## Inclusion of Diamondback Terrapin *Malaclemys terrapin* in Appendix II

## Proponent: United States of America

**Summary:** The Diamondback Terrapin *Malaclemys terrapin* is a medium-sized turtle that occurs in Bermuda and the USA. In the USA the species occurs in brackish coastal swamps in 16 eastern and south-eastern states. The population on Bermuda may well be the result of natural colonisation several centuries ago; it numbers fewer than 100 individuals at a single site. Life history parameters vary considerably across the range, with northern populations producing larger clutches (10-13 eggs compared with 4-7 eggs in southern populations). Male terrapins have been found to mature at 4-7 years of age, and females between 8-13 years, and are estimated to live for as long as 50 years. Historically very abundant in the USA, the species became popular as a gourmet food in the late 19th century in consequence of which the population declined greatly through overharvesting. As demand for the meat declined, populations began to recover. Nowadays, a major cause of mortality throughout much of the range is accidental capture and drowning in Blue Crab *Callinectes sapidus* traps, with a 1995 report suggesting that tens of thousands of individuals are killed in this way annually. Roadkill is also a significant cause of mortality in some areas. Males and juveniles are particularly vulnerable to being caught in crab traps as adult females are often too large to fit in the opening. Conversely, females are more likely to be killed by motor vehicles as they move around looking for nesting sites. Raccoon predation on adults appears to be important in some sites. There is no current range-wide population estimate, but the species is believed to number in the hundreds of thousands.

Since the 1980s there has been a resurgence in demand for the meat, both domestically and abroad, particularly in Asia. In addition to its meat, *Malaclemys terrapin* is also harvested for use in the pet trade due to its attractive patterning, and has been found for sale in pet markets in Asia. Trends in many parts of the range are unknown, but where there is information, populations are generally believed to be declining or stable. The species is currently classified as Lower Risk/Near Threatened by IUCN, based on a 1996 assessment (regarded as in need of updating). It is not listed as Threatened or Endangered in the US Endangered Species Act. Harvest for domestic use is, or has been, extensive, with a minimum of 10 000 turtles believed sold annually in New York city alone in the 1980s. At that time the annual harvest in Chesapeake Bay was estimated at 8000-12 000. More recently, in Maryland recorded harvest increased 23-fold to 10 500 in 2006 compared with 2005; legislation enacted in 2007 has closed the Maryland fishery. The extent of commercial harvest for domestic consumption in US States that still permit this is unclear.

Some 26 000 individuals were reported as exported from the USA in the period 1999-2010, Average annual exports increased from around 750 for the period 1999-2003 to a peak of over 6000 in 2006. Exports dropped to around 1800 in 2007 and then rose to an average of around 3000 per year for 2008-2012 (data for 2012 are incomplete). Data from 1996-2000 indicate around 60% of exports during that period were from wild-caught specimens, as were around two-thirds of the 2006 exports. More recently the great majority of exports have been reported as captive-bred, although some 800 individuals exported in 2012 are of wild or undeclared origin.

**Analysis:** The Diamondback Terrapin occurs in coastal areas of eastern and south-eastern USA, with a tiny, possibly natural, population on Bermuda. The species has an extensive range and evidently a substantial global population, although there are no precise estimates for the latter. Historically harvested in very large numbers for domestic consumption, populations greatly declined, although recovered to some extent in the 20th century. Harvest, at least initially largely for domestic consumption (and to a lesser extent for the pet trade), appears to have increased again from the 1980s. Export increased markedly after 2000, peaking in 2006 at 6000 individuals, although the likely source of most or all of the 2006 exports (Maryland) has now banned commercial harvest. The great majority of exports since then have been declared as captive-bred; however, a notable number of exports in the most recent year (2012) are of wild or undeclared origin. If a significant proportion of recent exports are in fact of wild origin, and given the relatively high mortality rates reported from other causes, particularly drowning in crab traps, it is conceivable that the species might meet the criteria for inclusion in Appendix II in that regulation of trade may be required to ensure that the harvest of specimens from the wild is not reducing the wild population to a level at which its survival might be threatened by continued harvesting or other influences (Paragraph B of Annex 2 a to *Resolution Conf. 9.24 (Rev. CoP15).*

