SeaWorld
ADVENTURE PARK
San Diego

Teacher Open House

Sept. 16, 2006
at the Adventure Camp Center

ACTIVITIES:

- *Blubberlicious*
- *Just Squidding Around*
- *Then and Now*

SEAWORLD ADVENTURE CAMPS℠

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Blubberlicious

Objective: To discover how dolphins and other whales keep warm.

To introduce the students to the scientific method.

California Science Standards Connections:

Kindergarten — Investigation and Experimentation

4.a. Students will observe common objects using the five senses.

Grade One — Investigation and Experimentation

4.b. Students will record observations and data with pictures, numbers, or written statements.

Grade Two — Life Sciences

4.g. Students will follow oral instructions for a scientific investigation.

Grade Three — Life Sciences

3.a. Students know plants and animals have structures that serve different functions in growth, survival, and reproduction.

Grade Three — Investigation and Experimentation

4.d. Students will predict the outcome of a simple investigation and compare the result with the prediction.

Grade 4 — Investigation and Experimentation

6.c. Students will formulate and justify predictions based on cause-and-effect relationships.

Grade 5 — Investigation and Experimentation

6.d. Students will identify the dependant and controlled variables in an investigation.

Grade 6 — Investigation and Experimentation

7.a. Students will develop a hypothesis.

7.d. Students will communicate the steps and results from an investigation in written reports and oral presentations.

Materials:

- ❒ One piece of Model Magic per student. The Model Magic should be molded into balls smaller than a ping-pong ball.
- ❒ One Model Magic bucket filled with ice water per three students.

Action: **Part I:** How do dolphins stay warm in water?

In front of Dan the acrylic dolphin, review dolphin/mammal characteristics. Have students turn themselves into marine biologists. Ask how people keep warm. Can dolphins keep warm in the same way people can? When marine biologists have questions that they can't answer they do experiments.

Grades 3 and above—discuss the scientific method. The scientific method involves the following steps: doing research, identifying the problem, stating a hypothesis, conducting project experimentation, and reaching a conclusion.

- Research is the process of collecting information from your own experiences, knowledgeable sources, and data from experiments.
- The problem is the scientific question to be solved.
- A hypothesis is an idea about the solution to a problem, based on knowledge and research.
- Project experimentation is the process of testing a hypothesis.
- The project conclusion is a summary of project experimentation results and a statement of how the results relate to the hypothesis.

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Part II: Blubberlicious experiment.

Group three students per one bucket of water. Have the students each put their index fingers into the cold water until the finger is cold. Use a watch to time how long the students can hold their fingers in the water (HINT: Tell the students to remove their fingers if they become numb or turn blue.) Students record times.

Ask students what dolphins use to keep warm. Distribute one *Blubberlicious* ball per student. Tell the students to flatten the ball into a pancake and then wrap it around their index finger. Time the students and have them compare the time it takes for their fingers to get cold with the time took before the *Blubberlicious* was placed on their fingers. Discuss results.

Teaching for different grade levels:

K-3

Vocabulary: Blubber, experiment

Roll-play: Finger with model magic blubber becomes a dolphin

Basic information: Students say new vocabulary out loud

4 and up

Vocabulary: Blubber, warm blooded, thermoregulation, and hypothesis

Open Ended Questions

More advanced information: Hypothesis and theory

Frequently asked questions:

Q: What is the difference between fat and blubber?

A: Blubber is a specialized type of fat that consists of layers of fat cells and connective tissue.

Q: Name some animals that have fat and some that have blubber.

A Penguins, humans, and dogs have fat. Killer whales, dolphins, seals, and sea lions all have blubber.

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Just Squidding Around

Objective: Through the use of observation and dissection, to introduce students to both the external and internal anatomy of squid (*Loligo opalescens),* an invertebrate belonging to the class ***cephalopoda.***

California Science Standards Connections:

Kindergarten — Life Sciences

2.c. Students know how to identify major structures of common plants and animals.

Kindergarten — Investigation and Experimentation

4.e. Students will communicate observations orally and through drawings.

Grade One — Life Sciences

2.a. Students know different plants and animals inhabit different kinds of environments and have external features that help them thrive in different kinds of places.

