



Lesson Time

75 minutes

Essential Question

What are the feeding methods of rays?

Materials

Large bowls or tubs
Small cereal/pasta, parsley flakes
Small net or small paper cup
Lab Research Sheet

Objectives- Students Will

Record and Analyze manta ray food consumption
Explain energy flow from the sun
Discuss human impact on the environment

Florida State Standards

Science Standard: SC.4.L.17.3

Trace the flow of energy from the Sun as it is transferred along the food chain through the producers to the consumers.

B. Both human activities and natural events can have major impacts on the environment.

C. Energy flows from the sun through producers to consumers.

Math Standard: MAFS.4.NBT.1.2

ELA Standard: ELA.K12.EE.2.1

NGSS CrossCuttingConcepts

Patterns
Cause and Effect

Background Information:

Manta rays are filter feeders, meaning they strain food out of the water by swimming around with their mouths open. When they find a patch of food, they unroll their cephalic (head) fins to help funnel the plankton-rich water into their mouths. They swim with their mouth open and chest cavity extended to allow for water and food to flow through. The food gets trapped in the manta ray's gills and then the manta can swallow it. Manta rays do have teeth, but they are very small and they don't use them for feeding. Manta rays eat plankton, small fish, krill, and crustaceans.

Mantas feed different ways: barrel rolling (looping in circles) filtering food at the surface, and skimming the bottom for plankton that settled on the bottom. Mantas also use "circling behavior as a social way of eating." Manta ray individuals "stack" behind one another while feeding. The one in front gets the most plankton via filter feeding with its giant gaping mouth, but they switch places as they swim so each gets a turn in the leader position.

Dr. Andrea Marshall, Co-Founder and Director of Marine Megafauna Foundation, talks about the feeding behaviors of manta rays. "The social and feeding behaviors of manta rays have been secretive until drone footage has revealed new information. When drone technology came out we noticed that mantas were behaving a lot more naturally without boats around,"





5C's

Computational Thinking
Communication

Vocabulary:

Consumer: an organism that eats producers (cannot make its own food)

Krill: small, shrimplike crustacean

Macroplastic: plastic items larger than 5mm

Microplastic: plastic items smaller than 5 mm

Ocean Zones: differing depths where certain types of plants and animals live

Phytoplankton: microscopic plants which live in sea water

Plankton: organisms that are unable to swim against a current

Producer: an organism that can make its own food and is eaten by consumers

Water Column: a vertical section of water from the sea floor to the surface

Zooplankton: microscopic animals

Manta rays are sadly susceptible to trash floating in the ocean. Most of the trash in the ocean comes from the land, washing into the sea through rivers and streams. Much of the trash in the ocean is plastic pieces. Plastic doesn't ever disappear it just breaks into smaller and smaller pieces called microplastics. Microplastics can float on the surface, hang in the water column, or sink to the bottom due to different densities.

Dr. Elitza Germanov has been working to understand the implications of microplastics and filter feeders. When mantas are filtering for their food, they are also eating plastic pieces. Dr. Germanov's research is important because it is the first time documenting that manta rays, do in fact, eat the plastic floating around them.

She estimated that manta rays are consuming 63 pieces of microplastic every HOUR! Whale sharks consume even more plastic, with Dr. Germanov calculating that they eat 137 pieces of microplastics each hour!

Teacher Preparation:

1. Large, deep bowls or sinks are needed for "ocean"
2. Cereal (Cheerio size) OR small pasta, parsley flakes**
3. Small fish nets OR small paper cups
4. Find trash, cut into small pieces
5. Paper to place food/trash on to count
6. Print "Lab Research Sheet" and "Food Chain" (back to back)
7. Print "Feeding Methods and Behaviors"

**Please do not replace parsley flakes with glitter as glitter is a microplastic that ends up in the ocean.





Procedures:

Pre-Lesson: Assess prior knowledge about Manta Rays. Show Introductory Video if needed.

<https://www.youtube.com/watch?v=tC06JYwpnDE>

Step 1: Engage: Phenomena

Ask: "What do manta ray's eat? How do they eat?"

