Oceans In Protection: Marine Protected Areas

Step 2. Select a target species. **Key based on example shown in student handout** Step 2 – 6 not graded here, used for student planning for Marine Reserve Design, graded in Part 2.

All species have specific habitat requirements; use the 'Habitat Requirements for Marine Organisms' (Table 2) when considering the minimum size of the reserve. Circle where your species falls in 'Species Type' in the Table below.

Species Type	Habitat Requirements	Prey Requirements	Minimum Home Range**	Other considerations
Piscivore (Fish)	Open ocean or kelp beds	Small, schooling fish	10 km^2	High demand commercially
Carnivore (Fish)	Rocky habitats	Invertebrates (shallow water)	1 km^2	
Planktivore (Fish)	Open Ocean	Plankton, upper 10m of ocean waters	10 - 100 km^2	High demand commercially
Herbivore (Fish)	Kelp Beds	Kelp Beds, 10m or shallower water near coastlines	1 km^2	High demand commercially
Invertebrate (Urchins, Lobsters, Crabs)	Rocks, sandy bottom or kelp for habitat	Zooplankton	10s of $meters^2$	High demand commercially
Zooplankton	Sunlight, upper 10 m ocean water	Phytoplankton, sunlit ocean waters	Global	
Kelp Beds (Algae)	Sunlight, rocky bottom, 30 m depth or shallower along coastline	No prey	1- 10 Km^2	Habitat supports hundreds of other species

Table 2. Requirements for Habitat of Marine Organisms.

List the main factors necessary for your target species

1. Needs kelp, or rocky, sandy bottom for habitat
2. Need zooplankton for food source
3. Home range = 10s of $meters^2$

Step 3. Select a total area for your reserve.

Limit the total area of your marine reserve to a maximum of100 km^2 for initial proposals. Use the 10km scale bar and the polygons approximating 100 km^2 drawn on the map to estimate the size and shape of your marine reserve.

Area for your reserve _____100 m^2 _____

Best Shape for this Total Area _____Rectangular, include near shore and openwater_____

Step 4. Decide on the best geographic location. Consider near shore vs. offshore, populated areas and other factors.

Near shore, in existing kelp beds, away from popular fishing spots; selected area NW of San Miguel Island

Notes on factors you want to include _____

Step 5. Consider all the factors in Steps 1-4 above and sketch out your marine reserve on the map image provided at the end of this lesson. Draw your reserve with a thick boundary line in the location you select.

Step 6. Justify and support your decision using scientific facts and information.

Examples for a proposed location, with references cited could include;

- The site is in a location with existing kelp beds (Map Template)
- The site is placed in shallow water, less than 30 m, which is ideal for kelp bed growth (Table 2).
- Studies have shown that numbers of lobsters (population density) increase inside marine reserves (Figure 9).

Part 2. Map Activity . (10 points possible).
Grading rubric

- **3 locations with solid justification based on correct interpretation of scientific findings = 10 points.**
- **Deduct 1 point for lack of justifications provided for each location.**
- **3 locations with no or inaccurate justification = 5 points.**
- **Less than 3 locations or no justification = 3 points.**
- **Incomplete or no attempt = 0 points.**

Sample full credit answer with locations and justifications shown below. Note that the first example is given for students reference in the worksheet handout.

