



June 11, 2023

Dear Dr. Nelson,

Please see my review below of the proposal to list horseshoe crabs as a Special Concern Species in Massachusetts.

For full disclosure I participated in a large-scale horseshoe crab population demographic study on Cape Cod from 1999 to early 2000's and am a co-author in this work which is cited in the proposal – James-Pirri et al. 2005.

Review for factual accuracy:

The contents of this report are accurate. One exception is on page 9: 'Other studies both confirm the 30 percent mortality rate and suggest that horseshoe crabs, dazed from bleeding, wander aimlessly on the seafloor, unresponsive to the tidal rhythms calling them to spawn (James-Pirri, et al., 2005)' has an incorrect citation. The correct citation is Kurz and James-Pirri 2002, though their study reported a 20% mortality rate. The Owings, Chabot, Watson 2019 paper may fit here as well as it also showed behavioral differences especially between control and bled female horseshoe crabs.

Provide any relevant data that may be missing:

There are no missing data to the best of my knowledge.

Provide your opinion as to whether or not the proposed listing has merit:

The proposed listing has merit. The authors present a strong and clear argument for why horseshoe crabs should be given species of special concern listing status in Massachusetts.

The following points support my conclusion:

- Current female:male ratio trends do not support horseshoe crab population stability or sustainability. Recent population surveys cited in the report suggest that the female:male ratios have become notably more disparate since the James-Pirri et al. 2005 study. A decrease in actual number of female animals in conjunction with behavior changes that have been shown to occur within the first one to two weeks post hemolymph collection could have additive negative population impacts, especially in a species that takes a relatively long time to reach reproductive maturity.

- From an animal health perspective, the behaviors of females post bleeding should be monitored and holding pens should be closely evaluated from an animal welfare lens. Ideally there should be transparency by biomedical companies on bleeding mortality rates ideally including sex ratios of mortalities, if these data are not already provided.
- The available scientific evidence suggest that horseshoe crab populations need to be immediately stabilized. A prominent feature of the submitted proposal is a comprehensive list of management measures for increasing horseshoe crab populations.
- Stabilizing and then increasing horseshoe crab populations would improve the sustainability of the harvesting industry and possibly preserve jobs. In the near future, however, the evidence suggests curtailing horseshoe crab harvesting and adopting new harvesting practices to maximize the species' reproductive capacity.
- There was a particular question posed as to the importance of the horseshoe crab as a food item for sea turtles. Loggerhead sea turtles are known to feed on horseshoe crabs and are well adapted to do so; studies in the 1980's in the Chesapeake Bay found horseshoe crabs to be the most abundant food item in loggerhead turtle digestive tracts. Loggerhead turtles need a diverse diet to ensure their health. If horseshoe crab populations continue to decline, loggerhead turtles will lose a nutritious and relatively easy to forage option in their diet.

Please feel free to contact me if you have any questions.

Sincerely,

A handwritten signature in cursive script that reads "Kathryn Tuxbury".

Kathryn Tuxbury, MS, DVM
Senior Veterinarian
ktuxbury@neaq.org