Activity 6: Kelp Help?
-Aquatic WILD-

Age:

Grades 6-8

Time:

Two or three 45 minute periods.

State Essential Learning Requirements:

Reading: 2.1, 2.2, 3.1

Communication: 1.1, 1.2, 2.5, All of 3

Science: 1.2, 1.3

Geography: 3.2

Arts: All of 1, 3.1, 4.1

Materials:

Aquatic WILD Activity provided: You need paper; pencils; standard library reference sources; art materials for a mural

Overview:

Students research the role of estuarine environments in the survival of salmon, create a mural and report to the class about their findings. Estuaries are the keyhole through which salmon pass to begin and end their journeys.

Washington adaptation provided:

Use the attached research document, news release and marine protected area poster information to determine the health of the Puget Sound estuaries for salmon. What has changed which impacts salmon survival?

Objectives:

- To describe the role of estuaries in salmon survival.
- To proposed solutions for survival of salmon in estuaries.

Critical Questions Addressed:

1. Life Cycle of Salmon
2. Endangered

Background:

Washington's Puget Sound is the key hole through which many Western Washington salmonids pass to migrate to the ocean and return to the streams a few years later. While in the estuary Salmonids feed on herring and other smaller fish plus invertebrates, but mostly shrimp.

Resources:

- State optimistic listings can be averted for marine species: News Releases (attached)
- Marine Protected Areas: Description and poster with graphs-Mary Lou Mills (attached)
- Wonders of Puget Sound (WDFW Resource Packet)
- *Forage Fish Management Plan,* C. Bargmann, 1998 - WDFW Report (WDFW Resource Packet)
- *Protection and Restoration of Marine Life in the Inland Waters of Washington State,* J. West, 1997 - WDFW Report. (WDFW Resource Packet)

Directions:

- Read the News Release and restate in your own words "the problem".
- How does this "problem" for marine species impact salmon. Refer to the life cycle of salmon.
- Read the Marine Protected Areas Poster and restate in your own words what the research found on marine species in these protected areas
- What does this research on Marine Protected Areas mean for salmon survival.
- Read the summary of the "Marine Species of Puget Sound" document and create a news release which reflects the problem statement, essential data and conclusion
- Create a science fair poster with 1 to 3 paragraphs each for problem statement, background, research, results and conclusion with appropriate graphs and illustrations.

Extensions:

- What or who is responsible for the challenges salmon face in the Puget Sound.
- What can individuals, the public and government do about these challenges to salmon.

KELP HELP

OBJECTIVE

Students will list and describe different ways that kelp can be beneficial to humans, wildlife and the environment.

METHOD

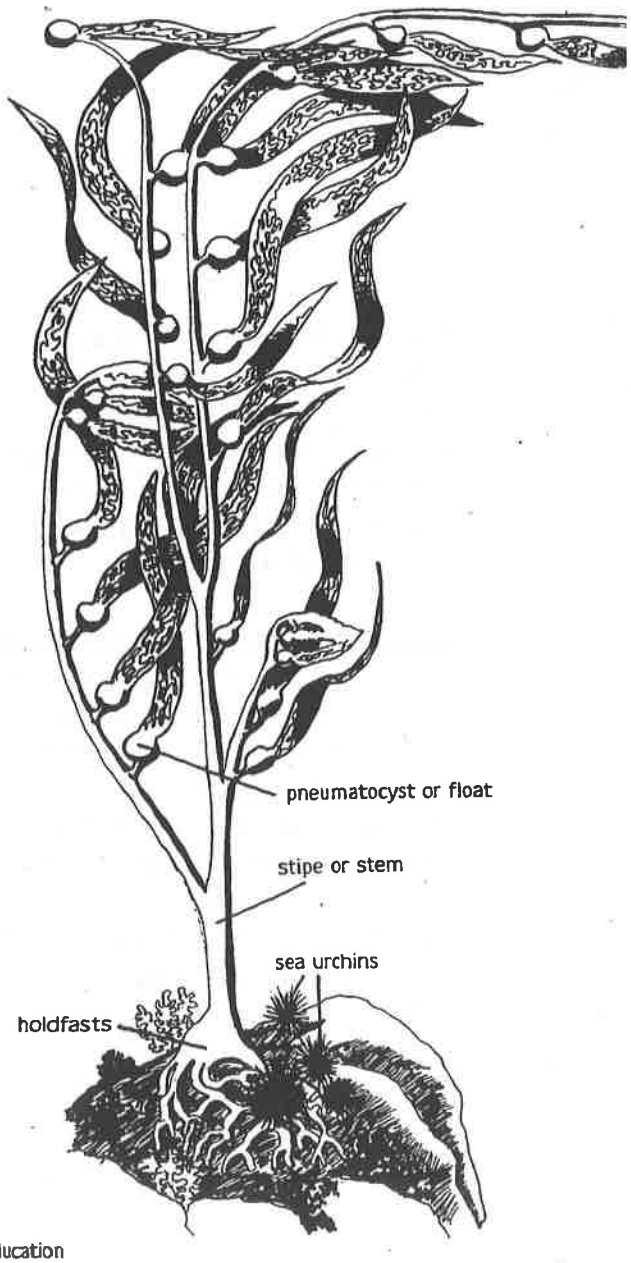
Students research kelp, create a mural and report to the class about their findings.

