NEST SITE USE BY ARCTIC-NESTING COMMON EIDERS: RELATIONSHIPS WITH HABITAT FEATURES, MICROCLIMATE AND NESTING SUCCESS

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Introduction

• Despite concerns over sea duck population declines, data required for their conservation and management are often lacking.

• Conservation strategies rely on understanding different life stages (e.g., adult & offspring survival) to estimate changes in population size.

• This project was aimed at complementing conservation & management research of common eiders *Somateria mollissima* (*hereafter 'eiders'*) by providing insights into ecological processes affecting breeding success.

Objectives

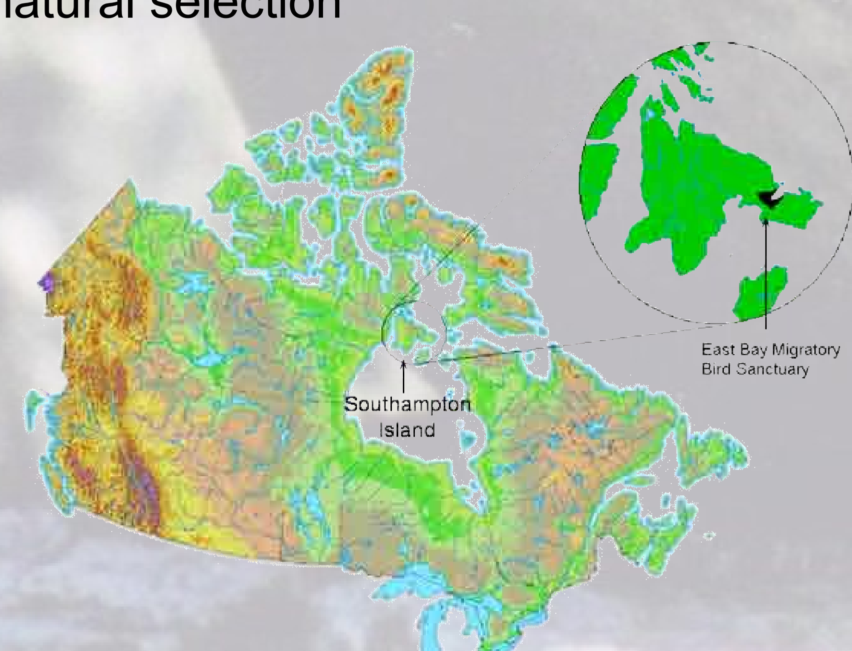
1- Investigate eider nest site selection patterns by:

(a) manipulating nest bowl contents prior to breeding

(b) comparing physical characteristics of non-nest sites, nest sites, and successful & unsuccessful nest sites

(c) exploring relationships between nest shelter, microclimate and body weight

2- Consider habitat selection results in the context of adaptive response involving natural selection



Study site was an island breeding colony (~64°02'N, 81°47'W) within East Bay Migratory Bird Sanctuary (black), Southampton Island, Nunavut.

Patterns of Nest Site Use & Success

NEST BOWL CONTENTS: Nest bowls at this colony are often re-used and are easily identified prior to arrival by nesting females. Eider eggs are frequently preyed upon during laying and eiders push moss into bowls, possibly to conceal their eggs from predators.

• We predicted eiders would select bowls with material to conceal eggs and lower predation; We removed moss and old down from nest bowls prior to egg-laying and applied treatments within bowls (n=30/group): (1) down (2) moss (3) remained empty; (4) nearby plots were unmanipulated controls.

• Bowls with experimentally-placed down had earlier onset of incubation compared to bowls where all material had been removed (Tukey test p=0.014).

