An Inventory of California Coastal Economic Sectors

I. Introduction

This memo presents a summary of the economic magnitude of selected economic sectors in California that may benefit from proposed improvements in the Coastal Ocean Observation Systems (COOS). We examine all major coastal economic sectors and provide available data on the economic value of these sectors and the extent of users/participants within each sector. This memo presents aggregated data on the economic magnitude of each sector. For commercial sectors, data on economic magnitude tends to include data on gross revenues or gross costs. Value added data are provided when available (e.g. for commercial fishing). For recreational sectors, values are given as expenditures and as estimates of consumer surplus. For public infrastructure and service sectors (e.g. oil clean-up, beach nourishment, wetlands restoration) values are in terms of gross expenditures.

The memo provides most recent year data (usually year 2001 or 2000) and mean annual data (usually for years 1997-2001). A more detailed presentation of the data, including breakdowns by sub-sector, and geographical subunits, are available in the appendix. The appendix also contains a detailed explanation of the data and sources used.

II. The Sectors

We group the sectors covered into 3 categories: 1) Recreation, 2) Environmental, and 3) Commercial sectors. Within Recreation, we provide data on beach recreation, recreational fishing, and recreational boating. The economic value associated with recreation includes the producer surplus derived from firms that cater to recreationists and the consumer surplus and non-market values enjoyed by recreationists. While the goal of the larger project is to focus on the ways in which an improved coastal ocean observing system impacts consumer surplus values, we provide both expenditure and consumer surplus data when available.

Within the Environmental sector, we include data on beach nourishment, shoreline protection, and wetlands. The value of activities within the Environmental sector largely comes from the impact of these activities on the well-being of constituents living within the areas affected by these activities and projects. Nevertheless, data on consumer surplus values for these sectors is uncommon. Therefore, we provide expenditure and cost data for these sectors as a proxy for the potential value of such activities.

Finally, we provide data on four primarily commercial sectors: fishing, maritime transportation, tourism, and oil. Fishing and maritime data are entirely commercial in nature and the data presented reflect gross revenues and value added. Tourism values include some double counting of expenditure figures presented in studies of beach recreation. To avoid double counting, we present only values for day trips in our beach recreation data while tourism data includes mostly expenditures from overnight trips. Finally, economic values associated with the oil sector address only the

economic value of avoided oil spills that could result from the enhanced COOS (following Kite-Powell and Colgan, 2001).

III. Economic Values

Table 1 provides a summary of the economic data compiled to date. By far, beach recreation and tourism generate the largest economic values of all economic sectors in the California coastal zone. Both the number of visits to beaches and the number of visits to coastal counties number in the hundreds of millions. The massive recreation and tourism potential of California beaches drives the coastal economy. We roughly estimate that expenditures associated with beach recreation may exceed $13 billion annually. In addition, we estimate that consumer surplus values associated with beach recreation in California may exceed $5 billion annually. Similarly, tourism related trip expenditures in coastal counties of California were in excess of $58 billion in 2001. Recreational boating also generates considerable economic value for the coastal economy. We estimate conservatively that boating-related expenditures (excluding fishing related expenditures) exceed $1 billion annually. Recreational fishing also generates substantial economic returns with nearly a quarter billion of expenditures spent on fishing trips and an associated $2 billion being spent on related items (including licenses, rods, reels etc.), however these related expenditures are not likely to be influenced significantly by the proposed improvements in the COOS.

Maritime transportation is the largest of the non-tourism commercial sectors. More than one hundred thousand vessel trips are logged in California each year. To provide a rough estimate of the economic value of maritime transportation in California, we conservatively assume that vessels remain in California waters for only two days per transit. Because the cost of operation varies by ship size and type, we estimated a simple regression model of operating costs in which costs are regressed on vessel draft, whether the vessel is foreign or domestic (domestic), and whether the vessel is a container ship (container). The final regression model used is

$$\text{cost} = 8223 + 7.346(\text{draft})^2 + 0.1467(\text{draft})^2\text{container} + 0.2975(\text{draft})^2\text{domestic} + 12184\text{container} - 6187\,\text{domestic}$$

All coefficients are significant at the 1% level (r-squared = .94, F=351(114)). The linear term "draft" and interactions of "draft" with the indicator variables were dropped due to insignificance. Based on this cost regression model, we estimate the operating costs of all vessels as $6 billion annually.

