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**MANAGEMENT OPTIONS FOR BIGEYE AND YELLOWFIN TUNA IN THE  
WESTERN AND CENTRAL PACIFIC OCEAN**

Prepared by the Interim Secretariat

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## Background

In response to the recommendations of the second meeting of the Scientific Coordinating Group on Sustainable Fisheries Management (SCG2), the fifth meeting of the Preparatory Conference (PrepCon) resolved, among other things, that the Interim Secretariat be requested to "...prepare a paper on management options, to be delivered to the next session of the Preparatory Conference, on how the Commission could respond to sustainability concerns in respect of bigeye and yellowfin...". The full text of the Resolution is provided at Attachment 1. This paper has been prepared in response to that request.

## Purpose

The paper recognizes the need for PrepCon and the Western and Central Pacific Fisheries Commission (WCPFC) to take a broad and long-term view of fisheries management options while also responding to currently identified management needs. It is intended, therefore, that the paper provide a general platform for discussion of management options, both now and into the future, as well as providing a basis for discussion of the possible and feasible management response to the immediate sustainability concerns for bigeye and yellowfin tuna. As suggested by the SCG2 Report (para 19) the paper takes, as one of its starting points, the experience of other tuna Commissions. It is acknowledged, however, that there are particular characteristics of the fisheries in the western and central Pacific Ocean (WCPO) which may determine the relevance and appropriateness of management options.

With these factors in mind, the paper:

- outlines the context in which management options will be considered;
- identifies and canvasses the broad range of management options available, their application elsewhere and their potential in the WCPO; and
- comments on the appropriateness and feasibility of these options in the context of the specific sustainability concerns for bigeye and yellowfin tuna and the particular characteristics of the WCPO fisheries for these species.

## Context

Some of the important factors in consideration of options for highly migratory fish species in the WCPO are listed below.

- Article 2 of The Convention on the Conservation and Management of Highly Migratory Fish Stocks in the Western and Central Pacific Ocean (the Convention) specifies that the Convention's objective is "to ensure, through effective management, the long-term conservation and sustainable use of highly migratory fish stocks in the western and central Pacific Ocean in accordance with the 1982 Convention<sup>1</sup> and the Agreement<sup>2</sup>".
- The previous resolutions of the fourth Multilateral High Level Conference (MHLC) in 1999 and PrepCon III in 2002 " ...urged all States and other entities to exercise reasonable restraint in respect of any expansion of fishing effort and capacity in the Convention Area and to apply the precautionary approach forthwith...."<sup>3</sup>.

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<sup>1</sup> The UN Convention on the Law of the Sea of 10 December 1982 (UNCLOS)

<sup>2</sup> The Agreement for the Implementation of the Provisions of UNCLOS relating to the Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks

<sup>3</sup> Resolution of the Preparatory Conference relating to illegal, unreported and unregulated fishing and limits on fishing capacity, 22 November 2002 (WCPFC/PrepCon/22)

- Despite these resolutions, there is considerable potential for effort and capacity in the WCPO to expand and this is likely to occur in the absence of management action by the WCPFC.
- There are a range of regional (the Palau Arrangement<sup>4</sup>, bilateral access agreements, the Nauru Agreement<sup>5</sup>, the US Multilateral Treaty<sup>6</sup>) and national fisheries arrangements already in place in the WCPO.
- SCG2 recommended that:
  - given the possible worsening status of the bigeye stock suggested by the 2003 assessment, the concept of the precautionary approach should be applied. The most practical immediate management recommendation in support of this approach would be to ensure there is no increase in fishing mortality on bigeye.
  - to reduce the risk of the yellowfin stock becoming over-fished further increases in fishing mortality (particularly on juvenile yellowfin) in the WCPO should be avoided.
  - if the assessment results for bigeye, and to a lesser extent yellowfin, are confirmed the PrepCon will need to consider how to implement management measures to address overfishing and alleviate over-fished stock conditions.

For the purposes of this paper these recommendations are used as the management objective against which options are assessed. In an operational sense the question for management is "Which management option/s provide the most feasible and effective means of ensuring that mortality of yellowfin and bigeye are not increased and, if necessary, of delivering a reduction in fishing mortality of bigeye and yellowfin?"

## Management Options

The discussion of management options below is drawn from a range of sources including fisheries management texts (eg King 1995) and the consideration and application of management options by other fisheries agencies, arrangements and tuna Commissions. The options are discussed following the classification adopted by the FAO (FAO 1997). In practice, no single management tool will address all management issues and a package of measures is likely to be necessary. For the purposes of this analysis, however, management measures are considered in isolation.

Each management option has its own set of characteristics in respect of factors such as: ease of implementation; the need for, and basis of, allocation; management costs; monitoring; observer coverage; compliance; data and research needs; impact on behaviour of fishers; and impact on the economics of fishing operations. The following analysis does not attempt to assess the options against each of these characteristics. Rather, it identifies the key, recognized positive and negative characteristics of each option so as to provide a basis for discussion at PrepCon VI and, ultimately, to assist in identification of preferred management options. Those will need to be subject to more detailed assessment and comparison against specific characteristics such as those identified above.

It is acknowledged, as recognised in the Resolution (Attachment 1) that there are some key data deficiencies, particularly in relation to catch, effort and size composition of the fisheries in Indonesia and the Philippines. The lack of reliable data from these fisheries increases the uncertainties in stock assessments and has ramification for all management options that rely

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<sup>4</sup> The Palau Arrangement for the Management of the Western Pacific Purse Seine Fishery

<sup>5</sup> The Nauru Agreement concerning Cooperation in the Management of Fisheries of Common Interest

<sup>6</sup> The Treaty on Fisheries between the Governments of certain Pacific Island States and the Government of the United States of America

on the results of those assessments. This is not the only source of uncertainty in the stock assessments and in the short term uncertainty is a constraint within which analysis of management options must be made. Even in the longer term it is unlikely that uncertainty will be eliminated.

## **Output controls**

Output controls aim to control the total catch directly by setting an upper limit on catch. The catch limit can relate to the total catch of a species (or group of species), catch in a specified area (eg high seas or in-zone), catch by a gear type (eg purse seine and longline) or catch of a certain size of fish. The two most recognized forms of output controls are competitive quotas and allocated quotas. Both rely on the establishment of a total allowable catch (TAC) and the basis for setting a TAC needs to be considered. If the fisheries management objective is to ensure catches are kept within sustainable limits then output controls based around the setting of a TAC provide the most direct management response to achieving that objective, assuming that the TAC can be adjusted in a timely manner in response to changes in stocks, and that monitoring and enforcement are adequate.

### **Competitive quotas**

A competitive quota involves the setting of a TAC, commonly on an annual basis but it can be for shorter or longer periods, for which participants compete until the TAC is reached and the fishery is closed.

Only where effective monitoring and enforcement measures are in place can a competitive quota provide effective control on total removals. Real-time monitoring of all catches supported by monitoring of reported catches through observer and port sampling programmes or a form of catch/trade documentation scheme would be required. After the TAC has been reached enforcement is relatively easy since fishing is prohibited, although enforcement may be more complex in a multi-species fishery.

A competitive quota avoids the difficulties associated with decisions on how the TAC should be allocated. Unfortunately, this also gives rise to the major recognized deficiency of a competitive quota approach, that is, rather than preventing a long-term increase in capacity, it actively encourages it. Competing fishers race to obtain a larger share of the TAC before it is filled and the fishery is closed. In order to gain advantage in this race, fishers invest in more vessels or in increasing the power of their vessels. The economics of fishing is, therefore, squeezed by increasing costs. This increases the risk of illegal fishing and/or transfer of effort to other species/areas as operators seek to maintain an adequate economic return on their investment.

In order to ameliorate the impact of the race to fish, competitive quotas can be accompanied by other controls such as limits on the amount of fish that may be landed per day or per trip. Such controls will be likely to further reduce the economic efficiency of vessel operations.

