PRACTICAL ACTION
Technology challenging poverty

FISHING OUT THE GENE POOL

Modern breeding methods and the economic pressures that favour the monoculture of grain are behind much of the loss of diversity in agriculture. Brian O'Riordan explains how the world's fish stocks are also in danger from modern fishing methods and the emphasis on a few economically valuable species.

Fish stocks are a fragile but naturally renewable resource base. If fishing is regulated, these resources could provide mankind with an important source of food and wealth. But the misuse of modem hunting and fishing technology has had a devastating impact on fish stocks and genetic diversity, and over the last decade clear lessons have been drawn from this abuse of modem technology.

There is a basic contradiction in the idea (widely held in the 1960s and 1970s) that fish can provide both high-value fish products for the North and basic food needs for the protein-deficit nations of the South. Both development priorities cannot be met by the same policy. Choices must be made between the use of fish for food (which provides protein for the masses) in the South, and fish for profit (where export earnings help the debt-burdened nations of the South).

Increasing world demand and declining resource levels caused by over-fishing combine to place more and more pressure on this delicately balanced resource base. Of the world trade in fish, 70 per cent flows from the South to markets in the North. Although this may earn valuable foreign exchange, it also tends to divert productive capacity away from species and products for local consumption. In addition, the concentration on high-value export species and the use of intensive non-specific fishing methods is disrupting the natural marine production cycle. Predator/prey relationships are being upset, links in the food chain are being weakened by the concentration on single species, and important habitats are being destroyed through the use of heavy equipment, such as demersal trawls, which trawl the seabed. Excessive numbers of juvenile and locally important fish species are being caught through the use of non-selective catch-all techniques, and these by-catches are dumped while only the high-value species are kept. Increases in fish prices as a result of scarcity and the relatively high purchasing power in the North are making fish unaffordable to poorer people in the South, those for whom it used to be the cheapest, and often the only, source of animal protein

technical brief

Practical Action, The Schumacher Centre, Bourton on Dunsmore, Rugby, Warwickshire, CV23 9QZ, UK
T +44 (0)1926 634400 | **F** +44 (0)1926 634401 | **E** infoserv@practicalaction.org.uk | **W** www.practicalaction.org

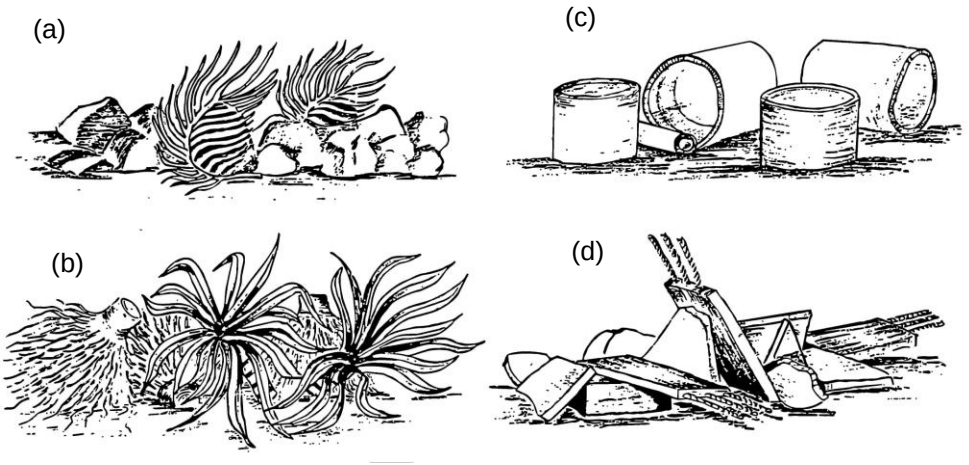

Figure 1: Some of the artificial reef materials traditionally used by South Indian fishworkers include (a) stones attached to coconut leaves, and (b) screw-pine plants and coconut stumps. Other 'materials of opportunity' that are now used are (c) concrete rings and (d) concrete waste.

