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## AN UPDATE ON GREEN TURTLE FIBROPAPILLOMA

Green turtle fibropapilloma was first reported approximately 50 years ago (Smith and Coats, 1938; Lucke, 1938). The tumors were identified in green turtles (Chelonia mydas) from the Florida Keys and were seen as papillary, arborizing masses on the body surface. In another report, a nodule was found in the lung of one turtle and was composed of cells similar to those in the dermal portion of the cutaneous tumors (Schlumberger and Lucke, 1948). Over the last four years I and several other investigators, including Dr. Lew Ehrhart (University of Central Florida), George Balazs (National Marine Fisheries Service, Honolulu Lab, Hawaii) and Dr. Sidney Simpson (University of Illinois, Chicago), have been working cooperatively to unravel the cause(s) of this disease. A paper describing the pathology of the disease on a light and electron microscope level and attempts at identification of a viral agent has recently been published (Jacobson et al., 1989). To date, no viral agent has been isolated, but on a comparative basis a virus seems to be the most likely cause of this disease. In mammals and birds, herpesvirus, poxvirus, and papillomavirus have been incriminated as causes of papillomas of different types.

Green turtle fibropapilloma is more than just an aesthetically unpleasing disease; it is life-threatening to affected turtles. Affected turtles are anemic compared to normal turtles and serum globulin values are lower than those of healthy turtles. In many cases, tumors grow on the conjunctivae, cornea, and palpebrae, resulting in blindness and turtles starving to death. Several cases of internal tumors have been seen in the lungs, intestinal surface, and kidneys. Over the last three years I have received several small grants from private organizations interested in the welfare of sea turtles. However, because of limited funding, progress in understanding the cause of this disease has been extremely slow. Currently, electron microscope evaluations of 30 biopsy specimens of green turtle fibropapilloma from the Indian River Lagoon System of east central Florida, the Florida Keys, and Hawaii are being completed and may shed some additional light on the cause(s) of this condition.

The fibroblastic component of the tumor has been cultured in vitro and a paper describing the ultrastructure of these cells was recently published (Mansell et al., 1989). Culturing the epidermal cell component of the tumor has been difficult and the work is currently ongoing in the laboratory of Dr. Sidney Simpson. Eventually both the fibroblasts and epidermal cells derived from tumors will be used in transmission studies. These studies will be done in 1990 and will be necessary to demonstrate that this is an infectious disease. A previous study was conducted at the Museum of Marine Science (Clearwater, Florida) in which cell-free and cellular material derived from cultured tumor fibroblasts was injected into several groups of juvenile green turtles. At the conclusion of a one-year study, no tumors developed. In 1990 various combinations of cultured fibroblasts and epidermal cells

will be used. Further, pieces of whole tumors will also be used in the transmission studies. Hopefully, if the disease can be transmitted, it may be easier to identify the causative agent in recently developing tumors.

The increased incidence of this disease in the Indian River Lagoon System (Florida) and in Hawaii is of concern to biologists working with these populations. Turtles showing evidence of fibropapillomas have also been reported from the Bahamas, Panama, Indonesia, the Netherlands Antilles, and Japan. If cases of fibropapillomas have been seen in any other populations, please contact Dr. Elliott Jacobson (address below). Although a virus is believed to be the causative agent, pollutants may be involved in the expression of the disease. Affected turtles are generally found in offshore foraging areas. For instance, over 50% of juvenile green turtles in the Indian River Lagoon System are affected whereas tumors have not been found in green turtles in the Atlantic Ocean, only a few miles from these populations. Clearly, a lot of work needs to be done to better understand the patho-ecology of this disease.

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## INCIDENTAL CAPTURE OF MARINE TURTLES BY THE SWORDFISH FISHERY AT SAN ANTONIO, CHILE

The resurgence of the swordfish (Xiphias gladius L., known locally as "Albacora") fishery in Chile has taken place rapidly since 1987, and is especially developed in four ports: Chañaral (26°22'S), Valparaiso (33°02'S), San Antonio (33°35'S) and Concepción (36°53'S). This increase in a specialized fishery has come about principally because of modernization of the fleet: vessels with greater operating distances, navigational aids, and more effective synthetic nets. In San Antonio alone there are some 250 vessels dedicated to the swordfish fishery; the majority are 14-15 m long, from 15-45 tons draft and make 7-10 knots. Wooden hulls are most common, but steel, ferro-cement and fiberglass are also used. These vessels are classified as "artisanal" and those of larger dimensions "industrial".

Traditionally swordfish have been harpooned from extended platforms from the prows of these artisanal boats (season: December to April). The use of "enmalle" or "enredo" nylon tangle nets is now widespread, and was adopted by artisanal fishermen in

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## KEMP'S RIDLEYS ARE RARER THAN WE THOUGHT

In 1989, 835 nests of the Kemp's ridley (Lepidochelys kempi) were recorded by the bi-national beach monitoring crew at Rancho Nuevo, Tamaulipas, Mexico (Márquez, personal communication). Despite intensive patrols, it was not possible to encounter all of the nesting turtles; the turtles spent a short time on land (about 45 minutes), showed unusually broad dispersal north of the camp headquarters at Barra Coma, and also a new tendency toward very early morning nesting during the 1989 season. Nevertheless, 201 turtles were tagged with Monel metal tags in 1989, and 74 turtles tagged in previous seasons were encountered. Of the 201, 116 were recorded nesting once, 72 twice, and 13 three times. Of the 74, 47 were seen once, 23 twice, and 4 three times. These data allow the calculation of an estimate of the average number of nests per female per season as follows.

Out of the 835 total nesting events, the turtle was seen (and tagged, or the tag number noted) on 404 occasions. Thus, based on the assumption that beach coverage was consistent throughout the season, there was $404/835 = 0.484$ chance of witnessing a given nesting event and consequently a $(0.484)^3$ probability of witnessing a three-time nester on all three occasions. So, if three-time nesters were observed on $13 + 4 = 17$ occasions, the actual season's total of three-time nesters can be estimated at $17/(0.484)^3 = 150$. Similarly, to estimate the actual total of two-time nesters, I note that the observed total of $72 + 23 = 95$ includes a subset of three-time nesters that were actually observed only twice. The chance of seeing a three-time nester on exactly two of its three nestings (i.e., on nestings 1 and 2, 1 and 3, or 2 and 3) may be estimated as $3x(0.484)^2(1-0.484) = 0.363$. Thus, $150 \times 0.363 = 54.5$ of the three-time nesters would have been seen just twice, leaving $95 - 54.4 = 40.6$ actual double nesters observed both times. This corresponds to a true total (observed + unobserved) of $40.6/(0.484)^2 = 173.3$ double-nesters.

The triple and double nesters together thus produced $(150 \times 3) + (173.3 \times 2) = 796.6$ nests for the season, leaving just 38.4 nests (835-796.6) made by single nesters. So 835 nests were made by $(150 + 173.3 + 38.4) = 361.7$ turtles, giving an average of 2.31 nestings per turtle. This figure is much higher than accepted literature values; for example, Márquez et al. (1982) calculated a value of 1.326. Later this figure was revised upwards to 1.47 (1.45 for neophytes, 1.55 for remigrants); but it is clear in the latter calculation (Márquez et al., 1989) that no correction was made for the diminishing probability of observing a multiple nester on