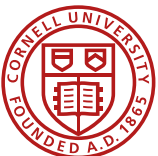




The Appledore Island Handbook



Dedicated to Undergraduate Education and Research in Marine Science since 1966.



Cornell University



University of
New Hampshire

Introduction

The offshore environment of the Isles of Shoals archipelago, which includes Appledore Island, presents a variety of challenges far different from any encountered during everyday life on the mainland. The history of human use, the maritime climate and rugged terrain, and the complexities of a modern teaching laboratory, all contribute to the “magic” of present-day Appledore Island.

Residents on Appledore live by the coming and going of the tides and the vagaries of New England weather. Consequently, things change frequently and flexibility is essential to dealing with all situations and circumstances. We also depend upon each other to a greater extent than on the mainland (academically, socially, psychologically) for safety and to “get the job done.” Our community is in an isolated environment with very limited access to services that we often take for granted on the mainland. Situation awareness, conservation, and safety-conscious decision-making are important at all times. Flexibility and patience are essential for coping with unpredictable events, foul weather, equipment or power failures, and last minute changes in schedules.

The *Handbook* is intended to help you enjoy Appledore Island and get the most out of your experience at SML. Although the many “do’s and don’ts” included throughout the *Handbook* may appear to be authoritative and even dictatorial, they reflect policy proven to *work* and thereby improve your chances of attaining your academic goals. Please talk to a staff member if you have any questions or concerns.

The *Handbook* provides some information about the history and establishment of SML, but is not intended to be exhaustive. If interested in details and history, consult John M. Kingsbury’s book, [Here’s How We’ll Do It!](#) (available in The Appledore Store, which also has field guides, other books of interest, and clothing). The *Handbook* also includes an introduction to the flora and fauna of Appledore Island, but again is not intended to cover the ecology and geology of all the rocks, plants and creatures that surround and inhabit our treasured isle. Appledore’s library and laboratories house textbooks and field guides for participant use – please feel free to take advantage of these reference materials during your program.

Safety and precautions

It is important to keep in mind that Appledore Island is a rough and isolated location. Situational awareness, conservation, and safety-conscious decision-making are always important.

Fire

Fire is the greatest danger on Appledore, particularly as all buildings are made of wood and there is no fire department on the island (WE are the fire department). Note and remember where the fire alarms/extinguishers/fire hoses are located in YOUR housing and in all the buildings that you frequent (classrooms, labs, etc.).

If you see flames or smell smoke in any building:

- EXIT the building at once, and ACTIVATE the fire alarm on your way out
- Alert others to vacate/avoid the building and notify staff members (most have handheld radios for communication).

Smoking is allowed **ONLY** on the smoking bench behind Kiggins Commons and use the sand-filled receptacles provided to discard the butts. **DO NOT smoke and NO OPEN FLAMES, in any building at any time!! DORMS INCLUDED.**

General or medical emergency

Seek assistance from a staff member (familiarize yourself with their photos posted in Kiggins Commons) in the main office on second floor of Hamilton; the kitchen; or Bartels Hall (in the evening). If you cannot locate a staff member, use the handheld radio located in the Hamilton office to call for help. To activate emergency services **dial 911 or UNH dispatch at (603)862-1212, and let them know you are located on Appledore Island, Kittery, Maine.**

Gulls, plants, and footwear

Approximately 1,200 pairs of gulls (Great Black-backed Gull and Herring Gull) nest widely on Appledore and are particularly aggressive in June and July when they feed and protect their chicks. Birds close to campus are generally more acclimated to people (and thus calmer) than those exposed to less human contact. Wearing a hat is a good idea and a stick held overhead could prevent a bird from striking you from behind. As much as the gulls may bother you, you are not allowed to seek revenge. Federal Law protects all the gulls, their nests, and their eggs. So please, for your sake and the sake of the gulls, do not disturb the birds or their nests.

Poison ivy is **VERY ABUNDANT** on the island. We clear and spray along roads, most paths, and in areas around the buildings, so contact is minimal or non-existent in these areas. Exercise caution when traversing in other areas. If you have come in contact with poison ivy, use **TECNU** (located in every bathroom) to remove the oils from your skin and prevent reaction.

Wear protective footwear at all times. Over 400 years of human habitation on Appledore have left glass and sharp metal objects along the paths and roads. The island's rocky and irregular terrain also demands protective footwear to prevent cuts and sprains. Be especially cautious when traversing the intertidal.

ALWAYS use the **buddy system** when walking away from the main campus. When in the intertidal, always keep one eye on the sea.

Water conservation and use

Water is a precious and limited resource on Appledore as it comes from a small freshwater 'pool' floating on seawater at a depth of 20 feet. If the water level gets too low, we must make potable water from seawater via reverse osmosis. Consequently, water conservation is crucial and is realized by strict conservation measures: two "Navy style" showers (run water only when rinsing) each week, never letting water flow unused from faucets, and the use of composting toilets in the Water Conservation Building (only 3 oz. water/flush). The average amount of water used by each individual on the mainland is 100 gallons/day; conservation practices on Appledore reduce water usage to 20 gallons/person/day. For more information about our sustainability and conservation efforts, please visit shoalsmarinelaboratory.org.

While we must conserve water at all times, it is imperative that everyone drinks plenty of water. Dehydration is a serious health issue (especially if you are out in the field or on boats for long periods of time) and is easy to prevent. Water from the faucets in the dorms, labs, and kitchen is safe to drink.

