Diet

2.1 Dinner Time

OVERVIEW
Students familiarize themselves with dolphin diet by investigating the type of foods that dolphins eat.

Driving Question
What do dolphins eat?

Objectives
• Students discover what kinds of food dolphins eat.
• Students familiarize themselves with dolphin dietary needs.
• Students understand why it is important to know what foods a dolphin prefers, realizing that information about dolphin diet helps researchers protect and conserve existing and future populations.

Time Required
One class period

Materials
• Student Handout: Dolphin Diet (page 127)
• Optional Student Handout: Reflections (page 129)

Teaching Notes
The diet of Atlantic bottlenose dolphins, such as those found in Sarasota Bay, Florida, and at Brookfield Zoo usually consists of a wide variety of foods, including mostly fish and squid. Adult dolphins may eat in excess of 30 pounds of food each day, or approximately 4% to 5% of their body weight in food per day, totalling an average of 14,000 kilocalories (Kcals). One Kcal equals 1,000 calories. A nursing mother’s daily intake is considerably higher: about 8%. Eighteen to 20% of a dolphin’s body weight is from blubber.

The foods available to dolphins varies with their geographic location. In Sarasota Bay, dolphins feed upon mullet, pinfish, pigfish, and spot. Interestingly, these are all soniferous fish—fish that make sounds!

Dolphins are selectively opportunistic feeders, meaning they eat some of the kinds of fish that are most available to them. Feeding behavior is also adapted to a dolphin’s habitat and the type of food available. Bottlenose dolphins often feed in association with fishing operations—dolphins in Texas bays, for example, frequently accompany shrimp boats, feeding on fish that are caught incidentally in trawl nets intended for shrimp.

The amount of fish they eat depends on the fish species on which they are feeding. Mackerel, for example, is a high-fat content fish. Therefore, they have a high caloric value. So to get the same energy intake (calories) dolphins need to eat much more if they feed on squid than if they feed on mackerel or herring.

Dolphins are highly adapted for efficient feeding. Their teeth are adapted for holding slippery fish. A strong sphincter muscle in the throat allows dolphins to swallow their food without consuming too much seawater—because ocean water is too salty for them to drink in large quantities. In fact, dolphins get most of the water they need from the food they eat. When dolphins metabolize fat, water is released in the process. Their kidneys are adapted to hold on to as much water as possible.

Though they have 80 to 100 teeth, bottlenose dolphins do not use their teeth to chew their food. Instead, they swallow their meal whole and headfirst so that the animals’ spines do not hurt their throat. Dolphins sometimes separate the heads from the tails of a prickly fish, like catfish, leaving the sharp fins for the scavengers. They break apart larger fish by shaking them or smashing them on the ocean floor. Their stomachs are compartmentalized into three to four chambers and can function as a crop, partially digesting and storing excess food that is taken opportunistically.
Hunting strategies are varied and diverse. Bottlenose dolphins sometimes cooperate when hunting and catching fish. Dolphin groups can surround a large school of fish and herd them into a small, dense mass. The dolphins then take turns rushing through the school to feed. Sometimes dolphins corral schools of fish and move them toward a sand bar or shoreline to trap the fish in shallow water where they are easy prey. Sometimes dolphins use their tail flukes to stun the fish; this behavior is called "fish-whacking." Dolphins have been observed hitting a fleeing fish up into the air with their tail, stunning it, then scooping the fish up when it falls back into the water.

Dolphins at Brookfield Zoo and at other zoos and aquariums eat a variety of restaurant-quality fish. The Brookfield Zoo diet consists of a combination of herring, squid, capelin, smelt, and sardines. Dolphin nutritionists carefully construct menus for the dolphins that meet their dietary needs. Goal weights are established and adult dolphins are weighed once a week when they voluntarily beach themselves on a scale. Diets are adjusted depending on these weekly weights.

Procedure
1. Introduce students to dietary/feeding information from the Teaching Notes.
2. Distribute the Dolphin Diet handout and instruct students to complete it either individually or in small groups.
3. Discuss the Reflections activity as a class or have students complete the optional handout on their own.

◆ Extension Activity ◆
Go to www.brookfieldzoo.org and access the Dolphins in Depth "Fast Food" game.
Dolphin Diet

You are an animal nutritionist responsible for managing the diet of a 400-pound male dolphin. This dolphin needs to consume 4 to 5% of his body weight each day—totaling an average of 14,000 kilocalories (Kcals). Create a daily diet with a combination of all the fish that will satisfy this dolphin. Keep in mind that capelin and herring are the most abundant and economical fish available.

<table>
<thead>
<tr>
<th>Type of Fish</th>
<th>Total Pounds of Fish</th>
<th>Total Grams of Fish (lbs x 454)</th>
<th>Kcals/Gram</th>
<th>Total Kcals</th>
</tr>
</thead>
<tbody>
<tr>
<td>Herring</td>
<td>10 lbs</td>
<td>4540 g</td>
<td>1.245</td>
<td>5652.3</td>
</tr>
<tr>
<td>Capelin</td>
<td></td>
<td></td>
<td>1.33</td>
<td></td>
</tr>
<tr>
<td>Smelt</td>
<td></td>
<td></td>
<td>1.86</td>
<td></td>
</tr>
<tr>
<td>Squid</td>
<td></td>
<td></td>
<td>1.1</td>
<td></td>
</tr>
<tr>
<td>Sardines</td>
<td></td>
<td></td>
<td>1.77</td>
<td></td>
</tr>
<tr>
<td><strong>Total Consumed Per Day</strong></td>
<td><strong>Total</strong></td>
<td></td>
<td><strong>7.305 kcals/g</strong></td>
<td></td>
</tr>
</tbody>
</table>
**Dolphin Diet**  
**Answer Key**

Teacher Note: These numbers are samples. Numbers will vary based on number of pounds of each fish chosen by the students.

<table>
<thead>
<tr>
<th>Type of Fish</th>
<th>Total Pounds of Fish</th>
<th>Total Grams of Fish (lbs x 454)</th>
<th>Kcals/Gram</th>
<th>Total Kcals</th>
</tr>
</thead>
<tbody>
<tr>
<td>Herring</td>
<td>10</td>
<td>4,540</td>
<td>1.245</td>
<td>5,652.3</td>
</tr>
<tr>
<td>Capelin</td>
<td>7</td>
<td>3,178</td>
<td>1.33</td>
<td>4,131.4</td>
</tr>
<tr>
<td>Smelt</td>
<td>2</td>
<td>908</td>
<td>1.86</td>
<td>1,688.88</td>
</tr>
<tr>
<td>Squid</td>
<td>1</td>
<td>454</td>
<td>1.1</td>
<td>499.4</td>
</tr>
<tr>
<td>Sardines</td>
<td>3</td>
<td>1,362</td>
<td>1.77</td>
<td>2,410.74</td>
</tr>
<tr>
<td><strong>Total Consumed Per Day</strong></td>
<td>23 pounds</td>
<td>10,442 grams</td>
<td>7.305 kcals/g</td>
<td>14,382.72 Kcals</td>
</tr>
</tbody>
</table>
Reflections

1. Why is it important to provide a variety of fish to dolphins in zoos?

2. What is a kilocalorie (Kcal)?

3. Which of the fish on the chart are the fattiest?

4. Which of the fish on the chart are the leanest?

5. A nursing mother needs to consume about 8% of her body weight each day. How many Kcals does a 500-pound nursing dolphin mother need?

6. Dolphins in the wild eat fish that ingest chemicals from the water in which they swim. Do dieticians of dolphins in collections such as Brookfield Zoo have to worry about chemicals in the fish they feed their dolphins?
Reflections
Answer Key

1. Why is it important to provide a variety of fish to dolphins in zoos?
   One reason is that different fish offer different nutrients. Even though Brookfield Zoo offers
   a variety of fish, each dolphin receives a multivitamin to ensure dietary needs are met. Also, nutritionists
   like to offer a variety of food in case some kinds of fish become unavailable.

2. What is a kilocalorie (Kcal)?
   A calorie is a measure of energy expenditure. One Kcal is equal to 1,000 calories. A cup of
   tomato soup is about 100 calories, so you would have to eat 10 bowls of tomato soup to equal
   one Kcal.

3. Which of the fish on the chart are the fattiest?
   Smelt and sardines have the most Kcals per gram. Therefore, they are the fattiest.

4. Which of the fish on the chart are the leanest?
   Herring and squid have the fewest Kcals, so they are the leanest.

5. A nursing mother needs to consume about 8% of her body weight each day. How many
   Kcals does a 500-pound nursing dolphin mother need?
   A 500-pound nursing mother would require about 40 Kcals. That would equal over 36 pounds
   of squid!

6. Dolphins in the wild eat fish that ingest chemicals from the water in which they swim.
   Do dieticians of dolphins in collections such as Brookfield Zoo have to worry about
   chemicals in the fish they feed their dolphins?
   If the body of water where the fish live is contaminated, the fish will be tainted. Brookfield
   Zoo dolphins are fed fish caught in the wild and in an effort to provide the best possible diet
   the zoo purchases only restaurant-quality fish for its dolphins and pinnipeds (seals, walruses, etc.).


