| **Indiana Dunes****Education** | National Park ServiceU.S. Department of the Interior**Indiana Dunes National Lakeshore****Education Department** | National Park Service Logo |
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**Lake Michigan Alive**

**Summary:**

Learn the history and significance of Lake Michigan and how it affects our lives. Experience the predator/prey relationships of the lake. Discuss how man’s influence has affected this relationship and what we can do about it.

**Objectives:** students will be able to

1. Describe basic geography and statistics of the Great Lakes.
2. 2. List and explain exotic species or pollutants. Explanations could include how they arrived stressing the human influences, what effect exotics or pollutants have, and what we can do about them.
3. State the natural and economic importance of Lake Michigan in their own words.

4. Demonstrate a predator/prey relationship process of bio-magnification and correlate this tohuman impact 

 **Setting:**

This year-round program will take place indoors at the Douglas Center for one hour. If a visit to the lake after the one hour indoor program is desired, then the program will last one and one half hours. If the recommended trip to the lake is presented, then the buses will have to be ready to take the group and the rangers to the lake after the one hour indoor program. There is little hiking involved in this program.

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**Grade:**

Aimed at 4th grade; will accommodate other grades.

**Ratio of students to ranger:**

30 to 1 unless staffing is limited; then the groups will be larger.

**Safety Issues:**

No apparent safety issues present. There will be no swimming during program.

**Background Information:**

Lake Michigan is why we’re here!

There would be no Indiana Dunes if it wasn’t for the powerful lake that has been depositing and eroding the sand that forms our beaches for the past 15,000 years.

Lake Michigan supports the industries that support our economy and the thousands of families that lived in Northwestern Indiana and the Chicago area.

The lake is also a fragile ecosystem housing many different organisms from microscopic plankton to large fish.

Human influence and activity such as pollution and introductions of non-native species of plants and animals have a detrimental effect on the life within and around the lake.

Our program stresses the importance of the lake not as an isolated ecosystem but as it relates to the landforms and populatios that surround it.

 Geography:

\*The Great Lakes are also known as the “Inland Seas” creating the nation’s “third coast”. \* Contain 1/5th of all the Earth’s standing fresh water; with 10,000 miles of shoreline.

\* The last major change to the Great Lakes occurred about 3,500 years ago.

\* Eight states and one Canadian province border the Great Lakes.

\* The lakes cover more than 95,000 square miles, an area larger than New York and Pennsylvania put together.

\* The five lakes and their connecting waterways stretch 2,342 miles from Kingston, Ontario at the eastern tip of Lake Ontario to Duluth, Minnesota, at the western edge of Lake Superior.

\* The Great Lakes were formed a mere 14,000 years ago.

Lake Michigan:

\* the 3rd largest of the Great Lakes and 6th largest lake in the world.

\*only Great Lake totally in the US.

\*307 miles long from straits of Mackinac to the shores of Indiana.

\*118 miles across from WI to MI.

\*average depth is 279'.

\* Maximum depth = 923’ (281m) near Manistee, MI; 2nd deepest.

\*connected to other Great Lakes via Lake Huron through the straits.

\*Lake Huron and Lake Michigan are biologically considered one lake because they are at the same sea level and connected.

\*Lake Huron/Michigan is 581' above sea level and 20' below Lake Superior and 10' above Lake Erie.

\*produces iron ore, steel, limestone, and grain and farm products

\*10 areas of concern.

\*water entering the lake will stay there for 99 years because water enters and exits through the same path.

\* Width = 60 to 110 miles.

\* Elevation 581’ above sea level.

\* Area = 22,300 square miles or 58,000,000,000 m.

\* Volume = 1,180 cubic miles or 1300 trillion gallons (4,900,000,000,000 m).

 Lake Superior:

\*world’s largest freshwater lake by surface area.

\*deep and cold.

\*least polluted.

\*sparsely populated.

\*surrounding natural resources include timber, metals and recreation.

\*supplies US with 97% of world’s iron ore.

\*water entering the lake will stay there for almost 500 years.

