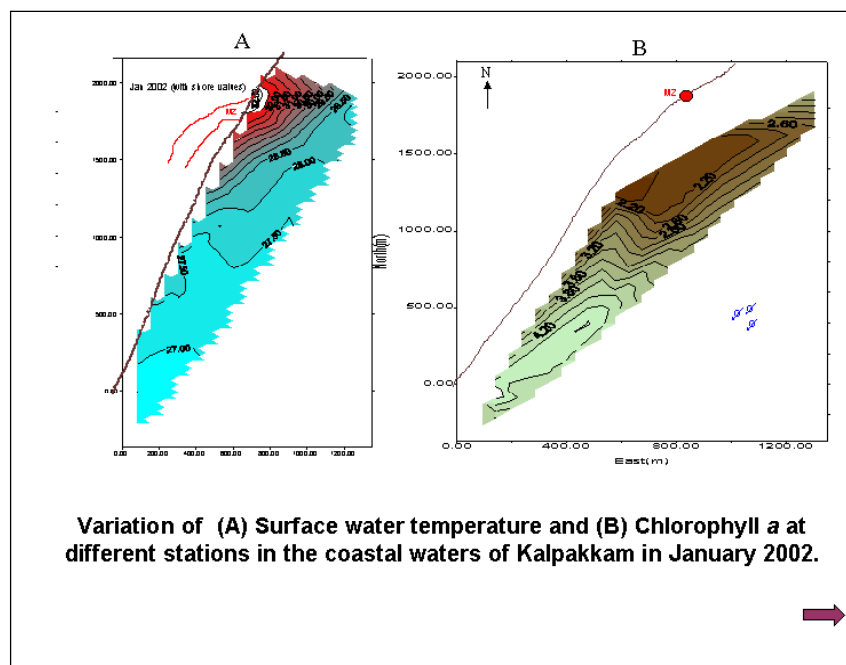


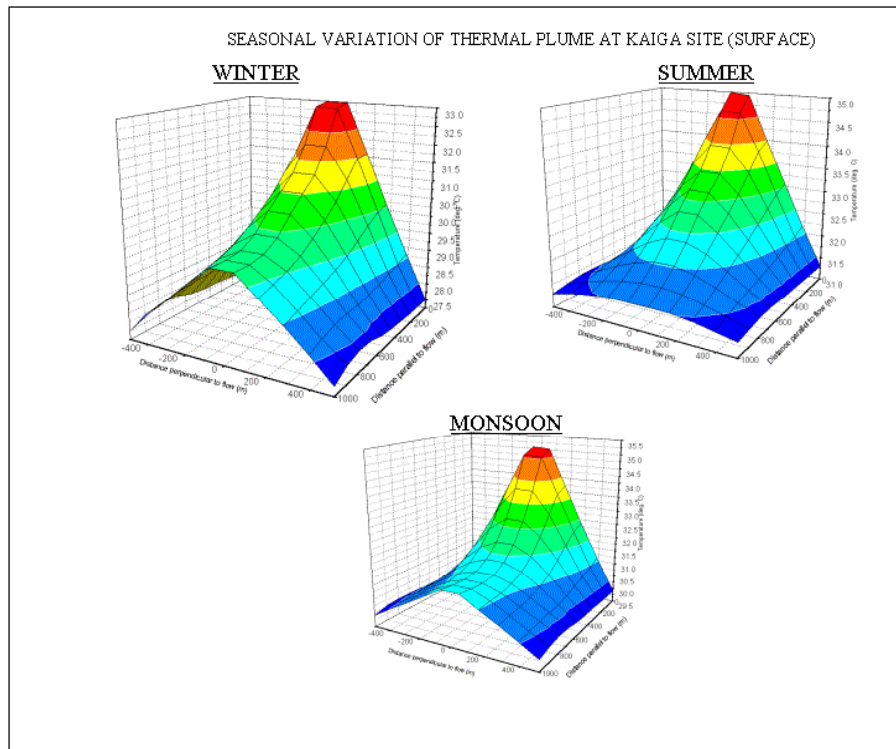
ENVIRONMENT

Technologies for Better Quality of Life

THERMAL ECOLOGY

Electricity is the main driving force for development in today's industrial world. Per capita gross national product as well as life expectancy are directly related to the per capita electricity production in the country. For production of electricity, the predominant method is to convert heat energy to mechanical energy, which is used to run electric generators and thereby generate electricity. Heat energy could be produced by burning of fossil fuels or by nuclear fission. It is not possible to convert all of heat energy into mechanical work and a significant part has to be rejected into appropriate heat sink. A steam locomotive does so by discharging steam into atmosphere, while in case of an automobile running on internal combustion engine, exhaust gases are discharged into atmosphere. This is done in an elegant fashion in case of modern power plants, where heat is rejected to appropriate water bodies by circulating water in large condensers or to atmosphere by the use of large cooling towers. Rejection of heat to water bodies is unavoidable, but has to be regulated so as to protect flora and fauna.



