WLF 419 - Waterfowl and Wetlands Ecology and Management
Lecture 8 – Prefledging Ecology
Next Time – Postbreeding Ecology

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1) Prefledging period extremely important
    a) Hatch to Flight
        i) Growth
        ii) Mortality
            (1) Predation
            (2) Weather
        iii) Impact size and performance as adults?
        iv) One of the least studied components of life cycle

2) Hatching
    a) Altricial vs. Precocial
        i) Altricial
            (1) Eyes closed
            (2) No down
            (3) Fed by parents
            (4) Stay in nest until fledge
        ii) Precocial
            (1) Eyes open
            (2) Down Covered
            (3) Leave nest in day or 2 (thermoregulation)
                (a) Brooding for 24 hours
                (b) Nidifuge – nest fugitive
            (4) Find own food

3) Growth and Development
    a) Eggs
        i) Waterfowl lay the largest egg of any birds
            (1) Larger than altricial species
            (2) Larger than similar sized galliforms
            (3) About 14% of body mass
            (4) About 45% yolk
                (a) Hatching energy reserves – yolk sac
                    (i) Thermoregulation
                    (ii) 2 to 4 days
                (b) About 75% yolk used from laying to hatching

(i) Larger eggs have more (absolute) reserves available at hatch
(ii) More reserves because does not increase directly with body size
(iii) Evidence from some studies

b) Ducklings and Goslings
  i) Sigmoid Growth Curve
    (1) For mass and some external characteristics
    (2) Described by Gompertz or Logistic equation
      (a) Gompertz - Mass ? $Ae^{?be^{?kt}}$
      (b) where, A = asymptotic mass, b = ln of initial to asymptotic mass, k = rate of approach to asymptotic, and t = age

