Sea Duck Joint Venture
Annual Project Summary for Endorsed Projects
FY 2005 – (October 1, 2004 to Sept 30, 2005)

Project Title (SDJV Project #45): Tracing Sources of Nutrients and Energy for Clutch Formation by White-winged Scoters (WWSC)

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Project Description:

In waterfowl, the egg synthesis stage of reproduction is particularly challenging, requiring large amounts of nutrients and energy over a relatively short period. Because waterfowl are diverse in morphology, distribution, behavior, and diet, considerable interspecific (and even intraspecific) variation exists in reliance on endogenous reserves for clutch formation. A study of prairie-nesting WWSC used proximate analyses to reveal that nutrients for egg production were primarily derived from dietary sources; endogenous reserves were used to a lesser extent during incubation. However, more recent studies on related species have indicated that relying only on proximate analyses without directly tracing nutrient pathways can produce misleading results. Also, this previous study did not consider birds from multiple breeding locations.

We are identifying important habitats for WWSC by determining where and when females acquire nutrients for reproduction. This is important because (1) the reasons for scoter declines are unknown; (2) WWSC strategies for nutrient acquisition are unclear; (3) acquisition and allocation of nutrients for reproduction have been linked to waterfowl productivity; and (4) this work will result in clear implications for management of habitats that contribute to WWSC productivity. In conjunction with related studies, samples of adult female reserves and reproductive tissue, as well as key prey items, were collected in 2004 and 2005 in three breeding areas (Figure 1).

Objectives:

Our primary objective is to use tissue and prey samples available from multiple concurrent and past studies to evaluate the timing and location of nutrient and energy acquisition for reproduction by female WWSC across their breeding range in western North America.

Preliminary Results:

1. Table 1 summarizes the prey and WWSC tissues we acquired in 2003-05 from three breeding areas and one marine area used by WWSC from winter into spring staging.

2. Research on marine staging areas indicates that many WWSC build substantial energy reserves at herring spawning events prior to departure for breeding areas. Figure 2 summarizes dominant fatty acids of WWSC reserves at these staging areas. If this pattern of fatty acids seen on marine staging areas is later found in the lipid fraction of their egg yolks, it would indicate use of marine-derived endogenous nutrients for clutch formation. The same signature in the adipose depots of adult females on breeding areas would signify use of marine fatty acids for maintenance costs during the nesting cycle.
3. Satellite telemetry indicates that WWSC wintering in Puget Sound and the Strait of Georgia typically depart from marine habitats for their inland breeding areas no later than mid-May. Recent studies have indicated that average nest initiation dates in the boreal forest and prairie parkland occur in mid-June. The increased metabolic demands of migration and a month of foraging in inland wetlands may contribute to substantial turnover in reserves. If so, nutrients from freshwater systems acquired either en route to or on nesting sites (thus comprising endogenous and/or exogenous reserves) may be important to reproduction.

Table 1. WWSC and prey tissues collected in 2003-05.

WWSC Tissues - Marine Areas

Tissue Type	*Quantity*	*Collection Date*	*Collection Location*
Subcutaneous adipose	213	Spring 2003 and 2004	Strait of Georgia, BC
Blood (plasma, cellular)	130	Spring 2003 and 2004	Strait of Georgia, BC

WWSC Tissues - Breeding Areas

Tissue Type	*Quantity*	*Collection Date*	*Collection Location*
Eggs	23	2004	Yukon Flats NWR, AK
Subcutaneous adipose	51	2004	Lower Mckenzie River Watershed, NWT
Eggs and Follicles	7 Eggs/23 Follicles	2004	Lower Mckenzie River Watershed, NWT
Subcutaneous adipose	50	2005	Lower Mckenzie River Watershed, NWT
Eggs	15	2005	Lower Mckenzie River Watershed, NWT
Eggs	112	2004	Redberry Lake, Saskatchewan
Eggs	In transit	2005	Redberry Lake, Saskatchewan

Prey - Marine Areas

Tissue Type	*Quantity*	*Collection Date*	*Collection Location*
Invertebrate Prey	Many	Spring 2003 and 2004	Puget Sound, WA
Bivalve Prey	Many	Spring 2004	Strait of Georgia, BC
Spawn	~5 samples/location	Spring 2003 and 2004	SF Bay, Puget Sound, Strait of Georgia, SE AK

Prey - Breeding Areas

Tissue Type	*Quantity*	*Collection Date*	*Collection Location*
Invertebrate Prey	Many	June, August 2002-03	Yukon Flats NWR, AK
Amphipods	Many	June, August 2005	Lower Mckenzie River Watershed, NWT

