# DREDGE DISPOSAL EFFECTS ON BLUE CRAB
## Report to USACE, Baltimore District

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# 1 Objectives

The U.S. Army Corps of Engineers (Baltimore District) has requested an opinion on (i) how placement of dredge materials from the channel dredging in Chesapeake Bay might affect blue crab survival and abundance, and (ii) alternative sites for dredge materials disposal where blue crab survival and abundance would not be reduced in winter (December-March). To address these two issues, we analyzed data from the blue crab winter dredge survey (WDS) from 2009-2016 in relation to the proposed dredge materials disposal sites at Wolf Trap and Rappahannock Shoal (Figure 1).

# 2 Methods

Blue crab, bathymetry, and sediment type data were derived from the WDS, which samples the blue crab population in wintertime at approximately 1,500 stations annually. The WDS is a cooperative survey between the Virginia Institute of Marine Science and the Maryland Department of Natural Resources. Further details are available at: http://www.vims.edu/research/units/programs/bc_winter_dredge/index.php.

# 3 Assessment of Wolf Trap and Rappahannock Shoal Disposal Sites

First, we evaluated the two disposal sites, Wolf Trap (WT) and Rappahannock Shoal (RS), relative to water depth (Figure 2) and sediment type (Figure 3). The RS site is mostly in 12-13 m water depths and in muddy sediments (Figures 2 and 3). In contrast, the WT site is somewhat deeper at 13-16 m water depths, and is composed of diverse sediments ranging from mud to muddy sand and sand (Figures 2 and 3).

Data from the WDS from 2009-2016 are portrayed in Figures 4-12. [Note that in the figures the densities have been multiplied by a factor of 1000 for clarity.]

At the WT disposal site, in the composite for 2009-2016, female blue crabs were generally very abundant in the southern portion of the WT disposal site, moderately abundant in the northern portion of WT, and less so in the middle section of WT (Figure 4), although the pattern varied across years (Figures 5 to 12). During 2009, 2010 and 2015, the general spatial pattern of crab abundance held (Figures 5, 6 and 11), wheres in other years (2011, 2013 and 2016), crab densities were high throughout WT (Figures 7, 9 and 12). Alternately, in two years (20112 and 2014) highest crab densities were to the northeast of WT, resulting in relatively low densities in WT (Figures 8 and 10). Consequently, it is difficult to predict if crab abundance will be high or low in a given section of WT for an upcoming winter. A risk-averse approach to management dictates that WT is not a suitable site for dredge

materials disposal in the wintertime, if management wishes to prevent significant blue crab mortality.

At the RS disposal site, the pattern differed significantly from that of the WT disposal site. In the composite for 2009-2016, female blue crabs were never abundant throughout the RS disposal site (Figure 4), and the pattern held across years (Figures 5 to 12). High densities of crabs always occurred to the east of the RS disposal site, and were generally low both in the RS disposal site and to the west of RS (Figures 5 to 12). Hence, the RS disposal site is an acceptable disposal site, even under a risk-averse management approach.

# 4 Alternative to Wolf Trap Disposal Site

In the process of evaluating the WT and RS disposal sites, we also evaluated an alternative disposal site in the deeper, muddy channel (WTalt) immediately north of the WT site (Figure 13). In general, crab densities were highest just east of the WTalt site, and low at the WTalt site (Figure 4), except for one year (2011) when crab densities rose throughout the lower bay, including the WTalt site (Figures 5 to 12). It is likely that within the deeper, muddy channel north of the WT site crab density will almost always be low due to the muddy habitat, which is usually avoided as an overwintering habitat by blue crabs. Thus, the WTalt site is suitable as a wintertime disposal site.

# 5 Acknowledgements

We thank Michael Seebo and Alison Smith of VIMS, as well as students in the Marine Conservation Ecology and Community Ecology Programs, for their hard work in the conduct of the blue crab winter dredge survey.

