

Revised 5 August 2005 (correction of Figure 4.)

**Background information on leatherback turtle (*Dermochelys coriacea*) takes in the large-mesh drift gillnet fishery off California, with comments on the calculation of leatherback turtle catch per unit effort (CPUE).**

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One of the Highly Migratory Species Management Team (HMSMT) agenda items for 2005 is to examine the potential impact of re-opening portions of the large-mesh swordfish and thresher shark drift gillnet fishery that have been under area closures since 2001 to protect leatherback sea turtles. In their May 2005 meeting in La Jolla, the HMSMT requested that the Protected Resources Division calculate leatherback CPUE for different regions within this fishery; specifically the area south of Point Sur, California (latitude 36 degrees), and another region north of 40 degrees latitude. Jim Carretta cautioned that relatively low take rates of leatherbacks could be found on small geographic scales purely by chance (through geographic overstratification) because leatherback takes are rare events in this fishery (23 observed in approximately 7,000 sets through early 2004)<sup>1</sup>. It is inadvisable to calculate CPUE values for such small regions as a tool for projecting future takes. Leatherback turtles are, however, more common north of Point Conception, California (latitude 34.45 degrees), thus, separate CPUE calculations for areas north and south of Point Conception are more appropriate, as these two regions coincide with major differences in oceanographic water masses, currents, and fauna. As such, they better represent "ecological strata", rather than geographical strata.

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<sup>1</sup> Peter Dutton of the Protected Resources Division's Sea Turtle Program noted at the May 2005 meeting that it was important to include biological information such as leatherback foraging habitat preferences and known migratory pathways in any decision-making regarding the relaxation of area closures or the determination of potential fishery takes. He further emphasized that foraging areas and migratory pathways may vary inter-annually, depending on prevailing oceanographic conditions.

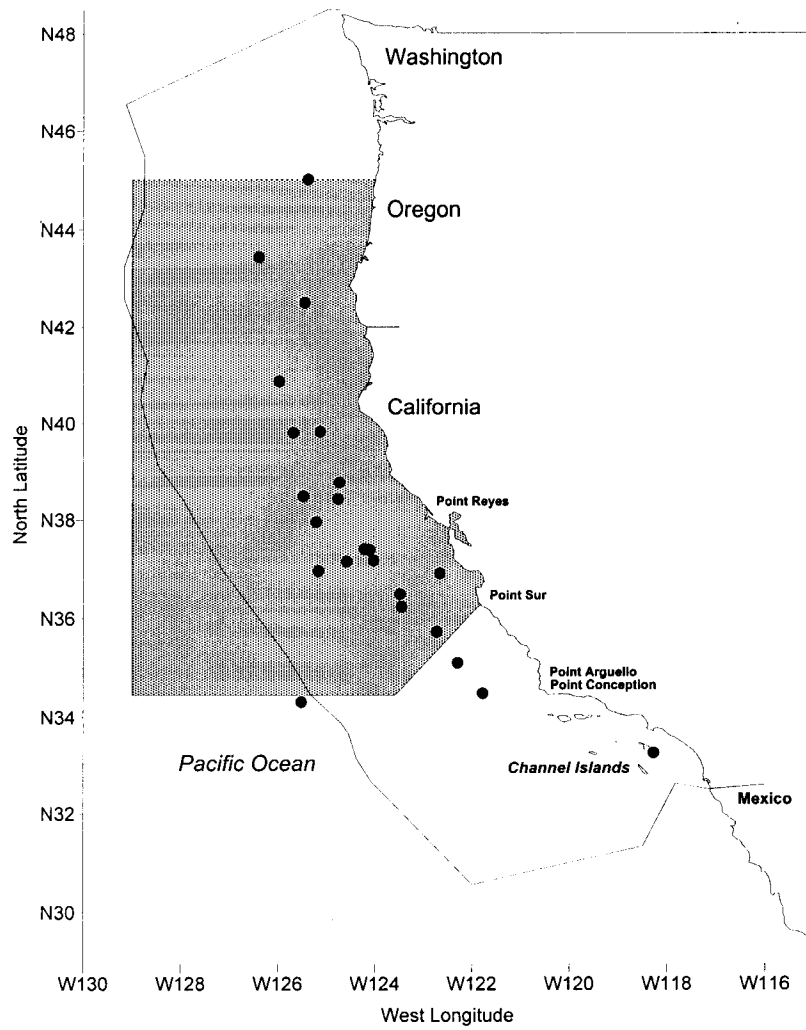
Of the 23 observed leatherback takes, only 2 occurred south of Point Conception, CA (N 34° 27' latitude) from 4,090 observed sets (~0.5 takes/1000 sets). The two takes observed south of Point Conception were in December and January. In comparison, there were 21 observed takes from 2,871 observed sets north of Point Conception (~7 takes/1000 sets). Fourteen of the 21 observed takes occurred in October; the remaining takes were in September (4), November (2) and December (1). Of all 23 takes, thirteen turtles were retrieved dead, nine alive, and one was recorded as 'unknown'. The location of all 23 observed leatherback takes in this fishery are shown in Figure 1. The location of observed sets for the period 1990 – January 2004 are shown in Figure 2.

