs live under one rock? What else lives with them?



I. Creating a Quadrant

- a. Tossers will toss the bean bag over his/her shoulder so it lands on a random section of the rocky sea shore.
- b. Then he/she will place four meter sticks on the grid around the bean bag creating a quadrant.



II. Marking the spots

- a. Observers will choose three “large rocks” within the quadrant for sampling.
- b. Observer will place 3 CDs provided on the 3 sampling spots (rocks).



III. Finding Footprints

- a. One or two flippers/Grabbers flip a rock to reveal sand under rock.



- b. This outline in the sand will now be known as the footprint.





IV. Observing Life In the Footprints

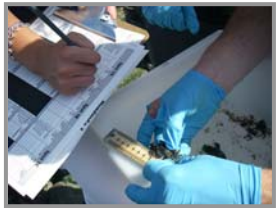
- a. Observer will measure the dimensions of the footprint and call out the measurements.
- b. Observers will collect samples of organisms found in the footprint and place them in the sampling jar.



V. Recording Data



- a. Recorder 2 will put information about size and gender of the crabs on the data sheet.
- b. Recorder 1 helps recorder 2 document the data.



- c. Recorders enter all information on data sheet. If the organisms listed on the data sheet are not present, enter "0." Do not leave any blank.



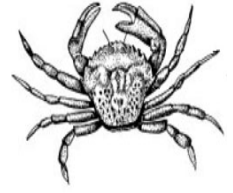
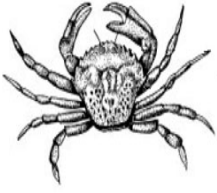
VI. Photographing the data

- a. Photographer takes a picture of crabs in basin and organisms in the jars.

VII. Finishing with spot

- a. Replace crabs back under the rock

VIII. Repeat procedure over again with a different spot.



*The **SO WHAT** behind the Program...*

Why should we care???

Where did these Asian Shore Crabs come from and how did it get here?

They came from the waters of Southern Russia to Hong Kong. They arrived here in Cape May County, NJ in 1988 through incoming ships of global trade via ballast water discharge.

Why do we need to know about them?

They out-compete native organisms for the necessary resources for survival. They disrupt habitats causing damage to natural ecosystems. They are actively breeding and expanding their population. They are highly reproductive. They breed from May to September and they are twice the length of native crabs.

What don't we know?

There are several things we don't know about these crabs: what eats them? What do they eat? What is the relationship between the male and female genders? What else lives with them?

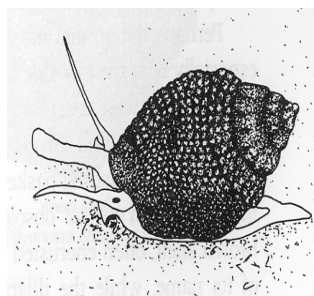
What should we do?

We should help National Park Service Scientists, do research and collect data. You are the first Citizen Scientists to do this research. Your research is highly valued!

How should we do it?

Work in collaborative groups, assign jobs, and carefully collect data and carefully record data. Also make good observations and report findings and come up with more questions.

Any experiments you would like to try???



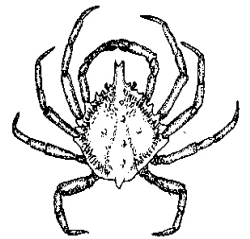
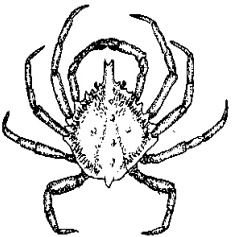
Materials Needed...

You will find the following materials in the box provided...

- 2 bean bags
- 8 meter sticks
- 6 CDs
- 2 rulers
- 4 sampling jars
- 2 trays
- Gloves
- 2 Data sheets

Supply your own...

