



Lesson Time

75 minutes

Essential Question

What are the behaviors of manta rays and where are their important habitats?

Materials

Copies of worksheets
Scissors
Blank paper
Colored pencils

Objective- Students Will

Explain what a critical habitat is
Explain why mantas need protection
Discuss social behaviors
Analyze diagrams

Florida State Standards

Science Standard: SC.5.N.1.1

Define a problem, use appropriate reference materials to support scientific understanding, plan and carry out scientific investigations of various types such as: systematic observations, experiments requiring the identification of variables, collecting and organizing data, interpreting data in charts, tables, and graphics, analyze information, make predictions, and defend conclusions

Background Information

Social Behaviors:

Manta rays exhibit social behaviors such as playing together and searching for food. Other interesting behaviors include breaching (possibly to attract a mate?) to barrel rolling and "stack" feeding where the leader gets plankton and then they switch positions.

Manta rays have the largest brain relative to their body size of all fish. They have a highly developed sensory system. Manta rays also exhibit patience in allowing humans to cut off fishing hooks and gear. They also can exhibit inquisitiveness towards swimmers and divers.

Another behavior shown by manta rays is visiting cleaning stations. Mantas can spend anywhere from 30 minutes to 8 hours getting shark wounds cleaned and parasites removed by smaller fish.

Females tend to have long term bonds with other females. Male manta rays do not have many strong bonds with other males. In an MMF study of 500 manta rays over five years, showed two separate but connected communities. One community was made up of mature females and one community was a mix of males, females, and juveniles.





LAFS.5.RI.1.3. Explain the relationships or interactions between two or more individuals, events, ideas, or concepts in a historical, scientific, or technical text based on specific information in the text.

LAFS.5.W.3.8. Recall relevant information from experiences or gather relevant information from print and digital sources; summarize or paraphrase information in notes and finished work, and provide a list of sources.

MAFS.5.MD.2.2. Represent and interpret data.

NGSS CrossCuttingConcepts

Systems and Systems Models
Stability and Change

5C's

Communication
Creativity
Collaboration

Critical Habitats:

Manta rays have **critical habitats**. These are areas critical to their survival. Such behaviors include feeding, visiting cleaning stations, and seasonally congregating for mating, giving birth, and migrating. Because of the importance of the activities that take place at the critical habitats, you will see more animals of a species there and they will spend more time in these habitats. The tendency for the manta rays to frequent or return to a site or region is known as philopatry. Some species of shark do this, returning seasonally or cyclically and manta rays may be the same.

The waters around Tofo Beach, Mozambique provide a critical habitat for both species of manta. The reef mantas (*Manta alfredi*) will use the area to feed, mate, and to visit the cleaning stations, whereas the giant mantas (*Manta birostris*) only seem to use the area for feeding and cleaning. The safety of the animals within critical habitats, such as around Tofo Beach is therefore critical to their fitness and survival and failure to identify or protect these sites could jeopardize the population.



Vocabulary:

Marine Protected Area: (MPA) a part of ocean that limits or restricts human interactions to conserve the natural ecosystem. It is like an underwater National Park.

Cleaning Station:
an area on the reef where animals visit to be cleaned of parasites and dead flesh by small cleaner fish and shrimp

Critical Habitat:
an area where an animal performs important roles in their life cycle such as mating or giving birth

Protected areas for marine life and manta rays:

Few national and international conservation measures are in place for manta rays. This is concerning due to the fact that they migrate across the borders of states and countries. Their predators are sharks, orcas, and humans. Marine Protected Areas (MPAs) can widely vary in how they are regulated. Some may entirely ban all human activity, some may have seasonal fishing bans (such as during spawning season) or some may ban extractive activities, such as fishing or mining, but allow boating and diving. However, a MPA must have adequate enforcement for it to be effective.

Teacher Preparation

1. Print all worksheets
2. "Department of Environment" can be projected
3. Gather blank paper and scissors



Procedures:

Assess prior knowledge on Manta Rays. Show Introductory Video if needed.

<https://www.youtube.com/watch?v=tC06JYwpmDE>

Step 1: Engage: Inquire

Ask: "What types of behaviors do you think manta rays do?" "What types of relationships do you think manta rays have?"

Why would they have these behaviors and relationships?"

Discuss: Think - Pair- Share- "How do behaviors help animals survive?"