Showers are permitted per the schedule located on the outside of the shower doors. Showers are never permitted ½ hour prior to, and 1½ hour after, meals. Water is needed during these periods for meal preparation and clean-up. Swimming is welcome alternative to showers. However, ADULT participants may swim only in the “Swimming Pool” (see Appledore map) or off the main floating dock during staff-supervised ‘swim calls’ (frequently called during hot weather). In all cases, the buddy system must be used.

SCUBA diving is restricted to students enrolled in *Underwater Research* and to independent/student researchers who have satisfied all diving requirements prior to arrival on Appledore. Guided snorkel excursions are part of many programs; while it is preferable for you to bring your own gear, the Lab has some gear for loan.

Island infrastructure

The island office and Infirmary are located on the second floor of Hamilton and is generally staffed between breakfast and dinner with additional hours as needed. If you have program or transportation-related questions or needs, please address the needs in the office, rather than during meal times. The classroom on the first floor is open at all times.

- Staff reside in **Bartels Hall** (behind dorms, with cupola) and the Kingsbury “K” House (above the floating dock). Participants are not allowed in either building, unless it is necessary to summon staff to address an emergency.
- **Laighton House** has two lecture halls on the 1st floor, and a lecture hall and library on the second floor. Laighton is open at all times.
- **Palmer-Kinne Lab** (PK) is the large building next to the Radar Tower. It is the primary teaching lab and is open at all times.
- The **Radar Tower** is condemned and off-limits.
- Most of the **facilities buildings** are located in lower campus or the Central Valley. Please do not enter the Paint Shed, Energy Conservation Building, Workshop, Pole Barn, or Generator Room unless accompanied by a staff member. Only students enrolled in Underwater Research and researchers are allowed in the Dive Locker.
- The **Grass Lab** (front of the Utility Building) houses a bird banding station during the spring and fall migratory periods when it is open from sunrise to sunset. Bird banders welcome ALL visitors during these hours. However, everyone must avoid the mist nets (behind the Pole Barn) and under **NO** circumstances should anyone but a qualified bander remove birds from the nets. During the rest of the season, the Grass Lab is used by Research Interns.
- Four **privately owned cottages** are located on the south side of Appledore and are not associated with SML in any way. Like all good neighbors, we respect their privacy and they ours. Please do not approach these cottages and respect any ‘No Trespassing’ signs.
- **Kiggins Commons** is the heart of the island where meals are prepared and served (buffet style). Hot and cold beverages, as well as snacks (fruit, bagels, bread, leftover desserts, etc.), are available 24/7 in the area between the dining hall and kitchen. The kitchen

proper is off limits unless invited to enter by a chef. Meal times are: breakfast at 7:30 am; lunch at 12:30 pm, and dinner at 6:00 pm. Sunday's have a different schedule with brunch at 10:00 am and dinner at 5:00 pm. Personal food restrictions, allergies and preferences (e.g. vegan) will be noted on your Health History Form, but should be confirmed with the kitchen staff on arrival. The kitchen staff will accommodate all dietary restrictions and special culinary needs within our facilities ability.

- **Showers** are located between Kiggins and the adjacent Water Conservation Building (restrooms). The Appledore Store is located on the west side of the dining hall and offers a variety of books, guides, and clothing. Finally, if anything around the island needs attention (leaky faucet, no soap, no TP, etc.), please inform the Island Coordinator.

Island Life

Controlled Substance Use

SML has a **zero tolerance** drug policy; if you are found in possession of, or using an illegal substance, you will be expelled from the island on the next available boat and at your own expense.

SML also has a **zero tolerance** alcohol policy for anyone less than 21 years of age. The Shoals Marine Laboratory is bound by Federal and State (Maine) laws, as well as policies of Cornell (New York) and UNH (New Hampshire); if you are under 21 and found to be drinking or in possession of alcohol, you will be expelled from the island on the next available boat and at your expense. Alcohol is not permitted in any dormitory/participant residence while participants who are younger than 21 reside in the same building. Those over 21 may also be asked to leave SML if their behavior is deemed dangerous or inappropriate.

Although marijuana is legal in Maine, it is still federally illegal, and it is not allowed on SML properties or vessels this includes adult use recreational use and medical marijuana.

Dining

Please wear a nametag to meals. It helps us get to know you and develops our sense of community.

Please DO NOT place computers (open or closed) on the dining tables during meals. Mealtime at Appledore is a time to interact with your classmates, faculty, and/or enjoy the view. Web surfing, social media monitoring, movie watching, and the like are NOT appropriate activities during Appledore meals.

After meals, please bus your dishware and cutlery to the appropriate bins in the dishwashing area of the kitchen. Scrape all food scraps into the compost buckets, along with paper napkins, coffee filters, and tea bags. Recycle paper, plastics, and metal in the recycle bins.

A meal clean-up schedule will be posted as the 'duty board' in the dining hall. Clean-up involves bringing leftover food into the kitchen and wiping down the tables. After dinner (but not breakfast or lunch), chairs are placed onto the tables and the floor is swept. See the kitchen staff for supplies and instructions. Program faculty give participants time to complete these tasks, but if you CANNOT clean up at your assigned meal, it is your responsibility to swap with another participant. DO NOT leave the task undone!

Recycling

Maine and New Hampshire employ 'single-stream' recycling. Please recycle paper, plastics, glass, and metal into 'Recycle' bins located in all buildings.