Show video clip of manta feeding methods:

Barrel roll Feeding (somersault) : <https://www.youtube.com/watch?v=zpF6tNVSV0k>

Cyclone Feeding: <https://www.youtube.com/watch?v=j-yF8OuKP3o>

Step 2: Explore: Lab

Small group work:

1. Show video clip of Manta swimming through trash: <https://www.youtube.com/watch?v=JLOVSfZ0yX4>

2. Go over phytoplankton and zooplankton from Vocabulary

3. Pass out "Feeding Methods and Behaviors" one per group.

Lab: Students will get a large bowl or tub of water and different sized food that float in different places of the bowl (Water Column). Students can use a small cup or net to "eat." Students will use Lab Research Data Sheet to record data. *If using a small paper cup, poke several holes in bottom to allow water to drain out.*

Amount does not matter:

Small cereal or pasta = krill (larger plankton, shrimp-like)

Parsley flakes= plankton (small plankton such as copepods) (crustaceans)

Trash=small pieces of a coffee cup lid, Styrofoam, plastic packaging etc

Step 3: Explain: Results

With partner/s explain your results. **Ask:** *Did you have more food pieces or more non-food pieces? What types of non-food items do you have? How do human activities have an impact on the environment?*

Step 4: Elaborate: Discuss

After students have completed lab sheets, discuss the feeding methods of manta rays from background information. **Ask:** *What are the advantages and disadvantages to feeding in these ways? How is your model (cup or net) like the real manta ray? How your model NOT like the real manta ray?*

Step 5: Evaluate: Food Chain

Students will diagram a food chain and incorporate their lab data into diagram. Check for understanding of producer and consumer and where the energy travels.

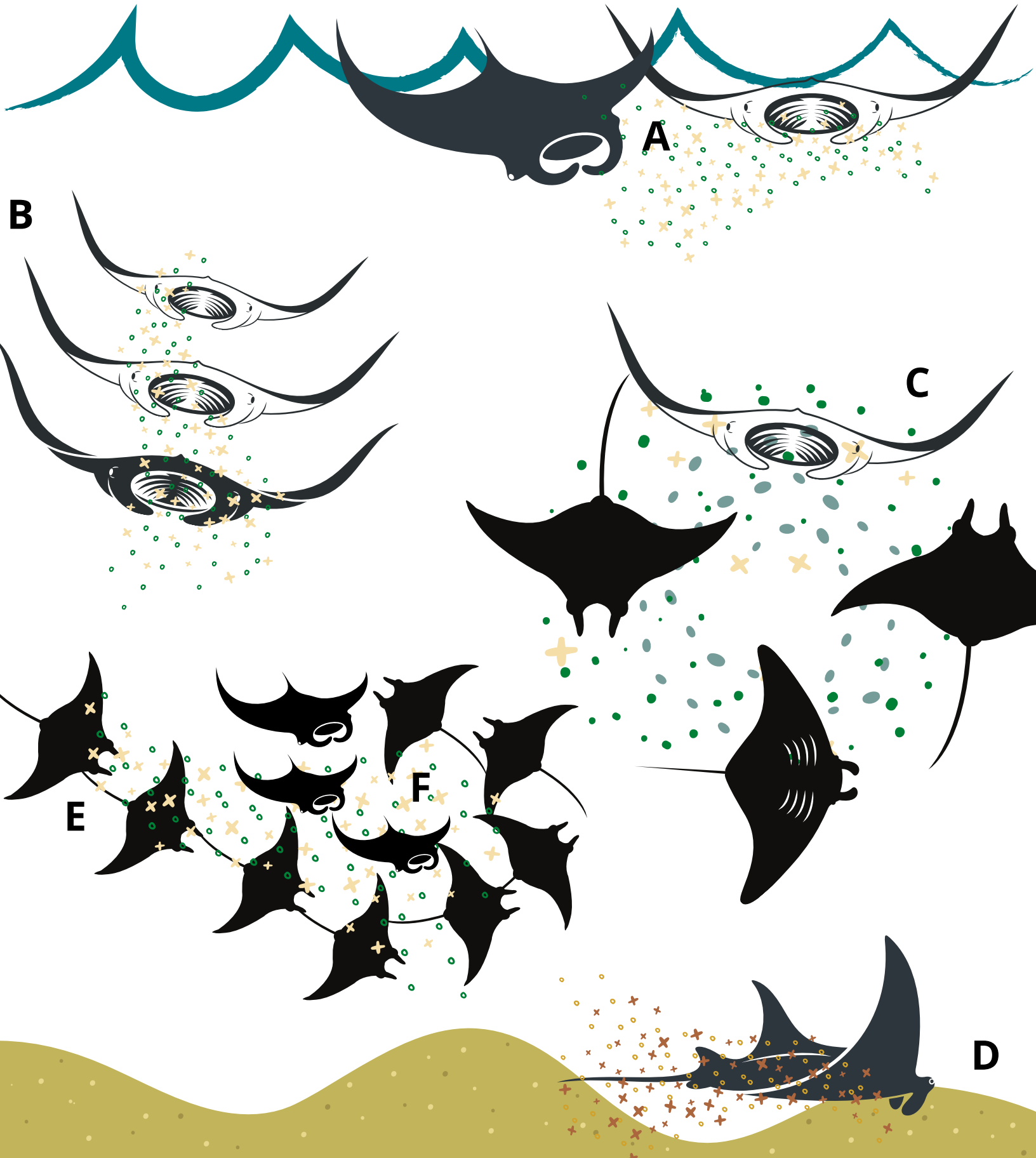
Linguistically diverse learners: Use diagram of Feeding Methods and Behaviors, allow to use vocabulary words (Producer, Consumer, Plankton) in native language.