Furthermore, modem high technology aquaculture is increasingly being shown to be environmentally damaging, producing high biological loadings, and high levels of organic pollution from the excessive use of pesticides.

Particularly damaging is the clearance of mangrove trees along the coast, as they play a key role in the marine production cycle, providing nurseries for small fish. The trees have been replaced by intensive shrimp farms, a form of aquaculture which is totally inappropriate for the needs of hungry people in the South and which in some cases causes marginal farmers to be displaced from valuable agricultural land, thereby destroying an important local source of employment and food.

Capture or nurture fisheries?

The problems caused by capture fisheries include the hunting to near extinction of the great whales, the collapse of the Peruvian anchovy fishery, the demise of the North Sea herring (rescued from the brink of extinction), and the destruction wrought on the shoals of Pacific tuna and squid by the 'walls of death' monofilament drift nets, which can be many kilometres long. There are many other examples, such as the reduced number of species now caught in South India (see box). It is estimated by FAO that all important stocks of demersal fish species (those found on or near the sea-bed) are either fully exploited or overfished, and that many more highly valued stocks are in decline[1]. The problem of overfishing stems from the traditional view that the oceans' resources are infinite, combined with the free-for-all mentality towards open access common property resources. Where fish stocks are considered common property and are available for exploitation on a first-come-first-served basis, fishing becomes a hunting activity, dependant upon the ingenuity of the hunter and the efficiency of the hunting technology. Given the rapid developments in the design and use of this technology, it cannot be sustained.

Table 1. Kerala marine fish landings 1970-90 (All figures in '000 tonnes)
Until 1970, fish catches in the artisanal sector had been steadily increasing; 90-100 per cent of production came from non-motorized traditional craft It is also important to note that over the 1960s as much as 70 per cent of the prawn catch came from fishermen using these craft and traditional gears.

Year	Traditional sector Landings	Mechanised sector landing	Total	Remarks
1970 1971 1972	340 390 257	53 47 39	393 445 296	Both sectors largely complementary, adding to total production.
1973 1974 1975	355 320 241	94 101 180	449 421 421	Competition for product starts between both sectors but total landings peak
1976 1977 1978 1980	272 238 256 144	59 107 118 135	331 345 374 279	Overall production declines drastically. Intensifying competition for resources by the mechanized sector at the cost of the traditional sector.
1981 1982 1983 1984 1985	201 240 287 263 197	73 85 98 130 129	274 325 385 393 326	Outboard motors taken up rapidly, boosting the artisanal share, Increasingly, catches from the motorized ring seines dominate the artisanal catch.
1986 1987 1990	252 152 250	131 151 150	383 303 400a	By the end of the decade catches approach pre-1970 levels, but with wide fluctuations. Non-motorized fishing almost entirely displaced.

Modem development strategies for fisheries have generally been based on industrial processes, where production is not seen to be limited by resource constraints, and where short-term economic gain and super-efficient hunting technology rule. The capacity of fish stocks to replenish themselves is limited; however, and the optimistic economic projections that have justified the huge investment in industrial fishing technology worldwide have not taken these resource constraints into consideration.

Overfishing problems generally arise when interests from outside the fishing communities invest in new technology: commercial interests that are either not aware of traditional taboos and community controls -or not bound by them. In Europe thousands of small-scale fishermen were displaced by the introduction of trawling and steam drift-netting before the turn of the twentieth century.

Similarly, the introduction of trawling technology to Kerala in south-western India is threatening the livelihoods of hundreds of thousands of artisanal fishworkers who depend upon inshore fishing. Investment in prawn-trawlers was actively supported by the Kerala Government in the 1960s, and by 1970 a sizeable fleet had been built up. During the 1970s the artisanal fish-catch fell dramatically, and by 1980 their share was 45 per cent of the 1970 level (see Table 1). The desperate response of many small-scale fishworkers was to react with violence and to invest in more intensive fishing technology to compete with the trawlers.