- Camera
- 2 clip boards



SAMPLE
WORKSHEETS

Spot 1A						Spot 1B						Spot 1C					
Name of Crab	# of Crabs	Size (cm)	Gender (M/F)	Name of Crab	# of Crabs	Size (cm)	Gender (M/F)	Name of Crab	# of Crabs	Size (cm)	Gender (M/F)	Name of Crab	# of Crabs	Size (cm)	Gender (M/F)		
Asian Shore Crab	15	1.0, 1.2, 1.0, 1.1, 0.5, 1.9, 1.4, 1.3, 0.8, 0.5, 1.1, 1.0, 1.1, 1.0, 2.0, size of male	14 - F 1 - M	Asian Shore Crab	10	0.9, 0.7, 1.2, 1.0, 0.5, 1.1, 0.2, 1.3, 1.0, 1.8, 1.1	9 - F 1 - M	Asian Shore Crab	4	1.1, 1.2, 0.5, 1.8	3 - F 1 - M	Asian Shore Crab	0				
Spider Crab	0			Spider Crab	0			Spider Crab	0			Spider Crab	0				
Green Crab	0			Green Crab	0			Green Crab	0			Green Crab	0				
Lady Crab	0			Lady Crab	1	1.2	F	Lady Crab	0			Lady Crab	0				
Rock Crab	0			Rock Crab	0			Rock Crab	0			Rock Crab	0				
Other	0			Other	0			Other	0			Other	0				
Name of Organism	# of Organisms	Name of Organism	# of Organisms	Name of Organism	# of Organisms	Name of Organism	# of Organisms	Name of Organism	# of Organisms	Name of Organism	# of Organisms	Name of Organism	# of Organisms	Name of Organism	# of Organisms		
Sand Shrimp	0	Clam Worm	0	Sand Shrimp	0	Clam Worm	2	Sand Shrimp	0	Clam Worm	0	Sand Shrimp	0	Clam Worm	0		
Mud Snail	1	Barnacle & Other	0	Mud Snail	0	Barnacle & Other	0	Mud Snail	1	Barnacle & Other	0	Mud Snail	1	Barnacle & Other	0		
Name of Shell	# of shells	Name of Shell	# of shells	Name of Shell	# of shells	Name of Shell	# of shells	Name of Shell	# of shells	Name of Shell	# of shells	Name of Shell	# of shells	Name of Shell	# of shells		
Common Periwinkle	0			Common Periwinkle	0			Common Periwinkle	0			Common Periwinkle	0				
Ribbed Mussel	4	2.8, 3.0, 2.5, 3.1		Ribbed Mussel	2	3.0, 3.1		Ribbed Mussel	3	2.8, 2.9, 3.1		Ribbed Mussel	0				
Blue Mussel	0			Blue Mussel	0			Blue Mussel	0			Blue Mussel	0				
Gem Clam	0			Gem Clam	1	3.5		Gem Clam	0			Gem Clam	0				
Quahog	0			Quahog	0			Quahog	0			Quahog	0				
Slipper Shell	0			Slipper Shell	0			Slipper Shell	0			Slipper Shell	0				
Jack Knife	0			Jack Knife	1	10		Jack Knife	0			Jack Knife	0				
Other	0			Other	0			Other	0			Other	0				
Name of Plant	# of Plants	Name of Plant	# of Plants	Name of Plant	# of Plants	Name of Plant	# of Plants	Name of Plant	# of Plants	Name of Plant	# of Plants	Name of Plant	# of Plants	Name of Plant	# of Plants		
Sea Lettuce	1	6.0		Sea Lettuce	0			Sea Lettuce	0			Sea Lettuce	0				
Rockweed	0			Rockweed	2			Rockweed	0			Rockweed	0				
Irish Moss	0			Irish Moss	0			Irish Moss	0			Irish Moss	0				
Other	0			Other	0			Other	0			Other	0				

Instructions: Fill out all Quadrant information on this data sheet. Each space on this data sheet requires an answer with a number.