Step 2: Explore: Videos

Manta ray social relationships (2:07min)

<https://www.youtube.com/watch?v=mMDq2Oup2el>

<https://news.mongabay.com/2019/08/manta-rays-are-social-creatures-who-are-choosy-about-their-friends/>

Step 3: Explain: Scientific Process Sheet

Explain: Manta rays are social animals meaning they interact with others and show different types of behaviors. A **critical habitat** for manta rays is an area where animals perform behaviors critical to their survival. The habitat can include a foraging ground for food, cleaning stations and seasonal congregations for mating, giving birth or being a passage when they migrate. The safety of the animals within critical habitats is essential to their health and survival. If a critical habitat is not identified or protected, it could jeopardize the population. It will be your job to look at the interactions and find the critical habitat

Partner Work:

Analyze the Infographic "Social Relationships in Reef Manta Rays" and fill in "Scientific Process Sheet"

Step 4: Elaborate: Create a Marine Protected Area Proposal

Read letter from Department of Environment.

Explain: Manta rays interact with others, their environment, and humans. Read the "Interaction Cards" to create a Marine Protected Area proposal. Draw the cards, use the KEY (from Infographic) and circle the location that should become a Marine Protected Area. Protected areas can either ban fishing for certain periods, ban a certain fish, or ban all fishing. These areas give some protection to fish during mating season and in general.

Step 5: Evaluate: Synthesize through letter

Students will use letter from to summarize their learning of what area is most important to protect.

Linguistically diverse learners: Allow to partner with someone for Steps 4 and 5. Research "Marine Protected Areas" and "Critical Habitat" in native language.





The Scientific Process

Name _____

"Collecting more information about their social relationships and structures will be needed to develop sustainable ecotourism and conservation initiatives that allow mantas to coexist with humans in their natural habitats," MMF Scientist, Rob Perryman

Define the problem

There are not many rules to protect manta rays
Manta rays have a complex social life
Manta rays travel between different locations

What is the problem?

Collecting and Analyzing Data

Scientists from MMF studied 500 manta rays for over 5 years to learn about their social interactions.

List ways you think they collected data:

- Example: Took LOTS of Photographs
- Example: Made charts
-
-
-



Observations from Research

Look at Infographic and KEY to help you write observations about the findings.

-
-
-

What can you INFER about the habitat that mantas need to survive?

Communication

An important part of a scientist's job is to share what they have learned. They will share their research with other scientists and the public.

List the ways that Scientist Perryman has shared his research:

-
-
-

SOCIAL RELATIONSHIPS IN REEF MANTA RAYS

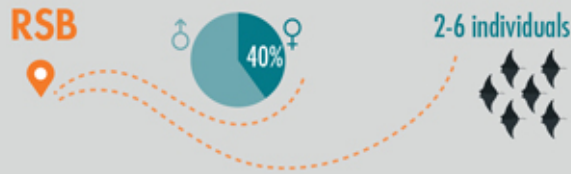


♂ Reef mantas actively choose to interact with each other

♂ Individuals repeatedly interact over weeks/months but don't form tight-knit groups

♀ Mature females form stable social groups with other females, and more dynamic groups with males

♂ Males tend to avoid each other, except for juveniles that form social groups



WSA
Manta rays usually found surface feeding close to island, typical group size 2-5 individuals



ESA
Manta rays usually found surface feeding in strong currents, typical group size 6-20 individuals

Manta Ridge
53% ♀
10-20 individuals

Manta Sandy
77% ♀
3-8 individuals



Perryman RJY, et al. Social preferences and network structure in a population of reef manta rays. Behav Ecol Sociobiol (2019).

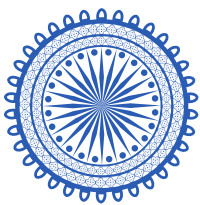
Infographic: GIULIA DE AMICIS

Key:

ESA: East Study Area- a set location where scientists collected data (feeding area)
WSA: West Study Area- a set location where scientists collected data (feeding area)

♂ = male manta ray

♀ = Female manta ray



DEPARTMENT OF ENVIRONMENT

Dear Manta Ray Researchers,

As the Director of the Department of Environment I would like to request your assistance in creating a protection area for manta rays. Please advise. Turn in your proposals of what habitat is most important to protect and why.

Sincerely,

Bella Parker

Bella Parker
Director,
Department of Environment



Interaction Cards: What habitat is most important to protect?

Create a Marine Protected Area for Manta Rays

Directions:

1. Read letter from Department of the Environment.
2. Read the cards below to learn about factors of critical habitats for manta rays.
3. Cut out cards and randomly draw 3 cards- one from each type of interaction (Habitat, Social, Human).
4. On a blank sheet of paper create a diagram to show the 3 factors interacting.
5. Circle the area that should be a Marine Protected Area.
6. Use the KEY on the infographic to help you.