\*estimated that 95% of persistent toxic substances enter lake from air.

\*7 Areas of Concern.

\* the largest freshwater lake in the entire world.

Lake Ontario:

\*slightly smaller in area than Lake Erie but much deeper, holding four times the amount of water.

\*eight areas of concern.

\*water entering the lake stays there for six years.

\* the smallest of the Great Lakes.

Lake Erie:

\*nine Areas of Concern.

\* resources include glass and steel production.

\*water entering the lake stays there for 3 years.

\* the shallowest of the Great Lakes.

\* Welland Canal helps ships go around Niagara Falls; has 40 locks; raise or lower ships 326 feet.

Lake Huron:

\*2nd largest of the Great Lakes and 5th largest lake in the world.

\*major resources include: salt, copper, silver, uranium, and the world’s largest limestone quarries.

\*4 Areas of Concern.

\* water entering the lake stays there for 22 years.

\* the only lake that connects to more than one Great Lake. Detroit and the St. Clair Rivers; Straits of Mackinac; St. Mary’s River.

\* Erie Canal, 363 miles long, bypasses St. Lawrence River between Buffalo and Albany, New York.

\* St. Lawrence Seaway built in 1959.

\* Soo locks allows travel between Lake Huron and Lake Superior.

St. Lawrence River:

\*870 miles long; 110 of these miles is in the US.

\* six tributaries nearly double the river’s flow, from its beginning as it leaves Lake Ontario to it’s outflow into the Gulf of St. Lawrence

Ecology:

\* Aquatic food chains are long compared to terrestrial ones: phytoplankton – zooplankton 🡪smelt🡪 herring🡪 perch🡪salmon.

\* In the lake water animals are long lived and plants are short lived. \* Chinook eat alewives exclusively. Lake Trout and Coho Salmon will switch if needed.

 Human History:

\* “Discovered” by the French in 1535 by Jacques Cartier. Huron first, then Superior, Michigan, Ontario, and Erie. Iroquois Indians guarded Lake Erie.

\* The first ‘ship’ on the Great Lakes was the Griffin in 1679.

\* Cities making up the region are Hammond, Gary, East Chicago, and Whiting.

 Industrial Uses and Consequences

\* 5 steel mills located within the Calumet Region. Cities making up the region are Hammond, Gary, East Chicago, and Whiting. \* An important ingredient for making steel is iron ore. Northern Minnesota and Wisconsin are known for their large deposits of iron ore.

\* If you drop pollution in Lake Michigan, it will take approximately 99 years to filter itself through and get out. Lake Superior will take about 200 years and Lake Erie about three.

\* Pollution comes from air this is the main pollution source as direct fallout from the atmosphere, sediments, tributaries.

\* Pollution becomes more concentrated over time.

\* There are 10 Areas of Concern along Lake Michigan. Each Area of Concern needs a Remedial Action Plan or RA.P

A Sample of Great Lake Exotics

1. Zebra Mussels

2. Ruffe

3. Spiny Water Flea

4. Eurasian Water Milfoil

5. Sea Lamprey

Exotic Sea Lamprey

\* Can live both in fresh and salt water, native to Atlantic though.

\* Found in all 5 great lakes; greatest concentration is in Lake Huron.

 young lamprey are produced in lake tributaries; many streams run into Lake Huron

\* Mechanical and electronic barriers are being built into Great Lakes tributaries

collapsed Lake Trout, Whitefish, and Chub populations in 40’s and 50’s

\* Welland Canal completed in 1829 and improved in 1919 and consequently lampreys spread to Lake Erie

\* In 1938 they entered Lake Superior by being attached to ships going through the locks on St. Mary’s River

