



Whale Watcher Game Lesson

In the Web-based game *Whale Watcher*, students take on the role of an *Ocean Adventures* expedition member in charge of filming various gray whale behaviors as the team follows the whales on their annual migration. Use the tips and handouts provided below to turn the *Whale Watcher* game into a structured learning activity for your students.

SUBJECTS

Science

GRADE LEVEL

Grades 6–10

TIME

One to two class periods

OBJECTIVES

Students will be able to

- describe the gray whale migration route and reasons for the migration.
- draw a sample gray whale food chain.
- graph the relationship between rising ocean temperature and declining gray whale population.
- predict what would happen to gray whales if they did not exhibit certain behaviors.

MATERIALS

- Volunteers Wanted! (student handout #1)
- Migration Data Sheet (student handout #2)
- Gray Whale Behavior Data Sheet (student handout #3)
- Migration Threats Data Sheet (student handout #4)
- Reporting Data (student handout #5)

BACKGROUND

In the third episode of *Jean-Michel Cousteau Ocean Adventures, The Gray Whale Obstacle Course*, Jean-Michel Cousteau and his team trail gray whales from their birthplace in the warm waters of Baja California, Mexico, to their nutrient-rich feeding grounds in the Bering Sea in Alaska in order to document and understand the variety of natural and man-made hurdles that these creatures must overcome in order to survive. This amazing expedition unlocks seldom-seen views of tragedy and triumph along a route that is nearly 12,000 miles long.

Based on the experiences of the *Ocean Adventures* team along the migration route, *Whale Watcher* is an educational look into the many behaviors gray whales exhibit that help them to survive along the coast of North America. Playing the part of an *Ocean Adventures* volunteer team member, students are charged with capturing various whale behaviors on film as well as with gathering additional information about the threats the whales face on their long journey. The game takes students above and below the water in five different locations along the migration route -- Baja California, Mexico; San Diego, California; Monterey, California; Depoe Bay, Oregon; and the Bering Sea in Alaska. Points are earned by capturing behaviors on film in a dwindling amount of time, and additional points can be accumulated by reading more in-depth information about the behaviors and threats discovered. Upon completion of the game, students analyze their data and compile a report describing what they have learned, then submit their report to the Volunteer Supervisor (the teacher).

TEACHER PREPARATION

- Using blank student handouts, play *Whale Watcher* yourself, paying particular attention to where you think your students will need extra guidance.
- Review the Game Background and Answer Key teacher sheets.
- Based on the availability of computers, decide the best way for students to play the game -- individually, in pairs or in groups.

- Game Background (teacher sheet #1)
- Answer Key (teacher sheet #2)
- *The Gray Whale Obstacle Course* Viewing Guide (optional; find at pbs.org/oceanadventures/educators/whales)
- Copy of *The Gray Whale Obstacle Course* episode of the **Jean-Michel Cousteau Ocean Adventures** series (optional)

WEB LINKS

Found at pbs.org/oceanadventures/episodes/whales

- Whale Watcher Game
- Trace the Migration interactive
- Tag, You're It! Tracking the Gray Whale Journey
- Navigating the Long Way Home

Find at pbs.org/oceanadventures/educators/whales:

- Gray Whales on the Move lesson plan
- Gray Whale Adaptations lesson plan
- San Ignacio Lagoon: Ecology or Economy lesson plan

Outside link:

- Journey North – www.journeynorth.org

STANDARDS

National Science Education Standards Grades 5–8

<http://www.nap.edu/catalog/4962.html>

Science As Inquiry - Content Standard A:

Abilities necessary to do scientific inquiry

Life Science -

Content Standard C:

Reproduction and heredity
Regulation and behavior
Populations and ecosystems
Diversity and adaptations of organisms

