

Commission for the Conservation of
Southern Bluefin Tuna



みなまぐろ保存委員会

2002 3 3-4 6-8

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MP/0203/5, 6

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CCSBT- MP/0203/Rep2

CCSBT- MP/0203/Rep1

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CCSBT- MP/0203/6

CCSBT- MP/0203/7

CCSBT- MP/0203/EGDB

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13 Steepness RO

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/			
	steepness R_0	steepness R_0 Depersati on	depersati on pri or
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	LL1, LL2	LL 1 (JPN 4-9), LL 2 (), LL 3 (JPN 2) 4	
		4 LL2 LL3 LL 1	
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	1 1/2 LL LL		

3 2

3 2 1

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(2) LL 1 4-9 LL 3-5

(3) LL 2 LL 1

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1.			
2.			30 20 a) b) c)

3.			
4.			Collapsing
5.	CPUE	CPUE CPUE CPUE	GLM
6.		Baranov D	
7.			
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9.			Hessian

10.		CCSBT CCSBT-MP/0203/4	
11.		CCSBT	
12.		(1951-A) A 1951 A = 20	

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5.1

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- (CPE)
- ()
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29.

CPE

5.3

30

31. (2002 SAG)

(1998 - 2000)
()

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32. 2

$$C_{t+1} = (1-\varpi)C_t + \varpi k C_t (1+\lambda)$$

	λ	time (t-1)	CPUE	10
$\log(\text{CPUE})$			k	

33

- 1)
- 2) ($\varpi=0$)
- 3) ($\varpi=0.5$)

6

6.1

6.1.1

34

CPUE	i.i.d () lognormal	CPUE 2002 SAG II
		2002 SAG II

35) (2002 SAG

6.1.2

36

6.2

37.

1)

- B_0 : (i) h / 5%ile B_0
- B/B_0 :
- (S-R)

2)

:

- CPU ()
 - ()
- 3) :
- (2) -
 - ()

- 4) :
- : B/B_0 1
 - (3) :

5) M

replicate $M()$

(4)

(5)

6 3

38 (1) 9 CPU

4

- B-Ratio
- GeoStat
- Spline-based
- ST-window

39 $M(V2, V6 \text{ and } V9),$ goodness-of-fit $R(0.4, 0.6), \rho(0.4, 0.8),$
()

6 4

40

2

7.

- -

41.

20

20

7.1

42

7.2

43

1)

$$B_t = \sum_a N_{t,a} m_a w_a$$

2)

$$NB_t = \sum_a N_{t,a} (1 - m_a) w_a$$

3)

$$SP_t = \sum_a N_{t,a} \sum_{j=a}^A [m_j w_j e^{-(j-a)M}]$$

(B)

$$B_0 = R_0 \sum_{a=1}^{a=A-1} (m_a w_a e^{-(a-1)M}) + m_A w_A e^{-(A-1)M} \frac{e^{-M}}{1 - e^{-M}}$$

4) R_y

$A = 30$

44.

- B_t t
- B_0
- R_0
- $N_{t,a}$ a
- NB_t t
- SP_t
- m_a a
- w_a a
- A

45.

B_t/B_0 , NB_t/NB_0 and

SP_t/SP_0 1980, y , $y+5$, $y+10$, 2020 $y+20$

46.

- 1. B_{2020}/B_{1980}
- 2. B_{y+20}/B_y
- 3. B_{y+5}/B_y
- 4. SP_{y+n}/SP_y
- 5. B_{2020}/B_{1980}

47.

7.3 ()

48.

49.

$$AAV = \frac{1}{n} \sum_t \frac{|C_t - C_{t-1}|}{C_t}$$

50

$$d_t = \frac{C_t - C_{t-1}}{C_t}$$

C_t

51.

percentiles

10th 90th

7.4

52

8

8.1

53

MP

8.2

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AD

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55

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56

CV

CPUE

8 3

57. (CM

1) ASCII (CM→MP) (MP→CM

2) CM AD C++)
ADMB C++

58)
CM →MP

9

59

:	:
9.1	2002 5
9.2	/ 2002 8
9.3	2002 8
9.4	2002 8
9.5	SAG 2002 9

9.6 () SAG (4)

9.7 2003 2 3

9.8 II - ()

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9.10 (5 SAG 2003 9 ?)
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9.12 III - 2004 3

60

9.1

61.