Where the TAC relates to a particular species, incidental catch of that species after the TAC has been reached may occur. The integrity of the TAC can be compromised by these mortalities unless they are taken into account in setting the TAC.

Safety of fishers may be compromised under a competitive quota since the incentive to take greater risks with respect to weather, to make catches before the TAC is filled, is high.

*Application elsewhere*

Competitive quotas are used by the Inter-American Tropical Tuna Commission (IATTC):

- An overall catch limit on purse seine catches of juvenile bigeye was in place between 1998 and 2001 that triggered a closure of the purse seine fishery on floating objects. The closure was triggered in 1998 and 1999.<sup>7</sup>
- A TAC was first applied to yellowfin in 1966 and remained in effect until 1979 when overcapacity and falling economic returns made it impossible for governments to reach agreement to close the fishery in time to stay within the recommended catch limits (Joseph 2003). A total catch limit applied to the purse seine catch of yellowfin tuna in the Commission's Yellowfin Regulatory Area in 1998, 1999, 2000 and 2001<sup>8</sup>. A maximum of 15% of yellowfin in the total catch of each vessel was provided for after the limit was reached.

These measures are monitored in the Eastern Pacific Ocean (EPO) by 100% observer coverage.

A competitive TAC for southern albacore has been in place in the International Commission for the Conservation of Atlantic Tunas (ICCAT) since 1998. Countries actively fishing for southern albacore compete for a TAC while others are subject to a catch limit of 100t<sup>9</sup>.

*Potential application in the WCPO*

In the WCPO the need to contain expansion of capacity and hence fishing effort, has been recognised for at least five years. A competitive quota would encourage rather than prevent further expansion of capacity and effective effort. The effective implementation of such a system would require the parties or the WCPFC to monitor catch on a near real-time basis and to effectively enforce a closure. The feasibility of a competitive quota in the WCPO is complicated by the balance of in-zone/high-seas catch and the use of bilateral and multilateral agreements between coastal states and distant water fishing nations. The movement and inter-annual variability in the geographical abundance of tuna stocks could result in inequalities in access to the stock under a competitive approach.

Competitive quotas are not likely to be an effective mechanism as the major instrument for regulating fishing mortality on target species in the WCPO tuna fisheries. However, they may have a role in particular circumstances. For example, a competitive TAC, along the lines of the IATTC's competitive TAC for juvenile bigeye, could be used to manage juvenile bigeye bycatch in the purse seine fishery. However, as in the EPO, the TAC might only take effect in periods of relatively high abundance of juvenile bigeye. When recruitment was poor, and the need to reduce fishing mortality more critical, it is unlikely the TAC would be reached and it would make no contribution to addressing sustainability concerns. In theory, a TAC for juvenile bigeye could be adjusted to reflect short-term recruitment changes, but in practice, it may not be possible to gather the data, undertake the stock assessment and adjust the TAC to reflect changes in abundance in young fish in the time frame required.

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<sup>7</sup> IATTC Resolution on Bigeye Tuna June 1998; IATTC Resolution on the Conservation and Management of Bigeye Tuna in the Eastern Pacific Ocean, July 1999; IATTC Resolution on Bigeye Tuna, 16 June 2000; IATTC Resolution on the Conservation of Bigeye Tuna in the Eastern Pacific Ocean, 21 June 2001.

<sup>8</sup> IATTC Resolutions on Yellowfin Tuna, June 1998, June 1999, June 2000 and June 2001.

<sup>9</sup> Recommendation by ICCAT on Limitation of Southern Albacore Catches (96-6); ICCAT Recommendations - Revision, Implementation and Sharing of S. Albacore Catch Limit (98-9, 00-7 and 01-6); Recommendations by ICCAT on the Southern Albacore Catch Limit and Sharing Arrangements for 2003 and 2004 (02-6 and 03-7).

## **Allocated quotas**

Under a system of allocated quotas the TAC is subdivided into shares (usually as a percentage converted to a tonnage of catch) for nations, fleets, fishing enterprises or vessels. The shares may be transferable (individual transferable quotas (ITQs)) or non-transferable.

As with competitive TACs the cap on total catch provided by allocated quotas can provide an effective direct control over the level of mortalities if it is adequately monitored and enforced. However, allocated quotas have the potential to address a number of the deficiencies of competitive quotas by generating incentives for economic rationalisation of fishing operations. The nation, fleet or individual fishing enterprise can make rational decisions on the appropriate level of capacity to take its allocated tonnage, when to fish, how much time to spend on vessel maintenance etc. Compared to competitive quotas, catch tends to be spread over a longer period with obvious benefits for processing, marketing and economic returns.

Allocated quotas encourage the adoption and implementation of effective conservation measures since each individual, fleet or country has a vested interest in maximising the long-term value of their allocation, in terms of the quantity of fish it entitles them to take.

Where quotas are allocated to individual operators or vessels an incentive for discards and high grading can be created. Discarding and high grading does not occur only in allocated quota fisheries. However, under allocated quotas, there is an additional incentive to discard to maximise the value of catches within the quota, and discarding may even be required by regulation when catch over and above allocated quota is taken. This can compromise the integrity of the TAC. Provisions that allow carryover/under of allocations from one year to the next can alleviate, although not eliminate, the problem. A monitoring programme to effectively estimate discarding is necessary with an allocated quota system.

Transferable quotas offer additional benefits. They are recognised as providing a mechanism for autonomous adjustment of overcapitalized fleets. The proceeds of the sale of an allocation by less efficient operators to more efficient operators may enable some operators to leave the fishery. Transferable quotas may also go some way to addressing inter-annual variations in the spatial availability of fish (eg within EEZs/high seas).

The accuracy of the TAC is an important element of the success of an allocated quota system. If the TAC is significantly overestimated relative to market demand or sustainable production, for example, there becomes little difference between a competitive and allocated quota system. If the TAC is underestimated, fishers may lose confidence in the system and bycatch and discarding of the species may distort catch records and subsequent stock assessments. The difficulties associated with TAC setting are increased in fisheries with high inter-annual variability in abundance.

Allocated quotas, by definition, require decisions on the basis by which shares are to be determined. This can be contentious and can cause significant delays in the implementation of management measures.

Allocated quotas provide an incentive to under-report catch and therefore require an effective quota monitoring system. The effectiveness and cost of such a system is affected by the size of the fleet, the geographical dispersion of the fleet and landing sites, the number of marketing channels and the proximity to other fisheries that take the same species but are not subject to quota. The failure of the quota monitoring system may lead to the TAC being exceeded and the data set used for stock assessment being corrupted. The costs of reliable monitoring and enforcement systems are likely to be high especially in the establishment phase. Once established, however, running costs may not be significantly higher than those incurred by monitoring and enforcement of input controlled systems.

In an international context, output controls, applied as national allocations of catch, provide participants with relatively high levels of flexibility since they are free to choose the measures they apply at a national level to operate within those catch limits.

#### *Application elsewhere*

The Commission for the Conservation of Southern Bluefin Tuna has allocated a TAC for southern bluefin tuna among its members since 1994, although catch limits have been agreed and allocated between the three original members (Japan, Australia and New Zealand) since 1985. Monitoring and surveillance of catch to ensure country allocations are not exceeded is the responsibility of each country.

ICCAT has adopted allocated quotas in its East and West Atlantic and Mediterranean bluefin fisheries; its North Atlantic albacore fishery; and its South and North Atlantic Swordfish fisheries. TACs have generally been set and allocations made for periods of 3-4 years.

#### *Potential application in the WCPO*

The scientific research and expertise available in the WCPO means that the capacity exists to set TACs for the main tuna species. The WCPFC could choose to allocate these TACs as quota for one or more species. If so, given the interaction between the catch of the longline and purse seine fisheries, there may be benefits in allocating quotas for at least the three main species (bigeye, yellowfin and skipjack). There are a range of ways in which national catch limits could be set or allocated and this might be a substantial task for the Commission. Depending on the basis upon which an allocation of catch might be made, the lack of reliable catch statistics, especially with respect to fisheries in Indonesia and the Philippines, may be a constraint.

