

Update on Status of the Red Knot (*Calidris canutus rufa*) for Atlantic States Marine Fisheries Commission Technical Committees – September 28, 2020.

Amanda D. Dey<sup>1</sup>, Lawrence J. Niles<sup>2</sup>, Stephanie Feigin<sup>3</sup>, Theodore Diehl<sup>1</sup>, Michael Pellew<sup>4</sup>

<sup>1</sup> *New Jersey Department of Environmental Protection, Division of Fish and Wildlife, Endangered and Nongame Species Program, 501 E. State St., PO Box 420, Trenton, NJ 08625*

<sup>2</sup> *109 Market Lane, Greenwich, NJ 08323*

<sup>3</sup> *8 West View Drive, Flemington, NJ 08822*

<sup>4</sup> *American Littoral Society, 18 Hartshorne Drive, Suite 1, Highlands, NJ 07732*

Findings:

- **Tierra del Fuego winter count** - The abundance of red knots, on the main wintering area in Tierra del Fuego, has followed a trajectory of overall decline: rapid decline 2000 to 2005 (51,255 to 17,653), a period of apparent stability 2006-2009 (17,211 – 17,780) and subsequent decline 2010 – 2020 (15,512 – 11,895), (Figure 1).
- **Delaware Bay Peak Count** - Peak stopover abundance of red knots in Delaware Bay (aerial/ground counts) had been low and stable for much of the last decade, 2009 to 2016 (24,000 to 21,128); (Figure 1). Peak abundance declined in 2017 (17,969); resightings of marked red knots (NY, MA) indicate some birds left the Bay early to seek food elsewhere due to low egg resources. This departure was seen in estimates of time-specific stopover population size by Lyons (2017). In 2018 and 2019, peak numbers of red knots were higher (32,930 and 30,880, respectively) as more birds remained in the bay to take advantage of surface eggs more widely available through the stopover period. In 2020, red knot peak abundance declined, (19,397 on May 24). By May 26, both red knot and ruddy turnstone numbers fell by 70 and 40 percent, respectively, indicating an early departure presumably due to low egg resources; (Table 1). An early tropical storm (Arthur) contributed to cool water temperatures (Figure 2) and delayed egg resource availability until late May; (May 24-30), (Figure 3 a. & b.). Aerial and ground survey does not account for turnover; (the total number of knots moving through Delaware Bay stopover, May 1 to June 7).
- **Red Knot Weight** – Red knot weights are statistically linked to Horseshoe Crab surface egg density (eggs/m<sup>2</sup> in top 5 cm of sand). Sufficient weight gain on Delaware Bay is statistically linked to adult survival (Baker et al. 1994) and Arctic productivity, (Duijns et al. 2017).
- **Horseshoe crab egg resources** – Surface egg density (eggs/m<sup>2</sup> in top 5 cm of sand) have not shown substantive or sustained increases over the 20-year survey period (2000 to 2020, Figure 4) and remain well below historic densities observed prior to crab overharvest; (~45,000 eggs/m<sup>2</sup> in 1991); (Botton et al. 1994). The lack of increase in egg resources is consistent with a lack of substantive and sustained increases in mature female horseshoe crabs over the same period (Virginia Tech Benthic Trawl Survey Report; Bi et al. 2020). We estimate 50,000 eggs/m<sup>2</sup> on 50 percent of suitable spawning beaches is the minimum necessary to begin red knot recovery (Niles et al. 2009).

- The proportion of red knots reaching 180 grams (P180) at time of normal departure (May 26-28) – P180 is useful as an index of foraging conditions (Figure 5). In 2018 and 2019, the proportion of red knots reaching  $\geq 180$  grams were 0.46 and 0.43, respectively, up from 0.28 in 2017. In 2020, P180 declined to 0.35. Since 2005, P180 has varied widely and has not shown substantive or sustained improvement. In 1997 and 1998, when shorebird studies began, the stopover population was larger, and a majority of red knots departed with sufficient weight. We estimate a P180 of 0.80, achieved year-on-year, is necessary to restore and maintain a recovered red knot population (80,000 individuals). We wish to note that Mispillion Harbor capture data are not included in P180 estimates. Lower-weight birds tend to be captured in Mispillion Harbor, versus other sites in DE and NJ, and thus reduce the estimate. In 2020, no red knots were captured in Delaware due to Covid-19 restrictions. Mispillion Harbor remains a highly important, protected foraging area in the Delaware Bay.

