



MINNESOTA ZOO®

CLIMATE CHANGE OCEAN TREK

A SELF-GUIDED TOUR FOR MIDDLE AND UPPER LEVEL STUDENTS.

WELCOME TO THE CLIMATE CHANGE OCEAN TREK

This TREK was developed for middle and upper level students to use at the Minnesota Zoo in order to examine how human actions have affected many aspects of marine life and understand methods for reducing human impacts on the oceans.

Students can find the answers to pages 4 -11 throughout Discovery Bay. Pages 12-14 can be answered back in your classroom using the information gathered during the field trip.

If you need assistance in locating something Zoo staff and volunteers can help.

We are meeting together at the Minnesota Zoo for _____.
(lunch or program)

Meet at _____ at _____.
(location) (time)

The bus will be leaving at _____.
(time)

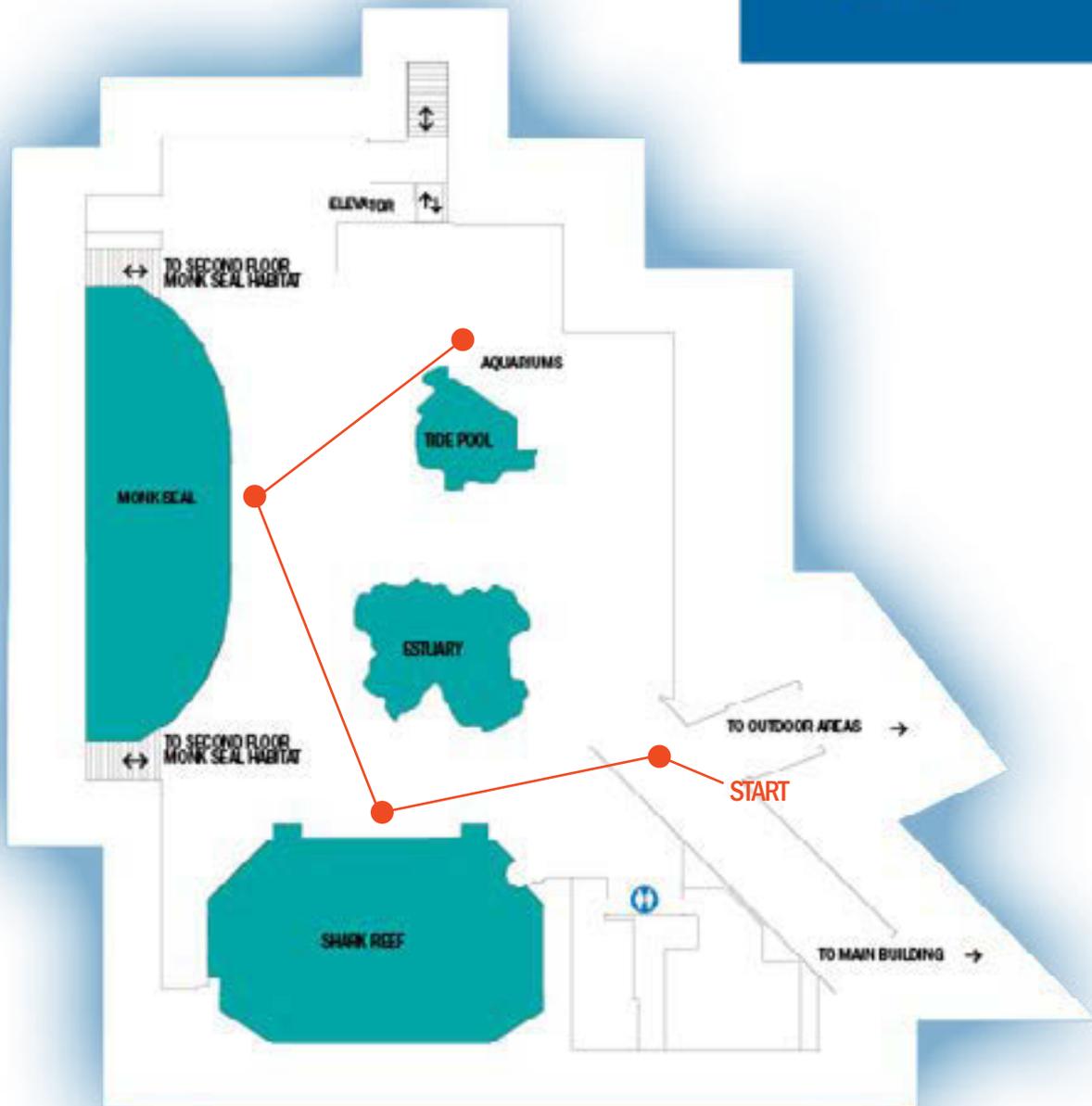
Meet at _____ before we depart.
(location)

