Full text of O L O W Life Science conference

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Life Science

Please add ocean content under the appropriate standard

http://books.nap.edu/html/nses/

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Developing Student Understanding

Item 1 **Peter Tuddenham** *Oct 22, 2004 19:23*

Developing Student Understanding

K-4

http://books.nap.edu/html/nses/6c.html#ls

During the elementary grades, children build understanding of biological concepts through direct experience with living things, their life cycles, and their habitats. These experiences emerge from the sense of wonder and natural interests of children who ask questions such as: "How do plants get food? How many different animals are there? Why do some animals eat other animals? What is the largest plant? Where did the dinosaurs go?" An understanding of the characteristics of organisms, life cycles of organisms, and of the complex interactions among all components of the natural environment begins with questions such as these and an understanding of how individual organisms maintain and continue life. Making sense of the way organisms live in their

environments will develop some understanding of the diversity of life and how all living organisms depend on the living and nonliving environment for survival. Because the child's world at grades K-4 is closely associated with the home, school, and immediate environment, the study of organisms should include observations and interactions within the natural world of the child. The experiences and activities in grades K-4 provide a concrete foundation for the progressive development in the later grades of major biological concepts, such as evolution, heredity, the cell, the biosphere, interdependence, the behavior of organisms, and matter and energy in living systems.

Children's ideas about the characteristics of organisms develop from basic concepts of living and nonliving. Piaget noted, for instance, that young children give anthropomorphic explanations to organisms. In lower elementary grades, many children associate "life" with any objects that are active in any way. This view of life develops into one in which movement becomes the defining characteristic. Eventually children incorporate other concepts, such as eating, breathing, and reproducing to define life. As students have a variety of experiences with organisms, and subsequently develop a knowledge base in the life sciences, their anthropomorphic attributions should decline.

In classroom activities such as classification, younger elementary students generally use mutually exclusive rather than hierarchical categories. Young children, for example, will use two groups, but older children will use several groups at the same time. Students do not consistently use classification schemes similar to those used by biologists until the upper elementary grades.

As students investigate the life cycles of organisms, teachers might observe that young children do not understand the continuity of life from, for example, seed to seedling or larvae to pupae to adult. But teachers will notice that by second grade, most students know that children resemble their parents. Students can also differentiate learned from inherited characteristics. However, students might hold some naive thoughts about inheritance, including the belief that traits are inherited from only one parent, that certain traits are inherited exclusively from one parent or the other, or that all traits are simply a blend of characteristics from each parent.

Young children think concretely about individual organisms. For example, animals are associated with pets or with animals kept in a zoo. The idea that organisms depend on their environment (including other organisms in some cases) is not well developed in young children. In grades K-4, the focus should be on establishing the primary association of organisms with their environments and the secondary ideas of dependence on various aspects of the environment and of behaviors that help various animals survive. Lower elementary students can understand the food link between two organisms.

5-8

http://books.nap.edu/html/nses/6d.html#ls

In the middle-school years, students should progress from studying life science from the point of view of individual organisms to recognizing patterns in ecosystems and developing understandings about the cellular dimensions of living systems. For example, students should broaden their understanding from the way one species lives in its environment to populations and communities of species and the ways they interact with each other and with their environment. Students also should expand their investigations of living systems to include the study of cells. Observations and investigations should become increasingly quantitative, incorporating the use of computers and conceptual and mathematical models. Students in grades 5-8 also have the fine-motor skills to work with a light microscope and can interpret accurately what they see, enhancing their introduction to cells and microorganisms and establishing a foundation for developing understanding of molecular biology at the high school level.

Some aspects of middle-school student understanding should be noted. This period of development in youth lends itself to human biology. Middle-school students can develop the understanding that the body has organs that function together to maintain life. Teachers should introduce the general idea of structure-function in the context of human organ systems working together. Other, more specific and concrete examples, such as the hand, can be used to develop a specific understanding of structure-function in living systems. By middle-school, most students know about the basic process of sexual reproduction in humans. However, the student might have misconceptions about the role of sperm and eggs and about the sexual reproduction of flowering plants. Concerning heredity, younger middle-school students tend to focus on observable traits, and older students have some understanding that genetic material carries information.

Students understand ecosystems and the interactions between organisms and environments well enough by this

stage to introduce ideas about nutrition and energy flow, although some students might be confused by charts and flow diagrams. If asked about common ecological concepts, such as community and competition between organisms, teachers are likely to hear responses based on everyday experiences rather than scientific explanations. Teachers should use the students' understanding as a basis to develop the scientific understanding.

