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A Survey of Moths in Two Rhode Island Barrier Dunes, Goosewing Beach and Napatree Point, During 2020

By MARK J. MELLO

Napatree Point Conservation Area in Westerly and Goosewing Beach Preserve in Little Compton (Fig. 1) are small barrier spits in Rhode Island that are representative of many seen in southern New England. Although Rhode Island's barrier beaches are largely protected, dune systems may be developed should it be shown that the development will have no negative effect on resource values such as flood prevention. Accelerated sea-level rise impacts the primary dunes, and storms impact both primary and secondary dunes. Thus, insects using barrier dune systems may be squeezed by habitat loss on both the seaward and landward ends. The purpose of this survey was to expand upon our knowledge of the relationship and importance of barrier dune habitats for moths.

Methods and Study Area

Portable ultraviolet light traps were operated roughly bimonthly from 3 June to 6 October 2020, obtaining 22 light trap samples. Traps were set prior to dusk and retrieved the following morning. Macro-moths (Families Thyatiridae through Noctuidae) were identified to species and counted. At least one voucher of each species per study site was saved. GPS coordinates for each station were recorded, and the habitats classified following the US National Classification System (Table 1).

Napatree Point Conservation Area (Fig. 1, top) is a 34.8-ha (86-acre) barrier spit owned and managed by the Watch Hill Fire District and the Watch Hill Conservancy. It extends west from the parking lot of a private beach club to the mouth of Little Narragansett Bay. Most of the barrier spit is dominated by American beachgrass (*Ammophila breviligulata*); however the point appears to have been a small glacial island where non-native plants, especially shrubs, are dominant in the uplands, and *Phragmites* (common reed) dominates the freshwater marsh. A small area of salt marsh occurs along the border of the lagoon.

Goosewing Beach Preserve (Fig. 1, bottom) is a 1.2-ha (3-acre) barrier spit located between the Tunipus and Quicksand Pond inlets. It is part of a 30.4-ha (75-acre) property owned by The Nature Conservancy. The barrier spit is dominated by American beachgrass, seaside goldenrod (*Solidago sempervirens*), small bayberry (*Morella caroliniensis*), and beach rose (*Rosa rugosa*). Salt marsh borders the inner boundary of Quicksand Pond.

Results

I identified 146 macro-moth species from 7 light-trap samples at the one station established on Goosewing and 161 species from 15 samples at the 6 stations established at Napatree during 2020, resulting in 216 species of macro-moths recorded by this survey.

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Of the total, 90 species were found at both sites, 55 only at Goosewing, and 71 only at Napatree. Thus, 126 species, or 58% of the species were unique to one site or the other. Randomized species accumulation curves for both sites show no evidence of leveling off (Fig. 2), indicating that increased sampling would continue to increase the number of new species for each site.

Past surveys suggest that even with a more intensive sampling regime, a single year produces only between 35 and 50 percent of the species using the site. The data suggest that Goosewing species richness may be greater than that at Napatree despite the increased number of samples and variety of habitats at Napatree. However, additional sampling might bring these curves closer together.

Figure 1. The two study areas, showing the specific sampling sites (*n*=6 and 1, respectively). Top Napatree Point; bottom: Goosewing Beach (aerial imagery from Google Earth).

Thirteen dune-affiliated species were documented, 11 at Goosewing and 9 at Napatree (Table 2). Distinct differences in numbers for some of the dominant species found at each site are explained by more than the difference in sampling effort. The most dramatic differences in dominant species can be explained by larval hostplant presence or lack thereof. One species, *Abagrotis benjamini* (Fig. 3), that is listed in *Rare Native Animals of Rhode Island* (Enser 2006) was found at both Goosewing (13 individuals) and Napatree (29 individuals). The near lack of its documented larval hostplant, beach plum (*Prunus serotina*) as documented by Goldstein and Nelson (2017), at both sites suggests that it is possible that other *Prunus* species such as black cherry (*P. serotina*) may be an alternate hostplant on barrier dunes. The remaining 12 species (Fig. 4) that I have identified as dune affiliates may be habitat restricted, as is *A. benjamini*, at least in the Northeast.

Table 1. Dune communities surveyed at Napatree Point (NP) and Goosewing Beach (GW) conservation areas during 2020. D = dominant habitat; C = Co-dominant habitats; S = secondary habitat; M = marginal habitat.

Community Type	Station						
	NP1	NP2	NP3	NP4	NP5	NP6	GW1
Beachgrass/herbaceous Alliance	D	C	D	–	–	C	S
Maritime shrubland	M	C	M	D	M	M	D
Pitch pine grove/woodland	–	C	–	–	–	S	–
Shrub swamp	–	–	–	–	S	–	–
Invasive-dominated shrubland	–	–	–	S	D	–	–
Salt marsh	–	–	–	–	–	M	M

A Message from the Editors:

This issue has two articles based on presentations at the 2019 RINHS Science Conference (Hale, Decker) and two articles from recipients of last year's Henry & Theresa Godzala Research Fund grants (Mello, Decker again). We are launching two new sections that we hope to have more of in future issues: Essays (Decker again) and Book Reviews (Gaffett). Also new are abbreviated summaries of long articles that will be put on the RINHS website (Mello, Reinert). Congratulations to Carolyn Decker, whose essay hit three categories!

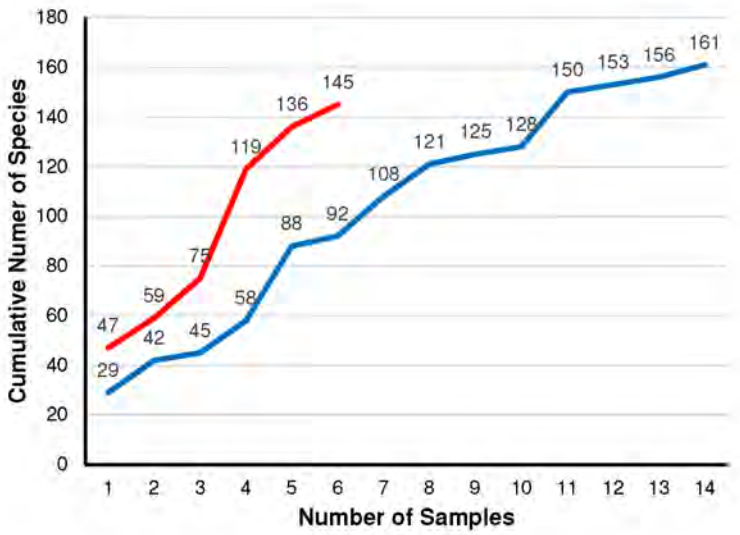

Figure 2. Randomized species accumulation curves for Goosewing Beach (red) and Napatree Point (blue) in 2020.

Table 2. Dune-affiliated macromoths documented at Napatree Point Conservation Area and Goosewing Preserve during 2020.

Species	Station								
	GW	Napatree Point							Both
	GW1	NP1	NP2	NP3	NP4	NP5	NP6	All	
EREBIDAE									
Catocala badia	3								3
Doryodes spadaria	1			2				2	3
NOCTUIDAE									
Sympistis riparia	1								1
Derrima stellata			1					1	1
Apamea burgessi			1					1	1
Apamea lintneri	35	5	53		65			123	158
Photedes inops	6								6
Papaipema duovata	2				1		1	2	4
Dargida rubripennis	1					1		1	2
Leucania extincta	21	18	29	41		5		93	114
Euxoa pleuritica	1								1
Euxoa detersa	364	20	14		25		16	75	439
Abagrotis benjamini	13	9	13		6	1		29	42
Total species	**11**	**4**	**6**	**2**	**4**	**3**	**2**	**9**	**13**
Total individuals	**448**	**52**	**111**	**43**	**97**	**7**	**17**	**327**	**775**
Number of samples	**7**	**2**	**5**	**1**	**4**	**2**	**1**	**15**	**22**

For most of the species, fewer than 10 per site were collected even where the larval hostplants were common. For example, small bayberry, the larval hostplant for *Catocala badia*, was common at both sites but only three individual moths were found at Goosewing and none at Napatree. Four species were moderately common (>10) to abundant (>50 at one or both sites). *Apamea lintneri* (158 individuals for both sites) and *Leucania extincta* (114) both likely feed on beachgrass as larvae. *Euxoa detersa* (439) also likely feeds on beachgrass as well as other forbs (Wagner et al. 2011). *Abagrotis benjamini* (42), as previously mentioned, feeds on beach plum and possibly other Rosaceae.

Figure 3. *Abagrotis benjamini* (photo by M. Mello).

The larval hostplants for *Doryodes spadaria* (beachgrass), *Derrima stellata* (unrecorded but likely the flowerhead of some Asteraceae), *Apamea burgessi* (grasses), *Papaipema duovata* (seaside goldenrod), *Dargida rubripennis* (switchgrass, *Panicum virgatum)*, and *Euxoa pleuritica* (grasses and probably forbs) are present at one or both sites. Thus, their low numbers may reflect suboptimal abiotic conditions for these species at the two sites. Only one individual of *Simpistis riparia* was recorded during this survey, reflecting the paucity of its larval hostplant, beach plum (Goldstein and Nelson 2017). Unlike *A. benjamini,* it may not be able to use other plant species. *Photedes inops* (6 individuals) was found only at Goosewing, where its larval hostplant, freshwater cordgrass (*Spartina pectinata*), occurs at the dune edge near the southwest corner of Quicksand Pond.

Because moths can fly, any light-trap sample may intercept moths that are wind-driven (especially along the coast), or simply flying by on route from one habitat patch to another. Two examples of this were seen from samples collected at Napatree. A single *Catocala nebulosa* (clouded

Figure 4. Dune-affiliated moths documented at Napatree and/or Goosewing during 2020. From top to bottom by column—left: *Catocala badia*, *Doryodes spadaria*, *Sympistis riparia*, *Derrima stellata*; center: *Apamea burgessi*, *Apamea lintneri*, *Photedes inops*, *Papaipema duovata*; right: *Dargida rubripennis*, *Leucania extincta, Euxoa pleuritica*, *Euxoa detersa* (photo by M. Mello).

underwing) occurred at Napatree, at station N5 on 24 August (Fig. 5). This is the first record for this species from Rhode Island. It is an example of a species that seems to be expanding its distribution eastward and northward due to climate change, as it has recently been reported from Connecticut (Larry Gall, Yale University, pers. comm.) and Massachusetts (MASSMOTHS, Mello in prep.). The larvae feed on hickory, which is absent from Napatree. Since the nearest upland likely to contain hickory is at least 2.4 km from Napatree, this individual clearly did not originate from Napatree nor could it breed there. An example of a southern species, *Xylophanes tersa* (tersa sphinx) also was found at Napatree station N5 on 6 August (Fig. 6). This species could not survive even southern New England's winters in any of its life stages, but is a regular late-summer northward wanderer as well as a strong flier.

Figure 5. *Catocala nebulosa* (photo by M. Mello)

Figure 6. *Xylophanes tersa* (photo by M. Mello).

Conclusions

Over 200 species of macro-moths were recorded from Napatree Point Conservation Area and/or Goosewing Beach Preserve in 2020, a fraction of which are tied to barrier dune habitats. This study confirms that even relatively small barrier-dune systems can support a community of barrens affiliates that would either be extirpated or become critically threatened if this habitat should disappear. Twin threats of development and rising sea level put the squeeze on this vulnerable habitat throughout the Northeast. Although the current configurations of the Napatree and Goosewing barrier dunes are protected from development, rising sea level and the specter of increasing violent storms is unabated. Dune restoration and protection from trampling of vegetation is underway at both these sites. Goosewing, and to a much greater extent Napatree Point, suffer from takeover by non-native plant species. Beach plum, abundant at the two Massachusetts dune systems surveyed in 2019, is nearly absent at Napatree and scant at Goosewing. When preparing future restoration plans, it would be beneficial to include beach plum plantings as a major component. Not only would several dune affiliates benefit, but it would improve storm damage prevention. Like beachgrass, beach plum can be buried in sand and continue to raise the elevation of the dune on which it sits.

