Sea Duck Joint Venture
Annual Project Summary for Endorsed Projects
FY 2007 – (October 1, 2006 to Sept 30, 2007)

Project Title:

Distribution of Sea Ducks in Southeast Alaska: Geographic Patterns and Relationships to Coastal Habitats. SDJV Project # 86. Year 1 of 2 years.

Principal Investigators:

Jerry Hupp, U.S. Geological Survey, Alaska Science Center, 1011 E. Tudor Road, Anchorage, AK, USA, 99508 (jerry_hupp@usgs.gov)

Dora Repard, School of Resource and Environmental Management, Simon Fraser University, 8888 University Drive, Burnaby, BC, Canada (trepard@sfu.ca)

John Hodges, U.S. Fish and Wildlife Service, Migratory Bird Management, 3000 Vintage Blvd, Juneau, AK, USA

Bruce Conant, U.S. Fish and Wildlife Service, Migratory Bird Management, 3000 Vintage Blvd, Juneau, AK, USA

Debbie Groves, U.S. Fish and Wildlife Service, Migratory Bird Management, 3000 Vintage Blvd, Juneau, AK, USA

Daniel Esler, Centre for Wildlife Ecology, Simon Fraser University, 5421 Robertson Road, Delta, BC, Canada (desler@sfu.ca)

Kristina Rothley, School of Resource and Environmental Management, Simon Fraser University, 8888 University Drive, Burnaby, BC, Canada (rothley@kutztown.edu)

Project Description:

Aerial surveys flown by the U.S. Fish and Wildlife Service (FWS) indicate that Southeast Alaska (Figure 1) provides winter habitat for at least 10 species of sea ducks totaling >300,000 individuals, making the region one of the most important sea duck wintering areas in the Pacific Flyway. In summer the region provides molting habitat for large numbers of scoters and mergansers. Despite this, relatively little is known about the coastal habitat requirements of many of the sea ducks that occur in this region.

This study utilizes existing aerial survey data collected by the FWS between 1996 and 2002 to examine sea duck distributions and relationships with coastal habitat attributes. The aerial surveys were very comprehensive and cover the majority of the Southeast Alaska coastline at a distance of ~50m from shore. Species extracted from the survey for analysis were: harlequin duck, black scoter, surf scoter, white-winged scoter, long-tailed duck, bufflehead, common goldeneye, Barrow’s goldeneye, common merganser, and red-breasted merganser. These could not all by identified to species during the survey, therefore some species were grouped (e.g.

Common and Barrow's goldeneye). Sea duck observations and habitat attributes have been summarized using GIS. Analysis of summary plots will include species diversity indices and generalized linear modeling to identify important habitat attributes. Results will be provided for summer and winter habitat use by species group.

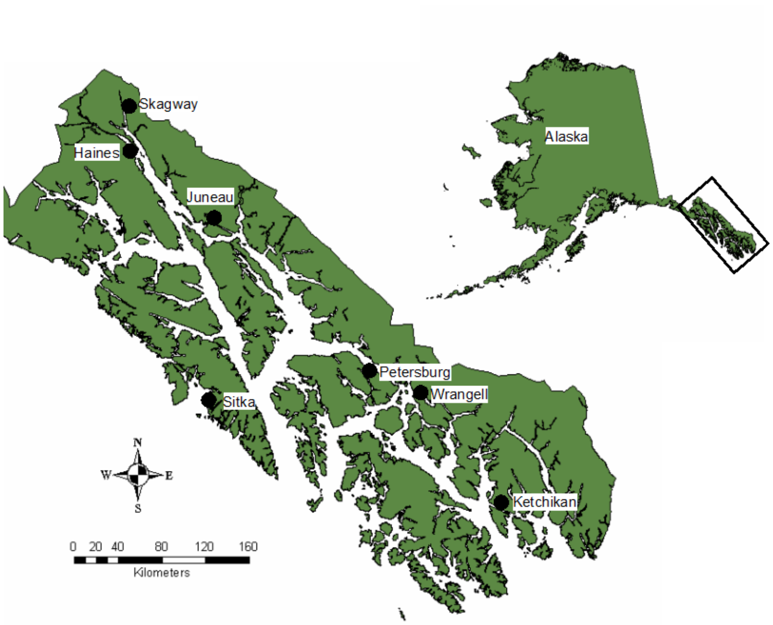


Figure 1: Study Location – Southeast Alaska

Objectives:

1. Document and map regional patterns of species diversity among sea ducks that occur in Southeast Alaska.

2. Compare regional distributions of scoters, harlequin ducks, goldeneye, bufflehead, long-tailed ducks, and mergansers in Southeast Alaska.