BACKGROUND

Aquatic plants that are visible at the surface of oceanic waters are often called "seaweed." The word "weed" is typically derogatory when we think of land-based gardening and landscape design. Yet sea "weeds," like weeds on land, are important to the natural ecological balance in habitats. "Weeds" are an important part of nearly all aquatic habitats. In each habitat they play a role central to the rhythm of life in water.

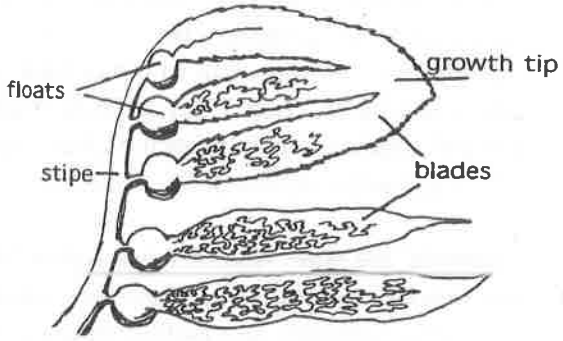
"Seaweeds" are algae. Algae are not restricted to the sea. They live in profusion in lakes, rivers and streams. Algae are as important to aquatic animals in marine and freshwater environments as grass is to cows, horses and other grazing animals. Some algae are microscopic. Others, like kelp, are huge. Kelp, a "seaweed," is an example of one of thousands of different plant forms found in aquatic habitats. Kelp is a dramatic form of algae.

Kelp is often found in great forests in the sea. Other forms of kelp are smaller and more solitary. The Pacific varieties of kelp often grow to be more than a hundred feet long. The plant is held to the bottom by a structure called a "holdfast." The holdfast anchors the plant to cobbles, large rocks, and debris in sandy bottoms. It looks like a root but is not. The holdfast cannot absorb nutrients like true roots do. It serves only to keep the kelp in place during storms, tides and normal wave action. Nutrients are absorbed through most of the kelp's surface area.



Age: Grades 6-8
Subjects: Science, Language Arts
Skills: communication, description, discussion, drawing, listening, listing, public speaking, reading, reporting, research, small group work, synthesis, writing
Duration: two or three 45-minute periods
Group Size: groups of four to five students
Setting: indoors
Conceptual Framework Reference: II.A., II.A.1., II.A.2., II.A.3., II.A.4., II.B., II.B.1., II.B.2., II.B.3., II.C., II.D., II.D.1, II.D.2, II.D.3, II.D.4, II.E., II.F., III.A., III.A.1., III.A.2., III.A.3., III.B., III.B.1., III.B.2., III.B.3., III.B.4., IV.B., IV.B.1., IV.B.2., IV.C., V.A., V.A.2., V.A.3., V.B.1., I.A.1., I.A.2., I.A.3.
Key Vocabulary: kelp, algae, seaweed, algin
Appendices: Ecosystem

The kelp plant grows rapidly in crowded waving forests, adding as much as one foot of growth per day. The growing tip of a kelp plant is called a frond. As the frond grows upward toward the surface it forms a long string of leaf-like structures called blades. Each blade has a float bulb that is attached to the growing main stem or stipe. As the frond grows toward the surface, the kelp plant's stem or stipe becomes the anchor for dozens of these floats and blades. When the frond reaches the surface the growth rate slows down and soon forms its last blade called the "terminal blade."



