



reTURN the Favor: Horseshoe crab rescue program 2021 report

The reTURN the Favor (RTF) program was initiated in 2013 to rescue American horseshoe crabs (*Limulus polyphemus*) stranded on Delaware Bay beaches in New Jersey, where large concentrations of crabs spawn every spring. The program is a collaboration of conservation organizations in partnership with New Jersey Division of Fish and Wildlife and a network of trained volunteers who rescue stranded crabs at risk of dying from exposure and predation (Botton and Loveland 1989). During walks scheduled around tides, spawning activity, and time of day restrictions, volunteers rescue and collect data on stranded crabs. Collectively, volunteers save crabs by the thousands, identify stranding hazards on the beaches, and make observations that inform conservation, restoration, and research. Program participants follow protocols to comply with New Jersey regulations to protect horseshoe crabs and other wildlife.

During spring and summer months, horseshoe crabs convene on sandy beaches to spawn. On the low-energy beaches of the Delaware Bay, spawning crabs are most numerous around the high tides of full and new moons in May and June. Female crabs can lay over 80,000 eggs over the course of a spawning season (Fredericks 2012). Sheltered in the sand, it takes about a month for eggs to develop into larvae that enter the Bay for an extended maturation period of nine or more years. However only a few eggs will survive that first month. Eggs are brought to the surface of the beach by waves and spawning activity of other crabs, forestalling further development. These eggs on the surface are readily accessible to foraging shorebirds hungrily scouring the beaches for food during stopovers on their thousands miles long migration routes, timed perfectly with the peak of spawning season. Other coastal animals, including fish, turtles, and gulls, also take advantage of the abundance of crabs and crab eggs as food.

Pressures from various sources have positioned horseshoe crabs as “Vulnerable” by the [IUCN](#) (Smith et al. 2016) and harvest of the species is managed by the [Atlantic States Marine Fisheries Commission](#). The harvest of horseshoe crabs for eel and whelk bait was one of the primary drivers of the population decline in the Delaware Bay. Crabs are also harvested by the biomedical industry for their blood, which is collected from live crabs before release back to the water, but this is not without impacts to survival and behavior (Anderson et al. 2013). With emerging concerns about the Delaware Bay population of horseshoe crabs and drastic declines in the shorebirds that visit the Bay, a moratorium was imposed in New Jersey in 2008 to prohibit further harvest of horseshoe crabs for bait (Niles et al. 2009). In 2003, beaches where spawning and foraging shorebird activity was most numerous were closed to visitation from May 7- June 7 each year since. Though the Delaware Bay population is now considered stable, factors such as stranding and biomedical harvest that contribute to additional mortality lengthen the recovery period.

Best conditions for spawning crabs include beaches that are sandy, gently sloped, and free of obstacles. Eroding beaches, coastal development, and shoreline hardening infrastructure has diminished the quality of spawning habitat and increased stranding risks. As a result, more crabs become stranded on beaches, stuck in debris and structures on the shoreline, or washed into marshes and overwash areas. This is where the reTURN the Favor program steps in — to reduce the loss of mature crabs — by connecting organizations; engaging new volunteers, community members, and children in conservation; and improving spawning habitat through debris removal, beach restoration, and revitalization of derelict structures on the Bay.



2021 reTURN the Favor Highlights

- **192** volunteers attended virtual and in-person trainings and **158** received materials by mail to lead walks. After a pause in 2020, new volunteers were again invited to participate - **65** new volunteers joined our trainings, **49** received materials, **25** became walk leaders, and **16** new volunteers along with **53** experienced volunteers met our goal of leading three or more walks!
- **107** volunteers led and submitted data for **867** walks this season, for a total of **2,605** volunteer hours. The season ran May 1 – July 15, and at least **2** walks were conducted every day.
- **8** organizations and **3** individuals sponsored beaches and assisted the RTF program in Cape May and Cumberland Counties.
- **152,962** horseshoe crabs were rescued on **19** beaches, our second highest annual total to date! These included **111,212** overturned crabs, **24,901** crabs stuck in man-made impingements, and **16,849** crabs stranded by natural impingements and in overwash areas.
- From 2013-2021, **840,667** crabs have been rescued by RTF volunteers in **4,860** RTF walks.