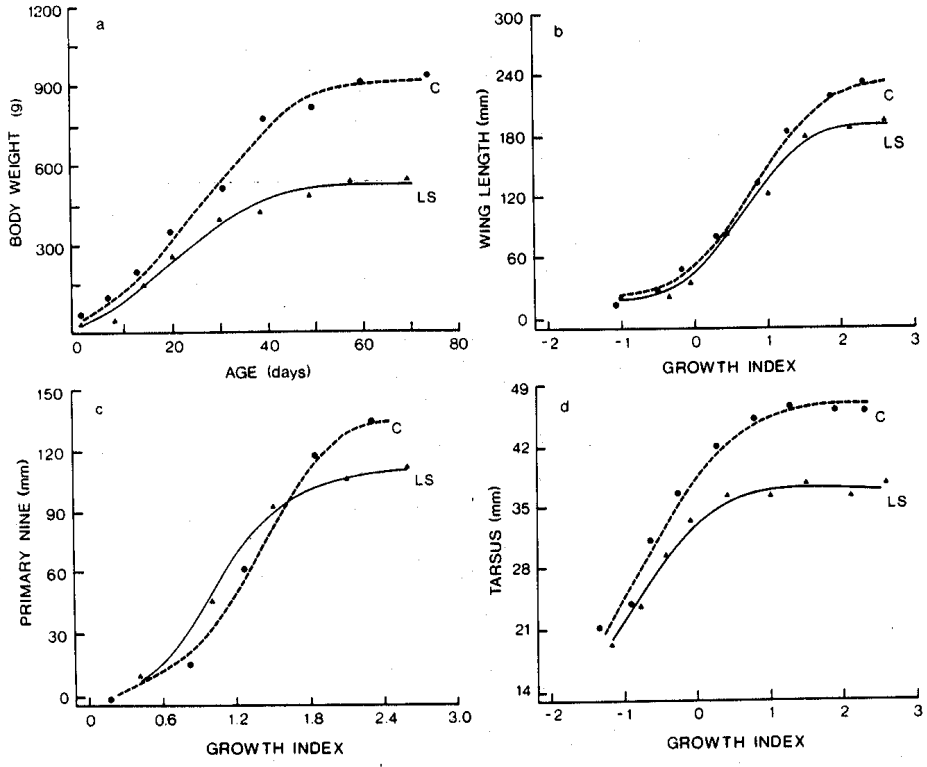


Fig. 1. Growth curves for Lesser Scaup (LS) and Canvasback (C) ducklings: (a) body weight, curves were best fit by the Gompertz equation; (b) wing and (c) ninth primary, curves were best fit by the Logistic equation; (d) tarsus, curves were described by the von Bertalanffy equation. See text for an explanation of growth index. For clarity of presentation, only weekly mean values are plotted. Standard errors of the means are presented in the Appendix.

From Lightbody and Ankney (1984)

Table 4-1. Growth rates, relative fledging weights, and adult weights of waterfowl

Species/sex[a]	N[b]	Growth conditions (wild/captive)	Growth rate K[c]	% Adult annual minimum weight at fledging[d]	Adult minimum wt.[e]	Reference
Black-bellied whistling duck	26	Captive	0.046		827[8]	Cain 1976
Black swan						Braithwaite 1981
Male	19	Captive	0.052		6270[1]	
Female	15	Captive	0.045		5100[1]	
Black swan	45	Wild	0.024		5685[1]	Braithwaite 1981
Swan goose						
Male	1	Captive	0.036		4500[2]	Würdinger 1975
Female	1	Captive	0.031		3500[2]	
Female	1	Captive	0.058		3500[2]	
Domestic graylag goose	1	Captive	0.033		3336[2]	Würdinger 1975
	1	Captive	0.067		3336[2]	
Eastern graylag goose						
Male	1	Captive	0.069		3575[2]	Würdinger 1975
Female	1	Captive	0.061		3097[2]	
Lesser snow goose	29	Captive	0.078	117	1890[3]	Ankney 1980
Lesser snow goose	100	Wild	0.10	79	1890[3]	Aubin et al. 1986
Bar-headed goose	10	Captive	0.064		–	Würdinger 1975
Bar-headed goose	10	Wild	0.044		–	Würdinger 1975
Atlantic Canada goose	5	Captive	0.054		3800[4]	Würdinger 1975
Moffit's Canada goose						
Male	7	Captive	0.051	71	5075[5]	Yokum and Harris 1966
Female	5	Captive	0.046	78	4111[5]	
Cackling Canada goose	54	Wild	0.074	97	1301[6]	Sedinger 1986a
Barnacle goose	3	Captive	0.097	109	1800[2]	Würdinger 1975
Nene	5	Captive	0.058	98	1892[7]	Kear and Berger 1980
Mountain duck	65	Captive	0.050		1425[1]	Riggert 1977
Mountain duck	11	Wild	0.065		1425[1]	Riggert 1977
Mallard	?	?	0.057	88	1148[9]	Ricklefs 1973
Mallard	15	Captive				
Male			0.075	94	1215[9]	Sugden et al. 1981
Female			0.074	88	1080[9]	

mallards, lesser scaup, bar-headed geese and black [illegible]

Table 4-1. Growth rates, relative fledging weights, and adult weights of waterfowl (continued)

Species/sex[a]	N[b]	Growth conditions (wild/captive)	Growth rate K[c]	% Adult annual minimum weight at fledging[d]	Adult minimum wt.[e]	Reference
Mallard						
Male	8	Captive	0.083	107	1215[9]	Greenwood 1974
Female	7	Captive	0.086	105	1080[9]	
Mallard						
Male	96	Captive	0.071	99	1215[9]	Rhymer 1983
Female	98		0.076	96	1080[9]	
Mallard	2	Wild	0.043	108	1148[9]	Schneider 1965
Black duck	?	Wild	0.056		1185[4]	Reinecke 1979
Gadwall						
Male	?	?	0.105		968[4]	Oring 1968
Female	?	?	0.072		836[4]	
Redhead	11	Captive	0.058		1041[4]	Lightbody 1985
Redhead						
Male (1952)	27	Captive	0.072		1109[4]	Weller 1957
Female (1952)	28	Captive	0.073		973[4]	
Male (1953)	24	Captive	0.058		1109[4]	
Female (1953)	32	Captive	0.056		973[4]	
Canvasback	64	Captive	0.059	86	1084[10]	Lightbody and Ankney 1984
Canvasback	122	Wild	0.073	99	1084[10]	Dzubin 1959
Canvasback	4	Wild	0.049	116	1094[10]	Schneider 1965
Lesser scaup	64	Captive	0.062	102	576[10]	Lightbody and Ankney 1984
Lesser scaup	6	Wild	0.053	97	576[10]	Schneider 1965