Mail service

Mail service is irregular; although we try to transport incoming/outgoing mail daily, weather and other conditions often interfere. Place outgoing mail in the box in the Hamilton Office. If you receive any mail, it will be distributed at meals.

We do not encourage short-term residents to have mail and packages delivered. For those staying on island for more than two weeks please use the following instructions:

UPS and FedEx packages should be sent to the UNH Pier Facility:

Name

Shoals Marine Laboratory

c/o Judd Gregg Marine Research Complex

29 Wentworth RD

New Castle, NH 03854

US Postal Service mail/packages should be sent to:

Name

c/o Shoals Marine Laboratory

University of New Hampshire

Morse Hall, Suite 113

8 College Road

Durham, NH 03824

Quiet time

Quiet hours in **all dorms** exist from 10:00 pm to 7:00 am. The library is reserved for quiet study; the Commons is for social activity and/or group study. You are welcome to use the Commons, laboratory and classroom buildings, and the library at all hours.

Food run

Everything you see on the island, from generators to photocopier paper, comes on the island as you did: up and over the rocks. Island wide cooperation is essential in this regard, particularly in transporting food and other necessary supplies. Every Wednesday is 'Food Run' day, when a week's worth of food and other products arrives via the Kingsbury around 4:30 pm. Upon hearing the ship's horn, every able-bodied participant (students, faculty, researchers) should meet at the floating dock and help staff convey food and other essentials via a human chain from the vessel to the waiting vehicles. Participants with temporary or chronic health concerns are exempt from this activity.

Housekeeping

Every Sunday at 9:00 am and before brunch, students are responsible for cleaning their dormitory. This includes sweeping out rooms and hallways, emptying the trash and cleaning the bathrooms. Cleaning supplies are provided and stored in the cabinets of each bathroom. If you cannot find cleaning supplies, please ask a staff member for assistance. Don't leave the job undone if you can't find a broom!

The ‘pack it in, pack it out’ rule applies when leaving Appledore. You must leave Appledore with ALL of the personal items you brought with you, including (but not limited to) footwear, clothing, toiletries, and all containers of any kind, even if empty.

All participants also must clean dorms, labs and classrooms at the end of each program and BEFORE you leave the island. Leave your room as it was when you arrived. Remember to check drawers and closets, SHUT all windows, sweep, and refold the blankets on the bed. Dorms may be inspected by staff before departure.

Cell phones

Cell phone reception is generally okay on Appledore, but we ask that everyone be courteous of others when choosing when and where to use cell phones. We particularly encourage a ‘no cell phone’ policy during meals, classes and other social spaces.

Computer use

Wi-Fi is available in the dining hall, dorms and lecture halls. The dining hall transforms into a social/study area between meals and at all hours of the evening. Access to the web for emails, library research, and limited social media is encouraged, but please DO NOT download/upload movies and videos or play games, our bandwidth is limited. Staff will disconnect student’s access to Wi-Fi if abuse is noted.

Weather

Weather can and will change suddenly, often with a vengeance. While it is mesmerizing to watch a storm develop, approach, and envelop, please close windows in dorms, classrooms, and labs BEFORE the storm. If you are close to a lab, a lecture room, the library, or other common areas, please do your part by closing windows and doors for the benefit of our island community.

It is important to keep an eye on developing weather to ensure safety on the island. No place outside is safe when thunder can be heard, everyone should make their way indoors, and remain inside until 30 minutes after the last heard thunder (National Weather Service).

Waterfront facilities

The Laboratory maintains several vessel moorings located just offshore of Babb’s Rock specifically designed for SML vessels. From time to time with SML permission, visiting commercial or recreational vessels use these moorings for day visits. SML does not encourage overnight moorage.

SML’s fleet of vessels includes the 47-foot **R/V John M. Kingsbury** and the 36-foot **R/V John B. Heiser**. The “JMK” was built to the Laboratory’s specifications in 1984 and is used as an integral component of many courses to provide students with working experience aboard a coastal research vessel. The “Heiser” is a state of the art jet-drive aluminum vessel that provides additional support to SML’s programs, operational needs and research activities. The R/V Storm Petrel, a Boston Whaler, inflatables, and a two sailboats, round out SML’s fleet.

Participants are not permitted to operate SML vessels at anytime.

Specimen collecting

SML allows reasonable collecting of invertebrate, vertebrate, and plant specimens for academic purposes, but we encourage conservation at all times. SML holds collecting permits from Maine, New Hampshire, and the National Marine Fisheries Service, which collectively require compliance with strict regulations. Additionally, handling and holding of vertebrates are regulated by protocols approved by the Institutional Animal Care and Use Committees (IACUC) of both Cornell and UNH. Before collecting plants or organisms of any kind, check with program faculty or SML staff. This will help to avoid non-compliance issues and prevent damage to populations that may be unusual, uncommon, or involved in someone's research. Collecting organisms or remains of organisms (shells, bones, etc.) for private use is not permitted. **The use of preservatives such as formalin is strictly prohibited except by or under the guidance of SML staff, faculty or and research staff with proper training.** At the end of all programs, surviving organisms will be returned to the sea.

Schedule changes

Because of changes in weather, boat schedules, plans of visiting lecturers, and many other factors, it is difficult to post detailed academic schedules much in advance. Core faculty or T.A.s will post the day's schedule on the 'Day Board' in the Kiggins Commons dining hall at breakfast; changes will usually be announced during lecture, lab OR mealtimes. Plan to arrive to all meals, lectures, labs and field trips promptly!