2

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LL1, LL2, LL3

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- 30)

CPU (4)

Laslett Core -

ST Window -

Geo -

B-Rati o -

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(LL1, LL2, LL3)

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A:

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CSIRO

CCSBT

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4.3- CPUE / /

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5.2.1. CPUE
5.2.2.
5.2.3.
5.2.4. ? ()

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(1.1-1.3)

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SAG, SC

9.5.

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(MPWS)**CCSBT-MP/0203/**

1. Terms of Reference, Draft Agenda and the Annotation
2. List of Participants
3. List of Documents
4. A Statistical Model for Stock Assessment of Southern Bluefin Tuna with Temporal Changes in Selectivity, 6 January 2002. : Doug S. Butterworth, James N. Ianelli, Ray Hilborn.
5. (Japan) Overview of characteristics of SBT stock, fisheries, and assumptions used in historical assessments and some consideration toward developing SBT Management Procedures. :Sachiko Tsuji.
6. (Japan) Management procedure development for the Namibian hake resource. :R.A.Rademeyer and D.S. Butterworth.
7. Management of Long-Lived Marine Resources: A Comparison of Feedback-Control Management Procedures. :Andre E. Punt and Anthony D.M.Smith

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1. (Australia) An Integrated Statistical Time Series Assessment of the Southern Bluefin Tuna Stock based on Catch at Age Data. CCSBT-SC/0108/19, Polacheck, T. and A. Preece. 2001.
2. (Australia) Application of a Statistical Catch-at-Age and -Length Integrated Analysis Model for the Assessment of Southern Bluefin Tuna Stock Dynamics 1951-2000. CCSBT-SC/0108/13. Kolody, D. and Tom Polacheck.
3. (Australia) Development and evaluation of management strategies for the southern bluefin tuna fishery. AFFA-FRRF Final Report. CCSBT-MS/0005/13. Polacheck, T., N. Klaer, C. Millar, and A. Preece. 1999.
4. (Japan) Exploration of cohort analysis based on catch at length data for southern bluefin tuna. CCSBT-SC/0108/32. H. Kurota et al.
5. (Japan) Review of history in recognition of stock status and some consideration on principles in developing management procedures. CCSBT-SC/0108/34. S. Tsuji.

CCSBT-MP/0203/Info**CCSBT-MP/0203/Rep**

1. The Report of the Management Strategy Workshop
2. The Report of the Sixth Meeting of the Scientific Committee

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CCSBT-MP/0203/Info

CCSBT-MP/0203/Rep
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CCSBT-MP/0203/WP

$$N_{y+1,a+1} = N_{y,a} \left(1 - \sum_{f \in f^1} H_{f,y,a} \right) \left(1 - \sum_{f \in f^2} H_{f,y,a} \right) e^{-M_a} \quad \text{for } 0 \leq a \leq m-2$$

$$N_{y+1,m} = N_{y,m-1} \left(1 - \sum_{f \in f^1} H_{f,y,m-1} \right) \left(1 - \sum_{f \in f^2} H_{f,y,m-1} \right) e^{-M_{m-1}} + N_{y,m} \left(1 - \sum_{f \in f^1} H_{f,y,m} \right) \left(1 - \sum_{f \in f^2} H_{f,y,m} \right) e^{-M_m}$$

$$N_{y+1,0} = R_{y+1}$$

$$N_{y,a}^* = N_{y,a} \left(1 - \sum_{f \in f^1} H_{f,y,a} \right) e^{-M_a/2}$$

$$H_{fya} = s_{fya} F_{fy}$$

$$F_{f,y} = \frac{C_{f,y}}{\left(\sum_{f \in f^1} w_{y,a}^1 s_{f,y,a} N_{y,a} \right)} ; \quad F_{f,y} = \frac{C_{f,y}}{\left(\sum_{f \in f^2} w_{y,a}^2 s_{f,y,a} N_{y,a}^* \right)}$$

$$N_{y,a} \quad a$$

$$N_{y,a}^* \quad a$$

$$M_a \quad a$$

$C_{f,y}$	y		
$F_{f,y}$	y		
$H_{f,y,a}$	a		
$S_{f,y,a}$		a	
$w_{y,a}^1, w_{y,a}^2$			a
R_y	y		
f^1			
f^2			
m			