\* Can consume 40 pounds of host fish in its lifetime

\* Adult lives for 18 months

**Fish Species in Lake Michigan**

Lake sturgeon Sea Lamprey

Alewife- Lake whitefish

Bloater- ^Blackfin cisco

^Deepwater cisco ^Shortjaw cisco

^Longjaw cisco ^Kiyi

^Shortnose Cisco ^Lake herring

Round whitefish Lake trout

Brook trout- Rainbow trout

Brown trout Chinook salmon

Coho salmon- Northern pike

Carp- Emerald shiner

Spottail shiner Longnose sucker

White sucker Channel catfish

Bullheads- Trout-perch

Burbot- Ninespine stickleback

Smallmouth bass Yellow Perch

Walleye -Freshwater drum

Slimy sculpin Fourhorn sculpin

Spoonhead sculpin Rainbow smelt ^ endangered

**History of Lake Michigan Timeline**

Time Event

12,ooo yrs. B.P. **GLENWOOD STAGE**

B.P. = before present Glacial Lake Chicago is formed.

10,000 yrs B.P. **CALUMET STAGE**

Lake level is 40 ft. above present level.

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8,000 yrs B.P.-  **TOLLESTON STAGE**

\_\_\_\_\_Chicago plain is formed.

 Post-glacial to late 1700’s Native American groups seine, net and spear fish from a relatively “pristine” lake

Early 1800’s Advent of a commercial fishery on Lake Michigan. Exploitation of streams, then near shore environment, then gill nets and hand lining in open water.

1825 Completion of the **Welland Canal** connecting Lake Ontario and Lake Erie.

1. **Erie Canal** completed connecting Hudson River and Lake Ontario; later connecting Lake Ontario with Lake Erie.

Introduction of the pond net.

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1870’s Commercial fish catch declines 50% from 1855 level.

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1840’s – 1900 **Lake Sturgeon** population is depleted close to extinction.

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1. **Carp** are introduced into Illinois. They establish themselves in Lake Michigan in 1890’s. **Chicago Sanitary & Ship Canal** constructed.

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1. **Goldfish** escape from World’s Fair and establish themselves in Lake Michigan.

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1900’s Population of Blackfin Cisco decline – after 1950 they disappear completely.

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1912 – 1920 Smelt is introduced into the Lake Michigan basin.

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1913 – 1934 Welland Canal enlarged. (It was probably at this time. 1913, that the sea lamprey made the passage.)

1921- The Sea Lamprey is reported in Lake Erie.

1. **Alewife** reported in Lake Erie.
2. Advent of **Sea Lamprey** into Lake Michigan. 1951 Lake trout fishery is wiped out by the sea lamprey and commercial fishing pressure. Burbot and whitefish populations are also reduced by the lamprey.

1950’s – 1960’s During the 1950’s alewives double their numbers yearly. During the 1960’s massive alewife die-offs occur. Alewives out compete other fish populations so that by 1970’s close to 90% of fish in Lake Michigan are alewives. Species affected include the emerald shiner, lake herring, yellow perch, “chubs” and whitefish.

1. St. Lawrence Seaway completed – increase shipping in Lake Michigan.
2. Introduction of coho, Chinooks, Lake trout and other salmon varieties to reestablish a predator population. Commercial fishing is greatly reduced while sport fishing gets an upsurge.

1960’s – 1970 Cultural eutrophication results in local “blooms” of Cladorphora.

**Prerequisite Classroom Activities:**

Before your visit to Indiana Dunes National Lakeshore, please take a moment to read through the information listed below. We suggest that you do one or more of the described activities with your class in order to prepare them for the lessons and experiences they will have during their field trip. A list of vocabulary words has been provided to prepare students for their visit.

If there is a special topic or area that you want the ranger to cover during the presentation, plese contact the park’s scheduling office, and every effort will be made to accommodate your request.

1. Look at a drop of lake, pond or stream water under a microscope. Discuss the importance of microscopic organisms in all bodies of water; where do they fit on the food chain?
2. Have the students write a story as if they were a fish living in Lake Michigan. What would they see, do and eat?
3. Water entering a lake mixes with the water already there in the lake.

It takes a very long time for substances that enter the lake to wash out; about 3 times longer than their fillling times. Questions to ask your students:

\* If you poured a cup of oil into Lake Superior, how long would it take for it to wash downstream of Lake Superior?

\* How long would it take to completely wash through the Great Lakes and out of Lake Ontario?