Visitors

The Isles of Shoals are unique and beautiful. "Day trippers" enjoy Appledore during pre-determined group tours throughout the summer. These visitors include the general public, Star Island visitors, alumni, friends of SML, members of the academic community, and past or potential benefactors. Non-scheduled visitors (sailors, etc.) are permitted to land only at the floating dock and must keep the outer end of the dock clear for Laboratory vessels.

Please greet and be friendly to visitors, identified by the absence of nametags. If, in your judgment, they're doing something "wrong" (e.g., walking a dog, entering lab buildings, walking barefoot) be diplomatic, yet direct, when inquiring whether they landed at the dock (this will tell you whether or not they come from one of the privately owned cottages). If they have just come ashore, instruct them to check in following the instructions at the welcome kiosk at the top of the hill by the dock, and collect an island map, which includes island rules and regulations for visitors.

Shoals Marine Laboratory Policy on Dismissals

SML is governed by the policies and rules of Cornell University and the University of New Hampshire. Registration in a program represents participant agreement to abide by such policies and rules.

SML reserves the right to dismiss from a program any participant who violates a major SML or university policy, especially when the participant's behavior may impair the rights and privileges of others in the SML community. Dismissal means that arrangements will be made for the participant to leave Appledore Island on the next available boat (with no refund of participant fees). Students enrolled in a credit course who are dismissed before the official end of their program will be required to complete an add/drop form, which will translate as a withdrawal on official transcripts. Participants are responsible for all costs associated with dismissal.

Geography and ownership of the Isles of Shoals

The Isles of Shoals lie six statute miles off the New Hampshire and Maine border in the western part of the Gulf of Maine and due east of Portsmouth, New Hampshire. The northern islands of the archipelago (Duck, Appledore, Smuttynose, Malaga, and Cedar) are in Maine, whereas Star, Lunging, White and Seavey Islands are in New Hampshire. Malaga, Smuttynose, Cedar, and Star Island define Gosport Harbor. White Island, owned by the State of New Hampshire, has an automated lighthouse and a tern colony monitored by Terns LLC and New Hampshire Fish and Game Department. Lunging Island (with a summer cottage) and Square Rock are privately owned. The Star Island Corporation owns Star Island and the Oceanic Hotel, which hosts summer conferences in the arts, humanities, and religion. Two families of lobster fishermen reside on Cedar Island in the summer. Smuttynose is privately owned, but the US Fish and Wildlife Service oversees preservation of the island by permitting only low impact, educational and recreational activities. The US Fish and Wildlife Service owns Duck Island and its surrounding shoals as part of the Maine Coastal Islands National Wildlife Refuge.

The Star Island Corporation owns approximately 90% of Appledore Island and leases it to Cornell University for purposes of education and research in marine science by the Shoals Marine Laboratory. The remaining 10% is privately owned. Of the four cottages along the south shore facing Gosport Harbor, the easternmost is the "St. Hilaire" Cottage followed by the gray "Birge" and white "Sullivan". Cottages. The fourth cottage is just inland from the Sullivan Cottage.

The Hugh G. Hamilton House just west of Kiggins Commons is the property of the University of New Hampshire. The foundation and ruins of the privately owned Winkley House are visible just north of Kiggins Commons. There also are two privately owned and undeveloped properties on Appledore: a house foundation west of the Celia Thaxter Garden, and an unmarked plot in the "North Head" area of Appledore. Owners of the private properties encourage non-destructive use of their property by the Shoals Marine Laboratory.

Geology of Appledore Island

Close examination of Appledore's rocky shoreline reveals evidence of major geological forces. The crystal structure, bedding, and stratum direction reflect Paleozoic orogeny and more recent plate tectonics. Note especially the vertical positioning of the more easily weathered layers of gneiss along the sides of the central valley and Babb's Cove. Deep clefts, or "trap dikes," can be found on the eastern side of Appledore and were created by the erosion of softer trap-rock or diorite (similar to basalt) that intruded into fissures in the surrounding bedrock. Pleistocene glaciations polished the smooth rocks of the north side, and resulted in the "plucked" stair-step structure of rocks of the south and east sides of the island. Note also presence of rocks and gravel of glacial origin at Broad Cove, and in the northern part of the island.

History of the Isles of Shoals

Archaeologists have documented pre-historic use of Smuttynose Island by Native Americans. Evidence also suggests that European fishermen fished the rich waters off the Isles in the 16th Century, well before the first written description of the Isles in 1614 by the explorer Captain John Smith. A thriving fishing community developed after 1620 and continued through the early 1700s. Early descriptions of the island described a rugged rocky terrain with low vegetation and large quantities of fish. The present name "shoals" derives from the old English

word for “schools” of fish, referring either to the number of fish or to the clustering of the islands in the archipelago.

When New Hampshire split from the Massachusetts Colony in 1680 and remained tax-free, most of the Appledore residents moved to Star Island (NH) and Appledore was sparsely inhabited until the mid-19th century. In 1847, Thomas Loughton of Portsmouth began construction of the Appledore House a large resort hotel. His daughter, Celia Thaxter, was a well-known poet and lived on Appledore during the summer months until her death in 1894. Largely because of Celia’s artistry and hospitality, the hotel became an important cultural center and attracted notable writers and artists of the time. The hotel and many nearby buildings were lost in a fire of suspicious origin in September 1914. Three buildings from the hotel era and untouched by the fire (Founder’s, Hamilton, and Loughton) have been substantially renovated and currently form part of the SML campus.

