Trade liberalisation and resource sustainability

Max Nielsen, Danish Research Institute of Food Economics[1], max@foi.dk.

Abstract: Traditional economic theory states that liberalising trade and moving to freer trade in conventional goods improves global welfare, as well as improving welfare in small countries. It also states that large countries only through the active use of their trade policies can maximise their welfare. However, these results are modified when trade in a renewable resource-based good without optimal management is liberalised, as overexploitation may follow. Welfare implications then depend on the size of the country on the world market, on the management system in place as well as on the use of it, on the countries status as importers or exporters, on the state of the fish stock, and on the type of fisheries. Based on this understanding as well as on the Brander and Taylor two-country, two-good model, this paper establishes a framework for discussing welfare implications of trade liberalisation in renewable resource-based goods such as fish. It is found that the welfare implication depends on the factors in a complicated context, which demands detailed knowledge of each market and each fishery. Therefore, a case study of European cod trade is provided and it is found that trade liberalisation, given the assumptions, would cause a long run welfare gain in a resource rich country with effective management, such as Iceland. The reason is that the price rise implying that consumption of the manufacturing good increases. In a resource rich country with conservative management, such as Russia, there would, given the assumptions, be no resource-caused welfare effect. This resource-caused effect is also absent in Norway, but is probably met by a negative effect through the disappearance of value added activities based on Russian imports. The long run welfare implication of liberalisation for a large importer with market power, like the EU, depends on whether the terms-of-trade welfare effect (probably negative) is offset by the resource-caused welfare effect (positive given the assumptions) and the localisation welfare effect (probably positive).

Keywords: Trade liberalisation, resource sustainability, fisheries management, Brander and Taylor Model, European cod trade

1. INTRODUCTION

Traditionally, liberalisation of international fish trade is analysed on the basis of the Ricardian theoretical tradition applied to international economics. Within this tradition, fish is regarded as a conventional good and the presence of international trade is explained by international division of labour and specialisation resulting from differences in technology. The Ricardian theoretical tradition was followed by the Neo-classical tradition, mainly the Heckscher-Ohlin theory, which states that the presence of international trade results from differences in factor endowments. The consequence is that a globally social optimum can only be reached in the case of free trade. Small countries, which are price takers on the world market, also face a situation where the social optimum can only be reached in the case of free trade, where large countries can affect their terms-of-trade and thereby reach a social optimum only in the presence of trade policies, provided that there is no retaliation from other countries.

The Neoclassical theoretical tradition applied to international economics is developed on the basis of a traditional understanding of trade as inter-industrial, in which the exchange of excess goods occurs between different industries. Today, according to the European Commission (1999) and discussed by the Danish Economic Council (2001), however, the majority of all trade is intra-industrial, in which trade with relatively similar goods occurs due to increasing returns to scale and product differentiation. The presence of this situation form challenges in the analysis of trade liberalisation, as the Hechcher-Ohlin model, which predicts trade based on differences in resources, are therefore not adequate. However, trade in fish products is a classical example of the inter-industrial type, as countries are very differently endowed with fish resources. Thereby, the traditional theory is suitable as a framework for analysis.

Implicitly understanding trade as inter-industrial, Bhagwati (1958) finds that economic growth can cause reduced welfare under certain conditions. One recent example, suitable for the present issue, relates to renewable resources, where continued growth and rising incomes globally tend to increase purchasing power, causing pressure on the renewable resources. This phenomenon, which is referred to as immiserizing growth, is related to international economics in that "economic expansion increases output which, however, might lead to a sufficient deterioration in the terms-of-trade to offset the beneficial effect of expansion and reduce the real income of the growing economy".

The concept of immiserizing growth also forms a basis for recent research, wherein international economics and environmental and resource economics are linked by analysing international trade with an unmanaged renewable resource. Goods produced on the basis of natural renewable resources such as fish stocks are not regarded as conventional goods, but as goods with production externalities. This implies that the fishery of the single fisherman affects the catch potential of the other fishermen and, therefore, the consequence of an open-access fishery is over-fishing. Thereby, the social optimal situation can only be reached in the presence of fisheries management

Brander and Taylor show in three seminal papers that advantages with free trade with limited renewable resources, that are not managed optimally, exist only under certain conditions and for certain types of countries. Brander and Taylor (1997a)

[1] Part of this paper was prepared during a stay at the OECD Fisheries Division in Paris during the winter 2001-2002.

find that a small open economy with export in an open-access renewable resource-based good will lose from increased trade caused by liberalisation. Brander and Taylor (1998) find that the imposition of tariffs by an importer country on imports of an open-access renewable resource-based good will always benefit the resource exporter and may be Pareto-improving. Brander and Taylor (1997b) find in a two-country model of trade between a consumer country with an open-access renewable resource and a conservationist country with a well-managed renewable resource, that trade liberalisation will cause net-export of the consumer country to rise in the short run and welfare to fall in the mild-overuse case in the long run. In the severe overuse case, however, both countries will experience gains from trade liberalisation.

Emami and Johnston (2000) show in a two-country, two-good model that import tariffs on a renewable natural resource with incomplete property rights might reduce welfare losses caused by weak resource management in one of the two countries. Moreover, it is concluded that e.g. the World Trade Organisation "should not always insist on free trade, rather they must pay careful attention to the particular relationships between trade conditions and natural resource policies among trading nations".

Within fisheries, Copes (1970) introduces the backward-bending supply curve of the fishing industry and Schulz (1996) uses it to study the partial effects of trade sanctions on marine products. Within the same framework, Hannesson (2001) gives special emphasis to the role of fisheries management systems when studying the implications of relaxing trade barriers. Three types of management regimes are discussed; open-access, catch-control and effective management. The implications of relaxing trade barriers differ in the three regimes. In a catch-control managed resource, there will be no effect on supply. Under effective management, supply and prices will rise in exporter countries and fall in importer countries. In an over-exploited open-access resource, prices will fall and steady state supply will rise in importer countries, whereas in exporter countries prices will rise and steady state supply will fall.

The above conclusions are obtained for countries fishing only one species, solely owned by that country, and without taking multi-species relations into account. Along that line, Schulz (1997) analysed the implications of trade sanctions in a multi-species context, emphasising the role of environmental relations between marine species.

The purpose of this paper is **"to outline a method for analysing long run welfare implications of liberalising trade in renewable resource-based goods such as fish products and to use this method in a case study"**. Based on the Brander and Taylor (1997b) two-country model, it is analysed under which circumstances trade liberalisation implies welfare gains, losses and unchanged welfare. The European cod market with large consumption within the EU and with main supplies from both within the EU and also from Norway, Iceland and Russia, is chosen as the case study.

