

BOWDOIN COLLEGE

BOWDOIN SCIENTIFIC STATION

BRUNSWICK, MAINE 04011

1990 Annual Report

Since the Last Annual Report

The Bowdoin Scientific Station has a new research laboratory, funded by a grant from the National Science Foundation with matching funds from Kent Island alumni. It is the first building to be constructed on the island in the last half-century. (During that period two aged buildings, the Captain Gillett wharf-house and the cow barn, have been abandoned; miraculously, the Hodgson House, a prefabricated structure donated to the station in 1937, still stands.) Mark Murray ('75) and a team of carpenters completed the project in the spring, working from plans drawn up by Chooi Siew Corish. The building's exterior is weathered cedar shingles, like the shop-garage, to which it is similar in shape and size. The inside is finished with wide pine boards, and it is connected to the dorm by a short breezeway. Within a few weeks of the opening of the station, the lab was already filled with plant specimens, insect collections, captive birds, researchers, and a battery of scientific equipment.

A major transition occurred in 1990 when Bob Tate decided to dedicate himself full-time to fishing after nearly a decade as caretaker of the station. Bob was the third generation of Tates to work on the island -- Lester built the radio shack (with help from young Bob Cunningham) in 1937, and Bob's father and mother, Myhron and Eunice, cared for the station and its inhabitants from 1962 until 1982. In the tradition of his family, Bob knew his boat and the sea, especially the deceptive waters surrounding Three Islands, and many of us at one time or another were awfully glad that it was Bob carrying us across a stormy Bay of Fundy. Bob, Elsa, Brian and Daniel will be missed on the island.

Bob has been succeeded by a caretaker "tag-team" of sorts, made up of Russell Ingalls and Mark Murray. Russell, captain of the *Fundy Girl*, is responsible for transporting visitors to Kent Island and watching over the field station when he isn't lobstering or seining weirs. He is no stranger to Three Islands. Two of the islands, Hay and Sheep, have been in his family for generations. When a boat broke away from the

lower mooring on a stormy night several weeks ago, lodged against the old weir stakes between Kent and Hay Island, and sank in the harbor, Russell and his father were called to salvage it and its crew and tow them back to Grand Manan. Seal Cove, where Russell, his wife, Angie, and their three children live, has become the Bowdoin Scientific Station's new base. More accurately, it is once again the station's base; Everett Giles ('37) recently sent me a letter on some yellowing stationery with the letterhead "Bowdoin Scientific Station, Kents Island, Bay of Fundy, Seal Cove, N.B. Canada."

Mark's responsibilities are mainly terrestrial, and his professional skills have earned him the title of Adjunct Professor of Insular Polytechnology. To give just one example, in 1989 it took us a week to reshingle the north-facing roof of the dorm; Mark cracked the whip over last year's crew and, with the assistance of apprentice Scott Welsh ('93), finished the southern side in little more than a day. He also opened and closed the station, reshingled the caretaker's cottage, breathed new life into the well-pump and Cub Cadet tractor, attached fire ladders to the two-story buildings, and made numerous improvements in boat safety. Mark even put to use the assortment of stuff that had accumulated under the tall raspberries around the buildings, creating a magnificent sculpture of rusty found objects, including a bent wagon wheel, a two-handled saw, a three-legged wood-stove, and a sign that says, appropriately enough, "Murray Roofing and Insulation."

The Summer of 1990

It was a cold and rainy May, and it blew hard. Most birds were late to breed as a result. Tree Swallows did not begin to lay eggs until May 31 and fewer than normal reproduced at all. The first Savannah Sparrow nest was found June 2; in 1989 we'd found 30 nests by that date. Clutch sizes of both species were smaller last year than in previous years. Even the mountain ashes had not

leafed out by early June.

Once again we held a July 4 beach cleanup and sent the *Fundy Girl* back to Grand Manan with a load of debris. Prizes were awarded for the discoveries of a life-preserver (empty and in good condition), some sort of an indigenous mask made of melted plastic, and an unused home-pregnancy kit. A special "foot-pounds per pound" award went to Janice Jaffe for the most garbage hauled the longest distance by the lightest person.

Margot Downs ('91) and Rob Anderson ('92) led 10 first-year students on a successful preorientation trip to Kent Island in late August. The station remained open until the last storm-petrel researchers finished their field season in mid-September. The last 1990 visitors to the station were Genie, Emily, Alex, and I. On the morning of New Year's Eve we sailed out on a 27-foot tide into a stiff north wind which blew sea smoke and freezing spray against Russell's father's boat, the *Bonus*.