PROCEDURE

- 1. Introducing migration and adaptation:** Use ideas from *The Gray Whale Obstacle Course* Viewing Guide to set the scene. Pay particular attention to the Segment Suggestions for the migration and adaptation themes. If you do not have access to *The Gray Whale Obstacle Course* episode, the *Ocean Adventures* Trace the Migration interactive and introductory activity may be sufficient preliminary activities.
- 2. Game setup:** Pass out the Volunteers Wanted! notice, a fictional posting from the *Ocean Adventures* team for a volunteer position introducing volunteers (the students) to their gray whale mission. Give students an overview of how to play Whale Watcher, hand out the Migration Data Sheet, the Gray Whale Behavior Data Sheet and the Migration Threats Data Sheet and explain that they will be collecting information on these organizers for later use. Have students record their hypotheses on their Migration Data Sheet before game play begins.
- 3. Game preparation:** Tell students that in order to prepare for their gray whale mission, Jean-Michel Cousteau has asked them to do some background research. Hand out the Migration Data Sheet and give students time to collect information from the Trace the Migration interactive as well as from the opening information in the Whale Watcher Game.
- 4. Game play:** Allow students sufficient time to play the game and collect data.
- 5. Data sharing:** Set aside time for students to gather in small groups to review data after game play has ended to ensure all students have understood the game.
- 6. Reporting information:** Pass out the Reporting Data handout and explain the directions. Students will submit this report to you, their Volunteer Supervisor.

Science in Personal and Social Perspectives - Content Standard F:

Populations, resources and environments
Science and technology in society

Ocean Literacy: Essential Principles and Fundamental Concepts

<http://coexploration.org/oceanliteracy/>

Essential Principle #1: Earth has one big ocean with many features.

- a. The ocean is the dominant physical feature on our planet Earth, covering approximately 70 percent of the planet's surface. There is one ocean with many ocean basins, such as the North Pacific, South Pacific, North Atlantic, South Atlantic, Indian and Arctic.

Essential Principle #5: The ocean supports a great diversity of life and ecosystems.

- d. Ocean biology provides many unique examples of life cycles, adaptations and important relationships among organisms (symbiosis, predator-prey dynamics and energy transfer) that do not occur on land.
- e. The ocean is three-dimensional, offering vast living space and diverse habitats from the surface through the water column to the seafloor. Most of the living space on Earth is in the ocean.
- i. Estuaries provide important and productive nursery areas for many marine and aquatic species.

TEACHER NOTES

- Depending on the number of computers available, you might want to make adjustments, such as having students play the game on alternate days.
- When students are working in groups, it may be advantageous for each group member to collect different information for the organizer, then share it with the rest of the group (be sure to have group members rotate who actually plays the game). Another option is to have separate individuals/pairs/groups collect different information, then share their data in small groups after game play. For example, pair #1 collects behavior data and pair #2 collects data on threats facing the whales; after game play, the two pairs join together to share and explain the data they have collected.

EXTENSIONS

- Lead students in the following activities to explore the gray whale and its migration more deeply:
 - **Whale Adaptations:** Use this collection of hands-on activities to experience simulations of whale adaptations.
 - **San Ignacio Lagoon: Ecology or Economy?:** Investigate the various sides of the debate on the best use of the Mexican lagoons where the gray whales calve and in which salt is plentiful.
 - **Gray Whales on the Move:** Track two gray whales along their migration route using longitude and latitude and interpret data for two migrating whales.
- Have students investigate how satellite tagging of whales works by instructing them to read the Tag, You're It! article and to then draw visual representations of the information in the article.
- Students may be interested in how the whales find their way along the migration. They can get a jump-start on a research project by reading the Navigating the Long Way Home article.
- Introduce students to the *Ocean Adventures* expedition team and their diverse careers using the Ocean Careers Exploration lesson.
- Visit the Journey North Web site for additional activities related to animal migrations.

These and additional educator resources for **Jean-Michel Cousteau Ocean Adventures** can be found at pbs.org/oceanadventures/educators.

Essential Principle #6:**The ocean and humans are inextricably interconnected.**

- b. From the ocean we get foods, medicines, and mineral and energy resources. In addition, it provides jobs, supports our nation's economy, serves as a highway for transportation of goods and people, and plays a role in national security.
- e. Humans affect the ocean in a variety of ways. Laws, regulations and resource management affect what is taken out of and put into the ocean. Human development and activity leads to pollution (point source, nonpoint source and noise pollution) and physical modifications (changes to beaches, shores and rivers). In addition, humans have removed most of the large vertebrates from the ocean.
- f. Everyone is responsible for caring for the ocean. The ocean sustains life on Earth, and humans must live in ways that sustain the ocean. Individual and collective actions are needed to effectively manage ocean resources for all.