\* What does this tell you about pollutants entering the lakes?

Recycling Times for the different lakes.

Superior =180 years

Michigan=99 years

Huron =23 years

Erie =3 years

Ontario =8 years

1. A captain of a sailing ship knows it is 50 miles to port. The wind is blowing 40 mph. When the captain’s sails are full, he can travel 40 mph. Will he make it to port before the storm arrives in 3 hours. What would you do? Gamble with the storm or run to the nearest shelter?
2. Connect the flags of countries capable of sailing into the Great Lakes from their home port to the Port of Indiana on a world map.
3. Five steel mills are located within the Calumet Region. Cities making up the region are Hammond, Gary, East Chicago, and Whiting. An important ingredient for making steel is iron ore. Northern Minnesota and Wisconsin are known for their large depositis of iron ore.

7) Imagine you are an ore boat captain based in Superior, Wisconsin. You have been hired to pickup a load of iron ore at a port in Duluth, Minnesota and deliver it to the Port of Indiana. Use a ruler or other straight edge to chart the course you will take on your map of the Great Lakes.

 Through which lakes and locks do you travel?

The Soo Locks close on December 15 and do not re-open for business until April. Think about its location and give one reason why you think these locks close for four months every year.

1. You are a sailor on an ocean-freighter. On this journey, your ship unloaded steel slabs at a steel mill in Indiana. When you reach the entrance to the St. Lawrence Seaway you decide to write a letter to a friend in Arizona. Your friend does not know much about the Great Lakes, so you should describe your trip through the Great Lakes in detail. Tell your friend about each of the lakes and all the locks you go through. Your friend does not know about how locks are used in the Great Lakes, so describe why a lock is used and how it works. If you want to do extra, you can also write about other details of your trip such as weather you experience or some of the cities you pass along the way.

 As you enter the Port of Indiana, a towboat comes to help push your boat, the Lady Lee along side the dock. A crane unloads the steel slabs you have delivered.

 Congratulations, you have successfully completed your mission!

1. Choose an organism in our Lake Michigan Alive word list activity and research it. Answer several questions about it; such as: Is it native or exotic? Is it harmful, helpful or neither? Can we get rid of it if we want to?

 How did it get in the lake in the first place?

10) Role Playing on Ways we use the Great Lakes. Assign a student to each role listed below and let them tell you why they think the lakes are important to their lives.

*Farmer Frank* (Agriculture)

The main products are wheat, corn, soybeans, barley, and oats.

The Lake Michigan area contains the most farmland and is a leading grower of vegetables and fruits. Cheeses and other milk products come from WI

The Lake Erie region raises pigs, sheep, soybeans, wheat, and chicken corn

The Lake Huron basin is world’s biggest produces of navy beans while the

Lake Superior region is a forest product producer.

*Freddie the Fisherman* (Fishing)

The Great Lakes is an important resource for fish, a food resource for both people and wildlife. Species include whitefish, yellow perch, lake trout, salmon, chub, white bass, and carp. Lake Erie’s walleye pike fishery is considered to be the best in the world.

*Samantha the Shipper* (Shipping)

The shipping has been responsible for the development of the entire Great Lakes Region. This natural transportation system helped with exploration and settlement, including trade and transport of goods. Today shipping is a major industry. Iron ore from Lake Superior area is shipped to the mills of Chicago, Cleveland, and Gary to be made into steel. This steel is then shipped to Detroit to be made into cars. Some of the products transported are coal, limestone, grain, newsprint, cement. The St. Lawrence Seaway helped the shipping to become an international transportation route.

*Mary the Manufacturer* (Manufacturing)

Manufacturing industries are attracted to the Great Lakes area because the water source provides cheap electricity and convenient transportation routes. Major industries include the steel mills (located in the southern end of Lake Michigan, and in Detroit, Cleveland, and Lorain, Ohio); the paper mills (located in the upper Great Lakes), the chemical manufacturers (located on the Niagara River and the Saginaw Bay in Lake Huron and the automobiles (located in Detroit).