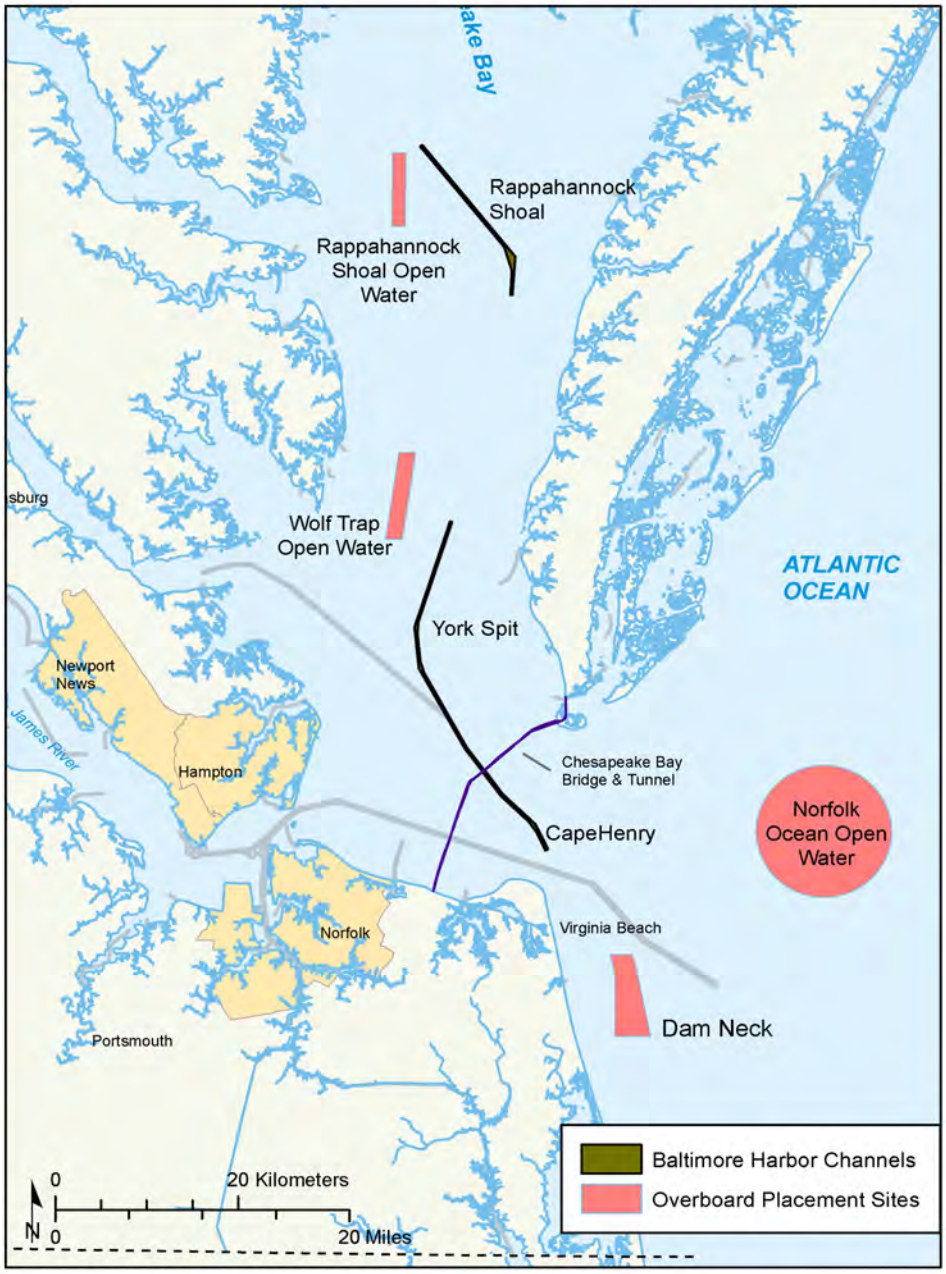


Figure 1: Proposed dredge materials disposal sites by U.S. Army Corps of Engineers, Baltimore District.

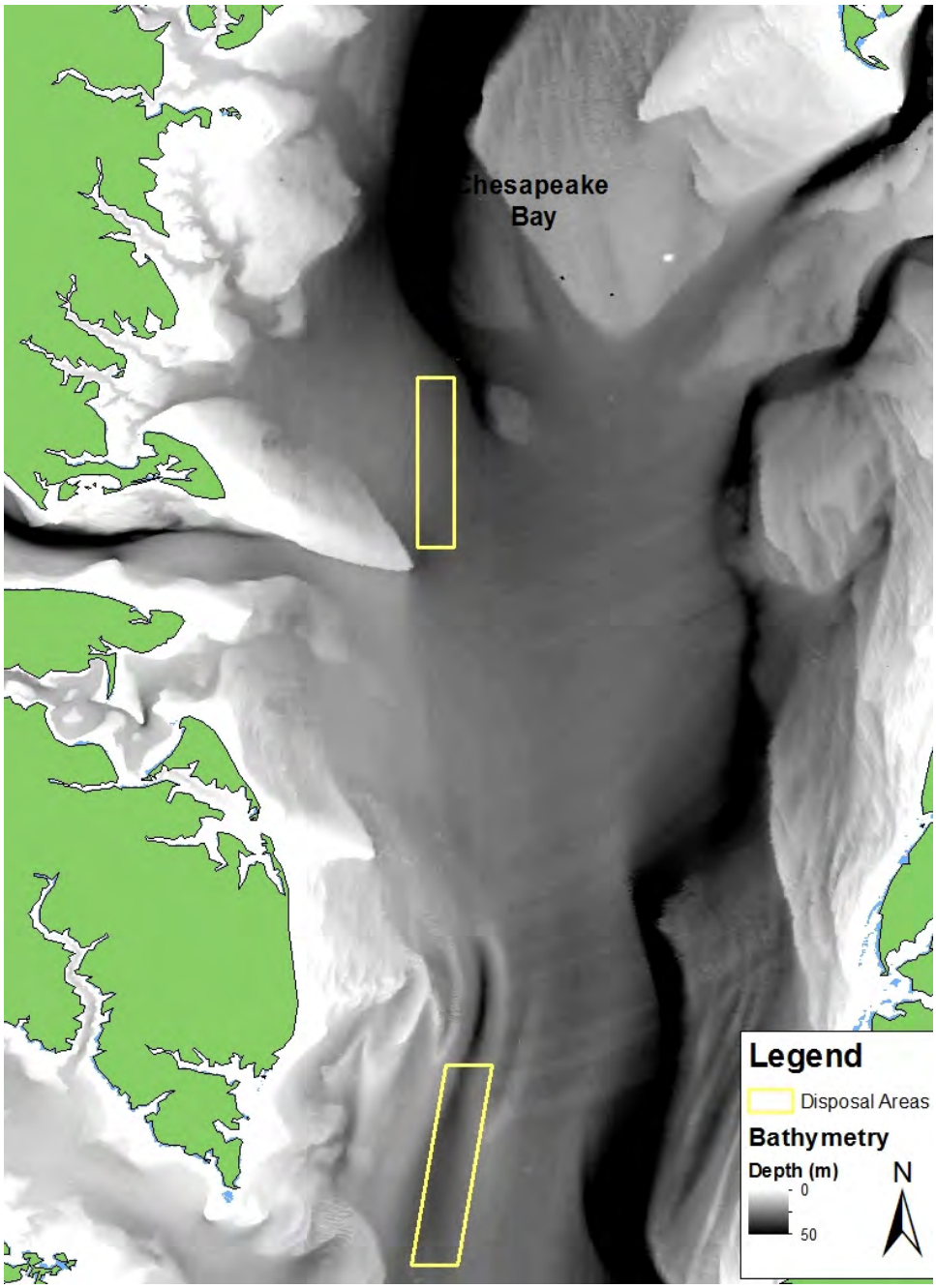


Figure 2: Proposed dredge materials disposal sites relative to bathymetry.

