

Commercialization of South Africa's Subsistence Fisheries? Considerations, Criteria and Approach¹

Ragnar Arnason* and Marisa Kashorte

**Department of Economics, University of Iceland.
Oddi v. Sturlugotu, IS-101 reykjavik
Iceland
E-mail: ragnara@hi.is*

*Department of Environmental Economics and Tourism,
Marine and Coastal Management.
Cape town, South Africa
E-mail: Kashorte@deat.gov.za*

Abstract

The subsistence fishing sector in South Africa represents a significant economic activity employing almost 30.000 fishers and providing sustenance for well over 150.000 people. According to the current legislation, those licensed as subsistence fishers are not allowed to sell their harvest beyond 20 km from the place of landing. This restriction has at least two major effects: On the one hand, it serves to lower the average price for fish received by subsistence fishers and thus contributes to their continued poverty. On the other hand, by making subsistence fishing economically less attractive, it has reduced subsistence fishing effort and thus served to protect some coastal marine resources. This paper examines under what conditions it would be socially beneficial to allow subsistence fishers to trade freely, i.e. allow commercialization of subsistence fishing. It finds that there are clear economic benefits to commercialization, which could drastically improve the economics of the subsistence fishing communities. However, these benefits will not materialize unless subsistence fishing activities are guided by an effective fisheries management regime. Moreover, the benefits will not be reasonably shared unless the initial fishing rights are appropriately allocated and individual welfare protected by a strong social structure. The paper suggests that community fishing rights composed of a combination of territorial fishing rights and community quotas may constitute the appropriate basic arrangement to generate sustainable economic benefits that are distributed in a socially fair way. Although, written with the South African situation in mind, the main results of the paper appear to be applicable to other subsistence fisheries faced with commercialization.

Keywords: Subsistence fisheries, subsistence fishing communities, commercialization, commercialization of subsistence activities, community fisheries management.

¹Much of the research for this paper was carried out the United Nations University Fisheries training Programme in Reykjavik Iceland.

Introduction

The South African regime shift in 1994 and the end of apartheid led to the popular expectation of a wider and more equitable access to the country's marine resources [1]-[4]. One consequence was that considerable numbers of native people flocked to the coast hoping to earn a better living by fishing. This addition to the already established communities of subsistence fishers, some of very long standing, substantially increased the pressure on many coastal marine resources.

Responding to this, the Minister of Environmental Affairs and Tourism, in 1994, launched a process leading to the development of a new fisheries policy for South Africa. The outcome of this process was the Marine Living Resources Act (hereafter referred to as the MLRA) of 1998 [5]. As was the case in previous legislation, the MLRA distinguished between recreational and commercial fishers. In addition, and for the first time in South Africa, subsistence fishers were recognized as a distinct group of fishers. As far as we have been able to ascertain, relatively few countries have legislation dealing specifically with subsistence fishers. Alaska and Canada are notable exceptions. Indeed, Alaska has devoted an entire Division within its Department of Fish and Game to deal with subsistence activities, which testifies to their perceived social and economic importance by the people in that state [6], [7].

In South Africa the cornerstones of the management of commercial fisheries are (i) fishing licences and (ii) individual harvesting quotas. In the MLRA of 1998, subsistence fisheries were similarly subjected to licencing but exempted from the individual harvesting quota constraint. However, another important restriction was imposed; any sales of harvests from subsistence fisheries were restricted to 20 km. radius from the place of landing.

The MLRA defines subsistence fisher as

“....a natural person who regularly catches fish for personal consumption or for the consumption of his or her dependants, including one who engages from time to time in the local sale or barter of excess catch, but does not include a person who engages on a substantial scale in the sale of fish on a commercial basis.”

This clause has served as a basis for issuing annually renewable fishing licences to subsistence fishers. These licences grant the subsistence fisher the right to carry out fishing operations in a stipulated area for the harvest of a given species of fish using specified fishing methods [8]. Thus, fishers that were deemed to be bona fide subsistence fishers before the passing of the MLRA have received licences as such. Also, new entrants have been licenced if they can produce evidence that they satisfy the same criteria. In practice this has meant that anyone who could establish himself as a subsistence fisher, by joining a subsistence fishing community or starting his own, would normally receive a subsistence fishing licence. Thus, new entry into the subsistence fishing sector has by no means been closed in the past. Since 1998, the number of subsistence fishers has been increasing suggesting that this constitutes a comparatively attractive employment opportunity. A recent estimate [9] put the number of subsistence fisher households at over 28.000 in the year 2000. This suggests that as many as 200.000 people may have derived their livelihood from subsistence fishing in that year.

The allowance for subsistence fishing in South Africa's fisheries legislation is obviously designed to meet the needs of poor people with few economic alternatives. Indeed, the large majority of subsistence fishers in South Africa are very poor. In most cases their fishing activities barely suffice for the basic necessities of life and do not provide adequate returns to allow them to add to their human and physical capital and thus improve their economic situation.

This raises the question of whether it is socially advisable to retain the 20 km. trading restriction. By closing the door to potentially more lucrative fish markets, this restriction serves to keep

subsistence fishers at a lower level of income than would otherwise be the case. Commercialization, i.e. the ability to trade more widely and thus realize higher prices, is one way, perhaps the only way, for subsistence fishermen to improve their economic situation. Indeed, many subsistence fishers feel hampered by the trade restrictions and often seek to violate them. However, due to the risk and added costs involved these violations are poor substitutes for unrestricted trade. On the other hand, by reducing the economic return to subsistence fishing, the trade restrictions have served to inhibit the expansion of subsistence fishing and thus possibly to avoid a more severe overexploitation of the marine resources.

This paper deals with these issues. More precisely, it attempts to answer the basic question whether it is socially advisable to lift the trading restrictions on subsistence fishers and thus allow them to become commercial fishers. Not surprisingly, we find that there is no simple answer to this basic question. It all depends. Therefore, instead of a definite answer, we attempt to delineate conditions under which such a move to commercialization would almost certainly be welfare increasing. In deriving these conditions we are helped by simple applications of standard neoclassical welfare theory [10], [11] and basic fisheries economics [12], [13].

Subsistence fisheries similar to those of South Africa are common in Africa and other less developed parts of the world. Increasingly they are all faced with the same problem. Should they become commercial or not? The process of globalization — the rapid expansion of market oriented activity worldwide — has added urgency to these considerations. Although, presumably, not many of these subsistence fisheries are subject to the South African legal restriction on trade they all face the pressure and temptation to become commercialized. Indeed, in the absence of sufficiently high legal or technical barriers, they will probably become so. The question is whether it is socially desirable to let this process to run its course without modification and if not what modifications or adaptations are appropriate. Since this paper, deals essentially with this basic question, many of its results should be applicable to other subsistence fisheries, irrespective of whether they face a similar legal constraint on trading as in South Africa or not.

The literature dealing with subsistence fisheries in various parts of the world is extensive. However, most of it approaches the problem from the sociological and anthropological perspective. Examples of recent papers in that mold are [9],[14]-[25]. In spite of considerable search we have not been able to find any papers that deal specifically with the particular problem of concern in this paper. The closest reference we found is a paper by Inge Tvedten from 1990 [26] on the transition from subsistence to commercial fishing in Guinea Bissau. That paper, however, is descriptive rather than analytical. Thus, the current paper may be the first to analyze the practical issue of moving subsistence fishing to commercial fishing.

The paper is organized roughly as follows: The next section, section 2, provides general background information on the subsistence fisheries in South Africa. Section 3 outlines the main issues involved and presents a conceptual model to assess when commercialization of subsistence fisheries will increase social welfare. Building on these analytical results, section 4, lists practical criteria for judging when a fishery is ready for commercialization. In section 5, a practical approach to further commercialization is discussed. Finally in section 6 we summarize the main results of the paper and how these can be applied to other cases of subsistence fisheries.