*Tommy Tourist* (Tourism and Recreation) Tourism and recreation are also major industries. For example, in Ottawa County, Ohio the regular population of 40,000 increases to 250,000 during the summer weekends. Marinas, restaurants, and stores have been built in popular areas. Over 60 million people each year visit the 98 state parks and the 12 national parks in the United States not to mention Canada’s tourists.

Start with the Ice Age Geology of the Glacier Carving out our Lake Michigan.

This activity brings out the concept of the shoreline fluctuation that Lake Chicago grew and shrunk many times.

\* Have students stand and represent the following: moraine, glacier, water line, water. \* Have glacier drop off debris for moraine and melt and fill new lake. As it melts and finds new drainage, some water moves out. Have glacier grow and take back some water and area, melt again, have glacier melt back and uncover the soil. Be sure to show fast water level changes everytime a new drainage develops.

12) Study the different Lake Eras. This activity involves having the students research and provide three things that should be done during the next 10 years to help the lake.

\* Voyageurs, fur trapping

\* Industrial age; increase shipping use; harvest and pollution

\* Using for a dump,

\* using power to harvest fish

\* Man removing natural barriers

\* Building of canals, movement of living things quickly between water zones

\* Aliens affecting natural balance

\* Human realizing mistakes

\* Setting standards to stop pollution

\* Controls to stop the advance of aliens

\* Trying to reverse mistakes made

( Planning for the future)

**Vocabulary:**

Exotic - plants and animals introduced from another country or region

Adaptation - adjustment to environmental conditions; an adjustment of a sense organ to the degree or quality of stimulation; a change in an organism or its parts that fits it better for the conditions of its environment

Pollution - to make impure; to spoil (as a natural resource) with waste made by humans

Glacial - of, relating to, or produced by glaciers; of, relating to, or being any of those parts of geologic time when a large portion of the earth was covered by glaciers (a large body of ice moving slowly down a slope or valley or spreading outward on a land surface)

Biological - relating to biology or to life and living things.

Bio - Magnification – the act of to enlarging in fact or in appearance.

Food Chain - a series of organisms in which each uses the next usually lower member of the series as a food source.

**Illinois Content Standards:**

The following is a list of the learning standards which the Lake Michigan Alive program at Indiana Dunes National Lakeshore will assist you in fulfilling. Please realize that every program is unique, based on the students’ abilities, weather factors and time, and not all of these standards may be articulated. This listing is meant as a guideline for you as an educator. You may want to conduct activities in your classroom to strengthen certain goals and standards, and our program may only briefly cover certain elements of the standards. There are many other curriculum standards which this program could also assist you in fulfilling, however, these identified provide the most obvious links between our program and your curriculum objectives.

**Science State Goal 12 understand the fundamental concepts, principles and interconnections of the life, physical and earths pace sciences.**

**B. Know and apply concepts that describe how living things interact with each other and with their environment.**

**12.B.2a** Describe relationships among various organisms in their environments (e.g. predator/prey, parasite/host, food chains and food webs).

**12.B.2b** Identify physical features of plants and animals that help them live in different environments (e.g. specialized teeth for eating certain foods, thorns for protection, insulation for cold temperature).

**E. Know and apply concepts that describe the features and processes of the world and its resources.**

**12.E.2b** Describe and explain short-term and long-term interactions of the world’s components (e.g. earthquakes, types of erosion).

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**Science** **State Goal 13 Understand the relationships among science, technology and society in historical and contemporary contexts.**

**B. Know and apply concepts that describe the interaction between science, technology and society.**

**13.B.2e** Identify and explain ways that technology changes ecosystems (e.g. dams, highways, buildings, communication networks, power plants).

**13.B.2f** Analyze how specific personal and societal choices that humans make affect local, regional and global ecosystems (e.g. lawn and garden care, mass transit).

