



reTURN the Favor: Horseshoe crab rescue program 2023 report

The reTURN the Favor 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. reTURN the Favor (RTF) is a collaboration of conservation organizations in partnership with New Jersey 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). Walks are scheduled around tides, spawning activity, and time of day restrictions to efficiently 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 during high tides. On the low-energy beaches of the Delaware Bay, spawning crabs are most numerous around the 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 two to four weeks for eggs to develop into larvae that enter the Bay for an extended maturation period of nine or more years. However, very few eggs will survive the incubation period. Eggs are brought to the surface of the sand by waves and spawning activity of other crabs, forestalling further development. These eggs on the surface are readily accessible to foraging shorebirds who are hungrily scouring the beaches for food during stopovers on their long migration routes, which can exceed 9,000 miles. The stopover in the Delaware Bay is 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, and there continues to be concerns over pressures from the harvest of Delaware Bay horseshoe crabs. Crabs are also harvested by the biomedical industry for their blood, which is collected from live crabs before release back to the water, but these actions are not without impacts to survival and behavior (Anderson et al. 2013). A moratorium was imposed in New Jersey in 2008 to prohibit further harvest of horseshoe crabs for bait due to concern for recovery of the Delaware Bay population of horseshoe crabs and shorebird populations that visit the Bay (Niles et al. 2009). However, other local states continue to harvest from the Delaware Bay and harvest limits are subject to change. Though the Delaware Bay population of horseshoe crabs may be showing signs of recovery, these pressures will continue to lengthen the recovery period.

Best conditions for spawning horseshoe crabs include beaches that are sandy, gently sloped, and free of obstacles. Eroding beaches, coastal development, and shoreline hardening infrastructure have 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. Providing further complications, closures of important spawning and shorebird foraging beaches from May 7- June 7 began in 2003 to reduce disturbance to foraging migratory shorebirds. These closures have proven beneficial for shorebirds, but limit the ability for people to



access beaches to rescue crabs. This is where the reTURN the Favor program steps in to reduce the loss of mature stranded crabs by connecting organizations; engaging new volunteers, community members, and children in conservation; creating an organized structure for rescue; and improving spawning habitat through debris removal, beach restoration, and revitalization of derelict structures on the Bay.

2023 reTURN the Favor Highlights

- **176** volunteers attended virtual and in-person trainings and **164** received materials by mail to lead walks. **56** new volunteers joined trainings, **48** received materials, and **16** became walk leaders. **69** volunteers, including **12** new volunteers, met our goal of leading 3 or more walks!
- **106** volunteers led and submitted data for **606** walks this season, for a total of **2,521** volunteer hours. The season ran May 1 – July 15, with **1 – 22** walks conducted every day.
- **7** organizations and **2** individuals sponsored beaches and assisted the RTF program in Cape May and Cumberland Counties.
- **119,795** horseshoe crabs were rescued on **19** beaches, which included **70,494** overturned crabs, **20,704** crabs stuck in man-made impingements, and **28,597** crabs stranded by natural impingements and in overwash areas.
- From 2013-2023, **1,058,822** crabs have been rescued by RTF volunteers in **6,150** 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 Fish and Wildlife • The Nature Conservancy • The Wetlands Institute • WHSRN Executive Office - Manomet

Table 1. Results from the 2023 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	26	4,316	952	414	107	5,789	222.7
Money Island	20	3,427	354	703	1,019	5,503	275.2
Gandys Beach	19	770	441	1	1,199	2,411	126.9
Dyer Cove	42	3,892	7,975	382	1,140	13,389	318.8
Fortescue/Raybins	98	11,808	8,947	317	1,493	22,565	230.3
East Point	47	1,419	706	5,219	242	7,586	161.4
Thompsons Beach	13	1,584	104	56	11	1,755	135.0
Moores Beach	15	5,579	12	7,870	3,085	16,546	1,103.1
Goshen Beach	1	330	-	-	-	330	330
Reeds Beach	83	23,440	643	295	581	24,959	300.7
Cooks Beach	11	53	-	1	-	54	4.9
Kimbles Beach	81	2,769	10	871	129	3,779	46.7
Pierces Point	30	854	73	2,905	-	3,832	127.7
Highs Beach	29	1,237	134	-	-	1,371	47.3
Sunray/Norburys	6	97	22	-	1	120	20.0
Villas Beach	56	7,581	252	24	62	7,919	141.4
North Cape May	20	1,322	52	6	231	1,611	80.6
Higbee Beach	5	16	8	-	22	46	9.2
Middle Township	4	-	19	211	-	230	57.5
Total	606	70,494	20,704	19,275	9,322	119,795	197.7

