

Horseshoe Crab Spawning Survey Instructions

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1. Instruction sheet and pacing estimation calculation
2. Random Numbers Table
3. Table of dates and times of surveys (to be included a later date)
4. Copy of Spawning Survey Data Sheet

Supplies for each site:

5 m² quadrat
thermometer
pens/pencils
datasheets and clipboard
flashlights
hip or knee boots

PREPARATION FOR THE SURVEY:

Determine your pace

Follow the instructions before your first assigned time to survey and preferably on a beach since pace length is affected by the surface you are walking on. This should take 15-20 minutes to complete.

*Note: Each person has to determine their pace **ONCE** for the whole season.*

*Note: All measurements are **metric***

1. Lay out the 20 **meter** measuring tape straight on the beach.
2. Count the number of paces it takes you to walk the length of the string using your normal stride. Remember that a pace is two steps. Enter this number in the space next to TRIAL 1 on the Pacing Trial Form.
3. Repeat this process twice more. Enter the second number next to TRIAL 2 and the third number next to TRIAL 3.
4. These three numbers are A, B, and C on the Pacing Trial Form. Add A, B, and C, and divide this number by three to find D, your average number of paces per 20 meters.
5. Divide D by 20 to find your average number of paces per meter (E).

NAME: _____

NUMBER OF PACES IT TAKES TO WALK 20 METERS OR APPROXIMATELY 66 FEET:

TRIAL 1 = _____ (A)

TRIAL 2 = _____ (B)

TRIAL 3 = _____ (C)

AVERAGE PACES PER 20 METERS:

TOTAL (A+B+C) = _____ / 3 = _____ (D) PACES PER 20 METERS

NUMBER OF PACES PER METER:

(D) _____ / 20 = _____ (E) PACES PER METER

Note: The average number of paces per meter is probably different for each person, because it depends on your stride length. It is important that you do this yourself and know these numbers before you arrive at the beach.

Clothing and accessories

- Wear appropriate clothing for weather and wet conditions at the water's edge. Consider using sunscreen during the day. *If thunderstorms are present do not go onto the beach.*
- For night surveys bring a headlamp or a flashlight. Headlamps are most useful because they free up both hands.
- Bring a clipboard or hard surface to write on. Also, bring a few pencils and pens.
- Shoes are a necessity. We recommend boots, water shoes or old sneakers. *Do not go barefoot.*
- An accurate wristwatch is needed for recording arrival time, as well as start and stop times of the survey.

SURVEY PROTOCOL:

Surveys should be conducted within 2 days of the FULL or NEW moon. This gives a 5-day (2 days prior, the day of, and 2 days after the moon) window to complete the surveys for each moon period. It is desirable to survey each location 2 to 3 times during each moon, preferably both day AND night (4 to 6 surveys) surveys at each location). Priority for surveys should be given to those dates closer to or on the full or new moon. The minimum number of surveys for a location and moon is 1 DAY and 1 NIGHT survey. If it is logistically impossible to conduct night surveys (for example, access to Marsh 2-3 or Hog Island) that the minimum is 2 DAY surveys per moon.

It is preferred that all surveys take place on the SAME day or night.

Setup

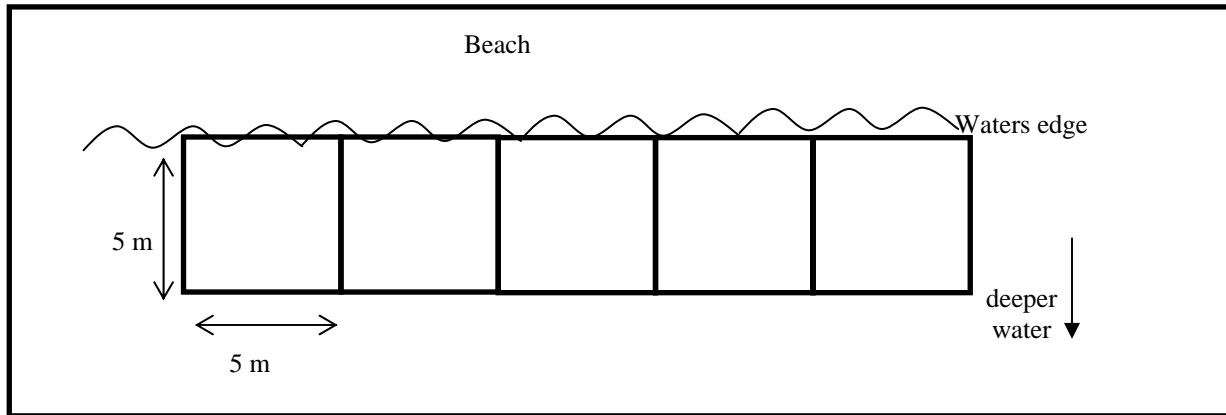
- Arrive at the beach at least 30 minutes before high tide. Record the time you arrive in the space marked ARRIVAL AT SITE on the Beach Site Sheet.
- Fill out the Survey Data sheet as completely as possible. The thermometers are used for both air and water temperature. Even if the weather prevents you from doing the survey, please fill out the survey sheet with all possible information and explain why the survey could not be completed.
- To survey the horseshoe crabs, you will start at one end of a section of beach, walk to the other end, and along the way place quadrats to count horseshoe crabs.
- Flip a coin to decide which end of the beach section you will start: if heads, start at the south or west end of the beach, depending on the orientation of the beach; if tails, start at the north or east end of the beach. Fill that information out on the SURVEY START POINT line of the Beach Site Sheet.
- Go to the end of the survey beach to begin depending on the results of the coin toss. This site will be either marked by a pole or described to the team members before the surveys. Specific instructions will be provided for each particular beach.
- As you walk to the starting location, find a stick (or use a flag stick) that you can use to determine high tide. When you get to the starting location, push the stick into 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 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.

