

Annual Report of the Bowdoin Scientific Station 2000

Since the Last Annual Report

The big excitement of 2000 has been our efforts to stop a Nova Scotia company from harvesting rockweed on Kent Island. Even more alarming are new attempts to develop salmon aquaculture sites offshore. One proposal calls for a series of pens just 100 meters off Kent Island's east beach, stretching from the "Moustache" (eastern ledges) to the northern tip. Industrial fish-farming and unsustainable removal rates of marine algae, the base of the marine food chain, would have major impacts on the local environment, bird populations, long-term research projects, and Kent Island's special sense of "Wildness" (to use Thoreau's term). Moreover, they have little in common with traditional fisheries by local families, which have always been welcomed at Kent Island. We contacted a number of Kent Island alumni, mostly biologists, asking them to urge the New Brunswick Department of Agriculture, Fisheries and Aquaculture to declare Kent Island an exclusion site from such activities.

One of the rewarding outcomes of this on-going battle has been the reminder of how many distinguished biologists have passed through Kent Island. Members of the National Academy of Sciences and the Royal Society of London (Donald Griffin and Knut Schmidt-Nielsen) wrote thoughtful and passionate letters. Leading Canadian scientists from the Canadian Wildlife Service, U. British Columbia, Simon Fraser U., and U. New Brunswick, all of whom had conducted research at the Bowdoin Scientific Station, requested that Kent Island be designated an exclusion area. They were joined by nearly three dozen biologists and faculty from Harvard, Ohio State, U. North Carolina, Duke U., U. California-Santa Barbara, and U. California-Davis, among others, many of them Bowdoin graduates. The Gross family turned out in full force, offering first-hand institutional memories dating back two-thirds of a century, as did many alumni who have supported the endowment funds that make the program at Kent Island possible (David Webster's Huntington-Wheelwright Fund, the Minot Fund, the Saito Fund, and the Spear Fund). We shall see if the government of New Brunswick will resist the temptation to promote short-term economic gain—much of it leaving the province—at the expense of conservation, fundamental research, environmental monitoring, education, and the pristine nature of a special place. If you want your voice to be heard, you may write Mr. Paul Robichaud, Minister, Department of Agriculture, Fisheries and Aquaculture, P.O. Box 6000, Fredericton, N.B. E3B 5h2, CANADA, with a copy to Nat.

THE SUMMER OF 2000

For the first time in 14 years, Nat spent most of the summer back in Brunswick, thinking and writing about Savannah Sparrows. Co-director Bob Mauck (Kenyon College) was left to run the ship. Although Bob is a long-time veteran of Kent Island, having worked on Leach's Storm-Petrels for his PhD dissertation, he discovered that there is much more to the job than meets the eye. Summer on Kent Island is a team effort, however, and thanks to plenty of good weather, and the help of Kent Island veterans and a fine group of motivated students, the summer of 2000 was a great success.

Mark Murray ('75) returned this year (after a five-year sabbatical dedicated to developing his boat-building business, Sea Hoss Skiffs) to work with caretaker Russell Ingalls on a number of projects and to improve the carpentry skills of the students. As long as anyone can remember, the bridge by the lower lab has been at the mercy of the tide; this year, Russell and Mark gathered all hands to build a more permanent structure. The new bridge is higher, drier, and far

more elegant than the old one, all the while conforming to Kent Island building codes. The end of the wharf was replaced and a new landing platform was added, completing the full-length renovation Mark had started 10 years ago when he first served as caretaker. Finishing touches were added to last year's renovations of the Hodgson House (paneled ceiling and a stove fashioned from an empty propane tank) and the Radio Shack (new east-facing window). No doubt both spots will now require advanced booking.

