Rivers in threat

As the monsoon retreats and the flood waters recede, the flood bank and bed of the River Dikrong in Itanagar, Arunachal Pradesh becomes a humming ground of the human activities. Temporary labour tents or huts, crusher machines, movement of trucks and other vehicles all along the length and breadth become the state of affairs in the river. These river sites during the lean season are lucrative to crowds of people to pile up stones, rocks, sands, etc. The demand for these materials is increasing day-by-day due to increased construction of new railway, roads, buildings, market places, etc. Unfortunately, the River Dikrong is the only river producing such materials, in the vicinity of the capital city Itanagar. So, the everincreasing pressure of demand for the supply of these materials is jeopardizing the resource wealth in general. Quarrying in the river catchment diminishes the hardy substratum of the rivers, creating habitat unsuitable for many aquatic animals with special rheophilous adaptations.

Extraction of gravels/stones/rocks from a river alters the sediment budget creating the potential for channel instability and increased turbidity. It potentially changes the channel depth and width, streambed substrate texture and bank vegetation. Fish communities are potentially impacted by changes in turbidity and sediment erosion, transport and deposition. Increased turbidity can affect fish by reducing their feeding efficiency, reducing their tolerance to diseases, and increasing their overall physiological stress. Increased sediment loads also can disrupt fish reproductive success by interfering with the viability of their eggs and fry[1]. Hardy substratum makes habitat congenial for fishes which feed on the periphyton biofilms formed on the surface of such substratum. Some fishes feed upon the invertebrate communities living underneath such substratum. Further, many winged insects pass their early life stages underneath of stones in water. The rock substratum is also important as they create a home for some fishes to hide under cover. Rivers with greater gradient of water-flow, and stone and rock as substratum possess more diversity of microhabitats and hence more specialized fishes become the denizens of such rivers. Besides, the stone substratum help the fishes to breed, as the female lays eggs by the pressure they produce by striking the lower abdomen with the edge of rocks under water at some shallower region.

The loss of stone, rocks and boulders from the riverbed and banks will have sequential effects not only on physical and biological quality of rivers but on its morphological behaviour as well. Since the speed of water-flow in a river is mostly controlled by the friction of water with the roughness of stones, boulders, rocks and some aggregates of logs, etc. in the river, their loss leads to gaps at certain segments of the river where a sudden fall of friction may result in tremendous speed energy of the water which will have both downstream and upstream effects. The river in its natural condition tends to achieve an equilibrium state for the supply, transportation and deposition of the materials. This equilibrium is imbalanced at certain points, i.e. quarrying sites, which may create hazardous effects during flood. Secondly, the loss of hardy substratum will result in the loss of many kinds of habitat preferences like feeding, hiding and breeding of fishes. There is simultaneous loss of habitats for the aquatic and semi-terrestrial insects.

Stone quarries are probably operating all over hill states in India, no doubt providing raw materials for constructional and developmental activities, and generating seasonal employment. Conversely, it is threatening the river ecosystem – the abode for many aquatic organisms. In the backdrop of large scale depletion of freshwater bodies, the unscientific mass exploitation of river bodies is a matter of concern today.

1. Waters, T. F., *Sediment in Streams – Sources, Biological Effects, and Control*, American Fisheries Society Monograph 7, 1995.

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A national level programme of quality mathematics education for bright students in schools

A country aspiring to be a world leader in science and technology must have quality education in mathematics at school level. It is necessary to remember that V. I. Arnold states: 'Mathematics training in Moscow usually begins before the school age'. In India, mathematics education up to class 10 is compulsory and the curriculum for this is largely quite good. But the quality of examinations is of great concern since, both average and very good students secure almost the same marks in these examinations. Hence, the examinations results are unable to distinguish a bright student from an ordinary one. This leaves no motivation for talented students (whose number is large in India) to learn mathematics deeply; they simply practice for high marks. Further, this situation drives institutions of higher education and companies to hold their own examinations for admissions/employment. This results in wastage of time and resources, and creates tremendous physical and mental pressure on students and parents.