Some marine biologists suggest that kelp forests provide habitat for as diverse a variety of wildlife as does a tropical rain forest on land. Both kelp forests and rain forests do support a tremendous diversity of wildlife. Worms, snails, crustaceans and mollusks abound in kelp forests. Fish live at all levels within the protection of the kelp forest.

Bottom fish thrive at its base. The dozens of aquatic species that live in kelp beds attract predators. Sharks, seals and sea otters find these forests to be attractive hunting areas. Kelp is commercially harvested for dozens of products that are used by people. For example, within kelp there is a chemical called algin. Algin is used as a thickener, stabilizer and emulsifier. Thickeners increase a substance's density by making the substance less watery. Stabilizers prevent deterioration of foods and emulsifiers help keep ingredients from separating. Algin from kelp is used in ice cream and a variety of other dairy products as well as in many kinds of processed foods, beverages and medicines. Algin is also used in the production of paper, cosmetics, ceramics, paint and insecticides. Small amounts are used directly as food.

Kelp forests are threatened by pollution, sea urchins and over-harvesting. Raw sewage dumped into sea water attracts sea urchins. The sea urchins feed both on the sewage and the kelp holdfasts. Once the kelp plants are cut adrift, they die and wash ashore.

The kelp described here is dominantly a Pacific plant although its counterpart exists in the Atlantic ocean as well.

The major purpose of this activity is for students to develop an appreciation for the importance of kelp—exploring its role in nature, medicine and the cultural experience of people the world over.

MATERIALS

paper; pencils; standard library reference sources; art materials for a mural

PROCEDURE

1. Divide the class into groups of four or five students. Assign (or have the students choose) topics such as the following to research related to kelp:
   - algin
   - kelp as a habitat for wildlife
   - kelp as a food source (kelp recipes)
   - emulsifiers
   - medicinal uses of kelp
   - aquatic weeds of the world (both marine and freshwater)
   - the Sargasso Sea
   - algae and the oceanic food chain
   - sea otters
   - sea urchins
2. Once the research is finished, have each group visually summarize its findings on a large sheet of paper.
3. When all groups are finished, have them place their art work on a wall and verbally report on their findings. As each group finishes, the next should place its art work so that the edges of the paper overlap, producing a mural related to kelp. NOTE: Teachers and students have created kelp forests that hang from classroom ceilings. These have been made of crepe paper streamers with various marine animals made from poster paper and cardboard.
4. Lead a class discussion about kelp, algae and the other freshwater and marine "weeds," inviting the students to react to the information and insights shared by each group.

EXTENSIONS

1. Investigate other aquatic plants and their role in aquatic habitats.
2. Draw an accurate portrayal of a kelp "forest" food web. Keep the animals and plants to their proportionate sizes in the drawings.
3. Visit an ocean beach where kelp can be found. Identify its parts. If an ocean beach is not available, make a small collection of aquatic "weeds" from a local pond or stream. Try to identify these. See the Aquatic WILD Activity, "Water Plant Art."
4. Visit an aquarium that exhibits kelp habitat.
5. Plan a Kelp Appreciation Day, including a potluck meal where kelp is a part of each dish.
6. Turn part of your classroom into a kelp forest. Use crepe paper, balloons and construction paper to depict the habitat and its inhabitants.

EVALUATION

1. What is kelp? Write a paragraph and draw a picture to illustrate your response.
2. Describe two ways that kelp is helpful to each of the following: humans, wildlife, aquatic habitats.

