COMMISSION
FIFTEENTH REGULAR SESSION
Honolulu, Hawaii, USA
10 – 14 December 2018

POTENTIAL TARGET REFERENCE POINTS FOR SOUTH PACIFIC ALBACORE

WCPFC15-2018-10_rev1[1]
5 December 2018

Paper prepared by
SPC-OFP

[1] Revision 1 replaces the original issued on 6th November 2018. The only change made was to clarify that the authorship of the paper is SPC-OFP, this change was made to avoid confusion.

1. EXECUTIVE SUMMARY

SC14 recommended the Scientific Services Provider provide CCMs with an updated analysis of candidate South Pacific albacore target reference points, based upon the SC14-agreed 2018 stock assessment and using an approach similar to that of HSW-WP-05. This paper presents results of the analysis, using long-term deterministic projections across the 2018 stock assessment grid to evaluate the ability of candidate target reference points to achieve biological and economic management objectives. Candidate TRPs are examined using average 'vulnerable biomass' levels available to the southern longline fishery relative to levels estimated in 2013. As CPUE is an important driver for the economic viability of the fishery, the relative changes in vulnerable biomass are used as a proxy for future changes in CPUE. Future fishery conditions are specified as changes in longline catch levels relative to the average catch over 2013-2015. Troll fishing is assumed to remain at 2013-2015 average levels.

To aid WCPFC discussions, this paper identifies the potential outcomes of maintaining 2013-15 average catches into the future (status quo) and the levels of catch in the southern longline fishery that on average achieve example candidate fishery objectives based on previous discussions. A full list of results for the range of alternative future relative vulnerable biomass ratios is provided in Appendix 1, and the vulnerable biomass ratio estimated in years 2000 to 2016 relative to that in 2013 is in Appendix 2. These can be used to examine alternative candidate TRP levels to the subset described below.

ACHIEVING MSY

MSY levels (estimated at 15%$SB_{F=0}$ within the 2018 stock assessment) imply a 73% reduction in vulnerable biomass (CPUE), 32% higher long-term average catch, and a 54% approximate risk of falling below the LRP.

STATUS QUO

Maintaining southern longline catch levels at the 2013-2015 average (approx. 63,125 mt) would lead to the vulnerable biomass (CPUE) falling by 30%, the stock falling on average to 0.42 $SB_{F=0}$, and a 24% approximate risk of the stock falling below the LRP.

DECREASE LONGLINE CATCH BY 10%

Decreasing longline catch by 10% leads to CPUE declining by 16%. The stock on average falls to 0.47 $SB_{F=0}$ and there is a 14% approximate risk of falling below the LRP.

MAINTAIN THE STOCK AT RECENT LEVELS

Keeping the stock at recent levels (0.52 $SB_{F=0}$) requires a 19% catch reduction, and leads to a small decline in average CPUE, and small approximate risk of breaching the LRP (3%).

INCREASE CPUE BY '*X*'%

Maintaining CPUE at 2013 levels requires a 20% reduction in catch. Increasing CPUE above that baseline requires larger catch reductions. To increase CPUE by 10% relative to 2013 levels, catch must be reduced by 27%; to increase CPUE by 17% compared to 2013 levels requires a 33% catch reduction; and by 25% requires a 38% catch reduction. In all these options, the approximate risk of falling below the LRP is 3% or less.

Average conditions for the southern longline fishery and South Pacific albacore stock, including the approximate risk of falling below the adopted LRP[1], under different candidate TRP levels. Greyed cells indicate the projection settings equivalent to the candidate aim of management. All values represent medians across the 72 assessment models.

Management aim	VB_{equil}/VB_{2013}	Scalar on 2013-15 avg catches	$SB/SB_{F=0}$	F/F_{MSY}	Approx risk SB < LRP
Achieve SB_{MSY}	0.27	1.32	0.15	-	54%
Maintain status quo (catch at 2013-15 avg)	0.70	1.00	0.42	0.26	24%
Reduce catch by 10%	0.84	0.90	0.47	0.20	14%
Maintain the stock at recent levels	0.99	0.81	0.52	0.17	3%
Keep CPUE at 2013 levels on average	1.00	0.80	0.53	0.17	3%
Increase CPUE by 10% from 2013 levels	1.10	0.73	0.57	0.15	0%
Increase CPUE by 17% from 2013 levels	1.17	0.67	0.60	0.14	0%
Increase CPUE by 25% from 2013 levels	1.25	0.62	0.63	0.12	0%

[1] this approximate risk is calculated across as the number of the 72 models that are projected to fall below the LRP at the end of the projection period. None of the uncertainty due to e.g. future recruitment variability is captured, and we therefore expect the risk to be underestimated.

