Regional Vessel Registries and Limited Access Programs

by

Brian Hallman
Inter-American Tropical Tuna Commission
La Jolla, California

Scott Barrett
School for Advanced International Studies
Johns Hopkins University

Raymond P. Clarke
NOAA Fisheries
Honolulu, Hawaii

James Joseph
Inter-American Tropical Tuna Commission
La Jolla, California

Victor Restreppo
International Commission for the Conservation of Atlantic Tunas
Madrid, Spain

Dale Squires
NOAA Fisheries
La Jolla, California

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1. Introduction

Overcapacity, overfishing, and economic inefficiency in transnational tuna fisheries spring from the customary right of any state to fish on the high seas. International law, specifically Article 116 of the Law of the Sea, qualified by Articles 117, 118, and 119, allows free entry to fish on the high seas (i.e. on the ocean beyond the Exclusive Economic Zones). Article 64 of the Law of the Sea mandates international cooperation among nations, but even with such cooperation, the effects of the absence of well-defined and fully structured property rights, national sovereignty, and jurisdictional issues are paramount, so that the dominant strategy for many vessels and flag states remains the race to fish and expand fishing capacity.

Despite the fact that virtually all of the world's tuna fisheries are subject to international management by multilateral commissions created by legally-binding treaties, incentives still remain, including for vessels of member nations of the commissions, to enter the global tuna fishery, steadily invest in fishing capacity and productivity, adopt technological advances, and in general to *not* identify with the long-term needs of resource conservation. Command-and-control regulations, such as by Total Allowable Catches (TACs) and seasonal closures, in themselves do not remove the negative incentives to race for fish.

One of the most effective policy responses to the overcapacity, overfishing, and economic inefficiency in transnational tuna fisheries is rights-based management (Barrett *et al*. 2004, Ram-Bidesi and Tsamenyi, 2004, Joseph 2005, Joseph *et al*. 2006, FAO 2005, 2006). Perhaps the most tractable and immediate way to strengthen the rights in many of the tuna Regional Fisheries Management Organizations (RFMOs) is to limit access to the fishery through closed Regional Vessel Registers (RVR), such as that introduced by the Inter-American Tropical Tuna Commission (IATTC).[1] Although stronger forms of rights, such as Individual Transferable Quotas (ITQs) or Individual Transferable Effort, may be preferred in many domestic fisheries, these mechansims may be out of reach in the near future in most transnational tuna fisheries (Joseph *et al*. 2006).[2]

It has been well documented that limited entry is seldom the long-term answer to the ill-structured property rights that underlie most instances of "The Tragedy of the Commons" (OECD 1997, Townsend 1990, 1992, Wilen 1988, 1989). However, limited entry can be effective if instituted early enough in the development of a fishery when total capacity is limited. In any case, limited entry, or some form of access limitation, is often a critical precondition to other and more effective conservation and management measures, such as comprehensive property rights.[3] Limited access is only an incomplete right, since exclusive use is not granted to an individual party or a well-defined group and it does not directly limit the catch of fish.[4] The incomplete right of limited access can generate short-term economic benefits, but over the long term these economic benefits erode through expansions in input usage not specified by the license on already active vessels, increased fishing by relatively inactive vessels, investment in the vessel and gear, and technical progress.

Critically, limited entry in any fishery, as an imperfect right (because it does not grant exclusive use to the resource, only access to use), does not fully solve the underlying incentives of fishermen trying to catch as many fish as soon as possible. Nonetheless, limited entry represents a major advance in the management of fishing capacity, use rights, and customary international law in the transnational setting, and limited entry provides the most promising and tractable next step forward towards more comprehensive rights-based management in many RFMO tuna fisheries. Because limited entry typically builds off some listing or registry of historical participants, and in some instances is in effect a closed RVR as in the Inter-American Tropical Tuna Commission (IATTC) region. RVRs can form the basis for limited entry regimes that are functionally the most immediate form of rights-based management in most of the global tuna RFMOs.

This paper discusses the possibilities for limited entry regimes in transnational tuna fisheries. Because the two key underlying problems for a transnational limited access program are to deter entry into the fishery and garner participation by those already in the fishery, considerable attention is paid to deterring entry and ensuring legitimate participation. Additional discussion focuses on the formation of common property by a well-defined group of participants under evolving customary

international law through the creation of a limited access program.[5] Transnational tuna fisheries, although unique, present sustainability and management challenges common to many transnational or share boundary stocks. This analysis may be of benefit well beyond HMS resources.

The paper is organized as follows. Section 2 reviews the RVR programs found in the HMS RFMOs, IATTC, International Commission for the Conservation of Atlantic Tunas (ICCAT), Western and Central Pacific Fishery Management Commission (WCPFC), Indian Ocean Tuna Commission (IOTC), and Commission for the Conservation Southern Bluefin Tuna (CCSBT). Section 3 briefly discusses some of the essential issues and Section 4 discusses entry and its deterrence in the transnational tuna fisheries. Section 5 discusses qualification and entry criteria. Section 6 considers some of the particular issues that arise, including defining the program at the vessel or flag state level, coastal and distant-water states, management of capacity units, differentiation by sector of the fishery, and RVRs and global vessels. Section 7 provides concluding remarks. The Appendix reviews limited entry programs in general to establish the general features of such programs, what they can be reasonably expected to achieve, and the conditions for success.

2. Regional Vessel Registers

During the past several years, some of the tuna RFMOs have initiated efforts to develop lists of vessels authorized to fish in their convention waters in an attempt to control the growth of fishing capacity in those regions. Three of these bodies, IATTC, ICCAT and IOTC maintain "positive lists" of longline vessels that are authorized to fish in the waters under their responsibility; vessels not on those lists would not be authorized to fish in the eastern Pacific, Atlantic or Indian Oceans. However, the lists do not limit the numbers of vessels that can be on them. New vessels can be entered on the lists if they meet the qualifications prescribed by the regional tuna bodies. The IATTC maintains a register which limits the number of purse seine vessels that can fish in the Eastern Pacific Ocean (EPO), and therefore limits the overall fishing capacity of purse seine vessels.

In the following sections, a brief review of each of these vessel registries is given, along with the

shortcomings and advantages of each regarding their effectiveness in limiting fishing capacity.

2.1. ICCAT

2.2. IATTC

After extensive international negotiation, the first measures to limit purse-seine fleet capacity in the EPO fishery were implemented in 1999 through a resolution that was agreed by the IATTC in October 1998. Purse-seine carrying capacity limits were assigned to each of the 13 nations involved in the fishery. (Not all of the 13 nations were members of the IATTC, but all participated in the negotiations to assign limits.)

During the negotiations, several factors were taken into account in assigning vessel limits. The most important was the level of catches taken during 1985-1998 by each of the 13 nations. Other factors that were considered were catches taken within the EEZs of the nations bordering the EPO, the landings of tuna from the EPO in each of the 13 countries, and the contribution of each of these nations to the conservation programs of the IATTC. For countries that were participating in the fishery during 1985-1998, the allocations of fleet capacity were approximately equal to the capacities of the actual fleets operating during 1998. Most of the coastal states of the region that did not have fleets insisted that the agreement provide the opportunity for them to acquire fleets. A capacity limit for assignment to each of these coastal states was negotiated by the governments, thereby assuring that they could acquire vessels within the framework of the program.

The total limit set by the resolution for purse-seine vessels in the EPO for 1999 was 158 thousand tons of carrying capacity (including current carrying capacity operating in the fishery and carrying capacity for some of the coastal states to acquire in the future). The scientific staff of the IATTC noted that a fleet carrying capacity of purse-seine vessels of about 130 thousand tons was adequate to harvest the current catches of tunas. The actual carrying capacity of the entire eastern Pacific purse seine fleet operating at the end of 1998 was 138 thousand tons. By the end of 1999, carrying capacity reached 158 thousand tons. It was clear that there was a rush to bring new capacity into the fishery before regulations prohibiting new entries could be enacted.

Unfortunately, it was not possible for the nations to agree to extend the resolution in its original form beyond 1999, although a resolution with a vague commitment to abide by the 1998 levels was agreed by the governments in 2000. The result was continued fleet growth, and by the end of 2002 it had reached nearly 180 thousand tons.