Citizens United for the Maurice River and its Tributaries • Conserve Wildlife Foundation of New Jersey
 • Friends of Cape May National Wildlife Refuge • New Jersey Audubon Society
 • New Jersey Division of Fish and Wildlife Service • The Nature Conservancy
 • The Wetlands Institute • WHSRN Executive Office - Manomet

Table 1. Results from the 2021 reTURN the Favor season by beach, ordered north to south on Delaware Bay, NJ.

Location	Walks	Crabs Rescued				Total	Avg per walk
		Overturned	Man-made Impingement	Natural - Impingement	Natural - Overwashed		
Sea Breeze	32	1,629	1,908	353	48	3,938	123.1
Money Island	54	4,531	2,779	443	1,455	9,208	170.5
Gandys Beach	39	1,530	1,592	-	16	3,138	80.5
Dyers Cove	68	3,966	2,310	350	393	7,019	103.2
Fortescue/Raybins	102	10,374	9,332	53	1,082	20,841	204.3
East Point	77	4,780	4,398	2,341	1,274	12,793	166.1
Thompsons Beach	59	18,020	1,345	110	999	20,474	347.0
Moore's Beach	37	13,525	96	1,091	3,863	18,575	502.0
Goshen Beach	1	183	-	-	-	183	183.0
Reeds Beach	90	31,955	475	334	592	33,356	370.6
Cooks Beach	26	505	6	273	163	947	36.4
Kimble's Beach	110	4,426	92	847	99	5,464	49.7
Pierces Point	25	742	12	60	49	863	34.5
Highs Beach	23	651	17	-	13	681	29.6
Sunray/Norburys	10	356	95	-	-	451	45.1
Villas Beach	75	10,711	322	60	116	11,209	149.5
North Cape May	23	2,796	141	-	287	3,224	140.2
Higbee Beach	15	530	36	18	12	596	39.7
Cape May	1	2	-	-	-	2	2
Total	867	111,212	24,956	6,333	10,461	152,962	176.4

2021 reTURN the Favor Season in Detail

In 2021, reTURN the Favor was able to continue our mission to rescue horseshoe crabs while integrating protocols for volunteer safety. Eight group trainings included in-person and virtual workshops in April and May for new and returning volunteers. Experienced volunteers kicked off the season on May 1, and new volunteers were able to join activities on May 15 in time to help as spawning activity peaked late May. Walks ceased on July 15, as spawning activity slowed considerably. Together, volunteers conducted at least two walks per day over the course of the 75 day season, for a total of 867 walks covering approximately 28 km of coastline on the Delaware Bay in Cape May and Cumberland counties in New Jersey.

Beaches were sponsored by eight partner organizations and three volunteer beach captains: *Citizens United for the Maurice River and its Tributaries* (East Point), *Conserve Wildlife Foundation of New Jersey* (Pierces Point, Goshen), *Friends of Cape May National Wildlife Refuge* (Kimbles), *New Jersey Audubon Society* (Cooks, Highs), *The Nature Conservancy* (Sunray/Norburys, Higbee), *The Wetlands Institute* (Reeds, Villas, North Cape May), *Western Hemisphere Shorebird Reserve Network (WHSRN)* Executive Office – Manomet (Dyer Cove, Sea Breeze, Thompsons), along with Meghan Wren, Sandra Anderson, and Melissa Bonham (Money Island, Moores, Fortescue/Raybins, Gandys).

The web-based volunteer management service, Sign-Up Genius, was used to schedule volunteer walks in advance to align effort with the greatest time of need (falling to low tides) over the array of sponsored beaches to reduce redundant effort, and to comply with beach access and permit restrictions. From May 7 until June 7, walks on many beaches were only permitted after sunset or before sunrise due to NJ beach closures during shorebird migration. RTF materials, including permits, permission letters, stickers, t-shirts, and vests to be easily identified as RTF volunteers, were mailed or made available for pickup. Updated protocols, datasheets, and beach-specific fact sheets were provided to volunteers on request and through the online RTF resource toolkit. In the field, volunteers collected data on RTF datasheets and submitted data online through returnthefavornj.org. Volunteers were permitted to use labeled totes to maximize rescue efforts and safety on certain beaches where crabs are known to strand in large numbers.

