

US Department of the Interior
National Park Service



Gateway

Gateway National Recreation Area
Jamaica Bay Unit
New York

Is Dead Horse Bay Dead or Alive?



**Gateway National Recreation Area
Jamaica Bay Unit**

EXPERIENCE YOUR AMERICA™

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Introduction

Dear Teacher:

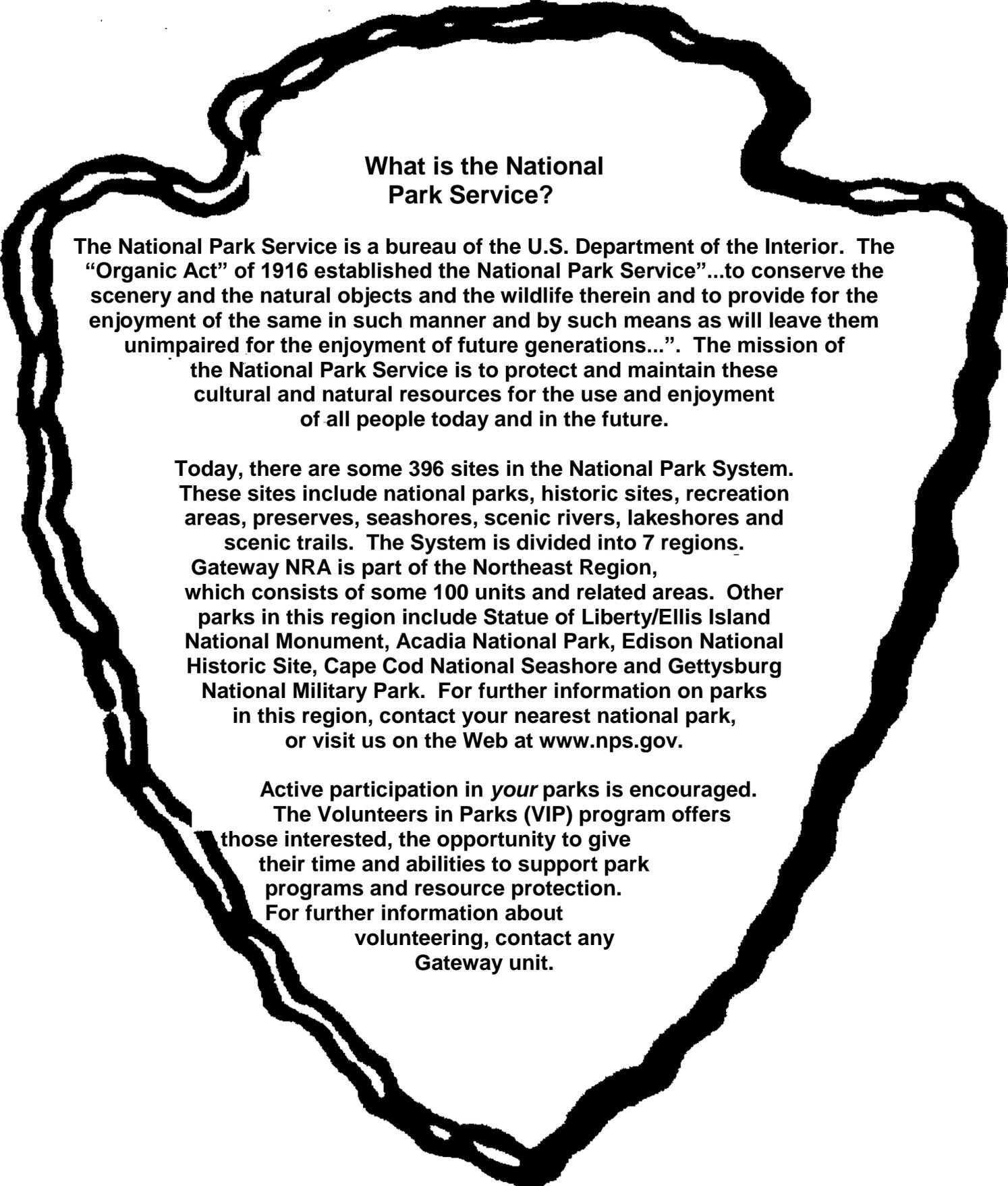
Gateway National Recreation Area and the staff of the Jamaica Bay Unit are pleased to welcome you to Dead Horse Bay. The information in this guide is designed to acquaint you with Dead Horse Bay prior to your visit so that you and your students can make the most of your experience.