**Diet**

### 2.2 Conspicuous Consumers

**OVERVIEW**
Students explore the SLD software to understand dolphin dietary needs.

**Driving Question**
How many kilocalories (Kcals) do dolphins consume?

**Objectives**
- Students familiarize themselves with dolphin dietary needs.

**Time Required**
One class period

**Materials**
- SLD software and computers
- Student Handout: Software Instructions (page 133)
- Student Handout: Software Overview (Resources section, page 343)
- Student Handout: Software Reporting Page (Resources section, page 342)
- Optional Student Handout: Reflections (page 135)

**Teaching Notes**
Before starting this activity, students should complete 2.1 Dinner Time.

Students will use the software associated with *The Secret Life of Dolphins* (SLD) to access the data of dolphin physical characteristics and determine the average number of kilocalories (Kcals) dolphins consume. This activity involves basic software investigation and simple mathematical averages.

Once the activity has been opened (see Software Overview in the Resources section), students should determine their hypothesis and record it in the journal section of the software. If you wish to have students turn in a written report, use the Software Reporting Page in the Resource section. Students can also print their on-line journal pages for your review.

To begin, students will need to open the Browse Data tab and look in the Browse Dolphins section. Within this section they can investigate every individual in the data set to see its personal profile. One of the traits included in each profile is Kcals. Note that although researchers gather as much data as possible, there may be missing information for some of the animals.

After browsing the database, students can analyze the data they have selected using a variety of different visualizations. For this activity, the most appropriate visualizations include data tables, bar graphs, Venn diagrams, and scatter plots. They can print out copies of the visualizations they create to support their hypotheses.

After the students have completed their investigations they should be able to find the average adult dolphin, age 10 to 40, consumes 14,000 to 16,000 Kcals/day.

Basic instructions are provided in the Software Instruction handout, which can be distributed to student teams to guide them in their investigations. A more detailed Software Overview can be found in the Resources section.
Software Instructions: Conspicuous Consumers

Introduction
Dolphins are selectively opportunistic feeders, meaning they eat some of the kinds of fish that are most plentiful at any given time. Their diets, therefore, can be very diverse. At the zoo, dolphins are fed a varied diet as well, which mostly consists of herring, capelin, smelt, and squid. Regardless of the kinds of fish dolphins eat, they require a certain number of calories each day to stay healthy.

Your Job as a Researcher
Use the physical data set to calculate the average number of kilocalories consumed by adult male and female dolphins.

Guide to Investigations

Open Activity
1. Select Browse Dolphins from the Browse Data tab.

New Dolphin Sets
To investigate relationships and help determine average food consumption, you may wish to group dolphins based on their age, gender, or other common characteristics.

• From Create Sets tab, choose new dolphins set.
• Create a title for your set.
• You may choose to Define this set to include: All Dolphins, The Following Dolphins, or Dolphins that meet these criteria.
• Click Edit and add dolphins to create sets that group based on age, gender, size, etc.
• You may now use these sets to evaluate the average number of Kcals consumed by dolphins.

Visualizations
You can create a variety of tables and charts to help prove or disprove your hypothesis.
1. From the Analyze Data tab, choose Create a New Visualization.
2. Select use physical data set.
3. Select the visualization you wish to create from the available visualizations box.
4. Select dolphin sets that include males and females from the available sets box.
   • Create a data table to look at a variety of different variables for individual animals (such as Kcals, weight, girth, and birth year) and then make comparisons between animals. To organize your table by a particular characteristic, double click on the appropriate column heading.
• Use a bar chart to evaluate the number of kilocalories that animals of different age groups consume.

• Create a Venn diagram to look at overlap between Kcal consumption in animals of different ages and then find averages.

• Use a scatter plot to evaluate any correlation between birth year and kilocalorie consumption.
Reflections

1. What was your hypothesis?

2. What was the first step you took to test this hypothesis?

3. Which visualizations did you create?

4. How did these visualizations help support or refute your hypothesis?

5. Were you able to reach a conclusion to your hypothesis? If so what was it? If not, why?

6. On average, how many kilocalories do adult dolphins consume? Juveniles between the ages of 5 to 9? Calves under age 5?
2.3 Marine Food Web

OVERVIEW
Students explore the Sarasota Bay food web and the interrelationship of living organisms.

Driving Question
How are the nutrient elements of the Sarasota Bay ecosystem related?

Objectives
- Students define a food web and explain how it works.
- Students become familiar with dolphins and how dolphins fit into the marine food web.
- Students understand what happens if humans disturb the food web, throwing off the balance of nature.
- Students solve the mystery of how the ocean naturally replenishes itself and what role dolphins play in this process.

Time Required
One to two class periods

Materials
- Index cards
- Markers
- Ball of string
- Scissors
- Student Handout: Bottlenose Dolphin Food Web (page 141)
- Student Handout: In the Researcher’s Words... A Postdoctoral Study of the Distribution of Dolphin Prey (page 143)
- Student Handout: In the Researcher’s Words... A Study of the Feeding Patterns and Preferred Prey of Dolphins (page 144)
- Student Handout: Dolphin Behavior (Resources section, page 324)
- Optional Student Handout: Reflections (page 145)

Teaching Notes
**Dolphin Food Webs:** Every ecosystem is based on a complex, intricate system of transferance of energy called a food web. Food webs are made up of organisms that rely on one another to get their energy or nutrition.

Each food web includes **producers**—the plants and animals that get their energy from nonliving things and produce food for other plants and animals. **Consumers** get their energy from eating plants and animals. **Herbivores** eat only plants, **omnivores** eat plants and animals, and **carnivores** eat only animals. **Decomposers** are some of the smallest, most important components of food webs. They turn dead plants and animals back into soil, therefore completing the circle. In the ocean, decomposing materials add **biomass** to the ocean floor, which, as it decomposes, provides nutrients for sea grass, kelp, and other marine flora.

Food webs are delicately balanced. If just one important species disappears from a web, the balance of nature is thrown off and the web may collapse because each component is so dependent on the others. In the ocean, as well as in any ecosystem, competition among plants and animals is so great that species have become specialized and each one may depend on one other to complete its life cycle.

For example, dolphins, though carnivorous, are indirectly dependent on sea grass, because that is where the fish that they eat live. Seagrass and mangrove trees are indigenous to the Sarasota Bay shoreline. In the last few decades, a tremendous amount of shoreline has been developed, or built upon. Seawalls, marinas,
and other facilities line the bay. This has significantly reduced the meadows of sea grass and eliminated the mangroves from a large portion of the bay.

Dolphins can be classified as secondary consumers because they feed on herbivores and detritivores—animals that consume decomposing organic particles, and as tertiary predators, since they are known to prey on other carnivores. Sarasota Bay dolphins are almost exclusively fish eaters. The average adult dolphin can consume around 25 to 35 pounds of food per day. That's approximately 4% to 5% of their body weight. A nursing mother's daily intake is considerably higher, as much as about 8%. A food web for bottlenose dolphins includes: algae, sea plants, squid, crustaceans, and various types of fish.

Dolphin Eating Habits: A dolphin's stomach is adapted for rapid digestion. When a dolphin comes upon a school of fish, it eats very quickly. The stomach is compartmentalized for rapid digestion. Portions of the stomach serve as a crop—a pouch-like enlargement of a dolphin's digestive system in which food is partially digested or temporarily stored. Foods not normally part of the dolphins' diet begin to be digested here, making it more easily digested later on. Dolphins do not chew their food. They often swallow fish whole, head first, so the spines of the fish won't catch in their throat. Dolphins break apart bigger fish by shaking them or rubbing them on the ocean floor.

Water Quality and Feeding: Because of the loss of plant life in and around the bay, fish that comprise the bulk of the dolphins' diet have experienced reduced habitat and food supplies. This leads to a decrease in prey species for dolphins. Since an adult bottlenose dolphin may consume 25 to 35 pounds of fish each day, a reduced fish population is serious. During the mid-1990s, a ban on net fishing in Florida helped replenish the fish populations. However, concerns about the habitat continue.

Pollution is an ongoing concern. Chemicals that are not easily metabolized become increasingly concentrated as they move up through a food chain, from single-celled plants to increasingly larger animal species. This is called "biomagnification." For example, a dolphin food chain includes phytoplankton, or tiny plants that live in the ocean. These plants take in toxins and pass them along to the small fish and crustaceans that eat the plants. Squid and larger fish eat the small fish and crustaceans, again increasing the level of toxins in the body. The dolphins (just like humans) are at the top of the food chain and, through their regular diet, may accumulate a much greater concentration of chemicals than was present in the organisms lower in the food chain.

Through biomagnification, the concentration of chemicals in dolphins could become high enough to cause negative effects on behavior, reproduction, disease resistance, and overall health. Therefore, chemicals in the water could endanger these animals.

Procedure
1. Start the unit by defining the word "ecosystem." An ecosystem is a natural community that includes living and nonliving things. (This is sometimes synonymous with the word "habitat.")

2. Ask the students to give examples of some ecosystems from around the world—such as deserts, forests, wetlands, etc.

3. Explain that Sarasota Bay is an ecosystem.

4. Ask the students to list on the chalkboard or on a large piece of paper some nonliving things, like sun, water, soil, rocks, etc. Ask one student to write each of these items on a separate index card.

5. Ask the students to help you list some living things in Sarasota Bay. Again, ask one student to write each of these on a separate index card.
Dolphin Introduction
1. Introduce students to our food web starting animal: dolphins. As the game progresses, they should list any new organisms that they think are part of the food web.

2. Distribute the Dolphin Behavior handout.

3. Discuss dolphins’ characteristics, food choices, predators, adaptations, and behaviors from the Teaching Notes.

4. As you go through the discussion, have one or two students list each of the foods that dolphins eat, each on a separate card. Include another card for the dolphin itself.

