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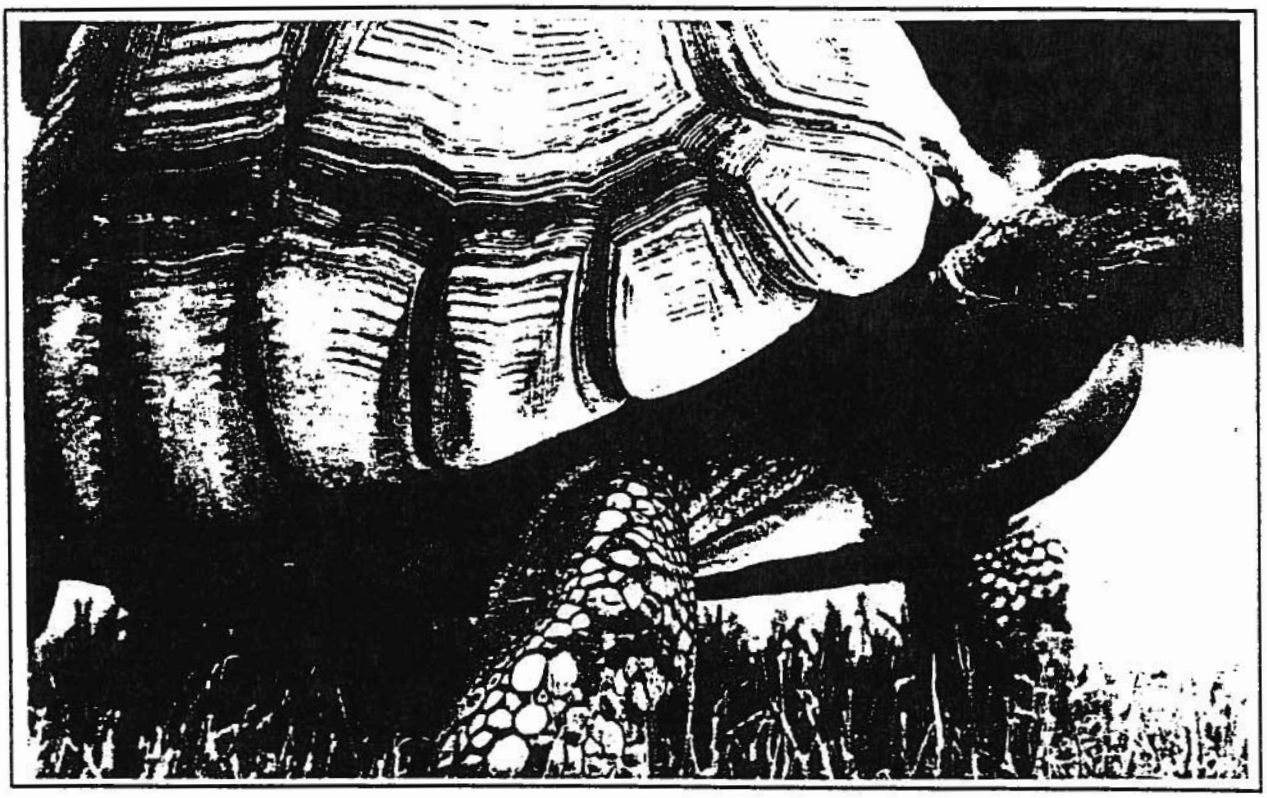

Astrochelys yniphora is the rarest tortoise in the world. Reared at Ampijorva, in Malagasy, and at St Catherine Island (in this photo), its total strength never exceed a few ten individuals in captivity and a few hundred ones in the wild. An excellent conservation programme concerns this animal, leaded by the Jersey Wildlife Conservation Trust and the Wildlife Conservation Society. Nevertheless, at the beginning of may 1996, part of the tortoise populations (adults and juveniles) have been stolen at Ampijorva, flying specialists into a rage and disappointment. So, this tortoise is a symbol, by its scarceness, by the efforts made to protect it, and by the threats which hang over it, of the difficult conservation of the tortoises in the world.