[a]Where sex is not specified, sexes are combined.
[b]Number of individuals included in the analysis.
[c]k estimated by fitting growth data to the Gompertz equation, except for the studies of Braithwaite (1981) and Aubin et al. (1986) for which the rate constant from the logistic equation was converted to the Gompertz rate constant (Ricklefs 1973).
[d]This column is the ratio (× 100) of the asymptote of the Gompertz equation and adult minimum weight. Ratios were not calculated for cases in which adult weights were from Johnsgard (1978) or Bellrose (1980), because these were not minimum weights and therefore not comparable to other estimates.
[e]Weights reported here represent periods of low weight during the annual cycle (i.e., midwinter or postnuptial molt), except weights from Johnsgard (1978) and Bellrose (1980), which are means or midpoints of the reported ranges. References for adult weights are as follows: (1) Johnsgard (1978), (2) Owen (1980), (3) Ankney (1982), (4) Bellrose (1980), (5) Akesson and Raveling (1981), (6) Raveling (1979), (7) Kear and Berger (1980), (8) Bolen (1964), (9) Titman unpubl., (10) Yokum (1970).

From Sedinger (1992)

(3) Sources of variation
  (a) Body Size
    (i) K – rate that young reach asymptotic size
    (ii) $K = 0.31M^{-0.22}$ for wild waterfowl
  (b) Sex-specific growth
  (c) Geographic (north vs. south)
  (d) Seasonal variation (strong evidence for geese)
    (i) Environmental vs. Genetic effects

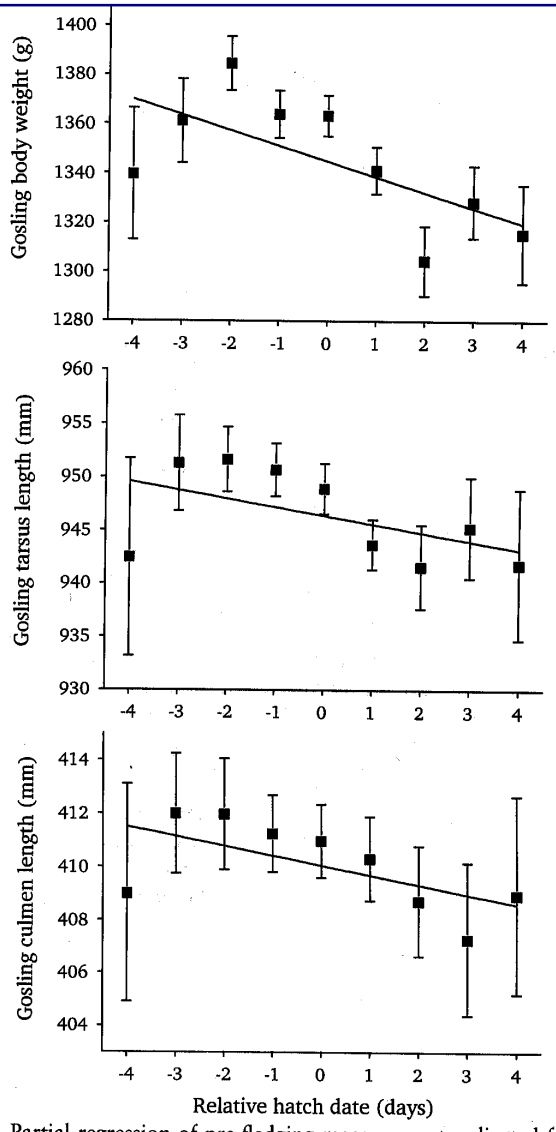


Fig. 13.1 Partial regression of pre-fledging measurements adjusted for brood size and gosling age with respect to hatch date scaled relative to annual means. Means are plotted with standard errors. (Adapted with permission from Cooch *et al.* 1991*a*).