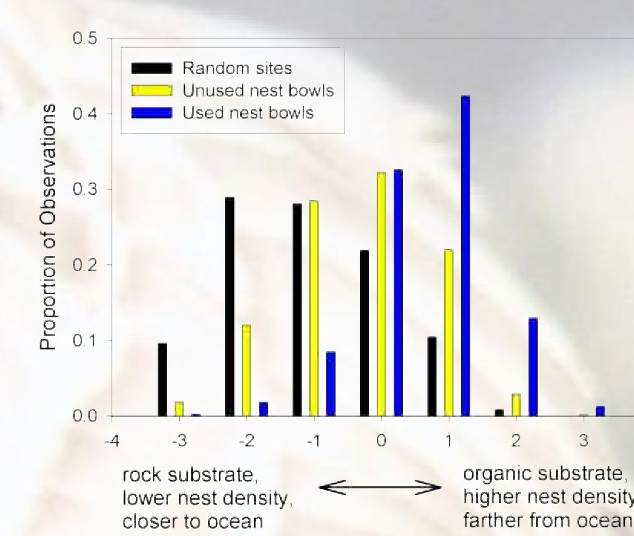
Typical Common Eider nest at the East Bay study colony

PHYSICAL CHARACTERISTICS OF NESTS: In 2001, we measured physical characteristics of systematically-selected non-nest sites, nest bowls with established nests and unused bowls.

• Discriminant Function (DF) Analysis was performed to distinguish between sites:

→ Histogram shows the distributions of discriminant function scores for random sites (n=217), unused nest bowls (n=379) and used nest bowls (n=409).

→ Non-nest sites (black bars) were more likely than nest bowls (blue bars) to have rock substrate, lower local nest density, and be closer to the ocean; unused bowls (yellow bars) had intermediate characteristics.



• Failed (n=92) & successful (n=716) nests differed in characteristics (1998-2002).

→ Canonical DF Coefficients for models relating physical characteristics of sites to nest bowl use & success. A *larger value* (**bold**) *implies the variable has a stronger influence on nest bowl use or success*:

Site Variable:	**Non-Nest sites vs. Nest Bowls**	**Used vs. Unused Bowls**	**Successful vs. Failed Nests**
Bowl substrate (organic selected)	**0.457**	**0.493**	**.245**
Dist. to ocean (farther selected)	**0.316**	**0.563**	**.574**
Dist. to herring gull nest (closer)	-0.140	**-0.596**	-.053
Dist. to nearest neighbor (closer)	**-0.389**	**-0.484**	.114
Habitat within 1 meter (+ rocky)	**-0.246**	**-0.201**	**-.428**
Dist. to fresh water (closer)	**-0.330**	**0.281**	-.146
*Significance at P>0.05 (in **bold**)*	*>|.182|*	*>|.105|*	*>|.203|*

• Variables associated with bowl use were also associated with nest success, providing some support for directional selection (*e.g.*, eiders selected nests farther from the ocean, and these sites had greater success).

NEST SHELTER, MICROCLIMATE & BODY WEIGHT: Eiders nesting on exposed, treeless islands lost weight faster than those nesting on wooded islands, possibly due to adverse thermal conditions at exposed nests *(*Kilpi & Lindström *1997; Oecologia 111:297-301)*; Our results indicated eiders select nests with organic substrates in rocky habitats and these variables also correlated with success.

→ We placed shelters over nests and monitored nest temperatures; females were captured in late incubation and weighed.

→ Eiders nesting beneath shelters experienced *cooler* daily maximum and mean temperatures and *warmer* daily minimum temperatures (Rep. Meas. MANOVA; all Ps<0.0001) and maintained *higher* late incubation body weight (ANCOVA; LSMEANS; P=0.033).

