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-