From Cooch et al. (1991)

(ii)Compensation of seasonal decline

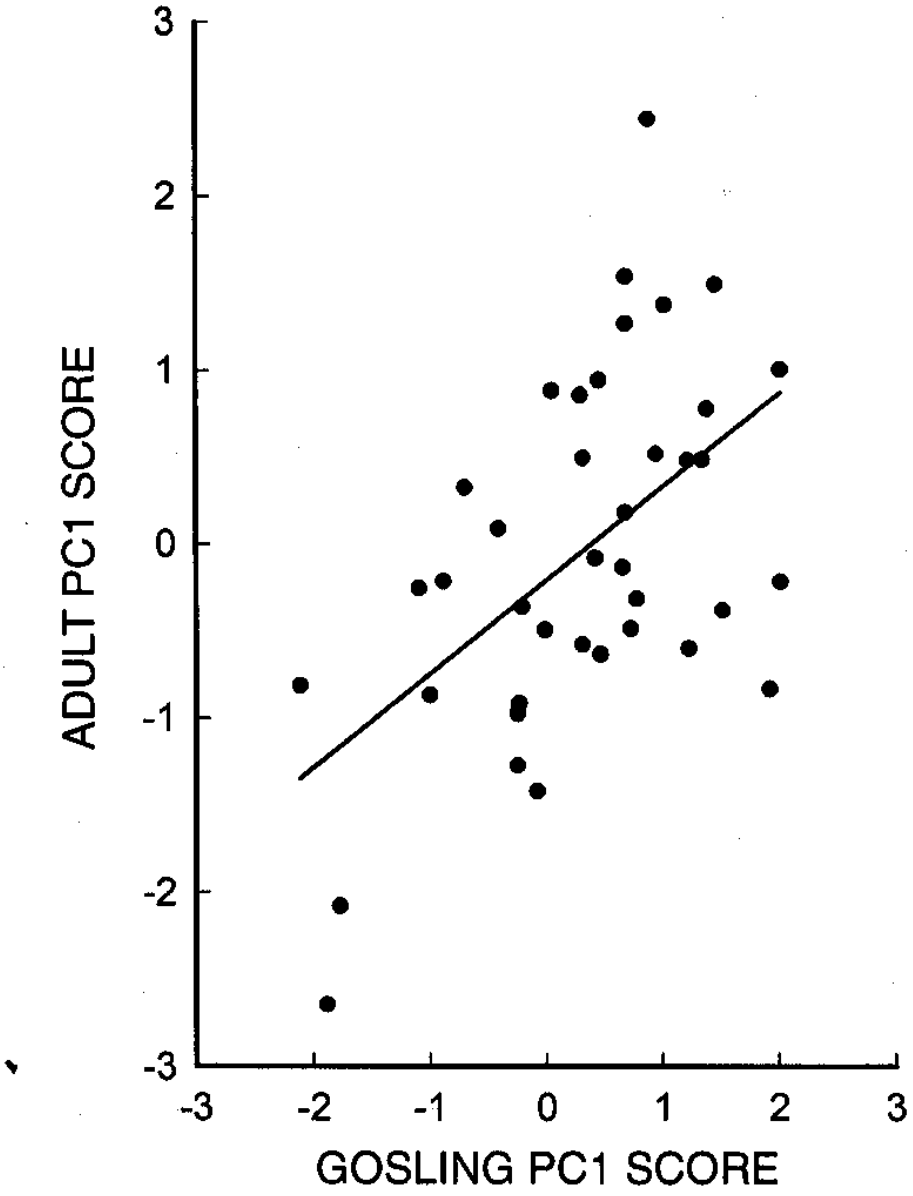


FIG. 3. Relationship between adult brant PC1 scores and the PC1 scores of the same individuals measured as goslings.