This is an abbreviated summary report; the full version will be made available on the RINHS website

Acknowledgments

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Your Seafood and *Its* Seafood Are Shifting Northward Along the US Atlantic Coast in Response to Warming Waters

By STEPHEN S. HALE

Introduction

If your preferred habitat was warming up to a level you found intolerable, given your thermal preferences, you could: (1) adapt in place (e.g., hook up an air conditioner), (2) move to a higher latitude (e.g., Maine) or altitude (e.g., Denver), or (3) stay where you are and suffer the consequences (e.g., heat exhaustion, heat stroke, death). Many of our fellow species on the planet can only exercise the second option, while many others are stuck with the third.

Numerous marine and terrestrial species have shifted their ranges poleward in response to rising water temperatures caused by global climate change (Burrows et al. 2011). Several studies have shown poleward movement of marine fishes (Nye et al. 2009, Pinsky et al. 2013, Hare et al. 2016) and benthic (bottom-dwelling) invertebrates (Wernberg et al. 2012, Hiddink et al. 2015, Weinert et al. 2016). Along the US Atlantic coast, that's been happening to the prey animals (e.g., clams, snails, crustaceans, and polychaete worms) of the fishes commonly caught in bottom trawls, along with many other species. Changes in species distributions are one of the expected outcomes of climate change (IPCC 2014). Species are trying to maintain their preferred thermal niche—poleward or into deeper water. As a consequence, in Rhode Island waters, the population of the iconic flounder species of Narragansett Bay, the winter flounder (*Pseuopleuronectes americanus),* has declined, along with that of lobsters (*Homarus americanus*) (Collie et al 2008; Wahle et al. 2015). More southern species, such as black sea bass (*Centropristis striata*), have shifted northward into our waters.

Methods

The Environmental Protection Agency lab in Narragansett was involved with EPA's National Coastal Assessment, a large, national monitoring program and database. The data were collected for ecological assessments but are well-suited for biogeographic studies because of wide spatial coverage, random stations, and consistent methods. I and my collaborators Harry Buffum, John Kiddon, and Melissa Hughes looked at those data from the US Atlantic coast to see if there was any evidence of northward shifts in benthic invertebrates (Hale et al. 2017). Our study covered two biogeographic provinces: Virginian (Cape Hatteras to Cape Cod) and Carolinian (mid-Florida to Cape Hatteras), spanning 15 degrees of latitude and two decades, 1990–2010 (Fig. 1).

Figure 1. Map of US Atlantic coast showing the Carolinian (CP), Virginian (VP), and Acadian Biogeographic Provinces and sampled stations (red dots), 1990–2010, in the CP and VP.

We hypothesized that (1) benthic invertebrates are shifting their ranges northward along the US Atlantic Coast and (2) warming water temperature is the main forcing factor. We used data from 3,200 stations, with 1,092 taxa identified to species level. We used Spearman rank correlations of abundance-weighted mean latitude of the 30 most commonly occurring species with year, used a sign test to test for changes in minimum and maximum latitude in the group of 30 species, and ran a multidimensional ordination of abundances of all species to look for changes in community composition. We also looked for evidence of species jumping their northern biogeographic boundary. We used the 30 most common species in each province

because there is a higher likelihood that rare species actually living in an area would be missed by the sampling program. Ranked-order plots of 1,092 species (Fig. 2) showed typical dominance by a few species and long right tail of rare species. The farther right on the plot, the greater the likelihood of false absences.

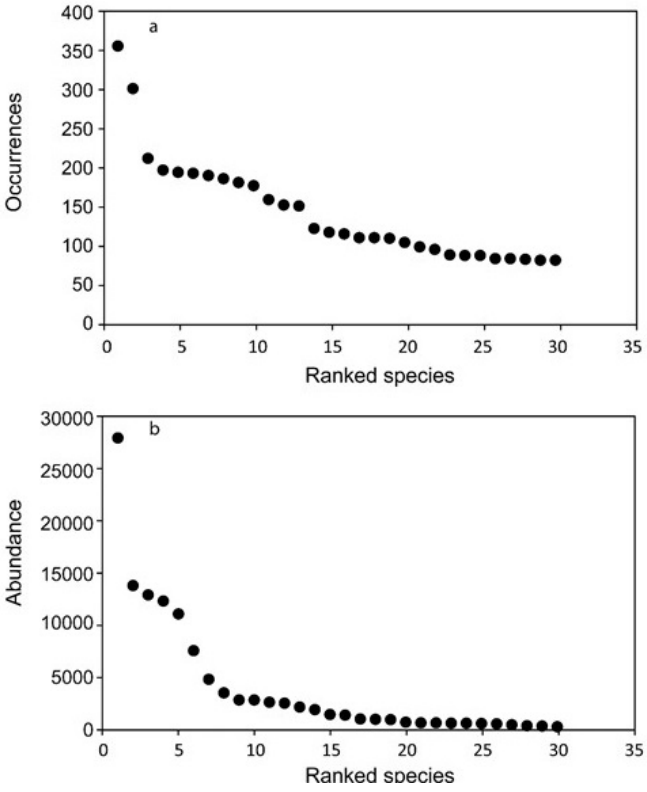

Figure 2. Rank order of the top 30 benthic species in the Carolinian and Virginian Biogeographic Provinces, 1990–2010, by (top) number of occurrences (3,194 stations) and by (bottom) abundance. One 0.04-m^2 grab per station; 0.5-mm sieve.

Results and Discussion

Mean water temperatures in the Carolinian and Virginian Biogeographic Provinces, 1993/1994–2010, increased significantly ($P < 0.001$) during the study period, bottom water by 1.6 °C (2.9 °F) and surface water by 1.7 °C (3.1 °F) (Fig. 3). Mean bottom water temperature increased in all one-degree latitude bands ($P < 0.001$). In general, there were larger changes in southern latitudes. Small changes in mean temperature can lead to large ecological impacts. Ocean warming is the dominant factor in observed range shifts (Hiddink et al. 2015, Sunday et al. 2015, Hare et al. 2016). For bottom-dwelling invertebrates, bottom water temperatures affect settling larvae, juveniles, and adults. Temperature affects reproductive success and offspring survival.

Of 25 species with statistically significant ($P < 0.01$) changes in centers of abundance (out of the 30 most prevalent); 18 (60%) shifted their center of abundance northward and 7 (23%) shifted southward (Table 1). For example, Figure 4 shows plots of mean latitude by year for three species of polychaetes and one gastropod. Species that shifted north moved an average distance of 181 km, in contrast with 65 km for species that shifted south. Shifts in centers of abundance occurred across three different phyla with a wide variety of feeding types, life-history strategies, mobility, larval-dispersion strategies, and habitat preferences. To maintain their preferred thermal niche, organisms have to track the rate of isotherm movement (e.g., the line of 20°C water). Some benthic invertebrates can physically move, but the primary mechanism for their range shifts is likely through their planktonic eggs and larvae, which move with the ocean currents. Others may simply cease to grow, reproduce, and survive in southern areas that exceed their temperature tolerances; this would also result in a northward shift of the center of abundance.

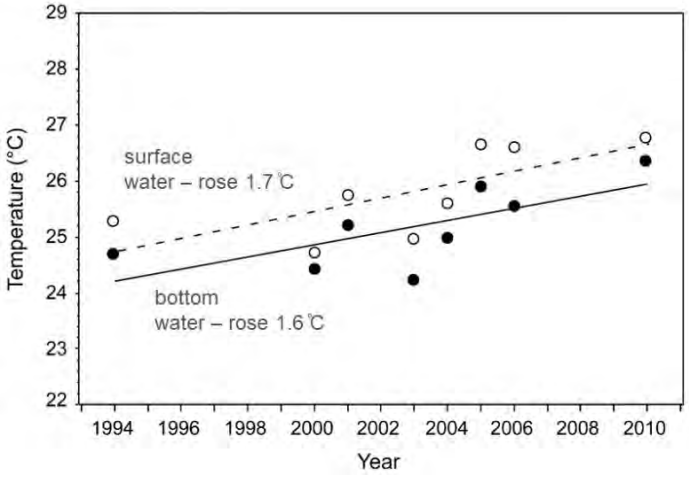

Figure 3. Mean summer (July-September) bottom (filled circles) and surface (open circles) water temperatures (taken concurrently with benthic samples) and trend lines in the Carolinian and Virginian Biogeographic Provinces, 1993/1994–2010.

The northern and southern boundaries of several species moved north. With a null hypothesis in a sign test that the median value (out of 30 species) was 15 species, the southern limits of 22 species showed significant northward shifts (Table 2). Because there was little change in northern limits, this resulted in an average 25% range contraction. Range contraction results in less habitat and potentially smaller populations.

Multidimensional scaling of abundances of 1,092 benthic species in the Carolinian and Virginian Biogeographic Provinces showed that community composition changed more in the Carolinian than in the Virginian province; this was also true of temperature and range extents. We speculate that as time goes on and warming continues, the more southern province will begin to look more like what the northern one looked like in its early years.

Table 1. Species (out of the 30 examined) that showed statistically significant ($P < 0.01$) northward shifts in mean centers of abundance, Carolinian and Virginian Biogeographic Provinces, 1993/1994–2010.

Species	Taxon	Distance (km)	Rate (km/yr)
Glycinde solitaria	Polychaeta	162	10.1
Heteromastus filiformis	Polychaeta	218	13.6
Mediomastus ambiseta	Polychaeta	38	2.4
Neanthes succinea	Polychaeta	316	19.8
Nephtys incisa	Polychaeta	7	0.4
Pectinaria gouldii	Polychaeta	179	11.2
Podarkeopsis levifuscina	Polychaeta	129	8.0
Sabellaria vulgaris	Polychaeta	669	41.8
Sigambra tentaculata	Polychaeta	269	16.8
Spiophanes bombyx	Polychaeta	57	3.5
Acteocina canaliculata	Gastropoda	178	11.1
Crepidula fornicata	Gastropoda	64	4.0
Nassarius trivittatus	Gastropoda	104	6.5
Gemma gemma	Bivalvia	26	1.6
Nucula proxima	Bivalvia	201	12.6
Tellina agilis	Bivalvia	20	1.2
Ampelisca abdita-vadorum	Amphipoda	127	7.9
Edotia triloba	Isopoda	220	13.7
Oxyurostylis smithi	Cumacea	260	16.2

Five Carolinian species (four polychaete worms and one amphipod crustacean) jumped their northerly biogeographic boundary, a potential northward range expansion. The WoRMS benthic species database (WoRMS 2017) lists distribution of all five as Gulf of Mexico or Caribbean. There was no evidence that any Virginian species moved south to the Carolinian Province.

There is evidence that some species are bunching up at their northern extent, such as at Cape Cod, which is a relatively strong biogeographic boundary. Like the settlers who congregated at the opening of the Cherokee Strip Land Run in Oklahoma in 1893—when conditions become favorable for a move across the boundary (starting gun for settlers, warmer waters for marine species), off they go. "Sooners"—ones that snuck across the Oklahoma line before the designated starting time—also occur with benthic invertebrates (e.g., those that move into the Gulf of Maine in the summer but are not able to reproduce or survive the winter).

Consequences of these range shifts include changes in benthic community structure and function, which have strong implications for ecosystem functioning and services, including changes in fisheries dependent upon benthic prey (Pershing et al. 2015, Wahle et al. 2015, Hare et al. 2016). Humans are both perpetrators of the problem and one of its victims. Ecological and socio-economic consequences of these results include: changes in fish food, changes in biogeochemical cycles, and changes in habitat structure. Range contractions can reduce habitat and population size. There can be spatial mismatches between predator and prey. Movement of a new species into an area can cause ecosystem disruption (e.g., fiddler crab *Uca pugilator* in Gulf of Maine salt marshes). Depletion of key species from an area can lead to economic and social changes (e.g., populations of Atlantic cod, winter flounder, and American lobster decreasing in Rhode Island). A shift of a center of abundance into an area can lead to ecosystem and fisheries management disruption (e.g., black sea bass moving north into Rhode Island waters). Changing the mix of species in an area can profoundly affect ecosystem processes (Kleisner et al. 2016). Loss of habitat structures such as oyster and mussel reefs in an area can affect ecosystem functions.