Dead Horse Bay is a place for the wondrous exploration of a unique stretch of upland trails, beach, and salt marsh. The mission of the National Park Service is to preserve and protect the natural and cultural resources within the park. Education plays a vital role in the accomplishment of this objective. Our hands-on approach to environmental education is interdisciplinary. We strongly encourage you to include all subjects into your pre-visit and post-visit lessons. It is extremely important that you and your students relate the field trip experience to the classroom and home/school environment.

The guided group consists of outdoor activities based on observation and exploration of Dead Horse Bay. Special activities designed to meet your specific goals can be included in the program. Requests of this kind can be made well in advance of your class visit.

Our primary goal is to activate children's natural sense of wonder and to educate them about their environment. Most importantly, for the students to understand that all citizens must act as stewards of these resources and play an active role in their preservation and protection. With your help, we can achieve this goal and instill a feeling of kinship with the natural environment.

Gateway National Recreation Area
Jamaica Bay Unit



What is the National Park Service?

The National Park Service is a bureau of the U.S. Department of the Interior. The “Organic Act” of 1916 established the National Park Service”...to conserve the scenery and the natural objects and the wildlife therein and to provide for the enjoyment of the same in such manner and by such means as will leave them unimpaired for the enjoyment of future generations...”. The mission of the National Park Service is to protect and maintain these cultural and natural resources for the use and enjoyment of all people today and in the future.

Today, there are some 396 sites in the National Park System. These sites include national parks, historic sites, recreation areas, preserves, seashores, scenic rivers, lakeshores and scenic trails. The System is divided into 7 regions.

Gateway NRA is part of the Northeast Region, which consists of some 100 units and related areas. Other parks in this region include Statue of Liberty/Ellis Island National Monument, Acadia National Park, Edison National Historic Site, Cape Cod National Seashore and Gettysburg National Military Park. For further information on parks in this region, contact your nearest national park, or visit us on the Web at www.nps.gov.

Active participation in *your* parks is encouraged.

The Volunteers in Parks (VIP) program offers those interested, the opportunity to give their time and abilities to support park programs and resource protection. For further information about volunteering, contact any Gateway unit.

Dead Horse Bay Curriculum based program

Gateway National Recreation Area offers urban students, in grades 4-8, and teachers the unique opportunity to experience and observe a variety of habitats. An understanding of our local ecosystems will inspire young learners to foster an ecological awareness of the importance of local and global ecosystems. Exposure to the rich diversity of organisms and the complex relationships found at Dead Horse Bay will enable students to formulate questions, investigate environmental phenomena, and take action to preserve and improve our environment.

Each activity is interactive and provides “hands-on, minds-on learning” for your students. Through the inquiry-based activities, students have the opportunity to generate questions and design investigations that begin with observations and lead to questioning, research, and experimentation.

The Dead Horse Bay program gives students the opportunity to collect information from the field, take measurements, make observations, and use technology to begin their investigation of local habitats. Back in the classroom students can pursue answers to their questions through further research, evaluate their findings, and generate new questions for further inquiry.

The lesson is correlated to the grades 4-8 Science Scope and Sequence. Copies of the on-site activities will be discussed and distributed separately during the teacher workshop. (At the end of this section, grade by grade correlations are listed.)

New York City Curriculum Connections: Grades 4-8 Science **Scope and Sequence**

Grade 4

Unit 1: Animals and Plants in their Environment

Discuss:

- Non-living and living elements
- Members of the ecosystem- Roles they play in their environment (Plankton)
- Plants- utilizing air, water and energy from the sun (Turbidity)
- Interdependence

Variations in species allow certain species to survive (Mummichog vs. Atlantic Silverside Fish→Survival of the Fittest!)

Environmental factors and the movement of organisms in their environment, effects on health, growth, and reproduction

Unit 3: Properties of Water

Different substances and ability to mix with water

Dissolved gases experiment

Unit 4: Interactions of Air, Water, and Land

Ocean meets river→ Dead Horse Bay

- ◆ Erosion
- ◆ Water Cycle
- ◆ Ground Water
- ◆ Seasonal Changes
- ◆ How does water sustain life?

Grade 5

Unit 1: The Nature of Science

- ❖ Formulate questions of scientific inquiry, create hypotheses:

Is Dead Horse Bay Dead or Alive?

Hypothesis formed

- ❖ Employ tools to gather and analyze data:

Use of water quality equipment to find out

- ❖ Create explanations using evidence:

Complete data sheet with explanations to the student's findings

Creating posters of their work, and relaying it to fellow students

- ❖ Identify dependent or independent variables.

