Sea Duck Joint Venture
Annual Project Summary for Endorsed Projects
FY 2010 – (October 1, 2009 to Sept 30, 2010)

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

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Project Description:
The American Common Eider (*Somateria mollissima dresseri*) is the most hunted sea duck in eastern North America (Caithamer et al. 2000), yet the impacts of hunting on the population dynamics of this eider are unknown. Affiliations between breeding, molting, and wintering sites must be delineated so that population structure is understood and harvest management strategies are defined for *S. m. dresseri*. Telemetry and band recovery information indicate that at least some eiders breeding across the range of *S. m. dresseri* use common molting and wintering sites (Reed 1975, Savard et al. 2008), suggesting that this subspecies can be managed as one population. However, the proportion of females from each breeding colony that use common molting regions has not been quantified, and the origins of harvested adults (e.g., their molting region) and juveniles are poorly understood.

Stable isotopes are useful tools for quantifying the origins of Anatinae (Hobson 2005). The aim of our study is to evaluate the potential use of isotope signatures from growing ninth primaries of *S. m. dresseri* for delineating the major molting and rearing regions throughout the range of this eider: 1) southern Labrador, 2) St. Lawrence Estuary (north and south shores), 3) upper Gulf of St. Lawrence, and 4) Maine. Accordingly, this information may provide a basis for quantifying the origins of breeding, staging, and wintering birds.

Objectives:

1) To isotopically define molting and rearing regions of *S. m. dresseri*;
2) To determine variation in use and the extent of fidelity to molting regions by female eiders within and among breeding colonies throughout the range of *S. m. dresseri*; and
3) To develop a tool for determining the origins of harvested after hatch-year (AHY) males and females and juvenile males and females.

Preliminary Results:

1) *Isotopic delineation of eider molting regions*. Stable $\delta^{13}C$ and $\delta^{15}N$ signatures were obtained from a primary feather of 64 AHY female and male eiders captured or collected in Labrador, St. Lawrence Estuary, and Gulf of St. Lawrence in 2009 (Table 1). Isotope values varied little among sites within each region ($P \geq 0.23$) and between sexes ($P \geq 0.24$). $\delta^{13}C$ decreased with higher latitudes ($r^2 = 0.68$) and increased westward ($r^2 = 0.70$).

The three molting regions were discriminated by values of $\delta^{13}C$ and $\delta^{15}N$ ($\chi^2_4 = 105.32$, P < 0.001; from 1st discriminant function; Fig. 1). The function correctly classified 94% of all cases (100% in the St. Lawrence Estuary and 88% in Labrador and the Gulf of St. Lawrence).

Table 1. Stable isotope signatures from the ninth primary of molting AHY female and male *S. m. dresseri* captured or collected in Aug.-Sept. 2009. ✓ - awaiting results from isotope lab.

		Stable isotope			
Region and site	# of females/ # of males	$\delta^{15}N$ (‰) Mean ± SD	$\delta^{13}C$ (‰) Mean ± SD	δD	$\delta^{34}S$
Labrador					
Wolf Island	1/7	12.9 ± 1.3	-18.9 ± 0.3	✓	✓
Ledge Island	0/2	13.7 ± 1.2	-18.8 ± 0.5	✓	✓
Ferrets	0/6	13.8 ± 1.3	-19.0 ± 0.1	✓	✓
MEAN for region	-	13.3 ± 1.3	-18.9 ± 0.2	✓	✓
St. Lawrence Estuary					
Godbout	5/0	12.4 ± 0.6	-16.4 ± 0.6	✓	✓
Baie Milles-Vaches	0/8	12.7 ± 0.4	-16.6 ± 0.7	✓	✓
Parc du Bic	1/1	12.7 ± 0.3	-17.6 ± 0.2	✓	✓
Baie-des-Sables	5/2	12.7 ± 0.6	-16.6 ± 0.8	✓	✓
Tartigou	7/1	12.9 ± 0.5	-16.3 ± 1.0	✓	✓
Saint-Ulric	0/2	12.5 ± 0.6	-16.8 ± 1.1	✓	✓
MEAN for region	-	12.7 ± 0.5	-16.6 ± 0.8	✓	✓
Gulf of St. Lawrence					
Havre Ste-Pierre	2/5	12.1 ± 0.5	-18.3 ± 0.5	✓	✓
Pontbriand	7/2	12.1 ± 0.7	-18.9 ± 0.8	✓	✓
MEAN for region	-	12.1 ± 0.6	-18.7 ± 0.7	✓	✓
Maine					
Green Island	10/13	✓	✓	✓	✓

