

# MAJOR TRENDS IN SMALL-SCALE MARINE FISHERIES, WITH EMPHASIS ON DEVELOPING COUNTRIES, AND SOME IMPLICATIONS FOR THE SOCIAL SCIENCES<sup>1</sup>

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*Abstract* The competition between large, industrial, and small-scale fisheries in the face of growing resource scarcity has led, in most parts of the world, to increased marginalisation of small-scale fisheries. However, the natural role of social scientists, who, given their expertise, should be informing mitigating activities, is often usurped by biologists and/or economists, as demonstrated here through a Google-based analysis. It is argued that this is based on social scientists: (1) neglecting in their field work key variables, such as catch levels, important to any understanding of fisheries; and (2) often conducting and reporting on locale-specific field work without attempting broader (and admittedly risky) generalisations -- the elements of a 'model' -- that are imperative for actual policy making. The former claim is illustrated with an example from the South Pacific, and it is shown that one result of current practices is the further marginalisation of small-scale fishers. The latter claim is illustrated with an example of a general model, which contextualises and thus explains a wide variety of phenomena related to migration within and into the small-scale fishing sector. An application of this 'Malthusian overfishing model' to the rebuilding efforts following the Asian tsunami of December 2004 is then presented. Finally, the case is made that despite their present problems, the small-scale fisheries of the world, suitably governed, are still our best hope for sustainable utilisation of coastal resources.

## **Introduction**

One of the major trends in global fisheries is increased competition between small-scale and large-scale fisheries due to overfishing (Pauly *et al.* 2002) and overcapitalisation (Mace 1997). The two sub-sectors share numerous attributes across countries, though the boats used by small-scale fisheries in developed countries can be as large as industrial boats in developing countries.

One major result of this trend, especially in developing countries, is the marginalisation of small-scale fisheries, although they meet most of the criteria required for an enlightened fisheries policy in terms of employment and income distribution, energy intensity, product quality and distribution, and sustainability (Thompson and fao 1988; Pauly 1997; Allison and Ellis 2001; Béné 2003).

Many of these positive attributes and the governance arrangements that go with them, which social scientists love to report on, are, however, undermined by two related trends. One is the entry into coastal small-scale fisheries of landless farmers or cattle-less pastoralists, where they overwhelm the traditional fishers and local governance arrangements (Pauly 1997). The other is the limitation in productivity of tropical coastal ecosystems (Longhurst and Pauly 1987), which

cannot support ever-increasing numbers of both traditional fishers and new entrants.

Ensuring the sustainability of coastal fisheries, especially in the tropics, requires that the migratory flows into coastal fisheries be reversed. These are political problems, and they ought to be informed mainly by social scientists, not biologists. Yet fisheries biologists - I dare not speak of 'fisheries scientists' in this context - share with fisheries economists the dubious privilege of being responsible for most of today's ideas on fisheries management.

Other social scientists, notably anthropologists, have far less input. This can be illustrated quantitatively: if one enters 'fisheries' and 'ecology' into *Google Scholar*, one gets, at the top, a paper with over one hundred citations, while the subsequent papers also had noticeable impacts, as measured by citations (76,500 hits in total). This is similar for 'economics' and 'fisheries' (22,100 hits), as one would expect. On the other hand, with 'anthropology' or 'sociology' and 'fisheries' as search terms, the top ranking items are minimally cited and subsequent items are not cited (3,260 and 3,950 hits, respectively). Why is that so and what does this order-of-magnitude difference imply for fisheries research and policy?

This is an issue about which I cannot pretend to be neutral. My perspective is that of a fisheries biologist, and I answer questions about the role of various fisheries-related disciplines from that perspective (Pauly 1994). Moreover, I will not pursue inferences on the past of fisheries (prior to 1950), because these are the provinces of historical geography, archaeology and ultimately palaeontology, which will not be called upon here (but see Jackson *et al.* 2001).