| Supporting Statement (SS) | Additional information |
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| **Range** | |
| Bermuda, United States of America. | |
| **IUCN Global Category** | |
| | *Lower Risk/near threatened (Assessed 1996, Criteria version 2.3) (needs updating).* |
| **Biological and trade criteria for inclusion in Appendix II (Res. Conf. 9.24 (Rev. CoP15) Annex 2 a)** | |
| **A) Trade regulation needed to prevent future inclusion in Appendix I** | |
| The US population size of *M. terrapin* in the United States is unknown but presumed to exceed 100 000. | |
| The Bermuda population is estimated at less than 100 individuals, has a very low recruitment rate and is dominated by females. | |
| Marked variation in life history traits of *M. terrapin* can be attributed to a broad latitudinal distribution. Female turtles from northern populations mature later and at a relatively larger size than those from southern populations. In northern populations, the average female may produce 0-3 clutches of about 10-13 eggs in a single nesting season (0 - 30 eggs/year); whereas smaller females from southern populations produce 4-6 eggs per clutch. There is little information available on whether females skip reproduction in particular years. | *Reproductivity varies considerably throughout the range of* M. terrapin*. In general, the further north the population is, the later the females will mature, the larger the females will be, the larger the clutches of eggs, and the shorter the nesting season (Pfau and Roosenburg, 2010). In Chesapeake Bay male terrapins mature at 4-7 years of age, and females between 8-13 years, and are thought to live for as long as 50 years (Roosenburg, 1991).*<br><br>*Clutch size is likely 4-7 eggs (Gibbons* in litt*., 2012).* |
| Given the species' population dynamics, slightly increased rates of loss of juveniles and adults significantly affect a *Malaclemys terrapin* population. Life history traits, including delayed sexual maturity and high juvenile mortality make *Malaclemys terrapin* particularly vulnerable when it comes to removing even a few adults from the population. | *Individuals aggregate in large numbers to hibernate, often in areas easily accessible to humans, making them vulnerable to collection. Hundreds of hibernating individuals can be removed in a matter of hours using mechanical means: the majority of which would be adult females (Haramis* et al*., 2011).* |
| *Malaclemys terrapin* is native to 16 states in the United States (Alabama, Connecticut, Delaware, Florida, Georgia, Louisiana, Maryland, Massachusetts, Mississippi, New Jersey, New York, North Carolina, Rhode Island, South Carolina, Texas, Virginia). Its distribution is best described as discontinuous along the ~5,000 km of coastline between Cape Cod, Massachusetts, and Corpus Christi, Texas. A breeding subpopulation is also found in Bermuda. | *NatureServe (2012) estimated the total range extent to be between 20 000-2 500 000 km$^2$. However, it is unclear how this estimation has been calculated as there has been no work done to estimate how far inland or into the ocean this species ranges (Burke* in litt*., 2012).* |
| The range of *Malaclemys terrapin* is coincident with dense areas of human population and habitat destruction poses a serious and ongoing threat to | |

| Supporting Statement (SS) | Additional information |
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*Malaclemys terrapin* populations. Coastal development, particularly salt marsh draining, increased use of coastal waterways for commercial and recreational purposes, and loss of sand dunes, an important habitat for nesting, contribute to the loss and degradation of this species' habitat. Four of the five US states with the highest levels of estuarine wetland losses are found within the range of *M. terrapin*: Florida, Louisiana, New Jersey, and Texas. The coastlines of these four states together comprise 67% of the range of *M. terrapin*.

Native Bermuda populations are localized to three brackish water ponds on a golf course on the eastern end of the island.

According to a range-wide survey of researchers and state biologists, most *M. terrapin* subpopulations are "declining to stable".

Declines in populations are now mostly associated with increased anthropogenic activity, usually the use of crab pots but also habitat loss and commercial harvest. Significant local declines have been documented in the US states of South Carolina, New Jersey and Maryland due to crab trap mortality and vehicle strikes.

On Kiawah Island, in the US state of South Carolina, population estimates from a mark-recapture study of *M. terrapin*, suggest a decline of 75% over the last two decades. High male and juvenile mortality rates in this subpopulation, likely due to incidental drowning in crab traps, result in an increase in the proportion of large females.