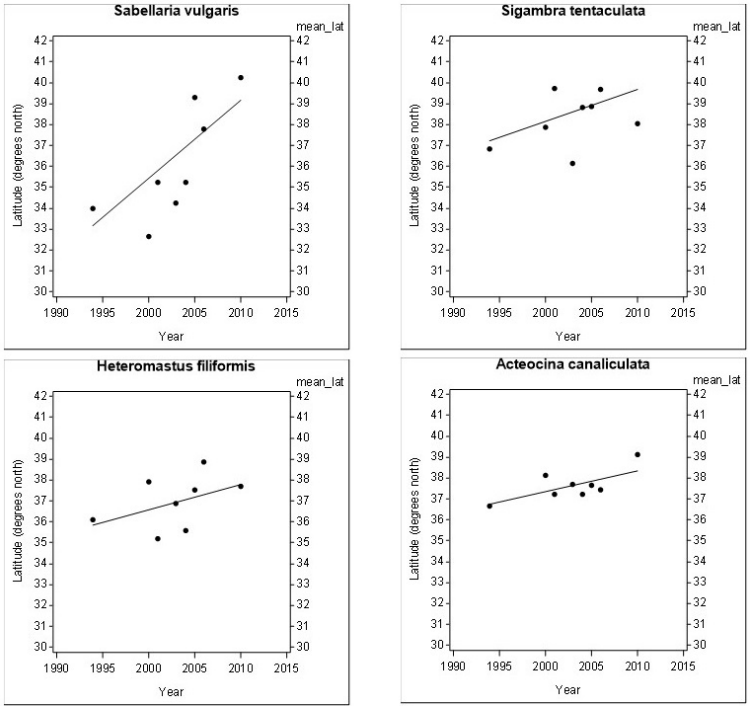

Figure 4. Example northward shifts of centers of abundance (mean of log abundance-weighted latitudes of occurrence) by year, 1993/1994–2010, in the Carolinian and Virginian Biogeographic Provinces. Showing three species of polychaetes and one gastropod (*Acteocina canaliculata*).

Table 2. Number of species (out of the 30 examined) that showed changes in their northern and southern boundaries between the first and last year of sampling, Carolinian and Virginian Biogeographic Provinces, 1993/1994–2010. The *P* value is based on a sign test where the null hypothesis is that the median = 15; NS = not significant.

Parameter	Direction	# Species (out of 30)	*P*	Change (km)	Mean (km)
Minimum latitude	North	22	0.01	47–1051	316
	South	8	NS	-	-
Maximum latitude	North	20	0.07	1–33	12
	South	10	NS	-	-

Perry Jeffries, a professor at the URI Graduate School of Oceanography who ran the bottom trawl survey before Jeremy Collie, said in the 1970s that the population of winter flounder, the iconic bottom fish of Narragansett Bay, was declining not only from over-fishing but also from warming waters. He pointed out that hardly anyone was raising an alarm and that if the declining species were oak trees, the iconic tree on land, the citizens would be up in arms to do something about it. Now, winter flounder populations in the bay have crashed and the fishery is largely gone.

Water temperatures are predicted to rise 1–5 ºC (up to 9 ºF) along US Atlantic coast, which is experiencing relatively rapid climate change, by 2100 (IPCC 2014). Species range shifts will become even more apparent as monitoring programs continue into the future (Melillo et al. 2014).

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Did You Feel It?

By BRYAN OAKLEY

Do you ever move the wrong way and feel that twinge of a decades-old back injury? Turns out, the same thing occasionally happens to the crust of the Earth. Sunday, 8 November 2020, started out like most other fall weekend days. The kids were headed outside to play and my wife and I were finishing our coffee when shortly after 9 AM the house started to shake like a herd of elephants was running through the second floor. Living less than a mile from an active quarry, the occasional rumble of an explosion is not that uncommon, but this dwarfed those events in both length and magnitude. We looked at each other as the shaking and sound subsided and said, "Was that an earthquake?" A quick look at the U.S. Geological Survey (USGS) website shortly after the event confirmed a 4.0 magnitude earthquake (later revised down to 3.6), located along the southern New England coastline in Bliss Corners, Dartmouth, Massachusetts (Fig. 1). The seismic waves generated from this earthquake were felt throughout southern New England, as evidenced by the reports submitted to the USGS. The relatively shallow depth of the earthquake (9.7 km; 6 miles) probably helped further transmit the waves, although it is not unusual for even small earthquakes to be widely felt in New England.

The shaking for most of New England was in the weak to light category, rating at II–IV on the Modified Mercalli Intensity Scale, although several reports very close to the epicenter reported strong shaking (Mercalli Scale VI). The Mercalli Scale is a description of the intensity of the earthquake at the Earth's surface based on the human response (e.g., would the shaking wake you up) and the level of damage. The scale as used by the USGS goes from I (not felt) to X (extreme shaking and lots of damage). More info on the Modified Mercalli Intensity Scale can be found at: https://www.usgs.gov/natural-hazards/earthquake-hazards/science/modified-mercalli-intensity-scale?qt-science_center_objects=0#qt-science_center_objects

Earthquakes are not unheard of in New England. The crust of the Earth in New England has been through a lot and has its share of "wear and tear"! Three major orogenic (mountain-building) events have shaped and added to the crust over the last 450 million years, the most recent event being the Alleghenian Orogeny, where Africa and North America collided, forming part of the supercontinent Pangea. These orogenic events formed numerous faults throughout the Earth's crust, analogous to an old back injury waiting to rear its head and cause you to reach for the ibuprofen! Occasionally, these faults release stress, producing earthquakes. The smaller faults are typically unmapped, and it is only when an earthquake occurs that they reveal themselves. The November 8th earthquake was what is known as a reverse fault, where one side of the fault moves up relative to the other in a compressive motion. The stress (force) being applied in this case was likely the western motion of the North American plate away from the Mid-Atlantic Ridge. This stress likely reactivated a normal fault (where one side of the fault drops down relative to the other side) formed as the crust was stretched during the breakup of Pangea 200 million years ago.

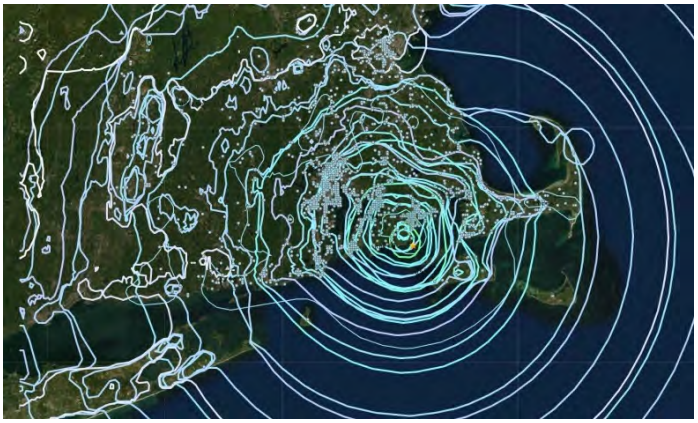
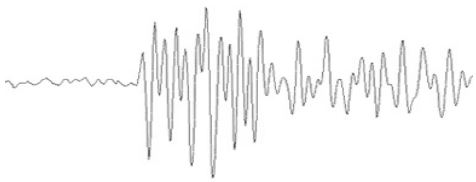


Figure 1: USGS Earthquake Hazards Map: Nov. 8, 2020.

While typically not as large as the events on the tectonically active West Coast, the age and contiguous nature of the rocks in the eastern US permit the transmission of seismic waves across great distances, and you may remember feeling the 2011 Virginia earthquake (magnitude 5.8), which was felt by people from Maine to Georgia and as far west as Chicago. Notably, that event also caused millions of dollars of damage to the National Cathedral and Washington Monument. More information on the November 8th earthquake (and others) can be found here: https://earthquake.usgs.gov/earthquakes/map/?extent=4.82826,-149.67773&extent=61.43877,-40.25391
If you feel the seismic waves from a future earthquake, report your observations to the USGS via the "Did you feel it" program at https://earthquake.usgs.gov/data/dyfi/. These observations help gauge potential damage and help seismologists better understand the impact of these infrequent events.

Bryan Oakley *is an Associate Professor in the Department of Environmental Earth Science at Eastern Connecticut State University in Willimantic, and a Survey Board member.*



Marine Mammals of Rhode Island: North Atlantic Right Whale—Part 1

By ROBERT D. KENNEY

The North Atlantic right whale (*Eubalaena glacialis*) is one of three species of right whales, with the other two occurring in the North Pacific and Southern Ocean. In the past all right whales have been considered to comprise either a single global species, or two species on opposite sides of the equator—northern and southern right whales. It is only within this century that genetic evidence has clearly shown that three species exist. Right whales are closely related to the bowhead whale (*Balaena mysticetus*). Bowheads are normally found only in the Arctic, although one individual (the same one each time) has been sighted with right whales off Massachusetts, in the Bay of Fundy, and in two other areas of the Gulf of Maine in 2012, 2014, and 2017 (Accardo et al. 2018). If I were to create a list today of Rhode Island's marine mammals, I would consider adding bowheads as another potential species.

North Atlantic right whales (simply right whales hereafter for brevity) are the species where we have seen the most significant changes since the publication of the Rhode Island Ocean SAMP in 2010 and my post on the RINHS blog in 2013 (http://rinhs.org/animals/marinemammsofri2/). Those changes have been mainly with how many whales there are in the population and in their distribution patterns, especially in our region of southern New England. The new information has made this species account much longer, therefore it is being cut into two parts across two issues—focusing on abundance and status here.

Description

Right and bowhead whales belong to the family Balaenidae. All have rotund bodies with thick blubber, relatively large heads with strongly bowed skulls, no dorsal fins, and large, squarish flippers with 5 sets of "finger" bones (other baleen whales have 4). Their baleen plates are long, narrow, and flexible with very fine fringing hairs, and they feed on smaller prey organisms than other baleen whales. North Atlantic right whale adults are 11–17 m (36–56 ft) long, with a maximum recorded length of 18 m (59 ft). Calves are about 4.5 m (15 ft) long and weigh around 800 kg (1800 lb) at birth. The color is usually black, and some animals have irregular white patches on the belly. The top of the head in front of the blowholes (the rostrum) is narrow and arched, and the edge of the mouth opening is very strongly curved (Fig. 1). There are irregular whitish patches called "callosities" on the rostrum, on the chin, along the lower jaw, and over the eye, usually behind the blowholes, and sometimes on the lower lips. These are patches of thickened skin inhabited by dense populations of light-colored whale lice (Fig. 2). The callosity patterns are individually distinctive and used for photographic identification of individuals. The tail flukes are broad, black on both surfaces, and tapered to points with a smooth trailing edge and deep central notch.

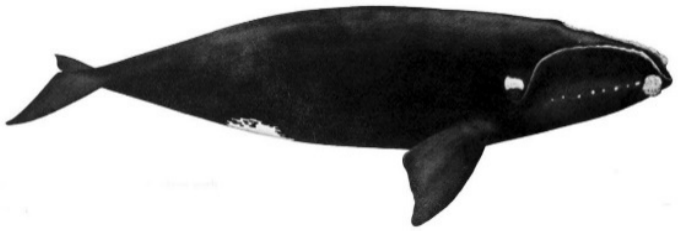


Figure 1. A "northern" right whale, showing the general form and the callosities on the head that are used like fingerprints to identify individual whales (illustration by Pieter A. Folkens, from *Cetaceans of the Channel Islands National Marine Sanctuary*, National Marine Fisheries Service, 1987, in the public domain).

Abundance and status

Right whales were the first targets of commercial whaling, beginning along the Bay of Biscay in Europe in about the 11th century. By the 16th century, right whaling had expanded throughout the North Atlantic. In our local region, shore-based right whaling began along the south shore of Long Island, New York, around 1650, and the last whale killed there was in 1918. Although all right whales have been protected from commercial whaling since the first International Convention for the Regulation of Whaling was ratified in 1935, whaling already had reduced the numbers in the North Atlantic and North Pacific to very low levels, and both species are among the most imperiled mammals in the world. North Atlantic right whales are listed as Endangered under the U.S. Endangered Species Act. They are listed as Federally Endangered on the Rhode Island state list. They had long been classified as Endangered on the international Red List, however they were down-graded to Critically Endangered on 9 July 2020 (IUCN 2020).

When I first wrote this species account for the Ocean SAMP report 11 years ago, our right whale population was estimated to be at least 500 animals, and appeared to be growing slowly. We had some guarded optimism about the species' prospects. No longer. It is now clear that the

population is declining at an alarming rate, and extinction in the foreseeable future is a distinct possibility. The rate at which a population grows is the difference between the birth rate and the death rate. Right whales are getting hammered from both directions—the birth rate has declined and the mortality rate is going up.

