Quantification of Morphometric Characteristics and Aquatic Vegetation Cover in Non-perennial Reservoirs using Remote Sensing Techniques for Planning Culture-based Fisheries

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Abstract

In most developing countries of Asia and Latin America, culture-based fisheries are recognized as an effective means to increase food fish supply and to generate income for rural poor. Sri Lanka is reputed for its ancient irrigation network, which includes small non-perennial reservoirs as well as medium and large perennial reservoirs. Small non-perennial reservoirs are scattered in dry zone, which receive annual rainfall < 187 cm. More than 12,000 such reservoirs are scattered in the island irrigating paddy lands benefiting over 700,000 rural farming families. These water bodies have a potential to develop culture-based fisheries as secondary use. However, non-availability of reliable information on reservoir area and productivity levels is a major problem in planning culture-based fisheries development in non-perennial reservoirs. As such, an attempt is made to quantify reservoir area and to group reservoir according to productivity levels using remote sensing techniques.

In 45 randomly selected non perennial reservoirs in five administrative districts, areas at full supply level were measured using geographical positioning system (GPS). In the same reservoirs, areas were determined from satellite imagery. Georeferenced IRS (24x24m resolution) satellite image was used to derived area and perimeter of reservoirs in Anuradhapura and Kurunegala districts. For Humbantota, Monaragala and Ratnapura districts, LANDSAT (30x30m resolution) satellite image was used. ENVI 4.1 software was used for image analysis. As there is a strong correlation between actual area determined by GPS and those derived from satellite images, remote sensing can be reliably used to determine reservoir area accurately. These estimated areas are significantly different from those reported in available databases.

Aquatic plant cover is a factor determining productivity level of reservoir because it has a negative correlation with productivity. As such, fish yield and percentage plant cover of reservoirs have negative second order negative relationship ($P<0.05$). Remote sensing techniques can be used to quantify plant cover so that reservoirs can be classified according to productivity level. Also, as it has been shown that the ratio of reservoir area to reservoir perimeter can be used as an index of productivity of non-perennial reservoirs, both these reservoir morphometric characteristics can be quantified by remote sensing techniques with a view to classifying them.