2. INTRODUCTION

At the 14th regular meeting of the Commission, members agreed that "WCPFC15 shall adopt a Target Reference Point for South Pacific albacore." (WCPFC 2017).

At its meeting in August 2018, SC14 reviewed and adopted the latest assessment of the South Pacific albacore stock within the southern WCPFC Convention Area (Tremblay-Boyer et al., 2018). SC14 advised that the median level of spawning biomass depletion $SB_{recent}/SB_{F=0}$ from the uncertainty grid was 0.52 and there was zero probability that recent spawning biomass was below the LRP. In turn, median F_{recent}/F_{MSY} was 0.20, with zero probability that F_{recent} has exceeded F_{MSY}.

To assist CCMs in the identification and evaluation of an appropriate TRP for South Pacific albacore, SC14 recommended that the Scientific Services Provider provide CCMs with an updated analysis based upon the agreed 2018 stock assessment, using an approach similar to working paper HSW-WP-05 as presented to the WCPFC Harvest Strategy Workshop held in late November 2015 (SPC, 2015).

This paper presents the results of this comparable analysis, where long-term deterministic projections from the SC14-agreed 2018 stock assessment grid for South Pacific albacore are used to evaluate the ability of candidate target reference points to achieve both biological and economic management objectives. Following discussions at both WCPFC SC and Commission meetings, candidate TRPs are evaluated using average 'vulnerable biomass' levels available to the southern longline fishery relative to those levels present in 2013 (a year where some CCMs consider the longline fishery to have an adequate catch rate to meet economic fishery objectives). As CPUE is an important proxy for the economic viability of the fishery, relative changes in vulnerable biomass are used as proxies for future changes in CPUE levels within the southern WCPFC-CA.

To aid WCPFC discussions, the paper identifies:

- The consequences for stock and fishery if recent catch levels are maintained (status quo conditions, used as a baseline for comparison);

and the levels of catch in the southern longline fishery that on average achieve example candidate fishery objectives based on previous discussions, namely:

- Achieve the spawning biomass assessed to equate to MSY.
- Result from a 10% decrease in catch relative to recent levels (2013-2015);
- Maintain the level of stock depletion at recent levels ($0.52SB_{F=0}$);
- Achieve alternative levels of future vulnerable biomass relative to that in 2013, including those suggested by some CCMs as the basis for TRPs.

Full results of the deterministic stock projections are also provided so that the consequences of alternative candidate TRP levels can be examined.

3. METHODS

Analyses were run from the agreed 2018 South Pacific albacore stock assessment (Tremblay-Boyer et al., 2018). The general steps taken in this analysis were to:

i. Deterministically project the South Pacific albacore stock forward for 30 years under alternative levels ('scalars') of future longline catch in the southern WCP-CA. Projections therefore ran to 2046.
ii. The future catch 'scalar' was applied relative to 2013-2015 average catch levels, and applied equally to all longline fleets within the 2018 assessment. Scalars examined ranged from 5% of the 2013-15 average catch levels, to 100% greater than those average levels.
iii. Future troll fleet catches were maintained at 2013-2015 average levels (approx. 2,744 mt).
iv. For a given longline catch scalar, deterministic projections were performed from each of the 72 assessment models used by SC14 for management advice. Future recruitments were defined through the stock-recruitment relationship estimated within each assessment model; i.e. uncertainty in future recruitment levels was not captured[2].
v. For a given longline catch scalar, results in the year 2046 were averaged across the 72 assessment models.
vi. Catchability (which can have a trend in the historical component of the model) was assumed to remain constant in the projection period at the level estimated in the last year of the assessment model.