With growing concern over the large increases in capacity, the IATTC intensified its efforts to limit purse seine fleet growth. The governments agreed in June 2000 to establish a definitive list of purse-seine vessels authorized by the participants to fish for tunas in the EPO (the Regional Vessel Register, RVR). In June 2002 the Commission passed a comprehensive resolution to limit purse seine fleet capacity, which is still in effect and has not been modified despite several attempts to do so. The salient features of the capacity resolution establish that (1) any purse-seine vessels fishing for tunas in the EPO that are not on the RVR would be considered to be undermining IATTC management measures, (2) only vessels flying the flags of participating nations could be entered on the RVR, (3) carrying capacity would be measured as the volume of the fish wells, (4) the entry of vessels not included in the RVR to the purse-seine fleet operating in the EPO are prohibited, except to replace vessels removed from the RVR, (5) five coastal states bordering the EPO with no tuna fleets could add vessels to the RVR with a total combined carrying capacity of approximately 20 thousand tons, (6) a participant is defined as a member of the IATTC, and states and regional economic integration organizations, and fishing entities that have applied for membership or that cooperate in the conservation programs of the Commission .

The capacity management system established by the IATTC does not include the concept of national capacity allocations or limits, unlike the approach taken in earlier negotiating efforts. Instead, fleet capacity limitations are essentially determined by the Regional Vessel Register. Therefore, the key elements of the Resolution address how vessels may be added to or removed from the Register.

One reason for adopting this approach is that nearly five years of negotiations based on national capacity limits proved to be exceedingly difficult and did not produce a lasting agreement. Also, many countries recognized that a system without national limits provided

more opportunities for countries, particularly smaller nations without large fleets, to develop their tuna fleets and industries.

Although the current system is not based on national capacity limits, the Resolution does allow, as noted above, certain developing coastal states with no tuna fleets the right to add to their fleets "new" vessels that are not on the Register. The total allowable capacity for these countries is approximately 20,000 tons.

The program allows vessels on the RVR to transfer flag to any other nation with vessels on the Register, thereby allowing the nation to which the vessels transfers to increase its capacity by the amount of the transferred vessel, with a concomitant decrease in the total capacity of the nation from which the vessel transferred. If a vessel on the RVR is replaced, or its capacity increased, then a vessel of equal capacity, or an amount of capacity equal to the increase in capacity, must be removed from the RVR. And if a vessel is removed from the Register, the nation removing it can add a vessel of equal size.

In a manner of speaking, the RVR could, theoretically, create a market for trading capacity. A vessel owner or a nation desirous of increasing its capacity can offer to purchase vessels listed on the RVR. When purchased, the vessel, which would remain on the RVR, along with its capacity quota, would go to the purchaser. Once the RVR was established, any transfers of vessels among nations would result from market forces. However, the system created does not allow market forces to operate because it allows governments to intervene in the free movement of vessels.

There have been different views among the governments on the intent of the system with respect to the free movement of vessels to different flags of participants. The resolution does not specifically address this matter, but is written in a way that allows each government involved to decide if it wishes to allow a vessel to transfer flag and take its capacity with it, so to speak; or, instead, to remove the vessel from the RVR prior to the flag transfer, thus allowing the government to replace the vessel. The IATTC Secretariat has stated its understanding that the Resolution was intended to allow vessels to transfer flag and remain on the Register, but in practice

many, probably most, of the nations involved have adopted policies of dropping vessels from the RVR prior to the flag change. The effect of such policies is make it very difficult for vessels to change flags, since they cannot legally fish if they are not on the Register, and once dropped can only get back on the Register if they go to a nation that has capacity available to it.

The IATTC has made a considerable progress in limiting fishing capacity in the EPO, but one effect has been to make vessel transfers very difficult. Also, because of the way in which the Resolution has been implemented, several disputes have arisen over flag transfers,which has threatened the effectiveness of the Resolution and has resulted in pressure to increase overall capacity.

Most of the unused capacity from the special allocations and from the replacement of vessels that had sunk prior to the resolution (and were on a replacement list) had been used by late 2006, making it likely that the overall fleet capacity in the EPO will not increase significantly in future if the resolution is effectively implemented. The challenge for the Commission in the coming years will be to consider how to reduce the existing purse seine capacity, which will be very difficult.

The IATTC also has, like the WCPFC and the IOTC, a "positive" list of longline vessels, which is a list of large longliners authorized to fish in the ETP. However, also like the lists of the other tuna Commissions, the positive list is not a mechanism to limit the number of vessels allowed to fish, in that governments are free to add as many vessels to the positive list of they choose.

2.3. Western and Central Pacific Fisheries Convention

The WCPFC is the newest of the global tuna RFMOs, and is unique from the perspective that it was entirely negotiated *ex post* of the entry into force of the United Nations Implementing Agreement (UNIA).

The Convention text (see WCPFC.org) calls for each member of the Commission (which would include cooperating non-members and Territories or CCMs) to maintain a record of fishing vessels entitled to fly its flag and authorized to be fishing in the Convention Area beyond its area of national jurisdiction (this would include the high seas as

well as another nation's EEZ). CCMs shall also ensure that all such fishing vessels are entered on the Commission record (or what we have been referring to as a "RAV"). The Convention text (Article 24 parts 4, 5, 6) is explicated about the elements to be included on the vessel record (as set out in Annex 4 of the Convention text) and requires prompt notification[6] to the Commission of changes in of the information submitted. The Convention text requires prompt notification of additions to the record, and deletions as a result of voluntary relinquishment or non-renewal of a fishing authorization, the withdrawal of a fishing authorization, if a vessels is no longer entitled to fly its flag, the scrapping, decommissioning or loss of a vessel, or for "any other reason". The Commission is also required to circulate the information contained on the vessel record to all members of the Commission and, on request, individually to any member.

The Convention drafters clearly sought an open and transparent record that contained key data on all vessels fishing within the high seas area of the Convention. The text is however, silent to the issue of if, and when, vessels actually fished. This key facet may need to addressed before the record can be employed as the basis of any effort limitation or limit entry scheme. Table XX compares the WCPFC vessel record with other key elements of the other RAV of the key global tuna RFMOs as well as key reference instruments (UNIA, 1993 Compliance agreement etc.)

The WCPFC record is currently less than two years old, and as of this writing not all CCMs have provided the basic data required under the Convention. Additionally, several members have submitted incomplete data bases or submitted data on *all* vessels authorized to fish on the high seas of any ocean. As such, considerable additional work will be required before the WCPFC RAV will be both complete and useful in terms of its intended purposes under the Convention text, as well as other applications that may emerge over time.

The Commission has not addressed, in any of its resolutions, the question of whether the overall fishing capacity in the region should be limited, or the entry of new vessels restricted, although concerns have been expressed over capacity increases and the need to limit capacity.

2.4. Indian Ocean Tuna Commission

The IOTC has taken steps to record which longline vessels are authorized to fish in the region, but has not pursued similar measures for purse seine vessels. In 2002 the Commission approved measures to establish and maintain a Record of Authorized Vessels (RAV), i.e. a RVR, of greater than 24 meters in overall length authorized to fish in the Indian Ocean. The involved nations could add or remove vessels to or from the RVR, but the RVR itself does not limit the number of vessels authorized to fish. However, any vessel not on the RVR would be considered to be engaged in IUU fishing. Measures were also approved requesting that nations participating in the agreement undertake certain actions, such as closing ports to and prohibiting imports from vessels involved in IUU fishing, and prohibiting the use of their flag to vessels that had been involved in IUU fishing unless the ownership of the vessel had changed.

In 2005, the cooperating parties agreed that vessels of less than 24 meters in overall length that fish outside the EEZ must be on an IOTC list of vessels authorized to fish in the Indian Ocean, or they would be considered to be IUU vessels.

The measures for vessels greater than 24 meters in overall length, and for vessels less than 24 meters in overall length that fish outside the EEZs, taken together would tend to reduce the number of vessels operating in the fishery, in that it would make it difficult or impossible for an IUU vessel to operate profitably in the Indian Ocean. However, this approach does not, in itself,result in a reduction of vessels authorized to fish in the Indian Ocean.