3. For each species or species group of sea ducks, assess consistency in distributions across years, and similarities between summer and winter distributions.

4. For each species or species group, develop and test models describing seasonal relationships between characteristics of shoreline or nearshore environments and numbers of sea ducks.

This project contributes to the identification of important coastal sea duck habitats, a SDJV priority. The characterization of winter habitats in particular was identified by the SDJV strategic plan (2001) as a moderate to high research need for most species of sea ducks that occur in Southeast Alaska.

Preliminary Results*:*

Data collection and compilation
Sea duck observations were imported and displayed in ArcGIS. This gave a preliminary visualization of areas where species groups were congregating, summer and winter. (e.g. Figures 2a, 2b).

Figure 2a – Summer scoter distribution in southeast Alaska

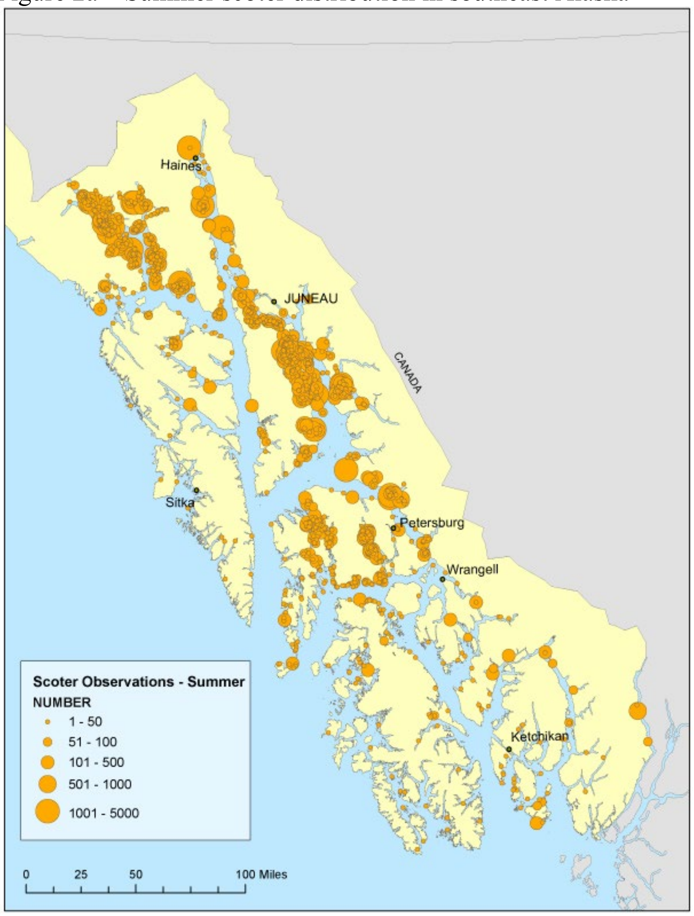
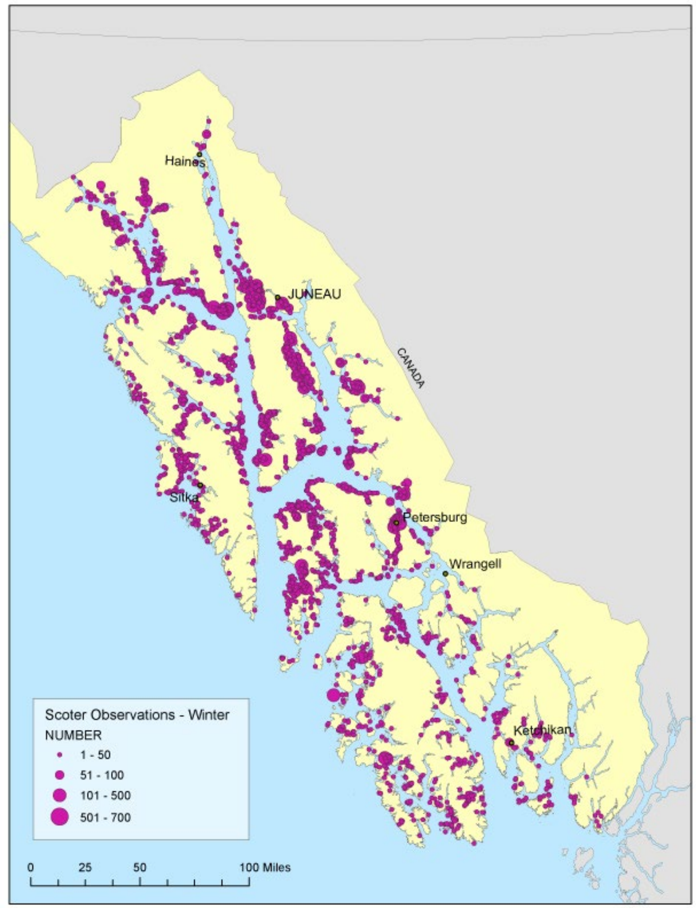


