To Fish or Not to Fish?

This role-playing activity is based on the Marine Reserves process at the Channel Islands National Marine Sanctuary and explores the complex decision-making process for establishing marine protected areas and resolving resource management issues.

BACKGROUND

This role-playing activity is designed to teach about marine policy. The game is modeled after a decision-making process that occurred at the Channel Islands National Marine Sanctuary in Santa Barbara, California. In this activity, students will participate as members of the community to discuss resource management. Seven constituencies are represented: sanctuary managers, marine ecologists, squid fishers, lobster fishers, recreational fishing boat captains, recreational fishers and recreational divers.

The Channel Islands National Marine Sanctuary (CINMS) is located off the coast of Southern California near the cities of Santa Barbara and Ventura. The sanctuary includes approximately 1,252 square nautical miles of water around five islands: San Miguel, Santa Rosa, Santa Cruz, Anacapa and Santa Barbara. Official sanctuary status was declared in 1980 to protect the biological, cultural and historic resources of these diverse and productive waters. Sanctuary regulations do not directly protect biological resources, but the sanctuary works with other agencies, including the Department of Fish and Game and the National Marine Fisheries Service, to manage biological resources.

Population growth in Southern California has significantly increased the number of people visiting, using and impacting our coastal resources. More people are participating in commercial and recreational fishing, wildlife viewing and tourism in the sanctuary. Technology has increased the efficiency, effectiveness and yield of sport and commercial fisheries. Increased human, industrial and agricultural waste drains into coastal waters, decreasing water quality. At the same time, there have been large natural changes that have affected resources, such as El Niño weather patterns, oceanographic regime shifts from warm to cool water, and dramatic fluctuations in seal and sea lion populations.

Any combination of these factors may contribute to the decline of resources. All members of the community want to understand the impacts of these factors on marine systems. To protect and enhance living marine resources, new management strategies must be developed. One strategy is to develop marine reserves where all
fishing is prohibited. Marine reserves protect plants and animals from the impacts of recreational and commercial fishing. Animals inside marine reserves will have the opportunity to live longer, grow larger and have more offspring than animals living in areas where people take resources. Reserves also offer educational opportunities and provide reference areas for studying the effects of fishing.

**TEACHER PREPARATION**

Prepare overheads: Using the original provided, make seven transparencies of the blank sanctuary map.

Prepare User Group position statements/worksheets: Make enough copies of each role to accommodate the group size after dividing your class into seven groups; (for example, for a class of 28 students, you would make four copies of each User Group statement). Copy the appropriate worksheet onto the back of each position statement.

**PROCEDURE**

1. **Assign (or have students choose) roles:** Divide the class into seven groups and assign (or have each group choose) a role or User Group. Roles include the following: sanctuary manager, marine ecologist, squid fisher, lobster fisher, recreational fishing boat captain, recreational fisher and recreational diver.

   Explain that each group role represents a constituency, or a group of people with similar opinions. Their responsibility is to present the user group’s goals during the discussion about resource management. They must propose and discuss ideas that protect their long-term goals for resource management. The sanctuary manager must balance the opinions offered by different groups during the decision-making process.
Ocean Literacy:
Essential Principles and Fundamental Concepts
http://coexploration.org/oceanliteracy/

Essential Principle #6:
The ocean and humans are inextricably interconnected.
b. From the ocean we get foods, medicines, and mineral and energy resources. In addition, it provides jobs, supports our nation’s economy, serves as a highway for transportation of goods and people, and plays a role in national security.
c. The ocean is a source of inspiration, recreation, rejuvenation and discovery. It is also an important element in the heritage of many cultures.
e. Humans affect the ocean in a variety of ways. Laws, regulations and resource management affect what is taken out and put into the ocean. Human development and activity leads to pollution (point source, nonpoint source and noise pollution) and physical modifications (changes to beaches, shores and rivers). In addition, humans have removed most of the large vertebrates from the ocean.
g. Everyone is responsible for caring for the ocean. The ocean sustains life on Earth and humans must live in ways that sustain the ocean. Individual and collective actions are needed in order to effectively manage ocean resources for all.

Essential Principle #7:
The ocean is largely unexplored.
c. Over the last 40 years, use of ocean resources has increased significantly; therefore, the future sustainability of ocean resources depends on our understanding of those resources, and their potential and limitations.