Research in 1990

• Leach's Storm-Petrel

How long do storm-petrels live? That is a question which has concerned Chuck Huntington, who, assisted by Geoff Trussell ('90) and Chuck's nephew Ben Slater, gathered another year of data on the survival, mate fidelity, and reproductive success of storm-petrels. "Prince Philip," the male storm-petrel who was banded in 1962 when he first started to breed at the age of about five years old, failed at last to return. Assuming the bird's disappearance means that he died, his lifetime reproductive output is now known and can be compared with that of other birds on Kent Island and elsewhere. Long-term studies like Chuck's are increasingly valued by evolutionary ecologists because the determination of biological fitness or evolutionary success depends on the measurement of the reproductive output over the course of an individual's entire lifetime, not just during a single breeding attempt. Last month Chuck presented a poster paper on the demography of the Kent Island storm-petrel population at the International Ornithological Congress in Auckland, New Zealand.

To analyze the mass of data that he has compiled over the years (37, to be precise), Chuck has begun to collaborate with Bob Mauck, a graduate student working with Tom Grubb at

Ohio State University. Tom conducted his own doctoral dissertation research twenty years ago at Kent Island, where he demonstrated that storm-petrels employ a sense of smell to locate food and perhaps their nest location. Last summer Tom returned to the station with Bob, Reuven Yosef (also an Ohio State graduate student), and Tom's son, Ben, to look at the relationship between age and nutritional status in storm-petrels. The project uses the rate of growth of an induced feather (a feather that replaces one that has been accidentally lost or experimentally removed) as an index of the nutritional condition of parent storm-petrels as they commute from their oceanic foraging grounds to feed their chick. Chuck had plucked the outermost right tail feather of 100 known-age storm-petrels in June; in September, Tom and his collaborators recaptured 80 of the birds and collected the induced feather from each. Currently, they are attempting to modify an electrophoretic gel reader to count the daily growth bars on the feathers in order to determine how long it took birds of different ages to manufacture a new feather.

Armed with a multitude of planned experiments and sophisticated physiological recording equipment, Larry Clark, a faculty member at the Monell Chemical Senses Center in Philadelphia, returned to Kent Island last summer to re-examine the question of whether storm-petrels use olfaction to find their burrows. Working with him were his wife, Cindy Smeraski (Bryn Mawr), Annalisa (Bidu) Schmorleitz ('92), John Lindsey (Stephen F. Austin University, Nacogdoches, Texas). Tom Grubb's dissertation research indicated that young storm-petrels prefer the odor of their home burrows when tested in Y-mazes. Intriguingly, Tom also found that adults tended to approach their colonies and burrows from downwind, and didn't return at all if their nostrils were plugged or surgically impaired. Larry's group took a novel approach. During the course of the breeding season, they "perfumed" some nests with strong odors with the aim of familiarizing birds with an identifiable odor cue unique to their nest site, and overwhelming any natural local odors. (Anyone who walked the trail between the well and the dorm in a cloud of essence of wintergreen will vouch for their success.) Later in the season, the odors were transplanted to other burrows to see if the birds' sense of smell would lead them to the wrong place. However, adults continued to visit their own burrows, and none appeared at the new

sites, indicating that other cues such as landmarks in the terrain may override odor cues. Similar results were obtained when natural burrow odors or chicks were moved, although, interestingly, many of the transplanted chicks that were moved only a short distance appeared to orient by smell in their attempts to get home to their original burrow. Odor samples from different parts of the island are presently being analyzed by gas chromatography to characterize burrows by their odor "fingerprints" and explore the possibility that storm-petrels home with the help of an odor map.

Making good use of contacts in the Federal government, Larry managed to borrow a pair of military night-vision goggles which allowed him and his assistants to record storm-petrels as they flew over different odor cues placed on an elevated platform. The chemical constituents of different foods (krill, cod oil) were tested separately to determine which were most attractive. Whole odors drew the greatest number of storm-petrels, carboxylic acids the second most; unexpectedly, amines, which produce a characteristic "fishy" smell, were least attractive. Finally, Larry set up an olfactometer in the new lab to determine storm-petrels' detection thresholds for a variety of reagents and natural odors.