Establishing the time period for TAC adjustments would be an issue in the WCPO. In general, adjusting TACs in an international regulatory framework is more cumbersome and less timely than making adjustments at a national level. Ideally the time period for adjustments would be shorter for the purse seine fishery in the WCPO because it takes younger fish (reflecting IATTC experience with essentially annual adjustments for yellowfin), and longer for longline fisheries targeting older fish (reflecting the ICCAT experience with, largely, three year periods).

Whether allocated quotas should be transferable or not may depend in large part on the institutional capacity available in the short term to administer a system of transferable rights.

There is high inter-annual variability in tuna abundance in the different areas within the WCPO. An allocated quota system would need to incorporate sufficient flexibility to deal with this. Seasonal transfers of quota and/or the incorporation of carryovers/unders of quota might need to be considered.

A combination of high levels of observer coverage, port monitoring of landings, at-sea inspection together with a catch documentation scheme might be required.

#### **Trip/Vessel/Country limits**

Output controls can also take the form of catch limits per trip or per vessel. In the absence of 100% observer coverage these measures are likely to result in increased discards.

In an international context it is possible to limit the total catch of vessels from each participating country to their catch in a specified earlier year or time period. This could be done without setting a scientifically based TAC but would serve to entrench the historical position of participants. Such an approach raises problems associated with excluding new entrants, or providing for the development aspirations of some members. These issues can be addressed by applying the limits only to those countries reaching a threshold on catch or

number of vessels, or exempting developing coastal states from the limits. However, this means that there is no effective upper limit on catch. Such measures require substantial monitoring.

#### *Application elsewhere*

The Indian Ocean Tuna Commission's (IOTC) Working Party on Tropical Tuna (WPTT) considered the use of trip limits on skipjack catches by purse seine vessels as a means of reducing mortality on juvenile bigeye and yellowfin tuna but found that it would be difficult to implement, would lead to a decrease in skipjack catch, only a possible reduction in the number of sets on fish aggregation devices (FADs) (and hence reduction in mortality of bigeye and yellowfin) and increased discards of skipjack (IOTC 2003).

ICCAT and IATTC have set catch limits for participants based purely on catch history in a particular period.

- In 2001, 2002, 2003 and 2004 ICCAT limited the catch of Atlantic bigeye by Contracting and Cooperating Non-contracting Parties to the average taken in 1991 and 1992. However, the restriction does not apply to participants whose reported catch in 2000 was less than, initially 2000t, now 2100t. Carryover/under of catch to the following year's limits was provided for.<sup>10</sup>
- IATTC has limited the 2004 longline catch of bigeye in the EPO by Contracting Parties to a level not exceeding their catch in 2001<sup>11</sup>.

#### *Potential application in the WCPO*

Given the relatively small quantities of bigeye and yellowfin tuna taken in the purse seine fleet in the WCPO the imposition of skipjack trip/vessel limits in order to reduce the impact on bigeye and yellowfin is likely to have similar impacts to those identified in the Indian Ocean.

A system whereby countries are restricted to their catch in a particular period but with exceptions to cater for smaller, developing fleets may have some value as a short-term measure. Such a system may have merit as an interim arrangement, pending, for example the development of longer term allocated controls on catch or effort, by restricting further expansion of industrial fisheries. However, in the long run it is unlikely to control overcapitalisation or overexploitation since it does not restrict the total catch.

Monitoring and enforcing catch limits would be relatively onerous in the WCPO given the diverse nature of the tuna fisheries. However it may be feasible to design a monitoring and enforcement arrangement for bigeye (at least for longline-caught bigeye) given the lower volume of the bigeye catch compared to yellowfin and the nature of bigeye markets.

## ***Input controls***

Input controls directly restrict one or more of the group of inputs (eg vessels, gear, fishing time) which, in combination, produce total fishing effort and, ultimately, catch. Input controls do not directly control catch, but can more directly control the rate of fishing mortality, if catchability remains relatively constant. Many fisheries managed under input controls require analysis of effective fishing effort and its relationship to catch in order to adjust controls regulating effective fishing effort in the fishery over time.

Like output controls, input controls can apply to a fishery, a specified area, a fleet or gear type and, if allocated, can be allocated according to nations, fleets, fishing enterprises or vessels.

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<sup>10</sup> ICCAT Recommendations on Bigeye Tuna Conservation Measures (01-1, 02-1 and 03-1).

<sup>11</sup> IATTC Resolution on the Conservation of Tuna in the Eastern Pacific Ocean (C-03-12)

Input controls remain a widely used fisheries management tool. This is despite widespread recognition that they generally fail to prevent over-exploitation and the development of over-capacity. This failure stems largely from so-called "capital stuffing" where restraints on one or more inputs are compensated for by investment in other inputs. A control on, for example, the number of vessels does not preclude remaining vessels fishing for longer, using new technology to fish more efficiently, setting more hooks, using larger nets, increasing the use of transshipping and support vessels, or increasing FAD use. As a result, input control regimes tend either to need regular adjustment of the total allowable effort (TAE) to take account of effort creep, or to become subject to a complex web of ever-increasing regulation as new attempts are made to wind back capacity, effort and catch.

Input controls need to be gear specific in order to avoid the substitution of one gear type for another, eg a single longliner by a super seiner.

Some input controls lend themselves to transferability, eg licences, numbers of days that can be fished, number of nets or hooks and units of vessel capacity or engine horsepower. In such cases a TAE that will produce what is estimated to be the sustainable harvest is determined and, generally, allocated between participants.

Input controls may cater better for inter-annual fluctuations than output controls in an international setting where it is difficult to adjust TACs quickly or substantially, and especially where catchability is relatively constant. They may also be easier and less costly to monitor and enforce than output controls, especially those in multi-species fisheries where output controls require separate TACs to be set for a range of species. The risk to corruption of data is also lower under input controls since they do not provide an incentive to fishers to misreport catch. Input controls do not provide any additional incentive to discard and high-grade catch (FAO 1997).

The effectiveness of input controls can be increased where they are applied within the framework of community-based fisheries management arrangements where the rights enjoyed by the community encourage fisher behaviour that promotes conservation.

At the international level, input controls generally provide less flexibility than output controls. As noted above, national catch allocation schemes leave countries with flexibility to choose management measures that keep their catches within the allocated limits. With capacity or effort allocations, there is much less flexibility available to countries in the implementation of limits at domestic/national levels.

Input controls relate generally to controls on capacity in terms of the number or size of vessels, or on other measures of effort such as fishing days, and hook numbers or hook days. These two forms of input control are discussed separately below.

## **Capacity**

Measures to control capacity may restrict:

- the number of participants (vessels or licences); and/or
- the type, size or power of vessels; or
- some measure of the aggregate fishing capacity (number times size).

Restriction of boat numbers/licences is a very coarse proxy for effort. On their own, limits on the numbers of vessels and/or licences are generally ineffective since, as discussed above, other inputs are used to increase the effort of the limited number of boats. In addition, where the vessel limit represents a reduction in existing numbers, the impact on effort in the fishery will be determined initially by the relative efficiency of the boats that depart and those that

remain. Such measures are, therefore, usually accompanied by restrictions on the size or power of vessels and vessel replacement policies, which restrict the size of new vessels to that of the replaced vessel.

Capacity limits are often seen as contributing more positively to enhancing the economic viability of fleets than some other options, and economic objectives are often important in the design and implementation of arrangements for capacity limits.

#### *Application elsewhere*

Capacity limits are the most widely used measure for limiting tropical tuna fishing. The other three tropical tuna Commissions all have in place some form of capacity limits.