### Red Knot Trend:

Peak Counts in Delaware Bay (NJ & DE) – Aerial and Ground 1986 – 2020

Winter Counts in Tierra del Fuego, Chile – Aerial Count 1986, 2000 – 2020

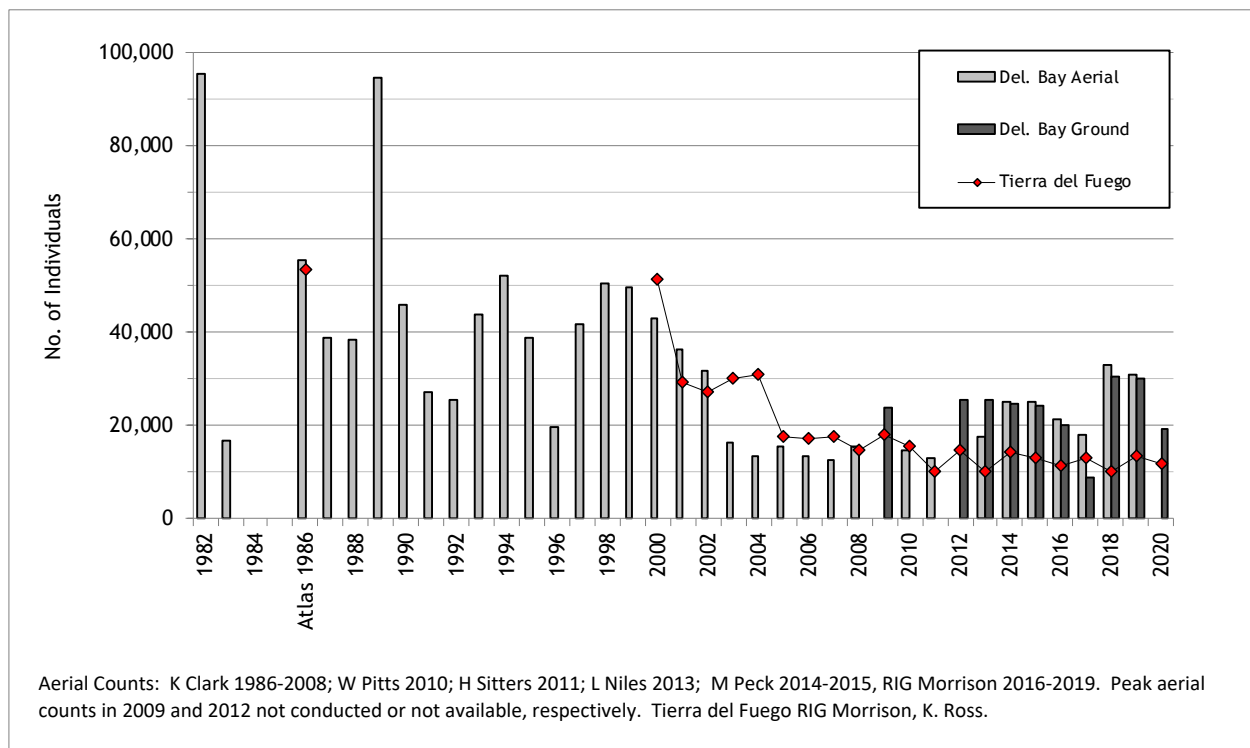


Figure 1. Peak aerial count of Red Knots in Delaware Bay during spring stopover, 1982-2020; aerial count from Tierra del Fuego (major wintering area) are included for comparison, 1986-2020. Delaware Bay aerial counts in 1982-1983 were conducted by New Jersey Audubon; no aerial counts were conducted in 1984-1985. Aerial counts from 1986-present were conducted by New Jersey Division of Fish & Wildlife, Delaware Division of Fish & Wildlife and various individuals after 2008, (see above). Aerial counts of in 2009 and 2012 were not conducted or

not available, respectively; peak values for these years are from ground counts. Beginning in 2009 with a change of long-term observers, ground and boat counts were conducted simultaneously with aerial survey to help validate aerial abundances, particularly in Mispillion Harbor, DE, where birds can be missed by aerial observers, and Egg Island, NJ, where large numbers of birds stage and may be undercounted. Ground surveys are presented for years when comprehensive ground/boat surveys were conducted in NJ and DE. Source: Atlas 1986, Morrison, R. I. G. and R. K. Ross. 1989. Atlas of Nearctic shorebirds on the coast of South America. 2 vols. Special Publication, Canadian Wildlife Service, Ottawa, Ontario. 325 pp.

