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**DRAFT: OPTIONS FOR INTERIM MANAGEMENT MEASURES FOR BILLFISH IN  
THE INDIAN OCEAN**

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**1. PURPOSE**

To provide an initial introduction to the types of Conservation and Management Measures (other than quota allocation) currently in use by other RFMOs and to discuss the pros and cons of each type of management approach. In addition, to discuss the particular characteristics of fisheries under the IOTC mandate which may influence the relevance and appropriateness of interim alternative management options for adoption by the Commission. Secondly, to seek comment on this paper so that it may be further refined for consideration by other IOTC bodies.

**2. BACKGROUND**

Recalling that the Commission, via IOTC Resolution 14/02 (which superseded Resolution 12/13 and previously 10/01), agreed that:

Para. 1. *CPCs shall implement the following action plan:*

- a) *Establishment of an allocation system (Quota) or any other relevant measures based on the IOTC Scientific Committee recommendations for the main targeted species under the IOTC competence;*
- b) *Advise on the best reporting requirement of the artisanal tuna fisheries and implementation of an appropriate data collection system.*

Also recalling that at the 1<sup>st</sup> Session of the Technical Committee on Allocation Criteria (TCAC01), held in Nairobi, Kenya (16–18 February 2011), participants agreed to the following request of the IOTC Secretariat:

*“The Technical Committee also recognized that the mandate it received from Resolution 10/01 includes consideration of alternative management measures. However, it noted that it was not in a position to discuss alternative measures with the information available. These measures would have more appropriately to be discussed during the Session of the Commission on the basis of scientific advice. A request was made to the Secretariat to provide information on alternative conservation and management measures implemented in other tuna RFMOs.” (IOTC–2011–TCAC01–R, para 35).*

Subsequently, at the 15<sup>th</sup> Session of the Commission, CPCs agreed to the following course of action:

*“The Commission requests that the Scientific Committee provide advice to the Commission that adds to the information currently available or already requested of the Scientific Committee regarding the take of juvenile yellowfin tuna, bigeye tuna and other species, and on alternative management measures, including an assessment of the impact of current purse seine activities, including the size/fishing capacity (and gear types i.e. mesh size etc.) of vessels, and the potential implications that may arise for tuna and tuna-like species. Such advice should include options for capping purse seine effort and use in conjunction with drifting FADs in the Indian Ocean.” (IOTC–2011–S15–R. para. 105)*

Finally, at the 2<sup>nd</sup> Session of the Technical Committee on Allocation Criteria (TCAC02) held in Muscat, Oman (18–20 February 2013), participants agreed to the following request of the IOTC Secretariat:

*“The TCAC RECOGNISED the mandate it received from Resolution 12/13 includes the consideration of alternative management measures. However, it noted that it was not in a position to discuss alternative measures in detail at the current meeting, and therefore REQUESTED that the Commission task the*

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*Scientific Committee with examining alternative management measures in combination with clear management objectives. The Commission should ensure that it specifies the level of reduction or the long term management objectives to be achieved with the alternative measures, as these will, in turn, guide and facilitate the analysis of the SC*’ (IOTC–2013–TCAC02–R, para. 38.)

Within the above context, the IOTC Secretariat has developed this paper to provide CPCs with the following:

- 1) provide an initial introduction to the types of Conservation and Management Measures (CMMs) currently in use by other RFMOs;
- 2) review of relevant IOTC CMMs and their effectiveness as interim and/or long term measures.
- 3) discuss the pros and cons of each type of management approach;
- 4) discuss the particular characteristics of fisheries operating under the IOTC mandate, which may influence the relevance and appropriateness of alternative management options for adoption by the Commission;

### 3. DISCUSSION

#### 3.1 Fishery management tools

There are two broad types of fishery management tools available to the Commission for application though IOTC Conservation and Management Measures (CMMs); 1) *input controls* and 2) *output controls*. Within each broad ‘type’ there are a suite of measures (tools) available for use, a subset of which are likely to be necessary to address the Commission’s sustainability concerns for specific fish stocks. However for the purposes of this paper, management measures are considered as independent actions. Of course there is a third option of ‘No controls’ which will also be discussed.

