



reTURN the Favor: Horseshoe crab rescue program 2020 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 formed by 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. In 2020, additional protocols for public and personal safety were added to comply with state orders for Covid-19 restrictions.

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, after about a month eggs have developed 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 a prime driver 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 that contribute to additional mortality will lengthen the recovery period.

Best conditions for spawning crabs include beaches that are sandy, gently sloped, and free of obstacles. Eroding beaches, housing and 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; connect organizations; engage new volunteers, community members, and children in conservation of the Bay; and improve spawning habitat through debris removal, beach restoration, and revitalization of derelict structures on the Bay.



2020 reTURN the Favor Highlights

- **118** volunteers attended virtual training workshops and received materials by mail to lead walks. This season participation was limited to experienced volunteers, who were encouraged to work solo or in small groups of <4 people in their household unit, social distance and wear masks, and not travel over 50 miles to volunteer.
- **78** returning volunteers led and submitted data for **707** walks this season, for a total of **1,670** volunteer hours. The season was shorter by 2 weeks, due to a delayed start.
- **8** organizations and **3** individuals sponsored beaches and assisted the RTF program in Cape May and Cumberland Counties.
- **182,076** horseshoe crabs were rescued on **18** beaches, including **123,335** overturned crabs, **42,087** crabs stuck in man-made impingements, and **16,654** crabs stranded by natural impingements and in overwash areas. Our highest single season totals in eight years!
- **687,705** crabs have been rescued by RTF volunteers in nearly **4,000** walks from 2013-2020.

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 • Executive Office of Western Hemisphere Shorebird Reserve Network

Table 1. Results from the 2020 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	40	2,042	2,526	468	236	5,272	131.8
Money Island	47	5,054	5,922	949	424	12,349	262.7
Gandys Beach	28	470	1,032	-	-	1,502	53.6
Dyers Cove	64	9,352	5,888	81	323	15,854	247.7
Fortescue/Raybins	114	18,066	9,718	791	1,391	29,756	261.0
East Point	110	9,534	12,929	3,130	1,306	26,899	244.5
Thompsons Beach	37	24,265	1,982	384	44	26,675	720.9
Moores Beach	44	20,486	672	845	4,350	26,353	598.9
Goshen Beach	1	499	-	-	-	499	499.0
Reeds Beach	56	21,888	139	512	128	22,667	404.8
Cooks Beach	15	502	2	3	1	508	33.9
Kimbles Beach	12	543	5	69	-	617	51.4
Pierces Point	31	1,207	136	1,152	6	2,501	80.7
Highs Beach	39	3,382	53	34	-	3,469	88.9
Sunray/Norburys	14	1,043	769	1	16	1,829	130.6
Villas Beach	27	2,902	245	-	8	3,155	116.8
North Cape May	24	1,997	3	-	-	2,000	83.3
Higbee Beach	4	103	66	-	2	171	42.7
Total	707	123,335	42,087	8,419	8,235	182,076	257.5

2020 reTURN the Favor Season in Detail

The 2020 season began unlike prior years for reTURN the Favor. Planned in-person training workshops for April were canceled, new safety protocols were implemented, opportunities for new volunteers and group participation were canceled for the season, and many hours were spent on virtual trainings and mailing materials so all who could participate would have the RTF paperwork and identification required. One thing remained the same, enthusiasm and support from RTF volunteers and partners was strong. Despite the obstacles and a two-week delayed start to the season, our group of trained volunteers set out on May 14 to rescue horseshoe crabs on 18 beaches, 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 individuals: *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), *Executive Office of Western Hemisphere Shorebird Reserve Network* (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 are only permitted after sunset or before sunrise due to [NJ beach closures](#) during shorebird migration. Following virtual trainings, volunteers were mailed permits, permission letters, stickers, t-shirts, and vests to be easily identified as RTF volunteers. Updated protocols, datasheets, and beach-specific fact sheets were provided to volunteers during trainings 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 118 returning volunteers who attended virtual trainings, 78 volunteers led walks and submitted data. A total of 707 walks were conducted from May 14 through July 15. On average, walks lasted 1 hr and 31 min \pm 58 min with 1.7 ± 1.2 participants. Altogether, over 1,670 hours were spent rescuing crabs this year. An average of 257.5 ± 373.6 crabs was rescued per walk (Figure 1). This new record was set even during a year when, compared to previous years, the number of walk leaders, total volunteers, and volunteer hours decreased. Due to Covid-19 safety guidelines, fewer volunteers spent more time to meet and exceed results with increases in total walk duration and total crabs and crabs per walk rescued increased.