The following results were calculated for each future longline catch scenario:

i. The median total longline vulnerable biomass in 2046 (summed across all regions and fisheries within the stock assessment model) relative to that in 2013, to indicate the average change in CPUE within the longline fishery. The level in 2046 represents the approximate 'equilibrium' status of the stock and fishery under the specified level of fishing (VB/VB_{2013})[3].
ii. The median adult biomass in 2046 relative to unfished levels ($SB/SB_{F=0}$; calculation consistent with that of the LRP).
iii. The median fishing mortality relative to F_{MSY} (F/F_{MSY}).
vii. A proxy for the risk of falling below the LRP ($20\%SB_{F=0}$) under that fishing level, calculated as the percentage of $SB/SB_{F=0}$ from the 72 runs that were below the LRP in 2046. As this is not a full characterisation of future uncertainty, we expect this risk to be underestimated.

Given the length of the deterministic projection period, these results represent approximate equilibrium conditions experienced by the stock and fishery under the future constant catch level applied. They therefore represent the long-term average conditions achieved, not the transition in stock and fishery to reach those conditions. That transition would be defined by the management actions taken to achieve the selected TRP (see for example: Pilling et al.,

[2] A level of uncertainty is captured through use of the grid of 72 assessment models.
[3] Note that this calculation represents the median relative to the total longline vulnerable biomass over the whole assessment model region, all longline fisheries within that model combined. Some regions and longline fisheries may perform 'better' than this average, and some may perform worse.

2016), and as shown in that paper managers can decide to phase-in the indicated change in catch over a number of years.

4. RESULTS

Results for different candidate TRP levels are presented in Table 1, and a short narrative is provided below for each of the options examined. A full list of results for the range of alternative future relative vulnerable biomass ratios is provided in Appendix 1. This can be used to identify alternative candidate TRP levels, the conditions required to achieve that level on average, and the approximate risk of falling below the LRP that results. Appendix 2 presents the median total longline vulnerable biomass estimated in year 2000 to 2016, as a ratio of that in 2013, which can be cross-referenced with the table in Appendix 1. For information, a modification of Figure 5 of the 'albacore trends' paper (WCPFC15-2018-IP02), presenting recent CPUE trends in key fleets, is presented in Figure 2.

ACHIEVING MSY

If the desired target were to achieve MSY levels (on average 15%$SB_{F=0}$, as estimated within the 2018 stock assessment) CPUE would fall by 73%, long-term average catch would increase by 32%, and there would be a 54% risk of falling below the LRP.[4] Based upon the yield curve estimated within the stock assessment, fishing mortality would need to be five times greater to achieve F_{MSY}.

STATUS QUO

In the 2018 assessment, the stock was assessed not to be overfished nor subject to overfishing ($SB_{recent}/SB_{F=0}$ = 0.52). However, maintaining southern longline catch levels at those equivalent to the average over 2013-2015 (approx. 63,125 mt) into the future would lead to the vulnerable biomass (CPUE) falling by 30%, the stock falling on average to 0.42 $SB_{F=0}$, and a 24% approximate risk of the stock falling below the LRP (Figure 1).

DECREASE LONGLINE CATCH BY 10%

Decreasing longline catch by 10% relative to the 2013-2015 average would be insufficient to prevent declines in CPUE, which is estimated to fall by 16%, nor sufficient to stop stock declines, as the stock on average falls to 0.47 $SB_{F=0}$ and there is a 14% risk of breaching the LRP.

MAINTAIN THE STOCK AT RECENT LEVELS

Maintaining the stock at recent levels as identified within the 2018 stock assessment (0.52 $SB_{F=0}$) would require a 19% reduction in catch, would on average lead to a small decline in CPUE (by 1%) relative to 2013 levels, and has a small approximate risk of breaching the agreed LRP (3%).

INCREASE CPUE BY '*X*'%

To maintain CPUE at 2013 levels requires a 20% reduction in catch. To increase CPUE above that baseline would require a greater catch reduction. To increase CPUE by 10% relative to 2013 levels, catch must be reduced by 27%; to increase CPUE by 17% compared to 2013 levels

[4] Note that no median F/F_{MSY} is calculated for this level; the stock in many of the 72 models crashed at the level of fishing needed to on average achieve MSY. F/F_{MSY} was infinite at those levels.

requires a 33% catch reduction; and to increase CPUE by 25% requires a 38% catch reduction. In all these options, risk of falling below the LRP is 3% or less.