In the US state of New Jersey, researchers found a significant decrease in the number and size of adult females of *M. terrapin* relative to the results of a study conducted 12-13 years earlier in the same tidal creek. This demographic shift was not attributed to crab trap mortality because the site is closed to trapping; however, a decline in large females is consistent with the observation that road mortality of nesting females has increased.

In the coastal town of Jamaica Bay in the US state of New York, researchers found significantly high (92-100%) and consistent raccoon predation on *M. terrapin* eggs during the years 1998-2010. While in 1998-9 this population had the largest number of nests of any reported *M. terrapin* population, 12 years later the number of nests had dropped 43%. Jamaica Bay's cord grass marshes, on which *M. terrapin* depend, are disintegrating at a rapid rate, and the bay is predicted to be essentially marsh-free within 50 years.

*At a workshop addressing the ecology, status and conservation of the Diamondback Terrapin in 1994, it was determined that of populations in 16 USA states, 11 had an declining or unknown population status and one was 'stable/increasing' (see Table below). In 2004, 13 states had a declining or unknown population status and no states reported an increase.*

*Table: Population status in the USA. Data were collected at workshops in 1994 (Seigel and Gibbons, 1995) and 2004 (Butler* et al.*, 2006).*

| ***State*** | ***1994*** | ***2004*** |
|---|---|---|
| *Alabama* | *Unknown* | *Declining* |
| *Connecticut* | *Declining* | *Unknown* |
| *Delaware* | *Unknown* | *Unknown* |
| *Florida* | *Unknown/declining/ stable* | *Unknown/declining/stable* |
| *Georgia* | *Unknown* | *Unknown* |
| *Louisiana* | *Unknown/declining* | *Unknown* |
| *Maryland* | *Declining/stable* | *Unknown/declining* |
| *Massachusetts* | *Stable/increasing* | *Unknown* |
| *Mississippi* | *Declining* | *Unknown/declining* |
| *New Jersey* | *Declining* | *Unknown/declining* |
| *New York* | *Stable* | *Unknown/stable* |
| *North Carolina* | *Declining/Unknown* | *Unknown* |
| *Rhode Island* | *Unknown/stable* | *Stable* |
| *South Carolina* | *Unknown/declining* | *Unknown/declining* |
| *Texas* | *Unknown* | *Unknown/declining* |
| *Virginia* | *Unknown* | *Unknown* |

*A review of surveys carried out by Burger (1989) found that the number of nesting females in West End and Cedar Beach, New York declined from 14 in 1978, to two in 1988. Similarly, numbers declined from 28 in 1974 to six in 1986 in Little Beach, New*

| Supporting Statement (SS) | Additional information |
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| | *Jersey. Finally, the number of male and female Diamondback Terrapin observed in Barnegat Bay, New Jersey declined from six in 1976/1977 to zero in 1988.*<br><br>*Loss of habitat, particularly in the northern parts of the range, forces individuals into sub-optimal nesting habitat such as along highways, which increases mortality (Burger* in litt,, *2012).*<br><br>*Rising human population density and development in coastal areas means when nesting beaches are destroyed by storms/hurricanes, there is no unused available habitat for the Diamondback Terrapin to move into (Burger* in litt*,, 2012). This problem may become more significant as the frequency and severity of storms increases.* |
| **B) Regulation of trade required to ensure that harvest from the wild is not reducing population to level where survival might be threatened by continued harvest or other influences** | |
| Historic trade was in the meat of *Malaclemys terrapin*. More recent exports are of live animals. The late 19th century, 400 000 lbs were harvested annually, but by 1920, *Malaclemys terrapin* populations had dwindled, and only 823 lbs were harvested that year on the Chesapeake Bay. | Malaclemys terrapin *was heavily exploited in the late 19th and early 20th centuries as a gourmet food item, causing populations to decline to very low levels at which point the species became commercially extinct. As demand for their meat decreased, it is presumed that many populations naturally began to recover (Gibbons* et al., *2001). Trade peaked in Maryland in 1891 when 89 000 pounds were sold, but by 1920 the population had declined by so much that only 829 pounds were sold (Carr, 1952* in *Butler* et al., *2006).* |
| Asian countries began importing *Malaclemys terrapin* and other US species due to the depletion of most of their native turtle species, with some vendors selling as many as 2,000-3,000 of these turtles in a single year. | *The recent resurgence in harvesting for meat began during the 1980's, driven by increased demand in the Chinatowns of the larger US and Canadian cities (Pfau and Roosenburg, 2010). Roosenburg (1990) estimated that in the late 1980's the annual harvest of* Malaclemys terrapin *in Chesapeake Bay was between 8000-12 000 individuals with a value of USD20 000-30 000. Most were sold to urban areas in the north eastern USA. Garber (1990* in *Moll and Moll 2004) estimated that during the 1980's at least 10 000* Malaclemys terrapin *were being sold annually in New York City's China town food markets.*<br><br>*In 2004 a genetic survey of* Malaclemys terrapin *being sold for food in New York City markets showed that they originated mostly from Maryland; the remaining terrapins were assigned to New York, New Jersey, Virginia, North Carolina, and South Carolina (Lester, 2007).*<br><br>*The threat of commercial harvest was one of the top three threats to* M. terrapin *populations in Maryland and Louisiana (Butler* et al., *2006).* |
| In 2006, the last year in which this species was legally harvested in the US state of Maryland, watermen reported a catch of 10 500 individuals of *M. terrapin*. The | *In Maryland, demand from Asian buyers for terrapins of any size resulted in a 23-fold increase in take during the shortened 2006 season, which amounted to over 10 000* |