Of the 192 volunteers who attended trainings this year, 107 volunteers led walks and submitted data, an increase from recent years and 69 individuals conducted 3 or more walks. On average, walks lasted 1 hr and 18 min \pm 56 min with 2.3 ± 2.0 participants. Altogether, volunteers spent over 2,605 hours rescuing crabs this year and rescued an average of 176.4 \pm 323.3 crabs per walk (Figure 1).

A total of 152,962 crabs were rescued, down 16% from a recording breaking year in 2020 but our second highest total ever for the program.

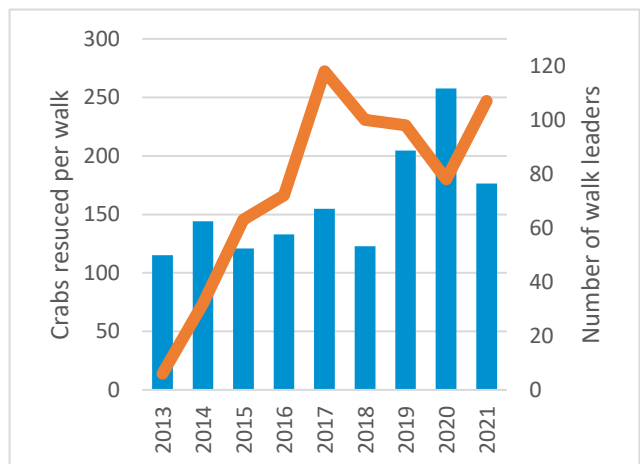


Figure 1. Total number of crabs rescued per walk (blue bars) and number of walk leaders (orange line) for each year of the reTURN the Favor program.

The peak number of crabs rescued was on May 28, with 12,358 crabs rescued during 23 walks across RTF beaches (Figure 2). Peaks in the number of crabs rescued followed the full and new moon phases, in late May and early June, and volunteers were encouraged to schedule walks during these times. During walks, we categorized rescued crabs into two general categories: **overturned** (upside down on the beach) and **impinged** (stuck in or obstructed by manmade or natural material or features), each further grouped into descriptive categories.