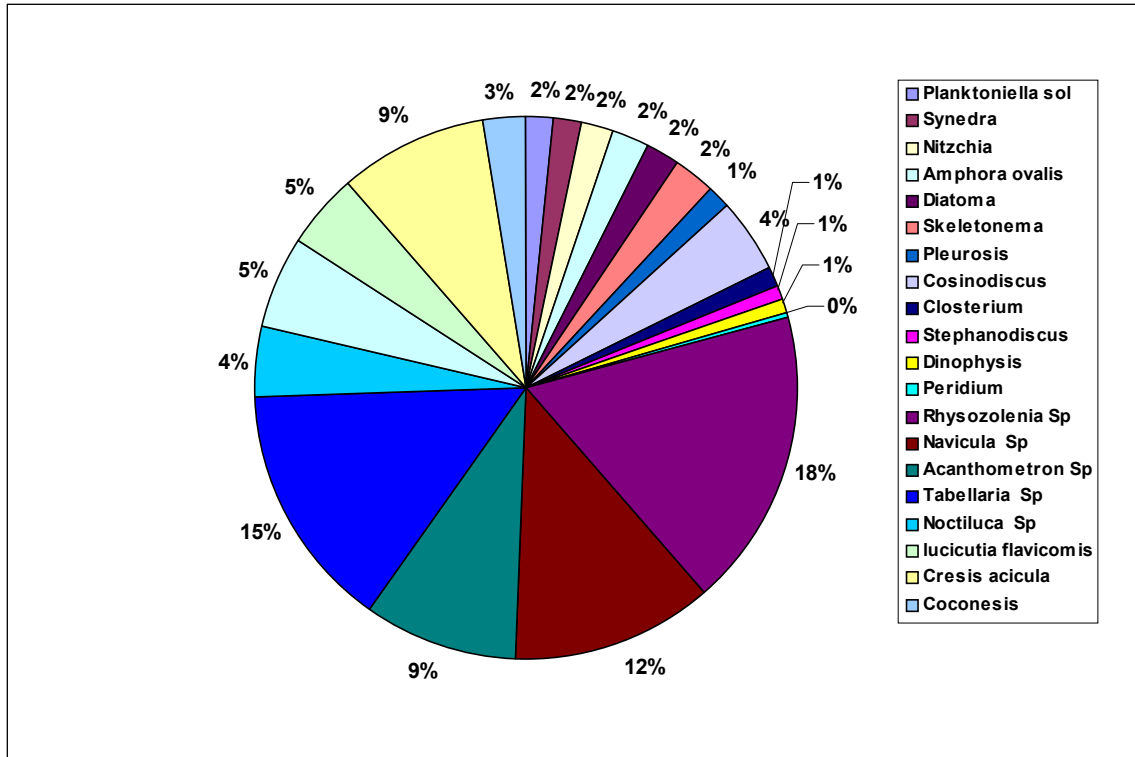


Regulatory agencies in the developed world have formulated appropriate limits with regard to thermal discharges based on experimental information collected by them in their countries. As we expand electricity generation in the country, we also have to be vigilant and generate scientific basis for the regulations necessary for the climatic conditions prevailing in India. In order to make a realistic assessment of the biological impact of thermal discharge on the life forms in the vicinity of the existing and/or forthcoming nuclear power plants, the Department of Atomic Energy (DAE) initiated the first major thermal ecological study in the country in 1999.

A co-ordinated research project (CRP) on thermal ecological studies (TES) of three year's duration was sponsored to investigate the thermal ecology around two of the existing (Kalpakkam and Kaiga) and one forthcoming (Kudankulam) nuclear power plant. A total of 8 laboratories from different universities/institutes participated in this effort which was funded by the Board of Research in Nuclear Science (BRNS) and co-ordinated and monitored regularly by an expert committee.

At Kudankulam the effort was to seek the baseline ecological information about the physico-chemical parameters of water quality, nutrient status and occurrence and distribution of major flora and fauna of the site. At Kalpakkam and Kaiga, the major aim was to assess the effects of thermal discharge on a marine and freshwater ecosystem. An extensive mapping of the thermal plume and its distribution was carried out at both these sites and effects of thermal discharge on water quality, nutrient status and growth, metabolism and development of life

forms at various trophic levels of the ecosystem (producers, consumers and decomposers) were investigated. Field data obtained through monthly cruises spanning large area over a three year period was validated by appropriate laboratory studies. Fish catch was also monitored to assess the economic impact of thermal discharge, if any. The project aimed at obtaining a comprehensive picture of different aspects of thermal ecology of the study sites. Experiments were specifically designed to address issues relevant to the stipulations/guidelines prescribed by MOE&F/PCB for existing/new power plants.

