**FIRST AGE-SPECIFIC VITAL RATE ESTIMATES FOR AUSTRALIA'S ENDEMIC FLATBACK SEA TURTLE (NATATOR DEPRESSUS) BY SKELETOCHRONOLOGY***

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Here we present the first-ever skeletochronology-derived age and growth data to address a major data-gap for flatback turtles. Using a valuable collection of bone samples gathered from across northern Australia, we applied skeletochronology with the goals of characterizing the length-at-age relationship, establishing baseline growth rates from the hatchling to adult life stages, and producing empirical estimates of age-at- and size-at-sexual-maturation (ASM, SSM) for the flatback species. We analyzed 74 flatback humeri and report all values as the range, mean and SE; 27 hatchlings/post-hatchlings (CCL: 6.0 to 17.0 cm, 9.4 ± 0.64 cm), 15 neonatal to juvenile stage (CCL: 17.6 to 36.6 cm, 26.6 ± 1.5 cm), and 32 putative adults (CCL: 78.8 to 96.0 cm, 87.5 ± 0.8 cm). Turtles were recovered from Western Australia (n=48), Eastern Australia (n=13), the Gulf of Carpentaria (n=5), Northern Territory (n=3), and unknown locations (n=5). We identified and measured a total of 690 lines of arrested growth (LAGs) from among the 73 fully processed humeri, with turtles retaining between 0 to 42 (9.3 ± 1.3) LAGs. We identified rapprochement growth patterns in 29 of the 73 turtle bones, thus indicating the onset of sexual maturity. Estimates for ASM ranged from 12.0 to 23.0 years (16.3 ± 0.53), and SSM ranged from 76.1 to 94.0 cm CCL (84.9 ± 0.90). The maximum observed reproductive longevity, estimated as the number of LAGs observed beyond the onset of maturity (rapprochement) was 31 years for a male flatback estimated to be 45 years old. The growth of flatback turtles, modeled by both a GAMM smoothing spline and a von Bertalanffy curve, showed similar patterns of monotonic growth, slowing around age 10, and further as turtles approached maturity at a range of body sizes. Mean SSM obtained from rapprochement (84.9 cm CCL) corresponded with a spline-predicted ASM of 18 (95% CI: 16 to 24) years. The total range of mean ASM estimates corresponded to the mean nesting sizes reported in the literature and ranged from 86.4 to 94 cm CCL, yielding ASM estimates of 24+ years. The bootstrapped von Bertalanffy growth model-estimated the ASM, at the mean rapprochement SSM, to be 16.3 ± 0.05 years (95% CI: 12.8 to 27.7 years), the estimated upper size limit, $L_{inf}$, was 89.2 ± 0.04 cm (95% CI: 85.5 to 95.9 cm), and the intrinsic growth rate parameter, $k$, was 0.185 ±

0.0004 (0.16 to 0.22). To test back-calculated ages against known chronology, deceased adult females (n=4) were recovered from rookeries with mark/recapture studies. The paired-samples Wilcoxon rank sum test found that the LAG-back-calculated CCL estimates and observed CCL measurements (mean value of all paired samples used for each individual turtle) were not significantly different ($p = 0.875$), providing initial validation for the use of LAG-based skeletochronology size estimates, as well as supporting the assumption of annual LAG formation in flatback humeri. This first skeletochronology study for flatback sea turtles has generated valuable empirical estimates for ongoing conservation and management efforts nationwide. Additional specimens are in prep to consolidate with the present findings.

NOAA Technical Memorandum NMFS-SEFSC-777
https://doi.org/10.25923/cv3r-ws82

# PROCEEDINGS OF THE FORTIETH ANNUAL SYMPOSIUM ON SEA TURTLE BIOLOGY AND CONSERVATION

40th International Sea Turtle Symposium

25 to 28 March, 2022

Perth, Australia (virtual)

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U.S. DEPARTMENT OF COMMERCE
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March 2024