NORTHERN COMMITTEE
ELEVENTH REGULAR SESSION

31 August - 3 September 2015
Sapporo, Hokkaido, Japan

PROPOSED FRAMEWORK FOR MANAGEMENT STRATEGY EVALUATION FOR NORTH PACIFIC ALBACORE TUNA

WCPFC-NC11-2015/WP-01

ISC

Proposed Framework for Management Strategy Evaluation

for North Pacific Albacore Tuna

Framework Goal: To develop a process for evaluating the performance of alternative management procedures for north Pacific Albacore Tuna (NPALB) against a range of scenarios that encompass observation (data) and process uncertainty in stock assessments and management, alternative hypotheses about stock dynamics and structural assumptions.

The key components of the framework are: (1) operating models that reflect a range of hypotheses concerning future states of nature, stock dynamics, and biology, (2) alternative management procedures (MP) comprised of data, stock assessment, and harvest control rules (HCR) including the rules in the proposed IATTC resolution and alternatives proposed by the Albacore Working Group (ALBWG), and (3) operational objectives and performance criteria to measure them, including fishery target reference points (TRP) and biological limit reference points (LRP), used to explore the expected performance of alternative management procedures.

Background: The USA submitted a draft resolution in July 2014 for the 87th Meeting of the IATTC (IATTC-87-PROP-J-1-USA-MSE). The resolution proposed that IATTC scientific staff, in collaboration with the ALBWG, evaluate several candidate target and limit reference points and harvest control rules using management strategy evaluation (MSE). This proposal was also discussed by the ISC14 Plenary, which recognized that MSE was a useful tool for addressing a range of scientific and management questions, that NPALB might be a good candidate for MSE, and that all WGs should consider the benefits of developing an MSE framework. Although the US proposal on MSE was withdrawn from consideration at the IATTC meeting, IATTC scientific staff have been engaged in MSE processes for bigeye tuna and dorado and there is ongoing interest in collaborating with the ISC on MSEs for Pacific bluefin tuna and north Pacific albacore tuna.

NC10 recommended the adoption of a management framework for north Pacific albacore tuna that includes some management goals, a limit reference point (LRP), and some decision rules, and requested that the ISC evaluate suitable target reference points for north Pacific albacore tuna, using MSE if appropriate. The Dec 2014 meeting of the WCPFC adopted CMM-2014-06 on developing and implementing harvest strategy approaches for key fisheries or stocks within the purview of the Commission, including NPALB. Key elements of a harvest strategy should include, wherever possible and where appropriate, operational objectives, decision rules, reference points, risk associated with exceeding reference points, and an evaluation of alternative management procedures (MPs) using MSE. Draft timeframes and harvest strategies for stocks which occur mostly in the area north of 20°N will be developed and recommended by the Northern Committee. Thus, the MSE process under development by the ALBWG will support the harvest strategy approach that specifies the pre-determined management actions necessary to achieve biological, ecological, economic and/or social management objectives.

Strengths and Weaknesses of MSE: Management strategy evaluation involves using simulation to compare the relative performance of alternative management procedures (including data collection schemes, analysis and assessment methods and subsequent procedures for management action) in achieving management objectives. In recent years MSE has been widely used in numerous management settings to try to identify management procedures that both achieve management objectives for fish stocks and are robust to the uncertainty in the system being managed. In this respect MSE is a tool for evaluating management strategies that explicitly accounts for the uncertainty in the underlying system, acknowledges the linkages between each of the components in the management system (stocks, fleets, assessments, management rules, etc.) and can account for time lags in the management process.

Furthermore, and perhaps more importantly, the MSE process creates a structured framework for discussion and collaboration between the key stakeholders (fishing industry, managers, scientists, others). It formalizes management objectives and specifies the performance criteria upon which candidate management strategies can be assessed and compared. The most successful management strategy may not be the one that maximizes long term yield or optimizes revenue, or maximizes any other criteria if it does not have the full support of all stakeholders. MSE is a process by which candidate management procedures can be evaluated and discussed to achieve the full consensus of all stakeholders in the management approach.