Subsistence Fisheries in South Africa: Background

South Africa's subsistence fishing communities are believed to comprise over 200 thousand individuals out of a national population of some 45 million. Most of these people are very poor and don't have many economic alternatives. They also share certain other traits such as owner-operated fishing vessels, primitive fishing technology, low harvest levels and simplistic methods of fish

conservation and processing. Apart from this, they are quite differentiated. They differ in terms of location, species harvested, tribal affiliations and, indeed, the level of commercialization or trading [26].

It may be taken as a matter of definition that subsistence fishers harvest exclusively for own consumption. In South Africa, however, there are few pure subsistence fishers in this sense as most trade to a certain extent. It may help to visualize the various fisheries lying on a continuum from purely subsistence to purely commercial as in Figure 1. Fishers legally classified as subsistence fishers in South African comprise pure subsistence fishers as well as semi-commercial fishers. Thus, seen as a group, South Africa subsistence fishers are some distance from the pure subsistence end of the continuum in Figure 1. Further research is needed to determine the exact distribution of the South African subsistence fishers along this scale. In Europe, by contrast, most fisheries are commercial but only a few are purely commercial. Thus, the average European fishery would be close to the far right end of the continuum in Figure 1.

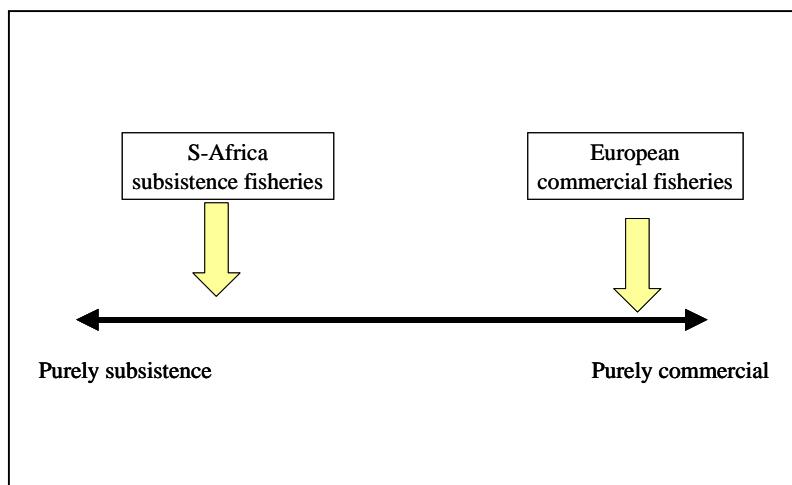
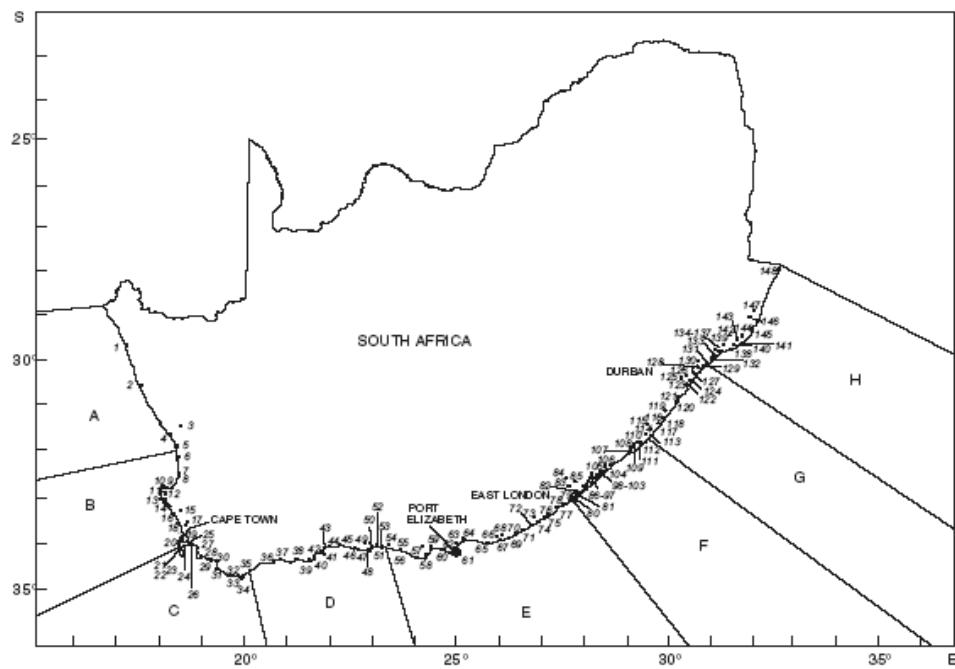


Figure 1: Subsistence-commercial continuum

For the purpose of depiction it is convenient to divide the coastline of South Africa into eight regions as follows:

- Region A Namibia border to Olifants River
- Region B Olifants River up to and including Hout Bay
- Region C Hout Bay to the Breede River
- Region D Breede River to the western boundary of Tsitsikamma National Park
- Region E The western boundary of Tsitsikamma National Park to Kei river
- Region F Kei River to Mtamvuna River
- Region G Mtamvuna River to Umvoti River
- Region H Umvoti River to Moçambique

According to the results reported in [26], there were close to 150 subsistence fishing communities along the South African coastline in 2000. The greatest density was in Regions B and C, around Cape Town on the West Coast and regions F and G on the East Coast. The least density was in Regions A and H adjacent to the Namibian and Mosambique border respectively. This distribution of the subsistence fishing communities is further depicted in Figure 2.

**Figure 2:** Locations of subsistence fishing communities in South Africa

Source: SFTG (2000)

The total number of subsistence fisher households in the country has been estimated to be 28.338 [9]. Using the estimate in [26] of 5,3 persons per household this would correspond to approximately 155 000 people directly deriving their livelihood from the subsistence fishing activity. Taking into account the supporting economic activities — the so-called backward and forward economic linkages [27] — the total number of people economically dependent on subsistence fishing could be much higher. Table 1 provides the number of fishing communities as well as the estimated number of fishers and their dependents by region.

Table 1: Number of subsistence fishing communities households, fishers and dependents by regions along the South African coast

Source: SFTG (2000)

Region	Number of communities identified			Number of households	Number of subsistence fishers	Estimated number of dependents
	Urban	Rural	Total			
A	1	4	5	458	411	2.427
B	4	12	16	643	675	3.408
C	7	6	13	1.272	1.352	6.742
D	10	8	18	1.424	1.269	7.547
E	12	14	26	1.452	1 031	7.696
F	0	33	33	4.239	4.830	22.467
G	7	10	17	18.399	16.811	97.515
H	1	18	19	1.346	1.959	7.134
Total	42	105	147	29.233	28.338	154 935

Subsistence fishers harvest an array of different species of widely different unit values including sandy beach, rocky-intertidal and estuarine invertebrates as well as seaweed and various species of fish from marine or estuarine environments. Harvested resources are consumed, used as bait or sold. The two most widely harvested resources are various species of fish and intertidal rocky-shore invertebrates [15]. Apart from this general pattern, the type of fishing that takes place varies greatly along the South Africa coast with the diversity of harvested resources increasing from west to east. On the East Coast, various species of fish and rock lobster (*Jasus lalandii*) are the most important resources. On the South and KwaZulu Natal Coasts estuarine invertebrates (sand and mud prawns, redbait, worms) are most important. Abalone (*Haliotis midae*), oysters, mussels, octopus, sandy-beach invertebrates, the alikreukel or giant periwinkle and seaweeds are other commonly harvested subsistence resources on the West Coast [15].

Subsistence fishers generally employ low fishing technology. Non-motorized boats are used along the entire coast [14], [15]. Almost all the equipment used to harvest resources is basic simple gear, including screwdrivers, knives and pangas, handlines, prawn pumps, rods and reels, gaffs, hoopnets for rock lobster on the West coast, gillnets, seine or trek-nets and traps [26]. Apart from boats, the only other expensive equipment used is diving gear (wet suits and scuba gear) used exclusively to collect abalone. This, however, is limited to a few subsistence fishers and most fishers harvest abalone without the help of diving equipment. Most subsistence fishers hold no fish processing capital and either consume their harvest or sell it locally. Often the sales are to local hoteliers on the coast at depressed prices due to the legal constraint on marketing.