2023 reTURN the Favor Season in Detail

To fulfill the program mission this year, we held in-person and virtual workshops in April and May to train 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 in late May. Walks ended on July 15, as spawning activity slowed. Together, volunteers conducted at least one walk per day over the course of the 75-day season, for a total of 606 walks covering approximately 28 km of coastline on the Delaware Bay in Cape May and Cumberland counties in New Jersey.

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

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](#). RTF materials, including permits, permission letters, and identification materials (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. Volunteers were permitted to use labeled totes to maximize rescue efforts and safety on certain beaches where crabs are known to be stranded in large numbers.

The program website also provided a place for visitors to learn more about the program through learning resources, past reports, a [data portal](#), and [story map](#). These components were recently added to provide interactive, user-friendly access to program results to increase volunteer engagement, understanding of target issues, and the use of data for action.

Of the 176 volunteers who attended trainings this year, 106 volunteers led walks and submitted data, and 69 individuals conducted 3 or more walks. On average, walks lasted 1 hour and 21 min ± 53 min with 2.8 ± 3.4 participants. Altogether, volunteers spent 2,521 hours rescuing crabs this year and rescued an average of 197.7 ± 392.9 crabs per walk (Figure 1).

A total of 119,795 crabs were rescued this season, with the peak number of crabs rescued was on June 6, with 10,111 crabs rescued during 9 walks across RTF beaches and the preceding days (Figure 2). This peak coincided

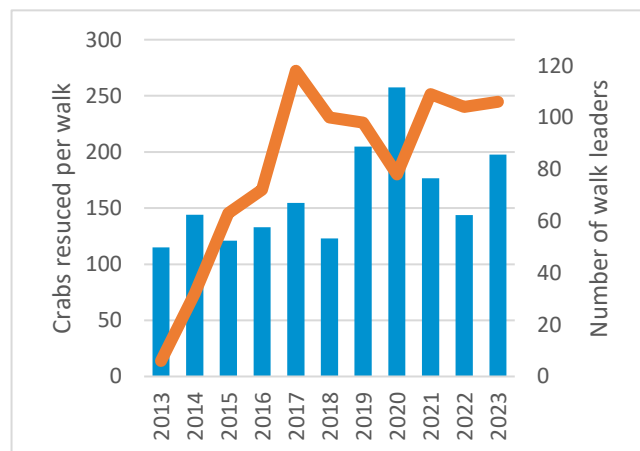


Figure 1. Total number of crabs rescued per walk (blue bars) and number of walk leaders (orange line) for each year of the reTURN the Favor program.

with full moon tides and a coastal storm that stranded thousands of crabs and eroded beaches. Peaks in the number of crabs rescued followed the full and new moon phases, in mid-May and June, and volunteers were encouraged to schedule walks during these times. There was an early pulse of spawning in April before the program began. During walks, we categorized rescued crabs into two general categories: **overturnd** (upside down on the beach) and **impinged** (stuck in or obstructed by manmade or natural material or features), which are further grouped into descriptive categories.