From Sedinger et al. (1995)

(iii) Evidence for ducks?

1. Temperate Habitat Studies
   a. Not a big treatment
2. Not linked to plant phenology?
3. Scaup vs. Canvasback (Lightbody and Ankney 1984)
4. Within Species (Rhymer 1983)

(e) Morphological variation

(i) Tarsus length

1. Precocial young – mobile at birth (see Fig. 1 Lightbody and Ankney (1984))

(ii) Digestive organs fully developed prior to other tissues

(iii) Little development of breast muscle during early brood rearing

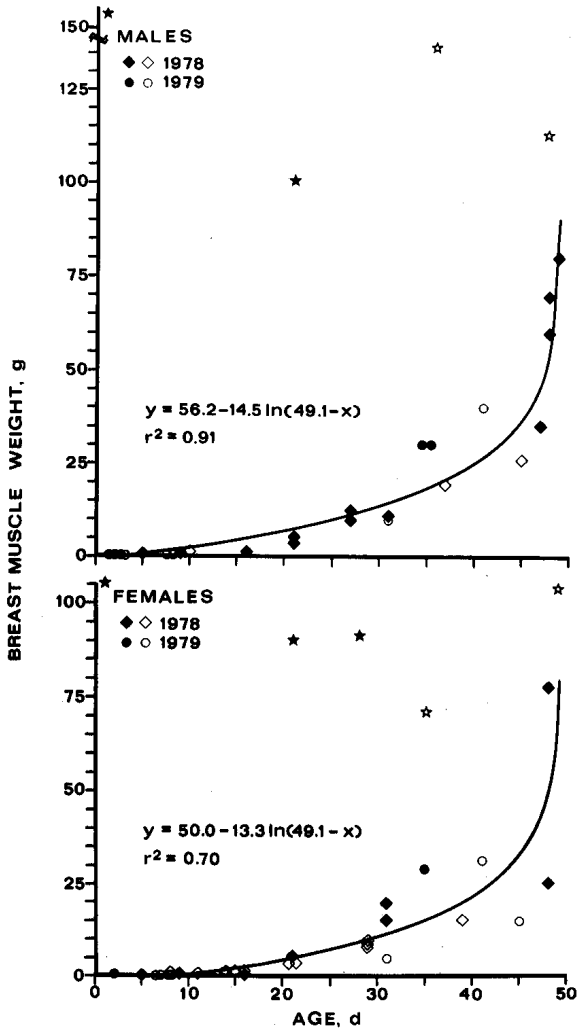


FIGURE 5. Weights of breast muscles of Cackling Goose goslings. Parameter estimates and solid lines are the result of performing linear regression on all data within each sex. Gosling ages were transformed to ln (49.1 − Age) to linearize the data prior to regression analysis. Symbols as in Figure 1.

From Sedinger (1986)

4) Foraging Ecology
   a) Ducklings and Goslings spend 62% of light hours feeding

Growing waterfowl spend an average of 62% of daylight hours feeding—that is, searching for—or consuming food (Table 4-3). Young waterfowl may spend less time feeding during their first few days because they

Table 4-3. Percentage of daylight hours spent feeding by waterfowl broods

Species	Age class[a] I	II	III	Reference
Cape barren goose	74	72	66	Pellis and Pellis 1982
Greater snow goose	–	55	–	Giroux et al. 1986
Cackling Canada goose	59	63	–	Sedinger and Raveling 1988
Barnacle goose	50	–	–	Ebbinge and Ebbinge-Dallmeijer 1975
Black brant	51	56	–	Sedinger unpubl.
Black duck	54	56	73	Hickey and Titman 1983
Mallard	78	65	57	Ringelman and Flake 1980
Blue-winged teal	78	70	75	Ringelman and Flake 1980
Bufflehead	42[b]			Gauthier 1987
Ruddy duck	37			Joyner 1977

[a] Age classes as in Gollop and Marshall 1954.
[b] Includes some data from class II ducklings.