Most subsistence fisher communities have strong tribal affiliations and some are even organized along tribal lines. A survey conducted during 1999 by the Subsistence Fisheries Task Group [26] contains a good deal of demographic and socio-economic data on subsistence fishers in South Africa. According to this survey, the average size of a subsistence fisher's household was 5,3 persons and the average age of a household member was 27 years. Approximately 20% of the fishers were female and 15% children. Education levels were found to be generally low, with only about 1/3 of people older than 20 years having completed primary school (i.e. grades 1-7). Most subsistence fishing communities were characterized by high degree of poverty. The mean adult monthly income per month ranged from R193 to R735 (approximately 30 to 120 US\$ at the exchange rate of 1999), far below the national average. Unemployment in subsistence fisher communities is similarly far above the national average or 40,3% compared to 29,3% for the nation as a whole [26]. Generally, it was found that socio-economic factors varied from the western to the eastern part of the coast. Thus, Branch *et al.* [14], [15] noted that the East Coast and subsistence fishing communities in the province of KwaZulu-Natal had higher larger household sizes, higher participation of women in fishing and more poverty than subsistence fisher communities on the South and West coasts. In accordance with this, the SFTG survey [26] found household expenditure on food on the South-East and KwaZulu Natal coasts to be approximately R450 per month compared to approximately R750 on the West Coast.

When will commercialization increase social welfare?

By the term "commercialization" we mean increased access to trade. In this section we will examine conditions under which commercialization of a given fishery will almost certainly increase social welfare. Although, we have the subsistence fisheries of South Africa specifically in mind, the analysis is essentially applicable to all fisheries. Consequently, we prefer to present it here in fairly general terms.

Production possibilities, both individual and communal, may be represented by a production possibility set.¹ At each point of time production possibilities are bounded above by technology and

¹ Basic references to this and the following economics can be found in [10] and [11].

the availability of natural resources and labour. This upper bound is referred to as the production possibility frontier or more simply as the production function. For our purposes it is convenient to describe production possibilities in output space as illustrated in Figure 3.

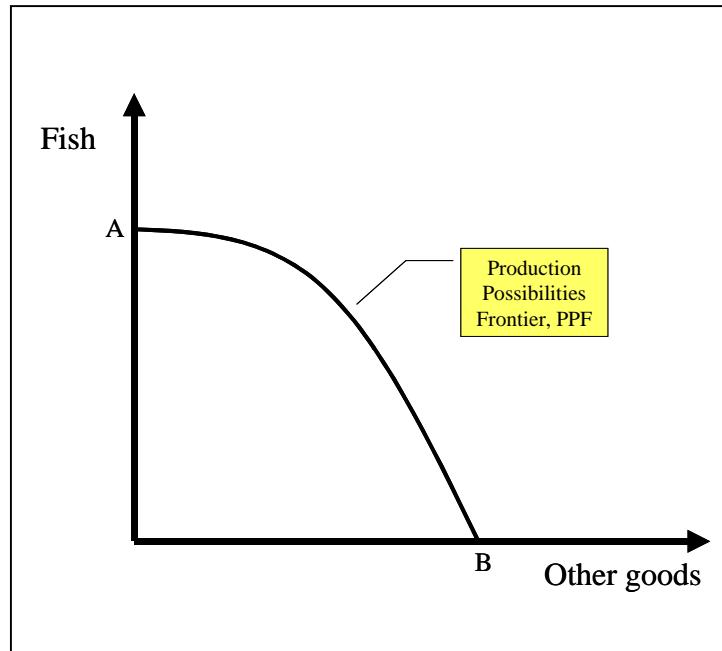


Figure 3: Production possibilities frontier

Figure 3 depicts the production possibilities for two goods referred to as fish and other goods. If all the production capabilities were devoted to the production of fish the output level would be A. The output level would be B if all are devoted to the production of other goods. The possibilities for producing the maximum amount of both goods are illustrated by the curve joining A and B. This curve, referred to as the production possibilities frontier, represents the upper bound on production possibilities. Needless to say, it is also possible to produce less of both goods, i.e. below the production possibilities frontier.

People, both individuals and communities may be taken to have preferences over goods. In economics, these preferences are traditionally represented by utility functions in the case of individuals and welfare functions in the case of communities. To simplify we will, in what follows use the term utility for both individual utility and community welfare. Normally utility increases with the amount of goods consumed. A given level of utility or welfare is represented by an indifference curve. Typically, many different combinations of the various goods can produce the same utility. An indifference curve is the loci of all combinations of goods that produce the same utility. Indifference curves are basically contour curves analogous to altitude contours on a geographical map. Three indifference curves labeled I_1 , I_2 and I_3 are illustrated in Figure 4. Note that utility increases as we get to a higher indifference curve.

Consider a collection of individuals or a community. Let's assume that this community does not have access to trade. It follows that the members of this community must produce for their own consumption or, conversely, consume what they produce. Their utility maximizing production (and consumption) is the one that attains the highest indifference curve. This occurs at a point where the production possibility frontier is tangent to an indifference curve as illustrated in Figure 5. As is easy to verify by inspection of Figure 5, all other points are either infeasible, i.e. outside the

production possibilities set, or inferior in the sense of generating less utility. Note that the optimal point illustrated in Figure 5, corresponds to a certain production of fish and other goods and the same consumption.

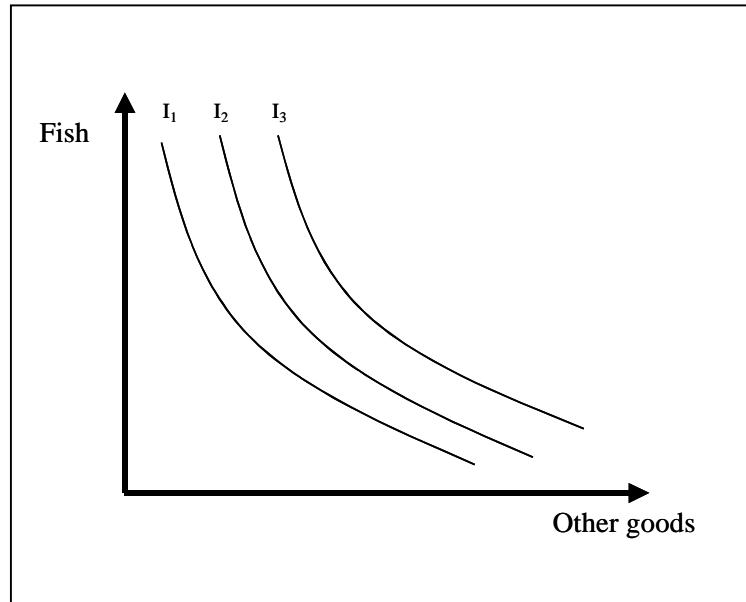


Figure 4: Indifference curves

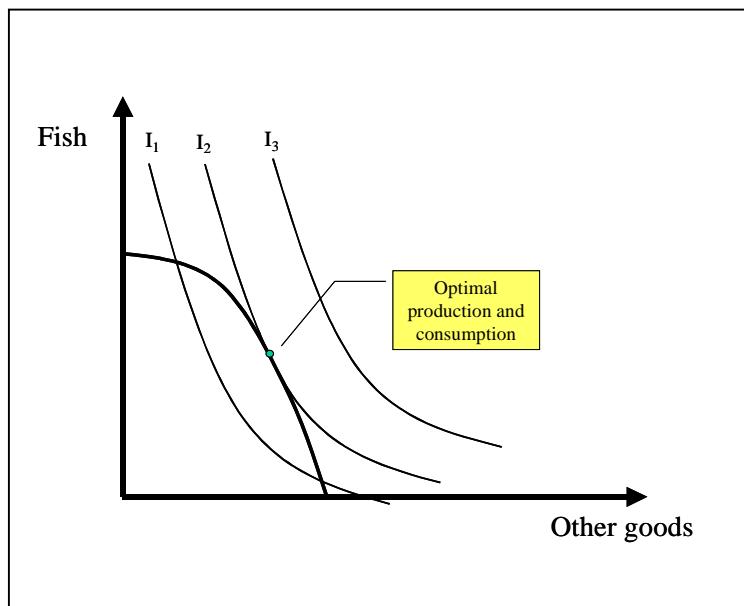


Figure 5: Absence of Trade: Optimal solution

Now, let us consider the possibility of trade. Trade means that goods can be exchanged one for another in certain proportions. The ratios at which goods can be exchanged are referred to as prices. Prices are relative and expressed in terms of other goods or money or, as the case may be, a common monetary unit. Given these exchange ratios or prices the trading possibilities may be represented by a straight line in the space of goods as illustrated in Figure 6. We refer to the straight

line as the trading line. For any given individual (or for that matter community), the trading line must go through his point of production (or more generally assets) because this is the quantity he has to trade. Given this quantity he can exchange it to obtain some other combination of the goods as indicated by the trading line. The slope of the trading line indicates the relative prices of the goods. Thus, in terms of Figure 6, the steeper the trading line the more fish has to be given up to obtain other goods, i.e. the lower the price of fish relative to other goods.