Beaches Less than 100m in Length

(This can also be done for beaches up to 200m in length)

Survey Protocol #1: Strip Transects with 5m blocks specific to Cape Cod (modified from Delaware Bay protocol)

- You will be surveying in groups with usually 3 people. A survey protocol diagram (below) illustrates the placement of quadrats. You will be recording the number of horseshoe crabs within EACH 5m quadrat or block of beach. It is important to record each block so the distribution of the crabs on the beach can be known.



- 1) **Flip a coin** to decide which end of the designated beach length to start sampling.
- 2) **Choose 1 random number between 0 and 10 from the random number table.** This number is the random start point (in meters) where the **1st quadrat begins** within the first 10 meters of beach. Pace to the location of the 1st quadrat (calculating the paces you take by multiplying your paces per meter by the random number chosen). All remain quadrats immediately adjacent to each other. *We are only choosing 1 random starting location.*
- 3) Begin sampling just as the water begins to recede from peak high tide – use a stick to determine this time.
- 4) The quadrat size is 5 x 5 meters in area. The **first quadrat begins at the toe of your last step.** You place one of the end stakes in the sand at the water line (high tide line for the first quadrat). One person then walks out into the water perpendicular to the shore line 5 meters and places the middle stake in the sand. He or she then walks parallel with the shoreline to place the third stake in the sand (*making sure to form a 90 degree angle as best as possible*). This forms half of the square where the horseshoe crabs will be sampled. Follow the last stake back to the shoreline to imagine where the square ends. The third person or recorder will stand where a fourth stake would be in order to visualize a complete square. Mark the spot in the sand where the fourth stake would go with your foot.

- 5) One person is recording the information on the survey sheet, one is in the quadrat counting crabs, the third person (if available) is assisting with male/female identification, the placement of stakes, and is standing at the position of where the fourth stake would be at the water's edge.
- 6) First count the number of males then the number of females in the quadrat.
- 7) For every quadrat count the number of **single** horseshoe crabs (single individuals), the number of **doubles or pairs** (ONE female with ONE male clasped on), and the number of **satellites** (males surrounding females which are not attached to her but trying to dislodge the clasped male).
- 8) Record all data on the Tally Sheet specific for your beach. Be sure to record the number of crabs in EACH quadrat or 5m block. If there are no crabs in the quadrat record a zero (0).
- 9) Once you are done with the count at a given quadrat, pull up the stakes and mark out the next adjacent quadrat. **The edge of the quadrat closest to land will line up with the receding water's edge as you work down to the other end of the site.** Repeat the quadrat setup and record the counts. Continue until you have sampled the entire beach section.
- 10) Fill out the Beach Site Sheet as appropriate.

Counting Horseshoe Crabs

- Once the quadrat is in place try not to move it again until you are done counting.
- You will count all the horseshoe crabs 'in the quadrat'. A horseshoe crab is considered 'in the quadrat' if **more than half of its body is inside the quadrat.**
- When there are numerous animals, you may have to lift some up to assure you've counted all of those underneath. Heavy work gloves are useful for this. 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.***
- 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 crowding on top of females. There also tends to be more males than females.
- Report your count of pairs, satellites, and singles and tally by total number of males & females to the recorder who will record the information for each quadrat (see data sheet). If the recorder is working with another observer, keep the tally in your head until the recorder can record quadrat counts for you. Don't pick up the quadrat and move to the next quadrat location until you know the recorder has recorded all the information for your present quadrat.
- If there are horseshoe crabs outside the quadrats keep a tally of the total number that are observed outside, place this number on the TOTAL # CRABS OUTSIDE space. This means all crabs that you can see, regardless how deep the water. Try to record the number of crabs by pairs, satellites, and singles. This information is used to estimate population size on the spawning beach.
- If you see a horseshoe crab with a tag, record the tag number and color of the tag. Tags are attached to the right rear point (although some animals were tagged on the left point). Record the tag numbers in the TAG #'S OF TAGGED CRABS space. DO NOT remove the TAG.

- Report zero (0) when there are no horseshoe crabs within the quadrat. Do not move the quadrat from the preselected quadrat location to include nearby animals. Empty quadrats are just as important as those with horseshoe crabs because they will help reflect changes in the population.