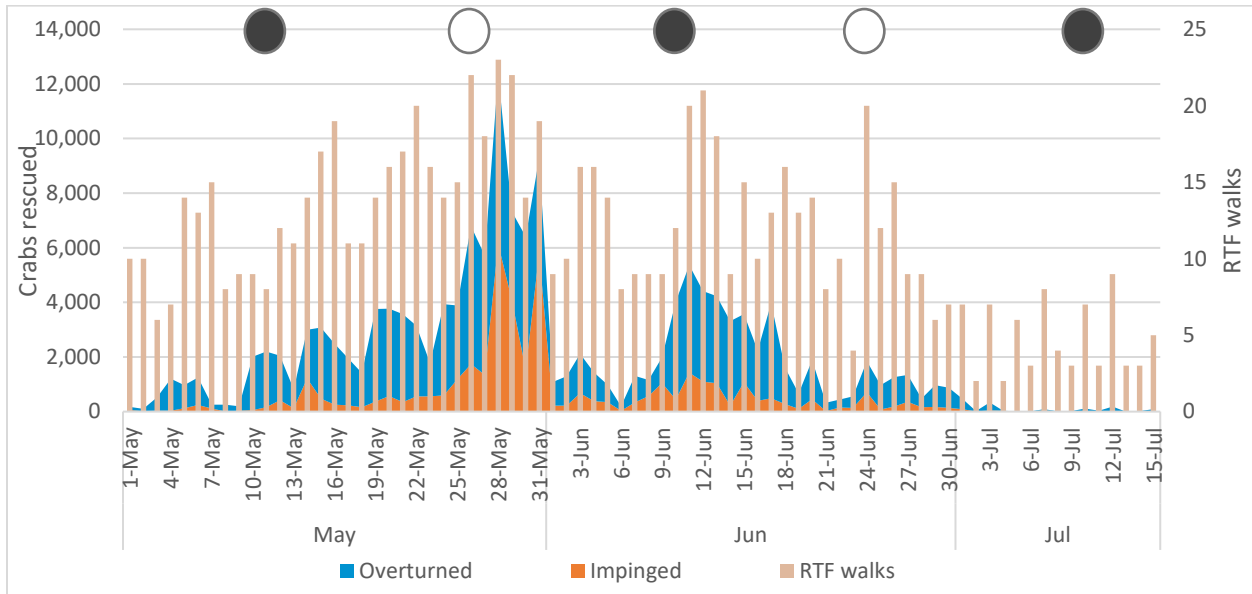


Figure 2. Total number of crabs rescued (stacked areas: overturned + impinged crabs) and RTF walks (bars) conducted by date, 2021. Moon phase is indicated above the graph by open circles (full moon) and filled circles (new moon).

Overturned Crabs

The majority of all crabs rescued were found upside down on the beaches (72.7%, 111,212 crabs), slightly more than average in the prior eight years of the program (range: 53.9 – 81.7%; mean: 68.7 ± 9.1%). Volunteers turned these crabs right side up so they could return to the water to spawn again, and reduce risk of adult mortality from exposure and gull predation.

In 2021, there were 17 walks with >1,000 overturned crabs rescued, a feat that could take up to 4 hours and multiple volunteers to accomplish. Eight of these most demanding walks were at Reeds Beach, which had the highest number of overturned crabs overall (Table 1). Thompsons, Moores, and Fortescue/Raybins beaches, in Cumberland County, and Villas Beach in Cape May County, also had high totals of overturned crabs and walks with >1,000 overturned crabs rescued. Accounting for walk effort on beaches with regular walks (≥5), the beaches with the most overturned crabs rescued were Moores (365.5 crabs/walk), Reeds (355.0 crabs/walk), and Thompsons (305.4 crabs/walk) beaches.

Impinged Crabs

Degraded conditions and marine debris at beaches exposed crabs to additional risks during spawning. Crabs became stuck in structures, debris, or shoreline features and were often unable to return to the water without assistance from volunteers. These stranded crabs were classified into three categories

based on where they are found: man-made impingements (e.g. homes and infrastructure, seawalls, derelict houses, bulkheads, and boat ramps, accumulated rubble and marine debris), natural impingements (i.e. exposed peat and vegetation above or below the high tide line), and areas where high water or storms stranded crabs beyond their typical intertidal range (i.e. overwash areas). The program has previously documented many of these problems and problem areas, but the condition and degree of stranding risk can change over time with restoration projects, beach cleanups, and natural processes. Data documenting persistent problem areas, such as derelict structures, rubble debris, and overwash areas, or emerging issues can be used to prioritize and inform restoration needs on the Delaware Bay beaches.

Man-made Impingements

Volunteers rescued 24,956 crabs from man-made impingements (16.3% of all crabs rescued), a 7% drop from 2020. In total, just 1,196 crabs were rescued from across all nine beaches in Cape May County with man-made hazards, compared to 23,760 crabs from eight beaches in Cumberland County. Beaches in Cumberland County tend to have more extensive hazards like rip-rap seawalls or large rubble fields that trap crabs, resulting in higher totals of rescued crabs from these beaches. In Cape May County, hazards tend to be more localized, though these persistent problem areas may trap sizable numbers of crabs over time.

Fortescue/Raybins beach had the most crabs freed from man-made impingements per walk, at 91.5 crabs/walk, where the jetty/groin and boat ramps posed significant hazards. Crabs trapped in rubble on the front beach increased this season, especially in an area where erosion exposed an old boat launch and rail system.

