

## **ABSTRACTS**

### **Harnessing energy from the motion of the ocean amidst a crowded sea of competing resource uses**

Mark L. Plummer and Blake E. Feist

Coastal and marine spatial planning (CMSP) encompasses a broad array of activities that take place in and affect large marine ecosystems. Assessing potential conflicts and evaluating tradeoffs among the activities is an important part of CMSP. In this study, we focus on the potential conflicts between wave energy facilities and existing marine uses in the context of CMSP in the California Current. We used the Wave Energy Model (WEM) of the Integrated Valuation of Ecosystem Services and Trade-offs (InVEST) toolkit to generate spatially explicit information for evaluating wave energy conversion facilities. We used this output to identify possible conflicts with other marine uses. We identified multiple conflicts with other marine uses, including commercial fishing, shipping and transportation, and marine conservation areas. While wave energy generation facilities may be economically viable in the California Current, we need to also incorporate costs associated with conflicts that arise with existing marine uses.

## **Can conceptual models and loop analyses advance integrative assessments of marine ecosystems?**

Chris Harvey

Ecosystems comprise diverse arrays of components, processes, currencies and services; representing them in quantitative models is complex and data-intensive. Integrative ecosystem assessments (IEAs) must confront this challenge in order to support management. Within NOAA's IEA program, conceptual models have helped to formalize ideas of marine ecosystem structure, identify information gaps, and communicate and build relationships with managers and stakeholders. However, these conceptual models have not been analyzed to determine their plausibility, nor have they been used in evaluation frameworks to inform management strategies or identify tradeoffs. Here, I analyze a series of conceptual models from the California Current IEA. I first estimate their stability using qualitative network models (QNMs, or loop analyses), a less data-intensive method in which links between ecosystem components are simply given positive, negative, or neutral signs, along with estimates of certainty. The stability analysis demonstrates if our conceptual models have gaps or particularly sensitive components or links. I then combine pairs of species-centered QNMs and apply different management levers to see if the models can identify potential ecosystem responses and tradeoffs. These analyses may help determine if conceptual models are not just organizing and communication tools, but also a basis for strategic modeling and decision-making.

## **Fishery Diversification along the US Pacific Coast**

Daniel S. Holland and Stephen Kasperski

Catches and prices for many fisheries exhibit high inter-annual variability leading to variability in the income derived by fishery participants. Income variability is reduced on average if individuals diversify their income by participating in several different fisheries. The annual variability of aggregate revenues for ports is also reduced by diversification. At the ecosystem level, strong concentration of revenues in a few fisheries may also increase variability of income. Thus fishery diversification at multiple scales can provide a useful indicator of economic risk for fishermen and fishing communities. We utilize the Herfindahl-Hirschman Index (HHI) to measure diversification fishing revenue for individual US Pacific coast fishermen, for major ports along the Pacific Coast, and for overall fishing revenues from Pacific coast fisheries. We look at trends in diversification over the last three decades and discuss determinants and implications of these trends. We also examine specifically how implementation of catch share programs in the Pacific coast limited entry sablefish fishery and more recently in the groundfish trawl fishery have affected diversification of fishermen involved in those fisheries.

## **If it is resilience for society we seek, what does that mean for ecosystems?**

Peter Kareiva

Mark Plummer always thought more clearly about trendy ideas than the rest of us. So, summoning Mark Plummer, with much ado regarding resilient communities, where is the clear thinking? It is clear that when policy leaders and the public seek resilience they mean the ability to maintain their homes, families, communities and livelihoods in the face of shocks such as floods, storms, and oil spills. When ecologists seek resilience their meaning is often unclear, but ranges from maintaining the same basic ecosystem structure and function, to maintaining the same species assemblages. In either case the evidence linking ecological resilience to social resilience is limited. Data on how ecosystems respond to shocks reveal little evidence of resilience, and it may well be that ecological transformation as opposed to ecological resilience is the key to social and human resilience.

