Biologically reasonable rebuilding timeframes for bigeye tuna

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Overview

- Biological timeframes
- Definition of Rebuilding level
- Fishery scenarios and projection methodology
- Summary of time to rebuild bigeye

Acknowledgements: Australia DFAT and EU (WCPFC simulation testing of reference points)

HS work plan

- WCPFC12 agreed a work plan for the adoption of those harvest strategies (WCPFC, 2015), which tasked the Scientific Committee to determine “a biologically reasonable timeframe for rebuilding bigeye tuna to [or above] its limit reference point”

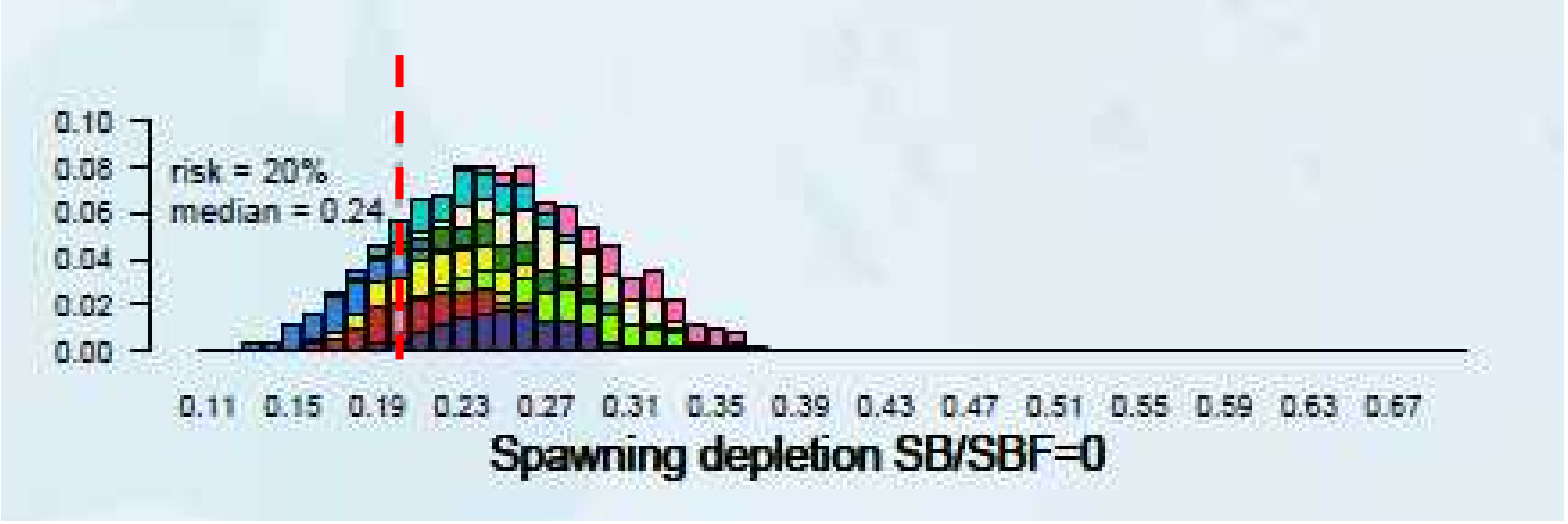
Biologically reasonable time frames

- Reasonable time frames defined by stock biology
  - Depends on life span, productivity, SRR
- Wide range of timeframes defined in fisheries mgmt. policies around the world
- Most common are related to either
  - 10 yr time horizon
  - Mean generation time (4 years in case of BET)
  - T_{min} (minimum recovery time - absence of fishing)

Definition of rebuilding level - 1

- Request to SC from WCPFC12 request to examine alternative rebuilding levels
  - adopted LRP for bigeye from 2014 assessment ($20\%SB_{F=0,2002\text{-}2011}$)
  - Levels consistent with 5%, 10%, 15%, 20% risk of stock falling below LRP

(Risk = *"% of times a population is predicted to be below the LRP when projected into the future under a particular management strategy")*



Definition of rebuilding level - 2

- "Rebuilt" defined as the year when stock achieved rebuilding level on average (50% probability)

