Bowdoin Scientific Station

Report of Activities

2014

The Bowdoin Scientific Station (BSS) is a multidisciplinary field research station and wildlife sanctuary operated by Bowdoin College and located on the Bay of Fundy's Three Islands chain (Kent, Sheep, and Hay Islands). BSS is dedicated to:

- *Conducting world-class ecological research,*
- *Supporting the scientific community by providing access to the organisms, habitats, and long-term ecological databases of the Three Islands region,*
- *Providing a working and living environment that is free of distractions, allowing scientists and students to become fully immersed in their work,*
- *Training students to become future leaders of their fields,*
- *Protecting the native flora and fauna of Three Islands,*
- *Providing a focal point to encourage collaboration and discourse among all members of the Bowdoin community, and*
- *Supporting the liberal arts mission of Bowdoin College and the activities of the broader scientific community.*

Bowdoin students on an unusually warm summer's day on Kent Island. This photo was taken in the late 1930s in front of the west end of the Warden's House.

DIRECTOR'S NOTE

As Janet (my wife and partner-in-crime on Kent Island) and I were driving home from Kent Island after the conclusion of last summer's field season, we reflected on the things that had worked during the season and on the aspects of the BSS-Kent Island program that could be improved in the future. Which research projects were executed successfully? What can we do to make life more comfortable and the work proceed more efficiently? What can we do to keep morale high throughout the long season and to strengthen the community ethic? We have this same conversation at the end of every summer during our drive back to Maine. The drive itself encourages the discussion; it's one of the few times all summer that Janet and I just get to chat for several hours, and few radio stations can be received on the Airline Road, between the border crossing in Calais and Bangor. Having just completed the very powerful experience of living on a small island with 20 students and visiting scientists for 10 weeks, the conversation inevitably gravitates toward one question: *Are we making a difference?* In other words, does Kent Island and all the effort we put into the research station make a difference in the lives of our students or in the world at large? It's always difficult to answer this question objectively, especially so soon after the research season. However, on this drive home, we received a clear answer from an unusual source.

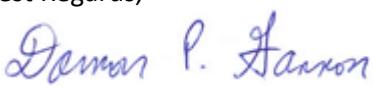
During a lull in our conversation, I was starting to get drowsy. Since we were approaching the outskirts of Bangor, I turned on the radio and was able to pick up a station. A call-in talk show was on the air, the topic of which was *Protecting Maine's Wildlife*. There was a panel of experts who gave all sorts of fascinating information about Maine's critters and answered callers' questions. One member of the panel was familiar; it was Laura Minich Zitske. Laura graduated from Bowdoin in 2001 and spent two summers studying Leach's Storm-Petrels on Kent Island with Bob Mauck. This seminal experience on Kent Island inspired her to go on to graduate school to study seabird ecology at the University of New Brunswick and she is now a wildlife ecologist at Maine Audubon and Director of Maine Audubon's Piping Plover and Least Tern Recovery Project. Janet and I listened to the program and realized that it would have been unlikely for Laura to follow the path that she did, if it had not been for her experience at BSS-Kent Island. Hearing Laura on the radio also reminded me of the countless times that I have met Kent Island alumni at scientific conferences and workshops. These alums often tell me that it was their formative experiences in research on Kent Island that led them to choose careers in science.

Then, as if to remind me that Kent Island's sphere of influence extends beyond science, I heard another familiar name in the credits at the end of the radio show. This name was Charlotte Rutty, who, as it turned out, was a production intern for the radio show. Charlotte was a BSS Artist-in-Residence during the summer of 2013 and is a member of Bowdoin's class of 2016. It was an extremely gratifying moment.

BSS indeed has a tremendous impact on the lives of its students, who go on to have a positive influence on our world in a variety of ways. Kent Island offers an experience for students that is exceptionally difficult to find elsewhere, either on Bowdoin's campus or at any other college or university. The three core elements of the *Kent Island Experience* are: **Immersion** (in ecological research or art), **Mentoring** (by professional scientists and artists), and **Community** (being part of a tight, supportive, self-sufficient community of scientists and artists that consists of both students and faculty). The Kent Island Experience is very powerful, often life-changing. The evidence of this is clear.

Share your story on how Kent Island changed your life by emailing me at dgannon@bowdoin.edu or join the Bowdoin Scientific Station FaceBook Group (https://www.facebook.com/groups/BowdoinScientificStation/). We look forward to hearing how Kent Island influenced your life.

Best Regards,



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2014 IN BRIEF:

BSS opened for the season in early April. The Savannah sparrow team was studying song learning and had to be present when the first sparrows returned to the island in early spring. There was still some snow in the woods and the plumbing froze most nights during the first month of work. This work continued through late September.

Use of BSS has been trending upwards, with a slight dip during 2011 and 2012 due to the dormitory renovation project. There were a record number of user days in 2014 (1,600). Over the course of the field season, BSS hosted 10 faculty from Bowdoin and four other institutions. Four high school students, 35 undergraduates (from four institutions), and two graduate students spent between two and 64 days at the station. Katrina Lukianchuk, a technician from the University of Windsor (Ontario), won the prize for spending the most time on Kent Island in 2014 (138 days).

In addition to the long-term projects on Savannah sparrows and Leach's storm-petrels, we also had research projects on rockweed, benthic marine fouling organisms, yellow warblers, and black guillemots. In addition to science, there were projects in fiction and nonfiction writing, painting, curriculum development, music, and documentary filmmaking.

For the first time in many years, Kent Islanders did not get to go ashore to see the seabird colony on nearby Machias-Seal Island (MSI). This was because of an unexpected guest—Tropical Storm Arthur—who came calling on the day we were scheduled to visit MSI. TS Arthur didn't cause any major problems but traveling by boat was out of the question. Since our permit from the Canadian Wildlife Service only gave us permission to land on MSI on July 5th, we missed our chance to observe the birds from the blinds within the colony. But we were able to view the colony from our boats when the seas subsided a few days later. Actually, this turn of events was fortuitous because as we were watching the razorbills, Atlantic puffins, common murres, and other species that nest on MSI, we made an unusual sighting of a tufted puffin. This species has only been documented in the Bay of Fundy on one other occasion, back in the 19th century.