Unit 4: Exploring Ecosystems (Focus: the forest → connect to marine ecosystem)

Marine vertebrates and invertebrates (What do they need to survive?)

How do organisms obtain energy?

Identify species that are in competition with one another.

Human Impact on Ocean:

- Look at what has washed up on shore? Who would/ can live here?
- Ocean Pollution
- Habitat destruction
- Over fishing
- Aquaculture

General skills: follow safety procedure, use of instrument tools (stopwatch, graduated cylinder, thermometer), use of appropriate units, recognize and analyze patterns and trends, use indicators and interpret results and identify cause-and-effect relationships.

Grade 6

Unit 2: Weather

- Precipitation
- Hydrosphere and atmosphere interactions
- Tides! Why is the water so close? (Connection to Marine Invaders Program)
- Weather
- Humidity and temperature

Unit 3: Diversity of Life

- What makes something alive?
- Food chains and food webs
- Exchange of energy → energy flow (sun, plants, oxygen, organisms)
- Role of producers (plants)

Unit 4: Interdependence

- Symbiotic relationships among animals (Discussion of algae and nitrification and parasites)
- Factors affecting growth and development of animals including humans

General Skills: Safety lab procedures, sequence events, identify cause-and-effect relationships, use of tools, classifying living organisms based on certain characteristic, using a magnetic compass, given the latitude and longitude; indicate its position on map.

Grade 7:

Unit 2: Chemistry and Physics

- Temperature and its effect on solubility

Unit 4: Dynamic Equilibrium: Other Organisms

- Sun- How do plants in water get their energy from the sun? What do plants need in order to complete photosynthesis? How is the sun used?
- Obtaining energy and nutrients
- Responding to external environment

General Skills: Use of tools (Balance, graduated cylinder, thermometer, spring scale, voltmeter), Use of appropriate units, Safety lab procedures, sequence events, identify cause-and-effect relationships, use of tools, classifying living organisms based on certain characteristic, using a magnetic compass, given the latitude and longitude, indicate its position on map, determining density, determine an unknown substance (mysterious salt in water)

Grade 8:

Unit 1: Reproduction, heredity, and Evolution

- Natural Selection
- Competition

Discussion of Mummichogs and their survival in drastic environments

Unit 3: Earth, Sun, Moon System (Connection to Marine Invaders Program)

- Phases of the Moon

Effects on tides (Low tide and high tide)

Balanced and unbalanced forces of motion

Unit 4: Humans in their Environment: Needs and Tradeoffs

- Human impact vs. natural causes
- Habitat destruction

Packaging and Solid Waste (Dead Horse Bay- a garbage dump)

- Depletion of Resources

Renewable/ non-renewable resources

Importance of water- the “so what” of these tests

- Global Warming
- Acid Rain
- Pollution
- Energy

General Skills: All skills mentioned above

TRIP INFORMATION

Travel Directions

Refer to the map of Gateway National Recreation Area.

From Manhattan, Brooklyn and Queens: Take the Belt Parkway to exit 11S, Flatbush Avenue South. Proceed south on Flatbush Avenue approximately one mile to the traffic light before the bridge. Turn left at the light into Floyd Bennett Field. Make the second left onto Ranger Road. Follow along until reaching the Ecology Village sign on the left, make left down the drive-way to the Ecology Village parking lot.

From the Rockaways: Take Beach Channel Drive to the Marine Park Bridge. Cross the bridge and make a right at the first traffic light onto Floyd Bennett Field. Follow the above directions.

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Bus Permit for the Belt Parkway

A bus permit is required by all buses to travel the Belt Parkway. The issuance of a permit is subject to restrictions due to construction schedules. If you intend to use the Belt Parkway to reach Gateway NRA ask the administration of your school for the proper transportation permit

Program Information

When you and your class arrive at Floyd Bennett Field the park ranger will greet the class at the Ranger Station parking lot. The park ranger and the class will continue walking to the trailhead of Dead Horse Bay where the program will begin. You should plan to arrive at 10am and expect the program to be two hours in length.