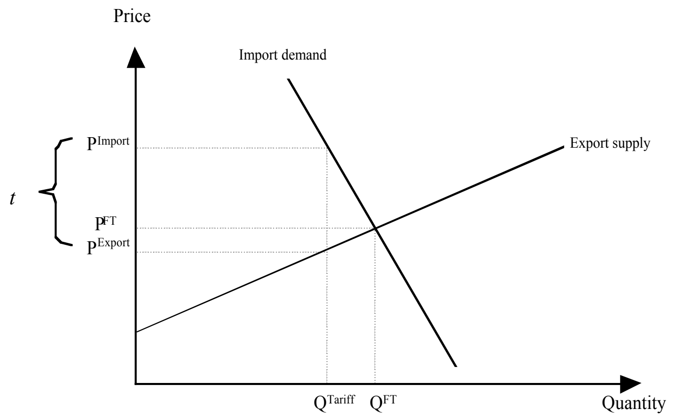
The relevance of the issue is in that the fisheries sector, according to WTO (2001), has become an issue in international trade negotiations after the Doha Ministerial Meeting in November 2001. Moreover, most countries worldwide use trade policies in fisheries and as these policies indirectly are resource taxes in exporter countries and subsidies in importer countries, trade policies indirectly serve as fisheries management instruments. Liberalising trade will therefore affect the fisheries. Furthermore, since FAO (2001) also assess that globally several fish stocks are either fully exploited or overexploited, integrated analysis of trade liberalisation and resource sustainability becomes important.

2. MODELING FISH TRADE LIBERALISATION

Trade policies applied on fish trade include several measures including tariff measures, non-tariff measures, subsidies, sanitary and hygiene requirements, technical import requirements, access to ports, restrictions on foreign investment and on fishing services. Trade policies are applied in a way that hinders the free movement of goods and factor input and thereby form a barrier to free trade. Trade liberalisation is the reduction of these barriers. In this paper the analysis of trade liberalisation is limited to reductions in tariff measures, although the modelling framework developed applies as well to the analysis of reductions in other trade measures that open up or increase trade between two or more countries.

The implications of trade liberalisation is analysed in two steps. Firstly, by performing a simple trade policy analysis of the effects on prices of liberalising trade. Secondly, by outlining a two-country model of trade in a renewable resource-based good and using it to study the welfare effect of the price changes found in the trade policy analysis. According to traditional Neo-classical theory of international economics, see e.g. Krugman and Obstfeld (2000), liberalising trade between two countries can be analysed on a "world" market where some countries sell excess supply and others buy excess demand. This is illustrated in Figure 1.

FIGURE 1: **Implications of removing a tariff.**



From the Figure the implication of removing a tariff t is apparent. In the presence of a tariff a wedge exists between export and import prices at a quantity of Q^{tariff}. Removing a tariff, then, removes this wedge and drives prices against each other to the "world" market-clearing price in free trade at P^{FT}, which is reached at a higher quantity at Q^{FT}. Thereby, the implications of removing a tariff are rising export prices and falling import prices. Based on the knowledge that trade liberalisation implies increased prices in exporter countries and decreased prices in importer countries, the long run implication for supply can be analysed in a two-country model of trade in a renewable resource-based good.

Brander and Taylor (1997b) introduce a model of trade between two countries in two goods. One good is produced on the basis of a renewable resource and the other is a numeraire good, accounting aggregately for all other productions in the economy. Both countries are diversified producers (produce both goods) and have the ability to affect prices on the "world" market. It is assumed that only two factors are used in the production process, labour and the natural resource. Due to this set-up, the implication of trade liberalisation is analysed in a General Equilibrium model, which covers the whole economy. The reason for a choice of a General Equilibrium model is that labour must necessarily be included in the model, as it is then possible to analyse the effect that too much labour might be tied up in harvesting. Capital is not directly included in the model, but can indirectly be analysed as a part of labour, as too much of both capital and labour can be tied up in harvesting. In the General Equilibrium model it is thereby possible to explore the interactions between the different sectors and agents in the economy. The relative supply function of each of the countries can then be deduced.

The production of the good based on the renewable resource is deduced from a classical Schaefer model (see Clark (1990)), although it might also be formulated on the basis of the Beverton-Holt stock recruitment model with year classes, which makes it possible in practical works to distinguish between small and large individuals of fish. This is important provided that perfect selectivity, due to gear restrictions, exists at large mesh size limitation, as the concept of maximum sustainable yield (MSY) is then inappropriate. The reason is that the yield curve will then be monotonously increasing and concave. The Beverton-Holt model is assessed superior to the Schaefer model empirically in fisheries where perfect selectivity exists at large mesh size limitations. However, even though mesh size limitations are widely used in practice, they might not necessarily be sufficiently large to hinder the option of biological overfishing. Thereby, as both models in several fisheries amount to the same yield-effort analysis with MSY present and as the Schaefer model is the simplest, the Schaefer model is used in the further analysis of this paper.

Following Brander and Taylor (1997b) all through to the deduction of the relative backward-bending supply function, the stock growth function is given by

$$\frac{dS}{dt} = G[S(t)] - H(t) \qquad (1)$$

Where S denotes the stock, t is time, G is the absolute natural stock growth and H is the harvest. From (1) it appears that the stock growth over time is the difference between the natural growth and the harvest. The natural stock growth in (1) is specified as

$$G(S) = rS\left(1 - \frac{S}{S_K}\right) \qquad (2)$$

Where r is the intrinsic growth rate of the stock and S_K is the carrying capacity of the stock. The harvesting function in (1) is specified as

$$H = \alpha S L_H \quad (3)$$

Where L_H is labour used for harvesting and α is the productivity of this labour. It appears that the harvest depends on the stock level, the labour input used on harvesting and on the productivity of this labour. Rearranging (3) the labour input per unit harvest is

$$a_{LH}(S) = \frac{L_H}{H} = \frac{1}{\alpha S} \quad (4)$$

Where a_{LH} denotes labour input per unit. The production function of the conventional numeraire good is given by

$$M = L_M \quad (5)$$

Where M is the production of the numeraire (M for manufacturing) and L_M is the labour used for the production of this good. It appears that the production function is of the Leontief type with only one factor, and thereby is without substitution possibilities and has a coefficient of one. This implies that constant returns to scale in the production of the manufacturing good is implicitly assumed. The analysis of decreasing returns to scale is e.g. undertaken in Hannesson (2000). The price of labour (wage) is normalised to one and it is assumed that the only factor used in the production of the manufacturing good is labour. The labour used for manufacturing is all the labour not used for harvesting.