In addition to the vessel lists, the IOTC in 2003 approved a resolution requiring each nation with more than 50 vessels on the RVR to limit the number of their fishing vessels greater than 24 meters in overall length to the number registered on the RAV in 2003. Exceptions to this limitation are made for some nations with fleets under development. In approving this resolution, the Commission expressed concern that the measures taken result in some

nations striving to bring their fleet capacity up to the 50-vessel guideline, resulting in an increase in capacity.

Also, it should be noted that the steps which have been taken only address longline fishing; no measures have been taken to limit the number of purse seine vessels, or even to place them on an authorized list.

2.5. The Commission for the Conservation of Southern Bluefin Tuna

The CCSBT is different from the other regional tuna bodies in that it is concerned primarily with southern bluefin tuna, and in that its area of concern is wherever this species is found. When CCSBT was formed, its three members, Australia, Japan, and New Zealand, were the only nations fishing for southern bluefin on a significant scale. A TAC of 12 thousand tons was implemented, and allocated among the three members. This provided the opportunity for the three nations to place controls on their vessels fishing for bluefin under the country allocations. In the case of Japan, certain restrictions were placed on the number of longline vessels that could participate in harvesting the allocation. Australia, through its own volition, implemented a kind of domestic ITQ system in which its share of the overall quota was partitioned among various Australian fishing companies, most of which were involved in aquaculture of bluefin. The companies control the number of vessels involved in harvesting Australia's share, and, because the industry seems to be limiting the number of vessels to reasonable levels, the Australian government has not considered it necessary to place overall limits on the number of vessels that can operate.

Over the last few years, however, the number of nations fishing for southern bluefin has increased. The Republic of Korea and Indonesia have joined the CCSBT, and the five members share a TAC of 14 thousand tons. An additional quota of 900 tons has been set aside for non-member states fishing for southern bluefin tuna. Recent concerns have focused upon potential unreported catches of sizeable magnitude.

In an attempt to stem the growing fleet size and increasing fishing pressure on southern bluefin, and in keeping with the intent of the FAO International Plan of

Action to Prevent, Deter and Eliminate Illegal, Unreported and Unregulated Fishing (IPOA-IUU), the CCSBT has created a record of vessels greater than 24 meters in overall length authorized to fish for southern bluefin tuna. The CCSBT considers any vessel that is not on the record and is fishing for southern bluefin to be engaged in IUU fishing. CCSBT members are urged to take certain actions against such IUU vessels in an attempt to correct the problem. The first action called for is to seek cooperation of the flag state of the IUU vessel in addressing the problem. If that approach fails, the members are urged to undertake more severe measures, including trade restrictions.

The impact of all these actions by CCSBT should serve to mitigate somewhat the problem of actual or potential excess capacity in the southern bluefin fishery, but, it is difficult to determine precisely how effective these measures are.

3. Essential Issues

The biggest challenge to limit entry on shared tuna stocks is establishing the conditions for international cooperation through gains from participation and compliance and deterring entry by non-parties and unauthorized actors. Gains to multilateral cooperation from reducing fishing capacity due to limited entry come from saving on losses due to overcapacity and excessive exploitation of common resources. Such gains at the level of the individual vessel include higher catch rates, longer seasons, and lower unit costs, and at the level of the entire industry lower investment and hence lower capital costs, and eventually expanding profits. Processors also gain through a more stable sustainable supply of fish, since TACs face less pressure for expansion into regions of greater uncertainty following a build-up of overcapacity. Ex-vessel prices could also fall due to higher production per vessel, giving lower costs to canners and consumers, while vessels benefits from lower costs as well.

Success requires that limited entry in a transnational fishery creates an aggregate gain and ensure that every party is better off with the program than without it, but to succeed the program also needs to ensure that each party would lose by not participating.[7] That is, free-riding through non-participation must be addressed by some credible means, such as a credible non-discriminatory trade

measure, as discussed below.[8] In addition to a negative incentive or stick, a positive incentive or carrot for participation comes to the remaining vessels through the aggregate gain from participating, in the form of increased profits, and to sellers of vessels and/or rights through compensation in the form of the payment.

In short, the two key challenges for the successful implementation of transnational limited entry programs are to deter entry into the fishery and elicit participation by the parties already in the fishery. Failure to invoke robust measures to deter entry as well as broaden participation to RFMO member countries will lead to the failure of limited entry as a management tool or even prevent limited entry from being considered in the first place.[9] As discussed below, the third, and most immediate, issue then becomes using limited entry to restructure incentives, to change behavior, and to ultimately favor greater conservation and profitability. The fourth fundamental issue is addressing the ever-continued growth in fishing capacity that erodes the benefits from limited entry. In most instances, the implementation of additional measures, such as an on-going buyback program, or additional restrictions on vessels and fishing days, or other supplementary measures, may be needed with the strengthening of rights-based management being the preferred option.

In summary, a transnational limited entry program needs to: (1) create an aggregate gain, so that all parties involved have a reason to participate; (2) distribute these gains equitably and transparently, so that all parties would prefer that the agreement succeed; (3) ensure that each party would lose by not participating, given that all the other parties agreed to participate; (4) provide strong and clear incentives for all the parties to comply with the limited access program; and (5) robust deterrents to entry by third or unauthorized parties.

4. Entry and Its Deterrence

1. Entry into a Transnational Fishery

A critical issue under existing international law is deterring non-parties to a RFMO from entering the fishery. Entry by new parties dilutes the gains from cooperation by existing parties, which in turn lowers the incentives of

existing parties to cooperate and lowers the aggregate gains that could be achieved if entry into the fishery were closed.[10]

Entrants to the fishery are most importantly new members with an interest in gaining membership in the RFMO and sharing the advantages and responsibilities on an ongoing basis.[11] In many instances, potential new entrants have lower fishing costs, sometimes through subsidies of various types, than existing operations. In other instances, the newcomer can be a coastal state that controls access to a large share of the resource and has development aspirations, and as such, requires accommodation. If the resource was fully utilized, the newcomer would have more difficulty receiving a share of the TAC, than if the resource is underutilized. Munro (2000) and BjØrndal and Munro (2003/2004) distinguish between the new member and the "interloper" who has only a sporadic interest in a particular fishery, and who is not interested in the ongoing gains and responsibilities of an RFMO. The interloper wants to take advantage of temporary, but possibly recurrent, advantages of entering the fishery for a short period, possibly under a flag of convenience, and then leave again as conditions deteriorate or conditions prove more favorable elsewhere or as part of a long-term strategy of fishing in multiple regions.

The UNIA, Article 8(3), provides that states having a "real interest" in the fisheries regulated by a RFMO may become members of that organization. The UNIA does not further define the term "real interest" (Plé 2000). New membership in most RFMOs does not necessarily guarantee immediate fishing opportunities, especially when the relevant target fish stocks are overexploited.[12] The UNIA lists criteria to determine the nature and participatory rights for new members, including the status of the stocks and the existing level of fishing effort in the fishery; the respective interests, fishing patterns and fishing practices of new and existing members; the contributions of new and existing members to conservation and management, data collection and scientific research; the needs of fisheries-dependent coastal fishing communities; and the needs of coastal states whose economies are dependent on the exploitation of marine resources. Given that the fishing opportunities for even existing RFMO members are often limited, and there is typically little, if any, additional fish to allocate to new members, if prospective

new members are not given the opportunity to fish, they may not have an incentive to join.

Entry may occur into the high seas portion of the fishery by states not a party to the existing cooperative agreement or which do not agree to abide by the conservation and management measures of the RFMO or other such body, as required by Article 8 of the 1995 UNIA (see also Articles 20 and 21).[13] But if fish are taken from the high seas in contravention of the relevant RFMO's conservation and management measures, such fishing may be deemed IUU fishing.

The number of nations and vessels, the composition of vessels from coastal and distant-water fishing nations (DWFNs), and alternative available fisheries all affect the ability of member parties to a RFMO to cooperate in deterring entry. Coastal and DWFNs are not homogenous; these nations vary among themselves and often compete with one another and can form alliances or sub-coalitions with one another, such as Parties to the Nauru Agreement in relation to the parties to the Palau Arrangement. Side payments, or transfers between and among participants, broaden the scope of bargaining and add to the flexibility and resilience of the cooperation that is required of member parties to deter entry.

