Benefits of protecting juvenile Nile perch

MultiTip Policy Brief #1

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Gear regulation of the Nile perch fishery has been a subject of discussion among Lake Victoria managers for a long time: How best to regulate gear to ensure high fishery yields for food security and income while maintaining healthy and reproductive fish stocks? A new study building on a size-structured, ecology-based and empirically validated model of the fishery found major benefits of protecting young Nile perch. Protecting young fish would lead not only to higher yields, but also to a larger spawning stock, and thus this measure fulfills the necessity to ensure a high number of large, reproductive fish and can be endorsed by conservationists, managers and stakeholders.

Key Insights:

1. **Protecting young fish increases the spawning stock biomass**: With the simulations we found that fishing large fish and protecting juveniles does not hurt the spawning stock biomass, but rather increases it. The road to a high spawning stock is by protecting fish when they are young. As an illustrating example: A Nile perch of 80cm length has more than 24 times the weight of a 30cm fish (6719g vs. 275g). Thus catching one large fish instead of 24 small ones maintains the yield, but allows a significant share of the 24 small fish to reach maturity and increase the spawning stock.

2. **Protecting young fish increases yield and income**: The positive effect is visible not only for biomass, but also for yield and for income (Fig. 1). A fishery with only 7” gillnets and above could have 21.81% higher yield and 33.44% higher income in the equilibrium (compared to 2020).

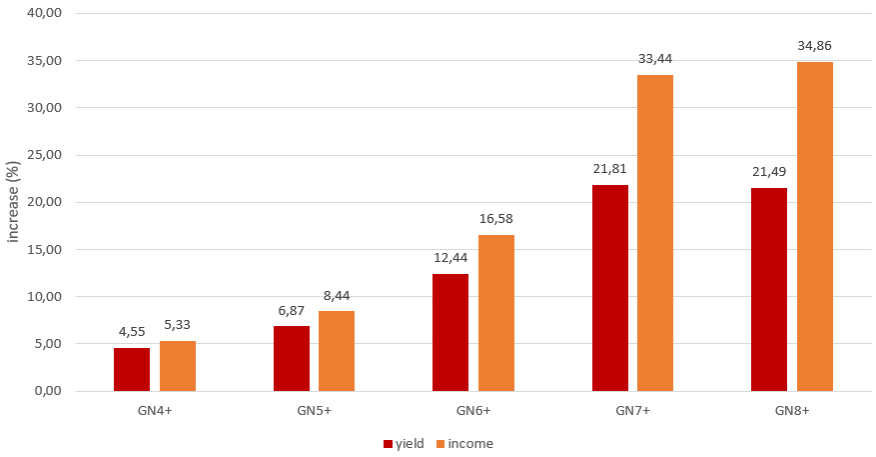

Figure 1: Increase of yield and income (%), relative to the fishery in 2020, if the fishery would only use gillnets 4” and above (GN4+), 5” and above (GN5+), 6” and above (GN6+), 7” and above (GN7+) or 8” and above (GN8+). Longline hooks are assumed to stay at 2020 level.

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3. **Young fish are protected by larger gillnets**: Young fish below 50 cm can be protected by larger nets. The peak of the target selectivity of 5" gillnets is at 47.7cm (±7.9cm standard deviation), for 6" at 57.2cm (±9.5cm) and for 7" at 66.8cm (±11.0cm) (Fig. 2).

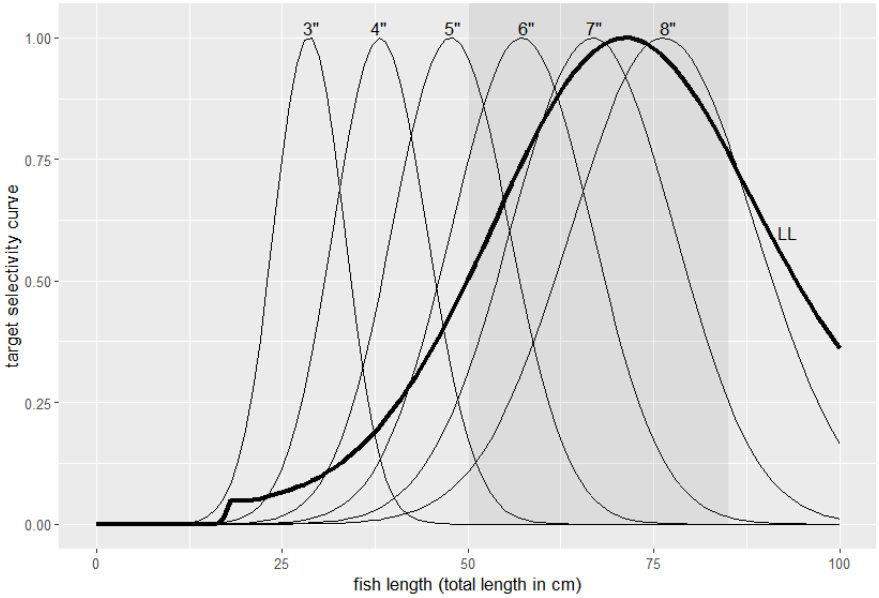

Figure 2: The target curves of gillnets (3" to 8") and of longlines (LL). The peak of the selectivity curves indicates which size each gear targets most intensely.

4. **We estimate that the maximum sustainable yield (MSY) is 207.8kt:** The validated model predicts that the maximum sustainable yield, given the current fleet selectivity, is 207.8 kt. This is somewhat lower than the estimate by Musinguzi et al. (2020) and more similar to the one by LVFO (2013) (see Nile Perch Fisheries Management Plan III for Lake Victoria, Tab. 8).

5. **Limitations of the study:** More research is needed to extend the study to include the interactions between fish species and to study the effect of longline bait and of gillnet paneling. Robustness checks with respect to parameter values and re-distribution of gears confirmed the trend of Fig. 1.

Methodology

The study uses a size structured model of the Nile perch population. Growth and natural mortality rates are based on a novel ecology-based framework which has already been successfully applied to other fish stocks. Dynamics are based on a Beverton-Holt recruitment function, calibrated with biological measurements. The model is simulated in the equilibrium with multiple selectivity scenarios. Current fleet selectivity comes from LVFO's 2020 CAS survey. The effect of re-distribution of gears was part of the robustness checks, but the values shown in Fig. 1 do not include the effect of gear re-distribution. Longline hooks are assumed to stay at 2020 level.

References:

Kammerer, J., Gómez-Cardona, S., & Nyamweya, C. (2022). Size selective fishing: The effect of size selectivity on the equilibrium yield in the Nile perch fishery of Lake Victoria. *AWI Discussion Paper 720*, Heidelberg University. https://doi.org/10.11588/heidok.00032308

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