**INSTRUCTIONS: SURVEYING HORSESHOE CRABS**

**Delaware National Estuarine Research Reserve**
**Kitts Hummock Beach, Ted Harvey Wildlife Conservation Area, North Bowers Beach**

# PREPARATION FOR THE SURVEY:
## CLOTHING AND ACCESSORIES

- Wear appropriate clothing for weather and wet conditions at the water's edge. Insect repellant may be needed. *If thunderstorms are present do not go onto the beach!*
- Work gloves may be useful if there are high densities of crabs on the beach. You will have to lift animals up to count those underneath.
- Shoes are required! Do not go barefoot. We recommend water shoes, old sneakers, or boots. Do not wear flip flops or tevas.
- An accurate wristwatch is needed for recording arrival time as well as the time that the survey begins and ends.

# SURVEY PROTOCOL:
## SETUP

The Reserve will be open 1.5 hours prior to the time of high tide. Here you will meet your group which will include one experienced staff member and at least 1 other volunteer, sign in and pick up the following materials:

- 5 Headlamps and one flashlight per group
- 3 clipboard
- 1 Beach Site Sheet
- 1 Random Number Table
- 2 Tally Forms
- 1 set of instructions
- 1 set of directions to the access point
- 2 quadrats
- 1 wind meter
- 1 First Aid Kit
- 1 box of pencils
- 1 Pencil sharpener
- 1 watch/clock
- 1 working cell phone & cell phone number of staff person

1. Arrive at the beach at least 30 minutes before high tide. **Record the time you arrive in the space marked ARRIVAL AT SITE on the Beach Site Sheet.**

2. **Fill out the Beach Site Sheet as completely as possible.** Addresses and phone numbers of each survey team member are important in case we have questions about the data. Even if the weather prevents you from doing the survey, please fill out the survey sheet with all possible information and explain why the survey could not be completed. The wind meters are optional. You may use these to record the wind speed and temperature.

3. **DETERMINING YOUR PACE**. Realize that the average number of paces per meter is different for each person, because it depends on your stride length. If you are going to be responsible for pacing the distance during the survey you must complete the Pacing Trial Form. Since pace length is affected by the surface on which you are walking, determine your pace on the beach before the survey begins. You can do this on the evening of your first count, just be sure to get to the beach a little earlier.

    - Lay the 20 m string out on the ground. You will use this to fill out the Pacing Trial Form.
    - Count the number of paces it takes you to walk the length of the string using your normal stride. Enter this number into the space next to TRIAL 1 on the Pacing Trial Form. You can do this as every step or as every "set of steps," whatever works for you. Just make sure that you always use the same method.
    - Repeat this process two more times. Enter the second number next to TRIAL 2 and the third number next to TRIAL 3.
    - These three numbers are A, B, and C on the Pacing Trial form. Add A, B, and C, and divide this number by 3 to find D, your average number of paces per 20 meters.
    - Divide D by 20 to find your average number of paces per meter (E on the form). You can use your average number of paces/20 meters for pacing 20 meters in between quadrats. You will need to know how many paces/meter for the random start points as the random numbers will change each survey night.

4. To survey the horseshoe crabs you will start at one end of the beach section and walk to the other end, along the way placing quadrats to count the horseshoe crabs. **The location of the start point, either up bay or down bay, has been predetermined by staff and is located on the sign-up sheet next to the beach name. Circle up bay or down bay on the Beach Site Sheet where it says STARTING LOCATION. In Delaware, when facing the bay, up bay will be to your left, down bay will be to your right.**

5. **Find the boundaries of the beach section.** It is important to check in at the Reserve prior to visiting the beach so that a staff member can verify the boundaries and access point. Refer to your pack of information for your beach's access and starting points.

