Project title: Annual cycle connectivity, inter- and intra-annual site fidelity, and habitat use of Pacific Barrow's Goldeneye (SDJV **Project # 85**; Year 3 of 3)

Principal Investigators:

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Project Description:

This project has helped fill some of the more important information needs for BAGO in the latest SDJV Strategic Plan, namely population delineation, population dynamics and population ecology. We marked individuals with satellite transmitters to quantify these important demographic attributes. Our project is generating information on seasonal connectivity, site fidelity and dispersal rates of all BAGO age and sex classes.

Objectives:

1) What are the rates, and geographic scale, of inter-annual site fidelity by different sex and age classes at various stages of the annual cycle (i.e., winter, breeding, molt)?
2) Do birds from the same breeding site occur in discrete areas during winter, or are they widely distributed, and vice versa?
3) How do the answers to 1 and 2 above combine to indicate demographically distinct management units?
4) Are there important habitats or specific sites that are used by a large proportion of marked birds, which would indicate their value for conservation?

Results

We deployed over 110 PTTs on BAGOs in BC to date. This involves all age and sex classes and encompasses breeding adults and young at Riske Creek BC (interior, south-central BC) and wintering adults at Indian Arm BC (near Vancouver) (see Table 1). We used PTT units manufactured by Microwave Ltd and HABIT Research. Most of the Microwave transmitters generated reasonably good location data over the course of their expected life-spans but most of the HABIT units produced poor data or failed prematurely. Largely because of this, our effective sample size is more on the order of 50-60 PTTs and most of these involve birds marked at Riske Creek.

Table 1: BAGO PTTs deployed during 2006 - 2009.

	Males	Females	HYs
Indian Arm (near Vancouver), wintering area			
Deployed Feb 2007	10	10	
Riske Creek, interior BC, breeding area			
Deployed May 2006	20		
Deployed May 2007	15		
Deployed May & Aug 2008	10	10	22
Deployed Aug 2009			17

Indian Arm, winter: In February of 2007, we marked 10 adult males and 10 females wintering in Indian Arm near Vancouver BC. Unfortunately, half the PTTs deployed were HABIT units which performed very poorly, generating very little information and for only a short period. Of the 20 birds marked, only 8 (3 males and 5 females) produced enough location data to map winter to breeding affiliations and only 2 females showed a full annual cycle. Hence, the tagging in Indian Arm resulted in a small effective sample size and poor geographic coverage. The data from the surviving birds/radios showed that both sexes dispersed over a broad area, spanning from Washington State to northern BC and west-central Alberta. Based on location/movement data, 3-4 females appeared to breed successfully while the males departed their respective breeding areas during mid-incubation and flew north to molt.

Riske Creek, breeding: In May 2006, 2007, and 2008, we marked adult males breeding at Riske Creek. From June to October each year these males showed the same general pattern of movement; i.e., almost all birds moved north to molt, with some migrating as far north as Great Bear Lake and Great Slave Lake, Northwest Territories (see the web site listed below for details). In addition, the data suggested a definite connection with a molting/staging lake in northern Alberta; roughly 30% of all males marked at Riske Creek were found to consistently use Cardinal Lake AB from June to November each year. From early November to late April all birds wintered on the Pacific coast, from northern Washington State to southern Alaska.

With EC funding, we secured 17 Microwave PTTs to mark HY birds in August 2009 at Riske Creek. Of these 17 units, 16 (9 HY males and 7 HY females) generated good location data through the fall period, along with 7 (of 10 original) adult females and 7 (of 10 original) adult males marked in 2008 at Riske Creek. All 7 adult females returned to Riske Creek in 2009 and 2 successfully raised broods. Fifteen of the 17 hatch year birds provided enough data to map their movement patterns from Riske Creek to the coast in 2009 (see map below). These HY birds dispersed widely over the coast in winter, from southern WA State to just north of Vancouver Island; this dispersal pattern is probably

representative of most interior breeding sites in southern BC. From this study we also learned that HY BAGOs separate from their mothers and siblings in late summer and travel independently to the coast.

Project Status

To describe the movement patterns of Pacific BAGOs marked at Indian Arm and Riske Creek, BC, and Prince William Sound, AK, we developed the following web site:

http://www.sfu.ca/biology/wildberg/CWESeaducksfolder/BAGOwebpage/BAGOMigrationHome.html

The web site shows maps of individual migration routes as well as connectivity patterns between breeding and molting sites, molt and winter sites, etc. The maps contain Argos data only to December 2009; data recorded since then to the present are currently being analysed and maps will be uploaded to the web site soon.

We are slowly accomplishing our goal of marking Pacific BAGOs to describe affiliations and delineate population management units. Each PTT has been programmed to generate location over at least two annual cycles to understand individual variation in movement patterns and site-fidelity across years. These data are needed to manage and conserve Pacific BAGO which is a high priority species for the SDJV.

To date, we have marked BAGOs intensively at an important breeding site (Riske Creek, BC), at an important molting site (Cardinal Lake, AB, described elsewhere), and at two wintering sites (Indian Arm, BC; and Prince William Sound, AK, described elsewhere). Sample sizes and Argos data derived from PTT deployments at Riske Creek and Cardinal Lake are considered to be sufficient but the winter range still has some major gaps. First, Indian Arm and Prince William Sound are at the southern and northern limits of the coastal winter range for BAGOs, respectively. The large majority of the Pacific population winters between these two extremes, suggesting that PTT marking somewhere in the middle (eg., Juneau, AK) is warranted. Second, poor weather, premature PTT failure, and bird mortality at both Indian Arm and Prince William Sound have resulted in low sample sizes for adult males and females at both sites. Additional markings are warranted to improve our understanding of BAGO movement patterns and affiliations; this should be done just prior to spring migration, to minimize weather related problems and to ensure that birds are in relatively good condition.

Argos data will continue to be downloaded and used to update the maps on the web site. Once we have completed marking at all key sites and all PTTs have stopped transmitting, we will merge the data from all BAGO sub-projects and analyse over the broadest geographic scale. Results will be published in a major report and journal papers to answer the questions posed in the Objectives section.

Movement Patterns of Hatch Year BAGOs from Riske Creek to the Coast, 2009