In the early 1900s, the hotel lost money and came into the ownership of a syndicate. In 1908, a Manchester firm drew up a subdivision map (still stored in the York County Courthouse, Alfred, Maine) that subdivided the island into several hundred tiny lots, with many named streets. By 1909, various parcels from that subdivision were for sale. The US Coast Guard bought rights to use the head of Babb’s Cove for a lifeboat-launching site and built the Coast Guard Building (now known as Bartels Hall) on the highest part of the island in 1910.

By 1930, most of the island had been obtained by the Star Island Corporation. In 1928, Dr. C. Floyd (“Prof”) Jackson, of the Department of Zoology at the University of New Hampshire, developed the Marine Zoological Laboratory on Appledore and offered summer courses from 1928 through 1940. With the coming of World War II in the early 1940’s, the federal government replaced the landowners at the islands and built the radar tower several other structures that since have been demolished.

During and just after the war years much of the formerly open land, including several cranberry bogs, grew back up into brush and poison ivy, and Herring Gulls increased in abundance, From the end of World War II to 1970, Appledore was nearly deserted and subjected to considerable vandalism.

Establishment of the Shoals Marine Laboratory

In the early 1960’s, Dr. John M. Kingsbury of Cornell University brought Cornell students to the Marine Biological Laboratory at Woods Hole for summer work in marine biology, but was interested in finding a more satisfactory way to introduce undergraduates to the science of the sea. He’d been a conferee in the programs at the Star Island Conference Center, and recognized the attractiveness of bringing students to the Isles of Shoals. In 1966 he began bringing students in the early summer to Star Island to a fledgling “Shoals Marine Laboratory.”

From the beginning, Cornell and UNH were interested in mutual operation of the Laboratory. Dr. Kingsbury desired a more permanent setting at the Isles for its operation and in the late 1960’s, with the lease of Appledore to Cornell from the Star Island Corporation, Dominic Gratta of Kittery began construction of SML. During the late 1960’s and early 1970’s, Dominic’s crew, along with student volunteers and SML staff, cleared brush and removed portions of ledge for establishment of roads; constructed docks; installed moorings; and lines for electricity, water and sewage. Old buildings were renovated and six buildings were built. The considerable

funds required for these projects came from private donors dedicated to the educational mission of the Laboratory.

General marine environment

- *Sea level.* Evidence from several sources indicates that sea level has increased approximately 4-8 inches (10-20 cm) during the past century, obliterating some near-shore construction of the colonial period and decreasing the islands' land area.
- *Currents.* Runoff from the Piscataqua River, six miles (10 km) to the west, lowers the salinity slightly from that of the central Gulf of Maine (32 psu) and is nutrient-rich. The island also is influenced by major currents of the Gulf of Maine, often in a counterclockwise gyre in our area, and by local tidal currents that constantly change direction and velocity.
- *Offshore water temperature.* By late summer, surface waters warm nearly to 60°F (15°C). At that time, there usually is a seasonal thermocline at a maximum depth of approximately
 - 60 ft (18 m). Below this, temperature decreases rapidly to nearly 40° F (4°C). Major storms in the summer may mix the water column enough to obliterate the thermocline.
 - *Tides.* Tides are regular and semidiurnal, with each day's cycles about 50 min. later than those of the preceding day. The mean tidal range is approximately 8.5 vertical ft (2.5 m) and the mean spring range approximately 9.5 ft (2.9 m). The lowest spring tides usually are at approximately -2.0 feet. The predicted extreme high tide mark of +12.5 ft (3.8 m) may be exceeded due to wave action accompanying severe storms. At such times, the effective high tide mark may be +25 ft (7.6 m) or more, with a likelihood of sea spray higher than that, depending upon fetch. Such factors affect the extent of intertidal algal zonation, and the lower limit of terrestrial turf and vegetation.
 - *Salinity.* The salinity is approximately 30-33 psu in the open water around the islands, but may vary considerably in intertidal and supratidal pools.
 - *Wind velocity and direction.* The Isles of Shoals are windy. In the summer, Gosport Harbor forms a refuge for vessels except during northwest blows, when sailing vessels often moor on the seaward side of the breakwaters. The Appledore dock in Babb's Cove generally is protected. However, southwest blows can create waves even in summer that make use of the dock impossible. Wind-blown sea spray limits the lower limit of turf and terrestrial vegetation, as well as vertical growth of trees and shrubs, by "nipping" buds, especially during critical periods of growth in April and May. The same species of shrub (e.g. Choke cherry) may not grow at all on very low Duck Island, only reach a few inches in height on slightly higher Seavey Island, and reach heights in excess of 20 feet only in the relatively protected low valleys on Appledore.
 - *Waves.* The sea surface usually has several classes of waves present, often simultaneously. The most important for navigation often are *local wind waves*. Generated by local wind conditions, they may form white caps that interfere with small boat operation. The most important waves ecologically are *storm waves* that emanate from storm centers 6-60 miles (10-100 km) or more to sea and which are responsible for surf and most onshore wave action. In the heaviest storms, waves crash completely over the lower islands, flow through the Central Valley of Appledore, break against the White Island Lighthouse, destroy breakwaters and near-shore construction, move mooring weights, and deposit huge boulders above the high tide line.
 - *Topography of the sea floor.* Depth topography between the Isles and the mainland is generally flat, with scattered rock outcroppings. The bottom represents glacial deposits of sand and gravel at a maximum depth of 100 ft (30 m). Faults and dikes in nearshore subtidal bedrock produce a markedly uneven topography, with many steep drop-offs. In general (and

this is the case along the Maine coast as a whole due to glacial sculpturing), advancing glaciers have abraded the north and west sides of the islands to a gradual slope, whereas seaward sides descend markedly to greater depths in a step-wise fashion.