Kelp Help? -Aquatic WILD-
Student Worksheet Page 1

Background:

Washington's Puget Sound is the key hole through which many Western Washington salmonids pass to migrate to the ocean and return to the streams a few years later. While in the estuary Salmonids feed on herring and other smaller fish plus invertebrates, but mostly shrimp.

Resources:

- State optimistic listings can be averted for marine species: News Release (attached)
- Marine Protected Areas: Description and poster with graphs-Mary Lou Mills (attached)
- Wonders of Puget Sound (WDFW Resource Packet)
- *Forage Fish Management Plan,* C. Bargmann, 1998 - WDFW Report (WDFW Resource Packet)
- *Protection and Restoration of Marine Life in the Inland Waters of Washington State,* J. West, 1997 - WDFW Report. (WDFW Resource Packet)

Directions:

- Read the News Release and restate in your own words "the problem".

- How does this "problem" for marine species impact salmon. Refer to the life cycle of salmon.

- Read the Marine Protected Areas Poster and restate in your own words what the research found on marine species in these protected areas.

- What does this research on Marine Protected Areas mean for salmon survival.

- Read the summary of the "Marine Species of Puget Sound" document and create a news release which reflects the problem statement, essential data and conclusion ***or***
- Create a science fair poster with 1 to 3 paragraphs each for problem statement, background, research, results and conclusion with appropriate graphs and illustrations.

Reflections:

- What or who is responsible for the challenges salmon face in the Puget Sound.

- What can I, my community and the government do about these challenges to salmon.

Me:

My Community:

Government:

NEWS RELEASE
WASHINGTON DEPARTMENT OF FISH AND WILDLIFE
600 Capitol Way North, Olympia, WA 98501-1091

June 21, 1999
Contact: Tim Waters, (360) 902-2262 or Margaret Ainscough (360) 902-2408

State optimistic listings can be averted for marine species

OLYMPIA–The state's top fisheries official said today he is optimistic that scientifically-based conservation plans can be developed for seven groundfish marine species so they will be restored and not need protection under the federal Endangered Species Act.

"We have already taken many actions to rebuild these species, including restricting harvest and creating sanctuaries where no fishing is allowed," said Washington Department of Fish and Wildlife Director Jeff Koenings. "These and other actions will serve as part of detailed, scientific conservation plans that hopefully will allow us to avoid ESA listings."

Koenings said that WDFW expects the conservation plans to be delivered to the National Marine Fisheries Service (NMFS) this fall.

NMFS today announced it would conduct a year-long biological review of the Puget Sound populations of Pacific herring, Pacific cod, Pacific hake, walleye pollock and brown, copper and quillback rockfish as a first step to determine if they should be listed under the act.

The seven species have been declining in Puget Sound for at least a decade for several reasons, including harvest and predation by marine mammals and other fish species. Warmer water conditions in Puget Sound also are believed responsible for the species' decline.

But Koenings said he is confident that by working closely with NMFS, other state natural resource managers and western Washington treaty tribes that the stocks can be rebuilt without being listed under the act.

If the state submits conservation plans that are approved by NMFS, listings could be avoided.

In recent years, WDFW, working with other resource agencies, has taken action to protect these fragile stocks, including closing or reducing fish harvests and working with NMFS to identify marine mammal predation problems and collaborate on solutions where seals, sea lions and other animals are impeding recovery of the marine species.

The department also is researching and developing a system of marine sanctuaries– refuges where no fishing is allowed– for some depressed species. Sanctuary areas have already been established in Puget Sound and the San Juan Islands. A more extensive sanctuary system may be needed for conservation in the future.

WDFW management and recovery activities are outlined in the Puget Sound Groundfish Management Plan and the Forage Fish Management Plan which were adopted last year by the Washington Fish and Wildlife Commission, the nine-member citizen panel which oversees WDFW policy. The plans detail conservation and use plans for each species group.

Those plans, scheduled to be completed this fall, will form the basis of WDFW's response to the proposed federal listing petition, according to Koenings.

