CLEANING OF THE HAWKSBILL TURTLE *(Eretmochelys imbricata)* BY ADULT FRENCH ANGELFISH *(Pomacanthus paru).*

Cleaning symbiosis between various aquatic organisms has been widely referenced in both scientific and lay literature for over three decades. Most reports involve interspecific interactions between marine fishes, with fewer descriptions involving fish and crustaceans. Although marine turtles in general, and the hawksbill *(Eretmochelys imbricata)* in particular, are known to carry a diverse variety of ectoparasites or commensals (Frazier et al. 1985, Hubbs 1977, Ernst and Barbour 1972, Carr et al. 1966 and others), I am aware of only one brief report of the cleaning of a marine turtle in the wild (Booth and Peters 1972). That interaction occurred off Australia, involved green turtles *(Chelonia mydas)* with two species of fish, moon wrasses *(Thalassoma lunare)* and damselfish *(Abudefduf sexfasciatus).*

The following discussion describes a cleaning interaction between a hawksbill *(Eretmochelys imbricata)* and two French angelfish *(Pomacanthus paru).* It should be noted that juvenile angelfishes are widely reported to occasionally clean other fishes (Boschung et al. 1983, Randall 1968, Marshall 1966). Limbaugh (1962) reported adult French angelfish being cleaned by the neon goby *(Elecantinus oceanops).* However, there are no reports of adult French angelfish acting as cleaners or of hawksbills being cleaned by other organisms.

The interaction occurred on 13 November 1985 in 22 m of water off the southwest tip of Grand Cayman Island, B.W.I. The location is atypical of most of Cayman's reefs; it consists of a flat rock bottom with a thin veneer of sand and low relief (1 m) coral spurs and large numbers of gorgonians. For two minutes, observations were made (from a distance of 3 m) of two French angelfish in proximity to a hawksbill turtle, then from 1 m for an additional minute. When I moved closer than 0.6 m, the turtle suddenly swam off. The French angelfish remained in the area 15 min, but the turtle was not seen again.

While being cleaned the hawksbill, tentatively judged to be a female between 75-85 cm total length (TL) with an estimated carapace length of 55-65 cm, was positioned on the sand. The front flippers were extended downward and to the side at approximately 60° to the long axis of the carapace; the rear flippers were extended nearly straight back with a gap between their inner margins. Front flipper placement resulted in the hawksbill being propped, head up, off the sand at an angle of about 45°.

Two large adult French angelfish (ca. 40 cm TL) were actively swimming over the hawksbill and biting at it. The two fish nibbled simultaneously at the right and left front flippers, respectively. Independently the fish would turn on their sides and swim under the anterior portion of the plastron and push their mouths into the pectoral axillae. Hubbs (1977) noted the presence of pelagic crabs *(Planes cyaneus)* in the pectoral axillae of a Pacific ridley *(Lepidochelys olivacea)* off California. No ectoparasites, lesions or abnormalities of any kind could be seen in the axilla or any place else on the hawksbill, with the exception of a thin film of algae on the lateral margins of the posterior half of the carapace.

The French angelfish moved up and down over the front flippers, under the plastron and around the turtle's mouth. Unlike many fishes who are cleaned, the turtle did not jerk, twitch or open its mouth. In fact, the hawksbill remained perfectly still and did not turn or stretch, in apparent accommodation to the cleaners, as discussed by Booth and Peters (1972) for the green turtle. Of course the elevation of the carapace by extension of the front limbs may have enhanced exposure to the cleaner fish.

Frazier (1985) shows that chelonild turtles are suitable substrates for mollusks and other organisms and comments that the rareness of turtle epizoa needs explaining. Despite the paucity of observations regarding the cleaning of sea turtles it seems possible that these creatures often utilize the services of cleaner fish to rid themselves of ectoparasites. It seems less likely that adult French angelfish regularly clean hawksbills, or any other sea turtles, because although these species are regularly sighted in the same areas cleaning behaviour has never been reported.

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HERPETOLOGICAL HUSBANDRY

See Herp. Review 19(1) for author's instructions.

THREE GENERATIONS OF CAPTIVE-HATCHED DESERT TORTOISES, *Xerobates agassizii*

There are few records of achieving an F2 generation among chelonians (Coakley & Klemens 1983; Kirsche 1985). The hatching of three desert tortoises in September 1985 marks the first documented F3 generation among terrestrial chelonians.

An adult male and female *Xerobates (Gopherus) agassizii* came into the senior author's possession in 1935. Precise geographical origin is uncertain but was probably central San Bernardino County, California. Nesting by the female was first observed 27-29 June 1956. The subsequent hatching in September of two eggs incubated artificially was heralded at the time as a first in chelonian husbandry (Booth 1958). While two other artificially incubated eggs failed to hatch, three others removed from the nest in early September hatched by 19 September. In November 1956, the remaining eggs in the nest were found to have spoiled. The two original F1 tortoises are still alive, as are the parent tortoises, which continue to produce offspring yearly or twice yearly until the present day.

INCUBATION TECHNIQUE

Eggs removed from outdoor nests are placed in a plastic bowl filled with one cm of washed sand. Indentations are made for each egg; after these are placed in the sand the bowl is covered with a damp cloth. Heat is provided with a 40 watt incandescent bulb suspended over the bowl. The temperature of the sand surface is kept at 26-27° C. Every few days the cloth cover is dampened.

Once actual hatching begins, the egg is removed to a sheet of waxed paper to prevent sand from adhering to the yolk sac. The gestation period under such conditions has varied from ninety to one-hundred fifteen days.

Hatchlings sometimes have appeared in August through October from undetected nests. The gestation period for such nests is not known.

RESULTS

Tables 1-3 summarize the reproductive output of artificially incubated eggs produced by F1 and F2 tortoises. Data are lacking for 1972 as neither nesting nor hatchlings were observed, and for 1984 because eggs from both generations were incubated together. Records were not suitably kept between 1978 and 1982. The reproductive failure in 1986 can be attributed to an electrical failure; the single 1986 hatchling emerged from an undetected nest. Three hatchlings from unde-