Grade Two — Life Sciences

2.a. Students know that organisms reproduce offspring of their own kind and that the offspring resemble their parents and one another.

Grade Two — Investigation and Experimentation

4.g. Students will follow oral instructions for a scientific investigation.

Grade Three — Life Sciences

3.a. Students know plants and animals have structures that serve different functions in growth, survival, and reproduction.

Grade 4 — Life Sciences

2.b. Students know producers and consumers are related in food chains and food webs and may compete with each other for resources in an ecosystem.

Grade 5 — Life Sciences

2.a. Students know many multicellular organisms have specialized structures to support transport of materials.

2.b. Students know how blood circulates through the heart chambers, [gills,] and body and how carbon dioxide (CO_2) and oxygen (O_2) are exchanged in the lungs and tissues.

Grade 6 — Ecology

5.c. Students know populations of organisms can be categorized by the functions they serve in an ecosystem.

Safety:

1. Emphasize to students that dissection scissors are not toys, and should be handled with care.
2. Do not allow students to *eat* any portion of the squid, including the lens. If hunger persists, refer them to Point Loma Sea Food for a tasty calamari sandwich.

Materials:

- ❒ Enough squid to provide one specimen per two students.
- ❒ Lunch trays covered with plastic trash liners.
- ❒ Dissection scissors and tweezers.
- ❒ Squid dissection photographs.
- ❒ Dry erase markers.

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Action: Initial Set Up

1. Divide the group into smaller sections of two or three students. REMEMBER: You will avoid behavioral problems by observing group composition, and reorganizing groups that may have potential for disruptions during the dissection.
2. Distribute covered lunch trays.
3. Distribute a paper towel to each group.
4. After instructing students to not touch the specimen, place one squid on each tray throughout the room.
5. Do not distribute any dissection tools. This will eliminate the possibility of any misbehavior or premature cutting of the squid.

Action: Observation

Along with the instructor, students will pick up their squids in hand and identify the following anatomical features:

- Eight arms and two longer tentacles, for a total of 10 appendages. Ask students to identify other related species. i.e., octopus, cuttlefish, nautilus.
- Suckers, which line the entire length of the arms, but are found only on the clubs, or terminal flattened end of the tentacles. The tentacles are used for grasping prey and drawing it towards the mouth.
- Mantle, or main body, and fins, which are used for steering and movement.
- Funnel or Siphon, which directs water flow from the mantle for propulsion. To swim, a squid will fill the mantle cavity with seawater, and expel it forcefully through the funnel.
- Skin, which contains color-bearing cells called *chromatophores.* Squid will use chromatophores to change color. At the instructor's direction, students may peel off the skin by rubbing the mantle between thumb and fingers. Observe the chromatophores. The remaining white flesh of the mantle is what is prepared as calamari.

Action: Dissection

Instructor will tell students to place squid on tray, then distributes dissection scissors and tweezers. Instructor should demonstrate each segment of the dissection before students make any cuts. The sequence for the dissection can be varied, but I have found the following order to work out well:

1. Observe the squid beak. Using the scissors, make a circular incision around the perimeter of the beak musculature, deep enough to free surrounding tissue. With thumb and forefinger, grasp the base of the muscle and pull gently outwards. If this is done properly, the squid's string-like esophagus will be attached.
2. Starting near the beak, make a lengthwise cut along the muscle, and use either fingers or tweezers to remove the two parts of the beak. Each part is called a mandible.
3. Notice that the beak parts are not symmetrical. Close examination reveals that the lower mandible actually overlaps the upper mandible.
4. On the dorsal (back) surface of the squid mantle, locate the tip of the gladius, or pen, which is actually an internal "shell." Cut away mantle tissue attached to the tip of the pen, and use tweezers to remove it. Have students set the pen aside.