Figure 2. Lateral view of the right side of a North Atlantic right whale's head, showing the curved line of the mouth and the callosity on the top of the head (called the "bonnet" by Yankee whalers). The raised black areas in the callosity are comprised of thick whale skin, while the white areas are dense patches of whale lice. This is whale #3293, a female named "Porcia." She was at least 3 years old at the time of the photo in August 2005 in the Roseway Basin off Nova Scotia, and was sighted most recently in 2019 (NOAA photo, from Wikimedia Commons, in the public domain).

The ability to repeatedly identify individual whales from photographs (Fig. 2), and more recently by genetic profiles, has given us an ideal tool for population monitoring. The catalog of known right whales now (on 12 January 2021) includes over a million photos of 764 whales (some are known to be dead, others presumed to be after long absences). The catalog is maintained by the New England Aquarium in Boston and is publicly accessible (http://rwcatalog.neaq.org/#/). Researchers and federal managers had been monitoring the trend in the population using a method called "Minimum Number Alive" (MNA). To calculate MNA for any year, you just count up all the individual whales that were seen that year, plus all the other individuals that were seen *both* before *and* after that year. MNA is not what a statistician would call an "estimate" of abundance, because it is a number that we know for sure to be true. We also know there are more whales than the MNA value, because at any time there are some living whales that have not been added to the catalog yet, but it's always a small number. There is one problem with the MNA method. If we assume today that the photo-analysis for 2020 is complete (which it won't be any time soon), there still could not be a reliable MNA value for 2020—simply because we have no idea which whales will be seen in 2021, 2022, and later (i.e., the "after" years). Up to about 2010, it took about 3 years of after photos for MNA to stabilize and be reliable.

Then the whales started messing things up. They started spending more time in different habitats where there weren't as many scientists running surveys and taking pictures, and spending less time in habitats where surveys had traditionally been done. That reduced the probability of re-sighting a particular whale within a year, stretching out the waiting time until the MNA value stabilized to 6 or 7 years. That made MNA not very useful, especially for tracking trends in an endangered species with suspicions that a decline might be happening.

A team of scientists led by Dr. Richard Pace, a biologist and statistical modeling whiz with the National Marine Fisheries Service in Woods Hole, developed a sophisticated model to estimate the annual abundance without the need to wait for all those additional years (Pace et al. 2017). The model was still based on the catalog of photographed whales, and is now updated every year to track the population. The results in their paper showed a population that began with 270 whales in 1990, slowly grew to a peak of 482 in 2010, and then began to decline—reaching 458 in 2015. The updates show that the decline continued to 451 in 2016, 428 in 2017, 410 in 2018 (but dropped to 385 by the most recent model run), and only 368 in 2019. The smaller numbers and continued decline are what led to the re-classification on the Red List.

Although hunting ended long ago, humans are still killing right whales. Human-caused mortality is clearly retarding recovery of the population, while at the same time calving has declined (to be covered in Part 2). The two most significant sources of mortality are entanglement in commercial fishing gear and collisions with ships. In a typical year, at least three right whales are killed in the US and Canada by entanglement and ship strikes, and there are certainly other deaths where the carcass is never recovered. There was a disastrous year in 2017; 17 whales died, with 12 of them over only a couple of months in the Gulf of St. Lawrence in Canada. A fishery that uses large traps to catch snow crabs (*Chionoecetes opilio*) has been implicated in some of those mortalities.

Both mortality sources have been regulated in US waters. A management regime to reduce mortalities from ship strikes, which includes limiting ship speed to 10 knots within 20 nautical miles of mid-Atlantic ports during migration periods, took effect in December 2008 and seems to be keeping ship-strike mortality low. A Take Reduction Plan is

in effect to reduce fishery-related mortality in US waters, including closures and gear modifications, with additional regulations now in the rule-making process. However, the plan has not been successful at reducing entanglements, which have actually been increasing in both frequency and severity. Corkeron et al. (2018) showed that the rate of mortality from ship collisions has remained low, but that entanglement mortality is steadily increasing. Alarmingly, we have *never* seen an adult right whale die from "natural causes." I published a paper (Kenney 2018) where I back-calculated what the past population trajectory might have been under several different scenarios of eliminating entanglement mortality while keeping the birth rate and ship-strike mortality the same. Under the best-case scenarios, population growth after 2010 would have slowed but not reversed to a decline. The situation has deteriorated further since then, and the North Atlantic right whale is in real danger of extinction in the near future—on our watch.

In the next issue, I'll cover natural history and distribution, including how climate change appears to be influencing the reproduction side of the decline in the population.

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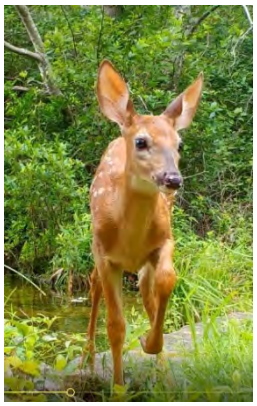
Rhode Island Nature Video Festival 2021



The Rhode Island Nature Video Festival is fast becoming a winter fixture for people who love capturing their explorations of nature on video. The Natural History Survey and the Environment Council of Rhode Island held the 2021 COVID edition on February 20th with live, remote live, and pre-recorded segments. The program was broadcast in real time on the Survey's YouTube channel.

The festival is growing in popularity, so this year some innovations include a jury to select 45 minutes of submissions to feature during the live broadcast; a special award for accomplishments in wildlife conservation, technology, and art; and a poll to identify winners for the Survey's Choice Award, with valuable prizes. Now on YouTube you can watch the whole hour and half program, a 45-minute reel of just the 12 jury-selected videos, or the pre-recorded award ceremony for distinguished, California-based camera trapper, Christen Wemmer. You can also visit the ECRI website to watch all 20 submissions where more than 100 viewers voted for their favorites in our first ever Peoples's Choice Award.

The Survey's YouTube channel: youtube.com/user/rinaturalhistory
ECRI's festival page: https://tinyurl.com/RIVNF

*Video still photos: Elise Torello

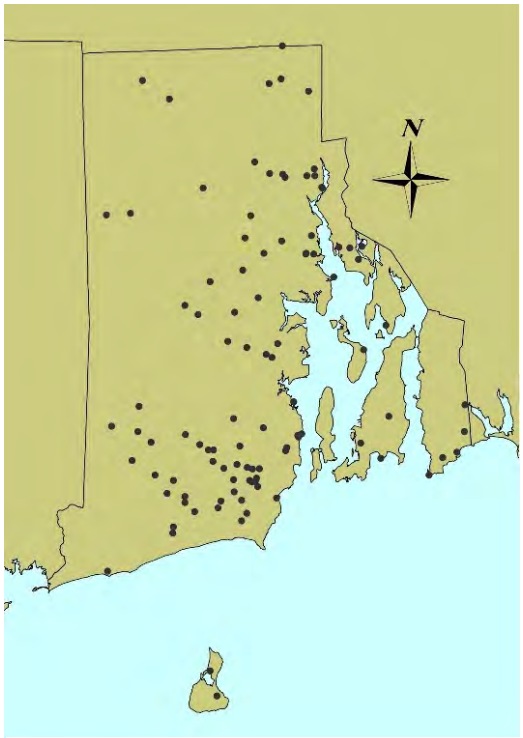
Executive Director's Journal:

Rhode Island Backyard BioBlitz 2020

By DAVID W. GREGG

The Natural History Survey organized the first-ever Rhode Island Backyard BioBlitz last June. Because of travel and gathering restrictions of COVID-19, volunteers were tasked with surveying biodiversity within walking distance of their homes. The event lasted from 1 PM Saturday, 27 June, to 1 PM Sunday, 28 June. Over 350 people participated, including more than 60 school-age children, surveying over 160 locations (see map) and identifying just over 1,400 species of animals and plants.

Normally in June the Survey would host an "in-person" Bioblitz, its flagship public event. A Bioblitz is an effort by teams of volunteers to count as many species of life as possible in 24 hours, on a particular parcel of land.



Preliminary map of sites surveyed in the June 2020 RINHS Backyard BioBlitz. Several more sites than shown were surveyed but lat/longs need to be verified. Sites were located in 30 of RI's 39 town and cities.

Science Central in Smithfield. Photo: Hollie Stillwell.

The Natural History Survey has organized a Bioblitz annually since 2000, moving from site to site every year and in that time covering much of Rhode Island. Because the COVID-19 pandemic led to restrictions on gatherings, the Survey could not bring people from all around the state to survey a single location. So, we decided to ask them to survey where they happened to be holed up.

Participants made over 6,000 observations; about half submitted via email and half using iNaturalist (www.inaturalist.org), an online social network that connects people around the world who are interested in learning about the animals and plants they observe. Of the over 1,400 species tallied in total, a little over 1,000 were reported via iNaturalist.

As the BioBlitz got underway on Saturday afternoon, a steady rain dampened some spirits but not those at Josh and Tarah Clements's house, "Not much luck in the rain but still having fun! Hope you guys are enjoying the day. Lots of memories with the nieces and extended family over for some outside fun." Volunteer Susan Marcus also persisted, "It's raining, it must be BioBlitz!! I'm so

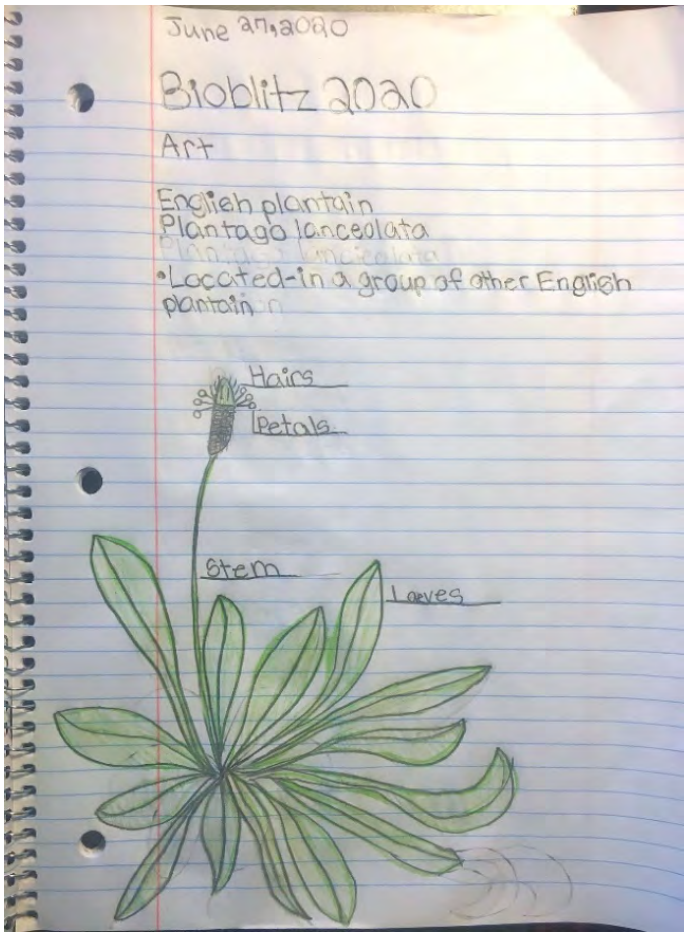
disappointed because I wanted to see what I could learn about the myriad flying critters in my meadow. Meanwhile, I'm making an interim report of 65 vascular plants, 1 butterfly, 1 moth, 10 birds, and 2 mammals. I hope I can collect some different sightings in the a.m."

The Zabel family, from Greene, got out all their field guides in preparation and ended up submitting 145 species in 11 taxonomic categories including the flies, where their finds—"mosquito, deer fly, house fly"—show that even pests can add to biodiversity. URI graduate student Karlo Berger bioblitzed his yard in Providence. He submitted 21 species and added, "A fun time! Thank you for organizing this." And Rachel Holbert from her home in Barrington said "We really enjoyed the chance to nerd out in our backyard."

Judolia cordifera, a longhorned beetle, on Japanese spirea. Photo: Suzanne Paton.

In the spirit of bringing people together, friends confined by COVID-19 outside of Rhode Island were also encouraged to participate, although their finds weren't included in the final count. The Colucci family participated in Rhode Island BioBlitzes before moving to Maine and the whole family, including children, participated in the backyard event, "Thank you so much for allowing out-of-staters to participate in the BioBlitz this year. We had so much fun learning about the organisms in our environment. The *Seek* app by iNaturalist was ever so helpful! Thank you for bringing iNaturalist to our attention."