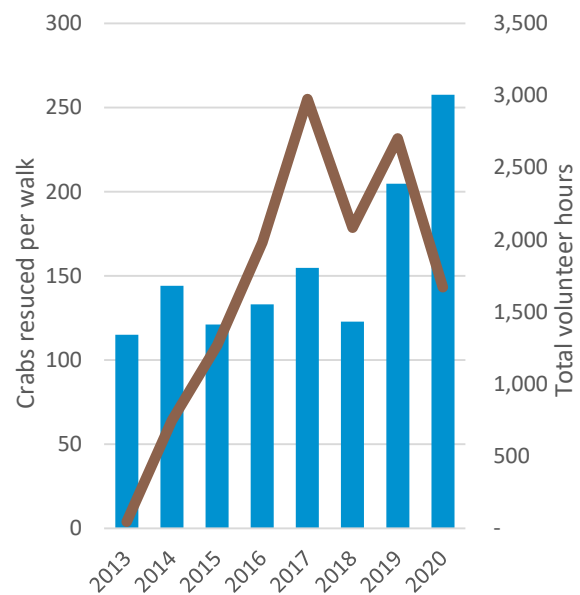


Figure 1. Total number of crabs rescued per walk (bars) and volunteer hours (line) for each year of the reTURN the Favor program.

A total of 182,076 crabs were rescued, setting another record for the program. The peak number of crabs rescued was on May 29, with 11,492 crabs rescued during 23 walks across RTF beaches (Figure 2). Peaks in the number of crabs rescued followed the full and new moon phases, from late May to late June, and volunteers are encouraged to schedule walks during these times. We categorize 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 category was further grouped into descriptive categories.