Beverton-Holt

$$R_y = \frac{\alpha S_y}{\beta + S_y} \exp(\tau_y - \sigma_R^2 / 2)$$

$$\tau_y = \rho \tau_{y-1} + \sqrt{1 - \rho^2} \omega_y$$

$$S_y \quad \rho$$

$$(\rho = \text{Cor}(\tau_y, \tau_{y-1})) \quad \omega_y \sim N(0, \sigma_R^2)$$

1951

1951

1931

$$S_y = \sum_{a=1}^m b_a w_{y,a}^1 N_{y,a}$$

$$b_a \quad a$$

Bo
" steepness "

$$\alpha = \frac{4hR_0}{5h-1}$$

$$\beta = \frac{B_0(1-h)}{5h-1}$$

$$R_0 = B_0 / \left[\sum_{a=1}^{m-1} b_a w_{1951,a}^1 \exp \left(- \left(\sum_{a'=0}^{a-1} M_{a'} \right) \right) + b_m w_{1951,m}^1 \frac{\exp \left(- \left(\sum_{a'=0}^{m-1} M_{a'} \right) \right)}{1 - \exp(-M_m)} \right]$$

Depensati on

$$s'_{f,y,a} = \lambda_{f,a} \quad \text{for } 1 \leq a \leq m^f$$

$$s'_{f,y,a} = \lambda_{f,m^f} \quad \text{for } a > m^f$$

$$s_{f,y,a} = \frac{s'_{f,y,a}}{\sum_{a=1}^m s'_{f,y,a}}$$

m^f

:

$$s'_{f,1951,a} = \lambda_{f,a} \quad \text{for } 1 \leq a \leq m^f$$

$$s'_{f,1951,a} = \lambda_{f,m^f} \quad \text{for } a > m^f$$

$$s_{f,1951,a} = \frac{s'_{f,1951,a}}{\sum_{a=1}^m s'_{f,1951,a}}$$

$$s'_{f,y+b,a} = s_{f,y,a} \exp(\gamma_{f,y,a}) \quad \gamma_{f,y,a} \sim N(0, \sigma_{s^f}^2)$$

$$s_{f,y+b,a} = \frac{s'_{f,y+b,a}}{\sum_{a=1}^m s'_{f,y+b,a}}$$

$\gamma_{f,y,a}$ a

b

()

$\gamma_{f,t,a}$

$\sigma_{s^f}^2$

($s_{f,y,a}$)

$\gamma_{f,y,a}$

$$\sum_{y=1951}^Y \sum_{a=0}^{m^f-3} \frac{(\ln s_{f,y,a+3} - 3 \ln s_{f,y,a+2} + 3 \ln s_{f,y,a+1} - \ln s_{f,y,a})^2}{2\sigma_{b^f}^2} = g^f(s_{f,y,a}; 2\sigma_{b^f}^2)$$

) (())

(2001) (mu) Kol ody Pol acheck
(age) = 2.0 + (1/30) * mu(age) cm
mu age time
(Paige Eveson, CSIRO pers comm)

$$T_{1951,a} = 0 \quad \text{for } a \leq 10$$

$$T_{y+1,a+1} = T_{y,a} \left(1 - \sum_{f \in f^1} H_{f,y,a} \right) \left(1 - \sum_{f \in f^2} H_{f,y,a} \right) e^{-M_a} +$$

$$\left(G_{y,a} - \frac{r_{y,a}}{\lambda_{y,a}} \right) e^{-M_a/2} \quad \text{for } 1951 \leq y \leq 2000 \text{ and } 0 \leq a \leq 10$$

$$T_{y,a}^* = T_{y,a} \left(1 - \sum_{f \in f^1} H_{f,y,a} \right) e^{-M_a/2}$$

$T_{y,a}$	a	
$T_{y,a}^*$	a	
$G_{y,a}$		a
$r_{y,a}$	a	
$\lambda_{y,a}$	a	

a

$$\hat{C}_{f,y,a} = s_{f,y,a} F_{f,y} N_{y,a} \quad \text{for } f \in f^1$$

$$\hat{C}_{f,y,a} = s_{f,y,a} F_{f,y} N_{y,a}^* \quad \text{for } f \in f^2$$

$$\hat{L}_{f,y,l} = \sum_a p_{y,a,l}^t \hat{C}_{f,y,a} \quad \text{for } f \in f_1, t=1 ; \text{ for } f \in f_2, t=2$$

$$p_{y,a,l}^t$$

(CPUE LL1)

