

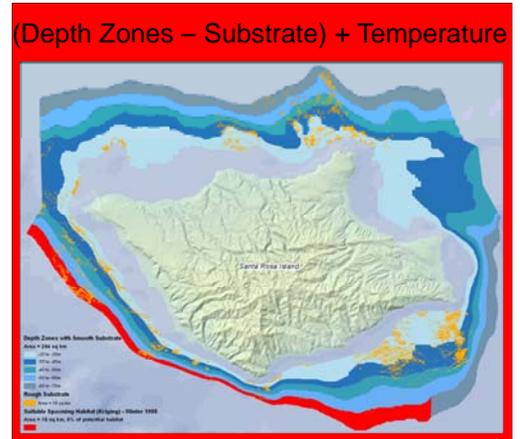
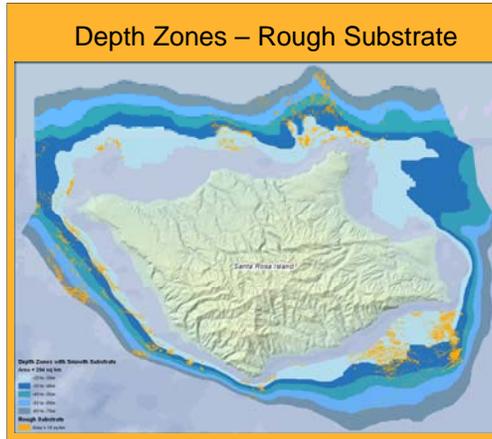
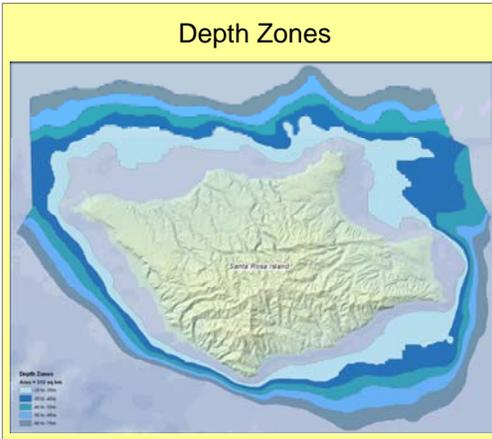
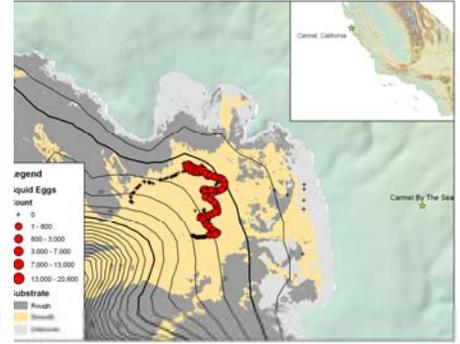
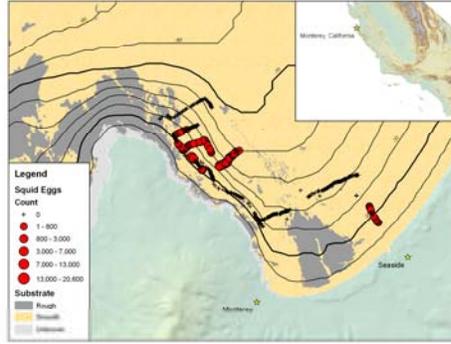
Quantifying spawning habitat for the California market squid, *Doryteuthis opalescens*

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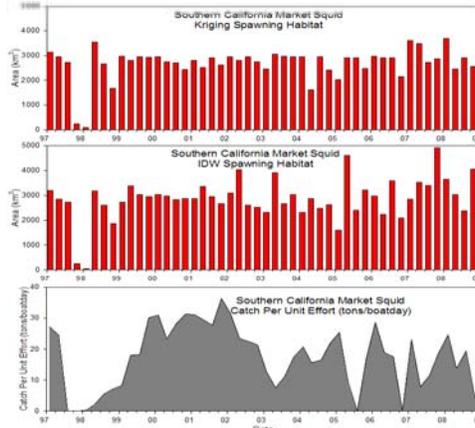
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1. The fishery of the California market squid is known for its variability. One possible explanation for the dynamic population is that the changing marine environment results in large or small cumulative areas of suitable spawning habitat.
2. Squids lay 100-300 eggs in capsules that are inserted into sand with a thin anchoring strand. Wave surge ventilates the eggs. From laboratory experiments, >95% of squid eggs hatch when reared between 9-13.5°C. 2001-2002 ROV surveys of squid eggs found >95% of egg capsules on a sandy substrate, between depths of 20-70m, and water temperatures between 10-14°C.
3. We determined the total area of suitable spawning habitat in the Southern California bight for market squid based upon the three parameters of substrate-type, depth, and temperature. Data is from the CSUMB Seafloor Mapping Lab, NOAA bathymetry, and CalCOFI CTD casts. Cumulative spawning habitat areas were mapped and calculated for each quarter of 1997-2008.

ROV surveys: 95% of squid eggs occur on sand, between 20-70m, and **10-14°C**.



Winter 2000, highest catch of decade.
Winter 1998, failure of fishery.



Results: Cross-correlation time-series analysis of spawning area vs. fishery catch per unit effort shows a significant correlation at a lag of 6 Months for both IDW and Kriging. While not predicting all inter-annual variability, suitable spawning habitat defined herein can explain some seasonality and predict El Niño based fishery collapses. This ArcGIS and python process can compare **ANY** long-term oceanography data (salinity, oxygen, pH, etc.) to the suitable habitat parameters of **ANY** species. Acknowledgments: Funding from NOAA-IOOS grant #20073439, Additional support and fisheries data from Stephen Wertz, Dale Sweetnam, and Marci Yaremko of California Dept. of Fish & Game.

ArcGIS Flowchart



CalCOFI temperatures for 20-70m, 1998 & 2000, Kriging & IDW

