

The New Member Problem in the Cooperative Management of the Northern Atlantic Bluefin Tuna*

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Abstract:

In this paper the new member problem faced by the regional fisheries management organisations is discussed for a typical highly migratory species: the northern Atlantic bluefin tuna. The analysis is based on simulation and optimisation results from a bio-economic model.

The results, for both the East and the West Atlantic stocks, show that presently the threat of the new members is not relevant for the breakdown of the cooperative management. This is due to the very low level of the stock, which makes non-cooperation a low payoff strategy. As the optimal cooperative strategy calls for an initial harvest moratorium the threat becomes progressively more relevant, showing that this is a dynamic problem which is aggravated in the long run.

Two possible solutions for this problem are simulated: “transferable membership” and “waiting period”. The simulation results show that a “transferable membership” scheme, if properly implemented, is fully efficient in protecting the cooperative agreements of the regional fisheries organisations from the free rider actions of the prospective new members. The “waiting period”, although protecting the member countries generally does not preclude such behaviours.

* This paper is part of the project PL96.1778 -“The Management of High Seas Fisheries”, financed by the European Commission. This document does not necessarily reflect the views of the Commission of the European Communities and in no case anticipates the Commission’s position in this domain.

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1- Introduction:

The successive cases of over-exploitation of straddling and highly migratory fish stocks¹ that followed the United Nations Convention on the Law of the Sea (UNCLOS-1982), revealed the inadequacies of its Provisions relating to these species.

In order to assess the problems related to the conservation and management of these two transboundary fishery resources, the United Nations convened the “U.N. inter-governmental Conference on Straddling Fish Stocks and Highly Migratory Fish Stocks (1993-95)”. In 1995 the Conference adopted an Agreement for the implementation of the Provisions on UNCLOS-1982, relating to the Conservation and Management of Straddling and Highly Migratory Fish Stocks (U.N. Agreement, hereafter). According to the U.N. Agreement, regional fisheries management organisations (RFMO) should form the basic bodies of conservation and management of these species (Munro, 1998). These organisations should integrate both the coastal states and the distant water fishing nations (DWFN) effectively interested in the fishery. Their management competence should include both the exclusive economic zones (EEZ) and the high seas.

The U.N. Agreement sets a "few plain rules" (Balton, 1999), which are pertinent for the new entrants phenomenon. The first rule is that all States whose vessels fish for the marine stocks regulated by RFMOs should either join these organisations or, at a minimum, apply its management regime to their flag vessels. The second rule is that RFMOs should be open to all States with a real interest in the fisheries concerned. The final rule follows from the others: only member states of the RFMOs, and the

¹ The highly migratory stocks move to and from the EEZs and the high seas, it includes mainly the six major tuna species. Straddling stocks are also found in the EEZ and the high seas but tend to migrate in smaller areas than the tunas.

states that apply the fishing restrictions adopted by those organisations, shall have access to the regulated fishery resources.

According to Munro (1999) the U.N. Agreement left unsolved two important issues to the long-term economic viability of the RFMOs. These are referred as the “interloper” and the new member issues. The former concerns the policing of vessels of states, which are non-members of the RFMO, whereas the latter concerns the possibility of new members attempting to join the organisation.

This paper is focused on the new member issue and addresses the case of a typical highly migratory species: the northern Atlantic bluefin tuna. Under the legal regime of the U.N. Agreement the new members appear as a relevant threat to the cooperative agreements, as the members of the RFMOs do not have the right to bar their access².

Two possible solutions for this problem are discussed: “transferable membership”, and “waiting period”. In the first, a system is implemented in which the members get transferable property rights over the stock. Thus a prospective new member would have to purchase quota share in order to enter the fishery. In the second, the new member must go through a waiting period before enjoying the benefits from the fishery.

The paper is organised as follows. The following section presents an economic approach to management of straddling and highly migratory fish stocks (section 2.1) and to the new member issue (section 2.2). In section 3, this approach is applied to the Eastern Atlantic bluefin tuna fishery. The optimal use of the species under a cooperative management scenario is addressed (section 3.1). Then the new member

² The U.N. Agreement permits members to bar the access of new members only if the new member refuses to adopt the RFMO management regime.

threat to the cooperative agreement is evaluated (section 3.2). The simulation results of the two proposed solutions, “transferable membership” and “waiting period” are discussed in sections 3.3 and 3.4, respectively. In section 4, a similar analysis is directed to the Western Atlantic bluefin tuna fishery. Finally, section 5 presents some concluding remarks.

2- Economic Approach

2.1 The Management of Straddling and Highly Migratory Fish Stocks

According to Munro (1999) the economics of the management of straddling and highly migratory fish stocks is still at an early stage of development. The reason behind it is that the management problem of these particular resources is a relatively new one.

