reTURN the Favor: Horseshoe crab rescue program 2019 report

The reTURN the Favor (RTF) program was initiated in 2013 to rescue American horseshoe crabs (*Limulus polyphemus*) stranded on beaches along the Delaware Bay in New Jersey, where large concentrations of crabs spawn every spring. With crabs at risk to dying from exposure and predation, this state partnership and collaboration among several New Jersey-based groups (non-profit organizations, consulting groups, and a university) formed to recruit and train volunteers to rescue crabs stranded during spawning. During walks scheduled around tides, spawning activity, and time of day restrictions, volunteers rescue and collect data on live stranded crabs. Program participants must follow protocols to comply with New Jersey regulations to protect horseshoe crabs and other wildlife. Collectively, volunteers save crabs by the thousands, identify problem areas on the beaches, and make observations that inform conservation, restoration, and research on the Bay.

Why rescue horseshoe crabs?

Most numerous around the high tides of full and new moons in May and June, horseshoe crabs crawl onto sandy beaches to lay clusters of eggs in shallow pits in the intertidal area of low-energy beaches of the Delaware Bay. Females can lay over 80,000 eggs over the course of a spawning season (Fredericks 2012). Under the sand, these eggs develop into larvae that enter the Bay for an extended period of >9 years before reaching sexual maturity, for the few that survive the duration. Other 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 animals, including fish, marine turtles, and gulls that live locally, take advantage of the abundance of crabs and crab eggs in the Bay.

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 (www.asmfc.org/species/horseshoe-crab). Though now considered stable, the harvest of horseshoe crabs for eel and whelk bait was a prime driver of population decline in the Delaware Bay in recent decades. Crabs are also harvested by the biomedical industry for their blood, which can be collected from live crabs before release back to the water, but not without impacts to survival. With so much of the Delaware Bay ecosystem tied to an abundant population of horseshoe crabs, and emerging concerns about 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.

The condition of beaches that increase stranding risk and loss of habitat to support spawning – beaches that are sandy, gently sloped, and free of obstacles and debris – is another threat to the population. Eroding beaches, housing and coastal development, and shoreline hardening infrastructure has diminished the quality of spawning habitat. As a result, mature crabs become stranded on beaches, stuck in debris and structure on the shoreline, or washed into marshes and overwash areas.

This is where the reTURN the Favor program steps in – reducing the loss of mature crabs; connecting organizations; engaging new volunteers, community members, and children in conservation of the Bay; improving spawning habitat through debris removal, beach restoration, and revitalization of derelict structures on the Bay.

2019 reTURN the Favor Highlights

- **106** new and returning volunteers attended **4** RTF training workshops in late April. Many more attended site-specific trainings or refresher trainings as returning volunteers.
- **10** organizations participated in RTF, covering beaches in Cape May and Cumberland Counties.
- **98** volunteers lead **703** walks, for total of **2,701** volunteer hours.
- **143,874** horseshoe crabs were rescued on **18** beaches, including **98,376** overturned crabs, **29,818** crabs stuck in man-made impingements, and **15,432** crabs stranded by natural impingements and in overwash areas.
- **505,629** crabs have been rescued by RTF volunteers in nearly **3,300** walks from 2013-2019.

Citizens United for the Maurice River and its Tributaries • Conserve Wildlife Foundation of New Jersey • Friends of Cape May National Wildlife Refuge • M. Wren Consulting • New Jersey Audubon Society • New Jersey Division of Fish and Wildlife Service • Rutgers University • The Nature Conservancy • The Wetlands Institute • Executive Office of Western Hemisphere Shorebird Reserve Network

Table 1. Results from the 2019 reTURN the Favor season by beach, ordered north to south on Delaware Bay, NJ.

