Nearshore Rocky Reef Habitat and Rockfish Site Fidelity—presentation by Dave Fox, Oregon Department of Fish and Wildlife

Analyses of fish-habitat relationships can be made using high-resolution maps that combine sonar images of the habitat with visual surveys of fish taken by remotely operated vehicles. Rock patch structure, size and relief can be an indicator of fish density and distribution, as well as community composition. Two examples are presented from Cape Perpetua and Orford Reef.

By using side-scan sonar at Cape Perpetua, you can see about 60 distinct small patch reefs, which can be an indicator of fish distribution. There are about 8 rockfish species commonly found in this area and we can see how the fish are distributed in these patches. For example, Quillback rockfish distribution on the patches at Cape Perpetua shows an increase in fish density with habitat patch size (Figure 1). The x-axis is surface area of the habitat patch and the y-axis indicates the density measure of the fish. A linear regression was fit to the data, but it was a poor regression with a lot of scatter. The results of this indicate that there were no Quillback on very small patches less than 5.5 m^2. In contrast, Kelp Greenling were found on smaller rock patches, starting at around 4 m^2, and actually decreased in density as patch size increased.

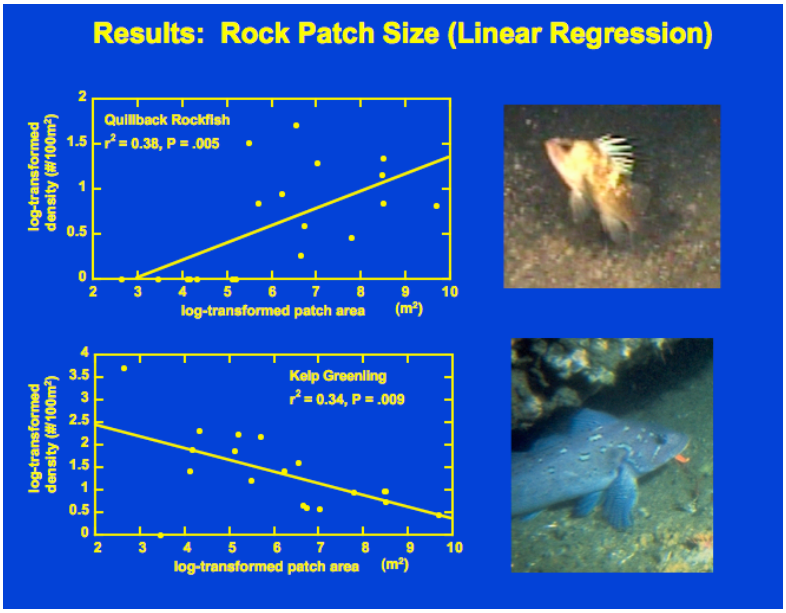

Figure 1. Linear regression of Quillback rockfish and Kelp Greenling sampled on rock patch reefs at Cape Perpetua, indicating there were no Quillback on very small rock patches, but there were Kelp Greenling on smaller patches.

The fish density data appeared to be a showing a "threshold" phenomenon. There were no fish or very low densities on very small rock patches, then once you reached a certain patch size densities increased dramatically but did not increase further as patch size increased. The overall trend seen in several distributions of this type was similar. Rock patches as small as approximately 10 by 20 m have abundant concentrations of fish. Small rock patches are significant in the number of fish they can hold, are common in Oregon's nearshore area, and should not be over looked simply because they are small.

At Orford Reef, vertical relief was found to be an important factor for fish abundance. There was a significant, but weak, positive correlation between vertical relief as represented by mean slope of rock surfaces and fish densities. High slope areas consistently had high concentrations of fish, while low mean slope areas had completely variable fish densities. This finding indicates that there is likely some other important factor coming into play. Habitat patches were then defined by variation in depth with buffer areas around transects. Portions of each buffer area with high depth variation were classified as high-relief habitat patches. The patches were then described with two-variables: percent cover of all high relief patches within a buffer area and density of individual patches (regardless of the size) within the buffer area. These analyses lead to a plot of patch density versus patch cover (Figure 2). Three patterns stand out:

1. High percent cover of habitat patches, including large outcroppings of rock yielded high fish densities —this result is similar to high slope areas
2. High density of small rock outcrops, but low percent cover yielded high density of fish
3. Low percent cover and low relief area yielded a low density of fish