5. Repeat number 4 above to list the predators of dolphins, and any other items in the food web.

Food Web Activity
1. This activity will simulate a marine food web. Using string, the students will weave a “web” as they explore the food web’s components. Then they will see what happens when the balance of nature is thrown off.

2. Ask the class to form a large circle outside or in the classroom, depending on space.

3. Give each student a card that has an ecosystem component on it. Some students will not yet have a card.

4. Start with the “dolphin” student. Give him or her the ball of string. Ask the “dolphin” what it would eat.

5. The dolphin will hold the end of the string and toss the ball to the person holding the appropriate food choice card.

6. Next, ask this second student what he or she eats or who eats him or her. Holding the string taut, he or she should gently toss the ball to the student who has the card that was named. Each person who receives the ball should continue to hold onto the string when the ball is passed to another player. Students should add new cards as they come up with new food choices, predators, or decomposers until a tangled web has developed in the middle of the circle. Be sure to also allow students to include the non-living elements on which they depend in the web.

7. While your students are still holding the string, guide a discussion with them. You may include the following ideas:
   • What happens when living things die? Explain that they become food for worms, fungi, insects, and invertebrates as well as the soil of the ocean floor. Create cards for these things, too, and add them to your web.

   • Ask all nonliving things to raise their hand. Discuss their importance to the web.

   • Ask the living things that are plants or plant products (like sea grass) to raise their hand. They are producers, getting energy from sun, soil, and water and producing foods for other animals.

   • Ask the living things that eat only plants to raise their hand. They are herbivores. They get their energy from plants and are prey animals, providing energy to other animals.

   • Ask the living things that eat both plants and animals to raise their hand. These are omnivores. They get their energy from plants and from animals and give it to other animals.

   • Ask the living things that eat only animals to raise their hand. These animals, like dolphins and sharks, are carnivores. They get their energy from herbivores and omnivores. Herbivores, omnivores, and carnivores are consumers.
• Ask the living things that eat dead plants and animals to raise their hand. They are decomposers. They are nature's cleanup crew. They turn dead things into nutritious soil that provides energy for plants to grow, starting the process all over again.

8. Explain that every component has its place or niche in the complex balance of the ecosystem. Each one depends on another for survival.

9. Now ask the students what would happen if dolphins were to become extinct and no longer be a part of the food web. For instance, what if sharks came in and killed all of the dolphins in the ecosystem? Ask the students to guess which other components of the food web would be affected.

10. Ask the dolphin to drop his or her string. Notice how many students are affected, evidenced by a loose string connection.

11. Then ask each component affected to drop their string. In the wild, each of them would be affected by the dolphins' exit from the web. How would that change affect the other components of the food web? It will become evident that the web would be unbalanced.

12. Explain that this can happen in many ways, and people can work to make sure that their actions do not upset the balance of nature.

13. Distribute the In the Researcher’s Words handouts; these should give students some insights into the real-world problems faced by scientists.

14. Discuss the Reflections activity as a class or have students complete the optional handout on their own.

◆ Extension Activity ◆

Brainstorm ways that humans can impact an ecosystem. Follow this discussion with ways that humans can regenerate an ecosystem, how environmental toxins travel up the food chain, and what is it about dolphin physiology that makes them susceptible to environmental contaminants.
Bottlenose Dolphin Food Web

Fish
Small to medium size fish of many species

Invertebrates
(Macro organisms, especially shrimp)

Zooplankton
(Very small or microscopic organisms)

Phytoplankton

Plants

Squid
Bottlenose Dolphin Food Web

This food web is supported by other, closely related factors. The sun—the ultimate source of energy—provides the energy for plant life, such as algae, seagrasses, mangroves, and all the other botanical organisms on Earth. This energy is transferred to other organisms farther up the food chain in the form of caloric energy (calories/kilocalories). Plants obtain nutrients needed for growth from detritus matter produced by decomposers such as certain bacteria. These decomposers "eat" every type of organism (dead and alive), from the dolphins to the tiniest cells of algae and plankton. The products of the decomposition of these organisms are the nutrient elements taken in by plant roots or other plant adaptations.

Dolphins feed on a large variety of small to medium-size fish, mostly fish that can be eaten whole and taken in headfirst. Soniferous fish—fish that make sounds (such as the pinfish, pigfish, mullet, spot, and toadfish)—are quite common in the diet of Atlantic bottlenose dolphins. Occasionally dolphins will capture larger fish, but it appears to be more challenging for them to break these up into bite-size portions by shaking them or rubbing them on the ocean floor than to simply capture smaller fish.

While sharks that might prey on dolphins reside in the open waters of the nearby Gulf of Mexico, the waters of Sarasota Bay are quite shallow and sharks are seldom seen there. However, 31% of Sarasota Bay dolphins have shark bite scars, and sharks kill dolphins in the bay from time to time. Shark stocks in the region have been dramatically reduced due to human fishing, but dolphins continue to be vulnerable to shark attacks.

Note
Decomposers, such as certain bacteria and other microorganisms, feed upon the remains of ALL dead organisms, reducing them to elementary particles that are used as nutrients. In this manner, these particles are returned to the system. They are taken in by organisms (initially plants and plant-like organisms, such as phytoplankton) and passed through the food chain to all of the organisms.
A Postdoctoral Study of the Distribution of Dolphin Prey

The following is a document by a dolphin researcher working on species conservation. Look up unfamiliar terms or see if you can determine their meaning from the context of the sentence.

"To conserve any species, scientists and government managers need to understand that species' specific habitat requirements. The bottlenose dolphins of Florida inhabit one of the most urbanized coastlines in North America. Despite intense study in recent decades, habitat requirements of bottlenose dolphins are poorly known. What qualities do dolphins look for when selecting habitat? To what degree do the distributions of prey, predators, and competitors influence the dolphins' habitat preferences? In addition, how does the presence of humans affect their use of coastal waters? These are just a few of the questions we hope to answer with our new investigation of dolphin prey.

As a new postdoctoral scientist with the Sarasota Dolphin Research Program, I will be coordinating an ambitious fisheries sampling program to determine how prey are distributed among the various habitats within Sarasota Bay and how the distribution of prey changes over the seasons. The sampling program will use both traditional tools of fisheries science (net sampling) as well as new techniques (passive acoustic monitoring of sounds produced by fish). By coupling the fish data with our long-term database on how dolphins and people use the bay, we will be able to quantify habitat quality for bottlenose dolphins.

With this knowledge, we can create a simple index of habitat quality that will allow scientists and government managers to quickly determine the quality of any habitat for bottlenose dolphins. Such a tool for assessing habitat could be of great benefit to the conservation of bottlenose dolphins all over the world by helping resource managers predict the consequences of altering habitats. The data on fish abundance in Sarasota Bay will also be used to make a model of Sarasota Bay's food web, which could allow managers to predict how changes to one part of the Sarasota Bay food web will affect all other parts of the food web. For example, the model will be able to predict how an increase in fishing activity will affect each fish species, as well as dolphins, manatees, seagrass, mangroves, and everything else that lives in the bay. This research is funded by the U.S. Government through NOAA (National Oceanic and Atmospheric Administration) Fisheries."

—Habitat Quality and Prey Availability for Bottlenose Dolphins
By Damon Gannon, PhD
A Study of the Feeding Patterns and Preferred Prey of Dolphins

The following is a document by dolphin researchers working on species conservation. Look up unfamiliar terms or see if you can determine their meaning from the context of the sentence.

"The movements and distribution of a predator are generally thought to reflect those of its prey, both in space and time. To better understand the trophic ecology of bottlenose dolphins in the Sarasota Bay area we used conventional (stomach content analyses) and novel technology (stable isotopic analyses), in addition to long-term behavioral observations of feeding. Analyses of stomach contents of stranded dolphins of known feeding history revealed a diet composed primarily of fish, most of which were associated with seagrass beds. We found a close agreement between the species represented in the diet and the observed feeding behaviors of resident dolphins. Dolphins in this area usually feed alone or in small groups in shallow, vegetated habitats. We applied stable isotopic techniques to reconstruct the dietary history of dolphins in Sarasota Bay and adjacent areas. Thus, isotopic signatures of carbon and nitrogen were obtained from available tissues of predators (dolphin teeth from the Mote Marine Lab specimen collection) and their main prey fish (pinfish, pigfish, spot, mullet). Comparisons of carbon isotopic ratios in tissues of dolphins and fish prey indicate that seagrasses and associated vegetation provide important feeding habitats for dolphins in Sarasota Bay. Trophic comparisons using nitrogen isotopic ratios in dolphins and fish also confirm the importance of particular species in the diet of dolphins. In addition, we found that dolphins of older ages had enriched carbon isotopic values and depleted nitrogen values, possibly an indication of ontogenetic shifts in diet or an exploration of different sites during foraging.

The isotopic composition of dolphin teeth from Sarasota Bay differed from that of dolphins from the adjacent Gulf of Mexico and the Charlotte Harbor estuary. The former had significantly higher carbon isotopic ratios than the latter two groups, confirming that seagrass beds provide important feeding habitats for dolphins in Sarasota Bay. We are pursuing these dietary studies to further investigate the trophic dynamics of dolphins along the central West Coast of Florida."