Note that when trade is possible, consumption possibilities are no longer restricted to the production possibility frontier. They are defined by the trading line which allows the individual to exchange whatever combination of the goods he produces for any other combination along the trading line. Thus, when trading is possible the objective of production is no longer to maximize utility (at least not directly) but the value of production. This happens at a point where the trading line is tangent to the production possibility set as illustrated in Figure 7. The crucial point is that, if the value of production is maximized in this way, consumption possibilities, as defined by the trading line, must be expanded compared to the production possibility set [10].

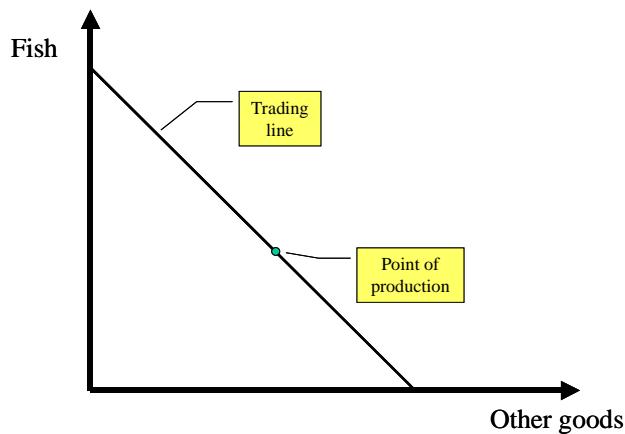


Figure 6: Trading line

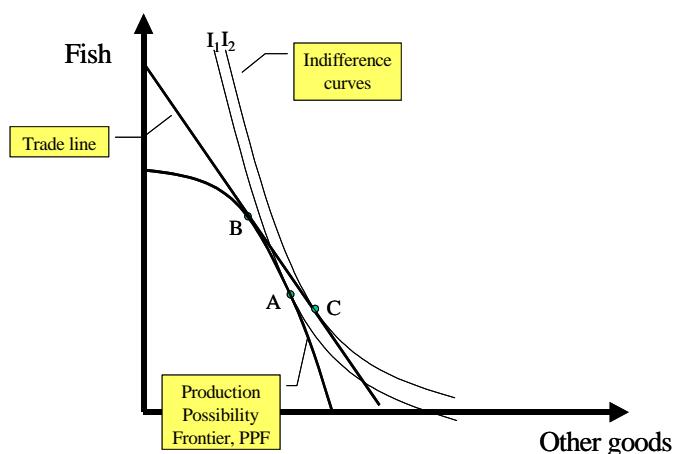


Figure 7: Gains from Trade: The Standard Model

The above elements can now be brought together to illustrate the basic economic theory of benefits from trade in the space of two goods as in Figure 7. In Figure 7, we have first of all the

production possibility frontier. Then we have preferences expressed as two indifference curves, I_1 and I_2 . Finally we have the trading line. There are three points of particular interest in Figure 7 labelled A, B and C. If there are no trading possibilities, as in Figure 5 above, A is the optimal point of production and consumption. This level of production (and consumption) corresponds to utility level I_1 . With trade, however, the optimal point of production is B, where the trading line is tangent to the production possibility frontier. The optimal point of consumption is C, which corresponds to the highest indifference curve that can be reached given the increased consumption possibilities offered by the trading line. Point C produces utility I_2 , which is obviously higher than I_1 , the maximum utility attainable with no trade. Hence there are utility or welfare gains from trade. The extent of these gains is measured by the difference $I_2 - I_1$. Note that trade in this case leads to increased production of fish or more specialization in fish production compared to the no trade case. This is also a general result in the economic theory of trade. Trading tends to promote specialization in the production of goods in which the trading parties have a comparative advantage.

The above has set out the basic theory of the gains obtainable from trade. We would now like to apply this theory to subsistence fisheries or more generally any fishery facing restrictions on fish trade. Where these trading restrictions come from is analytically immaterial. They may be legal restrictions as in the South Africa subsistence fisheries. They may also stem from domestic taxation and duties, quality inspection requirements and a variety of other sources. Note, moreover, that inadequate transportation and communication facilities and high risk of transportation losses can be tantamount to restrictions on trade. Irrespective of the nature of the restrictions they will always be reflected in a lower price of fish to the fishers than would otherwise be the case. In terms of our diagrams all of this would result in a steeper trading line than would be the case if trade were less restricted.

Under these circumstances, commercialization, i.e. less trading restrictions, will result in higher fish prices or equivalently less steep trade line. The impact on this on production, trade and utility is illustrated in Figure 8. In Figure 8, the initial restricted trade line, the steeper one, leads to the best production point B, consumption at C and utility level I_1 . With unrestricted trade, the relative price of fish rises and the trade line becomes flatter. The best production point is now A where there is more specialization in fish production, and consumption is at D which corresponds to utility level I_2 , which is much higher than before.

So, for a fish producing community, less trading restrictions, i.e. commercialization, and the resulting increase in the price of fish to the fishers will generally lead to expanded consumption possibilities and, consequently, increased utility of fishers. It is important to note however, that these particular benefits from trade only befall the people that have fish to sell, i.e. the fishers. Others in the community will not gain directly from the trade liberalization. They may, however, benefit indirectly, from secondary impacts. Thus, consumers of fish, outside the previously restricted trading area, will also normally benefit from increased supply of fish following less trading restrictions. Moreover, due to the benefits of increased specialization, less trading restrictions will also generally lead to an increased gross domestic product (GDP).

Thus, it appears that commercialization of a previously trade restricted fishery will generally be economically beneficial. This result, however, is subject to two important qualifications. First, since in this case fisheries are involved it may be the case that the common property problem [12], [29] will wipe out any gains from trade. Second, although there may be overall economic gains, it is not clear that everyone involved will gain. Depending on the particulars of the situation, there may indeed be a significant number of losers, in which case, it is not clear that commercialization is welfare increasing. Let us now turn to these questions.

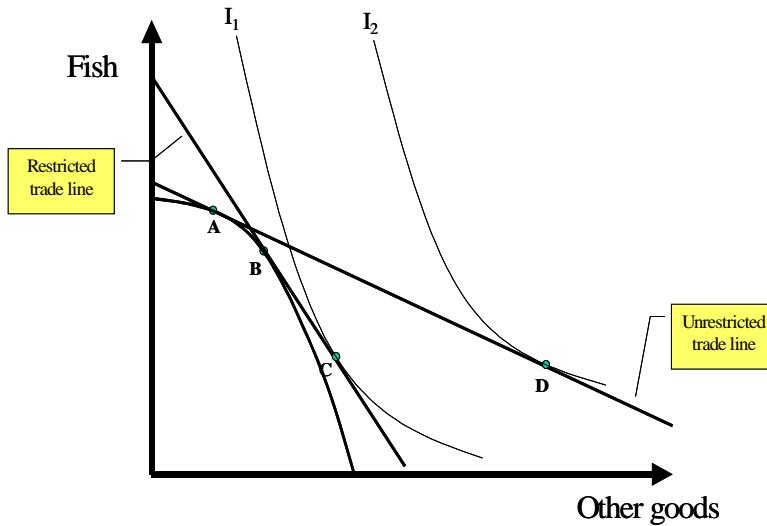


Figure 8: Subsistence Fisheries Commercialization: Gains from Trade

It is well known that in common property fisheries — i.e. fisheries where a number of fishermen harvest from a common resource — fishing effort tends to be excessive, the fish stocks overexploited and potential economic benefits from utilizing the resource dissipated [12], [29]. As a result, common property fisheries, irrespective of the market price of the harvest and the underlying productivity of the fish stocks, are generally characterized by low or nonexistent profits and poor fishermen. Moreover, advances in fishing technology and increase in the market price of fish will only make matters worse. This will give rise to the entry of new fishermen and more fishing effort and, consequently even more overexploitation of the fish stocks without any improvement in the economic outcome of the fishery. This is what Hardin [29] referred to as the tragedy of the commons. The tragedy of the commons can only be avoided if there is an appropriate fisheries management regime in place. Such a regime must be based on either corrective taxes or alleviation of the common property problem by sufficiently high quality fishing property rights (Arnason 1990, 1994).