The research on transboundary fish resources has been mainly centred on shared fish stocks (resources that cross the EEZ of several countries). Only recently the problem of the management of straddling and highly migratory fish stocks was addressed by the economists (e.g. Kaitala and Munro (1993); Munro (1999)).

The studies concluded that the economics of the non-cooperative management of “shared stocks” could be applied with little change to the non-cooperative management of the straddling/highly migratory fish stocks. The theory of non-cooperative games is the basic tool used to predict the consequences of non-cooperation. In most cases the non-cooperative game presents the features of the well known “The Prisoner Dilemma” and its outcome is the over-exploitation of the species.

Generally, the cooperative management of these species is also a very relevant scenario, as its payoffs tend to exceed those of non-cooperation. In this analysis the

theory of cooperative games is the central tool. Concerning these games there is a fundamental difference between the shared fish stocks and the straddling and highly migratory fish stocks. Neither the number nor the nature of the “players”, of a cooperative game on straddling and highly migratory fish stocks, can be assumed to be constant over time - as opposed to their natural stability in the shared fish stocks problems. The cooperative solutions of the highly migratory stocks are, thus, challenged by the instability on the nature and number of the players.

2.2 The New Member Issue

The possibility of new members attempting to join the RFMOs is a threat to the long run viability of the cooperative agreements. This threat emerges especially from the highly mobile DWFN fleets and was left unsolved by legal regime of the UN Agreement - under which the members of a RFMO do not have the right to bar the access of a prospective new member.

Although the new member issue remains unresolved (Munro, 1999), some interesting results can be found in the literature. Kaitala and Munro (1997) show that, when a RFMO is being established, the expected payoffs of cooperation may fall below the thread point payoffs, if a prospective new member must be admitted to the RFMO and must be given a share of the resource harvest.

Orebech et al. (1998) states that Article 8 of the U.N. Agreement requires that a cooperative new member "must be offered a just and reasonable share of the TAC". But the U.N. Agreement does not specify what a “just and reasonable share” is, or if a price could be applied to it. In fact, if entrance can be made at zero cost the problem of the free rider emerges and the RFMO’s cooperative agreement could be fatally undermined.

Regarding possible solutions to this problem Kaitala and Munro (1997) refers to the terms of entry for prospective new members suggested in a draft convention (UN, 1993) by a group of coastal states during the U.N. Fish Stocks Conference. The authors specially emphasise two of these terms: “transferable membership” and the “waiting period”. In the first, the charter members declare the transboundary stock to be fully utilised. Therefore, a prospective new member may participate in the fishery only if one of the members relinquishes its share. In the second, the new member is allowed to enter the RFMO but must go through a waiting period before enjoying benefits from the fishery. Both these solutions are considered as compatible with the Agreement emerged from the Conference.

In relation to the “transferable membership” solution, Kaitala and Munro (1997) refers that it is not reasonable to expect that coastal states may transfer their membership, but the DWFN due to the mobility of their fleets can certainly do so. Another relevant aspect is that the DWFN will require a payment in order to transfer its share. Thus this solution is based on the creation of “de facto property rights” for the members of the RFMO, in which the quotas would take some of the attributes of individual transferable quotas (ITQ).

The use of ITQ systems in ocean fisheries is relatively recent and it is worth to outline a few aspects of its history. The first comprehensive ITQ system was implemented in New Zealand in 1986, and was followed in Australia, Canada, Iceland and other countries.

In the literature, ITQ applications have progressively spread (e.g. Weninger (1998); Gauvin and Burges (1994)). Generally the authors conclude that the ITQ systems bring substantial efficiency gains, namely it provides mechanisms to eliminate redundant capital and restructure the fleet composition.

Christy (1996) relates the advent of the property rights based systems, such as the ITQs, with the natural economic rationalisation of ocean fisheries. The author predicts the death rattle of open access and in his opinion the TACs are only a stage in the development of management from licensing to property rights.

With the new legal framework of the U.N. Agreement the use of payment schemes, such as the ITQs, to solve the new member issue is clearly a possible economic solution.

Regarding the “Waiting period”, Kaitala and Munro (1997) conclude, through a theoretical scenario, that this mechanism may not be very promising in eliminating the threat that the new members pose to the cooperative agreements.

3 – The New Members in the East Atlantic Bluefin Tuna Fishery

Throughout this section the new member problem is discussed for East stock of the northern Atlantic bluefin tuna fishery. The results are based on a multi-gear and age structured bio-economic model developed for this species (Pintassilgo, 1999).

3.1 The Cooperative Management

As recommended in the UN Agreement the bluefin tuna has been managed by a RFMO – the International Commission for the Conservation of the Atlantic Tunas (ICCAT). This organisation, established in 1969, adopted over the years many resolutions and recommendations regarding the management and conservation of the bluefin tuna, for both the East and West Atlantic (Duarte et al., 1998). Nonetheless, these measures have not been effective, as weren't respected by the member and non-members parties.