Prawn Trawlers wreak havoc on reefs

The fishing communities of five coastal villages (Pallithottam, Port Quilon, Moothakara, Vaddy and Thagassiry) next to the town of Quilon have been particularly hit by the introduction of pawn trawling. Situated some 10km south of what is probably India's largest trawler base – Neendakara – their fishing grounds have been devastated by the uncontrolled plundering of thousands of trawlers. Mr Andrews, a fisherman from the village of Port Quilon (and Secretary to the local fishworker organisation), has studied and documented the impact of these trawlers on the fishing grounds and of the fish stocks. His underwater maps show how the trawlers have destroyed the sand bars and delicate reef structures that play such a key role in the reproductive and production cycle of marine life. He has listed some 150 once-common species (including some 135 fin fish species) that have been severely depleted by the uncontrolled trawl fishing, to the extent that they are no longer caught in the area by the artisanal fishermen.

technical brief

In many areas where fishing forms a traditional activity, however, the fishing communities have been able to organize themselves and create nurture fisheries. This is based on fishing as a harvesting activity, where time is needed for the stocks to replenish themselves, and where sowing and nurturing is required, as well as reaping[2]. To do this the local community controls and limits fishing by controlling hook size, banning night fishing, and restricting the kind of bait used. To achieve and enforce this control, communities in Kerala lobbied against the trawlers' encroachments into their inshore fishing grounds. The lobby was effective and a monsoon season (the spawning season of the principal commercial species, according to the artisanal fishworkers) trawling ban introduced by the Kerala State Government in 1989 was a victory for the organized fishworkers[3]. Directly or indirectly, it achieved an improvement in recorded catches.

Trading in biodiversity

Botswana, Malawi, Namibia, Zambia and Zimbabwe want all countries to stopnfishing for herring (Clupea harengus), an endangered species in European waters. They have jointly written to CITES, The Convention in International Trade in Endangered Species, the same organisation that is trying to ban the ivory trade to save elephants. These countries have proposed that herring products (eg. Kippers, herring roe, oil, and fishmeal) be included in Appendix I of CITES, the list of those endangered species in hose products trade is banned.

The over-intensive fishing of herring in the 1960s and 1970s severely depleted stocks. Catches in the North Atlantic as a whole fell from 3.3 million tonnes in 1964 to 1.6 million tonnes in 1974. Most of the catch is processed into herring products; only a small amount is sold fresh for human consumption. Despite a fishing ban from 1977 to 1983, illegal fishing prevented the full recovery of stocks. During this period many herring catches were falsely reported ass catches of, for example, sprats (*Sprattus sprattus).* Although the ban was partially successful and larval production subsequently peaked in 1985, it was short-lived. The production of larvae has halved in subsequent years. Because of overfishing, several of the races or groups of North Sea herring are considered to be close to extinction (eg. the Icelandic Herring). Fishing for herring in the North Sea, and in other fishing grounds under EC member states' jurisdiction, is governed by quota restrictions. But some argue that the permitted catches are too high and are not protecting endangered races.

After fourteen years of protection efforts, the genetic diversity of the stocks is still threatened. Existing *fishing* controls do not seem to be effective. It is for this reason that the five countries wish to see a stronger ban, enforced through controlling the *trade* in herring products.

