Benchmarking pre-spawning fitness, climate preferendum of some catfishes from river Ganga and its proposed utility in climate research

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Abstract The concept of threshold condition factor (Fulton), beyond which more than 50% of the female fish population may attain readiness for spawning coined as *pre-spawning fitness* ($K_{spawn50}$), has been proposed in the present article and has been estimated by applying the non-parametric Kaplan-Meier method for fitting survival function. A binary coding strategy of gonadal maturity stages was used to classify whether a female fish is "ready to spawn" or not. The proposed $K_{spawn50}$ has been generated for female *Mystus tengara* (1.13–1.21 units), *M. cavasius* (0.846–0.945 units), and *Eutropiichthys vacha* (0.716–0.799 units). Information on the range of egg parameters (fecundity, egg weight, egg diameter) expected at the pre-spawning stage was also generated. Additional information on species-specific thermal and precipitation window (climate preferendum) within which $K_{spawn50}$ is attained was also generated through the LOESS smoothing technique. Water temperatures between 31 and 36 °C (*M. tengara*), 30 and 32 °C (*M. cavasius*), and 29.5 and 31 °C (*E. vacha*) and monthly rainfall between 200 and 325 mm (*M. tengara*), > 250 mm (*M. cavasius*), and around 50 mm and between 350 and 850 mm (*E. vacha*) were found to be optimum for attainment of $K_{spawn50}$. The importance of parameterization and benchmarking of $K_{spawn50}$ in addition to other conventional reproductive biology parameters has been discussed in the present article. The purposes of the present study were fulfilled by generating baseline information and similar information may be generated for other species replicating the innovative methodology used in this study.

Keywords *Mystus tengara* · *Mystus cavasius* · *Eutropiichthys vacha* · Fulton's condition factor · Kaplan-Meier survival fit · LOESS fit · Climate change

Introduction

Catfish, the common name of a diverse group of ray-finned bony fish of the order Siluriformes, are found in Asia, Africa, and North and South America and live in inland or in coastal waters, though most of them inhabit shallow and running water (Bruton 1996). Catfish has significant importance in many countries due to its immense commercial importance and aquarium purpose. Catfishes give high rate of production and is also suitable to culture in warming climates. Catfishes have high resistance against disease despite the existence of