- The IATTC has applied, in the past, limits on purse seine capacity based on allocations of carrying capacity to Contracting Parties and other cooperating States. Currently, it has in place limits on the entry of new purse seine vessels based on the IATTC Regional Vessel Register, and on expansion of capacity of existing purse seine vessels<sup>12</sup>. The IATTC also committed itself in 2000 to the adoption of a Plan for Regional Management of Fishing Capacity giving priority to management of fishing capacity in the tuna purse seine fishery but also seeking to address management of longline capacity. The IATTC has considered an overall size limit for individual purse seine vessels.
- ICCAT has applied, since 1999, a measure limiting the number of vessels >24m length overall (LOA) that each Contracting and Cooperating Non-contracting Party, may operate in the Convention Area to the average number of its vessels that fished for bigeye in 2001 and 2002<sup>13</sup>. The restriction applies to States and entities that caught on average more than 2,000 tonnes (now 2100t<sup>14</sup>) in the previous five years. A limit on gross registered tonnage (GRT) also applies.
- The IOTC has adopted a measure restricting the number of vessels >24m LOA, and GRT, of those Contracting Parties and Non-contracting Parties that have more than 50 vessels on the IOTC Vessel Record, to the number registered in 2003. A vessel replacement policy also applies.<sup>15</sup>

#### *Potential application in the WCPO*

The Fourth meeting of MHLC and PrepCon III adopted resolutions that " ...urged all States and other entities to exercise reasonable restraint in respect of any expansion of fishing effort and capacity in the Convention Area and to apply the precautionary approach forthwith...."<sup>16</sup>.

The Parties to the Palau Arrangement have had in place, since 1993, a limit on the number of purse seine vessels that can be licensed to fish in their waters (the source of around 75 per cent on average of the catch of the major regional purse seine fishery). The limit is currently 205 vessels. The Parties have announced their intention to restructure the Arrangement to limit effort (in vessel days) rather than capacity.

The US Multilateral Treaty with Forum Fisheries Agency (FFA) member States sets a limit on the number of US purse seiners that can be licensed by these States.

Moving beyond the general formulations relating to limits on capacity in the WCPO as set out in the MHLC and PrepCon resolutions would require progress on allocation.

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<sup>12</sup> IATTC Resolution on the Capacity of the Tuna Fleet operating in the Eastern Pacific Ocean (Revised) (C-02-3).

<sup>13</sup> ICCAT Recommendation on Fishing Vessels >24m LOA (98-3)

<sup>14</sup> ICCAT Recommendation on Bigeye Tuna Conservation Measures (02-1)

<sup>15</sup> IOTC Resolution on the Limitation of Fishing Capacity of Contracting Parties and Cooperating Non-contracting Parties (03/01).

<sup>16</sup> Resolution of the Preparatory Conference relating to illegal, unreported and unregulated fishing and limits on fishing capacity, 22 November 2002 (WCPFC/PrepCon/22)

Implementing broader limits to purse seine capacity in the WCPO could draw on the experience in the EPO with the use of catching capacity and well size. In the longer term, the effectiveness of purse seine capacity limits as a measure to address sustainability concerns related to bigeye and yellowfin would depend on the extent of any effort creep in the form of an increase in fishing power per unit of capacity, and on the success of the participants in adjusting management to account for it. Effort creep could be substantial in the WCPO given the potential for further gains in fishing power per unit of capacity from factors including increased transshipping, faster port turnarounds and increases in catch per set, including increases from the use of more FADs.

In the short term, purse seine capacity limits by themselves might not make a substantial contribution to addressing the sustainability concern in respect of bigeye. Indeed, they might increase fishing mortality on bigeye from purse seining by the current fleet if the capacity limit led to greater use of FADs to maximize catch per unit of capacity. However, capacity limits could contribute to avoiding further increases in fishing mortality on bigeye and yellowfin by deterring further investment in additional new purse seine vessels. Purse seine capacity limits would be relatively easy to monitor and enforce in the WCPO compared to some other options, but implementation would have to address the complexities associated with definition and measurement of individual vessel capacities, that have arisen in the EPO for example.

The main aim of longline capacity limits in the WCPO in the short to medium term would be bigeye conservation. The diversity of tuna longline operations makes the application of capacity limits (and most other measures) to longline fleets more complex. This is reflected in the measures adopted or considered by the other tuna Commissions, which only cover larger longline vessels (> 24m LOA). The exclusion of smaller longline vessels from a capacity limit would be a more serious limitation in the WCPO where the operation of smaller, locally-based longliners is more important and growing. However, a limit on the number of large longliners might contribute significantly to bigeye conservation in the short term if it prevented large freezer tuna longliners transferring their effort to the WCPO in response to the capacity limits imposed by the IOTC and moves in this direction by the IATTC.

### **Other forms of effort control**

Measures to control effort may include those that restrict the amount of time, usually the number of days fishing units can spend fishing or the number of input units such as hooks or a combination of inputs such as hook/days. Such controls are a finer specification of fishing effort than capacity limits such as vessel numbers or sizes. Effort controls can be implemented as a competitive or allocated quota system.

Under a competitive system participants would fish as hard as possible in order, for example, to maximize their share of the available days. This provides an incentive to maximize catching capacity and will be likely to encourage the race to fish as described under competitive quotas. Without the addition of capacity controls, a competitive system of fishing days may encourage an increase in capacity and, in the long term, further problems in the WCPO and elsewhere.

An allocated system provides each participant with a specified number of days or other units of effort and, while there will still be an incentive to increase capacity, since catch is not limited, the incentive is reduced by the absence of the need to compete. However, effort measures will necessarily involve the determination of a TAE, eg number of days/hooks, and where allocated, a basis for allocation. As with TACs, the accuracy of the TAE will be important to the success of the scheme. However, where inter-annual variability in abundance is a factor a TAE tends to avoid fluctuations in the rate of fishing mortality more effectively.

Effort quotas can be difficult and costly to enforce. Monitoring of effort levels such as days fishing could be monitored by the use of a vessel monitoring system (VMS). However, regulation of measures such as levels of hook use would require the development of new monitoring arrangements and high levels of in-port and at-sea inspection.

#### *Application elsewhere*

In 2001, the IOTC recommended that non-Members of the Commission whose vessels fish for bigeye tuna reduce their fishing effort in 2002 to below that of 1999 levels<sup>17</sup>. The Resolution did not define how effort should be measured.

The IOTC's WPTT has considered both a reduction in the number of purse seine vessels and the imposition of a minimum number of days that a purse seine vessel must remain in port after unloading. The WPTT found that a reduction in the number of vessels could be difficult to implement given the differences in efficiency between vessels and that increasing time in port may also be difficult to implement and its impact could be reduced by increased transshipping at sea (IOTC 2003).

#### *Potential application in the WCPO*

The World Tuna Purse Seine Organization (WTPO) has implemented short-term effort limits for purse seining in the WCPO based on requiring vessels to tie up for a fixed number of days related to vessel carrying capacity, at a time when tuna prices were depressed (WTPO 2003). The Parties to the Palau Arrangement have indicated their intention to shift the Arrangement from being based on a capacity limit (number of purse seine vessels licensed) to a fishing days limit (purse seine vessel days allocated between the Parties).

The scope for applying effort limits to purse seine fishing in the WCPO could be related to the potential for extending the WTPO measure and the proposed Palau Arrangement purse seine days limit. Limiting purse seine fishing days would likely be more effective than limiting purse seine capacity in addressing sustainability concerns in respect of bigeye and yellowfin in the WCPO but would be more difficult and more expensive to enforce. Applying compulsory tie-up periods for purse seine vessels in port between trips could reduce purse seine effort in the short term and would be relatively easy to enforce, but would be costly to the fleet.

The diversity of longline operations and numbers of vessels involved in the WCPO would seem to make it relatively complex to apply any form of vessel day, hook or hook day limits to tuna longline fishing at the regional level in the short term, though these approaches may be practical and effective at the national level.