Discussion and consultation are fundamental components of the MSE approach and this alone can be a lengthy process. In addition the simulations that need to be run are often complicated, time consuming and require specialist skills to develop and analyse. Previous applications of the MSE approach have invariably found that the stock assessment and analysis workload is not decreased. The role of the ALBWG scientists in developing the MSE framework is to:

- Quantify the objectives of decision-makers and determine how to measure them;
- Identify the range of management strategy choices;
- Identify and quantify uncertainties (in the assessment, data, and management systems) to represent in the operating model(s);
- Evaluate outcomes, and
- Communicate results, highlighting trade-offs.

The role of managers (and other stakeholders) in the MSE process is to:

- Identify objectives for the stock and fishery;
- Articulate management procedures and relevant performance measures to evaluate MPs; and
- Make decisions on the final management procedure.

The purpose of this document is identify some of the key components needed to apply MSE to NPALB and seek feedback from managers and other stakeholders on these issues. This feedback process is iterative and will be an ongoing feature on the MSE process.

The ALBWG has developed a series of proposals on operational objectives, performance criteria, harvest control rules, and key uncertainties for the operating model along with two proposed workplans and timelines. Some of these proposals may be appropriate, some may not be appropriate. The goal of this document is to elicit feedback to eliminate some proposals, modify others, and identify new proposals.

1. Operational Objectives and Performance Criteria

The ALBWG examine existing CMMs, the management framework adopted by NC10 for the NPALB stock, the draft resolution on MSE to the IATTC, and other management statements to develop proposed operational objectives. Operational objectives quantify the policy statements in high level aspirational goals such as “conserve the stock.” Objectives identify things that matter to different stakeholders:

- Ecological – spatial distribution, stock structure;
- Biological – e.g., biological sustainability, abundance, age composition;
- Socio-economic –fishery sustainability, e.g., average annual catch, catch stability; and
- Cultural – e.g., availability of fishing opportunities, traditional use.

Article VII of the Antigua Convention of the IATTC identifies several functions of the Commission that contain statements concerning management objectives for tuna stocks within the Convention Area. These statements include:

- to ensure the long-term conservation and sustainable use of the fish stocks … *and to maintain or restore the populations of harvested species at levels of abundance which can produce the maximum sustainable yield …*"
- "… adopt, as necessary, conservation and management measures and recommendations for species belonging to the same ecosystem … *with a view to maintaining or restoring populations of such species above levels at which their reproduction may become seriously threatened*;"
- "apply the precautionary approach … promote the application of any relevant provision of the Code of Conduct …"

These statements provide insight into management objectives for fishery sustainability, i.e., maintain populations at levels of abundance that produce maximum sustained yield, and biological sustainability, i.e., maintain populations above levels at which their reproduction is seriously threatened. Historically, conservation recommendations from the Science Advisory Committee and the IATTC scientific staff have been based on an informal decision rule of whether current fishing mortality F_{cur} is higher than the F corresponding to the maximum sustainable yield (F_{MSY}). If $F_{cur}/F_{MSY} > 1$, then effort is adjusted. This rule implies that F_{MSY} is a target reference point. In contrast, there is little guidance regarding a limit reference point (LRP), other than the idea that a LRP is needed for the biological sustainability objective.

Both IATTC Resolution C-05-03 and WCPFC CMM 2005-03 on north Pacific albacore specify that no increase in [fishing] effort beyond current levels should occur. Neither measure defined the meaning of "current levels" when they were adopted, although the NC later clarified that current level is the average of 2002-2004 fishing effort in each fleet (country and gear combination). Although these measures have not been actively enforced, limit reference points have not been exceeded and, at least theoretically, a limit on vessel fishing effort targeting albacore (i.e., full and effective implementation of the measures) could be somewhat effective in constraining increases in catch and fishing mortality of the north Pacific albacore stock.

The precautionary management framework adopted by NC10 has as its management objective for North Pacific albacore tuna:

> *"… to maintain the biomass, with reasonable variability, around its current level in order to allow recent exploitation levels to continue and with a low risk of breaching the limit reference point."*

These policy statements provide information on the desired status and condition for the stock in broad terms, which the ALBWG summarizes as stabilizing catches and effort at historical levels to control exploitation.

Translating these broad policy goals into operational objectives for use in an MSE process requires three components:

1. a target or threshold value that can be represented in an operating model (e.g., abundance, inter-annual variation in catch, etc.);
2. a time horizon over which to measure the value (e.g., abundance might be measured over 2-3 generations, while catch or catch variability might be measured over shorter timeframes such as 5-10 years); and
3. an acceptable probability of either achieving the target or avoiding a threshold (e.g., 50% chance of being above a target, 95% chance above a threshold).