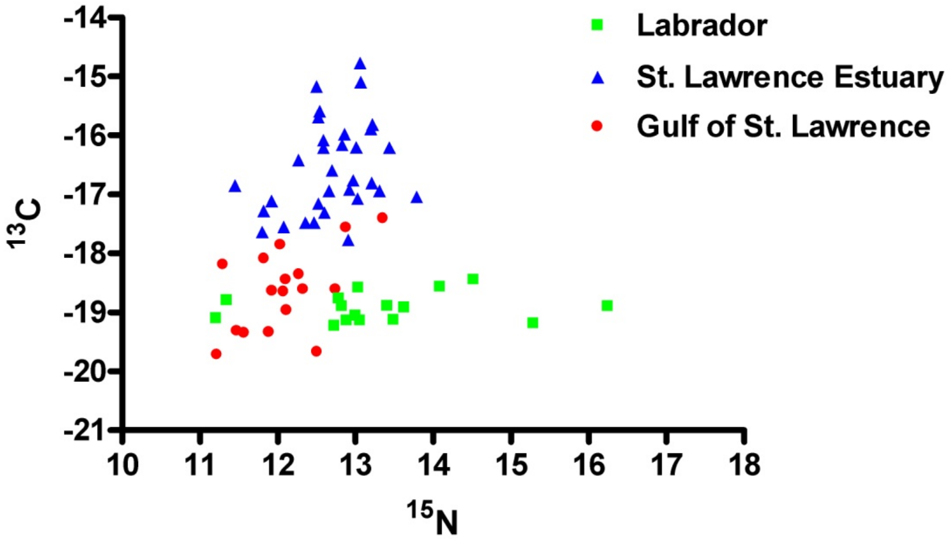

Fig. 1. Values of δ^{15}N and δ^{13}C from the ninth primary of molting AHY female and male *S*. *m*. *dresseri* captured or collected in August-September 2009.

2) ***Isotopic delineation of eider rearing regions*****.** Isotope signatures were obtained from a primary feather of 47 pre-fledging (hatch-year; HY) female and male eiders captured or collected in Labrador, St. Lawrence Estuary, and Gulf of St. Lawrence (Table 2). Values of δ^{13}C and δ^{15}N varied little among sites within each region and between sexes ($P \geq 0.12$). We found strong evidence that δ^{13}C decreased with increasing latitude (r^2 = 0.96) and increased westward (r^2 = 0.97). Feathers from HY birds had considerably higher values of δ^{13}C than those of AHY birds (Tables 1 and 2).

The three rearing regions were discriminated by values of δ^{13}C and δ^{15}N (χ^2_4 = 43.27, P < 0.001; from 1st discriminant function; Fig. 2). The function correctly classified 70% of all cases; (79%, 71%, and 55% in the St. Lawrence Estuary, Labrador, and the Gulf of St. Lawrence, respectively).

AHY female *S*. *m*. *dresseri* during molt drive near Milbridge, ME. (Photo courtesy of B. Allen).

3) ***Feather isotope values from breeding female eiders***. In the spring 2009, we obtained δ^{13}C and δ^{15}N signatures from a ninth primary feather of 386 AHY female eiders captured in 15 breeding colonies throughout the range of *S. m. dresseri* (Table 3). These signatures reflected those in local foods webs at molting regions during the summer of 2008. Isotope values in feathers from females breeding in the St. Lawrence Estuary were more variable than those from birds breeding in Labrador, the Gulf of St. Lawrence, and in Maine (Fig. 3). We identified considerable overlap in δ^{13}C and δ^{15}N signatures among feathers of most females breeding in the Gulf of St. Lawrence and in Maine and from about 60% of birds breeding in the St. Lawrence Estuary, suggesting that at least some females breeding in these regions use common molting regions.

Table 2. Stable isotope signatures from the ninth primary of pre-fledging HY female and male *S. m. dresseri* captured or collected in Labrador, St. Lawrence Estuary, and Gulf of St. Lawrence, August-September 2009. ✓ - awaiting results from isotope lab.