## **Technical measures**

Technical measures are used to regulate the output that can be obtained from a specific amount of effort. Such measures generally attempt to influence the way fishing is conducted and the efficiency of the fishing gear (FAO 1997) to achieve a specific purpose in a given fishery. The technical measures discussed below are:

- gear restrictions;
- area and time restrictions;
- minimum size restrictions;
- compulsory retention; and
- penalties.

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<sup>17</sup> IOTC Resolution on Limitation of Fishing Effort of Non-members of IOTC whose Vessels Fish Bigeye Tuna (01/04)

## **Gear restrictions**

Gear restrictions can take the form of prohibitions on the use of gear or restrictions of gear type or size. From an economic perspective, gear restrictions usually lead to inefficiency and raise the cost of catching fish. A range of gear restrictions is discussed below.

### ***(a) gear type, design, selectivity***

The size and design of nets can influence the total catch, catch of particular species and or catch of a particular size of fish. Restrictions on depth of net might be able to be used to avoid particular species in the water column. If, for example, bigeye are found at the bottom of mixed schools, limits on net depth might reduce the purse catch of bigeye but would also reduce catch of all species not just those for which there are sustainability concerns.

Net mesh size may be set to allow certain species/sizes of fish to escape. Additional features, such as grids, may be added to allow bycatch of specific species to be removed or to escape.

Restriction of net depth would require high levels of observer coverage (to preclude additions to the net at sea), port inspection and maritime surveillance. The use of grids would require regular in-port inspections of nets to ensure grids were incorporated in all nets.

Possible restrictions on FADs as a form of gear restriction are discussed separately below.

#### *Application elsewhere*

Net depth limits have been considered by a number of tuna Commissions as a means of reducing the catch of bigeye tuna in purse seine catches. IATTC research has demonstrated that the depth of FADs and purse seine nets have less of an effect on catches of bigeye, yellowfin and skipjack tunas per set than do location and time of year (IATTC 2001). The shallower thermocline in the EPO may mean that this finding may be less applicable in the WCPO where the deeper thermocline might make net depth more important.

IATTC has conducted some trials of grids for the release of juvenile tunas, particularly sorting grids. While more development and assessment is required, results to date indicate that sorting grids would be easy to monitor and inexpensive (IATTC 2001).

#### *Potential application in the WCPO*

It is not clear what role the depth of nets has played in the increase of purse-seine catches of bigeye that was observed from 1996 onwards, since deeper nets had begun to be adopted in the early 1990s (Lawson 2003a). However, the increased catches may be related to the use of deeper nets in conjunction with the increased use of FADs from 1996 onwards, primarily in areas with a deeper thermocline. Some analysis of the potential of net depth limits in the WCPO has been carried out and it was found that it was unlikely that such limits would be effective in limiting bigeye catch in the region (Opnai 2002).

The results of grid research and trials in the EPO should be monitored. However the results may not be transferable to the WCPO where the purse seine fishery is focussed on skipjack rather than yellowfin. A grid with gaps large enough to reduce catches of juvenile bigeye and yellowfin would also allow the escape of a large proportion of the potential skipjack catch.

### ***(b) methods to reduce search time***

Fishers use a range of technology to assist in identifying schools of fish and hence reduce search time and increase the efficiency of fishing. Constraints on the use of such technology necessarily impede that efficiency. The use of sonar, radar and helicopters to search for fish could be banned in order to slow down fishing operations and, theoretically, reduce catch. Such measures would affect all fishing operations, not just those for species of concern, and would, therefore, come with significant economic cost. Monitoring and surveillance would be relatively straightforward, based largely on in-port inspections.

#### *Application elsewhere*

No applications of such controls have been identified.

#### *Potential application in the WCPO*

It is believed that the use of helicopters, at least in the US fleet, in the WCPO has declined significantly in recent years as fishing on drifting FADs became the predominant, and less expensive, technique (Gillett *et al.* 2002) and 'bird radar' improved. Thus restrictions on use of helicopters may have relatively less impact than direct controls on FAD use.

The impact on fishery wide efficiency and catch, of restrictions on the use of technology such as sonar and radar, would be significant and needs to be weighed up against the contribution these measures would make to addressing sustainability concerns for specific species.

#### **FAD<sup>18</sup> restrictions**

Controls on FAD use might take the form of a:

- prohibition on FAD use in the WCPO;
- prohibition on FADs on an area and/or time basis;
- prohibition on FAD use once a trigger catch limit of juvenile bigeye and yellowfin, was reached;
- restriction on the number of FADs deployed/vessel;
- restriction on the number of sets on FADs; or
- restriction on the design of FADs that can be used.

A blanket prohibition on FADs would reduce effective effort in the short term although it may result in a return to the use of other methods such as helicopters to increase catches from free swimming schools. Total purse seine catch could be expected to fall, at least in the short term, but with a lower level of fishing mortality on juvenile bigeye (which are predominantly in the purse seine catch), and on juvenile yellowfin (since the average size of yellowfin taken in sets on free swimming schools is larger than the average size of yellowfin taken in sets on FADs). Purse seine fleet costs would rise, and the economic position of the purse seine fleet, which relies predominantly on skipjack catch, could be significantly affected by such a measure. The economic position of the longline fleet would be expected to improve with enhanced bigeye and yellowfin catch rates and sizes. Total prohibition would require extensive and ongoing maritime and aerial surveillance.

Use of FADs could be restricted to certain areas and/or times. Again, such closures would affect all catches of the purse seine fleet for the period of the closure, but the closure would be determined on the basis of when catches of the more vulnerable species were largest, and the benefit/cost ratio of the closure for the fishery for a limited time/area closure should be higher than under a blanket closure. Compliance with time-area closures on FAD use would require 100% observer coverage on vessels that continue to fish on free swimming schools in the closed areas, and VMS coverage and regular aerial and maritime surveillance to ensure that other vessels are not in the closed area.

Bans on FAD use triggered by a catch limit of a species would require comprehensive monitoring of landings to estimate catch of the species, which is likely to be impracticable in most fisheries. The alternative, estimating quantities of juvenile fish caught, compromises the integrity of the measure. Compliance during the closure would be as for time-area closures.

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<sup>18</sup> Unless otherwise indicated a reference to FADs includes all types of floating objects, natural and artificial.

The number of FADs that a vessel could deploy could be restricted by limiting the number of FADs or the number of FAD beacons that can be carried. However monitoring the number of FADs a vessel is using may be difficult (IATTC 2001) since:

- some FADs become lost because transmitters malfunction or are lost;
- vessels may share the use of FADs; and
- vessels may use frequency-scanning equipment to find FADs deployed by other vessels.

The number of FAD sets per vessel could be restricted. This may be extremely difficult to monitor and will have a significant impact on total purse seine catch. Compliance with a limit on the number of FADs used by a vessel or the number of sets that a vessel may make on FADs in any period would require 100% observer coverage and regular maritime surveillance.

Research may identify FAD designs that attract more, larger fish and fewer juveniles. No such designs are currently available.

#### *Application elsewhere*

ICCAT introduced a closed area/season for the use of FADs in 1999<sup>19</sup> whereby a three month closed season applies in the Gulf of Guinea, a major nursery ground for bigeye tuna. Analysis by the Standing Committee on Research and Statistics of the impact of the closure on tropical tuna stocks indicates that the measure has been effective in reducing fishing mortality on bigeye from fleets which complied with the closure, but the benefits of the measure have been undermined by increasing effort and non-compliance.

In 1999 the IOTC's Scientific Committee identified time/area closures of fishing grounds to fishing on floating objects as the best option to reduce catches of small bigeye tuna by purse seine vessels (IOTC 1999). In 2003 the WPTT assessed a number of time/area closure scenarios. The IOTC has not taken a decision on the introduction of such a closure.