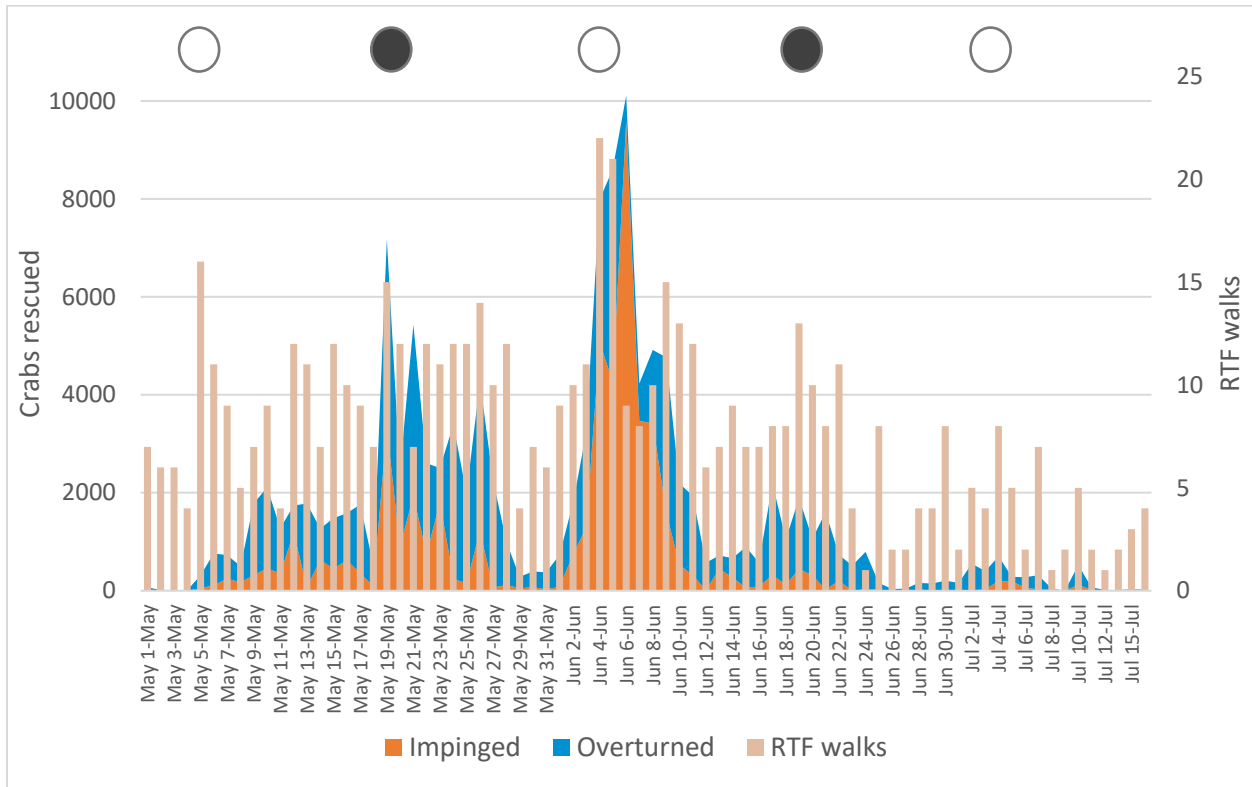


Figure 2. Total number of crabs rescued (stacked areas: overturnd + impinged crabs) and RTF walks (bars) conducted by date, 2023. Moon phase is indicated above the graph by open circles (full moon) and filled circles (new moon).

Overturnd Crabs

The majority of all crabs rescued this year were overturnd (58.8%, 70,494 crabs), however this was one of the lowest proportions of overturnd crabs recorded over the previous ten years (range: 53.9 – 81.7%; mean: 68.4 ± 8.5%). A third of all overturnd crabs were rescued on Reeds Beach in Cape May County (Table 1). This year, nine walks surpassed 1,000 overturnd crabs rescued. These walks were concentrated during the May new moon and June full moon and occurred at Moores, Villas, Reeds, and Thompsons Beaches. 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.

