Where Are They Now? The Kemp's Ridley Headstart Project

B. W. BOWEN

Archie Carr Center for Sea Turtle Research
223 Bartram Hall
University of Florida
Gainesville, FL 32611, U.S.A.

T. A. CONANT

North Carolina Wildlife Resources Commission
201 Ocean Bay Villas
Pine Knoll Shores, NC 28572, U.S.A.

S. R. HOPKINS-MURPHY

South Carolina Wildlife and Marine Resources Department
P.O. Box 12559
Charleston, SC 29422, U.S.A.

Introduction

In 1978 the U.S. National Marine Fisheries Service (NMFS), the U.S. National Park Service (NPS), and the U.S. Fish and Wildlife Service (FWS), in cooperation with the Mexican Instituto Nacional de Pesca (INP), began an ambitious program to enhance the Kemp's ridley turtle (*Lepidochelys kempi*) population. A beach at Padre Island, Texas, was "seeded" with eggs or hatchlings from the sole nesting beach in Tamaulipas, Mexico, with the intention of starting a second nesting population. This program was motivated by the desperate conservation status of the Kemp's ridley. The nesting population in Tamaulipas, Mexico, had dwindled from an estimated 40,000 (in a single nesting aggregate) in 1947 to less than 500 females per year in 1978 (Hildebrand 1963; Woody 1985). This demise is attributed to a massive harvest of eggs and nesting females in the 1950s (Pritchard 1976; Marquez 1990), followed by high adult mortality in the 1960s and 1970s associated with a developing shrimp fishery (National Research Council 1990).

The Kemp's ridley restoration project included an incubation and beach imprinting program operated by the NPS from 1978 to 1988 and a captive-rearing component conducted by the NMFS from 1978 to 1992. Eggs were incubated indoors to afford protection from predators and other natural hazards. Hatchlings were allowed to run down to the surf zone at Padre Island in the hope that this would prompt neonates to imprint on this beach for future nesting efforts (see Owens et al. 1982; Grassman et al. 1984). Hatchlings were recaptured in the surf zone and maintained in captivity at the NMFS lab in Galveston for 9–12 months (Phillips 1988). This "headstart" strategy was designed to bypass high mortality in neonates. As of May 1992, about 18,000 Kemp's ridley turtles had been released (Anonymous 1992*a*).

At the time of this writing, ridleys have not returned to nest at Padre Island above the sporadic level of nesting that occurred before the restoration program began (Shaver 1989 and unpublished data). Several explanations could account for this outcome. First, the sex of sea turtle hatchlings is determined by incubation temperature (Mrosovsky & Yntema 1980). This mechanism was unknown at the inception of the Padre Island project. Indoor (cooler) incubation almost certainly produced a high percentage of males during the first six years of the program (Wibbels et al. 1989). To correct

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for this bias, the program subsequently controlled temperature to produce a higher proportion of females (Shaver et al. 1988). Because males do not come ashore to nest, survivors from the early period of this program are difficult to document. Second, the imprinting process—(by which turtles return to their natal beach, according to one prevalent theory)—may be disturbed by captive-rearing conditions (Pritchard 1980), or the brief exposure to Padre Island beaches and surf may have been insufficient to induce an imprinting response (Mortimer 1988). Third, captive conditions may influence some aspects of behavior (feeding, locomotion, predator avoidance), physiology (muscle development, diving response, immunology), or health (nutritional imbalances and corresponding kidney and liver problems) that could put headstarted turtles at a disadvantage in the wild (Mrosovsky 1983; Caillouet 1987; Mortimer 1988; Woody 1990). Finally, it is possible that the time required to attain sexual maturity exceeds the 16 years since the inception of the program (or the 9 years since females were produced at higher ratios). Therefore, maturing individuals may yet return to nest at Padre Island. The NMFS, however, considers 6–8 years a reasonable estimate of age at sexual maturity for headstarted Kemp's ridleys (Wibbels 1990; but see Zug 1990).

With all these potential problems under consideration, many biologists and conservationists consider the Kemp's ridley headstart project an expensive lesson in the pitfalls of human intervention (Taubes 1992). But recent events may prompt a reappraisal of this conclusion.

Nesting on the Atlantic Coast of the U.S.

In May 1989, four Kemp's ridley nesting attempts were observed over a 9-day period in east Florida. During the same interval, a ridley successfully nested in west Florida (Meylan et al. 1990). In 1992, two Kemp's ridley nests were documented in South Carolina and North Carolina over a 2-month period (Anonymous 1992*b*; T. A. Conant, unpublished data; C. Ott, personal communication). Kemp's ridley nesting has *never* been previously documented in Florida or on the Atlantic coast (Meylan et al. 1990; Anonymous 1992*b*), and these locations are 1500–2000 kms from the known nesting range of *L. kempi*.