EDITIONS SOPTOM

TERRAPINS, TIRES AND TRAPS: CONSERVATION OF THE NORTHERN DIAMONDBACK TERRAPIN (*Malaclemys terrapin terrapin*) ON THE CAPE MAY PENINSULA, NEW JERSEY, USA

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Introduction

The diamondback terrapin (Malaclemys terrapin) is a highly aquatic North American emydine turtle specialized for life in coastal salt marshes. The species has an unusual geographic distribution, extending from the northern shores of Cape Cod in New England southward along the Atlantic coast to the Florida Keys and then northward and westward along the Gulf of Mexico coast to somewhere (as yet not precisely determined) in Texas. Hence, terrapins have a long but very narrow linear range, at least three to four thousand kilometers in length but never more than a few kilometers wide, corresponding to the width of coastal salt marshes.

Within this peculiar range, spanning both north temperate and subtropical climatic zones, seven subspecies have been formally described. Some of these subspecies, particularly along the Atlantic coast, exhibit a remarkable degree of individual variability in terms of coloration and markings. Terrapins are tolerant of a wide range of salinity, but never occur naturally in fresh water. And at least some terrapin populations (e.g. those in New Jersey) are distinguished by the fact that they nest both during the day as well as at night.

The topic of this report is an on-going study initiated seven years ago during the summer of 1989. It focuses on a population of northern diamondback terrapins (Malaclemys terrapin t occurring along the fringes of the Cape May Peninsula in southernmost New Jersey, on the Atlantic coast of the United States. Terrapins here (as in many other parts of their geographic distribution) have been adversely affected by human activities for more than a century. Foremost among these detrimental activities have been.-

1) a food fad for terrapin stew. This started in the late 1800's and continued into the early decades of the 1900's. Terrapins were in such inordinate demand that they were rapidly overhunted, particularly in the mid-Atlantic part of their range (from Long Island Sound to the Chesapeake Bay). Specimens became so scarce that, around the turn of the century, a dozen of them would fetch as much as $90, equivalent to approximately $1700 in today's currency!

The unbridled depletion of terrapin populations led, eventually, to piecemeal enactment of protective legislation by the various states within whose coastal waters terrapins occur. In New Jersey, for example, terrapins are officially considered to be a game species and there is a lengthy open season when it is legal to hunt them, extending from November 1st to March 31st. This period of time coincides with the winter hibernation season for northern diamondback terrapins so that, in fact, they are very difficult to find. Hunting or capture of terrapins during the remainder of the year (from April 1st through October 31st), when they are active, is strictly prohibited. In theory these are very clever regulations but they are almost impossible to enforce effectively.

2) large-scale habitat destruction and degradation has been another severe problem for terrapins. The preferred nesting sites for terrapins throughout most or all of their range are sand dunes occurring on barrier beach islands. In New Jersey (and elsewhere as well), these islands have been extensively developed as summer resorts. This has resulted in the leveling of dunes, the filling in of adjacent salt marshes, and the bulkheading of waterfront properties. As a consequence, terrapins no longer have access to their island nesting sites and, even if they did, the dunes no longer exist.

In some areas salt marshes have, until recently, been used for the indiscriminate dumping of municipal sewage and industrial wastes as well as the construction of large-scale industrial, military and recreational facilities. Terrapin habitat has thus been markedly diminished, particularly in the vicinity of heavily urbanized areas such as northern New Jersey and metropolitan New York. What the consequences may have been of the fouling of the water within which terrapins live is unknown, but it is likely to have been detrimental.

3) in certain parts of their range, the loss of their original nesting habitat has led terrapins to the extensive use of a highly dangerous alternative nesting site - the embankments of roads crossing and adjacent to salt marshes. The close proximity of nest-seeking adult female terrapins with speeding motor vehicle traffic during the egg laying season has inevitably resulted in significant, selective mortality on that part of the terrapin population which is most critically important for its survival. And

4) currently, the most serious threat to terrapins throughout their entire range is the proliferation of commercial crab traps in the salt marsh creeks and bays where terrapins live. Diamondback terrapins are broad-spectrum carnivores attracted to the bait (a type of fish known as bunker) typically used in crab traps. Consequently, terrapins of both sexes and

all sizes (except hatchlings) are indiscriminately caught by commercial crab traps. The large numbers of traps deployed together with the extended period of time during which they are used combine to make them a devastating source of mortality on terrapins almost everywhere that they occur.