It immediately follows from this, that commercialization of the South Africa fisheries, although it will almost certainly increase the price of fish received by the fishers, may not improve their economic return. Without an efficient fisheries management system, the price rise generated by the commercialization will lead to increased fishing effort and lower fish stocks and consequently reduced production possibilities. If the original utility level of the fishers was just sufficient to keep them in the fishery, the end result following commercialization is probably going to be the same level of utility. This can be illustrated with the same trading diagram as before (Figure 9).

In Figure 9 commercialization leads to a new “unrestricted” trade line. This one is flatter than the “restricted” one reflecting a higher relative price of fish. With production possibilities remaining constant as in Figure 8, this price rise would have led to higher utility at the indifference curve I_2 . With poorly managed common property fisheries, however, the fish stocks will decline and the production possibility frontier will contract correspondingly. Moreover, assuming the initial situation to have been one of full equilibrium, this process will continue until the maximum obtainable utility level under the new improved trading possibilities will be the same as before. Thus, as illustrated in Figure 9, the new production possibility frontier reflects less productivity in

fish production and, therefore, a comparatively more productivity in other goods. The point of production moves from B to A on the new production possibility frontier and the point of consumption from C to D on the new trade line. Importantly, as already pointed out, the consumption points C and D lie on the same indifference curve and, hence, generate the same utility. Hence, due to the contraction in the production possibility frontier, there have been no gains from the commercialization.

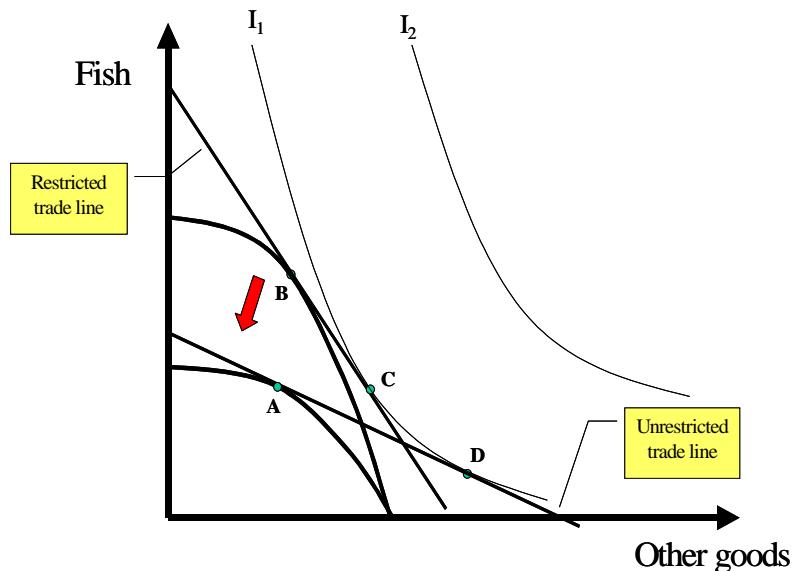


Figure 9: Commercialization in a Subsistence Fishery: Poor Fisheries Management

This outcome can, of course, be avoided with the help of an appropriate fisheries management regime. This will defuse the problem of the commons and thus escape biological overexploitation and the ensuing contraction of the production possibility frontier. Therefore, an important prerequisite for commercialization to benefit fishers is that such a fisheries management regime, usually based on property rights, is in place.

The second qualification concerns distributional questions; who will gain and who will lose? Even when the existence of an efficient fisheries management system all but guarantees that commercialization will lead to overall economic gains in society, it is still possible that some groups may be worse off due to the change. In the case of subsistence fisheries, local fish consumers and possibly also local fish workers, traders and processors would be particularly vulnerable in this respect. To the extent that less restricted trade will increase prices to fishers, it is bound to increase the local price of fish as well. So, local fish consumers will be adversely affected by commercialization unless compensated in some other way. The reason why local fish workers, processors and traders might be hurt as well is that less restricted trade in fish is quite likely to alter geographical pattern of fish processing and distribution. Thus, certain activities of this nature may be reduced or even disappear from the region. Even when total processing and trading activities do not diminish locally, alterations in the activities may leave certain groups of labour unemployed. Lack of education, experience and, more generally, market savvy, which are commonplace in many subsistence communities, will tend to exacerbate this problem.

Since this is a complicated problem, remedies are unlikely to be simple. Basically, the appropriate distributional measures have to be adopted. They may include the appropriate initial allocation of property rights in the fishery. Basically, the gains from less restrictive trade will befall

all those holding such rights, provided they do not drastically mishandle their property. Hence, by the judicious allocation of these rights everyone may be guaranteed a share in the overall benefits. Another measure is to provide education and technical assistance to prepare the parties involved for the change, help them to meet the challenges and enable them to take full advantage of new opportunities as well as their more valuable rights. A third measure to promote the appropriate distribution of benefits and costs would be the provision of social assistance to those that nevertheless suffer from the change. Needless to say, those that benefit would be prime candidates to finance this social safety net.

Criteria to judge when a fishery is ready for commercialization

The preceding analysis suggests certain basic criteria to judge whether moving a fishery toward commercialization is likely to be welfare increasing. As discussed in the previous section, commercialization, i.e. more free trade, is generally beneficial to those that can participate in the trade, provided other operating conditions remain unchanged.

However, as also discussed in some detail in section 3, when it comes to fisheries, there is often reason to fear that these other operating conditions, namely the fish stocks, will not remain unchanged. In fact, unless there is an effective fisheries management regime in place, the higher fish prices attainable by more free trade commercialization will generally lead to increased fishing effort and, consequently, reduced fish stocks. Moreover, as is well established in fisheries economics [12], [29] this process will not end until all the economic benefits from commercialization have been wiped out. Thus, it emerges that an effective fisheries management regime is a prerequisite for commercialization of subsistence fisheries to be socially beneficial.

Then there is the distributional issue. While an effective fisheries management regime will ensure that fishers and, indeed, society in the aggregate, will benefit from more free trade in fish, the same cannot be asserted for all occupations related to the fishing activity. In fact, it seems likely that local fish processors and traders could easily be hurt by increased commercialization of the local fishery. The associated welfare loss would tend to be particularly serious in subsistence fishing communities where alternative employment opportunities are relatively few and many of the inhabitants possess limited human capital to sell in other markets.

Our proposed criteria to judge whether moving a subsistence fishery to commercialization is likely to be welfare increasing are based these considerations. We take it for granted that the trade impact of commercialization is welfare increasing per se and consider conditions necessary to avoid detrimental impacts on fish stocks and the various social groups involved.

Criterion 1. An effective fisheries management regime

As is well known from the theory of fisheries economics [12], [13], increased price of landings is not going to improve the economic return to fishers unless there is a sufficiently good fisheries management regime in place.² Without such a regime, an increase in the price of landed fish will merely lead to increased fishing effort, and reduced fish stocks until any economic surplus generated by higher prices will be dissipated.