Understanding adaptation can be particularly troublesome at this level. Many students think adaptation means that individuals change in major ways in response to environmental changes (that is, if the environment changes, individual organisms deliberately adapt).

9-12

http://books.nap.edu/html/nses/6e.html#ls

Students in grades K-8 should have developed a foundational understanding of life sciences. In grades 9-12, students' understanding of biology will expand by incorporating more abstract knowledge, such as the structure and function of DNA, and more comprehensive theories, such as evolution. Students' understandings should encompass scales that are both smaller, for example, molecules, and larger, for example, the biosphere.

Teachers of science will have to make choices about what to teach that will most productively develop student understanding of the life sciences. All too often, the criteria for selection are not clear, resulting in an overemphasis on information and an underemphasis on conceptual understanding. In describing the content for life sciences, the national standards focus on a small number of general principles that can serve as the basis for teachers and students to develop further understanding of biology.

Because molecular biology will continue into the twenty-first century as a major frontier of science, students should understand the chemical basis of life not only for its own sake, but because of the need to take informed positions on some of the practical and ethical implications of humankind's capacity to manipulate living organisms.

In general, students recognize the idea of species as a basis for classifying organisms, but few students will refer to the genetic basis of species. Students may exhibit a general understanding of classification. However, when presented with unique organisms, students sometimes appeal to "everyday" classifications, such as viewing jellyfish as fish because of the term "fish," and penguins as amphibians because they live on land and in water.

Although students may indicate that they know about cells, they may say that living systems are made of cells but not molecules, because students often associate molecules only with physical science.

See the example entitled "Fossils"

Students have difficulty with the fundamental concepts of evolution. For example, students often do not understand natural selection because they fail to make a conceptual connection between the occurrence of new variations in a population and the potential effect of those variations on the long-term survival of the species. One misconception that teachers may encounter involves students attributing new variations to an organism's need, environmental conditions, or use. With some help, students can understand that, in general, mutations occur randomly and are selected because they help some organisms survive and produce more offspring. Other misconceptions center on a lack of understanding of how a population changes as a result of differential reproduction (some individuals producing more offspring), as opposed to all individuals in a population changing. Many misconceptions about the process of natural selection can be changed through instruction.

Many misconceptions about the process of natural selection can be changed through instruction.

9-12 Behavior of organisms

Item 2 **Peter Tuddenham** *Oct 22, 2004 19:26*

9-12 Behavior of organisms

Response 2:1 **Patricia DuBose** *Oct 27, 2004 16:04*

this is always a fun topic... all the marine mammals and their behaviors... relating behavior of organisms to the physical parameters of the ocean... grunions, turtle nesting; coral spawing; urchin spawning; plankton migrating the water column;

Response 2:2 **Gabrielle Johnson** *Oct 28, 2004 12:52*

fish also have many interesting mating displays
recent sutdies on great white also indicate interesting behaviors with tail slapping and warning signals

the orcas also have some amazing behaviors in hunting in addition to other whales and their cooperative hunting efforts

sea gulls have some fun foraging behaviors in relation to cost/benefit (optimal foraging theory)

sexual seletion also comes into play especially with regards to wrasses their ability to change sex

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Response 2:3 **Margaret Tower** *Oct 30, 2004 21:06*

The behavior of anaerobic life at the hydrovents, deep down in the ocean, on top of volcanoes, is amazing! That is where life is created, with the help of the basic elements that were originally acquired from space. That worm down there that was discovered in recent times is amazing!

5-8 Regulation and behavior

Item 3 **Peter Tuddenham** *Oct 22, 2004 19:26*

5-8 Regulation and behavior

Response 3:1 **Susan Snyder** *Oct 26, 2004 18:40*

Content topics: Symbiotic relationships exist in the ocean: competition, predation, parasitism, ...and mutualism (eg. zooxanthellae algae and corals, clownfish and anemones, cleaner fish and larger fish). Some marine animals migrate to feed, regulate temperature, and reproduce (eg. whales). Aquatic organisms have behaviors and other adaptations that help them survive predation (eg. schooling behavior, mass migrations, camouflage).

Response 3:2 **Lynn Whitley** *Oct 29, 2004 01:21*

Behaviors to enhance feeding strategies, such as whales 'bubble netting"

K-4 Organisms and environments

Item 4 **Peter Tuddenham** *Oct 22, 2004 19:26*

K-4 Organisms and environments

Response 4:1 **Sarah Schoedinger** *Oct 26, 2004 23:13*

The following were suggested by you all on the survey for this grade group:

Characteristics, classification of marine organisms;
The concept of adaptions (to marine/Great Lakes environments)
Food web interactions
Relationships between marine and terrestrial organisms.

