Position Statement on The Negative Effects of Blue Crab Traps / Pots on Diamondback Terrapin Populations and the Use of Bycatch Reduction Devices as a Practical, Inexpensive Solution

Diamondback Terrapins are estuarine turtles whose range and habitat overlaps with the use of blue crab traps (also referred to as "crab pots" in some parts of the country) used widely in the commercial and recreational harvest of blue crabs. Crab traps have been shown to substantially, negatively affect terrapin populations in multiple states, and the bycatch problem with crab traps is pervasive throughout the terrapin's range along the Atlantic and Gulf coasts from Massachusetts to Texas. In every study to date, a simple bycatch reduction device (BRD) has been shown to reduce terrapin bycatch mortality in crab traps, with the net crab catch across all studies largely unchanged. Therefore, it is the position of the Diamondback Terrapin Working Group (DTWG) that all commercial and recreational blue crab traps be fitted with a BRD on each entrance funnel into the crab trap. Further, all states with commercial and recreational blue crab fisheries within the range of the Diamondback Terrapin must have regulations requiring all blue crab traps manufactured, sold, or used within the state to be fitted with BRDs when fished. Finally, states should enforce BRD compliance with routine checks of commercial and recreational crab traps when fished.

The Problem

The scientific literature documenting terrapin mortality in blue crab traps and the devastating impacts on terrapin populations is clear (reviewed by Chambers and Maerz, 2019). Bycatch in blue crab traps have been linked to declines of terrapin populations in New Jersey, Maryland, Virginia, North Carolina, South Carolina, Georgia, and Florida. Terrapins enter blue crab traps and because they need to breath air, drown when they are entrapped underwater for more than a few hours. Terrapin mortality in crab traps can impact populations by chronic drowning of low numbers of terrapins in traps that are checked regularly and by the sporadic, mass mortality of large numbers of terrapins in pots that are over-soaked, derelict, or lost (aka "ghost traps").

94 dead Diamondback Terrapins in a derelict, commercially fished blue crab trap observed in Glynn County, GA (see Grosse et al. 2009). 133 terrapins were captured in this trap and an adjacent trap on five occasions in 2007.

Misperceptions of the Problem

Several arguments have been put forward to discount the impact of blue crab traps on terrapin populations and downplay the need for bycatch reduction measures.

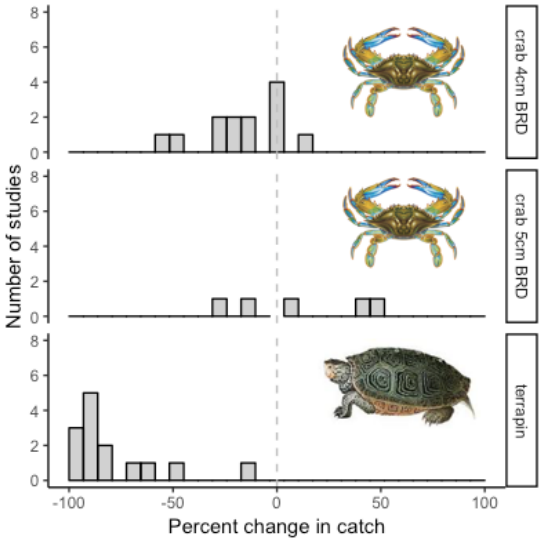
1. *Chronic but low rates of bycatch mortality of terrapins throughout the crabbing season indicates crabbing is benign.*
   This is false. Terrapin bycatch rates are generally less than one turtle per trap per day and vary depending on the habitat, time of year, and the current size of the terrapin population in the area. Because of their life history, we know that even small additions to terrapin mortality from drowning in crab traps can result in population declines and prevent the slow recovery of terrapin populations. The fishing of blue crab traps in terrapin habitat can dramatically reduce a terrapin population in as little as 5 years. Many terrapin populations have already been reduced or extirpated by use of crab traps such that current observations by crabbers that they seldom or never catch terrapins may already reflect the persistent legacy of crabbing bycatch.