Six peer-reviewed papers were published in the past year and five other manuscripts were submitted recently for publication (still undergoing review at the time that this report was written). It was a busy, productive year, as you will see throughout this report.

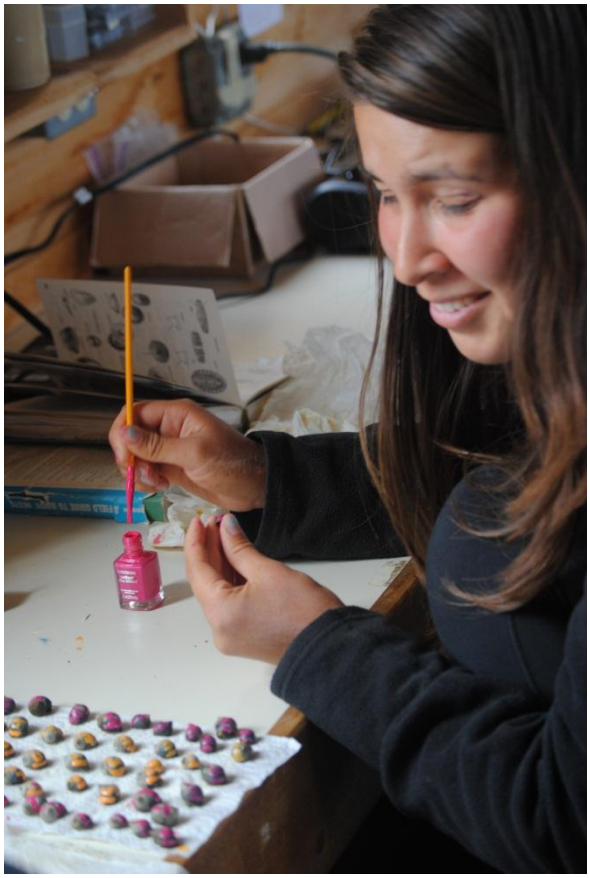
A very lost tufted puffin (*Fratercula cirrhata*) seen at the Atlantic puffin (*F. arctica*) nesting colony on Machias-Seal Island by BSS students, faculty, and staff. Tufted puffins are normally found in the North Pacific Ocean and Bering Sea. Photo by Jackson Bloch.

BSS Personnel Statistics:

User-days by category for 2010-2014.

User Groups	Years						
	2010	**2011**	**2012**	**2013**	**2014**	**Average**	**Total**
Undergrads	688	574	675	723	848	**702**	**3,508**
Grad Students	296	120	-	113	130	**132**	**659**
Senior Scientists	174	284	299	283	324	**273**	**1,364**
Technicians/Research Assistants	264	197	21	68	139	**138**	**689**
Other Professionals	5	-	-	37	36	**20**	**78**
High School Students	-	-	-	15	16	**6**	**31**
Visitors	78	83	128	209	104	**121**	**605**
Total, All User Categories	**1,505**	**1,258**	**1,123**	**1,448**	**1,600**	**1,387**	**6,934**

Graduate Student, Brad Woodworth (University of Guelph), helping to prepare our annual lobster bake.



Hannah Baggs (Bowdoin '17) marking common periwinkle snails for experiments in the intertidal zone.

2014 Summer Undergraduate Research & Art Projects

Leach's Storm-Petrel

Sarah Adrianowycz, Kenyon College '16

This summer on Kent Island I worked on the Leach's storm petrel project under the supervision of Robert Mauck. His study site, The Shire, has been utilized since 1991 and contains over 300 burrows which require daily checks. On a day to day basis our team surveyed the Shire, recording burrow occupancy and the presence of any eggs or chicks. Once an egg was found the burrow was left undisturbed for ten days, until which time the parents were removed for identification by their nine-digit USFWS band number and measurement of their wing length, tarsus length, and mass. Chicks were processed in a similar manner after five days of life, with subsequent measurements taken daily. In addition to gathering this basic demography data in the Shire, we also expanded our daily checks to the Ditch, a second study site that has been used intermittently for the past ten years, so that these burrows can be utilized in future studies.

We also conducted a manipulative experiment with heaters to model the impact of climate change on storm petrels, in terms of the reproductive success of their one egg clutch. By artificially increasing the burrow temperature an average of two degrees, we sought to isolate the influence of increasing air temperature from the influence of increasing sea surface temperature. We utilized iButton temperature sensors to determine the presence or absence of an adult incubating an egg in our ten experimental and ten control burrows. We also collected tail feathers from both adults, so that once we recaptured the birds we could measure the induced feather and determine how much energy they had available for feather regrowth.

Additionally, we received geolocators from the Canadian Wildlife Service which we placed on

ten pairs of storm petrels to track their extensive foraging trips. Recent publications have suggested that colonies of storm petrels forage in separate regions of the ocean, and our results indicate that those from Kent Island are foraging in a region distinct from the foraging areas of other nearby colonies. We also took blood samples for CWS, and a sample for our own use to determine the sex of both individuals. We hope to determine if there are sex based differences in foraging, and how these differences may relate to the quality of parental care.

My summer on Kent Island was an amazing experience, and one that has given me a greater appreciation both for the complexity of field research and the natural beauty of the island.