It would be difficult to change the present trend (which anyway is not any evil for average students) in question paper setting and evaluation. Then it becomes evident that we need to provide for full growth and for utilization of complete capacity of good and talented students in order to (i) attract them to study mathematics deeply, and (ii) inspire them to work hard to learn and enjoy it. It is quite simple to achieve both these aims and also grant recognition to their talent by an optional mathematics (OM) pro-

gramme which will comprise: (a) providing excellent books in OM from class 7 to 12 (or even earlier); (b) having two (or at least one) special classes per week in OM only for good students in mathematics, from these classes, in order to provide appropriate learning material along with guidance in learning and problem-solving on their own; (c) introducing a continuous evaluation all through the year in addition to annual examinations in OM and conducting final examinations at 10th and 12th level, incorporating innovative methods of evaluation.

Existence of mathematics Olympiad activity in India has ensured the availability of a large number of excellent books, advocated in (a). To achieve (b) and (c), all examination boards (e.g. CBSE, which can take a lead first) must introduce papers in OM, at 10th and 12th level, based on special enrichment material. These papers, meant only for those who have interest in learning deeper aspects of mathematics, would test good understanding of mathematics and ability to solve challenging problems. Marks scored in these papers must be recorded in transcripts. Problems set for these examinations must test the competence in mathematical deductions and not in employing tricks and mere practice. The responsibility of setting these papers and evaluation must be given to a special autonomous cell (headed by an eminent mathematics professor), set up for this purpose, in the examination boards. The cell would choose college and university teachers along with some school teachers for this task.

One may wonder 'why optional paper in mathematics alone and not in other subjects?'. We mention some answers to this: (i) Majority of the students taking OM would go in for a career in disciplines other than mathematics, and their enhanced capability in mathematics would enrich other disciplines. (ii) In contrast with other subjects, those who miss good mathematics till class 8 are not likely to learn good mathematics later on. (iii) Success of bright students in OM programme in many schools would instill confidence and will provide an excellent opportunity to the children of unprivileged members of the society to compete with other students in admissions to national institutions, an opportunity which probably no other existing programme can provide. (iv) USA's example, in rectifying and revamping mathematics education, after USSR's launching of the *Sputnik*, should not be lost sight of.

Olympiads and Government supported KVPY programme are serious attempts to spot and nurture talents. But there is no arrangement for students to learn various subjects (mathematics included) deeply at an early stage. In developed countries there exists provisions for bright students to learn subjects of their interest at their own pace. OM programme will provide this opportunity (at least in one subject). One great advantage of the OM papers at the 10th and 12th level will be a decrease in the number of examinations (like RMO; JEE and KVPY at least in one subject; and admission tests of many institutions of higher education).

In view of OM schemes, there will be no need to burden every student with too many deeper and difficult concepts in mathematics.

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Disappointment for Indian submissions in innovative global health funding opportunity

The Grand Challenges Explorations (http://www.grandchallenges.org/Explora-tions/Pages/Introduction.aspx) is a creative funding opportunity supported by the Bill and Melinda Gates Foundation (BMGF). Hoping to encourage innovative out-of-the-box thinking, twice every year, multiple grants of US$ 100,000 are given out, with a possibility of follow-up funding of US$ 1 million for successful projects. Targeting important problems of the developing world like the need for new diagnostic tools and vaccines for diseases such as malaria and TB, these grants can especially help and encourage young researchers in global health. Grant applications are limited to two pages, and the decision on funding is taken within four months of submission through a rapid review process (http://www.grandchallenges.org/Explorations/Pages/GrantProcess.aspx).

The results of the second round of funding were announced on 4 May 2009. Eighty-one grants were awarded to investigators from 17 countries and five continents. No India-based Principal Investigator received the grant in this round (the first round had only one India-based grantee from Puducherry). Interestingly, quite a few of the grants in round two went to investigators of Indian origin, but working in foreign universities. The lack of any grant from India in the awardees could be due to two reasons: a lack of knowledge about the grant opportunity, or a reflection on the quality of proposals (since it is a global grant competition). One hopes it was more of the former. Recently, two programme officers from BMGF came to India to encourage submission from Indian researchers for the next round[1]. They highlighted that of the 7000 applications from 118 countries received in the first two rounds, only 3% came from India.

I hope that more Indian applications will be submitted and selected in the forthcoming rounds: applications to be submitted by 28 May 2009 for the third round and the fourth round will be announced on 2 September 2009 with applications due by 2 November 2009. Indian scientists should take advantage of this new funding mechanism to engage in path-breaking research to address outstanding health needs in our context.

1. iGovernment Health 2009. Gates targets Indian researchers for health grants; http://www.igovernment.in/site/Gates-targets-Indian-researchers-for-health-grants/, accessed on 5 May 2009.

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