—From: Assessing the Trophic Ecology of Sarasota Bay Dolphins using Conventional Analyses and Stable Isotopes
By Nélio Barros, PhD, Peggy Ostrom, PhD, and Randall Wells, PhD
Reflections

1. Define a food web and explain how it works.

2. What is the difference between a food web and a food chain?

3. How do dolphins fit into the marine food web?

4. In what ways do humans upset the food web?

5. What happens if humans disturb the food web?

6. How does the ocean naturally replenish itself and what role do dolphins play in this process?
Reflections
Answer Key

1. Define a food web and explain how it works.
   A food web is a community of organisms where there are several interrelated food chains. This is a complex system wherein the loss of any one organism could impact the entire ecosystem.

2. What is the difference between a food web and a food chain?
   A food web is a natural community made up of plants, animals, other organisms, and non-living things. A food chain is more specifically a direct channel of what consumes what. It is a succession of organisms in an ecological community that constitute a continuation of food energy from one organism to another as each consumes a lower member and in turn is preyed upon by a higher member. For example, dolphins eat fish and squid, that eat smaller fish, that eat tiny shrimp, that eat plankton, that thrive on microscopic plants, that consume nutrients from the water and/or seafloor.

3. How do dolphins fit into the marine food web?
   Dolphins, along with sharks, are top predators. In other words, nothing eats them. (Though, sharks do attack and kill dolphins, these are generally the very old, very young or weakened individuals and these attacks are not frequent.) In the marine community, humans are the primary threat. Therefore, dolphins have a high importance value within the food web. If, for instance, the dolphin population would leave Sarasota Bay, the fish population could rise significantly. This could lead to many other imbalances.

4. In what ways do humans upset the food web?
   Students should offer specific ways that humans, directly or indirectly, can throw off the balance of nature.

5. What happens if humans disturb the food web?
   Students should offer specific effects of an unbalanced food web. For example, if fisheries severely deplete the fish population in an area, what could happen?

6. How does the ocean naturally replenish itself and what role do dolphins play in this process?
   Students should understand that biodegradation is necessary to replenish the nutrients into the marine ecosystem. Dolphins contribute to this in numerous ways such as excreting wastes from their bodies, allowing food wastes to settle on the seafloor, and eventually dying and contributing to the decomposing biomass.
2.4 Who Eats How Much

OVERVIEW
Students use a diet program to calculate the appropriate amount of food for a specific dolphin.

Driving Question
What correlation exists between a specific age, size, gender, and general condition of a dolphin and how much/what it eats?

Objectives
- Students differentiate the dietary needs of dolphins of different ages, sizes, and gender.
- Students infer that certain conditions such as pregnancy and lactation require different dietary plans.
- Students conclude that husbandry in a zoo collection requires the application of scientific principles to provide for animal needs.

Time Required
One to two class periods

Materials
- Student Handout: Dolphin Kilocalorie Matching Game (page 150)
- Student Handout: Dolphin Biographies (page 152)
- Student Handout: Dolphin Diet Changes (Resources section, page 329)
- Student Handout: Zoo Nutrition Services Dolphin Diet (Resources section, page 357)
- SLD software and computers
- Optional: Brookfield Zoo Dolphin Diet Planner (Excel program) on CD
- Optional Student Handout: Reflections (page 157)

Teaching Notes
Dolphin Diets: Coastal bottlenose dolphins are carnivores that feed on many different types of fish including, but not limited to, mullet, spot, pinfish, and pigfish. They occasionally eat squid. Their prey tends to make noises such as grunts, whistles, or frequent splashes that make them more susceptible to predation. Dolphins may detect prey by listening for the sounds of these soniferous (sound-making) fish. Dolphins are very active and feed both day and night.

The diet of Sarasota Bay dolphins is primarily striped mullet, spot, pinfish, and pigfish—all of which are soniferous or sound-making. Dolphins at Brookfield Zoo eat a combination of herring, capelin, squid, smelt, and sardines.

Food Requirements: Aquariums and zoos can learn a lot about dolphin dietary needs from the animals in their care and from the scientists (like nutritionists) at zoos. At Brookfield Zoo, adult dolphins voluntarily beach themselves onto a scale once a week. Trainers and keepers carefully calculate a goal weight depending on the dolphins' age, size, and gender. Dolphin goal weights help determine whether that dolphin needs more or less food. Goal weights for Brookfield Zoo dolphins are based on the weights of wild dolphins of similar age and size studied in Sarasota Bay.

The smelt and sardines in the zoo diet have the greatest fat content, though herring in the winter tends to be more fatty. Dolphins are generally not fed as much of these fatty fish as squid, smelt, and capelin—all leaner choices. A careful diet plan is established each week for the dolphins that will keep them within a few kilograms
of their goal weight. This seafood diet is augmented with vitamin supplements.

Most adult dolphins consume 4-5% of their body weight daily. Lactating females require as much as 8% of their body weight.

Calves need extra kilocalories (Kcals) while they are growing, just like human children. Elderly dolphins tend to require less food. Rarely is there an overweight dolphin. In the wild, competition for food and vulnerability to predators such as some sharks keep dolphins lean. Dolphins in zoos exercise vigorously and the keepers understand healthy weight ranges. Therefore, these individuals also maintain a healthy weight and lifestyle.

**Importance of a Healthy Environment:** Like humans, bottlenose dolphins can suffer from viral, bacterial, and fungal infections. The parasites (often diet related) that typically affect dolphins include tapeworms, flukes, and roundworms. Dolphins that ingest food from humans are at increased risk to develop infections. In the United States, it is illegal for people to feed wild dolphins (this is called “provisioning”).

The quality of dolphin food sources has much to do with the dolphin's general health. Human pollution has had a direct and destructive effect on the immune system of bottlenose dolphins. In the past decade, there have been at least five massive "die-offs" of marine mammals around the world, killing almost 3,000 bottlenose dolphin. In 1987 and 1988, over 700 bottlenose dolphins washed up dead on the east coast of the United States. Scientists originally believed that the dolphin deaths were triggered by a naturally occurring "red tide" toxin (originating in small marine organisms called dinoflagellates), which is not normally fatal. Scientists then discovered morbillivirus in the carcasses, and tissue analysis indicated that the red tide might have been a major contributing factor in the majority of the deaths, when combined with the bacterial and viral infections in the dolphins.

Since the vast majority of these deaths occurred in polluted areas of the coastline, human-caused chemical compounds (such as PCBs and pesticides) were suspected. These compounds don't just disappear; they remain in the environment for many years. They are thought to affect immunity and fertility in other mammals as well. Logic suggests that marine animals consuming a pollution-rich diet may not deal with common infections as effectively as pollution-free individuals.

**Procedure**

1. Review relevant information from the Teaching Notes with the students, especially the dietary needs of a dolphin.

2. Students should access the SLD software to find size, age, and gender data for Brookfield Zoo's Dolphins.
   - Open SLD software (open-ended activity)
   - Select **Browse Dolphins** from the **Browse Data** tab
   - Browse the Brookfield Zoo dolphins to find age, gender, and size for each

3. Divide students into teams of three or four. Distribute the Dolphin Kilocalorie Matching Game and Dolphin Biographies handouts. Also distribute the Dolphin Diet Changes spreadsheet, and the Zoo Nutrition Services Dolphin Diet spreadsheet (or you may have students use the actual spreadsheet on their computer).

4. Have students use all of this information to complete the Matching Game handout. Students should match the diet plan and individual dolphin to assess whether each dolphin listed is a normal (non-geriatric) adult, calf, or lactating mother.

5. Have students discuss their responses. Is there agreement?

6. Provide each student team access to the Excel spreadsheets on the SLD CD; if students don't have access to a computer have them consult their Dolphin Diet Changes and Zoo Nutrition Services Dolphin
Diet handouts for this activity.

7. Instruct student teams to use what they have learned about dolphin diets to first determine each dolphin’s profile and then to create an appropriate daily diet for each animal.

8. After all teams are done, instruct teams to pair with another team and compare diet plans.

9. Discuss the Reflections activity as a class or have students complete the optional handout on their own.
Dolphin Kilocalorie Matching Game

Your job is to use the information from the Dolphin Diet Changes and the Zoo Nutrition Services Dolphin Diet spreadsheets to determine what profile each dolphin fits into. These spreadsheets are the actual data that Brookfield Zoo’s nutritionists and keepers use when determining dolphin diets. Here is some additional data that will help.

Average Kcals Consumed Per Day
(Note: 1 Kcal = 1,000 calories)

- Calf (age 2-4, still nursing a little) = 6,000-8,000 Kcals per day
- Juvenile (non-nursing females age 4-7 and males age 4-9) = 9,000-14,000 Kcals per day
- Average adult (non-geriatric age 9-25) = 12,000-15,000 Kcals per day
- Lactating female (any age) = 18,000-20,000 Kcals per day

Most dolphins consume 4-5% of their body weight daily. Lactating females, calves, and juveniles require as much as 8% of their body weight.

Match the individual with the correct profile. Profiles may be used more than once.

Profile Options:  
(a) Normal, non-geriatric adult  
(b) Calf  
(c) Lactating female

<table>
<thead>
<tr>
<th>Dolphin Name</th>
<th>Profile</th>
<th>Kcals Consumed per Day</th>
</tr>
</thead>
<tbody>
<tr>
<td>F1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>F2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>M1</td>
<td></td>
<td></td>
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<tr>
<td>M2</td>
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<td>M3</td>
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<td>M4</td>
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<td></td>
</tr>
<tr>
<td>M5</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Explain your profile selections.
**Dolphin Kilocalorie Matching Game**

**Answer Key**

Your job is to use the information from the Dolphin Diet Changes and the Zoo Nutrition Services Dolphin Diet spreadsheets to determine what profile each dolphin fits into. These spreadsheets are the actual data that Brookfield Zoo's nutritionists and keepers use when determining dolphin diets. Here is some additional data that will help.