## **Inferring Spatially Explicit Relative Stock Abundance in a Commercially Exploited Natural Resource**

Jorge Holzer and Doug Lipton

We take advantage of the fact that fishing firms are profit-maximizers in order to estimate the relative spatially explicit abundance of the population during the period when no survey data is being collected. The approach is applied to the Chesapeake Bay blue crab fishery. We begin with a known starting distribution prior to the fishing season and observe the distribution and catch of fishing vessels over the area in subsequent periods. We then seek to infer the distribution of the population that is most likely to lead to the observed distribution of the fishing fleet, the population distribution that results in the highest fleet profits and where no individual vessel has an incentive to switch fishing areas during the period. We validate our model by taking advantage of data from some limited resource surveys that occur in some areas and periods for which we have model predictions.

## **Reference Points for Optimal Yield: Assessing Economic, Conservation, and Socio-Cultural Tradeoffs in Ecosystem Based Fishery Management**

Marc Mangel and Natalie Dowling

Although the Magnuson-Steven Fishery Conservation and Management Act mandates in National Standard 1 that management for Optimum Yield (OY) should produce “the amount of fish which will provide the greatest overall benefit to the Nation” nobody has yet made this operational. As Ecosystem Based Fishery Management (EBFM) becomes more common, decision makers and managers increasingly face trade-offs among conservation, economic and socio-cultural goals. However, ‘socio-economic considerations’ have often become a code for arbitrary increase of catch limits and ‘conservation goals’ for arbitrary decrease of catch limits. These changes are arbitrary in part because the trade-offs involve values that are difficult to compare directly but understanding them is essential for a holistic view of the ecosystem. We will describe a method for overcoming this problem that is so central to operationalizing EBFM in complex socio-ecological systems and illustrate it with a simple example.

## **Lessons at the confluence of data streams: mapping the social and biophysical landscapes on the Puget Sound's edge**

Karma Norman, Thomas Safford, Blake Feist

In our analysis we sought to expand the environmental management insights generated through a broad Puget Sound-oriented social survey by pairing survey data and results with attendant landscape data. Our social survey identified environmental management and ecological restoration attitudes and perceptions in the Puget Sound basin by asking respondents a series of questions regarding views on the local environment and the desirability of a range of potential ecosystem conditions within Puget Sound. We mapped the survey data to US zip code regions and spatially overlaid the survey response data with existing geospatial data layers of biophysical conditions. By pairing these data with landscape data, we characterized the relationships between urban development trajectories and local views on both environmental problems and their concomitant policy solutions. We found relationships between people's responses and the conditions within their residence zip code, which modified our interpretations of both our sociological and ecological data.

## **Evaluating ‘sense of place’ for cultural and ecological restoration in Puget Sound**

Melissa Poe, Jamie Donatuto, Terre Satterfield

In this paper, we assess the relationships between sense of place, wellbeing, and activities such as shellfish harvesting in the nearshore through semi-structured interviews and values elicitation in two regions of Puget Sound. Results indicate that sense of place spans at least four key dimensions: activities, heritage, personal, and social. Strength of place attachment was evaluated through an analysis of “substitutability” to assess whether or not people could find alternatives without impacting their wellbeing. In addition, three phenomena were found to aid in creating, maintaining and enriching sense of place: access, ecological integrity and knowledge. People who are active at the shoreline for many years (and over generations), and whose activities are an important part of their social network and identity, had the strongest attachments to place, which subsequently fostered stewardship. Understanding and improving the conditions that enable strong place attachments is important for ecological restoration as well as enhancing human wellbeing.

## **Where matters: Spatial variation in the value of coastal protection services**

Mary Ruckelshaus, Anne Guerry, Katie Arkema, Rob Griffin, Greg Guannel, Gregg Verutes, Jess Silver, and Amy Rosenthal

The costs and benefits of adapting to climate changes are not widely understood, limiting the ability of decision makers to prepare for future challenges. We summarize 3 different applications of an ecosystem services framework and valuation approach that considers natural capital supply along with grey infrastructure for coastal climate adaptation strategies in Texas, Alabama, and Belize. Integrated cost-benefit methods enabled analysis of complex relationships between 'green and grey infrastructure' adaptation activities, as well as tradeoffs among priorities for development, ecosystem services, and climate adaptation. The relative cost effectiveness of alternative strategies varied with local topography/bathymetry, extent of habitats, location of properties or communities, and tradeoffs or synergies with changes in other services such as tourism and fisheries. Addressing variation in the distribution of costs and benefits across an area helps decision makers identify who and what bear the risk of climate change effects or the benefits of corresponding adaptation measures.

