ABSTRACT

Lake Albert's diverse artisanal fishery, characterized by multi-species targeting with varied gears, is dominated by two small pelagic fish species (SPS), *Brycinus nurse* and *Engraulicypris bredoi,* primarily captured using vertically stacked small seine nets and artificial lights. Ecosystem impacts of these fishing techniques on target and non-target fish stocks remain poorly understood, while their use is characterized by conflicts, particularly with fishers targeting Nile perch (*Lates niloticus*), due to perceived negative impact of these gears on the large species stocks. This study, conducted from September 2019 to July 2022 on the Uganda side of Lake Albert, investigated the ecological effects of light attraction fishing to inform sustainable management. Employing a mixed-method approach, including literature reviews, experimental fishing, commercial catch evaluations, hydroacoustic assessments, and stakeholder consultations, the study assessed catch rates, species abundance and distribution, life-history traits, exploitation, and biological reference points.

Results revealed significant light fishing effort, comprising ~40% of the lake's fishing boats, with peak activity during moonless nights correlating with high SPS catch rates ($P = 0.05$). Excessive bycatch, unregulated light-fishing effort, excessive net stacking, and solar light usage emerged as major drivers of conflict on Lake Albert. Regional variations in SPS abundance were notes, with *E. bredoi* dominating the central region ($F (2, 15240) = 172.45$, $p<0.001$) and *B. nurse* the southern region ($F_{(2, 4447)} = 41.166$, $p<0.001$). Acoustics and commercial catch data revealed a dominance of the SPS, accounting for ~82% and ~70%, respectively, suggesting a high biomass in Lake Albert. Analysis of life history traits showed sexual dimorphism in length at 50% maturity (L_{m50}), with males of *E. bredoi* maturing earlier and larger (31.6 mm) than females (23.9 mm) while *B. nurse* females matured earlier and larger (60.9 mm) than males (56.8 mm). Both species exhibited positive allometric growth and robust condition factor: *B. nurse* ($b = 3.21$, $K = 2.08$) and *E. bredoi* ($b = 3.06$, $K = 1.27$), suggesting healthy stocks.

Light attraction fishing significantly increased SPS catch rates ($P = 0.05$), with almost zero catch obtained in the control treatment without light, corroborating earlier observations of intensive light fishing activity during the dark nights, and suggesting the necessity for light in SPS harvest. Bycatch, particularly of *Lates niloticus, Oreochromis niloticus, Hydrocynus forskahlii,* and *Distichodus niloticus,* was predominantly in shallow inshore habitats (< 20 meters deep),

confirming their critical role in biodiversity conservation and fish stock replenishment, and hence the need to protect these regions from fishing. Net stacking increased both SPS and bycatch rates, with optimal SPS catches and minimal bycatch obtained at 16 meters (8 panels). Maximum sustainable yield (MSY) and Effort at MSY estimates for both *E. bredoi* (~90,000 t; 2500 boats) and *B. nurse* (~37,000 t; 2000 boats) were below the 2022 thresholds, indicating underfishing of SPS.

These findings have significant implications for sustainable management of SPS in Lake Albert. The study recommends revision of fishing regulations to incorporate SPS-specific management measures, species-specific licensing, inshore habitats protection, regulated net stacking, promotion of solar fishing lights, and enhancing regional collaboration for comprehensive stock assessments and harmonized fisheries management frameworks. These measures aim to reduce bycatch, mitigate conflicts, and ensure multi-species ecosystem co-existence in Lake Albert.