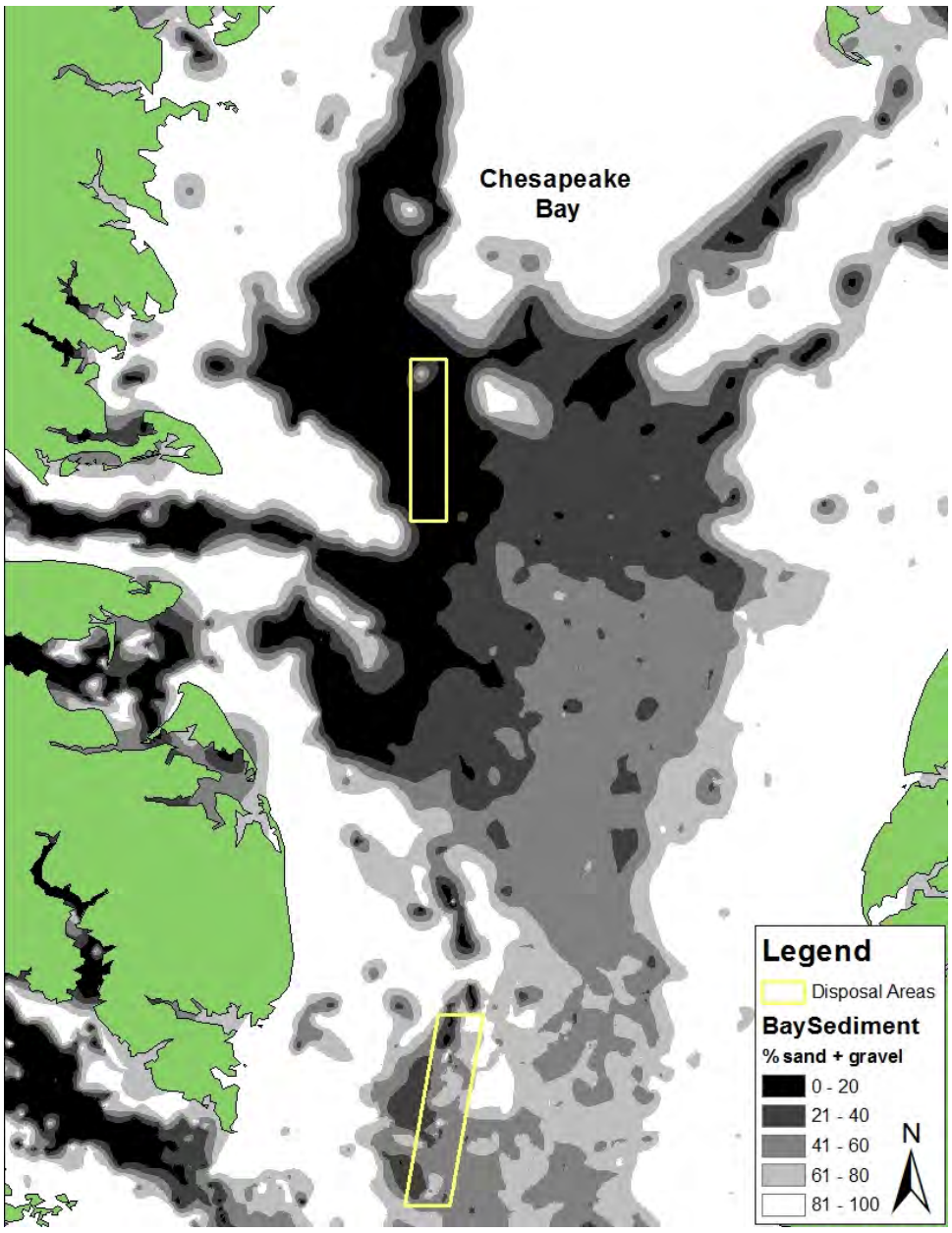


Figure 3: Proposed dredge materials disposal sites relative to sediment type.

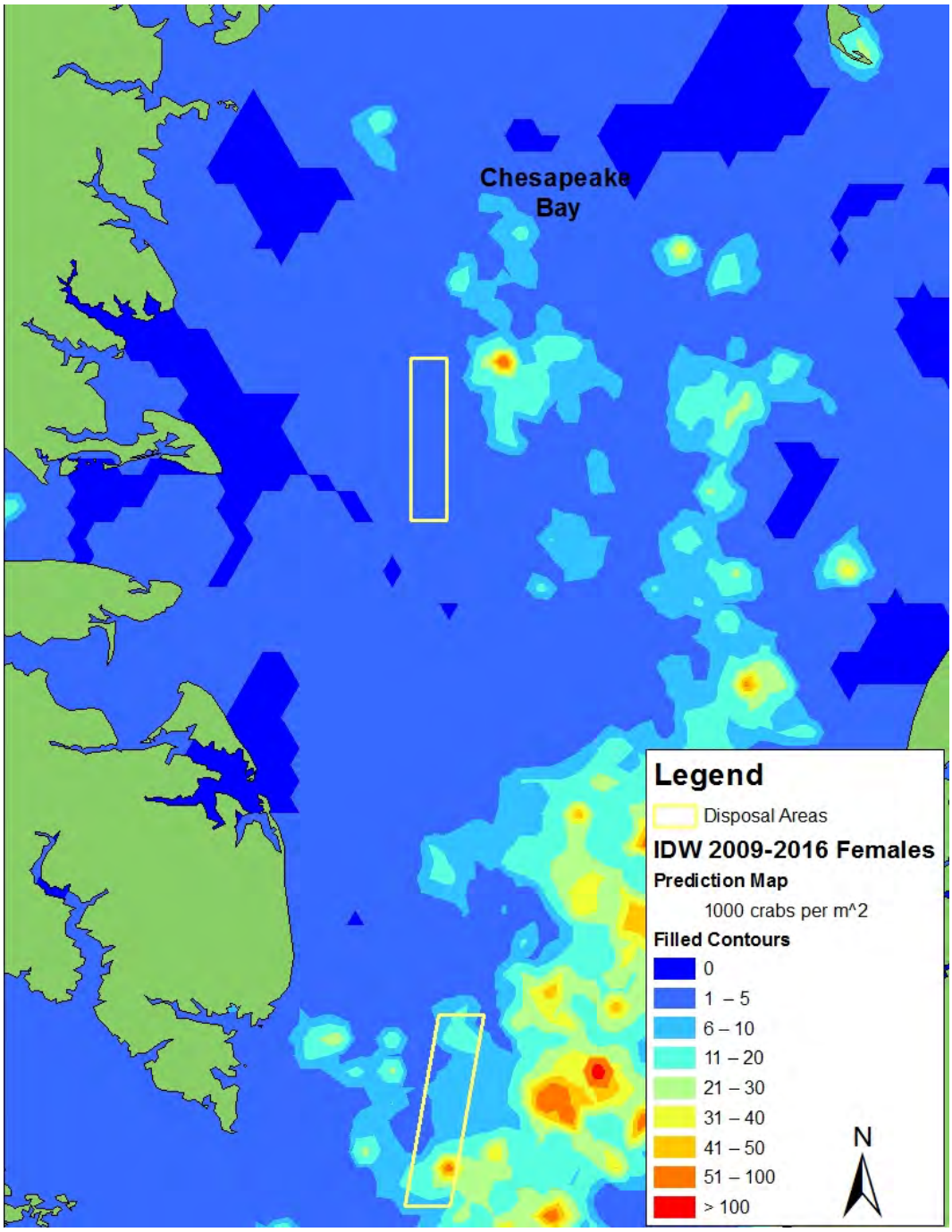


Figure 4: Density of blue crab females as a composite from 2009-2016.