One of the constraints that marine birds face is the osmotic challenge of drinking seawater and dealing with salty foods. Paul Sievert, a graduate student at the University of Pennsylvania, studied the growth of storm-petrel chicks raised on diets varying in salinity. Every day 60 nestlings were measured and fed meal supplements that ranged in salinity from pure seawater to distilled water. Nestlings raised on high salt diets grew particularly slowly, and presumably were forced to spend extra time in the burrow before fledging, whereas those given one-third strength seawater (which has a salt concentration similar to their body fluids) grew the fastest. To deal with salty diets, storm-petrels concentrate and eliminate excess salts using a special gland located below their nostrils. No one had previously determined the age at which the nasal gland becomes functional in storm-petrels or any other bird species, so Paul collected secretions from six adults and 24 nestlings of different ages. After an experimental dose of seawater, adults began secretions more quickly, produced a larger volume of secretions, and completed secretions sooner than nestlings, but the concentration of the secretions was the same for nestlings and adults.

Thus, the salt glands of storm-petrels turn out to be fully functional at an early age. The slow secretion rates of nestlings may be due to their proportionately larger volume of body water which is available for dilution of the salt load.

Because seabirds forage widely across the surface of the ocean and incorporate hydrocarbons and other pollutants into their eggs, they can be valuable early indicators of environmental deterioration on a broad scale. The Canadian Wildlife Service has been monitoring the eggs of seabirds at Kent Island for more than two decades. Nev Garrety returned last summer to collect storm-petrel eggs as part of the CWS's long-term study of marine pollution.

• Savannah Sparrows

Rob Anderson and Scott Welsh ('93) helped me locate and monitor Savannah Sparrow nests and band 569 individuals as part of a long-term study of the genetic basis of behavior and morphology, age-related reproductive ecology, and fluctuations in population size in a natural population. Population densities vary by a factor of two between years. Because the sex of young birds can be determined within a few weeks of leaving the nest, we have been able to provide some of the first data on fledgling sex ratios and differential survival of males and females among birds. With the help of Liz and Jan Pierson ('74), we censused the neighboring islands to find out how far birds banded on Kent Island disperse. Few banded birds settle as far away as Hay or Sheep Island, and none was found on the Green Islands. Some yearlings nest within 50 meters of where they were raised.

One of the puzzling findings of the research thus far was that a nestling's size at fledging is independent of whether its mother was mated monogamously or polygamously. Yet in certain years, the offspring of females who share parental care with other females return at much lower rates than the offspring of monogamous females. The key must be differences in post-fledging parental care, which was the focus of Corey Freeman's ('91) research. Corey monitored feeding rates by both male and female parents at the nest and after the young had fledged to determine the importance of paternal help. After uniquely color-banding nestlings, we discovered that the parents divide up the brood immediately after they leave the nest. Thereafter each parent feeds only the same 2-3 young, although the male may later

reacquaint himself with the young that have stayed with the female when he begins courting her again as she prepares to lay a second clutch. Corey is currently analyzing his data as part of his senior honors thesis. I returned in late August to gather data on the survival of juveniles, which form large age-specific flocks once they become independent of their parents. After I spent five minutes setting up two mist nets on the lawn in front of the dorm, it took another three hours to remove the flock of 76 juvenile Savannah sparrows that had become tangled in the nets in less than 45 minutes.

- Tree Swallows

Cheryl Schultz ('91), a veteran Kent Islander from the summer of '88, was responsible for the Tree Swallow project as part of her honors thesis research in biology. She banded 408 individuals, determined the identities and reproductive success of the 70+ pairs that nested on the island last summer, and performed an experiment to test whether a female's ability to respond to simulated nest predation improved with age and breeding experience. The results of her manipulations suggested that old birds lay more eggs, are more likely to replace lost clutches, and perhaps do so more rapidly and with less stress than young birds. Following Joanna Leary ('88) and Caragh Fitzgerald's ('90) earlier studies, Cheryl experimentally increased or reduced clutch sizes by two eggs to expose a "cost to reproduction" and an explanation for why Tree Swallows normally lay only 5-6 eggs. Contrary to expectation, females that raise extra offspring survive just as well as other birds and suffer no measurable decline in fecundity in future years. The jury is still out on the question of what factors limit clutch size in birds.

A different approach to try to answer the same question is a large-scale investigation of the environmental determinants of clutch size in Tree Swallows, spearheaded by David Hussell of the Ontario Ministry of Natural Resources. The Bowdoin Scientific Station is one of eight study sites, ranging from Canada's Northwest Territories south to Ohio, where the abundance of flying insects and the number of eggs laid by swallows have been quantified each breeding season for the last several years. The results so far indicate that the average Tree Swallow clutch size is larger and the initiation of egg-laying later as latitude increases, but that food abundance is

insufficient to explain such broad geographical patterns.