To examine leatherback CPUE in the drift gillnet fishery, a bootstrap analysis was performed on the actual set data to generate a distribution of “pseudo-CPUE values” for the regions south and north of Point Conception,. Simply, sets were randomly selected with replacement from the actual set data until the number of random sets was equal to the number of observed sets. This selection of random sets constituted “one bootstrap sample”. A CPUE value was calculated from each bootstrap sample and this was repeated 1,000 times, resulting in a distribution of 1,000 “pseudo-CPUE values”. Confidence intervals (CI) for this distribution were obtained by using the percentile method, where the lower 95% CI represents the 2.5<sup>th</sup> percentile of the bootstrap distribution and the upper 95% CI represents the 97.5<sup>th</sup> percentile. The actual set data and bootstrap CPUE values are included in the Excel file “LeatherbackCPUE.xls” (available upon request from Jim.Carretta@noaa.gov).

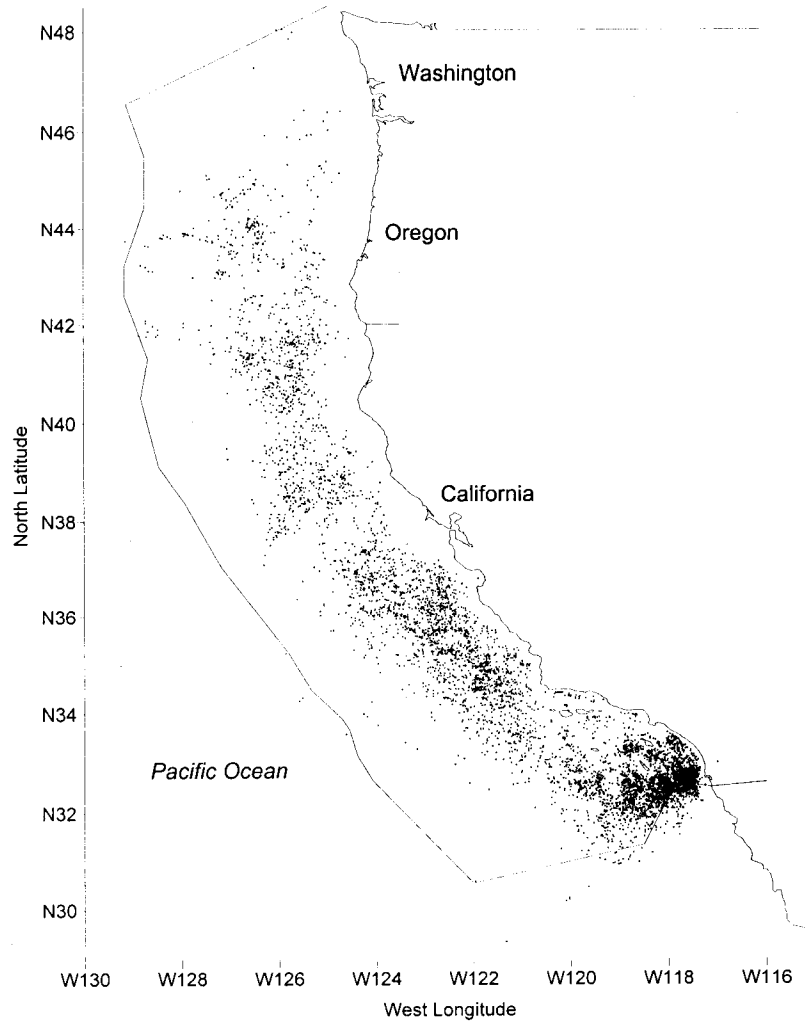
For the area south of Point Conception, the bootstrap mean CPUE is 0.5 leatherbacks per 1,000 sets, with a 95% CI of zero to 1.4 leatherbacks per 1,000 sets (Figure 3). North of Point Conception, the bootstrap mean CPUE is 7.7 leatherbacks per 1,000 sets, with a 95% CI of 4.5 to 10.8 leatherbacks per 1,000 sets (Figure 4). These CPUE values merely reflect the historical take rates in the fishery over large areas, and future CPUE of leatherbacks cannot be “predicted” based on these historical CPUE data. Much new information about the foraging areas and migratory pathways of leatherback turtles has been collected in this region since the area closure was implemented in 2001<sup>2</sup>. This biological information should be incorporated in determining which, if any, areas to re-open in this fishery, as historical CPUE values examined alone are not informative enough for good decision-making.