Based on the various policy statements and the above criteria, the ALBWG proposes the operational objectives shown below. Each objective has the components identified above plus several potential quantitative choices for each component in square brackets[ ]. This list is not exhaustive nor final. The ALBWG is using these proposals to elicit feedback on appropriate operational objectives, consistent with management goals.

Biological Sustainability

1. Maintain [spawning] biomass at its current level [e.g., B2012, recent average of 2008-2012; long-term average 1981-2010] with some variability [± 10%, 25%], in [50%, 95%] of the years measured over two albacore generations (30 years; or some other period); and
2. Maintain spawning biomass above the limit reference point LRP = $0.2SSBcurrent_{F=0}$ (or other choice) in 95% of years measured over two albacore generations (30 years or some other time period).

Fishery Sustainability

3. Maintain catch at recent levels (2012, recent average of 2008-2012; long-term average 1981-2010) ± 10%, 25% over a 5-year, 10-year period subject to achieving Objectives 1 and 2.

Based on MSE applications to other fisheries and fish stocks, a good set of objectives has the following qualities:

1. Complete – nothing important is left out;
2. Concise – no more than 6-10 unambiguous objectives with no duplication is ideal;
3. Understandable – clearly written and understood by all stakeholders and connected to things that matter; and
4. Sensitive – useful in distinguishing between alternative MPs.

2. Reference Points

A limit reference point (LRP) is a threshold state of a stock (or fishery) established scientifically, based on biological information, that is undesirable and avoided with a high probability. LRPs can be established to prevent stock collapse, weak recruitment, undesirable genetic selection, irreversible fishing impacts, uneconomical fishing or other undesirable states. Since the risk of serious harm to the stock is high below the LRP, then the probability of the stock declining below this point should be low but not zero (0) and, importantly, if it does go below the LRP, then a harvest control rule is implemented, such as terminating fishing, to prevent further compromises to the resiliency and productivity of the stock (Figure 1). The most common risk metric used for LRPs in the scientific literature is 5%, that is, when stock status is estimated relative to the limit reference point there is a 5% probability or less, that it is below the LRP or there is at least a 95% probability that it is above the LRP. LRPs are accompanied by operational control points (OCP) which specify a rule to reduce fishing rates as the stock approaches, but is above, the LRP

In contrast, based on the proposed IATTC resolution and the NC10 management framework for NPALB, managers appear to be interpreting a LRP as the biomass level (usually) at which fishing must be reduced in order to rebuild the stock to the target level (Figure 2). This interpretation uses the LRP as an OCP and is consistent with depictions of stock status in Kobe plots and determinations of overfishing or overfished states (Figure 2), but it does not recognize the potential harm to the stock that may occur below this level. Fishing levels are continuously reduced as biomass declines below the LRP, but there is no point at which fishing is terminated to allow the stock to rebuild.

