RESEARCH PAPER | Fisheries | Volume : 3 | Issue : 12 | Dec 2013 | ISSN - 2249-555X



Estimation of Fish Abundance in the Towkak River in Assam and Nagaland based on the Habitat Parameters

KEYWORDS: Habitat parameters, Fish diversity, Towkak River, Assam, Nagaland.

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ABSTRACT *A novel approach towards the study of fish assemblage structure, species inventory and habitat requirement of ichthyospecies with special emphasis on the fish diversity in the Towkak River is the major aim of the present work. Fish assemblages have been used as an indicator of the environmental degradation, ecosystem health in the river. The potential habitat parameters for the fishes of the Towkak River in Assam and Nagaland were estimated by using various habitat parameters via Dominant Vegetation, Bank Stability, and Surface Turbulence. The above three habitat potential parameters give clear reasons to justify the availability of fish diversity within the river.*

Introduction

Fishes are one of the most abundant groups of vertebrates, both in terms of number of species and individuals. India is known for its rich aquatic biodiversity specially the fish. At the same time, the increased population and environmental degradation have caused damage to this biodiversity. This damage could be severe and may result in loss of genetic diversity, populations and eventually to the extinction of species. The importance of the habitat and the relationship between fish and the habitat are major concerns of the fishery biologist, as the habitat features like depth, flow, substrate type etc., are generally considered as major determinants in distribution and abundances of fishes from earlier times (Kar D, 2007, 2010, 2012, 2013). Structural characteristics of the lotic environment are closely associated with the occurrence of the fish species. The importance of the habitat and the relationship between fish and the habitat are major concerns of the fishery biologist, as the habitat features like depth, flow, substrate type etc are generally considered as major determinants in distribution and abundances of fishes from earlier times (Shelford, 1911).

The purpose of this study is to identify the potential habitat for the fishes of some estimated habitat parameters. These habitat parameters are difficult to consistently qualify and expensive to quantify, which, defines each parameter, assigns a categorical rating to each and visual depicts the variation for each category using maps and images.

The parameters presented are not an exhaustive list of fish habitat types that could be collected during an inventory project work. The original intent of this project was to develop a concept where one could use images of habitat types to improve the precision of data that are collected to describe them. The habitat parameters included in this work were determined by comparative means to be statistically improved when estimated with the aid of this visual interference. (Jones, et al. 1998)

Methods

Collection of Fish Habitat Data

Three habitat variables using photographs and definitions are have been included in the present study for this piece of work. Although the method of data collection may vary depending on the variable being estimated, this section describes a suggested methodology for collecting these types of habitat data.

The number of transects and their positions presented here are an example and may vary between projects. For the first transect, estimates are made either along the transect or by looking upstream. A similar approach is used for the last transect where estimates are made along transect or by looking downstream. For all other transects, habitat data are estimated either along transect or looking both upstream and downstream. Data are estimated by looking as far as one can see.

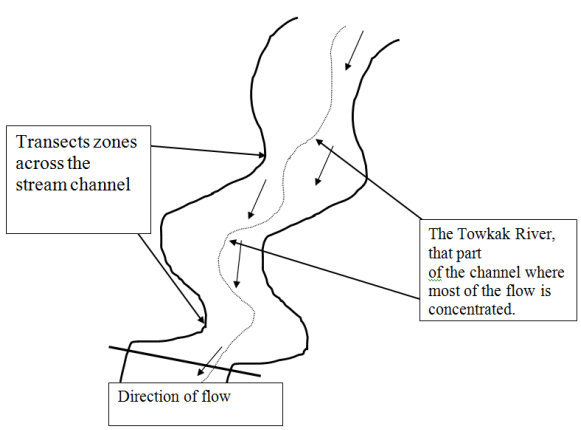
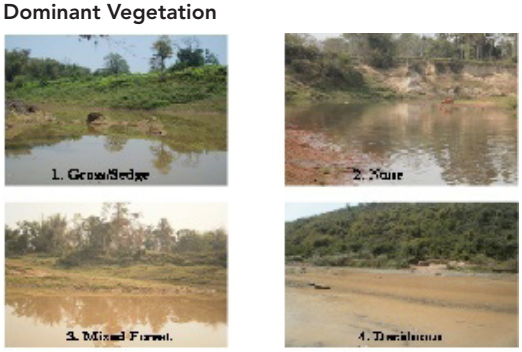


Figure 1. A typical site with transects indicated for fish habitat inventory.