The steady state equilibrium is when net growth equals zero, that is, when natural stock growth equals harvest in eq. 1. Substituting this into eq. 2 gives the steady state equilibrium in the market for the renewable resource-based good, which is

$$H = rS\left(1 - \frac{S}{S_K}\right) \quad (6)$$

The equilibrium in the market for manufacturing is obtained from the knowledge that all labour not used for harvesting is used for the production of the manufacturing good, and using (5) and (6) the equilibrium can be shown to be

$$M = L - \frac{r}{\alpha}\left(1 - \frac{S}{S_K}\right) \quad (7)$$

Where L is the total labour used for both harvesting and production of the manufacturing good. The supply function of harvest in relation to production of the manufacturing good can be deduced by dividing (6) with (7). The supply function of harvest in relation to manufacturing is

$$\frac{H}{M} = \frac{rS\left(1 - \frac{S}{S_K}\right)}{L - \frac{r}{\alpha}\left(1 - \frac{S}{S_K}\right)} \quad (8)$$

It appears that the relative supply is a function of the stock, but not of the relative price, which therefore must be introduced. Provided that there is also open-access, the resource rent is zero and the price of the harvest equals the unit cost. Using (4) the relative price is given by

$$P = w a_{LH} = \frac{w}{\alpha S} \quad (9)$$

Where P denotes the price of the harvest in relation to the price of the manufacturing good and w is the wage rate. Further assuming that labour is perfectly mobile between the two production sectors, the wages are equal in the sectors and knowing from (5) that $w=1$, (9) can be rewritten as

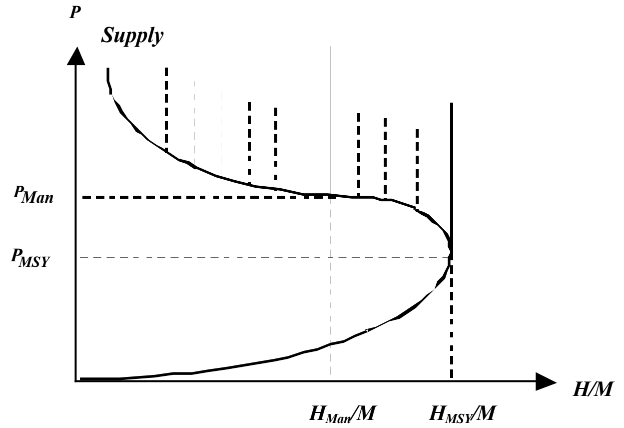
$$P = \frac{1}{\alpha S} \quad (10)$$

Isolating S in (10) and substituting this into (8), the relative supply function is for a country with an open-access renewable resource

$$\frac{H}{M} = \frac{\frac{r}{\alpha P}\left(1 - \frac{1}{\alpha P S_K}\right)}{L - \frac{r}{\alpha}\left(1 - \frac{S}{\alpha P S_K}\right)} \qquad (11)$$

It appears that the supply of the harvesting good in relation to the manufacturing good is explained by the relative price of the two goods. The first order derivative can, and is in Brander and Taylor (1997b), be found by differentiating (11) with respect to the relative price. By performing an examination of the function in (11) it can be shown that it is increasing with respect to the relative price until the MSY is reached in (H_{MSY}/M, P_{MSY}), and decreasing thereafter. The properties of the relative supply function are shown in Figure 2.

FIGURE 2: **The relative supply curve.**



From the Figure it appears that the relative supply curve is backward-bending. The logic behind this form is that prices increase with fishing effort and harvesting until MSY, as producers are willing to supply more, the higher the price is. After MSY, prices will continue to rise, as it is impossible to increase steady state harvesting due to resource scarcity. Fishing effort will also continue to rise.

Given the assumptions, following from the deduction of the supply function in (11), the relative supply curve can now be used to discuss the effects of price changes following trade liberalisation, e.g. in the good produced on the basis of the renewable resource. As shown in the trade policy analysis, the implication of trade liberalisation is increased prices in exporter countries and decreased prices in importer countries. In countries exporting the harvesting good, the effect of the increased relative price is that fishing effort and harvest increase, according to Figure 2, if the initial and terminal harvest is below MSY. If initial harvest is above MSY, fishing effort rise, but steady state harvest fall due to overfishing. In countries importing the harvesting good, the effect of the decreased relative price is that fishing effort and harvest fall, if the initial harvest is below MSY. If initial and terminal harvest is above the MSY, fishing effort will fall, but steady state harvest rises.

Based on the effect of trade liberalisation on relative prices and steady state harvest, welfare implications can be assessed using the relative supply function. It can, according to Clark (1990), be shown that the welfare is maximised at the maximum economic yield (MEY), which in a partial equilibrium set-up is lower than MSY. The reason is that costs of fishing (labour costs in the present simple model) are included. This also applies in a general equilibrium set-up, as too many resources are otherwise used on harvesting than on manufacturing. Therefore, welfare is increasing along the supply curve in Figure 2 until MEY is reached, and then decreases thereafter. Welfare above MSY decreases along the supply curve with increased use of labour.

However, these results are conditional on that the countries are small and thereby have no power on the world market. That is, that they cannot affect their terms-of-trade through changing tariffs. If countries alternatively are large and they can affect their terms-of-trade through changing tariffs, the results are modified, as the effects of trade liberalisation now also depend on the initial level of tariffs. In that context, Krugman and Obstfeld (2000) describe the concept of "optimal tariffs" and shows that positive optimal tariffs always exist for conventional goods in large countries, assuming the absence of retaliation. This amounts to a situation of the presence of a single supplier, a monopolist, on a single market. The monopolist have then the ability to control the price by supplying on a level which maximise his profit, a level of supply which can be shown to be lower than the welfare maximising level of supply of the whole economy. The same situation is present on the world market, where the large country (≈ the monopolist) has the ability to maximise own welfare by affecting the terms-of-trade P_{export}/P_{Import} through changing trade policies (as the monopolist maximise profit by changing its supply). Again, it can be shown that the optimal behaviour of the large country is not the optimal behaviour in a global context (as the optimal behaviour of the monopolist were not the optimal behaviour for the whole economy).

The welfare implications of trade liberalisation now depend on whether the initial tariff is above or below the optimal tariff. For goods produced on the basis of renewable resources, an optimal tariff might take into account both market power and the countries use of their renewable resources. However, for simplicity the concept of optimal tariffs are used only in relation to countries power on the world market in this paper. Stocks are analysed separately. Therefore, the concept of "optimal terms-of-trade tariff" is used throughout this paper based on the above understanding. Using the relative supply function in (11) for an open-access renewable resource, and integrating the welfare analysis of this with welfare analysis of both small and large countries, total welfare implications of trade liberalisation can be ascertained (see Table 1).