## The (Recent) Historical Background

By 1950, the countries of Western and Eastern Europe and other developed countries had recovered enough from World War II that they could re-launch their strongly industrialised fisheries. At that time, the majority of what are now 'developing countries' were still under European domination, or in the process of emancipating themselves from it, a process which culminated in the 1960s. As subsequent developments made clear, these countries were not only 'underdeveloped', but actively held back, and this was noticeable in the structure of their fisheries (Colonial Office 1961; Butcher 2004).

The early 1950s is also an auspicious time for the beginning of this tale, because in 1950, the United Nations Food and Agriculture Organisation (FAO), doing its part of a UN-based effort to quantify the world (Ward 2004), began to collect annual fisheries landings statistics for the entire world; an effort which continues to date, and which provides a unique perspective on fisheries and, ultimately, on their crisis. But we are getting ahead of the story.

European and North American fisheries in the North Atlantic (Pauly and Maclean 2003), and those of North Asia in the Pacific, peaked in the 1970s, with all major stocks exploited to the fullest (Grainger and Garcia 1996; Pauly *et al.* 2005). Fishing effort began to spill over from this region to areas further south such as West Africa, where it was the origin of the first distant water fleets in those waters (Bonfil *et al.* 1998; Alder and Sumaila 2004). Simultaneously, there were, in numerous countries, a multitude of fisheries development projects, then advertised as a noble effort to help the newly independent nations of the Third

World to make the best use of their marine resources. Many of these projects are now understood to have been the result of an East-West rivalry that used bilateral aid projects as part of a containment policy, which was hastily abandoned -- along with the projects -- after the collapse of the Soviet Union.

These development projects, usually staffed by biologists, largely neglected the experience of traditional fishers in the countries concerned. This is documented in classics as such as Firth (1946), in compilations such as Ruddle and Johannes (1985) and Dyer and McGoodwin (1994), and in historical accounts such as Butcher (2004). Rather, these projects sought to create local industrial fisheries based mainly on trawling and in direct competition with more traditional forms of fishing (Pauly 1996a). These were success stories in the sense that huge fisheries were developed, notably in Thailand (Panayotou and Jetanavarich 1987), which itself initiated distant water fisheries (Butcher 2002). In Africa, however, these projects did not catch on, in the sense that they failed to induce the development of large-scale fisheries, despite the presence of favourable starting conditions in some countries, notably Ghana (Lawson and Kwei 1974; Atta-Mills *et al.* 2004).

The primary reason for this was the existence of distant water fleets. Indeed, along much of Africa's coastline, especially off West Africa, the competition is still direct, between local small-scale fishers and foreign industrial fisheries (that is, distant-water fleets). In most countries of Latin America and the Caribbean, the industrial sector often consists of national fleets exploiting pelagics, and hence not directly competing with near shore, small-scale fisheries. In some other countries, distant-water fleets generate conditions similar to those in West Africa (see contributions in Agüero 1992). Whatever the route that 'development' took, the goals of fisheries development were generally 'biological' (high catches, utilisation of all resources, etcetera), to the near complete neglect of social goals such as employment, community well-being, food security, etcetera (Hersoug 2004).

These events and trends should have provided many opportunities for social scientists to contribute to the discourse in fisheries science, and even to insert themselves in actual fisheries management and policy making. This generally did not occur, as shown by the *Google* numbers above. I think this is due to two major aspects of the 'research mode' of social scientists. To put things stereotypically, social scientists working on fisheries:

- 1) Neglect key quantitative variables (this is especially true for the catch of small-scale fisheries, which social scientists could often estimate reliably, given their access); and
- 2) Fail to propose and test models of social behaviour of sufficient generality to be useful for policy making.

I will not back these claims through exhaustive citations of the literature, because proving negative statements of this sort would involve detailed hermeneutics of the key texts in social sciences and fisheries. Rather, I will give commented examples, which will also enable me to cover the ground defined by the title of this contribution.