These reports indicate that Kemp's ridley are nesting outside their historical nesting range. An alternate explanation is that Kemp's ridleys nested regularly on the Atlantic coast but were only recently identified among a much larger cohort of loggerhead turtles (*Caretta caretta*). We discount this possibility because (1) the major nesting beaches in the southeastern United States have been extensively monitored in recent decades; (2) the nests in South and North Carolina were discovered because nesting occurred during daylight, a behavior distinctive of ridley turtles; (3) the track of a nesting ridley is markedly different from that of *C. caretta*, and it would likely be noticed even if the turtle was not seen; (4) records of strandings of sexually mature ridleys on the southeast U.S. coast before 1989 are rare or nonexistent. Taken together, these facts argue against the possibility that ridleys historically nested on the Atlantic coast but eluded scientific detection.

An Outcome of the Kemp's Ridley Restoration Project?

We suggest that reproductive activity of the Kemp's ridley is occurring outside the historical nesting range of this species. What could prompt these unusual nesting efforts? One theory about nest site selection maintains that occasional strays are necessary for colony proliferation (Carr et al. 1978; Bowen et al. 1992). But this theory predicts colonization events on the order of one or two per generation (Bowen et al. 1992, 1993), and it therefore cannot explain the number of new nesting records over a relatively short time interval. An alternative explanation is that this behavior is the product of a disturbed early life history in headstarted turtles, as suggested by Pritchard (1980), Mrosovsky (1983), and Mortimer (1988). Under this scenario, headstarted turtles maintained in captivity during a critical developmental interval—in which their natural counterparts acquire location data for reproductive migrations (see Owens et al. 1982)—are unable to locate their natal beach for subsequent nesting efforts. A related explanation is that headstarted turtles do not initiate the social interactions that would aid in reproductive migration. In either case, headstarted turtles may survive to maturity but may neither return to their natal nesting beach nor respond to artificial imprinting to a transplant location.

Several tagging studies provide inferential evidence that captive-reared marine turtles, when released in the wild, behave differently than wild specimens (Bolten et al. 1990; Manzella et al. 1991). This conclusion about headstarting is consistent with broader lessons in recent conservation biology: while notable exceptions exist, captive-reared animals generally do not prosper in the wild (Woody 1990), and stocking programs seldom address the real causes for dwindling natural populations (Frazer 1992). For these reasons, headstarting as a conservation tool for marine turtles has been largely discredited (Huff 1989; Woody 1991; Frazer 1992; Hewavisenthi 1993).

Despite a hypothesized disturbance of early life-history stages, headstarted turtles may have been able to complete their reproductive cycle. Morphological analysis indicates that the nests in North and South Carolina produced pure-blood *L. kempi* hatchlings (S. R. Hopkins-Murphy, unpublished data), such that these females interacted with male ridleys as well. It is possible that Kemp's ridleys will successfully colonize the eastern coast of the United States.

On the other hand, some of these nests may be outside the thermal boundaries of suitable nesting habitat. Incubation for 50 days at approximately 30.2°C will produce a 50/50 sex ratio in Kemp's ridley clutches (Shaver et al. 1988; Shaver 1989). The nests in South Carolina and North Carolina incubated in excess of 68 days (T. A. Conant, unpublished data; C. Ott, personal communication). This exceptionally long incubation period likely produced a high proportion of males, and in both cases the emerging hatchlings were described as lethargic (T. A. Conant, unpublished data; C. Ott, personal communication). Thus lower incubation temperatures on the mid-Atlantic coast may preclude successful colonization.

Conclusion

None of these considerations should be construed as criticisms of the Kemp's ridley headstart project or personnel. The designers of this program were responding to a conservation crisis of extreme proportions, and it would be inappropriate to criticize their strategies retrospectively. Furthermore, captive specimens provided a variety of research opportunities that would have been otherwise unavailable (see Caillouet & Landry 1989). This scientific progress is complemented by a lesson in public education: ridley hatchlings proved to be powerful ambassadors for species preservation (Phillips 1988).

But these positive considerations do not justify continuing the headstart program. If any criticism is leveled, it should be at the private groups that wish to continue this program for political reasons. While the scientific and educational benefits derived from the headstart program are undeniable, these benefits could be sustained with a small number of turtles designated as captives for life.

Are headstarted ridleys nesting on the east coast of the United States? It seems indisputable that something unusual is occurring with the nesting of Atlantic Kemp's ridley, and it is a striking coincidence that these behaviors are manifested 11–14 years after the beginning of the headstart program. A direct test of this outcome is unlikely, however, because no tag applied to hatchlings has been documented to persist in adult stages. The evidence is inferential, but the possibility that headstarted turtles are nesting on the Atlantic coast must now be considered in the spectrum of potential outcomes for the Kemp's ridley restoration project. Fortunately, this scenario generates a simple prediction: if headstarted ridleys can survive the shrimp fishery and related incursions, one would expect a continued (and possibly increasing) level of nesting on the east coast of the U.S., and perhaps elsewhere in the Atlantic.

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