 Return to WDFW Home Page

POTENTIAL BENEFITS
of
HARVEST RESERVES

Benefits within the reserve:

Increased numbers of fish within the reserves

Older and larger fish in the reserve

Increased reproduction

More complete flora and fauna

Benefits outside the reserve:

Export of eggs and larvae

All ages of fish reproducing

"Spillover" of large fish

Trophy fish

Area to compare with fished sites

ROCKFISH IN PUGET SOUND

awning capacity of the common species: 20% of historic levels

Rockfish are long-lived
- Copper and quillback: up to 45 years
- Yelloweye: up to 90 years old

Age at first spawning
- Copper and quillback: 5-7 years old
- Yelloweye: 10-12 years old

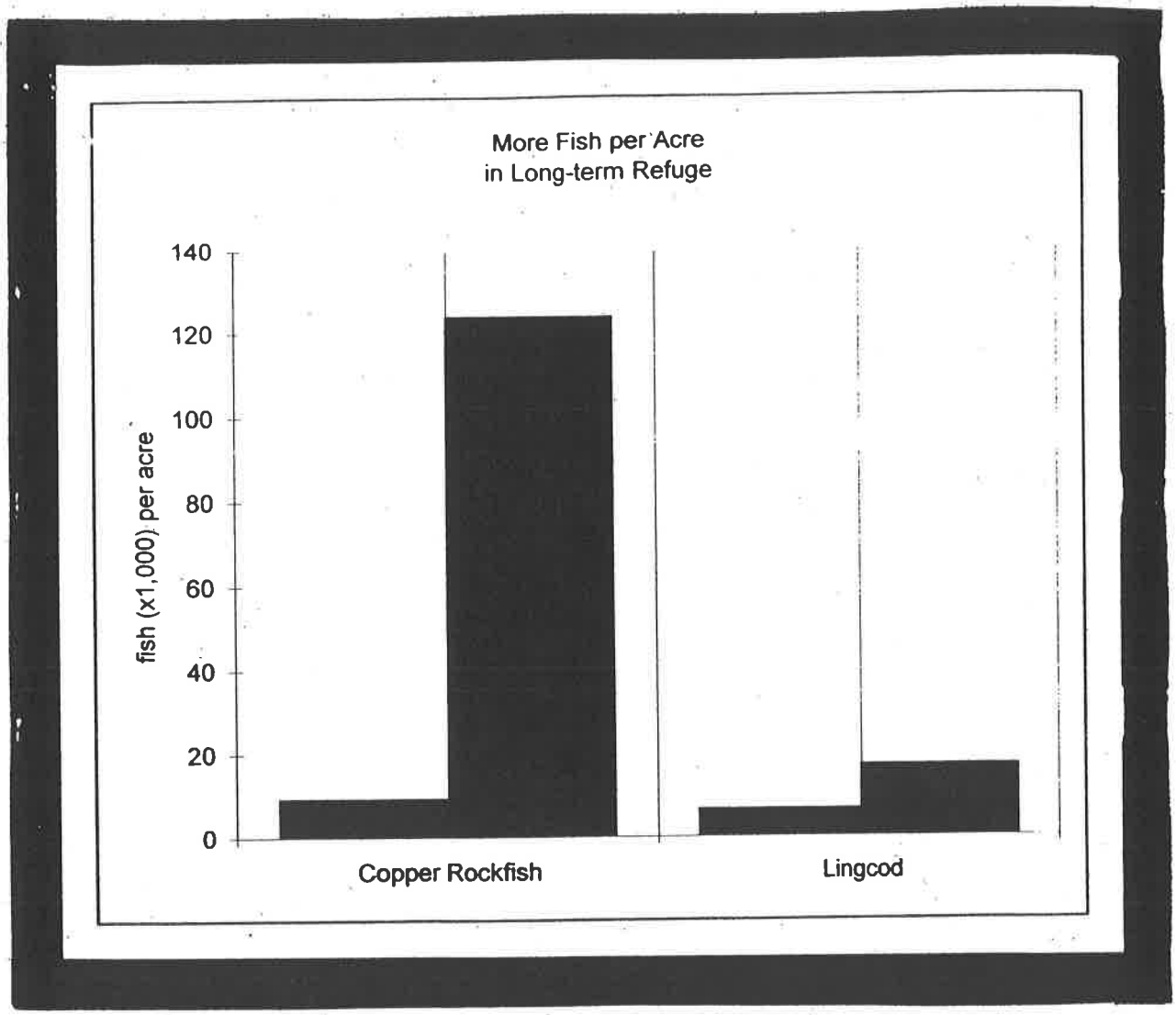
Copper and quillback stay close to home
- Fish return up to 6 kilometers if moved