## Marginalisation of Small-Scale Fishers (I): Underestimation of Artisanal Catches

The FAO issues world fisheries statistics annually, which many take to be the world 'catch'. But these statistics are incomplete. Discarded by-catch is not officially reported, although the FAO itself has commissioned estimates of discards (Alverson *et al.* 1994; Kelleher 2005), which others have commented on (for example Zeller and Pauly 2005). Also, a significant portion of the catch is landed illegally, and not estimated (Pauly *et al.* 2002). Finally, there are many fisheries which are unregulated, either because they take place on the high seas, or because they are small-scale, and fall below the radar screen of the national statistical agencies that report national catches to the FAO (see, for example: Zeller *et al.* 2006).

For the world as a whole, the catches of marine small-scale fisheries have been estimated as upward of thirty million tonnes (Chuenpagdee and Pauly 2004), but, it is not clear (due to the non-consideration of small-scale fisheries in the statistics in a large number of countries, and their consideration in others) what fraction of these thirty million tonnes is already included in the about ninety million tonnes of global annual 'catch' published by the FAO during the last ten years, and what fraction should be added. We are working on this because we assume that the latter is a large figure, which will lead to a reappraisal of the global role of small-scale fisheries.

This issue may be illustrated for the fisheries of the South Pacific, which tend to consist of two sub-sectors: the tuna fisheries (Anonymous 1997; Gillett *et al.* 2001), conducted mainly by distant-water fleets in the Exclusive Economic Zones (EEZ) of the various countries; and what might be called the 'inshore fisheries', based on exploiting reef and other neritic fishes (Dalzell *et al.* 1996). As indicated by the FAO statistics, and reflected in the database of the *Sea Around Us* project, which presents these statistics in a geographic context (see [www.seaaroundus.org](http://www.seaaroundus.org)), numerous South Pacific countries report no, or very limited inshore catch, although they are known to depend heavily on locally-caught fish for their nutritional needs and food security (see, for example, Chapman 1987; Dalzell *et al.* 1996).

Social scientists would be well placed to contribute this key variable, because of their local contacts, and because they are often embedded in the very institutions that take 'the pulse' of local small-scale fisheries. And social scientists should know the importance of catch levels: they are the very things that make people go fishing.

Yet, '*Words of the Lagoon*' (Johannes 1981), a classic which many fisheries anthropologists rightly attempt to emulate, does not contain the catch (and catch per fisher) data which, much better than words, would allow evaluation of the extent to which traditional Palauan fishing practices are sustainable, and also allow an assessment of the role of fisheries in the rural economy of Palau.