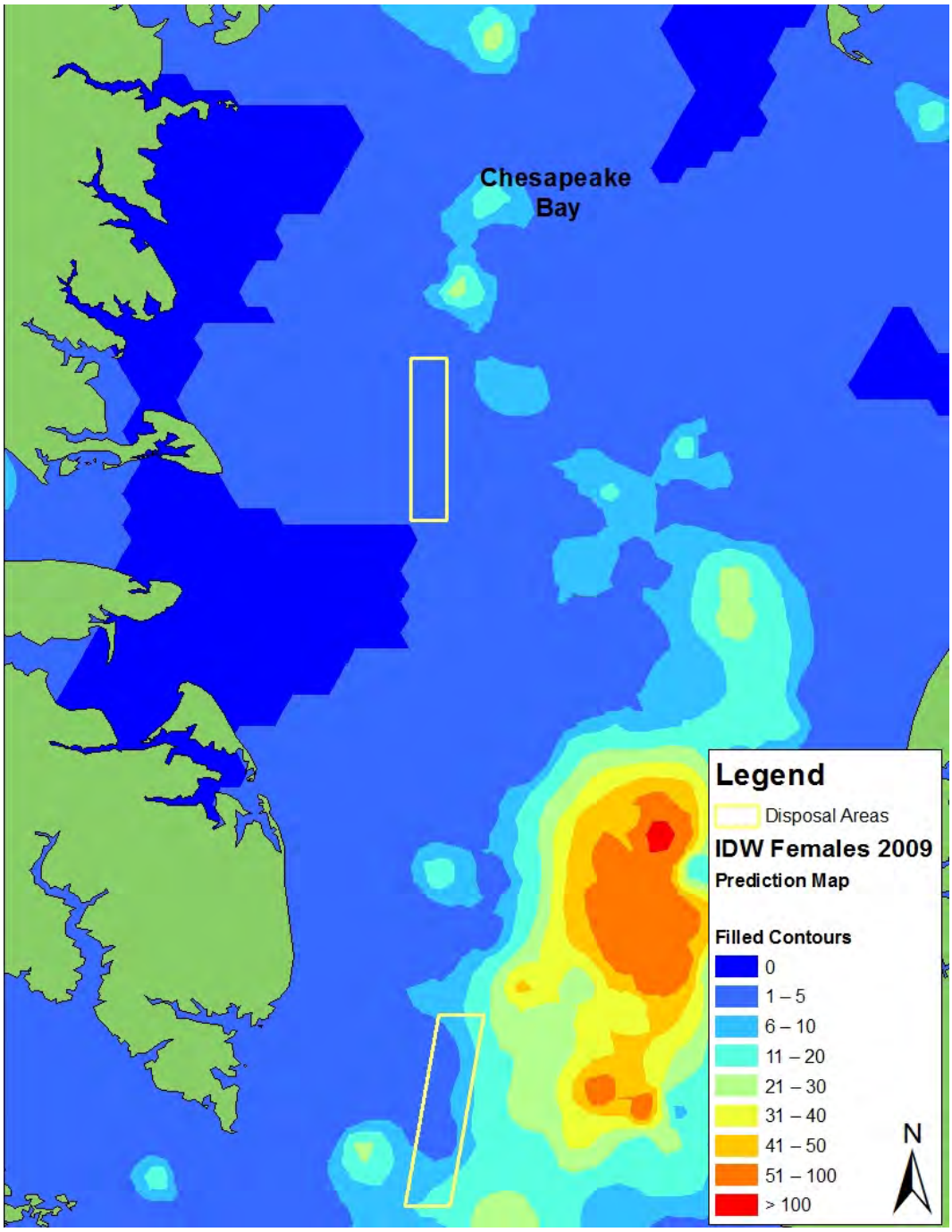


Figure 5: Density of blue crab females in 2009.

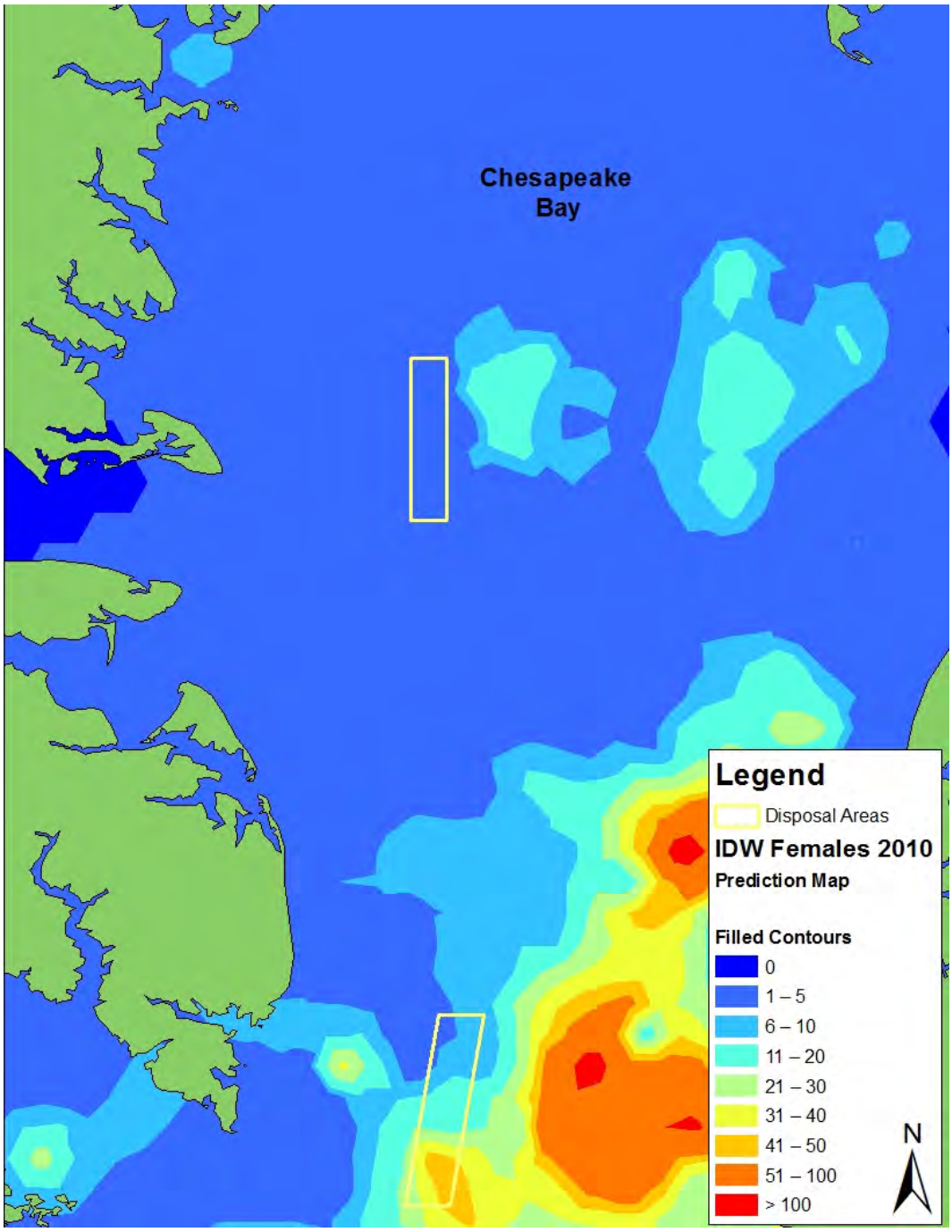


Figure 6: Density of blue crab females in 2010.