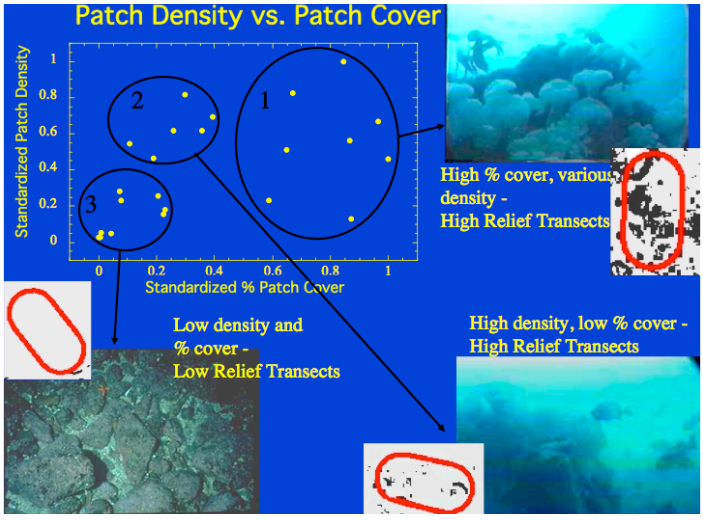

Figure 2. Diagram of relationship between patch density and patch cover in relation to fish densities

The second and third pattern occur in areas with low mean slope, helping to explain why low mean slope areas had both high densities and low densities of fish. While it is often assumed that rock patches are important if they are large and unimportant if they are small, the occurrence of many small habitat patches and the relative landscape position in the patches helps explain the overall abundance of fish on a reef. This type of landscape analysis is needed to fully define habitat quality and species diversity.

To further research site fidelity of fish species in rock patches, several species of fish were acoustically tagged at Siletz Reef off of Lincoln City and Black rockfish were specifically studied at Seal Rock. Siletz Reef is an area mapped with side scan and multibeam sonar. The tags had the ability to measure depth and other information on the fishes' location. The results of this tagging were approximately as follows:

- Quillback, Tiger, Vermillion and Yelloweye—high site fidelity
- Black rockfish—high to intermediate site fidelity

- Canary—low site fidelity

Overall, there is quite a bit of variation of what fish will do—some will leave the grid completely, some make short forays in and out of an area and many other combinations of movement. Figures 3 and 4 shows examples of high and low site fidelity, respectfully, by different species.

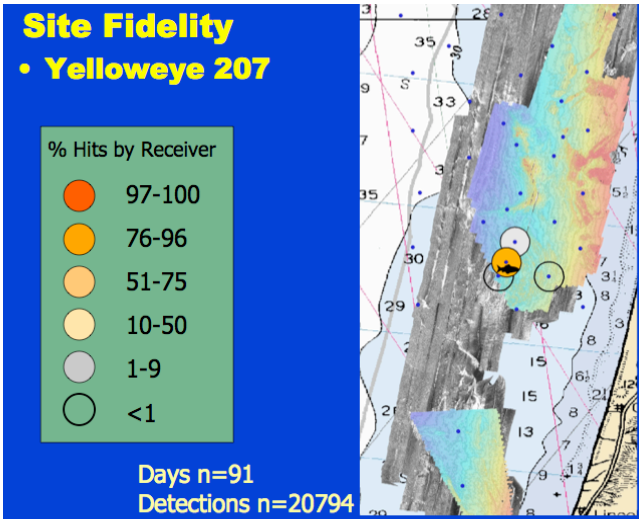

Figure 3. This map shows an example of high site fidelity by yelloweye rockfish

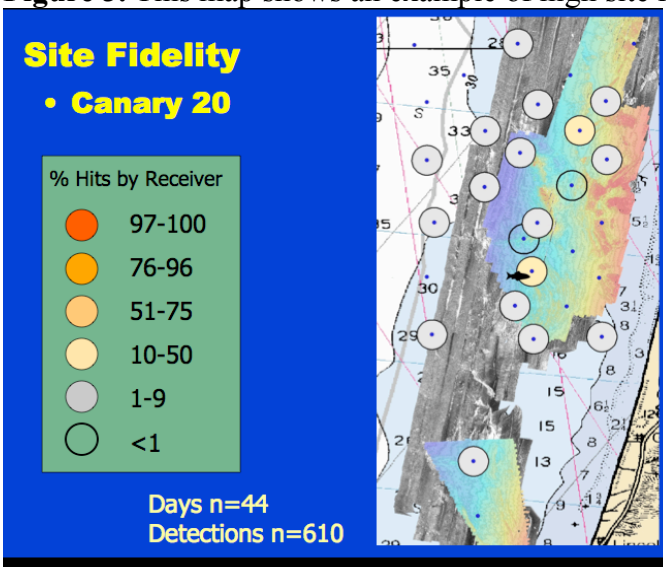

Figure 4. This map shows an example of low site fidelity by canary rockfish

The implications of these data to marine reserve design are as follows:

- With rocky reef habitat—don't oversimplify reef types, there can be a lot of differences among rocky reefs and they should not be over generalized
- Isolated small rocky habitat patches can be important habitat
- Relative "value" of rocky reef to fish is not a simple relationship to habitat relief; there are several scales of relief which can affect fish populations
- The response of fish species will depend on their site fidelity
- High resolution seafloor mapping is necessary to better understand rocky reefs