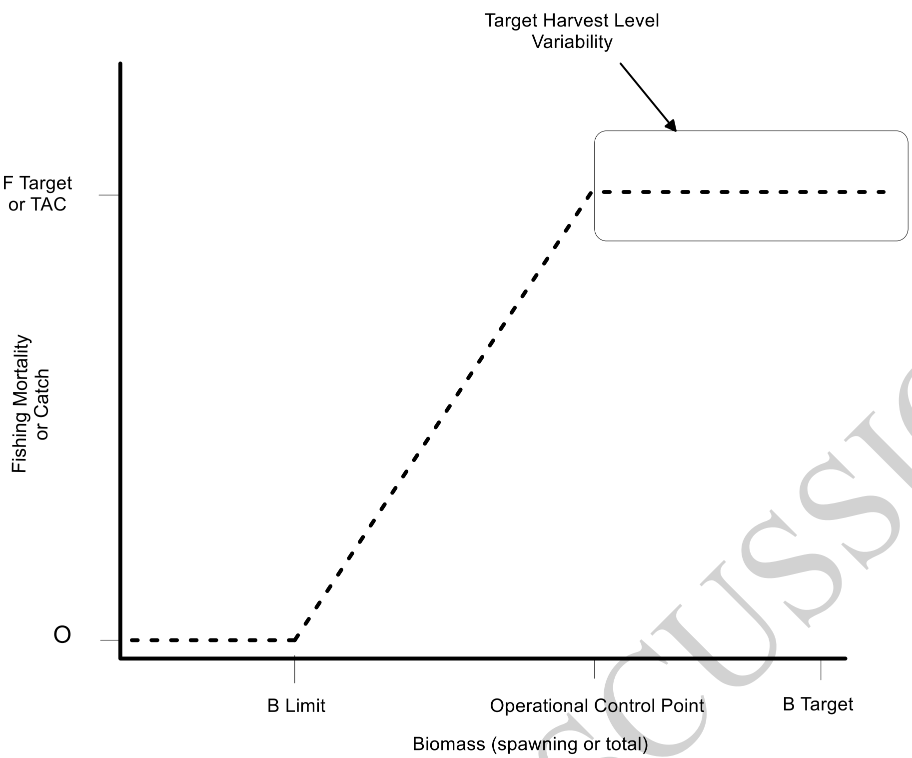

Figure 1. Scientific interpretation of limit reference points and associated harvest control rules in a precautionary framework.

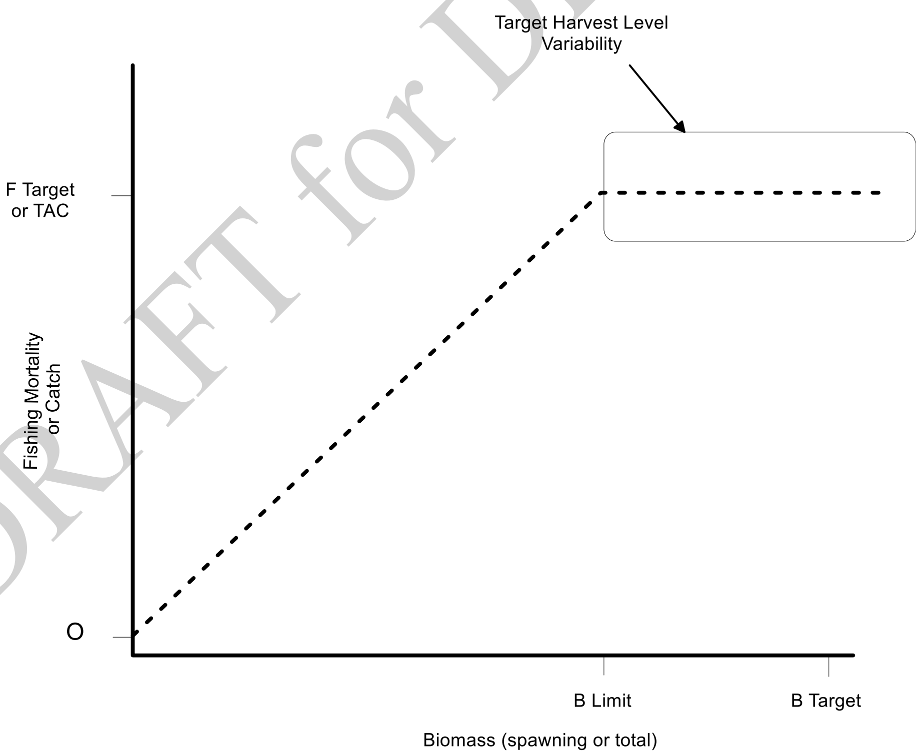

Figure 2. Management interpretation of limit reference points and associated harvest control rules in a precautionary framework.

The scientific interpretation of the precautionary framework includes three stock zones based on a combination of reference points and harvest control rules: Critical (below the LRP) where no fishing is permitted, Cautious (between the LRP and an upper control point set by managers) where fishing is reduced in order to rebuild the stock and avoid further declines to the LRP, and Healthy, when the stock is at the desired level or target set by managers and industry. A target reference point (TRP) is often F-based from which an associated target biomass level can be calculated.

A list of proposed LRPs for the north Pacific albacore stock that could be assessed with MSE was extracted from existing management guidance:

- 20%SSBcurrent F=0 – LRP adopted by NC10
- SB0.5R0, where h = 0.75 – proposed by the IATTC (Maunder and Deriso 2014: SAC-05-14);
- 14% of unfished SB; IATTC-87-PROP-J-1-USA; and
- 20% of unfished SB; IATTC-87-PROP-J-1-USA.