- Bird Populations

For the second consecutive year we censused songbirds breeding in an 11-hectare plot of spruce-fir forest. Our aim is to monitor population trends, especially for migratory species that spend the winter in the tropics. Last summer's population estimates were similar to those from the previous summer. Once again, American Redstarts were the most numerous woodland species, which is curious because their preferred deciduous forest habitat on the mainland is quite unlike Kent Island. (Yellow Warblers were as abundant as redstarts, but, as a species of forest edges, they were not included in the formal census.) On any given day during the summer, our citations usually totaled 50-55 species. During a three-day census in late December, the only common forest bird species were Golden-crowned Kinglets and Red-breasted Nuthatches. Both Black-capped and Boreal Chickadees, previously presumed to be year-round residents, apparently migrate to the mainland in winter.

- Insect Populations

Except for bird lice, the insects of Kent Island are poorly known. Rick Todhunter ('93) sallied forth from the kitchen every day to build the field station's first systematic insect collection. He collected and mounted more than 425 specimens representing virtually all of the common species. The insect collection will be sent to entomologists at the University of Maine for identification to species. As might be expected from an island with a simple, boreal flora, there are relatively few species of insects on Kent Island. The overwhelmingly dominant group of insects in terms of pollinators are the flies, at least 15 species of which can be found visiting the flowers of bunchberry (*Cornus canadensis*). Midges sometimes form smoky clouds over the island. Herbivorous insects in general and true bugs (Order Hemiptera) in particular are surprisingly scarce compared to mainland sites. Mosquitoes and deerflies hardly occur between May and July, thankfully, but in August (after most swallows have departed?) they make up for lost time. I had always wondered why there were screens on many windows. This year, when I returned in late August I discovered the reason.

- Meteorology

The summer of 1990 was the warmest on record, according to Bob Cunningham, whose observations at Kent Island stretch back to 1938. During the last 31 years, the average summer temperature recorded at the station has increased 2° F. Fog prevailed on half of all June days last summer, well above normal, although there was relatively rainfall. July and August showed the more typical pattern of fog on one out of three days. Working in collaboration with Dick Jagels and Jobie Carlisle (University of Maine-Orono), Bob developed a technique for collecting and measuring the acidity of fog water over brief intervals. Traditionally, researchers collect fog every 3-12 hours, but using portable field computers housed in his new weather shack (dubbed *Fog Heaven*), Bob could analyze the pH of fog samples and measure fog accumulation rates, solar radiation, temperature, and wind speed at 10-minute intervals around the clock. His alarming discovery was that individual fog masses sometimes are extraordinarily acidic, a result obscured by sampling at less frequent intervals. Apparently, the stable air over the Gulf of Maine minimizes lateral mixing of pollution plumes from cities upwind. On August 18, for example, the pH of one sample dropped to 2.3 (recall that a pH of 7.0 is neutral and that the pH scale is logarithmic). No one knows how plants are affected by brief acid baths -- they are known to suffer damage from prolonged exposures to a pH of 3.0, which may explain the die-off of red spruce in some foggy coastal and mountain areas. At the very least, we now know that Kent Island is not as pristine or isolated from the rest of the world as it sometimes seems.

Kent Island Life

Rick Todhunter warned us that he had had little experience as a cook, so we were braced for the worst. What a set-up. The food was splendid, ample, and ready by 6 PM. On days when groceries arrived, we dined on turkey and stuffing, cranberry jelly, stuffed squash, Swiss chard, steamed peas, mashed potatoes and gravy, biscuits, and apple pie. When supplies were sparse, Rick spoiled us with creative dishes of orache and steamed clams. Rick had weekends off, so we all had our chance to show him up, but none of us could.

Each summer the recreation activities of Kent

Islanders seem to reflect the different personalities at the station. I'm not sure what that says about this summer's crew. The favored sport was Home-run Derby (any fly ball hit from the Warden's House that cleared the lab or dorm roof scored a point; anything else was an out). After busting every tennis ball on the island, we turned to fungo, hacky-sack, soccer or volleyball for after-dinner entertainment.