RESEARCH IN 2000

* Leach's Storm-Petrels

With the help of Laura Minich ('01), Chuck Huntington continued his long-term demography project into its 47th year. Chuck reports that Aphrodite (36 years old) did not return this year. The oldest bird in Petrel Path (a mere youth at 28 years old) is in need of a name. Send your suggestions to Chuck at petrel@gwi.net. The only ground rules are that the name has to have some connection to the sea and be appropriate for the sex (male). With Chuck's encouragement and advice, Laura decided to census the Leach's Storm-Petrel population. The last such attempt, two decades ago, was that of Peter Cannell ('75) and Dave Maddox in which the population was estimated at 2,184 breeding pairs. As luck would have it, the very first likely looking burrow she checked was home to a muskrat. Yes, muskrats bite. Undaunted by a quick trip to the Grand Manan hospital, Laura proceeded with her census. By the end of July Laura had covered the heavily wooded northern end of the island, as well as portions of three other habitat types in the southern half of the island. It turns out that there may be far more petrels on Kent Island than anyone had guessed. Laura estimates that on the northern third of the island alone, there are 12,000-13,000 breeding pairs. Using her habitat-specific data and extrapolating from a 1994 habitat map of Kent Island by Jenna Barbour, Laura estimated that as many as 28,000 pairs may breed on Kent Island. Surprisingly, the density of active burrows may actually be higher in open areas (about 0.1/m²) than in forested areas (about 0.05/m²). The most beautiful burrow Laura encountered was on South Hill, high on a grassy slope with a sweeping view of the sea. Alexis Blackmer (U. California-Davis) continued work on her PhD dissertation, this year to try to explain observed differences in individual quality among Leach's Storm-Petrels. She and Bob proposed an energetic explanation such that "high quality" individuals (individuals that show both high survival and high reproductive success) should have lower basal metabolic rates than "low quality" individuals. The lower lab was outfitted with a temperature controlled metabolic chamber, air pump, and an oxygen analyzer. In an unprecedented study, Alexis and Bob measured basal metabolic rate for more than 60 known-age storm-petrels. Their study will be continued during the 2001 field season.

Katie O'Reilly (U. Portland) returned with Susie Imholt (U. Portland '01) to complete the fourth year of her investigation ecological endocrinology in Leach's Storm-Petrels. Older birds appear to show a reduced stress response compared to younger individuals, which may partly explain the greater reproductive success that comes with experience and age. Katie plans to compare corticosterone levels measured at Kent Island with levels obtained from Leach's Storm-Petrels on Tatoosh Island, Washington, and to use DNA fingerprinting to determine the genetic similarity of these two geographically isolated populations.

Katie also found time to study the stress response in Wilson's Storm-Petrels, which breed in the southern hemisphere and visit the Bay of Fundy during the Antarctic "winter." After the first attempt to catch Wilson's Storm-Petrels was frustrated by the myriad of gulls in the area, Russell found a dead gull which disgusted the gulls (and nearby whalewatchers) and enabled Katie to hoop-net 12 Wilson's Storm-Petrels. Two of the birds were missing a few flight feathers and others were in heavy molt. Preliminary analyses indicate very low levels of corticosterone in the wintering birds. Molt is energetically expensive and suppression of the stress response is

one way Wilson's Storm-Petrels may save energy. Katie and Dov Lank (Simon Fraser University) presented a paper at the 2000 American Ornithologists' Union Meeting in St. John's, Newfoundland, documenting a decline in the weights of migratory Semipalmated Sandpipers on Kent Island since the early 1970s. They hypothesize that increased numbers of falcons over the same period have favored sandpipers maintaining a lower body mass, thereby reducing the risk of predation (because the lighter birds are more maneuverable) while increasing the risk of starvation.

* Savannah Sparrows

It would be a stretch to say that the Savannah Sparrows hardly knew Nat was gone, but Kevin Oh ('01) didn't miss a beat continuing Nat's long-term study. After a crash course from Nat during the first week of June, Kevin was left alone to do the work traditionally done by Nat and an assistant. Kevin seemed well adapted to Nat's dictum "At least one new nest before breakfast" and added his own: "You never know what you might find just before dark." He found and monitored 77 nests, banded 41 adults and 220 nestlings, and mapped individual territories as a prelude to his honors thesis on territory size in male and female Savannah Sparrows. Hatching success (hatchlings/egg) in 2000 varied significantly among the first, second, and replacement clutches, with replacement clutches being unusually successful this year (100% hatching success). With Nat's return in late July, everyone sharpened his or her netting skills while banding more than 150 fledglings.

Never one to limit herself to a single species, Katie obtained blood samples (with Susie's help) from 29 males and 4 female Savannah Sparrows and videotaped nests in an effort to determine whether male parental care is negatively correlated with testosterone levels. Susie has already scored the videotapes for male and female nestling feeding visits; by spring the testosterone assays will be completed. Earlier work suggests that males offering little or no parental care have higher testosterone levels than males making frequent feeding visits to the nest.

* Tree Swallows

For the second year in a row, Kent Island weather made it a good year to be a Tree Swallow. Although the number of nests (26) was the second lowest on record, reproductive success was high. Robin Kramer ('02) found that in 23 of the 26 nests, all the eggs hatched and 25 of the 26 active nests fledged at least one offspring. Robin could often be seen in the field, stalking the elusive male swallows with her Remote Male Catcher, which allowed her to catch all but 3 of the male swallows. In a side project, Robin looked at scare distances of adult swallows during the nesting stage. She pulled gull decoys toward a nestbox with an attending parent and measured the distance at which the adult swallow flushed. Preliminary experiments revealed no effect of nestling age, parent sex, or location in the colony on scare distance.

