The ICE method for ecological continuity. Assessing the passage of obstacles by fishes and macro-crusteaceans in the French tropical islands of the Atlantic and Indian Oceans - Concepts and design

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Fragmentation of natural habitats is one of the main causes of biodiversity loss. The international community decided to act and created legal obligations in view of maintaining sufficiently diversified and interconnected habitats so that animal and plant species can satisfy their vital needs and, where possible, adapt to environmental changes. For example, the EU Water framework directive (WFD, 2000) highlighted the value of gaining knowledge, preserving and restoring ecological continuity in hydrosystems and riparian corridors. Many transverse obstacles in rivers (over 100 000 have already been inventoried in France) can degrade ecological continuity in aquatic ecosystems. This situation made it necessary to develop new, standardised tools to diagnose the risks, in a given area, of damage to ecological continuity (notably in terms of the movement of aquatic fauna) caused by obstacles to flow. It was in this context, shortly before 2010, that the National Agency for Water and Aquatic Environments (Onema), which later integrated the French Biodiversity Agency (OFB), decided to address the problem and coordinate the development of the ICE (Information on the Continuity of Ecosystems) method, designed to assess the severity of the impacts of obstacles on the movement of the main species of fish in continental France (Baudoin et al., 2014). In the French tropical islands of the Atlantic and Indian Oceans (Guadeloupe, Martinique, Mayotte and Réunion), a survey still under way has already revealed the existence of over one thousand obstacles in rivers. Many of these structures can limit and even completely block the movements, vital to the achievement of their life cycles, of fish and macro-crustaceans, virtually all of which are diadromous. To date, the assessment of the potential impacts on ecological continuity was generally undertaken by a small number of experts in the field. However, a series of issues, ranging from the number of obstacles requiring assessment to the need for a simplified means of sharing knowledge and common concepts among highly diverse stakeholders (project owners, consulting firms, site managers, civil servants, etc.), made it necessary to offer a simple method that is scientifically sound, objective, understandable and implementable in a minimum amount of time. Calling on the experience gained in deploying the method in continental France and in a partnership with all the overseas Environmental Directorates and Water Offices, and with the Écogea and Ocea consulting firms, OFB coordinated and facilitated the adaptation of the method to the tropical islands of Guadeloupe, Martinique, Mayotte and Réunion. This book in the Knowledge for action series is organised in three chapters. It summarises the main scientific and technical knowledge available internationally and presents the method as follows: - chapter one presents the issues surrounding ecological continuity for fish and crustaceans in tropical islands of the Atlantic and Indian Oceans. It discusses the types of obstacles encountered, the ecological and functional issues concerning the movement of the species of fish and macro-crustaceans in question, and describes for each species the main environmental, ethological and physical factors determining the possibility and their capability of overcoming obstacles; - chapter two elaborates on the fundamental concepts of the ICE method adapted to tropical islands of the Atlantic and Indian Oceans, the scope of its applicability, the groups of species under consideration, their characteristics and the five passability classes ranking the impacts of obstacles on the upstream migration of the species; - chapter three examines in detail the proposed method and looks at each step in the diagnostic procedure to determine the passability of obstacles to upstream migration using decision trees and explanatory text. In the process, the criteria used to define the passability classes for commonly encountered types of obstacles are presented. By comparing the hydraulic and physical characteristics of the assessed obstacle with the physical capabilities of the species, the method makes possible a scientifically sound, step-by-step analysis of the degree to which a given obstacle is passable by the species in question. The method expands its scope by including an analysis of specific taxa and proposes an assessment and diagnostic procedure for the crawling capabilities of eels, the suction and climbing capabilities of Sicydiinae and the post-larvae/juveniles of small, benthic species, as well as the walking capabilities of macro-crustaceans. This detailed and richly illustrated book in the Knowledge for action series clearly explains the method developed, the fundamental concepts and issues involved, and puts readers in a position to effectively implement the method in the field.

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