2. Distribute maps and other supplies: Distribute the appropriate User Group position statement and worksheet to each group. In addition,

- Give each student a locator map (overall view of the Channel Islands), a blank sanctuary map (Anacapa Island grid map: “Worksheet: Where would you establish marine reserves?”), and the bathymetry map (depths surrounding Anacapa Island).
- Give each group one overhead transparency of a blank sanctuary map and a dry-erase marker. (Each group should have a different color.)
- Give the recreational divers user group the map showing relative value of different areas for recreational diving.
- Give the lobster fishers the map showing lobster fishing grounds.
- Give the squid fishers the map showing relative value of different areas for squid fishing.
- Give the recreational fishing boat captain AND the recreational fishers maps showing relative value of different areas for recreational fishing.
- Give the scientists/marine ecologists the map showing relative value of different areas for conservation.
- Give the sanctuary managers the maps showing relative value of different areas for conservation and the map showing the different numbers of commercial fishing industries that use each square nautical mile.

3. Have students complete worksheets: Ask students to read the position statement for their role and attempt to answer the questions individually.

4. Have students develop user group map and presentation:

Have each group develop a single map of marine reserves around Anacapa Island that best represents their interests. Once they agree, students can use a dry-erase marker to draw this map on the group’s blank sanctuary map transparency.

Each group should choose one person to present its position and map to the rest of the class. Using an overhead projector, the representative can describe the group’s choices on their map.
5. **Discussion and decisions**: Discuss the options presented and explore the diversity of interests in the community. Look at all the maps developed by different groups; the various group overheads may be layered to illustrate different perspectives.

Have the students representing sanctuary managers (or the full class) develop a compromise design that uses ideas from different groups but does not impact any one group too much. The managers can present their compromise map to the class, and the class can discuss how decisions made by managers affect their livelihoods and hobbies.

**FURTHER RESOURCES**
Additional educator resources for Jean-Michel Cousteau: *Ocean Adventures* can be found at [pbs.org/oceanadventures](http://pbs.org/oceanadventures).

Also try:
- Channel Islands National Marine Sanctuary
  [http://channelislands.noaa.gov/](http://channelislands.noaa.gov/)

**CREDITS**
Adapted with permission from the Channel Islands National Marine Sanctuary, [http://channelislands.noaa.gov/](http://channelislands.noaa.gov/). The original activity was written by Dr. Satie Airame.

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RECREATIONAL DIVER
1. Recreational diver
2. Protect marine species and habitats, including all habitats from the intertidal to deep waters, within the Sanctuary. Recreational and commercial fishers should be restricted from certain areas because they are depleting public resources.
3. Answers may vary. Reserves must be at least 50 percent of the study area.
4. 50 percent of the study area to protect representative habitats and species of concern. Recreational and commercial fishing is causing declines of certain species. Reserves will help restore these species.
5. Urchins eat kelp. Urchins, in turn, are eaten by lobsters, California sheephead and sea otters. Because people fish lobsters and California sheephead, and people have already hunted the sea otters to extinction in Southern California, the urchins have few predators, and their populations are very large. Large urchin populations eat a lot of kelp, and so the kelp-associated species decline.

LOBSTER FISHER
1. Lobster fisher
2. Establish small reserves to grow big lobster. If large reserves are established, sustainable lobster fishing should be allowed in the reserves.
3. Answers may vary.
4. Small because the lobster industry has been sustainable over the last 100 years. It is not necessary to add to the existing regulations of the marine reserves.
5. Seasonal closures from March to October. Size limit to no less than 3¼ inches carapace length. All traps must have “escape ports.” The number of lobster fishing boats is limited.
6. El Niño conditions (warm water) and storms affect lobster populations.

SQUID FISHER
1. Squid fisher
2. Keep fishing squid at sustainable levels. Marine reserves are not necessary to sustain the squid fishery. Use marine reserves to reduce the impact of squid fishing boats on seabird populations on offshore islands.
3. Answers may vary.
4. Small. Squid fishing is sustainable under the current management strategies. Small reserves located near seabird colonies could help reduce the impacts that light on squid boats has on seabirds.
5. Squid fishing boats, which go out at night, cast light into the water to attract squid. The light may wake up seabirds on offshore islands and cause them to abandon their nests for a long period of time. Therefore, squid fishing affects seabird populations.

RECREATIONAL FISHING BOAT CAPTAIN
1. Recreational fishing boat captain
2. Establish small reserves to help offset the effects of overfishing. No reserves should be placed on the south side of Anacapa Island.
3. Answers may vary. No reserves should be placed on the south side of Anacapa Island.
4. Small, to offset the negative effects of overfishing.
5. Rockfish species are declining, including canary rockfish, Pacific Ocean perch, bocaccio, cowcod and lingcod. They are also declining because of overfishing, El Niño cycles (warm water, cool water), large ocean waves and strong currents.