It was to assess the impacts of both road kills and also commercial crab traps upon diamondback terrapins that the work reported here was initiated in 1989.

Road kills

In 1989 a pilot project was undertaken to tabulate terrapin road kills during the nesting season (which, on the Cape May Peninsula, is generally from early June through mid-July). During the course of this preliminary study we discovered that it is possible to rescue outwardly undamaged - and hence potentially viable - eggs from road-killed females and incubate them to produce hatchlings.

Consequently, our road-kill census and egg retrieval activities were considerably expanded the following year (1 990), and ever since then the same roads have been patrolled annually during the terrapin nesting season. Cumulative results for the 1989 through 1995 nesting seasons are presented in table 1 -

Through 1995, 4020 road kills have been recorded. The number of road kills found each nesting season has decreased annually, and often precipitously, from one year to the next. The most reasonable interpretation for these declining numbers of road kills is that, each year, there are fewer and fewer female terrapins of breeding age surviving in the marshes. Certainly, vehicular traffic has not decreased; if anything, it has increased. There is no evidence that drivers have become more careful. Barriers have not been erected to prevent terrapins from crossing roads. And it seems highly unlikely that the dwindling numbers of surviving terrapins have learned to avoid putting themselves in harm's way by staying off of the pavement.

Nearly as many eggs (3690) have been salvaged from road kills as there have been road kills recorded. However, little more than a quarter of these (1 175) have actually produced hatchlings. Since freshly emerged hatchlings are favored food items for a wide range of predators, they have not immediately been released back into their native salt marshes. Instead, we have established a "Terrapin Farm" at Stockton College in order to head-start hatchlings for nearly a year. By preventing these hatchlings from hibernating and feeding them as much as they are willing to eat throughout the winter following their birth, we are able to produce head-started hatchlings of sufficient size (generally 5 to 7 cm in carapace length, as compared to 2.5 to 3 cm for newly hatched terrapins) that they can no longer be readily crunched and/or swallowed by most marsh predators. Thus, their chances of surviving to adulthood are greatly improved. However, even if all head-started hatchlings eventually attained maturity - something which undoubtedly does not happen - only a fraction of the road-killed adults would be replaced. Therefore, our head-starting activities are not stabilizing the terrapin population or reversing its continued decline. At best, we are merely somewhat slowing down the rate at which the population would otherwise dwindle.

As an aside, we have been using the eggs recovered from road kills to study temperature-dependent sex determination in diamondback terrapins. As a result, not all of the hatchlings we have produced are females, so an even smaller percentage of the road-killed terrapin population is actually being replaced.

Impact of crab traps

Starting in 1989, and continuing to the present, a series of experiments over successive summers has been carried out in order to determine the impact of commercial crab traps upon terrapins. These experiments have shown that-.

- commercial crab traps are indiscriminate killers of sub-adult and adult diamondback terrapins of both sexes,
- five to six terrapins, on average, are caught per 1 00 traps every day in New Jersey's coastal waters;
- even under the most favorable conditions, at least 1/3 of all terrapins (and probably a considerably higher proportion under real working conditions) that are caught in commercial traps drown-,
- as a consequence, in any given year, it is probable that at least 30,000 to 40,000 terrapins drown in commercial crab traps along New Jersey's coast alone (table 2);
- a stiff, rectangular wire frame, which we call the Wetlands Institute Bycatch Reduction Apparatus, or BRA, with inner dimensions of 5 cm x 10 cm, inserted into the narrow (inner) end of a trap's four entrance funnels, will greatly reduce terrapin mortality. Only about 10% of all terrapins that would be caught in conventional, unmodified commercial crab traps are caught in similar traps equipped with BRA's. Moreover, no adult female terrapins, the most important component of the entire terrapin population, can enter into BRA-equipped crab traps "
- installation of BRA's on traps has the serendipitous consequence of

significantly increasing the numbers of marketable-sized crabs that are caught in commercial crab traps. Therefore, the use of BRA-modified traps not only has the potential to save the lives of large numbers of terrapins annually, but should also increase the profits of the commercial crabbers who use them.