The remaining sectors generate significantly smaller economic impacts. Beach nourishment activities in California are uncharacteristically small given the level of recreational use along the California coast. While these expenditures may increase in the future, current levels are only on the order of $10 million annually. Shoreline protection measures and wetland restoration represent long term investments in the coast. The net present value of shoreline protection over the next ten years is estimated by King (2001) to exceed $500 million. Projected wetland restoration costs over the next five to tens years are expected to be roughly $240 million. Finally, commercial fishing generates only $100 million annually in ex-vessel revenues and only $189 million in value added processing.

IV. The Impact of COOS on Selected Economic Sectors

It is important to recognize that the absolute economic magnitude of each sector may not reflect the economic value that improvements in the COOS will have on that sector. The impacts of the COOS can be considered both in terms of their absolute economic benefits and their relative benefits (i.e. the percentage change in value). In this sense, a small relative impact on a sector of large economic value would have a large economic impact on the economy overall. Table One provides scores of what we believe might be the relative impact on each sector that could be realized due to improvements in nowcasts and forecasts for wave, wind, current, and water level. Each sector is given zero, one, or two asterisks indicating no impact, some impact, or significant impact of the COOS on the sector.

Several sectors stand out as being areas in which improvements in COOS could have a significant relative impact on the performance. Improvements in wave and wind nowcasts/forecasts are likely to significantly impact both recreational and commercial fishing, recreational boating, and to a lesser degree maritime shipping. Recreational fishing, boating, and commercial fishing in California tend to take place in large part on vessels that are considerably smaller than maritime commercial vessels. To date, two research programs demonstrate the negative impacts of wind and wave conditions on commercial purse seine and urchin fishermen behavior (Pendleton 2002 and Wilen et al. (2002), Smith (2002) and Smith and Wilen (2002)). We assume that recreational fishermen and boaters would be even more adversely impacted by weather conditions.

In addition, fishing (both commercial and recreational fishing) and fisheries management would benefit from data on currents that could help predict the location of fish. During the 1998 El Niño event, market squid harvests fell dramatically in Southern California leading to a weekend closure on squid fishing. Within one year, however, the squid harvest returned to pre El Niño levels, indicating that shifting currents were largely responsible for changes in harvest. During the same year El Niño year, recreational fishermen in California reported substantial catches of dorado (a.k.a. mahi mahi or dolphin fish) as far north as Los Angeles, well beyond the normal range of dorado.

Beach recreation is likely to be impacted significantly by current forecasts and to a lesser degree by wind and wave forecasts. If the COOS can be improved to better predict near shore currents, then beach closures due to sewer spill and storm water run-off could be more accurately targeted - resulting in fewer unnecessary closures. Preliminary results from the Southern California beach valuation project indicate that the impact of closing Bolsa Chica State beach for one day would result in a loss of $7.3 million.

A sub-sector of beach recreation, surfing, already uses nowcasts and sophisticated models to forecast surf conditions throughout California (and the rest of the world). Nowcasts are usually made available to the public at no cost on such websites as www.surfline.com, www.wetsand.com, surflink.com, stormsurf.com, and surfpulse.com. Forecasts of surf conditions, however, are made available only as a premium pay-service. The models used for forecasting include off-the-shelf models developed by

NOAA and SCRIPPS as well as private swell prediction and tracking models. To our knowledge, the "surf forecasting" web industry represents the only industry that depends entirely on COOS and open ocean observing systems.

Unlike other long-term coastal environmental infrastructure projects (e.g. shoreline armoring and wetland restoration) beach nourishment projects could benefit from better forecasting of wind, wave, and water level conditions. Numerous instances can be documented of poorly timed beach nourishment activities in which substantial portions of sand was eroded within days or weeks of mechanical deposition. Better timing of beach nourishment could result in substantial savings and increase the longevity of beach nourishment efforts.

Oil prevention efforts could be significantly improved through improvements in nowcasts and forecasts, especially of currents that determine the distribution of oil slicks and wave/wind forecasts that determine the degree of natural dispersion of spills. Already, the California Department of Fish and Game uses models to predict oil spill movement.

Tourism in California is unlikely to be affected by improved nowcasts/forecasts since tourism decisions usually are made well in advance of reasonable forecasting periods. Further, tourists tend to be less flexible in their plans than day visitors and tourists have more land-based alternatives than beach recreationists.

