Sea Duck Joint Venture
Annual Project Summary for Endorsed Projects
FY 2011 – (October 1, 2010 to Sept 30, 2011)

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 (SLE, north and south shores), 3) upper Gulf of St. Lawrence (GSL), and 4) Maine (ME). 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.

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). The Maine samples were lost while being sent to Saskatoon. We thus used samples from nesting females as no bird banded in Maine colonies has been recovered north in the St. Lawrence estuary or Gulf or in Labrador (D.McAuley, USGS, pers. comm.). 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 ($r^2 = 0.53$) and increased westward ($r^2 = 0.60$).

The four molting regions were discriminated by values of $\delta^{13}C$ and $\delta^{15}N$ ($\chi^2_6 = 138.76$, $P < 0.01$; Fig. 1). However, the model generally had low prediction power, especially for Maine where only 36% of cases were classified correctly. This model had little potential to differentiate nesting birds that previously molted in SLE or ME. We thus considered a revised model that combined values of N and C for SLE and ME. This model performed much better than the original model and the three molting regions (SLE/ME, GSL, Labrador) were discriminated quite well ($\chi^2_4 = 134.00$, $P < 0.01$). Overall, 92% of birds were classified correctly with 98% for SLE/ME, 75% in GSL, and 88% in Labrador.

Fifty-seven additional samples were obtained in SLE and GSL in 2010 and are awaiting for isotope analyses (Table 1). This will allow us to estimate annual variation in isotope signatures and to improve our discriminant functions.

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 and 2010. Means followed by the same letter are not significantly different for each isotope.

			Stable isotope	
			$\delta^{15}N$ (‰)	$\delta^{13}C$ (‰)
Region	Year	N samples	Mean ± SE	Mean ± SE
Labrador	2009	16	13.4 ± 1.3*a*	- 18.9 ± 0.1*b*
Gulf of St. Lawrence	2009	16	12.1 ± 0.2*b*	-18.7 ± 0.2*b*
	2010	18	n/a*	n/a
St. Lawrence Estuary	2009	32	12.7 ±0.5*ab*	-16.6 ± 0.1*a*
	2010	39	n/a	n/a
*Maine***	2009	25	13.0 ± 0.9*a*	-16.1 ± 0.2*a*

* Awaiting results from isotope analyses.
** Nesting birds from Matinicus Island.

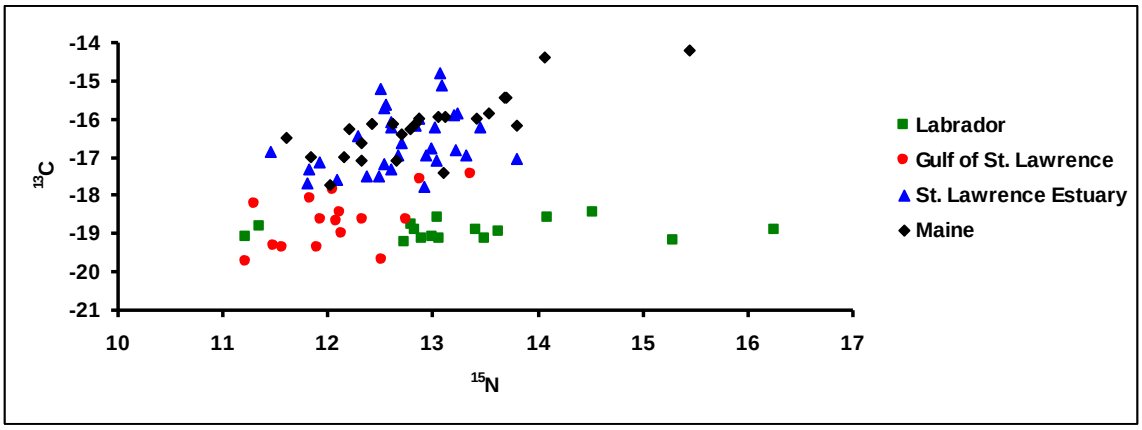

Fig. 1. Values of $\delta^{15}N$ and $\delta^{13}C$ from the ninth primary of molting AHY female and male *S. m. dresseri* captured or collected in August-September 2009. Data from Maine are from nesting birds.