Dominant Vegetation



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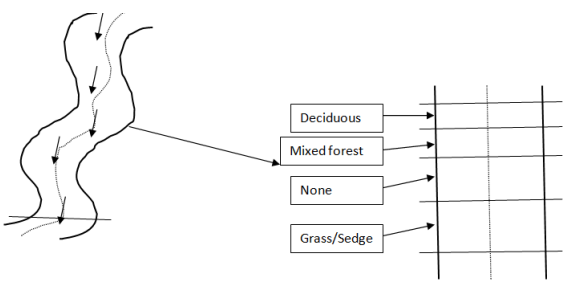
Definition: The dominant vegetation type found along the stream bank within 25m of the wetted perimeter. The deeper and more extensive the root system of the prevailing vegetation the greater stability provided to the stream banks (Stanfield et al. 1996).

Method: Determined the category of dominant vegetation within the river course having the photographs of riverine basin.

Category Type Description

Sl No	Type	Description
1	Grass/ Sedge	The riparian vegetation is grass or forbs (sedges) and constitutes > 75% of the stream side vegetation. The riparian vegetation is shrubs or willows and constitutes > 25% of the stream side vegetation.
2	None	Over 50% of the stream bank area without vegetation and the dominant material is soil, rock, road and bridge material.
3	Mixed forest	The vegetation consists of a combination of deciduous and coniferous trees with approximately equal percentages of each and constitutes > 25% of the stream side vegetation
4	Deciduous	The vegetation is deciduous trees and constitutes > 25% of the stream side vegetation



Fish abundance corresponding to bank vegetation abundance:

Dominant Vegetation Type	Fish abundance
1. Grass/Sedge	+++
2. None	++
3. Mixed Forest	++
4. Deciduous	++

(+++: Highly Abundant, ++:abundant)

Bank Stability



Definition: Stable banks are characterized by the presence of boulders, rocks, or rooted vegetation that reduces the bank's susceptibility to erosion, while unstable banks are characterized by the presence of exposed raw dirt, lack of rooted vegetation, steep sloped banks, undercuts, and often slumping banks.

Method: Determined the category of bank stability for the left upstream bank (LUB) and right upstream bank (RUB) separately at each transect.

Sl No	Type	Description
1	Stable	Banks well vegetated or covered with large boulders.
2	Slightly unstable	50% of bank vegetated or covered with rocks, and possibly some undercut banks.
3	Unstable	Massive bank slumping, large silt deposition, exposed raw dirt.

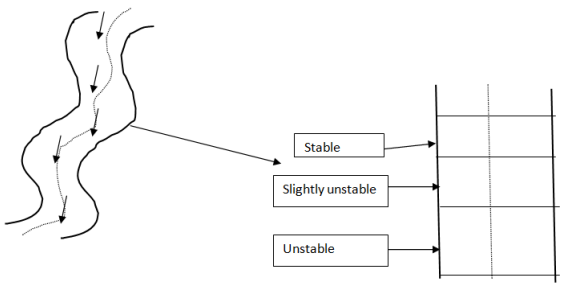


Fig: Bank Stability of Towkak river 2011-12 (S: 20-25%, SU: 25-40%, U:40-50% approx)

Abundance of fishes with respect to bank stability:

Bank type	Fish Occurrence
1. Stable	+++
2. Slightly unstable	++
3. Unstable	-

Surface Turbulence



Definition: Fast flowing water that is broken (not laminar) at the water's surface.

Method: Determined the category for surface turbulence at each transect, looking upstream for the first transect, both downstream and upstream for middle transects, and downstream for the last transect. Percent surface turbulence refers to that portion of the surface area that is covered by surface turbulence.

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Category Type Description

Sl No	Type	Description
1	Low	6 – 25 % surface turbulence
2	Moderate	26 – 50 % surface turbulence
3	High	> 50 % surface turbulence

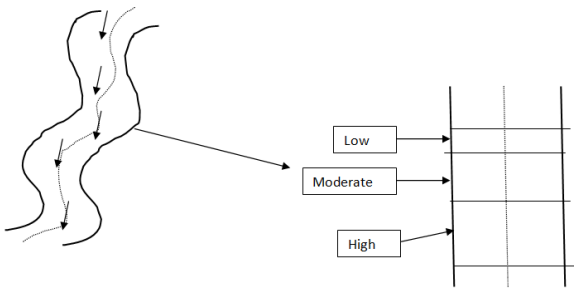

Fig: Surface Turbulance of Towkak river 2011-12 (Values as above approx)

Abundance of fishes corresponding to Surface Turbulence

Surface Turbulence Type	Occurrence of fishes
1. **Low**	+++
2. **Moderate**	+++
3. **High**	++

Conclusion:

A clear relationship is found with the different habitat parameters and fish availability. However, it is difficult to define the actual environmental conditions determining the presence of particular fish at particular place. This is because variation of depth, temperature, substrate type, ecological factors in different localities. The habitat parameter model based on these environmental conditions is able to predict part of the variance in the distribution. This model, however, perhaps, underestimates the actual densities. Nevertheless, an integrated and accelerated effort is essential towards environmental restoration and preservation, and to stop further deterioration of these fragile ecosystems (Kar, *et al*. 2003).

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