Table 1. 2020 Peak abundance of red knot and ruddy turnstone in Delaware Bay (NJ & DE) from ground and boat survey (no aerial count due to Covid-19).

May 24, 2020	Red Knot	Ruddy Turnstone
NJ	18,104	19,705
DE	1,293	4,117
<b>Total</b>	<b>19,397</b>	<b>23,822</b>

May 26, 2020		
NJ	5,441	11,303
DE	632	3,140
<b>Total</b>	<b>6,073</b>	<b>14,443</b>

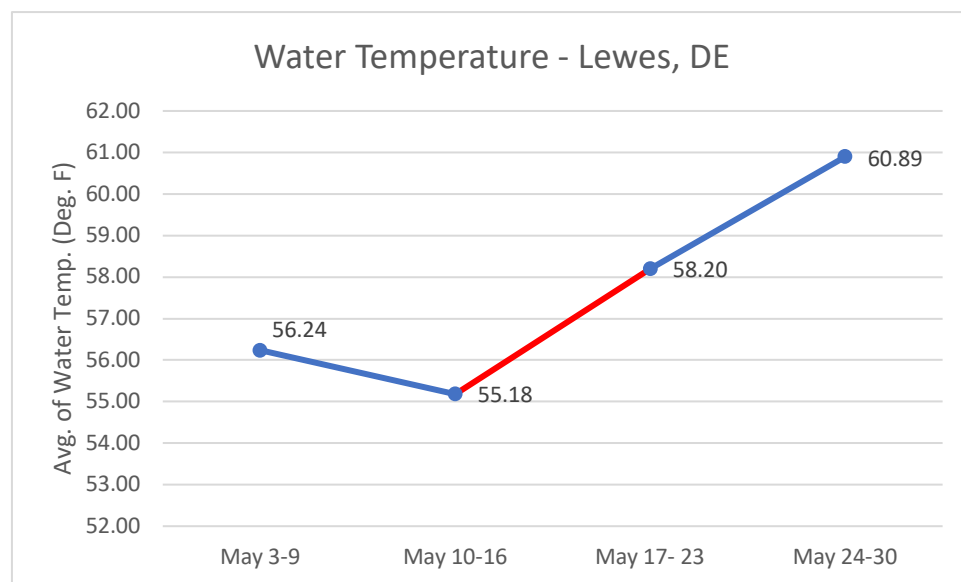
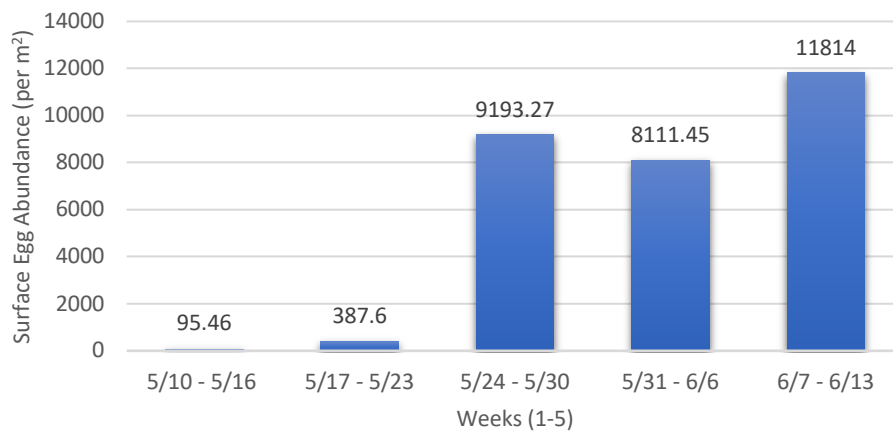


Figure 2 – Average of hourly water temperatures by week; Lewes, DE Buoy (8557380). Source: <https://tidesandcurrents.noaa.gov/>