TABLE 1: **Welfare implications of trade liberalisation – open-access**

Initial situation:	I	II	III	IV
Harvest	> MSY	> MSY	< MSY	< MSY
Terms-of-trade tariff	> Optimal	< Optimal	> Optimal	< Optimal
Welfare implication:				
Small importer	+	+	-	-
Small exporter	-	-	+	+
Large importer	+	+/-	+/-	-
Large exporter	+/-	-	+	+/-

The Table shows the combinations of initial harvest levels, initial terms-of trade tariffs, country size on the market, their status as importer or exporter, and the welfare gains and losses following trade liberalisation. One important conclusion arising is that free trade in an open-access renewable resource-based good is not necessarily the optimal situation. The welfare implication is case dependent. Several factors might affect the welfare implications for single countries of trade liberalisation in an open-access renewable resource-based good:

1. Country as im-/exporter of the harvesting good.
2. The country size on the world market.
3. The state of the fish stocks.
4. The management system and the use of it.
5. The type of fishery.

The welfare implications of trade liberalisation in 1-3 are as described above. However, the above analysis is only performed for an open-access renewable resource. The welfare implications might be different for managed resources. Moreover, the above analysis is performed only for a situation with separate stocks in each country. Aspects such as shared stocks and multi-species fisheries are then ignored. The presence of management affects the welfare analysis, as the purpose of management is to limit the possibility of increases in fishing effort and harvest in the short run and thereby limiting the risk of reductions in steady state harvest and welfare. In other words, the purpose of management is to prevent overfishing and stock collapse.

In the presence of management the relative supply function in (11) needs modification, as management is introduced with the purpose to limit the risk of overexploitation and extinction of the renewable resource. The management systems introduced might be optimally used in two senses, either by maximising the steady state harvest or by maximising the resource rent. Optimal management, which aims at maximising the steady state harvest, might be referred to as biological optimal management, as it corresponds to MSY. Optimal management, which aims at maximising the resource rent, might be referred to as the economic optimal management. The steady state harvest will always be higher under biological than economic optimal management, as biological optimal management, according to Clark (1990), will introduce economic inefficiency. Moreover, the management systems might also be used in a way that remove some, but not all, of the possible negative implications of open-access. The relative supply function of a managed renewable resource is given by (11) if $P<P_{Man}$, and by $H/M=H_{man}/M$ if $P\geq P_{Man}$, where H_{Man} and P_{Man} denote the harvest and the relative price in the presence of a management system aiming at maintaining constant steady state harvest, e.g. a Total Allowable Catch (TAC) system. The relative supply curve of a good produced on the basis of a managed stock is as depicted in Figure 2. For $P<P_{Man}$ the form of the relative supply curve is identical to the supply curve of open-access. For $P\geq P_{Man}$ the form of the supply curve depends on the management system in place. In the presence of biological optimal management, the relative supply curve is vertical (infinitive) and given by $H_{Man}=H_{MSY}$. In the presence of economic optimal management, the relative supply curve is also vertical and given by $H_{MEY}=H_{Man}<H_{MSY}$ at $P_{MEY}<P_{MSY}$, where H_{MEY} and P_{MEY} are harvest and price at MEY (where the resource rent is maximised). In the presence of other management regimes, the relative supply curve will still be vertical but at $H_{Man}<H_{MSY}$.

The rationale behind the forms of the relative supply function under biological optimal management is that overexploitation cannot continue in the long run, as the management system is then not optimal. Exploitation can only increase until MSY. The rationale behind the forms of the relative supply function under economic optimal management is similar to the biological optimal case. However, the addition is that costs are minimised under economic optimal management, implying that the quota under economic optimal management is less than the quota under biological optimal management. The form of the relative supply function under economic optimal management rests, however, on the assumption that the discount rate is zero, thereby ignoring the dynamic nature of the issue. Provided that the discount rate alternatively is positive, the discounted relative supply function will, according to Clark (1990), be backward bending. Thereby, the implications of trade liberalisation even under economic optimal management will be similar to the implications under open-access. In practice, however, even though a positive discount rate is presumed to exist it is not assessed to be large and, therefore, a zero discount rate is assumed throughout this paper. The rationale behind the relative supply function under other management systems is that the systems are introduced to remove some of the negative implications of open-access, but is not introduced effectively. The consequence is that the quota is less than MSY, as depicted in Figure 2.

Using the relative supply function in (11) modified for a managed renewable resource, and integrating the welfare analysis of this with welfare analysis of large countries, total welfare implications of trade liberalisation is ascertained in Table 2.

TABLE 2: **Welfare implications of trade liberalisation - management**

Initial situation:	A	B	C	D
Change in tariffs	Small	Small	Large	Large
Terms-of-trade tariff	> Optimal	< Optimal	> Optimal	< Optimal
Welfare implication:				
Small importer	0	0	+	+
Small exporter	0	0	0	0
Large importer	+	-	+	+/-
Large exporter	+	-	+	-

The Table shows the combinations of how much tariffs change, of initial terms-of trade tariffs, country size on the market, their status as importer or exporter, and the welfare gains and losses following trade liberalisation. A small change in a tariff implies that both the initial and terminal price is above P_{Man} for importer countries thereby leaving exploitation unchanged. It appears again that the welfare implication is case dependent, but also that the welfare implications in managed resources are quite different from open-access resources. In the presence of management, the welfare implications of liberalising trade will depend critically on how the manager uses the management system in response to the price changes caused by liberalisation. Several responses might appear:

1. Optimal response.
2. Conservative response.
3. Response affected by pressure groups.

The welfare implications of trade liberalisation in a managed renewable resource-based good can now be analysed assuming that countries are either small or large, and initially using a tariff at or above the optimal terms-of-trade tariff. The implications depend on managers' response to the price changes caused by liberalisation. If managers' response is optimal, the welfare implications should be analysed using the relative supply function for optimal management and the implications are as for a conventional good. This is the case both if the optimal response is based on biological and economic optimality, as the welfare implications of trade liberalisation are similar, provided that initial harvest is not between MSY and MEY. Provided that the initial harvest is between MSY and MEY, the welfare implications of trade liberalisation are contrary in the two optimal responses. In the further analysis, distinction is not made between the two, in order to maintain simplicity. The implications of trade liberalisation in exporter countries are that fishing effort, steady state harvest and welfare rise, and in importer countries that fishing effort, steady state harvest and welfare fall.