Breeding Site Activity of the Leach's Storm Petrel, *Oceanodroma leucorhoa*.
Liam Taylor, Bowdoin '17

Although I began the summer by venturing into the intertidal, most of my time on Kent Island has been spent as part of the long-term Leach's Storm Petrel project, working as a team under the guidance of Robert Mauck. This year, we found ourselves working on a variety of projects, including heating storm petrel burrows to isolate the effects of air temperature increases and attaching geolocators to several birds to analyze their pelagic foraging activities, in addition to continuing the annual demography surveys of numerous burrows. We've also gotten the opportunity to re-expand the study area, as an adjacent site, "The Ditch," was grubbed, ordered, and mapped, finally taking its place alongside the concentrated area of burrows studied in recent years, "The Shire."

My own project will focus on examining lattice data. Lattices, twigs and stems in the entrances of burrows, can help assess whether or not a bird has entered or exited. By using this lattice data as a proxy for the nightly activity of the birds, which can't be easily observed, I can examine the storm petrels' behavior in regards meteorological conditions and breeding status, such as whether or not an egg has been laid and whether or not two storm petrels have reproduced successfully in the past. I am excited to be working with such a long and storied data set!

This summer has given me experience with not only specific scientific questions, but also scientific and experimental processes in general. The opportunity to live and work with both scientists and artists has already been inspiring, and will certainly prove invaluable.

Nest Habitat Selection of Black Guillemots
Ben West, Bowdoin '16

This summer, I worked on habitat selection of black guillemots, *Cepphus grylle*, on Kent and Sheep Island. Guillemots are closely related to puffins and nest in all sorts of crevices, including under boulders, in driftwood piles, in dirt burrows, and even in salmon aquaculture pipe washed up on shore. Unlike other birds, such as storm-petrels or savannah sparrows, guillemots have not been studied consistently at BSS and have no long term data set, so I had my work cut out for me. My project went through several iterations; initially I was going to do a comparative study on both Kent Island and Grand Manan looking at the effects of invasive predators on guillemot nesting. When nests on Kent Island proved elusive, I built burrows out of the aforementioned salmon aquaculture pipe to see if any guillemots would nest in this additional habitat, but my artificial burrows remained unoccupied. It was at that point that, with advice from Damon Gannon, that I switched my project to focus on habitat selection.

It was only when previous station director and current Kenyon College professor Robert Mauck visited the island and gave me invaluable advice about nest-finding that my project finally took off. I had been trying to find burrows by observing birds from a blind, but what I ended up doing was sticking my hand in just about every crevice on the shore of the island. By the end of the summer, I found 67 burrows on both Kent and Sheep Island. I recorded the location of each nest using a GPS and created a map of the guillemot nests, which are located along the eastern and southwestern shore of Kent Island and the western shore of Sheep Island. While not finding, checking, and measuring the dimensions of nests, I surveyed the shores of all of the Three Islands (Sheep, Kent, and Hay), looking at the type of rocks on the shore, driftwood piles, dirt banks, drainages, and slope, among other things. Using these data, I hope to characterize the types of

habitats in which guillemots prefer to nest and to look at what characteristics of nests and nest habitat lead to the highest rates of egg and chick survival.

While I was not looking at guillemots, I enjoyed both the flora and other avian fauna of the island and nearby areas. Among the highlights of my summer included seeing a tufted puffin on Machias Seal Island, a king eider on Kent Island, and a red-bellied woodpecker, a bird never before recorded on the Kent Island bird list. I also made jam out of both rhubarb and gooseberries. With help from Nat Wheelwright, I expanded my knowledge of the flora of Kent Island, learning to identify yellow birch by its wintergreen-like odor and sheep sorrel by its tangy leaves and red-and-green flower clusters. Playing the tenor saxophone and penny whistle while others played string instruments and sang also brought me joy, though the sounds of the penny whistle where a bit shrill for some ears.

Ecological Effects of Rockweed (*Ascophyllum nodosum*) Harvesting

Christine Walder, Bowdoin '15

This summer, I expanded the research I had conducted on rockweed last year on Kent Island. I expanded my sample size on Kent Island and set up a comparative study site at Bowdoin's Coastal Studies Center in Harpswell, ME. I am studying the effects of cutting *Ascophyllum nodosum* (commonly known as rockweed or knotted wrack) plants to 16". Rockweed has traditionally been managed based on its regrowth rates—which are shockingly slow—while less is known about the ecosystem response to canopy removal. *A. nodosum* is the dominant intertidal macroalgal species from Maine to Canada; it plays an important role in buffering intertidal stresses and supports a variety of organisms such as molluscs, crustaceans, fish and birds. *A. nodosum* is harvested commercially for use in fertilizers and food additives, and landings have been increasing in Maine in recent years.

Paired 2x2m control and experimental plots were set up, harvested, and surveyed monthly during the summers of 2013 (15 plots on Kent Island) and 2014 (an additional 9 plots on Kent Island and 20 on Orr's Island) in a BACI design (Before, After, Control, Impact). Since I am doing a comparative study between Canada and Maine, I have spent about half my time in each place. One square meter surveys were conducted to determine algal species richness, algal percent secondary cover, and macrofauna abundance and diversity. Surveys were designed to assess the overall diversity within plots and count/identify all species present.

Initial t-tests of Kent Island data show a short-term reduction in amphipods and isopods, *Carcinus maenas* (green crabs), and *Littorina obtusata* (smooth periwinkles) and a short-term increase in *Littorina littorea* (common periwinkles) ($p<0.05$), with a long-term reduction in anemones and continued trends towards generally lower numbers of mobile macrofauna. However, macroinvertebrate biodiversity (H'), macroinvertebrate species richness, and algal species richness were not significantly affected by harvest. Although many of the same trends were observed at the study site in Maine, there were no significant changes following harvest. Initial results suggest that although the presence of mobile invertebrate species is not affected by harvest, removal of the canopy results in general reduction in abundance of most invertebrates, and this reduction in abundance can persist for at least a year. The harvested canopy was still significantly shorter than the control canopy one year following harvest (t-test, $p<0.0001$), although the algal percent secondary cover had returned to nearly normal levels (t-test, $p=0.8$).