Once you are done surveying

- Record the time in the space marked END OF SURVEY on the Beach Site Sheet.
Return all of the original data sheets to your survey coordinator:

Massachusetts Audubon: _____

Massachusetts Department of Marine Fisheries _____

US Fish & Wildlife Service: _____

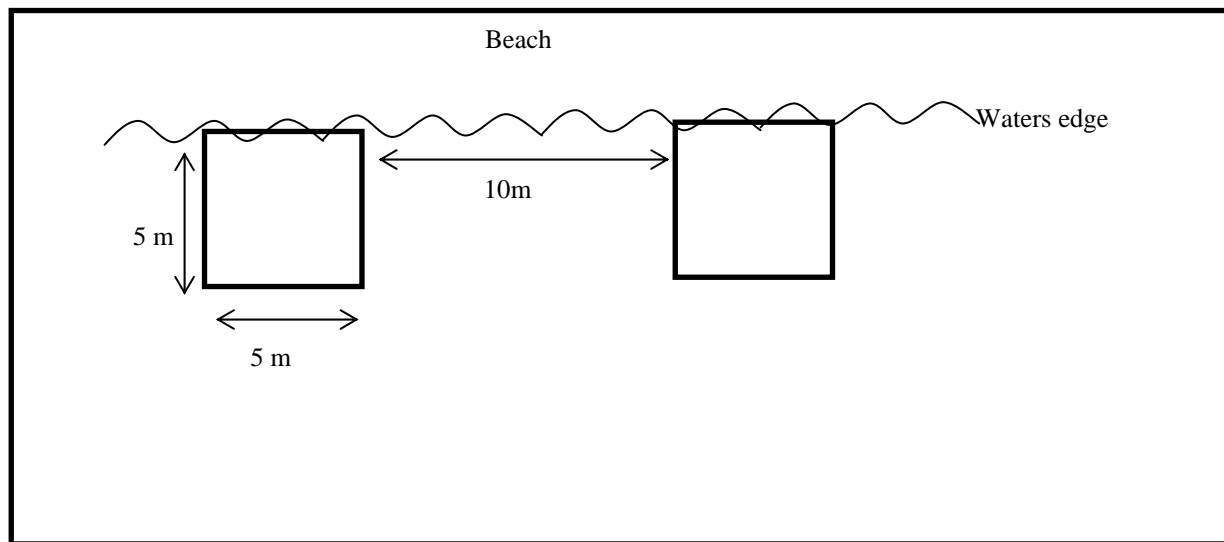
University of Rhode Island: _____

Other _____

Beaches Greater than 100m to 200m in Length

Survey Protocol #2: Placing the Quadrats with 10m intervals – specific to Cape Cod (modified from Delaware Bay protocol)

- You will be surveying in groups with usually 3 people. A survey protocol diagram (below) illustrates the placement of quadrats.



- 1) **Flip a coin** to decide which end of the designated beach length to start sampling.
- 2) **Choose 1 random number between 0 and 10 from the random number table.** This number is the random start point (in meters) where the 1st quadrat begins within the first 10 meters of beach. Pace to the location of the 1st quadrat (calculating the paces you take by multiplying your paces per meter by the random number chosen). All remain quadrats will be placed 10 meters apart. *We are only choosing 1 random starting location.*
- 3) Begin sampling just as the water begins to recede from peak high tide – use a stick to determine this time.
- 4) The quadrat size is 5 x 5 meters in area. The **first quadrat begins at the toe of your last step.** You place one of the end stakes in the sand at the water line (high tide line for the first quadrat). One person then walks out into the water perpendicular to the shore line 5 meters and places the middle stake in the sand. He or she then walks parallel with the shoreline to place the third stake in the sand (*making sure to form a 90 degree angle as best as possible*). This forms half of the square where the horseshoe crabs will be sampled. Follow the last stake back to the shoreline to imagine where the square ends. The third person or recorder will stand where a fourth stake would be in order to visualize a complete square. Mark the spot in the sand where the fourth stake would go with your foot.
- 5) One person is recording, one is in the quadrat counting, the third person is assisting with male/female identification, the placement of stakes, and is standing at the position of where the fourth stake would be at the water's edge.

- 6) First count the number of males then the number of females in the quadrat.
- 7) For every quadrat count the number of **single** horseshoe crabs (single individuals), the number of **doubles** (a female with a male clasped on), and the number of **satellites** (males surrounding females which are not attached to her but trying to dislodge the clasped male).
- 8) Record all data on the Tally Sheet specific for your beach.
- 9) Once you are done with the count at a given quadrat, pull up the stakes and stretch out the three stakes to form a 10 m length line to measure the distance to where the next quadrat starts. Measure the 10 m beginning at the spot marked in the sand where the fourth stake would have been. **The edge of the quadrat closest to land will line up with the receding water's edge as you work down to the other end of the site.** Repeat the quadrat setup and record the counts. Continue with 10 meters between quadrats and do as many as are specified for your particular site.
- 10) Fill out the Beach Site Sheet as appropriate.