The IOTC WPTT has considered the impact of a limitation on the number of FADs and/or the electronic equipment used on FADs. However its analysis concluded that there was a lack of baseline information on the number of FADs currently deployed and that the measure, while directly addressing the issue of mortality of juvenile bigeye and yellowfin, would require 100% observer coverage (IOTC 2003).

Between 1998 and 2001, the IATTC imposed catch limits on juvenile bigeye which triggered a blanket prohibition on sets on all types of floating objects across the EPO<sup>20</sup>. The closure was triggered in 1998 and 1999, but not in 2000 and 2001. Following this experience, the IATTC has moved away from the approach of a closure for sets on floating objects because it tended to come into force only in years when there was high recruitment, and because there were significant compliance problems with defining sets on floating objects.

IATTC has also investigated the potential of area/time closures for sets on floating objects reporting in 2001 that it had "...not been possible to find small areas and times for which it is possible to predict unusually high catches of small tuna." As discussed below, the IATTC has now moved to time/area closures to all purse seining, rather than to sets on floating objects.

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<sup>19</sup> ICCAT Recommendations on Closed Area/Season for Fishing with FADs in E. Trop. Atlantic (98-1) and on closed Area/Season to FADs (99-1).

<sup>20</sup> IATTC Resolution on Bigeye Tuna, June 1998; Resolution on the Conservation and Management of Bigeye Tuna in the Eastern Pacific Ocean, July 1999; Resolution on Bigeye Tuna, 16 June 2000; and Resolution on the Conservation of Bigeye Tuna in the Eastern Pacific Ocean, 21 June 2001.

#### *Potential application in the WCPO*

Time/area restrictions on sets on floating objects and bans on sets on floating objects once a trigger catch of bigeye catch has been taken have been favoured in other areas because they involve the most direct control on FAD use. However, bans on sets on floating objects once a trigger level is reached have the same disadvantages as a competitive TAC. In addition, both these bans and time/area restrictions on sets on FADs may have a high economic cost in terms of other purse seine catch foregone. This is particularly important in the WCPO given the low proportion of bigeye and yellowfin in the purse seine catch relative to that in other oceans. In the WCPO, time/area closures would have to be applied over relatively broad areas, unless more specific nursery or spawning areas are identified. Such closures might be more like the broader area closure recently considered for the EPO than the closure over a more limited nursery area applied in the Atlantic Ocean, and would therefore be likely to lead to higher economic costs than a closure over a more limited area.

The comprehensive monitoring of landings required where a catch limit triggers a FAD ban is only likely to be possible in the WCPO, where landing sites are numerous, by requiring vessels to land catch at designated ports where monitoring programmes are in place.

In the WCPO, limits on the use of artificial FADs that were not applied to other floating objects would increase sets on naturally occurring floating objects such as logs. Floating log numbers fluctuate (particularly with rainfall on landmasses), and are higher in the west. As a result a limit on artificial FADs that did not cover natural floating objects may encourage fishing effort to the west.

While there are practical difficulties in managing limits on floating objects the limitation of FAD numbers or FAD sets per vessel may be more practical than other FAD control measures.

#### ***(c) restrictions on use of tender vessels***

Tender vessels support, and hence increase the efficiency of, vessels fishing on FADs by deploying FADs, provisioning the fishing vessels etc. Banning their use would reduce the number of FADs a vessel can deploy without stopping the use of FADs completely. The impact will depend on the extent to which purse seiners rely on supply vessels (how many purse seiners utilize tender vessels and what impact they have on catch rates). Over time vessel operators would be likely to find ways of circumventing the impact of the ban.

Compliance with a limit on the use of tender vessels would require 100% observer coverage and regular aerial and maritime surveillance, or VMS on all carrier/tender/supply vessels.

#### *Application elsewhere*

The IOTC WPTT has considered the impact of a ban on the use of supply vessels to the purse seine fleet. Preliminary information on the use of supply vessels in the Indian Ocean fishery suggests that the use of tender vessels may result in higher catch rates but the overall effect is difficult to quantify (IOTC 2003).

The IATTC has prohibited the use of tender vessels in the EPO<sup>21</sup>.

#### *Potential application in the WCPO*

Tender vessels are not widely used in the WCPO so the impact of a ban on current catches may be minimal. It may, however, preclude the wider adoption of the practice.

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<sup>21</sup> IATTC Resolutions on Bigeye Tuna, June 1998 and on Fish-Aggregating Devices, October 1998.

**(d) restrictions on at-sea transshipment**

At-sea transshipment allows fishing vessels to stay at sea for longer and hence increases available fishing time and effort. At-sea transshipment can be prohibited in an attempt to reduce effort. Such a measure would decrease fishing efficiency for all species and have an impact on fishery-wide catches.

*Application elsewhere*

The IATTC has prohibited the transshipment of tuna on the high seas by purse seine vessels fishing for tunas in the EPO<sup>22</sup>.

*Potential application in the WCPO*

Transshipment of tuna in the WCPO will be regulated under Article 29 of the WCPF Convention. Section 1 of Article 29 provides that:

*‘In order to support efforts to ensure accurate reporting of catches, the members of the Commission shall encourage their fishing vessels, to the extent practicable, to conduct transshipment in port.’*

Section 3 provides that:

*‘The Commission shall develop procedures to obtain and verify data on the quantity and species transhipped both in port and at sea in the Convention Area and procedures to determine when transshipment covered by this Convention has been completed’*

Section 5 generally prohibits transshipment at sea by purse seine vessels as follows:

*‘...subject to specific exemptions which the Commission adopts in order to reflect existing operations, transshipment at sea by purse-seine vessels operating within the Convention Area shall be prohibited.’*

Transshipment at sea is prohibited in the national waters of Members of the FFA under the FFA Harmonised Minimum Terms and Conditions for Foreign Fishing Vessel Access.

While the provisions of the WCPF Convention originate from a concern to ensure accurate reporting of catches, they can also serve to limit the effect of increasing the fishing power of purse seiners over time, and Commission Members might have regard to this effect when framing the procedures called for in section 3 of Article 29.

**Area and time restrictions**

Area/time limits attempt to reduce catch of a species generally, or at a particular stage of its life cycle (spawning stocks or juveniles) by prohibiting fishing either during specified times or seasons (time closures) or in particular areas, or a combination of the two. Time limits may also specifically limit the number of days at sea. Time/area closures can also be used in relation to certain types of fishing or use of certain gear, eg FADs as discussed above.

The impact of area and time restrictions of a closure is difficult to estimate since the extent to which operators compensate by increasing fishing in other areas/at other times is unknown. However they appear to have some potential to reduce mortality on bycatch species, depending on the pattern of catches that results from the displaced effort. The feasibility and effectiveness of time and area limits will depend on whether there are predictable seasonal and annual patterns in catch, spatially and temporally. Such closures may be an effective means of protecting nursery grounds or spawning stocks but are more difficult and more costly to apply in the case of highly migratory species with large spawning areas and long spawning seasons.

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<sup>22</sup> IATTC Resolution on Fish-Aggregating Devices, October 1998

Marine protected areas (MPAs), are designated areas of water that are permanently subject to special protection measures ranging from no-take zones to provision for fishing by some gear types in, for example, some depths of the water column. MPAs are particularly useful for the protection of 'critical habitats' such as nursery or spawning areas. However MPAs would need to be large and moveable to be an effective tool for highly migratory species.

#### *Application elsewhere*

The IATTC recently considered proposals for broad time/area closures, including a proposal for a two month closure of the western area of the EPO in which most of the bigeye catch of the EPO is taken – this would have been west of 95°W in the EPO, which overlaps in part with the WCPFC Convention Area. Ultimately, the IATTC decided to prohibit purse seining:

- during December 2003 in an area which combines part of the area where bigeye catch has been highest with an area of substantial yellowfin catches in the past; and
- for six weeks in August/September 2004 across the EPO<sup>23</sup>.

