



ARE WE RELATED?

How do we classify marine organisms by their degree of relatedness?

HAWAI'I DOE STANDARD BENCHMARK

Science 4: Life and Environmental Sciences: STRUCTURE AND FUNCTIONING IN ORGANISMS

Classification

- SC.7.4.4 Classify organisms according to their degree of relatedness.

ACTIVITY AT A GLANCE

Student teams apply clues about features of organisms to identify and explain how scientists organize species by phylum. They play a phylum fishing card game to reinforce what they have learned.

MATERIALS

Provided:

- ✓ clue cards
- ✓ phylum fishing cards
- ✓ Learning Log - 4

Needed:

- ✓ box labeled Hilo Bay
- ✓ chart paper
- ✓ colored markers
- ✓ dictionaries

ASSESSMENT

Students:

- Complete a phylum booklet with illustrations or photographs that depict at least two organisms from each phylum studied, and written descriptions of anatomical features that distinguish each phylum.
- Analyze the degree of relatedness among selected organisms and list anatomical features that are characteristic of organisms in different phyla.

KEY CONCEPT

- Organisms can be classified according to similarities in their anatomical features.

TIME

2 - 3 class periods

SKILLS

observation, analysis, classification, research, use of scientific vocabulary

ADVANCE PREPARATION

- Copy five complete sets of the phylum fishing cards and one set of clue cards. Using a different colored marker for each set of phylum fishing cards, draw a line down the back of the cards so that you can easily reassemble the sets.
- Cut the sets of cards out and laminate.
- Copy Learning Log – 4 for each student.
- Gather some of the materials listed under References at the end of this lesson.



VOCABULARY

invertebrate – animals without a backbone or spinal column

mantle – folds of the body that line the shell and secrete the shell of molluscs



phylum – a primary division of a kingdom such as the animal kingdom (*pl. phyla*)

radula – flexible tongue-like organ with rows of horny teeth used for feeding

vertebrate – an animal with a backbone or spinal column

HAWAII DOE RUBRIC

Advanced	Proficient	Partially Proficient	Novice
Classify organisms according to their degree of relatedness and justify the classification.	Classify organisms according to their degree of relatedness.	Identify ways to classify organisms according to their degree of relatedness.	Recognize that organisms can be classified.

TEACHER BACKGROUND INFORMATION

Phyla and Representative Organisms

Some of the phyla and representative organisms found in Hawaiian coral reefs are:

Chordata: bony fishes, cartilaginous fish (sharks and rays); and reptiles (turtle). Fish commonly found living on Hawaiian reefs include: *hīnālea* (wrasses), *uhu* (parrotfish), butterflyfish, damselfish, surgeonfish, tangs, and *weke* (goatfish)

Echinodermata: black, brown, and red sea cucumbers, several sea urchins: *ina* (short-spined boring urchins), long-spined *wana*, red slate pencil urchins, and collector urchins

Mollusca: oysters, clams, snails, squid, octopus

Arthropoda: lobster, crab, shrimp

Cnidaria (Coelenterata): coral polyps, jelly fish, sea anemones

Annelida: feather duster worm, fire worm

Cyanobacteria: blue-green algae

Chlorophyta (green seaweeds) *Ulva*, *Halimeda*, *Caulerpa*, *Codium*, *Dictyosphaeria*

Phaeophyta (brown seaweeds) *Padina*, *Sargassum*, *Dictyota*, *Dictyopteris*

Rhodophyta (red seaweeds) *Gracilaria*, *Asparagopsis*, *Hypnea*, *Acanthophora*, *Laurencia*

Hawaiians were keen observers of nature and many of their classifications of plants and animals match family or phyla that scientists use for classification today. For example, similar names such as *'ōhi'a 'ai*, *'ōhi'a ha*, and *'ōhi'a* are all plants in the Myrtle family. The visual resemblance and similar anatomical features of organisms provide clues to their relatedness with other organisms.