Having the opportunity to conduct self-designed research and help set up a long-term study site has been wonderful, and working at Bowdoin's two marine research facilities has been a real pleasure.

Diversity of native and invasive settlement community organisms in the Bay of Fundy

Andrew Villeneuve, Bowdoin '16

If there is anything I am taking away from my time on Kent Island, it's that experimental field ecology can be really, *really* difficult, but intensely rewarding. I originally came to Kent Island with the purpose of studying the effect the invasive bryozoan *Membranipora membranacea* has on kelp frond breakage and subsequent community diversity effects. However, I soon discovered that there wasn't a colony of *M. membranacea* to be had for

love or money on kelp fronds; good for the island, bad for me. I soon switched my project to using settling plates and quadrat surveys to quantify marine settlement organism diversity in both low and high current areas around Kent Island. Organisms in settlement communities have planktonic juvenile states but sessile adult states, and includes sponges, bryozoans, hydroids, bivalves, barnacles, anemones, and tunicates. These organisms float about the ocean before settling and growing on hard surfaces such as rocks, buoys, docks, and aquaculture materials. I also wanted to watch for the presence of any invasive organisms on Kent Island, especially ones that are currently dominating the ecosystem at the Coastal Studies Center in Harpswell, ME like *Didemnum* sp. A.

I placed 35 buoys containing in total around 100 settlement plates around the island, some of which were destroyed or swept out to sea during Hurricane Arthur in early July, and as of writing this report in late July only a thin biofilm of algae, bacteria, and snail eggs have grown over my plates. I have concluded that the cold waters of Kent Island have resulted in much later spawning and larval settlement times than originally assumed, so that any settlement will occur when the water warms further in August and September, when I will be returning for a weekend to look for any target organism growth. My quadrat surveys have been more fruitful, resulting in at least 28 settlement organism species and the presence of two invasive organisms: *M. membranacea* (found under rocks, not on kelp fronds) and *Ciona intestinalis*, a large solitary tunicate of which I only found one individual. Preliminary results seem to indicate that higher diversity is found in high and low current areas with micro-level current protections (areas with lots of boulders) than in areas without any micro-level current protection. I can also only assume that, while it seems that Kent Island has avoided an influx of invasive marine organisms thanks to its cold surrounding waters, rising ocean temperatures resulting from climate change will only increase their presence on Kent Island as water temperatures sufficient for spawning and settlement occurs earlier and earlier in the year.

The experience on Kent Island has been challenging but immensely satisfying – daresay it's been my best summer? Nowhere else can undergraduate students do independent research during the day and spend evenings discussing each other's project problems or successes in such a supportive and beautiful environment. I leave with confidence that I can tackle independent research and its successes and tribulations head-on in a way that I would never have learned if I just worked in someone else's lab. Goodnight, sweet prince, goodnight dear old Kent Island.

Development of Begging Calls in Nestling Yellow Warblers

Jackson Bloch, Bowdoin '15

Songbird nestling begging calls can be influenced by physiological development, behavioral state, and ecological context; however, the effects of these variables on their structural ontogeny are understudied. I recorded 14 yellow warbler (*Setophaga petechia*) nests to assess how begging calls developed over time and whether they differ between nests and different ambient noise conditions. Nestlings were recorded on day two, day four, day six, and day eight. Initial data show that the dynamic frequency range of begging calls increases as nestlings age and that the minimum frequency of calls also increases with age. Nestlings may increase the frequency of their begging calls to compensate for increased vocal amplitude. Higher sounds attenuate more quickly, so high frequency begging calls could help mitigate the risk of auditory predator detection.

General breeding ecology of yellow warblers was also observed. Females incubated in 15-25 minute bouts, with 5-10 minute foraging breaks. Males often fed females one or two times on the nest during incubation bouts, and in several cases male-female feeding continue after fledging. Females laid clutches of either four or five eggs, although two clutches were reduced to two eggs by predators. Females began incubation after laying the penultimate egg and incubated for, on average, 12 days before the eggs hatched. Nestlings that survived to fledging fledged on day 11. A total of nine nests failed. One female built two unsuccessful nests that were likely lost to weather before successfully laying eggs in a third. A second female lost one nest with an egg in it before unsuccessfully building two more nests. Predators depredated a third female's nest after three eggs had been laid.

Her second nest only contained three eggs, two of which hatched. All nests were found in open habitats near forest edges and were spaced approximately 150 m apart at their closest. One nest on Hay Island appeared to be a two-story nest, characteristic of the way in which yellow warblers address brood parasitism, however no brood parasitizing brown-headed cowbird eggs were found. All nestlings were banded on day seven.

Observing yellow warbler breeding behavior was extremely rewarding, although at times also frustrating. Nest finding often entailed watching females forage for hours at a time before they began to build or return to their nests. Once I found nests, it was initially difficult to determine how much I could intrude and push the females. They often chipped and tried to draw me away from the nest, but ultimately, none of them abandoned. My intimate and constant observation of yellow warblers ultimately taught me more about the nuances of their behavior than I expected to learn. Hopefully my research will lend insight into nestling begging ontogeny and my experiences can inspire future work with yellow warblers on Kent Island.

Writing About the Science Taking Place on Kent Island

Emily Stewart, Bowdoin '16

My project interprets the scientific research that I have participated in and learned about from my peers on Kent Island into writing that makes it comprehensible and interesting to a wider audience, and that connects it to larger ecological and conservation issues. Over the past nine weeks, I have kept an online blog, named "Kent Island Journal: Environmental Science from the Source," that describes my experiences in the field and my research of the Bowdoin Scientific Station's records. My thirty five posts include Kent Island's history, wildlife field trips that we have gone on as a group, students' individual research projects, and other Kent Island species that I have researched such as Herring Gulls and Tree Swallows. The information in my posts about student research comes from my own experiences with scientists in the field and published research on their study species. In my posts, I have tried to clearly explain the research question that each person is investigating, background information about their study species, the methods they used, and what direction their research is heading in next. I want to convey the bigger picture of where these projects fit into our understanding of the environment, and have connected relevant projects to larger environmental trends and policy.