In this section it is assumed that only the ICCAT members participate in the fishery and implement an optimal cooperative solution. This solution corresponds to the maximum Total Net Present Value (TNPV) of the grand coalition (formed by all the ICCAT members).

Following the approach, presented in Duarte et al. (1999), the ICCAT members are aggregated into three main players: European Union (EU), Distant Water Fishing Nations (DWFN) and Other Coastal States (OCS). It is assumed that the player's shares in the total catch of each gear remain as in the base year (1995).

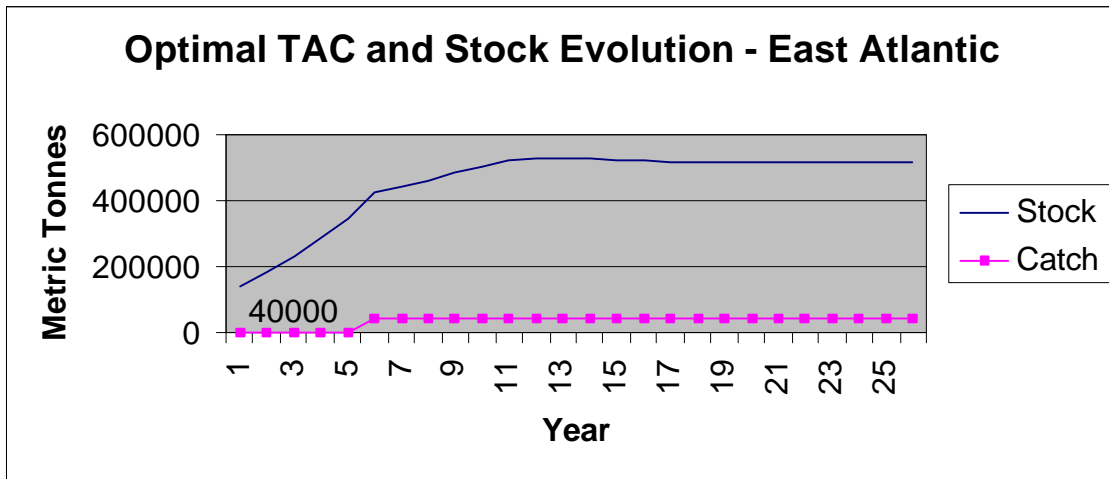
The optimal policy is set in terms of a TAC, as this is the main policy instrument used by the ICCAT and other fisheries organisations world-wide. A constant gear structure is considered in which the TAC is divided by gear as in the base year.

In the optimisation the TNPV is maximised for a 50 period³ horizon and the TAC is considered to be variable during the first 25 years and constant thereafter. For each year a precautionary limit on total catches is defined as a 40,000 MT⁴.

Given this framework the optimal policy, for a 4% discount rate, is to declare an initial harvest moratorium of 5 periods and harvest 40,000 MT thereafter. The optimal TAC and the stock evolution are presented in Graph 1.

³ As in this paper the TAC is considered to be variable during the first 25 years, the simulation period was extended from 25 periods (Pintassilgo, 1999) to 50 periods in order not to bias the values of the latest TACs, towards the upper limits.

⁴ Historical data show that catches above this limit tend to lead biomass to depletion. The model simulations also show that, with the present gear mix, 40,000 MT is close to a maximum sustainable catch, after a stock recovery (through an initial harvest moratorium).



Graph 1

As it can be seen from Graph 1, the optimal policy results in a significant stock recovery. The progressive trend of the stock towards stabilisation, after the initial recovery, points out that 40,000 MT is, for the particular level and composition of the stock after the moratorium, close to a maximum sustainable catch.

In order to evaluate the role of the discount rate in the results, 10% and 20% discount rates are also considered. With these rates the optimal policy is similar but with a shorter harvest moratorium: 4 and 3 periods respectively. Table 1 presents the payoffs of each player in the optimum cooperative strategy.

Table 1: Payoffs in the Cooperative Solution

	<i>Discount rate</i>		
	<i>4%</i>	<i>10%</i>	<i>20%</i>
<i>EU</i>	1327.1	484.2	177.6
<i>DWFN</i>	503.3	185.5	70.1
<i>OCS</i>	589.2	215.0	78.8
<i>Total</i>	2419.5	884.7	326.5

Values in 10^6 USD

One first conclusion, from table 1 is that the NPV varies significantly with the discount rate, although the optimal policy is similar. It is, nonetheless, worth to note

that these results are optimal with the precautionary limits on catches. In their absence, high discount rates imply optimal policies, which increase substantially the catches in the short run and leads the stock to depletion.