In this activity, students classify organisms according to similar features and see the relatedness among organisms in different phyla.



TEACHING SUGGESTIONS

1. Discuss how Hawaiian names indicate the keen observation skills of the people of early Hawai'i in recognizing similarities among related plants or animals.

- Show the phylum card with the picture of the *lauwiliwilinukunuku'oi'oi* (common longnose or forceps butterflyfish) to students and ask them to come up with adjectives to describe what it looks like.
- Write the Hawaiian name on the board and ask if anyone knows what it means (*lau*, leaf; *wiliwili*, native dryland forest tree; *nukunuku 'oi'oi*, sharp-beaked). Discuss the meaning of the name (its compressed body resembles the *wiliwili* leaf and its snout is long).
- Write the Hawaiian names for the following fish on the board and see if anyone knows what the names mean. *Lauhau* refers to the leaf of the *hau* tree.

lauhau kapuhili (confusing)

lauhau kikākapu (*kikā*, strong; *kapu*, taboo)

lauhau mahauli (dark gilled)

lauhau nukuiwi (pointed nose)

2. Ask students to find out if these fish are related (what family they are classified in) and have them identify similar anatomical features among the fishes.

- Direct students to the references listed at the end of this activity for their research.
- Have students share their findings and discuss how the observations of nature by people in early Hawai'i often correlate with classification that scientists use to group organisms today.

3. Challenge students to analyze features of marine organisms and group the organisms according to phyla.

- Discuss the way scientists classify plants and animals.
- Divide the class into five teams and have each team sit around a table.
- Give each team a clue card for a phylum (or phyla) of marine life in Hilo Bay: 1) Chordata, 2) Cnidaria, 3) Arthropoda and Annelida, 4) Mollusca, and 5) Echinodermata.
- Encourage students to use a dictionary to look up unfamiliar terms on their clue cards.
- Distribute a full set of phylum fishing cards to each team and challenge teams to study the organisms on the cards and use the information on their clue cards to identify the animals that belong in their phylum.
- Circulate and check each team's accuracy.

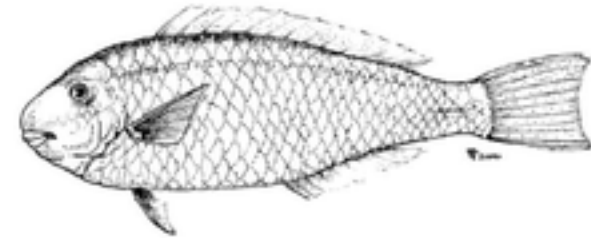




4. Give each team some chart paper and markers and ask students to present the animals in their phylum to their classmates.
 - Their presentations should include a list of the features that distinguish the phylum and a display of the animals on the cards.
 - Post each team's chart paper in the classroom for everyone to see.
 - Alert students to pay close attention to these presentations since they will need the information in a team card game to follow. Ask them to take notes of key features in each phylum.

5. Play a phylum card fishing game to reinforce what students have learned.
 - Collect and shuffle all of the cards. See directions provided at the end of this activity. If you have a large class, have students play the game in smaller groups.

6. After the game, distribute Learning Log - 4 and challenge students to create phylum booklets.
 - Review the directions on the Learning Log with students.
 - Challenge students to conduct research to list anatomical features that distinguish each organism in a phylum. (Internet searches will allow them to easily gather information on each phylum.) Note: if time is limited, have students work in teams with each student completing one phylum for a booklet, or with students pooling their talents as artists, researchers, and writers.
 - Have students share their booklets with other classes or display them in the school library.



ADAPTATION / EXTENSION

Language Arts: Writing: Range - Have students each select one phylum card and conduct research to learn more about the organism. Ask them to search for cultural information about relationships (see writing prompt). Have students combine their research to create a class phylum book to share with others.

Writing Prompt

In the Hawaiian view, humans are related to all life and the gods are manifest in the plants and animals, the water, and the land. Choose one of the phylum cards and find out how Hawaiians viewed this plant or animal through *pilina 'āina* (relationships with the land) and *pilina akua* (relationships with gods).