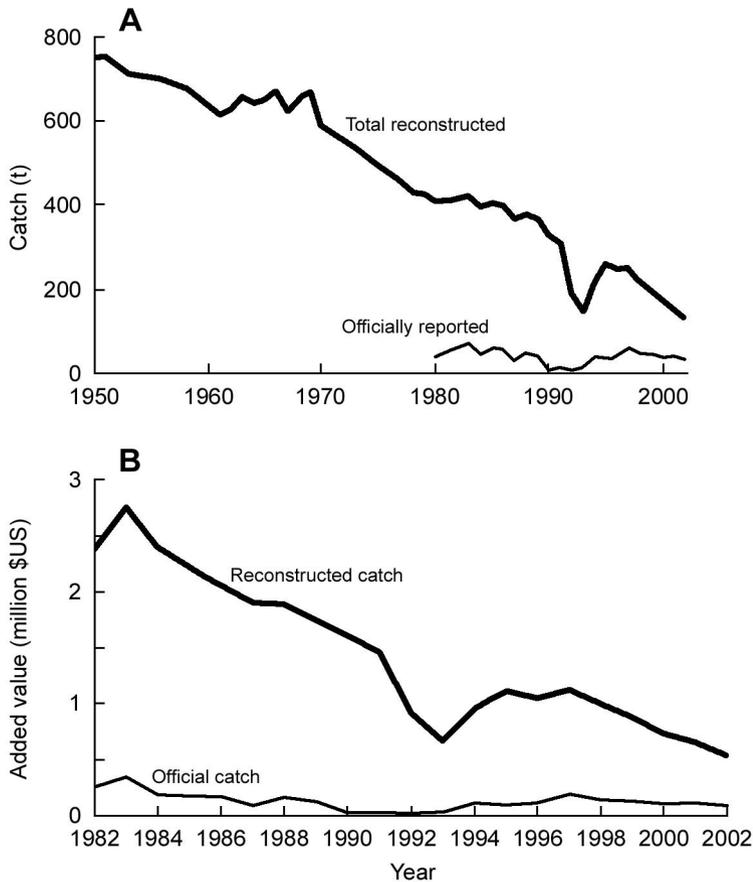


Figure 1. *Inshore (reef) fisheries catches in American Samoa; 1950-2001: catches reconstructed from grey literature and fish consumption statistics; 1982-2002: official catches, as reported to the FAO. For the latter period, the reconstructed catch is, on the average, seven times the official catch (Panel A, adapted from Zeller et al. 2006). This difference increases to ten times (Panel B) if values of the fish and downstream benefits are taken into account (adapted from Zeller et al. 2005).*

How important such a role can be, and the extent to which it is underestimated by FAO statistics, is illustrated here by Figure 1, which presents, for American Samoa, the reconstructed catch of the inshore (reef) fisheries vs. the official (FAO) numbers. For the period 1981 to 2002, when both time series are available, the reconstruction, although based on conservative assumptions (Gillet and Lightfoot 2002; Zeller et al. 2006), estimated a catch seven times higher than the official statistics, and this contributed nine times more to the rural economy than originally assessed (Zeller et al. 2005).

If these results can be reproduced through the region (and there are good reasons to think they can; Zeller et al. 2006), this will imply that the emphasis presently given to tuna in the South Pacific region may be misplaced, along with a version of food security that involves using the payment of distant water

fleet access fees for importing fish and other food (notably 'spam'). This emphasis has, at its flip side, the near complete official neglect of the inshore small-scale fisheries and their marginalisation.

### Marginalisation of Small-Scale Fishers (II): Malthusian Overfishing

The next issue concerns models -- mental constructs meant to reflect important aspects of reality, such as to articulate our knowledge of it, and enable the exploration of, for example, the implication of certain policies impacting on that reality.

I assert that social scientists have rarely proposed generalisable models of fishing communities. Rather, they have tended to offer descriptions of localised situations, from which such models might be constructed, and against which they could be tested (since all the non-trivial assertions of such models should be treated as hypotheses).

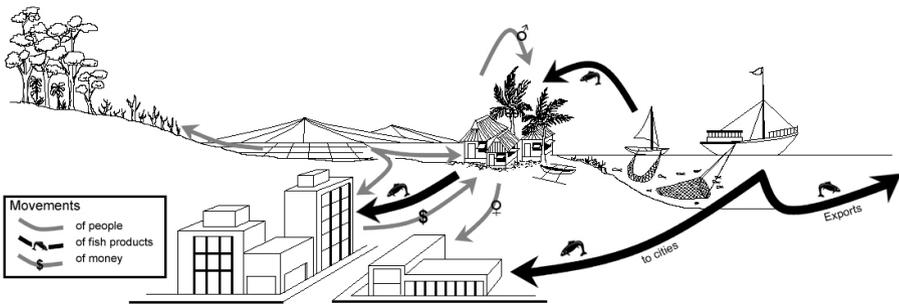


Figure 2. *Schematic representation of the 'Malthusian overfishing' model of Pauly (1997), which states that the modernising and mechanising agricultural sector releases excess landless farmers, who migrate to urban, upland, or coastal areas; under this influx, traditional fisheries management collapses; the excessive fishing pressure is exacerbated by inshore industrial fishing, by the entry of the male children of fishers, and by the subsidy provided by young women working in cities to their brothers, fathers, or husbands in fishing villages. Upland deforestation, also involving new entrants, leads to siltation of rivers, and eventually, of coastal ecosystems, further reducing coastal fisheries yields (see text).*