There were numerous visitors to the station this summer, including participants on birding tours organized by Field Guides and Victor Emanuel Nature Tours, members of both Chuck and my families, Peter Davis ('57 and a former field assistant of Chuck's), Peter and Lisa Cunningham, Bowdoin Professors Janice Jaffe and Amy Johnson, Mark and Rita Worthing ('77) and their children, and Frank Dye, from Wells-Next-To-The-Sea, England, who was sailing his diminutive dinghy, *Wanderer*, along the northeast coast. A Kent Island record may have been set on June 26 when nine children under the age of eight years old (including young Murrays, Wheelwrights, Ingalls, and Piersons) sat down together at the dinner table. Visitors to Kent Island are always welcome, especially in August, when the field station is less crowded. Our recent brochure gives additional information about arranging a visit and reaching the station. Station fees will be increased slightly this year to reflect the costs of operating the station. Note also that trips will leave from Seal Cove instead of Ingalls Head, and that mail should be sent to Seal Cove, EOG 3B0.

Additions to the List of Publications from the Bowdoin Scientific Station

Hébert, P.N. 1989. Decline of the Kent Island, New Brunswick, Herring Gull, *Larus argentatus*, colony. *Canadian Field-Naturalist* 103: 393-396.

Place, A.R., N.C. Stoyan, R. Ricklefs, and R.G. Butler. 1989. Physiological basis of stomach oil formation in Leach's Storm-Petrel (*Oceanodroma leucorhoa*). *Auk* 106: 687-699.

Nathaniel T. Wheelwright
Director, Bowdoin Scientific Station
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Preliminary results of the Savannah Sparrow study

Figure 1: Only about 10% of Savannah Sparrow nestlings raised on Kent Island return to the archipelago to breed. Because none of the thousands of sparrows banded as nestlings on Kent Island has ever been recaptured breeding elsewhere, those that disappear probably have died. If an individual survives to one year of age, its annual risk of mortality is about 50%.

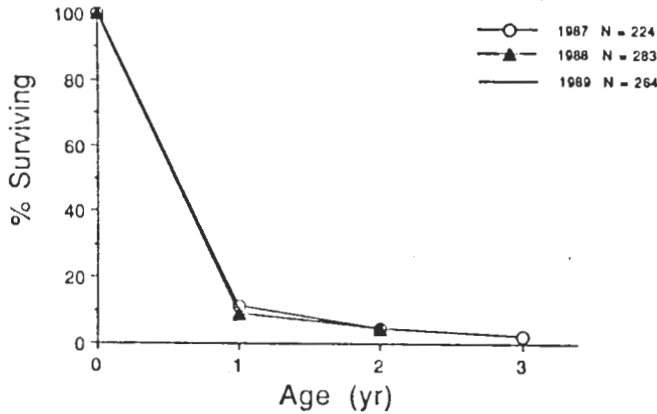


Figure 2: Yearling Savannah Sparrows orient their covered nests randomly with respect to compass direction. Older, more experienced birds appear to learn to build their nests so that they are protected from the most severe storms, which approach from the island's exposed eastern and southern shores.

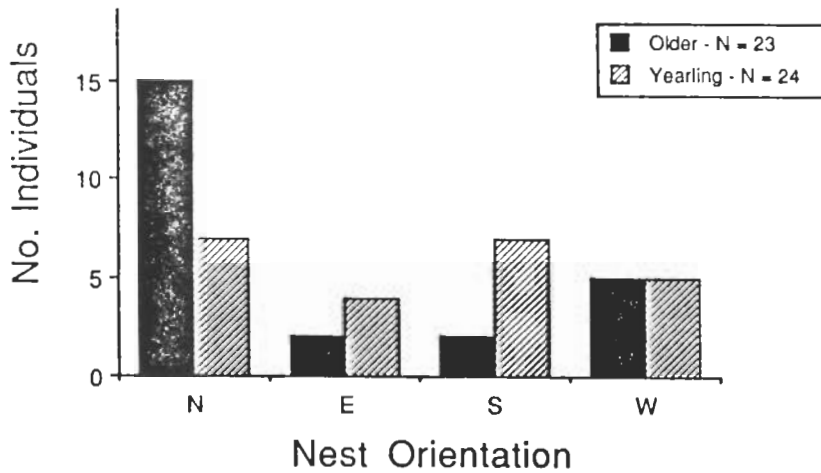


Figure 3: Few Savannah Sparrows fledge more than one or two clutches during their entire lifetimes. Given the high mortality of their nestlings, most females perish without leaving copies of their genes.