Eastern phoebe (*Sayornis phoebe)* in Exeter. Photo: Dennis Skidds.



Field notes & sketch by Ila Kutcher.

Volunteers observed, among other things, 28 mammal species, 97 bird species, 15 fish, 9 reptiles, 10 amphibians, and 13 butterflies. The most commonly reported species was *Bombus impatiens*, the common eastern bumble bee. Plants were the most diverse taxon, with approximately 590 species observed. The most commonly recorded plant species were common milkweed *(Asclepias syriaca*), common St. John's wort (*Hypericum perforatum*), white pine (*Pinus strobus*), and white clover (*Trifolium repens*). You can see some of the Rhode Island Backyard BioBlitz finds by visiting iNaturalist.org and searching for the "Rhode Island Backyard BioBlitz 2020" project. Highlights included a spotted turtle (*Clemmys guttata*) and rattlesnake plantain (*Goodyera* sp.), a wild orchid.

Interestingly, dispersing observers around the state in this way did not result in a lot of rarities, no doubt because for the most part people stayed near their homes. Though the "herptile" (reptiles and amphibians combined) count approached the R.I. BioBlitz record, there were no observations of noteworthy uncommon species such as box turtle, black rat snake, marbled salamander, or four-toed salamander. The record-high mammal count for all Bioblitzes was composed not of rarely observed water shrews, weasels, or bobcats but of common species such as

skunk, woodchuck, red fox, or raccoon plus a few common in the right habitat such as beaver. The results support the generally accepted inverse relationship between human occupancy and rare species.

Our traditional BioBlitzes have moved around the state, only returning to a site once, and that was Roger Williams Park, in Providence (site of the first and the 20th anniversary Rhode Island BioBlitz). Almost all have taken place in late spring, and so, over time, the roving Rhode Island BioBlitz has built up quite a picture of life across the entire state. In 20 events, 3,080 participants made 20,272 species identifications. The farthest north was at Cumberland Monastery, in 2006; the farthest west was in Westerly, at the Grills Preserve, in 2008. We have been to East Bay (Tiverton 2003, Little Compton 2015); islands (Middletown 2001, Block Island 2010, Jamestown 2012); cities (Providence 2000 and 2019); and rural areas (Glocester 2009, Hopkinton 2016). Rhode Island BioBlitzes have made important discoveries: over 100 rare species observations, the first Rhode Island discoveries of mosquito fish (*Gambusia holbrooki*) and thinstripe hermit crab (*Clibanarius vittatus*), and the rediscovery of the nine-spotted ladybug (*Coccinella novemnotata*).

In the Backyard BioBlitz last year, we had people making simultaneous surveys at sites across the state, something we never have done before. The volunteers rallied and made a

Field sketch in watercolor by Frances Topping.


Mating *Trichopoda pennipes*, a tachinid fly, a parasitoid on pentatomorph bugs (squash bugs*, inter alia*). Photo: Karen Beck.

silk purse out of the COVID-19 sow's ear. It is hard to strike a balance between a regular BioBlitz with a rigorous count and one like this that encourages maximum participation and engagement. People come to natural history from diverse science backgrounds and with many different understandings of the species concept and nomenclature. For participants on their own, iNaturalist was helpful for identifying and recording species in a single system. In contrast, with a traditional in-person BioBlitz, participants see how others are recording things and get immediate feedback on identifications, including instructions for narrowing down frequently confused species. They can look through guidebooks and checklists or be directed to a different taxonomic team. One can quickly ascertain whether a species seen has already been counted.

BioBlitz is virtually unmatched for the ability to lay open the natural historical enterprise for the public to see and learn. The feedback from participants in this Backyard BioBlitz was universally positive; it brought together families and inspired people to dust off old nets and field guides or to tackle a new taxon. It was a great excuse to get outside during a difficult time. It was even the featured activity at a birthday party. We are planning to try it again this year, putting to use lessons learned during our first attempt. Watch our email newsletter for updates.

Relationships of Nest-Site Selection and Nest Success of Saltmarsh Sparrows (*Ammospiza caudacuta*) in Upper Narragansett Bay, Rhode Island

By STEVEN E. REINERT, DEIRDRE E. ROBINSON, JAMES M. O'NEILL, MIRANDA B. ZAMMARELLI, and JOEL ECKERSON

The Saltmarsh Sparrow (*Ammospiza caudacuta*, Fig. 1) breeds in salt marshes from Virginia to Maine—and nowhere else on the globe, making it vulnerable to the impacts of rising sea levels. Those impacts can be caused by habitat loss from marsh erosion and vegetation changes and by increased frequency of nest flooding. The Saltmarsh Sparrow Research Initiative (SSRI; www.SALSri.org) has completed 4 years (2017–2020) of an intensive 5-year study of Saltmarsh Sparrow breeding ecology in a 10-ha (25-acre) salt-marsh study site at Jacob's Point on the east shore of the Warren River in Warren, Rhode Island, off upper Narragansett Bay (Fig. 2).

The marsh is dominated by "salt meadow" communities of the high marsh—stands or mixed communities of *Spartina patens* (salt marsh hay), *Distichlis spicata* (spike grass), and *Juncus gerardii* (black grass). The shrubby high-tide bush (*Iva frutescens*) occurs in areas of relatively higher marsh-surface elevation, and smooth cordgrass *(Spartina alterniflora)* occurs along creek and ditch banks in the low marsh and in patches on the high marsh.

We captured (by mist-netting) and banded adult and juvenile sparrows during May through August in all 4 years. We also banded nestling sparrows between nest-days 5 and 8. Nests were marked, after being located, by small flags 1 m to the east and west, and then monitored every other day for most of the month and daily during the highest flood-tide cycles. We assessed nest-site vegetation after a nest was no longer active, by visually estimating the percent cover of each vegetative species within a circular 0.125-m^2 (40-cm diameter) plot centered over each nest (n = 150 of 153 nests). In 2020 we also conducted standardized vegetation sampling within 1-m^2 plots at each nest found and at a paired, randomly located point for each nest (n = 68 for each).

Saltmarsh Sparrows arrived at our Narragansett Bay study site in mid-May, began nesting in late May, and continued into mid- to late August each year. Banded adult males remained on the marsh as late as 15 October during fall monitoring in 2018, and two fledglings banded in the nest during 2020 remained on the marsh as late as 17 October and 21 October.

We banded 316 Saltmarsh Sparrows in four years, 49% of which were adults. The sex ratio of captured adults averaged 1.6 males:1 female (62% male). Based on the numbers of banded adult sparrows, we estimate that 40–45 females occupy our study plot, and that 50–60 males are at least part-time breeding-season residents.

Figure 1. Adult Saltmarsh Sparrow perched in a high-tide bush at the Jacob's Point study site. Note the aluminum federal band and three plastic color-bands (photo by Deirdre Robinson).

We found 153 active Saltmarsh Sparrow nests during our four years of field work; and assessed nest outcome for all but one. Of 152 nests, 44 (29%) fledged at least one young ("successful nest"); females averaged 0.51 successful nests, 0.86 fledglings/nest, and 1.26 fledglings/female/season (fecundity). Tidal flooding destroyed 57 (38%) of 152 nests, and destroyed partial nest contents at an additional 11 nests (7%) that fledged young. Predation events destroyed 42 (28%) nests, and destroyed partial nest contents in an additional 8 nests (5%) that fledged young.

Only two vegetation types showed significant differences between nest sites and random plots (Table 1). *S. patens* occurred in significantly greater abundance at nests ($\bar{x}$ = 33.3%) than in random plots ($\bar{x}$ = 16.4%). *J. gerardii* occurred in a significantly higher proportion of nest plots (41.3%) than randomly placed plots (25.0%). Atypically,

Figure 2. Aerial view of the Jacob's Point salt marsh during a "king tide" in October 2020. Tides of this magnitude, which would inundate every Saltmarsh Sparrow nest on the marsh, will occur with greater frequency as sea levels rise in the years ahead (drone photo by Butch Lombardi).

sparrows placed 37 (24%) of 152 nests within 15 cm of the nearest vertical stem of *I. frutescens* and directly at the base of an *Iva* plant at 26 of those (17%). Nests near *Iva* typically occurred by single plants growing among salt-meadow grasses, or within 1 m of the edge of salt-meadow habitat in *Iva* "islands" or stands occurring along the marsh edge.

Significant relationships between nest success and vegetation type were found only for *J. gerardii* and *I. frutescens*. Presence of *J. gerardii* was associated with nest failures: percent cover was 19% at unsuccessful nests and 8% at successful nests ($t = 2.36$, $P = 0.02$); 19% of 62 nests with *J. gerardii* present in the plot were successful, vs. 34% of 89 nests with no *J. gerardii* present ($\chi^2 = 3.7$, $P = 0.05$). *Iva frutescens* was associated with positive nest outcomes. Successful nests were placed a mean of 4.4 m (± 8.9) from nearest *Iva*; unsuccessful nests were placed 7.2 m (± 8.9) from nearest *Iva* ($t = 1.75$; $P = 0.08$). Similarly, 38% of 37 nests with *Iva* occurring within the plot were successful, vs. 25% of 115 nests where *Iva* was absent from the plot ($\chi^2 = 3.20$; $P = 0.07$).

Table 1. Comparisons of nests and random plots (RPs), as expressed by percent cover and percent frequency of occurrence of vegetation types (RPs, n = 68; Nests, n = 150).

	Mean percent cover			Mean percent occurrence		
Plant Species	**Nests**	**RPs**	***P*[1]**	**Nests**	**RPs**	***P*[2]**
S. alterniflora	5.8	11.1	0.09	20.6	30.9	0.10
S. patens	33.3	16.4	<0.001	50.0	41.2	0.23
D. spicata	35.5	35.7	0.97	84.0	82.4	0.76
J. gerardii	16.0	12.0	0.29	41.3	25.0	0.02
I. frutescens	8.2	11.5	0.34	24.2	27.9	0.55
P. australis	0.5	0.3	0.62	3.3	7.4	0.19

[1]Independent-samples t-test.

[2]Chi-square test.

Our results show habitat-use patterns that are typical for Saltmarsh Sparrows range-wide, with sparrows nesting in high marsh dominated by *Spartina patens* and other plant species generally used in proportion to their relative abundance. The exception was the relatively high use of *Iva frutescens* at our study site, with substantial evidence that sparrows nesting close to *Iva* shrubs have a higher proportion of successful nests. We believe that this effect is related to the relatively high substrate elevation of *Iva* stands. Our major recommendation is that salt-marsh habitats in Rhode Island could be managed to enhance Saltmarsh Sparrow nesting by using spoils from excavation of drainage channels to create higher-elevation "islands" in the high marsh, which should promote the growth of *Iva.* Our Jacob's Point study marsh can be used as a benchmark site for monitoring marsh-restoration actions and Saltmarsh Sparrow demographics as rising sea levels encroach on the Northeast coast in the years ahead.

This is an abbreviated summary report; the complete article will be published as Special Issue 1 of Rhode Island Naturalist *on the Natural History Survey website.*

***Steve Reinert** is Co-Director of the Saltmarsh Sparrow Research Initiative (SSRI); he is retired after working four decades in medical (full-time) and ornithological (part-time) research. **Deirdre Robinson** is Co-Director of SSRI and has worked on salt marsh and shore bird ecology since the 1990s. **Jim O'Neill** is a retired IT professional and an avid amateur birder. **Miranda Zammarelli** plans to pursue a Ph.D. in evolutionary biology and served as a 2020 intern for SSRI. **Joel Eckerson** is an expert birder and wildlife photographer who served as an intern for SSRI during the 2020 field season. For further information on these SSRI team members, please see https://www.salsri.org/team-page.*

Essay:
Terrapin in the Rising Tide

By CAROLYN DECKER

At high tide, the salt marsh floods full to the edge. The robust green blades of *Spartina* reach up out of the water; the long whitish inflorescences tilt in the summer breeze. I've been researching diamondback terrapins (*Malaclemys terrapin*), the only North American turtle that lives in salt marshes. A century ago, we overharvested terrapins for food. Now, humans threaten terrapins through poaching, by developing coastal habitats, and, more insidiously, through sea level rise. Still, I hold out hope for sightings of wild terrapins.

