SEA OTTER DISTRIBUTION AND RELATIVE ABUNDANCE AND MANAGEMENT IMPLICATIONS IN GLACIER BAY

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On 25 and 26 August, 1998 we completed a survey of lower Glacier Bay to estimate the distribution and relative abundance of sea otters. The survey was conducted from a 25' skiff that was piloted along most shorelines from 100 to several hundred meters offshore. Survey speed was generally 10-12 knots and the skiff was slowed or stopped to count groups of sea otters. The area surveyed consisted of shorelines north from Point Gustavus and Pt. Carolus to Puffin Island on the east Bay to North Fingers on the west Bay and included Willoughby, the Marbles, and Leland Islands. The shoreline along Beartrack Cove was not surveyed due to poor viewing conditions. Survey conditions were generally good with winds less than 12 knots and 100% cloud cover. Survey conditions north of Flapjack Island were poor due to winds 15-20 knots. Two observers and a skiff operator using 4-10 power binoculars counted and mapped all otters observed. All other marine mammals observed were mapped and counted but are not reported here. Following is a summary of the areas surveyed and the number of sea otters counted.

Adults/pups

Pt.. Carolus	to	Rush Pt.	139/52
Rush Pt..	to	N. Fingers	55/21
N. Fingers	to	Sandy Cove	0
Boulder Is.	to	Strawberry Is.	9/0
Beardslee Is.*			6/0
Young Is.	to	Pt.. Gustavus	201/0
		TOTAL	**410/73**

* Includes Willoughby, Marble, and Leland Islands.

The total number and distribution of sea otters in Glacier Bay proper apparently continues to increase. Survey conditions were good or better between the Beardslee Is. and Pt. Carolus where nearly all of the animals were observed. Survey conditions were poor north of the Beardslee Is. where few sea otters were observed. It is unlikely that the large count of otters was simply due to different survey conditions or methods. The presence of large numbers of pups, particularly along the western shores of the lower Bay indicates sexually mature females are now occupying Glacier Bay. Prior to 1998, Glacier Bay was occupied principally by large groups of male sea otters in what are commonly recognized as colonizing "fronts". It appears as though good examples of these aggregations can presently be found at Pt. Gustavus (summer and fall) and in the north Beardslee Islands (winter and spring). Adult females typically establish themselves after colonization by these male groups. The presence of large numbers of females and pups suggests that recolonization will continue and that permanent residency by sea otters will likely occur, although movements within the Bay might be expected.

The large increase in the number of sea otters observed in Glacier Bay since 1996 (183) continues, although we caution against the use of these numbers in estimating the actual abundance of sea otters. We recognize that some proportion of animals are not observed, but we do not estimate that proportion. However, it appears obvious that sea otters are present in increasingly large numbers in Glacier Bay. Further, it appears as though the rate of increase cannot result from intrinsic growth alone but likely is the result of immigration from areas outside Glacier Bay, most likely Icy Straits and Cross Sound, where sea otters have been resident for several years (see previous reports).

At least four implications to management are apparent with the continued recolonization of Glacier Bay by large numbers of sea otters, including: 1) fisheries interactions, 2) ecological interactions, 3) visitor interactions, and 4) harvest interactions. We will briefly outline the issues we see relevant to management and encourage your consideration of these issues.

1. Fisheries interactions:

Sea otters will compete with existing and future fisheries, primarily for benthic marine

invertebrates, such as crabs, urchins and mollusks. With very little uncertainty it can be predicted that fisheries (both commercial, recreational and subsistence) for Dungeness, tanner and king crab will be strongly impacted, if not precluded, by competition with sea otters. Fisheries for clams, mussels, urchins, cucumbers and scallops will also be adversely affected by sea otters. Based on recent trends in sea otter populations it may be a very short period of time before conflicts arise. Without appropriate baseline data on shellfish populations along with sea otter abundance and forage data, it will not be possible to assign cause to changes that will likely occur.