Other reminders:



DISCOVERY BAY MAP

DISCOVERY BAY:
UNITED HEALTH
GROUP MARINE
EDUCATION
CENTER



DISCOVERY BAY

WELCOME TO THE OCEAN

Directions: You will either use the exhibits or graphics found in Discovery Bay to answer the questions on these pages. Start at the entrance to Discovery Bay before proceeding to the Shark Reef, Hawaiian Monk Seal Habitat, Living Reef Exhibit and finally the graphics behind the Tide Pool. Either fill in the blanks or give short answers.

Before proceeding, the oceans are incredibly important for humans. Can you list 3 things we use oceans for?

- a. Food
- b. Transportation
- c. Recreation



The oceans make up around 70% of the surface of the Earth and

possibly could contain more than 2 million marine species.

SUSTAINABLE FISHERIES

Sharks: Amazing Apex Predators, Delicacy or Demise?

1. How many years ago did the first sharks start swimming in the oceans?

400 million



2. Why are sharks more vulnerable to population loss from fishing and loss of habitat than other species?

Sharks reproduce slowly and need estuaries and mangrove forests for their young to live in.

3. How do top predators help create a healthy ecosystem?

Sharks eat fish that harm coral reefs.

4. What is the one big threat sharks are facing?

Capture.

5. What can we do to conserve large marine predators?

Choose better managed sustainable fish that are lower on the food chain, like herring and sardines.

SUSTAINABLE FISHERIES

Sharks, Jacks and Groupers

6. List three interesting characteristics, either physical or behavioral, about the Goliath grouper.

a.

(answers can include any of the following)

b.

very large-weigh 400 -700 lbs and 8 feet in length, eat large prey, grow slowly, reproduce slowly, don't travel far from territory; stay in one spot.

c.

7. What is significant about the Goliath grouper population in the 1970-80's?

Crashed to very low numbers. Fish became critically endangered.

8. Is there a connection between your answers to question 6 and 7? YES or NO (circle)
Explain why or why not.

They were desirable fish because of their size, easy to catch because they didn't move far, and aren't able to reproduce fast enough to recover the population loss.

9. In the exhibit tank, look for either a shark, jack or the Goliath grouper. Sketch one of them in detail, label what it is and the human activity that can hurt their survival.

Depending on what they sketch.

Shark-shark finning

Jack-coastal development or shortage of prey (due to commercial fishing)

Grouper-Fishing for them.

Saving Sea Turtles

In the Shark Reef we have two different species of sea turtles; a green and a Kemp's ridley. Both turtles cannot be released back into the wild.

10. Find a Zoo volunteer or staff member. Ask them what happened to the turtles out in the ocean. Write down the answer below. Could this type of injury be avoided? How?

Both our sea turtles were boat strike victims. The green was struck on the back (shell) and now has permanent buoyancy issues-called bubble butt. The Kemp's ridley was struck in the head and has permanent brain damage. Yes, this type of injury can be avoided by observing the surface of the ocean for turtles and reducing the speed of the boat. Both will allow to avoid a collision with the turtles.

11. In the chart below, identify three threats to sea turtles and possible solutions to those threats.

Threat to sea turtles	Possible solution to threat
1. <p style="text-align: center;">Illegal hunting</p>	1. <p style="text-align: center;">Pass laws, enforce laws, beach monitor</p>
2. <p style="text-align: center;">Bycatch</p>	2. <p style="text-align: center;">Create escape hatches for turtles</p>
3. <p style="text-align: center;">Floating plastic</p>	3. <p style="text-align: center;">Opt for no plastic use</p>

HUMAN IMPACT



Hawaiian Monk Seals

Found only in the waters surrounding the Hawaiian Islands, the monk seals are highly endangered.