AUTHOR

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CREDITS

Jean-Michel Cousteau Ocean Adventures is produced by KQED Public Broadcasting and the Ocean Futures Society.

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VOLUNTEERS WANTED!

**Join the *Ocean Adventures* team
in capturing gray whale behaviors on film!**

Position

Gray Whale Watcher volunteer

Location

The coast of North America from Baja California, Mexico, to Alaska

Start Date

Accepting volunteers year-round

End Date

N/A

Partners

Ocean Adventures team

Contact

Volunteer Supervisor

Activities

- Operate high-definition camera from boat
- Operate high-definition camera underwater
- Collect data on gray whale behaviors
- Collect data on threats encountered by gray whales during migration
- Complete Reporting Data form and submit to the Volunteer Supervisor

Details

Seeking persons with a steady hand and quick reflexes to capture behaviors on film as quickly as possible; must have note-taking skills and be detail-oriented

Suitability

Teens and adults

Difficulty

Average (though difficulty will increase with success)

Migration Data Sheet

Directions: Please fill out the following information for the location at which you are volunteering. This information will be used later when completing the report to submit to your Volunteer Supervisor.

Volunteer Position: Gray Whale Watcher volunteer

Before you begin your volunteer job, please make two hypotheses:

1. What types of behaviors to you expect to see during the expedition?

2. What dangers do you think gray whales run into along their migration?

Use the information found on the interactive Gray Whale Migration Map as well as the "More About Gray Whales" and "What's This?" features of the Whale Watcher Game to answer the following questions.

Migration start point: _____

Migration end point: _____

Length of migration route: _____

Name of surrounding ocean basin: _____

Reasons for migration: _____

Reason for low numbers of gray whales in the 1800s and early

1900s: _____

Gray Whale Behavior Data Sheet

BEHAVIOR	Describe the behavior.	Why is this behavior helpful to the whales?	Draw a picture of the behavior.	Give one additional interesting fact.
Mating (Level 1)				
Social behavior (Level 1)				
Rubbing (Level 1)				
Blowing (Level 2)				
Nursing (Level 2)				
Fighting orcas (Level 3)				
Swimming in kelp (Level 3)				
Spyhopping (Level 4)				
Feeding (Levels 4 and 5)				
Breaching (Level 5)				

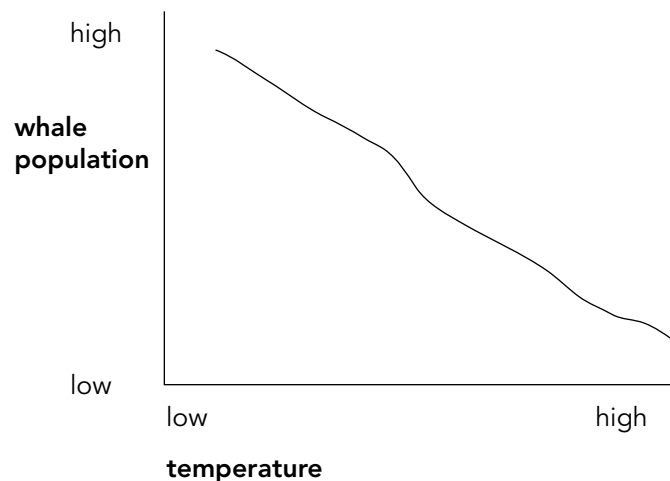
Migration Threats Data Sheet

THREAT	Why is this a danger to the whales?	Can whales avoid it? If so, how?	What can people do to help?
Whale-watching boats (Level 1)			
Ship traffic (Level 2)			
Fishing nets (Levels 2 and 4)			
Chemicals and pollution (Level 2)			
Orcas (Level 3)			
Sonar (Level 4)			
Global warming (Level 5)			
Ice (Level 5)			

Reporting Data

Directions: Once you have fulfilled your volunteer duties and collected the proper data, please answer the following questions on a separate sheet of paper and submit with all of your data sheets to your Volunteer Supervisor.

1. Describe the gray whale migration: Where do the whales migrate to and from and why?
2. What do you think would happen to a whale that did not exhibit the behaviors you filmed? List a possibility for each behavior, for example: "If a whale did not rub its skin on the bottom of the ocean floor, it would _____."
3. Which threat do you think is the most dangerous to the migrating whales? Why?
4. Draw a possible food chain from the animals you encountered in the game.
5. According to the following (fictitious) graph, how does rising ocean temperature affect gray whales? Use your data to explain this connection.