If managers' response is conservative, harvest and welfare will remain unchanged, assuming that prices remain above P_{Man}. However, if prices fall below P_{Man}, welfare implications will be as under open-access. If managers' response is affected by pressure groups, the welfare implication of trade liberalisation can be positive and negative, depending on the relative power of the players. Normally, in fisheries, which are managed but not effectively managed, the situation is that property rights are not distributed among the fishermen. As the fishermen currently active have an interest in maximising their individual harvest (or profit), they will have the incentive to lobby for a large quota today. Otherwise, their followers will gain in the future at their expense. Against them stands the interest of society, which might have the interest to reduce short run harvest in order to maximise steady state harvest, and thereby welfare. The level at which the quota is set will now depend on who is the strongest. Fishermen Associations will lobby for an open-access situation and the government will work for optimal management. This phenomenon might be described using the rent-seeking theory intertemporally, see e.g. Mueller (1989).

The type of fishery is also important for the welfare analysis as the above conclusions are reached only for fishing fleets fishing on one species solely owned by the single country. Therefore, aspects such as shared stocks, multi-species fisheries and environmental multi-species relations are ignored. In the case of shared stocks relaxing trade barriers can either undermine the potential of or assist agreements. In the case of multi-species fisheries, the welfare implication of relaxing trade barriers depends on whether vessels have freedom to switch from one species to another. In the case of multi-species environmental relations, Schulz (1997) analyses the implications of trade sanctions in the presence of predator-prey relations and "competing for feet" relations. It is found that the relations between the species as well as the management system in place, and the economic importance of each species, in a complex way are decisive for the implication of trade sanctions and thereby also of trade liberalisation. This follows from that the harvest of one species affects the stock and harvest of others. Schulz (1997) considers several situations, one being a predator-prey relationship between two open-access species both harvested above MSY and being of economic importance for a country exporting products produced on the basis of both species. In this situation, trade liberalisation in the good produced on the basis of the predator species implies that the price of the predator good rises and that the steady state harvest, as well as the predator stock, will fall. Thereby, either the prey stock or the prey steady state harvest rises. Whether a total gain or loss results depends on which effect dominates.

3. A CASE STUDY ON EUROPEAN COD TRADE

In Section 2 a method for assessing welfare implications of trade liberalisation was developed. In this Section the method is used to perform a case study on European cod trade. It is stressed that the main purpose of the case study is to show how a general applicable method can be used in a specific case. Therefore, although it is aimed that all assessments are as close to reality as possible, the case study is subject to uncertainties and subjective assessments.

Production and trade

Cod is principally found in the North Atlantic and North Pacific Ocean. Several species of cod exist, however only the *Gadus Morhua* species in the North Atlantic and the *Gadus Macrocephalus* species in the North Pacific are of commercial importance today. The *Gadus Morhua* species is present both in the Northeast and Northwest Atlantic, although, after the collapse of the cod fishery in the Northwest, the cod species is now almost extinct in that area. Moreover, although significant quantities of cod are caught in the North Pacific, this species is only exported to Europe in limited quantities. Therefore, the only cod species considered in this paper is *Gadus Morhua* caught in the Northeast Atlantic. Cod is traded in various different forms, the main ones being fresh, frozen, salted/dried and fillets. Cod is also traded in further processed forms in smaller quantities. Cod catches as well as trade in unprocessed cod (fresh, frozen, salted and dried) is shown in Table 3.

TABLE 3: **Cod catches and unprocessed cod trade, annual ave. 96-98.**

Sea	Country	Catches /tonnes	Trade flows /Million €		
			Export	Import	Net
Barents	Norway	352,000	668	196	472
Barents	Russia	288,000	277	1	276
North	EU (extra)	128,000	18	710	-692
Iceland	Iceland	208,000	195	25	170
NE-Atlantic	Other	179,000			
Total	All	1,155,000			

Sources: EUROSTAT Comext Database and FAO Fisheries Statistics.

From the Table it appears that the total catch of cod in the Northeast Atlantic Ocean is 1,155,000 tonnes annually. Of this 640,000 tonnes originated from the Barents Sea, fished mainly by Norwegian and Russian vessels, 208,000 tonnes originated from the waters surrounding Iceland and solely fished by Icelandic vessels, and 128,000 tonnes originated from catches of EU vessels in the North Sea. Thereby, the four largest European producers of cod are Norway, Russia, EU and Iceland. The largest supply sources are the Barents Sea, the waters surrounding Iceland and the North Sea.

It also appears from the Table that Norway, Russia and Iceland are net-exporters of unprocessed cod and that the EU is a large net-importer. Besides this the EU is also a large producer of cod for own consumption. That is, trade flows from Norway, Iceland and Russia to mainly the EU, although the Russian export is through landings in Norwegian ports. Although the EU is the main market for the three countries, they also export to outside Europe, with China being an importer of frozen cod and Brazil importing dried cod. Thereby, the EU is identified as a large consumer country of unprocessed cod with both own production and imports, as well as having market power on the world market. Norway, Iceland and Russia are producers and exporters with Norway being the largest and presumably the only one possessing market power on the world market. This picture of trade flows remains when looking at trade in cod fillets and processed cod, of which the EU imported for € 385 million annually in the years 1996-98. Of this Norway, Iceland and Russia contributed with for € 170, 102 and 21 million, respectively.

Trade policies

Trade policies include several measures. However, as only import tariff measures are examined here, only the import tariff schedules in importer countries as Norway and the EU are described. Norway does not apply tariffs on any cod products (all rates are zero). The EU uses a system where the tariff rates are fixed at the WTO-bound level. However, the Commission also lowers the rates on an autonomous basis by suspension, by using tariff quotas and by giving preferential rates to specified groups of countries. For cod products, all these measures are used with the preferential access given to the European Economic Area (EEA) of particular importance, since it includes Norway and Iceland as the two largest exporters of cod products to the EU. The EU tariff schedule is shown in Table 4.

TABLE 4: **The EU tariff schedule for cod products.**

Product	Tariff rates /%			Quota /tonnes	Import /Million €	
	MFN	SUSP	EEA PREF		Total	EEA
Fresh/Frozen	12.0	3.0	0.0	-	192	61
Klippfish	13.0	-	3.9	25,000	116	109
Dried/salted	13.0	-	0.0	25,000	373	306
Fresh fillets	18.0	-	0.0	-	14	12
Frozen fillets	7.5	-	2.2	-	386	282
Cod meat	7.5	-	2.2	-	13	9
Prepared cod	20.0	-	6.0	-	1	1
Total	-	-	-	-	1,095	780

Source: EUROSTAT Comext Database and EU TARIC Database.

From the Table it appears that the Most Favoured Nation (MFN) rates are relatively high, but the actually applied rates in most cases are lower. An autonomous suspended rate of 3% is used for fresh and frozen products, a tariff quota with an in-quota rate of zero is used for klippfish, salted or dried products, and preferential rates for imports from the EEA exists for all cod products. Based on this information a simple MFN tariff average for total EU imports of cod can be calculated to be 10.9% and a trade weighted tariff average of the actual applied rates can be calculated to be 2.4%, by taking suspensions, tariff quota, in-quota rates and preferential rates into account. The trade weighted tariff average of the actual applied rates for imports from the EEA is 1.1%.