According to the theory of fisheries management [30]-[32] a rent-maximizing fisheries management regime would have to be based on either sufficiently high quality property rights or corrective taxation. Property rights have been widely employed in fisheries around the world with generally good results while corrective taxes have not to our knowledge been used in any major ocean fishery.

² By a fisheries management regime we mean (i) a fisheries management system, (ii) a system for monitoring control and surveillance and (iii) a fisheries judicial system (see [30]).

Several types of property rights have been used in fisheries including (i) sole ownership, (ii) territorial use rights (TURFs), (iii) individual quotas (IQs) and individual transferable quotas (ITQs) and (iv) community rights (Arnason 2003). Of these sole ownership is the most effective and robust, but rarely used presumably for reasons of social equity. TURFs work well in cases where the species in question do not move much so that they mainly stay within a single TURF. Unfortunately, however, this applies to relatively few marine species unless the TURFs are very large. ITQs are economically much superior to IQs and are widely used with generally good results. IQs and ITQs, however, require rather strict monitoring of harvests, which is often impractical, especially in small scale primitive fisheries. Community property rights are not a management system as such. They only provide the community with collective property rights in the fishery, e.g. in the form of TURFs and/or communal quota, that allows the community to run its own fisheries management regime. If the communal property rights are of sufficiently high quality and the community decision making process sufficiently well designed, there is good reason to believe that the community will adopt a reasonably efficient fisheries management regime for its fisheries [33]. This may easily turn out to be IQs/ITQs for its individual members.

In the case of the South African subsistence fisheries, the most appropriate fisheries management arrangement is probably community rights based on TURFs and/or communal quotas. The TURFs set aside the community's exclusive fishing area. The communal quotas, necessary in the case of migratory fish stocks, guarantee the communities a share in the total allowable catch of the species and protect others from expansion in their harvest. In addition, centrally directed steps may have to be taken to ensure that the communities employ a sufficiently efficient fisheries management regime within their own confines.

Criterion 2. An appropriate allocation of rights

The initial benefits from commercialization, i.e. less restrictive trade, befall those with fishing rights. Although the majority of others are likely to benefit from secondary effects, there may, as discussed in section 3, be losers. Thus, to increase the probability that all groups will benefit from commercialization, fishing rights may be allocated in the appropriate way. In the case of community fishing rights, the community will be responsible for the allocation of the fishing rights to its members. Note that it is not necessary to allocate the rights to the actual fishers as long as the receivers of these rights can rent or trade these rights to the fishers. Alternatively, the community may hold some fishing rights and use the proceeds to compensate those disadvantaged by the change.³

What constitutes the appropriate allocation of fishing rights must of course be in accordance with what the community in question considers as fair. First, to the extent that prevailing perceptions of fairness reflect the social welfare function, a different allocation of rights may not be welfare improving. Secondly, an allocation of rights that is regarded as unfair may lead to political and social unrest with the associated costs.

Criteria 3. Strong social and community structure

There are several reasons for this requirement. First a strong social and community structure facilitates the design, introduction and operation of an efficient fisheries management regime. Second, a strong social and community structure is well placed to set up and operate the appropriate income distributional mechanisms. Third, at least in the case of community fishing rights, a strong social and community structure is in a better position to defend these rights against

³ This, of course, is a welfare system, which is subject to its own problems of longer term inefficiency which we will not go into here.

outside encroachers. Fourth, a strong social and community structure is in better suited to negotiate with the central government the terms and conditions of the communal rights to be conferred.

Criteria 4. Good knowledge and understanding

For a community and individual rights holders to make the best use of their rights they must be well informed about the basic facts of the situation. This refers primarily to three main fields of knowledge: (1) The implications of commercialization, (2) the elements of fisheries and fisheries economics, and (3) an appreciation of the value of rights.

Commercialization is bound to change the economic conditions in subsistence communities. Obviously, to be able to better adjust to these changes it is important to foresee them and the challenges and opportunities they offer. Even when starting with an effective fisheries management regime, a community will not be able to operate and, even more importantly, modify such a system unless it has clear understanding of the biology and economics, in short bioeconomics, involved. Finally, rights holders, without a good appreciation of the value of their rights run the risk of mismanaging their rights or mistakenly trading them.

For all these reasons, in order to be able to fully utilize the opportunities offered by commercialization it is crucial for the communities and their members to hold as complete an understanding of the facts of their situation as possible.

Commercialization: A Practical Approach

Commercialization of subsistence fisheries may happen spontaneously and, indeed, usually does. Opening of new trading opportunities, advances in transport techniques, increased population and so on may lead to the gradual shifting of subsistence fishing activities to production for the market, i.e. commercialization. This spontaneous commercialization is probably the most common way by which the world's subsistence fisheries have become and are becoming commercialized. In other cases commercialization of subsistence fisheries does not happen spontaneously but requires a positive action by some authority. There may be a variety of reasons for this. One such case is in South Africa where subsistence fisheries are legally constrained from becoming commercialized.

Irrespective of how commercialization of subsistence fisheries happens, the social problem is essentially the same. The first question is whether commercialization is likely to be socially beneficial. If the answer to that question is negative, the social task is obviously to try and stop the process. If the answer is yes, the social task is to influence the process in the direction of the social good. This clearly involves the attempt to design and implement the optimal process by which commercialization should take place. It seems highly unlikely that there is one best process. The best process probably depends on the particulars of each case.

In what follows we list some broad suggestions as how the South African authorities may approach the problem of commercialization of the country's subsistence fisheries. We formulate these suggestions as steps and give reasons for each. We make no claims that these define the optimal path. To us they simply seem reasonable in the South African social and political context. Although designed for South Africa, these suggestions hopefully also provide useful guidance as to how to influence the commercialization of other subsistence fisheries, even those where commercialization has spontaneously commenced.

Step 1. Formulate the general policy of commercialization.

This is important for two reasons: Firstly to ensure that the process of commercialization is thought out in a coherent way; secondly to provide a forum for different views on the matter. A possible step in this process is the publication of a white paper on the topic.

Step 2. Announce the policy

The basic reason for this is to create awareness amongst the general public and, in particular, subsistence fishing communities about the policy and how it may affect their situation. This implies that the policy should be widely and thoroughly publicized.

Step 3. Invite applications

In the case of South Africa, subsistence fishing communities would apply to be exempted from the trading restrictions. For other countries, where this particular legal constraint doesn't apply, there would be a different type of applications. They could for instance be for assistance in coping with the process of commercialization. In any case, the reason for applications is to identify the communities most interested in commercialization. In the South African situation, a high number of applications may be expected. Few applications, on the other hand, may indicate few perceived benefits of commercialization or lack of community organization, both of which are useful signals to the relevant authorities. Obviously, If interest, as measured by the number of applications, is regarded as inadequate, the authorities have at their disposal various means to encourage interest.

Step 4. Classifying communities in terms of readiness

Using the criteria laid out in section 4, the next step is to arrange the applications into categories in accordance with how ready the various communities are for successful commercialization. This is necessary because the extent and nature of the required centralized action depends on this level of readiness.

i. Communities that are ready for commercialization

These are communities that satisfy the four main criteria in section 4, i.e. they have an effective fisheries management regime with an appropriate distribution of rights, a strong community structure and a good understanding of the fisheries situation and the implications of commercialization. We believe that in the South-African context, few if any subsistence fishing communities would be completely ready for commercialization in this sense, although some may be close to it.

ii. Communities that are promising candidates for commercialization

These are communities that are close to satisfying one or more of the main criteria in section 4 and are well positioned to satisfying the others. We believe that in South Africa, several subsistence fishing communities are promising candidates for commercialization in this sense. A good number of subsistence fishing communities already have a reasonably strong social structure, a well-entrenched system of rights allocation and a fairly well established system of communal and social supports. Some of them even harbour a fair understanding of the fisheries situation. Although the situation varies from community to community, we believe that what these communities generally lack is a more effective fisheries management regime and a better understanding of its economic and social implications as well as those of commercialization.

iii. Communities that are further away from being ready for commercialization

These are communities that are considerable distance from satisfying any of the criteria of section 4. We believe that in South Africa a large part of the subsistence fishing communities would fall into this category.