**Fig. 3a. Average Number of Surface Eggs Per Square Meter by Week (2020)**



**Fig. 3b. Average Number of Clusters Per Square Meter By Week (2020)**

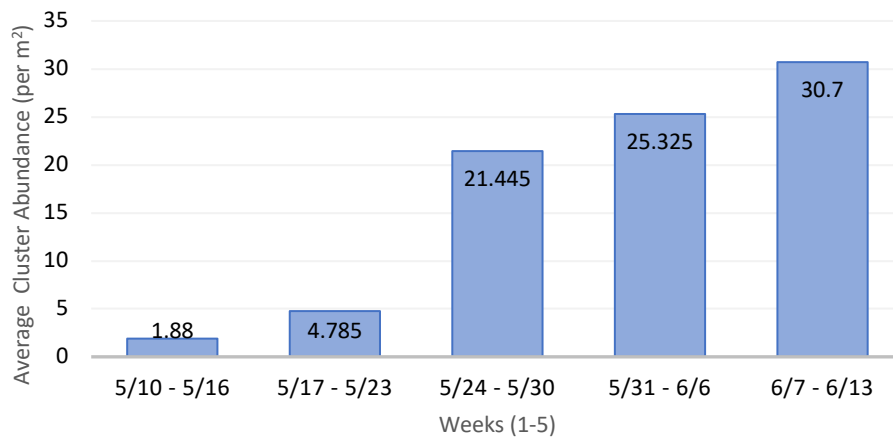


Figure 3 a. & b. Horseshoe Crab Egg Resources by Week, 2020 – surface eggs and buried egg clusters

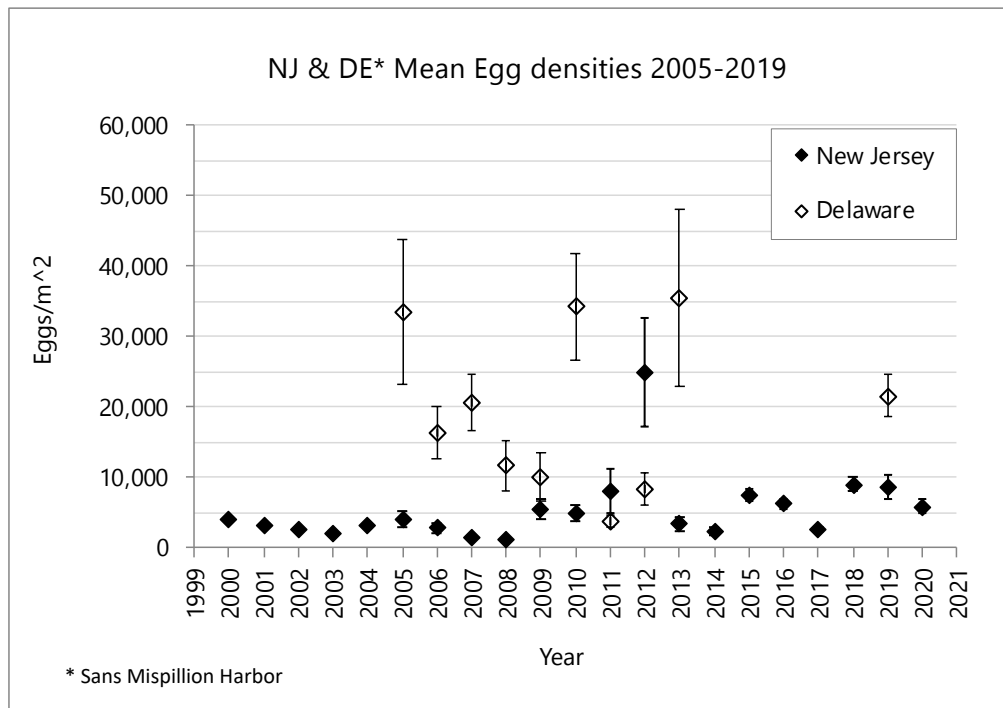


Figure 4. Surface egg densities on New Jersey & Delaware beaches. NJ & DE DFW unpublished data 2000-2020.