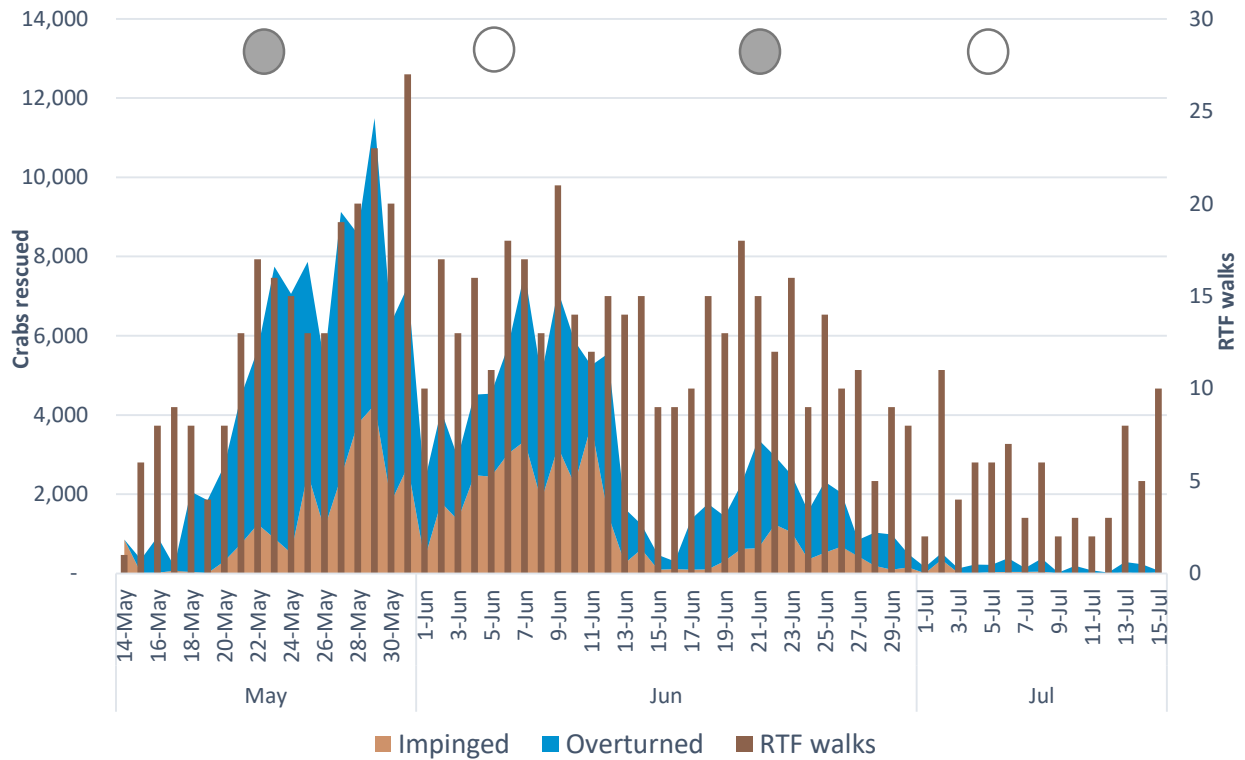


Figure 2. Total number of crabs rescued (stacked areas: overturned + impinged crabs) and RTF walks (bars) conducted by date, 2020. Moon phase is indicated above the graph by open circles (full moon) and filled circles (new moon).

Overturned Crabs

The majority of all crabs rescued were found upside down on the beaches (67.7%, 123,335 crabs), as we have found in every year 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 mortality from exposure and gull predation. Though the act of turning a single crab is simple enough, the number of overturned crabs following high spawning activity can be significant and requires dedicated volunteers. In 2020, there were 22 walks during which volunteers overturned >1,000 crabs, at times taking 4 hours to complete.

Beaches with the greatest number of overturned crabs included Thompsons and Moores beaches, in Cumberland County, and Reeds Beach in Cape May County (Table 1). Accounting for walk effort on beaches with regular walks (≥5), the beaches with the most overturned crabs rescued were Thompsons (655.8 crabs/walk), Moores (465.6 crabs/walk), and Reeds (390.9 crabs/walk; Figure 5).

Impinged Crabs

Degraded conditions and marine debris at beaches expose crabs to additional risks during spawning. Crabs become stuck in structures, debris, or shoreline features and are often unable to return to the water without assistance from volunteers. These stranded crabs are 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 (e.g. exposed peat and vegetation above or below the high tide line), and overwash areas. Many of these problem areas have been previously documented by the program, but may worsen or improve over time with restoration projects, beach cleanups, and erosion or accretion at the beaches. Data documenting persistent problem areas, such as derelict structures, rubble debris, and overwash areas, and can be used to prioritize and inform restoration needs on the Delaware Bay beaches.

Man-made Impingements

Volunteers rescued 42,087 crabs from man-made impingements (23.1% of all crabs rescued). 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 large numbers of crabs.

The beaches with the most crabs freed from man-made impingements per walk, were Money Island (126.0 crabs/walk) and East Point (117.5 crabs/walk) beaches (Figures 3-5, Table 1). This was the second year in a row with high numbers of trapped crabs at Money Island (116.9 crabs/walk in 2019), following the demolition of several homes along the shoreline through New Jersey’s Blue Acres Buyout program up that created debris on the beach (Figure 3). A small volunteer project was planned here in March 2020, but was canceled due to the Covid-19 restrictions. At East Point, the number of crabs rescued per walk and total number nearly doubled from 2019 (66.2 crabs/walk, 5,100 crabs), which is due in part to the installation of restoration structures in the intertidal zone. The large rip rap was installed to slow erosion of the rapidly disappearing shoreline in front of the historic lighthouse (Figure 3). Overall, rubble from broken down homes, bulkheads, and roads constituted the greatest number of impinged crabs, 15,778 crabs on 12 beaches, and one of the most widespread category of man-made impingements. Over a third of all crabs rescued were from man-made hazards (Figure 4).



Figure 3. Crabs impinged on Money Island (top; Megan Wren) and East Point (bottom; Teresa Brown) beaches before rescue by RTF volunteers.