		Crabs Rescued					
Location	Walks	Overturned	Man-made Impingement	Natural - Impingement	Natural - Overwashed	Total	Avg per walk
Sea Breeze	31	784	1,015	262	7	2,068	66.7
Money Island	49	3,534	5,728	2,446	228	11,936	243.6
Gandys Beach	43	575	3,210	-	1	3,786	88.0
Dyer Cove	59	7,919	2,431	244	15	10,609	179.8
Fortescue/Raybins	114	13,360	7,993	1,113	380	22,846	200.4
East Point	77	4,594	5,100	7,369	201	17,264	224.2
Thompsons Beach	34	11,959	1,571	1,168	333	15,031	442.1
Moores Beach	33	16,564	106	399	277	17,346	525.6
Reeds Beach	52	17,672	294	372	435	18,773	361.0
Cooks Beach	18	217	-	4	45	266	14.8
Kimbles Beach	26	1,298	2	79	1	1,380	53.1
Pierces Point	26	1,369	859	78	-	2,306	88.7
Highs Beach	40	2,360	37	-	-	2,397	59.9
Rutgers Beach	1	33	-	-	-	33	33.0
Sunray/Norburys	14	2,270	975	92	3	3,340	238.6
Villas Beach	69	12,986	450	124	4	13,564	196.6
North Cape May	12	710	46	-	-	756	63.0
Higbee	5	172	1	-	-	173	34.6
Total	**703**	**98,376**	**29,818**	**13,750**	**1,930**	**143,874**	**173.0**

2019 reTURN the Favor Season in Detail

reTURN the Favor volunteers rescued 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 nine partner organizations: *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), *M. Wren Consulting* (Money Island, Moores, Fortescue/Raybins, Gandys), *New Jersey Audubon Society* (Cooks, Highs), *Rutgers University* (Rutgers), *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).

The web-based volunteer management service, Sign-Up Genius (www.signupgenius.com), was used by volunteers to schedule 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 June7, walks on many beaches are only permitted after sunset or before sunrise due to NJ beach closures during shorebird migration (www.nj.gov/dep/fgw/ensp/beachclozmap.htm). In the field, volunteers collected data on standardized datasheets, then submitted data through returnthefavornj.org. During in-person trainings and refresher meetings, volunteers were supplied permits, permission letter, stickers, t-shirts, and vests to be easily identified as RTF volunteers. On certain beaches where crabs are known to strand in large numbers, volunteers were permitted to use labeled totes to rescue crabs this year, which helped volunteers maximize rescue efforts and stay safe in the process. Updated protocols, datasheets, and beach-specific fact sheets were provided to volunteers during trainings and through the website (http://returnthefavornj.org/get-involved/resource-toolkit/).

Volunteers (98 in total) submitted data for 703 RTF walks conducted from late April through mid-July 2019. On average, walks lasted 1 hr and 25 min ± 04 min with 2.9 ± 3.4 participants. Altogether, over 2,701 hours were spent rescuing crabs this year. An average of 204.6 ± 320.1 crabs were rescued per walk, for a total 143,874 crabs rescued. Peaks in the number of crabs rescued per walk followed the full and new moon phases, from mid-May to mid-June. Over a busy spawning period in early June, 8,200 crabs were rescued during 23 walks on a single day, June 7 (Figure 1). This highlights the need to continue to target volunteer activities around the new and full moons.

Overturned Crabs

The majority of all crabs rescued were found upside down on the beaches (68.4%, 98,376 crabs) typically during falling to low tides. 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. Beaches with the greatest number of overturned crabs included Fortescue/Raybins 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 Moores (501.9 crabs per walk), Thompsons (351.7 crabs per walk), and Reeds (339.8 crabs per walk; Figure 2), all of which were much higher than results from the 2018 season.

