REVIEWS IN FISHERIES SCIENCE & AQUACULTURE
2016, VOL. 24, NO. 2, 160–177
http://dx.doi.org/10.1080/23308249.2015.1112766

Taylor & Francis
Taylor & Francis Group

Fish Assemblages in Large Tropical Reservoirs: Overview of Fish Population Monitoring Methods

Anne Tessier[a], Stephane Descloux[a,b], Raymond Lae[c], Maud Cottet[d], Pierre Guedant[d], and Jean Guillard[a]

[a]UMR CARRTEL, INRA - Université Savoie Mont Blanc, Thonon-les-Bains, France; [b]Sustainable Development Department, EDF - Hydro Engineering Centre, Le Bourget du Lac, France; [c]UMR LEMAR 195, IRD - Boulevard Sidi Abderrahman Ain Diab, Casablanca, Morocco; [d]Environment and Social Division, Water Quality and Biodiversity Department, Nam Theun 2 Power Company Limited (NTPC), Vientane, Lao PDR

ABSTRACT
To preserve ecosystem services of tropical reservoirs that provide food and income for local populations, it is necessary to monitor fish population temporal dynamics, stock, and yield fishing. The aim of this review is to provide information to who monitor fish populations in tropical reservoirs. The topics, investigative methods, observation scaling, and metrics used in publications since 1960's were inventoried. Temporal and spatial variations in fish population and fish production were the primary topics. Since 2000, studies on trophic structures and fish biological parameters have appeared. Experimental fishing with gillnets has been the technique most often used, but others include hydroacoustics for fish stock assessments and modeling to characterize trophic structures. Annual and seasonal scaling approaches dominated, as well as longitudinal/transversal gradient sampling, which permitted the characterization of fish colonization processes and the detection of halieutic resource overexploitation. For modeling approaches, the entire reservoir was considered. The calculated metrics varied depending on the investigation method. Species richness, number of individuals, and biomass per unit effort were the most common metrics for the different topics. Trophic level, effectiveness, and consumption rate were specific to trophic structure. To monitor reservoir fish populations, it is necessary to have an eco-systemic approach.

KEYWORDS
impoundment; man-made lake; experimental fishing; hydroacoustics; modeling; stock

Introduction

Reservoirs (water areas that arise due to dams) are numerous worldwide and were first built 5000 years ago (Jorgensen et al., 2005; Icold, 2013). Reservoirs are used to meet human needs such as flood control, water supply, agriculture, recreational activities, and hydropower generation. Reservoirs are generally classified using various physical characteristics (surface, volume, and construction materials; Icold, 2011). For instance, the International Commission on Large Dams (ICOLD) identifies a large reservoir as one with a water surface area greater than or equal to 10 km^2 (Icold, 1992; Costa-Pierce, 1997). This definition is adopted in the present study. ICOLD inventoried more than 37,000 large reservoirs worldwide, 40% of which are located in tropical and subtropical regions (Costa-Pierce, 1997). The construction of dams is a more recent practice in Africa and Asia. Large reservoirs in Africa were built in the 1960s, including the Volta Reservoir in Ghana, Nasser in Egypt, and Kariba in Zimbabwe and Zambia. Numerous reservoirs of more modest size have since been added (Anne et al., 1991).

Since the 1960s, the construction of new tropical/subtropical reservoirs has significantly increased worldwide, primarily for flood control and crop irrigation. This is especially apparent in Asia, where 25% of all tropical and subtropical reservoirs are located (Bhukaswan, 1980; Sugunan, 1995). This trend is continuing into the second half of the 2010s with an added objective of realizing hydropower generation (Zarfl et al., 2015), which is currently the case places such as Lao PDR, where 71 reservoir projects are planned (MRC, 2010).

Most reservoirs have an indirect objective of fish production for local populations, who are affected by resettlement in new villages as a result of submersion of their habitations and agricultural fields. This indirect dam objective is particularly true in Asia and Africa, where inland fisheries are socially and economically important (Bhukaswan, 1980; Crul and Roest, 1995; Petr, 2005). In some Asian countries, such as China (60%) and Cambodia (70%), total fish production is mainly attributed to inland fisheries (Lymer et al., 2008; IFReDI, 2013). This is also the case in Africa, where certain landlocked

CONTACT Anne Tessier anne.tessier@thonon.inra.fr UMR CARRTEL, INRA - Université Savoie Mont Blanc, 75 avenue de Corzent, 74203 Thonon-les-Bains, France.