A few Barn Swallows nested in the rafters of the tool shed. Chuck, who has noticed their decline in Harpswell, too, thinks it may be part of a more widespread decline in the population. Cliff Swallows failed to breed on the island.

* Snowshoe hares

The effects of recent attempts to reduce the snowshoe hare population were short-lived. The hares were back in full force in 2000. For years, the visual impact of snowshoe hare browsing on shrubs and trees has been obvious, but never had it been quantified. This summer, Akane Uesugi ('00) put numbers to the damage. Making use of exclosures erected in 1994 by Jenna Barbour, as well as building her own, Akane showed that Red Spruce, Balsam Fir, Yellow Birch, and Mountain Ash seedling densities were much greater inside than outside the exclosures.

Surprisingly, seedling densities were lower on Outer Wood Island (where hares are scarce) than on Kent Island, but sapling densities showed the opposite trend, possibly due to microhabitat differences between the two islands. Akane found a significant difference in the height of the lowest White Spruce branches between the two islands: the lowest branches on Kent Island are about the height of snowshoe hare standing on its hind legs, whereas the lowest branches on Outer Wood nearly touch the ground. In a series of choice experiments, Akane presented captured hares with a smorgasbord of island fare, designed to mimic winter food choices and summer food choices. Young White Spruce needles were clearly preferred over all other foods, suggesting that snowshoe hare may have their greatest impact on the spruce forest during the summer months despite the availability of alternative foods. Finally, Akane measured Spruce Bud Moth larva infestation within individual trees. Trees on Kent Island had less infestation on low branches than on high branches, whereas branch height made no difference to moth infestation on Outer Wood Island. This result supports the hypothesis that Kent Island trees may differentially allocate defensive compounds to the vulnerable lower branches in response to snowshoe hare browsing.

* Butterflies

Building on Andrew Graustein's ('01) work on American Copper Butterflies the previous year, Sherri Kies ('01) used mark-recapture techniques in the apple orchard to look at sex-specific differences in home range. She followed individual butterflies for up to 17 days, discovering that males mate with multiple females. Observations of 75 females and 38 males showed that males are much more likely to be recaptured than females and that male home ranges were significantly smaller (29 m²) than those of females (50 m²). Sherri suggests that males may be more site-tenacious because they are guarding breeding territories, whereas females are less tied to a specific area, traveling widely in search of mating opportunities. If this is the case, Sherri hypothesized, then males should be more likely to return if captured and displaced from their territories. In late June, 50% of males released 50m from their point of capture returned to within a few meters of their origin; no females returned. When butterflies were displaced 75m, neither sex returned.

* Marine ecology

With rockweed harvesting becoming a major industry in the Grand Manan Archipeligo (and a growing political issue along the Maine coast), Anna Myers ('00) sought to assess the importance of brown algae on the life in the intertidal zone and to determine the effects of the removal of algae on invertebrate populations. Kent Island is unusual in the extent to which brown algae (notably *Ascophyllum* and *Fucus* spp.) dominate the intertidal. Anna denuded 19 sites around the island, evenly distributed with respect to wave exposure and tidal height. Using a global positioning system (GPS) device, she could precisely relocate each site every four days. At each site (and in adjacent control sites) she measured algal growth and counted invertebrates within a 25 cm x 25cm quadrat. Over two months, mussel predation increased and the number of invertebrate species decreased significantly in the denuded sites. Those species remaining in the denuded sites did not differ from controls in terms of number of individuals present. Anna's results suggest that organisms that can withstand long periods of severe exposure, such as the rough periwinkle (*Littorina saxatillus*), remain in denuded sites; less tolerant species, such as the smooth periwinkle (*L. obtusata*), move to more benign environments. By the end of July brown algae had not yet recolonized denuded sites, but the experimental disturbance provided an opportunity for invasion by green algae (particularly *Ulva*). Dog whelks that remained in the denuded sites tended to be smaller than those in the control sites. When given a choice between algal cover and exposed rock, whelks separated by size with the larger whelks inhabiting the algal cover. It isn't clear whether a size-specific microhabitat preference exists due to feeding habits, resistance to desiccation, or behavioral interactions.