Example for a Proposed Location

Site Chosen represented on map with this symbol

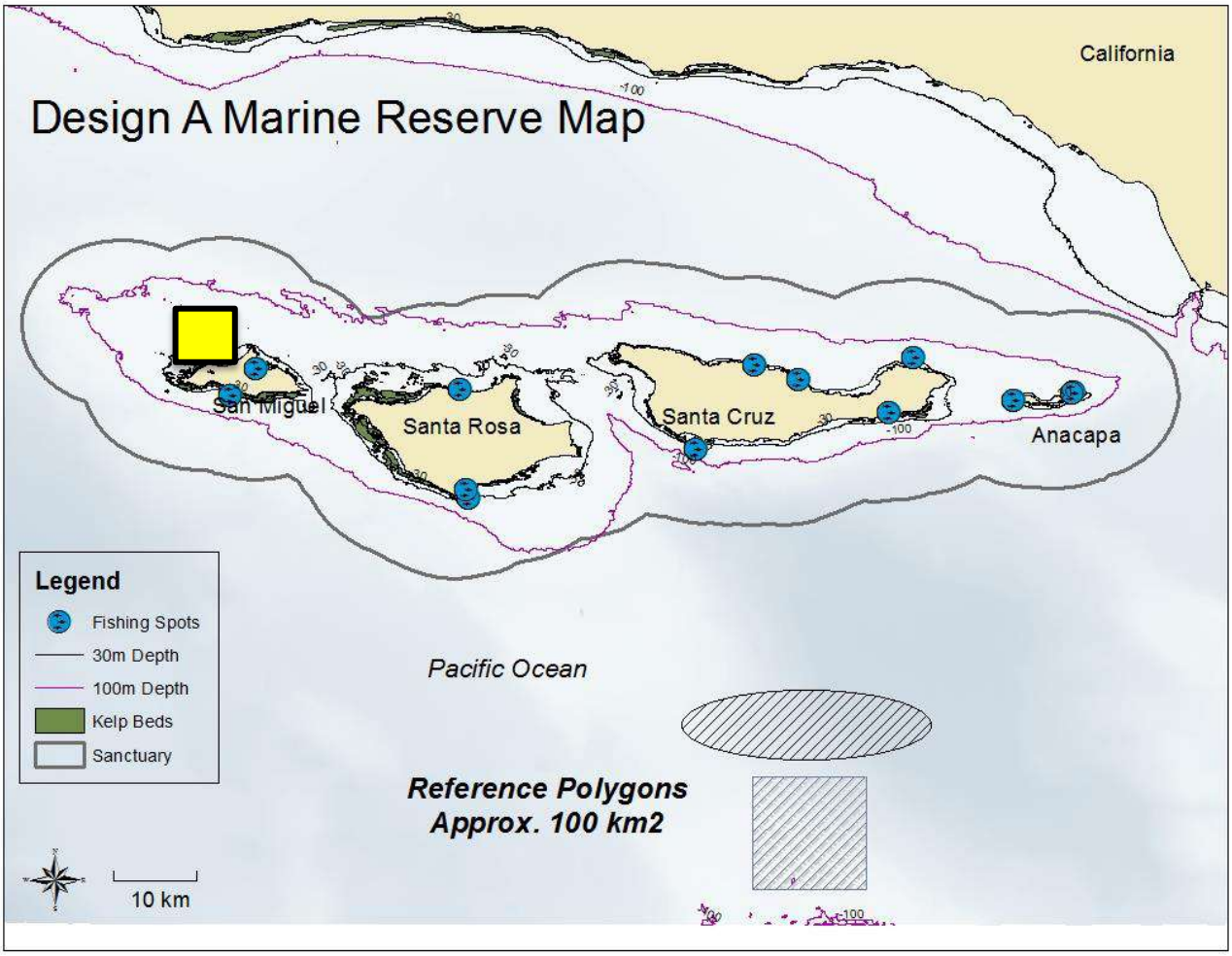
Step 2) Species = Lobster, Invertebrate

1. Larval Travel = 0.15 to 500 km (Figure 12)
2. Lobsters need zooplankton
3. Lobsters need kelp for habitat

Step 3) Area selected for reserve = 100km^2

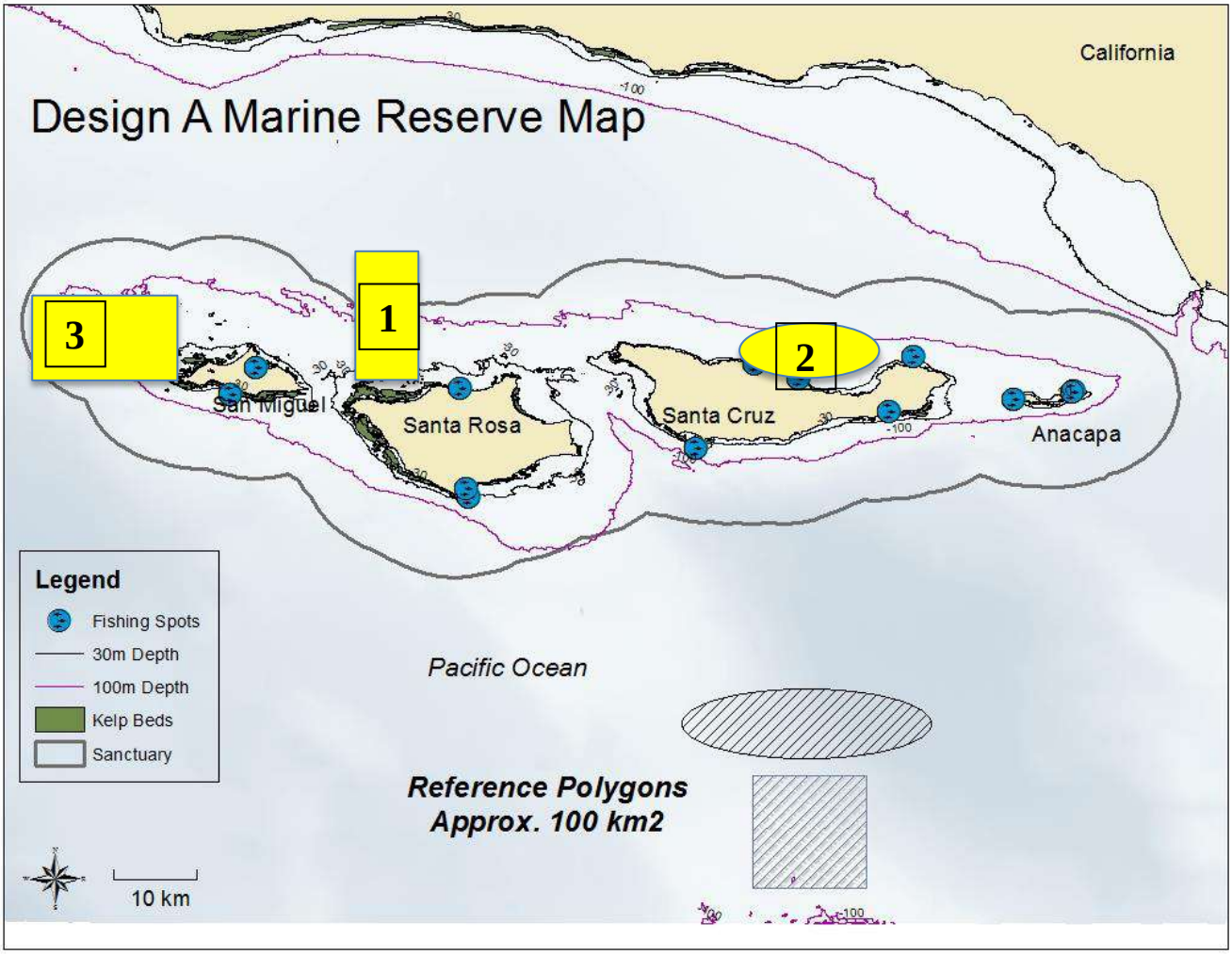
Step 4) Near coastline, near kelp beds, not including existing fishing spot

