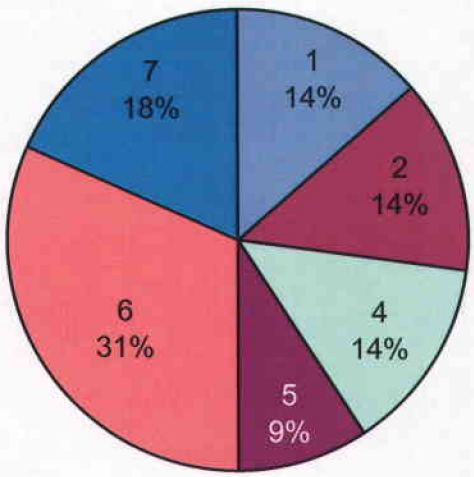

Figure 7: Percent of Commercial Fishermen Interviewed Targeting Different Numbers of Fisheries

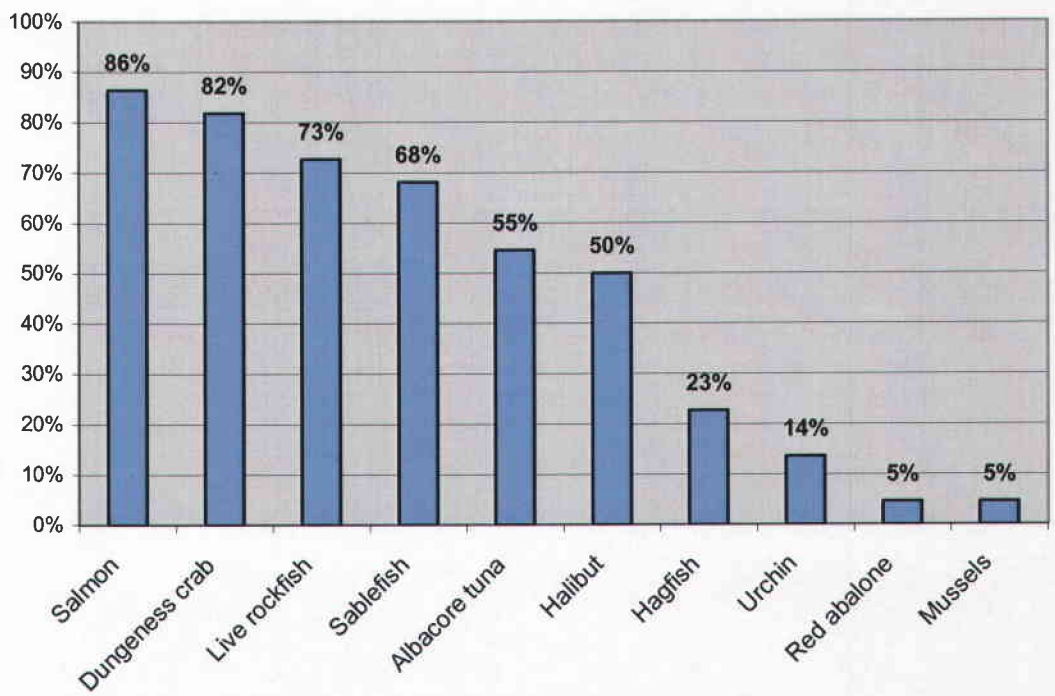

Figure 8: Percent of Commercial Fishermen Interviewed Targeting Specific Fisheries

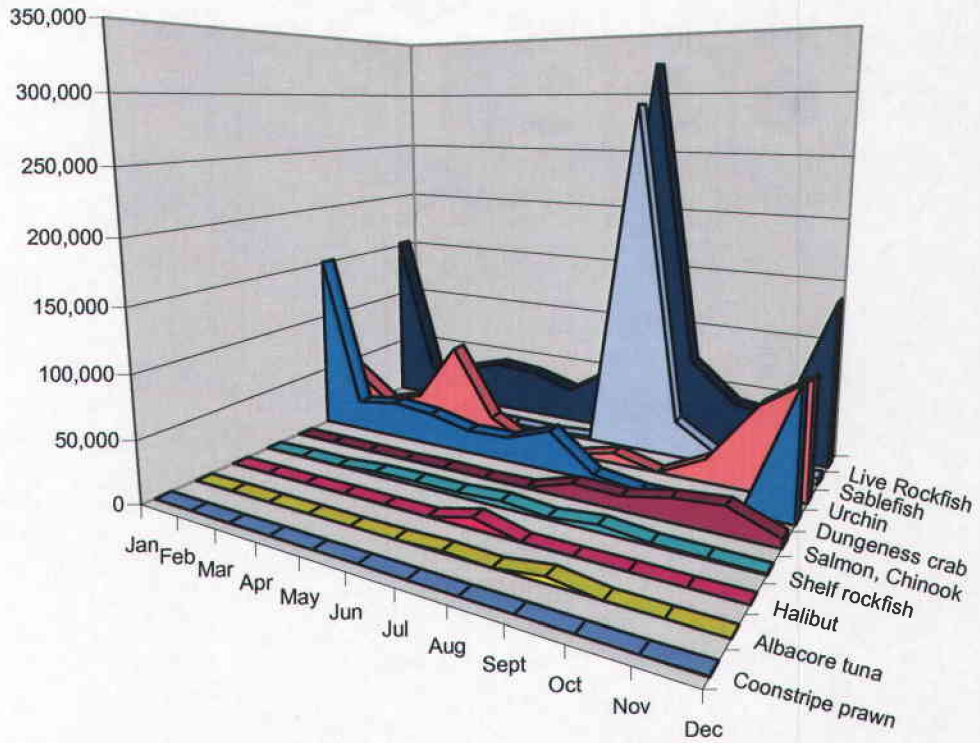

Figure 9: Monthly Landings (Pounds Round) of Commercial Fish and Shellfish at Port Orford, 2000

Groundfish are a diverse complex of over eighty species divided into two market categories, live and fresh (dead), which are targeted in different areas although some of the target species are the same. The groundfish fishery encompasses rockfish species, flatfish species, and roundfish species, like black cod. Black cod was the only groundfish species that POORT selected for aggregation by Ecotrust because it is an economically important and distinct fishery, separate from both the newer live rockfish fishery and the shelf rockfish fishery of the recent past. Outlined below is a more detailed analogy of the major fisheries of Port Orford, focusing on those that were highlighted through the development of community inventory maps.

Groundfish. Fishing businesses have had to adapt to increasingly restrictive conservation measures associated with the recovery of shelf groundfish fisheries. In Port Orford, the typical adaptation is to change target fisheries. However, few fisheries left can sustain increased fishing effort. At the same time that the shelf groundfish fishery declined, a nearshore live fish fishery was emerging in Port Orford. However, this was not a one-for-one exchange; the same vessels did not necessarily move from one fishery to the other. The short period of time over which regulatory change was imposed on the community is an important aspect to keep in mind. Short time horizons magnify the difficulty of transitions in the fishing industry. Many local fishermen lost a significant portion of their income, as much as 90 percent in one year as reported by one interviewee (899).

Port Orford has a long-established dependency on the groundfish fishery, with local longline vessels primarily targeting lingcod, canary, yelloweye and yellowtail rockfish. Before the harvest restrictions, the canary and yelloweye deep-water shelf groundfish were a valuable fishery for this small-scale fleet, as abundant fishing grounds are accessible due to the short continental shelf. Quota reductions placed on the fishery were coast-wide and encompassed all gear types, effectively shutting down Port Orford's longline groundfish fishery. This was a major change in the fishing portfolios of Port Orford fishermen. Deep-water shelf rockfishes would have been among the top five target fisheries (73 percent of interviewees). Due to the PFMC quota reduction throughout the 1990s, it is no longer economically viable for Port Orford fishermen to target these species (Interviews 649 and 737).

When a fishery closes, the traditional response by Port Orford fishermen is to shift effort to a new fishery. Although some fishermen did shift some of their effort to the nearshore live fish fishery, these fishermen were primarily from the displaced small boat urchin fleet. In the 1980s and 1990s, Port Orford had a booming local urchin

fishery that supplied product to the local processing plant, Pacific Premium Seafood. The plant closed in 2003 due in part to overfishing in the red urchin fishery in the late 1990s. The urchin fishermen found increased economic opportunity with high-value live fish and knew the grounds well from their experience navigating the Orford and Blanco Reefs diving for urchins. In contrast, the groundfish longline fishermen were reluctant to move into the live fish fishery, recognizing their added pressure could overfish the slow growing, late maturing rockfish. "We stayed out of it, that was those guys only fishery and we had crab, black cod and some salmon fishing" (Interview 207). The live fish fishery did not replace the income lost to longline fishing businesses from the lack of opportunity to fish the shelf groundfish.

The market value of fish landed at Port Orford is very high because of the live fish fishery value. The live fish fishery has been around since 1997 (Interview 138). Because of increased mortality when fishing in depths greater than 27 fathoms, Port Orford fishermen target nearshore groundfish species (such as china rockfish, black rockfish, blue rockfish, and vermillion rockfish) in the live fish fishery (Interview 193). Live fish prices range from $7 per pound for grass rockfish to $4.50 for kelp greenling. Between 2000-2004, the average value per ton of commercial catch landed in Port Orford was $3,443, compared to the average value of $741 for the rest of the Oregon ports (International 2004). Also, by getting such a high price for the fish, the live fish fishery is a high value and economically efficient use of the public resource. It is also a more sustainable fishery because the hook and line gear has minimal impacts to habitat and the ecosystem.

Black Cod. The black cod fishery is very important to the economy and the fleet because good fishing grounds are nearby due to the relatively short continental shelf off the coast of Port Orford. The community inventory map (Appendix H1) represents the primary locations fishermen target for black cod. These areas include the slope off the High Spot between 300-500 fathoms and along the north and south sides of the

Canyon. The large area extending from the edge of the High Spot west to the continental slope is intended to represent areas accessible to trap gear, although not to the more common longline gear. However, it is unlikely that this entire area is accessible by traps given that the deepest depth covered is beyond the continental slope, an area not accessible to either gear type.

In the validation workshop, three changes were proposed and accepted the map on the spatial distribution of the areas targeted for black cod. One small area off of the Port of Bandon was determined to be a misrepresentation and will be removed from the final map. Another necessary change was an artifact of utilizing the standard polygon for the High Spot when people did not draw their own polygon. The standard polygon encompassed the plateau of this ridge, whereas black cod fishing is focused along the slope coming off the ridge. The main suggestion for improvement was making high (7) intensity use continuous from 100 to 300 fathoms on the edge of the High Spot and decreasing the intensity of use to medium (3) intensity on the top. These same suggestions will be incorporated for the improvements for the draft map (Appendix H2) showing relative economic importance of black cod.

Presently the black cod season runs from April through October. Fishermen coordinate their landings with the market to maximize their catch and value. The black cod fishery is mainly a bottom longline fishery in Port Orford, although there is some pot fishing in the deeper waters. The longline gear used here is called "tub gear" because long fishing lines with baited leaders are wound up into metal tubs. The predominant setup is 160 hooks per tub (600 foot line) with about 10-20 tub sets. The fishermen make 2-3 sets each trip. There is some variation in the gear set up due to the preference and experience of individual fishermen and their target areas.

Port Orford has long a history of participation in the black cod fishery. Local boats fished black cod and helped develop the West Coast market in the 1970's. During the

Groundfish Limited Entry Program, which began in 1993, about a dozen permits were issued to Port Orford vessels. West Coast permits have been sold and have moved significantly among ports. At Port Orford there are presently eight Limited Entry Groundfish Permits with black cod endorsements and two permits that do not have the black cod endorsement.

The black cod fishery has gone through several changes in the last ten years, many of which are perceived to have marginalized this small vessel, fixed gear fleet. The limited entry program changed the level of historic participation by Port Orford boats in the black cod fishery and restricted their effort. The management scheme developed by the Pacific Fishery Management Council allowed some limited entry vessels to receive a black cod endorsement and also allocated boats into a three-tier system of landings. The Port Orford fishing community perceives this management arrangement as patently unfair and driven by a small, select set of fishermen who benefited greatly by designing a system that put them in the top landing tier (Leesa Cobb, pers. comm., 2004).

Salmon. The community inventory map (Appendix H3) displays the primary areas for targeting salmon. Oceanographic and climatic conditions, as well as the movement of forage species, determine good fishing areas for salmon. All of the Port Orford fishermen target salmon with hook and line gear, specifically troll gear. The Port fishermen have specific routes, or tacks, along which they target salmon. The Do-Da Hole is "everybody's tack" and a faithful spot to find some salmon (Interview 533). The "North Beach salmon area," a high-intensity use area nearshore between Port Orford and Cape Blanco, is captured in the inventory map created from the local knowledge interviews. This area is very important to Port Orford salmon fishermen because for about three months of the year it is the only area on the Oregon coast that is open to salmon fishing. "North Beach is the only place on the West Coast to fish fresh troll-caught salmon for the three month season – North of Blanco is closed and

south of Humbug is closed" (Interview 501). One interviewee discussed a local fisheries conflict that occurs when crab pots are left in this area during salmon season. This area is important to the salmon fishermen from Port Orford due to its proximity and accessibility of the Port Orford fleet and could provide a unique marketing opportunity.