I take off my boots, roll up my overalls, and wade into the marsh. It's easier to wade in barefoot. Easier to feel the soft spots in the muck—the "black mayonnaise" that swallows the hurried in a loose slurry of sulfide-rich sediment. Easier too, to avoid breaking the rigid culms of the *Spartina* grasses, whose roots hold the marsh together. In a very real sense, these grasses *are* the marsh. Centuries of living and dying layers of *Spartina* built the peat on which all the other marsh wildlife depend.

Like the willets and egrets on the opposite bank, I creep through the deepening waters toward the creek bank. Crabs, mummichogs, and grass shrimp dart alongside me in the shallows. As I dare an unchecked footstep, my right leg sinks. Slumped in a deep soft spot hidden by a raft of invasive *Phragmites* reeds, I grapple forward, soaked, but secretly thrilled. I lunge for a driftwood plank—the leftover of some dock's lost battle with a hurricane. Heaving myself up on the plank, I pry my leg from the muck with a deep sucking sound.

I steady on a firmer patch of peat and vow to be as still as the ancient basking log jutting out of the bank a few yards away. The longer I stand still, the more crabs skitter across my toes. Mummichogs swim by and nibble at my legs. Mosquitos buzz heavy and hungry. Worth it, for a chance of terrapins.

Ecologists describe the salt marsh as a dynamic ecosystem, by definition a place of cycles, of change. Bare spots among the *Spartina* are necessary for other marsh plants to take root. The fluctuations in salinity and flooding create unique niches for hundreds of fishes, birds, and invertebrates, as well as one highly specialized turtle.

Without, or with too few, terrapins, the unique relationships in the marsh food web erode, and so erodes the marsh. Low tide reveals a landscape like rotted swiss cheese: wide networks of holes carved in the peat by storms and crabs. At high tide, the worst of the damage is masked by the sparkling waters, but the waters bring greater peril. High tides keep getting higher. As seas rise, marshes drown. The long-serving cycles of life and death among marsh species simply cannot keep pace.

As a researcher, I ache for the information that would protect this place. More than information, I want action. I want funding. I want a shift in values and powers. I crane, trying to scan the sun-dazzled water for a diamond-patterned shell just below the surface.

An environmental crisis like sea-level rise is not as slow-moving as it seems. Like a terrapin, it moves fast through the water, bold and easy in the shallows of the creek. Under even the most conservative projections of sea-level rise, this marsh will be all but swallowed by the deepening waters. Amid all this beauty and the specter of so much loss, I wait, watching the marsh. The morning drifts with the tide. The *Spartina* wavers in the breeze. Osprey peer through the rising waters for the shimmer of a fish.

Three diamondback terrapins (*Malaclemys terrapin*) and one hitchhiking ladybug in Hundred Acre Cove in Barrington. Photo: Peter Muir.

Then, while I am distracted, a silent, six-inch-long young female terrapin pulls herself out of the water, climbing the weathered basking log. At this size, she is nearing maturity, and could, in a year or two, start nesting in the nearby uplands where she herself hatched several years ago.

A terrapin can live well over forty years. This female will see the survival or doom of her habitat in the years ahead, depending entirely on forces beyond her control, but potentially within mine. I watch, joyful, a few precious moments, until she slides away, hidden again, but not yet gone.

Carolyn Decker *is a graduate student working on an M.S. in the URI Dept. of Natural Resources Science, where she studies the ecology of the diamondback terrapin.*

Focus on RINHS Organizational Members: The Friends . . .

By ROBERT D. KENNEY

The full name of our organization is Friends of the National Wildlife Refuges of Rhode Island, but if I had spelled it out in full the title of this article would have taken half the page. The long name also makes it difficult to do things like create an easy-to-remember website address (http://FriendsNWRofRI.org), fill out a form, or write a check for a donation (hint: Friends of NWR of RI). For the remainder of this article I will simply use "the Friends" and treat it, perhaps somewhat awkwardly, as a singular noun.

The Friends is an independent, grassroots, non-profit organization established in 1998. Its mission, as stated in the by-laws, is "devoted to the conservation and development of needed healthy habitat for flora and fauna at the National Wildlife Refuges of Rhode Island and the provision of a safe, accessible, ecological experience for our visitors. The association promotes the benefits of the refuges and the National Wildlife Refuge System to the local community through public education and interpretation, and supports the refuge staff through projects designed to accomplish the goals of the comprehensive conservation plan for all the refuges in Rhode Island. The corporation shall promote the preservation of the natural and historical resources of the Refuges, foster their use and enjoyment by the public consistent with the protection and preservation of Refuge environment, and engage in such educational, scientific and civic activities as will assist the management of the Refuges in carrying out its mandates."

The Friends is one of more than 240 such groups across the country. Most are associated with National Wildlife Refuges, although there are a few that are connected to

Friends of the National Wildlife Refuges of Rhode Island logo.

National Fish Hatcheries. The National Wildlife Refuge System contributes $2.4 billion each year to the economy of local communities, and the National Wildlife Refuge Association estimates that Refuge Friends groups contribute the equivalent of over 600 full-time employees to the Refuge System—a value of $32 million annually.

The Rhode Island National Wildlife Refuge (NWR) Complex includes 5 refuges, approximately 2,400 acres (970 hectares) in all, set aside for the conservation and protection of diverse plants and animals, as well as special habitats including wetlands and barrier beaches (Fig. 1).

- Ninigret NWR includes 868 acres across 3 tracts in Charlestown, with over 6 miles of walking trails. The refuge includes the award-winning Kettle Pond Visitor Center, which houses the offices of both the US Fish & Wildlife Service (FWS) and the Friends, a large wildlife exhibit, a multi-purpose classroom, a creative area for children, and a native plant demonstration garden.
- Trustom Pond NWR in South Kingstown includes 777 acres of various wildlife habitats including fields, scrublands, woodlands, freshwater and saltwater ponds, sandy beaches, and dunes.

- John H. Chafee NWR at Pettaquamscutt Cove in Narragansett and South Kingstown includes 550 acres in multiple parcels along the Narrow River and Point Judith Pond. Accessible by canoe and kayak, it was established to protect and enhance the populations of black ducks, which helps other waterfowl, as well as salt marsh sparrows.
- The Ninigret, Trustom Pond, and Chafee NWRs are all within the larger Great Thicket NWR—whose boundary was approved in 2016 to protect shrubland habitats across 6 states from Maine to New York.
- Sachuest Point NWR in Middletown has 242 acres with 3 miles of trails, spectacular shoreline vistas, 8 fishing accesses, and a photography blind. The Visitor Center offers exhibits on the history of the property and the wildlife found there.
- Block Island NWR, with 133 acres, was established for its particular value in carrying out the national migratory-bird management program. The refuge has a half mile of walkable shoreline, and is renowned for birding during fall songbird migration.

The Friends supports the Refuge Complex in a variety of ways. We assist the FWS with interpretive and educational programs, and helped develop some of the refuge programs that reach out into the classroom to augment the science curriculum. Since 2005 we have sponsored "Wildlife Wednesdays"—a very popular weekly summer lecture series, which unfortunately was cancelled for 2020. We coordinate the Junior Duck Stamp program—an annual art competition, held in conjunction with Rhode Island K–12 schools, which helps youngsters learn about waterfowl through the medium of art. We sponsor an annual photography contest as a means of drawing people to the refuges, since all photos must be taken on one of the 5 refuges.

We also provide a substantial amount of direct financial support to the refuges for numerous projects every year—increasingly important in these times of shrinking federal budgets. We operate nature gift shops at both the Kettle Pond and Sachuest Point Visitor Centers to raise some of those funds. Sometimes we fund projects alone; other times we provide matching funds for major grants or pool our resources with other donors. In years past we have supported: installation of solar panels at Sachuest Point and Trustom Pond, the history exhibits at Sachuest, the Urban Wildlife Refuge program in Providence, multiple summer internships, and a variety of special events.

I encourage everyone to join the Friends as a member—visit our website, pick up a brochure at one of the Visitor Centers or the Trustom Pond contact station (they will be open again, maybe by the time you read this), or send us an email at friends.ri@verizon.net. We could always use another board member or two, but the by-laws say that board members must come from the membership, so first things first. I always remember advice given by one of my undergraduate professors at Cornell. Richard McNeil, who retired in 1999 and died in 2018, was in the Department of Natural Resources. He taught a course called "Ecological Basis for Conservation," which was so popular that it filled one of the largest lecture halls on the campus for two sections each semester. He encouraged students to join as many environmental conservation groups as possible. Any dues that you paid were important, of course, but more important was adding your voice to the chorus every time somebody from that organization wrote a letter to a member of Congress or other official that started: "On behalf of the XXX members of the [fill in any organization name], we strongly urge you to vote [for/against] . . ." Be one of those voices at every opportunity.

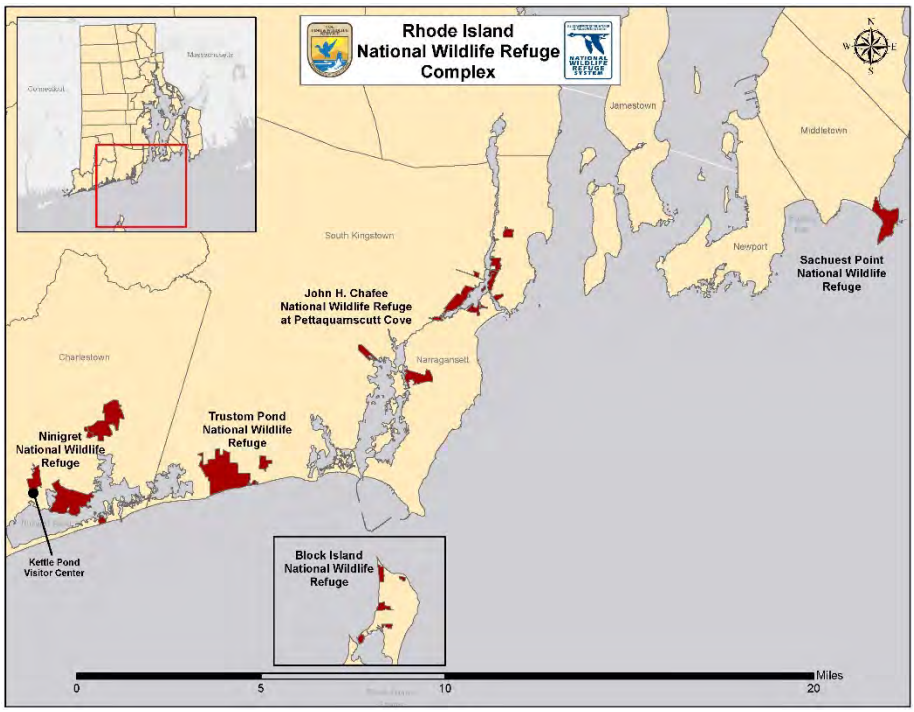


Figure 1. Map showing all of the properties (in dark red) included in the Rhode Island National Wildlife Refuge Complex (prepared by US Fish & Wildlife Service staff for the Friends).

Dr. Bob Kenney is the Secretary-Treasurer of the Friends Board of Directors, and the coordinator of the "Wildlife Wednesdays" summer lecture series.

Richard Ferren

RINHS Distinguished Naturalist 2020

Dick Ferren at one of many Block Island bird counts. Photo: Shai Mitra.

Richard "Dick" Ferren is one of the most accomplished ornithologists ever to work in Rhode Island. That he has not previously been recognized by the natural historical community is somewhat amazing. Ferren is a significant "bridge" figure in the continuum of Rhode Island ornithologists. In this continuum, Harry Hathaway's career spanned from the "shooting era" to the "modern era" of observational records, and after him, the flag was taken up by Dave Emerson, Dick Bowen, Roland Clement, and Doug Kraus, among others. Right on their heels came Ferren. He was strongly influenced by these early figures and in turn influenced the next generation of observers, including me, Shai Mitra, and Bob Emerson. Dick has never been attracted to finding or listing rare species, but has rather appreciated, as he calls it, "the ever-changing tapestry" of bird populations. He grew up in East Providence and was attracted to birds at an early age; as a teenager he produced a monograph of the birds of the East Providence reservoir. He became active at the Norman Bird Sanctuary, where he was influenced by Jim Baird and others, and he participated in observational studies of diurnal migration (how birds move through the local landscape). This greatly influenced his worldview of birds. He spent many hours observing and counting oceanic migrants such as loons and scoters and also studied raptor migration along the Rhode Island coast, which is where I met him—watching hawks at Napatree Point. He began to participate in the Newport Christmas Bird Count when he was quite young, and never missed a year (60+ in a row).