2. Deterring Entry into a Transnational Fishery

Access to the fishery by non-parties can only be denied if the existing parties are willing and able to enforce relevant provisions related to exclusivity. International law does recognize that, along with the right to fish on the high seas, comes the obligation not to undermine RFMO fishery conservation efforts. But to have any material effect, this latter obligation needs to be enforced. Enforcement is a classical collective-action problem, which is more effective when perceived as legitimate by all states, and not just parties to the agreement. Any state can enter under the existing rules of international law.

To deter entry requires negative incentives -- sticks. Practically, sticks help enforce provisions for member parties and deter entry by non-parties. At least four sticks are available, the first addressing member parties and the last three addressing non-parties: (1) domestic laws forbidding reflagging vessels and enforcing the

agreement for member parties, i.e. domestic compliance; (2) deterring entry by non-parties through credible trade measures and changes in custom; (3) preventing IUU vessels from fishing in the EEZs of member parties; and (4), seizure of non-complying vessels or products of non-parties.

Domestic Compliance One stick to deter entry is for the parties to the regional agreements to pass domestic laws forbidding their own vessels from reflagging with states that are non-parties to fishery agreements (Barrett *et al*. 2004). The North Pacific Fur Seal Treaty required just such domestic legislation prohibiting pelagic sealing on the high seas (Barrett 2003). Similarly, domestic laws are required obligating each of the parties to the regional agreements to enact and enforce such legislation as may be necessary to limit entry of that nation's own vessels into the fishery beyond what is allowed by the regional agreement. That is, member parties need to deter non-compliance by their own vessels. But the principle that flag states control the conduct of their own fishing vessels can be problematic because flag states may have little or no incentive to vigorously enforce catch limits, control fishing capacity, or other conservation and management measures against their own nationals (Bederman 2000). Regulatory laxness is sometimes justified on the ground that other members' fishing fleets are not complying in full, so that one state voluntarily restraining its nationals from exploiting a common resource when other member parties do not is difficult to overcome.

The other three sticks relate to deterring entry to the fishery by non-parties (Barrett 2003). This can only work if the existing parties are willing and able to enforce this provision. Again, the Fur Seal Treaty accomplished this. The costs here may be higher, but entry deterrence still remains necessary.

Credible Trade Measures Trade measures, acting as a credible threat, are one of the few sticks available to deter entry by non-parties into a transnational fishery. The two trade measures are to prohibit imports from non-member fishing vessels observed fishing in a RFMO regulatory area and to prohibit landing, other port use, and transshipments from non-parties (transshipments from non-member fishing vessels to member fishing vessels, for example, allow circumvention of requirements for port

inspections) (Plé 2000, Barrett 2003, DeSombre 2005, Riddle 2006).[14] Trade restrictions in the form of prohibited imports and processing of fur seal skins in the only processing center of note, London, allowed the North Pacific Fur Seal Treaty to create common property through limited access.[15] This treaty deterred entry into the high seas pelagic sealing industry, effectively transforming open access into common property, improved on unilateralism, and made every party better off by creating an aggregate gain and distributed this gain such that all countries would prefer the agreement succeed. This is also the approach Japan has taken with regard to OPRT and longline capacity reduction. Almost all farmed bluefin and most of the wild-caught bluefin enters the Japanese sashimi market, providing Japan leverage if it wants to apply trade restrictions.

Most tuna RFMOs allow for trade measures, which can be applied to both members and non-members. The IOTC, for example, requested nations participating in the Record of Authorized Vessels of greater than 24 meters in overall length to close ports to and prohibit imports from vessels involved in IUU fishing and not grant the use of their flag to vessels that had been involved in IUU fishing unless the ownership of the vessel had changed (Joseph *et al*. 2006). ICCAT's use of multilateral trade restrictions on non-members represents the first time that such measures have been recommended by a RFMO to ensure cooperation with agreed conservation and management measures by these non-members (Plé 2000, Barrett 2003, DeSombre 2005, Riddle 2006).

Credible trade measures may be especially effective for stable commodities such as canned tunas. Approximately one-third of all canned tuna is consumed in the EU, which is currently or will be a member in all of the major tuna RFMOs. Approximately one-third of all canned tuna is consumed in the U.S., which is also a member of all of the tuna RFMOs except the IOTC and the CCSBT. CHECK ON THIS. If the EU and U.S. could apply trade sanctions that were jointly recommended by members of the tuna RFMOs, the lion's share of the canned tuna markets would be covered.

Custom (Customary Law) Trade restrictions may not always sufficiently deter entry by non-parties into transnational fisheries for highly migratory species (Barrett *et al.* 2004).[16] Barrett *et al*. (2004) observe that in these

instances, "…access has to be limited by another means. The treaty system approach won't work, ultimately, because states need not be parties. What is really needed is a change in customary law. But custom can't be written in the way that a treaty can be. Custom reflects actual behavior."

Evolving customary law is reshaping conditions to deter free entry by non-parties through the formation of RVRs in the tuna RFMOs, particularly closed RVRs. Joseph *et al.* (2006, p. 26) observe that, "…ICCAT and IOTC maintain "positive lists" of vessels that are authorized to fish in the waters under their responsibility; vessels not on those lists would not be authorized to fish in the Atlantic or Indian Oceans. However, the lists do not limit the numbers of vessels that can be on them. New vessels can be entered on the lists if they meet the qualifications prescribed by the regional tuna bodies." However, some registers take a further step, such as in the case of the IATTC register, which restricts fleet growth through sizes of vessels, although expansion by some coastal states is allowed in the IATTC program. The IATTC register has begun the transformation of open access on the high seas into nascent common property, by evolving global customary international law and formal international law on a more regional basis through the formal agreement of the States involved in the eastern Pacific fishery.

In effect, implicit recognition is growing that extending and strengthening rights of access through a form of limited entry is critical. These rights would be created by resolution within the treaty body. Use rights in the form of rights of access for a well-defined group and magnitudes of fishing capacity are emerging. Dolphin Mortality Limits are another form of use right that also developed in the Eastern Pacific Ocean under the IATTC through a strengthening of the AIDCP. Originally, the dolphin conservation program was instituted as an *ad hoc* agreement among governments and through a resolution of the IATTC. This lead to the creation of a binding treaty, the AIDCP, that now governs the program. Nonetheless, most of the action taken by governments under treaties establishing the RFMOs needs to be strengthened.

Relations among participants are restructured in the process of extending and strengthening rights of access through limited entry. These programs represent necessary *de facto* if not *de jure* attenuation of national sovereignty

within EEZs and especially on the high seas, for coastal and distant-water fishing states alike, beginning a functional evolution from open access to common property. In short, a transformation is occurring, through custom, from free entry to the resource to exclusive use of the resource by a well-defined group of participants, thereby creating a form of rights-based management in the form of common property. Custom is beginning to address the key problems of participation, entry deterrence, and strategic restructuring of incentives.

In a domestic setting, the government assigns property rights or there may be traditional rights. In an international setting, however, custom must do so. A closed RVR in a RFMO, as a form of access or use right also forming a common property under customary international law, must be recognized by other nations. Custom evolves for many reasons, but with the closed RVR, custom is evolving for purposes of both conservation and economics. Open access is evolving into limited access due to scarcity, compounded by increasing numbers of vessels that are often more productive.

Preventing fishing in member parties' EEZs Besides domestic laws deterring non-compliance by participants, trade measures and changing custom, a third stick might also help deter entry by non-parties into transnational fisheries. Precluding vessels that have engaged in high seas fishing in contravention of the relevant regional fishing agreement from fishing in the EEZ of member states might sufficiently reduce profitability of fishing to deter entry (Hannesson 2005b).[17] Just such an approach is potentially feasible in the Western and Central Pacific Ocean, where about seventy percent of the tuna stocks are found within the EEZs of the nations of the Pacific Islands Forum and where, as a consequence, access agreements to member EEZs are required for profitable purse seine fishing. In other regions of the globe, a higher proportion of the tunas are found on the high seas, and such an approach may help deter entry in conjunction with other measures, but may not be sufficient to stand on its own. A difficult, unanswered question is how to address a coastal state that may be fishing in its own waters in contravention to an international agreement. However, if the coastal state is Party to the agreement, then it is bound to restrict fishing by its own vessels pursuant to the agreement, even when they are fishing in its own waters.

