Deep sea conservation has been one of my main focuses during the three years in which I have been a staff member of Marine Conservation Biology Institute, a science-based non-profit organization. We have focused extensively on the biology and conservation of deep-water coral and sponge ecosystems both in relationship to and independent of seamounts. I have learned that seamount and similar benthic ecosystem ecology is a burgeoning field, as indicated by last year's deep-sea coral session at the American Association for the Advancement of Science Meeting which included a focus on seamounts and by the ever increasing body of literature on the topic (Stone et al 2003). Only in the last ten to fifteen years has information begun to emerge on not only basic science of these ecosystems, but also their incredible uniqueness in relation to other marine habitats, and even in relation to other seamounts. As areas with incredible rates of endemism (as high as 52% for invertebrates on chains of Chile and 35% for all species on seamounts off Tasmania; Parin et al 1997, Stone et al 2003) and elevated productivity, particularly over shallow seamounts (Daniel Pauly, University of British Columbia, personal communication), seamount ecosystems are fascinating – and incredibly valuable.

The majority of the ocean is in essence a desert for most large, pelagic migrating species. With the ability to dive to approximately 1500 m at best in the case of elephant seals (*Mirounga leonine*), and considerably less for aerial species such as albatrosses and petrels, most of the ocean floor is out of reach. Frontal zones occurring at water masses of differing temperatures are beginning to be recognized as important resource sites for migrating species such as turtles (Polovina et al 2000), blue whales (Etnoyer et al 2004) and large tunas (Schick et al 2004), forming moving hot spots of increased productivity, creating floating "snack bars" in the ocean. Seamounts and other similar bathymetric features, however, have the ability to produce similar though relatively stationary productivity and while the physical and oceanographic basis for this work is fairly well understood (Rogers 1994, Forney et al 2002, Gad and Schminke 2004), the effects this has on the larger biological ecosystem has not even begun to be fully explored.

Research has been completed on the use of seamounts by bigeye tuna (Sibert et al 2000, Musyl et al 2003), yellowfin tuna (Sibert et al 2000) and seabirds (Haney et al 1995), but little other work has been explored, though there are anecdotal mentions heavily scattered throughout seamount and migratory species literature that these ecosystems are of importance to many migratory and threatened species. While fronts may be important feeding grounds for many migrators, seamounts may be of greater or equal importance to species which are primarily benthic feeders, such as elephant seals, or may be important stationary destinations of increased primary or secondary productivity, resulting in increased pelagic foraging success.

Of increasing concern, however, is the vulnerability of these ecosystems (Probert 1999, Stone et al 2003). Although the tide of scientific interest is just beginning to rise, it is many years – even decades – behind that of the commercial fishing industry, which has been fishing seamounts for generations. Particularly concerning is that the principle gear utilized in catching seamount fishes such as orange roughy (*Hoplostethus atlanticus*) and oreosomatids in bottom trawls which have the ability to greatly alter and destroy delicate ecosystems, such as deep water coral colonies which are frequently found on seamounts (Koslow et al 2001, Stone et al 2003, Watson and Morato 2004). New international efforts are being formed, such as the Deep Sea Conservation Coalition (www.savethehighseas.com), that are working to prevent bottom trawling in fragile ecosystems such as those that occur on seamounts. Additional efforts are focusing on the pelagic realm above seamount floors. For example, Larry Crowder's lab at Duke University Marine Laboratory is completing analysis to determine if pelagic longlining occurs with increased intensity over seamounts. If this is the case and if large pelagic migrators, many of which are endangered, also concentrate in these areas, a new dimension to protecting these species and seamount ecosystems may be necessary. It is important to note that most seamounts occur in international waters, presenting a daunting challenge for protection. However, some of the strongest international conservation oriented agreements pertain to endangered species, creating the possibility of the protection of both species and seamounts if it can be proven that seamounts are critical habitat for their migratory success (Alder and Wood 2004).