RESOURCES

Classification of Living Things. Web site created and maintained by Dr. Dennis O'Neil. Behavioral Sciences Department, Palomar College, San Marcos, California. Retrieved June 1, 2005, from http://anthro.palomar.edu/animal/animal_4.htm#top

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Farber & Associates. 2004. *Final Environmental Assessment for Kō'ie'ie Fishpond Revitalization Project Ka'ono'ulu, Maui, Hawai'i*. (No publication information available.)

Hobson, Edmund, and E.H. Chave. 1972. *Hawaiian Reef Animals*. University of Hawai'i Press. Honolulu, HI.

Profiles of Marine Life. Waikīkī Aquarium. Retrieved May 25, 2005, from <http://waquarium.otted.hawaii.edu/MLP/index.html>.

Pukui, Mary Kawena, Haertig, E.W. & Lee, Catherine. 1972. *Nānā I Ke Kumu: Look to the Source*. Hui Hānai. Honolulu, HI.

Titcomb, Margaret. 1977. *Native use of Fish in Hawai'i*. University of Hawai'i Press. Honolulu, HI.



PHYLUM FISHING GAME

INSTRUCTIONS

OBJECTIVE

To match organisms by phylum and display the most sets of correctly matched organisms.

GAME SET-UP

Place the five sets of shuffled cards in a box to represent Hilo Bay. Assemble teams around the "Bay."

TO PLAY

- A representative from each team fishes for five cards from the "Bay" without looking.
- Teams organize their cards and display any phylum matches, picture side up on the table in front of them. A match consists of at least two organisms (they may be the same species) that belong to a phylum.
- Teams may challenge the phylum matches of their classmates. The first team to indicate a challenge proceeds. If the team challenges successfully, they take the cards that were incorrectly displayed and return them to the "Bay." The challenging team then receives an extra turn. If they challenge unsuccessfully, they lose a turn. (See the box below for types of organisms in each phylum.)
- Teams take turns drawing a card from the "Bay" *or* taking a card from the displays of another team.
- After the first round, if the card they draw constitutes a match with any of their cards, they have the option of holding onto the cards or displaying them. However, once teams have at least three cards in a phylum, they must display the cards for others to see.

TO END THE GAME

The game ends when the first team runs out of cards. At this time, teams holding onto matches will not be able to count them. Only the matches displayed will count. Teams receive one point for each card correctly displayed in a phylum match.

PHYLA AND REPRESENTATIVE ORGANISMS

Chordata: bony fishes, cartilaginous fish (sharks and rays); and reptiles (turtle)

Echinodermata: sea urchins, sea stars, sea cucumbers

Mollusca: oysters, clams, snails, squid, octopus

Arthropoda: lobster, crab, shrimp

Cnidaria (Coelenterata): coral polyps, jelly fish, sea anemones

Annelida: feather duster worm, fire worm



ARE WE RELATED?

CLUE CARDS

Instructions: Copy and cut out one set of clue cards (one card for each group of students).

<p>CHORDATA are the vertebrates - animals with backbones or spinal column. Find all of the vertebrates and then figure out a way to place them in three groups.</p>	<p>ECHINODERMATA means “spiny skin.” Most of these invertebrates are covered by hard plates and have spines or other projections. Their body parts are arranged symmetrically around a “mouth” but they don’t have a head. Who are they?</p>
<p>MOLLUSCA are invertebrates that have three major features: 1) a specialized “foot” used for creeping, digging, or grasping; 2) a mantle that encloses their internal organs (and sometimes secretes a shell); and 3) a radula modified teeth used for feeding. Who are they?</p>	<p>ARTHROPODA are invertebrates with jointed legs, segmented bodies, and gills or tracheae. Who are they?</p>
<p>CNIDARIA are invertebrates that have cnida or nematocysts used for feeding. Their body forms can be sedentary such as polyps or moving medusa. Who are they?</p>	<p>ANNELIDA are segmented worms. Some have bristles; some move, and others remain stationary.</p>



ARE WE RELATED?