In the 1970s, Dick continued the early work of documenting Rhode Island's colonies of sea birds and began the statewide surveys of Narragansett Bay with Jim Myers, which I continued after Myers retired. This work resulted in a nearly unbroken record of the nesting status of several gull, tern, and egret species. During the first Rhode Island Breeding Bird Atlas, Dick would spend days at a time, usually sleeping in his truck, probing the countryside to document (and count) nesting birds. He recognized that various physical parameters influenced the breeding densities of birds and his theories to account for this are still relevant today.

Dick's biggest ornithological legacy will probably be his compilation of much historical material for his magnum opus manuscript of the *Birds of Rhode Island*. In this work, he summarized most of the historical material related to Rhode Island birds, including reading the original diaries of Elizabeth Dickens, Harry Hathaway, Maybelle Davenport, and others. The scope and detail of this work is virtually unprecedented for any local or regional bird text. He has an extensive library featuring many original manuscripts and other items from Rhode Island's ornithological history.

Dick has toiled away at documenting Rhode Island birds in relative obscurity, in part because he taught biology at Berkshire Community College and has lived in Massachusetts for several decades. He is, therefore, virtually unknown to the newest crop of observers. However, it is an even stronger testament to his commitment to Rhode Island birds that living in the Berkshires didn't prevent him from making the 3-hour drive to Rhode Island to pursue his passions. There are few, if any, people who have pursued natural history with such intensity and passion or have made a larger contribution to Rhode Island natural history than Dick Ferren.

Adapted from the nomination letter by Christopher J. Raithel, with contributions by Rachel Farrell.

Reynold T. Larsen

RINHS Distinguished Naturalist 2020

Birders sometimes speak of a "spark bird": the first bird that really grabbed their attention, often at an early age . . . a bird that "sparked" their love of birding. It may be a bird as common as a robin; it may be something more exotic, like a roseate spoonbill. For Reynold "Rey" Larsen, the recipient of this year's Rhode Island Natural History Survey Distinguished Naturalist Award, it was more of a "spark project." As a fourth-grade student, Rey joined his class in using Audubon birding kits his teacher had ordered. By the time a year had passed, Rey had recorded 17 species. Not bad for a nine-year-old.

Dr. Larsen was a physician in the US Navy and served as ship's surgeon in submarines. In 1963, while stationed in New London, Rey would pursue his other passion in life—birdwatching—often at the Napatree Point Conservation Area. Though his work took him around the world, he eventually settled in Rhode Island. When he did, he began to inventory birds across the state, maintaining meticulous records of what he observed and where.

Nearly 60 years later, Reynold Larsen has submitted over 6,000 checklists to the Cornell Lab of Ornithology's eBird database. His lists document 297 bird species from Rhode Island. These numbers are astonishing and have made a significant contribution to the body of knowledge surrounding Rhode Island birds, their migrations, and their habitats. He has mentored innumerable naturalists, students, and birders as they find their own "spark birds."

Today Rey still patrols the Rhode Island shoreline, carefully recording his observations and sharing his discoveries with everyone interested. Here are some of the comments made by those with firsthand knowledge of Reynold Larsen's extraordinary dedication.

- Our most stalwart and dedicated volunteer, Reynold "Rey" Larsen, started counting birds at Napatree on a cool, foggy morning on November 23, 1963. Since then, Rey has returned to Napatree 626 times over the last 54 years to tally 228,393 individual birds of 174 species.
- Although Rey precedes the Millennials and Gen Xers, he uses all the latest tools to record and share his bird observations. He ranks as the top eBirder in the state in terms of total checklists submitted (6,090); #2 has submitted 5,282 checklists, with most top eBirders submitting far fewer than 1,000 checklists. Thus, the information he has compiled contributes substantially to our understanding of the distribution and abundance of birds in Rhode Island.
- Napatree Point Conservation Area is designated as a Globally Important Bird Area by the National Audubon Society. That designation is largely based on Rey's data.
- Rey produced more than 470 records for the Odonata Atlas and carefully prepared high-quality museum specimens to document these records. He willingly slogged the state's ponds and wetlands with great enthusiasm, was a skilled netter of fast-flying dragonflies, and was a great member of the Odonata Atlas team.
- He is a walking Wikipedia of ornithological wisdom.
- If you are lucky enough to join Rey on a bird survey, you'll be treated to his marvelous wit and historic tidbits as he recalls the last time he recorded a seldom seen species: "The last _____ I observed here was a female in 1993 . . ." A generous mentor, Rey offers natural history information, explaining various plumages or territory ranges to novices like me. Rey Larsen is certainly Napatree's most precious "natural resource" and I dare say, one of Rhode Island's too.

Rey Larsen at Napatree Point Conservation Area.

Adapted from letter of nomination by Hugh Markey, with contributions from Peter August, Ginger Brown, Bryan Oakley, Peter Paton, Kevin Rogers, and Janice Sassi.

RINHS Founders' Award for Exceptional Service

The Sharpe Family

Last year, the Natural History Survey Board of Directors, reviewing the body of Distinguished Naturalist recipients and nominees, concluded that natural history in Rhode Island, and the Natural History Survey specifically, owed debts not only to great naturalists but also to organizers, volunteers, and contributors of things other than natural historical knowledge. To acknowledge these debts and thank the organization's heroes, we instituted the Rhode Island Natural History Survey Founders' Award for Exceptional Service, which is just what it says it is. The spirit of volunteerism is something we wish to acknowledge, to celebrate, and to honor. Many of our organizational heroes have worked in the shadows for decades and we want to recognize their contributions.

For the inaugural recipient of this award, it was an easy decision to recognize the exceptional service done for the Natural History Survey by the Sharpe Family, including Hank and Peggy Sharpe along with Julie and Henry Sharpe. The Sharpes' contributions have been many and longstanding and, collectively, they have done much to get the Survey where it is today. Their support has taken all kinds of forms and the Survey would not exist without it. The presentation of the award was made via a zoom call with two founding board members, Pete August and Keith Killingbeck, executive director David Gregg, and the Sharpes.

Peggy and Hank Sharpe (sitting) with Julie and Henry Sharpe (standing).

To view the 2020 Founders' Award, Golden Eye Award, and Distinguished Naturalist Award presentations search: "2020 RI Natural History Survey Annual Awards Ceremony YouTube" and click on the video link.

RINHS 2020 Golden Eye Awards

Established in 2008, the "Golden Eye" award recognizes a naturalist for reporting an extraordinary field find—a "good catch." It could be a new species for Rhode Island, a rare or otherwise unusual species, an invasive species, or some other natural historical phenomenon. The award recognizes not just luck, though luck certainly plays a part in many good finds in the field, but also the best naturalists' skills, including perseverance, taxonomy, biological and ecological knowledge, curation and record keeping, and communication.

For the 2020 awards, there were actually a number of good prospects, including the discovery of a thin-striped hermit crab at the Camp Fuller BioBlitz and the first find of the invasive vine kudzu in Rhode Island. But the hands down favorite finds were herpetological, and Golden Eye Awards went to Suzanne Paton for the discovery of a new population of ultra-rare spadefoot toads, and to Bill Sharkey for discovery of a five-lined skink.

Suzanne Paton. Photo: David Gregg.


Eastern spadefoot toadlet (*Scaphiopus holbrookii*). Photo: David Gregg.

In response to the award, Paton, who works as a wildlife biologist for the US Fish & Wildlife Service's Coastal Program, said she just happened to be at the right place at the right time, but also that she was primed to recognize the toads' unique call by all the conservation interest in the species in recent years (she had been involved in creation of artificial breeding ponds for spadefoots the previous year). She expressed her gratitude for the overwhelming response to her discovery by the conservation community in the state, including the University of Rhode Island, Rhode Island Department of Environmental Management, Roger Williams Park Zoo, the land trusts, and the Natural History Survey. She looked forward to doing more for the species in coming years.

About his skink discovery, Sharkey said he spent most of his life flipping boards and looking under rocks to see what he could find, trying to find cool stuff. In 40 years of looking in Rhode Island he'd never seen a lizard before and he recognized this was an important find. He was happy to be able to share it with the community and grateful for the recognition of the Golden Eye Award.

Bill Sharkey. Photo: David Gregg.

Readers are reminded if they find remarkable discoveries to report them to the Natural History Survey and they might just be recognized as having a Golden Eye!


Five-lined skink *(Plestiodon fasciatus)*. Photo: Will Brown, Wikimedia Commons, CC-BY-2.0.

Book Review:
The Nature of Nature

By KIM GAFFETT

The Nature of Nature: Why We Need the Wild
by Enric Sala
National Geographic, Washington, DC; 2020. 288 pp.
ISBN: 978-1426221019

The Nature of Nature is a wonderful book for the times that we are in. As an internationally renowned oceanographer, educator, and National Geographic Explorer-in-residence, Sala has both the background and skills to present a book that has the potential to inspire change and save the Earth.

The book can be divided into generally three areas. Sala describes in the first part—in clear and concise language, with ample examples—many of the basic principles that maintain our biosphere. Concepts are explained such as: the nature of an ecosystem, the process of ecological succession, the import of food webs, and the role of keystone species.

In the center part of the book, Sala asks, and answers, probing questions that illuminate how we humans have had an outsized impact on nature; an impact that is resulting in the destruction of our biosphere. Questions such as "Are all species equal?" lead to the understanding that the top predators in a system, which may have an obvious effect on species abundance, are not more critical to the functioning ecosystem than other species. It may be that mycelium is equally important by supporting the vegetative structure of the ecosystem. This is a simplistic explanation; Sala's discussion is infinitely more refined. Likewise, Sala's discussion of other important questions (Is diversity good? How are humans different from other top predators? Is there a moral imperative for human-imposed preservation?) are equally well reasoned and considered. In a nutshell, this section is a comprehensive exploration of the many ways in which humankind has tipped the balance towards annihilation of the biosphere's ecosystems.

In the final section of the book Sala offers examples of proven tools that can/should/must be used to repair and reverse the damage that has been wrought by humans to the biosphere (including the necrosphere—"everything that was alive and is not any more"). Sala argues very convincingly that protecting areas from human impact (with conserved land and marine reserves), as well as re-wilding formerly exploited lands, is not only doable, it is irrefutably necessary for continuing life on Earth as we know it and for support of critical ecosystem services. It also is economically viable.

In the closing chapter, "Why We Need the Wild," Sala brings home the case that humans need the wild, if for no other reason—and there are lots of other reasons (psychological and aesthetic to name a couple)—than to ensure enough clean air, water, food, and structural resources to support all life on Earth. Humankind must shift to acknowledging that we are part of nature, a cog like all the other beings in the natural world, not the ruler. We must forego our domination and extractive perspectives, or face the reality that humans are a dead-end branch on the tree of life.

Many authors have written similarly about the plight of the relationship between humans and the Earth at this time. In *The Nature of Nature*, Sala also outlines the changes necessary to accomplish a halting of our downward spiral towards a system collapse. It would be going too far to conclude that Sala is optimistic and has ready solutions. But, after reading *The Nature of Nature*, it seems possible that humankind *could* stop the steady march towards killing the Earth and its diversity of life (from viruses and minute organisms to humans); but, will we? The take-home message seems to be: To care for the whole is to care for the individual and vice versa. We cannot save ourselves without saving the biosphere.

The Nature of Nature had a planned publishing date for late spring 2020, but by then the world was shrouded by a pandemic. Publication was delayed a few months so that Sala could add an epilogue: "The Nature of Coronavirus." It is as if the evolution and spread of COVID-19 provides a current-day proof of concept and case study supporting the very premise and principles put forth in the rest of the book.

In addition to the epilogue, the book is enhanced by Edward O. Wilson's introduction, and a forward by HRH The Prince of Wales.

Wilson's introduction is brief and impactful. In just a few paragraphs he knights nature with dual powers: one of aesthetics and one of life-giving. Nature, Wilson concedes, has an elusive definition, and he commends Sala's endeavor to understand the ecosystem relationships of our home planet as ". . . one of the most important challenges of science in the present century."