If you have any questions about the information in this packet or the event of inclement weather on the morning of your trip please feel free to contact us at (718) 338-4306, Monday-Friday, 8:30-5:00

Gateway National Recreation Area



THINGS TO REMEMBER

Preparation

1. The success of your visit depends on how well you and your class are prepared.
2. To enable the ranger to make the trip more personal for each student, have them wear name tags.
3. Discipline and control of the group are the responsibility of the teacher. The class must stay together as a group.
4. Please have one chaperone per every 8-10 children.
5. Please discuss the rules with your class before the trip

Dress

1. The trail is usually windier and colder because it is near the shore, so please dress accordingly
2. We suggest layered clothing: hats and gloves in cool weather, hat and sun protection in warm weather.
3. Casual clothes should be worn: long pants, long sleeve shirts and closed sturdy walking shoes, boots or sneakers. **No sandals**

Safety Rules

1. Review the tick information bulletin included in this packet with your students. Pant legs should be tucked into socks to keep ticks out. Periodically check for ticks that may be clinging to clothing or skin. Check yourselves again for ticks before boarding the bus. Remind the students not to walk into any grassy or bushy areas because they more likely to come into contact with ticks.
2. Poison Ivy grows throughout Gateway. During the growing season the shiny leaves are in groups of three. Many people are allergic to the oils of this plant. Wash hands with soap and water after contact with poison ivy.
3. Please do not eat any plants or berries you find along the trail. Plants may look attractive and edible but they could make you sick.
4. The program is held outdoors, so please have the students' dress accordingly.
5. Pieces of wood containing nails and beach debris such as broken glass and metal objects are often being washed ashore. Please have the students avoid contact with these materials.
6. Students at all times must keep their shoes on.

Collection

1. The collection of plants and animals (dead or alive) is prohibited in federal lands.
2. Please leave only footprints and take only memories

Things to Bring

1. First Aid Kit
2. Insect Repellant
3. Bring along items to explore the trails of Dead Horse Bay such as: binoculars, hand lens, field guides, small notebooks, and camera.

Lunch

1. There is no place to purchase food. Students should bring their own food and beverages.
2. Lunches must be left on the bus during the program.
3. The picnic gazebo at Ecology Village is available for the groups to use after the field trip.
4. Bathrooms are available at Ecology Village for after the field trip, please inform the students of this information because the program begins on arrival.

HISTORY

Strange as the name may sound, Dead Horse Bay is an area rich in cultural and natural history. Dead Horse Bay is located at the southern end of Flatbush Avenue, north of the Gil Hodges/Marine Park Bridge, northeast of the Rockaway Inlet. The earliest known inhabitants of the Jamaica Bay area were the Canarsie Indians. The Native Americans fished and harvested abundant shellfish found in these waters. During the seventeenth century Dutch settlers moved into the area, and it was during this time that tidal mills appeared on the bay. These mills utilized the power derived from the changing tides to grind wheat into flour. One cannot help but notice the one remaining millstone along the trail that bears its name.

From the middle of the nineteenth century to the early twentieth, the former Barren Island, now Floyd Bennett Field, was the site of numerous factories which manufactured fertilizers from the remains of dead animals. Later, fish oil produced from the menhaden caught in the bay was used in tanning leather, mixing paint, and making rope for ships. When the menhaden became scarce Barren Island became a landfill for the disposal of New York City's garbage.

In 1928, the shallows around Barren Island were filled in to create Floyd Bennett Field, New York City's first municipal airport, making the island part of the Brooklyn mainland. The deteriorating pilings and pieces of wooden dock at the shore of Dead Horse Bay are what remains of old ferry slips. Ferries were the means of transportation to and from the Rockaways prior to the construction of the Gil Hodges/marine Park Bridge.

As industry, landfill, and development altered the land the ecosystem changed. Filling in the shallows cut some of the flow of water between Jamaica Bay and Dead Horse Bay. This and similar changes that have occurred in and around the bay have contributed to the slowing down of the natural flushing of the bay. Acres of salt marsh that remove certain contaminants and provide nurseries for marine life have been drained and filled. Landfill leachate and road run-off contributes to the pollution of the bay, as well as other factors. Although the water quality has improved over the years, efforts must continue to ensure the protection of the bay. There is still much work to be done.

NATURAL RESOURCE INFORMATION

BEACH

DEFINITION: The shore of an ocean or bay, seashore.

GENERAL DESCRIPTION

As you approach the beach from the Millstone trail, notice the salty scent of the air. Looking south, you will see the Rockaway peninsula and to the west the remains of the former docks that would have been destroyed long ago if this beach was not protected by the Rockaway peninsula, a barrier beach. These beaches protect the land that lies behind them, receiving the brunt of storm wind and waves, thereby forming a barrier to the mainland, in this case, Brooklyn's south shore.

Sand, small pebbles and broken shells make up the beach substrate at Dead Horse Bay. A line of beach wrack usually lies on the upper beach marking the last high tide. Beach wrack may contain seaweed, pieces of wood, the remains of marine animals and other floatable material.