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, extreme storms, 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

Of all crabs rescued this year, 17.3% were freed from man-made impingements (20,704 crabs), which is lower than the ten-year program average of $22.5 \pm 8.4\%$ (range: 14.0 – 46.1%). The issue of man-made impingements is largely concentrated at Cumberland County beaches. In fact, 94.1% (19,491 crabs) of crabs rescued from man-made hazards this year were from eight beaches in Cumberland County. By contrast, 5.9% (1,213 crabs) of rescues in this category occurred across ten sites in Cape May County, showing drastic difference in beach condition and hazards for spawning crabs. Several beaches in Cumberland County have significant hazards from rip-rap seawalls and large rubble fields that trap crabs, resulting in higher totals of rescued crabs. In Cape May County, hazards tend to be more localized, though these persistent problem areas can trap sizable numbers of crabs over time.

Fortescue/Raybins and Dyer Cove beaches had the most crabs freed from man-made impingements per walk (Table 1), though Dyers had twice the number of crabs rescued per walk (189.9 crabs/walk) compared to the rate at Fortescue beach (91.3 crabs/walk) and had much higher rates than the remaining beaches (all < 37 crabs/walk). The 2023 results signal the magnitude of poor conditions at Dyer Cove beach, where over 7,000 crabs were rescued from rubble on the shore, and the need for restoration at the site. The rubble at Dyer Cove was the biggest hazard identified through the program this year, and it could be removed or covered with sand to improve conditions for spawning crabs, as the Blue Acres restoration project at Money Island has demonstrated.

The number of impinged crabs rescued at Money Island continued to decline this year (2022: 26.5 crabs/walk, 2023: 17.7 crabs/walk) from the pre-restoration impingement levels (2021: 51.5 crabs/walk) following a winter restoration project in 2021-2022 that removed rubble and added sand to the beach to cover remaining rubble (Figure 3).

Overall, rubble from broken down homes, bulkheads, and roads was responsible for trapping nearly half (47.2%, 9,769 crabs) of all man-made impingements crabs this year across 10 beaches (Figure 4).



Figure 3. Horseshoe crabs impinged in rubble at Dyers Cove (Laura Chamberlin).