I will compile my writing from the blog, which served as a forum for drafts, into a printed publication. It will include a section on the science community, a section on ocean and intertidal ecology, and a section on the species that inhabit the Island, which weaves current projects into the context of both past studies and current policy issues. I will also feature an excerpt of Tracey Faber's creative writing, which richly evokes the atmosphere of Kent Island, and plan to use Jackson Bloch's wildlife photographs throughout. The goal of my publication is to share the process of science and the discoveries that scientists here have made on the island, especially ones that are relevant to environmental issues, in an accessible, readable way. I will print copies of my book for Kent Island, for Bowdoin and for the public libraries in Brunswick and on Grand Manan. I will also create an online version of the publication so that it is accessible to everyone.

Developing Science Education Materials for Middle School and High School Students

Hannah Baggs, Bowdoin '17

During my time as an artist in residence on Kent Island I worked on a self-designed education project that provides earth science and early biology materials for middle school science teachers and students. These are primarily aimed at grades seven through nine because these are typical curricula in the United States for this age group. The materials will be videos and articles centered around two central concepts: "Ecology", featuring topics such as habitat and symbiotic relationships; and "Science Outside the Classroom", featuring topics such as field stations and the scientific process. Over the last two months, I have filmed and interviewed researchers as they developed and carried out their respective projects, while also gathering footage on the island's natural processes, organisms and scenery. I also have been researching the various topics in regards to the publications produced on Kent Island and information relevant to its

ecosystem. In addition, I plan on producing material that focuses on what Kent Island is and its value to Bowdoin and Bowdoin students.

I plan to spend the next semester sorting through footage and researching other educational materials, along with talking to local teachers and educators, so that I can produce resources that are valuable to Maine middle school students and teachers. Ideally these would be available through a website and easily accessible. Kent Island is one of those unique places where the lore of the island manifests itself in both the present community and the development of community over time. I asked each person I interviewed, "What kind of a place is Kent Island?" The responses were rich and varied, but a general consensus was that it was an extension of Bowdoin in which we were fortunate to take part.

Artist-In-Residence
Tracey Faber, Bowdoin '16

My project began as a combination of short story writing and painting, with the goal of exploring how to express narratives with a focus on place and identity, based on the stories of the current Kent Island community, and its long history. I wanted to tell stories employing the visual imagery of painting, and to use written imagery to articulate the same narratives. I expected to create paintings and short stories that correlated, the written story being explicit and the painted being implicit. However, I found that in writing I was able to mix together the stories that the people living on the island shared and created this summer, the history of Kent Island, and my sense of the environment itself, in a far more fluid and immediate way, which I will hopefully be able to eventually replicate in my visual art.

Over the course of the past two months, while I have produced paintings related to my stories, and written a story based on a painting I completed, the visual aspect of my project became more about relating to the Kent Island community, rather than using the material the community has imparted to me, from creating a chess set to making a painting for a father's day gift and adding a Tufted Puffin to the walls of the dorm. I have written eight short stories and created four paintings based on my summer on Kent Island, but the community and place will continue to influence my work heavily in the future. Having two months dedicated to working on writing and painting has enabled me to improve my technique in both media, provided me with long-term material for stories and images, and also given me the ideal place and community to formulate my ideas about the artistic and literary process, and how life and art do and should interact.

Sonic Sketches of a Summer on Kent Island
Sam Seda, Bowdoin '15

Sonic Sketches is an attempt to harness the sense of mindful awareness engendered by the simple, isolated lifestyle practiced by the Kent Island Community, directing it at the island itself in the hopes of creating an album of compositions that simultaneously document and evoke the interactions between the island and its inhabitants, both human and nonhuman(as well as their interactions with each other), through the arrangement and manipulation of audio samples taken from field recordings made on and around the island over the course of the summer. In keeping with the ethos of voluntary austerity cultivated on the island, this project was undertaken with the minimum of equipment thought necessary: A small digital recorder, a laptop with two audio editing programs(Audacity and Ableton Live 9), and headphones. This process was aided by a voluntary abstention from use of phones or internet, allowing near-total immersion in the creative process(aside from time spent cooking, another substantial portion of my time on the island). Tracks presently range from 6 to 35 minutes, and generally focus on a single area, incorporating audio samples from the entire recording period to create a mental image of the location. The audio samples are generally chosen due to their innate musicality or poignance, and manipulated/arranged to emphasize this, especially in relation to other samples used within the track.

Recordings were mostly taken within the first 6 weeks of being on the island, with supplemental recordings taken as needed. I would either accompany researchers into the field to record them as they worked or go out into the field myself. This was followed by roughly two weeks of listening to recorded material and isolating usable material. This was organized first by week, and then by location, culling more recordings each time. After the tracks' respective sample lists were finalized,

time was spent in each locale to regain familiarity, both alone and with the researchers who worked in those areas. This was followed by composition itself, which ended up following a similar process. The samples were laid out in Ableton in relative chronological order, or if there were specific series of events I wanted to include, they would be laid out accordingly. Some would be allowed to loop, as others played their lengths and finished. I would start a few initially, listen to how they interacted with one another, and then add or subtract samples as needed. Like navigating through the areas themselves, I would move through the samples, listening for interesting confluences of sounds or important events as they occurred. I would experiment with weaving samples in and out of the mix through direct use of Ableton's faders and indirectly automated fades. A similar process was used to determine amounts of reverb and placement in the stereo field for individual tracks. After spending enough time with the samples and forming a general idea of how I wanted to represent the area through the sounds at my disposal, I would record myself navigating through the samples as I had many times before. This process was not foolproof, and many takes were needed to produce a satisfactory result, reminiscent of my experiences navigating the island. Exclusive use of prerecorded non(strictly)musical sound made overdubbing and specific changes difficult and tedious, while starting the recording over allowed me to become even more familiar with the material while avoiding making the same mistakes.