**Average Kcals Consumed Per Day**
(Note: 1 Kcal = 1,000 calories)

- Calf (age 2-4, still nursing a little) = 6,000-8,000 Kcals per day
- Juvenile (non-nursing females age 4-7 and males age 4-9) = 9,000-14,000 Kcals per day
- Average adult (non-geriatric age 9-25) = 12,000-15,000 Kcals per day
- Lactating female (any age) = 18,000-20,000 Kcals per day

Most dolphins consume 4-5% of their body weight daily. Lactating females, calves, and juveniles require as much as 8% of their body weight.

**Match the individual with the correct profile. Profiles may be used more than once.**

<table>
<thead>
<tr>
<th>Profile Options: (a) Normal, non-geriatric adult</th>
<th>(b) Calf</th>
<th>(c) Lactating female</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dolphin Name</td>
<td>Profile</td>
<td>Kcals Consumed per Day</td>
</tr>
<tr>
<td>F1</td>
<td>C</td>
<td>12,000-15,000</td>
</tr>
<tr>
<td>F2</td>
<td>A</td>
<td>12,000-15,000</td>
</tr>
<tr>
<td>M1</td>
<td>A</td>
<td>12,000-15,000</td>
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<tr>
<td>M2</td>
<td>A</td>
<td>12,000-15,000</td>
</tr>
<tr>
<td>M3</td>
<td>A</td>
<td>12,000-15,000</td>
</tr>
<tr>
<td>M4</td>
<td>A</td>
<td>12,000-15,000</td>
</tr>
<tr>
<td>M5</td>
<td>B</td>
<td>4,000-9,000</td>
</tr>
</tbody>
</table>

Explain your profile selections.
Dolphin Biographies

You are head keeper for a collection of dolphins. A new group of dolphins will be coming to the zoo on breeding loan in a month. You must plan what they will eat. Using the information in the Dolphin Diet Planner spreadsheets, determine the profile for each dolphin. Then calculate the appropriate number of pounds of fish and Kcals needed per day for each dolphin.

**Daphne:** at age 33, Daphne has produced five calves. She weighs about 425 pounds. Her youngest, Dolfred, will be moved with her. Daphne is still in good health and of prime breeding age.

**Dolfred:** at nearly age 4, Dolfred needs a diet to fit his growing body. He is 350 pounds now and may gain another 200-300 hundred or more pounds before he is full-grown.

**Dominick:** at age 25, Dominick is at his growth peak. He weighs 550 pounds and is very active, loving to play with his trainer.

**Dolly:** this 18-year old lactating mother has given birth to three healthy calves in the last nine years. She weighs about 500 pounds and dotes on her latest arrival, Delmonico.

**Delmonico:** 110-pound calf Delmonico is now old enough to travel safely. He leaves Dolly's side often to romp with his new friend, Dolfred.
Dolphin Biographies

Answer Key

You are head keeper for a collection of dolphins. A new group of dolphins will be coming to the zoo on breeding loan in a month. You must plan what they will eat. Using the information in the Dolphin Diet Planner spreadsheets, determine the profile for each dolphin. Then calculate the appropriate number of pounds of fish and Kcals needed per day for each dolphin.

Daphne: at age 33, Daphne has produced five calves. She weighs about 425 pounds. Her youngest, Dolfred, will be moved with her. Daphne is still in good health, but she is somewhat old by dolphin standards.

12,000-15,000 Kcals—Average adult
212.5 lbs of fish

Dolfred: at nearly age 4, Dolfred needs a diet to fit his growing body. He is 350 pounds now and may gain another 200-300 hundred or more pounds before he is full-grown.

9,000-11,000 Kcals—Juvenile
29 lbs of fish

Dominick: at age 25, Dominick is at his growth peak. He weighs 550 pounds and is very active, loving to play with his trainer.

12,000-15,000 Kcals—Average adult
275 lbs of fish

Dolly: this 18-year old lactating mother has given birth to three healthy calves in the last nine years. She weighs about 500 pounds and dotes on her latest arrival, Delmonico.

19,000-20,000 Kcals—Lactating female
40 lbs of fish

Delmonico: 110-pound calf Delmonico is now old enough to travel safely. He leaves Dolly's side often to romp with his new friend, Dolfred.

6,000-9,000 Kcals—Calf
88 lbs of fish
Reflections

1. Summarize the dietary needs of dolphins of different ages, sizes, and genders.

2. Why might certain conditions such as old age, pregnancy, and lactation require different dietary plans? How did you accommodate these needs in your diet plan?

3. In what ways do dolphin keepers use scientific principles in an effort to provide for dolphin needs?

4. What problems, if any, did you encounter in planning a dolphin diet? How did you resolve these problems?

5. What problems might dolphin keepers encounter in planning a dolphin diet? How might these problems be resolved?

6. What diet problems may be encountered by dolphins in the wild? How does this affect the health of individuals and the population as a whole?
Reflections

Answer Key

1. Summarize the dietary needs of dolphins of different ages, sizes, and genders.
Check to make certain students mention the trends noted in the activity (see pages 137 and 101-151 for specifics).

2. Why might certain conditions such as old age, pregnancy, and lactation require different dietary plans? How did you accommodate these needs in your diet plan?
Check to make certain students mention the trends noted in the activity (see pages 137 and 101-151 for specifics).

3. In what ways do dolphin keepers use scientific principles in an effort to provide for dolphin needs?
Students may mention observations made in collections and in the wild, documented nutritional information, and modern medical health surveillance.

4. What problems, if any, did you encounter in planning a dolphin diet? How did you resolve these problems?

5. What problems might dolphin keepers encounter in planning a dolphin diet? How might these problems be resolved?
One consideration to ensure that the fish are fresh and as contaminant free as possible. For this reason, dolphins at the Brookfield Zoo location are fed restaurant quality fish.

6. What diet problems may be encountered by dolphins in the wild? How does this affect the health of individuals and the population as a whole?
Students should acknowledge the effect of contaminants, provisioning (feeding) of dolphins by humans, loss of habitat creating a loss of prey, etc.
OVERVIEW
Students use mathematical calculations and data from Sarasota Bay, Florida, to determine how many fish a specific population of dolphins would consume.

Driving Question
How many fish would a population of 140 dolphins eat in a year?

Objectives
- Students recognize the importance of food resources to a dolphin population.
- Students apply this information to contemporary issues such as the fishing industry.

Time Required
Less than one class period

Materials
- Pencil and paper
- Optional Student Handout: Reflections (page 157)

Teaching Notes
According to statistics from the 1980s when commercial fishing in Sarasota Bay, Florida, was at its height, the striped mullet catch was 2,000,000 to 6,000,000 pounds each year. Mullet was the only one of the four primary dolphin prey species targeted by commercial fisheries at that time. (The gill nets that catch mullet have been outlawed since 1995 in Florida, but are still allowed in North Carolina and other states.) Other prey species favored by dolphins in Sarasota Bay include pinfish, pigfish, and spot.

Procedure
1. Assemble student teams to tackle this quick math problem

2. Familiarize the students with the following assumptions:
   - The average dolphin in Sarasota Bay weighs 400 pounds
   - Dolphins eat about 4% of their body weight each day
   - 140 dolphins use Sarasota Bay on a regular basis

3. Challenge the teams to be the first to correctly calculate the amount of fish eaten by the Sarasota Bay dolphin population in one year.
   
   Answer:
   
   400 lbs./dolphin x 4% of body weight (lbs.)/day x 140 dolphins/Sarasota Bay x 365 days/year = 817,600 lbs. of fish in Sarasota Bay per year

4. Discuss the Reflections activity as a class or have students complete the optional handout on their own.
Reflections

1. How many fish would a population of 140 dolphins eat per year?

2. What would happen to Sarasota Bay if the food resources were diminished?

3. The gill nets that catch mullet have been outlawed since 1995 in Florida. What do you think was the impact on the fishing industry when the gill net ban went into effect? Speculate upon the impact on the environment after the ban.
Reflections
Answer Key

1. How many fish would a population of 140 dolphins eat per year?
   140 dolphins x 400 lbs x 4% x 365 days = 817,600 lbs (Advise the students that mullet is only one
   of four primary fish prey of the Sarasota Bay dolphin population)

2. What would happen to Sarasota Bay if the food resources were diminished?
   Students may approach this question from a number of levels: loss of prey for the dolphins
   could lead to a relocation of the dolphin population or, possibly reduce their numbers; loss of fish
   would have a direct effect on the food web, causing other species stress and possible death;
   recreational fishing (game fishing) would diminish. Many other effects could be presented.

3. The gill nets that catch mullet have been outlawed since 1995 in Florida. What do you
   think was the impact on the fishing industry when the gill net ban went into effect?
   Speculate upon the impact on the environment after the ban.
   Students may suggest that the mullet population has grown, effectively providing the dolphin
   population with an abundance of food. Students may also recognize that when one population grows,
   other factors within the food web are affected and must be monitored. Biologists in Sarasota
   Bay believe that this is a good law, but they do monitor the area closely and note any issues
   of concern.
Diet

2.5 Food Fluctuations

OVERVIEW
Students graph the amount of food eaten by an individual dolphin over a period of time and use these data to hypothesize reasons for consumption quantity fluctuations.