5. REFERENCES

Pilling, G., Skirtun, M., Reid, C. and Hampton, J. (2016). Biological and economic consequences of alternative trajectories to achieve a candidate South Pacific albacore target reference point. WCPFC13-2016-13.

SPC (2015). Potential target reference points for South Pacific albacore fisheries. HSW-WP-05.

Tremblay-Boyer, L., Hampton, J., McKechnie, S. and Pilling, G. (2018). Stock assessment of South Pacific albacore tuna. WCPFC-SC14-2018/SA-WP-05.

WCPFC (2017). Summary report of the 14th regular session of the Commission. Manila, Philippines, 3 - 7 December 2017.

Table 1. Average conditions for the southern longline fishery and South Pacific albacore stock, including the approximate risk of falling below the adopted LRP[1], under different candidate TRP levels. Greyed cells indicate the projection settings equivalent to the candidate aim of management. Values represent medians across the 72 assessment models, with the exception of LRP risk.

Management aim	VB_{equil}/VB_{2013}	Scalar on 2013-15 avg catches	$SB/SB_{F=0}$	F/F_{MSY}	Approx risk SB < LRP
Achieve SB_{MSY}	0.27	1.32	0.15	-	54%
Maintain status quo (catch at 2013-15 avg)	0.70	1.00	0.42	0.26	24%
Reduce catch by 10%	0.84	0.90	0.47	0.20	14%
Maintain the stock at recent levels	0.99	0.81	0.52	0.17	3%
Keep CPUE at 2013 levels on average	1.00	0.80	0.53	0.17	3%
Increase CPUE by 10% from 2013 levels	1.10	0.73	0.57	0.15	0%
Increase CPUE by 17% from 2013 levels	1.17	0.67	0.60	0.14	0%
Increase CPUE by 25% from 2013 levels	1.25	0.62	0.63	0.12	0%

[1] this approximate risk is calculated across as the number of the 72 models that are projected to fall below the LRP at the end of the projection period. None of the uncertainty due to e.g. future recruitment variability is captured, and we therefore expect the risk to be underestimated.

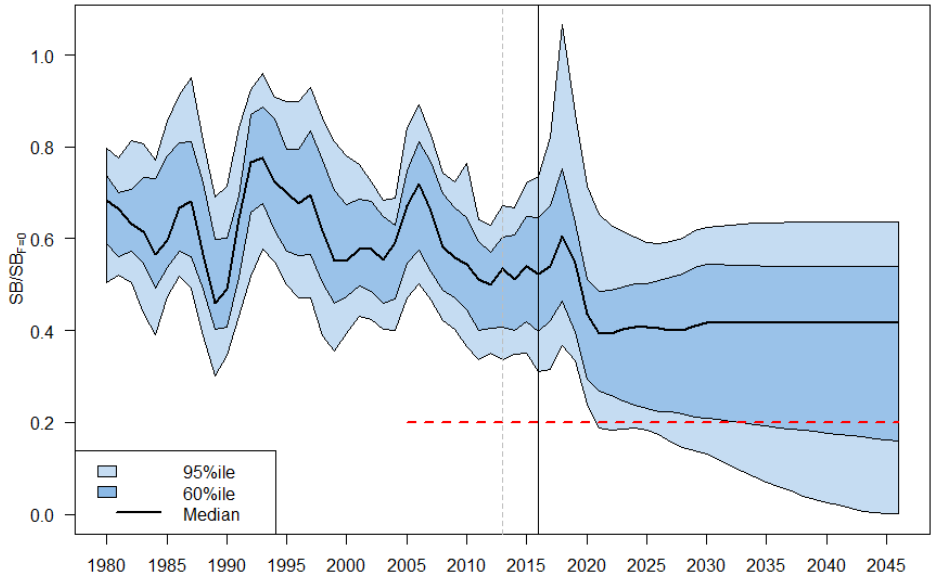

Figure 1. Time series of SB/SB$_{F=0}$ across the 72 South Pacific albacore models under status quo (2013-2015 average) catch levels, <u>deterministically</u> projected from 2016 to 2046. The dotted grey line denotes 2013, the 'reference year'. Note the percentiles presented here are across those 72 individual runs, <u>not</u> stochastic projections from those runs as underpins similar figures in e.g. the tropical tuna CMM analyses.