The interview participants proposed three minor changes to the community inventory maps for salmon. The first was an extension of the area targeted to both the north and south, keeping the intensity of use the same as the area contiguous to the extension. This was an artifact of the limited spatial extent of the original basemaps. The community inventory maps display a larger area. Another change was to reduce the intensity of use south of Cape Blanco and north of the mineshaft because this area is difficult to fish with troll gear due to the density of kelp and shallow rocks here. The intensity will be changed to medium (3) and then to low (2) as you approach the cape from the south. The participants disagreed on one proposed change, with one fisherman wanting to increase the intensity of use to the highest level (7) directly west of the port and south of Orford Reef, while another fisherman thought that the map was accurate in its original form. At the beginning of the workshop the participants were instructed that if consensus could not be reached the maps would remain in their original form, as was the case for this suggestion.

Although salmon fishing has decreased in its economic opportunity, salmon are still an important part of fishing opportunities in Port Orford. Port Orford vessels are typical salmon trollers and the fleet used to be dominated by an unofficial cooperative of about 18 vessels (Interview 533). These fishermen regularly communicated about where, what type, how many and how deep the salmon were hitting through a radio code, which was only shared among those in the co-op. Most Port Orford fishermen still choose to target Pacific salmon, but many do so more for the fun of it rather than for the price, which is often low.

Dungeness Crab. Dungeness crab is also a very important fishery to Port Orford, although it offers significant challenges for local fishing businesses because of the large amount of instability in this fishery. Crab move inshore seasonally and after a few weeks most of them have been caught. Crab season starts the beginning of December and lasts until May, although most all the crabs are landed during the first few weeks. Port Orford is not considered a significantly robust area for crab. Fishermen describe the history of crab fishing as being a less than average area for production compared to other Oregon coast areas. The issues of soft-shell crab, and more recently increased domoic acid levels in crab, have contributed to poor marketing conditions in some years. Both soft-shell and domoic acid are conditions that occur regionally.

Local perception is that the limited entry program allowed many new vessels into the fishery. The limited entry system for the ocean Dungeness crab fishery went into effect in 1995 and the number of permits issued for that season was 444. Of those 444, the number of active vessels in the fishery was 346. There are 28 crab permits for Port Orford boats.

Each year fishermen and processors fight to set a price and season opening date. It is common for Oregon crabbers to strike for a higher price beginning in December and not fish until after the first of the year. This situation may change because a new arbitration system allows the Oregon Department of Agriculture to bring processors and fishermen's marketing associations together to negotiate the price. Responding to the need for participation in the pre-season negotiations, local fishermen formed the Port Orford Seafood Marketing Association in 2004.

Consider the case of the beginning of the 2003 crab season. Negotiations with the Oregon Department of Agriculture occurred before the season to set the opening price

for the season. It was informally agreed that the price would be $1.55 per pound for the first two weeks. This was a huge improvement over previous years when the price was very low. Federal management allows fishermen to "soak their gear" as early as two days before the start of the season. This means that they can go out and set their crab pots on November 29th, then leave them in the water until the first of December, the first day they are allowed to pull the gear and land the crabs at the dock. Just as the season started in 2003, rough weather blew in, making it a dangerous scenario for those crab fishermen who wanted to go pull their gear. However, if they hesitated to get their gear, they risked product loss through predation by octopus or damage from other crabs. The extreme winter weather at Cape Blanco also contributes to the problems of crabbing. While smaller vessels must stay on the dock to wait out winter storms, large vessels move in from other areas and harvest the local crab and land them at other ports.

The problem of outside, large vessels moving into Port Orford's historic crabbing grounds after exploiting their local areas around Charleston and Brookings is increasing with each passing year (Leesa Cobb, pers. comm. 2004). In 2004, the number of outside boats exceeded Port Orford vessels with many of the outside boats more than 60 feet long and with capacities of more than 80,000 pounds. In contrast, Port Orford vessels can hold around 9,000 pounds of crab. To make the situation worse, the buyers put the Port Orford vessels on a 1,500-pound landing limit (reportedly because of quality issues with damoic acid), whereas vessels from other ports were not limited. Many fishermen theorized that the main issue was transportation. The primary crab buyer did not have product totes and had limited trucking services to get the product to the processing facilities in Charleston.

The spatial extent of effort for crabbing is determined by the movement of crabs in and offshore with the season and by competition with larger vessels that move in from other ports. For Dungeness crab, three areas of highest intensity are evident in

the draft community inventory map (Appendix H4). These areas correspond to sandier habitat. Accessibility to these grounds is the primary reason for their higher level of use. However, north of Cape Blanco weather can limit use of this area, because traveling above the cape can be difficult for these small vessels. One change suggested and accepted was to increase the intensity of use to the highest (7) level in the North Beach area. The other suggestion was to extend the low (1) priority use south to the state line from 90 fathoms in to shore. Again, this change is most likely an artifact of the limited spatial extent of the original basemaps used during the local knowledge interview process.

Halibut. The community workshop did not suggest any changes be made to this draft map (Appendix H5). The halibut target area is primarily a large off-shore bank known locally as "The High Spot". This heavily utilized area is determined mainly by fisheries management, which sets a halibut opener (reduced from 72 to 10 hours in recent years). Although fishermen know halibut are located in other areas, when there is only 10 hours to fish, they go to the "money spot."

Port Orford Involvement in Recreational Activities

Pressure on the Port to maximize financial returns involves difficult social and economic tradeoffs. In many of these decisions, the port will have to balance recreational and commercial fishing interests. Several non-water-dependent business ventures are already beginning to compete for the scarce infrastructure on the dock. For example, in a 2003 port planning board meeting, potential investors presented their proposal to place a seaweed spa in the location of the only processing infrastructure on the dock, the old PPS building. RV traffic that flows up and down Highway 101 often finds its way onto the dock area. Although this quaint fishing community intrigues these travelers, the vehicle traffic can often be frustrating and dangerous for commercial fishermen who must pull their boats around on trailers and into parking spots in limited area. Traffic is also a problem in the harbor as

commercial and recreational vessels wait in line to use the hoists. Decisions made by the port authority today have socioeconomic impacts that will greatly influence the characteristics of the Port Orford fleet of tomorrow.

"Recreationalists" in this report refer to people who regularly participate in recreational activities in the ocean or coastal areas. Beachcombing, wave surfing, wind surfing, diving, kayaking, and wildlife (whale, seal, sea lion, and birds) watching are the common non-consumptive recreational activities that occur in Port Orford. Recreational fishing and surf fishing are the primary consumptive recreational activities occurring in the study area. Although some sport fishing does occur near Port Orford, it is less prominent here for a variety of reasons. There are few large rivers nearby, although the Elk and Sixes Rivers attract many anglers looking to catch salmon in the fall and winter. Few recreational vessels have proper equipment installed on their boats to be hoisted from the dock into the ocean and back. The dangerous weather conditions and few safe anchorages keep some recreational fishing interests from this area. However, one advantage to sport fishermen launching from Port Orford is that there is no dangerous bar to cross. Entry to the open ocean is a marketing point for attracting sport fishers and other recreationalists.

At the community validation workshop, four changes were proposed and accepted for the recreational activities inventory map (Appendix H6). All of the edits involve increasing the intensity of use in various areas. Inside ten fathoms from Hubbard's Creek south beyond Humbug Mountain the intensity will be increased two levels. This creates a gradient of very high (6) intensity in the Port Orford harbor to medium-low (3) along the shoreline. The area adjacent to the west of this, from the Port Orford Heads south to Island Rock into the ten fathom bathymetric contour will be increased one level to low (2) intensity. The North Beach, from the Heads west of Klootney Rocks out to about five fathoms, will be increased to low (2) intensity. The High

Spot will also be increased to medium-high (5), due to high intensity of recreational fishing that occurs there. The large comma-shaped area is Orford Reef, this is a factor of the standardized polygon that was used to input into the GIS database. This was not considered a misrepresentation by the individual interview participants or to those present at the community validation workshop.

Conducting local knowledge interviews in a community-driven setting provided information that answered some of the spatially explicit scientific questions developed by POORT. This process was used to determine the 1) distribution of species near Port Orford, 2) distribution of recreational and commercial effort, and 3) the relative economic value of areas targeted for commercial fishing. The key to success was the triangulation of the most accurate locations. Since every individual will have a slightly different representation, aggregating the individual GIS layers for a particular species or activity was used to determine where the most overlap of observations occurred.

The information collected is useful for the development of a complete baseline community inventory of the distribution of species and uses in the marine area. Because there is such a plethora of species information, the POORT will have to prioritize data for subsequent aggregation and spatial analysis based on immediate need and financial resources. Although only six themes were chosen to test the community mapping protocol, many other themes are possible. The local knowledge inventory documented over sixty other species and human uses, including kelp, invertebrates, birds, marine mammals, fishes, and safe anchorages. Of particular interest to fishery managers will be distribution of groundfish target areas. Groundfish distributions will require additional categorization because the location and relative value of the areas are different depending on the different target complexes (e.g., live rockfishes, lingcod, and shelf rockfishes). The community mapping project also

provided some of the baseline information needed to answer other questions for future research projects.

Future Analyses

All uses of GIS are subject to uncertainty and therefore, all decisions based on GIS are too. Error focuses on the differences between measurements or observations and has an intimate relationship to the scale of data collection and analysis. The utility of public participation GIS analyses for contributing to science or informing management depends on how much uncertainty or error can be tolerated before the information is considered unusable. The acceptable degree of uncertainty and the appropriate scale of data are application-specific. They both also depend on what activity or species are being addressed and the context and goals of the analysis.

Longley et al. (2001) states that in many cases there are no natural units of geographic analysis. However, when comparing the commercial fishing maps and the recreational activities map, it is apparent that the recreational observations occur over a smaller area or extent. Even the 1:24,000 scale maps were too coarse a resolution for the small-scale recreational activities that take place within the Port Orford harbor and along the coast. In the future analyses, the recreational activities and live fish fishing effort maps would benefit from finer resolution map of the nearshore area including the rocky reefs. The interviewers often had even more detailed knowledge of certain areas, using descriptors such as "inside of Island Rock" or "outside of Fox Rock." Unless the interviewee made this detailed knowledge explicit by drawing the area on the basemap, the standard polygon for Island Rock was joined to the attribute data. In this case, the details are only recorded in the attribute description of the area.

Groundtruthing the location and intensity of commercial and recreational uses will require extensive visual or electronic surveys. Verifying the accuracy of these data could be accomplished through a comprehensive Vessel Monitoring System (VMS),

which track the location of a vessel using satellite arrays and receivers called the Global Positioning System (GPS). Coast Guard surveys could also accomplish the same purpose, by taking a visual sample of the commercial fishing vessels in a specified location. However, the Coast Guard would have to be able to determine that the vessels were from the Port Orford fleet. Groundtruthing the location of commercial vessels could also be accomplished through comprehensive observer coverage. Recreational activities in the harbor could also be verified through a systematic visual survey performed by a researcher. ROV surveys, tagging research, and genetic sampling could contribute to the verification of the species distributions provided during the local knowledge interviews. Groundtruthing the data though actual visual surveys or by electronic means would increase the scientific-credibility of the maps for use in fisheries management.

Comparing the economic importance data layers with spatial representations of recorded fish landings or surveys or could verify the accuracy of the level of fishing effort occurring in the area, if the scale of information was comparable. This might be possible through an extension of the Groundfish Fleet Restructuring Information and Analysis Project spearheaded by Ecotrust and the Pacific Marine Conservation Council. The GFR project used 10 minute by 10 minute (latitude-longitude) cell blocks as the spatial scale for deconstructing the most likely locations of commercial fishing activity as reported through landings data collected at the time of sale (Scholz 2003). Voluntary or mandatory logbooks with finer-scale catch blocks would also provide a record of the economic importance of target areas in a spatial format.

Future analysis of the local biological inventory information collected could include studies of species diversity. By aggregating the species distribution layers, species diversity could be analyzed. These analyses could address the overall number of species or of fish species specifically. However, the propagation of error through this process could be detrimental to the utility of spatial information. Because each

individual's species distribution layer has a certain degree of error associated with it, the error is propagated through the analysis when the individual layers are aggregated. The error associated with "standard polygons" for local places could be reinforced through the aggregation process. Scientific surveys of the locations in question could inform the precision of the spatial representations of standardized areas like "the Banana." However, it is possible that the areas determined to have the highest intensity of overlap among the interviews indicates the most precise location of use because of the replication of that observation by interview participants.

Habitat correlations to species distribution or diversity could be examined by overlaying the geologic substrate data layer with the species distributions from the local knowledge interviews. The geologic substrate layer provided by Dr. Chris Goldfinger's Seafloor Mapping Lab at Oregon State University is an interpolation of a variety of different sources including side scan sonar, multibeam sonar, ROV transects, and geologic sampling points. The "effective scale" of the interpolated product is approximately a 100 meter by 100 meter grid. An analysis to correlate species or diversity to habitat types will also have to deal with the propagation of error from the diverse data sources and the different scales of the GIS layers. Propagation of error is not unique to local knowledge sources.

