APPLICATION OF MASS BALANCE MODELLING TO ASSESS THE EFFECTS OF FISH STOCKING ON THE ENERGY FLOW IN A RESERVOIR ECOSYSTEM

Preetha Panikar*[1], M. Feroz Khan[1] and A.P. Sharma[2]

[1] *Research Centre of Central Inland Fisheries Research Institute, Hessarghatta, Bangalore, India*

[2] *Central Inland Fisheries Research Institute, Barrackpore, Kolkota, India*

*Corresponding author: preetha23@gmail.com

ABSTRACT

The impact of fish stock supplementation on the energy flow in Hemavathy reservoir ecosystem in Karnataka, South India was assessed using mass balance modeling. The mass balanced model structured around thirteen ecological groups which included the nonliving group, detritus. Hemavathy Reservoir with an area of about 9162 ha was constructed in 1981, on the river Hemavathy for irrigation purpose in Karnataka. The fish landings data of Hemavathy reservoir was collected and studied for three years from 1983 by earlier workers. During this period there was no systematic stocking of fish in this reservoir. Central Inland Fisheries Research Institute investigated this reservoir in 2002 to 2004 when regular stocking and harvesting regime had become an established management practice. Hence the present study was conducted to analyse the impact of fish stocking on the energy flow and ecosystem maturity of a reservoir ecosystem by comparing two scenarios; pre- and post- fish stocking regimes. The mass-balance models of the reservoir ecosystem were constructed for two periods, 1984 and 2003 using Ecopath with Ecosim software to compare the fluctuations that occurred within each of these years before systematic stocking and post-stocking period. Flow at the trophic level II largely involves the zooplankton (the dominant herbivore), bottom biota and the two groups of fishes the minor carps and the exotic carps. Though aquatic birds occupy the highest trophic levels in both phases, among fish groups Eels in the pre-stocking phase and murrels in post-stocking phase occupy top trophic levels. The pattern of energy flow through the network is described in terms of the number of trophic interactions of each group and the mean length of pathways (MLP) through the network. For top predators, the number of connections was high (78–233) and with a high number of steps (MLP =

3.69). In the middle of the trophic chain, the exotic carps and major carps were (MLP = 2.87 &2.27) and the groups at the bottom of the pyramid like zooplankton and bottom biota are characterized by low numbers of trophic interactions (2 & 3 respectively) and path lengths (2.0). The ecotrophic efficiency of the carps were low in post-stocking phase showing these groups were not heavily exploited by the fishermen but the increase in biomass due to stocking are evident. The resilience of reservoir ecosystem before stocking the reservoir and the impact on ecosystem after fish stocking were compared using various indices of ecosystem maturity. A decrease of the flow of the system from pre-stock to post-stock is evident (22.28%). The system overhead was higher by 0.29% in the post-stock phase indicating maturity. The ecosystem indices tested indicate that the reservoir during post-stock phase was in a more resilient state compared to the pre-stock phase. The maturity of the ecosystem showed an improvement which indicates a positive impact of stocking.

Key words: Ecosystem maturity, Indian major carps, mass balance modelling, trophic levels, diet composition, reservoir fisheries.