12. Write down three adaptations the monk seals have and the benefit to their environment.

Trait	Benefit
Streamline shape	Move swiftly through water
Flippers	Steering
Teeth	Eat crustaceans and fish
Claws	Grooming and scratching an itch
Protective eye cover	Diving
Close nostrils	Diving
Whiskers	Finding prey

13. How many monk seals are estimated to be left?

1000

14. Identify two threats to their survival?

a.

(answers can be any of the following) Predators on pups, Diseases, Fishing hooks/lines, Human disturbance.

b.

15. What is the most vulnerable time for a Hawaiian monk seal and why?

Their 1st year of life. The pups are weaned at 6 weeks and left to fend for themselves. They often become prey to large sharks and/or starve to death.

OCEANS AND A CHANGING CLIMATE

Stony Corals

The ocean, and all of its living inhabitants, have adapted perfectly to a certain set of temperatures, seasons, and rhythms. Unfortunately, a series of rapid changes are occurring to the ocean, and many of the species are struggling to adapt and survive.

16. Take a few minutes to observe the living reef exhibit. Using tally marks, count the number of different kinds of marine species you see. *Be sure to look in the rock crevices.*

This number will vary but it should be over 25 if they are looking long and hard.

17. What are the three biggest threats to coral reefs?

a.

(answers can be any of the following)
Warm temperatures, rising sea levels, acidic
ocean waters, diving and collecting corals

b.

c.

18. To the right of the living reef exhibit is a smaller aquarium with small coral rock fragments. After reading what its purpose is, how could this technique help the reefs?

This is taking fragments of live rocks from reefs that are broken off, and raising them as separate pieces. They can then be planted back on a reef or in a new area to start anew.

OCEANS AND A CHANGING CLIMATE

Corals-Sensitive Animals

Corals require specific environmental conditions in order to survive. They are very sensitive to any changes in their environment. Corals cannot move to a different location thus leaving them extremely vulnerable to these small changes and they suffer.

19. The major threat to the world's coral reefs is called ocean acidification.

It is when fossil fuels like coal and gas

are burned and they release excess carbon dioxide into the atmosphere.

The oceans absorb some and it changes the chemistry.

Changing the ocean chemistry reduces calcium carbonate found in the ocean.

Sea creatures, like corals, need it to build skeletons and shells

otherwise they get thin and brittle.

This matters because these animals are the base of the food chain. It would affect the other animals, the

reefs and humans too.

OCEANS AND A CHANGING CLIMATE

Coastal Ecosystems

20. What is happening to the ocean temperature?

Warming (rising)

21. What are two threats when this happens?

a.

(answers can be any of the following) Rising water levels, unwanted invaders, stress on the oceans, glaciers melting.

b.

22. In your opinion, the ocean expanding or glaciers melting, which one do you think leads to a greater rise in sea level? Why?

Answers will vary. Check for valid answers to their opinions.

23. The oceans are heating up and their chemistry is changing. What is the most effective way to prevent additional stress on the ocean climate system?

Reducing use of fossil fuels.

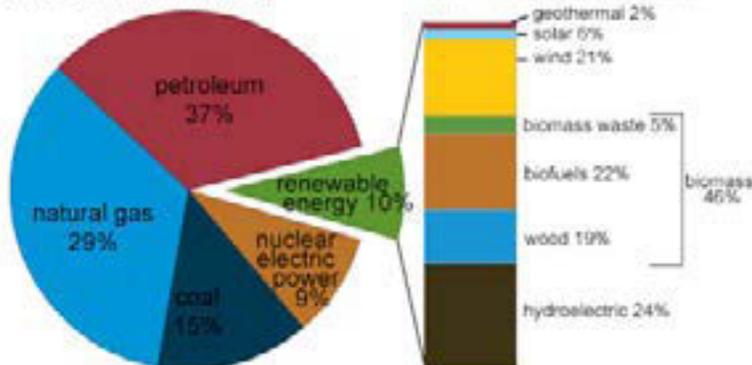
APPLICATION QUESTIONS

Great job with the Climate Change Ocean Trek! It's time to take all of that knowledge and apply it to real work scenarios.

1. Fossil Fuels include coal, petroleum, and natural gas. Review the pie charts below and list three things YOU can do to reduce your fossil fuel consumption. **Answers will vary but should be in line with the following:**
 - a. Reduce use of petroleum which includes: driving less, using less plastics and other petroleum based products.
 - b. Increase use of natural resources like solar, wind, and renewable energy.
 - c. Encourage business/companies to reduce energy waste or support companies that do.