SAMPLE

SAMPLE

SAMPLE

SAMPLE

SAMPLE

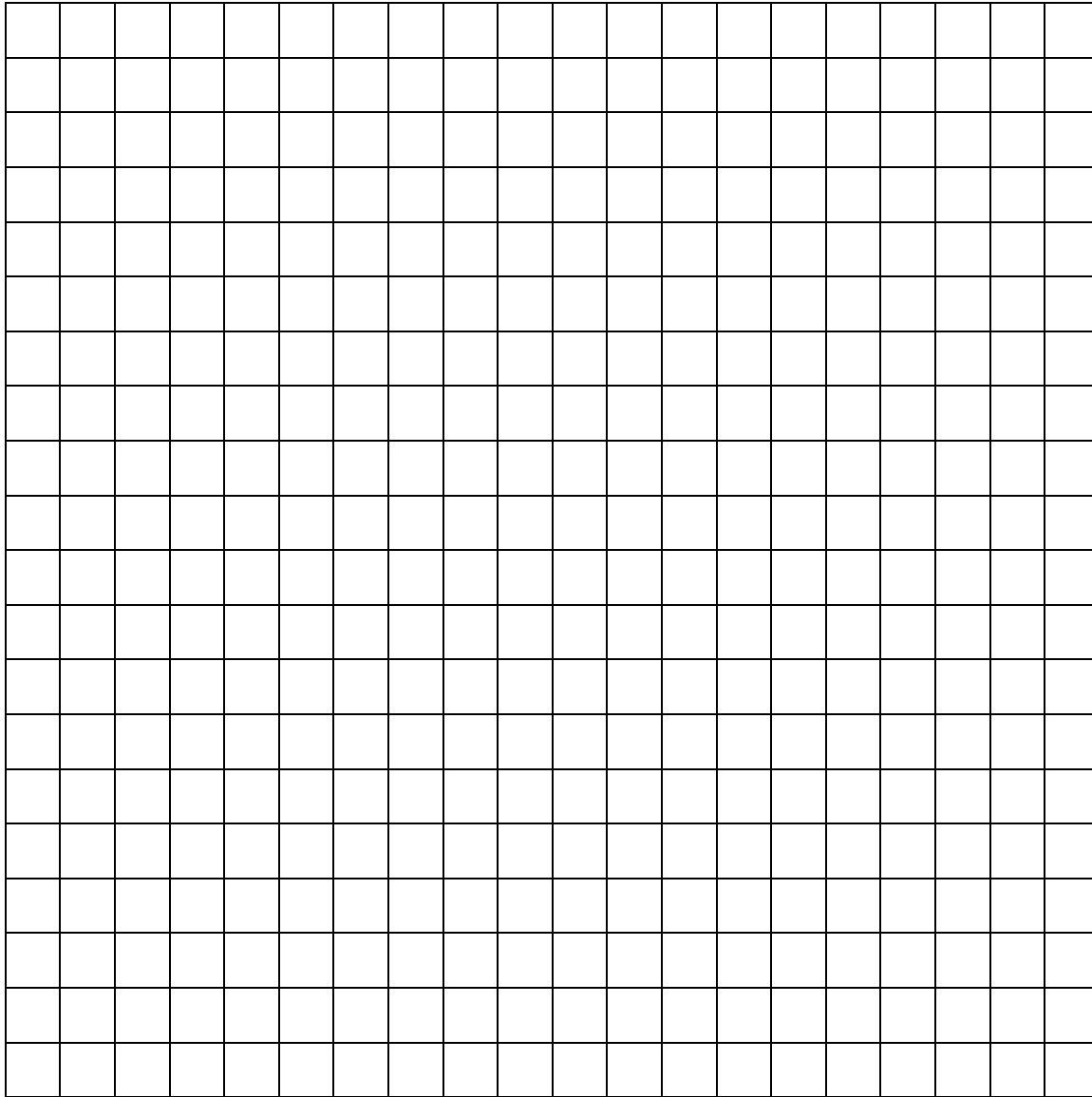
SAMPLE

ACTUAL
WORKSHEETS

Spot 1A				Spot 1B				Spot 1C			
Name of Crab	# of Crabs	Size (cm)	Gender (M/F)	Name of Crab	# of Crabs	Size (cm)	Gender (M/F)	Name of Crab	# of Crabs	Size (cm)	Gender (M/F)
Asian Shore Crab				Asian Shore Crab				Asian Shore Crab			
Spider Crab				Spider Crab				Spider Crab			
Green Crab				Green Crab				Green Crab			
Lady Crab				Lady Crab				Lady Crab			
Rock Crab				Rock Crab				Rock Crab			
Mud Crab				Mud Crab				Mud Crab			
Name of Organism	# of Organisms	Name of Organism	# of Organisms	Name of Organism	# of Organisms	Name of Organism	# of Organisms	Name of Organism	# of Organisms	Name of Organism	# of Organisms
Sand Shrimp		Clam Worm		Sand Shrimp		Clam Worm		Sand Shrimp		Clam Worm	
Mud Snail		Barnacle & Other		Mud Snail		Barnacle & Other		Mud Snail		Barnacle & Other	
Name of Shell	# of shells			Name of Shell	# of shells			Name of Shell	# of shells		
Common Periwinkle				Common Periwinkle				Common Periwinkle			
Ribbed Mussel				Ribbed Mussel				Ribbed Mussel			
Blue Mussel											
Gem Clam				Gem Clam				Gem Clam			
Quahog				Quahog				Quahog			
Slipper Shell				Slipper Shell				Slipper Shell			
Jack Knife				Jack Knife				Jack Knife			
Other				Other				Other			
Name of Plant	# of Plants			Name of Plant	# of Plants			Name of Plant	# of Plants		
Sea Lettuce				Sea Lettuce				Sea Lettuce			
Rockweed				Rockweed				Rockweed			
Irish Moss				Irish Moss				Irish Moss			
Other				Other				Other			