Unilateral actions by member parties A fourth stick, one that may deter entry by non-parties, is something akin to Canada's 1995 seizure of the *Estai* on the high seas, Latin American seizure of U.S. tuna purse seine vessels prior to the expansion of EEZs to 200 miles, U.S. seizure of Canadian schooners pelagic sealing on the high seas in 1886-89, Russia's 1892 seizure of schooners pelagic sealing on the high seas, or the seizure today of vessels in the Pacific fishing with drift nets (Barrett 2003, Barrett *et al*. 2004). The North Pacific Fur Seal Treaty allowed signatory countries to seize a violating ship from another signatory country and deliver it to the violating ship's authorities, which were bound by their own domestic laws to tackle the issue. Several other existing treaties, most notable the UNIA. allow the vessels of one member party to board and inspect vessels of another party to the treaty, and some agreements go even further an allow the seizure (and return) of vessels and crews of parties that have committed a violation by another member party's vessels (Bederman 2000).[18]

Seizure of non-signatory nations' vessels goes a step farther. Barrett *et al*. (2004) observe that custom may never be established without states doing this. Direct enforcement of non-parties to fishery conventions on the high seas is not unprecedented in international law (Bederman 2000). The UNIA is an attempt to establish global guidelines for enforcing international and regional fishing regimes irrespective of whether the violator is a party to the agreement establishing the rule.[19]

Actions, such as seizure of vessels, must be perceived by others as legal. This, in turn, requires that the agreement must be seen to be legitimate. The rights of coastal states must be recognized, not least because these states can potentially undermine cooperation. It could be argued that the rights of other states must also be recognized, because through ordinary entry into the fishery, they can also undermine cooperation. But plainly the situations of these countries are different.

5. Qualification and Entry

Imposing strong limits on resource use raises the question of which community of users is initially defined as having use rights and who is excluded from access

(Ostrom *et al.* 1999). Joseph (2005) observes that to qualify to be entered on a number of RFMO's RVR a vessel would have to be considered to be actively fishing, and this term requires definition. To remain on the register, a vessel would have to continue to be active, according to the same or a similar definition. Establishing such a requirement would prevent vessels that have not been fishing from adding more capacity and would prevent a flood of vessels entering a region as soon as the intention to limit capacity became public knowledge.

Another facet of the eligibility issue is the allocation of licenses, units of fishing capacity, or shares of the catch in a way that satisfies all parties. The very process of devising methods of exclusion has substantial distributional consequences (Liebcap 1989). The allocation of use rights is governed by widely held beliefs about how rights are to be allocated; beliefs that are enshrined in custom (Barrett 2003). In most fisheries of the world, such rights are assigned to those who have exercised a consistent pattern of use over time (Ostrom *et al.* 1999). The IATTC Regional Vessel Register "grandfathered in" the existing participants in the fishery based on the current vessel sizes, measured in cubic meters of well capacity. Such an inclusive moratorium invariably codifies an existing condition of overcapacity and economic inefficiency, but nonetheless can provide the basis on which to initiate capacity reduction measure. The reliance upon historical patterns of use may be changing in the post-UNIA world, where for example, the WCPFC convention established 10 criterion, with no guidance on weighting (see Article 10.3)

Those who later desire to use a resource that has become commonly held after rights have been assigned and who have been excluded entirely may have to pay an entry cost (Ostrom *et al.* 1999). The growth of market mechanisms, whereby new entrants and existing fishers purchase the right to fish - licenses and capacity units - from existing participants, can provide a decentralized mechanism to facilitate new entry or expansion by current participants. Such market mechanisms are standard in national limited entry programs. Such market mechanisms are most efficient when licenses and capacity units are not tied to flags. If this feature of transferability was not retained, the effectiveness of the system would weaken and there would be less economic efficiency than would otherwise be realized.

The result would be a limit on fleet size that was fixed among nations and could be not changed without difficult and time-consuming negotiations, and the tendency would develop for capacity to grow over time (Joseph *et al.* 2006).

If licenses are tied to nations rather than vessels, then when one country enters, an existing country must withdraw some fishing capacity to maintain an existing capacity limit and to not contravene a buyback program. Matching the units of capacity is also more difficult with a thinner national market to draw on, and incentives are created to sell the vessel outside of the region and thereby exacerbate the overcapacity elsewhere. The value of a vessel would also drop substantially if it was bound to a flag state, and that state could impose on the vessel whatever constraints or monetary requirements it chose (Joseph et al. 2005). Maintaining transferability within the RVR system would also provide the opportunity for the have-nots to acquire vessels; they could compete in the market place for capacity allocations.

While new entrants may have to buy out the incumbent, this may not necessarily be seen as legitimate in a transnational setting (Barrett *et al.* 2004). Why should the incumbent have such an advantage? This would only perpetuate perceived inequalities over time. At the same time, inducing incumbents to give up their existing right of entry voluntarily will also be difficult without some type of compensation.

The units of a limited access program pose another issue: is entry limited simply to vessels of any size, or is there an additional qualification of limiting entry to vessels according to units of capacity? The IATTC, for example, limits the overall capacity, measured in cubic meters of wells, of member states rather than simply imposing a cap on the number of vessels (of any size) that can access the fishery. In contrast, the Palau Arrangement in the Western and Central Pacific Ocean had traditionally simply limited the number of purse seine vessels to 205 of any size, although it has been reported that the standard metric will soon be the vessel day.

6. Additional Issues

6.1. Coastal and Distant-Water States

The distribution of vessels and fishing capacity among coastal and distant-water states is an important issue. More generally, the unique nature of the required multilateral cooperation to manage fishing capacity when there is asymmetry among states, i.e. when there are important differences among the states, is a critical concern. This issue is not unique to fisheries. Major international environmental agreements, such as the Montreal and Kyoto Protocols, addressed similar asymmetries between developed and developing nations with the global atmospheric public goods of ozone-depleting chemicals and greenhouse gasses. Coastal states control entry into their EEZs and special privileges are enshrined in international law.[20]

Potentially viable limited entry programs have to provide for the expansion of vessels and fishing capacity by coastal states, a measure allowed by the IATTC, for example, in its RVR and capacity limitation program. This provision represents "side payments" (transfers of benefits from one party to another) and a strategic choice in response to the asymmetries between coastal states and distant-water fishing nations.[21] It also reflects an implicit agreement about use and property rights, beginning a transformation from open access to common property or use rights. This provision can be seen as a form of side payment and helps ensure that the countries, which might otherwise lose by participating, instead gain given that the others have agreed to participate. Such a provision is thus a strategic choice and can redefine the cooperation problem, making participation in the interests of coastal states.

Beside the provision for room to expand for coastal states, several other forms of side payment are possible, including decommissioning greater capacity from DWFN's fleets, assessing DWFN fleets at a different rate than coastal fleets in industry-financed buyback programs, and fractional licensing in which coastal states receive a fraction of a license greater than one and DWFNs receive a fraction of a license less than one (or some other variation with differential impacts on coastal and distant-water fishing states). As with the Montreal and Kyoto Protocols, side payments can be made for technology transfer or multilateral funds to finance fleet expansions by, in this case, coastal states. Limited allocation of

unused capacity to coastal states creates a reserve held by these states and is a form of side payment; just such an approach was adopted by the IATTC with vessel capacity (Joseph *et al.* 206). New entrants can purchase or lease this capacity with the proceeds accruing to the coastal states.

Alternatively, a limited percentage of license or capacity units, with limited duration of the right, could expire on a periodic basis, requiring repurchase for continued use or purchase by new entrants. Similar features appear in Chile's ITQ program, where this use right has a staggered and limited duration. New entrants might also be required to purchase additional units of capacity and retire some portion of the excess. Similar restrictions might apply to reinvestment, such as "stretching" of an existing vessel. Such features are common to many limited entry programs.

Reflagging can complicate the definition of a coastal and distant-water state. Coastal states with unused capacity, or perhaps more accurately the right of access measured in units of capacity (vessel size), allowed by a RFMO can invite vessels from DWFNs to fish under coastal state flags.