Figure 2b – Winter scoter distribution in southeast Alaska



Habitat attribute data were collected from the Nature Conservancy Alaska Chapter and the United States Geological Survey (USGS). In 2005, the Nature Conservancy Alaska compiled a comprehensive dataset of shoreline attributes for Southeast Alaska. Original sources for this data are NOAA, U.S. Forest Service, USGS, and FWS. The dataset includes information about shoreline substrate, slope, width, depth offshore, and exposure. This dataset was supplemented by stream data from the USGS National Hydrography Dataset. In order to examine habitat associations, sea duck and habitat variables were summarized into 4500 randomly selected plots with a 0.5 mile radius using ArcGIS.

Habitat Association Models

Summer and winter sea duck observation data are being modeled separately by species group. For both seasons, plots containing sea duck and habitat attribute information are being analyzed using Generalized Linear Modeling (GLM) techniques. Due to a large proportion of zeros, a two step "hurdle" approach is being used. Presence/absence is modeled using logistic regression, and presence-only count data is modeled using poisson regression. Global models (containing all habitat attributes) using logistic regression on presence/absence data have been run for all species groups in the winter season.

Model Selection and Parameter Estimation

For each species group, season, and model (presence/absence and count), Akaike's Information Criterion (AIC) is being used to compare candidate models that have different combinations of predictor variables and select the most parsimonious model(s). Weighted model parameter estimates are being used to estimate effect sizes. Models of Harlequin duck presence/absence data for the winter season are presented below as an example (Tables I-II).

Table I: Harlequin winter habitat association models ranked by Akaike weight

Model (see Parameter description in Table **)	Delta AIC	Akaike weight
2,3,4,6,7	0	0.241756249
2,3,4,6	0.4	0.197933275
1,2,3,4,6,7	1.2	0.132678642
2,3,4,5,6,7	1.2	0.132678642
1,2,3,4,6	1.6	0.108628085
2,3,4,5,6	2.2	0.080473664
1,2,3,4,5,6,7	2.6	0.065886264
1,2,3,4,5,6	3.6	0.039962039

Table II: Harlequin winter habitat association models parameter estimates (for presence)