Intertidal Environment

The Appledore intertidal is predominantly consolidated igneous/metamorphic bedrock, except for a few coarse gravel coves and the “Swimming Pool”/Babb’s Cove area of fine gravel and mud. Intertidal zonation is typical of the rocky Maine coast:

- *White zone*: bare rocks with scant, hardy halophytes or seasonal terrestrial plants and pools of highly variable salinity; few organisms of marine origin except in deeper pools.
- *Spray zone* (black or green): dominated by encrusting filamentous algae, cyanobacteria, and the rough periwinkle, *Littorina saxatilis*.
- *Rockweed zone*: dominated by the abundant brown alga genera *Ascophyllum* and *Fucus* along with and barnacles. Many other marine invertebrates and algae are present, including fishes and foraging gulls.
- *Chondrus zone* (along the “low tide line,”): dominated by red algae of the genera
- *Chondrus* and *Mastocarpus*; many invertebrates are found in the shell gravel at the bases of algae, some graze over the zone at high tide.
- *Kelp zone* (at and below the spring low water mark): marked by the presence of large (over 1 meter in length) brown algae, predominantly of the genera *Saccharina* (sheltered) and *Alaria* (exposed). Several algal genera have invaded the subtidal zone since the late 1980s (e.g., *Codium*, *Heterosiphonia*, *Colpomenia*).

Soil

Several different soil types are present on Appledore Island, although in general, soil cover is minimal.

- *Dense peat*: represented by tough tangles of roots of grass and herbaceous plants along exposed ledges. Prior to 1940, few gulls nested on Appledore. The increase in gulls since the mid-1970’s has led to a significant buildup of soil, with the peat layer increasing 3 inches (7.5 cm) in the past 50 years.
- *Deep black organic soils*: in protected valleys such as south of Bartels Hall (formerly the Coast Guard Building)
- *Bog mats*: in small depressions such as the Hotel Reservoir and the northern valley,
- *Tidal marsh peat*: isolated patches along the northern shore, in northern valley drainage area
- *Gravel*: resulting from storm action, found in eastern portion of the central valley (last flooded by the Patriot’s Day storm of 2007).

Vegetation

Spruce forest typical of Maine islands from the midcoast region to Canada have never been recorded (at least since 1614) on Appledore. Instead, Appledore vegetation consists of shrubs, brambles, and small grass fields. Mowing and grazing activities were more common in the early 1900s. Since 1950, however, sparse woody vegetation has developed into dense thickets due to decreasing disturbance and increasing gull populations. A *Dune Shrub* community (similar to what is found between fore and back dunes on a barrier island) has developed in the protection of the rocky ridges. The deepest valleys are moist, with a mixture of Winterberry (*Ilex verticillata*), Juneberry (*Amelanchier intermedia*), various species of cherry, and many other shrubs and small trees.

Exposed ridges support a mixture of *Gull Lawn*, with low herbaceous plants resistant to the activity of the birds, and *Dry Shrub Thicket*, dominated by Pasture Rose (*Rosa virginiana*), other members of the rose family, and many other low shrubs. Around buildings and pathways are *Disturbed Areas* with many introduced weeds, including grasses and composites. The island's boggy, wet depressions have many species of wetland plants. The rocky shore has many species of halophytes, tidal marsh plants, and species that may establish from time to time due to transport of their fruits or seeds on the surface of the ocean.

Terrestrial vertebrates

Several species of terrestrial mammals occur on Appledore. Muskrats (*Ondatra zibethica*) are abundant in some years, uncommon in others. Their, fecal "signposts" adorn nearly every stone on the trails. As vegetarians, they cause no harm to the nesting gulls, although young and adults frequently are consumed by greater black-backed gulls. Muskrats occur in a wider variety of ecological niches than their counterparts on the mainland. Genetic data suggests that the island population originated from the Rye, NH area and may have been introduced by fishermen in the mid-1940's.

Norway rats (*Rattus norvegicus*) undoubtedly have been introduced on several occasions. They are secretive and nocturnal and their numbers fluctuate from year to year, as well as from spring (higher) to fall (lower). They occasionally are sighted in the evening behind the Commons.

An undetermined number and species of bats are known to migrate over and/or briefly stop on Appledore. Students in the 1930's introduced two species of snakes to Appledore Island, the smooth green snake (*Liochlorophis vernalis*) and the northern brown snake (*Storeria dekayi*). They occur under rocks and boards in the central valley. The red-backed salamander (*Plethodon cinereus*) was discovered in 1987 and occurs under boards and rocks.

Birds of Appledore Island

- *Terrestrial Birds.* About a dozen species of mainland birds nest on Appledore, of which the most common and regular are the song sparrow, common yellowthroat, gray catbird, European starling, red-winged blackbird, and barn swallow. Over 200 additional species occur as migrants, winter visitors, or vagrants from the mainland.
- *Water Birds.* About 700 pairs of herring gulls and about 500 pairs of great black-backed gulls nest on Appledore annually. Numbers of both species have remained constant from 2009-2014.