U.S. energy consumption by energy source, 2016

Total = 97.4 quadrillion British thermal units (Btu)



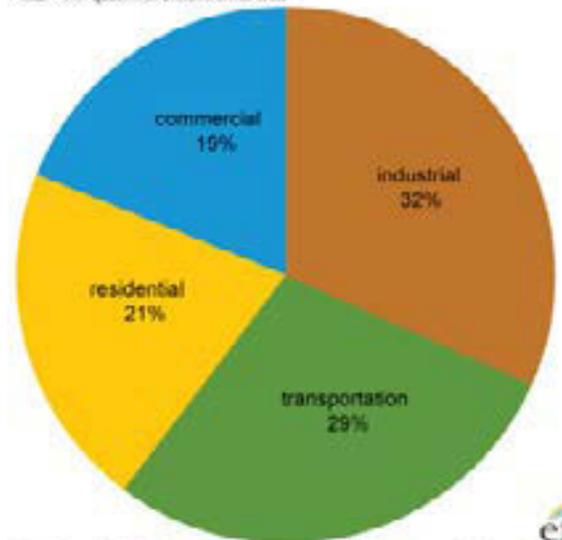
Note: Sum of components may not equal 100% because of independent rounding.

Source: U.S. Energy Information Administration, Monthly Energy Review, Table 1.3 and 10.1, April 2017, preliminary data



Share of total U.S. energy consumed by end-use sector in the United States, 2016

Total = 97.4 quadrillion British thermal units



Note: Sum of individual percentages may not equal 100 because of independent rounding.

Source: U.S. Energy Information Administration, Monthly Energy Review, Table 2.1, April 2017, preliminary data



APPLICATION QUESTIONS

2. Think about if the sea level rises one meter worldwide, how would that affect us in Minnesota?

Answers may vary. Real affects include changes in our weather/climate, influx in our population, food resources may be limited, recreation areas (beaches) won't be there to vacation at, etc.

3. Do an internet search for the percentage of the world's population that lives within 100 km (62 miles) of a coastline.

What does it say? 40%

Think about where those animals and people would go if the ocean level rises.
Does this change your answer in how it would affect us in Minnesota?

Answers will vary. Check for valid answers.

APPLICATION QUESTIONS

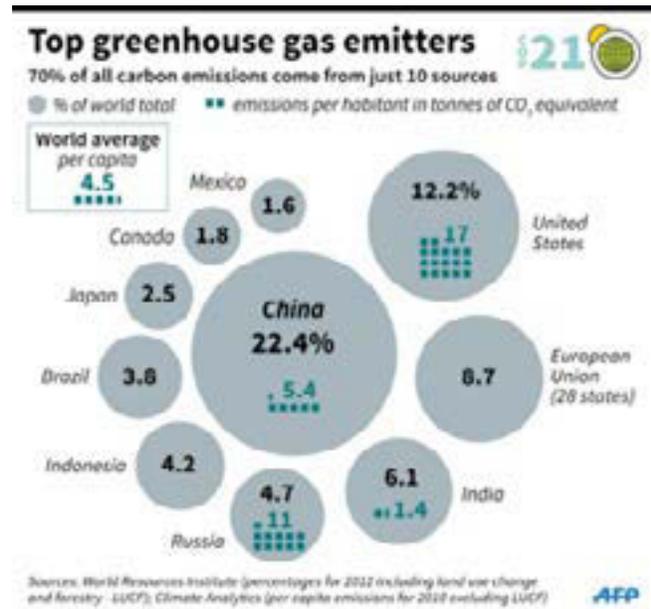
Look at the figure below to answer the following questions.

4. Which countries are the top greenhouse gas emitters?

China and U.S.

Why do you think this is?

They have the largest populations.



b. The top three populated countries in the world are China, India and the United States, respectively. Look at the emissions per habitant for those three countries. Who should bear the most responsibility for limiting greenhouse gases and why?

U.S. We are 3rd in world population but 1st in emitting more greenhouse gases/capita.

c. Who will suffer the most from the ocean climate change? Which people and which animals? Will this have a direct effect on YOUR life?

Answers will vary. Check for valid answers.