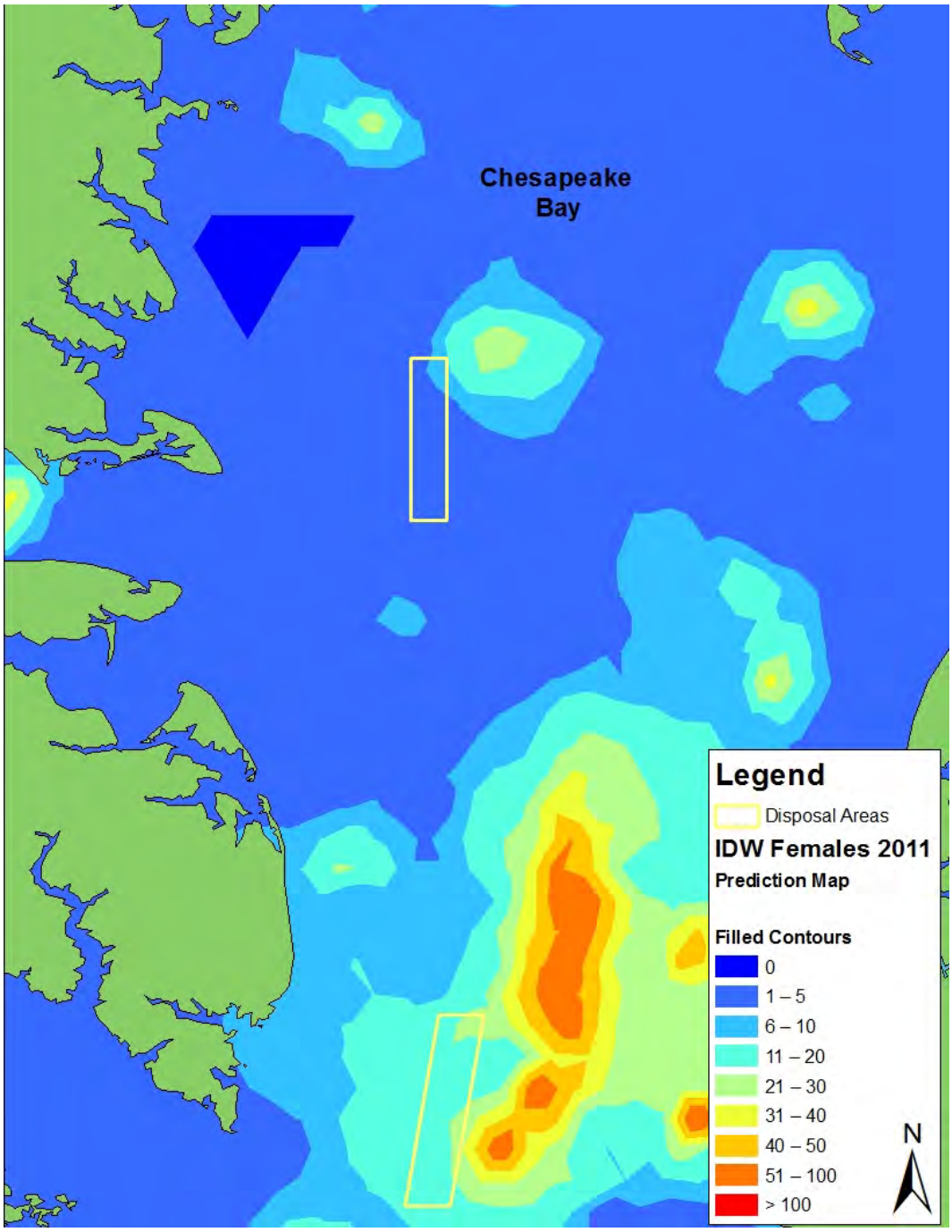


Figure 7: Density of blue crab females in 2011.

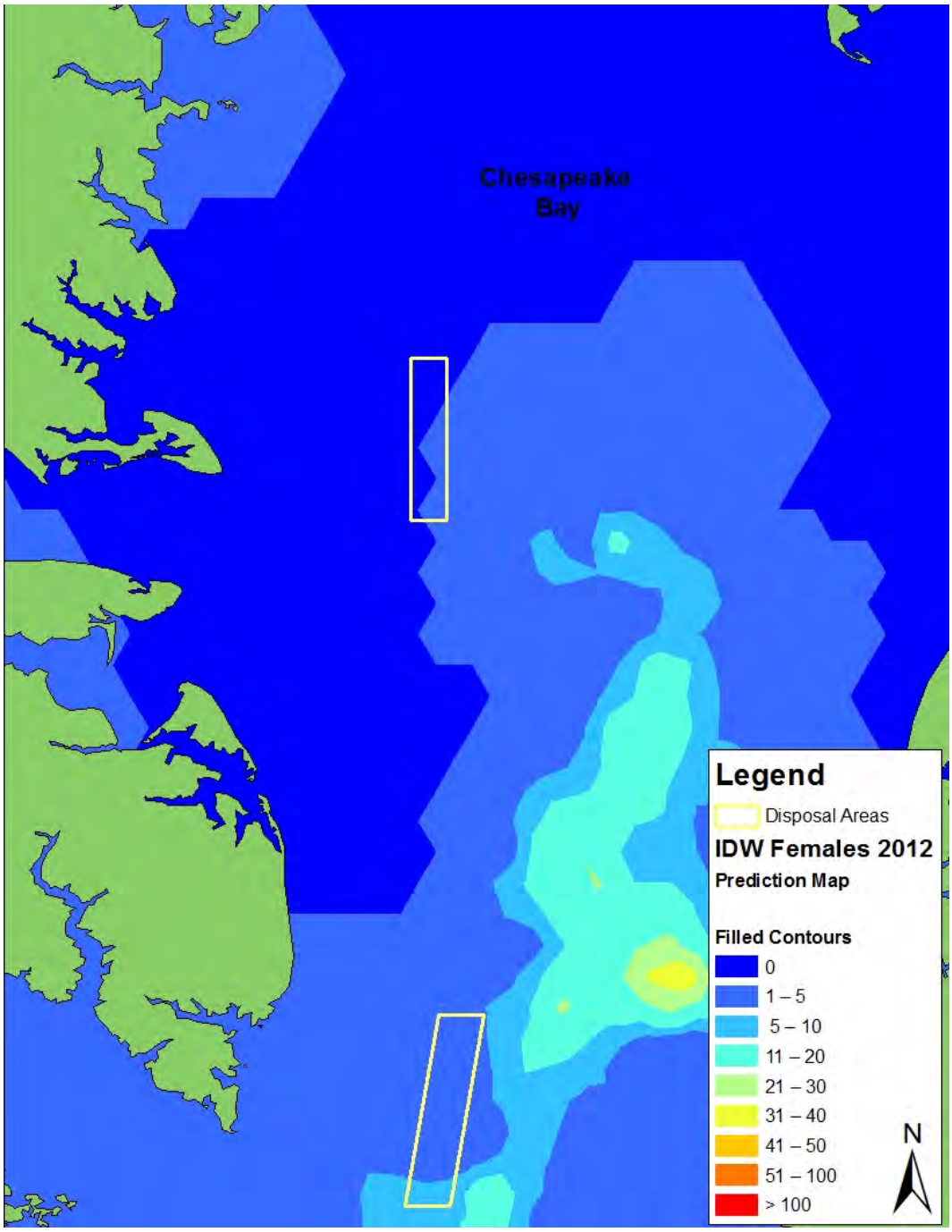


Figure 8: Density of blue crab females in 2012.