Feeding Methods and Behaviors:

A: Surface **B:** Stacked (Take turns being the leader) **C:** Barrel Roll (Somersault) **D:** Bottom (settled plankton) **E:** Chain **F:** Cyclone





Lab Research Data Sheet - Manta Ray Feeding Behaviors:

Name _____

Background information: There are many different zones in the ocean. Different food(pre) for manta rays live in different parts, or zones of the ocean. **Plankton are plants and animals** that float with the ocean currents. Some plankton you can see and some you cannot (microscopic). See back page for drawings of small crustaceans: krill and copepods (favorite food of manta rays). Different types of plastic float at different depths because of what they are made of.

Directions: Use net or cup as a scoop to "eat" as a manta ray. Then empty net or cup onto paper and count the pieces of food & trash collected. For each feeding method, scoop 3 times. Record totals in data tables below. Summarize your data in the **RESULTS**.

Feeding Method: Surface- Skim surface with cup/net

	Plankton: Krill (pasta or cereal)	Plankton: Copepods (parsley flakes)	Trash pieces
1			
2			
3			
Totals			

RESULTS: Use <, >, = to show comparisons of items the manta ray ate:

The number of food items is ____ the number of trash items

The number of krill is _____ the number of copepods

Feeding Method: Bottom- Skim bottom with cup/net

	Plankton: Krill (pasta or cereal)	Plankton: Copepods (parsley flakes)	Trash pieces
1			
2			
3			
Totals			

RESULTS: Use <, >, = to show comparisons of items the manta ray ate:

The number of food items is ____ the number of trash items

The number of krill is _____ the number of copepods

Feeding Method: Stacked- 2 people will stack cup/net

	Plankton: Krill (pasta or cereal)	Plankton: Copepods (parsley flakes)	Trash pieces
1			
2			
3			
Totals			

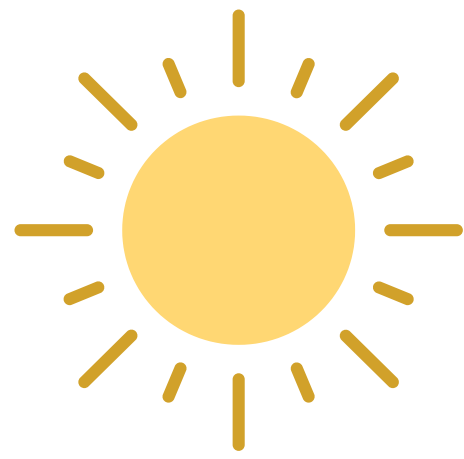
RESULTS: Use <, >, = to show comparisons of items the manta ray ate:

The number of food items is ____ the number of trash items

The number of krill is _____ the number of copepods



Food Chain- Manta Ray Feeding:



Directions:

1. Fill in the lines to the right with **Sun, Producer, Consumer**

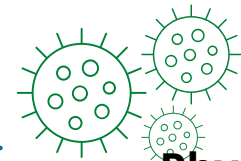
2. Draw arrows to show the direction of the food chain

3. What does the arrow mean?

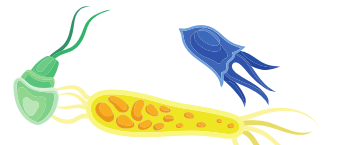
4. Since manta rays cannot make their own food, what do they get from eating food?

5. What do producers use to make their own food?

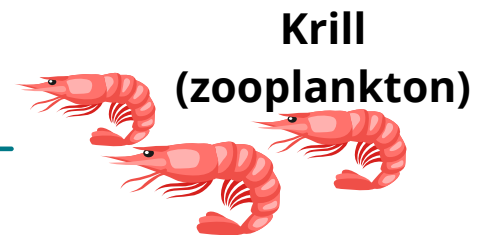
6. Why is eating plastic bad for manta rays?