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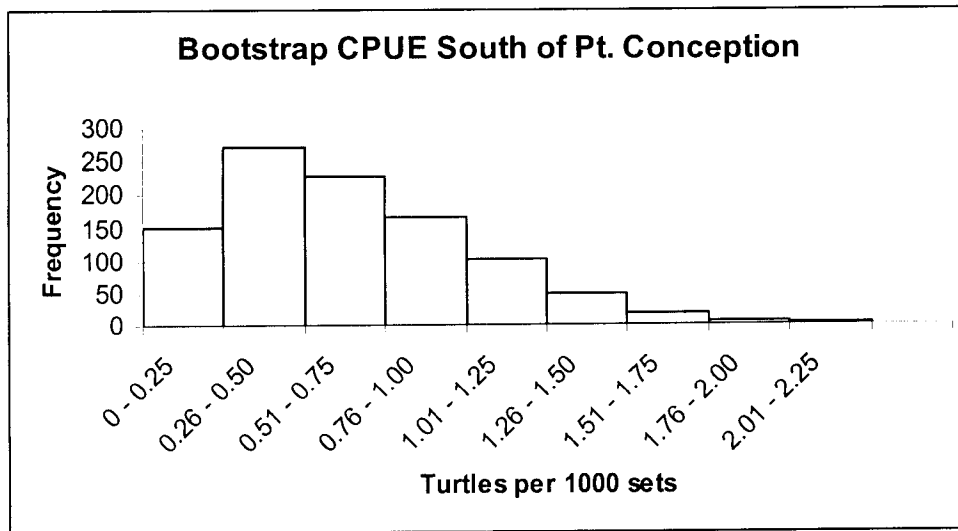
<sup>2</sup> Peter Dutton, Southwest Fisheries Science Center, Marine Turtle Program, 8604 La Jolla Shores Drive, La Jolla, CA 92037.



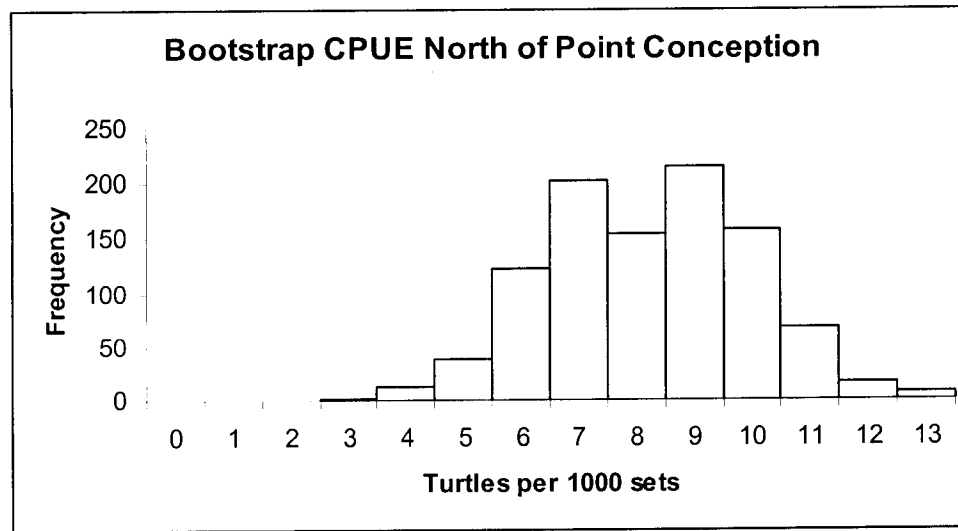
**Figure 1.** Location of observed leatherback sea turtle takes ( $n = 23$ ) in the large-mesh drift gillnet fishery for swordfish and thresher shark, 1990 – 2004. The shaded region represents the area closure implemented in 2001 to protect leatherback sea turtles.



**Figure 2.** Locations of all observed sets ( $n = 6,961$ ) in the large-mesh swordfish and thresher shark drift gillnet fishery, 1990 – January 2004.



**Figure 3.** Distribution of bootstrap-derived leatherback CPUE values for the area south of Point Conception, California.



**Figure 4.** Distribution of bootstrap-derived leatherback CPUE values for the area north of Point Conception, California.