Construction, articulation, and/or eventual refutation of such models, the most successful of which become 'theories', is current in the natural sciences. The following, although not expressed in quantitative terms, and dealing with social science issues, is structurally akin to such models. This model (Figure 2) describes what I called, perhaps unfortunately, the 'Malthusian overfishing' of small-scale fisheries (Pauly 1997), although raw population growth is only one of its drivers. The major elements of this model, each formulated as a testable hypothesis, are:

- i. that a large agricultural sector (at least when compared with the fisheries sector) releases excess labour because of population growth, mechanisation and land 'reform';

- ii. these landless farmers migrate either to urban, upland, or coastal areas;
- iii. under this influx, traditional arrangements preventing open access to the fisheries gradually collapse;
- iv. this leads to excessive fishing pressure;
- v. which is exacerbated by inshore industrial fishing;
- vi. and by new recruits to fishing, as the male children of fishers pick up their fathers' trade;
- vii. and by the financial contribution of many young women who leave their communities to work in urban areas, providing a subsidy for men to continue to fish even when resources are depleted.
- viii. The migrants to upland areas accelerate and/or complete the deforestation initiated by logging companies, which leads to siltation of rivers and streams;
- ix. and eventually to smothering of coral reefs and other coastal habitats, thus further reducing coastal fisheries yields (Pauly 1997).

Since this model was formulated, on the basis of personal observations in, and literature from South America, South and Southeast Asia, and Africa, all I have encountered is an accentuation of the trends it builds on. Hence, I would suggest that it still might provide good questions for fisheries anthropologists and other social scientists to investigate and test. However, one new element that may be added to iii/iv is globalised export markets into which communities of small-scale fishers can plug themselves directly, which offer them potentially higher incomes, but which contribute to removing the last remnants of traditional, place-based management.

### **Malthusian Overfishing: Application to the December 2004 Asian Tsunami**

The Malthusian overfishing model provided the background for recommendations on damage mitigation (Pauly 2005), following the tsunami of December 26, 2004, which devastated South and Southeast Asia, and which read as follows [original references added]:

‘The tsunami that hit South and Southeast Asia on December 26, 2004, taking a horrific toll in human lives, also affected several coastal industries, including tourism and agriculture, though to what extent is unclear. As noted by Pearson [2005], the effects in some areas were exacerbated by existing environmental problems stemming from settlement and industry. The governments of Thailand and Indonesia have announced some estimates of fishing boats lost and highlighted the need for investments to restart the fisheries.

However good their intentions, I believe that Western aid agencies, and indeed, the governments of the region would be ill-advised to rebuild the fisheries as they were before the tsunami. Apart from oceanic fisheries for tuna and other large fish, fisheries in the tsunami-affected region fall into two categories: “artisanal fisheries”, relying on small (five meters or less), owner or family-operated craft, some non-motorised; and “industrial fisheries”, using larger vessels, mainly trawl-

ers but also other specialised craft with salaried crews. Jointly, their fishing activities have radically depleted the nearshore resources, down to depths of a hundred meters in places. Governments in the region have tried to encourage the industrial fisheries to operate farther offshore, but with little success, mainly because biological production, in tropical waters, is much higher inshore than offshore [Longhurst and Pauly 1987]. Hence, the artisanal and industrial fisheries essentially target the same shrimp and fish stocks, leading to intense competition. This competition and the ensuing violence, including boat burnings and riots, can be serious enough to prompt governments to take action, such as the 1980 ban on bottom trawlers in western Indonesia [Sarjono 1980]. Usually, however, government policies ignore these conflicts. Sometimes they exacerbate conflict by subsidising the construction and operation of industrial vessels, even in cases where these do not add to the total catch, but reduce that of the artisanal fishers. International aid has often aggravated this through technological and capital transfers, or donations of surplus vessels. Meanwhile, failed agricultural and social policies aggravate the situation by driving thousands of landless farmers to coastlines, where they usually fail to emulate the more sustainable ways of “traditional” fishers [Pauly 1997]. After the tsunami, the initial push will be to get people back to the jobs they know, and it will be hard to argue otherwise in the midst of the chaos. But rebuilding the fisheries without structural reform will only intensify these trends and conflicts. The challenge is to rebuild fisheries while directing as much money and energy as possible to generating land-based job opportunities for young fishers. Emphasis should be given to basic education and technical skills: many fishers in South- and Southeast Asia are illiterate, and this limits their social mobility [Bayley 1982]. Amending the old adage that teaching people to fish is better than giving them a fish to eat, we should instead be teaching them to repair bikes, sewing machines and water pumps.’