6. Draw a comic strip from the point of view of a migrating gray whale calf. Describe the lagoons in Mexico, some of the behaviors you watch the adults exhibit, and the threats you and your mother run into along the trip. What do you wish humans would do differently to make your trip easier?

Game Background

In this game, the player takes on the role of an *Ocean Adventures* volunteer team member attempting to capture various gray whale behaviors on film. Along the way, various threats to whales pass by, and the player can pause to read more information about the threat, thereby garnering additional points. Each level has a goal number of behaviors to capture as well as a time limit in which to do so. Each level ends when the goal has been met; the player gets a bonus for time left on the clock. At the end of each level, graphics show the behaviors captured, with inset video to show each one. Additional graphics show whale threats encountered. Clicking any item brings up information about why it is a problem. In addition, clicking each item adds 50 points to the player's score, but only once per item per game, regardless of game level. (In other words, clicking an item twice does not result in 100 additional points.)

Assisting the players are hint balloons from Jean-Michel Cousteau that offer additional notice as to when the whale behaviors and threats will be encountered. Players can pause game play to click on these hints (which they must do to gather data for their data sheets) and score additional points. This information is also available at level changes if the player does not want to interrupt game play.

LEVEL 1

Baja California, Mexico: In the protected lagoons of Baja California, Mexico, mature gray whales meet to mate. Groups of whales gather to attract potential partners. The gray whale gestation period is 12 months, so females that became pregnant the previous year give birth in the warm waters here. These new mothers and their calves are last to leave the lagoons to head north, which gives the newborns as much time as possible to develop insulating blubber.

- Behaviors to collect: mating, social/friendly, rubbing
- Threats encountered: whale-watching boats

LEVEL 2

San Diego, California: The coast of southern California is one of the busiest shipping routes the gray whales encounter. Whales are forced to alter their routes to avoid the dangerous shipping traffic.

- Behaviors to collect: blowing, nursing
- Threats encountered: ship traffic, nets, chemicals/pollution

LEVEL 3

Monterey Bay, California: This stretch of coastline is one of the most dangerous parts of the migration due to the threat of orcas. Orcas are among the gray whale's few natural predators, teaming up to attack young calves and their mothers.

- Behaviors to collect: fighting orcas, swimming through kelp
- Threats encountered: orcas

Game Background

LEVEL 4

Depoe Bay, Oregon: not every migrating gray whale swims the entire journey. Between 200 and 300 whales coming from the Baja lagoons make their seasonal homes along the coast between California and southeast Alaska. Researchers also believe that a small population of grays live permanently at points along the coast and don't make the migration at all.

- Behaviors to collect: spyhopping, feeding
- Threats encountered: nets, sonar

LEVEL 5

Bering Sea, Alaska: At last the gray whales have reached their final destination. Most whales have lost about a third of their body weight along the journey. Here, they will feed until the changing daylight hours, cooling temperatures and dwindling food supply tell them it's time to head south again.

- Behaviors to collect: breaching, feeding
- Threats encountered: global warming, ice

Answer Key

Migration Data Sheet Answers:

Migration start point: *Magdalena Bay, Mexico*

Migration end point: *Bering Sea in Alaska*

Length of migration route: *Approximately 12,000 miles*

Name of surrounding ocean basin: *Pacific Ocean*

Reasons for migration *Warm waters of Mexico good for calving; plenty of food available in the cold waters of Alaska*

Reason for low numbers of gray whales in the 1800s and early 1900s: *Almost hunted to extinction*