Instructions: Fill out all Quadrante information on this data sheet. Each space on this data sheet requires an answer with a number.

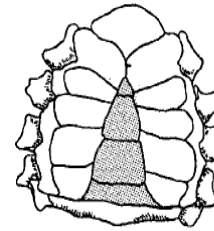
Quadrat 1



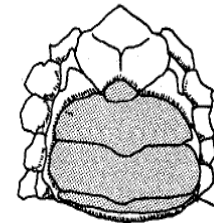
Spot 1A: Length _____
Width _____
Area _____

Spot 1B: Length _____
Width _____
Area _____

Spot 1C: Length _____
Width _____
Area _____



Male



Female

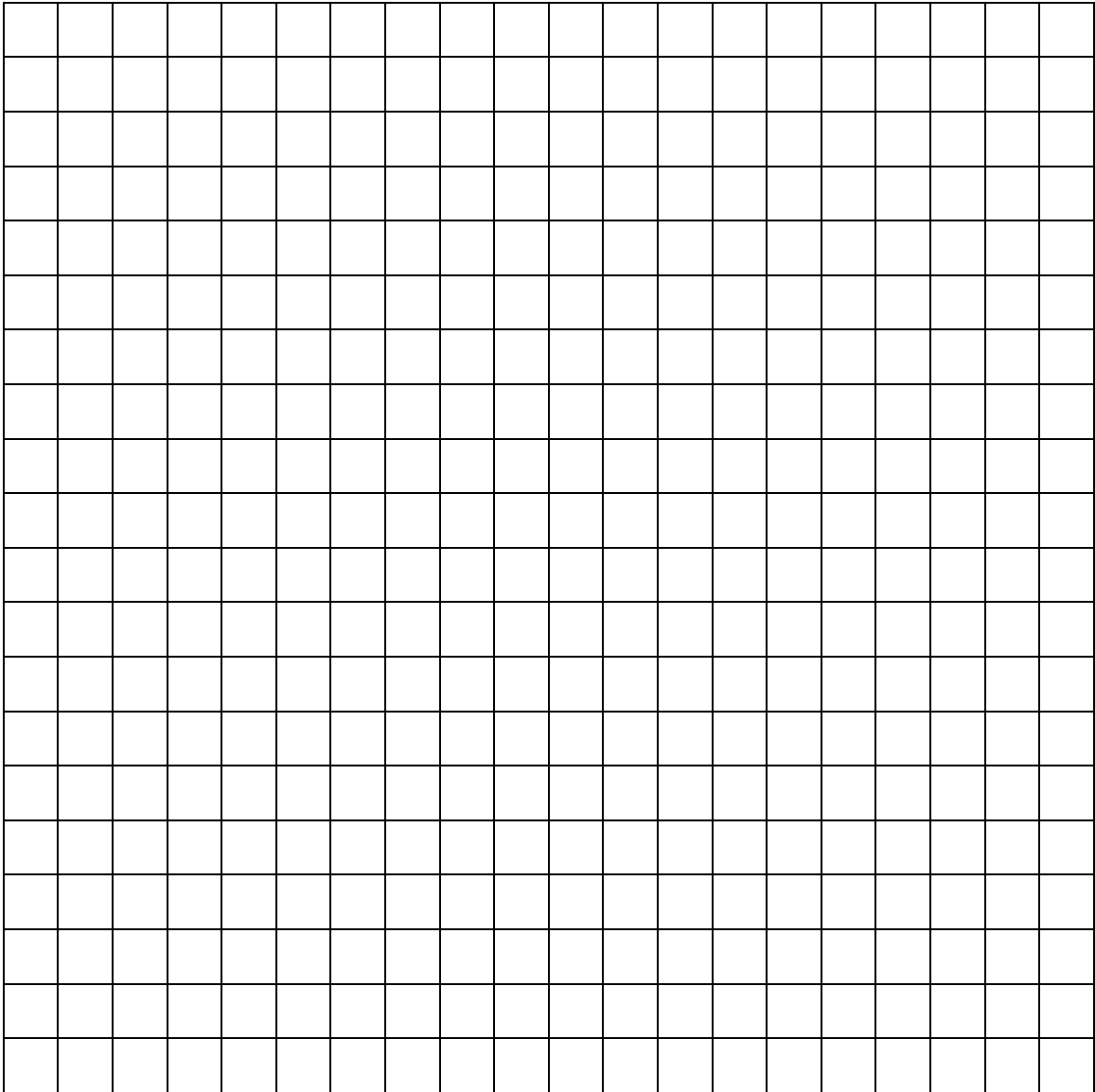
Crab Gender Key
(only for crabs
measuring greater
than 1 cm)