Driving Question
What factors might affect food consumption in dolphins?

Objectives
• Students recognize that the weight and general health of dolphins in the Brookfield Zoo collection are carefully regulated, monitored, and adjusted to meet individual dolphin needs.
• Students infer that dolphins’ weight is not determined by food consumption alone.
• Students conclude that different dolphins have different dietary needs.
• Students apply their understandings to the situation of wild dolphins in Sarasota Bay, Florida.

Time Required
Two class periods

Materials
• Student Handout: Dolphin Diet Changes (Resources section, page 329)
• Student Handout: Zoo Nutrition Services Dolphin Diet (Resources section, page 357)
• Student Handout: Brookfield Zoo Dolphin Weights (Resources section, page 323)
• Student Handout: Brookfield Zoo Dolphin Gcal Weights (page 161)
• Optional Student Handout: In the Researcher’s Words...Beggar and Government Relations (Resources section, page 332)
• Optional Student Handout: Testimony of Randall S. Wells (Resources section, page 350)
• Optional: Brookfield Zoo Dolphin Diet Planner (Excel program) on CD
• Optional Student Handout: Reflections (page 162)

Teaching Notes
At Brookfield Zoo, all the animals—including dolphins—receive individually planned and prepared diets. A special kitchen exclusively for marine mammals is maintained in the lower level of the Seven Seas exhibit. The dolphins’ food is assembled in a kitchen and consists of restaurant-quality fish, which arrives frozen in large boxes.

Gleaming stainless steel buckets, all color-coded for a particular animal, hang from hooks on the wall. Staff assemble the food using information calculated by the lead keeper from the same Dolphin Diet Changes Excel program that students have access to. Daily vitamin pills are concealed in the fish as part of the dolphins’ healthy diet.

Once a week, all the marine mammals are weighed. The dolphins voluntarily beach themselves on large scales. From this weight, the lead keeper determines the dolphin’s goal weight—the weight the dolphin should be. Calves and late-term pregnant females are not weighed in this manner. Careful observations are maintained of these animals until they can be safely weighed. It is common to add food for a dolphin that is particularly small and provide less food to one that is gaining too much weight. When a dolphin goes on a diet, the keepers cut portions of fish into smaller pieces so that the dolphin still has plenty of rewards.

The science behind maintaining a healthy diet for the animals in zoos and aquariums is learned from scientists’ understanding of the dietary needs of dolphins in the wild.
Procedure
1. Have students use the Brookfield Zoo Dolphin Weights Excel program or handout to create a graph of the weight of all six dolphins for the dates spanning April 7, 2003 to July 7, 2003. Note commonalities and discrepancies.

2. Divide students into teams. Select an individual dolphin for each team and have students graph the weight of that dolphin over any three-month period. Have students note if a dolphin exhibits a significant weight gain or loss. Then have students use these data to hypothesize reasons for consumption quantity fluctuations, which might affect weight.

3. Using the same program and the Brookfield Zoo Dolphin Goal Weights, have students calculate the amount of food (Kcals) needed by each dolphin during the week of June 9, 2003, based on his/her goal weight for that week. (Note: Tapeko was pregnant when this data was recorded.)

4. Discuss the Reflections activity as a class or have students complete the optional handout on their own.

◆ Extension Activity ◆
Have students read the In Researcher's Words...Beggar and Government Relations, and the Dr. Wells Testimony to U.S. House of Representatives. Ask teams of students to list of pros and cons to the issue of government regulations as indicated in the excerpt. Establish a debate question and have the class conduct a debate.
# Brookfield Zoo Dolphin Goal Weights

<table>
<thead>
<tr>
<th>Dolphin</th>
<th>Goal Weight</th>
<th>Gender</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tapeko</td>
<td>195-205</td>
<td>Female—above that weight during pregnancy and lactation</td>
</tr>
<tr>
<td>Kaylee</td>
<td>195-200</td>
<td>Female—above that weight during pregnancy and lactation</td>
</tr>
<tr>
<td>Lucky</td>
<td>220-230</td>
<td>Male</td>
</tr>
<tr>
<td>Hastings</td>
<td>205-215</td>
<td>Male</td>
</tr>
<tr>
<td>Chinook</td>
<td>195-200</td>
<td>Male</td>
</tr>
<tr>
<td>Kai</td>
<td>165-170</td>
<td>Male—goal range continues to change as he gets older</td>
</tr>
<tr>
<td>Micco</td>
<td>GROW</td>
<td>Male—born in October 2001, he is still in a nursery group</td>
</tr>
<tr>
<td>New baby girl</td>
<td>GROW</td>
<td>Female—born in October 2003, she is still nursing and is in a nursery group</td>
</tr>
</tbody>
</table>
Reflections

1. Summarize your findings. In what ways does using data management programs (like Excel) help scientists maintain a healthy population of dolphins?

2. Other than consulting goal weights, how do dolphin keepers assess the dietary needs of dolphins?

3. What are some needs of dolphins that keepers in zoos try to accommodate?

4. What other information would have been helpful when calculating the dolphin diet requirements?

5. Why do you think you did not have the information you may have wanted for each individual?

6. Given any options, how would you want to further investigate dolphin diet?

7. How does knowledge of dolphin diets in the wild help dolphins in zoos and aquariums?
Reflections

Answer Key

1. Summarize your findings. In what ways does using data management programs (like Excel) help scientists maintain a healthy population of dolphins?
   Students should present specific calculated findings. Excel data management attributes may include an organized format, automatic calculations for accuracy, ability to highlight critical data fields, and visual representation options for data collection and analysis.

2. Other than consulting goal weights, how do dolphin keepers assess the dietary needs of dolphins?
   Students should realize that careful observation of activity level is important. Furthermore, some dolphins, such as calves and pregnant females, are not weighed on the scales. Observation of behavior, measurements of blubber depth, and physical appearance of these individuals is especially important.

3. What are some needs of dolphins that keepers in zoos try to accommodate?
   Students may note exercise, general health, and age (growing dolphins need more food than geriatric dolphins), sex (males are generally larger animals for their chronological age), and some females may be pregnant or lactating.

4. What other information would have been helpful when calculating the dolphin diet requirements?
   Blubber depth measurement, reproductive status, health status, and activity levels/time budgets.

5. Why do you think you did not have the information you may have wanted for each individual?
   The database did not include the same type and level of information for each dolphin. Observations of behavior and physical appearance were not universally noted as well.

6. Given any options, how would you want to further investigate dolphin diet?

7. How does knowledge of dolphin diets in the wild help dolphins in zoos and aquariums?
   Expect details and an explanation as to why students believe research can help nutritionists and trainers set goal weights and appropriate caloric values.
Diet

2.6 Prey in the Bay

OVERVIEW
Students research the diet of wild dolphins and compare their findings to a zoo population.

Driving Question
What kinds of prey do Sarasota Bay dolphins eat?

Objectives
• Students generalize that wild dolphins eat a wide variety of prey, but several species are prominent.
• Students recognize that Sarasota Bay dolphins have a diet that differs from dolphins in other regions of the world and from dolphins in zoo or aquarium collections.
• Students recognize and state the limitations of data gathered from sick and/or weak dolphins in the wild.
• Students describe locations of strandings and make a rough correlation to prime dolphin observation locations.

Time Required
Two class periods

Materials
• Student Handout: Journal of Mammalogy, Tables 2, 3, 4, and 6 (pages 167-172)
• Student Handout: Sarasota Bay Map: Detailed (Resources section, page 341)
• SLD software and computers
• Optional Student Handout: Reflections (page 173)

Teaching Notes
A study conducted by researchers Nelio B. Barros and Dr. Randy Wells explores the stomach contents of stranded (dead) bottlenose dolphins in an effort to study potential factors and links to patterns of habitat use. Composition and sizes of prey were analyzed and correlated with the feeding behavior of dolphins with known histories. Specific information as noted in the abstract include:

• The stomach contents of sixteen dolphins that died of a variety of factors revealed a strong correlation with > 10 species of fish known to exist in and near seagrass meadows.

• Observational records for ≤10 years showed that feeding generally occurs in shallow (2-3 meter) waters and near seagrasses in 23% of the cases.

• Dolphins usually feed alone or in small groups and on non-obligate (able to exist or survive in a variety environments) schooling prey.

• The main species of fish are soniferous, that is, fish that make some type of sound. Some fish make guttural sounds like grunts, while others such as the mullet jump out of the air and slap the water, effectively attracting dolphins.

• The seagrass meadow habitat of these fish is of importance to dolphins in the Sarasota Bay area and its protection is important for conservation of these animals.

• The researchers have not yet been able to demonstrate clear changes in diet from season to season. Instead, they are seeing a shift in habitat use patterns of the animals from season to season, which conforms to changes in prey fish habitat during those same periods. They will continue investigating these patterns.

164 ◆ Pilot Program
Studies at Zoos Help Wild Dolphins: While this study exclusively examines stomach remains of Sarasota Bay dolphins, continual diet research takes place at Brookfield Zoo and within other dolphin collections. These studies are reciprocal. Understanding dolphins in various social structures and habitats is instrumental in providing the best possible living condition for all dolphins.