Phytoplankton



**Copepods
(zooplankton)**



**Krill
(zooplankton)**

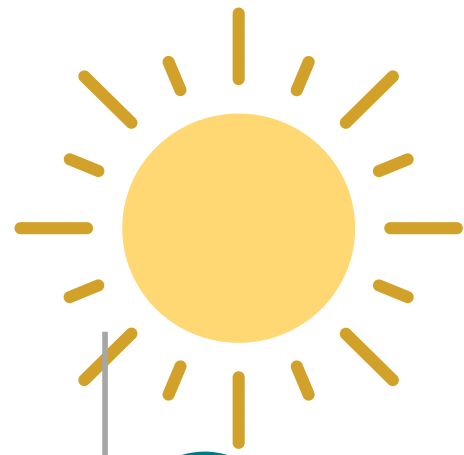


Manta Ray



Food Chain- Manta Ray Feeding:

Teacher Key



Sun

Directions:

1. Fill in the lines to the right with **Sun, Producer, Consumer**

Primary, Secondary, Tertiary Consumer can be added at teacher discretion

2. Draw arrows to show the direction of the food chain
See arrows to right

3. What does the arrow mean?

The arrow shows the direction of energy.

4. Since manta rays cannot make their own food, what do they get from eating food? **ENERGY**

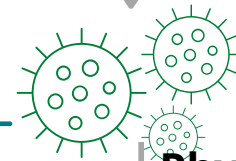
5. What do producers use to make their own food?

The SUN

6. Why is eating plastic bad for manta rays?

When animals eat plastic, they can "fill up" on plastic and then don't get the nutrients from food.

Producer

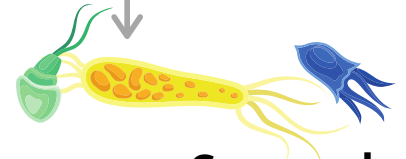


Phytoplankton



Consumer

Primary

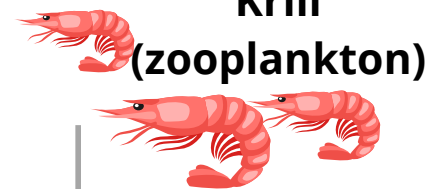


Copepods
(zooplankton)



Consumer

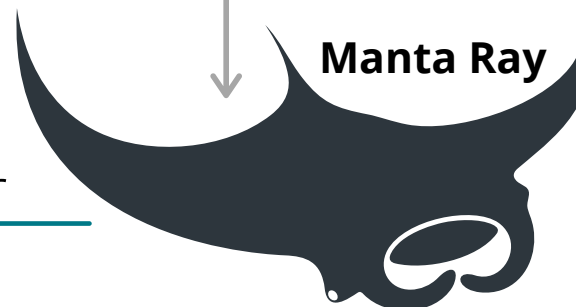
Secondary



Krill
(zooplankton)

Consumer

Tertiary



Manta Ray



Exit Ticket

SC.4.L.17.3

Name:

Fill in the blanks with words or drawings:

Energy flows from the _____ through _____
to

_____.



Exit Ticket

SC.4.L.17.3

Name:

What is a human activity that can have a major impact on the environment for manta rays?



Exit Ticket

SC.4.N.1.3

Name:

What types of challenges does Dr. Germanov face working in the ocean with manta rays?



Meet the Scientist



DR. ELITZA GERMANOV

Manta Ray Researcher,
Manta Ray Program, MMF

**Degree:
PH.D**

Murdoch University, Australia

What she does in the field:

- Snorkel with mantas
- Give presentations to schools and public
- Work with other scientists
- Collect and measure plastics
- Collect manta vomit and poop!

Research Focus

Ellie is a conservation biologist focusing on manta rays with a background in microbiology, immunology and biochemistry. She started as a biochemist, often working in a lab. She enjoyed SCUBA diving as a hobby and she was so enthralled with the ocean that she became a SCUBA Instructor. The more she went diving, the more she loved the large animals of the sea- the megafauna. She decided to pursue her graduate work in Conservation Biology.

Her current project focus is understanding the implications of microplastics in the marine environment on filter feeding marine megafauna. Her microplastics research is in collaboration with Udayana University in Indonesia.





MARINE MEGAFUNA FOUNDATION

SCIENTIST
SERIES
FOR STUDENTS

Grade 4

Module 1 Filtering for a Living

Author:

Hilary Penner M.Ed

Scientific Advisory:

Jessica Pate, M.Sc
MMF Florida Project Manager

Grant provided by:



We value your feedback!

Please fill out this Teacher Evaluation form at shorturl.at/zIJT4

As a Thank You, your class will receive a *Manta ray Adoption Certificate!*

We'd love to see your lessons in action!

Please send an email to florida@marinemegafauna.org and tag us in social media.

 @MarineMegafauna

 @marinemegafauna

 Marine Megafauna Foundation

Resources:

<https://www.nationalgeographic.com/news/2017/07/manta-rays-swimming-hawaii-video-spd/#close>

<https://a-z-animals.com/animals/manta-ray/>

https://www.youtube.com/watch?v=DpHIM_uhIQ