PLANTS AND ANIMALS

As you step off the trail and onto the beach, look at the gradual change in vegetation. The closer you get to the beach the fewer the plants you will encounter. The plants and animals of the shore are all adapted to their life in the harsh, salty marine environment. The upper beach is submerged only during high tides and is inhabited by microscopic plants and animals (plankton) living in the water and between the sand grains. The area above the upper beach is where American beach grass, little blue stem, and Virginia creeper grow. These plants have root systems called rhizomes that enable them to anchor securely in loose sand and to absorb fresh water.

The lower beach is always under water. It supports a variety of marine life, such as tiny amphipods, clams, crabs and snails. At Dead Horse Bay, it is possible to find periwinkles on pilings, mud snails, horse crabs and spider crabs, all of which are common to Jamaica Bay and the Rockaway Inlet.

Animals are usually secretive, we may never see them, even though they are present somewhere nearby. Insects and birds are somewhat conspicuous. They are some of the easiest animals to observe.

Several species of birds live at the beach year-round, such as the herring gull and ring-billed gull. It is very likely that you will see them during your trip. There are many other species that only frequent this area for a brief time, as they pass through during migration.

Two summer residents that may be seen feeding on small fish from late April to September at Dead Horse Bay are the least tern and common tern. In New York State, the least tern and the common tern are threatened due to loss of habitat. Some pairs nest at the beach at Breezy Point at the eastern tip of the Rockaways. This nesting area is protected through the efforts of the National Park Service and volunteers.

HUMAN IMPACT

Floatable materials, such as, bottles, plastics, and wood often litter the beach. These items are carried sometimes many miles from their place of origin. This litter may be due to people, industry, and nautical accidents. Plastic bags, balloons, loose fishing line, pieces of fishing net and six-pack loops are hazardous to marine life. Fish, turtles, birds, and seals can sometimes be trapped and drown due to free floating netting, fishing line, and six-pack loops. Plastic and rubber objects that can be swallowed and become lodged in the airway of sea turtles, birds and seals can cause them to suffocate. If these objects become lodged in the stomach the animal will starve.

Problems have arisen due to the massive quantities of waste that is produced and must be disposed of daily. Communities throughout the United States are implementing recycling/reuse programs. We can help by recycling and discouraging litter at home, at school and in our community. By addressing the solid waste problem in this manner our beaches will hopefully become cleaner in the future and result in a cleaner environment for all.

DUNES

DEFINITION A mound or hill formed by the deposition of sand from waves, currents, and wind.

DESCRIPTION

The dunes lie above the beach, beyond the Phragmites dominated upland. The dunes at Dead Horse Bay are small and not as dramatic compared to those of ocean beaches along the Atlantic coast. You may barely notice them, but these small dunes undergo accretion and erosion in the same manner as other dunes and the plants and animals of this habitat are typical of dune communities elsewhere on the east coast.

ECOLOGICAL IMPORTANCE

Dunes build slowly over time as sand is deposited. They become moderately stabilized by grasses and other plants. The plant roots anchor the sand in place, aiding the building process. The first dunes to form are called primary dunes. Once established, secondary or back dunes can form. Dunes are very fragile. Even a narrow path over a dune can cause rapid erosion. A break in the dune line exposes the plants to salt spray and storm flood tides.

Dunes and barrier beaches are constantly changing due to the natural process of accretion and erosion of these sand formations. Without dunes beaches rapidly erode. At the western edge of Dead Horse Bay, there is an eroding sand bank/dune edge. The sand is being moved by wind and water action from the inlet, exposing the old landfill underneath the bank. Think of the effects a hurricane could have on the coastal areas of Brooklyn, Queens, and Long Island without the protection of barrier beaches.

PLANTS AND ANIMALS

As you walk up from the beach toward the primary and secondary dunes, notice the gradual increase in plant variety. Hardy plants, such as beach grass and poison ivy, anchor themselves in the shifting sand by deep, spreading roots called rhizomes. These pioneer plants can tolerate the salt spray, harsh sun, low moisture and poor soil quality of a primary dune. These plants hold the sand and enrich the soil as they die and decay. Over time, the soil will support other plants such as, sea rocket, seaside goldenrod, and the fragrant beach rose.

Eventually, plant succession will progress to the point where pioneer shrubs, such as, bayberry, and trees, such as, wild black cherry are able to grow. Provided succession continues, a forest community will someday be reached. The process is evident in the upland trails where vast stands of phragmites, the giant reed grass are dwarfed by a few large trees.