Gray Whale Behavior Data Sheet Answers

BEHAVIOR	Describe the behavior.	Why is this behavior helpful to the whales?	Draw a picture of the behavior.	Give one additional interesting fact. (Answers will vary; samples are given below.)
Mating (Level 1)	High-speed chases, lunging, bow waves.	Keeps the species going.	Answers will vary.	Maturity between 5 and 11; 12-month gestation period; calves are about 1,250 pounds and 15 feet long.
Social behavior (Level 1)	Hanging out in groups of three to 16; calls, moans, rumbles, growls, knocking.	Safety (not stated in game).	Answers will vary.	Varied.
Rubbing (Level 1)	Whales rub skin on rocks and gravel at the bottom of the ocean.	Scratches itchy skin and helps to remove lice and barnacles.	Answers will vary.	A single whale can have 1,000 pounds of barnacles and sea lice.
Blowing (Level 2)	Misty air shoots out of two blowholes on the top of their head.	Lets them breath.	Answers will vary.	Whales can hold their breath for 15 minutes; they breathe faster when nervous.
Nursing (Level 2)	Calves nurse from mothers for many months.	The high fat content in the milk helps calves gain blubber to stay warm.	Answers will vary.	Gray whale milk is 53 percent fat; mothers can lose up to 16,000 pounds while nursing.
Fighting orcas (Level 3)	Fight for their life; mothers use their bodies as shields to save their calves.	If they don't fight back, they will die	Answers will vary.	Packs of orcas attack together.
Swimming in kelp (Level 3)	Swim through thick kelp beds in Monterey.	Hide from orcas; find a mid-migration snack.	Answers will vary.	Orcas can't swim through the kelp very well.
Spyhopping (Level 4)	Poking their heads out of the water.	A way for whales to see what is going on at the surface of the water.	Answers will vary.	Some whales can hold half of their bodies out of the water for 15 to 30 seconds.

Answer Key

Gray Whale Behavior Data Sheet Answers

BEHAVIOR	Describe the behavior.	Why is this behavior helpful to the whales?	Draw a picture of the behavior.	Give one additional interesting fact. (Answers will vary; samples are given below.)
Feeding (Levels 4 and 5)	Roll to one side, suck in sediment and water from the bottom of the ocean, push it out through their baleen plates, and lick the critters off the baleen with their tongues.	Get nourishment.	Answers will vary.	Gray whale tongues can weigh up to 2,000 pounds.
Breaching (Level 5)	Leap out of the water and land with a big splash.	May serve as communication or to help dislodge barnacles and lice.	Answers will vary.	Most common when whales are hanging out in groups.

Answer Key

Migration Threats Data Sheet

THREAT	Why is this a danger to the whales?	Can whales avoid it? If so, how?	What can people do to help? (Answers will vary; samples are given.)
Whale-watching boats (Level 1)	Boats travel too close to whales; whales change speed and direction, messing up their migration routes.	Many travel out of their way to avoid the boats.	Whale-watching companies can follow regulations and stay 100 yards away from whales.
Ship traffic (level 2)	Collisions with ships can injure or kill whales; breathing rates increase; mothers and calves are separated; ship noise can confuse or deafen whales.	Hard to avoid because the ships are so much faster than the whales.	Boats can travel slower and avoid migration routes.
Fishing nets (Levels 2 and 4)	Nets can trap and drown whales.	Hard to avoid because nets are miles wide with hundreds of hooks.	Discontinue discarding nets in the ocean; make a better effort to clean up discarded nets.
Chemicals and pollution (Level 2)	Chemicals enter the whales' body when they eat plankton that has already absorbed the toxins; makes it difficult for whales to fight infections; have trouble reproducing.	No way for whales to avoid.	Be vigilant about not polluting the ocean and waterways.
Orcas (Level 3)	Gray whales are part of the orca's food web; orcas hunt the gray whales.	Some whales stick closer to the coastline, where fewer orcas hunt.	
Sonar (Level 4)	Noise created by ships may harm whales' hearing, disorient them and lead to beach strandings.	No way for whales to avoid.	Be very careful about using harmful types of sonar within the range of the whales.
Global warming (Level 5)	Warming ocean temperatures causes a loss of amphipods, the whales' main food source.	No way for whales to avoid.	Lessen impact on global climate change
Ice (Level 5)	Ice can trap late-leaving whales, eventually drowning them.	Leaving the Bering Sea at the proper time.	N/A

Reporting Data Answers:

1. Migration takes place between Baja California, Mexico, and the Bering Sea in Alaska. Whales migrate to the warmer waters to mate and give birth, then return to the colder waters of Alaska for the plentiful food.
2. Answers will vary. Students should have a possible scenario for each threat encountered.
3. Answers will vary.
4. Amphipods/mysid shrimps → gray whales → orca whales
5. Rising temperature results in fewer amphipods which then results in fewer gray whales.
6. Answers will vary.