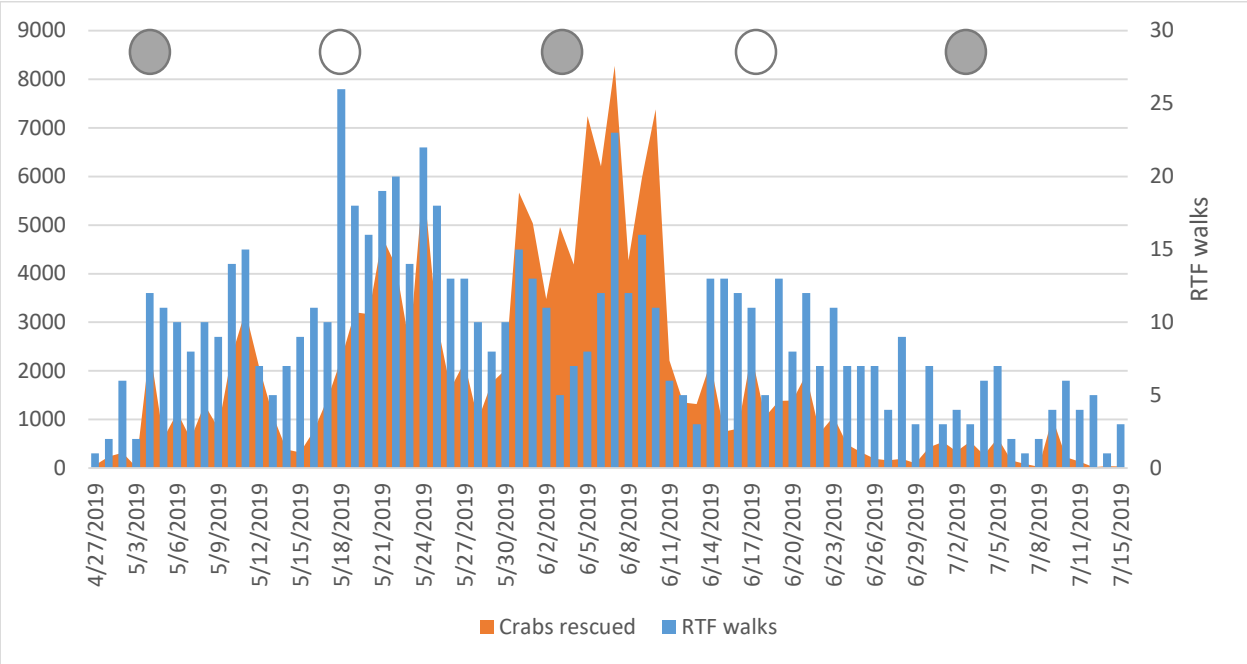


Figure 1. Total number of crabs rescued and RTF walks conducted by date, 2019. Moon phase is indicated above the graph by open circles (full moon) and filled circles (new moon).

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 Bay 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 and accretion at the beaches. Data documenting persistent problem areas, such as derelict structures, rubble and debris, and overwash areas, for crabs can be used to prioritize and inform restoration needs on the Delaware Bay beaches.

Volunteers rescued 29,818 crabs from man-made impingements (20.7% of all crabs rescued). For the second year in a row, beaches with the most crabs freed from man-made impingements per walk, were Fortescue/Raybins (70.1 crabs per walk), Gandys (74.7 crabs per walk), and Money Island (116.9 crabs per walk) beaches (Figures 3 and 4, Table 1). The increase at Money Island, up from 72.2 crabs per walk in 2018, is likely due to the increase in rubble on beaches following house demolitions from New Jersey's Blue Acres Buyout program. Rubble, bin blocks, and rip rap constituted the greatest number and one of the most widespread category of man-made impingements, at 17,345 crabs on 11 beaches, or 58.1%. Boat ramps were a more localized problem, with 6,828 crabs rescued at four beaches, Dyer Cove, East Point, Fortescue, and Gandy's beaches.

Figure 2. Number of overturned horseshoe crabs rescued per walk by RTF volunteers in 2019.