6. **Find a stick (1 to 2 ft. long) that you can use to determine high tide. When you get to the starting point, stand the stick in the sand at the tide line. The tide line is the highest point on the beach that the water reaches. Move the stick up the beach as the water reaches higher and higher on the beach. Begin the survey when the tide begins to recede and the water no longer reaches the stick. Record your starting time on the Beach Site Sheet where it says START OF SURVEY.**

## PLACING THE QUADRATS AND COUNTING CRABS

- You will be surveying in groups with at least two people. A Survey Protocol Diagram (provided) illustrates the placement of the quadrats described in the next section.

- The "horseshoe crab line" you will follow is not a straight line and may be above or below the water line.

- If there is an obstruction or discontinuation of the beach (bulkhead, large boulder, etc) pace up to the obstruction, walk to the other side of it, and then continue your pace count on the other side. Do not include the width of the obstruction in your pace count. If you run into a section of peat, continue to lay down quadrats, but make a note of the stretch of peat on the data sheet. If you "run out of beach" and cannot go any further on the beach, but are not done with 100 quadrats, please note this on the tally sheet. Do not just put zeros.

- The quadrats on the Tally Sheet are numbered 1-100.

- There might be tagged horseshoe crabs that you come across while surveying. While conducting the survey only record those crabs that fall within the quadrats. There is a place for the information on the reverse side of the tally sheet complete with detailed instructions. You may go back at the end of the survey to record additional tagged crabs.

- If you decide to work in two teams on the beach and do odd/even quadrats, be sure to record them properly on the tally sheet. Do not have both team members record on 1-50; the first team should record on the odd numbers and vice versa.

1. **Choose 2 random numbers from 0-19 (Use the random number sheet and instructions to select random numbers) to locate the 1st and 2nd quadrats within the first 20 meter stretch. Be sure to record your random number start points on both the Beach Site Sheet and the Tally Sheet.**

2. **The first team member will pace the first number of meters randomly selected and then set down his/her quadrat. Be sure to hold onto the quadrat or place your foot on it so that it will not float away.**

3. Once the quadrat is in place try not to move it again until you are finished counting.

4. **Count all the crabs in the quadrat.** A horseshoe crab is considered in the quadrat if more than half of its body is inside the quadrat.

5. When there are numerous animals, you may have to lift some up to assure you've counted all of those underneath. Try to minimize disturbance to the spawning horseshoe crabs. Spawning females will be partially buried in the sand while laying eggs. **DO NOT LIFT UP A PARTIALLY BURIED HORSESHOE CRAB!**

6. **Count the animals of each sex separately.** If a horseshoe crab is not buried, the two most common ways to determine its sex are its size and position. Males are for the most part smaller and clasped or crowded on top of females. There also tends to be more males than females.

7. **Report your count of each sex to the recorder who will record the information under TOTAL on the Tally Sheet.** Do not pick up the quadrat and move to the next location until you know the recorder has recorded all information for your present quadrat.

8. **Report zero (0) when there are no horseshoe crabs in the quadrat.** Do not try to move the quadrat from the pre-selected location just to include one or more nearby animals. Empty quadrats are just as important as those with horseshoe crabs because they will reflect changes in the population.

9. **The next team member will then pace (beginning at the starting point) the 2nd number of paces to the second quadrat and set down his/her quadrat. Count and record the crabs in the same fashion as the other team member.**

10. **Each team member then paces 20 meters from his/her respective quadrat to the next quadrat location where you will again count the crabs in the same fashion.**

11. **Continue this way until you have sampled 100 quadrats.** If you run out of beach make a note of this; do not return to the beginning and start again.

**ONCE YOU ARE FINISHED SURVEYING**

- Record the time in the space marked END OF SURVEY on the Beach Site Sheet.
- **RETURN THE FOLLOWING DATA SHEETS TO THE ST JONES RESERVE ASAP. Do not fax them! We need the originals.:**
  - **Completed Beach Site Sheet**
  - **Completed Tally Sheets**
  - **Completed Pacing Trail Form for each survey team member (only turn this in once)**
- **Return your materials to the Reserve PRIOR to the next survey evening.**

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