afflicted. Statewide, the percentage of turtles with tumors has been increasing among those recovered dying or dead along the coastline.

Scientists so far do not know what causes the disease, how it is spread, nor what the disease's impact will be on the recovery of the Hawaiian green turtle. Under the U. S. Endangered Species Act (ESA), this species is considered threatened in Hawaii and endangered worldwide. [*Editors' note:* Breeding colony populations of Chelonia mydas in Florida and on the Pacific coast of Mexico are considered endangered under the ESA; elsewhere the species is considered threatened.] Scientists also have yet to pinpoint why the disease has spread and simultaneously reached epidemic proportions at certain sites in Hawaii and also Florida during the past few years. The disease is believed to be exceedingly rare in other areas.

One University of Florida researcher has initiated a study to learn whether the disease can be transmitted from one turtle to another. In May 1990, Dr. Elliott Jacobson, a veterinary pathologist specializing in reptiles, inoculated a group of captive green turtles in the Florida Keys with papilloma cells cultured from afflicted turtles. The cells used in the study were from Hawaiian green turtles. The inoculated turtles, which have old injuries or physical disabilities that prevent them from ever being returned to the wild, will be kept under observation for one year to see whether any tumors develop. In another effort to better understand this disease, a working group meeting of scientists with expertise in animal diseases will be held at the Honolulu Laboratory later this year. The meeting will give scientists an opportunity to discuss what is known about the tumor disease and to devise a comprehensive and cooperative research plan on the cause of this disease.

The [NMFS] Honolulu Laboratory is an agency within the U. S. Department of Commerce. Source: NMFS Southwest Fisheries Center *News Release*, 9 July 1990.

FIBROPAPILLOMAS ON SEA TURTLES IN SAN DIEGO BAY, CALIFORNIA

Sea turtles have aggregated in the warm water effluent channel of the San Diego Gas and Electric Power Company plant, located at the southernmost point of San Diego Bay in southern California, since the plant's construction in 1960. As part of an ongoing study to assess the current status of these turtles (genus Chelonia), we have made preliminary observations on their physical condition. We have seen at most nine turtles at any one time, and have tagged seven since February 1990. Stinson (1984) studied turtles in this area about ten years ago and tagged six; none of those we captured showed any sign of previous tagging. The turtles appear to be healthy. However, we have noticed growths on the eyes of three: an adult male, an adult female, and a juvenile. Some of these growths appear as small (ca. 1 x 2 mm) white flakes on the eyes, while others are fleshy, pinkish protrusions (ca. 3 x 5 mm) on the eyelids. From photographs, George Balazs (National Marine Fisheries Service, Honolulu Laboratory) has identified these as early stages of fibropapilloma tumors. In addition, the female had concentrations of parasites under both axillas which Balazs identified as Ozobranchus (probably O. branchiatus), a species of marine leech often found in association with fibropapilloma tumors (Choy et al., 1989). One juvenile also had these parasites, but, although the eyes appeared inflamed, we did not find tumors.

We do not know the precise origin of the turtles in the Bay. The darkly pigmented skin and carapace, gray plastron, and slightly elongated carapace with indentations above the hind flippers suggest that the majority of them are East Pacific green turtles, commonly referred to as 'black' turtles (Chelonia agassizi), perhaps from Mexican nesting stock.

Nonetheless, at least one individual, an adult female tagged and photographed by Stinson, does not appear to be C. agassizi. This female still frequents the Bay some 10 years after Stinson tagged her. Her carapace is comparatively round in shape and we identify her easily by a distinctive carapace deformity. She weighed nearly 400 pounds in 1979 (Stinson, 1984), and we have tentatively designated her as C. mydas. One of the males which we tagged also has a relatively round carapace and lacks indentations above the hind flippers; however, his plastron pigments are predominately gray (Dutton and McDonald, 1990). Animals such as this male, which appear "mixed" in their characters, render it difficult sometimes to confidently distinguish 'green' (C. mydas) from 'black' (C. agassizi) turtles using color and carapace shape.

We do not know whether the infections we have observed originated elsewhere, or developed after the turtles entered the Bay. However, their appearance on the Bay turtles is presumed to be a recent occurrence. Stinson (1984) did not mention the presence of tumors, and close examination of her photographs does not reveal any evidence of the disease. We do not know whether the turtles ever leave the Bay (to nest, for example), but the presence of smaller juveniles (< 60 cm curved carapace length) indicates that at least some recruitment is occurring from elsewhere. If these turtles are of eastern Pacific stock, our data suggest that sea turtle field workers in this region should be alert to the disease. If at least some of the Bay turtles have their origins further west, perhaps in Hawaii where the tumors are widespread (Balazs, 1986; and see the proceeding article in this issue), the disease may have been introduced from that area.

Research is needed to determine the movements of Chelonia in the Pacific, the relative mixing between eastern Pacific, Hawaiian, and western Pacific stocks, and the implications of that mixing for the spread of this debilitating and potentially fatal disease. To report occurrences of the disease, please contact Dr. Elliott Jacobson, College of Veterinary Medicine, University of Florida, Gainesville, Florida 32610 USA [MTN 49:7-8].

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DONNA McDONALD and PETER DUTTON, Sea World Research Institute, 1700 South Shores Road, San Diego, California 92109 USA.