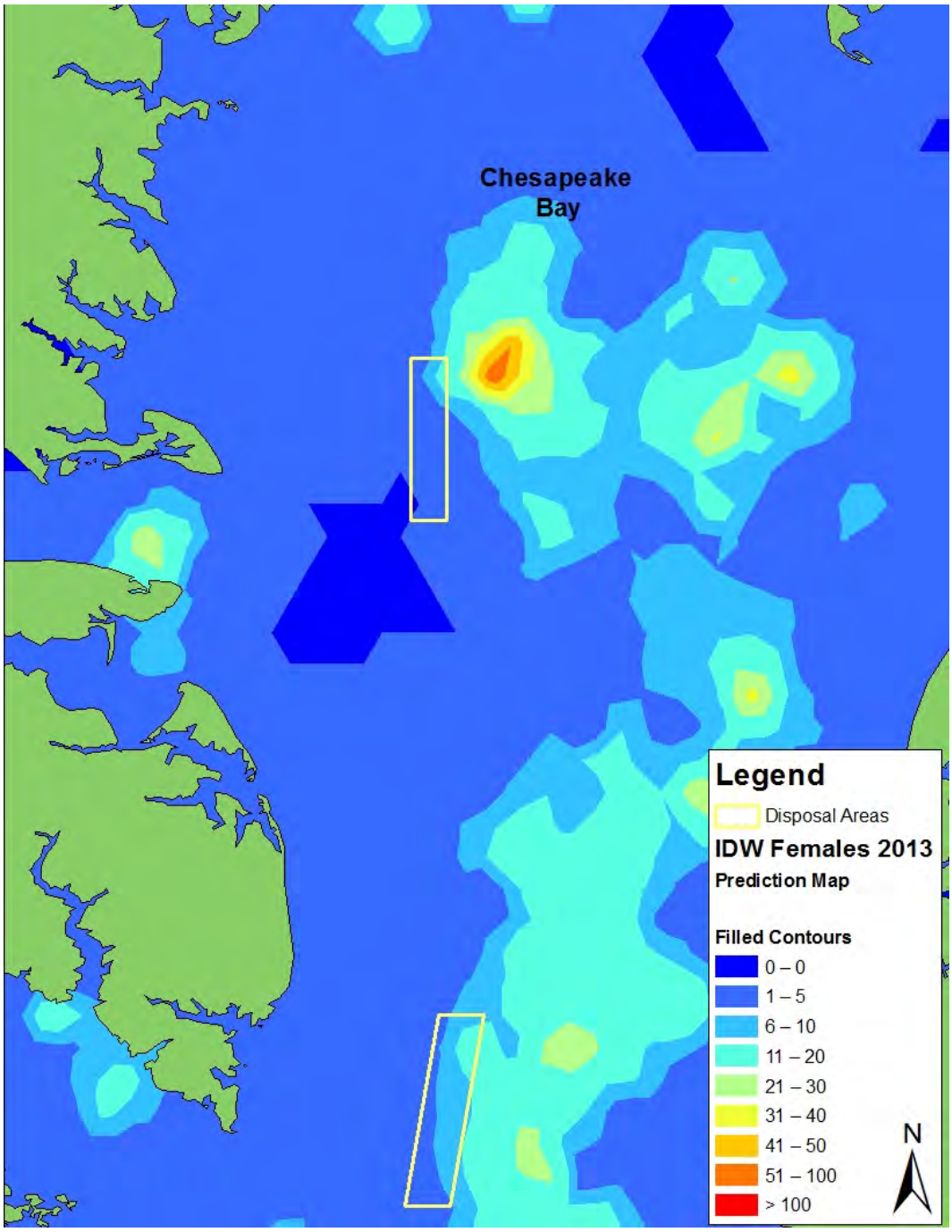


Figure 9: Density of blue crab females in 2013.