Other interview processes could have also been successful. New developments like the graphical user interface in the GIS program, OceanMap, developed by Scholz et al. (2004) could reduce the time and fiscal resources needed to transcribe interview data. In OceanMap, the interviewees can digitize their use areas at the computer and document attributes by making selections from drop-down boxes linked to the GIS database. The level of comfort level of the interview participants with this kind of technology should be evaluated before pursuing this option.

Communicating community concerns to managers with systematically collected data is important for a community organization to be considered a legitimate partner in management functions. Groundtruthing would provide scientific verification and increase the legitimacy of this local knowledge and participatory GIS process to provide useful socioeconomic and biological information. New tools, like OceanMap, provide opportunities to refine the process used and improve the efficiency of data collection and database creation. Community groups will be more willing to allocate resources to this kind of research when it is confirmed that fishery managers will value local knowledge when mapped in this way.

Implications for Community-based Management in Port Orford

Port Orford, led by the Port Orford Ocean Resource Team (POORT) is in the beginning stages of evolving a fisheries co-management strategy for the area. The Port Orford Community Mapping Project contributed to several co-management functions described by Pinkerton (1989), including data gathering and analysis and community development planning. It also empowered the community to increase their participation in the identification and evaluation of management strategies. This experience could position the POORT to participate in other co-management functions that positively contribute to attaining the POORT's goals and objectives.

The interview and mapping process was a consensus-building and mutual learning exercise, which resulted in the development of a common geographical representation of a shared marine environment and an improved understanding of the dynamics of the Port Orford fishing community. Topics discussed in the Port Orford Community Mapping Project shed light on potential market opportunities, rockfish spawning cycles, habitat-species associations, perceptions on and potential locations of marine

parks, and the ecological changes and perceived drivers of these changes in the local area.

Assisting in the design and implementation of the mapping project helped participants develop a foundation of cooperation within the fishing community. Participants in such processes see opportunities to achieve individual goals through collective action, and also become empowered to do so. Identifying and describing the local ocean places of importance to the Port Orford community promotes the collective stewardship of that area. In this respect, the participatory GIS project can bridge the competitive nature of fishing with collaborative learning approaches in community-based management. To address locally relevant scientific and management questions, Port Orford is building social capacity, generating fine-scale data, and beginning to evaluate potential beneficial management and economic strategies such as harvest allocation and regulation, fisheries enhancement, and marketing opportunities. This fishing community is increasing its own capacity to share responsibility and actively participate in fisheries management.

The Port Orford Community Mapping Project makes three significant contributions to community-based fisheries management. This project provided the opportunity to conduct a preliminary profile the Port Orford fishing community, which included developing an understanding of how and where the local residents utilize the coastal and marine environments. It generated information from which to assess local fishing infrastructure planning to maintain marine-dependent industries. Through implementing the project, the author also developed a process and product from which to evaluate area-based resource management measures contribution to local fisheries goals and objectives.

Community and Port Profiling

In-depth knowledge and profiles of ports and their socioeconomic conditions and linkages do not exist for many commercial fishing communities. National Standard 8 of the Sustainable Fisheries Act requires consideration of impacts to fishing dependent communities. However, in order to qualify for consideration, coastal communities will have to meet the definition of a fishing-dependent community as defined by the federal government and their level of "dependency" will have to be measured. A fluid definition of community is problematic for management strategies such as Community Development Quotas (CDQs) and community-based management that require a well-defined community. Federal fisheries management is starting to address this through comprehensive projects to profile the ports and communities (e.g., Hall-Arber et al. 2002). The purpose of these profiles is to provide a concise description of communities and their engagement in or dependence on fishing to fisheries management so that fisheries management might begin to have a minimal understanding of communities and might have something to draw on when policy makers consider who and where might be socially and economically impacted by fishing regulatory changes.

Qualitative information generated from the Port Orford Community Mapping Project is already being integrated into the traditional fisheries management system through a port profiling exercise completed by the author (Appendix A) (K. Norman, Northwest Fisheries Science Center pers comm. Aug. 2004). Although fishing community identification and profiling is at an early stage in the NOAA Fisheries Northwest Region, the first communities to be profiled are those West Coast ports that have significant groundfish fishing activity. This community profile is broken down into three main sections:

- People and Place (location, demographics, history)
- Infrastructure (economy, governance, facilities)
- Involvement in Pacific Fisheries (commercial and sport).

The NOAA Fisheries Northwest Region community profiling project is a two-part study, with "short form" profiles completed in the first phase. In the second phase, a subset of the "short form" communities will have a more in-depth "long form" profile completed based on community research. Surprisingly, the short form community profile template did not include the proportion of the community employed in commercial fishing occupations, although most of the academic research in defining fishing communities includes this measure. Other social and economic linkages were also not explicitly identified in the short form. Local knowledge interviews and time in town provided the author with insights into these demographic and socio-cultural indicators of fishing communities that will be useful in the second phase of this project.

Increased involvement in fisheries management was accomplished through the development of community profile. This profile has increased the visibility of this small-scale fishing community to Pacific fishery managers. The state of Oregon and the Pacific fisheries region need comprehensive information on their fishing communities. However, because state and federal agencies are so limited by staff and resources necessary to conduct profiles, individual fishing communities can use similar processes to develop their own profile for consideration by managers if they have local leadership.

Planning for Fisheries Infrastructure

The DLCD Coastal Management Program could be a resource to help the community seize an opportunity to address future development of the city in a proactive way to meet a variety of needs. Statewide planning goals 19 and 9 offer potential avenues to address the implementation of community-based fisheries management in Oregon. The purpose of Goal 19: Ocean Resources is "to conserve marine resources and ecological functions for the purpose of providing long-term ecological, economic, and

social value and benefits to future generations" (2000). Goal 19 also gives higher priority to the protection of renewable marine resources over non-renewable ocean resources, such as oil and gas development. The 2000 amendments to Goal 19 require state and federal agencies to protect areas important to fisheries including: areas of high catch, areas of highly valued fish, seasonally important areas, areas important to commercial or recreational fishing (including those of a particular port or fleet), and important habitats. The other potentially important goal to community-based fisheries management is Goal 9: Economic Development, which is "to provide adequate opportunities throughout the state for a variety of economic activities vital to the health, welfare, and prosperity of Oregon's citizens" (1973). Goal 9 specifically refers to the planning guidelines and implementation of local comprehensive plans. It states that the plans should emphasize the expansion of and increased productivity from existing industries, like fishing, and allows for land use controls and ordinances for land use.

Special area management plans (SAMPs) may be used in coordination with the statewide planning goals. Communities can develop management plans for marine areas to address the unique management needs for resource protection, resource utilization, and interagency cooperation. In Port Orford, it would be beneficial to focus on the future development of the oceanfront, the port, and related commercial areas along or near Highway 101. The real issue becomes how the local plan and boundary designation get adequate statutory and financial support to be implemented, monitored and evaluated.

Currently, two overarching dynamics are coming together in Port Orford. The first is the prospect of a significant increase in urban or recreational development in the city due to completion of the city's ocean outfall and the lifting of the Mutual Agreement and Order (MAO) with the state DEQ, which has severely limited water and sewer hookups within the city. While much of the development is going to be residential,

commercial development centered on the oceanfront is highly likely. During the period of this MAO, land values in Bandon have skyrocketed due, in large part, to demand stimulated by the Bandon Dunes golf resort. Land values in Port Orford have remained relatively depressed due in part to building restrictions under the MOA. This disparity, coupled with continuing interest in development on the south coast, makes Port Orford properties attractive. New development is likely to be oriented to recreational, tourism and retirement, with an emphasis on the oceanfront, port area, and adjacent Highway 101 "downtown." This likelihood alone should be enough for the city to upgrade its planning, particularly the economic development components, to encourage development that is compatible with community needs. The city's comprehensive plan is more than twenty years old and could use some work to address emerging economic development issues.

The second dynamic is the future of the port area and the sustainability of ocean fisheries that is central to the port and the economic and social well being of the community. At present, a large part of Port Orford's "character" is because it is still a working waterfront and its fleet of small commercial fishing vessels. The community already has a significant investment in this area. Inappropriate development could overwhelm the existing port investments and local fisheries economy which is already vulnerable to a wide range of forces such as market prices, limited processing facilities, distance to markets, regulatory changes in West Coast groundfish fisheries, and insufficient scientific information about fisheries stocks and habitats.

The three main interests in this kind of "special area" planning are the city, the port, and the participants in local fisheries who have strong personal and economic interests in the long-term viability of local fisheries. Much of the fleet has organized through POORT, which is working to create a community-based sustainable fisheries regime to maintain and promote the fisheries based economy as well as the culture and character of Port Orford. Because POORT has members from more than half the

vessels in the local fleet, it is uniquely positioned to participate in this process to ensure that fishermen are represented in this planning process.

These factors create an opportunity to plan for development in Port Orford that will maintain and strengthen the basic identity of the community. A special area plan could address land use and design in the area that the city believes would benefit the most people. Planning of this type will require professional resources beyond the city's current capability. The Oregon Coastal Management Program (OCMP) in the Department of Land Conservation and Development is in a position to provide the city with financial, technical, and coordination assistance.

Evaluating Area-based Fisheries Management Strategies

The inherently spatial nature of GIS and many communities promotes the consideration of place-based methods for community-based fisheries management. Some of the research questions POORT asked were "Are spatial management strategies appropriate for Port Orford's offshore waters?" and "What kind and where might they be located?" Finding the answers to these questions will require addition deliberation by the community before a final determination can be made. A series of community workshops to fully develop the desired goals and objectives of potential area-based management strategies and to analyze the impacts of possible design alternatives would be required. The participatory GIS maps developed in the community mapping process will likely serve as a foundation for these future discussions. However, the author has taken the first steps to consider the implications of area-based management through the following analysis.

Spatial management strategies can take on many forms and functions depending on the goals and objectives of such areas. The goals and objectives determine the desired restrictions placed on the activities in that area and any associated user rights that are implied through the designation of these places. The POORT developed a goal

statement through a consensus process that occurred during 2001. The POORT's goal is:

> "A sustainable fishery that combines the best science and local experiential knowledge for the community to make local fishery management decisions that:
> 1) Sustain and improve the local habitat and population base of fish;
> 2) Provide high quality, high value seafood products to consumers; and
> 3) Support the economic viability of the Port Orford community."

Another goal identified through the interview process, but not explicitly stated in the goal statement, was Port Orford's reliance on participation in diverse target fisheries. Several quotes from interviews illustrate that this is an important aspect of fishing in Port Orford. Interviewee 758 said that "The key to success in Port Orford is diversification and to keep alternatives open." Another interviewee (620) noted, "Port Orford is a real fishing community. They have diverse fisheries including crab, salmon, tuna, halibut, shelf rockfish, and nearshore rockfish, and are not dependent on a single fishery. This makes them better for the resource. They are not hammering one species all year long." The success of the small-scale Port Orford fishing fleet does depend on a diversity of target fisheries and the flexibility to move from one to another as weather, ocean conditions, regulations, and market conditions change. These goals of sustainable and diverse fisheries, improved local fish habitat and fish populations, and economic sustainability are the starting point for analyzing whether area-based management would be an appropriate management strategy for Port Orford.

The specific management objective for designating a zone is important for measuring the success of the strategies used within that zone. Objectives have to be very specific. For example, the criteria for selecting areas will be different depending on if the objective is to manage areas for the most number of fisheries, or if the area is targeted for a specific fishery. Some members of the Port Orford community thought that area management for some specific fisheries or gear conflicts could contribute to

the community objectives of sustainable fisheries, improved habitat, and economic viability. Groundfish fisheries, fresh and live market categories, and the Dungeness crab fishery were identified during the local knowledge interviews.

Habitat Protection. Several Port Orford fishermen indicated that habitat protection from damaging gears could be addressed through area management. Several groundfish fishermen reported that underwater high spots, or seamounts, have suffered impacts from bottom trawls. Possible areas to analyze would be the sensitive shelf habitats or depths that the fixed-gear groundfish fleet uses to target shelf rockfish. These areas are preferred habitat of schooling canary and yelloweye rockfishes. Many fishermen would like to protect the local habitat so that it is still intact if the harvest restrictions are lifted.

- "I don't think a hook and line fishermen will hurt a reef, but a dragger will" (Interview 501).
- "Roller gear is destroying habitat. They flatten the bottom" (Interview 402).
- "The High Spot is being worn down by roller gear. [It's] destroying valuable habitat" (Interview 899).
- "Do away with longline, cable gear, and dragging in the nearshore, only (have) longlining in deep water for black cod and halibut" (Interview 103).
- Roller gear destroys rocky habitat (and) should stay outside 50 fathoms" (Interview 444).
- "Get the draggers out of the three-mile limit and also off the High Spot and the Canyon" (Interview 031).