* Plant ecology

The round-leaved sundew, *Drosera rotundifolia*, is an insectivorous plant common in the acidic and nutrient-poor bogs around Kent Island. In addition to her work on butterflies, Sherri quantified insect capture rates, digestion rates and subsequent leaf growth, building on earlier work by Peter Ingram ('98). In mid-July, with the help of Bowdoin College Assistant Professor Barry Logan, Sherri began an experiment to assess the role of insect-derived nutrients in sundew growth. She manipulated nutrient availability, then measured new shoot production and leaf growth in five experimental groups: (1) control (watered, no insects removed), (2) watered, insects removed, (3) phosphorous added, insects removed, (4) nitrogen added, insects removed, and (5) potassium added, insects removed. She found no significant differences between treatments in the number of leaves produced or average leaf length (which represent area available to capture prey) in this preliminary study. Interestingly, however, the number of leaves in the control group in particular decreased as the season progressed. She hypothesized that leaf senescence occurs more rapidly after prey capture.

* Barnacle behavior

Besides serving as island physician, Barnacle Bill Ward (Kenyon '01) examined the behavioral mechanisms behind barnacle anti-predator behavior. Bob's previous work at Kent Island showed that that barnacles switched their behavior in accordance with competition and predation-risk theory, spending only about one-third as much time in hiding when surrounded by other barnacles as when alone (Mauck and Harkless 2001). Bill and Bob hypothesized that two primary cues—olfactory and mechanical—signal group-living barnacles when their neighbors have emerged from hiding, thus triggering this change in behavior. Bill spent much of June determining that olfactory cues have absolutely nothing to do with it. That established, he and Bob turned to mechanical cues. Bill devised a series of ingenious tests to mimic barnacle-induced micro-turbulence that showed that barnacles exposed to a very slight, localized current will emerge from hiding more quickly than barnacles in still water, whether the current is generated by neighboring barnacles or by artificial means. Groups as small as five barnacles were sufficient to trigger the change in behavior.

* Meteorology

Bob Cunningham cites a single entry in the weather log to sum up the summer's weather: "An absolutely beautiful day for KI" [Susie Mauck, July 6]. For the second summer in a row, Kent Island weather resembled that of a tropical paradise. The total days of fog for June and July (14) were the second lowest in 56 years (after 1999's total of 13 days), and far below the 56-year average of 26.1 days. As in 1999, temperatures were far above normal. Swimming was an important activity with frequent trips to the pool at the southern end. Although less rain fell than usual, we never worried about the well running dry. Much like Camelot, rain would fall after sundown and by 0800 hr the morning dew would disappear. Even in the face of such unrepentant sunshine, Fog Heaven churned out the data. A grant from the Canadian Forest Service enabled Bob and his collaborator Roger Cox to have the fog-monitoring equipment operating from June 16 to September 16th. Anna Myers was Bob's assistant, dashing out to make pH measurements and operate the fog collectors whenever the fog did appear. Capital improvements to Fog Heaven included a new front step and a new 200 m fog marker.

Kent Island Life

The salient feature of Kent Island culture this year was the music. Akane brought her recorder and could often be heard improvising from the widow's walk at dusk. Everyone seemed to play one of the four guitars on the island with Kevin supplying the classical tones and Bill the funk.

Laura, an accomplished cellist, solved the transport problem and brought a violin instead, which she played as if it were a cello. Nina Murray and Katie Mauck piped in with their flutes. Kevin wailed away on his harmonica. The Kent Island Fashion Show and Review is fast becoming an island tradition. Mark Murray won best of show with his accurate portrayal of Chuck, complete with caribou-adorned sweater, glasses, and hard hat. Haute cuisine included a delicious array of Japanese dishes thanks to Akane's willingness to assume the role of chief cook. Bottle washing was a communal effort, as always. Games included Fictionary, Balderdash, and spoons, and Chuck impressed everyone with his ability to name all the countries in Africa and South America in both alphabetic and geographic order. Bill countered with a song reciting all fifty states, as learned in fifth grade. Ross Mauck introduced the rules of Jinx to one and all. Bill employed his digital video camera in documenting Kent Island life with good effect. We are still waiting for the director's cut.

Susie, Katie and Ross Mauck arrived in mid-June, whereupon Susie re-arranged the furniture in the Warden's house. Bob Cunningham walked in soon afterward, shook his head twice, and remarked that it had been 40 years since it looked like that. The Fourth of July saw the traditional beach clean-up along with a candlelight and sparkler rendition of "God Bless America" in a pea-soup fog in the dark. On the nautical scene, numerous trips to Outer Wood Island provided students with a turn at the wheel of our boat, the Ernest Joy, as well as camping opportunities for Akane and her helpers (Sherri, Robin, and Anna). Sherri paddled her kayak in the Basin and Kevin turned the dinghy (a.k.a. the "Chuck") into a sloop with great success, although she left something to be desired in terms of leeway. Russell led an expedition to Wood Island to visit a cave where there is an inscription dating from the late 1700s. A number of students helped Russell retrieve traps and learned, first-hand, about seasickness. Russell's heroics landing us in the heavy surf at Machias Seal Island will not soon be forgotten, nor will the whale-watch for which he arranged clear blue skies and a calm sea. Finbacks and Right Whales were abundant, if not as close as in 1999. The sight of hundreds of Red-necked Phalaropes was one of the highpoints of the trip.