Through my graduate research, I plan to determine the reasons for and extent to which large pelagic animals utilize seamounts as part of their migratory routes and the potential of using habitat dependency by internationally protected species as a means to protect seamounts and their associated species in international waters. The anticipated components of my research are outlined below.

1. Gather as many satellite tracks as possible for a variety of taxa (including sea turtles, marine mammals, seabirds and large pelagic fishes) and analyze spatial correlation to seamount locations and density using GIS to show if there is a coarse-scale relationship between organism movement and seamount locations and density.
2. Consider 1 to 3 small sections of the Pacific (100-500 km) including an area of high seamount density as well as an area of low density and analyze the fine scale movements of a number of taxa within these regions using GIS in order to hypothesize both usage of seamounts within this area and also potential behaviors based on other data gathered by satellite tags, such as water temperature and dive depth.
3. Using spatial data, compare movements and uses of seamounts within and between taxa in an attempt to show the similarities and differences in the way different individuals and taxa utilize seamounts using spatial data.

4. Through literature research and comparison of spatial data, determine if seamounts serve as attractants for migratory species due to primary or secondary productivity and to what extent benthic ecosystems are utilized by migratory species through literature research and comparisons of the spatial data.
5. Possibly include a field component which would include tagging individuals of various taxa near seamounts to record fine-scale movements, analyzing stomach contents of individuals found near seamounts, or using internal temperature probes to determine feeding times of individuals.
6. Thoroughly review international framework in place that could be used to protect seamount ecosystems, including consideration of protected species critical habitats.
7. Conduct interviews with deep-sea fishermen to collect anecdotal information pertaining to migratory species associations with seamounts.

I am applying to the University of California – Santa Cruz, to work with Dan Costa who is one of the co-principal investigators of the Tagging of Pacific Pelagics (TOPP) program with Barbara Block of Stanford University (Block et al 2003). As part of Dr. Costa's laboratory, I would have access to satellite telemetry data of the 5000 individuals from 20 taxa which are part of the TOPP program as well as GIS support from his and Dr. Block's laboratory. Larry Crowder of Duke University Marine Laboratory will be a member of my graduate committee and his laboratory will provide additional GIS support. At the 2004 North Pacific Marine Science Organization Meeting (PICES) in Honolulu, Hawaii, I had the chance to discuss a potential collaboration to do some of the above work using spatial sea turtle data collected by Jeff Polovina of NOAA Fisheries Southwest Fisheries Science Center Honolulu Laboratory. I am also discussing the potential to continue to collaborate with MCBI on seamount work throughout my graduate study.

Communicating the findings and methods of my research is an element to which I have given extensive consideration. I participated in the AquaLink workshop which was held as part of the 2004 World Fisheries Congress in Vancouver, British Columbia. The workshop and the Congress as a whole both reinstated the need for increased efforts in the communication of science to stakeholders and the public at large. I hope to include fishery stakeholders in the process by initiating an interview process where their long-term knowledge can be gathered and potentially utilized as a baseline for some of my work. I hope to have the opportunity to publish my work in not only peer-reviewed scientific journals, but also in related industry and general interest periodicals, and to similarly reach stakeholders and the general public by giving presentations at appropriate venues in addition to scientific meetings. I also hope to use my research as an educational tool presenting work such as migratory patterns in relation to bathymetry as seen by satellite telemetry in classrooms to excite children and young adults about the ocean. Similarly, I hope to integrate my work with websites that show movements in real-time so that the general public can follow individual animals along their migrational journey.

Overall, my hope is to create a solid body of literature as a result of rigorous science produced with the help of the latest technologies such as GIS and satellite telemetry to form a strong basis for the protection of seamount ecosystems. Given the isolation of seamount ecosystems, their potential importance to the overall ocean ecosystem and the current lack of science showing how these features interact with the living ocean around them, this research is both timely and essential.

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