From Sedinger (1992)

   b) Diet
      i) Anatini, Aythini, and Mergini largely animal material
      ii) Anserini largely plant material

5) Brood Movements
   a) Limited movements for most Anatini and Aythyini
      i) Usually < 1km

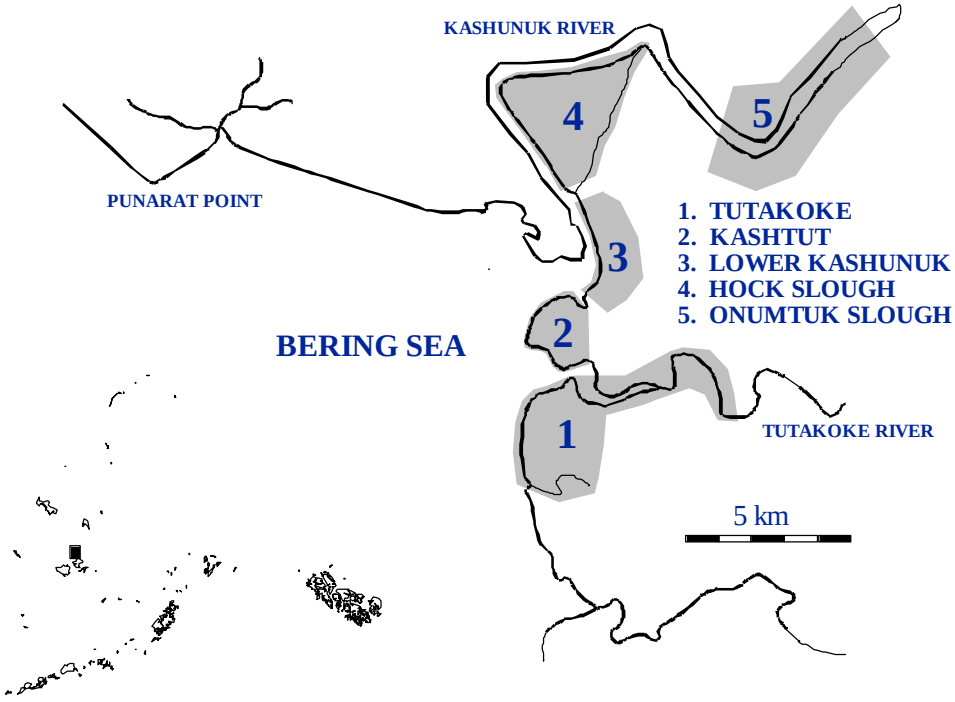
Table 2. Interwetland-movement data for mallard broods, Minnedosa, Manitoba, 1987–89.

Year	n broods	No. interwetland moves/30 days $\bar{x}$	SE	Median[b]	No. wetlands used/30 days $\bar{x}$	SE	Median[b]	Move from nest to water (m)[a] $\bar{x}$	SE	Median[b]	Total distance moved/30 days (m) $\bar{x}$	SE	Median[b]
1987	7	2.9	0.8	2	2.4	0.5	2	418	159	274	1,267	132	1,224
1988	9	4.3	0.9	3	3.6	0.9	2	633	320	231	1,987	783	1,020
1989	13	4.9	1.1	5	2.7	0.4	3	403	140	219	1,391	324	1,436
All[c]		4.0	0.6		2.9	0.4		485	74		1,548	222	

[a] Distance from a brood's nest to the first wetland used.
[b] Median tests, no differences among years were detected: interwetland moves, $P = 0.37$; wetlands used, $P = 0.71$; nest to water, $P = 0.87$; total distance, $P = 0.56$.
[c] Equal weighting of annual means, standard error of annual means.