Dr. Wells says:
"There's a lot that goes on in the lives of animals that we will never see or that we have a great deal of difficulty seeing in the wild. Being able to get physiological correlates with these behaviors is something that is nearly impossible to get in the wild in real time. Having access to animals that are well cared for in a captive environment and that work cooperatively with their trainers is a tremendous resource for understanding these animals at a much greater level and depth than what would be possible in wild studies alone."

Procedure
1. Divide students into teams and distribute Table 2 and 3 and the Detailed Map of Sarasota Bay handouts. The tables are reproductions of actual scientific information published in the Journal of Mammalogy.

2. Table 2 is used with the detailed map of Sarasota Bay. Students will locate the area of the strandings from the table and pinpoint them on the map. Comparing these points with the sightings data on the SLD software will reveal a correlation. However, students must understand that the dead dolphins may have drifted some distance from the site where they lived. This table also indicates the probable cause of death.

3. Instruct students to examine the map of Sarasota Bay and predict areas where they believe dolphin groups may gather.

4. Confirm these predictions using sighting events in the SLD software.
   - Open SLD software (any activity)
   - Select Browse Sightings from the Browse Data tab
   - Browse sightings to look for common gathering areas for dolphin groups.

5. Have students indicate on the map the general locations of dolphin strandings. Are there correlations with information from the sightings data?

6. Look at Table 3 as a class. This table provides information about the seasons, and about the weight and number of prey species (taxa) found.

7. Have students calculate the four most common dolphin prey species. Based on the stomach contents and the average weight of consumed mullet, students should assume that the comparative equivalency in consumption of biomass was 1.0 striped mullet = 2.1 spot = 4.9 pigfish = 5.4 pinfish. Students can extrapolate the distribution of prey species within this context. (Students should understand the limitations of these data. A sick or injured dolphin might not have eaten normally for a time. This is an important consideration.)

8. Explain the labels, calling particular attention to the species of prey. Make certain that students understand that the number of items and the number of times that a specific species is represented are very important.

9. Ask student teams to decide how these data are important to better understanding the dolphin population.

10. Challenge students within their teams to design their own Dolphin Wild Prey Data Sheet and assemble these data in a clear manner that would be helpful if the teams were to do further research. Instruct stu-
students to analyze Tables 4 and 6. From these data, challenge students to draw their own correlates. Encourage the communication of their analyses and conclusions with the class as a whole.

11. Discuss the Reflections activity as a class or have students complete the optional handout on their own.
<table>
<thead>
<tr>
<th>Sex</th>
<th>Age (Years)</th>
<th>Body Length (cm)</th>
<th>Date of Stranding</th>
<th>Location of Stranding</th>
<th>Cause of Death</th>
</tr>
</thead>
<tbody>
<tr>
<td>M</td>
<td>3</td>
<td>252.0</td>
<td>5 November 1984</td>
<td>Lido Key (Gulf)</td>
<td>Natural, undetermined</td>
</tr>
<tr>
<td>F</td>
<td>7</td>
<td>237.0</td>
<td>2 August 1988</td>
<td>Longboat Key (Bay)</td>
<td>Natural, infection, pneumonia, probable</td>
</tr>
<tr>
<td>M</td>
<td>11</td>
<td>255.0</td>
<td>24 September 1988</td>
<td>Lido Key (Bay)</td>
<td>Natural, infection, probable</td>
</tr>
<tr>
<td>M</td>
<td>39</td>
<td>264.5</td>
<td>30 August 1990</td>
<td>Anna Maria Island (Gulf)</td>
<td>Natural, cardiac involvement, possible</td>
</tr>
<tr>
<td>M</td>
<td>4</td>
<td>216.0</td>
<td>13 March 1991</td>
<td>Anna Maria Island (Gulf)</td>
<td>Natural, infection, possible</td>
</tr>
<tr>
<td>F</td>
<td>10</td>
<td>239.0</td>
<td>3 September 1991</td>
<td>Longboat Key (Bay)</td>
<td>Human-induced, stabbed</td>
</tr>
<tr>
<td>F</td>
<td>3</td>
<td>206.0</td>
<td>13 September 1991</td>
<td>Longboat Key (Bay)</td>
<td>Human-Induced, entanglement, possible</td>
</tr>
<tr>
<td>F</td>
<td>24</td>
<td>258.0</td>
<td>12 April 1992</td>
<td>Anna Maria Island (Bay)</td>
<td>Natural, ruptured uterus</td>
</tr>
<tr>
<td>M</td>
<td>4</td>
<td>233.0</td>
<td>13 May 1992</td>
<td>Longboat Key (Bay)</td>
<td>Natural, parasitic infestation, possible</td>
</tr>
<tr>
<td>F</td>
<td>4</td>
<td>216.0</td>
<td>26 July 1992</td>
<td>Lido Key (Bay)</td>
<td>Natural, pneumonia, infection, confirmed</td>
</tr>
<tr>
<td>F</td>
<td>9</td>
<td>236.0</td>
<td>10 September 1992</td>
<td>Longboat Key (Gulf)</td>
<td>Natural, stingray barb puncture</td>
</tr>
<tr>
<td>M</td>
<td>9</td>
<td>233.0</td>
<td>15 September 1992</td>
<td>Longboat Key (Gulf)</td>
<td>Natural, infection, probable</td>
</tr>
<tr>
<td>F</td>
<td>50</td>
<td>251.0</td>
<td>5 January 1994</td>
<td>Lido Key (Gulf)</td>
<td>Natural, infection, probable</td>
</tr>
<tr>
<td>M</td>
<td>42</td>
<td>268.0</td>
<td>14 June 1995</td>
<td>Siesta Key (Gulf)</td>
<td></td>
</tr>
<tr>
<td>F</td>
<td>36</td>
<td>238.5</td>
<td>27 August 1995</td>
<td>Lido Key (Bay)</td>
<td>Human-induced, ingestion of fishing line</td>
</tr>
<tr>
<td>F</td>
<td>44</td>
<td>250.0</td>
<td>9 August 1996</td>
<td>Long Bar Point (Bay)</td>
<td>Natural (?), undetermined</td>
</tr>
</tbody>
</table>

Data collected by Nelio B. Barros and Randall S. Wells
### Journal of Mammalogy Table 3
Prey Species of Resident Bottlenose Dolphins from Sarasota Bay, Florida

<table>
<thead>
<tr>
<th>Dolphin</th>
<th>Season</th>
<th>Total Wet Weight (g)</th>
<th>Total No. of Prey Items</th>
<th>Total No. of Prey Taxa</th>
<th>Prey Species</th>
<th>Common Name</th>
<th>Total Fish</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Winter</td>
<td>na</td>
<td>1</td>
<td>1</td>
<td><em>Caranx hippos</em></td>
<td>Crevalle Jack</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>Summer</td>
<td>797</td>
<td>29</td>
<td>4</td>
<td><em>Lagodon rhomboideos</em></td>
<td>Pinfish</td>
<td>23</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td><em>Leiostomus xanthurus</em></td>
<td>Spot</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td><em>Elops saurus</em></td>
<td>Ladyfish</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td><em>Orthopristis chrysoptera</em></td>
<td>Pigfish</td>
<td>1</td>
</tr>
<tr>
<td>3</td>
<td>Autumn</td>
<td>43</td>
<td>3</td>
<td>2</td>
<td><em>Lagodon rhomboideos</em></td>
<td>Pinfish</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td><em>Orthopristis chrysoptera</em></td>
<td>Pigfish</td>
<td>1</td>
</tr>
<tr>
<td>4</td>
<td>Summer</td>
<td>114</td>
<td>4</td>
<td>3</td>
<td><em>Mugil cephalus</em></td>
<td>Striped mullet</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td><em>Orthopristis chrysoptera</em></td>
<td>Pigfish</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td><em>Opsanus beta</em></td>
<td>Gulf toadfish</td>
<td>1</td>
</tr>
<tr>
<td>5</td>
<td>Spring</td>
<td>114</td>
<td>3</td>
<td>2</td>
<td><em>Archosargus probatocephalus</em></td>
<td>Sheephead</td>
<td>2</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td><em>Mugil cephalus</em></td>
<td>Striped mullet</td>
<td>1</td>
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<tr>
<td>6</td>
<td>Autumn</td>
<td>1516</td>
<td>54</td>
<td>2</td>
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<td>Pinfish</td>
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<td><em>Leiostomus xanthurus</em></td>
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<tr>
<td>7</td>
<td>Autumn</td>
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<td>16</td>
<td>3</td>
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<td>Pinfish</td>
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<td></td>
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<td><em>Brevoortia</em></td>
<td>Menhaden</td>
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<td>1</td>
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<tr>
<td>9</td>
<td>Spring</td>
<td>12</td>
<td>11</td>
<td>3</td>
<td><em>Lagodon rhomboideos</em></td>
<td>Pinfish</td>
<td>9</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td><em>Mugil cephalus</em></td>
<td>Striped mullet</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td><em>Elops saurus</em></td>
<td>Ladyfish</td>
<td>1</td>
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</table>
### Journal of Mammalogy Table 3 (continued)
#### Prey Species of Resident Bottlenose Dolphins from Sarasota Bay, Florida