Seabreeze (59.6 crabs/walk), East Point (57.1 crabs/walk), and Money Island (51.5 crabs/walk) beaches each had consistent issues with rubble and binblocks/riprap (Figures 3-5, Table 1). Though the seawall at Seabreeze was demolished in early 2021, rubble that remains from the wall continues to be a problem for crabs. No rubble impingements were reported this year for section 1 at Sea Breeze, where an RTF project funded by US Fish and Wildlife Service’s Partners for Fish and Wildlife Program cleared significant rubble in late 2019. At East Point, recent measures to slow erosion, including riprap, geotubes and landscape cloth, entrapped crabs regularly this season. In general, bin blocks/riprap and house structures accounted for a lower portion of impingements this year than in 2020. This was the third year in a row with high numbers of trapped crabs at Money Island following the demolition of several homes along the shoreline through New Jersey’s Blue Acres Buyout program up that created debris on the beach. Volunteers spent time removing crabs from significant areas of rubble, including open septic tanks (Figure 3).

Overall, rubble from broken down homes, bulkheads, and roads constituted the greatest number of impinged crabs, 10,538 crabs (25% of all man-made impingements) on 12 beaches, and one of the most widespread categories of man-made impingements.



Figure 3. Crabs trapped in geotubes at East Point Lighthouse (top; Sue Harasink) and rubble from house demolition on Money Island (bottom; Tom and Elizabeth Frydel) beaches.