Ants, spiders, and various insects commonly live in the dune. These and other animals either feed on the plants or on other animals. Meadow voles, white footed mice, cottontail rabbits, common yellowthroats and song sparrows eat plants, seeds, and insects. The northern harrier (marsh hawk), a bird of prey, eats voles, mice, rabbits, and birds.

HUMAN IMPACT

Dunes are threatened naturally by wind, waves, and fierce storms. The dunes at Dead Horse Bay are no exception. Visitors pose a threat to dune communities by walking and climbing on them. Dune building is extremely slow and the pioneer plants must be protected. Please, “keep off the dunes” to avoid trampling the important plants and grasses. On some beaches, wooden snow fencing is erected as a physical barrier which also helps to hold the sand in place. Kindly respect the fragility of this area by walking on the trails and open beach areas. It is up to all of us to be stewards of the environment and protect our natural resources.

SALT MARSH

DEFINITION The land and water behind the barrier, at the edge of the bay subject to the rise and fall of the tides.

DESCRIPTION

A small salt marsh lies on the northeastern edge of Dead Horse Bay, adjacent to the marina. The marsh is best observed at low tide. When the salt marsh cord grasses are exposed, the marsh emits a rich briny odor.

ECOLOGICAL IMPORTANCE

Of all the world’s ecosystems, the salt marsh is the most productive. Phytoplankton (minute, free floating, aquatic plants) grow in abundance and are the basis of the marine food web. Scientists estimate that phytoplankton is responsible for the production of 80% of the earth’s atmospheric oxygen.

Salt marshes are spawning sites for countless species of marine animals. Salt marshes play a critical role in controlling beach erosion and modifying the effects of coastal storms. The plants of a salt marsh have the natural ability to absorb certain pollutants from the water. We are now beginning to realize the massive loss of resources that accompanies the destruction of a salt marsh, once common along our coasts. Fortunately, there are still a few salt marshes remaining in the Rockaway inlet and Jamaica Bay, of varying sizes. The small salt marsh at the western end of the Dead Horse Bay is an excellent example of a salt marsh habitat in miniature.

PLANTS

The most important species of this habitat are salt marsh cord grass, Spartina alterniflora, which grows in clumps at mid tide level and salt meadow cord grass, Spartina patens, growing at higher ground. These grasses have the ability to remove excess salt from their tissues. Look along the leaves for tiny salt crystals that have formed where the plant oozed a drop of salt laden water. The grass provides cover for young fish and shellfish so they mature into adulthood. At the root/soil interface, mussels attach in order to remain anchored so they can feed and grow.

ANIMALS

Crabs, mussels, and horseshoe crabs can be seen along the edge of the salt marsh and at the base of the salt marsh cord grass stems. Empty shells and crab molts are often there too.

Wading birds like the great egret, snowy egret, great blue heron, and black crowned heron hunt for fish in the tide pools from spring to autumn. Oystercatchers and glossy ibis search for tiny mussels and other protein rich foods in the marsh. During the winter, brant geese and several species of ducks feed and rest here.

HUMAN IMPACT

Over the past three hundred years, extensive marshlands have been drained and filled throughout the United States. During the 1930's it was proposed that all marshland of Jamaica Bay should be filled. Fortunately, that proposal was not carried out. Today, these marshes are protected by law.

Erosion from excessive wave action (and possibly siltation) is the biggest threat to the marsh now. Marshes are of vital importance to breeding marine organisms and their developing young. Marshes are an integral part of natural flood control and the earth's water cycle. In order to retain the benefits, marshes must be protected from future development and maintained as the natural, functional systems.

Background Information for Teachers

Water quality

The students will be performing water quality tests at Dead Horse Bay. This includes dissolved oxygen, salinity and pH. Dissolved Oxygen is crucial for aerobic organisms to survive. Low dissolved oxygen can occur because of high temperatures, because of increased nutrients in the water or because of a lack of turbulence.

Temperature is influenced by the seasons and the climate. Since water warms slowly but holds heat, seawater can often have warm temperatures in the cooler fall weather and cooler temperatures in the warming spring temperature. High temperatures can cause low dissolved oxygen levels.

Salinity will measure the amount of salts in the water. This level will change according to recent rains, inflow from creeks and streams and turbulence.

pH measures the acidity of the seawater. Most species of fish are adapted to slightly alkaline pH and will suffer if the pH drops too low. pH is affected by the dissolved nutrients and minerals, buffering of local rock, precipitation and pollution.