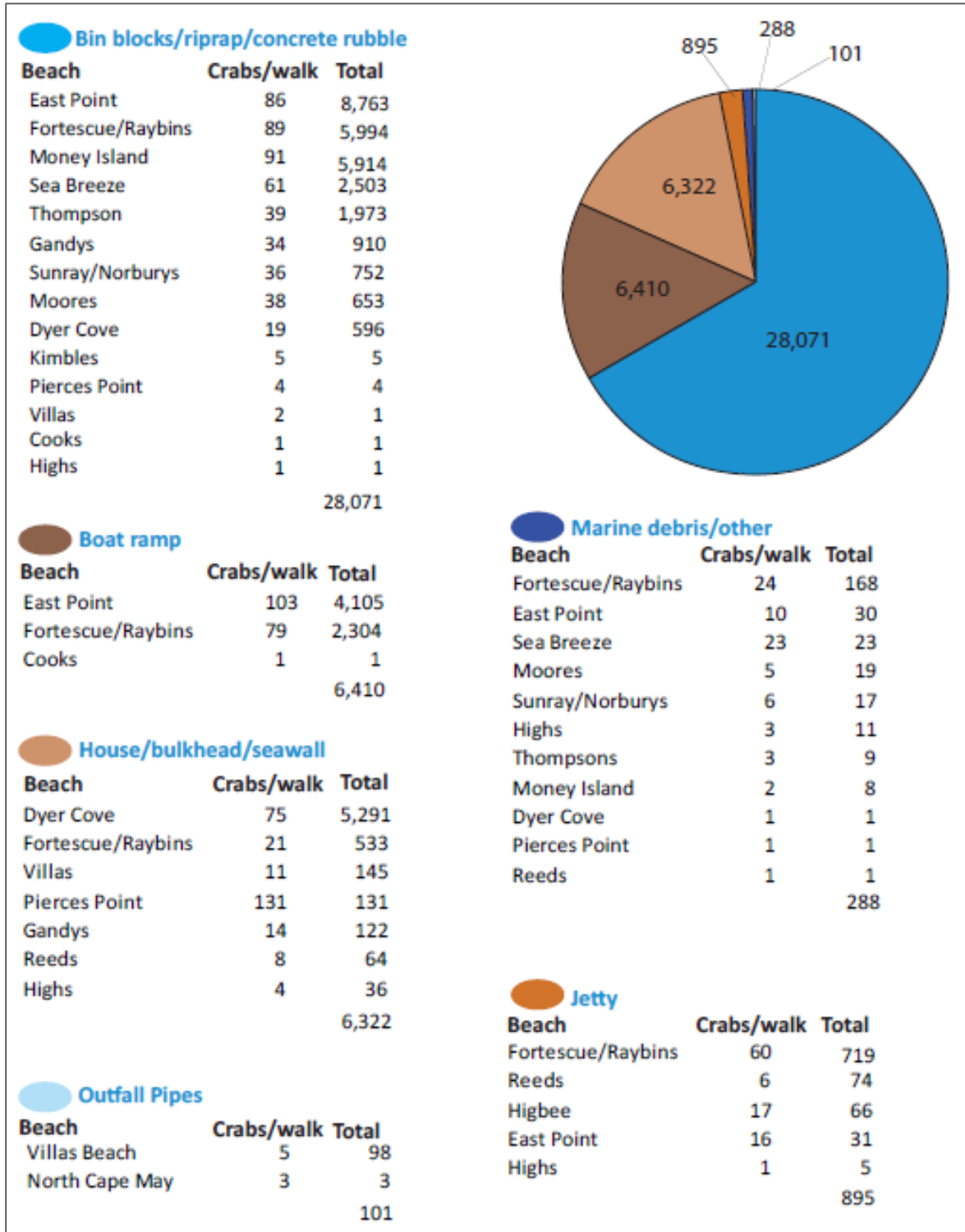


Figure 4. Number of crabs rescued from man-made impingements in 2020 by hazard type and beach.

Natural Impingements

Crabs can 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 16,654 crabs in 2020 (9.1% of all crabs rescued). Beaches with the most crabs rescued from natural impingements and overwash areas per effort included Moores (118.1 crabs/walk), East Point (40.3 crabs/walk), and Pierces Point beaches (37.4 crabs/walk; Table 1, Figure 5). 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.