Seamounts and submarine ledges are important habitat types that help sustain local populations of fishes. Because the various life stages of fish species have different habitat type requirements, these local habitats are only a portion of the range of the species. An argument can be made that the protection of these rocky areas from damaging gear types would benefit the entire groundfish fishery. This is demonstrated by the PFMC's implementation of a gear-type restriction on roller gear to accomplish

the same objective of protecting rocky reef habitat. However, an area-based management strategy that restricts only one sector of a fishery for the perceived disproportionate benefit to another sector or community is politically difficult to accomplish, even if the rationale is scientifically sound.

Economic sustainability. Another objective of area-based management could be for retaining the economic benefits of a fishery or fisheries to contribute to the economic viability of the Port Orford community. One interviewee expressed his feelings of social inequity between large trawlers and small fixed-gear vessels. "We need to get rid of damaging gears. Trawl only supports one captain and two deckhands, while it would take 5-6 small boats to take the same amount" (Interview 758). Area-based suggestions for increased economic opportunities in the Dungeness crab fishery and the groundfish fishery were discussed during the local knowledge interviews. Several Port Orford fishermen reported that the discards from trawling "spoil" traditional fishing grounds because fish avoid these areas when the bottom has been littered with decaying fish carcasses.

- "Draggers are the ones that are doing damage to the habitat and our livelihood. Processors should have to stay outside 500 fathoms because of fouling the grounds" (Interview 193).
- "Hake dragger boats sour the water through their discards (Interview 501).
- "Large factory trawlers are souring the bottom 150 fathoms and beyond" (Interview 031).

An area-based management strategy targeted to preserving the economic viability of a local Dungeness crab fishery would be designation of an exclusive use area for Port Orford's commercial harvest during part of the season. The intent would be to control the effort shift of large crabbing vessels from other communities into the local fishing area of the Port Orford fleet. Combining this management strategy with additional provisions for adjusting the crab season opening date would address the soft shell and domoic acid problems in the Port Orford region. Both of these suggestions have

economic objectives at the heart of the issue and are demonstrations of territorial user rights in fisheries (TURFs).

In co-management fisheries systems, area management methods can involve some sort of territorial user rights in fisheries. Whereas common property resources are those resources to which access is both free and open, TURFs refer specifically to conditions governing access to, not ownership of, the resources. They are the formal declaration of exclusive use rights to a specific community or group for specific fisheries in a given area (Anonymous 1998). These community-held rights of use delegated to the community from a centralized government include certain responsibilities for maintenance and proper management, but also may include restrictions on community use as well.

An example of a TURF in U.S. fisheries management is the Sitka Sound Local Area Management Plan (LAMP) in Alaska (Gretchen Harrington, Alaska Department of Fish and Game, pers. comm 2004). In February 1998, the Alaska Board of Fisheries (BOF), part of the Alaska Department of Fish and Game (ADF&G), and the North Pacific Fishery Management Council (NPFMC) jointly adopted a protocol for developing LAMPs based on a local effort from the citizens of Sitka, Alaska. The Sitka LAMP was to address the issue of localized depletion of halibut stocks in Sitka Sound and the associated user conflicts from large commercial vessels and increased charter operators in the sound. The adopted plan is based on seasonal closures of waters inland of a defined boundary to commercial longline vessels larger than 35 feet and to charter vessels/guided anglers. At the request of commercial and charter operators, the Sitka LAMP allows chartered anglers and commercial operators to fish for salmon in the waters closed to halibut fishing.

The distinction between TURFs has to do with the size and nature of the territory, the kinds of rights that can be exercised, and the specificity of ownership. A TURF

territory can relate to the surface of the water, the water column, or the bottom. The size depends on the intended usage, the resources, and the oceanographic characteristics. It should be sufficient size so that the use outside of the territory does not significantly diminish the value of the use within. The area should be readily defensible and protected by the laws and institutions of the country. The boundaries of the territory should, therefore, be clearly demarcated and identifiable. This qualification describes TURFs as not so much resource-specific as it is site-specific.

The owner of a TURF can be a private individual, a cooperative, an association or community, a national government, or a multinational agency. The effectiveness of the TURF will be greatest where the specificity of the ownership is the highest (Christy 1982). Assigning a right or obligation to a fishing-dependent community can be problematic if the definition for what constitutes a fishing community is too fluid.

Determining the content of TURF-rights is more complex than determining the same kind of property rights on land because the ocean's resources are public resources, the 'area' is actually a three-dimensional volume, and the resources and medium are more fluid (Christy 1982). If TURFs are to be successful from an economic standpoint, certain rights need to be delegated to the community: the right of exclusion (to limit or control access), the amount and kind of use allowed within the territory, the right to extract benefits from the uses within the area, and the rights to future returns in the area (Christy 1982).

Benefits of TURFs potentially include more economically efficient use of resources and the incentive and opportunity to manage them well. The benefits can include user fees or taxes, or the lease or sale of use rights, or in profits to the owner. These benefits can be returns to labor and capital or non-monetary terms, such as larger and more satisfying employment opportunities. Since the owner is entitled to future benefits, there is increased incentive to ensure the flow of future resources and

promotes local stewardship. An example of how this might work in Port Orford would be an exclusive use right with an adjacency requirement.

However, there are both natural and social conditions that may hinder the acquisition and protection of local exclusive use rights in fisheries. Major challenges with TURFs are that they require a redistribution of wealth and that some of the present users will be excluded. Although this may be economically and socially accepted, it may be politically difficult. There may be competition from large powerful interest groups to maintain the status quo if they are capturing a large portion of the catch from the proposed local territory. TURFs break down if there is no strong legal and institutional protection of the use rights, and few countries have these mechanisms in place. Where the costs for acquiring and defending exclusive use rights are greater than the benefits, common property arrangements will continue to exist.

Non-extractive Use Values. Just as community-based fisheries management provides an opportunity for people to discuss what areas of the ocean are important to sustain fisheries and economic viability of communities, it can provide a forum for the discussion of locations that may be valuable for other reasons, such as scientific research and recreational opportunities. The local knowledge interviews indicated that these are also values held by some local fishermen. One fisherman suggested:

> "Leave some diversified area for scientists to study. [They] need to be accessible to scientists and people to see the results of their labors. Put a line of buoys around it to make it visible for enforcement. [There] should be a program like the "river keepers" where young adults (19-21) are required to work for the government and enforce MPAs" (Interview 193).

"Marine parks" were mentioned during two local knowledge interviews, although it is uncertain if the participants were referring to that same concept of a marine park. One of these interviewees suggested that this area would be for "recreational diving and some sport fishing" (Interview 123). The other interviewee said that this area could

serve as a trade-off if other more commercially important areas were threatened for closure. Both people voluntarily drew the location of this proposed area, and had significant overlap with the other person's map (without ever seeing the other map).

Perhaps one of the most controversial discussions in fisheries management today is the utility of marine reserves to achieve fishery management objectives. Marine reserves are typically closed to all extractive uses. In contrast, other types of marine protected areas usually afford more general protection and may prohibit some forms of extractive uses while allowing others. Both of these strategies are generally associated with ecosystem-based management. Ecosystem-based management includes more diverse goals and represents more diverse interests than traditional fisheries management. However, all fisheries are dependent on a healthy ecosystem.

When considering the design of area-based fishery management strategies, the ecological and socioeconomic impacts of both the physical space of the areas as well as the placement of those areas along the Oregon Coast must be considered. Small-scale fishing communities will have differential socioeconomic costs and benefits depending on the "space and place" of marine managed areas. The "space" of a management area is how large the extent of an area is covered. Different socioeconomic costs and ecological benefits occur depending on the size and what spatial configuration it takes. For example one fisherman said, "Making zones concentrates effort in other areas. These can be expensive for Port Orford fishermen because of trip limits. Also there's the problem of "fishing the line" (Interview 758). The "place" of marine managed areas involves a consideration of where along the coast will the area occur and whether it is inshore or offshore. The included habitats also will have differential impacts due to the correlation of habitat to fishing gear types and therefore, to fishing vessels and communities. The placement of zones also must consider transportation routes and safe anchorages, such as those that were identified in the community mapping process. The permanence of the area is often

one of the most contentious decisions of area-based management. Even though some fishermen support he concept of marine protected areas, most do not support permanent closures. For example one interviewee stated, "(They) should leave some places sit...have moving area and time closures" (Interview 193). Any type of area management measure is highly controversial and would require extensive discussion and analysis, and is therefore not likely to happen soon.

Implementing spatial management of fisheries resources in the United States involves the federal and state fisheries management agencies that have jurisdiction over the marine area. In Oregon, the Oregon Department of Fish and Wildlife has control over fisheries activities in waters within three nautical miles from the shoreline. Nearshore rocky outcroppings bump out the jurisdictional boundary to include in state waters both of the Orford and Blanco rocky reefs and some deeper shelf habitat out to 100 fathoms (Figure 5). The Pacific Fisheries Management Council and NOAA Fisheries have jurisdiction in areas beyond three miles to the exclusive economic zone (EEZ) boundary, 200 miles offshore. The location of a hypothetical local management zone in ocean space would determine which agencies would need to be involved in the planning and management of such a zone.

CONCLUSION AND RECOMMENDATIONS

The Port Orford Community Mapping Project tested a participatory GIS process for using local fisheries knowledge to answer science and management questions developed by the POORT, namely the distribution of species and human activities in the Orford Reef area. Because this interview process did not answer all scientific, market, or management questions, additional data and projects to supplement this project are being prioritized by the POORT. For example, in order to identify whether there are localized populations of fish species, the POORT is currently involved in several cooperative research projects. One project involves the training of POORT members to take biological and genetic samples from four rockfish species in the Port Orford area. These data are being provided to supplement several state and university cooperative research projects. Another project is a juvenile rockfish study. By working more collaboratively with scientists and managers, the community is proactively developing capacity for increased participation in management discussions.

The maps effectively display the "place" of the Port Orford community and position the community to contribute to discussions about implications of area-based management strategies being considered by fishery managers. It was a good survey of the Port Orford fishing and recreational community, representing approximately fifty percent of the vessels and a diversity of recreational interests. To keep the focus on the larger community, the interview protocol also targeted those people, like the local fish buyers, who have general knowledge of the activities and species occurring in the ocean and coastal area, even though they do not make direct observations out on the water. The participatory GIS process helped develop consensus about how the community utilizes the local marine environment. The map products display the composite knowledge of interviewed individuals and moved the scale information from the individual to the community through a spatial analysis from Ecotrust and the subsequent community validation workshop.

A comprehensive community mapping process would require substantial funding, human resources trained in ethnographic methods, technical assistance and capable local leadership. Although baseline information on communities is greatly needed, it is still a lower priority than most biological research, at least for fisheries management. Although the Port Orford Community Mapping Project did identify other communities that utilize the same areas, it was primarily limited to the fishing components of other ports or recreational fishing in general. However, other communities could utilize the process to document knowledge about their local places provided that the community had sufficient local leadership and organizational and fiscal capacity. Applicability to other communities will also depend on the relative homogeneity of the port community and the degree of trust among those conducting the interviews and among the industry participants. The Port Orford inventory maps had few changes suggested to them partially because the fishermen here are all from small vessels and use slight variations of the same gear. If a comprehensive coastal community mapping project was developed by the state or region, communities and managers could better identify the stakeholders who have an interest in local places. With additional spatial analyses like Ecotrust's determination of the relative economic importance of areas for targeting black cod, communities and managers might begin to identify the relative economic impacts of spatial management arrangements. With comprehensive information, all affected communities could then be involved in the evaluation of the design of spatial management arrangements.

One limitation of participatory GIS, especially for a small community-based management organization such as POORT, is technical expertise in GIS and financial resources for computer hardware and software and labor. Access to large format plotters, laminating costs, and rolls of acetate also impose considerable costs. New GIS programs with graphical user interfaces and associated database, such as OceanMap (Scholz et al. 2004) have potential to increase the efficiency with which local knowledge and GIS are

combined to produce spatial data for analysis. The integration of participatory GIS products with other GIS technology like the Oregon Coastal Atlas will improve user accessibility when it is wanted and can restrict information dissemination through password protecting data layers (Haddad et al. 2005). The atlas currently allows users to select GIS data layers to display and print out in pdf format. In future fisheries mapping projects, it would be beneficial for the Oregon Coastal Atlas to have a geospatial layer that displays Loran lines from nautical charts because many of the fishermen still utilize this spatial reference frame. As of this project, the author could find no such layer. A public participation tool that combined the user interface and relational database components of OceanMap with the accessibility and display capabilities of Oregon Coastal Atlas would allow communities greater participation in developing GIS capabilities with less cost.

Community organizations like POORT require sustained funding and technical support to remain a viable partner in cooperative fisheries management. POORT relied on funding from various grants through non-profit organizations, academia, and government agencies during the course of this project. However, currently POORT is struggling to maintain the level of funding it had a few years ago. A more stable source of income is necessary to maintain essential organizational infrastructure.