2. *Few terrapins recovered during removal of derelict crab traps, which suggests that these traps do not capture and kill many terrapins.*
   This is false. Reports of low terrapin bycatch in derelict crab traps are unreliable indicators of the effect of blue crab traps on terrapin populations. Crab trap roundups or "rodeos" generally occur during closed portions of the crabbing season, which are colder months when terrapins are not active. Recent work has demonstrated that decomposition of terrapin carcasses in crab traps is rapid (< 3 weeks). The only portions of the terrapin skeleton that may persist within crab traps are very difficult to detect in a fouled crab trap and may only be identifiable by individuals familiar with turtle anatomy.

<u>Bycatch Reduction Devices Reduce Terrapin Entrapment in Crab Traps</u>

Bycatch reduction devices are typically rectangular devices installed in the funnels of crab traps to alter the dimensions of the funnel opening, thereby preventing terrapins from entering the crab trap. Terrapins are primarily restricted by the height of the device. All published studies report some reduction of terrapin bycatch with the installation of BRDs. Different sizes of BRDs have been evaluated in a variety of states throughout the terrapin's range (see Appendix Table 2). A 4.5 cm (1.75 inch) high BRD reduces terrapin catch by 70-80% whereas a 5 cm (2 inch) high BRD can be less effective at reducing terrapin catch (40-50%). The width of the BRD does not play a role in reducing terrapin capture and thus can be variable. Other BRD designs or orientations may be feasible alternatives but need to be evaluated to demonstrate their effectiveness.

Percent change in catch of Diamondback Terrapins and Blue Crabs in crab traps with BRDs relative to crab traps without BRDs. The vertical dashed line represents no change in catch between traps with and without BRDs.



Bycatch Reduction Device Effects on Crab Catch

A large majority of BRD studies have shown that both the 4.5 and 5 cm BRDs have little if any effect on numbers or sizes of crabs caught (see Appendix Tables 3 & 4). A few studies report reduced numbers of crabs caught while others report higher numbers of crabs caught in traps with BRDs; but the average effect of all these studies centers on no effect on the numbers of crabs caught. Some studies that report lower numbers of crabs caught may have had the BRDs installed inappropriately on the outer face of the funnel, which could discourage crabs from entering traps. Whether BRD placement explains the occasional reduction in the numbers of crabs caught needs to be evaluated.

Recommended Installation, Use, and Enforcement of BRDs

BRD installation is an inexpensive and easy retrofit to existing crab traps. To minimize the potential for reducing crab capture, we recommend installing the BRD on the inside end of the funnel. Installing the BRD on the outside surface of the funnel will not affect terrapin exclusion, but crabs might sense the obstruction while entering the funnel.

Left panel: Wire BRD installed as recommended at the back, inside margin of the funnel to maintain its integrity. Right panel: Plastic BRD installed on the outer face of the funnel in a manner more likely to affect crab catch.

Although the habitat of Diamondback Terrapins and location of the blue crab fishery largely overlap, some coastal environments that are far from shore are fished for blue crabs and have never been terrapin habitat. Evidence from Georgia and North Carolina suggest that terrapins are particularly prone to bycatch in crab traps set in smaller, shallower tidal creeks. The softshell "peeler" crab fishery may be particularly prone to terrapin bycatch. New Jersey requires the use of BRDs on all commercial style crab traps fished in waterbodies less than 150' wide from shore to shore, though this may not be a sufficient criterion for all states within the terrapin's range. BRD regulations could be tailored to require BRDs only in areas of overlap between commercial and recreational crabbing with blue crab traps and terrapin habitat. Of course, requiring the use of BRDs on all blue crab traps creates easier guidelines for compliance and enforcement. Compulsory use of BRDs likewise would reduce the risk of terrapins drowning in traps originally placed outside their habitat but accidentally blown into the nearshore as derelict traps.