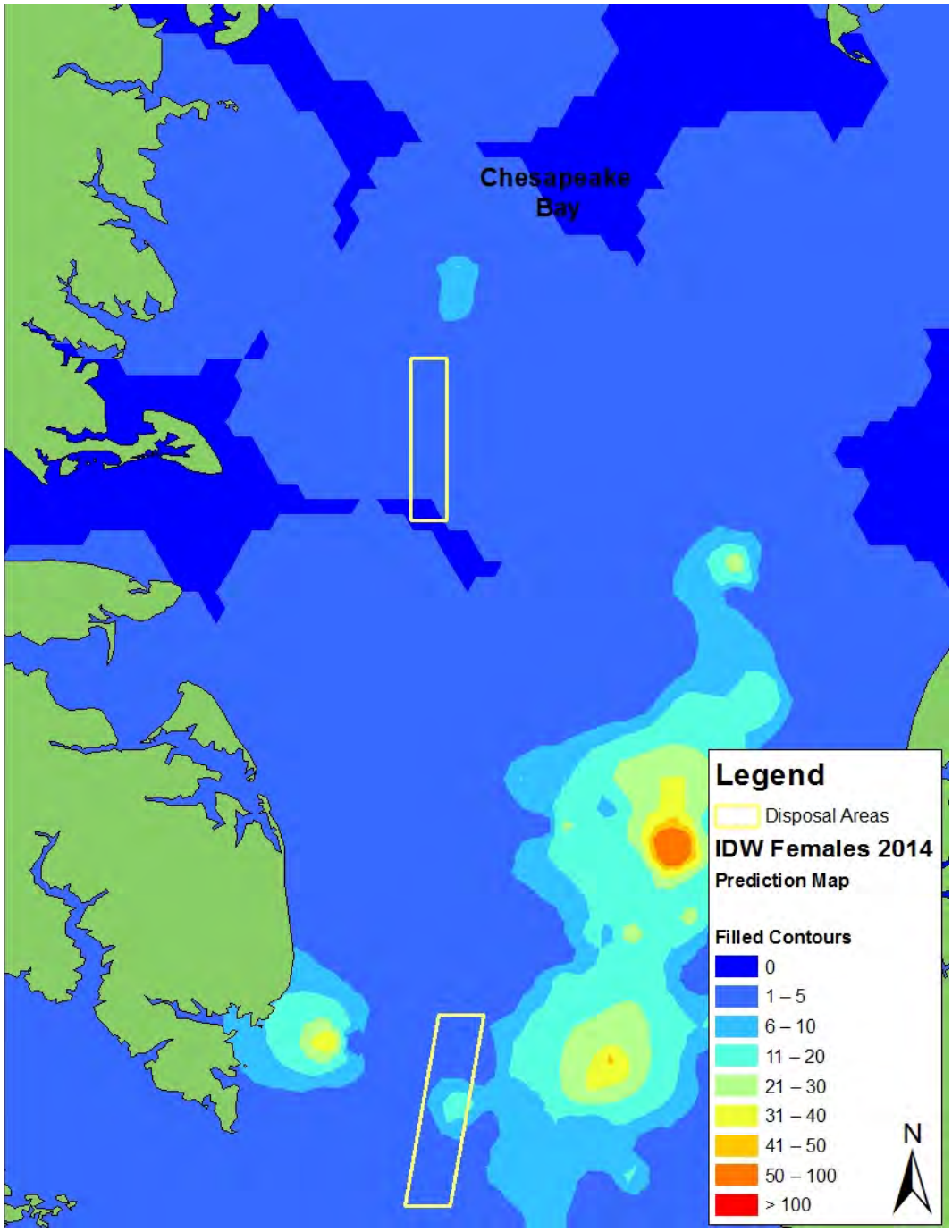


Figure 10: Density of blue crab females in 2014.

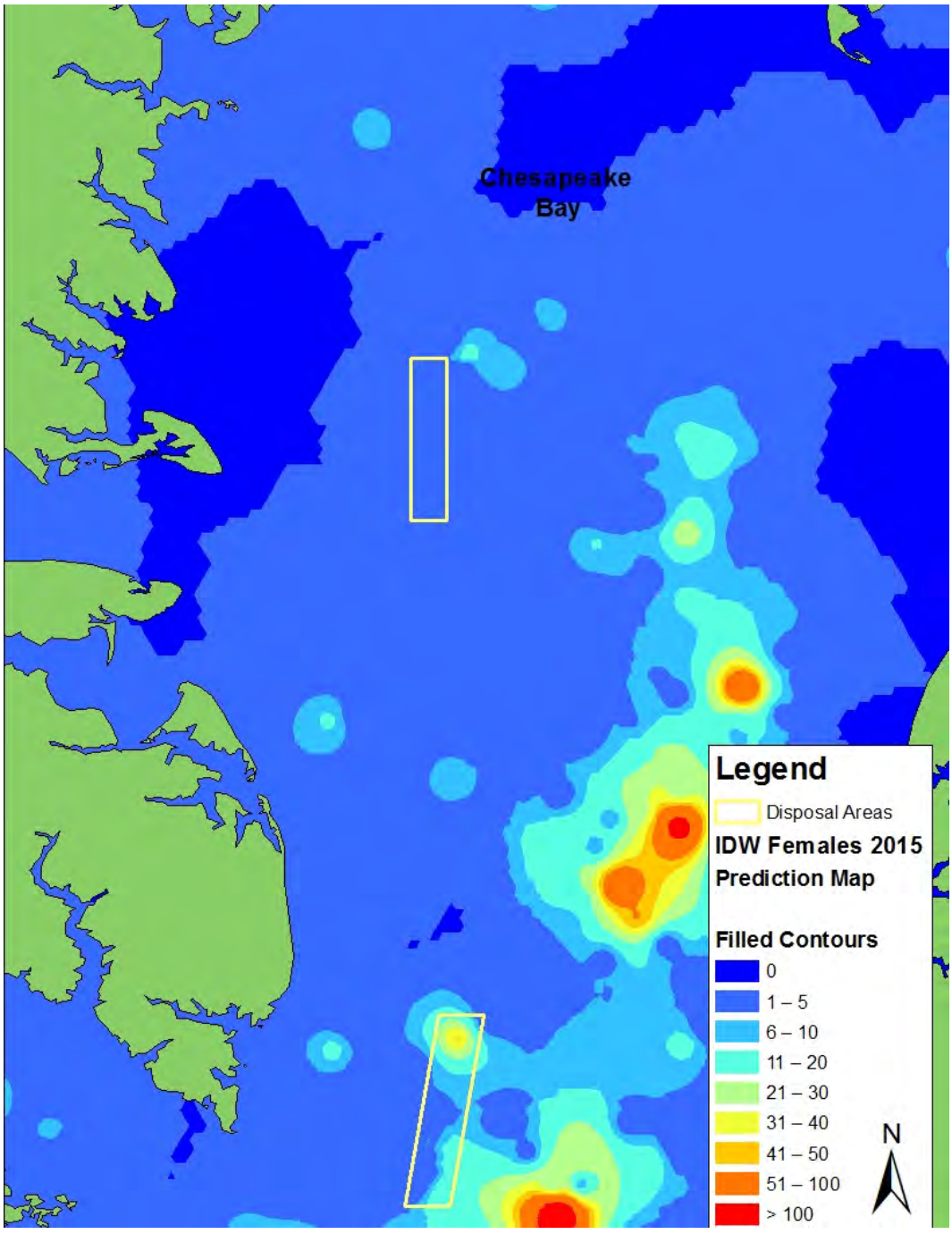


Figure 11: Density of blue crab females in 2015.