2. Ecological interactions:
As sea otters continue to move into Glacier Bay in increasing numbers, they will have profound (and somewhat predictable) effects on the structure and function of the nearshore marine communities. For example, much of the subtidal community is currently (in the absence of sea otters) dominated by green sea urchins, algal assemblages are sparse (or non-existent), bivalve populations are abundant and disturbance to the substrate is minimal. As sea otters recolonize they will remove most urchins resulting in decreased grazing and increased kelps. Kelps and sea grass beds will provide physical structure to the community and provide adult and juvenile habitat for associated fauna. In preying on clams, substrates to depths of up to 1 meter will be excavated and filtration by bivalves will be greatly reduced. Clam shells will serve as a settling substrate on the sea floor that may have previously been limiting. Indirect interactions (both positive and negative) with other nearshore predators (e.g. fishes, sea ducks, shorebirds, sea stars, bears, river otters) may be predicted. Many opportunities for understanding structure and function of marine communities will present themselves in a situation that will provide for rigorous experimental design.

3. Visitor interaction:
The presence of sea otters in Glacier Bay will present a new opportunity for visitors of the park. Sea otters can and likely will become important aspects of the visitor experience that will be facilitated by appropriate education and interpretation. Little information currently exists to facilitate the visitor opportunities for observing sea otters in Glacier Bay or on the potential effects of human visitors on the recolonization of Glacier Bay by sea otters.

4. Harvest interactions:
A legal harvest of sea otters by Alaska natives is permitted under the Marine Mammal Protection Act. The average annual harvest is highest in the southeast Alaska region and numbers into the hundreds of animals per year. It is possible that with the increasing abundances of sea otters in Glacier Bay, hunters from villages in the local area may consider hunts in Glacier Bay.

Recommendations :

1. Past and current surveys of sea otters in the Glacier Bay area have been for the purpose of assessing distribution and relative abundance only. It is probably timely, given the recent rate of increase to consider a more rigorous survey, on the appropriate temporal and spatial scales, to estimate abundance that accounts for recognized sighting bias and can provide defensible estimates. Such a technique has recently been designed and tested and is available for application in Glacier Bay. An accurate description of the abundance and distribution of sea

otters in Glacier Bay is critical to describing the changes that can be attributed to their presence, as well as the effects of disturbance and legal harvest.

2. Sea otters provide one of the best examples in the ecological literature of top-down forcing effects on the structure and functioning of nearshore marine ecosystems in the North Pacific. Most of the literature on sea otter ecology resulted from studies over rocky reef habitats along outer coasts and is related to effects of sea otter reductions of sea urchins, reduced herbivory and subsequent increases in kelp production. Two approaches have proven valuable in understanding the effects of sea otters. One is contrasting communities over time, before and after recolonization by sea otters. This approach, in concert with appropriate controls, provides an experimentally rigorous and powerful study design allowing inference to the cause of the observed changes in experimental areas. The other approach consists of contrasting different areas at the same time, those with and those without the experimental treatment (in this case sea otters). Both opportunities currently present themselves in Glacier Bay National Park and Preserve. Because of our inability to manipulate large carnivore populations, this opportunity is relatively unique in large mammal ecology, however, the present situation will not persist for a long period of time.

3. Work is in progress related to the MADs study that is identifying foraging behavior of sea otters in Glacier Bay. This work needs to be expanded outside of the crab study areas and analyzed with the intent of identifying those species and areas where one or more of the four issues identified above may be relevant. This work is easily accomplished with minimal funding but does require specialized skill.

4. It may be appropriate to consider modeling the future of commercially viable Dungeness crab populations in the Beardslee Islands. Reasonably good data on the energetic requirements of sea otters are available as well as estimates of diet species composition. With estimates of sea otter abundance, and Dungeness crab biomass and productivity, a simple model could be developed that may prove useful in predicting fishery viability.