The importance of precautionary limits on catches is clearly emphasised in the UN Agreement (Tahindro, 1999). In a context of a world-wide over-fishing, the UN Agreement provides “Guidelines for application of precautionary reference points in the conservation and management of straddling fish stocks and highly migratory fish stocks”. In particular it refers to conservation or limit reference points, which sets boundaries intended to constrain harvesting within safe biological limits, allowing the stocks to produce Maximum Sustainable Yield (MSY).

3.2 The New Member Threat

Kaitala and Munro (1997) show that if the only condition for prospective new members to achieve membership in the RFMO is a willingness to accept its management program, then cooperative resource management could most certainly be at serious risk. The authors show, with an application of a Nash bargaining scheme (in which the gains from cooperation are divided equally among the players), that the anticipation of prospective new members can destroy the incentives to a cooperative management of the resource.

In this section a similar approach is conducted for the East Atlantic bluefin tuna fishery but, instead of a Nash bargaining scheme, it is assumed that the ICCAT determines a TAC by gear and each player has a right to a share of it. These shares are not transferable and side payment schemes are not feasible.

The new member problem concerns specially the possibility of distant water fishing nations that might want to join the ICCAT. Therefore, it is assumed that the new members are DWFN which:

- i) Use only longline gear;
- ii) Have fleets similar to the ones already in the fishery;
- iii) Call for entry in the ICCAT at the end of the harvest moratorium;
- iv) Agree to follow the ICCAT regime;
- v) Receive a share of the longline quota⁵;

Regarding assumption v) it is worth to say that in a simpler scenario where the TAC is issued by country and is not divided by gear (as in the present ICCAT policy), the new members would naturally receive a share of the total catch. The simulation results proved that, for both scenarios, the results are qualitatively similar. Nonetheless, if the TAC were not divided by gear, the effects of the new members would be more evenly distributed among the players and not so concentrated on the DWFN, which dominates the longline gear.

Let us now suppose that the players are rational and therefore, if the entry of a new member is anticipated, they will evaluate if its payoff under cooperation exceeds that of non-cooperation.

It is assumed, for the sake of simplicity, that if one of players breaks the agreement all the others will react with a non-cooperative strategy. As in Kaitala and Munro (1997) no cooperative sub-coalitions are considered.

Let us also suppose that the new members will not enter the fishery if non-cooperation starts at the beginning of the game.

⁵ The other players share on the longline quota decrease in that proportion.

In this framework, if condition (1) holds, for any of the original members, the anticipated entry of new members will lead the players to non-cooperative behaviour.

$$u_{i,0}(x_0, s_i^{NC}, s_{-i}^{NC}) > e^{-rT} u_{i,T}(x_T, s_i^C, s_{-i}^C, s_{NM}^C), \quad i = EU, DWFN, OCS \quad (1)$$

Where :

$u_{i,t}$ - Payoff of player i, evaluated in period t;

s_i^{NC} - Strategy under non - cooperation of player i;

s_i^C - Strategy under cooperation of player i;

s_{-i} - Strategy of the original members of the RFMO, other than i;

s_{NM} - Strategy of the new members ;

x_t - State of the stock at period t

r - discount rate

T - Period just after the moratorium

In order to analyse condition (1), the non-cooperative⁶ and the cooperative strategies were simulated, for different shares of the new members. The results are presented in Table 2.

Table 2: Payoffs by Player in the Presence of New Members at t=0

	<i>Non Coop.</i>	<i>Cooperative - New member share on the longline quota</i>					
		<i>0%</i>	<i>10%</i>	<i>30%</i>	<i>50%</i>	<i>70%</i>	<i>90%</i>
<i>E.U.</i>	-8.8	1327.1	1308.3	1270.8	1233.2	1195.7	1158.2
<i>DWFN</i>	30.2	503.3	453.0	352.3	251.7	151.0	50.3
<i>O.C.S.</i>	-3.0	589.2	573.0	540.5	508.1	475.7	443.3
<i>N.M.</i>	-	-	85.3	255.9	426.5	597.1	767.7
<i>Total</i>	18.4	2419.5	2419.5	2419.5	2419.5	2419.5	2419.5

Values in 10⁶ USD

⁶ The payoffs for this strategy differ slightly from those presented in Duarte et al. (1999) as the modeling of the last period was revised.

A major conclusion emerges from Table 2: even if the new members receive a considerable share of the longline quota, the original members would still prefer a cooperative strategy, instead of a non-cooperative one. This is due to the very low level of the stock in the beginning of the game, which makes non-cooperation a low payoff strategy.

Table 2 also shows that with a cooperative agreement, in this scenario, the DWFN are the most penalised with the entry of the new members, as it presents the largest longline share.

The prospective new members clearly gain by entering the RFMO after the moratorium, but this does not threaten the cooperative agreement.

Nonetheless, the threat posed by the new members does not end with the initial decision to cooperate in the recovery of the stock. In fact, in the case of non-binding agreements, this is a dynamic problem that tends to undermine cooperation in the long run. At any period t each of the players evaluates if a non-cooperative strategy is worth more than a cooperative one. Therefore, once the stock is recovered the non-cooperative behaviour becomes more appealing.