IV. Candidates for Inclusion in the COOS Study

We base our selection of proposed candidates for study on two criteria: 1) potential economic impact and 2) availability of data. In addition, we place more weight on sectors that generate significant consumer surplus values as this is an area of importance for the overall project. With this in mind, we suggest more detailed study on beach recreation (with a module on surfing), recreational fishing, oil spill prevention, and beach nourishment. Not only do all of these sectors generate significant consumer surplus values, but research already is underway to address the consumer surplus values of these sectors. Further, all of these sectors are likely to be directly and significantly impacted by improvements in the COOS.

In addition maritime transportation could be added easily since the methodology is already well developed by Kite-Powell and Colgan and because data to estimate these values is easily obtained.

Table 1: Summary of Economic Inventory for California Coastal Economy

Sector	Users	Economic Value		Impact of COOS			
			most recent year	wave	wind	current	level
Recreation							
beach recreation	378.5 million day visits	expenditures	$13 billion (2001)	*	*	**	
		Consumer Surplus	$5.341 billion				
recreational fishing	1,843,253 anglers (1.513 m, 1997-2001)	direct trip expenditures	$240 million (2000)	**	**	*	
	6,259,785 trips (5.279m, 1997-2001)	related expenditures	$2.2 billion (2000)				
		CS estimates	$65.3 million				
recreational boating	536,933 registered boats (521,981 (1997-2001)	total expenditures	$ 1.3 billion (2001)	**	**	**	
Environmental							
beach nourishment		federal appropriations	$8 million (2001)	**			**
		state funding	$10 million (FY 2000-2001)				
shoreline protection		planned project costs	$122 million (2000)				
		estimated net benefits (NPV over ten years)	$502 million (2000)				
wetlands		projected spending	$242.6 million				
Commercial							
fishing		ex-vessel value	$104 million (2001)	**	**	**	
		value added from seafood production	$189 million (2000)				
maritime transportation	1454 deep draft vessels (2000)	estimated operating costs in CA waters (assuming 2 days)	$6 billion	**	*	*	
	125,725 outbound trips (2001)						

Table 1: Summary of Economic Inventory for California Coastal Economy (continued)

Sector	Users	Economic Value	most recent year	Impact of COOS wave	wind	current	level
	126,413 inbound trips (2001)						
tourism	193 million domestic visitors (2001)	travel expenditures	$57.9 billion (2001)				
oil	128 million short tons	savings from reduced oil spills		**	**	**	
	7601 trips	(following K-P and Colgan 2000)	$371,216				
	1.5 billion barrels						

Table 2: Estimating the Average Operating Costs of Commercial Vessels in California.

Type	Container (1 if container, 0 if not)	Domestic (1 if Domestic, 0 if Foreign)	Avg Draft Feet for U.S. Deep Draft Vessels	Avg Draft Feet for U.S. Deep Draft Vessels Squared	Estimated Daily Operating Cost at Sea	Annual Vessel Trips	Avg Coastal Days at Sea per Vessel Trip	Total Annual Cost (in 000s)
Self-Propelled								
Dry Cargo	0	1	27.8	773.77	$26,207	33411.2	2	$1,751,189
Dry Cargo	0	0	27.8	773.77	$13,908	6511.3	2	$181,119
Container	1	1	37	1369	$31,068	18873.5	2	$1,172,716
Container	1	0	37	1369	$18,682	3678.1	2	$137,429
Passenger	0	1	20.0	400.0	$23,406	2040.4	2	$95,514
Passenger	0	0	20.0	400.0	$11,162	397.6	2	$8,877
Tanker	0	1	39	1521	$31,806	1314	2	$83,585
Tanker	0	0	39	1521	$19,398	1673	2	$64,904
Tow or Tug	0	1	17	289	$22,574	48254	2	$2,178,590
Tow or Tug	0	0	17	289	$10,347	278	2	$5,753
Non-Self Propelled								
Dry Cargo	0	1	18	324	$22,836	5507	2	$251,521
Dry Cargo	0	0	18	324	$10,604	123	2	$2,609
Tanker	0	1	21	441	$23,713	4310	2	$204,407
Tanker	0	0	21	441	$11,463	42	2	$963
								$6,139,176