The Oregon Watershed Enhancement Board (OWEB) model should be explored as one possible alternative. OWEB is a state agency with a policy oversight board that consists of members from state natural resource boards and commissions, private citizens, and non-voting federal representatives. OWEB administers a watershed monitoring and assessment program and grants program "to help create and maintain healthy watersheds and natural habitats that support thriving communities and strong economies" (website address or statute). They assist with the development of locally integrated action plans believing that management techniques and programs for the protection and enhancement of watersheds are most effective and efficient when voluntarily initiated at the local level.

OWEB works cooperatively with volunteer local watershed councils through their grants and enhancement programs to foster locally driven watershed protection projects. Coastal and fishing communities would benefit from a coastal equivalent of the watershed councils and the OWEB management framework.

The federally approved Oregon Coastal Management Program (OCMP) and its Ocean Policy Advisory Council (OPAC) could be another opportunity for state support of community-based management programs. Administered through the Oregon Department of Land Conservation and Development (DLCD), the OCMP uses a combination of state planning and regulatory provisions, state criteria and standards, and state review to manage Oregon's ocean and coastal resources. Any state or federal action in the coastal zone must be consistent with the standards set forth by the OCMP. Through the OCMP, coastal cities and counties have developed local comprehensive plans to address specific coastal and ocean issues at the community scale. However, the local plans have not traditionally addressed commercial fisheries issues, possibly because of the perceived lack of decision space and the focus on city lands. Coastal communities could form local groups, similar to the watershed councils, and propose coastal and nearshore resource protection and management plans for evaluation by OPAC. Federal and state funds could be guided through OPAC to support small projects or project coordination. The strength of a networked coastal management program is that it can be comprehensive and flexible, while promoting local involvement.

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Appendices

Appendix A

Port Orford Community Profile

PORT ORFORD COMMUNITY PROFILE

Victoria Wedell

Sept. 15, 2004

In 2000, Port Orford began exploring how a community-based framework could improve the understanding and management of their local fisheries and recreational uses. Through a non-profit organization called the Port Orford Ocean Resources Team (POORT), science and management questions are being addressed at the scale of a single fishing community. In March 2003, the POORT established a local office (Figure 9: POORT office) on the street down to the dock and harbor. Since then, the office has become a hub for community members and scientists to get information and to find assistance for cooperative research projects.

POORT recognizes the importance of strategic alliances and has partners at national, regional, and state levels, from academia, government, and conservation perspectives. Twenty-six local commercial fishermen and recreationalists have joined the POORT Advisory Board (AB). The AB is guided in part by a Science Advisory Committee, consisting of state, federal, non-governmental and academic scientists. Through early scoping efforts, POORT established its vision:

> "A sustainable fishery on the Port Orford Reef that combines the best science and local experiential knowledge for the community to make local fishery management decisions that:
> 1) Sustain and improve the habitat and population base of fish;
> 2) Provide high quality, high value seafood products to consumers; and
> 3) Support the economic viability of the Port Orford community."

POORT's mission is "To engage Port Orford fishermen and other community members in developing and implementing a strategic plan and framework that ensures the long-term sustainability of the Port Orford fishery ecosystem and the

social system dependent on it." Developing a comprehensive strategic plan is a long-term goal for POORT. Two initial steps have been taken concurrently to facilitate the evolution of a functional community-based management structure in Port Orford: education and empowerment of local stakeholders to contribute to sustainable solutions, and assessment of the biological, economic, and social health of the Orford Reef, shoreline, and uses including fisheries. As a result, fishermen, recreational users, and scientists have come together to plan and execute cooperative research and expand the knowledge base the community has about Port Orford's nearshore resources.

Within the last few years Port Orford fishermen assisted in several cooperative research projects including: NOAA Fisheries survey of sea lion populations, an Oregon State University graduate project on sea urchins ecology, and the NOAA Fisheries Observer Program. In addition to the GIS work, the POORT is participating in several biological projects in 2004: fish biological and genetic sampling, and a project design for a subsequent fish tagging and gear selectivity study. The POORT will also conduct more in-depth economic surveys and spatial analyses and visual ecological surveys using a remotely operated vehicle.

Local Fisheries Context

Established in 1851, Port Orford was one of the first Euroamerican settlements on the Oregon Coast and has depended on natural resource extraction throughout its history. Originally settled by Captain William J. Tichenor with hopes of tapping into the gold mining industry, Port Orford still has some pioneer families who own and execute mineral rights in nearby rivers (Interview 007). The original port facility dates back to 1856, with the port district being formed in 1911. Logging and lumber milling supported the community for many years, reaching a peak during the 1930s, mainly with the logging, processing, and shipping of Port Orford cedar. Shipping of lumber stopped shortly after the jetty was completed in 1968. This was primarily due to poor

market conditions and the decline of local timber supply (Private Public Service Site, 2004a). Currently, the port's only commodity is local seafood. Many current commercial fishermen were also loggers, or come from logging families. Port Orford's maritime history includes about 40 fishing families, with some having third generation fishermen with over 50 years of cumulative knowledge passed down through the generations.

The geographic isolation of Port Orford may contribute to the town's sense of cohesion and community. By both land and by sea, Port Orford is physically isolated relative to other Oregon port communities. Port Orford's 'claim to fame' is being the most westerly-incorporated city in the *contiguous* United States (Private Public Service Site, 2004b). This fishing town is situated within a semi-enclosed ocean embayment, unlike most other Oregon ports, which are located within estuary harbors or along river channels. Large sand bars outside the nearest ports of Bandon to the north and Gold Beach to the south, both about 25 miles away, make water-borne transportation into these ports potentially dangerous to the small fishing vessels of Port Orford, especially during poor weather conditions (Interview 193). The Port Orford Lifeboat Station provided rescue services to the southern Oregon coast from 1934 through 1970 when it was decommissioned (Port Orford Heritage Society. 2003). Currently, the commercial fishermen (and often recreationalists) here must depend on each other when trouble arises out at sea. Port Orford fishermen have often risked their own safety and financial liability for others people's property and personal well-being.

This port is also relatively isolated from other cities and ports by land; located approximately 50 miles south of the nearest large population center of Coos Bay/Charleston/North Bend (combined population of ~26,000) and 70 miles north of the port of Brookings, population 5,447 (2000 Census) and the Oregon-California boarder. It is about a three and a half hour (160-mile) drive between Port Orford and

Eugene, Oregon (population 137,893; 2000 Census), the closest interior city. Port Orford has the basic ammenities: grocery stores, gas stations, restaurants, motels and RV parks, some small businesses and an elementary-middle school. The town is relatively isolated because of its geography and infrastructure and has a unique blend of both traditional independence of fishermen and a true sense of community offered by close personal and professional ties.

Just 10 miles north of Port Orford, Cape Blanco is a prominent oceanographic feature in the California Current system, separating two distinct oceanographic regions of the Northeast Pacific Ocean (Mackas et al. 2002). Therefore, the ocean area in front of Port Orford exhibits some characteristics of both these regions. Generally, eastern boundary currents like the California Current induce strong upwelling conditions in the nearshore area and support diverse and abundant marine life including fishes, invertebrates, marine birds and marine mammals. The continental shelf is quite narrow along this section of the Oregon coast, providing the Port Orford fleet access to both nearshore and shelf fish species that would typically be out of range for smaller sized vessels like those in the Port Orford fleet.

The Orford and Blanco Reefs are marine extensions of the cape's rocky headlands, and together, consist of about seven miles of rocky reef and bull kelp (*Nereocystis*) habitat. Several reef features including Fox Rock of Orford Reef break the surface of the water to form small islands that extend the three-mile limit of state jurisdiction to include most of the nearshore reef area near Port Orford. This extension of the Territorial Sea means the inclusion of some deep-water shelf habitat, extending out to 100 fathoms. Small pocket beaches enclosed north and south by rocky headlands make for a diverse range of nearshore benthic and shoreline habitats. For example, in a shoreline less than 20 miles south of Cape Blanco, you find North Beach, then Port Orford Heads, then Battlerock Beach, then Rocky Point, and finally other small beaches before you finally reach Humbug Mountain, a major littoral cell boundary.

Winds and rains are seasonal, but often fierce because Port Orford juts out into the Pacific. Late fall, winter, and early spring account for 81 percent of the 72 inches of annual precipitation (Western Regional Climate Center - Desert Research Institute, 2003a). January brings winter storms and gale force winds out of the southwest, from which there are no safe anchorages for mariners. "The only time its calm in Port Orford is when the wind is blowing the same from both directions" a local fisherman only halfway joked during an interview (Interview 447). As the spring rains decrease, winds switch directions and come from the northwest through most of the summer. Moderated by the Pacific Ocean, temperatures range from 45 to 61 degrees F through the entire year (Western Regional Climate Center - Desert Research Institute, 2003b).

Governance

The city of Port Orford was established as an incorporated city in 1935. It has a city manager form of government, which gets policy guidance from a six-person city council. Port Orford has a 15-person volunteer city fire department and a small police department. Other city services include city planning, sewer, water, and parks. The city also has several committees that provide advice on budgets, ordinances, personnel, watershed management, parks, and emergency planning, and other matters. The City of Port Orford has a comprehensive plan and land use ordinances that serve as the basis for planning and development decisions, including the oceanfront and the port dock and facilities. Portions of the land and water there are reserved for development that is water dependent—that is, uses and activities that must be on the water to operate effectively. The local plan and zoning thus play an important role in defining the future of the port and adjacent lands.

While ports do not have land use planning responsibilities under Oregon law, they have great influence over promoting development of ocean resources in a way that is both economically and environmentally sound. Ports help decide what kind of

businesses and infrastructure are maintained in the port district, and thus shape the face of the port community. Ports must assess short- and long-term tradeoffs, and also balance both socioeconomic and environmental impacts. The environmental impacts include air and water pollution, dredging, public access, aquatic nuisance species, loss of wildlife habitat, and land use. It often comes down to recreational and tourism activities poised against industrial and commercial activities. In order to retain commercial fishing infrastructure and facilities in spite of a West Coast groundfish crisis, Oregon ports must have a clear vision and make strategic coastal land use planning decisions that prioritize commercial fishing as an important activity in their waterfronts.

Since the mid-1970s many cities are revitalizing their urban waterfronts to increase their value. Redevelopment is currently threatening the survival of traditional maritime enterprises such as commercial fishing. Erosion of the infrastructure and industries necessary to maintain local fishing fleets results in loss of jobs and businesses to other ports. The waterfront area is a scarce resource imperative to the activities and businesses that require contiguity to navigable waters. Recreational interests value the area for its recreational and aesthetic qualities. Waterfront revitalization often transforms abandoned wharves, docks and piers into attractive destinations for tourists. However, there is a growing sentiment that something real has been lost and may not be able to be recaptured as waterfronts displace the activities that made them the authentic working waterfronts tourists come to see.

The Coastal Zone Management Act of 1972 recognized the importance of ports and maritime industry to coastal and ocean resource management. The CZMA is a statute designed to encourage coastal and Great Lakes states to plan and manage uses of the land and water in the nation's coastal zone. It designates urban waterfronts as Geographical Areas of Particular Concern (Goodwin 1988). Salient parts of the CZMA identify national policies for conserving historic and cultural resources,

restoring urban waterfronts for public use, and reserving land for water-*dependent* industries. The significance of this is that water-*dependent* activities have a fundamental need for access to the waterfront to support water-related commerce or recreation. Examples would be a fish processing plant or boat launch/hoist. Water-*related* activities are businesses associated with the water that do not require waterfront access to operate. Examples of water-related activities are a nautical museum and gift shop. The CZMA along with Oregon's legislation and planning goals can provide guidance to fishing communities interested in maintaining their traditional maritime activities.

Oregon is ahead of the land use planning game having passed its statewide planning goals in 1973. Goals 17 and 19 directly support the goals of the Oregon Territorial Sea Plan. Oregon's Statewide Planning Goal 17 (Coastal Shorelands) prioritizes "marine-dependent" activities over "marine-related" activities in the limited space of waterfront areas (OAR 660-015-0010(2)). Goal 19 (Ocean Resources) prioritizes the maintenance and restoration of the long-term benefits derived from renewable marine resources over non-renewable resources (OAR 660-015-0010(4)). It encourages the protection of renewable marine resources; biological diversity and the functional integrity of the marine ecosystem; important marine habitat; and areas important to fisheries.

Oregon's public ports are institutions of local government. They are unlike any other local government entity in the state because they serve both public and private purposes. Oregon Revised Statutes Chapter 777 establishes ports in Oregon as "municipal corporations." Ports are not subject to state oversight, but are considered to be independent local government organizations subject only to the enabling statutes that outline port authority and powers. Ports are formed by a vote of the people who live in the proposed port district. At the initial election, voters determine a port's boundaries and elect the first board of commissioners, which governs the port

district. While managed on a day-to-day basis by either full or part-time staff, ultimate responsibility and authority over each port's activities and facilities reside in the hands of locally elected boards of port commissioners.