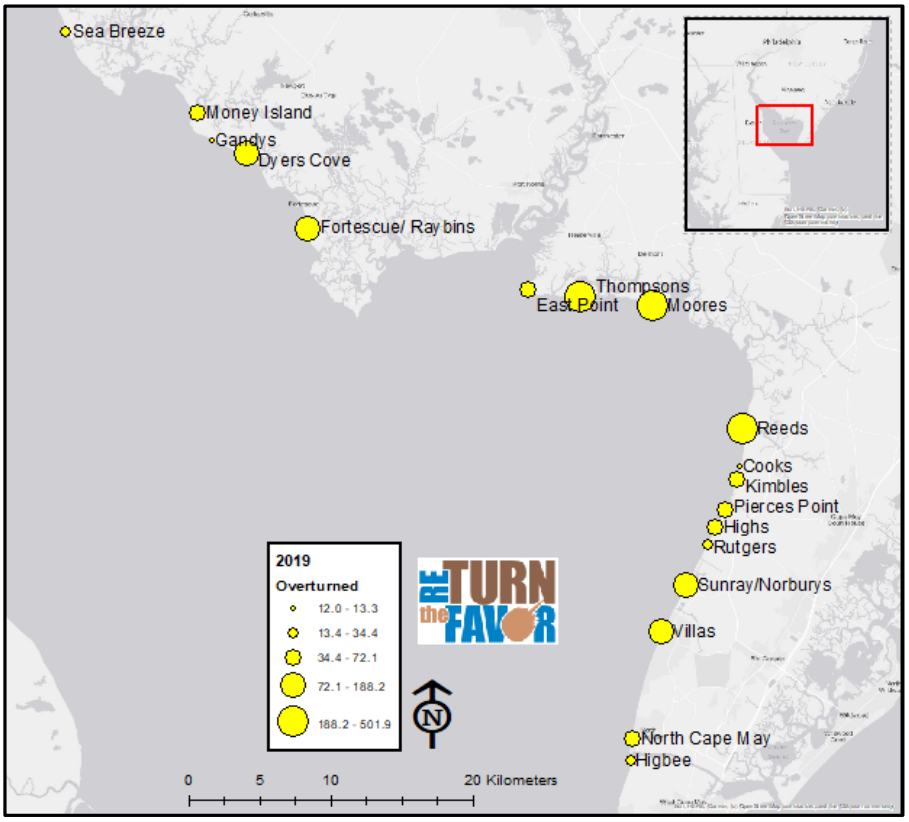
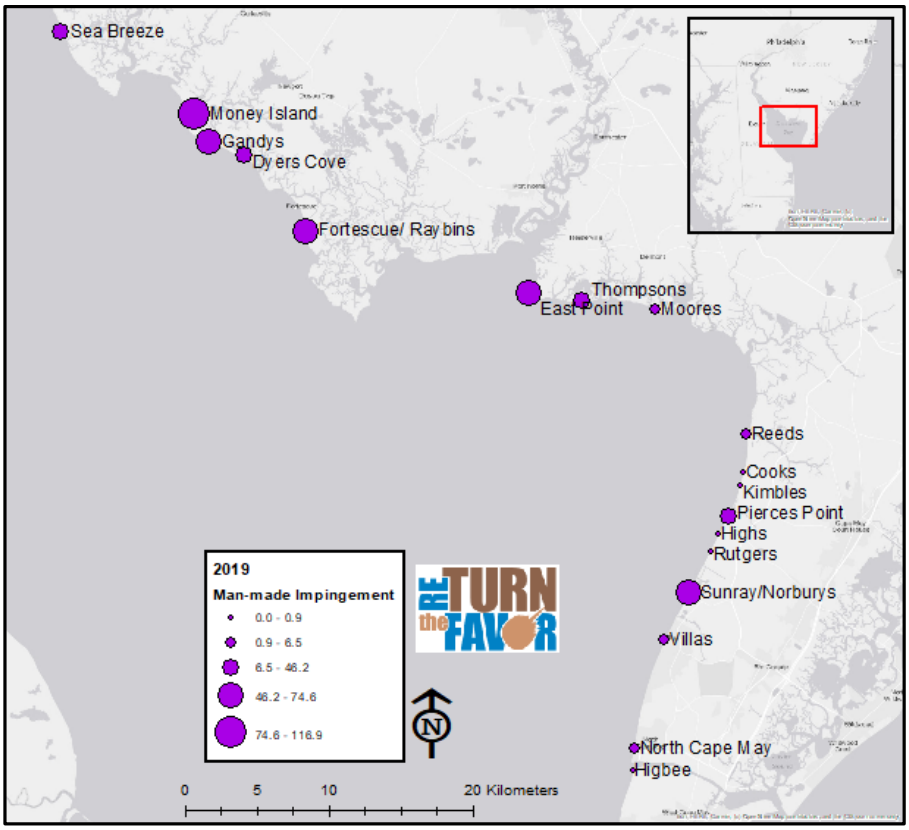
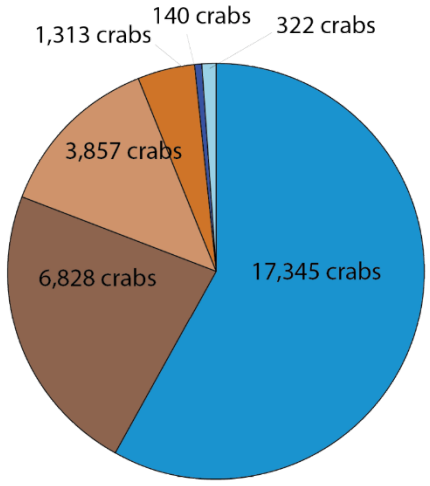


Figure 3. Number of horseshoe crabs rescued from man-made impingements per walk by RTF volunteers in 2019.



