

Importance of multidisciplinary research for the sustainable exploitation of aquatic resources

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Introduction

Sri Lanka is blessed with large number of diverse aquatic habitats including lentic and lotic inland water bodies as well as marine habitats, both coastal and offshore. The freshwater habitats include, streams, rivers, flood lakes, villus, marshes, and perennial and seasonal reservoirs.

Sri Lanka has a river system comprising 103 rivers. However, exploitation of living aquatic resources from the major rivers is not well developed in Sri Lanka except for exploitation of ornamental fish from some tributaries and streams. The riverine fishery of food fish is also not well developed in Sri Lanka. However, villus or the flood lakes are found mainly in the flood plains of Mahaweli river, Kala Oya and Modaragam Aru and the total extent of these are estimated to be around 40,000 ha (de Silva 1988 a). Fisheries of these flood plains are also not well exploited for commercial purposes. However, fish yields of 35 – 70 kg ha⁻¹ year⁻¹ have been recorded from some villus in the Mahaweli flood plains (Jayasinghe 2000).

Although there are no natural lakes, large number of man made lakes, both perennial and seasonal, exist in Sri Lanka. These have been constructed during the ancient times for agricultural purposes and in the recent past for hydro power generation. The perennial reservoirs which retain water throughout the year generally exceed 200 ha in surface area. The total extent of major perennial irrigation reservoirs in Sri Lanka is estimated to be around 70820 ha (Jayasinghe 2000). The seasonal reservoirs, which dry up during the latter part of the dry season cover a total area of around 56250 ha. The total area of lentic inland water bodies in Sri Lanka is estimated to be around 4 ha/km² of land. The inland reservoirs play a significant role contributing to inland fisheries. The inland fish production from these perennial and seasonal reservoirs is estimated to be around 10% of the total fish production of the country.

Freshwater Ornamental fish and ornamental aquatic plants are also harvested from some of the inland reservoirs, streams and marshes. Ornamental fish and ornamental aquatic plants have now become very important as foreign exchange earners. The demand for tropical aquarium fish and tropical aquatic plants is extremely high worldwide.

Further, freshwater aquatic habitats are sometimes important as nature tourism sites.

The major non living resource extracted from inland water bodies is river sand. However, this has caused severe environmental damage and is banned in some river systems.

The marine resources include both living and non living resources in the coastal zone and the off shore region. The exclusive economic zone, which extends for 200 nautical miles into the sea from the coast line, covers an area of about 517,000 km², which is about 8 times of the area of the land mass (NARA 2000). When the outer margin of the continental shelf is demarcated, it is estimated that Sri Lanka has a jurisdiction for benthic resources in the marine environment over an area of about 35 times of the area of the land mass.

The living resources in the marine environment, which are commercially exploited include fish, crustaceans (shrimp and crabs), molluscs (cuttle fish, squids, mussels, etc.), sea cucumbers and sea weeds. Some fish, crustaceans, molluscs, corals and echinoderms are harvested for ornamental purposes too. The non living resources include various minerals and sand. In addition, many coastal habitats serve as the basis for tourism industry. These includes beaches, coastal seas, scenic bays, coral reefs etc. As such, the marine resources, in addition to providing food for the nation, significantly contribute to the economy and are among the prime foreign exchange earners.

Current status of multidisciplinary research in exploitation of aquatic resources

It is well accepted that, aquatic research on multiple components of resources are extremely useful for their sustainable exploitation. These include research on the aquatic resource itself, the surrounding environment and the human component. For example, when the fishery resources are considered, it is necessary to carry out research on the biota, abiotic environment and the humans associated with them. The list of publications resulted from research carried out on fisheries and aquatic sciences from 1900 to 2004 has been compiled recently by Silva (2005). It is evident from Silva (2005) that during the past century, many research on various disciplines associated with the exploitation of aquatic resources has been carried out in Sri Lanka. The status of water resources in Sri Lanka has been described recently by Manchanayaka and Madduma Bandara (1999) and Madduma Bandara (2000). Scope of the use of geoinformatics for the development and management of water resources has been described by Perera (2004). Research on the biotic components include not only those on the species that are harvested by the human but also on the groups which are not harvested by humans but constitutions of the community. These research include those on taxonomy, physiology, behaviour, food and feeding, reproduction, population dynamics, and ecological interrelationships (see Silva 2005). The groups studied include all groups of invertebrates, fish, aquatic birds, phytoplankton, mangroves, sea grasses, and marine algae (see Silva 2005). When the harvested resources are considered, many research has been carried out on the biology of fishes, fish diseases, impact of pesticides on fish, fish population dynamics and optimum yield levels (see Silva 2005).