2) *Feather isotope values of breeding female eiders*. In the spring 2009, we obtained $\delta^{13}C$ and $\delta^{15}N$ signatures from a ninth primary feather of 467 AHY female eiders captured in 16 breeding colonies throughout the range of *S. m. dresseri* (Table 2). These signatures reflected those in local foods webs at molting regions during the previous summer/fall. Isotope values in feathers from females breeding in the St. Lawrence Estuary were more variable than those from birds breeding in Labrador, Gulf of St. Lawrence, and Maine (Table 2). We estimated that approximately 50% of the birds breeding in Labrador had molted locally the previous summer while the rest molted in the Gulf, the Estuary or in Maine(Table 3). For birds breeding in the Gulf of St. Lawrence colonies, one third molted there and two thirds in the Estuary or Maine. Finally, most females breeding in the St. Lawrence Estuary molted in th eestuary or Maine. Our results confirm that some common molting sites are used by birds from different breeding regions.

In 2010 and 2011, we collected 623 additional samples in 10 colonies of the St. Lawrence Estuary (Table 2). A total of 69 females sampled in 2009 were recaptured during these two years and will be used to test for fidelity of adult females to molting sites (Table 4). These samples are awaiting for isotope analyses.

Table 2. Coefficient of variation of stable isotopes 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, 2010, and 2011.

				Coefficient of variation (%)	
Region	Year	N colonies	N samples	$\delta^{15}N$	$\delta^{13}C$
Labrador	2009	4	88	6.4	5.5
Gulf of St. Lawrence	2009	2	93	6.1	5.5
St. Lawrence Estuary	2009	8	240	10.2	13.8
	2010	10	307	n/a*	n/a
	2011	9	316	n/a	n/a
Maine	2009	2	46	7.2	9.1

* Awaiting results from isotope analyses.

Table 3. Assignment of breeding females *S. m. dresseri* from 3 breeding regions in 2009 to the previous year molting sites in Labrador (LAB), Gulf of St. Lawrence (GSL), St. Lawrence Estuary (SLE), or Maine (ME).

Breeding region in 2009	Molting region in 2008 (%)				
	LAB	GSL	SLE/ME	LAB or GSL	GSL or SLE/ME
Labrador	24	9	15	30	23
Gulf of St. Lawrence	3	4	65	18	10
St. Lawrence Estuary	0.5	0.5	98	1	0

Table 4. Number of breeding females *S. m. dresseri* sampled during 2 or 3 years in the St. Lawrence Estuary, 2009-2011.

Years of capture	N of birds
2009-2010	14
2009-2011	28
2010-2011	23
2009-2010-2011	4
TOTAL	69

3) *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 in 2009 (Table 5). No HY birds were caught and sampled in Maine. Values of $\delta^{13}C$ and $\delta^{15}N$ varied little among sites within each region and between sexes ($P \geq 0.12$). We found strong evidence that $\delta^{13}C$ decreased with increasing latitude ($r^2 = 0.96$) and increased westward ($r^2 = 0.97$). Feathers from HY birds had considerably higher values of $\delta^{13}C$ than those of AHY birds. The three rearing regions were discriminated by values of $\delta^{13}C$ and $\delta^{15}N$ ($\chi^2_4 = 43.27$, $P < 0.001$; 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). Only 3 HY birds were collected in the Estuary and Gulf of St. Lawrence in 2010 (Table 5). These samples are also waiting awaiting for isotope analyses but will not greatly affect the patterns observed in 2009.