The IOTC WPTT has assessed a number of possible area/time closures of the purse seine fishery and estimated potential reductions in the catch of juvenile bigeye and juvenile yellowfin. While the WPTT found that such a measure could improve the long-term yield per recruit it stressed the uncertainty in its findings flowing from the unknown extent to which additional catch is taken outside the closed area. The analysis indicated that the benefits would flow to the purse seine, driftnet and longline fisheries for yellowfin but only to the longline fishery for bigeye. It would, however, reduce skipjack catch, be difficult to enforce and may lead to a redirection of effort to other areas in the Indian Ocean (IOTC 2003).

#### *Potential application in the WCPO*

The effective use of area/time closures in the WCPO would rely on the identification of areas/seasonal patterns of larger than average catches of the species in a particular area/time. Studies to date indicate that there is no apparent seasonal pattern that would support the imposition of such limits in the WCPO (Opnai 2002).

A closure to all purse seine fishing in an area for a specified time could be enforced through a VMS, without the need for observers. Such a closure would relate to both sets on free schools as well as FADs. Depending on the extent to which skipjack catch is taken on free schools this may unnecessarily restrict the catch of skipjack.

### **Minimum size restrictions**

A minimum size restriction requires fish below a certain size to be returned to the sea or for schools of predominantly small fish to be avoided. Minimum size restrictions rely on the economic disincentive associated with the waste of fishing time/costs involved in catching fish that have to be discarded to cause fishers to actively avoid those fish. However fishers may not be able to gauge fish size well and compliance with size limits tends to be low.

The effectiveness of this disincentive will depend on the extent to which the fisher can, in practice, avoid the catch of a certain size of a particular species and the proportion of total catch represented by that species. If the latter is relatively small there is little disincentive to change fishing practice.

An alternative measure, based on size, is the abandonment of high juvenile sets. This measure relies either on visual inspection of the catch composition prior to completion of the set or the development of technology that can determine the size composition of the school

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<sup>23</sup> IATTC Resolution on the Conservation of Tuna in the Eastern Pacific Ocean (C-03-12).

prior to setting. In the former case the timing of the decision as to when to release the fish is critical in order to avoid significant mortalities. The latter approach would avoid this problem. These approaches would reduce but not eliminate catches of small fish. Where mixed catches are taken, identification of the species could prove problematic either visually or by technological means. If the technology were able to discriminate by species it would minimize the impact of restrictions on one species on the catch of others.

Compliance with such an approach is likely to be difficult since it relies on either a visual judgement about the size/species composition or an interpretation of information provided by technology. Complete observer coverage would appear to be necessary. Any measure which affects the size composition of the catch, or reporting of size composition, has technical implications for stock assessments.

#### *Application elsewhere*

ICCAT introduced a minimum size restriction of 3.2kg on yellowfin in 1973 and on bigeye in 1980<sup>24</sup>. These regulations have not been adhered to (ICCAT 2003).

The IOTC WPTT considered size limits for bigeye and yellowfin and found that the impact would depend on the extent to which the size limits were adhered to and the survival rates of fish returned to sea. Given the current technology survival rates are likely to be low.

IATTC has indicated the need for research of the potential application of technology, eg acoustic technology, to determine the size and perhaps species of fish in a school before setting on it. The technology is, however, likely to be expensive (IATTC 2001).

#### *Potential application in the WCPO*

In the WCPO, any minimum size measure would have to be applied both to bigeye and yellowfin since it is not possible to differentiate at sea between juvenile of these species.

### **Compulsory retention**

The intention of such a policy is to financially penalize those that catch large amounts of small fish. This may be effective if small fish make up a significant share of the total catch, because the vessel will be forced to bring to shore fish that are not economic to land and this should provide an incentive to avoid such catches. A risk involved in such a strategy is that fishers develop a market for the small fish, eliminating the disincentive to avoid them. Compliance would require 100% observer coverage to avoid dumping, port inspections of catches, use of VMS to minimize the chance of transshipment and regular maritime and aerial surveillance.

#### *Application elsewhere*

The IATTC has introduced a pilot programme (2001 to 2004) requiring full-retention of bigeye, skipjack and yellowfin taken by purse seine vessels (unless not fit for human consumption).

#### *Potential application in the WCPO*

This has potential application in the WCPO if monitoring and enforcement are adequate.

### **Penalties**

This measure relies on the imposition of an administrative or economic penalty if fish of a certain quantity, proportion of catch or size are taken. Measures may include compulsory tie-up periods or short term bans on use of particular methods (eg FADs). They require high levels of monitoring and enforcement because of the strong incentive to the individual operator to dump catch to avoid the penalties.

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<sup>24</sup> ICCAT Recommendations on Yellowfin Size Limit (72-1) and Bigeye Size Limit (79-1).

#### *Application elsewhere*

No examples of these measures by other tuna Commissions have been identified. However members of the WTPO agreed to apply monetary penalties to vessels that breached the purse seine vessel tie-ups implemented by the Organization in early 2003.

#### *Potential application in the WCPO*

The impact of such a measure on total purse seine catch of tunas would depend on the level of bigeye/yellowfin catch at which the penalties were applied. There are also very large differences in reported rates of bigeye catch between different purse seine fleets and different purse seine vessels in the WCPO. This approach might enable measures to reduce bigeye bycatch to be targeted at vessels and fleets that are the major cause of the problem without disturbing the operations of others. Enforcement capacity would be a critical determinant of its applicability in the WCPO.

### **Feasibility of Management Options**

The analysis of management options has identified a range of issues regarding their feasibility as conservation measures for bigeye and yellowfin in the WCPO. These include:

- The other three tuna Commissions concerned with the management of tropical tunas (IATTC, ICCAT and IOTC) have all committed substantial effort to addressing broadly similar issues relating to conservation of bigeye and yellowfin tunas that are outlined in the SCG2 report, that are now being faced by the PrepCon, and that are likely to be priority issues for the WCPFC Commission.
- A wide range of measures has been applied by the other tuna Commissions and an even wider range has been considered.
- The experience and analyses of other tuna Commissions offer valuable information on the effectiveness or otherwise of several different forms of these measures.
- From the information available it is not clear that the strategies put in place through the other tuna Commissions are regarded as working satisfactorily and the Members of the other Commissions generally continue to seek better ways to address sustainability concerns related to bigeye and yellowfin.
- While there are substantial similarities between the WCPO and other tropical oceanic regions in the nature of sustainability issues with respect to bigeye and yellowfin, there are also some substantial differences. These include:
  - The scale of the WCPO tuna fisheries, with larger catches, more vessels, more landing and transshipment points and more countries actively participating (Lawson 2003b)
  - The relative balance of catches in high seas and in waters under national jurisdiction, with most of the WCPO tuna catch being taken in waters under national jurisdiction
  - The difference in the status of the Commissions, with the WCPFC needing to give substantial attention in its early years to establishment tasks, but created under a Convention designed to give it, and its Members, in time, a generally fuller range of duties, powers and programmes than the other tuna Commissions
  - The relative importance of skipjack in the WCPO tuna fishery as a whole and the purse seine fishery in particular. Skipjack has been around 60-65% of the total tuna catch in the WCPO compared to 20-50% in the three other tropical oceanic regions. Bigeye and yellowfin, on the other hand, are a smaller component of the WCPO catch and a smaller component of the purse seine catch in general than elsewhere.
  - The economic costs incurred by the purse seine fishery under some management options directed at reducing catch of juvenile bigeye and yellowfin tuna are likely to be significantly larger in the WCPO than in other areas given the much lower proportion of these species and the much higher proportion of skipjack taken in the purse seine fishery in the WCPO in comparison to that in other areas.

- There may be large differences in costs between options in terms of both the direct cost of monitoring and enforcement and the broader economic costs involved.
- Most of the options identified would require strengthening of monitoring programmes, including observer programmes, port sampling, VMS, statistical documentation programmes and establishment of new enforcement measures. This applies particularly to the application of various technical measures to purse seine fishing, and options involving real-time monitoring of catch and effort.