Writer, Emily Stewart (Bowdoin ’16), taking advantage of nice weather to practice her craft outdoors.

Ben West (Bowdoin ’16) and his helpers surveying nesting habitat of black guillemots

2014 INFRASTRUCTURE IMPROVEMENTS

Over the past several years, BSS has made great strides in performing much-needed major maintenance and improvement projects on our physical infrastructure. BSS caretakers Mark Murray and Russell Ingalls, along with Russell's crew, continued their break-neck work pace in 2014. Major projects included:

- Performing a major structural refit (Raised the gunwale by 2" and replaced the structural core of the transom, structural beams, main bulkhead, fore deck, main deck, side decks, cabin, and pilothouse) and complete paint job on the vessel *Ernest Joy.* After 20 years of service, the *Ernest Joy* is essentially a brand new boat, acquired at a small fraction of the cost of a comparable new boat. *Ernest Joy* should give us 20 more years of dependable service.
- Raising the Lower Lab and Captain Gillette by a foot and replacing the structural beams and foundation footings beneath them.
- Installing a new backup electrical generator.
- Acquiring two new composting toilets and building a small out-building to house them near the Lower Lab. This will reduce our impact on the ecology of the basin and inner harbor.

Many smaller projects were also accomplished. These critical infrastructure improvements make it possible to live safely and work productively on Kent Island. Regular major maintenance will prolong the service life of our infrastructure, thus saving the Station money in the long run. These efforts were made possible by donations from individual supporters and funds from Bowdoin College's Office of Academic Affairs and Office of the Treasurer.

We have made great progress but there is no end to the list of maintenance tasks. Projects planned for 2015 include renovating the Captain Gillette (re-sheathing and replacing siding, which suffered minor damage during Tropical Storm Arthur last July), Lower Lab (new windows and siding), and Hodgson House (replace roof and add a propane heater).

The Capt. Gillette, which started its life as a herring shed, was one of three existing structures when J. Sterling Rockefeller bought Kent Island in 1930 (the herring weir and barn—soon to become the dorm—were the other two structures present at that time). The Hodgson house was a prefabricated building donated to Bowdoin by the Hodgson House Company in the 1930s.

The results from the Station's External Review also made it clear that BSS needs to improve/increase its housing for families and to perform a major renovation on the Warden's House (see below). Funding sources need to be identified for these projects. The Warden's House was built in the early 1930s when Rockefeller owned Kent Island.

Ernest Joy after the refit; ready to serve another 20 years. (Isn't the storm-petrel silhouette on the side of the wheelhouse a nice touch?) The Capt. Gillette (l) and Lower Lab (r) are the two red-roofed buildings in the background.

The Warden's House in 2014, looking just as it did in the 1930s, with the addition of a fire escape ladder (see cover photo).

It's "all hands on deck" when *Island Bound* visits Kent Island to deliver a load of building supplies.

NEWS AND NOTES

NSF-Funded External Review

It is standard practice for academic departments at colleges and universities to undergo external review every five to ten years. However, BSS had never had a review in its entire 80-year history. The purpose of an external review is to have a team of experts with no *skin in the game* perform a comprehensive evaluation of a program. These reviews help the departments stay abreast of current practices in teaching and research. BSS obtained a grant from the National Science Foundation to perform an external review. The review team consisted of Doctors Ian Billick (Rocky Mountain Biological Laboratory), Knute Nadelhoffer (University of Michigan Biological Station and U.M. Dept. of Ecology and Evolutionary Biology), and Robin Hadlock Seeley (Shoals Marine Laboratory). The reviewers met with students, faculty, staff, visiting scientists, and representatives of the College administration during visits to BSS-Kent Island in May and to Bowdoin's main campus in September.

The review team's report affirmed the value of BSS to Bowdoin College's academic mission and strongly favored continued investment in the program, stating:

> *The research value of BSS can be seen in its productive publication track record, as well as in its ability to attract strong scientists from Bowdoin College and other prestigious institutions. This combination of a unique location, long-term research, and student engagement in world-class research makes it a priceless research resource.*

The reviewers went on to state in their report that "BSS has long had, and continues to have, a strong research program." They noted that BSS's long-term studies "are among the oldest field studies nationally and are priceless scientific resources that have attracted international scientific attention and which will likely continue to advance the research profile and reputation of BSS." They pointed out that because of its strategic location—at the confluence of the Gulf of Maine and Bay of Fundy—research carried out at BSS has "economic and cultural importance as well as scientific value."

The review team made observations and recommendations in six key areas: Research and Education, Facilities and Infrastructure, Budgeting, Staffing, Public Outreach, and Habitat Management. There are too many recommendations to be summarized here. However, one of their main suggestions is to increase and improve the housing on Kent Island for families in order to attract and retain visiting scientists and mentors for student. The reviewers linked the family housing conditions to BSS's ability to support long-term (i.e., multi-decade) research programs, concluding that it would be "quite difficult to retain the long-term commitment of scientists and staff, unless the facilities are sufficient to support faculty at different stages of their careers."

The external review team's recommendations will be invaluable for charting BSS's course for the next five to ten years. And we wish to extend our sincere thanks to Drs. Billick, Nadelhoffer, and Seeley for their hard work and keen insight.