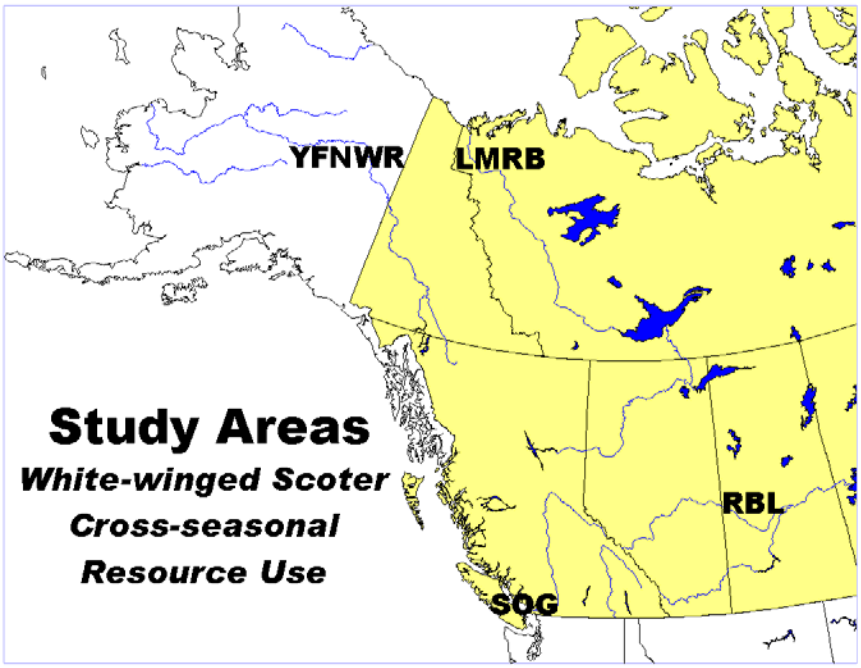

Figure 1. Study areas at which reproductive and adult WWSC tissues and prey items have been collected: Yukon Flats National Wildlife Refuge, AK (YFNWR), Lower Mackenzie River Watershed, Northwest Territories (LMRW), and Redberry Lake, Saskatchewan (RBL). To identify marine-derived sources of reproduction, adult WWSC tissues and prey items were collected from multiple spring staging areas in the southern Strait of Georgia, B.C. (SOG).

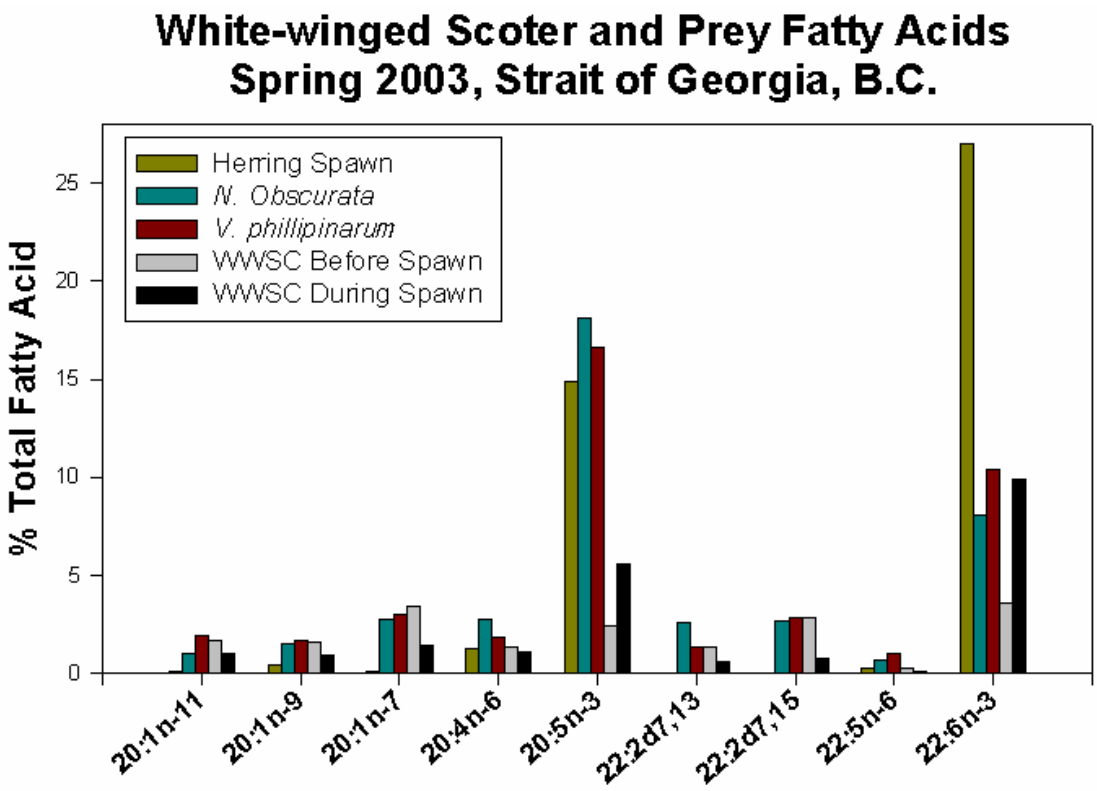

Figure 2. Comparative samples of fatty acids in WWSC subcutaneous adipose derived from their common marine prey in the southern Strait of Georgia, B.C. *N. obscurata* and *V. phillipinarum* are bivalves that constitute a large fraction of WWSC winter diet at this coastal site. Only the dominant fatty acids derived exclusively from the diet (i.e., those that

cannot be synthesized *de novo* by animals) are included. WWSC were captured at multiple times in late winter into periods of spring staging (including the period before and during herring spawning events).

Project Status

Some waterfowl species display inter-annual variation in where nutrients are derived for breeding efforts. Thus, in the summer of 2005 we gathered additional adult, reproductive, and prey tissues from the Lower Mackenzie River Watershed and Redberry Lake (collection opportunities did not exist for Yukon Flats). Final samples were gathered in August 2005. Prior to initiation of this study, samples were collected by independent projects using variable protocols. This presented a challenge, in particular, for preparation of fatty acid signatures from egg constituents. Technicians at Sara Iverson's lab at the University of Dalhousie have verified that preparations will be possible, and with their assistance we are developing appropriate protocols. Preparation of samples from breeding areas was begun in September 2005 and should be complete by February 2006. We have prepared an initial set of samples from the Strait of Georgia; additional samples will be processed if warranted by preliminary analyses. We plan to complete analyses and a manuscript by early 2007.