Although, these are mainly carried out by biologists, the fields other than biology such as mathematics, statistics and computer applications are frequently incorporated into these studies. When research on productivity of aquatic resources is considered, studies on multiple fields such as biology of fishes, limnological features of the water bodies, chemical and physical characteristics of water, catchment characteristics, and land use pattern are needed. The GIS applications and mathematical modeling are also used today in the research on the exploitation of aquatics resources.

Since human use is an integral part of the exploitation of aquatic resources includes studies on research on aspect should also be carried for their sustainable exploitation. These research on marketing (Chandrasoma 1988, Nothanael and Silva 1988, Murray *et al.* 2001), cost and profitability (Fernando 1984), socio economics (Chandrasiri 1986, Munasinghe 1984, 1990, Weerasooriya *et al.* 2001), bio-economics (Sanders and Siripala 1997, Wimalasena and Rupamoorthy 2000) and community based management (Atapattu and Dayaratne 1992, White 1996, White and Samarakoon 1994, Amarasinghe *et al.* 2002).

For the sustainable use of aquatic resources, another area where the attention has to be paid is the environment. Many research on the pollution and environmental conditions of aquatic ecosystems has also been carried out (see Silva 2005). These studies cover many areas such as limnology, land use patterns, environmental chemistry and environmental biology.

As such, when the research on aquatic resources carried out during the past 105 years is considered, it is evident that many studies on multitude of disciplines has been carried out.

Problems and Constrains

Although many research on various disciplines associated with the exploitation of aquatic resources have been carried out, most of these have been done by individual researchers in an isolated manner. Concerted multidisciplinary research on aquatic resources is rare in Sri Lanka. However, few such multidisciplinary research had been carried out in the recent past in collaboration with overseas institutes. These include the research carried out in Parakrama Samudra in early 1980s where the integrated research on fish yields, sediment characteristics, benthic fauna and water chemistry were carried out. Multidisciplinary research on inland reservoir fisheries in a concerted manner has also been carried out recently by several institutes and organizations such as the University of Kelaniya and the German Technical Cooperation. Central Environmental Authority has also produced a set of documents on wetlands identifying the conservation management plans based on the multidisciplinary research.

However, multidisciplinary research on marine resources carried out in a concerted manner is not much documented. Marine research has to be more of multidisciplinary nature. With new advances in technology such as the use of remote sensing techniques and accurate GPS, much research of multidisciplinary nature could be carried out on marine resources, both living and non living, for their sustainable exploitation.

One of the main constrains for multidisciplinary research is the lack of Coordination among the researchers and different interest groups. Due to this, individual researches carry out research projects of their own interest. In addition, there is no mechanism to promote multidisciplinary research. Usually multidisciplinary research projects require relatively large research grants and the local granting agencies as well as local research institutes may not be able to provide adequate funding for such projects. Most of the multidisciplinary research projects carried out in the recent past are funded by foreign donor agencies such as German Technical Cooperation, Australian Centre for International Agricultural Research, Sida/SAREC and also by the European Union. Further, linking of different research projects is likely to be a difficult task because of the involvement of large number of different activities.

Lack of a national research agenda or a concerted research agenda for the research institutions dealing with aquatic resources could be identified as another constrain for the development of concerted multidisciplinary research in this field.

Instead of carrying out large number of small research projects which are of diverse nature, few multidisciplinary research projects should be carried out.

There should be a national research agenda which addresses the research needs in the field of aquatic resources. Such an agenda has to be prepared with the participation of all interested

groups. Since there are large number of stakeholders associated with aquatic resources, the conflicts among different interest groups are not uncommon. Participation of all interested groups in the identification of a national research agenda may help to resolve some of the conflicts among different interest groups.

The conservation and management objectives, policies and actions with respect of aquatic resources have already been identified. The proposed actions to meet the objectives include many research of multidisciplinary nature. The research agenda of the institutes dealing with the sustainable exploitation of aquatic resources should be compatible with these national objectives and policies. The donor agencies should also give priority when awarding research grants to the research proposals which are compatible with these national objectives and policies.

The personnel and institutions capable of conducting different aspects of multidisciplinary research may be identified and the responsibility of conducting relevant studies may be entrusted to them. A suitable mechanism may be identified to carry out such a scheme. The results of such multidisciplinary research should be compiled and used to meet the national objectives.

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