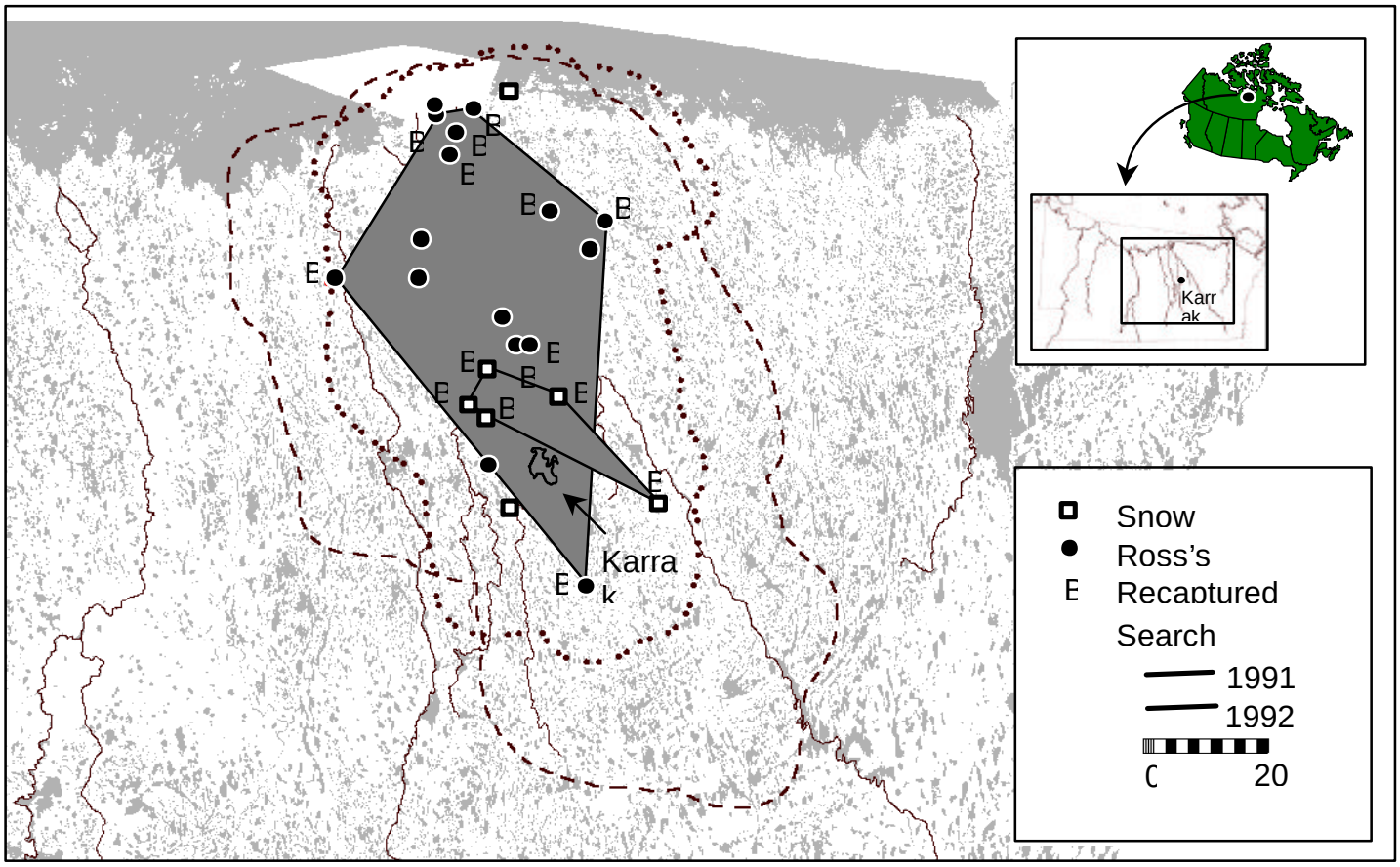
From Rotella and Ratti (1992)

ii) Longer movements for Mergini and Anserini
  (1) Larger, lower mass specific metabolic rate
  (2) Goslings – feeding en route
    (a) Extensive movements in degraded habitats?