6.2. Management of Capacity Units

The traditional response in limited fisheries has been changes in vessel design and increases in other dimensions of the multi-dimensional capital stock (e.g. expanding GRT and engine power when length is limited and more efficient use of vessel time, i.e. spending less time in port) and accelerated adoption of technical advances. Nonetheless, if limited access is the best that can be expected in the foreseeable future due to the limitations of international law and custom, limits on growth of the physical measures of fishing capacity may be the preferred, albeit imperfect, management option. Replacement of existing vessels with new vessels might be restricted to vessels of the same size (within some tolerance, as in the IATTC RVR). Replacement with a larger vessel may also require purchase of the license for a second vessel to provide the necessary magnitude of capacity units. To counter the inevitable creep in vessel productivity or fishing power due to innovations, replacement of a vessel with one of the same

size could even require purchase of additional capacity units through purchase of another license.

6.3. Differentiation by Sector or Area

Limited entry programs can be differentiated by sector or methods of fishing. Transnational fisheries may be composed of different methods of fishing, for example between surface fisheries purse seining, pole-and-line and swordfish and deep-set longline fishing or within a fishery, such as sets on unassociated schools, dolphins, or floating objects. For example, one sector, such as the school fishery in the WCPO, may not be subject to overcapacity relative to yellowfin, bigeye, or skipjack tunas, but another sector, such as the floating object (FAD, log, etc.) fishery may be subject to overcapacity relative to bigeye and yellowfin tunas. Similarly, swordfish are caught by both drift nets and pelagic longlines. Under this approach, limiting total numbers of participants through a traditional license limitation program is a first step which eliminates the threat of further entry (Wilen 1989). Once in place, the fishery may be further subdivided into individual fisheries, each containing a fraction of the individual fleet and total quota. A complicating factor is the differing participation in different sectors by different nations.

Along similar lines, access rights can be attenuated to a specific and naturally definable geographic area, creating a well-defined group right with exclusive access, thereby creating an area licensing scheme (Wilen 1989). When the area of access is sufficiently restricted, the number of fishermen in each area is reduced, and a well-defined group of fishers is created, cooperative behavior by the individual players should be boosted. Wilen (1989, p. 261) observes, "At some point, as numbers are reduced, it becomes obvious to each group that controlled harvesting is superior to a frenzied race to maximize share of the (area) quota. …There is much anecdotal evidence in traditional limited entry fisheries that fishermen revert to cooperative behavior when numbers are small enough and the gains are clearly evident." This has been found to improve the conservation and management for other types of common resources (Ballard and Platteau 1996, Ostrom 1990).[22] Capacity is reduced in each area. Multiple area licenses can be held by a single vessel owner/operator.

6.4. Fractional Licensing

Fractional licensing at one fell stroke reduces fishing capacity, in contrast to limited entry programs which tend to "grandfather in" the entire fleet in a moratorium (Townsend 1992, Townsend and Pooley 1995, Joseph 2005). The management authority first establishes a target number of licenses (N). Once the number of qualifying fishermen, vessels, or standard units of gear (Q) is determined, the fractional value of the license is determined by dividing the target number of license by the number of qualifiers: N/Q. For example, if 200 vessels qualified for a target of 100 licenses, each qualifier receives 50 percent of a license. Freely transferable licenses allow consolidation of the fractional licenses into a whole license required to fish. Licenses can be further defined by different fractions for different vessel sizes or methods of fishing. While only N vessels are allowed to fish, the economic rents are shared among all Q fractional license share holders since fractions of licenses were sold on markets to assemble a full license. We are unaware of any instance or the application of this scheme to the tuna realm, although it does present an interesting possibility.

6.5. Regional RVRs and Global Vessels

The establishment of RFMOs for tunas in the different ocean basins did not fully eliminate the transnational externality, which has implications for limited entry. In the Pacific, the IATTC and the WCPFC manage tunas in the eastern and western parts of the Pacific, respectively, yet uncertainty remains whether there are biologically distinct stocks of fish in the different jurisdictions. Coordination is therefore required between the two regional fishery management organizations, as called for in Article 22 of the WCPF Convention. More critically, vessels harvesting highly migratory species are highly mobile, and readily traverse from one part of the globe to another. Control of fishing capacity by one organization may simply create spillovers to other regions and regional fishery management organizations as vessels fish in other areas and/or reflag. The potential also exists for vessels to engage in IUU fishing.

In short, limited entry in a transnational tuna fishery remains unilateral in a broad sense. Tunas

transverse large areas of the ocean basins and purse seine, longline, pole-and-line, and driftnet vessels harvesting these species can go a step further by spanning the globe. The transnational tuna fisheries are ultimately global, and global coordination of management, including limited entry, will be required to fully address the transnational externality.

7. Concluding Remarks

Extending and strengthening rights of access through limited entry is a fundamental first step for addressing excess fishing capacity in transnational tuna fisheries. Separate programs can be established for each of the major gear types, including purse seines, longlines, and pole-and-line. The most basic form of limited entry is a vessel moratorium, which precludes further entry into the fishery but incorporates existing vessels. More restrictive forms of limited entry do not encompass all existing vessels, especially those that are non-functional, inactive or only marginally inactive, or simply planned, and require continued fishing at some level to maintain a vessel's license. The more restrictive the limited entry program, the greater are the chances of success.

The development of RVRs within each regional tuna body provides the basis for establishing such a program of limited entry. The RVRs and the incomplete property right of limited access may not be the most efficient means of managing fishing capacity, or even the final long-term goal, but they represent the most practical step over the short term. Once RVRs in the form of limited entry have been established, more comprehensive rights-based management systems to address excess capacity can be developed, all of which fundamentally build upon limited entry in any case. After RVRs are developed for the regional tuna bodies, they can establish a global RVR to monitor global fishing capacity and to address the incomplete jurisdictions of the regional bodies and mobility of vessels that lead to spill-over effects from one region to another.

The biggest challenge to limit entry is establishing the conditions for international cooperation through gains from participation and compliance and deterring entry by non-parties and unauthorized actors. Enforcing provisions for member parties and deterring entry by non-parties

requires negative incentives, including: (1) domestic laws forbidding reflagging vessels and enforcing the agreement for member parties, i.e. domestic compliance; (2) deterring entry by non-parties through credible trade and customs measures, including prohibition of imports from non-member fishing vessels observed fishing in a RFMO regulatory area and prohibition of landing, other port use, and transshipments from non-parties; (3) preventing IUU vessels from fishing in the EEZs of member parties; and (4), perhaps even as far as creating new customary law through seizure of non-complying vessels or products of non-parties.

Transferable licenses, especially if tied to the vessel, allow adjustments to the fleet and facilitate economic efficiency. Perhaps most critically, a market for transferable licenses provide a decentralized mechanism whereby existing participants can readily exit the fishery or expand existing operations and new participants can enter. Accommodation can be made for developing countries in the form of coastal states to allow expansion of their industry.

Additional measures to limit on-going increases in fishing capacity from expansion of unregulated inputs and technical progress may be necessary. Limited entry programs often restrict maximum boat size permissible in the fishery, such as well capacity by the IATTC, in order to constrain fishing capacity. Combining licenses may be required in order to increase boat size. Limited entry also needs to be accompanied by other management measures that insure conservation of tuna stocks and the ecosystem, such as Total Allowable Catches, bycatch provisions, gear provisions, and other such measures.

Limited entry programs in transnational tuna fisheries requires *de facto* if not *de jure*, attenuation of national sovereignty within EEZs and especially on the high seas, for coastal and distant-water fishing states alike, beginning a transformation from open access to common property. Fortunately, while the LOS and UNIA do not address limited entry, there is nothing in them that makes limited entry difficult to achieve in a regional setting. Such a transformation is occurring, through custom, from free entry to the resource to exclusive use of the resource by a well-defined group of participants, thereby creating a form of rights-based management in the form of common

property. More critically, regional formal binding agreements limiting entry and creating closed RVRs are required.

Appendix: Limited Entry[23]

Background

Limited entry, first proposed by Sinclair (1961) and also called limited access and license limitation, sets a maximum number of fishing units (vessel and/or gear) allowed to participate in the fishery. Historically, the entry restriction has been applied to the number of vessels (often of particular lengths), to some index of the vessel's fishing power (a combination of vessel size and horsepower, for example), to a particular gear (such as the size or type of net used), or to specialized members of the crew (such as divers in an abalone fishery).