Community organisation

The South Indian fishing communities are responding to the destruction of the ecosystem and the impoverishment of marine biodiversity by constructing artificial reefs. These efforts are being supported and studied by local organizations such as the Programme for Community Organization (PCO) and the South Indian Federation of Fishermen's Societies. They are providing the basis for discussions on conservation of stocks and the community management of fishing grounds. The practice of placing rocks fastened to coconut fronds in the near shore waters to attract fish is probably centuries old. The upsurge of interest in artificial reefs goes further than aggregating fish, however, and fishworkers are attempting to rehabilitate the coastal ecosystem by providing artificial fish habitats[3]. Since 1980 nineteen artificial reefs have been constructed in the districts of Kanyakumari and Trivandrum using easily available 'materials of opportunity'. In a recent study of these artificial reefs and other low-cost concrete and bamboo modular structures, undertaken by PCO, the potential benefits noted included enhanced community management of fishing grounds and the enhancement of stocks. While many current initiatives being undertaken by local fishworkers are probably only a drop in the ocean, they do form the basis for promoting alternative concepts for marine management. They demonstrate the potential benefits artificial reefs can play in the replenishment of marine biodiversity through providing protected habitats, and they can also form the basis for establishing exclusive fishing zones under the control of local communities[4]. Representatives from PCO presented a paper to the Fifth International Conference on Aquatic Habitat Enhancement held at Long Beach, Los Angeles, in November 1991. They were able to discuss the experience of the Kerala fishworkers, and to learn about relevant developments in other countries which will be of use in south India.

technical brief

Mangrove rehabilitation

In Kerala the 'backwaters', lagoon areas, and mangrove swamps play a key role in the natural marine production cycle, and the ecology of these water bodies is fragile and probably unique. Traditional fishing and farming activities benefit from the seasonal monsoon cycle, alternately providing ample fresh water for rice growing, and inflows of sea water for the extensive culture of fish and prawns. The damming of these lagoons and 'backwaters' for more intensive fish farming, especially of prawns, is disrupting this natural cycle of interchange between the sea and inland water. The increasing levels of industrial pollution are also killing off aquatic life and rendering the waters unusable. The ever-increasing demand

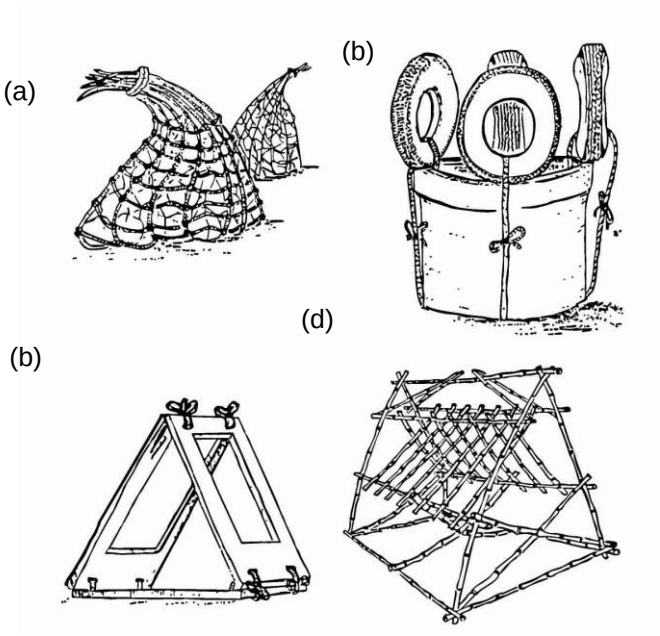

Figure 2: New innovations in artificial reef materials by South Indian fishworkers include (a) stones inside bags and (b) tyres attached to a concrete ring. Other innovations in modular design from PCO and made out of (c) concrete or (d) bamboo.