In determining which management tools could be used by the Commission, the Commission will need to consider each management tool in terms of its characteristics in respect of factors including, but not limited to: data and research needs, ease of implementation, potential management costs for individual CPC’s, monitoring of compliance, the impact on the economics of fishing operations, etc. This paper does not attempt to assess the options against each of these characteristics but rather, it identifies the key, recognised positive and negative characteristics of each option so as to provide a basis for discussion/consideration by the Commission. At the end of the paper, a qualitative discussion on how management tools could be used in tandem with others, to meet the Commission’s sustainability goals, is provided.

Once the Commission identifies its preferred management tools, those could be subject to more detailed assessment and comparison against specific characteristics such as those identified above or those required by the Commission.

##### 3.1.1 No Controls

**No Controls** essentially means doing nothing, other than to leave the management of IOTC stocks to individual CPCs, with the hope that the fisheries will regulate themselves. The results of recent Working Party on Tropical Tunas (WPTT) stock assessments for bigeye tuna and yellowfin tuna indicated that the option for **No Controls** on fishing mortality of these principal target species is **unsupportable** within the IOTC Agreement framework.

However, any future analysis of **Input** or **Output controls**, could be measured against **No Controls** as a benchmark against the analysis of more adaptive management measures. It could be argued that such analyses have already been conducted in the form of current stock assessments considering that fishing mortality of both species has increased steadily to date despite nominal efforts to limit effort and capacity in both longline and surface fisheries (noting the slight decrease in overall catch and effort from 2007–09).

##### 3.1.2 Input controls

**Input controls** limit the amount of effort fishers put into their fishing activities, indirectly controlling the amount of fish caught. Input controls can include restrictions on the number of licenses, the types and size of fishing gear and vessels (e.g. mesh size of nets, engine capacity, vessel length) and/or the areas and times which can be fished (e.g. by restricting

the area and the amount of fishing time). Examples used by the IOTC to date are listed below, although their effectiveness has been negligible, and is discussed in the sections that follow:

### ***Fishing capacity limitation***

- **Active:** Resolution 03/01 *On the limitation of fishing capacity of Contracting Parties and Cooperating Non-Contracting Parties* had attempted to ‘freeze’ the number of vessels at 2003 levels for fleets with more than 50 vessels (> 24 m in length) on the IOTC Record of Vessels (note that this is on the IOTC Record, not necessarily ‘Active’). **Effectiveness:** Unknown, but see Resolution 15/11.
- **Active:** Resolution 15/11 *On the implementation of a limitation of fishing capacity of Contracting Parties and Cooperating Non-Contracting Parties*. The Commission agreed to limit the fishing capacity of the fleets targeting tropical tunas to the capacity (measured in Gross Tonnage) of active vessels in 2006 (Resolution 06/05), and to the 2007 level (Resolution 07/05) for those fleets actively targeting albacore and swordfish. The provisions of these two Resolutions are now captured in Resolution 12/11 *On the implementation of a limitation of fishing capacity of Contracting Parties and Cooperating non-Contracting Parties* (which supersedes Resolutions 12/11, 09/02, 07/05 and 06/05). Resolution 15/11 calls on CPCs to implement a limitation on their fishing capacity targeting tropical tunas, swordfish and albacore stocks, while allowing for the inclusion of vessels under construction during specific reference years, and those proposed by the developing coastal States in their fleet development plans. **Effectiveness:** See paper IOTC-2015-CoC12-05, which indicted the FDPs, if implemented, will result in a 317% increase in GRT over the target baseline for tropical tunas and a 489% increase in GRT over the target baseline for swordfish and albacore, by 2020. If realised, none of the stocks would be fished at sustainable levels.

### ***Time-area closure***

- **Superseded:** Resolution 10/01 *For the conservation and management of tropical tunas stocks in the IOTC area of competence* (Superseded by 12/13, then 14/02 which removed the closure component). Contained a seasonal time-area closure of the fisheries on tropical tunas from 15 January to the 1 March in the IOTC area of competence.

Input controls directly regulate the rate of fishing mortality by controlling some aspect of the fishery that contributes to total fishing effort (e.g. number/type/power of vessels, gear limitations (type, net size, number of hooks, etc.), gear specific restrictions on fishing time/area, etc.). The implicit assumption when applying effort controls is that catchability, or the susceptibility of fish to fishing gear, remains relatively constant.

Input controls can be applied broadly or to highly specific sector/s of a fishery. For example, Input controls can apply to a fishery, a specified area, a fleet or gear type and, if allocated, can be allocated according to flag states, fleets or vessels.