Today most rockfish are taken as "by-catch" in the recreational salmon fishery

MARINE PROTECTED AREAS

Definition

Any area of intertidal or subtidal terrain, together with its overlying waters and associated flora, fauna and historical and cultural features which have been reserved by law or other effective means to protect part or all of the enclosed environment. (IUCN, 1994)



EDMONDS UNDERWATER PARK

Only one area in Puget Sound has been closed to harvest 30 years

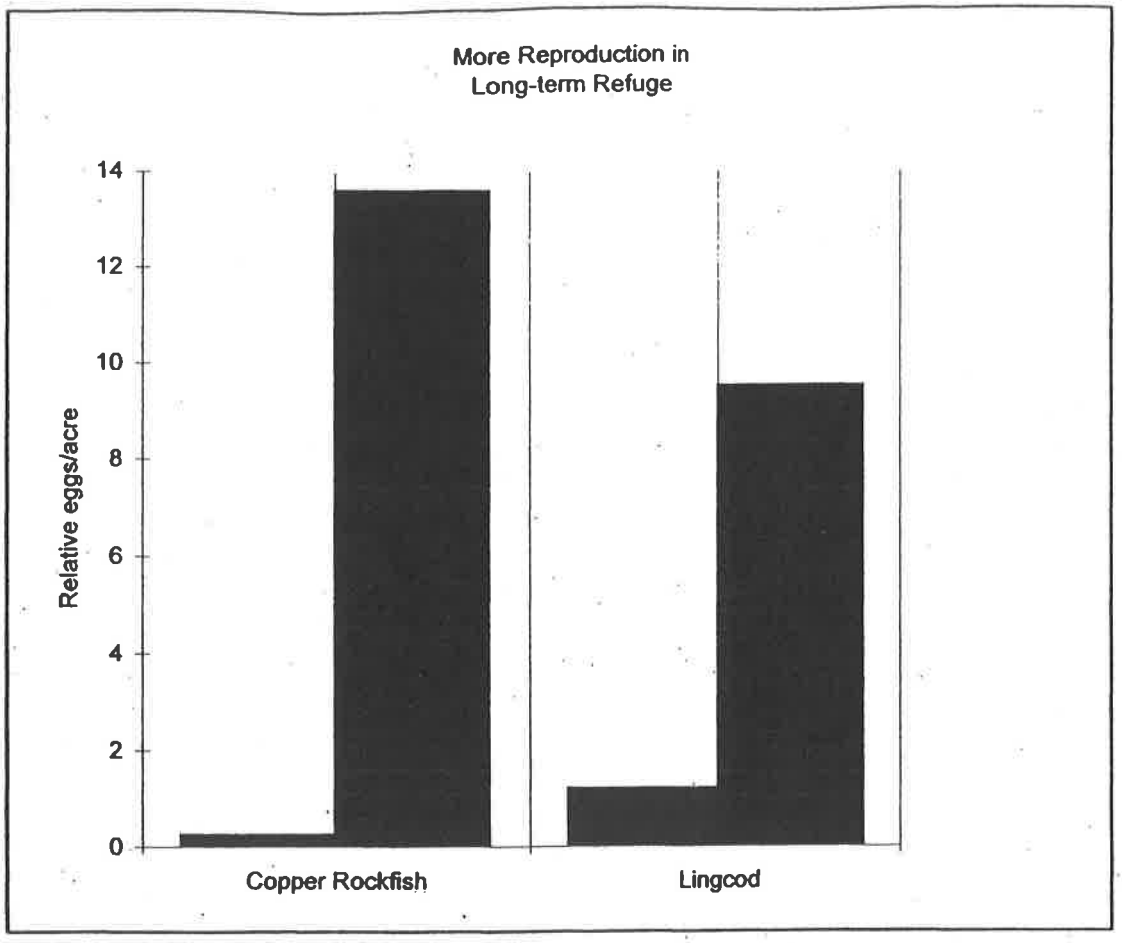
Edmonds Underwater Park was closed as a recreational diving site

