

A Bayesian Population Model to Estimate Reference Points of Bombay-Duck (Harpadon nehereus) in Bay of Bengal, Bangladesh Using CMSY and BSM

Authors : Ahmad Rabby

Abstract : The demographic trend analyses of Bombay-duck from time series catch data using CMSY and BSM for the first time in Bangladesh. During 2000-2018, CMSY indicates average lowest production in 2000 and highest in 2018. This has been used in the estimation of prior biomass by the default rules. Possible 31030 viable trajectories for 3422 r-k pairs were found by the CMSY analysis and the final estimates for intrinsic rate of population increase (r) was 1.19 year⁻¹ with 95% CL= 0.957-1.48 year⁻¹. The carrying capacity(k) of Bombay-duck was 283×10³ tons with 95% CL=173×10³ - 464×10³ tons and MSY was 84.3×10³tons year⁻¹, 95% CL=49.1×10³-145×10³ tons year⁻¹. Results from Bayesian state-space implementation of the Schaefer production model (BSM) using catch & CPUE data, found catchability coefficient(q) was 1.63 ×10⁻⁶ from lcl=1.27×10⁻⁶ to ucl=2.10×10⁻⁶ and r= 1.06 year⁻¹ with 95% CL= 0.727 - 1.55 year⁻¹, k was 226×10³ tons with 95% CL=170×10³-301×10³ tons and MSY was 60×10³ tons year⁻¹ with 95% CL=49.9 ×10³- 72.2 ×10³ tons year⁻¹. Results for Bombay-duck fishery management based on BSM assessment from time series catch data illustrated that, Fmsy=0.531 with 95% CL =0.364 - 0.775 (if B > 1/2 Bmsy then Fmsy =0.5r); Fmsy=0.531 with 95% CL =0.364-0.775 (r and Fmsy are linearly reduced if B < 1/2Bmsy). Biomass in 2018 was 110×10³ tons with 2.5th to 97.5th percentile=82.3-155×10³ tons. Relative biomass (B/Bmsy) in last year was 0.972 from 2.5th percentile to 97.5th percentile=0.728 -1.37. Fishing mortality in last year was 0.738 with 2.5th-97.5th percentile=0.525-1.37. Exploitation F/Fmsy was 1.39, from 2.5th to 97.5th percentile it was 0.988 -1.86. The biological reference points of B/BMSY was smaller than 1.0, while F/FMSY was higher than 1.0 revealed an over-exploitation of the fishery, indicating that more conservative management strategies are required for Bombay-duck fishery.

Keywords : biological reference points, catchability coefficient, carrying capacity, intrinsic rate of population increase

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