The objective of the port authority and its businesses is to spur economic growth in the local community through economic development and transportation (Port of Hood River, n.d.). In order to do this, ports are given an unusual collection of powers and authorities. Like other local governments, ports are authorized to levy taxes, borrow money, issue bonds, and charge for services. A very small portion of most ports' revenues is derived from taxes. Oregon ports also operate like businesses through negotiating economic development projects, leasing land, buildings and equipment, and promoting their facilities and districts for potential economic growth and opportunities. Oregon law allows ports to partake in water-related commerce, transportation, and other commercial and industrial activities. The primary role of Oregon's smaller ports, like the Port of Port Orford, is to encourage economic activities within the district's boundaries.

Ports often must improve their bays, rivers, and harbors through dredging to support navigation needs for shipping and commercial fishing activities, a major factor for the Port of Port Orford. Ports can construct and own warehouses, industrial parks, shipping terminals, and other commercial buildings. They can develop and operate piers, docks, jetties and wharves and associated facilities and infrastructure. Oregon ports also own and operate marinas and recreational facilities and can even promote tourism.

Ports also work closely with the Ports Division of the Oregon Economic Development Department to increase funding for the Port Revolving Fund. This fund

provides capital for development of public facilities such as sewer and water as well as providing job development assistance to existing or new industries located in port districts. The Oregon Port Revolving Fund provides long-term loans to ports at below-market interest rates (Oregon Economic and Community Development Department, 2004). The 23 public ports in Oregon are the only entities eligible for Port Revolving Fund loans. Individual loans may be made to a maximum of $700,000 per project and the total amount loaned cannot exceed $2 million at any time. The program may not refinance existing debt. Funding may be used for port development projects (infrastructure) or to assist port-related private business development projects. A large variety of projects are eligible and include water-oriented facilities, industrial parks, airports and eligible commercial or industrial developments. Projects must be located within port district boundaries.

Demographic Profile

As other coastal towns in Oregon have seen much larger and more rapid increases in population, Port Orford has almost refused to grow. Its population has increased only 10 percent in the last 30 years, while at the same time, Oregon port communities on average grew 28 percent (Center for Population Research and Census, 2000). In the year 2000, Port Orford had a recorded population of 1,153 and of those 48 percent were male and 52 percent were female (Figure A1).

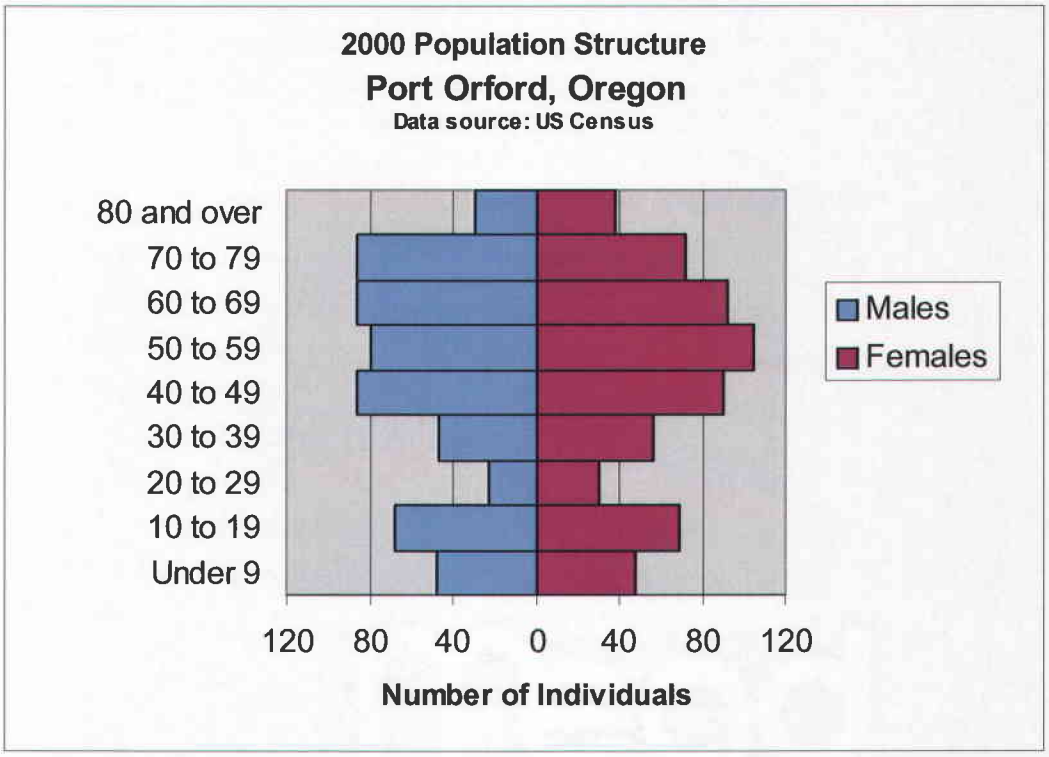


Figure A1

It is likely that Port Orford's population will continue to grow, most likely at an increased rate, as retirees and other new migrants settle in this quiet, livable oceanfront community. However, despite the fact that coastal areas of the US are projected to receive over half the nation's expected population growth in the next 15 years (Beach 2002), only a little of that growth is likely to end up along the southern Oregon coast, particularly in small communities like Port Orford. Common perceptions held by the community are that the immigrating people are predominately Californian retiree, who because of their significant skills and experience, increasingly take the limited number of available living-wage jobs in the community.

The median age for Port Orford in the year 2000 was 50.5 years, whereas the national median was 35.3 years old. The racial structure of the population of Port Orford is

not very diverse, with the predominant race being white (Figures A2 and A3). Approximately 85 percent of those people 25 years and over had graduated from high school or had higher degrees. Of those 25 and over, 19.7 percent had a bachelor's degree or higher. In 2000, about 84.2 percent of the population was part of the potential work force, aged 16 and above. Out of the population age 16 and over, 41 forces, and 55.5 percent were not in the labor percent were employed, 3.5 percent were unemployed, 0 percent was in the armed force (Figure A4). The per capita income in the year 2000 for Port Orford was $16,442 and the median household income was $23,289. About 17.8 percent of individuals in Port Orford's population were below the poverty level in 2000.

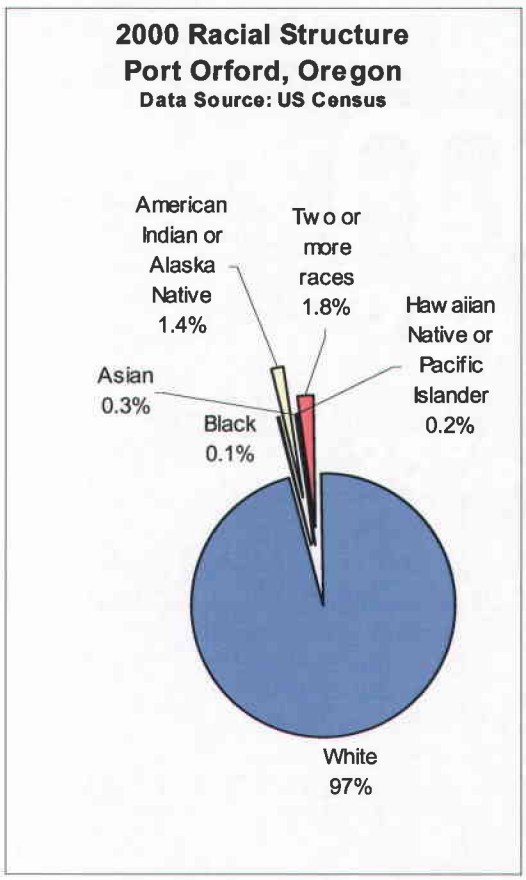
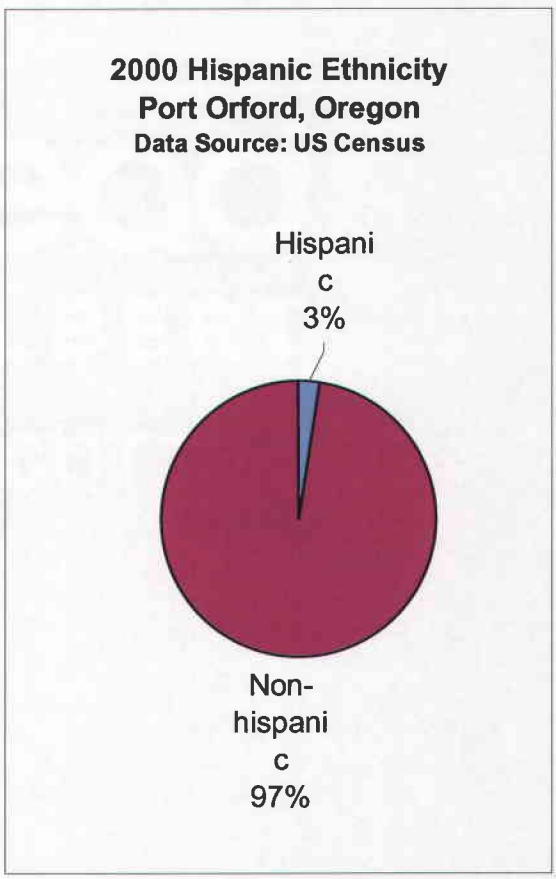


Figure A2



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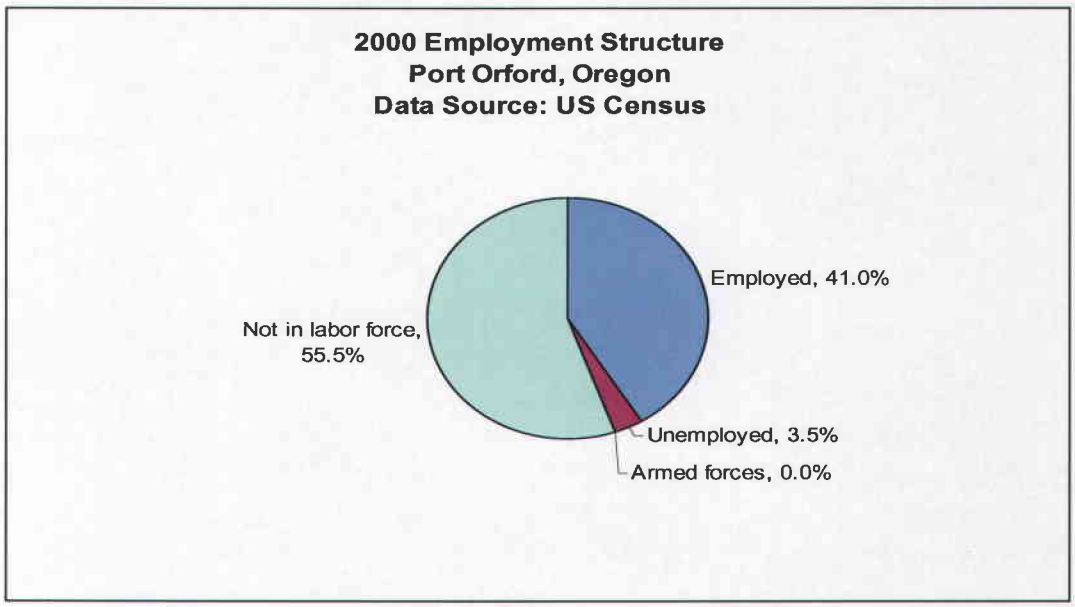

Figure A4

Fishing Industry Employment in Port Orford and the Groundfish Crisis

Port Orford is very much a fishing community, supporting about forty local fishing families (Anderson 2001). The relative proportion of fishing-related employment has statutory and management implications as set out by National Standard 8 of the 1996 Sustainable Fishing Act. However, the estimates vary considerably, from as high as thirty percent to as low as less than seven percent, as reported by Scholz (2003) and the U.S. Census (2000), respectively. Anderson (2001) reports that depending on the season, the community has between 100-150 people directly or indirectly involved in the day-to-day activities of commercial fishing, which would represent about ten to fifteen percent of the estimated 2000 population. Radtke and Davis (1997) reported that the port brings 217 commercial fishing-related jobs, representing twenty-two percent of the estimated population in 1996 (US Census Bureau). Apparent dilution of dependency occurs with increases in non-fishing proportion of populations, as with immigrating California retirees to Port Orford, or with the reduction in fishing employment such as those moving out of the industry due to lack of fishing opportunity.

Social and Cultural Linkages to the Fishing Industry

The dock is the fishing community's hub of social activity in the town. Port Orford has several local organizations associated with the commercial fishing industry, including the Port Orford Ocean Resource Team (POORT), the Port Orford Fishermen's Association and the Port Orford Women's Fishery Network (a.k.a. "the fish wives"). During the Port Orford Forth of July Jubilee, the fish wives and their fishermen co-host the annual Salmon Bake and the men compete in the Dinghy Race. For 2003 the theme of the Forth of July festivities was "Fishing the Wild Sea." The Blessing of the Fleet Ceremony occurs annually in summer and honors those fishermen who have died at sea and prays for the continued safety of those who make their living out on the ocean. In 2003, the ceremony, complete with bagpipe accompaniment, took place at the new Fishermen's Memorial overlooking Port Orford harbor. The Port Orford Arts and Seafood Festival also celebrates Port Orford's fishing history. The cultural importance of the ocean and of commercial fishing is even evident in the many maritime murals and ocean-related names that adorn small businesses and schools in Port Orford as well as residential homes.