Input controls are commonly used as a fisheries management tool particularly in tuna RFMOs. This is despite widespread acknowledgement that they generally fail to prevent over-exploitation and the development of overcapacity. This failure occurs where restraints on one or more inputs are compensated for by capacity building in other inputs. For example, a capacity control that limits the number of vessels operating in a fishery does not preclude registered vessels from increasing effective effort by using larger nets or deploying more hooks, fishing for longer periods or fishing more frequently using Fish Aggregation Devices. Similarly, area exclusions often result in a relocation of effort, leading to increased exploitation of fish stocks that would not normally be targeted. Thus, the efficacy of input controls requires constant monitoring and the controls need modification to ensure management objectives are being met.

[Appendix I](#) outlines the most commonly used Input Controls and their advantages and disadvantages relevant to tuna and tuna-like stocks.

Appendix II provided a summary of the application of Input Controls in other RFMO's. [Appendix II](#) highlights that capacity limits are the most widely used measure for limiting tuna fishing mortality. The other three tuna Commissions that catch tropical tunas (bigeye tuna, skipjack tuna and yellowfin tuna) all have in place some form of capacity limits.

### **Potential application in the IOTC: Capacity limits**



**Purse seine:** Implementing broader limits to purse seine capacity in the IOTC could draw on the experience in the WCPFC and IATTC with the use of catching capacity and well size. The effectiveness of purse seine capacity limits as a measure to address sustainability concerns would depend on the extent of any effort creep. Effort creep could be substantial in the IOTC 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 drifting FADs.

In the short term, purse seine capacity limits by themselves might not make a substantial contribution to addressing sustainability concerns. Indeed, they might increase fishing mortality from purse seining by the current fleet if the capacity limit led to greater use of FADs to maximise catch per unit of capacity. This effect has been shown in 2008 and 2009 whereby the Scientific Committee has identified increases in the use of FAD fishing. However, capacity limits could contribute to avoiding further increases in fishing mortality by deterring further investment in additional purse seine vessels. Purse seine capacity limits would be relatively easy to monitor and enforce in the IOTC compared to some other options, but implementation would have to address the complexities associated with definition and measurement of individual vessel capacities.

**Longline:** The diversity of tuna longline operations makes the application of capacity limits (and most other input control 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 length overall). The exclusion of smaller longline vessels from a capacity limit would be a more serious limitation in the IOTC where the operation of smaller, locally-based longline vessels is a substantial portion of the overall Indian Ocean longline fleet.

#### **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 sets/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 maximise their share of the available days. This provides an incentive to maximise 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 IOTC 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 Total Allowable Effort (TAE), e.g. number of days/hooks, and where allocated, a basis for allocation. As with (Total Allowable Catches) 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.

#### **Area and time closures (spatial and temporal)**

Area and time restrictions can be used to protect a component of a stock or community such as spawning adults or juvenile stages. As with gear restrictions, they have an important role to play but, unlike gear restrictions, can be used to regulate total fishing mortality on a resource.

In addition to their role in conserving the resources, area and time restrictions can be used to reduce or eliminate conflict between different components of the fishery system (e.g. artisanal and industrial fleets) or between them and other users. By partitioning fishers or other interest groups into appropriate time or space slots according to the nature of their use or fishing practice, encounters between them can be reduced. Such partition leads, however, to implicit allocations, and conflicts may arise if such allocations are not considered equitable by some users.



## Other forms of effort control - Potential application in the IOTC

In 2001, the IOTC recommended that Cooperating Non-Contracting Parties of the Commission whose vessels fish for bigeye tuna reduce their fishing effort in 2002 to below that of 1999 levels. 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.

The scope for applying effort limits to purse seine fishing in the IOTC could draw upon the experience of the WCPFC 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 tuna and yellowfin tuna in the IOTC but would be more difficult and more expensive to enforce.

The diversity of longline operations and numbers of vessels involved in the IOTC 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.

In 2009, the IOTC banned the use of large scale driftnets (>2.5 nm in length) in the IOTC area of competence high seas (Res. 09/05). Similar bans could be applied to other gears and time/areas.

