Sea Duck Joint Venture
Annual Project Summary for Endorsed Projects
FY 2009 – (October 1, 2008 to Sept 30, 2009)

Project Title:
Relationships between breeding, molting, and wintering sites of Common Eiders (*Somateria mollissima dresseri*) - SDJV #118

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Project Description:
The extent of the breeding range of the American Common Eider (*Somateria mollissima dresseri*) is well known, and many important molting and wintering sites have been identified. Geographic links between breeding, molting, and wintering areas, however, are poorly understood, but must be delineated to define management objectives for *S. m. dresseri*. Satellite telemetry and hunter band recovery information indicate that some eiders breeding across the range of *S. m. dresseri* use common molting and wintering sites, suggesting this subspecies can be managed as one population unit. However, the proportion of females from each breeding colony that use similar molting sites is unknown. Attention also needs to be given to determining the origin of harvested birds. The sample sizes required to obtain this information are unattainable with exogenous markers.

Stable isotopes ($\delta^{15}N$, $\delta^{13}C$, δD, $\delta^{34}S$) are powerful tools for quantifying movements and origins of Anatinae because their signatures reflect those in local food webs during feather growth (Clark et al. 2006). The basis of our study is to isotopically define molting regions of females breeding in colonies throughout the range of *S. m. dresseri*. We are using a sample of the ninth primary from females captured at breeding colonies in 5 regions: 1) St. Lawrence Estuary, 2) upper Gulf of St. Lawrence, 3) Labrador, 4) Nova Scotia, and 5) Maine (Table 1). We will associate these females to their previous season's molting site by comparing their primary's isotope signatures with those from primaries of flightless AHY females captured at molting sites in 5 regions: 1) St. Lawrence Estuary – north shore, 2) St. Lawrence Estuary – south shore, 3) upper Gulf of St. Lawrence, 4) Labrador, and 5) Maine.

Objectives:
Our main goal is to quantify affiliations between breeding sites and molting regions of female *S. m. dresseri*. Specifically, we aim to determine variation in use of molting regions by females within and among major breeding colonies. Second, we want to develop a tool for determining the origin of harvested birds (molting regions for AHY birds and breeding areas for HY birds). This will be achieved by obtaining isotope signatures from growing primaries of AHY birds at molting sites and from pre-fledged birds (HY) at breeding sites across the range of *S. m. dresseri*. Finally, we will examine variation in chronology of wing molt between female age classes (subadults and adults), years, and regions (St. Lawrence Estuary, Gulf of St. Lawrence, Labrador, Maine). This information will be obtained by determining the stage of wing molt for females captured and collected for isotope analyses.

Preliminary Results:
Breeding birds. In spring 2009, we collected feather samples from female eiders captured at 14 colonies (Table 1). Samples were forwarded to the stable isotope laboratory in Saskatoon to determine values of $\delta^{15}N$, $\delta^{13}C$, δD, and $\delta^{34}S$. For females captured in the St. Lawrence Estuary, Gulf of St. Lawrence, and Maine, we obtained values of $\delta^{15}N$ and $\delta^{13}C$ for their 2008 molting sites (Fig. 1). We identified 2 major isotope clusters: one with relatively high values of both $\delta^{15}N$ (Mean = 14.9‰ SD = 0.8) and $\delta^{13}C$ (Mean = -12.8‰ SD = 1.6) and one with lower $\delta^{15}N$ (Mean = 12.5‰ SD = 0.6) and $\delta^{13}C$ (Mean = -16.4‰ SD = 0.9; from cluster analysis). Globally, approximately 50% of eiders that nested in the St. Lawrence Estuary colonies were represented in both clusters, whereas >85% of birds breeding in the Gulf of St. Lawrence and in Maine were in the cluster with relatively low $\delta^{15}N$ and $\delta^{13}C$ (Fig. 1). Higher values of $\delta^{15}N$ and $\delta^{13}C$ may be associated with greater freshwater input (Knoche et al. 2007), so it is conceivable that females breeding in the St. Lawrence Estuary molted previously at sites with relatively high (e.g., the estuary) and low (marine sites) freshwater input, whereas those that nested on Île aux Oeufs and in Maine molted primarily at marine sites. This supports satellite telemetry results showing that some females breeding in the St. Lawrence Estuary remain in the estuary to molt, while others molt in coastal Maine (Savard et al. 2008).