SHRIMPERS ARRESTED FOR NON-COMPLIANCE AS EFFORTS TO ENFORCE TED REGULATIONS INTENSIFY

Nearly two decades ago, scientists concluded that the greatest threat to the survival of the Kemp's ridley sea turtle was shrimp trawling (Pritchard and Márquez 1973). Earlier this year, after an independent assessment of the situation, the National Research Council concluded in its report to Congress that "the incidental capture in shrimp trawls ... kills more

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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

8. 18 September: Chris Mlynski found a dead leatherback turtle caught in his crabpot lines 2.5 miles southeast of Portloe. It had been trapped for 2-3 days, and had become so entangled that the front right flipper had to be severed to release it; the carcass subsequently stranded some 28 miles up the coast at Downderry. Overall length: 7 feet; carapace width: 39 inches. The tail was large, indicating a male. According to local fishermen, there were plenty of jellyfish (e.g., Rhizostoma pulmo) about.

9. 19 September: A dead leatherback washed ashore on Perran Beach below Carn Haut, just south of the mine adit. Head, flippers, and tail were missing; skin was stripped from its back revealing the bony carapace. The carapace measured 150 cm long and about 85 cm wide.

10. 26 & 28 September: John Hurr sighted a leatherback during the morning of the 26th about two miles north of Portreath while hauling in his crab pots. Then, on the 28th, in the same area, he saw a turtle estimated to be at least 2 m in length. He approached within 10 m of the creature, which was feeding on large jellyfish. Hurr wrote, "The turtle was slowly pushing the jellyfish in front of his mouth (in the manner of a water-polo player controlling a ball), keeping his prey steady with his flippers. Every so often he would lift his head and the remains of the jellyfish out of the water, open his mouth wide, take a deep breath and continue with his meal." Mr. Hurr and his crew watched the turtle for about 20 minutes, regretting only that no one had a camera on board.

11. 8 October: A leatherback turtle, with a carapace estimated to be about six feet long, was found trapped in Barry Mundy's lobster pot lines set about three miles off Mullion. Not until the 12th was he able to enlist the assistance of local divers to release the animal, an operation which took nearly an hour, so entangled had it become. On its release, the turtle swam close around the boat a few times allowing the divers to touch it before it swam off, little the worse for wear apart from a skin break on one flipper. The turtle was accompanied by pilot fish and a number of smaller grey fish, most likely remoras (Remora remora), which attached themselves from time to time to the underside of the turtle. This is the first time I have heard of remoras associated with a turtle off Cornwall.

Penhallurick, R. D. 1990. Turtles off Cornwall, The Isles of Scilly and Devonshire. Dyllansow Pengwella, Cornwall, Great Britain. 95 p.

ROGER D. PENHALLURICK, 2 Chapel Terrace, Trispen, Truro, Cornwall TR4 9BA, GREAT BRITAIN.

SEA TURTLE TAG CENTER OF THE PACIFIC

The Sea Turtle Tag Center of the Pacific is a cooperative program to make available tags, tag applicators, and technical assistance in the tagging of sea turtles for research purposes to government and other qualified organizations in the Pacific islands region of Polynesia, Micronesia, and Melanesia. The program is jointly conducted by the Southwest Fisheries Center Honolulu Laboratory of the National Marine Fisheries Service, and the University of Hawaii's Hawaii Institute of Marine Biology (HIMB). The program is designed in particular to aid those locations where small to moderate numbers of tags (i.e., 100-500) are needed, and local authorities or organizations might not otherwise order them from the manufacturer.

The tags available for use are made of Inconel, a superior corrosion-resistant alloy composed of cadmium and nickel. The tags are self-piercing, self-locking, and simple to use when applied with a special plier-like applicator to the trailing edge of a turtle's front flippers. All tags are imprinted consecutively with a letter-number combination to identify individual turtles. In addition, the following inscription appears on each tag:

Write HIMB
University
Hawaii 96744

Persons who report the sighting of a tagged turtle to this address are sent a T-shirt bearing a sea turtle logo. The sighting information that is received is relayed in a timely manner to the research organization responsible for tagging the turtle. The distribution of tags in the Pacific region under this cooperative program has been underway for several years, but without the benefit of a formal name until now. Organizations interested in receiving more information about the availability of tags from the Sea Turtle Tag Center of the Pacific should write to George Balazs at the address below.

GEORGE H. BALAZS, NMFS Southwest Fisheries Center Honolulu Laboratory, 2570 Dole Street, Honolulu, Hawaii 96822-2396 USA [FAX: (808) 942-2062].

TAGGING PROGRAM FOR THE PACIFIC COAST OF LATIN AMERICA

In 1986 a single tagging program was established for the sea turtle research projects on the Pacific coast of Latin America. The goal of this program is to coordinate the tagging activities of investigators working in the region, to assist in the purchase and distribution of tags, and to facilitate the recovery of information. The program is coordinated through the University of Costa Rica (UCR) Sea Turtle Program. The data base is located at UCR, where all tag data submitted by investigators are stored. The program informs investigators about recoveries and re-observations, and also coordinates the payment of rewards for tag returns. All tags distributed by this Latin American program to countries in the eastern Pacific region list UCR as the return address:

Premio Devolver
Biol-UCR, SJOSE
Costa Rica

The tagging program is supported by the U. S. Fish and Wildlife Service via WWF-US, and is under the auspices of the School of Biology/UCR and the "Vicerrectoria" of Research. During its four years, the program has distributed 25,000 tags among 19 projects in seven countries. The data bank has entries for 20,000 applied tags in a computerized system. Besides managing the tag data system, the program offers advise to projects that request it. For more information, please contact Anny Chaves at the address below.

ANNY CHAVES, Programa de Tortugas Marinas, Universidad de Costa Rica, Apdo. 177-2070, Sabanilla M. O. COSTA RICA. Tel: (506) 34-2736, FAX: (506) 24-9367 (Vicerrectoria de Investigacion-UCR, attn Tortugas Marinas).

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