RECREATIONAL FISHERS
1. Recreational fisher
2. Small marine reserves could help some fish populations grow larger. No reserves should be established on the south side of Anacapa Island because these areas are traditional recreational fishing grounds.
3. Answers may vary. No reserves should be established on the south side of Anacapa Island because these areas are traditional recreational fishing grounds.
4. Small, to offset the negative effects of overfishing.
5. Rockfish, lingcod, California sheephead, yellowtail, white sea bass, albacore, kelp bass, barracuda, squid, sardines, anchovies, halibut, sand bass, etc.
6. Some fish species, including rockfish, lingcod and California sheephead, are seriously depleted. These fish are less abundant and smaller than they were 10 years ago. On the other hand, yellowtail, white sea bass and albacre seem more abundant now than in previous years.

MARINE ECOLOGIST
1. Marine ecologist
2. Protect marine habitats and species. If the goal is for conservation, then approximately 50 percent of the total study area should be protected. If the goal is to sustain fisheries, then approximately 30 percent of the fishing grounds should be protected.
3. Answers may vary.
4. If the goal is for conservation, then approximately 50 percent of the total study area should be protected. If the goal is to sustain fisheries, then approximately 30 percent of the fishing grounds should be protected.

5. Rockfish, sharks, abalone, sheephead, black sea bass and sea cucumber. Reasons for the decline include fishing, El Niño cycles, disease and increased pollution.

6. Animals in marine reserves can grow larger and produce more offspring.

SANCTUARY MANAGER
1. Sanctuary manager
2. Protect the natural environment while allowing people to use the ocean for recreational and commercial reasons.
3. Answers may vary.
4. Between 30-50 percent to protect marine habitats and species.
5. Scuba diving, sailing, commercial fishing, recreational fishing, free diving, photography, scientific research, etc.
To Fish or Not to Fish
Student Handout

Recreational Diver

BACKGROUND
You have been diving in the Channel Islands for about 20 years. You dive primarily at Anacapa Island and at the eastern end of Santa Cruz Island. During your dives, you do sightseeing, photography and research. You observe marine habitats, including kelp forests, and you observe marine species, including a variety of fish and invertebrates.

OBSERVATIONS
You have seen a dramatic loss of kelp forest habitat in the Channel Islands over the last 20 years. In the past, the kelp forests around Anacapa extended at least one mile offshore. Today, there is one large kelp forest located in the small “no-take” reserve at the northeast end of the island. The kelp probably persists in the reserve because of the natural balance in the food chain. In the reserve, California sheephead fish and lobsters eat sea urchins that, in turn, eat kelp. The predators (sheephead and lobster) keep the sea urchin populations from growing and eating all the kelp. Outside the marine reserve, consumptive divers and fishers take sheephead and lobsters; historically, people also hunted sea otters at the Channel Islands. Reduced populations of these natural predators allowed urchin populations to grow larger. Large urchin populations ate most of the kelp outside the reserve, thus causing declines in species associated with kelp forests.

You have seen dramatic changes in fish and invertebrate populations. Today, aggregations of fish associated with kelp forests (such as rockfish, giant seabass, and California sheephead) are smaller than they used to be. In the past, angel sharks and basking sharks were common, but you have not seen any in 10 years. Scientific studies show that several rockfish populations have declined approximately 97 percent in the last 20 years. Black and white abalone populations have declined to record low numbers, and white abalone was recently listed as an endangered species. The primary cause of the white abalone decline was fishing.

POSITION
You support establishing a “no-take” marine reserve network that includes at least 50 percent of the representative habitats and species of concern in the Channel Islands National Marine Sanctuary. Although recreational diving is limited to the waters between subtidal to 30 meters deep, you are interested in protecting all habitats from the intertidal to deep waters within the sanctuary. You are concerned that recreational and commercial fishers are exploiting and depleting a public resource (such as fish and invertebrates) without considering the impacts to other users.
Recreational Diver

QUESTIONS
1. What is your role in the community?
2. What are your goals for resource management?
3. Where would you establish marine reserves? Draw your answer on the blank map. Explain why you would establish reserves in these locations.
4. How large should marine reserves be? Why?
5. Name three species that you have observed interacting in the kelp forest and describe the interactions.
To Fish or Not to Fish
Student Handout

Lobster Fisher

BACKGROUND
You started fishing for lobster about 25 years ago, and you spend about 150 days per year fishing in the Channel Islands. You have fished at all five islands in the CINMS. Currently, you concentrate your fishing effort around Anacapa Island.