Response 4:2 **Gabrielle Johnson** *Oct 27, 2004 13:52*

Adaptations are a great one to teach for this concept. Especially how organism adapt to the intertidal: wave action, dessication, predation. One could also include competition and keystone predators (starfish and mussel communities or otters and kelp communities)

The deep or pelagic sea also works. The students list off the physical characterties of the environment and disucss how various organims are adapted. I usually show a photo and them we discuss each one. There is also a cool interactive website where you match the fish to its environment.

Response 4:3 **Gabrielle Johnson** *Oct 27, 2004 18:15*

Exmaining how the presence or absence of plants in aquariums affect water quality over time. Discuss the interactions of plants and animals

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Response 4:4 **Francesca Cava, Nat. Geo. Society, Santa Barbara, California** *Oct 28, 2004 10:52*

What lives in a kelp forest; what lives in a rocky intertidal area; what are tide pools; how can whales live in the ocean if they need to breathe, etc.

Response 4:5 **Francesca Cava, Nat. Geo. Society, Santa Barbara, California** *Oct 28, 2004 11:04*

My five year old niece has a collection of sea shells -- she loves them and wonders how things live in these unique environments!

Response 4:6 **Rita Bell** *Oct 29, 2004 15:53*

All animals depend on plants
a few related ocean topics:
Marine food web
Ocean predator and prey relationships

Organism's behavior is related to the environment
ocean topics:
build a tidepool, what happens as the tides change?
How do rocky shore animals hold on?
How do rocky shore animals keep from drying out when the tides change?

All organisms cause change
ocean topics:
On field trips, look for evidence of animals changing the habitat: wharf pilings, sea lion colonies, bird rocks

Humans depend on/change environments
ocean topics:
How do humans change the rocky shore/sandy beach?
Wharfs, coastal construction, jetties
How does the ocean help humans?
Fish as a food product, recreation, transportation, exploration
What is ocean conservation?
What can kids to to help conserve the ocean?

Response 4:7 **Pam Stryker** *Oct 29, 2004 19:00*

I agree with Rita's ideas. We can do this with each habita: sandy beach, open ocean, marsh.

Response 4:8 **Bob Stewart** *Oct 30, 2004 14:45*

How is ocean life adapted to an aquatic environment? How does an aquatic environment differ from a land or air environment?

9-12 Interdependence of organisms

Item 5 **Peter Tuddenham** *Oct 22, 2004 19:27*

9-12 Interdependence of organisms

Response 5:1 **Patricia DuBose** *Oct 27, 2004 16:07*

symbiotic relationships found throughout the marine environement... coral and zooxanthellae; cleaner fish; predator/prey relationships;

fisheries management and human impacts... humans are organisms!!!

Response 5:2 **Margaret Tower** *Oct 30, 2004 21:11*

The role of anaerobic bacteria deep down in the ocean at the hydrovents on top of the volcanos is astonishing in the way this allows other forms of life to appear. My classes are following Alvin, the submersible with aquanauts in it , this week in the Pacific Ocean with the University of Deleware Graduate School of Marine Studies, by internet.

5-8 Diversity and adaptions of organisms

Item 6 **Peter Tuddenham** *Oct 22, 2004 19:28*

5-8 Diversity and adaptions of organisms

Response 6:1 **Susan Snyder** *Oct 27, 2004 10:24*

Content topic: There is great biodiversity in the ocean because it its many habitats (eg. rocky shores, coral reefs, kelp forests, mangrove swamps, sea grass beds, sandy beaches, deep plains and trenches). Organisms have adapted to these habitats (eg. below the zone of light penetration, some organisms are bioluminescent).

Response 6:2 **Gabrielle Johnson** *Oct 28, 2004 12:58*

it might be interesting to have students run a comparison between various terrestrial vs. aquatic systems, examining food webs, interactions, energy outputs, etc.

K-4 Life cycles of organisms

Item 7 **Peter Tuddenham** *Oct 22, 2004 19:28*

K-4 Life cycles of organisms

Response 7:1 **Sarah Schoedinger** *Oct 26, 2004 23:16*

"Life cycles of [marine] organisms"
This was taken from the survey question on this group of grades. So what would we want someone to know by the time they complete the 4th grade? Are there specific life cycles of marine organisms that are important for students at this stage to know, or is this just the case that marine examples can be used to meet this standard?