Licenses are allocated, usually *gratis* but sometimes sold, to each vessel or owner in the fishery, where the owner can choose the license with any vessel and gear. That is, the license can be tied to the vessel or gear, or the license can be held by the owner and used as the owner sees fit. When licenses are tied to the vessel, it is difficult to distinguish the value of the license and the vessel.

The access rights are most commonly issued to a group of historic participants. In some instances, these historic participants are divided into groups on the basis of some criterion, and different classes of licenses issued. For example, one group of licenses may be for a permanent group of fishers without expiration and another group of licenses may only apply to temporary fishers and may expire after a limited period of time and not be transferable.

The access rights may apply to the fisher or to the vessel. This limited access right can be transferable or not between vessels, where transferability is generally viewed as increasing the economic efficiency of the fishery. The duration of this right can range from a single season to perpetuity. In most limited entry programs in the world, this access right has unlimited duration, although in some fisheries the right expires when the owner exits the fishery and does not renew the license and cannot be transferred to a new owner outside of the fishery. That is, there can be a "sunset clause," which is intended to eventually reduce the size of the fishery. The right is generally not divisible beyond the unit of the individual vessel, although a fractional licensing system specifies divisibility at less than a single vessel in order to force

consolidation of licenses and reductions in fleet sizes. When there are different classes of licenses, each class may be treated differently in terms of transferability, duration, and divisibility. The access right may also be attenuated by restrictions on the gear, area of fishing, or season. Licenses may also be attenuated by restrictions on use as collateral or private loans or other limits on transferability, including restrictions on leasing or transferability to non-residents or different flag states.

License limitation programs are often accompanied by restrictions on maximum boat size (e.g. length) permissible in the fishery in order to constrain fishing capacity, requiring combining licenses in order to increase boat size, in a process called "pyramiding." The construction or purchase of a larger vessel then requires the purchase of two or more licenses, each with its own size restriction, to consolidate to allow the larger vessel. Limited entry programs also typically prohibit splitting larger licenses into more than one smaller license. Similarly, limited entry programs typically limit gear types, thereby prohibiting converting a vessel with one gear type into a vessel with a different gear type.

Conclusions

Several general conclusions have emerged about the effectiveness of limited entry programs in addressing overfishing, overcapacity, and economic inefficiency based on the global experience. One of the key limitations to the effectiveness of a limited access program is that most programs are established as moratoria on new entry that "grandfather in" a large number of active and inactive or only partially active participants due to political forces that favor the issuance of more licenses rather than less. Both the initial qualification criteria and the hardship appeals process are usually quite inclusive. A rush to qualify for licenses that exacerbates the problem frequently accompanies the program.

Conversely, the global experience demonstrates that more restrictive programs are more likely to be economically successful. The most restrictive programs either reduce capacity or close entry before capacity reaches rent-dissipating levels. Moratoria on entry including phased reduction in capacity have been marginally successful. The least restrictive programs, which are largely moratoria

with no capacity or effort reduction, seldom, if ever, generate economic rents (revenues in excess of the necessary costs of production).

Another common problem in limited entry programs is the expansion of unregulated inputs, fishing time, and investment for individual vessels, which is sometimes called "capital stuffing". When the number of vessels is limited, and even more likely, when vessel size or gear size and configuration are restricted, expansions in input size and use are a typical response. For example, limited entry programs limiting the length of vessels often induce the construction of new or reconstructed vessels that expand some other dimension of vessel size, such as tonnage, or might induce enhanced hull designs. Vessels might also fish longer as the economic conditions improve following a license limitation program.

On-going technical progress also limits the effectiveness of limited entry programs. Technical progress, such as electronics, leads to expansions in a vessel's productivity or fishing power. Nothing in a limited entry program is configured to block technical progress.

The problems associated with substitution of unregulated for regulated inputs, increased fishing time, continued investment, and technical progress highlight the problem of any input control, and limited access in particular. There is only an indirect relationship between the inputs or fishing effort and the catch, and limiting inputs or fishing effort seldom produces a direct and corresponding reduction in catch.

The more complex the fishery, the less effective is the limited entry program – although this problem is not confined to only limited entry, but plagues all fishery management. Multispecies fisheries and fisheries with important and diversified bycatch are more complex than single-species fisheries. Complex fisheries also include multiple gear types or methods of fishing, such as sets on dolphins, schools of tunas, or fishing aggregator devices. Complex fisheries also include vessels that participate in a number of other, different fisheries.

The level of program complexity affects the limited access program's effectiveness. Additional restrictions on the program are sometimes implemented to achieve certain

management objectives. For example, while transferability may be allowed, the regulatory body may curb transfers between boats with different gear types or different ports. However, such restrictions make it more difficult and confusing for individuals to operate within the system and can increase the management cost of implementing and monitoring the limited access program. Regulatory bodies carefully weigh the trade-offs between meeting management objectives by designing special rules, and the increased costs such complexity can generate.

Gains in economic rent following a limited entry program tend to be fully or partially capitalized into the value of the license or permit. These values fluctuate with changes in prices and catches.

Limited access can set the stage for subsequent conservation and management measures, most notably strengthened use rights and buyback programs, through establishing a well-defined universe of participants. Proper registration of licenses and vessels creates a well-defined group of eligible owners and delineates well-defined boundaries to the fishery and program. Without a pre-existing program of limited entry, ITQs, or some form of common or private property or use rights, funds from a buyback program can be used to purchase an upgraded or new vessel for the fishery or new participants may enter the fishery as it becomes profitable.

Limited entry is seldom the long-term answer to the ill-structured property rights that underlie most instances of overfishing, overcapacity, and economic inefficiency, as noted above. Critically, limited entry does not solve the underlying incentives of open access or incomplete property rights of individual fishers to catch as many fish as soon as possible – the "race to fish." Restrictions on inputs or fishing effort can help to slow down the race, but these restrictions also raise the costs of fishing and create thereby create economic inefficiency. Such restrictions also do not fundamentally alter the incentives facing fishers and the resource stock externality created by incomplete property rights.

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Endnotes

[1] The Parties to the Nauru Agreement are considering an Individual Transferable Effort (ITE) program for the right to fish via purse-seine in their Exclusive Economic Zones, but this program is in part possible because these nations control a large proportion of the fishing area through their EEZs and is also beyond the scope of this paper. Nonetheless, limited access may be an important, if critically overlooked, accompanying feature to preclude pressures to expand the Total Allowable Effort.

[2] When TACs are allocated among nations (forming a state use right), as with ICAAT, it is one more step for each nation to allocate its own share of the TAC among its own vessels, thereby providing an exclusive catch right in the spirit of an ITQ. Such rights can extend for any duration, from one year to perpetuity, can be divisible into small units of weight, and transferable. When such catch rights are not fully transferable and of sufficient duration of use, limited access remains an important accompanying management tool, or otherwise there could well continue to be pressures to expand the TAC and country allocations (Joseph *et al.* 2006). Dolphin Mortality Limits established by the International Dolphin Conservation Agreement under the IATTC represent such a step.

[3] Comprehensive property or use rights, which address such characteristics as exclusive use, divisibility of the right, duration, security, and transferability, are in many instances effective forms of management tools (Scott 2000). Comprehensive property or use rights in ocean fisheries can directly address the lack of exclusive use by individuals or groups, which is a major contributor to the commons problem in fisheries.

[4] Rights-based management not only entails use and property rights for individuals, such as ITQs or ITEs, but also use and property rights held by well-defined groups, giving common use and property rights (Baland and Platteau 1996). Baland and Platteau make clear that commonly held resources with effective management can lead to fully efficient resource exploitation. In some fisheries, voluntary agreements or cooperative management by a well-defined group of vessels, contracting with the regulator to self-manage an allocated share of the TAC, is leading to such an outcome (Pinto da Silva and Kitts 2006).