The reference point proposed by Maunder and Deriso (2014: SAC-05-14) is interpreted as the spawning biomass corresponding to a 50% reduction in recruitment assuming a conservative value for the steepness parameter (*h*=0.75) in the Beverton-Holt stock recruitment relationship.

The ALBWG requests clarification from managers on the following points:

(1) Is this list of proposed LRPs complete?
(2) Is 20% SSBcurrent $_{F=0}$ (NC10) equivalent to 20% unfished SB (IATTC-87-PROP-J-1)?
(3) These LRPs can be calculated as equilibrium reference points, which remain fixed over time or as dynamic reference points, which track changes in productivity over time. As currently specified, the LRP recommended by NC10 is calculated as an equilibrium reference point. What is the preferred calculation method for LRPs: equilibrium or dynamic?
(4) Is interpretation of the LRP consistent with scientific understanding (a lower limit for fishing or management understanding (a threshold below which fishing is reduced to allow stock rebuilding)?

Management is usually implemented to achieve target reference points (TRPs). The list of proposed target reference points extracted from available guidance documents includes:

- $F_{10\%}$
- $F_{20\%}$
- $F_{30\%}$
- $F_{40\%}$
- $F_{SSB\text{-}ATHL}$
- Fcurrent% (estimated as $F_{41\%}$ in 2012 in the 2014 assessment) – inferred from NC10 Precautionary Management Framework

The ALBWG requires clarification from managers on the following issues:

(1) Are there additions/deletions to this list of proposed TRPs?

3. Harvest Control Rules

Management procedures (MPs) or harvest control rules (HCRs) are pre-agreed rules that determine what happens to the fishery and stock based on proximity to reference points or some data-based threshold. Model-based HCRs use a stock assessment model to estimate biomass, fishing mortality or related quantities which are inputs for the harvest control rule. In contrast, empirical or data-based HCRs use fishery data directly, usually after some summary methods have been applied (e.g., CPUE standardization for catch and effort data) as input to the harvest control rule. Data-based HCRs are easy to test and describe and can be applied annually but the application of a model-based HCRs is dependent on stock assessment frequency, which is 3-years for north Pacific albacore, although this interval can be tested.

Two proposed model-based HCRs based on total allowable catch (TAC) and total allowable effort (TAE) controls in the IATTC draft resolution, where t+3 is a TAC or TAE set for the next 3 years, are:

TAC management:	SBcurr ≥ SB-limit	$TAC_{t+3} = F_{-target}$ at B_{curr}; (to the right of B-limit in Figure 2)
	SBcurr < SB-limit	$TAC_{t+3} = (F_{target} \times SB_{curr})/SB\text{-limit}$ at B_{curr}. (left of B-limit in Figure 2)
TAE Management	SBcurr ≥ SB-limit	$TAE_{t+3} = F\text{-}_{target}$; (right of B-limit in Figure 2)
	SBcurr < SB-limit	$TAE_{t+3} = (F\text{-}_{target} \times SB_{curr})/SB\text{-limit}$. (left of B-limit in Fig. 2)

The ALBWG proposes the following model-based decision rules for consideration, based on the concepts illustrated in Figure 1 and assuming an assessment model is run every 3 years, where t+3 indicates a TAC or TAE set for the following three years:

TAC Management	Bcurr ≤ LRP	$F_{t+3} = 0$; (left of B-limit in Fig. 1)
	LRP < Bcurr < B Threshold	$F_{t+3} = (F_{target} \times SB_{curr})/B\text{-threshold}$ (sloped line in Fig. 1)
	Bcurr ≥ B Threshold	$F_{t+3} = F_{target}$; (right of B-threshold in Fig. 1)
TAE Management	Bcurr ≤ LRP	$TAE_{t+3} = 0$; (left of B-limit in Fig. 1)
	LRP < Bcurr < B Threshold	$TAE_{t+3} = (F\text{-}_{target} \times SB_{curr})/B\text{-Threshold}$ (sloped line in Fig. 1)
	Bcurr ≥ B Threshold	$TAE_{t+3} = F_{target}$ (right of B-threshold in Fig. 1)