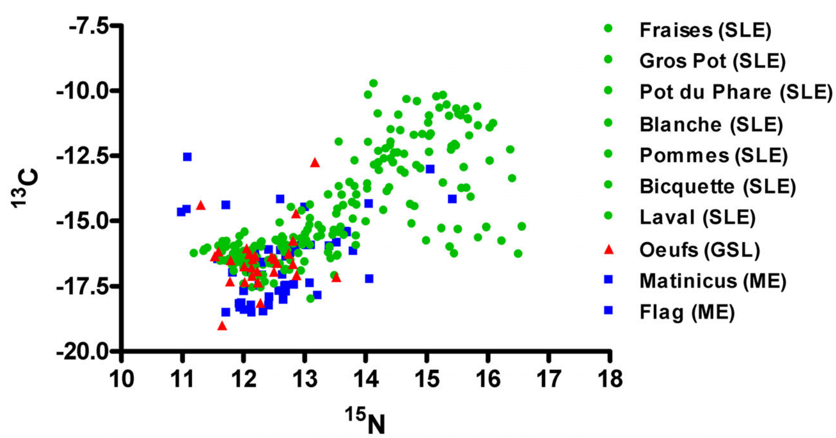

Figure 1. Values of $\delta^{15}N$ and $\delta^{13}C$ from ninth primary feathers of female *S. m. dresseri* captured in breeding colonies in the St. Lawrence Estuary (SLE), Gulf of St. Lawrence (GSL), and Maine (ME), spring 2009. **Values reflect isotope signatures of molting sites used in 2008.**

Table 1. Number of *S. m. dresseri* females sampled for stable isotope analyses, 2009. SLE – St. Lawrence Estuary, GSL – Gulf of St. Lawrence, LAB – Labrador, NS – Nova Scotia, ME – Maine.

		Stable isotope			
Breeding colony (region)	N females	$\delta^{15}N$ (‰) $\bar{x}$ (±SD)	$\delta^{13}C$ (‰) $\bar{x}$ (±SD)	δD	$\delta^{34}S$
Île aux Fraises (SLE)	30	13.0 (±1.4)	-15.4 (±1.6)	✓	✓
Gros Pot (SLE)	29	14.1 (±1.3)	-13.5 (±2.2)	✓	✓
Pot du Phare (SLE)	24	13.6 (±1.5)	-15.3 (±1.8)	✓	✓
Île Blanche (SLE)	29	13.9 (±1.2)	-14.2 (±1.8)	✓	✓
Île aux Pommes (SLE)	40	14.0 (±1.5)	-14.0 (±2.1)	✓	✓
Île Bicquette (SLE)	30	12.9 (±1.0)	-15.9 (±1.6)	✓	✓
Île Laval (SLE)	30	13.2 (±1.1)	-14.7 (±2.2)	✓	✓
Île aux Oeufs (GSL)	30	12.3 (±0.5)	-16.5 (±1.1)	✓	✓
Île Fantôme (GSL)	30	✓[a]	✓	✓	✓
Île Innu (GSL)	30	✓	✓	✓	✓
Île Madam (NS)	5	✓	✓	✓	✓
Table Bay (LAB)	40	✓	✓	✓	✓
Matinicus Island (ME)	25	13.0 (±0.9)	-16.1 (±1.0)	✓	✓
Flag Island (ME)	25	12.3 (±0.7)	-17.0 (±1.7)	✓	✓

[a] Analyses to be be completed by December 2009.

Molting birds and ducklings. In September 2009, we captured and collected AHY and HY birds (Fig. 2) to characterize stable isotope signatures at molting and breeding regions across the range of *S. m. dresseri* (Table 2). Feather samples are being forwarded to Saskatoon for stable isotope analyses ($\delta^{15}N$, $\delta^{13}C$, δD, $\delta^{34}S$).

Molt chronology. Mean ninth primary length of 29 AHY females collected with growing remiges during 5-10 September 2009 in the St. Lawrence Estuary and Gulf of St. Lawrence was 54 mm (95% CI: 42-66 mm) and ranged from 1 to 128 mm. Assuming a ninth primary growth rate of 4 mm day^{-1} (van de Wetering and Cooke 2000), the average date that new remiges emerged was 26 August (95% CI: 23-29 Aug., range 8 Aug.-10 Sept.), indicating that many of these birds were in the earliest stages of flightlessness. Birds collected in the St. Lawrence Estuary initiated growth of new remiges (Mean = 26 Aug., 95% CI: 22-29 Aug., *n* = 20) at about the same time as those collected in the Gulf of St. Lawrence (Mean = 26 Aug., 95% CI: 10 Aug.-3 Sept., *n* = 9).

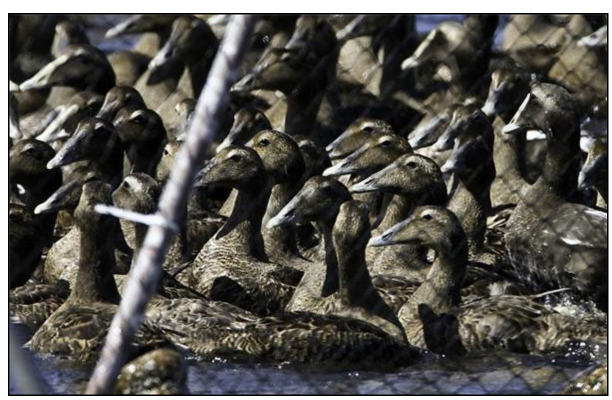

Figure 2. AHY female *S. m. dresseri* during

molt drive near Milbridge, ME, Sept. 2009 (Photo courtesy of B. Allen).