## **Exploring Social Impacts in Diverse Communities in a Catch Share System**

Suzanne M. Russell, Albert Arias-Arthur, Anna Varney, Kim Sparks

The West Coast Groundfish Fishery transitioned to a catch shares management system in January 2011. The Pacific Coast Groundfish Fishery Social Study is a multi-year study. The goals of the study are to identify social impacts to participants and communities as a result of the catch shares system.

Baseline data was collected in 2010. One year post implementation, in 2012, additional data was collected. Survey and interview data was collected primarily in-person. Extensive data analysis includes sorting by trawl participants only and sorting by processor participants only. This paper however, focuses on fishing communities, or where there is insufficient data to protect confidentiality, by fishing regions.

The geographic distribution of this fishery is from the U.S. Canadian border to approximately Morro Bay, CA. Many different communities participate in this fishery. This paper aims to explore any different or similar impacts of the catch shares system on pertinent communities.

## **Can whaling be scientific?**

Robin S. Waples, Mark L. Plummer, and Gardner Brown

The International Court of Justice recently ruled that Japanese whaling in Antarctica was not “for purposes of scientific research,” but allowed that a revised program might meet that standard. However, no one has outlined a rigorous framework for evaluating whether whaling is “scientific.” We suggest this can be done using cost-effectiveness analysis: If the same effort (time, money) spent on existing programs were applied exclusively to non-lethal sampling methods, how would the amount of management-relevant information compare to that produced by lethal take? Although this test is a necessary condition for whaling to be considered “scientific,” it is not sufficient to demonstrate that lethal take of whales is ‘justified,’ as that determination requires considering a host of normative issues. However, at the core of that larger issue is the question we pose above, which is amenable to objective, quantitative analysis.

## **Human Wellbeing Indicators for Puget Sound Recovery**

Kelly Biedenweg, Katharine Wellman

Since its establishment in 2007, the Puget Sound Partnership (PSP or Partnership) has been actively working to more effectively address the human dimensions of ecosystem recovery. As captured in Governor Gregoire's statement, to be recovered, Puget Sound must be "fishable, swimmable, diggable, and drinkable". It has become increasingly accepted that people are direct beneficiaries of a healthy Puget Sound ecosystem while at the same time posing some of the greatest threat to the health of the Sound as we through work, travel, recreation, and everyday life take advantage of all that the region provides. Further, people are both the architects and the implementers of the recovery effort that is needed to protect and restore the ecosystem on which we depend. Understanding, monitoring and effectively addressing the complex, multi-dimensional role that people play in ecosystem recovery will be critical to the success of our efforts. Using a suite of Vital Signs to "take the pulse" of Puget Sound, the Partnership tracks, reports on and guides a regional effort to protect and recover the health of Puget Sound. This memorandum summarizes work conducted over the past three years to expand and improve the suite of Vital Signs by addressing human wellbeing related to the Puget Sound environment.

Mark Plummer was an instrumental figure on a Provisional Indicator Task Group comprised of regional social scientists where he and an intern conducted a comprehensive literature review of all possible human wellbeing indicators and rated each indicator based on a set of criteria designed to be consistent with the parallel process being used to develop biophysical indicators for Puget Sound Recovery. A small subset of these indicators was included as potential indicators of the status of Human Health and Human Quality of Life in the first Action Agenda. This presentation will provide an overview of the conceptual model that includes the human dimension in ecosystem recovery and subsequent research, identification and proposal of a set of human-wellbeing indicators being considered by the Puget Sound Partnership.