Visitors included New Zealander Ethan Minot, son of Midge and Ed Minot (Ô70), who first met on Kent Island in the late sixties (Ed is the son of Bill Gross, one of the original "four Kent Island pioneers"; Bill's father, in turn, was Alfred Gross, Bowdoin's first ornithology professor—four generations of Kent Islanders!). Louise Huntington brought even more music to the island, as always. To his consternation, Nev Garrity set foot on the island only long enough for Alexis to hand him a dozen storm-petrel eggs needed for the Canadian Wildlife Service's long term investigation of pollutants in the Bay of Fundy. Deb Jeffrey, also with the Canadian Wildlife Service, spent a few busy days collecting Herring Gull tissue samples as part of Glen Fox's long-term research on environmental contamination. Jill and Tom Grubb (Ohio State University) returned to Kent Island briefly in late July; they had spent the summers of 1969-71 on the island and directed the field station when Chuck was on sabbatical in 1976. Jill remarked at the modern conveniences that have cropped up, such as solar-powered electricity, and the upscale look of the wharf and its environs. Josh Ackerman, a graduate student at U. California-Davis arrived in late July to help Alexis complete her summer's research. Nina and Seth Murray spent much of the summer on the island with Mark. Seth took over the island's trail maintenance duties and was last seen heading toward the south hill with the Gravely tractor mower. He also helped mightily with our photovoltaic system, and installed a new gearbox in the aged Cub Cadet tractor. For the first time in 13 years, Genie, Emily and Alex Wheelwright couldn't make it out to Kent Island; they're looking forward to making up for that next summer.

Marci Brandenburg ('01), who had spent the previous summer at the Bowdoin Scientific Station, wrote us all a letter from Indiana, contrasting her current experience as a research assistant on a wolf project in the midwest with her memories of Kent Island: "On Saturdays we sometimes go in a group to a restaurant or a movie, or watch television or a video. It's funny, though—I'm often bored here. I never remember being bored at Kent Island...."

The last visitors for the season were a fresh group of first-year students on their pre-orientation expedition and Nat's Ecology class field trip. Julie Ellis, a graduate student at the U. New Hampshire, accompanied us to investigate the effect of muskrat herbivory and gull damage on plant populations. During the stormy late fall and winter months, Russell checks on the island monthly (occasionally returning to Seal Cove with a few Black Ducks for dinner), and at the time of this writing, he is planning to take Naomi Schalit, an intrepid reporter from Maine and National Public Radio, on what promises to be a wild January outing as part of her coverage of the pressures of rockweed harvesting and aquaculture development in the Gulf of Maine.

Addenda to the List of Publications from the Bowdoin Scientific Station

More than 150 articles have been published in peer-reviewed journals based on research on Kent Island. Papers with an author who was an undergraduate at the Bowdoin Scientific Station are indicated by asterisks. Numbers in parentheses represent Contribution Numbers from the Bowdoin Scientific Station.

**Futamura, C.W., and N.T. Wheelwright. 2000. The mosses of Kent Island, New Brunswick. *Northeastern Naturalist* 7: 277–288. (139)

** K. Apigian, and N.T. Wheelwright. 2000. Forest ground beetles (Coleoptera: Carabidae) on a boreal island. *Canadian Entomologist* 132: 627–634. (142)

**Mauck, R.A., and K. Harkless. The effect of group membership on hiding behavior in the northern rock barnacle (*Semibalanus balanoides*). *Animal Behaviour* (in press).

**Conrad, K.F., P. V. Johnston, C. Crossman, B. Kempnaers, R. J. Robertson, N. T. Wheelwright, and P. T. Boag. 2001. High levels of extrapair paternity in an isolated, low-density, island population of tree swallows (*Tachycineta bicolor*). *Molecular Evolution*. In press.
Wheelwright, N.T., and J.J. Templeton. Development of foraging skills and the transition to independence in juvenile Savannah Sparrows. *Animal Behaviour*. In review.

**Freeman-Gallant, C.R., and N.T. Wheelwright. Offspring mass at fledging: a reliable indicator of adult fitness. *Ecology*. In review.

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