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5. Observe the eye of the squid. Discuss briefly the purpose of the lens (focusing of light). Given that squid live in a marine environment, ask students to hypothesize as to the shape of the lens, compared to the elliptically shaped lens of humans and other land animals. Why do squid have a spherical lens?
6. To extract the lens, use the tip of the scissors to gently pierce the exterior of the eyeball. Using fingers or tweezers, grasp and remove the spherical lens CAUTION: Refrain from squeezing the eyeball during the initial puncture, as clothes-staining purple goop may spray outward. If there is sufficient time, allow students to remove both lenses.
7. Now it's time to investigate internal anatomy within the mantle cavity. Starting closest to the head, make a lengthwise (longitudinal) cut along the mantle, and open it to reveal the contents. The following are body parts that should be readily identifiable:
   a. The gills are white, feathery structures located on each side of the mantle. Although not really visible in this small species of squid, a tiny branchial (gill) heart is associated with each set of gills. The function of the branchial hearts is to pump deoxygenated blood through the gills. The main heart then pumps oxygenated blood to the systemic circulation. Remember: squid blood does not contain hemoglobin, but rather hemocyanin, which gives it a clear or slightly bluish appearance.
   b. The liver, better described as the digestive gland, is the long, brownish-orange mass. This organ has a number of different functions including the production and secretion of digestive enzymes, and the absorption of food.
   c. The translucent funnel retractor muscles are attached to the funnel and run lengthwise along the mantle. Contraction of the muscles allows the squid to adjust the direction of water flow from the funnel.
   d. Sex of the squid can be determined easily by looking for the yellowish, gelatinous ovary that is located near the tip of the mantle. If present, the specimen is a female; if absent, the specimen is a male. Male specimens will instead have diffuse, whitish testis.
   e. If the squid is female, students can locate the white, tube-like nidamental glands that secrete a protective covering over the eggs. Squeeze the nidamental glands to extract the white goop, which feels like paste.
   f. The ink sac is a small, silvery black object that looks like a tiny fish. The ink sac can be punctured (carefully!) with scissors to reveal the ink. Depending on the age, students may want to write their name on a paper towel with the "pen and ink"

Action: Cleanup *Now it's time for the cleanup:*

- Walk by each table and instruct students to place all dissection tools in the plastic container for cleaning.
- Next, show the students how to turn the plastic bag "inside out" to envelope and contain the disassembled squid. To avoid spillage of excess squid juice or tissue, *stress cleanliness and attention to detail*.
- Instruct students to place their squid bag in your larger garbage bag.
- Instruct students to hold their hands in the air, as if surgeons preparing to operate, and send them to the nearest restroom for cleanup.

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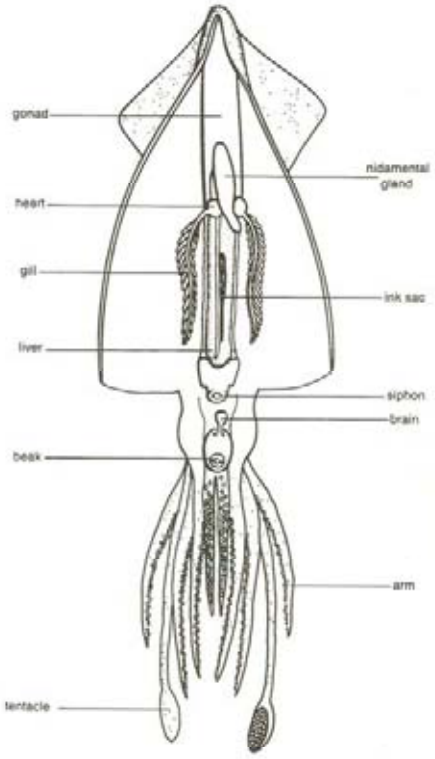
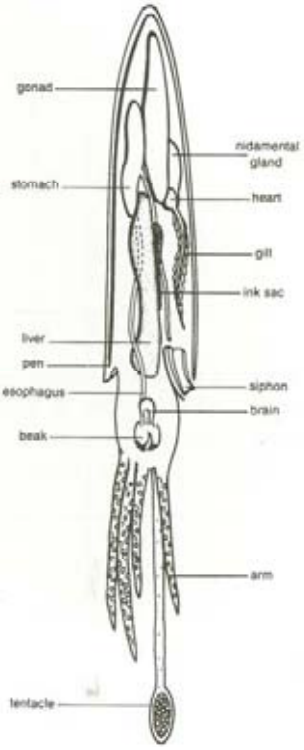
Just Squidding Around

exploring squid anatomy

BOTTOM



SIDE VIEW



Make a check next to the name as you identify different parts of the squid.