| Supporting Statement (SS) | Additional information |
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| market demand for northern *Malaclemys terrapin* from Asian markets led to the permanent closure of the terrapin fishery in Maryland in April 2007; however, several other US states still allow commercial harvest of terrapins. | Malaclemys terrapin *being harvested. Under the new 2007 legislation, no wild-taken terrapin can be sold for any reason (Roosenburg* et al*., 2008).* |
| Commercial interest in *M. terrapin* remains high, primarily for the pet trade and, to some extent for use as food, in Asia. Hatchlings sell in pet markets of Hong Kong for USD50-100 apiece. Additionally, harvest of *Malaclemys terrapin* for turtle farms in Asia is taxing wild populations in the United States and contributing to potential illegal harvest in US states where they are currently protected. The extent to which *Malaclemys terrapin* is subject to illegal trade is unknown. | *Of 294* Malaclemys terrapin *sold in Florida between 1990-1991, four were reported to be destined for Japan, whilst the rest for the USA (Enge, 1993). The same study found that between 1990-1992, eight* Malaclemys terrapin *were bred in captivity in Florida for sale in the pet trade. In comparison, during the same two year period, 176* Malaclemys terrapin *were collected from the wild in Florida and sold.* |
| A survey of online animal dealers estimated that 40% of the turtles for sale were wild-caught (using descriptions and sizes of animals provided by the seller) and that the average selling price per specimen was USD80 (with a range from USD35 to USD125). | *There are some speciality terrapin breeders in the USA which produce for the pet trade, whereas in Europe there are few breeders (Pfau and Roosenburg, 2010).*<br><br>*A* Malaclemys terrapin *farmer in Maryland sold 2500 terrapins to a dealer in Louisiana who in turn sent many of the terrapins to China to be eaten or for breeding (Pelton, 2006).*<br><br>*Between 2000-2003,* Malaclemys terrapin *was recorded for sale as pets in markets in Hong Kong and Guangzhou, Southern China (Cheung and Dudgeon, 2006).*<br><br>*Shiau* et al. *(2006) found two subspecies of* Malaclemys terrapin *(*M. terrapin marcrospilota *and* M. terrapin terrapin*) for sale in pet stores in southern Taiwan during 2004-2005.*<br><br>*Four* Malaclemys terrapin *were found for sale in Jakarta in 2010, whilst none were found in 2004 (Stengel* et al*., 2011).*<br><br>*Between 1998-2002, 877 wild caught individuals were exported from the USA, and Schlaepfer* et al. *(2005) identified* Malaclemys terrapin *as a species expected to be particularly vulnerable to commercial take on the basis of their life-history characteristics, geographic distribution, and levels of US trade (Schlaepfer* et al., *2005).* |
| The exports in Table below were reported in LEMIS as commercial trade. Of the 26 342 individuals exported during this time period, 7,309 individuals (28%) were sourced as wild; 19 029 individuals (72%) were reported as captive-bred or ranched; and 4 individuals (0.02%) were reported as “other.” Overall, there appears to be an increasing trend in export of *Malaclemys terrapin* from the United States. Specimens were primarily exported to Asia.<br><br>An earlier analysis of LEMIS data from 1989–1997 showed that the number of live *Malaclemys terrapin* exported from the United States totalled 4002 specimens. The number of *Malaclemys terrapin* exported from the United States during 1996-–2000 | *As included in the SS, Reed and Gibbons (2002) reported that 2936 individuals were exported from the United States during 1996-2000 This gives an average of 587 individuals per year over the 5-year period. This is an increase on exports between 1989 and 1997 (445 individuals per year), and a decrease on exports between 2001-2010 (2476 individuals per year). Of the 2936 individuals exported during 1996-2000, 59% were reported as being wild caught (Reed and Gibbons, 2002). This suggests there has been a decline in recent years in the percentage of exports that are reported as coming from wild sources.*<br><br>*According to export data obtained from the US Fish and Wildlife Service, the number* |

