ALASKA DEPARTMENT OF FISH AND GAME
DIVISION OF WILDLIFE CONSERVATION
PO Box 115526
Juneau, AK 99811-5526

Alaska Department of Fish and Game
State Wildlife Grant

GRANT AND SEGMENT NR: T-1-16

PROJECT NUMBER: 5

PROJECT TITLE: Detecting trends in marbled murrelet populations in Southeast Alaska

PARTNER: School of Aquatic and Fishery Sciences, University of Washington

PRINCIPAL INVESTIGATORS: Dr. Julia Parrish, University of Washington & Dr. John Piatt, USGS Alaska Science Center

COOPERATORS: US Fish and Wildlife Service, Alaska Department of Fish & Game, US Forest Service

PROJECT DURATION: May 25, 2006 – December 31, 2007

REPORT PERIOD: May 24, 2007 – December 31, 2007

I. PROBLEM OR NEED THAT PROMPTED THIS RESEARCH

The Marbled Murrelet (*Brachyramphus marmoratus*) is a small seabird that inhabits near-shore marine waters from central California to the Bering Sea of Alaska. Its distribution is closely tied to that of the Pacific Coast Temperate Rainforest, where it nests primarily on natural moss platforms in the canopy of old-growth trees. The loss of nesting habitat, especially in the southern portions of its range outside of Alaska, and increased mortality from anthropogenic factors such as oil spills and fishery by-catch, led to this species being listed as threatened in California, Oregon, Washington and British Columbia. Southeast Alaska is an important population center for the species, supporting an estimated 65% of the global population.

Recent surveys (see below) suggest that the number of Marbled Murrelets in southeast Alaska has declined precipitously. Declines in Prince William Sound were less extreme. Numbers of *Brachyramphus* murrelets along the Malaspina Forelands, in Kachemak Bay, and at Adak Island were all negative, and slightly positive at Kenai Fjords.

A number of these historical surveys for seabirds at sea in SE Alaska, including those conducted by the U.S. Forest Service (USFS) but not analyzed by Piatt et al. (2007), could be repeated in order to better evaluate population trends at local or regional scales. However, it is not entirely obvious which methods of surveying would be best to replicate in the future. These surveys have differed markedly with respect to data collection protocol and sampling design, and they have never been contrasted for their power to detect trends. The purpose of this project was to collate and analyze existing historical murrelet survey data to determine which offers the most efficient method for

detecting trends, and to make recommendations for conducting region-wide population and trend surveys in Southeast Alaska.

II. REVIEW OF PRIOR RESEARCH AND STUDIES IN PROGRESS ON THE PROBLEM OR NEED

The original population estimate for Southeast Alaska is derived from a single region-wide survey conducted by the USFWS in the summer of 1994 (Agler et al. 1998; hereafter called the "Agler surveys"). Other agencies and individuals conducted surveys at various locations in the early 1990s for purposes of monitoring this species and detecting population trends. Except for the Glacier Bay/Icy Strait area, however, these surveys have never been repeated and population trends for the region are poorly known. Results of recent analyses (Piatt et al. 2007) suggest that there has been a rapid and widespread decline in *Brachyramphus* murrelet populations throughout most of their range in British Columbia and Alaska. The evidence for major declines in abundance is strongest from Southeast Alaska and Prince William Sound owing to time-series data in both locations. In Southeast Alaska, there is good agreement with rates of *Brachyramphus* murrelet decline estimated from Icy Strait and Glacier Bay (-12.7 vs. -11.8 percent per year), and these declines are corroborated by comparison of Agler's survey with a region-wide survey conducted by Hodges et al. (Piatt et al., 2007) 4-7 years later than Agler, although questions remain about their comparability.

III. APPROACHES USED AND FINDINGS RELATED TO THE OBJECTIVES AND TO PROBLEM OR NEED

OBJECTIVE 1: Develop a statistically reliable survey protocol for estimating marbled murrelet population trends in Southeast Alaska based on an assessment of available data and existing survey protocols.

Analysis of datasets were performed to determine: *power* (what degree of change, assessed annually, can be detected with each data set. How do surveys measuring temporal variance (e.g., BC surveys) compare to those measuring spatial variance (e.g., Alaska surveys)? What is the relative power of surveys conducted with random sampling, opportunistic sampling, or systematic sampling; surveys conducted from small skiffs versus larger, slower vessels; transects conducted nearshore versus offshore, or data collected using line transect protocols?); *sample size* (what is the relationship between survey effort and power (specifically, degree of change that can be assessed annually)?); *superior method*(what transect method is the most efficacious, providing the highest degree of certainty with the lowest input of survey effort?); *interannual sampling rate* (assuming a necessity for determining 50% changes over different times intervals (say 10, 15 or 20 years) and assuming that survey effort is limited by personnel and financial resources, which is the superior method for surveying murrelets: annual surveys or surveys every n years?); *survey design* (what is the most efficacious geographic design for surveys (selected from a continuum of a single survey, repeated within seasons, to multiple surveys, each conducted once annually). In other words, from the point of view of power to detect change, but also given that the population is dispersed widely over all of SE Alaska (ca. 30,000 square km), and that resources for monitoring in the future will

only ever permit sampling the entire area infrequently (e.g., once every 10 years) or to sample a much smaller area annually (and perhaps repeatedly within season), but not both, which is the superior strategy for monitoring populations? Should we move towards a i) spatially comprehensive survey, or, ii) a (random or core?) selection of several sub-areas to survey, perhaps repeatedly within year?)