Port Infrastructure and Facilities

Of Oregon's 23 public ports, the Port of Port Orford is one of the smallest ports in size (its taxing district comprises just 150 square miles), but it is relatively large in terms of economic contribution to the community. In 1997, the port district owned the fourth-smallest amount of land at 18 acres, and had the fifth smallest operating budget of $310,000. The small, partially-enclosed harbor is maintained at a depth of 16 feet (Radtke et al. 1997). Radtke and Davis (1997) estimated that the port brings $4,310,000 of personal income and 226 jobs, with 96 percent of both from fishing-related income and employment. They also estimate that the port generates $915,000 in state and local taxes, from industries closely linked to the port's activities. Between 2000-2004, the average value per ton of commercial catch landed in Port Orford was $3,443, compared to the average value of $741 for the rest of the Oregon ports

(International 2004). This is due to the increase in the live rockfish market, a low-volume and high-value fishery, in which about 30 Port Orford vessels participate. Live rockfish are sold for between $2.00 per pound for Copper rockfish (over 2 pounds) to $7.00 for Grass rockfish. The relatively high landings value of Port Orford in comparison to other Oregon ports is also due in part to the high-volume, low-value landings of other Oregon ports, including whiting in Newport and Astoria and sardines in Astoria.

The fishing community of Port Orford is a uniquely homogeneous small-scale port on the South Coast of Oregon with relatively traditional fishing grounds determined by vessel size and capacity. The commercial hoists and limited moorage in the Port of Port Orford constrains the Port Orford commercial fishing fleet in both vessel size and number of vessels. Vessels must meet the weight and dimensional requirements of the commercial hoists that lift them in and out of the water to dry moorage. The vessels in the Port Orford are restricted to a maximum length of 44 feet and a maximum width of 15 feet and no more than 44,000 pounds (Private Public Service Site, 2004a). The same Port Orford resident built many of these traditional salmon trollers in the 1970s. For the Port Orford Community Mapping Project, the author interviewed people from approximately 50 percent of the vessels in the Port Orford fleet. The average length of these fishermen's vessels was 34 feet. Port Orford has minimal infrastructure. There are facilities and services that include a dock and jetty, two commercial hoists, one sport crane, dry moorage area and parking spaces, minimal land and buildings for lease, beach access and restrooms and showers. About forty vessels call the dock at Port Orford home. You will find them either parked on the dock on trailers or moored in the harbor during the summer (weather conditions permitting).

The original jetty was built in 1968 and is in desperate need of repair. It is close to being totally compromised in the middle with enough damage for waves to break

through and further displace rocks from the structure. The jetty's inability to deflect storm waves keeps many vessels from mooring in the harbor. The port commission and community do not consider repairing the existing jetty a priority because the original design of the jetty created the extreme shoaling problem. One local perspective is that the old jetty does not fit the new dock (Interview 169). The Port Orford dock was recently renovated and rebuilt between 1999-2002. The previous structure was made of wooden-pilings whereas the new structure has steel-sided construction. The old dock often had to be rebuilt due to damage from the severe weather and waves off this coast, however it allowed sediment to more naturally circulate in and out of the harbor with the flow of water and this helped with the shoaling problem. There is a strong desire to make significant design changes to the jetty in the repair process and that work would require engineering assistance and a great deal of money from the Army Corp of Engineers.

With the sediment circulation disrupted by the solid base of the new dock, sand accumulates more often inside the harbor. Annually, usually in the fall and winter, the harbor must be dredged in order to remove the accumulated sediment. In spite of annual dredging, the port has been unable of to keep the area in front of the commercial hoists cleared of sand, which creates an untenable situation for the Port Orford fishing fleet. The first big southerly storm that moves a high volume of sand into the harbor makes the basin too shallow to hoist boats in or out of the water on anything but high tide. This restricts fishing opportunity for Port Orford vessels and is dangerous for vessels that may be caught out in a storm and are unable to get to the dock and hoist out of the water. However, launching into the open ocean gives Port Orford fishermen an advantage over other small-boat fleets of not having a dangerous bar to cross. This allows them to spend more time during the winter on the ocean than small boats leaving from other ports.

Economics of the Port

Mooring on a dry dock in the open ocean is an expensive operation and incurs expenses unique to the Port Orford fleet and port district. Costs to the port include purchasing the new cranes, maintenance of cranes, and operation of the cranes by a team of employees. In the winter, the ocean waves regularly overwhelm the dock and cause damage to the infrastructure. The design of the new dock drain system is not adequate to remove the flooding water, causing damage to the electrical systems. Maintenance and repair costs have to be passed on to the fishermen via their moorage rate. One parking space for a vehicle and one boat trailer costs $170 dollars per month as of June 2004. "Unlimited" hoist use is included in the monthly charge, but is actually limited otherwise due to sport and recreation use of the hoists and water depth limitations imposed by tidal fluctuations not providing enough clearance for vessels to approach the dock. Other income to the port includes a tax on fuel and landings. The port sells both diesel and gasoline, marking up prices 20 percent. The port also charges a 1 percent poundage fee for each pound of fish landed. This means that the fish buyers pay one cent of every dollar earned from fishing to the port authority. The port district attempts to balance the operation costs with the maximum amount of revenue the fishing fleet can afford to pay for services. Mooring on a dry dock also imposes additional costs to fishing businesses for upkeep and repair to their vessels from the stress of hoisting in and out of the water daily.

Limited space and building infrastructure on the dock restricts the expansion of commercial fishing. For example, the port has very limited gear storage space. As of the summer 2004, five businesses lease land, buildings, or other facilities on the Port Orford dock. Three product hoist areas occupy the Port Orford dock: NorCal, Hallmark and the old Premium Pacific Seafood hoist. Recently a local fishing family is leasing the old PPS hoist using Oregon Bait & Seafood Company as their business name. Currently, two fish buying stations at the port, Hallmark Fisheries and NorCal Seafood, purchase almost all of the Port Orford fleet's seafood products. However,

NorCal buys only live product, including Dungeness crab and live rockfish. (Interview 138). The combination of the decline in local sea urchin harvesting and the increase in live rockfish fishing has diminished the demand for local fish processing. As a result, the other buying station and processing plant, Pacific Premium Seafood (PPS), closed in 2003. The port has retained possession of the PPS building on the dock and currently leases out the usable portion to NorCal Seafood; the entire second story is in disrepair and essentially unusable. The port applied for loans to rebuild the decaying building, but only was approved for money for the roof while the walls holding them up would continue to rot away.

Port Orford does not currently offer ice or cold storage, which is burdensome to the fleet. Premium Pacific Seafood (PPS) had a small ice machine that is no longer available. Hallmark ships in ice from Charelston and holds it in totes in their container freezer. During tuna season, fishermen drive their own totes to Charleston or actually go into Charleston with the boat to pick up ice. However, in 2004 a grant was awarded to the port to repair freezers in the old PPS building and store ice purchased from the Port of Brookings Harbor. With the upgrade to the freezers in the old PPS building in 2004 the port hopes to attract a pacific eel processor. This would create more opportunity for fishermen and provide a tenant for the processing building.

There are no vessel repair shops in Port Orford. Most of the vessels are repaired right on the dock or towed to a personally owned shop in town. Some supplies are bought from local hardware and auto supply stores. However, most of the repair supplies come from Coos Bay and almost all of the gear comes from Englund Marine or Basin Tackle in Charleston.

The other marine businesses on the dock include Dock Tackle and Pac Nor West Charters. Dock Tackle is a combination of tackle and gift shop, nautical museum, and

fish market. It supplies seasonal fresh fish, fish and chips and chowder, and a limited amount of gear (i.e., jigs and line) for the sport and commercial rockfish fishery. Pac Nor West Charter opened in 2003 and has a small office on the dock from which the owners run recreational scuba and fishing trips. A floating dock for recreational fishing boats on the side of the pier can be drawn up in bad weather.

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Appendix B

POORT Confidentiality Agreement

The Port Orford Ocean Resources Team (POORT)

Confidentiality Agreement

POORT is conducting Local Knowledge Interviews with Port Orford commercial fishermen, recreationalists, and other citizens. The purpose of this interview is to establish a foundation for incorporating local knowledge into local management decision-making. Through analyzing the information gathered, POORT seeks to identify ocean resource use, abundance and distribution in the Port Orford area. This information will be used to design cooperative research projects that will assess the condition of the study area. This agreement between the POORT and the Interviewee assures the Interviewee complete confidentiality of the information provided to the POORT.

Individual data will not be accessible by any person other than the Interviewer and the person who will input the data into the computer using geographic information system (GIS) software. Raw interview data will be securely stored until such time that all data are entered and verified. At that time, the information will be returned to the Interviewee, destroyed, or stored at said location with the Interviewee's permission.

Interview information will be aggregated with data from other interviews to produce compilation maps, which will NOT display any one individual's information. Furthermore, the POORT will NEVER share any one person's information without express written consent of the Interviewee.

The unique identification number below will be used to identify this interview in the computer database. The only place where your name and ID number will appear together is on this form, which will be securely stored indefinitely. By signing here you agree to the conditions of this confidentiality agreement.

Date: _____

POORT Interviewers:

_____ _____

Interviewee:

Identification number: _____

Name (please print and sign): _____

Address: _____

Phone: _____

Appendix C

Human Subjects Research Informed Consent Document

INFORMED CONSENT DOCUMENT

Project Title: **Port Orford Ocean Resources Inventory**
Principal Investigator: **Jim Good, Marine Resources Management Program**
Research Staff: **Vicki Wedell, Laura Anderson, Leesa Cobb, Dave Revell**

PURPOSE

The purpose of this research study is to conduct an inventory of the local knowledge of species, resources, and activities that occur in the marine environment important to the community of Port Orford. Computer mapping is used to document and display the information shared in the interview process. The purpose of this consent form is to give you the information needed to help you decide whether to be in the study or not.

We are inviting you to participate in this research study because you utilize the Port Orford marine environment for your occupation or recreational activities. A snowball sampling approach will be used to get an estimated 40 people in this interview process. Volunteers from POORT Advisory Board will be recruited first, while other willing participants will be identified through suggestions made by interviewees or other POORT members.

PROCEDURES

If you agree to participate, your involvement in the interview process will last for three hours total. A two-hour interview will be followed a few weeks later by a one-hour consultation to verify the accuracy of the maps created. A community workshop will allow another opportunity to make modifications to the composite community map.

The following procedures are involved in this study. At least two interviewers are present for each interview. A random identification number will be used to reference your local knowledge maps. Confidentiality agreements are offered and signed at the onset of the interview. Then, you refer to a list of potential species and human uses and describe your personal observations of those that occur in the Port Orford study area. Identification guides are on-hand for reference, if needed. You use wax pencils to draw the areas of your observations on clear plastic mylar, which is overlaid on base maps having fathom contours and the relevant nautical chart displayed. Information shared at the interview process is taken back and digitally documented in map form. The maps are brought back to you after a few weeks for a 1-hour consultation where any necessary modifications are identified and corrected. After all consultations are completed for all participants, species and use maps will be aggregated and presented as the Port Orford Ocean Resources Inventory.

RISKS

There are no foreseeable risks associated with participating in this research project. Sensitive information is protected through random identification numbers.

BENEFITS

There may be no direct personal benefit for participating in this study. However, society may benefit from this study by learning about a participatory process for computer mapping of local ecological knowledge.

COSTS AND COMPENSATION
You will not have any costs for participating in this research project. You will be compensated with a rockfish poster even if you withdraw early.

CONFIDENTIALITY
Records of participation in this research project will be kept confidential to the extent permitted by law. Individual data are not accessible to any person other than the interviewer and the person who will input the information into the computer. Raw interview data are securely stored until such time that all the data are entered and verified. Then the data are returned to the interviewee or destroyed. Information is aggregated with data from other interviews and compilation maps generated for exclusive use by POORT. Maps and information are not shared with outside groups without express written consent of the POORT Advisory Board members.

VOLUNTARY PARTICIPATION
Taking part in this research study is voluntary. You may choose not to take part at all. If you agree to participate in this study, you may stop participating at any time. You are also free to skip any question in the interview that you prefer not to answer.

QUESTIONS
Questions are encouraged. If you have any questions about this research project, please contact: Vicki Wedell at 541-619-4699 or vwedell@coas.oregonstate.edu or Jim Good at 541-737-1339 or good@coas.oregonstate.edu. If you have questions about your rights as a participant, please contact the OSU Institutional Review Board (IRB) Human Protections Administrator, at (541) 737-3437 or by e-mail at IRB@oregonstate.edu.

Your signature indicates that this research study has been explained to you, that your questions have been answered, and that you agree to take part in this study. You will receive a copy of this form.

Participant's Name (printed): _____

_____ _____
(Signature of Participant) (Date)

RESEARCHER STATEMENT
I have discussed the above points with the participant. It is my opinion that the participant understands the risks, benefits, and procedures involved with participation in this research study.