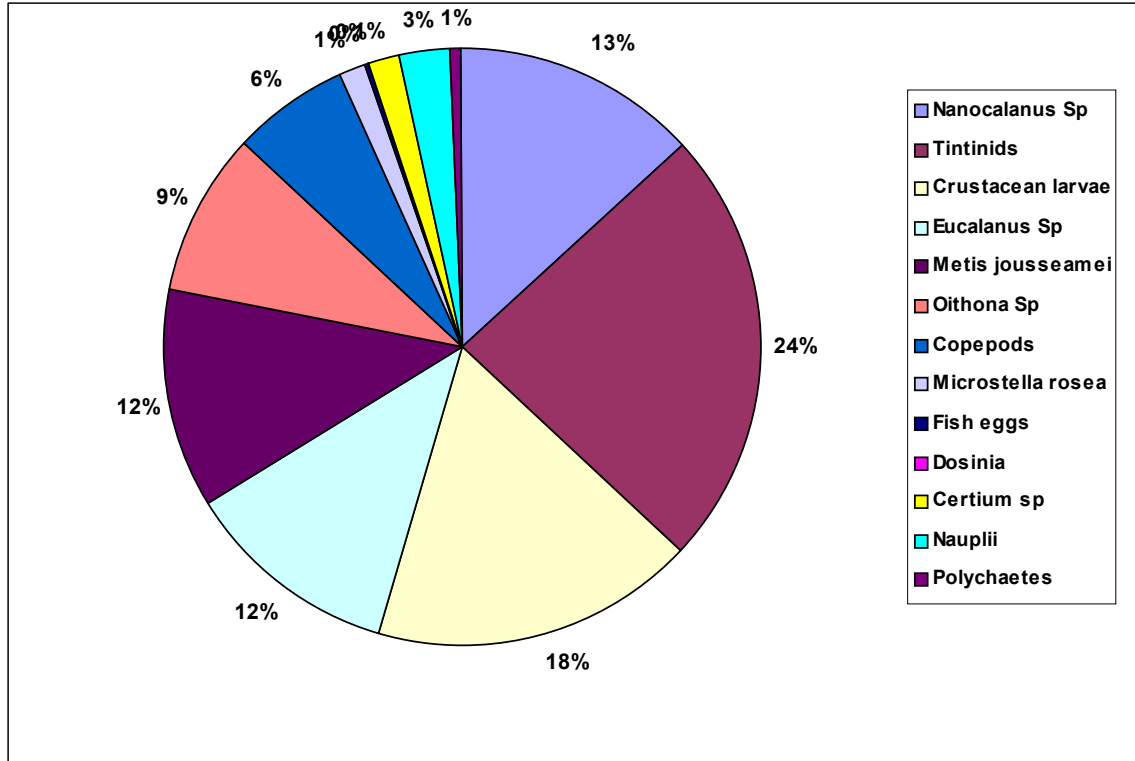


*Phytoplankton population diversity in Kudankulam Marine Environment
September 2000 to March 2003*

The data obtained so far show that at Kalpakkam and Kaiga sites the thermal plume distribution conforms to the MOE&F stipulations. An impressive finding was the ability of the motile forms such as fishes and crabs to recolonise the sites near discharge points during power plant shutdown when the thermal plume disappeared or at different times of the year when the discharge point shifted for a variety of reasons.

The results support the notion that it may be more practical to consider and evolve the concept of a “mixing zone” within which heated effluents can be allowed to mix with the water body and beyond which the life forms would be safe from possible effects of thermal discharge. A predictive model for thermal plume distribution has also been prepared for the Kaiga site. It is worth mentioning that at all three sites new/additional power generation units have been proposed. The data obtained under this CRP would therefore allow

predications for thermal plume distribution with additional units and the “T effects on life-forms which can be verified in future studies at these sites. The study is in its final phase and a final report of the findings will be completed in the next 6 months.

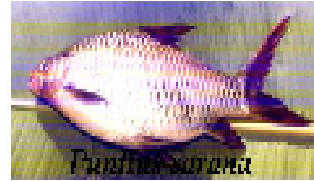


*Zooplankton population diversity in Kudankulam Marine Environment
September 2000 to March 2003*

The details of the first two year’s findings were presented at a National Symposium of Thermal Ecology (NSTE) held in Thirunalveli in February, 2002 and at the Fifth Asian Workshop on Environmental Law and Policy held at Agra in February, 2003 and were widely acclaimed. The rationale, objectives and work plan of the CRP and implications of the findings have also been highlighted in an article in IANCAS Bulletin II pp 86-93, 2003. This has helped to sensitize the scientific community and regulatory agencies about this unique model CRP, its relevance and the need to undertake such studies by other agencies . Expert consultancy on various aspects of thermal ecological studies is available at BARC, DAE upon request.

The outcome of the study is expected to evolve a better understanding of the concerns, approaches, priorities and solutions to various aspects of thermal ecology of relevance to power plant sites in our country. Hard data on biological impact of thermal discharge in tropical waters are lacking. It is desirable to obtain such data and authenticate/update/revise currently practiced legislation regarding discharge of heated effluents in natural water bodies.

Fish population diversity in Kudankulam Marine Environment



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