Lake Victoria's fish tale of woe

Until recently the rich biodiversity of fish in Lake Victoria provided an important source of employment, income and food for the lake shore communities in the three countries that border its waters -Tanzania, Uganda, and Kenya. Today the economic and social fabric of these communities is disintegrating because of the disappearance of the small nutritious fish species belonging to the genus *Haplochromis,* of which over 200 species used to be found in the lake. Ms Irene F.P. Wekiya recently drew attentions to the central importance that the Enkejje *(Haplochromis spp)* used to play in the social, cultural and economic life of the Ugandan lake fishing communities. She explained the benefits derived by women (who construct and use simple and effective fish traps) through the capture and marketing of Enkejje. She also shows the benefits derived by malnourished children, for whom it is the only palliative for measles and the common disorders of *kwashiorkor* and *marasmus.* There are two main reasons cited for the disappearance of the Enkejje: over-exploitation caused by the increased demand for the fish outside the fishing communities, and the introduction of two species of carnivorous fish - the Nile Perch *(Lates niloticus)* and the Nile Tilapia *(Oreochromis niloticus).* Over the last 20 years there has been a dramatic population explosion of Nile Perch, a voracious predator that is alleged to have caused the decline of the Enkejje and many other fish species indigenous to the lake. Ironically, one reason given for the introduction of this species was to lessen fishing pressure on the stocks of *Haplochromis.* The other ironic aspect of the Nile Perch story is that, although highly nutritious, it is not well liked in the local communities. The rich flesh is highly prized, however, in the restaurants of African capital cities and in the markets of the North. In Kenya this has led to an investment stampede in intensive fishing technology and cold chain marketing infrastructure to take this potentially rich protein source away from the hungry mouths that need it, to the restaurant tables of the rich. Even if local people developed a taste for it, they would be unable to compete with the prices offered by city merchants who, like the Nile Perch, snap up everything available.

The rich diversity of aquatic species can be sustained in rivers, lakes and the oceans, but it will require stronger controls at a local level, and the restraint of industrial fisheries, for it to happen. If the plunder of fish stocks continues at the rate of the last decade, then it will not take long for this source of basic protein to become scarce and unavailable to those who need it most.

References

1. Alexandros, N., (ed.), *World Agriculture Towards* 2000, FAG, Rome, 1989.
2. Kurien, J., 'Technical assistance projects and socio-economic change' and 'Norwegian intervention in Kerala's fisheries development', *Economic and Political Weekly,* Vol. XX, Nos 25 and 26, June 1985.
3. Kurien, J., (ed.), 'Motorization of fishing units -Benefits and burdens', Programme for community organization with the South Indian Federation of Fishermen Societies, 1991.
4. Creech, S., Femandez, J., and Tito D'cruz, S., 'Community reef building and habitat regeneration', PCG, 1991.
5. Wekiya, Irene F.P., 'Fish processing at Lake Victoria', Do-it-herself Seminar, ITDG, Harare, 1991.

Further reading

- *Artificial Reefs and Their Placement* Practical Action Technical Brief
- *Plywood Boats in South India* Practical Action Technical Brief
- *Fibre glass boat building* Practical Action Technical Brief
- *Fishing boat construction: Building a fibreglass fishing boat.* Ned Coackley. FAO
- *Fisheries Technical Paper 321*, FAO, 1991
- *Fisheries* a selection of Technical Briefs Practical Action
- *Livelihood from Fishing* A Le Sann Practical Action Publishing 1998
- *Country Boats of Bangladesh* E Janssen et al Practical Action Publishing 1989
- *Sailing Against the Wind* E Janssen Practical Action Publishing 1992

This Technical Brief was originally published in the *Appropriate Technology* journal Volume 18/Number 4 March 1992. Brian 0' Riordan was ITDG's (now Practical Action) International Fisheries Programme Manager and is now working for the International Collective in Support of Fishworkers. ICSF

ICSF Liaison Office
65 Rue Gretry
B-1000 Brussels,
Belgium
Tel: +32 2 218 1538.
Fax: +32 2 2178305
Website: http://www.icsf.net/

For more information about *Appropriate Technology* contact:
Research Information Ltd.
222 Maylands Avenue
Hemel Hempstead, Herts.
HP2 7TD
United Kingdom
Tel: +44 (0)20 8328 2470
Fax: +44 (0)1442 259395
E-mail: info@researchinformation.co.uk
Website: http://www.researchinformation.co.uk
Website: http://www.appropriatetechnology.com

Practical Action
The Schumacher Centre
Bourton-on-Dunsmore
Rugby, Warwickshire, CV23 9QZ
United Kingdom
Tel: +44 (0)1926 634400
Fax: +44 (0)1926 634401
E-mail: inforserv@practicalaction.org.uk
Website: http://practicalaction.org/practicalanswers/

technical brief