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Applications of Electrofishing for Shrimp and Fish in Shallow Tropical Streams

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Description

Assessment of fish assemblages (e.g. species richness) depends on representative sampling that often requires high sampling effort. Particularly in larger water bodies, boat-based electrofishing or net fishing is needed, which requires sufficient personnel and infrastructure and in the case of net fishing often more than one visit of each site. Studies defining minimum sampling effort are therefore a prerequisite for developing applicable fish sampling methodologies. Electrofishing is one of the most common methods for quantitative assessment of fish populations allowing a minimally invasive capture of fishes. Furthermore, electrofishing provides an assessment of species richness including rare species. In contrast, methods like gill nets and seines are more selective for species and fish sizes. Electrofishing is particularly recommended for representative samples in littoral habitats. However, electrofishing is less efficient in open water, e.g. for pelagic species. Sampling of fish communities in structurally complex environments faces several challenges. These structures hamper fishing, although littoral structures, e.g. submerged bushes, trees and rooted macrophytes may attract fishes. Despite this, for example, catches of all fish species are lower in areas with high macrophyte cover. The attraction range of electrofishing is affected by physico-chemical parameters, especially water temperature and specific conductivity, the applied voltage, substrate composition, water depth, fish size, and species. Many studies have investigated the relationship between sampling effort by electrofishing and species richness in rivers, but few have evaluated this relationship in lakes or lentic habitats, while including the relevance of fish avoidance behaviour or the required sampling distances.

Influence of Fish Attractant on Hooking

Hence, the efficiency of electrofishing in lentic systems is in need of more study. Differences in a wide range of abiotic and structural conditions between lentic waters and rivers prevent a direct transfer of insights. Our objective was to quantify the influence of littoral structure on required minimum sampling distances for electrofishing in lentic waters. Connected oxbow lakes of the River Rhine were used as study areas. Block nets were used to temporarily isolate the first 50 m of each 200-m sampling section. This enabled quantification of avoidance or escape of fish by electrofishing. We hypothesised that (a) the fish community (species composition; number of individuals) determined by electrofishing in oxbow lakes would differ among littoral structures; and (b) the species accumulation (i.e. increasing number of species) with increasing length of total sampling section at a given site would depend on littoral structures. The study area, along the Upper River Rhine in southwest Germany, included 62 connected oxbow lakes, 150–5500 m in length, along a 194-km stretch of the river between Iffezheim and Bingen. Five oxbow lakes were selected that ranged between 800 and 5200 m in length and 21.5–103 ha in surface area. They were connected at one end to the main river channel, so water chemistry and water-level fluctuations were largely determined by the River Rhine. Water-level fluctuations up to 3.7 m in 2010 (level Maxau 49°2.339′N, 8°18.334′E) influenced the temporal availability of littoral structures for fish. A GIS analysis of land use in the surrounding of a larger number of oxbow lakes ensured that unusual land uses, such as harbours, industrial land use, and water bodies with other point sources of potential impact, were excluded from the study.

Electrofishing Equipment

Selected oxbow lakes represented all relevant littoral structures found in this type of waters along the Upper River Rhine (i.e., shoreline characteristics and submerged littoral structures; see below). The bottom of selected oxbow lakes was characterised by a shallow slope (<20°) due to gravel mining operations and shoreline with riprap stones. For multi-species fisheries, identifying the distribution of different species could help fishers prioritise fishing grounds and avoid catching unwanted species. In this study, we identified the most cost-beneficial fishing grounds by considering four major taxa caught in the torchlight fishery of Taiwan. We used logbook data of 56 vessels during 2009–2020 to predict the distribution for each taxon using maximum entropy models. We determined optimal fishing areas by considering overlap among taxa, each taxon's economic value and traveling costs. Sea surface height was a critical factor in determining occurrence for all taxa. Fishing at these optimal areas varied across vessel sizes. Small vessels could not access the most profitable areas because of mobility constraints and larger vessels fished in areas with relatively lower benefit-per-cost. Our findings could help fishers enhance their spatial selectivity, given increasing catch restrictions on some species in the fishery. Recreational fishing gear continues to evolve, and factors such as anatomical hooking location may change over time due to technology creep. We revisited studies conducted in 1996 by re-examining hooking location in experiments where hard-bodied and soft plastic lures were presented to stripey (Lutjanus carponotatus) and wire netting cod (Epinephelus quoyanus) either with or without application of a synthetic fish attractant. These data were compared to those of fish hooked on organic bait using circle or J-style hooks. Lure type and application of attractant both significantly affected hooking location. Addition of attractant to hard-bodied lures reduced foul hooking of both species. For L. carponotatus, soft plastic lures both with and without attractant tended to be taken deeper than hard-bodied lures. For E. quoyanus captured on soft plastic lures coated with attractant, hooking locations were similar to those using organic baits on circle hooks. However, deepest hooking of both species occurred using organic bait on J-style hooks. The use of soft plastic lures with an effective fish attractant may result in deeper hooking, which could potentially influence post-release survival and increase fishing power.