Tariff averages can be interpreted as measuring the level of protection, although the simple average overestimates the real level of protection provided by tariffs and the trade-weighted average underestimates it. On this basis, the relevant tariff average is between 2.4% and 10.9%. Therefore, regardless of which tariff average is used, the level of protection seems limited compared to e.g. trade weighted tariff averages on EU imports of unprocessed and processed agricultural products in 1996 of 11% and 33%, respectively, according to OECD (1997). The level of protection on cod products is more similar to the one on salmon, as the trade weighted tariff average on EU imports of salmon was 2.5% in 1998. Therefore, the EU level of protection provided by tariffs is low, but nonetheless existent. Moreover, both tariff averages measure the nominal rate of protection, not the effective on value added activities. Provided that the value added activities form 20% of total revenue in the fishing industry, the effective average level of protection is 12% and 55%, respectively, for the two tariff averages.

State of stocks

FAO (1997) assess that cod in the Northeast Atlantic Ocean is either fully exploited or depleted. Fully exploited implies that "the fishery is operating at or close to an optimal yield level, with no expected room for further expansion" and depleted implies that "catches are well below historical levels, irrespective of the amount of fishing effort exerted". The report is based on catches only until 1994, after which the state of the stock has worsened. The International Council for the Exploration of the Sea (ICES) provide assessments and recommendations for fisheries management of cod stocks in the Northeast Atlantic Ocean on a yearly basis. Recommendations are based on surveys and landing records and are more detailed than the FAO assessments. In opposition to FAO, ICES does not consider one single cod stock in the whole Northeast Atlantic, but considers e.g. the Barents Sea stock, the stock in the waters surrounding Iceland and the North Sea stock as separate stocks.

ICES advise on both fishing mortalities (harvest) and stocks and the ICES advise relates to pre-defined reference points, which are defined according to the precautionary approach and a limit value, below which the fishing mortality implies a low probability of unknown population dynamics and stock collapse. Fishing mortality on the limit (F_{lim}) is larger than the precautionary fishing mortality (F_{pa}) and the precautionary stock (B_{pa}) is larger than the limit stock (B_{lim}), where the difference between the two reveals the risk. Below, parts of the last ICES (2001) assessment of the state of the stocks in the Northeast Atlantic is summarised in Table 5.

TABLE 5: **State of the main stocks and state of exploitations, 2001.**

Stock	State of the stocks/exploitations
Barents Sea	The stock is outside safe biological limits. Fishing mortality in the last four years has been among the highest observed and above F_{lim}, and is not sustainable. The spawning stock biomass has been well below B_{pa} since 1998. Surveys indicate below average 1998 and 2000 year classes and a very poor 1999 year class.
North Sea	The stock is outside safe biological limits. The spawning stock is estimated to have been in the region of B_{lim} since 1990. The spawning stock biomass in 2001 is estimated at a new historic low and remains in a region where the risk of stock collapse is high. Fishing mortality has remained at about the historic high and fishing mortality in 2000 is estimated to be about F_{lim}. Except for the 1996 year class, recruitment has been below average in all the years since 1987. The 1997 and 2000 year classes are estimated to be the poorest on record.
Iceland	The spawning stock biomass is currently estimated to be about 240,000 tonnes, near its historic low of 220,000 tonnes (1993), is currently below long term average and the current fishing mortality exceed the limit value. Recruitment was poor or below average for the year classes 1985-96. The 1997 to 1999 year classes are estimated at about average size and the first signs of the 2000 year class suggest that it is at least average.

Source: ICES (2001).

From the Table it appears that the North Sea and the Barents Sea stocks are outside safe biological (precautionary) limits. The situation is most severe in the North Sea, as the spawning stock biomass in 2001 was at a historic low and remains in a region where the risk of stock collapse is high. The situation in the Barents Sea is not much better with a fishing mortality well above the limit value. The state of the Icelandic stock is ambiguous with the biomass near its historic low, but three of the last four year classes have been at or above average. Based on this it is assumed in the further analysis that the North Sea and the Northeast Arctic stocks are exploited above MSY and that the Icelandic stock is exploited at MSY.

Type of fishery

The type of fishery relates to whether the stock of a given species is owned and fished by fishermen from one or more countries and whether more species are related, either ecologically or in the fisheries. That is, whether shared stocks and multi-species relations are present. The cod stocks in the Northeast Atlantic Ocean are for the overwhelming majority found inside the 200-mile zones of one or more countries, although smaller quantities are caught outside the 200-mile zones in the loophole in the Barents Sea. The stock in the waters surrounding Iceland is found solely within the EEZ of Iceland. The stocks in the Barents Sea and the North Sea are shared. The Barents Sea stock is shared between Norway and Russia, whereas the North Sea stock is almost solely in the EEZ of the EU, although a smaller part is within the Norwegian EEZ.

Multi-species relations is present as ecological interdependency in the “competing for feet” form in the Barents Sea, North Sea and in the waters surrounding Iceland, as cod, haddock, saithe and whiting share the same level in the food web and compete for the same feet. Ecological interdependency is also present in the “predator-prey” form, with species as capelin, herring and sandeel as preys and marine mammals including seals as predators.

Cod is caught mainly by groundfish fleets, which fish several groundfish species, including cod, haddock, saithe and whiting. Cod is also caught as by-catch in other fisheries. The composition of catches differs among waters, although cod is both caught by trawlers in mixed groundfish fisheries and taken in fixed gear in all waters. Therefore, some level of catch-related dependency exists between these species, although cod in all waters remains the most important groundfish species. As a matter of fact, in all seas commercial alternatives to cod exist and, as a consequence, alternative fishing opportunities are present. However, with cod being the main commercial species, and with a high level of exploitation of all the groundfish species, these opportunities as a whole are relatively limited in the long run. Therefore, it is assumed in the further analysis that the property rights of the shared cod stocks are well defined between countries and that fleets do not have the freedom to switch effort between cod and other species.

Fisheries management

Fisheries management have developed over the last decades and today almost all parts of the cod fisheries in the Northeast Atlantic are managed. Various means are used, including Regional Fisheries Management Organisations, international management agreements, technical measures, and input and output regulations. The management systems used, however, differ. The management systems are described below on the basis of OECD (2001) and the use of them assessed using ICES (2001).