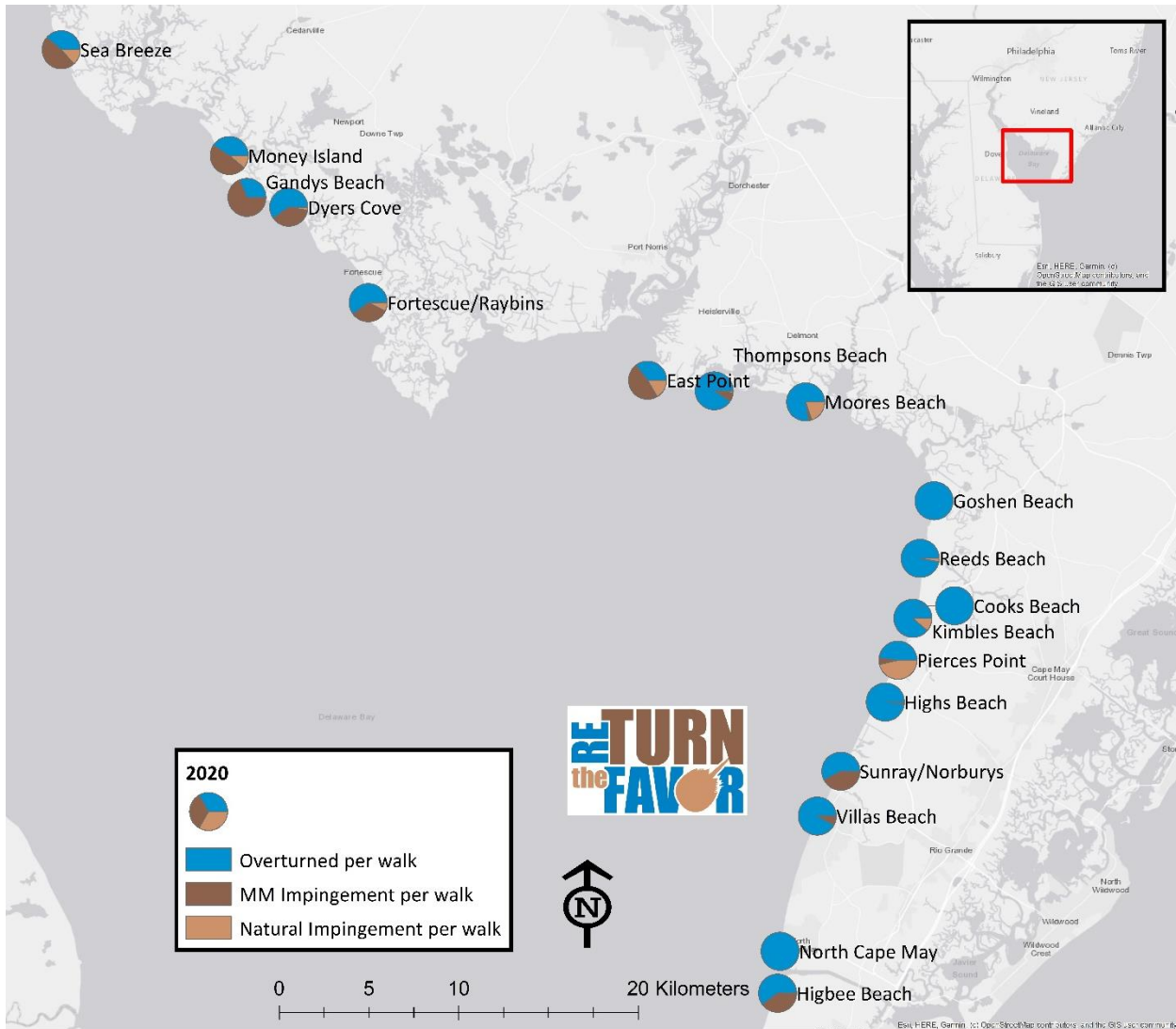


Figure 5. Each symbol indicates for each beach the proportion of rescued horseshoe crabs that were overturned or stranded in man-made (MM) or natural impingements per walk by RTF volunteers in 2020.

Other results

Through a grant provided by the US Fish and Wildlife Service’s Partners for Fish and Wildlife Program, we were able to improve crab spawning and shorebird foraging conditions at two beaches over the past year. At Sea Breeze Beach, we filled a 20-yd dumpster with concrete rubble left from demolished homes on the site. At Reeds Beach, we worked with property owners to obtain permission to remove sections of dilapidated bulkheads that trap spawning crabs on private lots often inaccessible to volunteers during walks. These projects continue hazard removal projects previously conducted through RTF at Moores Beach, Fortescue Beach, and others.