PHYLUM FISHING CARDS - INVERTEBRATES

Instructions: Copy and cut out five sets of cards to be distributed one to each group of students.

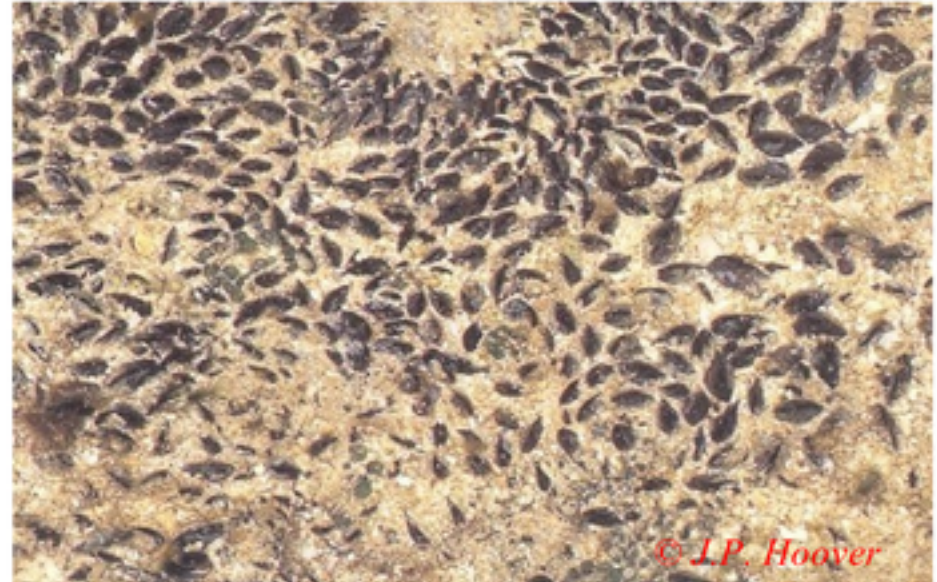
Phylum: Mollusca

***Pā* (Black-Lipped Pearl Oyster)**



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***Kio Nahawele* (Hawai'i Mussel)**



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***Pūpū Kupa* (Rounded Cockle)**



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***Leho Kupa* (Snakehead Cowry)**



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***Mūhe'e* (Squid)**



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***He'e Pūloa* (Ornate Octopus)**



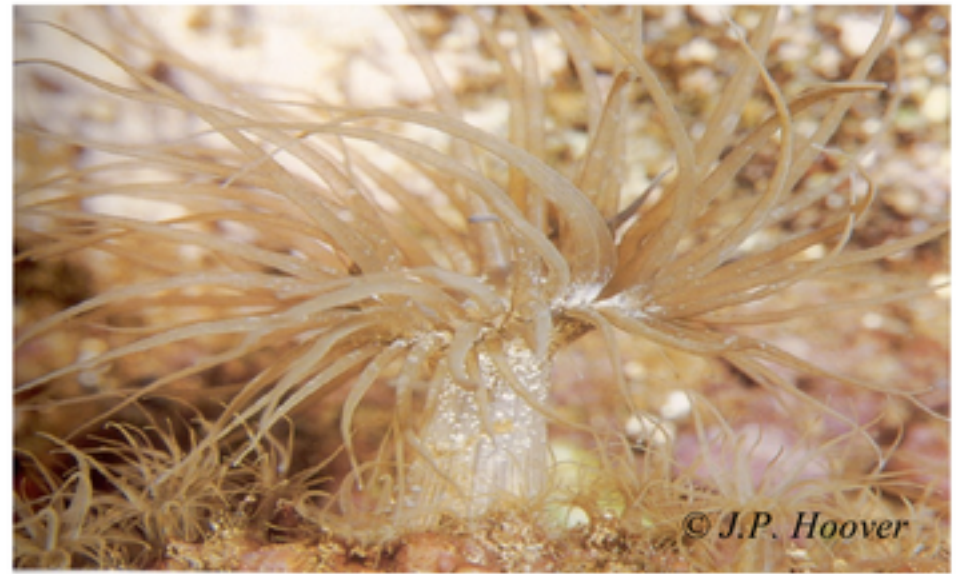
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***Pa'imalu* (Portuguese Man-of-War)**