In the Barents Sea, the Russian-Norwegian Fisheries Commission (RNFC) is established in order to manage the shared stock. The purpose of the Commission is to negotiate and agree on management including Total Allowable Catches (TAC) and the distribution between the two countries. Thereby, the overwhelming majority of the cod stock in the Barents Sea is under ownership and management. Based on the TAC distribution, Norway and Russia have their own management systems. Norway uses on the output side a system where national TACs are divided between vessel groups, which are further divided as fixed (non-transferable) quotas to each participating vessel. Norway also uses input regulation by license requirement and by fixing the number of vessels in particular groups of vessels. Russia agrees on a national quota in the RNFC. Technical measures such as mesh size limitations, sorting grids, minimum sizes, maximum by-catch of undersized fish and non-target species, and closure of areas are used on an obligatory basis in the whole Barents Sea.

The Norwegian management system might be relatively restrictive and effective, where the situation in the Russian management remains unclear. Given that the Russian system is neither restrictive nor effective, the whole Barents Sea cod management is ineffective. In that situation, the effect of trade liberalisation will be as in the open-access situation. Given that the Russian system is functioning, the whole Barents Sea cod management is potentially effective, with the effectiveness depending on how the manager uses the system. According to ICES (2001), the TAC in 2001-03 is set at a level higher than the one recommended by ICES, although TACs based on ICES advise have been reduced in the preceding years. It is thus assumed in the further analysis that a management system is present in the Barents Sea and that managers behave conservatively.

In the waters surrounding Iceland, Iceland is the sole owner and manager of the cod stock. Iceland uses on the output side a system where a national TAC for the whole stock is set and distributed between vessels as an individual quota, forming a fixed share of the TAC. The individual quota is freely transferable between vessels. On the input side there is, according to OECD (2001), no limitations, as all Icelandic vessels have the right to obtain a fishing permit. As in the Barents Sea, a number of technical measures are used in the Icelandic fisheries.

Iceland has established an ITQ management system, which is assessed effective, provided that the yearly TACs are fixed on levels not higher than the MSY. According to ICES (2001), fishing mortality dropped markedly in 1994-95 due to measures to reduce fishing effort against cod, and the TAC has also been set in the region of the given scientific advise. This indicates that the management system is used effectively. However, ICES (2001) also underline that despite advise being followed, overexploitation might have occurred as the advise has been based on consistently overestimated stock levels. However, as this is assessed to be only a short run deviation from a long run pattern, the management is assessed optimal.

In the North Sea, the whole cod stock is managed. The EU and Norway negotiated annually on the management until 1999, wherein a long-term management plan was agreed on. Under these negotiations, agreement is reached on the TAC and the distribution between the two parties. Based on the agreed TAC, Norway and the EU have their own management systems. Norway uses a management system after the same principles as the Norwegian system in the Barents Sea. The EU uses the principle of “relative stability” in the Common Fisheries Policy (CFP), where each of the member states obtains a fixed share of the TAC available to the whole EU. Moreover, the EU uses input regulation and the Multi-Annual Guidance Programme aiming at reducing fishing capacity. Based on this fixed share, each member state has its own management system within the CFP. Seven member states are active in the North Sea cod fishery, the main ones being the UK, Denmark and the Netherlands. According to OECD (2001) the UK operates a restrictive licensing scheme, Denmark a periodical limiting fishery for some groups of vessels and a quota fishery for other groups, and the Netherlands a co-management system where individual vessels quotas and days at sea can be rented within co-management groups. For all the countries, the total national TAC also limits fisheries. Several technical measures are applied.

On this basis, it appears that managements systems are well established in all parts of the North Sea cod fisheries. Therefore, management systems can potentially be effective, provided that the yearly TACs are fixed at levels not higher than MSY. According to ICES (2001), advise has been followed consecutively for the last decade, but despite this, the state of the cod stock is poor. This is assessed due to that former assessments of fishing mortality have consistently been underestimated and stock sizes have been overestimated. However, ICES (2001) also assess that another reason is that TACs alone are not effective in regulating fishing mortalities, and on that basis recommend that restrictions on effort of fleets exploiting cod should be implemented. That is, despite presence of potential optimal management systems, these systems are not used effectively implying that either conservative management or an “open-access like situation” remains. Based on the ICES (2001) assessments, the management situation is characterised as “open-access like”, not in the understanding that management is totally absent, but rather in that management do not work after the intension. There might be several reasons for this, e.g. that the management system is developed for a one-species fishery and therefore not suitable for a multi-species fishery such as the cod fishery, that the quota setting is based on incorrect stock assessments, that overcapacity remains and that control is not perfect. However, the result is the same, the state of the stock have became gradually poorer and is today on a level with risk of stock collapse. Them management system has simply not been able to maintain steady state harvest at a sustainable biological level and, therefore, the system is subjectively characterised as “open-access like”. Based on the above, it is assumed in the following that:

- A management system where the managers behave conservatively is present in the Barents Sea.
- The management system for the cod stocks in the waters surrounding Iceland is optimal
- Despite management in the North Sea an “open-access like situation” understood as above remains.

Long run implications of trade liberalisation

Above, it appeared that trade in cod products flows from Norway, Iceland and Russia to the EU. It also appeared that although import tariffs on this trade are used, the level of protection is low. The majority of the EU import originates in Norway and Iceland, and the EU tariffs from these countries are small, due to favourable market access for countries from the EEA. The implication of a total liberalisation of trade by removing all tariffs on trade originating in this area is therefore small. Another considerable part of the EU import originates in Russia, but most of it through landings in Norwegian ports without tariffs. This Norwegian import is made subject to processing and re-exported to the EU. The Russian products finally appear as EU imports from Norway, e.g. under the preferential arrangement, as the existent rules of origin, where imports should be subject to imposition of tariffs due to country of origin, are not fully respected. The implication of liberalisation is then that Russia will export directly to the EU instead of through Norway.

According to traditional economic theory, the implications of liberalising trade for exporters acting as price takers on the market, such as Iceland and Russia, are increased prices and welfare. An exporter with market power as Norway will only reach a social optimum in the presence of export barriers by collecting revenues from e.g. export taxes. However, as the EU collects the tariff revenue from Norwegian export to the EU, the implications of trade liberalisation in Norway will be as for small exporters. Norway will face increased prices on their export market and increased welfare. However, this will be met by welfare losses arising from that value added obtained from the processing and re-export of cod landed in Norwegian ports by Russian vessels will probably fall. An importer country with market power as the EU will only reach a social optimum in the presence of optimal terms-of-trade tariffs, and therefore the implication of liberalising trade depends on whether the initial tariffs are above, at or below this level. The present relatively low tariffs, however, might be at or lower than the optimal terms-of-trade tariffs, implying that EU face a welfare loss through reduced terms-of-trade.