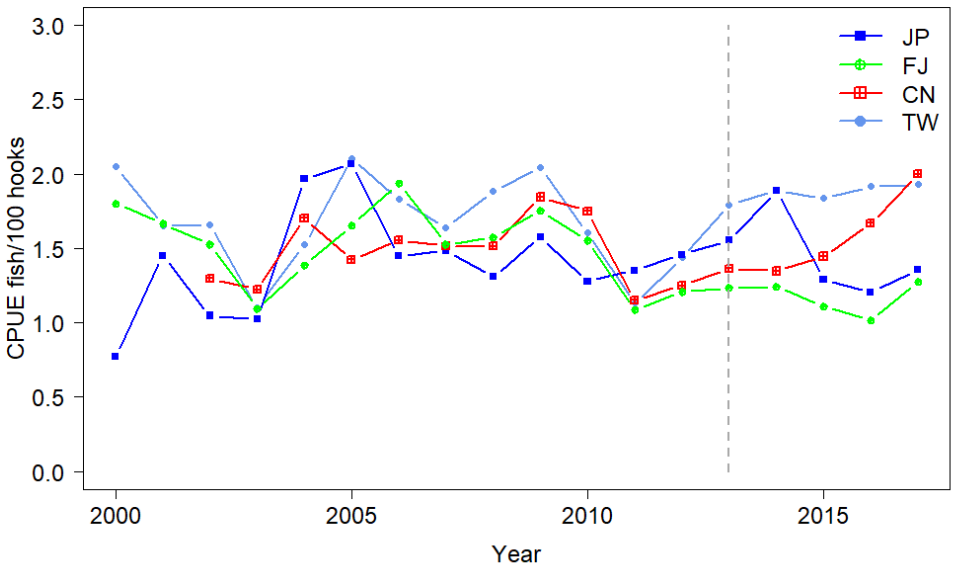

Figure 2. Trends in the nominal CPUE (number of fish per 100 hooks) over time for key fleets in the southern WCP-CA south of 10ºS, over the period 2000 to 2017. The 'reference year' of 2013 is indicated by the dotted vertical line.

APPENDIX 1. RESULTS FOR ALL VB/VB_{2013} LEVELS EXAMINED

VB/VB_{2013}	Scalar off 2013-15 average catches	$SB/SB_{F=0}$	F/F_{MSY}	Approx risk SB < LRP
2.13	0.05	0.94	0.03	0.00
2.12	0.06	0.93	0.03	0.00
2.11	0.07	0.93	0.03	0.00
2.09	0.08	0.92	0.04	0.00
2.08	0.09	0.92	0.04	0.00
2.07	0.1	0.91	0.04	0.00
2.05	0.11	0.91	0.04	0.00
2.03	0.12	0.90	0.04	0.00
2.02	0.13	0.90	0.04	0.00
2.00	0.14	0.89	0.04	0.00
1.98	0.15	0.89	0.05	0.00
1.97	0.16	0.88	0.05	0.00
1.95	0.17	0.88	0.05	0.00
1.94	0.18	0.87	0.05	0.00
1.92	0.19	0.87	0.05	0.00
1.91	0.2	0.86	0.05	0.00
1.89	0.21	0.86	0.05	0.00
1.88	0.22	0.85	0.06	0.00
1.87	0.23	0.84	0.06	0.00
1.86	0.24	0.84	0.06	0.00
1.84	0.25	0.83	0.06	0.00
1.82	0.26	0.83	0.06	0.00
1.81	0.27	0.82	0.06	0.00
1.79	0.28	0.82	0.06	0.00
1.78	0.29	0.81	0.07	0.00
1.76	0.3	0.81	0.07	0.00
1.75	0.31	0.80	0.07	0.00
1.73	0.32	0.80	0.07	0.00
1.71	0.33	0.79	0.07	0.00
1.70	0.34	0.79	0.07	0.00
1.68	0.35	0.78	0.08	0.00
1.67	0.36	0.78	0.08	0.00
1.65	0.37	0.77	0.08	0.00
1.63	0.38	0.76	0.08	0.00
1.62	0.39	0.76	0.08	0.00
1.61	0.4	0.75	0.08	0.00
1.60	0.41	0.75	0.09	0.00
1.58	0.42	0.74	0.09	0.00
1.57	0.43	0.74	0.09	0.00
1.56	0.44	0.73	0.09	0.00
1.54	0.45	0.73	0.09	0.00
1.52	0.46	0.72	0.09	0.00
1.51	0.47	0.72	0.10	0.00
1.49	0.48	0.71	0.10	0.00
1.47	0.49	0.70	0.10	0.00
1.46	0.5	0.70	0.10	0.00
1.44	0.51	0.69	0.10	0.00
1.42	0.52	0.69	0.11	0.00
1.40	0.53	0.68	0.11	0.00
1.38	0.54	0.68	0.11	0.00
1.36	0.55	0.67	0.11	0.00
1.34	0.56	0.67	0.11	0.00
1.33	0.57	0.66	0.12	0.00
1.31	0.58	0.65	0.12	0.00
1.29	0.59	0.65	0.12	0.00
1.27	0.6	0.64	0.12	0.00