Cost of BRDs Use and Non-Use

BRD costs vary based on the material and manufacturer but they can be homemade from rigid (9 gauge or less) galvanized wire. Plastic BRDs are commercially available from $0.45 -$1 each, and traps require a BRD for each funnels, typically 2 or 4. Range-wide implementation of BRDs or state regulations to require

that BRDs be installed on any traps sold within the state would likely result in the manufacture of crab traps with BRDs pre-installed.

Recent watchlists now advocate complete avoidance of purchasing blue crab harvested from states where BRDs are not required and unsustainable deaths of terrapins from the crab fisheries are documented. For example, the Monterey Bay Seafood Watch currently recommends avoiding blue crabs from Virginia, North Carolina, South Carolina, Georgia, Florida, Mississippi, Louisiana and Texas because regulations to protect terrapins have not been implemented (www.seafoodwatch.org). The small cost of adoption of BRDs is likely to be dwarfed by increased calls for boycotts of blue crabs harvested in states without BRD regulations.

Position of the Diamondback Terrapin Working Group

The Diamondback Terrapin Working Group was formed in 2004 by individuals from academic, scientific, regulatory and private institutions/organizations working to promote the conservation of the Diamondback Terrapin and the preservation of intact, wild terrapin populations and their associated ecosystems throughout their range. The Diamondback Terrapin Working Group is committed to and supports research, management, conservation, and education efforts with the above goals in mind. The Diamondback Terrapin Working Group calls for regulations requiring the use of Bycatch Reduction Devices (BRDs) in blue crab traps throughout the terrapin's range. The position of the working group is that the scientific data are abundant and clear that commercial and recreational use of blue crab traps is a primary threat to the conservation of Diamondback Terrapins throughout the species range, and that BRDs effectively reduce terrapin capture and mortality with minimal effect on crab catch. State agencies throughout the terrapin's range or federal authorities should require the adoption of BRDs.

Appendix

Table 1. Catch rates of terrapins in crab trap

State and Study	**CPUE terrapins* crab pot^{-1} day^{-1}**
South Carolina (Bishop 1983)	0.16 -0.24
South Carolina (Hoyle and Gibbons 2000)	0.027
North Carolina (Grant 1997)	0.15
North Carolina (Hart and Crowder 2011)	0.003 – 0.008
Maryland (Roosenburg et al. 1997)	0.17
Maryland (Roosenburg and Green 2000)	0.044-0.23
Maryland (Jenkins and Roosenburg unpub)	0.19
New Jersey (Wood, 1997a, 1997b)	0.071 -0.49
Alabama (Coleman et al. 2015)	0.0125
Florida (Butler and Heinrich 2007)	0.0 – 0.147
Virginia (Upperman et al. 2014)	0.295
Virginia (Rook et al. 2010)	0.201
Texas (Baxter 2013)	1.15
Georgia (Belcher et al 2008)	0.60 – 1.15 /soak

Table 2. Effectiveness of BRDs at eliminating terrapin capture in crab traps.

State	BRD Type	Dimensions (cm)	Terrapin Bycatch Control: BRD
Alabama	Wire	5x15	22:2
Delaware	Wire	5x10	97:40
Delaware	Wire	3.8x12	106:0
Delaware	Wire	4.5x12	106:36
Delaware	Wire	5x12	106:93
Florida	Wire	4.5x12	37:4
Georgia	Plastic	5x15	136:5
Louisiana	Wire	5x10	0:0
Maryland	N/A	4.5x12	1:0
Maryland	Wire	4.5x12	105:19
Maryland	Wire	5x10	105:56
Maryland	Plastic	4.5x12	41:6
Mississippi	Wire	5x15	0:0
Mississippi	Wire	5x10	0:0
New Jersey	Wire	5x10	40:3
New Jersey	Wire	4.5x10	3:0
New Jersey	Wire	5x10	25:4
New Jersey	Wire	5x10	46:5
North Carolina	Wire	4x15; 5x15	13:1
North Carolina	Wire	5x16	7:0
North Carolina	Wire	4x16; 4.5x16	1:0
South Carolina	Plastic	5x15	30:0
South Carolina	Plastic	4.5x12	75:3
Texas	Plastic	4.5x12	2:0
Virginia	Plastic	4.5x12	2:0
Virginia	Plastic	4.5x12	69:2