Given that 10 to 20 years of sample data will be collected, our professional judgment is that strip transect surveys of the same spatial sample over the entire SE Alaska area should be conducted under the assumption that more species than murrelets will be surveyed. Our analysis suggests that for assessing population trends of murrelets it makes little difference which counting protocol (line versus strip), platform (skiff versus ship), or sampling layout (random versus systematic) one employs, but methods should be standardized in any case. Having said that, we note that line transect methods are more accurate for estimating absolute population size of individual species. Since they can be employed for *Brachyramphus* murrelets while conducting strip transects for everything else, and since they are widely used for murrelet surveys elsewhere, they are recommended. In contrast to protocol issues, sampling effort (sample unit area, frequency of sampling) and total area being sampled are very important issues to sort out in advance.

We make the weak recommendation that segments/transects be of size comparable to the Icy Strait segments (ca. 1 km^2) which were determined in previous analyses to be largely uncorrelated (Piatt et al. 2007). Segments/transects should be well interspersed throughout the study area by the GRTS procedure or a systematic sampling procedure. Surveys every third year with total effort comparable to that in the Icy Strait surveys should give 80% power to detect a 50% decline in population density in 20 years (at the α = 5% level of testing and under the assumption that the decline is relatively smooth). Minimum total effort should be at least 44 km^2 of surveyed area with the survey effort in the Icy Strait study (ca. 70 km^2) as a more reasonable minimum target.

From a practical standpoint, it may not be possible to sample the entire Southeast Alaska area every third year. Our simulations indicate that surveys conducted every 5 years with sampling effort between that of the Icy Strait and Glacier Bay surveys will meet the same criterion of 80% power to detect a 50% decline in population density in 20 years. Similar power to detect trends could be obtained by conducting repeated surveys of a small area (for example, 7 repetitions of a 10 km^2 survey). We recommend this kind of sampling to assess local-scale trends in different areas of SE Alaska and provide more “real-time” information on annual variability.

IV. MANAGEMENT IMPLICATIONS

These findings and recommendations provide a framework for establishing a long-term monitoring program for marbled murrelets in Southeast Alaska; surveys that might be conducted and/or funded by various wildlife management agencies including the Alaska Department of Fish and Game, U.S. Fish and Wildlife Service, National Park Service and National Forest Service. Southeast Alaska is the most important area for populations of marbled murrelets throughout its range. Populations in Washington, Oregon and California are declining and will likely be extirpated in this century without intervention

(McShane and others, 2004). The status of populations in Alaska and BC is less clear, but possibly declining rapidly in most areas, especially Southeast Alaska (Piatt et al. 2007). The USFWS is currently re-reviewing the status of the murrelet and considering whether it should be listed throughout its range. The results of this study will help with establishing and interpreting new population surveys in Southeast, and contribute to conservation of the species in Alaska and the North Pacific.

V. SUMMARY OF WORK COMPLETED ON JOBS FOR LAST SEGMENT PERIOD ONLY *(July 1, 2007 – December 31, 2007)*

JOB/ACTIVITY A: Collect existing datasets and summarize methodological details on each.

Completed. See Appendices 1 and 2 of full final report. Funds spent on an hourly biologist.

JOB/ACTIVITY B: Collect additional marbled murrelet at-sea protocols from British Columbia, Washington, and Oregon and summarize methods.

Protocols (and data) for British Columbia were collected and summarized (see Appendix 2). Protocols for Washington and Oregon were not specifically summarized, although additional eneral strip transect protocols were collected and summarized (e.g., Gould and Forsell Balance; see Appendix 2). Funds spent on an hourly biologist.

JOB/ACTIVITY C: Determine the statistical power of existing survey data to detect significant trends.

Completed. See final report. Funds spent on statistical consultant.

JOB/ACTIVITY D: Prepare final reports and publications.

Completed. Funds spent on statistical consultant. Matching funds (Parrish) and in-kind personnel (Piatt) also used.

VI. PUBLICATIONS

No peer-reviewed publication has resulted from this work. A final report has been submitted:

Nations, C., McDonald, L., and Parrish, J. 2008. Power to Detect Trends in Brachyramphus Murrelet Populations in Southeast Alaska. Final Report for the Alaska Department of Fish and Game. 70p.