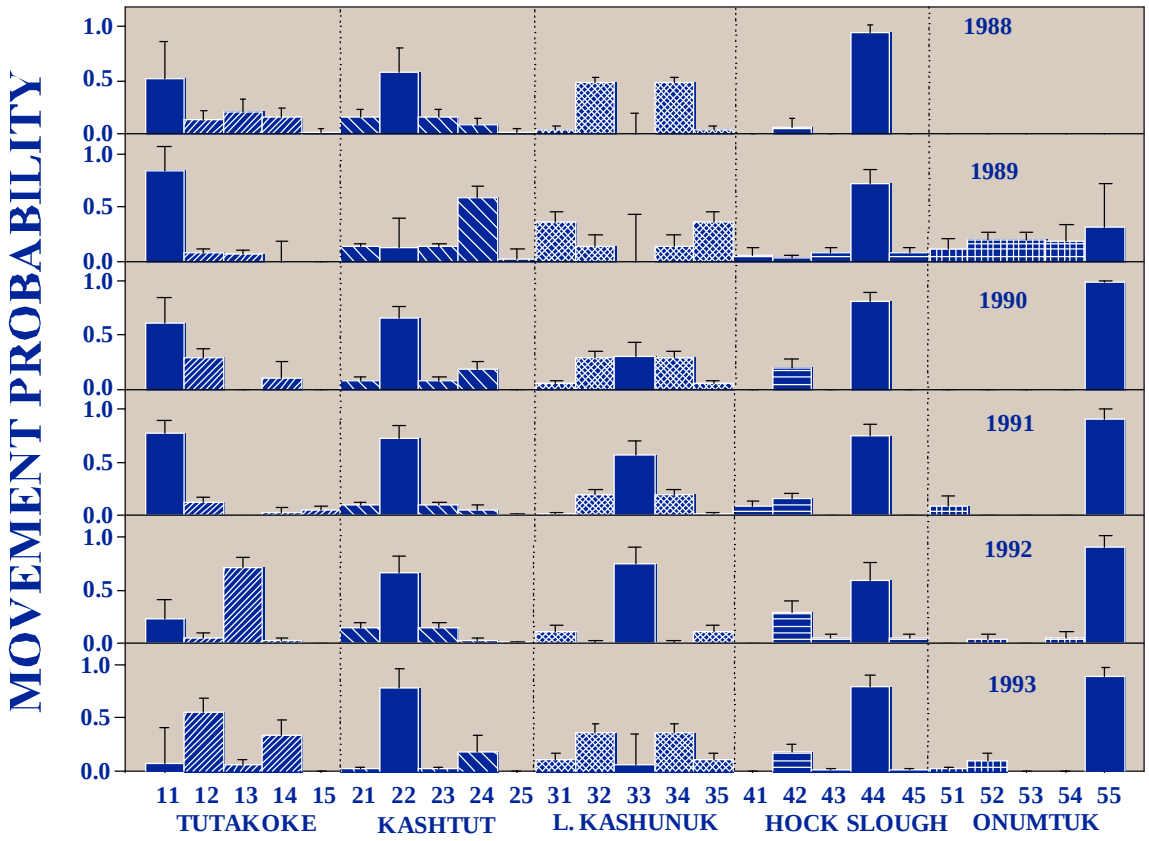
Adopted from Lindberg and Sedinger (1998)

Locations of hens marked with radios @ Karrak during nesting. Shaded areas cover the distribution of broods



Used with permission from S. Slattery (2001)

iii) Site Fidelity
  (1) Some evidence for geese
  (2) Not examined in ducks



Adopted from Lindberg and Sedinger (1998)

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