Virginia	Plastic	5x15	69:0
Virginia	Plastic	4.5x12	9:0
Virginia	Plastic	4.5x12	42:0
Virginia	Plastic	4.5x12	46:2
Virginia	Plastic	5x15	58:10
Virginia	Plastic	5x15	23:6

Table 3. Effect of 4.5 cm high BRD on crab catch.

State	BRD Type	Dimensions (cm)	Change in Crab Size	Change in Crab Number	Reference
Delaware	Wire	4.5x12	No Change	~14% Decrease	Cole and Helser 2001
Florida	Wire	4.5x12	No Change	No Change	Butler and Heinrich 2007
Maryland	N/A	4.5x12	N/A	29% Decrease	Lukacovic et al. 2005
Maryland	Wire	4.5x12	No Change	No Change	Roosenburg and Green 2000
Maryland	Plastic	4.5x12	No Change	No Change	Jenkins and Roosenburg 2018
New Jersey	Wire	4.5x10	No Change	12% Increase	Wood 1997
North Carolina	Wire	4x16; 4.5x16	N/A	23% Decrease	Hart and Crowder 2011
South Carolina	Plastic	4.5x12	N/A	21% Decrease	Powers et al. 2009
Texas	Plastic	4.5x12	No Change	No Change	Baxter 2014
Virginia	Plastic	4.5x12	Slight Decrease	~25% Increase	R. Lipcius, VIMS, pers. comm.
Virginia	Plastic	4.5x12	No Change	53% Decrease	Upperman et al. 2014
Virginia	Plastic	4.5x12	N/A	17% Decrease	Morris et al. 2011
Virginia	Plastic	4.5x12	N/A	47% Decrease	Morris et al. 2011
Virginia	Plastic	4.5x12	No Change	No Change	Rook et al. 2010

Table 4. Effect of 5 cm high BRD on crab catch.

State	BRD Type	Dimensions (cm)	Change in Crab Size	Change in Crab Number	Reference
Alabama	Wire	5x15	N/A	31% Decrease	Coleman et al. 2011
Delaware	Wire	5x10	No Change	No Change	Cole and Helser 2001
Delaware	Wire	5x12	No Change	No Change	Cole and Helser 2001
Georgia	Plastic	5x15	No Change	~14% Decrease	Belcher et al. 2007
Louisiana	Wire	5x10	N/A	38% Increase	Guillory and Prejean 1998
Maryland	Wire	5x10	No Change	No Change	Roosenburg and Green 2000
Mississippi	Wire	5x15	No Change	No Change	Graham et al. 2011
Mississippi	Wire	5x10	No Change	No Change	Cuevas et al. 2000
New Jersey	Wire	5x10	No Change	No Change	Mazzarella 1994
New Jersey	Wire	5x10	No Change	10% Increase	Wood 1997
New Jersey	Wire	5x10	No Change	49% Increase	Wood 1997
North Carolina	Wire	4x15; 5x15	No Change	No Change	Chavez 2014
North Carolina	Wire	5x16	N/A	No Change	Hart and Crowder 2011
North Carolina	Wire	5x15	No Change	12% Decrease	Chavez and Williard 2017
South Carolina	Plastic	5x15	N/A	N/A	Powers et al. 2009
Virginia	Plastic	5x15	No Change	No Change	Upperman et al. 2014
Virginia	Plastic	5x15	Slight Decrease	No Change	Corso et al. 2017
Virginia	Plastic	5x15	Slight Increase	No Change	Grubbs et al. 2018