[5] Open access is a form of property right (*res nullis*), but in which no individual, group, or state has exclusive use, so that entry to the resource is open. Common property (*res communes*) is a form of property right in which exclusive use of the resource is vested in a well-defined group, i.e. is commonly held. In this case, the group is the signatories and cooperating parties in the IATTC. The common "ownership" is due more to custom than binding international law, so that exclusive use is through the IATTC, and exclusive use by this group does not provide for full deterrence of entry (and where any trade measures, acting as a credible threat, apply only to group members and not to non-members). The key question is the conditions under which common property or use rights can be created, particularly with transnational fisheries.

[6]Prompt notification has initially been interpreted as within 15 day however, recent evidence suggests that this standard may need to be relaxed somewhat.

[7] The second condition is that of Pareto Optimality.

[8] Free-riding is the situation in which non-participants in a cooperative resource management program enjoy the benefits of cooperation without cost. The participants bear the entire costs of cooperative resource management. Barrett (2003) argues that free-riding by non-participants is the binding constraint upon international cooperation. Barrett (2003) further states that when international cooperation is concerned with a (rivalrous or depletable) common resource, such as fish stocks, the Antarctic, or polar bears, rather than a (non-rivalrous or non-depletable) public good, such as the atmosphere, that entry into the exploiting harvest sector is an additional key binding constraint.

[9] Ostrom *et al*. (1999, p. 279) observe, "Managing common property resources involves two distinct elements: restricting access and creating incentives (usually by assigning individual rights to, or shares of, the resource for users to invest in the resource instead of overexploiting it…Limiting access alone can fail if the resource users compete for shares, and the resource can become depleted unless incentives or regulations prevent overexploitation." The individual rights can be extended to

common or group rights. Participation is an additional issue in transnational common resources (with their rivalry or depletion or subtractability).

[10] Article 11(a) of the 1995 UNIA requires existing members of an RFMO, when preparing to accommodate new entrants, to take into account the status of the relevant stocks and existing fishing effort. For further discussion, see Örebach *et al.* (1998), who state that new entrants to a RFMO must be offered a just and reasonable share of the available TAC; Kaitala and Munro (1997) demonstrate that this share can constitute a form of free-riding (the new member enjoys the benefits of cooperative conservation but does not bear the costs) and a threat to the stability of a cooperative agreement (since the payoffs to full cooperation could fall below the Threat Point payoffs of the charter members).

[11] Under Articles 8, 10, and 11 of the 1995 UNIA, new entrants must be accommodated by a RFMO. Article 8 indicates that only States which are members of a RFMO, or which agree to abide by the conservation and management of the RFMO, shall have access to the fish stocks of concern. States that ignore Article 8 and fish the high seas portions of the fish stocks managed by the RFMO, and in a way that is incompatible with the RFMO management, are engaged in unregulated, as opposed to illegal, fishing (Munro *et al.* 2002).

[12] The WCPFMC has taken up both the concept and the language of the UNIA.

[13] The UNIA does not permit the original members of an RFMO to bar would-be new members outright. Some commentators interpret Articles 8, 10, and 11 as permitting charter members of an RFMO to exclude would-be new members only on the basis of non-cooperation, in which new members refuse to abide by the terms of the RFMO management regime (BjØrndal and Munro 2003/2004, Orebech *et al*. 1998). Van Dyke (2000) argues that the language of Article 11 does not give a clear answer to whether or not new distant-water fishing nations must be allowed into a RFMO once established. Van Dyke further reasons that Article 11 seems to indicate that some new entrants could be excluded if the current fishing nations that have developed a dependency on the shared fish stock in question, and that developing

nations from the region would appear to have a greater right to enter the fishery than would developed nations from outside the region. Other commentators have restrictively interpreted Article 11 as conduct of actual and significant fishing operations in the region. Article 17(2) addresses non-member states that decline to cooperate with the RFMO not to authorize their vessels to operate in the area managed by the RFMO. Article 17(4) maintains that members "shall take measures consistent with this Agreement and international law to deter activities of such vessels which undermine the effectiveness of sub-regional or regional conservation and management measures".

[14] NAFO provides that non-member vessels that have been sighted engaging in harvesting in the NAFO Regulatory Area are presumed as undermining this agreement and shall not be permitted to land or transship any fish in a NAFO member port until it has been inspected. "In cases where such inspection exposes species regulated by NAFO, landings and transshipment will be prohibited unless the vessel can prove that the taking of this fish has not contravened NAFO rules." (Stokke 2000, p. 221) In addition, Articles 18 and 21 of the UNIA establish the legal conditions.

[15] A credible trade measure, built on a near-monopoly for processing, was one of the key factors contributing to the success of the North Pacific Fur Seal Treaty (Barrett 2003). Virtually all processing of Pacific fur seal skins was in London, giving a credible threat to restrict trade. Article III of the North Pacific Fur Seal Treaty banned imports of non-authenticated skins (the skins of seals killed by non-parties to the treaty). The trade restriction deterred entry by non-parties into the pelagic sealing industry because the entire pelagic harvest of sealskins was processed and sold in London. The treaty went a step farther. "Implicit in the original treaty is also a kind of "Grim" strategy calling for complete dissolution of the agreement and, by implication, a reversion to the disastrous open access outcome, should any of the parties withdraw at a later date." (Barrett p. 36, 2003)

[16] Four recent papers, Bederman (2000), Plé (2000), DeSombre (2005), and Riddle (2006) discuss trade sanctions against countries that are not members of an RFMO. They discuss CCLMR, ICCAT, and NAFO, which restricted market access for products and bans on transshipments and use of ports. In

addition, multilaterally agreed trade measures consistent with the World Trade Organization could include the adoption of multilateral catch documentation and certification requirements, and import and export controls or prohibitions. Such measures would be adopted in a fair, transparent, and non-discriminatory manner.

[17] In 1994, Norway introduced legislation prohibiting landings of catches taken on the high seas in defiance of international fisheries regulations. Stokke (2000, p. 220) observes that, "A more indirect way of using economic sanctions to coerce compliance with high-seas management measures, and one which does not depend upon voluntary port calls, is expressed in the Norwegian practice of blacklisting vessels engaged in unregulated high-seas harvesting from subsequent access to the Norwegian EEZ – even if the vessel has changed ownership in the meantime. This has served to reduce the second-hand value of vessels…" Similarly, from 1993 until 1995, Russia prohibited the allotment of catch quotas in the Russian zone to foreign vessels that had been engaged in harvesting in the Peanut Hole (Stokke 2000).

[18] Bederman (2000) lists the following treaties that allow some or all such practices: *International Convention for the High Seas Fisheries of the North Pacific Ocean; the Niue Treaty on Cooperation in Fisheries Surveillance and Law Enforcement in the South Pacific Region; Certain Pacific Island States – United States: Treaty on Fisheries; Convention on the Conservation and Management of Pollock Resources in the Central Bering Sea; Canada-European Community: Agreement on the Conservation and Management of Fish Stocks.* In addition, the 1993 FAO Compliance Agreement specifies the duty of parties to exercise effective jurisdiction over high-seas fishing operations by vessels flying their flags, including by taking measures to ensure that such vessels do not undermine the effectiveness of international conservation and management measures.

[19] Bederman (2000) cites Article 21, paragraph 1 and Joyner (1998). In addition, Article 64 calls for international cooperation with HMS, but there still can be problems with coastal states fishing within their own EEZs in contravention to international agreements. All problems will not be restricted to the High Seas.

[20] Joseph *et al.* (2006, p. 10) state, "Articles 56 and 61 of the Law of the Sea recognize the rights of coastal states to control access to the waters under their jurisdictions, and therefore to decide who can fish for tunas in those waters, with the caveat (Article 62) that, if the resource is not fully utilized, access to fish must be provided to the vessels of other states."

[21] Side payments are essentially transfers from one participant to another. The transfers can be in the form of money or in some other form. Side payments help broaden participation and make agreements fair and hence legitimate. Side payments, by which gainers of a policy can compensate those who bear the burdens, help insure that nations that would otherwise lose by participating instead gain.

[22] When area use rights are actually assigned, thereby creating a more well-specified property right than limited access, such a program is called territorial use rights for fisheries or TURFs (Christy 1992).

[23] This general discussion of limited entry draws from OECD (1997), Wilen (1988, 1989), Townsend (1990, 1992), Townsend and Pooley (1995), World Bank (2004), Joseph (2005), Joseph *et al.* (2006), Groves and Squires (in press 2007).