Key Words:

Abiotic, Anemometer, Biotic, Density, Ecosystem, Estuary, Habitat, Hydrometer, ppm, Temperature, Thermometer, Salinity, Turbidity, Water, Water quality, Wetland

Plankton

The students will observe and identify plankton under microscopes. Plankton are plants (phytoplankton) and animals (zooplankton) that either float in the ocean currents or have limited swimming abilities. The size of plankton varies widely. Plankton can be microscopic and single-celled while others may be 20 inches or more across. Some resemble animals such as shrimp while others look mysterious and alien.

Phytoplankton are major photosynthesizers in the ocean and are mainly responsible for providing a rich food supply for zooplankton and other plant-eating animals.

Phytoplankton provide oxygen to the ocean environment, through photosynthesis.

Zooplankton can be microscopic or can be much larger, such as a jellyfish. Many marine species begin their lives as zooplankton; the larvae of crabs, lobsters, fish, sea stars, etc. look very different from their mature relations. They grow by eating plankton and eventually change into their mature forms capable of swimming or floating on the bottom of the sea floor. Together, zooplankton and phytoplankton form the basis of the ocean food web.

Key Words

Biodiversity, Diatom, Food chain, Food Web, Niche, Plankton, Plankton net, Phytoplankton, Seine net, Zooplankton

Pre-Trip Activity- I Love My Thumbs!

Aim: The power of observation to confirm or reject a hypothesis.

Objectives: After completing these activities, students will be able to:

- Create a hypothesis
- Confirm or reject a hypothesis based on observations and data analysis
- Use data to identify adaptations

Background Information on the Scientific Method and Adaptations:

The pre-trip activity will help the students' practice creating and testing a hypothesis. The scientific method is a way to ask and answer scientific questions by making observations and doing experiments. The steps of the scientific method are to:

- Ask a question
- Do background research
- Construct a hypothesis
- Test your hypothesis by doing an experiment
- Analyze your data and draw a conclusion
- Communicate your results

By completing the experiment you will be proving whether the hypothesis (an educated guess) is true or false. With each thumb activity the students experience the concept of adaptation. Using your thumb to achieve basic tasks is very simple, but if you take the thumb out of the equation it becomes difficult. The activities encourage the students to adapt to different scenarios. Animal species must also learn to adapt to their changing environment in order to survive. Survival involves escaping predators, reproducing, and finding food, water and shelter.

Preparation: The five thumb activities will prepare the students, on how to follow self-guided directions. Divide the class into cooperative groups of 5-7 students, depending on the size of the class. Out of the five, the teacher will pick a recorder, to record all the results on the activity sheet. The rest of the group will be observers. It is important that everyone in the group work together. If time allows, the teacher will rotate the recorder job within the group. This will give each student the opportunity to do the activities and be the recorder. These groups will work together in **both** the *I Love My Thumbs!* activity **and** *Is Dead Horse Bay Dead or Alive?* activity. **These groups should remain the same for the indoor (school classroom) and outdoor activities (Ecology Village Camping Program).**

Key Words:

Adaptation, Scientific Method, Hypothesis, Observation

On Site Activity-Is Dead Horse Bay Dead or Alive?

Aim: To construct and test a hypothesis by conducting an experiment.

Objectives: Students will be able to answer the question of whether DHB is healthy (alive) or unhealthy (dead) based on the data and observations made in the field.

Materials

- Thermometer
- pH kit
- Dissolved oxygen kit
- Turbidity Tube
- Instant Ocean Hydrometer
- Pitcher
- Anemometer
- Instruction Booklet
- 5lb Bucket
- 30ft Seine Net

On Site Activity:

1. In the park classroom the students will get an introduction to the program and they will create a hypothesis.
2. Distribute the test kits and measurement tools to the groups of 5-7 students. Have the students use the tools in the backpack as well.
3. The team must work together to complete the data sheet. The students need to follow the instructions in the water quality instructional booklet (found in the backpack).
4. Students create a hypothesis and record their results from the experiments on the **Is Dead Horse Bay Dead or Alive?** data sheet.
5. The rangers will collect the water and plankton samples for the groups. The rangers and the teachers will seine to be able to see what is living in the water. The students will test their hypothesis.