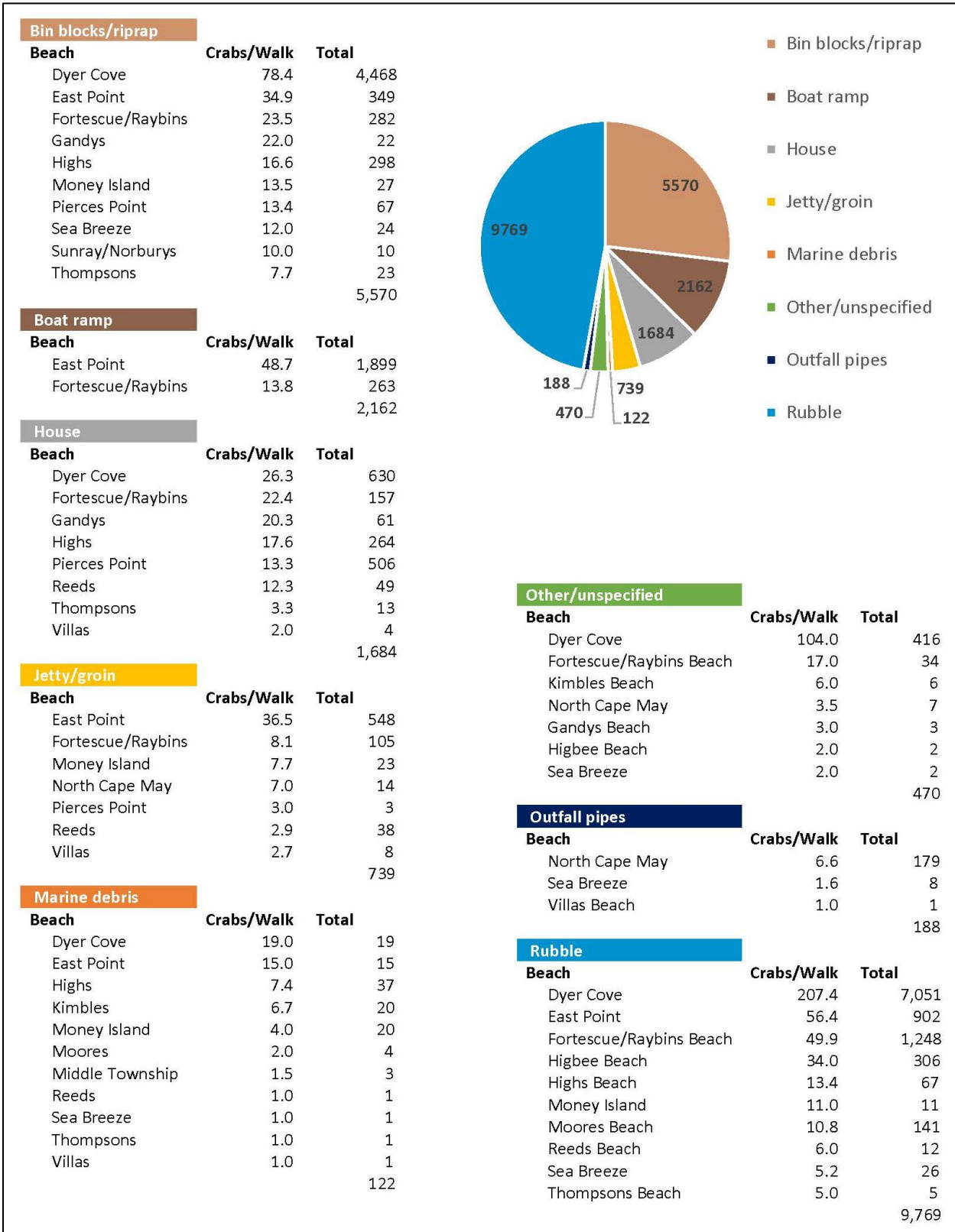


Figure 4. Number of crabs rescued from man-made impingements in 2023 by hazard type and beach.

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 accounted for 23.9% (28,597 crabs) of all crabs rescued in 2023, up from 15.3% of all crabs rescued last year and the annual average of $10.0 \pm 8.4\%$ (range: 3.9 – 25.5%) since natural impingements were categorized in 2014. Natural impingements were more prevalent on Cumberland County beaches (77.6%, 14,962 crabs) compared to Cape May County (22.4%, 4,313 crabs), supporting the trend in larger scale differences in spawning hazards for crabs.

Beaches with the most crabs rescued from natural impingements and overwash areas included Moores, East Point, and Pierces Point beaches (Table 1, Figure 5). The early June storm event this season that coincided with peak spawning activity around the full moon resulted in thousands of crabs trapped in saltmarshes and overwash lobes above the typical high tide range. Moores Beach is 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 this season. Efforts to build protective dune features, such as the berms constructed at Pierces Point in 2021-2022, have the potential to reduce overwash potential from storms initially but may require additional restoration or management to resolve the issue long term.