Another implication of liberalisation following from traditional economic theory is that the localisation of the import dependent cod processing industries, such as in Norway and the EU, might be affected. The processing sector in an importer country as the EU will face decreased prices of their final product as well as allowing processors to obtain cheaper raw material. Nonetheless, the EU processing industry will probably face a welfare gain from re-location, as the costs of raw materials is expected to fall more than the revenue of final sale. The reason is that Russia is expected to export considerably more directly to the EU, instead of through Norway. Of the same reason, the processing sector in Norway probably face welfare losses from re-location, as rising costs of raw materials is expected to offset rising revenue of final sale.

According to the method outlined in Section 2, which analyses welfare by taking resource sustainability of renewable resources into account, and according to the situation on the European cod market described above, the main long run resource-caused welfare implications of liberalising European cod trade is shown in Table 6.

TABLE 6: **Resource-caused welfare implications of liberalisation.**

	The EU North Sea	Norway Barents	Russia Barents	Iceland Icelandic
Trade status	Importer	Exporter	Exporter	Exporter
Exploitation	Over	Over	Over	Fully
Management	"Open-access like"	Conservative	Conservative	Effective
Welfare implication	+	0	0	+

From the Table it appears that the resource-caused welfare implications of liberalising European cod trade result in either welfare gains or no change in welfare. Resource-caused welfare gains appear from the stock in the waters surrounding Iceland, as price increases lead to increased earnings on the fully exploited and effectively managed stock. Thereby, consumption of the non-harvesting good will increase. Welfare gains will also appear from the EU part of the North Sea stock, as the price decrease leads to reduced fishing effort, thereby allowing the "open-access like" managed (in the above understanding) stock to resume. The welfare will increase with increased consumption of the harvesting good. Unchanged welfare remains from the Barents Sea stock, as the management system is used conservatively and is therefore not supposed to change prices.

By integrating traditional economic theory with welfare analyses, taking resource sustainability into account, a welfare gain will result in Iceland. The reason is that prices rise without causing negative resource effects, implying that consumption of the manufacturing good will rise. In Russia and Norway there will be no resource-caused welfare effects, although this effect in Norway is met by a probably negative welfare effect, due to the disappearance of value added activities based on imports form Russia. For the EU the welfare implication depends on whether the terms-of-trade effect (probably negative) is offset by the resource-caused effect (positive) and the localisation effect (probably positive). The overall long run welfare implication of liberalisation is then unknown for both Norway and the EU.

These results are obtained assuming that the single countries fish only one species. If a stock is shared between countries, as is the case for the Barents Sea stock (between Norway and Russia), trade liberalisation might undermine the incentive for keeping already existent management agreements. Russia might through liberalisation obtain an incentive to stop the agreement as the Russian prices increase both in absolute terms and in relation to the Norwegian prices. The long run result would be welfare losses in both Norway and Russia, as management will then be "open-access like".

The above assessments of whether stocks are exploited above, at or below MSY are based on ICES (2001). Moreover, since it is concluded for the North Sea stock that there is risk of a stock collapse, the obtained conclusions on overexploitation is assessed reliable. The assessment of how management systems are used is associated with uncertainty and subjectivity. In particular the characterisation of the North Sea management system as "open-access like" might be controversial, but is based on that biologists "repeatedly have stated over the last decade that fishing effort is too large and that TACs alone are not enough to limit fishing mortality" (ICES, 2001).

The implications of a total liberalisation of cod trade have been analysed. However, presently it is considered by the European Commission to change the suspended tariffs on fresh and frozen cod from 3% to zero, in order to make it easier for the domestic EU processors to obtain raw materials. This liberalisation favours domestic EU processors at the expense of foreign processors, as their raw material becomes cheaper without changes in the final price. Thereby, the localisation welfare effect of import dependent processors of this trade liberalisation will then certainly gain EU processors at the expense of Norwegian processors. Moreover, the implication of this liberalisation is also the same as for a total liberalisation.

References

Bhagwati, J. (1958), Immiserizing Growth: A Geometrical Note, *Rev of Econ Stud*, 25, 201-5.

Brander, J., and Taylor, M. (1997a), Int. Trade and Open-Access Renewable Resources: The Small Open Economy Case, *Can J of Econ*, 30, 526 – 552.

Brander, J., and Taylor, M. (1997b), International Trade Between Consumer and Conservationist Countries, *Res and Ener Econ*, 19, 267 – 298.

Brander, J., and Taylor, M. (1998): Open-access Renewable Resources Trade and Trade Policy in a Two-Country Model, *J of Int Econ*, 44, 181 – 210.

Clark, C. W. (1990), *Mathematical Bioeconomics – the optimal management of renewable resources*, second edition, John Wiley & Sons, Inc.

Copes P. (1970), The Backward-Bending Supply Curve of the Fishing Ind., *Scot J of Pol Econ*, 17, 69-77.

Danish Econ. Council (2001), *Danish Economy*, Autumn.

Emami, A. and Johnson, R. S. (2000), Unilateral Resource Management in a 2-Country General Equilibrium Model, *Amr J of Agr Econ*, 82, 161-172.

European Commission (1999), Report on Product and Capital Markets, Available at: www.europa.eu.int.

FAO (1997), *Review of the state of the world fisheries resources*, FAO Fisheries Circular No. 920 FIRM/C920), Available at: www.fao.org/.

FAO (2001), *The State of World Fisheries and Aquaculture 2000*, Available at: www.fao.org/.

Hannesson, R. (2000), Renewable Resources and the Gains From Trade, *Can. J. of Econ*, 33, 122 – 132.

Hannesson, R. (2001), Effects of liberalising trade in fish, fishing services and investment in fishing vessels, OECD paper no. 8 (1), 1.

ICES (2001), *Report from the Advisory Committee on Fishery Management*, ICES Cooperative Research Report no. 246, Available at: www.ices.dk.

Krugman, P.R. and Obstfeld, M. (2000), *International Economics - Theory and Policy*, 5. ed. Ch. 8.

Mueller, D. C. (1989), *Public Choice II – A revised edition of Public Choice*, Cambridge University Press.

OECD (1997), *Indicators of tariff and non-tariff barriers.*

OECD (2001), *Review of Fisheries in OECD Countries – Policies and Summary Statistics*, Paris.

Schulz, C. E. (1996), Trade, Policy and Ecology, *Env and Res Econ*, 8, 15-38.

Schulz, C. E. (1997), Trade Sanc. and Effects on LR Stocks of Marine Mammals, *Mar Res Econ*, 12, 159-78.

WTO (2001), *Ministerial Declaration, Fourth Session*, Document WT/MIN/DEC/W/1, Doha, November.