Project Status:

The initial sampling took place in 2009 both on the breeding colonies and at molting sites throughout the range of *S. m. dresseri*. All the analyses of $\delta^{13}C$ and $\delta^{15}N$ have been conducted and we are in the process of determining δD and $\delta^{34}S$ values of molting birds to improve our discriminatory ability. Although, we did not receive funding in 2010, we sampled eiders in colonies and molting sites of the St. Lawrence Estuary and Gulf. Priority for analyses is given to molting birds to improve our model. Funding obtained in 2011

allowed us to sample the breeding colonies and to carry the isotope analyses of the 2010 and 2011 samples. We are still awaiting for these results.

Our preliminary results suggest that stable isotope values from developing ninth primary feathers are a potential tool for delineating molting and rearing regions beween Labrador, the Gulf of St. Lawrence, and the Estuary. Using samples of nesting females from Maine colonies in replacement of molting birds' samples that were lost, we failed to discriminate between Maine and the St. Lawrence estuary. We hope to get new samples of molting birds from Maine in 2012. Including other isotopes may also help to further improve discrimination among molting regions.

Our data confirm movements of some birds breeding in Labrador and the Gulf of St. Lawrence to distant molting sites while birds breeding in the Estuary remained there to molt or move to Maine.

Table 5. Stable isotope signatures from the ninth primary of pre-fledged HY female and male *S*. *m*. *dresseri* captured or collected in Aug.-Sept. 2009 and 2010. Means followed by the same letter are not significantly different for each isotope.

			Stable isotope	
			δ^{15}N (‰)	δ^{13}C (‰)
Region	Year	N samples	Mean ± SE	Mean ± SE
Labrador	2009	17	13.8 ± 0.3*a*	-17.4 ± 0.4*a*
Gulf of St. Lawrence	2009	11	12.2 ± 0.2*b*	- 15.6 ± 0.5*b*
	2010	2	n/a*	n/a*
St. Lawrence Estuary	2009	19	12.8 ± 0.1*b*	-13.8 ± 0.3*c*
	2010	1	n/a*	n/a*

* Awaiting results from isotope analyses.

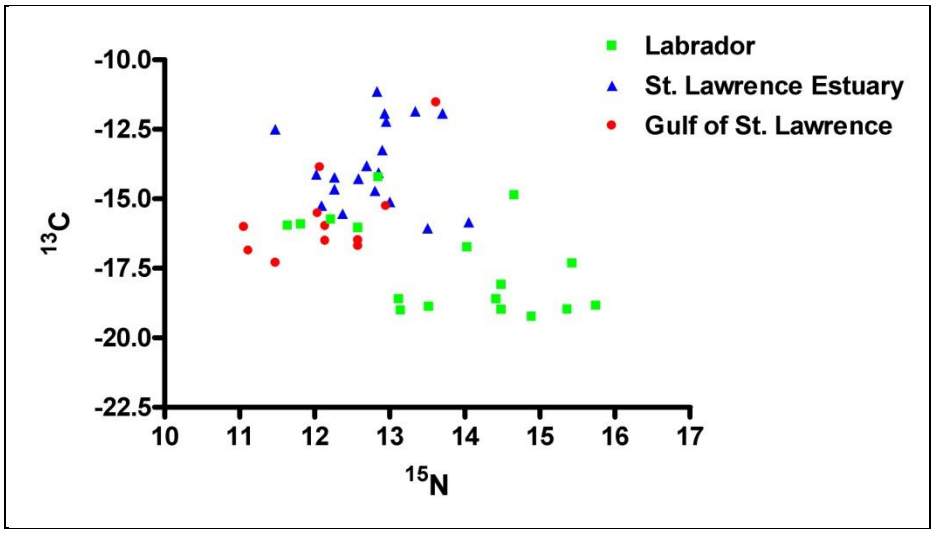

Fig. 2. Values of δ^{15}N and δ^{13}C from the ninth primary of pre-fledging HY female and male *S*. *m*. *dresseri* captured or collected in Labrador, St. Lawrence Estuary, and Gulf of St. Lawrence, August-September 2009.

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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)
37,840$			5,000$		Env. Canada
				3,500$	UQAM
				500$	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	31,340$	20,000$			51,840$