Needless to say, this advice was not heeded (Baldauf 2005; Chuenpagdee 2005; Erdmann 2005): the urge to subsidise was just too hard for relief agencies to resist. Never mind the devastating effects of subsidies, which can destroy small-scale fisheries as well as industrial ones (Smith 1981; Pauly *et al.* 2002).

### **Malthusian Overfishing: Final Comments**

Google Scholar suggests that the paper in which the Malthusian overfishing model was fully developed (Pauly 1997), following briefer accounts in various outlets, was [as of Jan. 2006] cited over thirty times, but overwhelmingly by biologists. The major criticism that the ‘Malthusian overfishing’ model has received from social scientists is due to its dynamics being perceived as *caused* by industrial fisheries, which massively deplete the resources previously available to small-scale fishers. It is partly true: most small-scale fisheries throughout the world have seen their resources depleted by industrial fishing vessels, notably trawlers, fishing on or near their inshore fishing grounds. Yet this is not the whole story. An ever-increasing number of small-scale fishers operating motor-

ised canoes or similar mobile and versatile crafts can deplete the entire resource available on a country's continental shelf, and this is particularly clear in the Caribbean and the South Pacific. The local and/or foreign industrial fleets are only accelerating, albeit to a tremendous extent, an overfishing process which, if not controlled, would eventually engulf even the most seemingly benign small-scale fisheries.

Thus, for example, the foreign fleet exploiting the Bissago Archipelago in Guinea-Bissau consists of both the ubiquitous trawlers of European fleets, but also fishers on motorised canoes from neighbouring Guinea, and as far as Senegal, who set up camps in the Bissagos' outlying islands, from which they systematically deplete all resources in the neighbourhood, before returning with their catches, to be landed in Conakry or Dakar (Kaczynski 2005).

The best example of Malthusian overfishing is, however, the Bolinao reef fishery, in the Philippines, documented in great detail by McManus *et al.* (1992). In this instance, internal dynamics led to resource destruction without any 'help' from a large-scale fishery. Perhaps I should mention it is also the site that inspired the model (Pauly 1988).

## Conclusion

The observations presented above can be interpreted in numerous ways and, as stated in the introduction, I can offer only the perspective of a fisheries biologist. With these caveats, here are my views of research topics that I consider worthwhile.

*For fisheries economists:* First, rights-based fishing seems to be at present *en vogue*. However, in most of the developing world, rights-based fisheries likely will not work, at least not in the form of individual transferable quotas (Pauly 1996b). In fact, restricting entry for small-scale fishers (and even for national industrial vessels) is not going to be politically feasible until distant water fleets are curtailed or at least invisible; in other words, far offshore. A second point regarding fisheries economics is that the emphasis on foreign exchange gain, while music to the ears of most local politicians, is not necessarily leading to economic development. A complete analysis ought to always look at whether or not this foreign exchange actually flows back into the economies of the countries in question. If not, the economic role of local fisheries, which generate substantial rural incomes, will be more important (Zeller *et al.* 2005).

*For anthropologists:* It is certainly the case that studying the local adaptation of a village and emphasising its uniqueness *vis-à-vis* other villages and the mainstream culture is what gets one credibility in a field where the 'local' is so prized (Geertz 1985). Yet, the negligible role that anthropology and related social sciences play in informing fisheries management should be a warning that there is a need for social-science generalisation which is presently not met, for example, to formulate people-orientated and sustainable government policies for an entire region or an entire country.