Glass Sea Anemone



Phylum: Cnidaria

***Pōhaku Puna* (Finger Coral)**



***Ko'a* (Cauliflower Coral)**

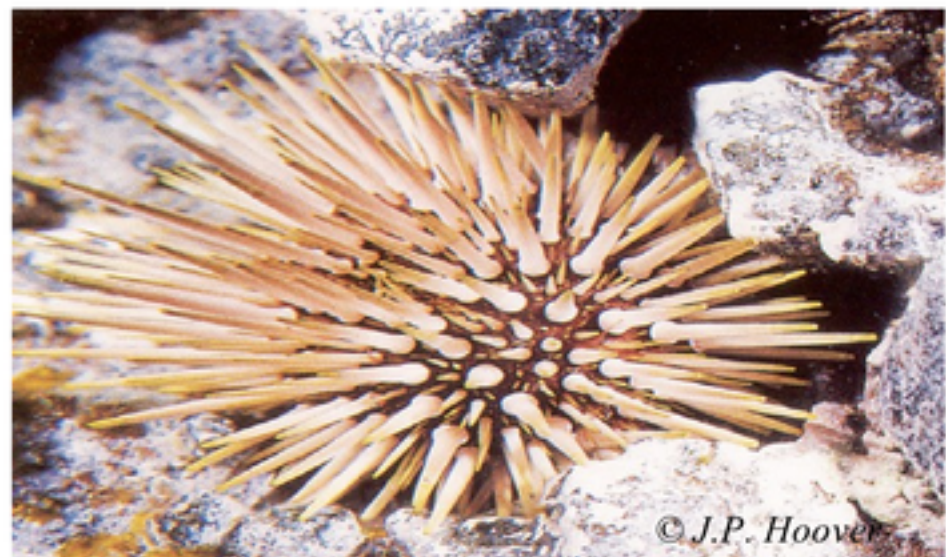


Phylum: Echinodermata

***Weli* (Conspicuous Sea Cucumber)**

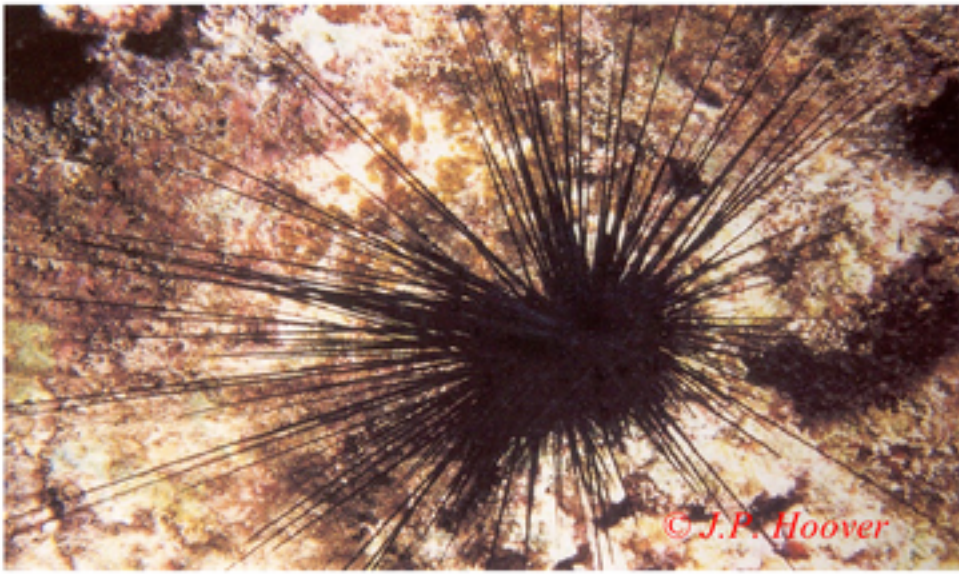


***'Ina Kea* (Rock-Boring Sea Urchin)**





Wana (Long-Spined Sea Urchin)



