ABSTRACT

Aquaculture is one of the most important component of food production chain and is essential part of food security assuring good quality and sustainable food supply to 9 billion people in 2050. This study aims to find the potential sites for cage culture in the coastal water of the Bay of Bengal (BoB) using remote sensing (RS) and Geographical Information System (GIS). First, all the five monitoring stations in the coastal water of the BoB are grouped into three significant clusters using cluster analysis (CA) based on their similar water quality characteristics. Then the quality of waters in these groups are identified as good, average and bad/poor based on the presence of nutrient load and dissolved oxygen (DO) concentration. The discriminant analysis (DA) is used to develop water quality index (WQI) to access the quality of water in the study region. The range of the WQI is found to vary between -1.5 to 3. The value close to -1.5 (3) represents good (bad) water. It is found that cumulative effect of industrial effluents and domestic discharge due to rapid urbanization and agricultural runoff are responsible for bad quality of water at the observation stations. All the stations showed poor water quality during monsoon as well as winter period. The poor water quality in monsoon season is mostly contributed by agricultural and river runoff. However, the poor water quality in winter is attributed to the variation in local current, the East India coastal current (EICC).

The difficulty in obtaining the in-situ observations is a limitation of water quality assessment. Therefore, the RS data such as chlorophyll-a concentration (chl-a), sea surface temperature (SST) and total suspended mater (TSM) are used to assess the coastal water quality. Since, TSM is not a standard satellite product; a retrieval algorithm is developed for the study area using the satellite reflectance values. An artificial neural network (ANN) model is developed to predict WQI in the coastal water of the BoB using chl-a, SST and TSM.

Suitable sites for cage culture are identified in the coastal water of the BoB using different criteria such as hydro-meteorological, WQI, socioeconomic and constraints in a GIS environment. The suitability map based on analytical hierarchy process showed that out of the total area (2018 km^2), 984 km^2 (46.6%) area is most suitable, 567 km^2 area (27%) is moderately suitable for cage culture operation. These areas are located in the northern parts of coastal Andhra Pradesh and some parts of the coastal Odisha. The results are verified with existing cage culture sites and are found to be consistent.

Keywords: Water quality Index, multivariate statistical techniques, artificial neural network, satellite data, multi criteria evaluation techniques, Analytic hierarchy process, cage culture.