### 3.1.3 Output controls

**Output controls** directly regulate the catch which can be taken from a fishery and can be seen as an attempt to circumvent the problems associated with defining and enforcing appropriate technical measures and effort regulations by directly limiting the factor of primary concern: the total catch. This is often done by restricting the quantity of fish that can be taken from a fishery within a specified period of time. This can be by either a competitive total allowable catch (TAC) or a TAC allocated to participants as Individual Transferrable Quotas (ITQs).

#### *Catch limits*

- **Active:** Resolution 14/02 *For the conservation and management of tropical tunas stocks in the IOTC area of competence* (Supersedes 12/13 and 10/02). Proposes a move to an '**allocation quota system**', an output system based on allocated quota.
- **Active:** Resolution 05/01 *On conservation and management measures for bigeye tuna*, 'requests' that Taiwan, Province of China, limit's its bigeye tuna catch to 35,000 t annually, effective from 2006. From 2006 to 2013, Taiwan,China has reported catches of bigeye tuna above the requested limit in 3 of the 8 years: 2006 (35,815 t), 2007 (26,145 t) and 2012 (21,889 t).

The first step in implementing an output control management system is the determination of a Total Allowable Catch (TAC) for each target species. The TAC is usually determined through a scientific process that determines based on the current information available from the fishery and species biology, the sustainable catch level. A TAC can be fished either on a competitive basis or allocated among participants in the fishery so that all fishers have an individual quota ([Appendix III](#)). A TAC which is divided between the participants means that in any one year or fishing season, a commercial fisher/entity is not able to catch more than their allocated weight of that target species. The IOTC is currently in the process of determining how best to allocate quota, which will be based on the sustainable catch limit recommendations of the Scientific Committee.

Output controls are generally regarded as good mechanisms to control the total catch in single species, high value fisheries which are targeted using a few primary gear types (such as tuna). However, thorough monitoring schemes such as daily catch logbooks are often required to ensure that individual quotas are not exceeded.

## Output Controls - Application in other RFMO's

### ICCAT



- Total Allowable Catch and allocation; closed season – time/area; fishing capacity reductions; rebuilding strategy: Res 09-06 & 08-05 – Mediterranean Bluefin tuna. The total allowable catches for eastern Atlantic and Mediterranean bluefin tuna shall be set at 13,500 t in 2010. The allocation scheme established by Recommendation 08-05.

#### WCPFC

- SWO TACs – Limits the amount of swordfish caught by fishing vessels flagged to each Member in the Convention Area south of 20°S to the amount caught in any one year during the period 2000 – 2006.

#### Output Controls - Potential application in the IOTC

The IOTC has adopted several measures in the past aimed at limiting the landings of tuna and tuna-like species by Contracting Parties and Cooperating Non-Contracting Parties (Res. 05/01). Given the IOTC has already agreed to move to an Allocation based quota system, this will not be discussed here.

#### RECOMMENDATION/S

That the WPB13:

- 1) **NOTE** paper IOTC–2015–WPB13–09 which provided an initial introduction to the types of Conservation and Management Measures (other than quota allocation) currently in use by other RFMOs and to discuss the pros and cons of each type of management approach. In addition, to discuss the particular characteristics of fisheries under the IOTC mandate which may influence the relevance and appropriateness of interim alternative management options for potential adoption by the Commission.

#### APPENDICES

- [Appendix I](#) Input (effort) controls
- [Appendix II](#) Input controls: Application in other RFMO's
- [Appendix III](#) Output controls

**Appendix I**  
**Input (effort) controls**

Type	Pros	Cons	Comments	IOTC context
Capacity Limits - Number of participants (vessels/ licences/ permits)	Improve the overall economic health and marketing situation.	<p>Create more efficient fleets, which may work against management goals.</p> <p>Other inputs may be used to increase the effort of the limited number of vessels.</p>	<p>Restriction of vessel numbers is a very coarse proxy for effort. On its own, limits on the numbers of vessels are generally considered ineffective.</p> <p>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 were removed versus those that remain.</p>	<p>The IOTC has already adopted a measure restricting the number of vessels larger than 24m length overall, and GRT, of those Contracting Parties and Cooperating Non-Contracting Parties that have more than 50 vessels on the IOTC Vessel Record, to the number registered in 2003 (Res 03/01). The Resolution also contains a vessel replacement policy.</p> <p>Resolution 15/11 (originally 09/02 then 12/11) attempts to determine the level of capacity in the IOTC area of competence for a potential future capacity limitation, but does not limit capacity in itself.</p>
Capacity Limits - Type, size or power of vessels, gear restrictions	[To be discussed]	Impediments to improved efficiency often increase the cost of fishing relative to other fleets and hence may lead to an increased pressure for higher catches to maintain income levels.	<p>Usually used as a tandem measure to restrictions on the number of participants.</p> <p>Vessel replacement policies, which restrict the size of new vessels to that of the replaced vessels are required.</p> <p>Regulation of gear characteristics such as minimum mesh size, net length, number of hooks etc. is generally introduced to control fishing mortality on some particular component of the</p>	Nil.