As an alternative, the ALBWG proposes the following data-based harvest control rules, which are evaluated annually, where TAC is total allowable catch and RC_Y is realized or actual catch in year Y and for purposes of this proposal TAC is long-term average catch, 1981-2010:

$RC_Y < TAC_Y$	$TAC_{Y+1} = TAC_Y$; (below the long-term average in Fig.3
$RC_Y > 1.1 \times TAC$	$TAC_{Y+1} = TAC_Y \times (TAC_Y/RC_Y)$ (above the long-term average in Fig. 3)

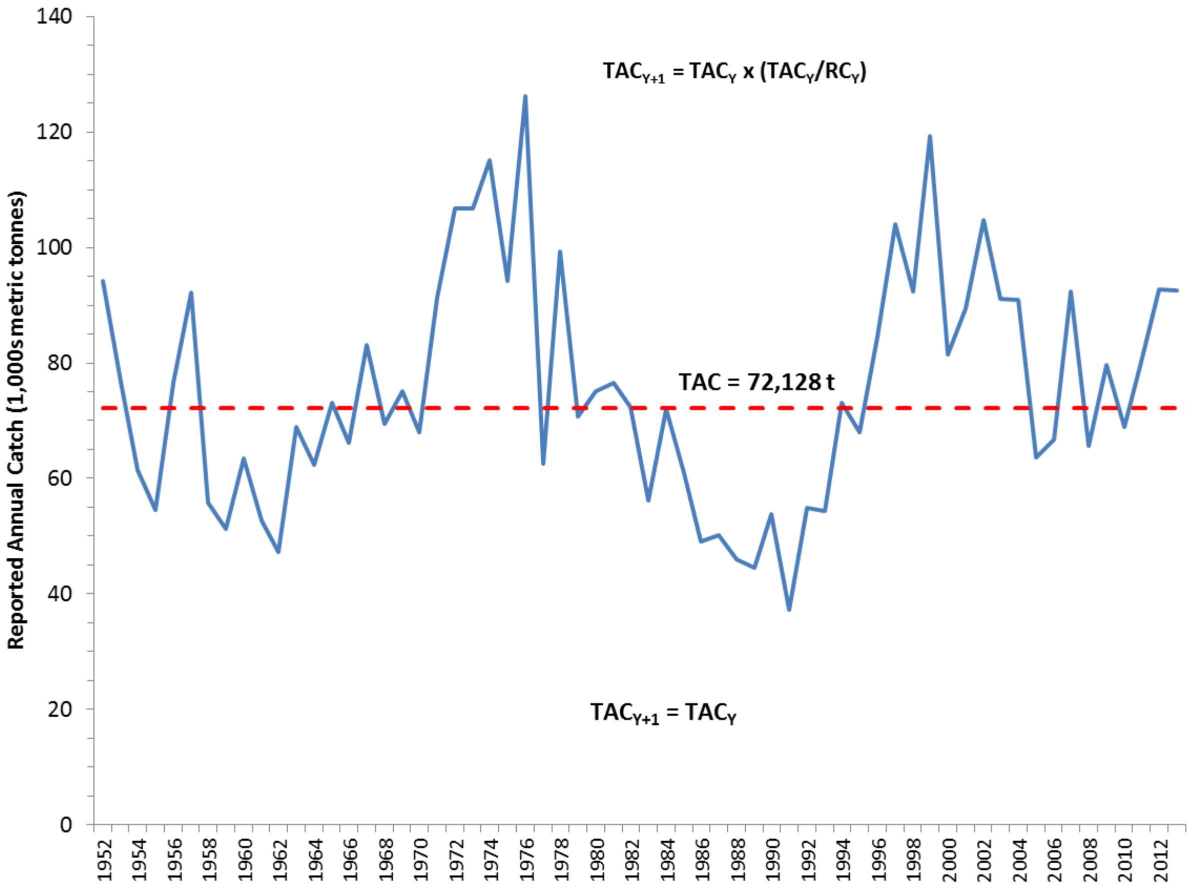

Figure 3. Illustration of data-based decision rule proposed by the ALBWG for north Pacific albacore tuna using the long-term average catch (1981-2010 – dashed red line) to set total allowable catch. When realized catches in year Y are > TAC, then TAC in Y+1 is reduced by TAC/realized catch. When realized catches are < TAC, then TAC is not changed.