Step 5. Implementation

Obviously, the implementation of the commercialization policy depends crucially on the readiness of the various communities.

i. Communities that are ready for commercialization

Since these communities, by definition, are already well prepared in terms of the criteria in section 4, they do not require much in way of further preparation or assistance. For these communities the role of the fisheries authority would primarily be to monitor progress with the possibility of intervention in case things start to go wrong. For these communities, we believe that the process of commercialization could be completed within a year.

ii. Communities that are promising candidates for commercialization

For this category of communities the crucial first step is to identify their strengths and weaknesses in terms of the criteria of section 4. The second step is to undertake the appropriate measures to strengthen the areas of weakness to the point where they are sufficiently well developed to make full use of the opportunities of commercialization.

In the South African context, promising candidates for commercialization would often be communities that have a strong social structure with a well-developed system of resource allocation and mutual supports and a reasonable understanding of the economics of fisheries and markets. What these communities would typically lack would be an effective fisheries management regime, although in many cases some rudimentary management would be in place, and a deeper understanding of the problems of fisheries overexploitation and the implications of commercialization. For these communities the process of implementation would vary with their level of preparation but could in most cases be completed within, say, three years.

As discussed in section 4, we believe that a fisheries management regime based on community fishing rights would in most cases be the most appropriate. This implies first of all that the community as a whole must be granted sufficiently high quality fishing rights. Depending on the actual situation, they could be based on a combination of the TURF principle — the community is awarded an exclusive fishing zone — and community fishing quotas — the community as a whole receives quota rights in the appropriate fish stocks. Needless to say, these quota rights should constitute a proportion of the total allowable catch of the species and be secure, exclusive and permanent [31], [32]. Initially, at least, they should not be transferable from the community. Clearly, the granting of these rights is a matter for the government. The rights, however, should not be granted unless the community in question would first assume the communal responsibility for not exceeding the community fishing rights and second establish the appropriate internal fisheries management regime. At the minimum, the fisheries management regime would (i) require the establishment of a community body, preferably composed of vessel-owners fishers only, with the mandate to allocate the communal right to operators and make other fisheries management decisions, and (ii) a convincing system of enforcement of the fisheries management rules. Finally, information in terms of fisheries management, biology, economics, marketing etc. should be provided to the community fisheries management body and the community as a whole. Under these conditions, the experience of other nations [34]-[36] indicates that there is a good chance the community fisheries management would be reasonably efficient and at least with the passage of time evolve toward increased efficiency.

It is worth noting that irrespective of its ability to further good fisheries management within the community, community fishing rights endow the subsistence fishing communities with a substantially greater control over their own economic and social destiny. Thus, community fishing rights constitute a step toward economic empowerment of the subsistence fishing communities and their inhabitants.

iii. Communities that are further away from being ready for commercialization

For these communities adequate preparation for commercialization is considerably more demanding. To meet the criteria of section 4 many of the necessary institutions such as the community organization and the fisheries management regime may have to be built from scratch or near scratch. Since these are fundamentally social institutions that have to be based on, if not social custom, social acceptance and appreciation, this is a very delicate task. In most cases this process would take years. Not much can be said about the appropriate approach *a priori* or the time it would take. The approach selected must be based on the actual conditions in each community. In this, however, the experience of other subsistence fishing communities further along the way or already enjoying the fruits of successful commercialization would be helpful.

It is clear that a good deal of technical and financial resources are needed to adequately prepare South African subsistence fishing communities for commercialization. Obviously, the further away from readiness a community is, the more resources are required. The main expertise needed is in the fields of fisheries biology, fisheries economics, fisheries management, economic management, sociology and political science. This expertise has to a great extent to be provided by the authorities. However, while many of the experts would work for the authorities, it is of considerable importance that some of the necessary expertise be provided directly to the communities themselves to work for the communities and to be answerable to the communities.

In most cases several man years of expert labour would be needed and the calendar time required to adequately prepare each community would be measured in years rather than months. On the other hand, possibly following a pilot project in a few communities, this work could take place in many communities simultaneously. Nevertheless, given the extent of the resources needed, it is clear that this approach requires very considerable financial outlays. Therefore, needless to say, care should be taken to ensure that the expected benefits exceed the costs in each case.

Commercialization of the South African subsistence fisheries requires relatively little legislative action. It is necessary to abolish or dramatically relax the current stipulation in the legislation restricting fish trading by subsistence fishers. The other aspects of the commercialization process recommended in this paper such as the allocation of TURFS and quotas to fishing communities and individual fishers is already provided for in the current law.

Conclusions and extensions

It was shown in the third section of this paper that there are clear economic benefits to commercialization, i.e. more free trade in fish. Presumably, in many cases these benefits are so substantial that, if properly used, they could drastically improve the economic fortunes of subsistence fishing communities. However, as also shown in section 3, these benefits will quickly evaporate unless subsistence fishing activities are controlled by the appropriate fisheries management regime. Without such a regime, subsistence fishing basically finds itself in the common property predicament, and any benefits will be rapidly dissipated by the inflow of new subsistence fishers, or increased fishing activities by existing fishers or both. Thus, an effective fisheries management regime, i.e. fisheries management system and a fisheries enforcement system, is an absolute prerequisite for commercialization of subsistence fishing to be a socially advisable.

Another important consideration concerns the distribution of benefits. Even if commercialization leads to the generation of substantial economic benefits, there is no assurance that they will be shared in the socially desirable way. Subsistence fishing communities are predominantly populated by people with few employment alternatives. Commercialization on the other hand is likely to

radically alter the employment structure of these communities. Thus, in the absence of special measures, it may well be the case that some inhabitants of subsistence fishing communities will actually be harmed by commercialization. In that case, one can no longer be reasonably certain that commercialization is socially beneficial, even if aggregate benefits expand. The distributional problem may, on the other hand, be solved by the judicious allocation of rights, especially fishing rights. It is axiomatic that benefits from fishing primarily befall those with fishing rights [31]. Thus by the appropriate initial allocation of fishing rights the desired distribution of benefits may be achieved.

The paper suggests that community fishing rights composed of a combination of territorial fishing rights and community quotas may constitute the appropriate basic arrangement to ensure the generation of maximum economic benefits on a sustainable basis and the socially appropriate distribution of these benefits. This, however, is not sufficient. To make the best use of the community fishing rights the community must be strong, well organized and well informed about the economics of fisheries, fisheries management as well as the implications of commercialization. It is obviously the obligation of the authorities to ensure that these conditions be met before commercialization is allowed. For many, perhaps most South African subsistence communities, this requires a good deal of effort on behalf of the authorities that is inevitably costly both in terms of manpower and financial resources.

Although, the above conclusions have been derived with a special reference to the South African situation, the key results of the analysis apparently apply to most other subsistence fisheries faced with commercialization. This applies for instance to the quite extensive subsistence fisheries in many other African as well as Asian and Latin American countries many of whom have a very large subsistence fishing sector. The basic facts of the matter are always the same. For commercialization of subsistence fisheries to be socially beneficial, it must be the case that those fisheries be subject to an effective fisheries management system and that the benefits generated be shared in a socially appropriate way. Therefore, irrespective of the legal conditions and the actual process of commercialization, the government in each country has the obligation to try to ensure both of these things. We suspect that in many cases our basic proposal of community fishing rights coupled with a strong and informed community social structure would go a long way toward solving the problem. In that case, the governments' role is to try to bring this about.