<table>
<thead>
<tr>
<th>Dolphin</th>
<th>Season</th>
<th>Total Wet Weight (g)</th>
<th>Total No. of Prey Items</th>
<th>Total No. of Prey Taxa</th>
<th>Prey Species</th>
<th>Common Name</th>
<th>Total Fish</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td>Summer</td>
<td>26</td>
<td>37</td>
<td>3</td>
<td><em>Lagodon rhomboides</em></td>
<td>Pinfish</td>
<td>35</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td><em>Orthopristis chrysoptera</em></td>
<td>Pigfish</td>
<td>1</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td><em>Unidentified clupeid</em></td>
<td>Herring</td>
<td>1</td>
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<tr>
<td>11</td>
<td>Autumn</td>
<td>64</td>
<td>1</td>
<td>1</td>
<td><em>Ophichthus gomesi</em></td>
<td>Shrimp eel</td>
<td>1</td>
</tr>
<tr>
<td>12</td>
<td>Autumn</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td><em>Lagodon rhomboides</em></td>
<td>Pinfish</td>
<td>1</td>
</tr>
<tr>
<td>13</td>
<td>Winter</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td><em>Cynoscion</em></td>
<td>Sea trout</td>
<td>1</td>
</tr>
<tr>
<td>14</td>
<td>Summer</td>
<td>16</td>
<td>15</td>
<td>6</td>
<td><em>Lagodon rhomboides</em></td>
<td>Pinfish</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td><em>Leiostomus xanthurus</em></td>
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<td>3</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td><em>Opsanus beta</em></td>
<td>Gulf toadfish</td>
<td>2</td>
</tr>
<tr>
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<td></td>
<td></td>
<td></td>
<td><em>Mugil cephalus</em></td>
<td>Striped mullet</td>
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<td></td>
<td></td>
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<td></td>
<td></td>
<td><em>Unidentified carangid</em></td>
<td>Jack</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td><em>Unidentified teleost</em></td>
<td>Porgy</td>
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</tr>
<tr>
<td>15</td>
<td>Summer</td>
<td>1916</td>
<td>5</td>
<td>2</td>
<td><em>Archosargus probatocephalus</em></td>
<td>Sheepshead</td>
<td>4</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td><em>Unidentified elasmobranch</em></td>
<td>?Slingray</td>
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<tr>
<td>16</td>
<td>Summer</td>
<td>86</td>
<td>23</td>
<td>4</td>
<td><em>Opsanus beta</em></td>
<td>Gulf toadfish</td>
<td>14</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td><em>Lagodon rhomboides</em></td>
<td>Pinfish</td>
<td>5</td>
</tr>
<tr>
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<td></td>
<td></td>
<td></td>
<td></td>
<td><em>Orthopristis chrysoptera</em></td>
<td>Pigfish</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td><em>Gerres cinereus</em></td>
<td>Yellowfin mojarra</td>
<td>1</td>
</tr>
</tbody>
</table>

Data collected by Nelio B. Barros and Randall S. Wells
### Journal of Mammalogy Table 4
Seasonal Frequency of Occurrence of Prey in the Stomach of Resident Bottlenose Dolphins in the Sarasota Bay area, Florida

<table>
<thead>
<tr>
<th>PREY SPECIES</th>
<th>Winter (n=1)</th>
<th>Spring (n=3)</th>
<th>Summer (n=6)</th>
<th>Autumn (n=6)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Caranx hippos</td>
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<td></td>
<td></td>
<td>1 (17)</td>
</tr>
<tr>
<td>Lagodon rhomboides</td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Elops saurus</td>
<td>1 (33)</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Orthopristis chrysoptera</td>
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<td>4 (67)</td>
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</tr>
<tr>
<td>Mugil cephalus</td>
<td>2 (66)</td>
<td></td>
<td>2 (33)</td>
<td></td>
</tr>
<tr>
<td>Opsanus beta</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Archosargus probatocephalus</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Leioptomus xanthurus</td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Brevoortia</td>
<td></td>
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<td></td>
<td>1 (17)</td>
</tr>
<tr>
<td>Ophichthus gomesi</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cynoscion</td>
<td>1 (33)</td>
<td></td>
<td>1 (17)</td>
<td></td>
</tr>
<tr>
<td>Gerres cinereus</td>
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<td></td>
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<td></td>
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<td>Unidentified olupeid</td>
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<td>1 (17)</td>
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<tr>
<td>Unidentified spard</td>
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</tr>
<tr>
<td>Unidentified carangid</td>
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<td></td>
<td></td>
<td>1 (17)</td>
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<tr>
<td>Unidentified elasmobranch</td>
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<td></td>
<td></td>
<td>1 (17)</td>
</tr>
</tbody>
</table>

Data collected by Nelio B. Barros and Randall S. Wells
### Journal of Mammalogy Table 6
Features of Feeding Locations for Groups, Including Dolphins from Sarasota Bay, for which Stomach-Content Data are Available

<table>
<thead>
<tr>
<th>Dolphin Field No.</th>
<th>Total No. of Observations</th>
<th>Total No. of Feeding Observations</th>
<th>No. of Feeding Observations Near Seagrass</th>
<th>Feeding Observations Near Seagrass to Total No. of Feeding Observations</th>
<th>Water Depth (m) Near Feeding Sites</th>
<th>Proportion of Feeding Observations</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>243</td>
<td>64</td>
<td>27</td>
<td>0.42</td>
<td>2.1</td>
<td>7.0 4.3</td>
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<td>B</td>
<td>73</td>
<td>10</td>
<td>4</td>
<td>0.40</td>
<td>2.4</td>
<td>0.85 8.0</td>
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<tr>
<td>C</td>
<td>217</td>
<td>57</td>
<td>19</td>
<td>0.33</td>
<td>2.1</td>
<td>1.10 7.0</td>
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<tr>
<td>D</td>
<td>141</td>
<td>19</td>
<td>6</td>
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<td>2.1</td>
<td>0.79 7.0</td>
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<tr>
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<td>108</td>
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<td>8</td>
<td>0.31</td>
<td>2.4</td>
<td>1.55 8.0</td>
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<td>0.30</td>
<td>2.4</td>
<td>1.83 8.0</td>
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<tr>
<td>G</td>
<td>133</td>
<td>23</td>
<td>7</td>
<td>0.30</td>
<td>2.4</td>
<td>1.04 8.0</td>
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<tr>
<td>H</td>
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<td>2.1</td>
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<td>28</td>
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<td>0.18</td>
<td>2.7</td>
<td>1.40 9.0</td>
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<td>64</td>
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<td>0.17</td>
<td>2.4</td>
<td>1.35</td>
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<td>0.17</td>
<td>1.8</td>
<td>1.10 6.0</td>
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<td>2.1</td>
<td>0.91 7.0</td>
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<td>1.74 10.0</td>
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</tr>
</tbody>
</table>

**Average**

0.234

Data collected by Nelio B. Barros and Randall S. Wells
Reflections

1. State the purpose of your team's data analysis. How were you able to justify your purpose?

2. Wild dolphins eat a wide variety of prey, but several species are prominent. Summarize the findings of your research.

3. Why would a researcher want to specify that these strandings were found at sites in Sarasota Bay?

4. What other information about these dolphins would have been helpful?

5. These data came from necropsies (animal autopsies) of dolphins that had died. What factors are considered when collecting this type of data from animals that had been ill or injured?

6. What do the locations of the strandings represent? Is it possible to make a rough correlation to prime dolphin observation locations?

7. What aspect of this actual researchers' field study did you find most interesting? Why?

8. What did your research suggest about the locations of the strandings? What correlations do you suspect?

9. Given any options, how would you want to further investigate this topic?
Reflections

Answer Key

1. State the purpose of your team's data analysis. How were you able to justify your purpose?

2. Wild dolphins eat a wide variety of prey, but several species are prominent. Summarize the findings of your research.
   Students should note the primary prey species from the tables they used including pinfish, pigfish, spot, and mullet.

3. Why would a researcher want to specify that these strandings were found at sites in Sarasota Bay?
   Students should understand that Sarasota Bay dolphins have a diet that differs from dolphins in other regions of the world and that of dolphins in zoos and aquariums. Therefore, the food found in these dolphins would likely vary significantly from dolphins in other populations.

4. What other information about these dolphins would have been helpful?

5. These data came from necropsies (animal autopsies) of dolphins that had died. What factors are considered when collecting this type of data from animals that had been ill or injured?
   Responses should reflect a general understanding that these animals may not have a normal amount or variety of food.

6. What do the locations of the strandings represent? Is it possible to make a rough correlation to prime dolphin observation locations?
   Most of the strandings are near locations known to attract dolphins, such as seagrass beds. However, the stranding location may have resulted from a death site some distance away with the body washing ashore far from the last place the dolphin ate. Researchers would not draw a firm conclusion based exclusively of the stranding site. However, it does indicate a trend that is worthy of consideration in future studies.

7. What aspect of this actual researchers' field study did you find most interesting? Why?

8. What did your research suggest about the locations of the strandings? What correlations do you suspect?
   Expect concrete examples including proximity to seagrass beds and other verified dolphin site areas.

9. Given any options, how would you want to further investigate this topic?
Diet

2.7 Open Explorations

Once your students have completed each section you may wish to explore the data further. Generate questions as a class and use the software and other resources to prove or disprove your theories. Here are some suggestions to get started. Note that those questions with a (✓) can be supported by the SLD software.

• What are the likely long-range effects on humans provisioning (feeding) dolphins? Justify your response.

• What kinds of food do dolphins seem to prefer and how does this relate to their nutritional needs?

✓ In what ways is the diet at Brookfield Zoo different than the diet in the wild? Note differences in the diets and consider all aspects of a dolphin’s dietary needs, food acquisition, and environmental factors.