The ALBWG requests clarification on the following issues concerning harvest control (decision) rules:

(1) Rules based on total allowable effort imply that there is a relationship between a unit of effort and the fishing mortality (F) on the stock for all fisheries, which are defined as country and gear combinations. Knowledge of these relationships would be important for any MSE employing effort-based rules. At present, the ALBWG is unaware of any such relationships and believes that defining such relationships is a non-trivial task.

(2) Are model-based or data-based decision rules preferred?

(3) If model-based rules are chosen, are the rules extracted from draft IATTC resolution or the alternatives proposed by the ALBWG preferred?

(4) Are there other decision rules that should be considered?

4. Operating Model Uncertainties

The ALBWG identified three categories of uncertainty and noted whether they should be included in evaluation scenarios (1) or not necessary for the first round of evaluations (2).

<u>Biological</u> (1 – important; 2 – not so important)

1. Natural mortality (length-based (Lorenzen))
1. Recruitment (steepness (0.84, 0.95; values from other ALB stocks (SPALB – 0.8, range 0.65-0.95; IALB – 0.7-0.9; AALB - 0.80-0.88), variation (CV, autocorrelation), environmental effects (some prelim research suggests PDO effect on recruitment, simulate decadal scale variation)
1. Growth (regional (eastern, central, western Pacific), sexually dimorphic growth (yes/no); cohort growth (inter-annual variation), form of the growth model – VBGF, Richards)
1. Migration (spatial structure, stock structure, sex and age structure; migration parameters estimated in 2008 CJFAS paper, at least for juveniles)
2. Maturity – form of maturity ogive; earlier or later than anticipated; length-based

<u>Fisheries (or Data)</u>

1. Catchability –variation through time, effort creep, fishery development (new equipment/techniques), relationship between unit of effort and fishing mortality for multiple gears
1. Gear selectivity – variation through time (e.g., LL shallower and deeper sets over time)
1. Fisheries movements – non-random; contraction of JPN LL; troll contraction in range to North America; changes in fishing grounds
1. Target switching (ALB versus SKJ)
2. Targeted versus bycatch fisheries – classifying effort by different types of fisheries, especially when effort control on harvest used. Effort of bycatch fisheries controlled by other factors (e.g., bigeye measures)
1. Unknown fishery operations (China and Vanuatu)
1. Observation error (effective sample size for size composition data, CPUE CVs)
2. IUU – uncertainty in catch/F

Management

1. Estimation error in assessment outputs going into HCR
1. Implementation error on advice from assessment (catch achieved versus TAC/TAE set; targeted vs. bycatch fisheries, managers adjust or ignore science advice)
2. Time lags (between assessment cycle (3 year) and action on advice; between data and assessment)

5. Workplans and Timelines

The ALBWG has addressed two issues in developing proposed workplans and timelines for conducting an MSE process:

1. Present resources and personnel are not sufficient to develop and conduct an MSE process given existing commitments of scientists to domestic issues and internationally to the stock assessment process. Therefore, an MSE analyst will have to hired or contracted to deliver on the MSE process, and

2. The next stock assessment of north Pacific albacore will be conducted and delivered in 2017. The MSE process will not interfere with delivery of the assessment. Thus, if work schedules must be rearranged, the first priority will be the stock assessment.

The WG scoped out two timelines for the MSE process: (1) an optimistic timeline, assuming that an MSE analyst will be in place by the beginning of 2016, and (2) a less optimistic timeline, based on the expectation that the arrival of the MSE analyst is delayed relative to the beginning of 2016 (see Attachment 4). Both timelines have stronger engagement with WCPFC managers, industry, and other stakeholders than those in the IATTC. It should be noted that neither of the proposed timelines reflects WG stock assessment activities (i.e., research, data preparation, and assessment meetings).

