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c. Third World Fisheries (by Dr D. Pauly)

The remarks below are my personal views, and differ in this from the paper by Cruz and Pauly (Annex 5) in which we reported the views of others.

The first point to make here is that worldwide fisheries-catch trends have flattened out in the last decades, i.e. catches are fluctuating between 70-80 million tons per annum, with no major conventional stocks left untapped and many stocks severely overfished.

In tropical Third World countries, this situation is aggravated by specific expectations connected with fishing resources, which are that:

i. production be increased to meet increasing domestic demand due to increased incomes of/or increasing populations;
ii. increasing amounts of high-quality protein become available for export (e.g. in the form of shrimps, tuna and other high value fish);
iii. opportunities for local investors are created.

The first of these expectations is constrained by the fact that fisheries yields that can be extracted on a sustained basis are always finite, and generally lower than suggested by various superficial analyses.

The second of these expectations, often driven by staggering external debts, implies that external demand prevails over internal demand, and usually implies a higher degree of dependence (not interdependence!) of Third World countries on developed countries.

The third expectation is the most common cause for conflicts between small-scale artisanal fishermen and large-scale commercial operators, who generally succeed in increasing their share of total national catch, but without necessarily increasing this catch. Put differently, "development" in the face of resource limitation is a zero-sum game, with far more losers (dispossessed small-scale fishermen) than winners (entrepreneurs with access to subsidized loans, infrastructure developments, subsidized fuel, etc.).

These expectations led to generally uncontrolled growth of fishing effort. Throughout the world, fishing effort generally stabilizes (for economic reasons) at two to three times the effort appropriate for extracting optimum yield. The excess effort is a form of economic waste, particularly costly and hurting in developing countries. This situation, incidentally, is one of the key reasons why FAO and some international development banks are increasingly reluctant to support fishery development projects across the board.

All of this occurs, in developing countries, before a background of generalized rural poverty, the main causes for rapid increase of fishing pressure on nearshore stocks. This poverty in fact is such that gradually, destructive methods that provide income even in the face of dwindling resources (e.g. using dynamite or cyanide for catching fish) replace environmentally benign fishing methods, while reckless overexploitation replaces age-old community-based management scheme. Politicians and administrators in developed countries do not handle these problems better than those of developing countries. However, given the poverty background alluded to above, the available options in developing countries are more limited, and those chosen usually reinforce the status quo, leading to more environmental degradation, overfishing and conflicts on resource use between small-scale fishermen and large-scale operators.

How does training and education in the marine science (i.e. fishery science) relate to this? Generally it does not. Indeed, very few of the responses received and analysed by Cruz and Pauly (Annex 5) even dealt with the widening problem of overfishing and resources destruction that is occurring in developing countries.

To deal with these issues, one would expect an added emphasis on aquaculture and mariculture, which may have a potential of 10 to 20 million tons per year, and on conservation, which definitely should not be left to conservationists, but should become part of the mainstream of fisheries and marine science. Also, there should be added emphasis on resource and rural economics as well as on community development and alternative employment schemes, i.e. on working with people. Unfortunately, what the year 2000 will see, is probably more of everything else.

d. Marine Biotechnology (by Dr M. Walch)

The application of molecular biology to marine research and resource development has opened up promising new areas for research which have tremendous scientific and economic potential for all regions of the world. Marine pharmaceuticals, genetic engineering of marine and estuarine animals and plants for food production, and marine specialty chemicals offer particularly good prospects for both immediate and long-term rewards for island and riparian nations. In the short term, practical results are anticipated in improving stocks of fish and shellfish for aquaculture as well as in developing compounds of pharmaceutical value from marine sources for human and domestic animal application. Also anticipated to be of immediate benefit are vaccines produced by genetic engineering methods for prevention and control of diseases of fish and shellfish in aquaculture.

Marine biotechnology holds the greatest promise for developing countries where fish and shellfish are a major source of food, as well as an industrial commodity. Furthermore, developing countries possessing abundant marine and estuarine natural resources are ideally suited for exploration of marine biotechnology, since access to unusual and/or novel marine life