In order to test this argument a scenario is created in which, after the initial harvest moratorium, new members join the RFMO and each member decides whether to cooperate or not. Again it is assumed that if one of the original members breaks the agreement then all the other will react non-cooperatively.

The agreement breaks if, after the moratorium, for any of the players:

$$u_{i,T}(x_T, s_i^{NC}, s_{-i}^{NC}, s_{NM}^{NC}) > u_{i,T}(x_T, s_i^C, s_{-i}^C, s_{NM}^C), \quad i = EU, DWFN, OCS \quad (2)$$

Where

T – A time Period after the moratorium

The case of the non-cooperative reaction of a member to an unexpected entry of a new member to the RFMO is also defined by the previous condition.

The following table shows the payoffs, of the cooperative and non-cooperative strategies, at the end of the moratorium. In the case of non-cooperation it is assumed that the original members, in the period after the moratorium, use the same effort level as in the base year and the new members use 10% of the total longline effort of that year.

Table 3: Payoffs by Player in the Presence of New Members at t=6

	<i>Non-Coop.</i>	<i>Cooperative – New member Share on the longline quota</i>					
		<i>0%</i>	<i>10%</i>	<i>30%</i>	<i>50%</i>	<i>70%</i>	<i>90%</i>
<i>E.U.</i>	832.8	1674.4	1650.7	1603.3	1556.0	1508.6	1461.3
<i>DWFN</i>	385.8	635.0	571.5	444.5	317.5	190.5	63.5
<i>O.C.S.</i>	410.3	743.3	722.9	682.0	641.1	600.2	559.3
<i>N.M.</i>	65.4	0	107.6	322.9	538.1	753.4	968.6
<i>Total</i>	1694.3	3052.7	3052.7	3052.7	3052.7	3052.7	3052.7

Values in 10⁶ USD

Table 3 shows that after the moratorium, for the DWFN, the incentive to break the cooperative agreement increases. New members with a longline share between 30% and 50% would be sufficient to make profitable for the DWFN to break the cooperative Agreement. Therefore, in this scenario, the new members pose a threat to the long run stability of the cooperative agreement.

3.3 Solutions for the New Member Problem

In this section the two possible solutions for the new member problem, presented in section 2.2, are simulated for the East stock of the northern Atlantic bluefin tuna.

3.3.1 Transferable Membership

The basic premise in implementing a system of transferable membership is that a prospective new member can only have access to the fishery by acquiring the corresponding quota from the member countries.

In this section “transferable membership” is defined in a broad sense, as a system in which each member can sell any share of its quota. Thus this is equivalent to an Individual Transferable quota (ITQ) system.

According to Munro (1999) the transferable membership is expected to function basically with DWFNs selling quota to other DWFN. In this study the scope of trade is enlarged to all members. Thus any member is allowed to sell its share.

In the beginning of ITQ systems it is common to use restrictions on quota transfers. Representative examples are the implementation of this system in Iceland (Arnason (1993)) and Canada (Crowley and Palsson (1992)). The aims of these restrictions are usually connected with stabilising employment, in the short run, and avoiding the consolidation of shares.

In this case study, it is assumed that the ITQs are non-transferable between gears, as the different gears tend to correspond to specific areas. Therefore, a new member must acquire an ITQ for the particular gear it wants to use. This scenario gives rise to a specific market for each gear.

A standard economic result, which remains valid in multi-fleet fisheries (Garza-Gil (1998)), is that the market price of a perpetual ITQ is equal to the present value of the marginal returns generated by it. In this case-study the market price of a perpetual ITQ is computed, for each gear, as the corresponding share on the Net Present Value

of that gear - an average value, which for the particular bio-economic model used is also the marginal return⁷.

Table 4 shows the market price of a perpetual ITQ corresponding to a 1% share of the total catches, under the optimal cooperative strategy. Different discount rates, and the respective optimal strategies, are used in order to assess the importance of this parameter.

Table 4: Market Price of a Perpetual ITQ (1% of the Total Catch)

	<i>Discount Rate</i>		
	<i>4%</i>	<i>10%</i>	<i>20%</i>
<i>Longline</i>	26,573	9,793	3,700
<i>Purse Seine</i>	14,068	5,184	1,959
<i>Trap</i>	74,084	26,761	9,492
<i>Bait Boat</i>	6,480	2,333	841
<i>Remainder</i>	50,377	18,197	6,455

Values in 10³ USD

From table 4 it can be concluded that the value of the ITQ is, as expected, very sensitive to the discount rate.

The highest ITQ prices are those of the trap and the remainder, as they present high prices and the highest catch-stock elasticity - thus benefiting the most from the stock recovery. In this scenario, if we assume that a new member will use longline gear it will have to pay, with a 4% discount rate, around 26.6 million USD for a 1% share of total catches.