## Supporting Statement (SS)

totalled 2936 specimens.

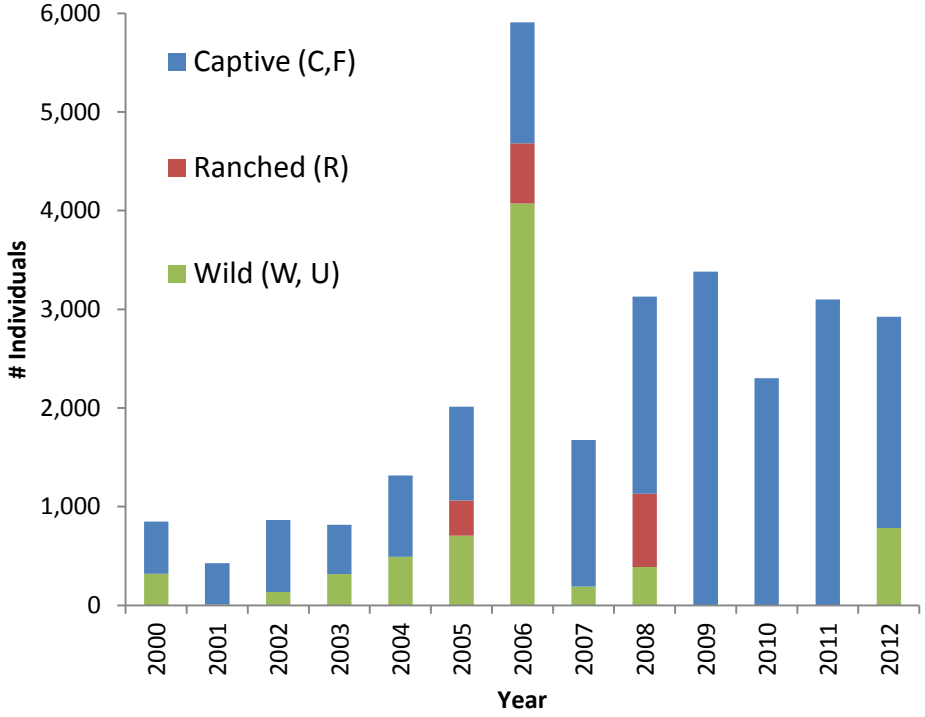
Table. US Export Data for *Malaclemys terrapin* 1999-2010 (LEMIS 2011)

| Year | # Individuals | # Shipments |
|---|---|---|
| 1999 | 737 | 19 |
| 2000 | 846 | 31 |
| 2001 | 422 | 27 |
| 2002 | 911 | 38 |
| 2003 | 904 | 35 |
| 2004 | 1499 | 76 |
| 2005 | 2399 | 78 |
| 2006 | 6129 | 96 |
| 2007 | 1867 | 77 |
| 2008 | 4021 | 77 |
| 2009 | 3609 | 69 |
| 2010 | 2998 | 88 |
| Total | 26 342 | 711 |