Region and site	# of females/ # of males	Stable isotope $\delta^{15}N$ (‰) Mean ± SD	$\delta^{13}C$ (‰) Mean ± SD	δD	$\delta^{34}S$
Labrador					
Paudy's Cove	1/1	11.7 ± 0.1	-15.9 ± 0.03	✓	✓
Wreck Cove	4/5	14.0 ± 1.2	-16.7 ± 1.7	✓	✓
Hackets Harbour	1/2	14.6 ± 1.1	-18.9 ± 0.1	✓	✓
Ferrets	0/3	13.7 ± 1.0	-19.0 ± 0.3	✓	✓
MEAN for region	-	13.8 ± 1.3	-17.4 ± 1.7	✓	✓
St. Lawrence Estuary					
Baie Milles-Vaches	2/8	13.0 ± 0.7	-13.2 ± 1.7	✓	✓
Parc du Bic	4/4	12.5 ± 0.4	-14.6 ± 0.7	✓	✓
Tartigou	1/0	12.9	-14.1	✓	✓
MEAN for region	-	12.8 ± 0.6	-13.8 ± 1.5	✓	✓
Gulf of St. Lawrence					
Havre Ste-Pierre	2/8	12.3 ± 0.7	-15.6 ± 1.7	✓	✓
Baie Johan-Beetz	0/1	11.1	-16.0	✓	✓
MEAN for region	-	12.2 ± 0.8	-15.6 ± 1.7	✓	✓

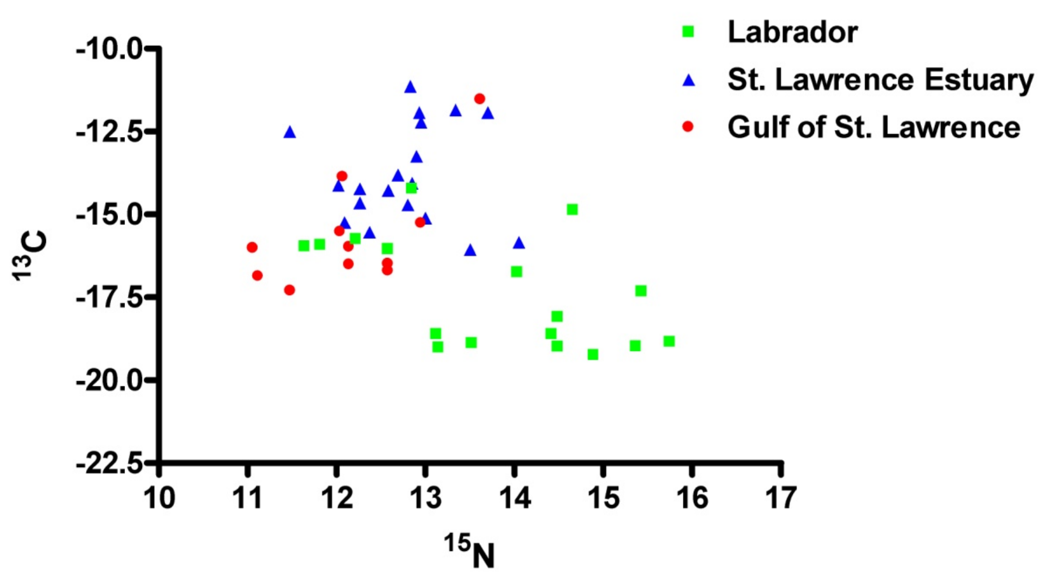

Fig. 2. Values of $\delta^{15}N$ and $\delta^{13}C$ from the ninth primary of pre-fledging HY female and male *S. m. dresseri* captured or collected in Labrador, St. Lawrence Estuary, and Gulf of St. Lawrence, August-September 2009.

Table 3. Stable isotope signatures from the ninth primary of AHY female *S. m. dresseri* captured at breeding colonies in Labrador, St. Lawrence Estuary, Gulf of St. Lawrence, and Maine, May-June 2009. Values reflect isotope signatures from molting sites in 2008. ✓ - awaiting results from isotope lab.

Region and island	# of females captured	Stable isotope $\delta^{15}N$ (‰) Mean ± SD	$\delta^{13}C$ (‰) Mean ± SD	δD	$\delta^{34}S$
Labrador					
Duck Island	17	13.4 ± 0.8	-17.6 ± 1.2	✓	✓
Green Island	24	12.9 ± 0.9	-18.8 ± 0.9	✓	✓
C. G. Green Island	25	12.8 ± 0.8	-18.3 ± 0.7	✓	✓
Big Grass Island	25	12.8 ± 0.8	-18.3 ± 0.9	✓	✓
St. Lawrence Estuary					
Île aux Fraises	30	13.0 ± 1.4	-15.4 ± 1.6	✓	✓
Gros Pot	29	14.1 ± 1.3	-13.5 ± 2.2	✓	✓
Pot du Phare	24	13.6 ± 1.5	-15.3 ± 1.8	✓	✓
Île Blanche	28	13.9 ± 1.2	-14.2 ± 1.8	✓	✓
Île aux Pommes	40	14.0 ± 1.5	-14.0 ± 2.1	✓	✓
Île Bicquette	30	12.9 ± 1.0	-15.9 ± 1.6	✓	✓
Île Laval	29	13.2 ± 1.1	-14.7 ± 2.2	✓	✓
Gulf of St. Lawrence					
Île aux Oeufs	30	12.3 ± 0.5	-16.5 ± 1.1	✓	✓
Île Madam	5	16.0 ± 1.3	-18.3 ± 0.7	✓	✓
Île Fantôme	49	✓	✓	✓	✓
Île Innu	48	✓	✓	✓	✓
Maine					
Matinicus Island	25	13.0 ± 0.9	-16.1 ± 1.0	✓	✓
Flag Island	25	12.3 ± 0.7	-17.0 ± 1.7	✓	✓