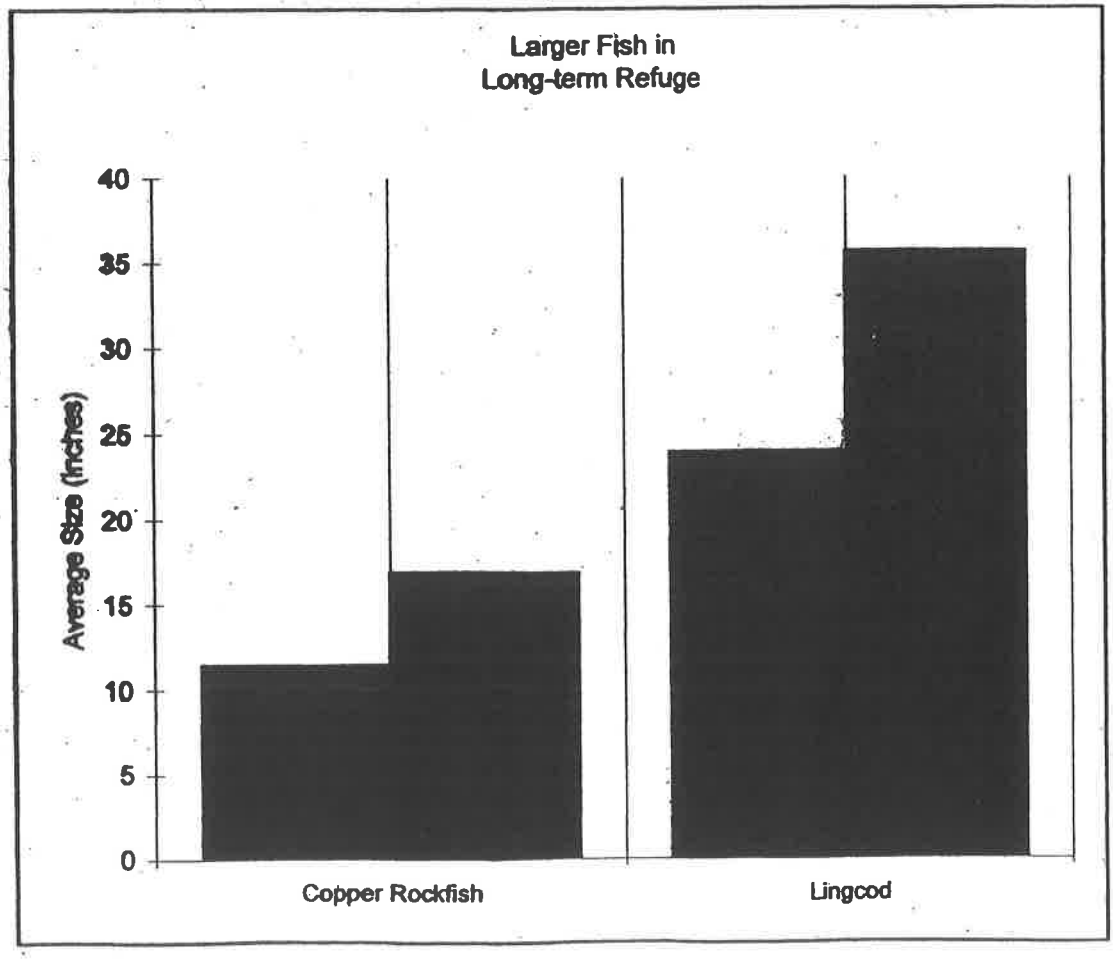
Rockfish and lingcod are larger and more abundant in the park

Larger fish have many times as many eggs as small fish

Acre for acre, compared with fished areas, the park produces:
- 50 times as many rockfish
- 20 times as many lingcod