References

- [1] Lewis, W. 1988. Good and not-so-good Sea Fisheries Act. *S. Afr. Shipp. News Fishg Ind. Rev.* **43**, pp. 33
- [2] Cochrane, K. L. 1995. Anticipated impacts of recent political changes on fisheries management in South Africa. *Naga* **18**(1), pp. 4–8.
- [3] Hutton, T., Cochrane, K. L. and Pitcher, T. J. 1997. Post-apartheid fisheries management policy in South Africa: the need for a change in management philosophy. In *Developing and Sustaining World Fisheries Resources: the State of Science and Management. Proceedings of the Second World Fisheries Congress, Brisbane, 1996*. Hancock, D. A., Smith, D. R., Grant, A. and J. P. Beumer (Eds). Collingwood, Australia; CSIRO Publishing: pp. 307–314.
- [4] Martin, R. and Nielsen, J. R. 1997. Creation of a new fisheries policy in South Africa: the development process and achievements. In *Fisheries Co-management in Africa. Proceedings from a Regional Workshop on Fisheries Co-management Research, Mangochi, Malawi, March 1997*. Normann, A. K., Nielsen J. R. and S. Sverdrup-Jensen (Eds). Institute

- for Fisheries Management and Coastal Community Development. Fisheries Co-management Research Project. Report No. 12: pp.153–171.
- [5] Anon. 1998. Marine Living Resources Act (Act No. 18 of 1998). *Government Gazette, S. Afr.*, **395**(18930): 66 pp.
- [6] Berkes, F. 1990. Native subsistence fisheries: a synthesis of harvest studies in Canada. *Arctic* **43**, pp. 35–42.
- [7] Fall, J. A. 1990. The division of subsistence of the Alaska Department of Fish and Game: an overview of its research program and findings: 1980–1990. *Arctic Anthropol.* **27**(2), pp. 68–92.
- [8] Cockcroft, A. C., Sauer, W. H. H., Branch, G. M., Clark, B. M., Dye, A. H. and Russell, E. 2002. Assessment of resource availability and suitability for subsistence fishers in South Africa, with a review of resource management procedures. *S. Afr. J. mar. Sci.*, **24**, pp. 489–501.
- [9] Clark, B. M., Hauck, M., Harris, J. M., Salo, K. and Russel, E. 2002. Identification of subsistence fishers, fishing areas, resource use and activities along the South African coast. *S. Afr. J. mar. Sci.*, **24**, pp. 425–437.
- [10] Layard, R. and A. Walters. 1978. *Microeconomic Theory*. McGraw-Hill. New York
- [11] Varian, H. 1984. *Microeconomic Analysis*, (2. ed.). W.W. Norton and Company. New York.
- [12] Gordon, H.S. 1954. The Economic Theory of a Common Property Resource: The Fishery. *Journal of Political Economy* **62**, pp. 124-42.
- [13] Clark, C.W. 1990. Mathematical Bioeconomics: *The Optimal Management of Renewable Resources*. 2nd edition. Wiley and Sons. New York
- [14] Branch, G. M., Hauck, M., Siqwana-Ndulo, N. and Dye, A. H. 2002. Defining fishers in the South African context: subsistence, artisanal and small-scale commercial sectors. *S. Afr. J. mar. Sci.* **24**, pp. 475-487.
- [15] Branch, G. M., May, J., Roberts, E. and Clark, B. M. 2002. Case studies on the socio-economic characteristics and lifestyles of subsistence and informal fishers in South Africa. *S. Afr. J. mar. Sci.*, **24**, pp. 439-462.
- [16] Hanna, S. 1999. Foreword. S. Iudicello, M. Weber and R. Wieland. *Fish, Markets and Fishermen: The Economics of Overfishing*. Washington, D.C.: Island Press and Center for Marine Conservation.
- [17] Hanna, S. and M. Hall-Arber, eds. 2000. *Change and Resilience in Fishing*. Oregon Sea Grant, Oregon State University.
- [18] Hanna, S. 2000. Change and Resilience in New England and Pacific Groundfish Fisheries. Chapter 1 in S. Hanna and M. Hall-Arber, eds. *Resilience and Change in Fisheries: Experiences from New England and the Pacific*, Oregon Sea Grant, Oregon State University.
- [19] Hanna, S. 2002. Transition in the American Fishing Commons: Management Problems and Institutional Design Challenges. Chapter 5 in N. Dolšak And E. Ostrom. eds. *The Commons In The New Millennium: Challenges And Adaptation*. Cambridge: MIT Press, in press.
- [20] Hauck, M., Sowman, M., Russel, E., Clark, B. M., Harris, J. M., Venter, A., Beaumont, J. and Maseko, Z. 2002. Perceptions of subsistence and informal fishers in South Africa regarding the management of living marine resources. *S. Afr. J. mar. Sci.*, **24**, pp. 463-474.
- [21] Ostrom, E. and Schlager, E. 1993. Property-Rights Regimes and Coastal Fisheries: An Empirical Analysis. In Terry L. Anderson and Randy T. Simmons, eds. *The Political Economy of Customs and Culture: Informal Solutions to the Commons Problem*. Lanham, Md.: Rowman & Littlefield Publishers, pp.13-41.
- [22] Ostrom, E. 1995. Self-Organization and Social Capital. *Industrial and Corporate Change*, **4**(1), pp. 131-59.

- [23] Ostrom, E. and Schlager, E. 1996. The Formation of Property Rights. In Susan Hanna, Carl Folke, and Karl-Gorn Mler, eds. *Rights to Nature: Ecological, Economic, Cultural, and Political Principles of Institutions for the Environment*. Washington, D.C.: Island Press, pp. 127-56.
- [24] Ostrom, E. and Ahn, T. K. 2001. A Social Science Perspective on Social Capital: Ostrom, E. and Walker, J. 1997. Neither Markets Nor States: Linking Transformation Processes in Collective Action Arenas. In Dennis C. Mueller, ed. *Perspectives on Public Choice: A Handbook*. Cambridge: Cambridge University Press, pp. 35-72.
- [25] Tvedten, I. 1990. The difficult transition from subsistence to commercial fishing: the case of Bijagos of Guinea Bissau. *Maritime Anthropological Studies* 3(1), pp. 119-130.
- [26] SFTG 2000. 2000. *Recommendations for Subsistence Fisheries Management in South Africa*. Subsistence Fisheries Task Group Final Report. Unpublished Report, Department of Environmental Affairs and Tourism: Marine and Coastal management. Cape Town, South Africa: pp. 88.
- [27] Kindleberger, C.P. 1965. *Economic Development*. McGraw-Hill.
- [28] Social Capital and Collective Action. Report prepared for the Bundestag - Enquete Commission. Presented at the EURESCO conference on Social Capital: Interdisciplinary Perspectives, Exeter, UK, September 15-20, 2001.
- [29] Hardin, G. 1968. The Tragedy of the Commons. *Science* 162, pp. 1243-47.
- [30] Arnason, R. 1994. Theoretical and Practical Fisheries Management. In E. Loayza (ed) Managing Fishery Resources, World Bank Discussion Papers 217, pp. 3-10.
- [31] Arnason, R. 1990. Minimum Information Management in Fisheries. *Canadian Journal of Economics* XXIII, 3, pp. 630-53.
- [32] Arnason, R. 2000. Property Rights as a Means of Economic Organization. In R. Shotton (ed.) Use of Property Rights in Fisheries Management. *FAO Fisheries Technical Paper* 401/1. Food and Agriculture Organization of the United Nations. Rome.
- [33] Arnason, R. 2003. Community and Cooperative Fisheries Management: Possible Applications to Mediterranean Fisheries. In M. Spagnolo (ed.) *Conference on Fisheries Management and Multi-level Decision Systems: The Mediterranean Case*. IREPA. Salerno. 2003.
- [34] Hatcher, A and A. Read. 2001. Fishing Rights and Structural Changes in the UK. Fishing Industry. In R. Shotton (ed) *Case Studies on the Effects of Transferable Fishing Rights on Fleet capacity and Concentration of Quota Ownership*. FAO Fisheries Technical Paper 412. Food and Agriculture Organization of the United Nations, Rome.
- [35] Hatcher, A and A. Read. 2001. The Allocation of Fishing Rights in UK Fisheries. In R. Shotton (ed) *Case Studies on the Allocation of Transferable Quota Rights in Fisheries*. FAO Fisheries Technical Paper 411. Food and Agriculture Organization of the United Nations, Rome.
- [36] Valatin, G. 2000. Development of Property Rights-based Management in the United Kingdom and the Netherlands: a Comparison. In R. Shotton (ed) *Use of Property Rights in Fisheries Management*. FAO Fisheries Technical Paper 404/2. Food and Agriculture Organization of the United Nations, Rome.