The Nature of Nature is a pleasure to read. It is fascinating, well researched, well written, understandable, and engaging. It illuminates a dire picture, but somehow does not elicit despair.

***Kim Gaffett** is a board member and past president of RINHS, and occupies the Ocean View Foundation Naturalist Perch for The Nature Conservancy on Block Island.*

Tiger moth, probably *Apantesis nais* (top) and giant leopard moth (*Hypercompe scribonia*). Photo: Keith Killingbeck.

Absent Friends

PRENTICE K. STOUT
(1933–2021)

Prentice Kellogg Stout died at the age of 88 on 11 January 2021 after a brief illness. He was the consummate gentleman and naturalist—a lifelong educator, writer, lecturer, wildlife photographer, film-maker, storyteller, and travel guide—and snappy dresser. Keith Killingbeck's comment upon hearing the news was, "If I had a bow tie with me today in my office, I would put it on in his honor. He was a Rhode Island gem." Prentice served on the Survey's Board of Directors and later on the Board of Advisors, and was presented with the RINHS Distinguished Naturalist Award in 2000.

Prentice was born in 1933. He grew up in New York City, but the family summered away from the city in New Jersey, on the shore of the Shrewsbury River. His parents were his early inspirations. His father, a stockbroker, was also a dedicated birder who served for 10 years after retirement as president of the American Museum of Natural History. His mother was an accomplished artist and an expert conchologist. He graduated from the Ransom School in Cocoa Beach, Florida, and Denison University, and earned a master's degree in Marine Science from Wesleyan University.

His first job out of college was in banking, but he eventually made the switch into education as his life's work. He taught at the Hotchkiss School in Connecticut and the Far Hills Country Day School in New Jersey, teaching courses including geology, biology, marine biology, botany, physics, chemistry, and astronomy. He spent two additional years in New Jersey as an education director for the American Littoral Society. He was recognized with the New Jersey Governor's Award for Excellence in Science Education.

From 1974 to 1995, Prentice worked as a marine education specialist at the URI Bay Campus in the Marine Advisory Service and then the Office of Marine Programs, and was instrumental in a substantial expansion of the latter. His role encompassed science education on natural history and marine topics, with presentations to groups of all ages and at all educational levels. Bob Kenney got to know him during his own graduate student days on the Bay Campus, and was known to remark that he would like to be Prentice when he grew up. During his URI years, Prentice also served as naturalist and lecturer for Save The Bay and filled several roles for the National Marine Educators Association—president in 1982–1983, executive director in 1983–1987, and editor of their journal.

From the "Camp Fuller Archive Project" web site, with permission of the Greater Providence YMCA.

Did he slow down and take things easy after retirement? Perish the thought! He continued to teach at Rocky Hill School and Prout School. He maintained a long relationship with Camp Fuller in Wakefield, on the shore of Point Judith Pond (possibly his favorite place in the world), where he created and ran a marine biology program called SeaQuest. He inspired students old and young with field trips and lectures for the Osher Lifelong Learning Institute at URI. He would gladly do a presentation for any group who asked, no matter how small. With his wife Patty, he guided natural-history trips to the Galapagos, Turkey, Egypt, Antarctica, Costa Rica, Botswana, and more—taking more photos that he could then turn into additional illustrated lectures. He published two books: *Land of Fires: A Natural History of Potowomut Neck and Rocky Hill School's Nature Trail* in 1998 and *A Place of Quiet Waters: The History and Natural History of Point Judith Pond and the Harbor of Refuge* in 2006.

David Gregg summed up how everyone at the Survey feels: "If you didn't know Prentice you missed a treat: he was simply terrific. He was the consummate naturalist, a relentless educator, and a wonderful human being in the best old-school tradition. Since we moved to East Farm he frequently dropped into the office when he was passing by because he had something that was on his mind or he just wanted to say hi. He was the force behind the Camp Fuller BioBlitz. He will definitely be missed."

Assembled and adapted from his obituary, the Distinguished Naturalist Award nomination by Candace Oviatt, and personal reminiscences.

Atlantic marsh fiddler crabs *(Uca pugnax)* by Helen Granger for Camp Fuller BioBlitz t-shirt 2018.

SINDY HEMPSTEAD
(1925–2020)

Dipping our paddles into the crystal-clear waters of Schoolhouse Pond, we quietly maneuvered our canoe to the edge of a distant bed of waterlilies. On this warm summer day in the early 1990s, Sindy Hempstead and I glided among the masses of plate-size pads. Settling on our first sampling location, we tossed a floating PVC plot into their midst. One after another, we deployed plots, explored more beds, and recorded data. Sindy was a newbie graduate student of mine in the Department of Botany at URI and just beginning her journey into uncovering the botanical secrets of the fragrant waterlily, *Nymphaea odorata*.

The canoe was a luxury on this day given that almost all of Sindy's future on-water studies were tackled in her robin-egg blue solo kayak. She hefted and paddled that boat everywhere waterlilies beckoned; no small task for anyone. Did I mention that Sindy was 66 years old? Mabel (Sinden) Hempstead passed away peacefully, 4 December 2020. She was 95.

Sindy may have been a proverbial rookie when she began her Master of Science Program at URI, but she was anything but a rookie in science and life. Even at the age of 4, Sindy had a fascination with aquatic plants—as evidenced by a 1929 photograph depicting her admiring a waterlily look-alike plant (*Nelumbo*) while sitting, where else, but in a boat on a lake. After growing up in Aurora, Illinois, 60 miles west of Chicago and Lake Michigan, Sindy headed north to the University of Wisconsin for a Bachelor of Arts degree focusing on chemistry and education. Her first Master of Science degree followed at the University of Minnesota (UM) after majoring in zoology and biochemistry.

A long and varied working career included teaching math and science in Wisconsin before her UM degree, working at the Woods Hole Oceanographic Institute, raising four children after moving to Rhode Island, teaching math and science in Rhode Island (Davisville Middle School, Rocky Hill School), and later, rising to the challenge of more fully testing her chemistry skills by taking positions in industry at two companies, one of which was the National Chemical Company.

Sindy's idea of exiting from the working world did not include retiring to a life of leisure. To Sindy, retirement was merely her golden opportunity to ramp up, not shut down. The Rhode Island Wild Plant Society (RIWPS), URI Watershed Watch, and her Master of Science graduate program occupied most hours of her newfound "leisure" time. You may not normally associate the phrase "ball of energy" with a 60+ year-old, or a 70+ year-old, or certainly not an 80+ year-old, but Sindy was just that in all of her decades.

Photo: Joyce Hempstead.

At RIWPS, Sindy wrote articles on a variety of native plants for their publications, led botanical explorations, and served in leadership roles. For Watershed Watch, she collected water samples for subsequent chemical analyses that would serve as ongoing measures of water quality. The ponds she sampled over the years included, perhaps her favorite, Bull Head Pond in South Kingstown. Favorite because it was within eyesight of a completely green, off-the-grid house she had built for herself—a definite nod to her strong feelings about leaving a small footprint on our planet.

In her graduate program at URI, Sindy immersed herself in the demanding field studies, data synthesis, and thesis writing that were the essence of her waterlily research. Daunting as it was to study waterlily beds in multiple

ponds—with floating quadrats—from a kayak, Sindy was in botanical, limnological heaven doing so. The probing questions she asked were insightful, and their numbers grew exponentially as her research unfolded. These new questions posed methodological problems, but Sindy reveled in the challenges of finding low-tech, high-reward solutions to these problems. More than a few of those solutions happened "with the help of a few trips to the hardware store," as she put it. Kid's swimming pools, from Benny's of course, held waterlily experiments that sat on an elevated ledge on the south side of Ranger Hall for several summers.

Sindy finished her MS degree with a flourish. An absolutely superb thesis and defense in 1994 were followed by a paper based on her thesis and published in the international journal, *Aquatic Botany*: "Influences of water depth and substrate nitrogen on leaf surface area and maximum bed extension in *Nymphaea odorata*."

As was the case with "retirement," completing her third university degree was not an endpoint, only another notch of achievement in her kayak paddle. Speaking of kayaks, in 2014, at age 89 and after already sampling every week for 20 summers in a row for Watershed Watch, Sindy noted that "every year they call me and wonder if I am going to do it again, and I never have a good excuse not to." Elizabeth Herron, Program Director of Watershed Watch, told me that it was only with great reluctance that Sindy finally gave up her water-sampling forays.

In June of this crazy 2020, a note was inadvertently circulated, and quickly retracted, announcing Sindy's death. I reminded her via email that Mark Twain had long ago remarked upon hearing of his demise that the reports of his death had been greatly exaggerated. Her response to me that same afternoon was "I just noticed that I died – when I looked at my email after lunch I was still here. Good thing I checked." Pure Sindy, sharp as ever.

In all her endeavors, Sindy's approach was one of quiet joy—always game for a lively discussion about any topic that piqued her interest. She was a gentle presence, a consummate naturalist, a committed advocate for the environment, and most of all, an inspiration to all of us. There are countless significant notches in her kayak paddle, but it is the kayak paddler herself who made a difference with her life; a life full of endless curiosity.

Memories of Sindy from long time mentor, colleague, and friend Keith Killingbeck.

This 231-cm (7 ft, 7 in) adult male common dolphin (*Delphinus delphis*) was found dead on 17 January 2021 on the shore of Cormorant Cove in the southwestern corner of Great Salt Pond on Block Island, Rhode Island. It was an older individual based on the relatively large size and the worn condition of its teeth, but there were no other obvious injuries. No necropsy was performed to investigate cause of death. Common dolphins are the most abundant marine mammal in our waters, and strandings happen regularly. Four dead dolphins (3 common, 1 bottlenose) washed up on our beaches this winter, which is about the expected number (33 common dolphin strandings occurred over the 5-year period between 2011 and 2015). The total population of common dolphins off eastern North America numbers well over 150,000 therefore natural mortality (disease, parasites, predators, "old age") can be expected to result in hundreds or thousands of dead dolphins every year. Photo: Kim Gaffett, The Nature Conservancy – Rhode Island.

There are as many ways to build our knowledge of Rhode Island's animals, plants, and natural systems as there are people willing to help.

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Our Mission

The Rhode Island Natural History Survey is an independent, member-supported non-profit, founded in 1994, that connects people knowledgeable about Rhode Island's animals, plants, and natural systems with each other and with those who can use that knowledge for research, education, and conservation.

For environmental conservation there are fewer resources than ever…but with zoonotic diseases, climate change, invasive species, and habitat loss all accelerating, the natural world isn't getting any less complicated. We need good science and we need everybody to work together to make the most of our combined knowledge and experience.

The Natural History Survey manages data documenting the state's species and natural communities, publishes books and articles, facilitates science projects that have diverse partners or complex funding, and hosts events bringing people together, including conferences and the annual Rhode Island BioBlitz. The Survey is not a state agency or university department: it is embodied in members and friends who make generous gifts of time, money, and expertise to do this important work.

Call for Nominations

Dick Ferren and Rey Larsen, the two most recent winners of our Distinguished Naturalist Award, are profiled on pages 22 & 23 of this issue; Mary Jo Murray, who was presented with a posthumous 2020 Award, was profiled in the previous issue; and Prentice Stout (pp. 27–28) received the Award in 2000. The Rhode Island Distinguished Naturalist Award is presented by the Rhode Island Natural History Survey to an individual who has made outstanding contributions to advancing our knowledge of Rhode Island's organisms, geology, and ecosystems. In particular, we want to identify those who have excelled in one or more of the following areas:

- Made significant contributions in the advancement of scientific knowledge of Rhode Island's organisms, geology, and ecosystems as evidenced by published books, scientific papers, and monographs
- Recognized as an outstanding teacher and educator to students and the public on the form, functions, and ecological significance of Rhode Island's biota and natural systems
- Made significant contributions in enhancing public awareness of the importance of understanding the natural history of Rhode Island's ecosystems

Distinguished Naturalists are selected by the RINHS Board of Directors. To nominate someone, send a letter or email to the Survey office marked "Attention: DNA" or contact a member of the Board of Directors. In your correspondence please describe the ways in which your nominee excelled in one or more of the three criteria described above. Please include as much specific detail as possible, as we may not be personally familiar with your nominee's work. Past, unsuccessful nominations are kept and reconsidered every year, so if you've nominated someone in the past who did not win, you are not required to re-nominate them. You may wish to provide additional information on your nominee if you feel it would strengthen the nomination.

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