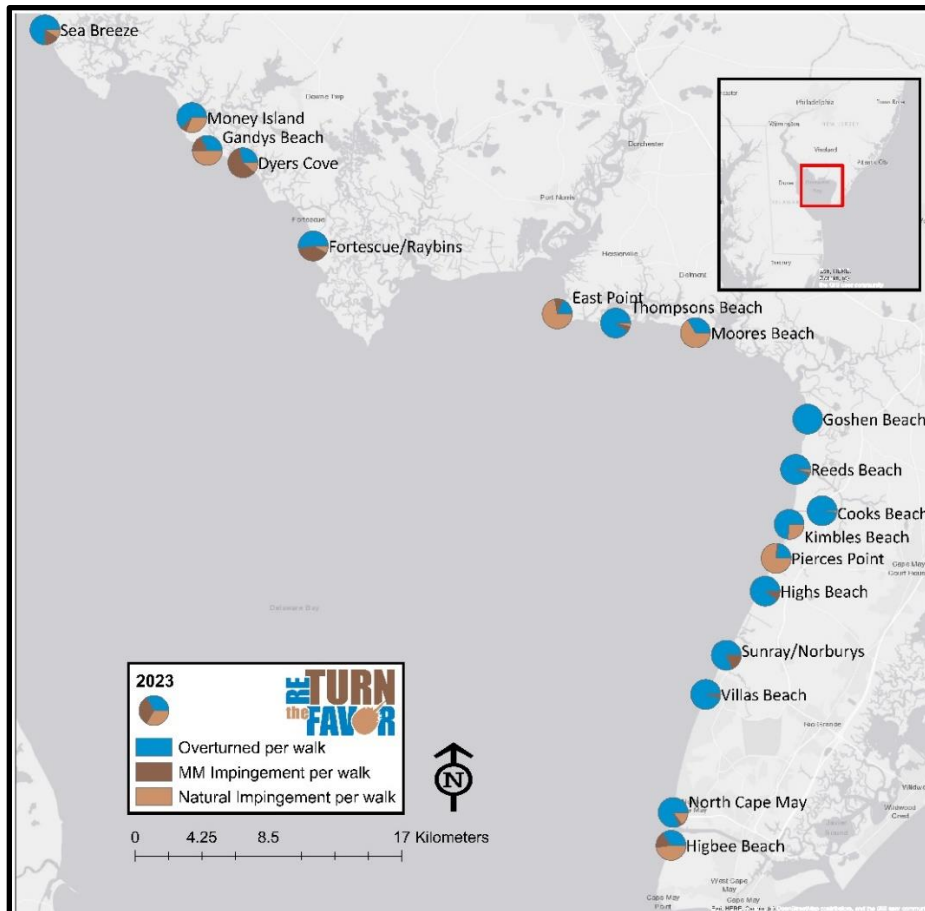


Figure 5. Each symbol indicates the proportion of rescued horseshoe crabs that were overturned or stranded in man-made (MM) or natural impingements per walk by RTF volunteers in 2023.



Other results

Of all crabs rescued in 2023, 83,558 or 69.8% were male, and 36,237 or 30.2% were female, a 2.31 M:F sex ratio, which is at the lower bound of the ratio among years (2013-2022 average 2.64 ± 0.33). By proportion to male crabs, more female crabs were overturned (M:F = 2.14) compared to rescued from impingements (M:F = 2.58). Tagged crabs from 11 beaches were reported during 72 walks for reporting to U.S. Fish and Wildlife Service to contribute to studies of population trends and movements.

Volunteers incidentally recorded observations of other stranded species and notable wildlife observed at the beaches they walked. In a departure from protocol the past three years, volunteers in 2023 were not asked to take pictures of dead diamondback terrapins (*Malaclemys terrapin*) and tallying carcasses often found dead on the beaches was optional. Despite these changes, hundreds of carcasses were reported from 15 of the monitored beaches, with as many as 30 terrapin carcasses on one walk. The bloated or partially decayed condition of the terrapins indicated likely drowning in crab traps. The results of terrapin carcass data collected by volunteers in previous years are being analyzed presently.

Conclusions

This year RTF reached a milestone of over 1,000,000 crabs rescued. The program continued to draw passionate and dedicated volunteers joining for another year or the first time who together made this achievement possible.

Acknowledgements

The successes of the reTURN the Favor program are due to the dedication of so many volunteers and program partners who contribute to horseshoe crabs and the Delaware Bay in so many ways. 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 volunteers who took on beach coordination role, behind the scenes coordination roles, and spread the word through social media engagement and organizing groups, troops, families, friends, and students. We extend thanks to NJ Fish and Wildlife for providing a scientific collecting permit and permission to the program. In 2023, partners participating in the program supported their efforts through their organization, including but not limited to grants, donations, foundations, and general operating funds. Funding for programmatic and volunteer support provided by Ocean Wind - An Orsted & PSEG Project and private donations.



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