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Fish Density Through Gillnet Catches Underwater Populations

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Introduction

We propose a new method for estimating fish density using catches obtained by gillnets of given mesh size. This method builds on work for estimating the number of fish approaching a gillnet by modelling the fish movement that leads to a gillnet encounter. The theoretical framework is developed, and the method is tested on catch data for cod Gadus morhua and Dolly Varden Salvelinus malma to demonstrate how the method can be applied. The method relies on knowledge of geometric properties of the net, and morphological and behavioural properties of the fish, so we explore the sensitivity of the estimates to some of these parameters. Estimates are most sensitive to the morphological parameter of the angle the mouth is open while swimming and largely invariant to estimates of uncertain parameters like maximum number of fish that can be caught by the particular net.

Assessing fish populations is a crucial aspect of fisheries management and conservation. One method that has proven effective in estimating fish density is through the catches obtained using gillnets. Gillnets are widely used in commercial and research fisheries, providing valuable insights into the abundance and composition of underwater populations. This article explores the use of gillnets as a tool for estimating fish density, highlighting its benefits, limitations, and the considerations necessary for accurate population assessments.

Gillnets consist of a mesh netting suspended vertically in the water column. Fish swim into the mesh and become entangled, allowing researchers to sample and estimate population parameters such as abundance, size distribution, and species composition. Gillnets are versatile, with variations in mesh size, length, and deployment methods to target specific fish species and size ranges.

Gillnets offer several advantages in estimating fish density. They provide an integrated view of the population over a defined area and time period, allowing for a representative sample. Gillnets are non-selective in nature, capturing fish based on their encounter probabilities, which enables unbiased estimates when properly designed and deployed. However, sampling efficiency can vary based on factors such as mesh size, fish behavior, and environmental conditions.

Habitat Suitability

Gillnets are most effective in areas where fish species of interest are known to occur and where the habitat is suitable for net deployment. Factors such as water depth, substrate type, and presence of obstructions can influence the efficiency and selectivity of gillnet catches. Understanding the target species' habitat preferences is crucial to ensure representative samples and accurate density estimates.

Gillnets have inherent size selectivity, with larger mesh sizes capturing larger fish more efficiently than smaller individuals. Selectivity can lead to underestimation or overestimation of fish density, depending on the target species and size distribution. Accounting for size-related biases and implementing appropriate mesh sizes or multiple mesh panels can help mitigate these limitations.

Fish behavior can influence gillnet catches and, consequently, the estimation of fish density. Some species may actively avoid gillnets, reducing encounter probabilities and potentially leading to biased estimates. Behavioral responses, such as avoidance or attraction, should be considered and accounted for when interpreting gillnet catch data to obtain accurate population assessments.

Habitat and Temporal Variability

Estimating fish density through gillnet catches provides valuable insights into underwater populations, contributing to fisheries management and conservation efforts. Gillnets offer a non-selective, integrated view of fish populations, facilitating the assessment of abundance, size distribution, and species composition. However, several considerations and limitations must be acknowledged to ensure accurate density estimates.

Understanding habitat suitability, size selectivity, and behavioral interactions is crucial when using gillnets as a tool for population assessments. Careful planning, appropriate mesh sizes, and consideration of species-specific behaviors are essential to mitigate biases and obtain reliable density estimates.

As fisheries management and conservation efforts continue to evolve, the combination of multiple survey methods, including gillnets, acoustic techniques, and underwater visual surveys, can

provide a more comprehensive understanding of fish populations. By integrating these methods and considering their respective strengths and limitations, researchers and resource managers can make informed decisions to sustainably manage and protect underwater ecosystems for the benefit of present and future generations.

Tanzania demarcated three prawn fishing zones along its coast to spread fishing pressure and help the prawn fishery to recover. However, it is unknown whether the demarcated zones correspond to the genetic stock structure of the world's most commercially important prawn, the giant tiger prawn (Penaeus monodon). Thus, this study used partial mitochondrial control region sequences (534 base pairs) to test the hypotheses that (1) giant tiger prawns in Tanzania's demarcated prawn fishing zones are a single stock and (2) the giant tiger prawns on the Tanzanian coast experienced a recent demographic expansion. The sequences showed high haplotype diversity (h = 0.998–1.0) and low nucleotide diversity. The neutrality test and mismatch analysis showed that the hypothesis of recent demographic expansion could not be rejected. The analysis of molecular variance revealed low and insignificant fixation indices between the zones, suggesting that the three demarcated fishing zones constitute a single stock and that fishers may be targeting the same stock. Furthermore, it was discovered that Zone 2 has the potential to replenish depleted areas; thus, it should be prioritised in future conservation planning.

Studies of migratory fish species in Neotropical Basins have generally focused on adult fishes, especially on their reproductive migration, whereas sites of growth and refuge of juveniles remain poorly investigated. We aimed to evaluate if smaller rivers play a role in the life cycle of these species. We used 13 rivers of different sizes in the upper São Francisco Basin, Brazil. We found that smaller rivers, especially when draining regions close to floodplains, were the first places where juveniles moved after leaving floodplain lakes. We also found that individuals moved downstream as they grew, and were found in increasingly larger rivers that were more distant from floodplains. Currently, the best-known strategy for conservation of neotropical migratory fishes is the maintenance of free-flowing stretches encompassing necessary habitats for life cycle completion. We conclude that small tributaries near floodplain regions are also needed in these protected free-flowing river systems.