Newer closed areas are beginning to show the same changes


More Reproduction in
Long-term Refuge
Relative eggs/acre
14
12
10
8
6
4
2
0
Copper Rockfish
Lingcod


Larger Fish in
Long-term Refuge
Average Size (inches)
40
35
30
25
20
15
10
5
0
Copper Rockfish
Lingcod

MARINE PROTECTED AREAS

"Any area of intertidal or subtidal terrain, together with its overlying water and associated flora, fauna, historical and cultural features, that has been preserved by law or other effective means to protect part or all of the enclosed environment."
World Conservation Union (IUCN), 1994

Think of Puget Sound as a large estuary. Broad intertidal and shallow subtidal areas extend the entire circumference, plus around the many islands. These near-shore areas are critical to one or more life history stages of almost all fish, marine mammals, birds and invertebrates in the sound.

In addition, deeper "rocky-reef" areas provide critical habitat for many invertebrate and fish species as they mature. Some species spend their entire life history in these areas (but still depend for forage on species that spend significant time in near-shore areas) . Seven Puget Sound fish species are being considered for listing under the Endangered Species Act. All seven use rocky-reef habitat for a major portion of their life histories: brown, copper and quillback rockfish, plus Pacific cod, hake, herring and walleye pollock

In the last 20 years, Puget Sound has warmed between two and four degrees Celsius (3.6 to 7.2 degrees Fahrenheit). This change in water temperature is stressful to fish, especially Pacific cod and pollock, which are at the southern end of their range in Puget Sound. Stocks that are in a strong decline from "natural" causes must be protected so their populations can recover when environmental conditions improve.

Protection of both near-shore and rocky-reef habitats can be accomplished by designating "Marine Protected Areas," where no commercial or recreational fishing or algae- or vegetation-gathering is allowed. This type of protection is crucial to the long-term health of currently viable species, and the recovery of less-healthy species and stocks.

- MPAs provide an insurance policy against:
  - future unfavorable weather patterns (el nino, la nina)
  - future environmental failures (oil spills, toxic runoff)
  - possible management failure (over-harvest in other areas)
  - loss of habitat

- MPAs provide a natural ecosystem to compare with "exploited" areas
  - they let us examine natural functions
  - provide an unharvested baseline

- MPAs provide an enhanced "natural hatchery" production area
  - protect species that reproduce in subtidal and intertidal areas and are thus most vulnerable to human impact, such as herring and other forage fish
  - allow rocky-reef species to reproduce with minimal human impact; rockfish production is 50 times greater in protected areas, lingcod production 20 times greater
  - contain a wider range of fish sizes and age classes compared to fished areas, especially the larger sizes that are most valuable for spawning

- MPAs provide a cost-effective way to protect the most vulnerable species
  - long-lived, slow-growing species such as yelloweye rockfish; fecundity increases greatly with age and size
  - species with high "site fidelity" (species that move ≤ 100 yards)
  - less data collection and management effort than in areas of active fishery

- Other MPA benefits include:
  - Protect eel-grass beds
  - Protect kelp beds
  - Maintain genetic diversity
  - Maintain population size and age structures
  - Provide possible trophy fish

- Eel-grass
  - critical to smaller fish, plus crustaceans and other invertebrates
  - needs a substrate of mixed fines (sand-sized) and clear water
  - damps water movement and anchors the substrate, creating its own environment
  - eel-grass beds carry epiphytes that live on the grass
  - eel grass beds produce detritus which becomes fertilizer as it dies
  - is not harvested by humans, but humans destroy it by
    - digging it up to build marinas
    - building structures that shade and thus kill it
    - changing water quality; turbidity kills it

- Kelp beds
  - only grow on rocky reefs, a mixture of boulders and cobble with cavities for fish to hide in
  - grow to a depth of 50 feet where there is adequate light penetration

For more in-depth information about Marine Protected Areas and the species that benefit from them, please refer to the following WDFW publications:

- Protection and Restoration of Marine Life in the Inland Waters of Puget Sound, James E. West, May 1997, Puget Sound/Georgia Basin Environmental Report Series: Number 6

- Forage Fish Management Plan, Greg Bargmann, September 1998, WDFW 542