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Pe'a (Spiny Brittlestar)



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Phylum: Arthropoda

Ula (Spiny Lobster)



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'Alakuma (Seven-Eleven Crab)



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Pokipoki (Box Crab)



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'Ōpae Kai (Harlequin Shrimp)



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Phylum: Annelida

***Kio Po'apo'ai* (Feather Duster Worm)**



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***'Aha Hululu* (Orange Fire Worm)**



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Phylum: Chordata – Bony Fish

***Hinālea Lauwili* (Saddleback Wrasse)**



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***Uhu* (Spectacled Parrotfish)**



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***Mamo* (Sergeant Major)**



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***Pūhi Lau Milo* (Undulated Moray Eel)**



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Lauwiliwilinukunuku'oi'oi (Common Longnose or Forceps Butterflyfish)



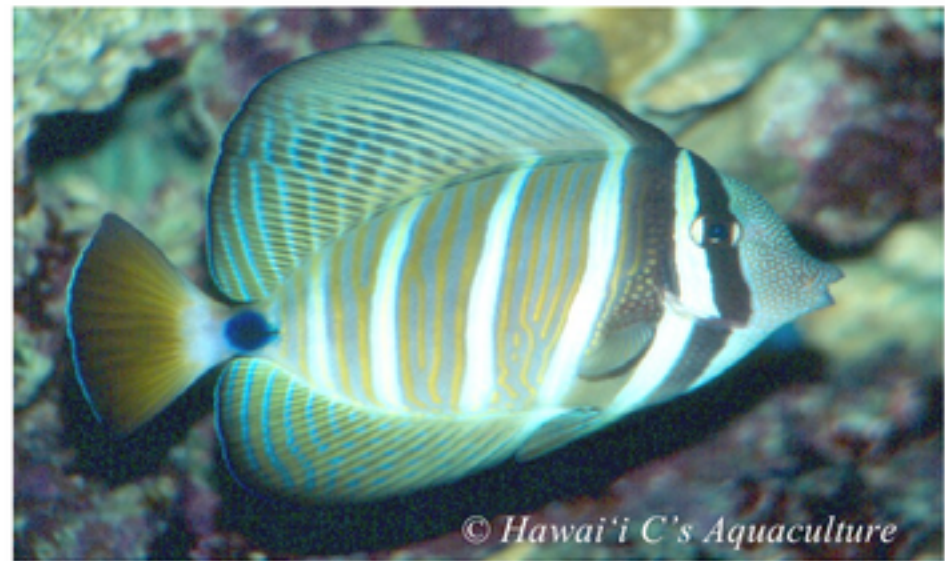
Kīkākapu (Ornate Butterflyfish)



Pualu (Yellowfin Surgeonfish)



Māneoneo (Sailfin Tang)



Weke 'Ula (Yellowfin Goatfish)



Ulua Akea (Giant Trevally or Jack)





Pāpio (Young Trevally or Bigeye Jack)



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To'au (Blacktail Snapper)



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Roi (Peacock Snapper)



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Kākū (Great Barracuda)



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Phylum: Chordata – Cartilaginous Fish

Hihimanu (Hawai'i Stingray)



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Māno Kihikihi (Scalloped Hammerhead Shark)



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Phylum: Chordata – Reptiles and Mammals

***Honu* (Green Sea Turtle)**



***Nai'a* (Bottlenose Dolphin)**