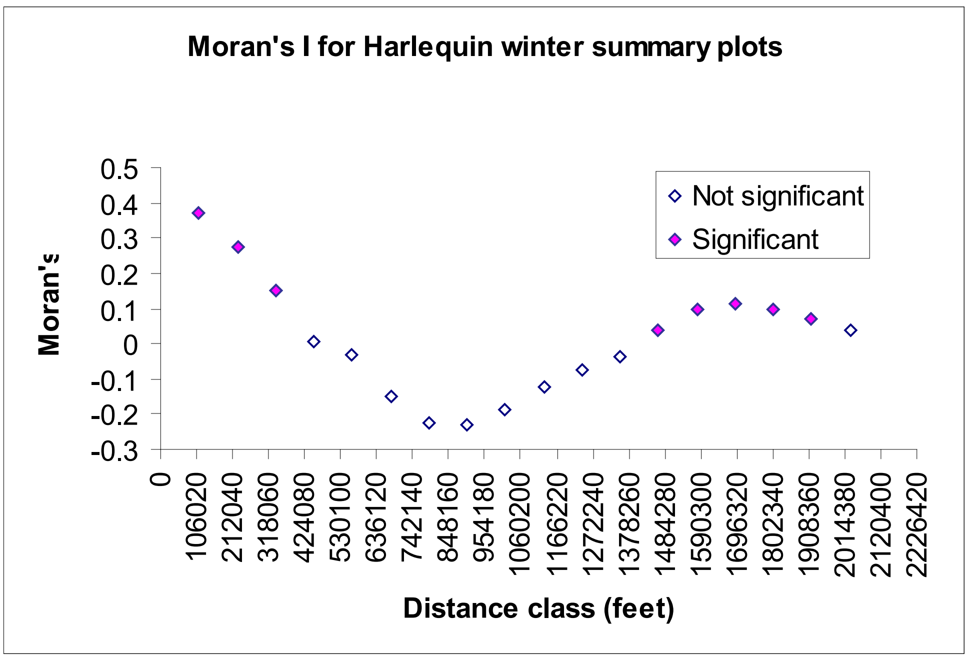
Parameter	Summed Akaike weight	Weighted Parameter Estimate	SE
1. Number of perennial stream outflows	0.347	-0.0237	0.0280
2. Average High Tide - Low Tide Width (m)	1.000	-0.0072	0.0016
3. Maximum Depth within 1km of shoreline (m)	1.000	0.0141	0.0019
4. Average Exposure (no units)	1.000	0.0039	0.0006
5. Number of Islets <1ha	0.319	0.0060	0.0081
6. Percentage of shoreline that contained rock as opposed to sand, gravel etc.	1.000	1.0932	0.1326
7. Distance to outer coast (categorized as shoreline that was "very exposed) (km)	0.573	0.0019	0.0012

These results indicate that the probability of harlequin duck presence is very strongly related to intertidal width, maximum depth, exposure, and percent rock. The weight parameter estimates and associated SE can be interpreted to indicate the direction and strength of the relationships.

Spatial Autocorrelation

A further refinement of this study is the consideration of spatial autocorrelation (SA). Individual observations in a dataset that is spatially autocorrelated cannot be considered entirely independent, and can result in a higher rate of Type I errors. An initial examination of winter Harlequin summary plot data using Moran's I calculations suggests that some positive spatial autocorrelation is present (Figure 3) in both small and large distance classes. In order to correct for this, additional explanatory variables can be included in the model. Different variables are currently being tested for their ability to reduce the effects of spatial autocorrelation on the model.

Figure 3: Results of Moran's I tests for spatial autocorrelation in Harlequin winter plots



Project Status ***(e.g., did you accomplish objectives, encounter any obstacles, what are your plans for the future?)***

The project is moving ahead as planned, and good progress has been made towards meeting our objectives in the specified (2yr) timeframe. Analysis of habitat associations (objective 4) is nearing completion, and formal writing will begin shortly. This is the largest of the four objectives, and the preparation it required lays a solid foundation for the completion of objectives 1-3. The only challenges encountered have been ensuring the statistical procedures required for analyzing habitat associations are stringent and up to current journal standards (e.g. Journal of Wildlife Management). For example, many recently published papers have incorporated spatial dependency into habitat models.

A proposal for the second year of funding has also been submitted to the SDJV. This proposal outlines our tasks for year 2, and estimated completion date (December 2008).

Project Funding Sources (US$)

SDJV (USFWS) Contribution	Other U.S. federal contributions	U.S. non-federal contributions	Canadian federal contributions	Canadian non-federal contributions	Source of funding (agency or organization)
15,400					
	19,500				USGS
	9000				USFWS
				12,000	SFU

Total Expenditures by Category (US$)

ACTIVITY	BREEDING	MOLTING	MIGRATION	WINTERING	TOTAL
Banding					
Surveys					
Research				55,900	55,900
Communication					
Coordination					