## Additional information

*of captive-bred* Malaclemys terrapin (source code C or F) *being exported for all purposes increased steadily between 2000 and 2009, and accounted for 100% of exports in 2010 and 2011 (Figure below). In the first 10 months of 2012, captive-bred individuals accounted for 73% of all exports. A peak in the total number of* Malaclemys terrapin *exported can be seen in 2006, and captive-bred individuals only accounted for 21% of exports that year. Elevated harvest rates in Maryland that year likely contributed to this. The countries importing the greatest number of* Malaclemys terrapin *from the US were Hong Kong, Japan, Taiwan POC, the Republic of Korea and China.*

*Figure: U.S. Export Data for* Malaclemys terrapin *2000-2012 (US Fish and Wildlife Service's LEMIS database). Note data for 2012 is incomplete as it does not contain full records for November or December*



| Supporting Statement (SS) | Additional information |
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| **Inclusion in Appendix II to improve control of other listed species** | |
| **A) Specimens in trade resemble those of species listed in Appendix II under Res. Conf. 9.24 (Rev. CoP15) Annex 2 a or listed in Appendix I** | |
| There are no similar species in international trade. | |
| **Other information** | |
| **Threats** | |
| In US states with a commercial blue crab fishery, incidental drowning in crab pots is considered to be the major threat to *M. Terrapin.* Small males and juveniles are caught more frequently than adult females due to the limitations on the size of the trap entrance. | *Throughout much of its range, the major cause of mortality for* M. terrapin *is incidental capture in commercial crab traps and subsequent drowning. Roosenberg* et al. *(1997) estimated up to 78% of a population could be captured annually by crab traps; Bishop (1983) stated that in April and May in South Carolina alone, 285* M. terrapin *died per day after being captured, not including those caught in 'lost' crab traps. Grosse* et al. *(2009) estimated that 91% of the total* M. terrapin *biomass of a tidal creek in Georgia was lost as a result of neglected crab pots.* |
| Predicted sea-level rise represents a particularly severe impact on *Malaclemys terrapin* habitat, as it would affect inter-tidal and supra-tidal coastal marshland and nesting beaches at the seaward side. | *Haramis* et al*. (2011) found that the proportion of young (smaller) female* Malaclemys terrapin *in areas with no crab pots was 2.4 times higher than that in areas with crab pots.* |
| Adult females of *M. terrapin* are frequently struck and killed by motor vehicles while attempting to cross motorways in search of nesting sites. Hatchlings of *M. Terrapin* migrating to water after nest emergence can get trapped in tire tracks from vehicular traffic on nesting beaches. | Malaclemys terrapin *foraging and nesting habitat is under threat from ocean level rise (Burke* in litt*,, 2012).*<br><br>*Between 1989-1995, 4,020* M. terrapin *were killed along a busy stretch of road in New Jersey (Wood and Herlands, 1997).* |
| Human-subsidized predators, native or introduced animals whose populations prosper as a result of association with humans and human-altered habitats, are another threat to *M. terrapin* populations. | *Diamondback terrapins and their eggs are vulnerable to predation by racoons, foxes, skunks, otters, sea gulls, crows, willets (*Catoptrophorus semipalmatus*) and king snakes (*Lampropeltis getulus*) (Pfau and Roosenburg, 2010). Raccoon predation on adults appears to be significant at some sites (Burke* in litt*,, 2012) as does predation by foxes (Burger* in litt*,, 2012).* |
| Large females of *M. terrapin* often bear scars from the propellers of motor boats. | *M. terrapin basking on the water's surface can be maimed or killed by high speed motor boats (Roosenburg, 1991).* |
| **Conservation, management and legislation** | |
| *Malaclemys terrapin* is not protected under the U.S. Endangered Species Act or other US Federal laws. | |