Challenge: If you discover organisms in your quadrat that are NOT UNDER ROCKS, write the names of the organisms, and mark their positions relative to the rocks on your grid.

Spot 2A				Spot 2B				Spot 2C			
Name of Crab	# of Crabs	Size (cm)	Gender (M/F)	Name of Crab	# of Crabs	Size (cm)	Gender (M/F)	Name of Crab	# of Crabs	Size (cm)	Gender (M/F)
Asian Shore Crab				Asian Shore Crab				Asian Shore Crab			
Spider Crab				Spider Crab				Spider Crab			
Green Crab				Green Crab				Green Crab			
Lady Crab				Lady Crab				Lady Crab			
Rock Crab				Rock Crab				Rock Crab			
Mud Crab				Mud Crab				Mud Crab			
Name of Organism	# of Organisms	Name of Organism	# of Organisms	Name of Organism	# of Organisms	Name of Organism	# of Organisms	Name of Organism	# of Organisms	Name of Organism	# of Organisms
Sand Shrimp		Clam Worm		Sand Shrimp		Clam Worm		Sand Shrimp		Clam Worm	
Mud Snail		Barnacle & Other		Mud Snail		Barnacle & Other		Mud Snail		Barnacle & Other	
Name of Shell	# of shells			Name of Shell	# of shells			Name of Shell	# of shells		
Common Periwinkle				Common Periwinkle				Common Periwinkle			
Ribbed Mussel				Ribbed Mussel				Ribbed Mussel			
Blue Mussel											
Gem Clam				Gem Clam				Gem Clam			
Quahog				Quahog				Quahog			
Slipper Shell				Slipper Shell				Slipper Shell			
Jack Knife				Jack Knife				Jack Knife			
Other				Other				Other			
Name of Plant	# of Plants			Name of Plant	# of Plants			Name of Plant	# of Plants		
Sea Lettuce				Sea Lettuce				Sea Lettuce			
Rockweed				Rockweed				Rockweed			
Irish Moss				Irish Moss				Irish Moss			
Other				Other				Other			

Instructions: Fill out all Quadrate information on this data sheet. Each space on this data sheet requires an answer with a number.

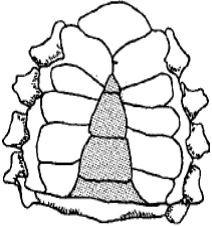
Quadrat 2



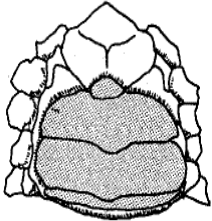
Spot 1A: Length _____
Width _____
Area _____