			resource, such as smaller (juvenile) individuals.	
Capacity Limits - Fishing days, shots per day and duration	[To be discussed]		Restrictions on the amount of time units can spend fishing, such as individual effort quotas, and restrictions on the size of vessels and/or gear.	
Other - Time/Area Closures	Can be used to regulate total fishing mortality on a resource, and protect sensitive life history stages (spawning adults or pre-reproductive individuals)	These measures are subject to the same social and economic problems in open access systems as all other control measures.  Highly migratory species, such as tuna and billfish, may move into and out of closed areas too quickly for the closure to be effective.	Need to monitor available effort and specify appropriate closed areas or seasons such that the effort expended in the open areas did not exceed the sustainable levels for the resource or that restrictions in some time-space areas do not simply lead to transfer of excess levels of effort to other areas in excess of that which was desirable.	
General comments	Miss-reporting of catch is not a serious factor, as there is little or no incentive for the fisher to provide incorrect catch statistics.  In multi-species fisheries there should be less of a problem with discarding and/or high-grading as fishers are not regulated on the amount of byproduct or bycatch landed or reported.	Gear restrictions and area and time restrictions can lead to economic inefficiency and distortions, as they may effectively reduce CPUE below otherwise attainable levels.	Some gears are prohibited outright to (i) avoid increases in fishing capacity through increased efficiency, (ii) avoid unwanted impact on non-commercial sizes, species or critical habitats, or, very often, (iii) avoid an injection of new technology which could modify significantly the existing distribution of exploitation rights.	



**Appendix II**  
**Input controls: Application in other RFMO's**

Input control	IATTC	ICCAT	WCPFC
Capacity limits	<ul style="list-style-type: none"> <li>Historically, limits on purse seine capacity based on allocations of carrying capacity.</li> <li>Currently, limits on the entry of new purse seine vessels.</li> <li>In 2000, committed 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.</li> <li>An overall size limit for individual purse seine vessels.</li> </ul>	<ul style="list-style-type: none"> <li>Since 1999, a measure exists that limits the number of vessels &gt;24m length overall (LOA) that may operate in the Convention Area to the average number of its vessels that fished for bigeye tuna in 2001 and 2002.</li> <li>Restriction currently applies to States and entities that caught on average &gt;2100 t in the previous five years.</li> <li>Limit on gross registered tonnage (GRT).</li> </ul>	<ul style="list-style-type: none"> <li>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....".</li> <li>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.</li> <li>The Parties have announced their intention to restructure the Arrangement to limit effort (in vessel days) rather than capacity.</li> <li>The US Multilateral Treaty with the Forum Fisheries Agency (FFA) member States sets a limit on the number of US purse seiners that can be licensed by these States.</li> </ul>
Time-area closure	<ul style="list-style-type: none"> <li>Time are closure: Res 13-01 applicable in the years 2014-2016 to all CPCs' purse seine vessels of IATTC capacity classes 4 to 6 (more than 182 metric tons carrying capacity), and to all their longline vessels over 24 meters length overall, that fish for yellowfin, bigeye and skipjack tunas in the Convention Area. Time periods are applicable for each year, of differing duration.</li> </ul>	<ul style="list-style-type: none"> <li>Time area closure: Res 09-04 Mediterranean Swordfish. Catching of swordfish, both as a targeted fishery and as bycatch, shall be prohibited in the Mediterranean during the period from 1 October to 30 November each year, until a long-term management plan is decided by ICCAT. Mediterranean swordfish shall not be retained on board, transhipped or landed during the period of closure.</li> </ul>	<ul style="list-style-type: none"> <li>In 2006, introduced a effort control by area for striped marlin. Limited the number of fishing vessels fishing for striped marlin in the Convention Area south of 150S, to the number in any one year between a set period.</li> <li>Introduced a measure (CMM 2009/07) to ensure that total fishing effort by vessels fishing for northern Pacific bluefin tuna in the area north of the 20 degrees north shall not be increased from the 2002-2004 level for 2010, except for artisanal fisheries.</li> </ul>