The reason why biologists and economists have come to almost monopolise the policy arena is their willingness to develop such generalisations even when they lack knowledge of the social consequences and insight in the assumptions implicit in the view of human behaviours on which these policies have been developed.

Furthermore, there is a real danger that the small-scale fisheries, if they don't manage the influx of new fishers into their midst, will be destroyed by new entrants; in this case, non-traditional fishers. Thus, there is a real need for generalisable work on the causes of migration within, into, and from coastal fisheries.

*For sociologists:* There are very few studies available of how collapsed fisheries are phased out, and how this affects different social groups. Yet, if the trends alluded to above hold, 'fisheries extinctions' should become common. We need guidance on how to integrate ex-fishers into other gainful activities, and how to create other sources of employment in communities that cannot continue to rely on fishing. To date, no such guidance is available, though there is a great need for it, as evidenced by the tsunami example.

Another topic that is understudied is the role of women in small-scale fisheries. Women catch fish (though often not the glamorous ones; Chapman 1987), and they process fish, too; these activities are conventionally studied. What is little studied (if at all) is how women (the wives, sisters, and daughters of fishers), by engaging in employment outside the fishing sector, and keeping the family in cash, literally subsidise male fishers, and allow them to continue exploiting overfished resources.

*For all of us:* The massive reduction of biomass which is the characteristic *modus operandi* of modern fisheries (for example Christensen *et al.* 2003), and the erosion of biodiversity and ecosystem function that this entails (for example expressed by the fishing down phenomenon; Pauly and Watson 2005), endangers the long term sustainability of fisheries. In the long term (two to three decades?), fisheries and fishing-based cultures will not survive if we do not manage to put small-scale fisheries and resources first, and to rein in both the floating behemoths that this industrialisation has brought us and the massive rural migration into small-scale fisheries. Realistic scenarios for such transitions exist (Pauly *et al.* 2003), but the alternative scenarios, with more overfishing by subsidised industrial fleets and neglect of the small-scale fisheries, are still more appealing to our policy makers.

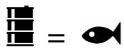
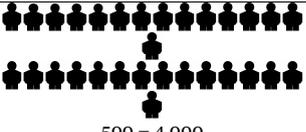
FISHERY BENEFITS	LARGE SCALE 	SMALL SCALE 
	Number of fishers employed	 about ½ million
Annual catch for human consumption	 about 30 million t	 same: about 30 million t
Capital cost of each job on fishing vessels	\$\$\$\$\$\$\$\$\$\$\$\$ 30,000 - 300,000	\$ 300 - 3,000
Annual catch reduced to meals and oils	 20 - 30 million t	 Almost none
Annual fuel consumption	 About 37 million t	 About 5 million t
Catch per tonne of fuel consumed	 1 - 2 t	 4-8 t
Fishers employed for each \$1 million invested in vessels	 5 - 30	 500 - 4,000
Fish and other sealife discarded at sea	 8-20 million t	 Very little

Figure 3. Schematic illustration of the duality of fisheries prevailing in most countries of the world, using numbers raised to global levels. This duality of fisheries largely reflects the misplaced priorities of fisheries 'development', but also offers opportunity for reducing fishing mortality on depleted resources while maintaining most social benefits. The solution here is to phase out the large-scale fisheries. Based on an original graph by Thompson and FAO (1988), with updates from Chuenpagdee and Pauly (in press); Kelleher (2005); Tyedmers et al. (2005) and data on the FAO website ([www.FAO.org](http://www.FAO.org)).

I conclude with a vision of vibrant small-scale fisheries contributing to coastal communities and supplying, throughout the world, the bulk of fish for human consumption, harvested with a minimum expenditure of energy, in a sustainable fashion (Figure 3). This is what small-scale fisheries can do, once they are freed from the constraints under which they presently operate.

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## Notes

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