Stock rebuilding level ($SB/SB_{F=0}$)	Basis
0.20	Adopted limit reference point, implicitly consistent with 50% risk of falling below the LRP
0.24	Consistent with a 20% risk of falling below the LRP
0.25	Consistent with a 15% risk of falling below the LRP
0.26	Consistent with a 10% risk of falling below the LRP
0.28	Consistent with a 5% risk of falling below the LRP

Fishery scenarios and projections

- Examine the implications of different rebuilding targets for different future scenarios
- Five fishery scenarios defined; designed to bracket possible scenarios. Extension of those used to evaluate CMM 2014-01

Scenario	Scalars relative to 2012	
	Purse seine (Effort)	Longline (Catch)
Status quo	1	1
Pessimistic	1.02	0.97
2015 choices	0.95	0.84
Optimistic	0.76	0.84
'Closure'[1]	0.01	0.01

- Stochastic projections run for 30 years (200 simulations) from reference case assessment only
- Future uncertainty comes from sampling of stock recruitment deviations ONLY from 2002-2011. Note these are above-average values relative to long term recruitment hence optimistic

Median rebuilding times

Rebuilding level	Status quo	'Pessimistic'	'2015 choices'	'Optimistic'	'Closure'
20%$SB_{F=0}$	8 years	8 years	7 years	6 years	**2 years**
24% $SB_{F=0}$	13 years	13 years	8 years	7 years	**3 years**
25% $SB_{F=0}$	18 years	15 years	10years	8 years	**3 years**
26% $SB_{F=0}$	22 years	20 years	11 years	8 years	**4 years**
28% $SB_{F=0}$	>30 years	>30 years	13 years	9 years	**4 years**

- Fastest rebuilding time – closure
- Higher the rebuilding target, longer the rebuilding time

Median rebuilding times

Rebuilding level	Status quo	'Pessimistic'	'2015 choices'	'Optimistic'	'Closure'
20%$SB_{F=0}$	**8 years**	8 years	7 years	6 years	2 years
24% $SB_{F=0}$	**13 years**	13 years	8 years	7 years	3 years
25% $SB_{F=0}$	**18 years**	15 years	10years	8 years	3 years
26% $SB_{F=0}$	**22 years**	20 years	11 years	8 years	4 years
28% $SB_{F=0}$	**>30 years**	>30 years	13 years	9 years	4 years

- Slowest rebuilding time - status quo
- Driven by recent 'high' recruitments
- Highest rebuilding scenario not achieved

Median rebuilding times

- Rebuilding timeframe – generation time/T_{min}

Rebuilding level	Status quo	'Pessimistic'	'2015 choices'	'Optimistic'	'Closure'
20%$SB_{F=0}$	8 years	8 years	7 years	6 years	2 years
24% $SB_{F=0}$	13 years	13 years	8 years	7 years	3 years
25% $SB_{F=0}$	18 years	15 years	10years	8 years	3 years
26% $SB_{F=0}$	22 years	20 years	11 years	8 years	4 years
28% $SB_{F=0}$	>30 years	>30 years	13 years	9 years	4 years

- Note: T_{min} depends on the rebuilding target…

Median rebuilding times

- Rebuilding timeframe – 10yrs

Rebuilding level	Status quo	'Pessimistic'	'2015 choices'	'Optimistic'	'Closure'
20%$SB_{F=0}$	8 years	8 years	7 years	6 years	2 years
24% $SB_{F=0}$	13 years	13 years	8 years	7 years	3 years
25% $SB_{F=0}$	18 years	15 years	10years	8 years	3 years
26% $SB_{F=0}$	22 years	20 years	11 years	8 years	4 years
28% $SB_{F=0}$	>30 years	>30 years	13 years	9 years	4 years

Median rebuilding times

- Rebuilding timeframe – 10yrs + 1 generation

Rebuilding level	Status quo	'Pessimistic'	'2015 choices'	'Optimistic'	'Closure'
20%$SB_{F=0}$	8 years	8 years	7 years	6 years	2 years
24% $SB_{F=0}$	13 years	13 years	8 years	7 years	3 years
25% $SB_{F=0}$	18 years	15 years	10years	8 years	3 years
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Summary

