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Mapping fish research in India – Missed opportunity

Jayashree and Arunachalam[1] have analysed the impact of fish research in India among the global scientific community and reported that majority of publications, particularly those from the central research laboratories, are published in non-*Science Citation Index* (*SCI*) and non-*Journal Citation Reports* (*JCR*) journals of low impact with poor visibility. They have concluded 'fish research in India appears to be mediocre in general'.

The fish production in our country increased by more than five times[2] and the contribution of fisheries to the GDP of India increased by nearly three times[3] during the last 5 decades, a growth arguably one of the highest among the food production sectors. This growth would not have been possible without an effective research support. A few examples of research-supported fish production are as follows: (i) The then Central Inland Fisheries Research Institute (Barrackpore) published the first paper on the success in induced breeding of carps in 1957 (ref. 4). Subsequently, technologies on induced breeding and larval rearing were developed for a number of species of carps, all of which were published in non-*SCI* journals. These research developments paved the way for the current annual carp production of >1 million tonnes. (ii) The Central Marine Fisheries Research Institute (CMFRI), Kochi developed the hatchery technology of penaeid shrimps in 1973 (ref. 5), and by 1978, larval rearing of several shrimps was successfully developed and documented. All these achievements were published in the Institute's non-*SCI* journals. In 1999–2000, the country has exported farmed shrimps worth US $ 0.8 billion. (iii) The CMFRI developed hatchery and mariculture technologies for the pearl oyster[6], edible oyster, mussels[7] and clams. All these technologies were, and are being documented in non-*SCI* journals since 1973. Of these, pearl culture and mussel culture have made significant impacts among the entrepreneurs and fishermen. (iv) The Bay of Bengal Programme (FAO), Chennai designed a high opening trawlnet with the help of gear experts in India. The design, which revolutionized the capture fisheries sector, was published as a BOBP working paper in 1980 (ref. 8). In two decades, all the trawlnets (150,000 in number in 1998) in the country are of high opening type. These nets now produce 1.2 million tonnes of fish/year. (v) Several special publications and bulletins of the central fisheries institutes have helped the Supreme Court, Parliamentary Standing Committees and the maritime state governments in framing several policy documents such as the Aquaculture Authority Bill, Deepsea Fishing Policy and Marine Fishing Regulation Acts, which are milestones in the development of fisheries sector in India. There are many more examples, which paved the way for, what is hailed as 'Blue revolution' in India. The growth of the fisheries sector, to a very large extent, is due to the impact of research on the fish farmers, fisherfolk, fisheries planners and managers.

The mandate of the central research institutes is to develop technology packages and transfer them to the beneficiaries to increase/sustain fish production. Publications in high impact journals will not help in meeting the objective of directly reaching the beneficiaries. The philosophy of Garfield[9] has not considered the importance of this kind of production-oriented research, which is crucial for developing countries like India. By following the methodology commonly adopted for measuring the quality of publications of physical, chemical and biological and several other disciplines of science, Jayashree and Arunachalam[1] have missed a good opportunity to evolve a specialized methodology for proper assessment of the impact of fisheries research (and for other food production researches as well). Scientometrics has to perhaps redefine and reorient its methodology and evolve a meaningful tool for quantitatively measuring the output of science and scientists.

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Seismic wave amplification – Similarities between West Bengal (India) and Seattle (USA) basins

As detailed earlier[1] success of natural hazards and disaster management depends on a combined input from systematic scientific research, proper extensional education, organized training and involvement of common man.

As I was contemplating to formulate a comprehensive research programme for detailed seismic surveillance in the West Bengal basin, I came across an article in *EOS, Transactions of American Geophysical Union*[2], with significantly similar but more detailed findings as in the case of the West Bengal basin[3]. The high resolution seismic refraction coverage in the Seattle basin, Washington (USA) has revealed that seismic shots in Seattle even though small (180 kg or less), were much more energetic than expected and were felt by Seattle residents as far as 4.5 km from shot points. Similarly, in the case of the West Bengal basin a shot charge of only 125 kg during seismic refraction survey in 1988, has produced unexpectedly considerable surface vibrations, resulting in panic amongst Burdwan population. It is attributed that this energy propagation[2] could be both due to the well-coupled detonation of the explosions within the water table and trapping of the seismic energy by low-velocity surficial units within the basin. It is further stated[2] that there is a strong correlation between the geometry of the basin filled with sediments and the amount of amplification of the seismic waves. It is stated[2] that the amplification results from either focusing associated with the entire basin, or resonances and trapping of the seismic energy within the specific layers in the basin, probably the uppermost lower velocity quaternary deposits, whose geometry may measure the geometry of the entire basin. The finding that the seismic wave amplification was confined to the Seattle basin and nothing unusual has been noticed in the surrounding Olympic mountains region could be ascribed to a major extent even to the West Bengal basin, but for the differences in the geometries of the two basins. The seismic refraction studies[4] confined to the adjacent crystalline part, near Beliator, produced no amplified signal, as in the case of shots closer to Burdwan.

In the West Bengal basin as detailed earlier[3], in similar geologic terrain all the phenomena noticed in Seattle basin were observed. As in the case of Seattle[2], determining the origin of the amplification of the seismic waves within the West Bengal basin needs to be taken up as a priority research topic, as a part of detailed surveillance package that includes stress studies, three-dimensional tomographic imaging of the area in and around Burdwan and close seismic surveillance network to record even micro tremors of magnitude ≥ 2.

These observations emphasize the need for a detailed study in the West Bengal basin as it is well established[2] that crustal faults and sedimentary basins could pose seismic hazards in regions like the Seattle basin.

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