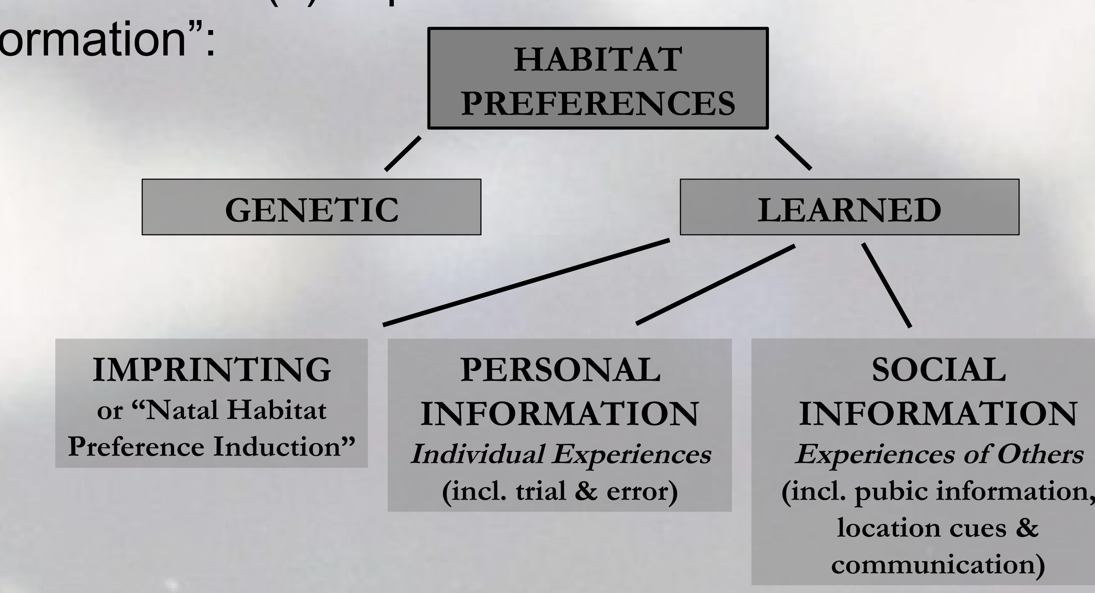
	Daily Max Temp °C (± 95% CI)	Daily Min Temp °C (± 95% CI)	Daily Mean Temp °C (± 95% CI)	Body Weight grams (± SE)
Sheltered (n=11)	24.8 (± 1.4)	2.5 (± 0.3)	9.9 (± 0.6)	1312 (± 14)
Control (n=10)	29.4 (± 0.9)	1.1 (± 0.3)	11.8 (± 0.6)	1266 (± 15)

Processes Underlying Habitat Use

• Ecologists seek a comprehensive understanding of whether and how natural selection produces non-random habitat use patterns.

→ Understanding mechanisms underlying animal distribution has great practical value when evaluating potential for evolution of habitat selection traits in response to habitat changes (e.g., **arctic climate change**).

• Habitat preferences may be (1) **genetic** and/or (2) **learned** *(note: learning ultimately has a genetic basis),* and learning can occur through (a) natal habitat preference induction or "imprinting" (b) individual experiences or "personal information" & (c) experiences of others or "social information":



• Generally speaking, phenotypic plasticity allows *individuals* to adapt strategies, and *populations* can adapt via either phenotypic plasticity or natural selection.

• Unfortunately, genetic basis for habitat choice is poorly understood, and little is known about the role of imprinting, personal information & social information in informing habitat choices within wild populations.

Summary & Conclusions

• We recommend using natural selection theory to frame habitat use studies.

• Non-random patterns of nest use occurred at our study site; some variables associated with likelihood of use were also associated with success.

• To predict whether populations will be able to adopt new habitat selection strategies in response to contemporary climate changes, we must understand mechanisms underlying habitat choices and evaluate whether they are sufficiently responsive to keep pace with climate change (see Berteaux et al. *2004. Integr. Comp. Biol. 44:140-151*).

Acknowledgements

• R.Alisauskas, K.Allard, J.Bêty, M.Bidwell, I.Buttler/R.Kelly (shelter photo), M.Fast, C.Fournier, H.Jewell, L.McKinnon, D.McRuer, J.Nakoolak, M.Robertson, K.Wiebe

• University of Saskatchewan, Canadian Wildlife Service (Saskatoon & Yellowknife), Carleton University, Nunavut Research Institute, NSERC, NSTP (INAC), PCSP, ArcticNet

Canadä Indian and Northern Affairs Canada

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