- The site is in a location with existing kelp beds (Map Template)
- The site is placed in shallow water, less than 30 m, which is ideal for kelp bed growth (Table 2), and includes up to 10 km offshore for larval travel (Figure 12).
- Studies have shown that numbers of lobsters (population density) increase inside marine reserves (Figure 9).



Sample Proposed Location for Marine Reserve

Sample Reserve Locations and Justifications (note there are many options and answers)



Location 1 – Northern side of Santa Rosa Island.

Justifications - near, but outside fishing areas, includes 30m bathy line and some existing kelp beds.

1. Relative changes in kelp inside reserves increased 13x (Figure 4).

2. Biomass of piscivores (2.6x), carnivores (1.3x) and planktivores (1.02x) were higher inside the reserves (Figure 5).

3. Different fish species traveled between 1 and 800 km away from marine reserves, indicating different sizes of home ranges (Figure 11).

Location 2 – South side of Santa Rosa Island - near, but outside a popular fishing area, includes 30m bathy line and some existing kelp beds.

1. Relative changes in kelp inside reserves increased 13x (Figure 4).

2. Abundance increased both inside reserves (by 61%), and outside reserves (by39%) (Figure 10).

3. The dispersal distance for seaweeds (.01 – 5km), invertebrates (.05 – 100+km) and fishes (1 – 700km) differs, with ranges reported as noted in parenthesis. (Figure 12).

Location 3 – Northwest side of San Miguel Islands - includes 30m bathy line and some existing kelp beds.

1. Fish inside marine reserves show an age structure of larger, more reproductive individuals (Figure 6).

2. Older, larger individual fish are capable of producing greater numbers of offspring (Figure 7).

3. Fish densities increased inside and outside Marine Reserves (Figure 8).

Step 7. Question: Imagine that you are a politician running for office in Southern California. You are speaking to your constituents about conserving local ocean areas and want to support the proposal of a Marine Reserve in coastal waters. List 5 talking points you would use to convince voters that the Marine Reserve to support your idea. Be sure to include at least one idea that would appeal to fishermen, one idea that would appeal to consumers of seafood and one idea that would appeal to recreational users.

1. Scientists have shown that there is a "spillover effect" outside of Marine Reserves, and bigger and healthier fish will populate your favorite fishing spots if we place reserves near them. (Appeal for fishermen).

2. Marine Reserves allow for fish to grow older and larger under protective cover. Older and larger fish produce more offspring per spawning season, which means a healthier fish stock and better commercial fishing opportunities. (Appeal for consumers).

3. The establishment of Protected Areas along with Marine Reserves allows for no-take recreational areas in healthier ecosystems, providing for more enjoyable recreational activities in pristine and healthy ecosystems. (Appeal for recreational users).

4. Answers will vary. Look for answers that combine good scientific research with valid political policy in a convincing argument.

5. Answers will vary. Look for answers that combine good scientific research with valid political policy in a convincing argument.