- Life history defines biologically reasonable rebuilding timeframes:
  - Generation time ~4yrs
  - Rebuilding time in absence of fishing ~2-4yrs
  - Latter depends on desired rebuilding level and distance stock is from that level
- Selection of rebuilding timeframe a management decision
  - Rebuilding within BET generation time only achieved under “closure”
  - Rebuilding within 10 years possible at lower target rebuilding levels and reduced fishing effort
  - Status quo and ‘pessimistic’ rebuilding times range from >8 to >30 years
- Once rebuilt, transition to maintaining biomass around a TRP

Recommendations

- Note estimated bigeye generation time of 4 years, and minimum rebuilding time in the absence of fishing of 2-4 yrs;
- Note timeframes influenced by the rebuilding level specified, and assumptions of future recruitment patterns;
- Note the Commission's consideration of acceptable risk for the bigeye stock falling below the limit reference point will influence the findings;
- Acknowledge that it will be important to examine not only the timeframe but also the stock trajectory of rebuilding; and
- Consider issues raised in this analysis when providing advice to WCPFC13

Pacific Community

Communauté du Pacifique

‘Pessimistic’ scenario

- Purse seine choose maximum FAD sets from either:
  - 4 mth FAD closure:
    - Non-SIDS: Max of 4mth FAD closure or Attachment A, col. D (annual FAD ceiling)
    - SIDS: Max of 4mth FAD closure, Attachment A, col. D or 2014 level
    - all + HS FAD closure
  - or annual FAD set limits (Attachment A, col. A) + HS FAD closure;
- Longline:
  - limited longline CCMs take their entire 2017 catch limit, 2014 level for others.
- Note: not as pessimistic as it could be…
  - HS closure reduces FADs, not modelling some exemptions, FAD ceiling not in place, some LL fisheries could expand, etc.

	Non-SIDS		SIDS					
	Max(4 Mnth FAD closure + HS closure, Appendix A column D + HS closure)	**FAD set limit (Attachment A column A + HS closure)**	**Max (4 Mnth FAD closure + HS closure, Appendix A column D + HS closure or 2014+HS closure)**	**FAD set limit (Attachment A column A + HS closure)**	**FAD closure + HS closure**	**FAD set limit + HS closure**	**Maximum**	**Basis**
CHINA	1,271	845			1,271	845	1,271	Column D - HS
ECUADOR	287	98			287	98	287	Column D - HS
EL SALVADOR	128	41			128	41	128	Column D - HS
FSM			678	603	678	603	678	Column D - HS
JAPAN	1,254	2,136			1,254	2,136	2,136	FAD set limit - HS
KIRIBATI			821	493	821	493	821	2014 (no HS reduction)
MARSHALL ISLANDS			1,257	1,028	1,257	1,028	1,257	2014 - HS
NEW ZEALAND	174	167			174	167	174	Column D - HS
PAPUA NEW GUINEA			1,719	2,210	1,719	2,210	2,210	FAD set limit - HS
PHILIPPINES (distant-water)	322	462			322	462	462	FAD set limit - HS
REPUBLIC OF KOREA	1,468	2,268			1,468	2,268	2,268	FAD set limit - HS
SOLOMON ISLANDS			186	165	186	165	186	Column D - HS
SPAIN	238	80			238	80	238	Column D - HS
CHINESE TAIPEI	2,597	2,402			2,597	2,402	2,597	Column D - HS
TUVALU			73	127	73	127	127	FAD set limit - HS
USA	2,743	2,260			2,743	2,260	2,743	Column D - HS
VANUATU			392	349	392	349	392	Column D - HS
					15,607	**15,733**	**17,973**	

Scalar from 2012	**1.02**

‘2015 choices’ scenario

- Purse seine:
  - CCMs apply the FAD closure duration/annual FAD set limits choice they made in 2015;
  - Numbers within choice as defined in pessimistic scenario.
- Longline
  - limited longline CCMs take the lower of their catch limit or 2014 level, others their 2014 level.

‘Optimistic’ scenario

- Purse seine choose maximum FAD sets from either:
  - 4 mth FAD closure, being the lower of:
    - FAD closure duration (8/9 * 2010-12 avg) + HS FAD closure (i.e. no FAD ‘cramming’), or
    - 2014 set level + HS FAD closure
  - or the lower of:
    - annual FAD set limits (Attachment A, col. A) + HS FAD closure or
    - 2014 set level + HS FAD closure.
- Longline:
  - limited longline CCMs take the lower of their catch limit or 2014 level, others their 2014 level.
- (Similar to the previous CMM evaluation)