The decisions facing countries participating in the PrepCon and the WCPFC are:

- the immediate action that the WCPFC can take to preclude further increases in fishing mortality of bigeye and yellowfin tuna;
- the action that can be taken to reduce bigeye mortality if current stock assessments for bigeye tuna are confirmed;
- the preferred long-term management for highly migratory species in the WCPO; and
- the programme of work, including the gathering of further information and/or scientific advice, required to ensure that the Commission is in a position to implement these actions within the necessary timeframe.

Both feasibility and effectiveness will determine the choice of management measures. In the short term the driving forces include the feasibility of moving quickly to establish comprehensive observer, in port monitoring and vessel monitoring programmes and whether progress can be made on allocation. Against this background the range of feasible options in the short term, and in the medium to longer term might be described as follows.

In the short term, two broad groups of measures would seem potentially feasible.

- The feasibility of applying some form or forms of national capacity, effort or catch limits by state, territory and entity in the short term would be likely to depend on whether PrepCon and/or the Commission could make sufficient progress on the development of allocation criteria.

Applying national capacity limits for purse seine vessels could draw on the experience of the IATTC, noting the issues related to definition and measurement of purse seine capacity. Applying national longline capacity limits could draw on the experience of ICCAT and IOTC, noting that these limits generally apply only to larger vessels and larger fleets. Applying national effort limits for purse seine vessels could build on the proposed new structure of the Palau Arrangement, using VMS for monitoring fishing days, but it would be more difficult to develop a similar arrangement to manage longline effort. It might also be feasible in the short term to apply national catch limits for bigeye, at least for the longline component of the bigeye catch, based on monitoring through a catch documentation scheme. Applying national catch limits for yellowfin in the short term would be more complex.

- Feasible options in the short term that do not require progress on allocation are likely to be largely limited to some of the technical measures discussed above, which generally apply only to purse seining. In the main these measures require increased monitoring capacities, especially on-board observers, and monitoring of landings, which should be achievable. If so, then technical measures that might be feasible in the short term include time/area closures (related either to closures on sets on FADs, or on all purse seine fishing) and limits on numbers of FADs being used by individual vessels, noting that IATTC experience and analysis points to practical difficulties with measures relating to limiting the use of FADs and sets on FADs.

Other technical measures that might be feasible with stronger monitoring and compliance capacities include restrictions on the use of tender vessels, tight regulation of transshipment at sea and various size-related measures (minimum sizes, compulsory retention of juveniles). In addition, an input control that might be feasible in the short term without resolving the allocation issue is some form of competitive limit on fishing days for purse seine fishing.

In the medium to longer term, technological developments, enhanced monitoring programmes and enforcement measures, and agreement on allocation criteria and processes would make a wider range of options feasible.

- In the medium term, with enhanced real-time monitoring of landings, it would be feasible to operate a competitive catch limit which led to closures of purse seine fishing, and/or fishing by other gears, when overall annual catch limits were reached for bigeye or yellowfin, following the kind of approach that has been used by the IATTC.
- In the longer term, comprehensive, rigorously applied output controls, in the form of TACs with national allocations of catch limits appear likely to be the most effective option for managing the large, multi-species, multi-gear tuna fisheries of the WCPO.
- Technological development in FAD and net design and in equipment that can provide better information on the size and species composition of tuna schools might also provide options in the longer term to complement and increase the effectiveness of more comprehensive catch or effort limits for bigeye and yellowfin management.

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**PREPARATORY CONFERENCE FOR THE COMMISSION FOR THE  
CONSERVATION AND MANAGEMENT OF HIGHLY MIGRATORY  
FISH STOCKS IN THE WESTERN AND CENTRAL PACIFIC**

Fifth session  
Rarotonga, Cook Islands  
29 September – 3 October 2003

WCPFC/PrepCon/34  
3 October 2003

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**RESOLUTION OF THE PREPARATORY CONFERENCE IN RESPONSE TO THE  
RECOMMENDATIONS OF THE SECOND MEETING OF THE SCIENTIFIC  
COORDINATING GROUP ON SUSTAINABLE FISHERIES MANAGEMENT**

*Recalling* the resolutions adopted at the fourth session of the Multilateral High Level Conference (MHLIC IV), on 19 February 1999, and the third session of the Preparatory Conference for the Establishment of the Commission for the Conservation and Management of the Highly Migratory Fish Stocks in the Western and Central Pacific Ocean, on 22 November 2002, in which the participants, *inter alia*, urged all States and other entities concerned to exercise reasonable restraint in respect of any regional expansion of fishing effort and capacity,

*Noting* that, since the adoption of the aforementioned resolutions, some fishing industries are reportedly still building or have already built a large number of purse seine fishing vessels to be deployed in the Western and Central Pacific Ocean to target tuna species covered by the Convention,

*Recognizing* the need to apply the precautionary approach to fisheries management,

*Considering* that the second meeting of the Scientific Coordinating Group (SCG) held in July 2003 recommended that fishing mortality of both yellowfin and bigeye not be increased from current levels,

*Recognizing* that the second meeting of the SCG further cautioned that if current stock assessments for bigeye tuna were confirmed, practical management actions to decrease fishing mortality would be required to prevent further decline in stock,

*Noting further* that the SCG considered that the lack of data from Indonesia and the Philippines was a serious concern because of its substantial contribution to the uncertainties in the stock assessments and requested that participants in the fifth session of the Preparatory Conference consider as a matter of urgency ways to assist in improving this situation,

*Taking into account* the interests and aspirations of developing States, particularly small island developing States, and of territories and possessions, in developing their national fisheries in accordance with their commitments under international law and instruments;

*Recognizing* the importance of existing regional licensing and other arrangements to participants,

*Recalling* article 30, paragraph 2 (c), of the Convention, and the need to ensure that conservation and management measures do not result in transferring, directly or indirectly, a disproportionate burden of conservation action to developing States Parties, territories and possessions,

*Recalling further* article 10, paragraph 3, of the Convention, which provides for the development by the Commission of criteria for the allocation of the total allowable catch, or the total level of fishing effort, and

*Noting* the likely entry into force of the Convention by the middle of 2004,

*The participants in the fifth session of the Preparatory Conference for the Establishment of the Commission for the Conservation and Management of the Highly Migratory Fish Stocks in the Western and Central Pacific Ocean held at Rarotonga, Cook Islands, from 29 September to 3 October 2003, resolve to:*

1. *Request* the Interim Secretariat to prepare a paper on management options, to be delivered to the next session of the Preparatory Conference, on how the Commission could respond to sustainability concerns in respect of bigeye and yellowfin identified by the second meeting of the SCG,
2. *Invite* the Commission at its first session to consider management options in respect of bigeye and yellowfin,
3. *Encourage* participants to consider financing proposals seeking to improve the collection of catch effort and size composition data, especially from the domestic fisheries of Indonesia and the Philippines,
4. *Strongly urge* participants to fully implement the previous resolutions of MHLC and the Preparatory Conference calling for participants to exercise reasonable restraint in respect of any expansion of fishing effort and capacity in the Western and Central Pacific Ocean, and to note that certain States, territories, fishing entities and other entities continue to breach these resolutions,
5. *Urge* participants, and particularly those from States, territories, fishing entities and other entities continuing to breach the MHLC IV and Preparatory Conference resolutions, to take measures to prevent their nationals from building and operating new purse seine vessels in the Convention Area under foreign flags, unless those vessels have been constructed to operate under legitimate licences,
6. *Strongly urge* States, territories, fishing entities and other entities who have continued to breach these resolutions since the original MHLC IV resolution to reduce any overcapacity they have created, and
7. *Urge* that any information on activities contrary to the provisions of this resolution should be reported to the next session of the Preparatory Conference and circulated to all participants.

3 October 2003