OBSERVATIONS
From your observations, commercial fishing for lobster appears to be sustainable. After fishing for 25 years, you have seen the “ups and downs” of the fishery, but overall, the lobster population size is similar from year to year.

Lobsters migrate during El Niño conditions and storms, resulting in more productive fishing. A few years ago, warm waters increased the number of large lobsters around the Channel Islands, and the fishing was excellent. However, in subsequent years, cooler water reduced the abundance of lobster.

You start fishing on the first Wednesday in October, and you are required by law to stop fishing on the first Wednesday after the 15th of March. You can only take lobsters that are larger than 3¼ inches carapace length. Since the early 1970s, lobster fishers have been required to use “escape ports” in traps. Escape ports are small holes that allow small lobsters to get out of the trap while the larger, legal-sized lobsters remain in the trap. In 1985, the market for live lobster expanded, increasing the demand for, and the price of, lobster. In 1996, the Department of Fish and Game implemented a limited boat entry policy, which reduced the total number of lobster fishers. Today, there are more fishing boats than in the 1970s, but the number of lobster traps in the water has not changed.

POSITION
You support establishing a marine reserve network in the Channel Islands National Marine Sanctuary in order to protect a portion of the lobster population. You anticipate that lobsters in the reserves will become larger and produce more offspring. Scientific studies demonstrate the potential for “export” of lobster larvae and “spillover” of lobster adults from reserve areas into nearby fished areas. However, you are concerned that the establishment of a marine reserve network will confine the efforts of all fishers to a smaller area. You would like to establish marine protected areas that allow limited fishing for lobster. You argue that the lobster industry has been sustainable over the last 100 years. You believe that small marine reserves are enough to increase lobster abundance and individual size.
Lobster Fisher

QUESTIONS
1. What is your role in the community?
2. What are your goals for resource management?
3. Where would you establish marine reserves? Draw your answer on the blank map. Explain why you would establish reserves in these locations.
4. How large should marine reserves be? Why?
5. What regulations already exist in the lobster fishery?
6. What environmental factors affect the size of lobster populations?
Squid Fisher

BACKGROUND
You are a squid fisher around the Channel Islands, especially Anacapa Island.

OBSERVATIONS
Squid populations change with environmental conditions. Today, squid populations are relatively large. However, El Niño conditions and the associated warm water are devastating for squid. Squid populations declined dramatically after the El Niño cycles in 1992-1993 and 1997-1998.

The Department of Fish and Game established weekend (two-day) closures for squid in order to prevent excessive fishing. The weekend closure of this fishery is good because it gives all the fishing grounds two days to rest and recover from fishing. Some squid spawn during the weekend closure, allowing populations to increase over time. In addition, the Department of Fish and Game limited the number of tons of squid that can be caught each year. The squid fleet is getting larger every year, and there are many boats willing to fish for less money. You think that a reduction in the size of the squid boat fleet is necessary to reduce fishing pressure.

You are concerned that the lights used to attract squid to the surface during fishing may negatively impact seabirds (such as pelicans) that roost on cliffs. Decreasing the power of lights used to attract squid at night (from 100,000 to 30,000 watts per boat) will keep squid closer to the boat and reduce impacts on nesting seabirds. A coastal marine reserve near bird colonies might reduce the negative impacts of squid fishing on seabirds.

POSITION
You do not feel that marine reserves are necessary to sustain the squid fishery in the Channel Islands. If a reserve is established, you feel that negative economic impacts on all fishers must be considered. You recommend establishing a marine reserve in a place that is not used by squid fishers. You suggest that establishing marine reserves near seabird colonies could be one way to reduce impacts of squid boat lights on seabird populations.
Squid Fisher

QUESTIONS
1. What is your role in the community?
2. What are your goals for resource management?
3. Where would you establish marine reserves? Draw your answer on the blank map. Explain why you would establish reserves in these locations.
4. How large should marine reserves be? Why?
5. Does the squid fishery affect other species? If so, what species are affected?
To Fish or Not to Fish
Student Handout

Recreational Fishing Boat Captain

BACKGROUND
You started working as a deckhand on fishing boats about 25 years ago. After a few years in the business, you became a captain of a recreational fishing boat. You typically fish off the coast of Santa Barbara and around the Channel Islands, from very shallow waters to depths of more than 500 feet.