_____ _____
(Signature of Researcher) (Date)

Appendix D

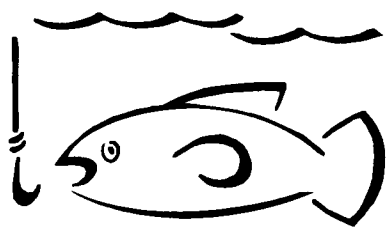
Flyer for Local Knowledge Interviews for the Port Orford Community Mapping Project

Port Orford Ocean Resource Team

POORT is engaged in a community-based management effort and is conducting a local inventory of the ocean region important to the Port Orford community.

We want to talk to commercial and recreational fishermen, recreationalists (divers, kayakers, surfers, etc.), and other citizens who have personal knowledge about the resources, species, and human activities that occur in the Port Orford ocean area.

Local knowledge interviews will be conducted in the POORT office: 351 W 6th St



Get involved! We want to talk to YOU!!!

Sign-up in the POORT office or call us to be a part of this unique opportunity!

Appendix E

Local Knowledge Interview Questions

Port Orford Ocean Resources Team - Local Knowledge Interviews

Interview questions:

1. User profile
    a. Identification number
    b. Age
    c. Sex
    d. Profession/activity (owner, captain, deckhand, recreational activity)
    e. Duration
        1. Start/end year
        2. Number of days/year in area
        3. How many years have you maintained this level of activity?
    f. What generation fisherman are you? (if applicable)
    g. What vessel(s) do you fish from? (if applicable)
        1. What are its length and size of engine?

2. Where are your primary (fishing) zones? (if applicable)
    a. What are the primary fisheries in each zone?
    b. What are the primary gears in each zone?
    c. What is the percent of fishing effort spent in and the relative economic importance of each fishing area? (Divide 100 pennies among sites)

3. What "resources" do you use or have you observed in the study area? **(Use list)**
    a. Where do you use/observe resource X?
    b. What is the current status of the resource in the study area? (abundance)
    c. Has the location or status of this resource changed since you have been involved in your activity in the study area? If so, how and why?
    d. What are the seasonal changes of this resource in the study area? (spawning locations, nursery grounds)
    e. What other changes have occurred with respect to this resource? When and why did they occur?

4. Is there anything else about the ecology, economic, social, or cultural factors of this area that you want to tell us?
5. Anything else?

Appendix F

LKI's Species, Resources and Activities List

Resource, Activity and Species Categories

Invertebrates and Plants

- Kelp
- Mussels
- Sea anemones
- Sea cucumbers
- Sea urchins (red and purple)
- Scallops
- Red abalone
- Starfish
- Pacific eels (slime eel/hagfish)
- Octopus
- Squid
- Shrimp
- Dungeness crab

Other animals

- **Birds**
  - Albatross
  - Murres
  - Puffin
  - Pelican (brown)
- **Marine Mammals**
  - Whales (gray, orca)
  - Dolphins
  - Sea lions
  - Seals (harbor or elephant)
  - Sea otter
- **Turtles**

Humans

- **Recreation**
  - Diving
  - Kayaking
  - Wave/wind surfing
  - Whale/bird watching
  - Power boating
  - Shore-fishing
  - Recreational fishing
- **Other Commercial fishing**
  - Small trawlers
  - Large trawlers
  - Non-Port Orford vessels
- Safe Anchorages
- Navigational hazards

Fish

- Salmon/Steelhead
- Albacore tuna
- Black Cod (aka sablefish)
- Halibut
- **Slope Rockfish**
  - Darkblotched
  - Pacific Ocean Perch
  - Redbanded
  - Rougheye
- **Shelf Rockfish**
  - Canary
  - Yelloweye
  - Yellowtail
  - Chillipepper
  - Greenstripe
  - Rosethorn
  - Rosy
  - Boccacio
  - Shortbelly
  - Tiger
  - Vermillion
  - Widow
- **Other Shelf**
  - Cabezon
  - Sea Trout (aka greenling)
  - Lingcod
- **Nearshore Rockfish**
  - Blacks
  - Blues
  - Quillback
  - Copper
  - China
- Whiting
- Sturgeon
- Flounder
- Sole
- Sculpin
- Surfperch/Surf smelt/Sand lance
- Sardines Anchovies
- Pacific mackerel
- Skates
- Sharks

Appendix G

Ecotrust GIS Analysis Methods

GIS Analysis Methods for Port Orford Local Knowledge Inventory

Introduction

The following description explains the methods used regarding the spatial analysis of the Port Orford local knowledge inventory for community based fishery management.

The analysis was broken up into three phases.

1. *Assess the current structure of the local knowledge dataset and aggregate the data appropriately in order to perform the analysis.*
2. *Analyze the recreational activities and targeted commercial species data in grid based on a 30 meter cell size for the study region. A 30-meter cell size was determined as the best spatial resolution to use due to the size of the study area and the desired scale of accuracy we could obtain.*
3. *Evaluate the relative economic importance of black cod.*

Phase One – Organization, Compilation, and Initial Assessment of the Local Knowledge Dataset

We initially assessed the current structure of the dataset and determine how best to aggregate the data used to evaluate the recreational and commercial activities in Port Orford. The data was originally organized by interview, which meant for each interviewee, a shapefile was created for every recreational activity or commercially targeted species that interviewee identified. Based on a brief introduction to the dataset and procedures used to conduct the local knowledge surveys we decided to aggregate the data into two sub-directories, 1) Recreational and 2) Commercial.

Phase Two – Analyze recreational activities and targeted commercial species (Black cod, Crab, Halibut, and Salmon)

Recreational Activities

The recreational activities included in this analysis are as follows; beach combing, bird watching, kayaking, boating, diving, shore fishing, recreational fishing, wind and wave surfing, and whale watching. Each shapefile that was created for an interviewee that identified one of these activities was converted to a coverage and placed in a subdirectory organized by activity. In cases where there were overlapping polygons for one interviewee, multiple coverages were created so that they were evaluated separately once they were converted to grids.

Once all the shapefiles were converted to coverages within each activity subdirectory, an aml (arc macro language) was created to perform the analysis. The basic routine of the aml consisted of converting each coverage to a grid with a 30-meter cell size. Once each coverage was converted to a grid, we identified the minimum and maximum inputs (xmin, ymin, xmax, ymax) in order to set our analysis window to the appropriate extent. After the analysis window was set, a conditional statement was executed on each grid consisting of:

output grid = con(is null (input grid) ,0,1)

The output grid now has a value of 1 for each cell where an activity was identified and a value of 0 where there is no data (is null). After this condition was performed for each grid, all of the output grids were added together to create a resulting summary grid. This resulting summary grid now has cell values ranging from 0 to the maximum number of input grids.

Example: If there were three interviewees that identified the same area for surfing, each area was converted to a grid with a 30-meter cell size and each cell was given a value of 1. After adding the three grids together, if each interviewee identified the same cell for surfing then the resulting cell from the summary grid would now have a value of 3, if only two interviewees identified the same cell for surfing the resulting cell from the summary grid would now have a value of 2, if only one interviewee identified a cell for surfing the resulting cell from the summary grid would have a value of 1, and if none of the interviewees identified a cell for surfing the resulting cell would have a value of 0.

After creating a composite grid that scored all of the recreational activities (surfing, bird watching, boating....) separately, we wanted to evaluate all of the recreational activities together in our final analysis. We did this by adding each of the composite grids together to create a final grid that contained a cumulative cell value for every cell were a recreational activity was identified. The reason why we didn't initially evaluate all of the recreational activities at the same time was due to the processing capabilities in the grid environment, where the maximum number of input grids that can be added together is 50 and there were more then 50 grids representing areas used for recreational activities. This is why we chose to organize and perform the preliminary analysis for each unique recreational activity separately.

Example: If the composite grid for surfing had a cell with a value of 3 (meaning 3 interviewees identified that cell for surfing) and the same cell for the composite grid of bird watching had a value of 4 (meaning 4 interviewees identified that cell for bird watching) the final cell value in the final grid would have a value of 7 (meaning 7 interviewees identified this particular cell for a recreational activity).

Finally a nearest neighbor, focal mean using a circle with a radius of 6 was performed on the resulting final recreational grid to smooth out the data. The radius is identified in cells measured perpendicular to the x- or y-axis. Any cell center encompassed by the circle or wedge will be included in the processing of the neighborhood.

Only cells that had a value greater than 0 were displayed for mapping purposes. The displayed areas utilized by recreational users who participated in the survey were classified using an equal area distribution, with 7 classes, and re-categorized into low, medium, and high usage. Cells that have the greatest value represent high usage areas and cells that have the least value represent low usage areas.

Commercial – Targeted Species (Black cod, Crab, Halibut, and Salmon)

The species identified as commercial important and targeted by fishers included; black cod, crab, halibut, and salmon. Each shapefile that was created for an interviewee that identified an area or areas where they targeted one of these species was converted to a coverage and placed in a subdirectory organized by specie. In cases where there were overlapping polygons for one interviewee, multiple coverages were created so that they were evaluated separately once they were converted to grids. For this part of the analysis each specie will be evaluated separately.

Once all the shapefiles were converted to coverages within each specie subdirectory, an aml (arc macro language) was created to perform the analysis. The basic routine of the aml consisted of converting each coverage to a grid with a 30-meter cell size. Once each coverage was converted to a grid, we identified the minimum and maximum inputs (xmin, ymin, xmax, ymax) in order to set our analysis window to the appropriate extent. After the analysis window was set, a conditional statement was executed on each grid consisting of:

output grid = con (is null (input grid) ,0,1)

The output grid now has a value of 1 for each cell a fisher identified as where they targeted a particular specie and a value of 0 where there is no data (is null). After this condition was performed for each grid, all of the output grids were added together to create a resulting summary grid. This resulting summary grid now has cell values ranging from 0 to the maximum number of input grids for that specie.

Example: If there were three interviewees that identified the same area for targeting black cod, each area was converted to a grid with a 30-meter cell size and each cell was given a value of 1. After adding the three grids together, if each interviewee identified the same cell for targeting black cod then the resulting cell from the summary grid would now have a value of 3, if only two interviewees identified the same cell for targeting black cod the resulting cell from the summary grid would now have a value of 2, if only one interviewee identified a cell for targeting black cod the resulting cell from the summary grid would have a value of 1, and if none of the interviewees identified a cell for targeting black cod the resulting cell would have a value of 0.

Finally a nearest neighbor, focal mean using a circle with a radius of 6 was performed on the resulting final recreational grid to smooth out the data. The radius is identified in cells measured perpendicular to the x- or y-axis. Any cell center encompassed by the circle or wedge will be included in the processing of the neighborhood.

This process was used to evaluate each specie (black cod, crab, halibut, and salmon) individually.

Only cells that had a value greater than 0 were displayed for mapping purposes. The displayed areas for each specie targeted by a commercial fisher who participated in the survey were classified using an equal area distribution, with 7 classes, and re-categorized into low, medium, and high usage. Cells that have the greatest value represent high usage areas and cells that have the least value represent low usage areas.

Phase Three – Evaluate the Relative Economic Importance of Black cod

We evaluated the relative economic importance of black cod by assessing the answers given by each interviewee, when asked, "of the areas they target black cod, which area is relatively more important then another, a.k.a., "100 pennies question". The "100 pennies question" asks each fisher, "based on the number of areas they use to target black cod, place a weighted percentage or number of pennies, out of 100, that describes how economically important that areas is compared to another.

In the previous analysis for areas targeted by commercial fishers, we assigned a value of 1 for each cell a fisher identified as where they targeted a particular specie and a value of 0 where there is no data. For evaluating the relative economic importance of black cod, we assigned the value based on the number of pennies the fisher placed in that area, with all of the areas totaling 100 for each fisher. After all of the grids for each interviewee that specified a "100 pennies" value for their areas were created, the grids were then combined into a resulting summary grid by adding of them together. The resulting summary grid now has a range of cell values from 0 to the maximum number of fishers that provided an answer to the "100 pennies question" x 100. (e.g. 13 fishers provided answers = 1300 total pennies)

Example: One fisher specifies three areas they target black cod. Of those three areas, they placed 30 pennies in one, 20 pennies in another, and 50 pennies in the last area. This means each cell in each of those areas they specified, has the same value as the number of pennies they placed in it. We will call it the "relative economic importance" of each area. Another fisher specifies only one area where the target black cod and places 100 pennies in that area. This area completely overlaps all three of the other fishers' areas and extends past them to the south. When these two grids representing the "relative economic importance" for each fisher are added to together, the area where they overlap will have the resulting cell values of 120, 130, 150, and the cells in the area to the south where they don't overlap will have a value of 100.

By adding all of the grids together based on the number of pennies placed in each area by an interviewee, we are able to determine why fishers target one area vs. another area based on it's "relative economic importance". Only cells that had a value greater

than 0 were displayed for mapping purposes. The "relative economic importance" was displayed for black cod areas targeted by a commercial fisher who participated in the survey were classified using an equal area distribution, with 7 classes, and re-categorized into low, medium, and high usage. Cells that have the greatest value represent the greatest areas of "relative economic importance" and cells that have the least value represent the areas of the least "relative economic importance".

Appendices H1- H6

Draft Maps from Port Orford Community Mapping Project