Spot 1B: Length _____
Width _____
Area _____

Spot 1C: Length _____
Width _____
Area _____



Male



Female

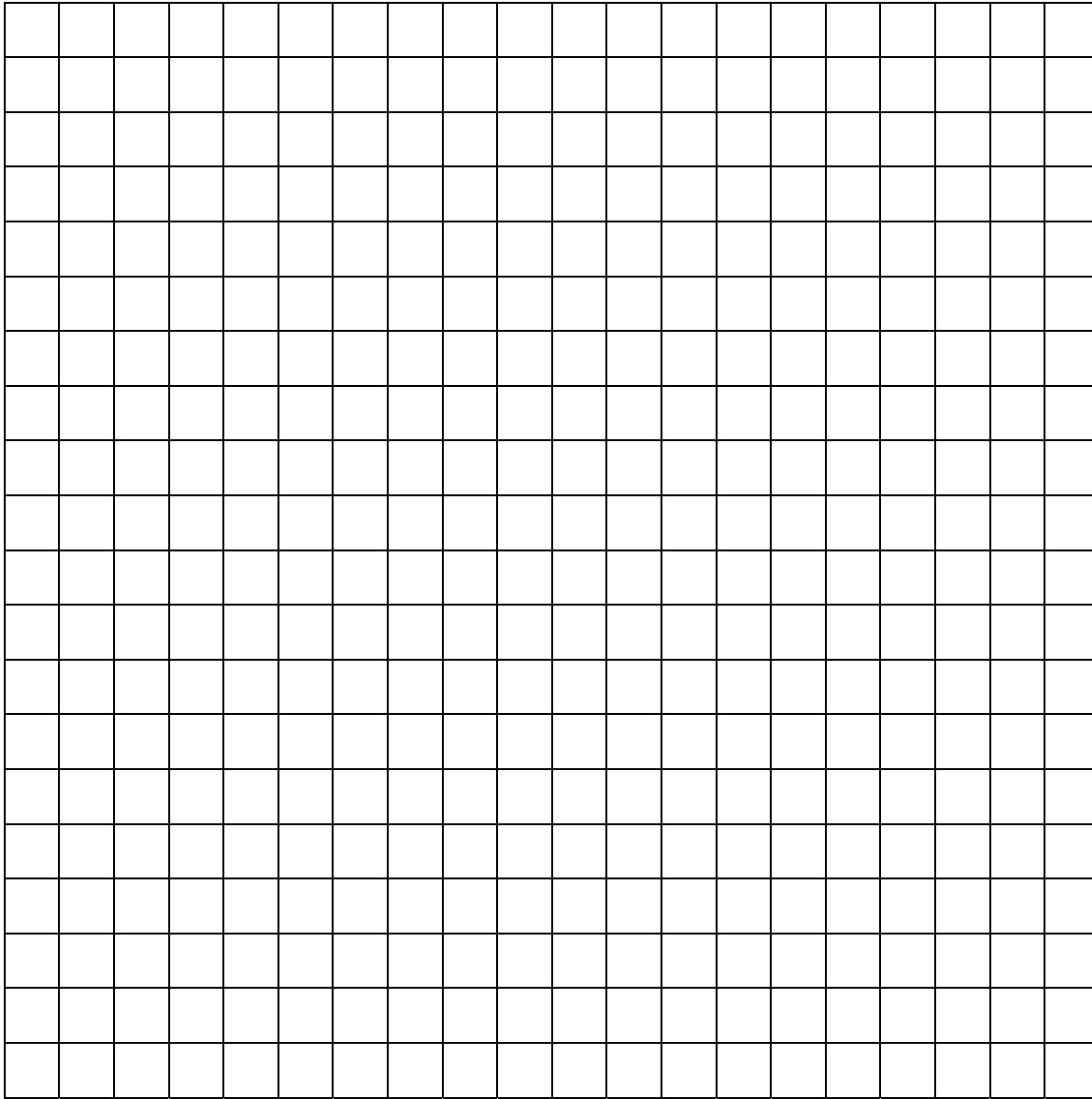
Crab Gender Key
(only for crabs
measuring greater
than 1 cm)

Challenge: If you discover organisms in your quadrat that are NOT UNDER ROCKS, write the names of the organisms, and mark their positions relative to the rocks on your grid.