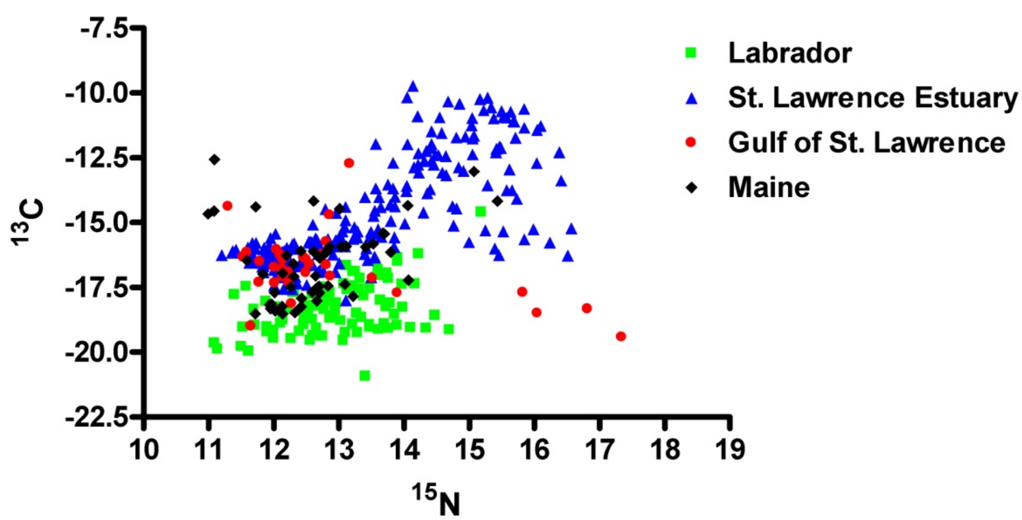

Fig. 3. Values of $\delta^{15}N$ and $\delta^{13}C$ from the ninth primary of female *S. m. dresseri* captured in breeding colonies in Labrador, St. Lawrence Estuary, Gulf of St. Lawrence, and Maine, May-June 2009. Values reflect isotope signatures from molting sites in 2008.

Project Status:

Our preliminary results suggest that stable isotope values from developing ninth primary feathers are a potential tool for delineating molting and rearing regions throughout the range of *S. m. dresseri*. Using $\delta^{13}C$ and $\delta^{15}N$ values, we discriminated among molting regions of AHY birds in Labrador, the St. Lawrence Estuary, and the Gulf of St. Lawrence in 2009 with high accuracy (>90%), and discriminated among rearing regions with moderate-to-high accuracy (70%). We anticipate that variation in δD and $\delta^{34}S$ signatures from these feathers will also be useful in discriminating among the four regions.

Isotope signatures from molting AHY birds and pre-fledging HY birds captured in Maine during 2009, however, must be added to these preliminary models before we pursue further analyses (e.g., attempting to affiliate breeding females to molting regions). We anticipate on obtaining all remaining isotope data associated with feather samples collected in 2009 shortly (see Tables 1,2,3).

To address any potential variation in isotope signatures among sites within each region and among years, and to determine the extent of fidelity to molting regions by breeding females, we must obtain feather samples from birds in each region over multiple years (minimum of 2 years). We obtained required sample sizes in 2009, the project's first field season. Due to a lack of funding in 2010, our sampling efforts were limited to a few breeding and molting sites in the St. Lawrence Estuary and Gulf of St. Lawrence, and we have yet to analyze these feathers for isotope signatures. Nevertheless, we hope to meet sample size requirements for breeding females, pre-fledging HY birds, and molting AHY birds from each of the four regions in 2011 (see accompanying SDJV proposal).

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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)
			9,000$		Env. Canada
				3,000$ *3,500$*	UQAM
				1,000$	SPEE
				5,000$	Duvetnor

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)					
Surveys (include only if this was a major element of study)					
Research	13,500$	8,000$			21,500$