Please avoid unnecessary entry into the gull colony away from regular paths during May, June and July when young birds can be frightened out of their territory (and subsequently attacked or consumed by neighboring gulls). Around the northern half of the island, follow carefully the trail marked with paint marks on rocks. During especially hot or cold, wet, or rainy weather, avoid lingering unnecessarily in the territory of any gull pair.

About 200 pairs of long-legged wading birds, including Snowy Egret, Black-crowned Night-Heron, Glossy Ibis, and Little Blue Heron used to nest each year in the dense woody vegetation east of Crystal Lake. In the late 1990s and early 2000s, many of these birds nested to the southwest of Palmer Kinne Lab. Sometime during 2003-2004, however, raccoons

appeared on Appledore and Smuttynose Islands and their predatory activities seriously disrupted nesting activities of resident gulls and wading birds.

Additional water birds that nest each year include the Mallard, American Black Duck, Common Eider, Canada geese and Black Guillemot.

Special features of interest

There are numerous places of interest on Appledore. Many are close to the dock and Babb's Cove. Others are on the seaward side of the island, and involve taking paths slightly out of the way.

With the hard work of volunteers, the UNH Thompson School of Applied Science, and staff of the Laboratory, we maintain *Celia Thaxter's Garden* adjacent to the foundations of her house, near the Utility Building. The design and plantings match, as nearly as practical, the arrangement of her plantings as described in her 1894 book, *An Island Garden*.

On a site on high ground in the shrubs north of the Utility Building is the *Laighton Cemetery*, where Thomas and Eliza Laighton, their two sons Cedric and Oscar, and daughter Celia are buried. Hidden by shrubs north of the central valley are *Foundations* of buildings associated with the Appledore Hotel that burned in September 1914. Please do not move or remove relics discovered around these foundations, as they are part of the island's history.

Near the edges of open areas of the central valley, and especially along the path called "Celia Thaxter Way," are many *Apple Trees*, some of which are of the variety "Gravenstein" that dates back to the middle of the last century. Many of these trees were planted during the hotel era.

On the shore west of the Utility Building are several objects of interest, including timbers jutting from the shore gravel (down shore from the power pole) that remain from the hotel pier, and the *Navy Pier* with pilings and cribs beyond it. The original marginal road is so eroded in that area, as well as partially destroyed by quarrying of rocks used later for the pier, that except for the remaining iron gate posts it is nearly unrecognizable. The exposed bedrock of the island may bear a number of interesting man-made features, including carved initials, U.S. Coast Guard and Geodetic Survey markers, iron posts, various eyebolts, and ringbolts. SML personnel in the 1970's set in place transect marking pins that mark the position of 28 transect locations across the intertidal zone, for use in field research exercises of students at SML. The pins are at +13.5' above MLW.

Adjacent to the only clump of American elm (now dead) on the island, inland from the Navy Pier, is the *Hotel Reservoir* site, now nearly empty, and covered with bog and marsh vegetation.

On the seaward side of the island are some spectacular geological features, including, *Broad Cove*, a gravel beach overrun by severe winter storms, *Thunder Hole*, a narrow inlet just southeast of Broad Cove where at certain times the waves crash with a roar, *Broadway and 42nd Street*, an X-shaped depression in the shore rocks on the northeast end of the island, formed by an eroded diabase dike crossed by a deep east-west cleft, and *Sheep Cave*, a cavity beneath a granite ledge inland from the southeast side of the island, just about big enough for two people (Celia Thaxter wrote of this in her book).

Pre-1970 buildings

Founder's Hall was built as part of the Appledore Hotel complex in the last century, and was named informally by the students in the SML class of 1974 for one of the "founders" of SML, Dr. Oliver Hewitt. Founder's is typical 17th and 18th century architecture, and is nearly identical in design to the no longer existing Celia Thaxter's cottage. Founder's served as the kitchen and dormitory for the UNH Marine Zoological Laboratory from 1928 and 1940, when it was called Barton Hall. During World War II, it served as the Operations Building for the Navy personnel.

Sometime during the 1950's and 1960's vandals entered the building and destroyed windows and sashes, removed radiators and pipes, and defaced walls. Prior to SML's construction of the three dormitories, it served as student housing. Currently, it functions as housing for students, researchers, and faculty. This building was completely renovated in 1993.

Winkley House was built in the 19th century along the hillside near Founder's, and was vacant for over a half century. It is privately owned and now collapsed.

The *Hugh G. Hamilton House* was also built in the 19th century, with its easterly foundation aligned that the porch could be connected by a continuous set of steps, porches, and boardwalk with both Founder's Hall and Appledore House in the central valley. In the early 1900s, it had a circular gazebo in the corner of the porch. Hamilton House served as faculty housing for the Marine Zoological Laboratory 1928-1940 and was donated to UNH. Hamilton House was renovated for combined UNH/SML use with a large lecture hall forming the 1st floor and the Island Office comprising the 2nd floor.

Laighton House also was built in the last century, but more recently than the Founders and Hamilton. It was the main laboratory building for UNH's Marine Zoological Laboratory in the 1930's. A memorabilia cabinet just inside the front entrance contains articles relating to that era. SML has completely renovated the building, rebuilt the porch, and redesigned the interior. The upstairs now houses a small library and a classroom. Two lecture halls are on the 1st floor.

