後龍溪魚類適合棲地分析研究

The study on habitat analysis of fish species in the Holong River

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摘　要

本研究以 HEC-RAS 二維水理模式與棲地適合度曲線，探討河川水理條件與生物棲地之關係。以後龍溪二張犁堤防河段為研究樣區，並以樣區中表層活動之魚類，分析魚類棲地適合度（HSI）。棲地適合度（HSI）參考 Gillenwater(2006)等人評估棲地適合度之方式，並採二維水理模擬格點之流速與水深，配合目標魚種臺灣石鱝流速與水深適合度曲線，本研究選擇重要值最高之魚類物種-臺灣石鱝，表示出現頻度最高且魚類資源量豐富，具有代表性，計算研究樣區適合度 HSI。

後龍溪二張犁堤防河段位於苗栗縣苗栗市及後龍鎮交界處，本研究區域以頭屋大橋至北勢大橋為計算模擬討論案例。依據河川原生魚種及棲地適合度曲線調查與資料庫建置(經濟部水利署水利規劃試驗所，2018)說明後龍溪指標魚種臺灣石鱝平均水深與出現頻度之關係，合理出現頻度指數之平均水深介於 0.1-1.5 公尺；平均流速則介於 0-1.5 每秒公尺。本研究以流速、水深等二變數為主要變數進行分析，二維水理模式進行模擬，上下游資料採用後龍溪 2019~2020 間北勢大橋流量水位資料，用以計算研究樣區內各數值網格點之流速、水深，參考臺灣石鱝流速、水深適合度曲線，推算棲地適合度之空間時間分佈情形，選擇棲地適合度（HSI）大於等於 0.6 為其最佳適合棲地，並推估其整體面積占比。研究顯示後龍溪二張犁堤防河段，最適棲地面積占比分析，該值介於 24.9%~76.3%，平均最適棲地面積占比 58.7%。

本研究亦採用 2020 年 0522 豪雨事件進行研究，0522 豪雨事件於 5 月 23 日流量高達 281.8cms，經本研究計算結果指出，其最適棲地面績占比由原 58.7%比降至最低為 35.7%，經過數日後洪峰流量過後，棲地適合度 HSI 又回升，顯示洪峰流量（高流速）雖然會造成魚類棲地短暫的影響，但待其河道內水位流速降低後，棲地又可回升至原有的最適棲地條件，適合魚類的生存。本研究區域範圍內約有六成棲地面積為指標魚種台灣石鱝適合活動、生存空間，希冀本研究成果可作為生態棲地評估參考。

關鍵詞：魚類棲地適合度、二維水理模式、臺灣石鱝

Abstract

This study investigates the relationship between river hydrological conditions and aquatic habitats using the HEC-RAS 2D hydraulic model and habitat suitability curves. The research focuses on the Erzhangli embankment section of the Houlung River, located at the border of Miaoli City and Houlung Township in Miaoli County. The study area spans from the Touwu Bridge upstream to the Beishi Bridge downstream.

The Habitat Suitability Index (HSI) is employed to assess habitat suitability for fish species, with reference to methods proposed by Gillenwater (2006) and others. It incorporates flow velocity and water depth data obtained from the 2D hydraulic model and aligns it with suitability curves specific to the target fish species, in this case, Acrossocheilus paradoxus. This species was chosen due to its high importance, being both the most frequently occurring and resource-rich fish species in the area.

The analysis focuses on two primary variables: flow velocity and water depth. Data for these variables were derived from the HEC-RAS 2D hydraulic model, utilizing flow and water level data from the Beishi Bridge between January 2019 and October 2020. Specific flow velocity and water depth suitability curves for Acrossocheilus paradoxus were applied to estimate the spatiotemporal distribution of habitat suitability. Areas with an HSI greater than or equal to 0.6 were considered optimal habitats.

The analysis of the proportion of optimal habitat area from January 2019 to October 2020 showed that this value ranged from 24.9% to 76.3%, with an average proportion of optimal habitat area of 58.7%. However, the study also considered the impact of the heavy rainfall event on May 22, 2020. On that day, the flow rate reached a high of 281.8cms. The results indicated that during this high-flow event, the proportion of optimal habitat area decreased to a minimum of 35.7%. However, after several days of reduced flow following the peak flow, the habitat suitability index (HSI) rebounded, suggesting that while high-flow events can have a temporary impact on fish habitat, the habitat can recover to its original optimal conditions once water levels and flow velocities decrease.

In general, approximately 60% of the habitat area within the study region is suitable for the target fish species, Acrossocheilus paradoxus, demonstrating the potential for their activity and survival. This research provides valuable insights for ecological habitat assessments.

Keywords: habitat suitability index(HSI)，2D hydraulic model，Acrossocheilus paradoxus