Collaboration with Grand Manan Museum

BSS is collaborating with the Grand Manan Museum to create a large mural depicting a Bay of Fundy intertidal scene inside one of the Museum's exhibit halls. Bowdoin Student artists Tracey Faber ('16) and Isaac Jaegerman ('16) will work with the Museum's Executive Director, Mary Joan Edwards, and professional artist Sarah Griffin on this project, which is funded by an Exhibit Renewal Grant from the Province of New Brunswick. Janet and Damon Gannon will act as biological consultants. Phase I of the two-year project will begin in late May.

Upward Bound

In 2013, BSS initiated a partnership with Upward Bound, a program that helps high school students get into and succeed in college. Upward Bound is a national program; the chapter based at Bowdoin College works with students from Maine. Four Upward Bound students and their councilor spent a week in July 2014 on Kent Island, learning about the science taking place at BSS and conducting their own

research on intertidal ecology. Plans are in the works to host more Upward Bound students in 2015.

National Academy of Sciences Report

The National Academy of Sciences released a report in July of 2014 on the critical importance of field stations and marine laboratories (FSMLs) for understanding the complex interactions that take place in the environment and for predicting how the environment will be affected by perturbations such as climate change and ocean acidification. The report, titled *Enhancing the Value and Sustainability of Field Stations and Marine Laboratories in the 21st Century*, focused largely on strategies to maximize the scientific productivity of field stations and marine laboratories by promoting the formation of stronger research networks, increasing the entrepreneurship of FSML directors, and doing a better job of documenting the impacts that FSMLs have on science and society. The full report and a summary are available online at: http://dels.nas.edu/Report/Enhancing-Value-Sustainability/18806.

News from Kent Islanders

- BSS alum and award-winning nature documentarian, Ann Johnson Prum, led a team of filmmakers to create a three-part documentary called "Animal Homes" for PBS's *Nature* documentary series. Prum and her team, including independent filmmaker Michael Male, worked on location at Kent Island's Leach's Storm-Petrel colony in 2013, and Michael returned twice in 2014 to do more filming. These films will air on PBS in April.
- Iris Levin ('05) returned to Bowdoin to give a seminar to the Biology Department on her research, titled "Seabirds, Swallows, and Social Networks." Iris received her Ph.D. in Ecology, Evolution and Systematics from the University of Missouri-St. Louis and is now a National Science Foundation Postdoctoral Fellow at the University of Colorado in Boulder.
- Christine Walder ('15) won the James Malcom Moulton Prize in Biology, which is given by Bowdoin College's Biology Department to an outstanding biology major in the junior class. Christine also won an award for best poster presentation at the Northeast Undergraduate Research & Development Symposium, held at the University of New England. Christine's Presentation was titled: "Ecological effects of harvesting rockweed, *Ascophyllum nodosum*.
- Cailey Oehler ('15), BSS artist-in-residence and cook in 2012 and 2013, has been awarded a Fulbright Fellowship. Cailey will be teaching English and organizing a community kitchen in Colombia next year!
- Amy Johnson's *Biology of Marine Organisms* and Damon Gannon's *Biology of Marine Mammals* classes went on a joint field trip to BSS-Kent Island in September to perform a necropsy on a dead humpback whale that washed ashore on Sheep Island. Students learned about anatomy, physiology, biomechanics, ecology and conservation of large whales. The skeleton of the whale is being saved so that it can be exhibited by the Grand Manan Whale & Seabird Research Station. It was a smelly job but much fun was had by all!
- Mary Helen (Miller) Montgomery ('09) is a multimedia journalist at the Chatanooga Times Free Press. She was part of a small team of journalists who were chosen as finalists for a Pulitzer Prize in Local Reporting for their investigative series on the "Code of Silence" that exists in Chatanooga's inner city with respect to reporting crimes to the police. Mary Helen will be taking a brief leave from her normal job to teach at the Transom Story Workshop in Woods Hole, MA this summer. Transom is an intense eight-week training program for promising, young producers of radio and multimedia content and is run by American Public Media. Mary Helen is a Transom alum.
- Damon Gannon was elected to be a member-at-large of the board of directors of the Organization of Biological Field Stations in 2014. In early 2015, he was elected vice president of OBFS.

ACADEMIC PRODUCTS

(* = Graduate Student, ** = Undergraduate)

Publications

Dearborn, DC, AB Gager, ME Gilmour*, AG McArther, DA Hinerfeld, and RA Mauck. 2015. Non-neutral evolution and reciprocal monophyly of two expressed Mhc class II B genes in Leach's storm-petrel. *Immunogenetics* 67:111-123.

DeLuca, WV, BK Woodworth*, C Rimmer, PD Taylor, PP Marra, K McFarland, S Bearhop, SA Mackenzie & DR Norris. 2015. Transoceanic migration by a 12g songbird. *In press: Biology Letters, Royal Society.*

Gilmour* ME, CR Lattin, LM Romero, MF Haussmann, RA Mauck, and DC Dearborn. 2015. Finding the best predictor of reproductive performance of Leach's Storm-petrels. *Auk: Ornithological Advances*. 132:191-205.

Teplitsky, C, M Tarka, AP Møller, S Nakagawa, J Balbontín, TA Burke, C Doutrelant, A Gregoire, B Hansson, D Hasselquist, L Gustafsson, F de Lope, A Marzl, JA Mills, NT Wheelwright, JW Yarrall, and A Charmantier. 2014. Assessing multivariate constraints to evolution across ten long-term avian studies. *PLoS One* 9 (3) e90444. doi:10.1371/journal.pone.0090444 (15 p.).

Wheelwright, NT, L F Keller, and E Postma. 2014. The effect of trait type and strength of selection on heritability and evolvability in an island bird population. *Evolution* 68(11):3325-36.