Response 7:2 **Gabrielle Johnson** *Oct 27, 2004 13:49*

Algae is a fun one they could do. You don't have to get into the complexes of sporphyte or gametophyte but one could still talk about the basic cycle. Larval plankton life cycles are also interesting including fish, crabs, etc. There are some great website with microscope pictures and several books with drawings of these stages. I use an exercise where the students try to match the larval stage with the adult. Jellyfish are also a cool one, there is video of this on the web.

Response 7:3 **Lynn Whitley** *Oct 28, 2004 04:03*

I think Gabrielle has identified some key life cycles to use, especially the larval plankton life. Perhaps life cycles of sea turtles and marine mammals would also be relevant and engaging to this age group.

Response 7:4 **William Bragg** *Oct 28, 2004 07:47*

And, this age group is perfect for anything relating to animals, so they'd love it! Especially seeing the "baby" stage, and how they grow up, and all the comparison/contrast...

Response 7:5 **Francesca Cava, Nat. Geo. Society, Santa Barbara, California** *Oct 28, 2004 11:01*

I think that kids always love to see shark cases, whatever their ages. Its incredible for them to see how such thrilling/frightening/well adversited creatures start. I think we should include this topic for kids at this level as long as we keep it simple.

Response 7:6 **Rita Bell** *Oct 29, 2004 15:03*

Plants and animals have life cycles
A few possible ocean-related topics:
Penguin and sea otter life cycles; other marine mammal life cycles; shark life cycles.

Plants and animals resemble their parents
Build off the life cycle activities

Many characteristics are inherited others result from interaction with the environment
A possible ocean-related topic:
Compare seastar or crab species, look for evidence of regeneration.

Response 7:7 **Pam Stryker** *Oct 29, 2004 18:57*

There are too many butterfly and frog life cycles in this world. Marine organisms provide a great variety. I agree with Gabrielle 7.2. Crabs, jellyfish, etc. I also do an activity where students match the larva to the adult. I have also brought plankton from the coast. They can grow brine shrimp as well as butterflies. They can student the ones that they are most familiar with...shrimp, crab, etc.

9-12 Matter, energy, and organization in living systems

Item 8 **Peter Tuddenham** *Oct 22, 2004 19:29*

9-12 Matter, energy, and organization in living systems

Response 8:1 **Patricia DuBose** *Oct 27, 2004 16:05*

ecosystems within the ocean... flow of energy thru the system... coral reefs, hydrothermal vents; wetlands/marshes;

Response 8:2 **Margaret Tower** *Oct 30, 2004 21:17*

Life around the hydrovents has a very unique organization, especially in its arrangements to obtain energy to live. The unusual life that is found down there, unseen by many before, has a chemical basis that is amazing!

5-8 Structure and function in living systems

Item 9 **Peter Tuddenham** *Oct 22, 2004 19:30*

5-8 Structure and function in living systems

Response 9:1 **Melissa Demetrikopoulos** *Oct 25, 2004 09:40*

This is a wonderfully broad standard that we have mapped to quite a lot. Students love ocean animals and they are a great hook to teach about anatomy and physiology. For example, we have used comparisons of dolphin, sealions and manatees to teach about the brain and about how structure and function are related. This is a natural place to connect to the standards and to teach content that will be spelled out in the local standards more directly. I am happy to announce that this has just been accepted for publication in The Science Teacher and should be out early 2005. The game is similar to our Crabby Behavior at the Beach game (Current, The Journal of Marine Education Vol 20,2) which compares hermit, fiddler and blue crabs.

Response 9:2 **Susan Snyder** *Oct 26, 2004 11:03*

Content topics: ocean biomes (major ecological communities), food webs in the oceans and Great Lakes

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Response 9:3 **Stacey Halboth** *Oct 28, 2004 23:52*

Squid are another marine animal to help students understand functions and structure.

Response 9:4 **Melissa Demetrikopoulos** *Oct 30, 2004 08:26*

Yes, squid are great animals to introduce. Mollusks have tremendous diversity and are thus very good subjects for this area. In addition, there are wonderful on-line disection guides available for squid and clams. To take advantage of this, we have developed a comparison game for mollusks similar to our games with marine mammals and crabs. I am not sure where we will publish this, but we plan to post all of our games on our website soon www.BioPhi.org. While students may not need to know the specific content for each of these groups, they can serve as model organisms to help students understand structural and functional relationships.