- ❑ arms — seize prey.
- ❑ beak — cuts prey into bite-sized pieces.
- ❑ brain — controls movement. A squid's brain is highly developed for an invertebrate. The brain appears as a small white ball just behind the beak.
- ❑ chromatophores — pigment-bearing cells that expand or contract to change the skin color (dark spots on mantle).
- ❑ esophagus — carries food from the mouth to the stomach.
- ❑ eyes — form an image, detect changes in light.
- ❑ fins — stabilize squid while swimming.
- ❑ gills — absorb oxygen from the water.
- ❑ gonad — the male gonad (testis) is a white filamentous mass that produces sperm. The female gonad (ovary) is an opaque mass that produces eggs.
- ❑ heart — circulates blood.
- ❑ ink sac — holds thick, black ink that the squid releases to confuse predators.
- ❑ liver — secretes digestive enzymes. The liver is salmon colored and is often found under the ink sac.
- ❑ mantle — body, holds internal organs.
- ❑ nidamental gland — females only; secretes a gelatinous mass that surrounds the eggs in the mantle cavity.
- ❑ pen — remnant of shell.
- ❑ siphon — squirts water to propel squid.
- ❑ stomach — digests food.
- ❑ tentacles — seize prey.

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Then and Now

Objective: Students will use observation skills to draw conclusions about a pod of killer whales.

Materials:
- ❒ Copies of ***Then and Now*** fun sheets (one per student).
- ❒ Pencils.

Background: In male killer whales, the dorsal fin is tall and triangular. In females, it is smaller and curves slightly toward the tail flukes. Researchers have learned to recognize many individual killer whales from photos. They take photographs when the whale rises highest out of the water as it breathes normally and exposes its dorsal fin and saddle region. These researchers must be skilled at recognizing subtle differences in the whale's body appearance as they study the pictures. Photo-identification is an important research tool for studying various aspects of cetacean biology, including distribution, habitat, and population changes.

A good book about identifying killer whales is *Killer Whales. A Study of Their Identification, Genealogy & Natural History in British Columbia and Washington State* by Michael A. Bigg, Graeme M. Ellis, John K.B. Ford, and Kenneth C. Balcomb, Phantom Press & Publishers Inc., 1987).

Action:
1. Give each student a copy of the ***Then and Now*** fun sheets.
2. Share the background information on this page with your students.
3. Students study the pictures on the activity sheet to answer the questions.

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Then and Now

A field biologist has asked you to help with a study of a pod of killer whales. Picture Set A was taken five years ago. Picture Set B was taken last month.

1. Which whales from Picture Set A and Picture Set B do you think are the same? Write the numbers of the matching whales.

2. The biologist suspects that Whale A3 and Whale B5 might be the same individual. What do you think? If it is the same whale, what might have caused the change in appearance?