Woodworth*, BK, GW Mitchell, DR Norris, CM Francis & PD Taylor. 2015. Patterns and correlates of songbird movements at an ecological barrier assessed using landscape- and regional-scale automated radio-telemetry. *In press: Ibis.*

Manuscripts Submitted (as of 01 April 2015)

Eichenwald**, A, B Connery, T Divoll, and D Gannon. Correcting for differences in recording abilities of acoustic bat recorders. (In review: *Methods in Ecology and Evolution*)

Mitchell, GW, BK Woodworth*, PD Taylor & DR Norris. Age specific differences in flight duration and groundspeed are driven by wind conditions aloft: an automated telemetry study. (In review: *Movement Ecology)*

Wheelwright, NT, E Begin, C Ellwanger**, S Taylor, and J Stone. Minimal loss of genetic diversity and no inbreeding depression in blueflag iris (*Iris versicolor*) on islands in the Bay of Fundy. (In review: *American Journal of Botany*).

Wheelwright, NT, and C Teplitsky. Divorce in Savannah sparrows: causes, consequences and inheritance. (In review: *Proceedings of the National Academy of Sciences*).

Williams, H, CW Robins, DR Norris, AEM Newman, CR Freeman-Gallant, and NT Wheelwright. Regularization of a learned behavior: the buzz segment of Savannah sparrow song. (In review: *Animal Behaviour*).

Theses

Jenkins**, C. 2014. The effect of MHC Class II genes on mate choice in vertebrate populations. Undergraduate Thesis, Bates College.

2014 Presentations

Bloch**, J. Environmental effects on begging call ontogeny of nestling Yellow Warbers. President's Science Symposium, Bowdoin College.

Cornell, D, B Putnam, R Cornell, and NT Wheelwright. "Quiet Skies" (multimedia interactive installation on the collapse of songbird populations). Kala Art Institute, Berkeley, California.

Eichenwald**, A, T Divoll, B Connery, B Wheeler, V Douhovnikoff, and D Gannon. Changes in chiropteran community structure associated with the white nose syndrome epidemic: evidence for competitive release? Northeast Undergraduate Research & Development Symposium. Biddeford, ME

Gannon, DP. Building a Research Network: notes from a nascent network of coastal field stations surrounding the Gulf of Maine. Annual Meeting of the Organization of Biological Field Stations. Marine Biological Laboratory, Woods Hole, MA.

Lukianchuk*, K, R Norris, A Newman, H Williams, S Doucet, and D Mennill. Seasonal and diel variation in

singing behaviour in an island population of Savannah Sparrows (*Passerculus sandwichensis*). Poster presentation at the annual joint meeting of the American Ornithologists' Union, the Cooper Ornithological Society, and the Society of Canadian Ornithologists. Estes Park, Colorado, USA. September 23-28, 2014.

Mennill, D. The Song of the Sparrow: Insights into animal vocal learning from a wilderness study. Spoken presentation to Canada South Land Trust's annual fundraising dinner. Windsor, Ontario, Canada.

Villeneuve**, A. The effect of current on native and invasive settlement community diversity in the Bay of Fundy. President's Science Symposium, Bowdoin College.

Walder**, C. Ecological effects of *Ascophyllum nodosum* harvesting. President's Science Symposium, Bowdoin College.

Walder**, C. Ecological effects of *Ascophyllum nodosum* harvesting. Northeast Undergraduate Research & Development Symposium, University of New England, Biddeford, ME. (Christine Walder won an award for best poster presentation at this conference.)

Grants Received in 2014

Dearborn, D. Bates College Phillips Faculty Fellowship for full sabbatical plus reseach funds. (~$60,000); "Opposites Attract: Immune Function Creates a Preference for Dissimilar Mates"

Dearborn, D and F. Hailer. National Evolutionary Synthesis Center (~$5,000); "Balancing Selection and Mate Choice at the Major Histocompatibility Complex"

Gannon, D.P. Rusack Fund, Bowdoin College. "Workshop on developing a Research network among field stations in the Gulf of Maine region."

Marine Biology classes studying the humpback whale known as "Harmonic," which washed ashore on Sheep Island.

IN MEMORY: DAVID Z. WEBSTER, 1935-2014

David Webster died on August 7, 2014, after a 25-year battle with prostate cancer. David graduated from Bowdoin in 1957 and then served in the Army, after which he went on to earn a law degree at George Washington University and an MBA at Babson College. He had a very successful career in the insurance industry. David was president of Aon Corporation's Providence, RI office in the 1980s and then became the executive vice president of Aon's Boston office until his retirement in 1998.

David was an extraordinary philanthropist and advocate, working to support many charities in the fields of education, the arts, and social welfare. Among his many volunteer and philanthropic activities, he chaired the New England Dollars for Scholars campaign, served the Pine Street Inn in several capacities, was on the board of the Wang Center for the Performing Arts, and was a director of the Barn Playhouse in New London, NH. For his tireless volunteer work on behalf of Bowdoin College, the Bowdoin Alumni Council awarded him the Alumni Service Award in 1998.

He was a good friend of the Bowdoin Scientific Station, playing a major role in the effort to acquire Sheep and Hay Islands, as well as in ensuring the long-term strength of the Station's research and education programs.

David's energy, good spirit, and passion for Kent Island will be missed. He is survived by his wife of 53 years, Janie; sons David and Charles; his twin brother, Peter; and five grandchildren.

The view of Kent Island from South Hill, with Hay Island in the background.

IN THE WORDS OF OUR STUDENTS

If there is anything I am taking away from my time on Kent Island, it's that experimental field ecology can be really, really difficult, but intensely rewarding…I leave with confidence that I can tackle independent research and its successes and tribulations head-on in a way that I would never have learned if I just worked in someone else's lab.

-Drew Villeneuve ('16)

This summer has given me experience with not only specific scientific questions, but also scientific and experimental processes in general. The opportunity to live and work with both scientists and artists has been inspiring, and will certainly prove invaluable.

-Liam Taylor ('17)

Island Bound!

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BSS is a member of the Organization of Biological Field Stations (OBFS.org).