Bin blocks/riprap/concrete rubble

Beach	Crabs/walk	Total
Money Island	116	5,664
Gandys Beach	70	3,022
Fortescue/Raybins	24	2,753
East Point	28	2,172
Thompsons Beach	42	1,441
Seabreeze	29	912
Dyer Cove	11	648
Pierces Point	15	397
Sunray/Norburys	16	217
Moores Beach	3	88
Highs Beach	1	31
		17,345



Boat ramp

Beach	Crabs/walk	Total
East Point	38	2,892
Fortescue/Raybins	32	3,660
Dyers Cove	5	274
Gandy's Beach	1	2
		6,828

House/bulkhead

Beach	Crabs/walk	Total
Fortescue/Raybins	25	1,481
Dyer Cove	53	744
Moores Beach	18	462
Sea Breeze	3	381
Thompsons Beach	5	284
East Point	4	186
Money Island	2	164
Reeds Beach	4	119
Kimbles Beach	1	31
Villas Beach	1	5
		3,857

Outfall Pipes

Beach	Crabs/walk	Total
Fortescue/Raybins	4	246
North Cape May	1	72
Villas Beach	1	4
		322

Jetty/groin

Beach	Crabs/walk	Total
Fortescue/Raybins	9	1,060
Seabreeze	3	92
Money Island	1	60
North Cape May	4	42
Villas Beach	1	38
Sunray/Norburys	1	14
Reeds Beach	1	6
Higbee Beach	1	1
		1,313

Marine debris/other

Beach	Crabs/walk	Total
Fortescue/Raybins	1	67
Dyer Cove	1	28
Moores Beach	1	18
Sea Breeze	1	11
Thompsons Beach	1	11
East Point	1	5
Money Island	1	4
Reeds Beach	1	4
Kimbles Beach	1	2
Villas Beach	1	2
Highs Beach	1	1
		140

Figure 4. Number of crabs rescued from man-made impingements in 2019, by hazard type and beach.

Stranded crabs rescued from natural impingements and overwash areas totaled 15,680 crabs in 2019 (10.9% of all crabs rescued). This is higher than standard years, when natural impingement accounted for 3.9-6.1% of all crabs rescued. Crabs can become impinged in these hazards due to degraded and eroded beach conditions and/or high tides that transport crabs to dunes or marshes adjoining the spawning beaches. Beaches with the most crabs rescued from natural impingements and overwash areas included East Point, Money Island, Thompsons, and Fortescue/Raybins beaches (Table 1), while the beaches with the most crabs rescued when accounting for effort on beaches with regular walks (>2) were East Point (98.3 crabs per walk), Money Island (54.6 crabs per walk), and Thompsons (44.1 crabs per walk; Figure 5).