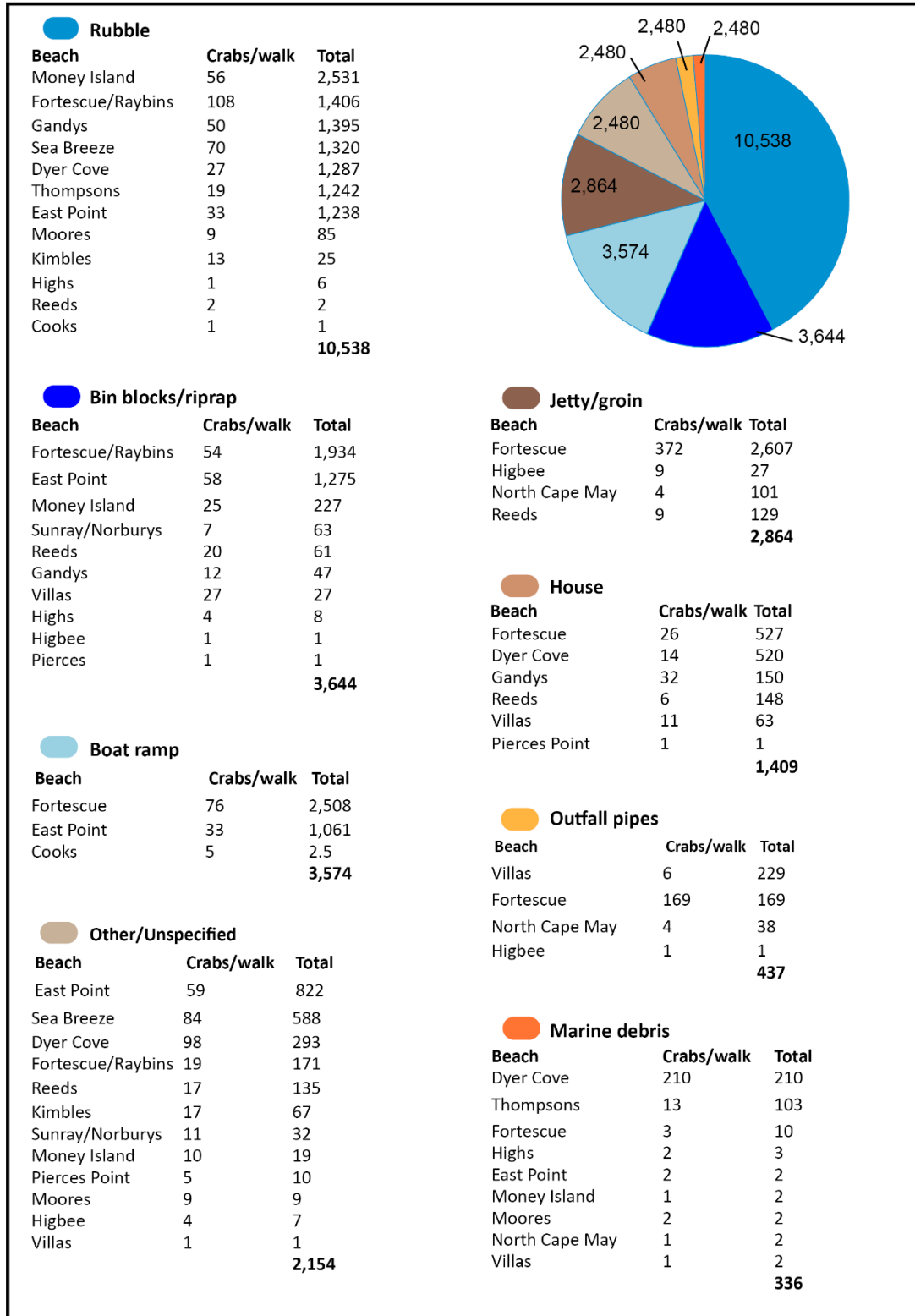


Figure 4. Number of crabs rescued from man-made impingements in 2021 by hazard type and beach.

Natural Impingements

Crabs become impinged in natural hazards due to degraded and eroded beach conditions and/or high tides that transport crabs to dunes or marshes adjoining the spawning beaches. Stranded crabs rescued from natural impingements and overwash areas totaled 16,794 crabs in 2021 (11.0% of all crabs rescued). Beaches with the most crabs rescued from natural impingements and overwash areas per effort included Moores (133.9 crabs/walk), East Point (46.9 crabs/walk), and Money Island (35.1 crabs/walk) beaches; Table 1, Figure 5). Moores Beach was characterized by several overwash areas and degraded dunes that can strand large numbers of crabs. These features were the primary driver for high natural impingements at Moores Beach again this season.

Pierces Point, where berms were constructed to block overwash areas in early 2021, saw a reduction in rescued crabs from natural impingements, primarily vegetation above the high tide line. In 2020, 1,158 crabs were rescued from natural impingements on Pierces Point during 31 walks, compared to 109 crabs during 25 walks in 2021. Berms were also constructed at an overwash area on south Reeds Beach.