Table 2. Number of molting adults and pre-fledged juveniles *S. m. dresseri* captured in Labrador and Maine and collected in the St. Lawrence for isotope analyses, 2009.

	AHY Females	AHY Males	HY
Region			
SLE – north shore[a]	5	8	10
SLE – south shore [a]	15	6	9
Gulf of St. Lawrence [b]	11	7	11
Table Bay, Labrador	1	6	10
Milbridge, ME	10	6	0
TOTAL	42	33	40

[a]SLE – St. Lawrence Estuary. North shore study sites were at Baie des Milles-Vaches and Godbout, and south shore sites were at Parc du Bic and Tartigou.
[b]Study sites were at Havre-Saint-Pierre and Pontbriand.

Project Status:

We met our main field objectives for May-September 2009 by collecting feather samples of breeding females, molting AHY males and females, and ducklings across the range of *S. m. dresseri*. We confirmed that it is feasible to obtain the necessary samples sizes for most breeding and molting sites, whether by collecting (molting birds in the St. Lawrence Estuary and Gulf of St. Lawrence) or capturing birds. We identified important female molting sites along the north (Godbout area) and south (Matane area) shores of the St. Lawrence Estuary and in the upper Gulf of St. Lawrence, particularly in the Mingan Archipelago National Park Reserve of Canada.

Our preliminary stable isotope results indicate that this method shows considerable promise for affiliating adult female *S. m. dresseri* to their molting regions. We therefore expect to continue developing our study in 2010 and 2011. Our interpretation that females breeding in the St. Lawrence Estuary undergo wing molt in the estuary and in marine environments whereas eiders nesting in the Gulf of St. Lawrence and in Maine molt primarily in marine environments, however, is speculative and needs to be confirmed once we delineate isotope signatures of the five molting regions (by late October). By isotopically defining molting sites, we expect to link females to their molting regions and have a better understanding of the sources contributing to variation in isotope signatures (e.g., for those nesting in St. Lawrence Estuary). Finally, we anticipate determining δD and $\delta^{34}S$ values by the end of 2009 for all breeding females, including those captured in the Gulf of St. Lawrence (Îles Fantôme and Innu), Nova Scotia, and Labrador. This information may help distinguish molting sites of breeding females, especially among marine sites located at different latitudes. It will provide additional insight into potential variation in stable isotope values among females within (between colonies) and between breeding regions.

In 2010 and 2011, we will collect ninth primary feather samples from breeding females, molting AHY birds, and ducklings at our study sites. Accordingly, we plan to examine annual variability in isotope signatures at molting sites, to examine molting site fidelity among banded females recaptured at breeding colonies, and to work with wildlife agencies to further develop a tool for determining the origin of harvested *S. m. dresseri*. This will be done in collaboration with Chris Dwyer who recently submitted a proposal to the Survey, Monitoring and Assessment program within the Division of Migratory Birds of the USFWS to look at samples obtained from eider wings collected during the USFWS/CWS Parts Collection Survey.

Literature Cited:

Clark, R. G., K. A. Hobson, L. I. Wassenaar. 2006. Geographic variation in the isotopic (δD, $\delta^{13}C$, $\delta^{15}N$, $\delta^{34}S$) composition of feathers and claws from Lesser Scaup and Northern Pintail: implications for studies of migratory connectivity. Canadian Journal of Zoology 84:1396-1401.

Knoche, M. J., A. N. Powell, L. T. Quackenbush, M. T. Wooller, and L. M. Phillips. 2007. Further evidence for site fidelity to wing molt locations by King Eiders: integrating stable isotope analyses and satellite telemetry. Waterbirds 30:52-57.

Van de Wetering, D., and F. Cooke. 2000. Body weight and feather growth of male Barrow's Goldeneye during wing molt. Condor 102:228-231.

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 (name of agency or organization)
$ 38 180					
		$ 3 650			Maine DIFW
			$ 12 300 *$ 10 425*		Env. Canada S & T
			$ 3 650		CWS NF/Labrador
				$ 8 000	Duvetnor
				$ 7 250	UQAM

In-kind contributions in italics

Total Expenditures by Category (SDJV plus all partner contributions; US$):

ACTIVITY	BREEDING	MOLTING	MIGRATION	WINTERING	TOTAL
Banding (include only if this was a major element of study)	**$ 10 000**	**$ 5 000**			**$ 15 000**
Surveys (include only if this was a major element of study)					

Research	**$ 33 000**	**$ 35 455**			**$ 68 455**