Chart Key:

■ Cannot Live
 ■ -Most Die
 ■ -Over 50 % die
 ■ → ■ -Survival Possible
 ■ → ■ 90-100% Survival

| Mummichog | | | |
|------------------------|-------------------------|----------------|----|
| Water Temperature (°C) | Dissolved Oxygen (mg/L) | Salinity (ppt) | pH |
| 0 | 0 | 4 | 1 |
| 5 | | 6 | 2 |
| 10 | | 8 | 3 |
| 15 | | 10 | 4 |
| 20 | | 12 | 5 |
| 25 | | 14 | 6 |
| 30 | 4 | 16 | 7 |
| 35 | | 18 | 8 |
| 40 | | 20 | 9 |
| 45 | | 22 | 10 |
| 50 | | 24 | 11 |
| 55 | | 26 | 12 |
| 60 | | 28 | 13 |
| 65 | 8 | 30 | 14 |

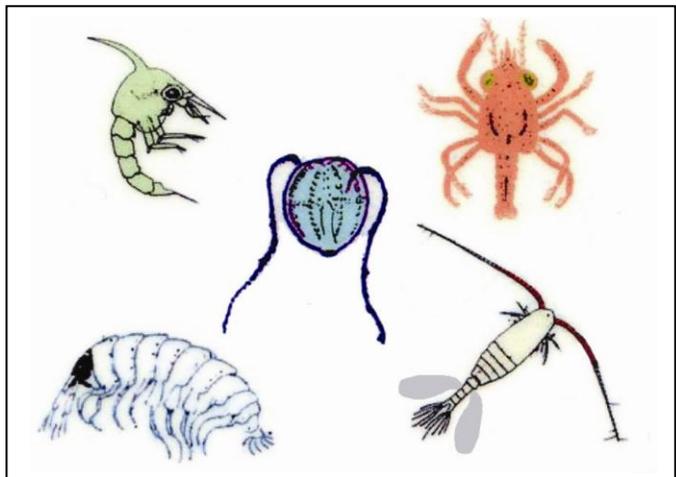
| Striped Killifish | | | |
|------------------------|-------------------------|----------------|----|
| Water Temperature (°C) | Dissolved Oxygen (mg/L) | Salinity (ppt) | pH |
| 0 | 0 | 4 | 1 |
| 5 | | 6 | 2 |
| 10 | | 8 | 3 |
| 15 | | 10 | 4 |
| 20 | | 12 | 5 |
| 25 | | 14 | 6 |
| 30 | 4 | 16 | 7 |
| 35 | | 18 | 8 |
| 40 | | 20 | 9 |
| 45 | | 22 | 10 |
| 50 | | 24 | 11 |
| 55 | | 26 | 12 |
| 60 | | 28 | 13 |
| 65 | 8 | 30 | 14 |

| Tautog | | | |
|------------------------|-------------------------|----------------|----|
| Water Temperature (°C) | Dissolved Oxygen (mg/L) | Salinity (ppt) | pH |
| 0 | 0 | 4 | 1 |
| 5 | | 6 | 2 |
| 10 | | 8 | 3 |
| 15 | | 10 | 4 |
| 20 | | 12 | 5 |
| 25 | | 14 | 6 |
| 30 | 4 | 16 | 7 |
| 35 | | 18 | 8 |
| 40 | | 20 | 9 |
| 45 | | 22 | 10 |
| 50 | | 24 | 11 |
| 55 | | 26 | 12 |
| 60 | | 28 | 13 |
| 65 | 8 | 30 | 14 |

Make a hypothesis predicting which fish you think you will find in the water. Based on the charts and your numbers, what fish will you find?

A Closer Look...

There are other organisms in the bay that help the fish to survive. They provide food and even oxygen for the fish. These tiny creatures are called plankton! Use your plankton net to catch the plankton and put them under your microscope. Circle the plankton you've observed.



Now.....

Is Dead Horse Bay Dead or Alive?

Post Trip Activity-Is Dead Horse Bay Dead or Alive?

Organize field data and field trip observations and then have students analyze their information. Set aside a day for teams to report on their scientific investigations.

Materials

Data sheets from Is DHB Dead or Alive? On Site Activity

The Field Trip Report

1. Have each student make a final data table that includes all of the site measurements. This should include water quality measurements, plankton observations and seining observations.
2. Have students construct a poster board describing their research and their findings. Answering the question "Is Dead horse Bay Dead or Alive".
3. Each report should:
 - a) State the hypothesis
 - b) List the factors that were measured
 - c) Include the final table with each teams' data highlighted
 - d) Compare data for each
 - e) Are there differences between the groups?
 - f) Discuss the differences and why they exist.
 - g) What conclusions can you draw from the data?
 - h) What else should be measured in the future or how would you change your techniques?
4. Students can compare their reports to reports from students in the past or from other areas to make inferences about differences in the environment.
5. Students can share their results with local marine biologists or scientists, the National Park Rangers or with other schools to create/maintain a database of research on Dead Horse Bay.

Example of a finished poster board