Habitat

interaction:

Cleaning station
Manta rays go here to
get their wounds
cleaned and parasites
picked off by other
fish

Habitat

interaction:

Feeding area
There is plenty of
food in the this
location

Habitat

interaction:

Nursery area
Is an area where
manta rays have
their young, there
are not a lot of
predators here

Social Interactions :

juvenile males

Social Interactions:

large group of
feeding manta rays

Social Interactions:

large group of
females/ friends

Human Interaction:

Threats from
Tourists ,
People swim/
snorkel with manta
rays

Human Interaction:

Threats from
Fishing
Mantas get fished
for food and gills
and get caught as
"extra" fish

Human Interaction:

Threats from
fishing gear
Hooks and fishing
gear get stuck on
manta rays



Teacher Key sample

One card from each category of interaction:

<p>Human Interaction:</p> <p>Threats from Fishing</p> <p>Mantas get fished for food and gills and get caught as "extra fish"</p>	<p>Social Interactions:</p> <p>large group of females/ friends</p>	<p>Habitat interaction:</p> <p>Cleaning station</p> <p>Manta rays go here to get their wounds cleaned and parasites picked off by other fish</p>
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Proposal for Director of Environment

Students should only show drawings- Interaction wordage is shown here to explain drawings

Human Interaction:
Threats from Fishing
Mantas get fished for food and gills & get caught as "extra" fish

Social Interactions:
large group of females/ friends

Habitat interaction:
Cleaning station
Manta rays go here to get their wounds cleaned and parasites picked off by other fish

Circle=Marine Protected Area



Dear Director of
Environment,

Thank you for seeking out scientific research
to help make your decision.

My area of research includes

a _____,
_____, and
_____.

This area needs to be protected
because _____

_____.

It also needs to be protected due
to _____

_____.

Sincerely,

Manta Ray Researcher





Dear Director of
Environment,

Teacher KEY

Thank you for seeking out scientific research to help make your decision.

My area of research includes **(EXPLAIN your 3 Cards)** a popular fishing spot, a large group of female manta rays and a cleaning station.

This area needs to be protected because **(Any logical reason about how Mantas have complex social lives)** manta rays are social animals and we are still learning about them.

It also needs to be protected due to **(Explain one card with more detail)** the fishing boats nearby accidentally catch manta rays.

Sincerely,
Manta Ray Researcher



Exit Ticket



SC.5.N.1.1

Name:

Grade 5

Module 1 Manta Behavior

What is a critical habitat?

Exit Ticket



SC.5.N.1.1

Name:

What question would you like to ask Scientist Perryman about his work?

What challenges do you think he has with working with Manta rays?

Exit Ticket



SC.5.N.1.1

Name:

Write one other question you still have about Manta ray behavior:



Meet the Scientist



ROB PERRYMAN

Project Leader, Manta Ray
Program, MMF Indonesia

Degree:

Ph.D Candidate,
Macquarie University
Sydney, Australia

What he does in the field:

Operates drone to count and
identify mantas
Identify mantas through
photographs
Works with ecotourism
businesses to present research
Analyzes manta movements and
social interactions
SCUBA dives

Research Focus:

Rob has his Masters in Science in Marine Biodiversity and Conservation. He is a PhD candidate at Macquarie University, working with the Fish Lab (Behavioural Ecology and Evolution of Fishes research group).

He conducts fieldwork on manta rays in Raja Ampat, Indonesia, working with the Marine Megafauna Foundation. His main research interests are the behavioral ecology and social systems of elasmobranch species, particularly manta rays.

His published paper, "Social preferences and network structure in a population of reef manta rays" was published in the journal *Behavioral Ecology and Sociobiology* on 22 August 2019. His research provided the information for the infographic used.

"Like dolphins, manta rays are intelligent and perform collective behaviors such as foraging and playing. They are curious, often approaching humans, and individuals appear to have different personalities. It turns out that reef manta rays actively choose to group with preferred social partners."

Knowing this information will help to learn about how to best protect manta rays and enable humans and manta rays to coexist.





MARINE MEGAFUNA FOUNDATION

SCIENTIST SERIES FOR STUDENTS *Grade 5*

Module 1 Manta Behavior

Author:

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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/zlJT4
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://researchers.mq.edu.au/en/persons/robert-perryman>

<https://www.youtube.com/watch?v=mMDq2Oup2eI>

<https://marinemegafaunafoundation.org/blog/underwater-listening-stations-track-reef-manta-rays-in-mozambique/>

Zoom meeting, Jessica Pate, May 1, 2020

<https://phys.org/news/2019-08-manta-rays-social-bonds.html>

<https://www.nationalgeographic.com/animals/fish/group/manta-ray/>