Response 9:5 **Dr. William Bragg** *Oct 30, 2004 08:38*

Melissa, great site!

If you put http:// in front of a link, it becomes "hot" - and opens a NEW WINDOW, so people can go look, and keep this site open "behind" it!

Such as:
http://www.BioPhi.org

Thanks for sharing the site!

Response 9:6 **Dr. William Bragg** *Oct 30, 2004 08:40*

(p.s. - your workshops look really interesting! When will you have 2005 schedule up?)

K-4 Characteristics of organisms

Item 10 **Peter Tuddenham** *Oct 22, 2004 19:30*

K-4 Characteristics of organisms

Response 10:1 **Melissa Demetrikopoulos** *Oct 26, 2004 10:32*

This is a good area that can be tied to important marine science. The marine science can be used as a hook to learn about this area. For example, students can sort organisms into plant vs animal at a young age. Coral are fun to introduce at this time due to potential difficulty in placing them in this dicotomy. The use of coral allows one to determine if the students really understand the distinction. I have taught students as young as 3 years old how to classify vertebrates and aquatic animals are terrific to include since they show some exceptions that are key in truly understanding these differences. Another animal that is fun to introduce at a young age is the sponge for obvious reasons.

Response 10:2 **Marlene Hilkowitz** *Oct 26, 2004 20:24*

I would like to add a cautionary note to statements like the one above where children as young as three years old have been taught how to classify vertebrates. When we are discussing standards, we are talking "all children by the end of a certain grade band or age". Sure, some children can do things earlier but statements about how young a child can understand may lead to teaching concepts at a too early an age for most students. Children have to understand living vs.non-living before they can understand vertebrate vs. non-vertebrate.

Response 10:3 **Melissa Demetrikopoulos** *Oct 27, 2004 10:49*

I guess my point was that children love to sort the world. That is basicly what they are doing as they develop language. I know that the classification of living vs non-living is generally the first sorting that occurs in the standards in many states. However, I have found that is is actually a much more abstract issue and can be more difficult than telling a mammal from a bird or fish. As adults there are cases where it is difficult to understand if something is an object or an organism ie prions. I am not a classroom teacher, but I have had the opportunity to work with both advanced and disadvantaged students through supplemental science programs. I think by 4th grade every non-developmentally challenged student can surely understand what a fish is. I only brought up the very young children (who were not a gifted group--just regular kids) to demonstrate the fact that kids naturally like to sort the world and can generally easily learn some big concepts quite young (ie mammals have hair, birds have feathers).

Response 10:4 **Gabrielle Johnson** *Oct 27, 2004 13:45*

By the end of 4th grade students should be able to identify the difference between the major groups: plants vs animals, invertebrates vs. vertebrates, and the groups of vertebrates: birds, mammals, fish, amphibians and reptiles. Mammal vs fish is probably the most commonly used relationship for this age group.

They can also identify analgous anatomy such as flippers and fins. One could also talk about marine mammal evolution.

Response 10:5 **Rita Bell** *Oct 29, 2004 14:39*

Organisms have basic needs: food, water a place to live.
A few possible ocean-related topics:
Where do rocky shore/sandy beach animals live?
Where do sea otters/penguins live?
How do their habitats help them meet their basic needs?
What do rocky shore/sandy beach animals eat?

What do sea otters/penguins eat?

Each plant or animal has different structures
A few possible ocean-related topics
Examine the external anatomy of fish: fins, scales, gills. How do these structures help the fish?
Penguins have feathers to keep warm and wings that they use for swimming. How are penguins like other birds? How are they different?
Penguin and sea otter life cycles.
Compare seastars. How do seastars eat?
Compare crabs. How do crabs use their claws?
Investigate hermit crabs. What behaviors do you notice? How do they get their shells?

Humans and other animals have senses
A few possible ocean-related topics:
Can fish see?
Kids compare cold water and warm water, fresh water and salt water (also works for physical science)

Response 10:6 **Pam Stryker** *Oct 29, 2004 19:09*

Even when I taught Kindergarten, I was amazed with the students ability to classify. I had them come up with their own classification system. It is less important that they classify in the scientific classifications than it is that they can identify a characteristic that is found in all of the group and sort by that characteristic. Give a set of pictures of marine invertebrates, they could come pretty close. The Texas test will vary the content, but the skill will be can they identify the common characteristic. They need to be able use the tools of observation and classification, be able to read the question to identify what is being asked, then they should be able to answer correctly without even knowing the exact content. When I reviewed the test questions on the Fifth Grade TAKS science, I discovered that many were process frames and not content specific. In other words, if you could think like a scientist you could figure it out. Kids need lots of experiences observing and identifying characteristics, then classifying.