3. Has the pod grown or shrunk?

4. How many whales have joined the pod in the last five years?

5. How many whales have left the pod in the last five years?

6. How many males were in the pod five years ago?

7. How many males are in the pod in the most recent photo set?

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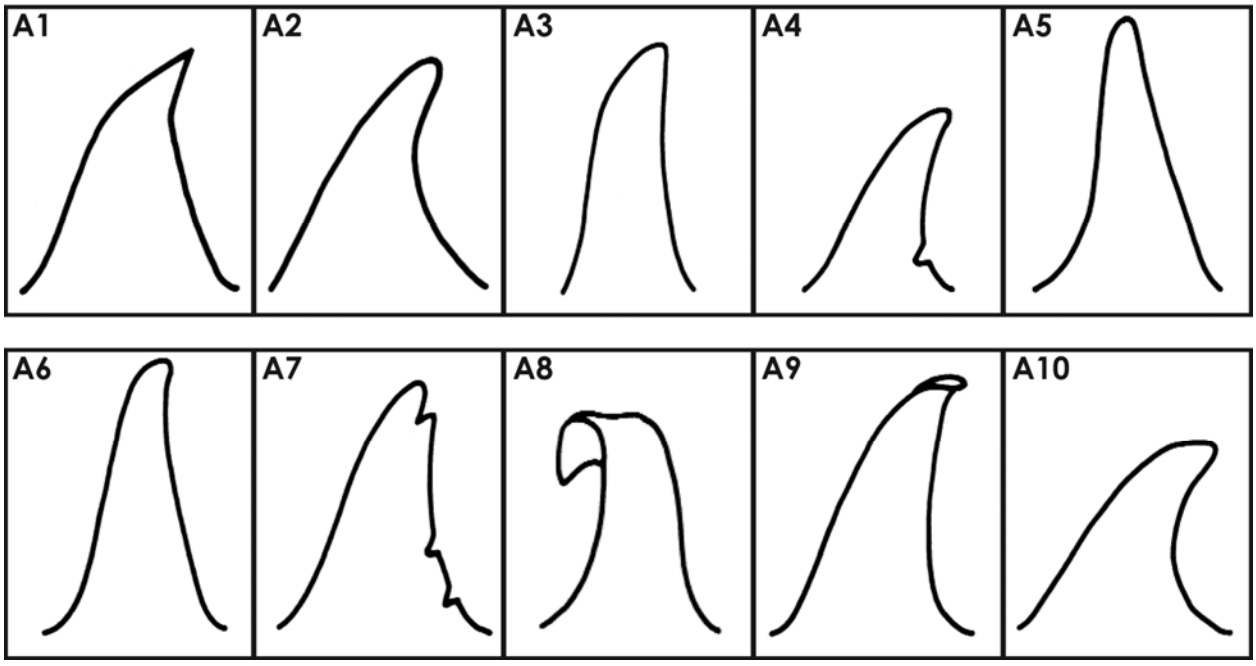
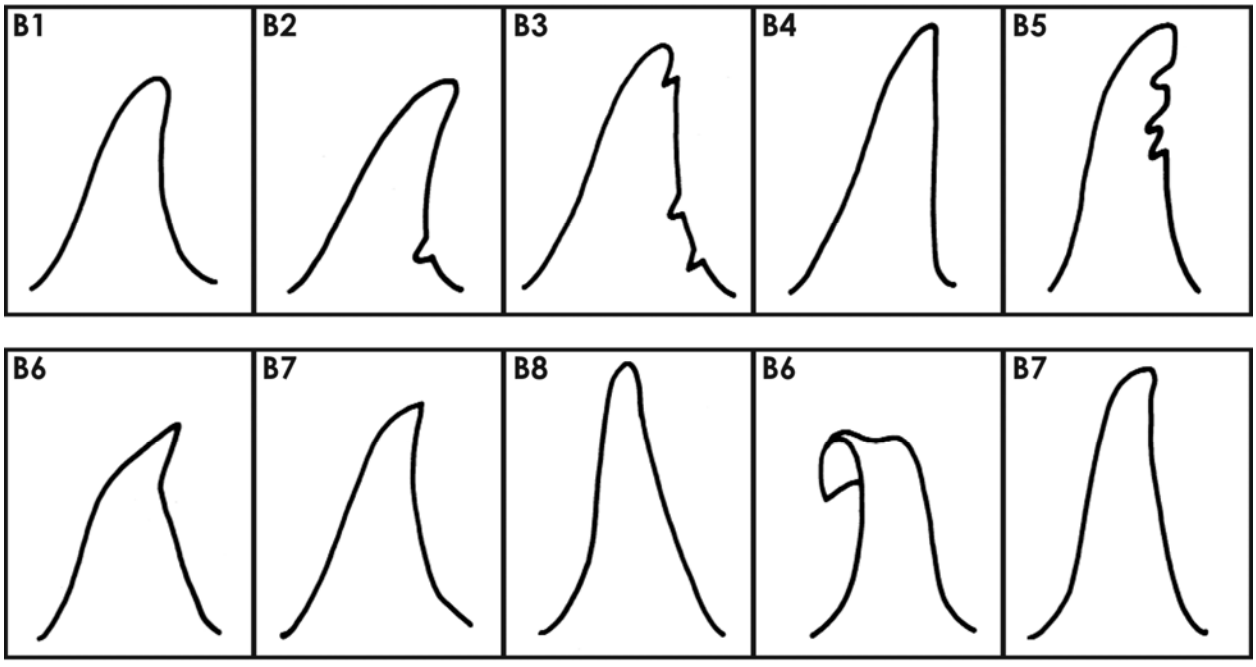
Then and Now

Picture Set A



Picture Set B



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