OBSERVATIONS
Fish come and go over time. For example, white seabass populations vary throughout one year, and from year to year. You have observed large groups of white seabass in spring and early summer, especially when squid are spawning. Populations of Pacific halibut seem to be increasing at the Channel Islands. It is easy to catch halibut in shallow waters, especially during squid spawning. On the other hand, rockfish have declined in recent years. Rockfish populations increased slightly after the 1982-1983 El Niño, but since then, rockfish have been less and less abundant.

Fishing is probably the main cause for the rockfish decline. Environmental and other stresses, such as El Niño cycles, large ocean waves and strong currents, also impacted rockfish populations. The rockfish fishery has become less productive over time. Areas that have been impacted include Anacapa Island.

Five species of rockfish (canary rockfish, Pacific Ocean perch, bocaccio, cowcod and lingcod) are considered overfished by the Pacific Fisheries Management Council. A large area (approximately 4,200 square nautical miles) around the southern Channel Islands (including Santa Barbara Island) was closed to cowcod fishing in waters below 120 feet. The Department of Fish and Game stopped all fishing for rockfish species in Southern California for two months of each year.

POSITION
Marine reserves could put recreational fishing boat captains out of business. If marine reserves are established in the Channel Islands, recreational fishers may go to other places that offer more opportunities. You are primarily worried about losing business.

You think that marine reserves may help some fish recover from overfishing. You have heard that, in Florida, world-record catches for three species of fish occurred within 100 kilometers of a marine reserve. You hope a reserve in the Channel Islands will help rockfish populations grow larger and produce more offspring.

You strongly oppose establishing marine reserves on the south side of Anacapa Island because this is a productive area where you fish.
Recreational Fishing Boat Captain

QUESTIONS
1. What is your role in the community?
2. What are your goals for resource management?
3. Where would you establish marine reserves? Draw your answer on the blank map. Explain why you would establish reserves in these locations.
4. How large should marine reserves be? Why?
5. Which fish species are declining around the Channel Islands and why? Give at least three reasons why a fish population may decline.

Relative Value of Different Areas for Recreational Fishing

- High
- Intermediate
- Low
Recreational Fisher

BACKGROUND
You began recreational fishing about 20 years ago, and you fish about 75 days each year. You enjoy fishing in the Channel Islands and along the coast from Santa Barbara to Ventura. You fish for many different species, including kelp bass, white seabass, yellowtail, rockfish, barracuda, squid, sardines, anchovies, halibut, sand bass, lingcod, mackerel and bonito.

OBSERVATIONS
You believe that some fish species, including rockfish, lingcod and California sheephead, are seriously depleted. These fish are less abundant and smaller than they were 10 years ago. You are concerned about the recent declines in fish abundance, so you “catch and release” all kelp bass, sheephead and rockfish. On the other hand, yellowtail, white sea bass and albacore seem more abundant now than in previous years, so you catch these species for food.

Fishing is probably the main cause for the rockfish decline. Environmental and other stresses, such as El Niño cycles, large ocean waves and strong currents, also impacted rockfish populations. The rockfish fishery has become less productive over time. Areas that have been impacted include Anacapa Island.

Five species of rockfish (canary rockfish, Pacific Ocean perch, bocaccio, cowcod and lingcod) are considered overfished by the Pacific Fisheries Management Council. A large area (approximately 4,200 square nautical miles) around the southern Channel Islands (including Santa Barbara Island) was closed to cowcod fishing in waters below 120 feet. The Department of Fish and Game stopped all fishing for rockfish species in Southern California for two months of each year.

POSITION
You think that small marine reserves could help some fish populations grow larger. However, you are against closing large areas where you enjoy fishing. You are concerned that commercial fishing is causing the decline of rockfish, and you do not want recreational fishers to be punished for the impacts from commercial fishing. You are strongly opposed to establishing marine reserves on the south side of Anacapa Island because these areas are traditional recreational fishing grounds and because this is an area where you fish.
To Fish or Not to Fish
Student Handout

Recreational Fisher

QUESTIONS
1. What is your role in the community?
2. What are your goals for resource management?
3. Where would you establish marine reserves? Draw your answer on the blank map. Explain why you would establish reserves in these locations.
4. How large should marine reserves be? Why?
5. List three fish species that live in the Channel Islands National Marine Sanctuary.
6. Which of these fish species are becoming more abundant? Which species are declining?
To Fish or Not to Fish
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Marine Ecologist

BACKGROUND
You are a marine ecologist at the University of California, Santa Barbara. You have studied rockfish populations in the Channel Islands for more than 25 years. You have worked with marine scientists to establish marine reserves in New Zealand and South Africa.