With this system the new entrants will have to pay for its share in order to have access to the fishery, therefore it will only buy the share if it is at least as efficient as the marginal longline fleet in the RFMO. This eliminates the incentives of non-

⁷ The estimated profit functions are linear on catches, which results in identical marginal and average profits for each unit of catch.

efficient prospective new members to enter the fishery once the stock is recovered, as the ITQ price will increase.

The ITQ system also indicates that the players with a long run interest in the stock (more conservatives) will tend to buy the ITQs as they attribute more value to the resource.

A problem often raised to the implementation of ITQs systems concerns the initial allocation. How can the shares be allocated in a fair way? Is it reasonable that nations get a free perpetual right and others that may want to enter the fishery have to pay for it? A possible solution is to make an initial allocation based on historical catches and also incorporate other relevant coastal states.

3.3.2 Waiting Period

In this section a fundamental question is raised: can the cooperative agreements of the RFMO be protected by imposing a “waiting period”, in which prospective new members cannot have access to the fishery. In order to draw some light on this issue an hypothetical scenario is created in which the new members get a 25% share of the longline catch⁸ and the other players see their longline share reduced proportionally, relatively to the base year. With these assumptions three situations are simulated: no entry, entry with no “waiting period” and entry with a five-year “waiting period”. In this setting no waiting period means that the new member will start to catch, together with the other players, just after the harvest moratorium.

Table 5 shows the payoffs for the 4 players. In order to analyse the impact of the discount rate on the results different rates are considered.

⁸ For a total catch of 40,000 MT, a 25% share of the longline catch corresponds to about 3,210 MT.

Table 5: Payoffs of the Fishery – Waiting Period Scenario

	<i>Discount rate</i>								
	<i>4%</i>			<i>10%</i>			<i>20%</i>		
	<i>No Entry</i>	<i>0 Years</i>	<i>5 Years</i>	<i>No Entry</i>	<i>0 Years</i>	<i>5 Years</i>	<i>No Entry</i>	<i>0 Years</i>	<i>5 Years</i>
<i>EU</i>	1327.1	1280.1	1289.8	484.2	466.9	474.2	177.6	171.1	175.6
<i>DWFN</i>	503.3	377.5	403.5	185.5	139.1	158.7	70.1	52.6	64.9
<i>OCS</i>	589.2	548.6	557.0	215.0	200.1	206.4	78.8	73.2	77.1
<i>NM</i>	0	213.3	169.2	0	78.6	45.4	0	29.7	8.8
<i>Total</i>	2419.5	2419.5	2419.5	884.7	884.7	884.7	326.5	326.5	326.5

Values in 10⁶ USD

The results presented in table 5 show that among all the players the DWFN are the most affected by the loss of 25% of its longline quota, due to the entry of the new members. In fact, the DWFN is the most important player using this gear – it represents 59% of the longline catches in the base year.

By comparing the payoffs of no “waiting period” with a 5-year “waiting period”, it can be concluded that the introduction of a waiting period increases the payoffs of the original members and the rate of this increase rises with the discount rate. E.g. for a 4% discount rate the payoff of the DWFN rises 6.9%, whereas for a 20% discount rate that increase is of 23.4%. This indicates that this scheme may be relevant in the context of high discount rates.

As in this fishery the non-cooperative strategies are not appealing in the short run the “waiting period” mechanism, although protecting the member countries, is not sufficient to finish the incentives to free rider behaviors by the prospective new members. Therefore, this mechanism cannot be seen as a solution to the new member problem in the long run.

4 – The New Members in the West Atlantic Bluefin Tuna Fishery

In this section the new member problem is discussed for the West Atlantic stock. The analysis is similar to the one of the previous section, therefore only the main points will be addressed. .