The collective implications of these experiments extend far beyond the coastal waters of New Jersey. Commercial crab traps are commonly used throughout much of the range of diamondback terrapins and it has already been shown that they can catch and drown significant numbers of terrapins in other areas besides New Jersey (Bishop, 1983). It appears that terrapin populations are declining, or have already been severely reduced, in many parts of their range (Seigal and Gibbons, 1995), and much of this decline is almost certainly attributable to large-scale commercial crab trapping activities.

But the widespread adoption of BRA's for commercial crab traps can greatly reduce (by 90%) needless terrapin drownings; most importantly, BRA's can essentially eliminate mortality on breeding females.

Thus, the use of BRA-modified traps has the potential to be a win/win situation for both terrapins and commercial crab fishermen. Far fewer terrapins will be drowned by commercial crab traps than is presently the case, while at the same time crabbers will catch significantly larger numbers of marketable-sized crabs than they otherwise would using traditional,

Literature cited

Bishop, J. M., 1983. Incidental capture of diamondback terrapin by crab pots. Estuaries, vol. 6, nr. 4: 426–430.

Seigal, R. A. and J. W. Gibbons, 1995. Workshop on the ecology, status, and management of the diamondback terrapin (Malaclemy terrapin) , Savannah River Ecology Labaratory, 2 August 1994- final results and recommendations. Chelonian Conservation and Biology, vol. 1, nr. 3: 240-243.

Table 1: Summary of selected data resulting from the wetlands institute's diamondback terrapin conservation project (1989-1995)

	1989+	1990	1991	1992	1993	1994	1995	Totals
Total Number of Road Kills	273	1077	712	586	535	419	418	4020
Total Number of Eggs Salvaged	180	933	746	734	448	399	250	3690
Number of Resultant Hatchlings	77	85	286	235	222	157	113	1175
Hatching Success	43%	9%	38%	32%	50%	39%	45%	32%

+ Pilot project

Table 2: Impact of unmodified commercial crab traps on diamondback terrapins: computations for new jersey

Background information:

(a) In 1993 (the most recent year for which government statistics are available), there were approximately 63,280 commercial crab traps licensed for deployment in New Jersey's coastal waters.

(b) In addition, in 1993 4,865 recreational licenses were issued. Each recreational license authorizes a licensee to put two commercial traps into the water. Thus, there were approximately 9,730 recreational traps in New Jersey waters.

(c) Field experiments over the course of three successive summers indicate that roughly 5.5 terrapins/ I 00 traps/day are caught in New Jersey's coastal waters.

(d) Field experiments also indicate that, even under the most favorable conditions, 1/3 of all the terrapins caught in commercial traps drown.

Given these facts, we can calculate:

(a) 63,280 traps x (5.5 terrapins/100 traps) = 3,480 terrapins caught/day

(b) 3,480 terrapins caught x 1/3 drown = 1,160 terrapins drowned/day

Then, if there are:

(a) 4 months of active crabbing (123 days) x 1,160 terrapins drowned/day = 142,680 drowned terrapins

(b) 5 months of active crabbing (153 days) x 1,160 terrapins drowned/day = 177,480 drowned terrapins

However, let us assume that only a fraction of all commercial traps over the course of the season are set in areas where terrapins are abundant:

Percentage of traps set where terrapins occur	Number of drowned terrapins in 4 month season	Number of drowned terrapins in 5 month season
50%	71,340	88,740
25%	35,670	44,370
10%	14,268	17,748

Comments:

1. These calculations do not include recreational traps. If we assume that one out of every two licensed recreational traps drowns one terrapin per year, this represents an additional mortality of nearly 5,000 terrapins to any of the above projections.
2. The possible impact of "ghost traps" is not factored into any of these calculations. If it were possible to do so, the mortality figures would increase further.
3. What is happening to terrapins in New Jersey is also happening throughout much of the rest of the range of diamondback terrapins, so it would not be unreasonable to multiply the New Jersey estimates by at least five or ten-fold to approximate trap mortality on the species throughout its entire range.