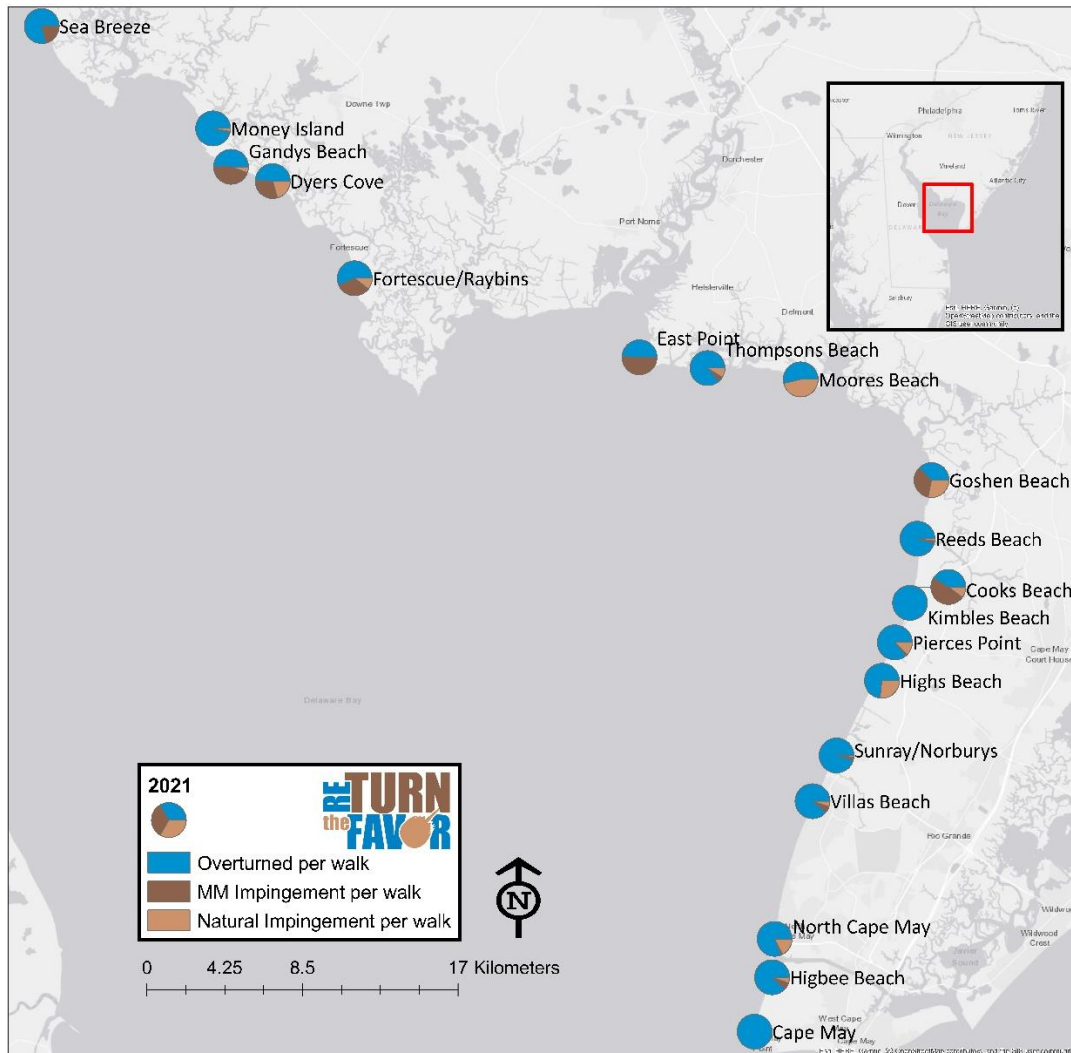


Figure 5. Each symbol indicates for each beach the proportion of rescued horseshoe crabs that were overturned or stranded in man-made (MM) or natural impingements per walk by RTF volunteers in 2021.



Other results

Of all crabs rescued, 109,564 or 71.6% were male, and 43,398 or 28.4% were female, a 2.52 M:F sex ratio, which is a fairly consistent ratio among years (2013-2021 average 2.61 ± 0.34).

Tagged crabs were reported during walks; 191 observations of 169 horseshoe crab tags from 15 beaches were made. Data were reported to US Fish and Wildlife Service to contribute to studies of population trends and movements. Data were not available for tags released in 2021 at the time of this report, but tags released in years prior originated from New Jersey (69%), Maryland (17%), Delaware (14%), and New York (1%). The oldest tag was released on a crab in 2012 and recaptured on Money Island.

Volunteers incidentally recorded observations of other stranded species and notable wildlife observed at the beaches they walked. Notably, hundreds of dead diamondback terrapins (*Malaclemys terrapin*), sometimes numbering up to 19 carcasses a walk, were found on 18 of the monitored beaches. The bloated or partially decayed condition of some terrapins indicated likely drowning in crab traps. A trap was found on Reeds Beach containing at least 26 dead terrapins. Other notable observations made by volunteers included observations of a dead sea turtle on Fortescue/Raybins beach.

Conclusions

In its ninth year, RTF saw extraordinary volunteer enthusiasm and turn out, helped by the addition of many new volunteers joining those who have been with the program for many years now. High volunteer numbers matched high spawning activity on the Delaware Bay beaches in New Jersey this season. The program not only rescued over 150,000 crabs, but also identified emerging and persistent hazards for crabs (and other wildlife and people) on the beaches and contributed to monitoring restoration projects on the Bayshore.