1.26	0.61	0.64	0.12	0.00
1.25	0.62	0.63	0.12	0.00
1.23	0.63	0.63	0.13	0.00
1.22	0.64	0.62	0.13	0.00
1.20	0.65	0.62	0.13	0.00
1.19	0.66	0.61	0.13	0.00
1.17	0.67	0.60	0.14	0.00
1.16	0.68	0.60	0.14	0.00
1.14	0.69	0.59	0.14	0.00
1.13	0.7	0.59	0.14	0.00
1.12	0.71	0.58	0.14	0.00
1.10	0.72	0.57	0.15	0.00
1.09	0.73	0.57	0.15	0.00
1.08	0.74	0.56	0.15	0.00
1.07	0.75	0.56	0.15	0.00
1.06	0.76	0.55	0.16	0.00
1.04	0.77	0.55	0.16	0.00
1.03	0.78	0.54	0.16	0.01
1.02	0.79	0.53	0.17	0.01
1.00	0.8	0.53	0.17	0.03
0.99	0.81	0.52	0.17	0.03
0.97	0.82	0.52	0.17	0.06
0.95	0.83	0.51	0.18	0.06
0.93	0.84	0.50	0.18	0.06
0.92	0.85	0.50	0.18	0.07
0.90	0.86	0.49	0.19	0.10
0.89	0.87	0.49	0.19	0.10
0.87	0.88	0.48	0.20	0.10
0.86	0.89	0.48	0.20	0.11
0.84	0.9	0.47	0.20	0.14
0.83	0.91	0.47	0.21	0.18
0.81	0.92	0.46	0.21	0.19
0.80	0.93	0.45	0.22	0.19
0.78	0.94	0.45	0.22	0.19
0.77	0.95	0.44	0.23	0.21
0.76	0.96	0.44	0.23	0.21
0.74	0.97	0.43	0.24	0.22
0.73	0.98	0.43	0.24	0.22
0.71	0.99	0.42	0.25	0.22
0.70	1	0.42	0.26	0.24
0.69	1.01	0.41	0.26	0.26
0.68	1.02	0.40	0.27	0.29
0.67	1.03	0.40	0.27	0.31
0.66	1.04	0.39	0.28	0.32
0.65	1.05	0.38	0.28	0.32
0.64	1.06	0.38	0.29	0.33
0.63	1.07	0.37	0.29	0.35
0.62	1.08	0.36	0.29	0.36
0.60	1.09	0.36	0.30	0.36
0.59	1.1	0.35	0.30	0.36
0.57	1.11	0.34	0.31	0.36
0.55	1.12	0.34	0.32	0.36
0.54	1.13	0.33	0.33	0.36
0.52	1.14	0.32	0.33	0.38
0.51	1.15	0.32	0.35	0.38
0.50	1.16	0.31	0.32	0.39
0.49	1.17	0.30	0.33	0.40
0.48	1.18	0.29	0.33	0.42
0.47	1.19	0.28	0.34	0.43
0.46	1.2	0.27	0.35	0.44