| Supporting Statement (SS) | Additional information |
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| The U.S. state of Massachusetts has designated *M. terrapin* as Threatened in this state. All US states within this species' range, except New York have designated this species as a Species of Greatest Conservation Need. Legislation in the US state of Maryland ended the commercial harvest of *M. terrapin* in this state in 2007. State protection or harvest regulation in the remaining US states within the species' range has been recommended. | |
| There are a number of US Fish and Wildlife Service wildlife refuges and other protected areas within the range of *Malaclemys terrapin*; however the proportion of the species' habitat that is protected has not been quantified. | *US Fish and Wildlife Service wildlife refuges in coastal areas are subject to flooding and erosion, and in the north-eastern USA, changes in available beach (Burger* in litt*,, 2012).* |
| **Captive Breeding/Artificial Propagation** | |
| Experiments with captive propagation for commercial purposes were initiated by the United States Government in the early 20th century because the range-wide population was believed to be in danger of extinction. | *Several thousand* Malaclemys terrapin *were released into Cape Romain National Wildlife Refuge (CRNWR) waters from the North Carolina Beaufort Fishery Station in 1947(Anonymous, 1947* in *Griffon* et al*., 2006).* |
| This species is bred in captivity by hobbyists, but no large-scale captive-breeding programs exist. In 2006, researchers at the University of Alabama initiated a head-starting program with 150 hatchlings to be raised in captivity to a larger, less vulnerable size before being released back into the marshes of Dauphin Island in the US state of Alabama. | |
| **Other comments** | |
| The seven subspecies within the United States are as follows: *M. terrapin terrapin, M. terrapin centrata, M. terrapin tequesta*, *M. terrapin rhizophorarum, M. terrapin macrospilota, M. terrapin pileata, M. terrapin littoralis*. | *There have been known escapes and releases of* Malaclemys terrapin *throughout its range, meaning there is a possibility that populations contain subspecific hybrids (Pfau and Roosenburg, 2010). However, range-wide genetic analysis indicates genetic structuring consistent with the hypothesis that these releases have had little or no effect (Hart, 2005).* |

**Reviewers:** J.W. Gibbons, R.L. Burke, J. Burger, M. Dorcas, C. Shepherd.

**References:**

Anonymous (1947). Annual Report on the Cape Romain National Wildlife Refuge to the Regional Office of USFWS. In: Griffon, D., Owens, D. and Gibbons, J.W. (2006). Diamondback terrapin. www.dnr.sc.gov/cwcs/pdf/DiamondbackTerrapin.pdf. Viewed 6 November 2012.

Bishop, J. M. (1983). Incidental capture of diamondback terrapin by crab pots. *Estuaries* 6: 426-430.

Burger, J. (1989). Diamondback terrapin protection. *Plastron Papers* 19:35-40.

Burger, J. (2012). In litt. to the IUCN/TRAFFIC Analyses Team, Cambridge, UK.

Burke, R.L. (2012). In litt. to the IUCN/TRAFFIC Analyses Team, Cambridge, UK.

Butler, J.A., Heinrich, G.L. and Seiger, R.L. (2006). Third workshop on the ecology, status and conservation of diamondback terrapins (*Malaclemys terrapin*): Results and Recommendations. *Chelonian Conservation and Biology* 5: 331-334.

Carr, A.F. JR. (1952). *Handbook of Turtles. The Turtles of the United States, Canada, and Baja California*. Comstock Publ. Assoc., Cornell University Press, Ithaca, New York. 542 pp In: Butler, J.A., Seiger, R.L. and Mealey, B.K. (2006) *Malaclemys terrapin* – Diamondback Terrapin. Meylan, P.A. (ed.) Biology and Conservation of Florida Turtles. *Chelonian Research Monographs* 3:279-295.

Cheung, S. M. and Dudgeon, D. (2006). Quantifying the Asian turtle crisis: market surveys in southern China, 2000–2003. *Aquatic Conservation: Marine and Freshwater Ecosystems* 16: 751-770.

Enge, K.M. (1993). Florida's commercial trade in native amphibians and reptiles. Proceedings of the *Southeastern Association* of *Fish and Wildlife Agencies* 47:403-413.

Garber, S.W. (1990). The ups and downs of the diamondback terrapin. *The Conservationist (Albany)* 44: 44-47. In: Moll, D. And Moll, E.O. (2004). *The ecology, exploitation and conservation of river turtles.* Oxford University Press.

Gibbons, J. W. (2012). In litt. to the IUCN/TRAFFIC Analyses Team, Cambridge, UK.