Acknowledgements

The successes of the reTURN the Favor program are due to the dedication of so many volunteers and program partners who contribute time, miles, late nights, and sunny days to horseshoe crabs and the Delaware Bay. We are grateful to every person who joins to help, who spreads the word about horseshoe crab conservation, and supports this program. Special thanks to Brittany Morey for with program support and Carolyn Richards for assisting with schedule development. We extend thanks to NJ Division of Fish and Wildlife for providing a scientific collecting permit, permission, and guidance. In 2021, partners participating in the program supported their efforts through various means through their organization, including but not limited to grants, donations, foundations, and general operating funds. Funding for programmatic, habitat improvement, and volunteer support provided by: Orsted, the Marshall Reynolds Foundation, and private donations.

Ocean Wind

An Ørsted & PSEG project

Report prepared by:

Lisa Ferguson, The Wetlands Institute

Laura Chamberlin, Western Hemisphere Shorebird Reserve Network Executive Office

November 2021

Ferguson, L. and L. Chamberlin. 2021. reTURN the Favor: Horseshoe crab rescue program 2021 report.



References

Anderson, R.L., W.H. Watson III, and C. Chabot. 2013. Sublethal Behavioral and Physiological Effects of the Biomedical Bleeding Process on the American Horseshoe Crab, *Limulus polyphemus*. *Biol. Bull.* 225: 137-151.

Botton, M.L. and R.E. Loveland. 1989. Reproductive risk: high mortality associated with spawning by horseshoe crabs (*Limulus polyphemus*) in Delaware Bay, USA. *Marine Biology* 101: 143-151.

Fredericks, A. D. 2012. *Horseshoe Crab: Biography of a Survivor*. Washington, DC: Ruka Press.

Penn, D. and J. Brockmann. 1995. Age-biased stranding and righting in male horseshoe crabs, *Limulus polyphemus*. *Animal Behavior* 49: 1531-1539.

Niles, L.J., J. Bart, H.P. Sitters, A.D. Dey, K.E. Clark, P.W. Atkinson, A.J. Baker, K.A. Bennett, K.S. Kalasz, N.A. Clark, J. Clark, S. Gillings, A.S. Gates, P.M. Gonzalez, D.E. Hernandez, C.D.T. Minton, R.I.G. Morrison, R.R. Porter, R.K. Ross, and C.R. Veitch. 2009. Effects of Horseshoe Crab Harvest in Delaware Bay on Red Knots: Are Harvest Restrictions Working? *BioScience* 59 (2): 153-164.

Smith, D.R., Beekey, M.A., Brockmann, H.J., King, T.L., Millard, M.J. & Zaldívar-Rae, J.A. 2016. *Limulus polyphemus*. The IUCN Red List of Threatened Species 2016: e.T11987A80159830.

<http://dx.doi.org/10.2305/IUCN.UK.2016-1.RLTS.T11987A80159830.en>. Downloaded on 29 October 2018.

Previous reTURN the Favor reports can be found at returnthefavornj.org

Danihel, M.S., L.M. O'Donnell, and T.R. Catania. 2014. reTURN the Favor Horseshoe Crab Rescue Project Pilot Year Summary Report.

Ferguson, L., L. Chamberlin, K. Sellers, and M. Danihel. 2014. reTURN the Favor Horseshoe Crab Rescue Project 2014 Season Summary Report.

Ferguson, L., L. Chamberlin, and A. Anholt. 2015. reTURN the Favor Horseshoe Crab Rescue Project 2015 Season Summary Report.

Ferguson, L., L. Chamberlin, and A. Anholt. 2016. reTURN the Favor New Jersey's Horseshoe Crab Rescue Program: 2016 Summary Report.

Ferguson, L., L. Chamberlin, and A. Anholt. 2017. reTURN the Favor New Jersey's Horseshoe Crab Rescue Program: 2017 Summary Report.

Ferguson, L. and L. Chamberlin. 2018. reTURN the Favor: Horseshoe crab rescue program 2018 report.

Ferguson, L. and L. Chamberlin. 2019. reTURN the Favor: Horseshoe crab rescue program 2019 report.

Ferguson, L. and L. Chamberlin. 2020. reTURN the Favor: Horseshoe crab rescue program 2020 report.