			<ul style="list-style-type: none"> <li>• Time/Area closure for purse seine fishing on Fish Aggregating Devices (FADs) (CMM 2008-01 and 2009-02). The purpose was to ensure consistent and robust application of FAD closures and catch retention in the high seas between 20S and 20N through the specification of minimum standards. To apply high standards to the application of the FAD closure and catch retention in order to remove any possibility for the targeting of aggregated fish, or the discard of small fish.</li> </ul>
Size restrictions	<ul style="list-style-type: none"> <li>• Implemented size restrictions (Res 04/05) to limit fishing mortality on juvenile tunas, via gear specifications.</li> </ul>		
Effort restrictions			<ul style="list-style-type: none"> <li>• The World Tuna Purse Seine Organization (WTPO) has previously 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.</li> <li>• 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 day limit (purse seine vessel days allocated between the Parties).</li> <li>• In 2008, introduced a package of measures, over a three-year period commencing in 2009, a minimum of 30% reduction in bigeye tuna fishing mortality from the annual average during the period</li> </ul>



			<p>2001-2004 or 2004; Ensure that there is no increase in fishing mortality for yellowfin tuna beyond the annual average during the period 2001-2004 average or 2004. The measure included a Vessel Day Scheme (VDS) which limits total days fished in the EEZs of some members to no greater than 2004 levels. Time area closures of fishing on FADs. Effort control and time/area closures: CMM 2008-01 – Bigeye tuna and yellowfin tuna.</p>
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**Appendix III**  
**Output controls**

Total Allowable Catch	Pros	Cons	Comments	IOTC context
Competitive TAC	Simpler to establish than an Allocation mechanism.	<p>Likelihood that a “race to fish” scenario will develop.</p> <p>Encourage the adoption of increased fishing power/ strategies to harvest fish rapidly.</p> <p>Safety considerations for vessels fishing when they normally would not, to catch the available quota.</p> <p>Uneven temporal catch characteristics with negative economic impacts on the fishery and markets due to stockpiling of frozen product.</p>	While a competitive TAC may protect the resource, in the absence of limited entry and individual quotas, it does not reduce the social and economic distortions brought about by competing fishers racing to obtain the greatest possible share of the TAC before the fishery is closed.	[To be discussed]
Allocation of TAC	[To be discussed]	<p>Initial setting of reasonable and equitable quotas is difficult for political, social and economic reasons.</p> <p>Requires close monitoring of catch per user and in total, to ensure the TAC, and individual quotas where issued, are not exceeded.</p>	<p>If fishers have filled their quota of a given species but continue fishing for other species, they will be left with little choice but to discard or land illegally catches of the species for which the quota is filled.</p> <p>Quota swapping and carry-over of quota from one fishing season to the next may alleviate this problem.</p>	[To be discussed]
General - TAC	[To be discussed]	Need near real-time (OR if not real-time, then include	A fundamental constraint to the use of TACs as a management tool	[To be discussed]



		<p>over-catch and under-catch annual adjustments), accurate and usually costly species-specific monitoring of catch. Requires high observer and port sampling coverage.</p> <p>Incentive for high-grading and discarding at sea to reserve quota for optimally sized fish, and because quotas for co-occurring species will be filled at differing rates.</p> <p>Incentive for under-reporting of catches.</p> <p>Need to establish and update appropriate TAC levels in a timely manner that achieves goals of sustainability.</p>	<p>for the IOTC is the setting and timely adjustment of appropriate TAC levels that reflect rapid adjustments by the fisheries in response to inter-annual variability in stock abundance or vulnerability.</p> <p>Establishing a TAC level carries a high degree of risk due to uncertainties that remain in the robust prediction of recruitment processes and movement, as evidenced in the Scientific Committee report.</p>	
Size and maturity restrictions	Minimum size and maturity restrictions can be used to reduce fishing mortality on life stages of stocks which are considered to require protection.	Where implementation requires returning captured individuals to the water, the determination of the survival of returned individuals to ascertain the efficacy of these measures is desirable and may be costly.	[To be discussed]	[To be discussed]