OPTIMISTIC TIMELINE

Year	Quarter	Month	Milestone
2015	Q2	April	ALBWG mini-workshop to scope MSE
	Q3	July	ISC15 Plenary – approval of ALBWG MSE planning
		September	NC11 meeting to confirm workplan, request feedback from managers
	Q4	December	WCPFC meeting
2016	Q1	January	MSE analyst hired or contracted by ISC country
	Q2	March/April	Proposed workshop on objectives/HCRs with managers
		May	7th SAC of IATTC; report plans and progress
	Q3	July	ISC16 Plenary – progress report
2017	Q2	April	Prototype OM for MSE developed and reviewed by ALBWG
		May	8th SAC of IATTC; review prototype OM
	Q3	July	ISC17 Plenary – stock assessment reviewed for approval and prototype MSE reviewed and approved
	Q3	September	NC13 – initial evaluation of MSE operating model by managers
2018	Q1	March	Complete first round of MSE for Managers

	Q3	July	ISC18 – report MSE results to ISC
		September	NC14 – report MSE evaluation results and conclusions
2019	Q2	May	9th SAC of IATTC – report MSE evaluation results and conclusions

LESS OPTIMISTIC TIMELINE

Year	Quarter	Month	Milestone
2015	Q2	April	ALBWG mini-workshop to scope MSE
	Q3	July	ISC15 Plenary – approval of ALBWG MSE planning
		September	NC11 meeting to confirm workplan, request feedback from managers
	Q4	December	WCPFC meeting
2016	Q2	April	MSE Analyst hired by ISC country
		May	7th IATTC SAC meeting; MSE plans and progress
	Q3	July	ISC16 Plenary – progress report on MSE
		September	NC12 – 1-day workshop on MSE needs from managers
2017	Q2	May	8th SAC of IATTC; MSE plans and progress
	Q3	July	ISC17 Plenary – stock assessment reviewed for approval and report on MSE progress
		September	Prototype OM for MSE developed and evaluated by ALBWG
		September	NC13 – review prototype OM
2018	Q2	April	MSE OM revisions reviewed by ALBWG
		May	9th SAC of IATTC; report on progress with revisions to MSE
	Q3	July	ISC18 Plenary – revised MSE reviewed and approved
		September	NC14 – evaluation of revised MSE by managers and other stakeholders
2019	Q2	May	10th SAC of IATTC - report first round MSE results and conclusions
	Q3	July	ISC19 – report first round MSE results and conclusions
		September	NC15 - report first round MSE results and conclusions

The ALBWG used these policy statements and the criteria above to develop proposed operational objectives. , along with performance criteria with which to measure them and has used them as examples in Table 1 of the type of feedback that is needed to advance the MSE process. The examples in Table 1 are presented to show the level of detail necessary to craft a useful objective for MSE. Using a value (e.g., SSB_{2012} as a measure of current biomass) in an example should not be construed as ALBWG endorsement of that value. Additional example questions are shown to define other objectives within each category. The example questions and potential objectives shown in the list are not comprehensive nor do they represent the only considerations that could be addressed.

Table 1. Types of objectives and questions to consider when defining operational objectives. Note that the examples in **bold** are presented to show the level of detail necessary to craft a useful objective for MSE.

Category	Question	Potential Objective	Target or Threshold Value	Measurement Time Horizon	Acceptable Probability for Achieving Target/Avoiding Threshold
Biological – biological sustainability	What is the desired status (i.e., abundance) of the stock?	**Maintain biomass above the LRP**	**20% $SSB_{0\ F=0}$**	**2 generations, 30 yr**	**95% of the projected years**
		Maintain SSB at a specified level	**SSB_{2012}**	**2 spawning cycles - 10 yr**	**50% of projected years**
		Maintain a spawning biomass above a minimum unfished biomass level (TRP)	30% $SSB_{0\ F=0}$	3 yr (stock assessment cycle)	0.5
Socio-economic; fishery sustainability	What is the desired level of catch?	**Maintain catch at average levels subject to achieving biological objectives**	**Average catch**	**1981-2010; or 2008-2012**	**50% of projected years; or ±10% of average**
		Maximize average annual catch	Max average	10 years	
		Maximize yield in each region of the north Pacific Ocean			
Socio-economic – fishery stability	What is the maximum change in catch (or effort)?	Limit average annual variability (AAV) in catch (or effort)	10%, 25%	Annual	
	What is the minimum acceptable catch?	Lowest observed catch	Avg of 10 lowest observed; Lowest observed since 2008	Annual	95% of the projected years
Cultural	What is a viable level of resource access?	Maintain current fishing opportunities in targeting and non-targeting (longline) fisheries	Average; median 2008-12	Annual	50% of projected years