Spot 3A				Spot 3B				Spot 3C			
Name of Crab	# of Crabs	Size (cm)	Gender (M/F)	Name of Crab	# of Crabs	Size (cm)	Gender (M/F)	Name of Crab	# of Crabs	Size (cm)	Gender (M/F)
Asian Shore Crab				Asian Shore Crab				Asian Shore Crab			
Spider Crab				Spider Crab				Spider Crab			
Green Crab				Green Crab				Green Crab			
Lady Crab				Lady Crab				Lady Crab			
Rock Crab				Rock Crab				Rock Crab			
Mud Crab				Mud Crab				Mud Crab			
Name of Organism	# of Organisms	Name of Organism	# of Organisms	Name of Organism	# of Organisms	Name of Organism	# of Organisms	Name of Organism	# of Organisms	Name of Organism	# of Organisms
Sand Shrimp		Clam Worm		Sand Shrimp		Clam Worm		Sand Shrimp		Clam Worm	
Mud Snail		Barnacle & Other		Mud Snail		Barnacle & Other		Mud Snail		Barnacle & Other	
Name of Shell	# of shells			Name of Shell	# of shells			Name of Shell	# of shells		
Common Periwinkle				Common Periwinkle				Common Periwinkle			
Ribbed Mussel				Ribbed Mussel				Ribbed Mussel			
Blue Mussel											
Gem Clam				Gem Clam				Gem Clam			
Quahog				Quahog				Quahog			
Slipper Shell				Slipper Shell				Slipper Shell			
Jack Knife				Jack Knife				Jack Knife			
Other				Other				Other			
Name of Plant	# of Plants			Name of Plant	# of Plants			Name of Plant	# of Plants		
Sea Lettuce				Sea Lettuce				Sea Lettuce			
Rockweed				Rockweed				Rockweed			
Irish Moss				Irish Moss				Irish Moss			
Other				Other				Other			

Instructions: Fill out all Quadrante information on this data sheet. Each space on this data sheet requires an answer with a number.

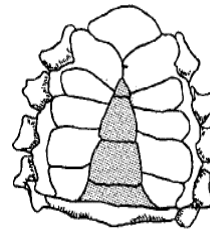
Quadrat 3



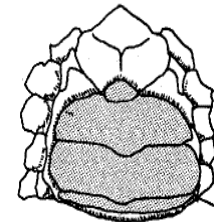
Spot 1A: Length _____
Width _____
Area _____

Spot 1B: Length _____
Width _____
Area _____

Spot 1C: Length _____
Width _____
Area _____



Male



Female

Crab Gender Key (only for crabs measuring greater than 1 cm)

Challenge: If you discover organisms in your quadrat that are NOT UNDER ROCKS, write the names of the organisms, and mark their positions relative to the rocks on your grid.

Reference Guide

Spider Crab



Brown, has long legs and has spikes.

Lady Crab



Pink shell is covered with spots; has paddle-like legs on back.

Mud Crab



Has two black-tipped claws, and indent between teeth.

Green Crab



Black/green body, has hairy back legs. Has 5 marginal teeth on each side of eyes.

Rock Crab



Red/purple fan shaped shell.

WARNING

MaRiNe InVaDeRs

Asian Shore Crab



Striped legs, small

Chinese Mitten Crab



Has hairy front claws

Crabs

Other Organisms:

Sand Shrimp



Mostly white; < 2 inches

Clam Worm



Little hairs come out from its sides

Mud Snail



Like tiny black rocks with white heads

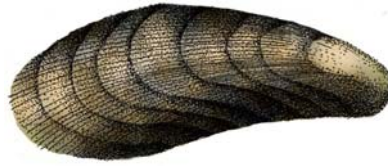
Barnacle



Round with hole on top, 1 in. (2.54 cm)

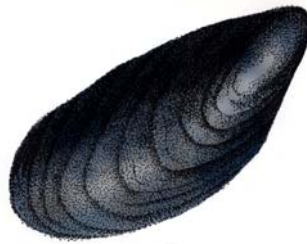
Shells:

Ribbed Mussel



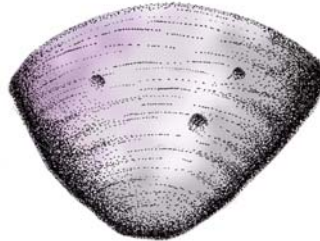
Beige/black shell with lines across it

Blue Mussel



Black and blue and smooth

Gem Clam



< 1/8 in. (.32 cm) Glossy smooth shells or with concentric ridges.

Slipper Shell



< 1.5 in. (3.81 cm), looks like slipper, and is purple/ white.

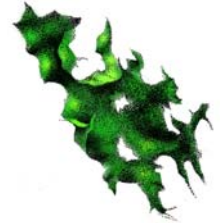
Jack Knife Clam



Long, smooth hard shell

Plants:

Sea Lettuce



Green/ dark green; lettuce floating in the water

Rockweed



Yellow/ deep green; bulbs at the end

Irish Moss



Purplish/red; near rocks; 7-10 in. (17.8-25.4 cm) tall