Of all crabs rescued, 130,146 or 71.5% were male, and 51,930 or 28.5% were female, a 2.51 M:F sex ratio, which is a fairly consistent ratio among years (2013-2020 average 2.62 ± 0.36). There was some variation in the sex ratio of crabs rescued by impingement type (Figure 6). A higher M:F ratio rescued from man-made impingements and M:F lower ratio rescued from natural impingements may be an indicator of sex-biased risk due to body size, behavior, or environmental factors. The M:F ratio also may be affected by volunteers selecting for female crabs when time or effort for rescues is limited.

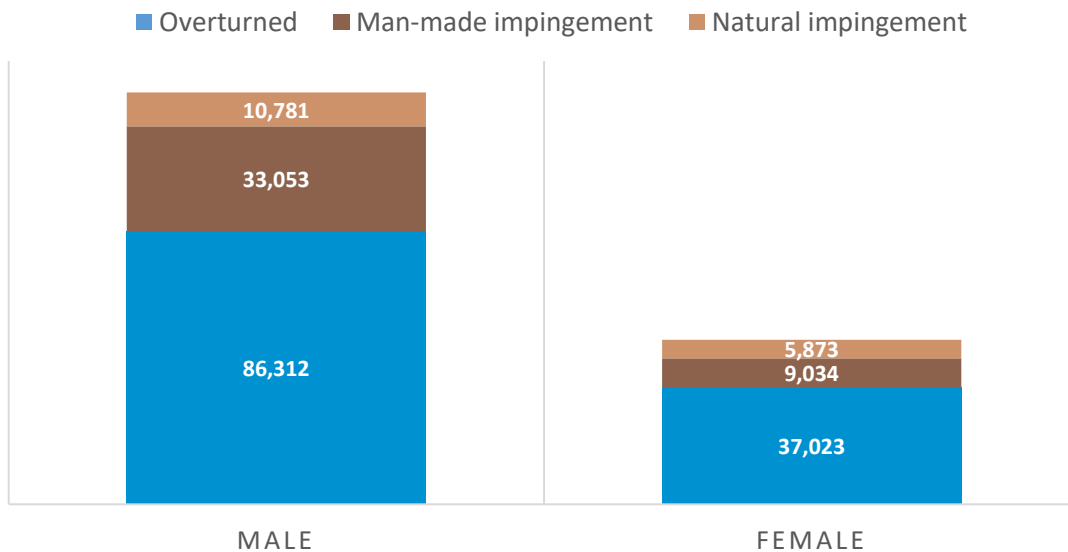


Figure 6. Total male and female horseshoe crabs rescued in 2020 by stranding category.

Tagged crabs were also reported during walks; 108 observations of 90 horseshoe crab tags on 13 beaches were made this year. The oldest tag found on a live crab was observed by RTF volunteers on Thompsons Beach in May 2020 and initially released in May 2001 at Pickering Beach in Delaware. Tag data are reported to US Fish and Wildlife Service annually to contribute to federal and state efforts to study horseshoe crab population trends and movements.

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 20 or more carcasses a walk, were found on 15 of the monitored beaches. The bloated or partially decayed condition of some terrapins indicated likely drowning in crab traps. Other notable observations made by volunteers included observations of a dead sea turtle on Fortescue/Raybins beach.



Conclusions

The unusual conditions of the 2020 season have shone a light on the dedication of RTF volunteers and the collective work that can be accomplished through the program. Spawning activity did not cease, and as a group we were able to safely get out to help the crabs that became stranded in the process. Though the year necessitated a shift away from training new volunteers and in-person outreach programs, we connected with volunteers and other interested parties through virtual trainings and presentations, socially-distanced conversations on the beach, and a busy social media network to continue our education and engagement objectives. Through reTURN the Favor, we continue to learn about horseshoe crab spawning and habitat hazards, and make meaningful contributions to horseshoe crab conservation in New Jersey.

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. We extend thanks to NJ Division of Fish and Wildlife for providing a scientific collecting permit, permission, and guidance. In 2020, 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, US Fish and Wildlife Service, and private donations.

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