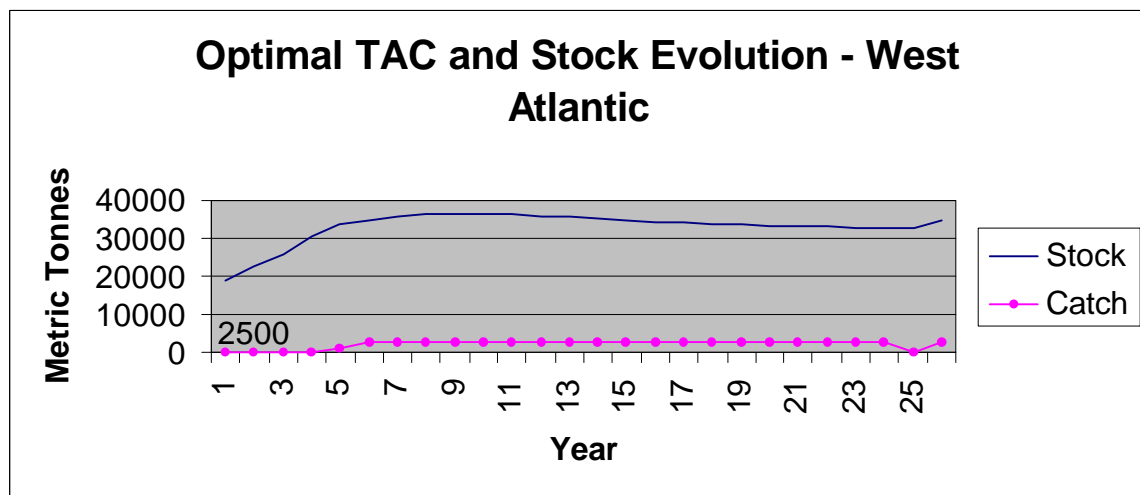
4.1 The Cooperative Management

Following Duarte et al. (1999), the ICCAT members can be represented by three main players: United States of America (USA), Canada (CAN) and Distant Water Fishing Nations (DWFN).

The optimal policy is determined, as for the East Atlantic, and a precautionary limit on catches is defined as a 2,500 MT⁹.

The optimal policy is to declare a 4 period moratorium, catch 1300 MT in the 5th period and 2500 MT thereafter - with the exception of 25th period (200 MT)¹⁰.

The TAC and the stock evolution are represented in Graph 2



Graph 2

⁹ The model simulations show that, with the present gear mix, 2,500 MT is close to a maximum sustainable catch, after a stock recovery through an initial harvest moratorium.

¹⁰ As it is assumed that the TAC is constant from t=26 to t=50 the optimal path calls for a TAC decrease at t=25, in order to allow a higher initial stock for the remainder periods.

Graph 2 shows a stock evolution that, after an initial recovery, tends towards stabilisation, which indicates that a 2,500 MT catch, after the moratorium, is close to a sustainable level.

By considering different discount rates it can be concluded that the optimal policy is not sensitive to this parameter. In fact for 10% and 20% discount rates the optimal policy is to declare a harvest moratorium of 3 and 2 years, respectively, and catch 2,500 MT thereafter.

Let us now turn to the payoffs of the optimal strategies, which are presented in table 6.

Table 6: Payoffs in the Cooperative Solution

	<i>Discount rate</i>		
	<i>4%</i>	<i>10%</i>	<i>20%</i>
<i>USA</i>	58.6	23.2	9.5
<i>CAN</i>	30.2	11.8	4.8
<i>DWFN</i>	23.9	9.5	3.9
<i>Total</i>	112.7	44.5	18.2

Values in 10⁶ USD

Table 6 shows that the discount rate has a significant impact on the payoffs. It can also be noted that United States earns more than 50% of the total payoff.

4.2 The New Member Threat

In this section the new member threat is analysed for the West Atlantic stock using a similar setting to the one presented for the East Atlantic stock. In particular it is assumed that the new members are DWFN, using longline gear, which are equally efficient to ones already in the fishery.

Table 7 shows the payoffs of the non-cooperative and cooperative strategies evaluated in the base year.

Table 7: Payoffs by Player in the Presence of New Members at t=0

	<i>Non Coop.</i>	<i>Cooperative – New member Share on the longline quota</i>					
		<i>0%</i>	<i>10%</i>	<i>30%</i>	<i>50%</i>	<i>70%</i>	<i>90%</i>
<i>U.S.A</i>	0.65	58.6	58.2	57.2	56.3	55.4	54.4
<i>CAN</i>	-0.60	30.2	30.2	30.1	30.1	30.0	30.0
<i>DWFN</i>	0.29	23.9	21.5	16.7	11.9	7.2	2.4
<i>N.M.</i>	0	0	2.9	8.6	14.4	20.1	25.9
<i>Total</i>	0.34	112.7	112.7	112.7	112.7	112.7	112.7

Values in 10⁶ USD

From table 7 it can be concluded that, in the beginning of the game, even if the new members receive a substantial share of the longline quota it will not induce the other players to break the cooperative agreement. The reason behind it is the depleted state of the stock, which makes the non-cooperation a low payoff strategy.

In this case the USA and especially Canada loose very little if the new entrants receive a share of the longline quota, as this is not a determinant gear for both nations. If the new member share is not computed based on a specific gear but on the total catch this asymmetry does not occur.

Let us now turn to the situation after the moratorium. The player's payoffs are presented in table 8.