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**Social Science Goal 15**

**Understand economic systems, with an emphasis on the United States.**

**D. Understand trade as an exchange of goods or service.**

**15.D.2a** Explain why people and countries voluntarily exchange goods and service. **Social Science Goal 16**

**Understand events, trends, individuals and movements shaping the history of Illinois, the United States and other nations.**

**E. Understand Illinois, United States and world environmental history.**

**16.E.2c (US)** Describe environmental factors that influenced the development of transportation and trade in Illinois.

**Social Science Goal 17 Understand world geography and the effects of geography on society, with an emphasis on the United States.**

**B. Analyze and explain characteristics and interactions of the world’s physical systems.**

**17.B.2b**  Explain how physical and living components interact in a variety of ecosystems including desert, prairie, flood plain, forest, tundra.

**C. Understand relationships between geographic factors and society.**

**17.C.2a** Describe how natural events in the physical environment affect human activities.

17.C.2c **Explain how human activity affects the environment**

**Extension or Follow- up Activities:**

After your field trip, the following activities can enhance what was taught during your field trip experience.

Class reflection paper or writing sample:

Ask each student to write a short essay, letter or story about what they learned on their field trip to Indiana Dunes National Lakeshore. Rangers love receiving mail from their students. Send the ranger the packet of essays from your class (or a copy of them), and your ranger will send your class a certificate from the dunes. Send your essays to:

Indiana Dunes National Lakeshore

1100 N. Mineral Springs Road

Porter, IN 46304

Attn: Your ranger’s name or just Education Department

If you are using this essay as a class assignment for a grade, we would like to suggest that each essay contain the following elements. Use the rubric below to score them.

The name of the park and the location of their field trip—for example: Douglas Center, Indiana Dunes National Lakeshore

Three facts they learned on the field trip about Lake Michigan.

\* A brief explanation of why Indiana Dunes is unique and therefore a national park.

\* At least two things the student can do to help take care of his or her national park.

\* Fill in the blank of this statement and provide an explanation:

I would like to learn more about \_\_\_\_\_\_\_\_\_\_ at Indiana Dunes.

\*\*\*For advanced groups, add the following element:

Tell the park rangers if you would like to bring your families and friends to the dunes and if so what would you do here and where would you go.

Assessment :

**Grading for Class reflection writing assignment:**

1. **Writing and organization**- ***4 points*** the writing sample is very well written and organized by the elements provided. It has a strong introduction, middle and conclusion. ***3 points*** the writing sample is well written and organized by the elements provided. It includes an introduction, middle and conclusion. ***2 points*** the writing sample is choppy and is not well organized. It lacks an introduction or conclusion. ***1 point***the writing sample is very short and unorganized.
2. **Grammar & Spelling-** ***4 points*** Mistakes in spelling and grammar are minor or non-existent. ***3 points*** Mistakes in spelling and grammar are minimal—about 4-5. ***2 points*** mistakes in spelling and grammar are numerous—5-10. ***1 point*** mistakes in spelling and grammar are more than 10.
3. **Facts and content**- ***4 points*** the writing sample demonstrates the student’s learning on the dunes program and includes three or more facts provided by the park staff. ***3 points*** the writing sample demonstrates the student’s learning and includes only two facts provided by the park staff. ***2 points*** the writing sample does not demonstrate much learning and only includes one fact provided by the park staff.***1 point*** the writing sample does not demonstrate any learning and does not include any facts provided by the park staff.
4. **National Park Service theme** - ***4 points*** the writing sample clearly demonstrates the student’s understanding of the role of the NPS in preserving the dunes by explaining why Indiana Dunes is such a unique treasure.***3 points*** the writing sample mentions the NPS and its role in preserving the Indiana Dunes. ***2 points*** the writing sample mentions the NPS and Indiana Dunes. ***1 point*** the writing sample does not mention anything about the NPS or its role at Indiana Dunes.
5. **Stewardship-** ***4 points*** the writing sample lists three things the student can do to assist in taking care of the Indiana Dunes. ***3 points*** the writing sample lists two things the student can do to assist in taking care of the Indiana Dunes. ***2 points*** the writing sample lists one thing the student can do to assist in taking care of the Indiana Dunes. ***1 point*** the writing sample does not list anything about what the student can do to take care of the Indiana Dunes.