Response 10:7 **Bob Stewart** *Oct 30, 2004 14:41*

Many different types of animals in ocean compared to land. Most ocean life must ve very small to float and drift. Most oceanic life is way too small to see. Most land life is big. Grass and trees compared with phytoplankton. Mammals compared with fish-few mammals are as small as anchovies and sardines.

9-12 Biological evolution

Item 11 **Peter Tuddenham** *Oct 22, 2004 19:31*

9-12 Biological evolution

Response 11:1 **Patricia DuBose** *Oct 27, 2004 16:01*

i intend to use current research on the breeding populations of sea turtles on the eastern coast... georgia turtles would never mate with florida turtles!!! students should be able to interpret dna fingerprints to see the differences... students should be able to look at satellite data to see where these turtles go after they leave the beach to explain differences in breeding populations...

Response 11:2 **Gabrielle Johnson** *Oct 28, 2004 12:53*

in a similar theme to Patricia there a recent intertidal (and probably coral) studies examining recruitment of populations, much of this uses GIS

Response 11:3 **Margaret Tower** *Oct 30, 2004 20:57*

Biological evolution should be studied as it is currently occurring at the hydrovents deep in the ocean on top of volcanoes, with the anaerobic bacteria, which change our ideas of systematics. Taxonomy is changed, like the kingdoms, (ie. archbacteria). All life originates here, using some basic elements acquired from space.

5-8 Populations and ecosystems

Item 12 **Peter Tuddenham** *Oct 22, 2004 19:32*

5-8 Populations and ecosystems

Response 12:1 **Robin Goettel** *Oct 25, 2004 19:10*

This life science standard provides a perfect framework for teaching about the concept of biodiversity and its importance to maintaining a balanced aquatic ecosystem. I have become somewhat specialized in the topic of aquatic invasive species education and have found that teachers that I have trained find it very useful to incorporate invasive species in their lesson plans to teach students how aquatic ecosystems (oceans/Great Lakes/rivers) can be disturbed by these invasions, and what this means both in the short term and the long term. This gets at the big question: Why should we be concerned about the oceans' and Great Lakes' resources? Why are native populations so essential to maintain healthy, balanced ecosystems?

Response 12:2 **Peter Tuddenham** *Oct 25, 2004 21:30*

thank you Robin, again, a very helpful contribution and exactly what we want to see here.

Response 12:3 **Susan Snyder** *Oct 26, 2004 18:18*

Content topics: There is an interdependence of life on land and in the ocean; ocean ecosystems are distinct and yet many overlap with each other and with terrestrial ecosystems (eg. rocky coasts, mudflats, sandy beaches, coral reefs); as in all ecosystems, energy is transferred in the ocean through food webs

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Response 12:4 **Gabrielle Johnson** *Oct 27, 2004 18:11*

This would be a great place to introduce MPAs and their role in maintaining biodiversity in a region and resource protection.
One could also discuss fisheries management

Basic food web dynamics. Keystone predators, introduced/invasive species, etc.

9-12 Molecular basis of heredity

Item 13 **Peter Tuddenham** *Oct 22, 2004 19:32*

9-12 Molecular basis of heredity

Response 13:1 **Patricia DuBose** *Oct 27, 2004 16:10*

differences between sexual reproduction and asexual reproduction... the benefits of each... why some organisms are able to do both while others are only one or the other... importance of genetic variability in the survival of a species...

5-8 Reproduction and heredity

Item 14 **Peter Tuddenham** *Oct 22, 2004 19:33*

5-8 Reproduction and heredity

Response 14:1 **Lynn Whitley** *Oct 29, 2004 01:31*

Larval plankton and jelly fish are great examples of reproductive cycles. I would venture that students at this age would also be interested in some of the unusual reproductive strategies of marine life: hermaphrodites such as sea hares, fish changing sex such as sheephead.

9-12 The cell

Item 15 **Peter Tuddenham** *Oct 22, 2004 19:33*

9-12 The cell

Response 15:1 **Patricia DuBose** *Oct 27, 2004 15:59*

types of osmoregulation in fishes... cover the location of photosynthesis, respiration in the cells...

K-12 Other topics

Item 16 **Peter Tuddenham** *Oct 22, 2004 19:35*
K-12 Other topics