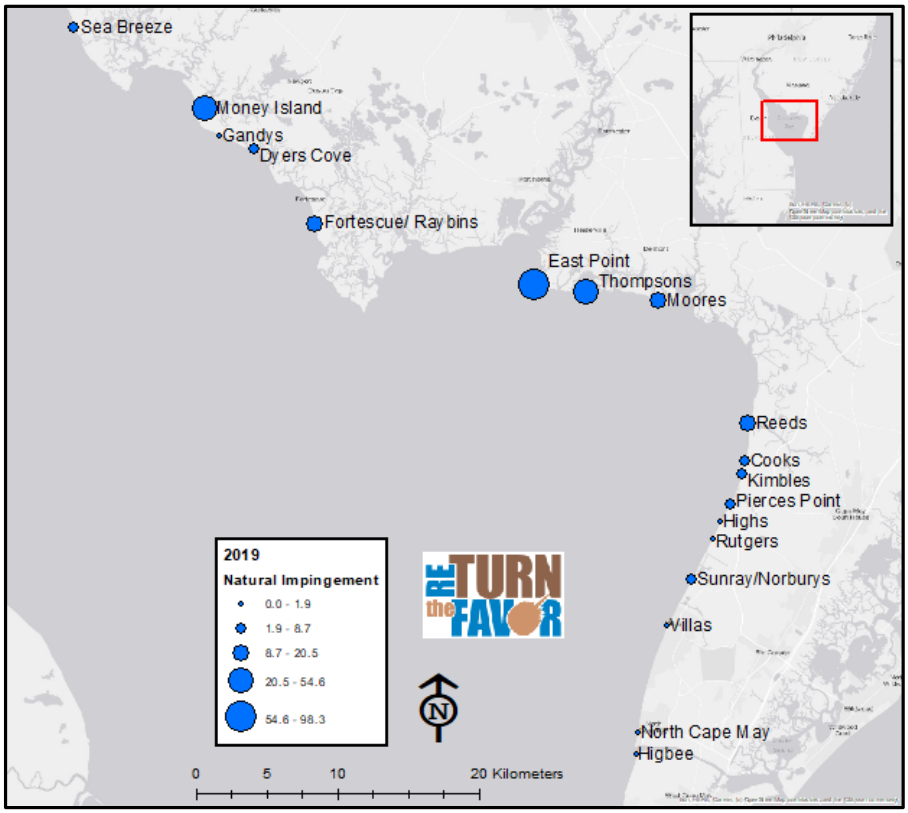


Figure 5. Number of horseshoe crabs rescued from natural impingements and overwash areas per walk by RTF volunteers in 2019.

Other information

Of all crabs rescued, 97,081 or 67.5% were male, and 46,793 or 32.5% were female, a 2.07 sex ratio. A great proportion of female crabs were rescued this year compared to previous year, which ranged from 2.19 in 2016 to 3.24 in 2018. Females comprised 35.5% of overturned and 22.6% of man-made impinged crabs rescued. Sex-ratios based on spawning surveys tend to be more male biased compared to results from this program (Swan et al. 2017). This suggests that proportionally more females may become stranded on the beaches during spawning compared to males, though results may vary by factors such as beach and date. Data on tail length and age were not recorded, though these factors likely contribute to stranding and mortality risk and could be investigated further (Bottom and Loveland 1989, Penn and Brockmann 1995, Smith et al. 2010). Tagged crabs were also reported during walks; 203 observations of 187 tagged crabs were made this year. Data are reported to US Fish and Wildlife Service to contribute to federal and state efforts to study horseshoe crab population trends and movements.

Other Wildlife

Program volunteers also recorded observations of other stranded species and notable wildlife observed incidentally at the beaches they walked. Notably, dead diamondback terrapins (*Malaclemys terrapin*) have been regularly encountered during walks of the intertidal areas, often bloated or partially decayed, suggestive of drowning in crab traps. Other notable observations made by volunteers included observations of dead sea turtles on Fortescue/Raybins and Money Island beaches.

Conclusions

The 2019 season was the busiest year yet for reTURN the Favor, with program volunteers and partners rescuing our highest annual total yet. The program has been able to rescue over half a million stranded horseshoe crabs, educated and engaged residents and visitors in conservation for the Bay, and documented areas for restoration and habitat improvement. Through this program we are learning about horseshoe crab spawning and habitat hazards, and making meaningful contributions to horseshoe crab conservation in New Jersey. The program will continue to put the data to work by seeking opportunities for small-scale, volunteer-based habitat improvement projects and contributing to development of large-scale restoration projects.

Acknowledgements

The successes of the reTURN the Favor program are wholly due to the dedication of so many volunteers and program partners who contribute time, miles, and late nights to horseshoe crabs and the Delaware Bay. We are so grateful to every person who joins to help, who spreads the word about horseshoe crab conservation, and supports this program. This program is also indebted to NJ DFW for providing permits, permission, guidance and communication for keeping this program operational. In 2019, partner groups 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 and volunteer support provided by: Orsted, US Fish and Wildlife Service, and private donations.

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