Fish Surveys and Habitat Investigations of Cowcod and Bocaccio*

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Our goal was to establish a quantitative process of assessing rockfish stocks in the California Bight using new technology. Rockfish schools over local banks were mapped quantitatively with split-beam echo-sounders and habitat was mapped using multi-beam sounders (Fig. 1). Remotely operated vehicle transects were conducted to identify species composition of fish schools and to "ground truth" bottom type.

First, a multi-beam sonar was used to map rockfish habitat and thereby minimize the area to be more comprehensively surveyed. For habitat classification, we combined a 200 kHz multi-beam sonar, state-of-the-art positioning instrumentation, and mature algorithms to produce digital terrain maps of the seafloor

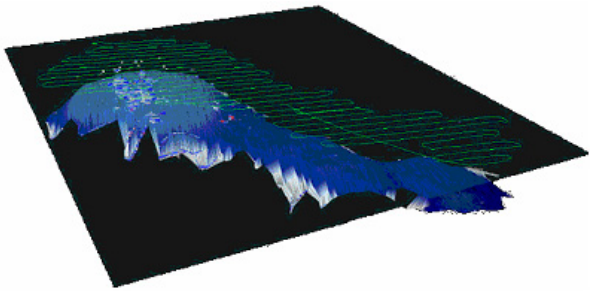

Figure 2. Three dimensional image of Forthy-Three Fathom Bank.

(Fig. 2). Additionally, we exploited the frequency- and angular-dependencies of the acoustic backscatter from the echo sounders and the sonar, respectively; that is, backscatter from different seafloor types is dependent on the acoustic wavelength relative to the particulate size, density, and sound speed, and it is a function of the acoustic incidence angle. Therefore, much more information about essential bocaccio habitat can be remotely sensed and classified by combining the data from these instruments and exploiting the fundamentals of scattering physics. High resolution underwater video and still-camera

Figure 1. Fish schools above Forty-Three Fathom Bank.

*Not presented at workshop.

images were obtained with an ROV to validate the acoustic seabed classifications.

Next, volume backscattering strengths at four frequencies were used to remotely identify scatterer taxa (i.e., large fish, small fish, and zooplankton) and to observed their diel behavioral characteristics. The acoustic backscatter data was identified as rockfish via an empirical four-frequency acoustical signature and the ROV video. Again, the backscatter from different fish species is dependent on the acoustic wavelength relative to the particulate size, density, and sound speed, and it is a function of the acoustic incidence angle. One square mile grids were established over key rockfish habitat. These grids were mapped at 0.2 nautical mile (nmi) intervals using split-beam echo sounders (four frequencies).

Because the four different frequencies allow us to distinguish the size of individual fish, schools of small rockfish can be distinguished from larger fish (Fig. 3).

Figure 3. A cow cod (*Sebastes levis*).

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