Table 8: Payoffs by Player in the Presence of New Members at t=5

	<i>Non Coop.</i>	<i>Cooperative – New member Share on the longline quota</i>					
		<i>0%</i>	<i>10%</i>	<i>30%</i>	<i>50%</i>	<i>70%</i>	<i>90%</i>
<i>U.S.A</i>	39.0	68.6	68.0	67.0	65.9	64.8	63.7
<i>CAN</i>	19.3	35.4	35.3	35.3	35.1	35.1	35.1
<i>DWFN</i>	16.0	27.9	25.1	19.5	14.0	8.4	2.8
<i>N.M.</i>	1.9	0	3.4	10.1	16.8	23.5	30.3
<i>Total</i>	76.2	131.9	131.9	131.9	131.9	131.9	131.9

Values in 10⁶ USD

Table 8 shows that, after the moratorium, the payoffs of the non-cooperative strategy rises substantially. Thus for the DWFN, already in the fishery, new member shares between 30 to 50% would be sufficient to induce non-cooperation.

As in the East Atlantic, it can be concluded that the new member threat is aggravated in the long run.

4.3 Solutions for the New Member Problem

In this section the two solutions suggested in section 2.2 are discussed for the Western Atlantic bluefin tuna fishery.

4.3.1 Transferable Membership

As in the analysis of the East Atlantic stock the value of a perpetual ITQ is determined. The ITQ prices for each gear are presented in table 9.

Table 9: Market Price of a Perpetual ITQ (1% of the Total Catch)

	<i>Discount Rate</i>		
	<i>4%</i>	<i>10%</i>	<i>20%</i>
<i>Longline</i>	902.1	357.5	147.7
<i>Purse Seine</i>	955.2	378.5	156.4
<i>Rod & Reel</i>	955.2	378.5	156.4
<i>Remainder</i>	2,559.2	996.6	396.2

Values in 10³ USD

From table 9 some interesting points emerge. The remainder gears present the highest value for the ITQ due to its high catch-stock elasticity. For the purse seine and the rod & reel the same ITQ price is obtained, this results from the assumptions of equal prices and cost margins for the two gears.

4.3.2 Waiting Period

The impact of establishing a waiting period is analysed in a hypothetical scenario in which the new entrant receives a 25% share of the longline quota. Table 10 presents the results for different discount rates.

Table 10: Payoffs of the fishery – Waiting Period Scenario

<i>Lag</i>	<i>Discount rate</i>								
	<i>4%</i>			<i>10%</i>			<i>20%</i>		
	<i>No Entry</i>	<i>0 Years</i>	<i>5 Years</i>	<i>No Entry</i>	<i>0 Years</i>	<i>5 Years</i>	<i>No Entry</i>	<i>0 Years</i>	<i>5 Years</i>
<i>USA</i>	58.6	57.4	57.7	23.2	22.7	22.9	9.5	9.3	9.5
<i>CAN</i>	30.2	30.2	30.2	11.8	11.8	11.8	4.8	4.8	4.8
<i>DWFN</i>	23.9	17.9	19.1	9.5	7.1	8.1	3.9	2.9	3.6
<i>NM</i>	0	7.2	5.7	0	2.8	1.6	0	1.2	0.3
<i>Total</i>	112.7	112.7	112.7	44.5	44.5	44.5	18.2	18.2	18.2

Values in 10⁶ USD

The simulation results presented in Table 10 shows that, in this scenario, introducing a 5-year waiting period does not produce significant gains for the original members. Nonetheless, for the DWFN these gains increase substantially with the discount rate (6.8% and 24.1% for a 4% and 20% discount rates, respectively). As in the beginning of the game non-cooperative strategies yield a low payoff this mechanism clearly does not prevent possible free-rider behaviours by the new members.

5. Concluding Remarks

The new member problem faced by the regional fisheries organisations is presently considered as a serious threat to the cooperative management of the straddling and highly migratory fish stocks.

In this paper an economic approach to this problem is centred in a typical highly migratory species: the northern Atlantic bluefin tuna.

The results show that in the beginning of the game the threat of the new members is not relevant for the breakdown of the cooperative agreement. This is due to the very low level of the stock, which makes non-cooperation a low payoff strategy. As the optimal cooperative strategy calls for an initial harvest moratorium the threat becomes progressively more relevant, showing that this is a dynamic problem which is aggravated in the long run.

The simulation results for the two proposed solutions emphasise the importance of the discount rate. In fact the price of the transferable quotas are very sensitive to this parameter and the impact of the “waiting period” is especially relevant for high discount rates.

One main conclusion is that the “transferable membership” solution, by issuing property rights, is globally efficient in protecting the cooperative agreements of the regional fisheries organisations from the free rider actions of the prospective new members. The waiting period solution although enhancing the cooperative agreements in the short run does not solve the new member problem in the long run. This is especially true in cases of highly depleted stocks, as is the present state of the bluefin tuna.

In the complex world scenario in fisheries it is not clear which solution will be adopted by the regional fisheries organizations regarding the entry of new members, but surely strong economic forces must be in action in order to avoid the threat of free riding behaviors. The two solutions discussed, and especially the ITQ system, can be good milestones to implement these forces as they provide economic incentives in the right direction.

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