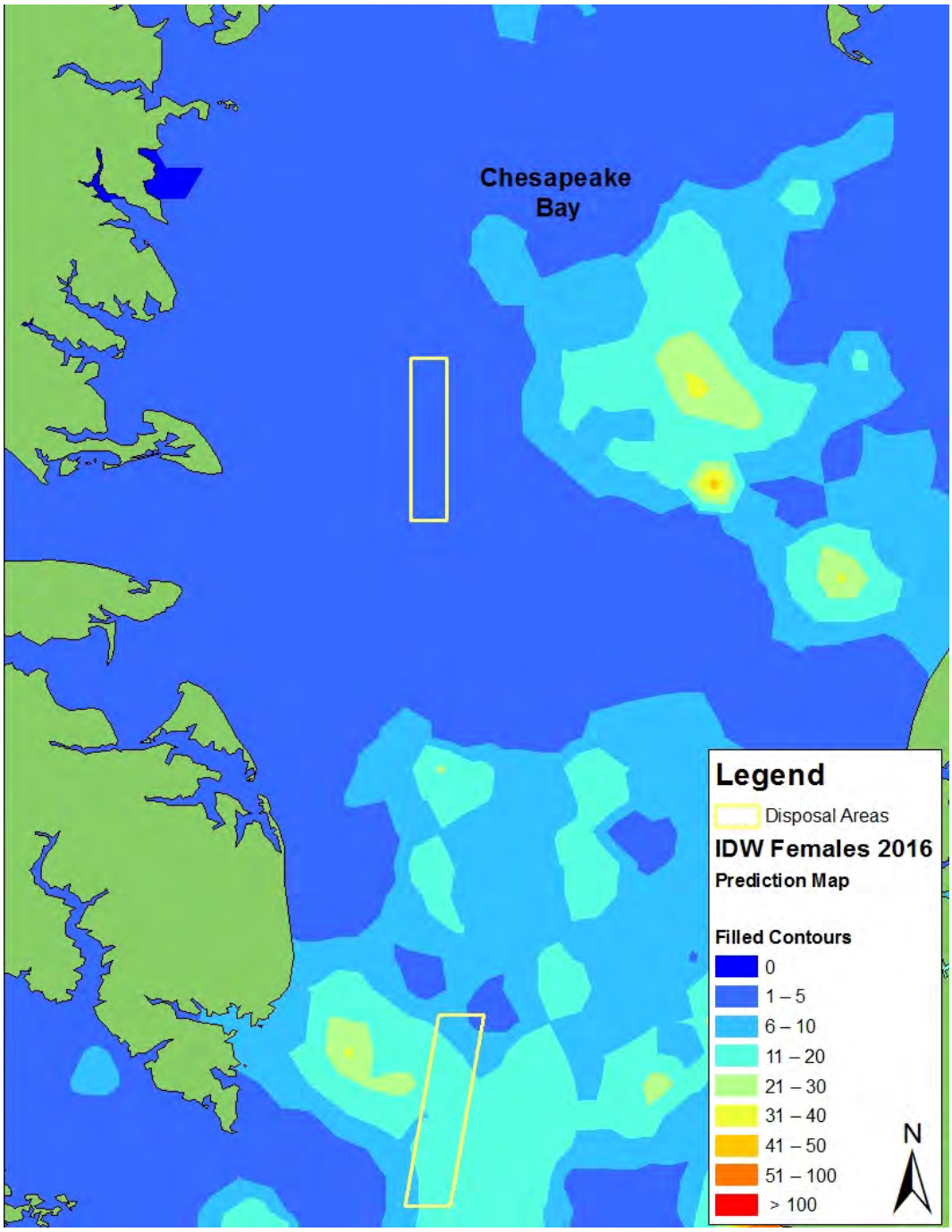


Figure 12: Density of blue crab females in 2016.

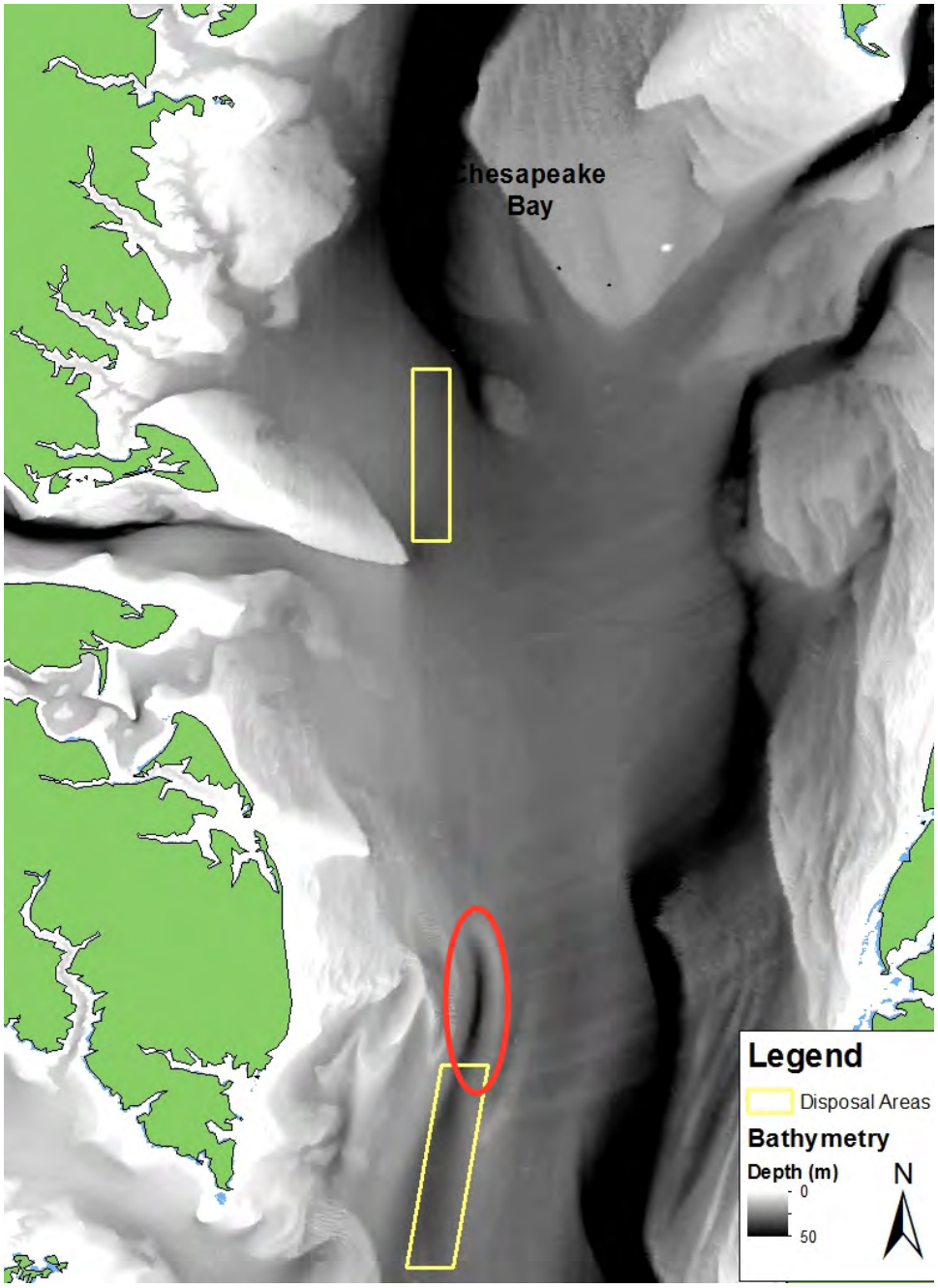


Figure 13: Proposed alternative disposal site (red oval) north of the WT disposal site.