0.44	1.21	0.26	0.35	0.46
0.43	1.22	0.25	0.34	0.46
0.42	1.23	0.24	0.36	0.46
0.41	1.24	0.23	0.38	0.46
0.39	1.25	0.22	0.37	0.47
0.37	1.26	0.21	0.38	0.49
0.36	1.27	0.20	0.41	0.50
0.35	1.28	0.20	0.42	0.50
0.34	1.29	0.19	0.43	0.53
0.33	1.3	0.18	0.40	0.53
0.32	1.31	0.18	0.41	0.53
0.31	1.32	0.17	0.42	0.54
0.30	1.33	0.17	0.43	0.54
0.29	1.34	0.16	0.44	0.56
0.28	1.35	0.16	0.45	0.56
0.27	1.36	0.15	0.44	0.56
0.27	1.37	0.15	0.49	0.57
0.26	1.38	0.15	0.61	0.58
0.25	1.39	0.14	0.62	0.58
0.24	1.4	0.14	0.56	0.58
0.23	1.41	0.13	0.58	0.58
0.22	1.42	0.13	0.60	0.58
0.22	1.43	0.12	0.62	0.60
0.22	1.44	0.12	0.64	0.60
0.21	1.45	0.12	0.66	0.60
0.20	1.46	0.11	0.69	0.61
0.20	1.47	0.11	0.70	0.64
0.19	1.48	0.10	0.72	0.64
0.18	1.49	0.10	0.73	0.64
0.17	1.5	0.09	0.74	0.65
0.16	1.51	0.08	0.75	0.65
0.16	1.52	0.08	0.76	0.67
0.15	1.53	0.08	0.79	0.67
0.14	1.54	0.07	0.79	0.68
0.14	1.55	0.07	0.80	0.68
0.14	1.56	0.07	0.79	0.68
0.13	1.57	0.07	0.80	0.68
0.13	1.58	0.06	0.85	0.68
0.13	1.59	0.06	0.78	0.69
0.12	1.6	0.06	0.82	0.71
0.12	1.61	0.05	0.73	0.71
0.12	1.62	0.05	0.74	0.72
0.11	1.63	0.04	0.83	0.74
0.11	1.64	0.04	0.80	0.74
0.10	1.65	0.03	0.78	0.74
0.09	1.66	0.03	0.80	0.75
0.08	1.67	0.03	0.75	0.75
0.07	1.68	0.03	0.78	0.75
0.07	1.69	0.03	0.84	0.76
0.07	1.7	0.02	0.83	0.76
0.06	1.71	0.02	0.87	0.76
0.06	1.72	0.02	0.89	0.76
0.06	1.73	0.02	0.90	0.78
0.06	1.74	0.02	0.79	0.78
0.05	1.75	0.02	0.89	0.78
0.05	1.76	0.02	0.94	0.78
0.05	1.77	0.02	0.96	0.78
0.05	1.78	0.01	0.86	0.78
0.04	1.79	0.01	0.96	0.78
0.04	1.8	0.01	0.88	0.78

0.04	1.81	0.01	0.83	0.78
0.04	1.82	0.01	0.86	0.78
0.04	1.83	0.01	0.86	0.78
0.04	1.84	0.01	0.91	0.79
0.03	1.85	0.01	0.88	0.79
0.03	1.86	0.01	0.93	0.79
0.03	1.87	0.01	0.90	0.79
0.03	1.88	0.01	0.92	0.81
0.02	1.89	0.01	0.95	0.81
0.02	1.9	0.01	0.94	0.81
0.02	1.91	0.01	0.98	0.83
0.01	1.92	0.00	0.97	0.85
0.01	1.93	0.00	1.01	0.86
0.01	1.94	0.00	1.01	0.86
0.01	1.95	0.00	1.03	0.86
0.00	1.96	0.00	1.04	0.88
0.00	1.97	0.00	1.04	0.88
0.00	1.98	0.00	1.05	0.88
0.00	1.99	0.00	1.06	0.88
0.00	2	0.00	1.07	0.88

APPENDIX 2. VULNERABLE BIOMASS (VB) ESTIMATED IN YEAR 2000 TO 2016, AS A RATIO OF THAT ESTIMATED IN 2013.

Year (y)	VB_y/VB_{2013}
2000	1.04
2001	1.03
2002	0.96
2003	1.01
2004	1.04
2005	1.08
2006	1.19
2007	1.17
2008	1.15
2009	1.11
2010	0.99
2011	0.95
2012	1.01
2013	1.00
2014	1.07
2015	1.09
2016	1.16