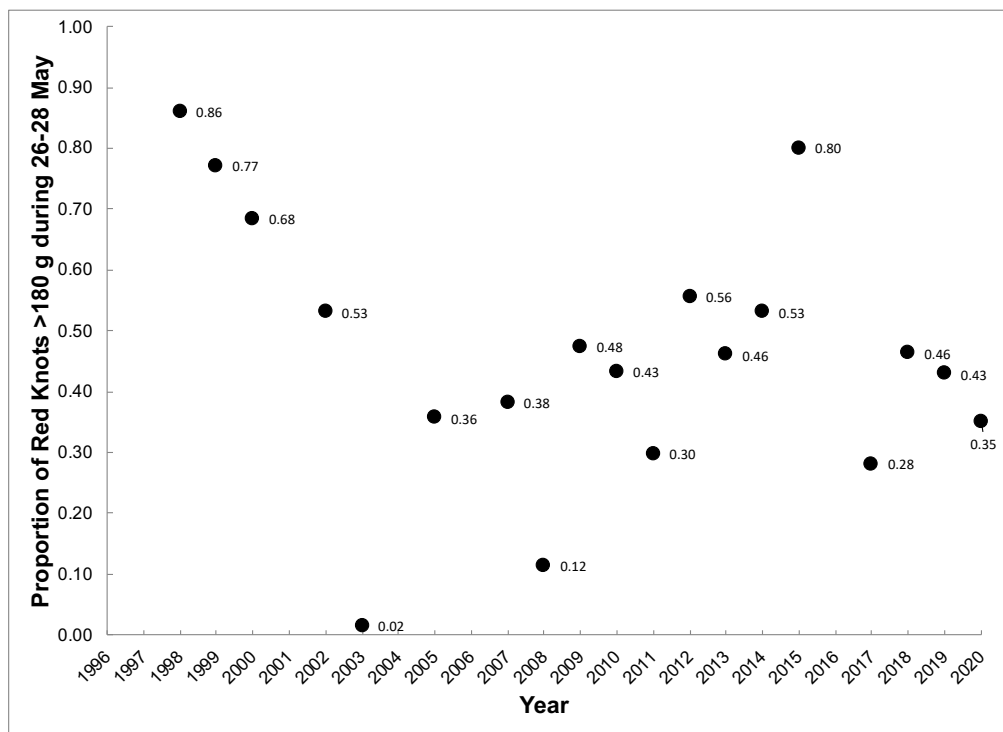


Figure 5. The proportion of red knots reaching  $\geq 180$  grams (P180) at time of departure from Delaware Bay (May 26-28) excluding capture data from Mispillion Harbor, DE. Note: in 2020 there were no captures in Delaware due to Covid-19.

Literature Cited:

- Baker, A.J., P.M. González, T. Piersma, L.J. Niles, I. de Lima Serrano do Nascimento, P.W. Atkinson, N.A. Clark, C.D.T. Minton, M.K. Peck & G. Aarts. 2004. Rapid population decline in Red Knots: fitness consequences of decreased refueling rates and late arrival in Delaware Bay. *Proc. R. Soc. Lond. B.* 271: 875–882.
- Botton, M. L., R. E. Loveland, and T. R. Jacobsen. 1994. Site selection by migratory shorebirds in Delaware Bay, and its relationship to beach characteristics and abundance of horseshoe crab (*Limulus polyphemus*) eggs. *The Auk.* 111(3):605-616.
- Duijns, S. et al. 2017. Body condition explains migratory performance of a long-distance migrant. *Proc. R. Soc. B* 284: 20171374. <http://dx.doi.org/10.1098/rspb.2017.1374>.
- Bi, R., D. Hata, & E. Hallerman. 2012. Results of the 2019 Horseshoe Crab Trawl Survey: Draft report to the Atlantic States Marine Fisheries Commission Horseshoe Crab and Delaware Bay Ecosystem Technical Committees. August 27, 2020. Virginia Polytechnic Institute, Blacksburg, VA. 28 pp.
- Niles, L.J., J. Bart, H. P. Sitters, A.D. Dey, K.E. Clark, P. W. Atkinson, A.J. Baker, K.A. Bennett, K. S. Kalasz, N. A. Clark, J. Clark, S. Gillings, A. S. Gates, P. M. Gonzalez, D. E. Hernandez, C. D. T. Minton, R. I. G. Morrison, R. R. Porter, R. K. Ross, and C. R. Veitch. 2009. Effects of Horseshoe Crab Harvest in Delaware Bay on Red Knots: Are Harvest Restrictions Working? *Bioscience* 59:153-164.