Bartels Hall (formerly known as the Coast Guard Building) was built by the U.S. Life Saving Service in 1910 at the very top of Appledore, in a style typical of many east coast, Coast Guard structures from that period, such as the one at the mouth of Portsmouth Harbor. Some of the foundation stones were taken from a cairn, which according to legend, was built by Captain John Smith. The building was renovated and enlarged through the generosity of Hank and Nancy Bartels, dedicated Cornell and SML supporters. Bartels Hall is the staff residence hall.

The *Radar Tower* is the only major construction remaining from the 1940's. It is used to store equipment and supplies, but is off limits to non-staff members. The base of the tower boasts a fine population of *Xanthoria* sp. (Golden Lichen), a species especially resistant to, or benefited by, gull guano. The top of the tower occasionally is used to house research instruments.

The *Paint Shed* also was built in the World War II years. It is used to store paint, gasoline, and other flammable materials.

The *Dive Locker* serves as a staging area for SML research divers, such as members of the *Underwater Research* course and research interns.

Post-1970 construction

Construction of Palmer-Kinne Laboratory, Kiggins Commons, Utility Building, and the three dormitories was financed by private, non-governmental donations, primarily raised by the Laboratory's founder and first director, Dr. John M. Kingsbury. Dominic Gratta of Kittery, Maine and his crew, following his and Dr. Kingsbury's designs, constructed all the new buildings. They are positioned to be a functional and integrated campus, and blend with the topography. *Kiggins Commons* was completed in 1974 and houses the kitchen and dining area. The *Appledore Store* is located in the west corner of the dining hall. The spacious dining area also serves as a commons for study, lectures, and evening socializing. The ground level floor houses a research area for the Research Interns.

Palmer-Kinne Laboratory was built in 1975 and is SML's major teaching laboratory, with space for up to 60 students. Each student has about a meter of space along the windowed borders of a spacious work area for books, notes, specimens, tools, and optical equipment. The lab is equipped with a variety of scientific sampling equipment, and two large sea tables supply running seawater for housing marine organisms.

Dormitories were built over several seasons in the late 1970's. Each of the three dorms has washrooms and 10 double occupancy rooms. Their location is convenient both to the Commons, laboratories, and classrooms. An array of solar panels on the roofs of Dorms 2 and 3 provide power to the dorms, the Radar Tower, P-K Labs, and K-House.

The *Utility Building* was the first building to be constructed at Appledore Island in the early 1970's and currently houses:

- The *Grass Foundation Laboratory*, which provides space and running fresh and salt water for faculty and student research, as well as the Appledore Island Migration Banding Station;
- A central bay with machine workshop and space for winter storage of equipment and vehicles;
- Generator room;
- A reverse osmosis desalination system.

The *Pole Barn* is a multi-functional building completed in 2000 specifically to house all of SML's heavy equipment and vehicles. It serves as a woodworking shop in summer.

Kingsbury House (K-House) was completed during the summer of 2001. The multi-use building serves as the home of SML's director, guests, faculty with family, and the residence for close-down crews in the fall. The house is named in honor of John and Louise Kingsbury, SML's founding director and his wife.

The *Water Conservation Building* was constructed in the Fall of 2010 and brought to use in the Spring of 2011. The two-story structure adjacent to Kiggins Commons contains foaming composting toilets, which use only three ounces of water per flush. The toilets play a large role in reducing the daily consumption of water from 100 gallons/day by residents on the mainland to 20 gallons/day by Appledore Island residents.

The *Energy Conservation Building* was built in 2013 with funds from NSF and private donations. It houses a large bank of batteries that store energy produced by the solar panels and wind turbine, as well as the generator when necessary.

Engineering systems

The Laboratory operates an engineering system equivalent to that of a small coastal city, including power supply, transport, communication, water supply and treatment, and waste disposal.

Power Generation. SML obtains its power from one of three diesel generators in the rear of the Utility Building. Kitchen equipment is powered by propane gas. Outboard motors run on gasoline. We bring propane and gasoline from the mainland on laboratory vessels as needed. Small coastal tankers deliver diesel fuel for the generators; this fuel is stored in twin tanks located in the central valley. Insulated conduits on or under the ground transmit electricity among the Laboratory buildings. In 2007, SML installed a 7.5kW *Wind Turbine*. Solar panels are located on Dorms #2 and 3 totaling ~7.5 kilowatts (kW). Additional *Solar Panels* were added in 2014 totaling ~26kW and an additional ~29kW will be added in 2015. The new additions will bring Appledore Island closer to the goal of utilizing 100% of its energy from green sources.

Vehicles. The Laboratory has one truck, a multi- use tractor, a backhoe, and 2 “gators.”

Communication. The Laboratory communicates with the rest of the world using marine VHF radios and cell phones. Hand held VHF marine radios are used for island communications, and communication between vessels. Internet service is provided by a wireless microwave link from the mainland. Most cell phone carriers work fairly well on Appledore.

Drinking Water Supply and Treatment. A dug well located in the central valley of the island provides the Lab with drinking water. This water is filtered, chlorinated, and is safe for human consumption. The well water is supplemented by a reverse osmosis system if the well level is too low. The “RO” desalinates water from the ocean; this water is then chlorinated and routed into the drinking water system.

Wastewater System and Treatment. Two leach fields were installed on Appledore Island in 2009 to handle wastewater treatment. This new system eliminates the use of harsh chemicals for treatment, and uses fewer pumps, which conserves energy!

Seawater System. Seawater is distributed throughout the labs from an intake and pump house near the floating dock.