Gibbons, J.W., Lovich, J.E., Tucker, A.D., Fitz Simmons, N.N. and Greene, J.L. (2001). Demographic and ecological factors affecting conservation and management of the Diamondback Terrapin (*Malaclemys terrapin*) in South Carolina. *Chelonian Conservation and Biology* 4: 66–74.

Grosse, A.M., van Dijk, J.D., Holcomb, K.L. and Maerz, J.C. (2009). Diamondback terrapin mortality in crab pots in a Georgia tidal marsh. *Chelonian Conservation and Biology* 8:98–100.

Haramis, G.M., Henry, P.P.F. and Day, D.D. (2011). Using scrape fishing to document terrapins in hibernacula in Chesapeake Bay. *Herpetological Review* 42: 170-177.

Hart, K. M. (2005). Population biology of diamondback terrapins (*Malaclemys terrapin)*: defining and reducing threats across their range. Dissertation. Duke University, Durham, North Carolina. USA.

Lester, L. A. (2007). Tracking terrapins through genetic analysis: multilocus assignment tests shed light on origin of turtles sold in markets. Thesis. Duke University. Durham, North Carolina. USA.

NatureServe (2012). NatureServe Explorer: An online encyclopedia of life [web application]. Version 7.1. NatureServe, Arlington, Virginia. www.natureserve.org/explorer Viewed 7 November 2012.

Pelton, T. (2006). *Farm points way out of turtle trap*. www.cterrapin.org/newspaperarticle/110106farmpointsway.pdf Viewed 28 October 2012

Pfau, B. and Roosenburg, W. M. (2010). Diamondback terrapins in Maryland: research and conservation. *Radiata* 19:2-34

Reed, R.N. and Gibbons J.W. (2002). *Conservation status of live U.S. nonmarine turtles in domestic and international trade.* A report to: U.S. Department of the Interior, U.S. Fish and Wildlife Service.

Roosenburg, W. M. (1990). *Final Report: The Chesapeake diamondback terrapin investigations for the period 1987, 1988, 1989.* Chesapeake Research Consortium Publication. No 133.

Roosenburg, W. M. (1991). The diamondback terrapin: Population dynamics, habitat requirements and opportunities for conservation. In: Mihursky, J. A. and Chaney, A. (Eds.) *New Perspectives in the Chesapeake System: A Research and Management Partnership. Proc. 2nd Chesapeake Bay Research Conference, Baltimore, Maryland, 4-6 Dec. 1990.* Chesapeake Research Consortium Publication No. 137: 147-160.

Roosenburg, W.M., Cresko, W., Modesitte, M. and Robbins, M.B. (1997) Diamondback Terrapin (*Malaclemys terrapin*) mortality in crab pots. *Conservation Biology* 11: 1166-1172.

Roosenburg, W.M., Cover, J. and van Dijk, P.P. (2008). Legislative closure of the Maryland terrapin fishery: perspectives on a historical accomplishment. *Turtle and Tortoise Newsletter* 12: 27-30.

Schlaepfer, M.A., Hoover, C. and Dodd, C.K. Jr. (2005). Challenges in evaluating the impact of the trade in amphibians and reptiles on wild populations. *BioScience* 55: 256-264.

Seigel, R.A. and Gibbons, J.W. (1995). Workshop on the ecology, status, and management of the Diamondback Terrapin (*Malaclemys terrapin*), Savannah River Ecology Laboratory, 2 August 1994: Final Results and Recommendations. *Chelonian Conservation and Biology* 1: 240-243.

Shiau, T.W., Hou, P.C., Wu, S.H. and Tu, M.C. (2006). A survey on alien pet reptiles in Taiwan. *Taiwania* 51: 71-80.

Stengel, C.J., Shepherd, C.R. and Caillabet, O.S. (2011). *The Trade in Tortoises and Freshwater Turtles in Jakarta Revisited.* TRAFFIC Southeast Asia, Petaling Jaya, Selangor, Malaysia.

Wood, R.C. and Herlands, R. (1997). Turtles and tires: the impact of roadkills on Northern Diamondback Terrapin, *Malaclemys terrapin terrapin*, populations on the Cape May Peninsula, Southern New Jersey, USA. *Proceedings: Conservation, Restoration, and Management of Tortoises and Turtles—An International Conference* 46–53.