OBSERVATIONS
Over the last 25 years, you have observed many declines in marine resources. There are many causes for these declines, including fishing, El Niño cycles, disease and increased pollution. The populations of some species, such as squid and red sea urchin, vary from year to year. Other species, such as rockfish, sharks, abalone, sheephead, black sea bass and sea cucumber, have continued to decline over the years. In addition, many species that are fished interact with other species as either predators or prey. Changes in the population sizes of fished species will affect many other species through these interactions. After considering the data, you concluded that current management strategies do not provide enough protection for some species, particularly rockfish. Rockfish are vulnerable to fishing because they grow slowly, and they have relatively few offspring.

You gathered data to show that marine reserves will help vulnerable species recover from the impacts of fishing. You studied 80 marine reserves from different parts of the world. On average, targeted populations are larger in marine reserves. Also, the average body size of targeted species is larger in marine reserves than in fished areas. Larger fish produce more eggs than small fish. In some places where marine reserves were established, fishing has gotten better. You heard that, in Florida, world-record catches for three species of fish occurred within 100 kilometers of a marine reserve.

POSITION
The size of a marine reserve network depends on the goals established by the community. If conservation is the primary goal for reserves, then the reserve should be approximately 50 percent of the total area under consideration. Larger reserves will protect more species. If the goal for marine reserves is to sustain fisheries, then reserves should be approximately 30 percent of the fishing grounds. Without reserves, fish populations will continue to decline, putting fishers out of a job.
Marine Ecologist

QUESTIONS
1. What is your role in the community?
2. What are your goals for resource management?
3. Where would you establish marine reserves? Draw your answer on the blank map. Explain why you would establish reserves in these locations.
4. How large should marine reserves be? Why?
5. What fish species have declined? Give two reasons for the decline, in addition to fishing.
6. How do marine reserves help marine animals?
Sanctuary Manager

BACKGROUND
You are appointed by the United States government to enforce the National Marine Sanctuary Act of 1972 at the Channel Islands National Marine Sanctuary. The mission of the National Marine Sanctuary Act is to manage areas of special significance and to protect their ecosystems and culture for current and future generations. In 1980, due to their exceptional natural resources and beauty, the waters around the Channel Islands were designated as the Channel Islands National Marine Sanctuary. The sanctuary includes waters within six nautical miles of five of the Channel Islands: San Miguel, Santa Rosa, Santa Cruz, Anacapa and Santa Barbara.

OBSERVATIONS
The Sanctuary Act requires that we protect the natural environment while allowing people to use the islands for recreational and commercial reasons. Your job is to maintain a balance of interests. You work with the California State Department of Fish and Game to manage fishing in the sanctuary. The department recently stopped fishing for rockfish for two months of the year and completely stopped fishing for abalone (an invertebrate mollusk). Information gathered during years of experience suggests that you should designate between 30 percent and 50 percent of the sanctuary waters as marine reserves. You must balance the different ideas in your community in a way that will be fair to everyone while following the Sanctuary Act.

POSITION
The size of a marine reserve network depends on the goals established by the community. If conservation is the primary goal for reserves, then the reserve should be approximately 50 percent of the total area under consideration. Larger reserves will protect more species. If the goal for marine reserves is to sustain fisheries, then reserves should be approximately 30 percent of the fishing grounds. Without reserves, fish populations will continue to decline, putting fishers out of a job.
Sanctuary Manager

QUESTIONS
1. What is your role in the community?
2. What are your goals for resource management?
3. Where would you establish marine reserves? Draw your answer on the blank map. Explain why you would establish reserves in these locations.
4. How large should marine reserves be? Why?
5. List five recreational or commercial activities that occur in the ocean.
Bathymetry Map

Depth of the Sea Floor Around Anacapa Island

Depth (m):
- 30 - 0 m
- 100 - 30 m
- 200 - 100 m
- 300 - 200 m
- 400 - 300 m
- 500 - 400 m
- 600 - 500 m
- 700 - 600 m
- 800 - 700 m
- No Data
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Anacapa Grid Map

Worksheet: Where would you establish marine reserves?