CPUE

$$\hat{I}_y = q \sum_a (s_{f,y,a} N_{y,a}^*) \quad \text{where } f = \text{LL1}$$

$$q$$

$$r'_{f,y,a} = s_{f,y,a} F_{f,y} T_{y,a} \quad \text{for } f \in f^1$$

$$r'_{f,y,a} = s_{f,y,a} F_{f,y} T_{y,a}^* \quad \text{for } f \in f^2$$

$$r'_{f,y,a} \quad y \quad a$$

$$\hat{r}_{y,a} = \frac{\sum f'_{f,y,a}}{\lambda_{y,a}}$$

CPU

CPU

σ_I^2

$$-\ln L = n_I \ln(\sigma_I) + \frac{\sum (\ln(I_y) - \ln(\hat{I}_y))^2}{2\sigma_I^2}$$

n_I CPU

$$-\ln L = n^f \sum_y \sum_k p_{f,y,k} \ln(\hat{p}_{f,y,k})$$

$k = a$

$k = l$

$$p_{f,y,a} = \frac{O_{f,y,a}}{\sum_a O_{f,y,a}}, \quad \hat{p}_{f,y,a} = \frac{\hat{C}_{f,y,a}}{\sum_a \hat{C}_{f,y,a}} \text{ for age-based data}_1, \text{ and}$$

$$\hat{p}_{f,y,l} = \frac{\hat{L}_{f,y,l}}{\sum_a \hat{L}_{f,y,l}} \text{ for length-based data}$$

n^f

$O_{f,y,a}, \hat{C}_{f,y,a}, \hat{L}_{f,y,l}$

Poi sson Poi sson

Q 5

$$-\ln L = \sum_y \sum_a \frac{(\sqrt{r_{y,a}} - \sqrt{\hat{r}_{y,a}})^2}{2\sigma_T^2}$$

$r_{y,a}$

a

Poi sson

over - di spersi on

Q 5

steepness

steepness
 $N \sim [\tilde{h}, \sigma_h^2]$

$$N \sim [\tilde{\rho}, \sigma_\rho^2]$$

$$\ln(\sigma_h) + \frac{(h - \tilde{h})^2}{2\sigma_h^2} \quad \text{and} \quad \ln(\sigma_\rho) + \frac{(\rho - \tilde{\rho})^2}{2\sigma_\rho^2}$$

log space

$$E(\tau_y) = 0, \text{Var}(\tau_y) = \sigma_R, \text{Cor}(\tau_y, \tau_{y-1}) = \rho \quad \text{AR}(1)$$

$$\frac{(\tau_{y_1})^2}{2\sigma_R^2} + \frac{\sum_{y=y_1+1}^{y=y_n} (\tau_y - \rho\tau_{y-1})^2}{2\sigma_R^2(1-\rho)^2} + n_R \ln(\sigma_R) + 0.5(n_R - 1) \ln(1 - \rho^2)$$

$$n_R \quad y_1 \quad y$$

$$\sum_f g^f (s_{f,y,a}; 2\sigma_{bf}^2)$$

$$\sigma_{bf}^2$$

$$\sum_f \sum_{y \in y^f} \frac{(\gamma_{f,y,a})^2}{2\sigma_{sf}^2}$$

$$y^f$$

$$f$$

1.

		V2, V6
	$M_{\underline{a}}$	V9
	b_a h $\ln(B_0)$ $\bar{\omega}_y \quad y = 1931, \dots, 2000$ σ_R^2 ρ	$b_a=0$ for $a < 10$ $b_a=1$ for $a \geq 10$ $U(0.2, 1)$ or Gaussian $U(-\infty, \infty)$ $N(0, \sigma_R^2)$ fixed at 0.4- 0.6 or estimated fixed at 0, 0.4 and 0.8 (estimated?)
$f:$	$\lambda_{f,a} \quad a = 0, \dots, 7$	
$f:$ JA1	$\lambda_{f,a} \quad a = 5, \dots, 20$	
$f:$ ILL	$\lambda_{f,a} \quad a = 5, \dots, 20$	
$f:$ LL1	$\lambda_{f,1951,a} \quad a = 3, \dots, 15$ $\gamma_{f,y,a} \quad a = 3, \dots, 15 \quad y = 1951, 1955, \dots$	曲率のペナルティ $N(0, \sigma_{sf}^2)$
$f:$ LL2	$\lambda_{f,1951,a} \quad a = 3, \dots, 15$ $\gamma_{f,y,a} \quad a = 3, \dots, 15 \quad y = 1951, 1955, \dots$	曲率のペナルティ $N(0, \sigma_{sf}^2)$
$f:$ LL3	$\lambda_{f,1951,a} \quad a = 3, \dots, 15$ $\gamma_{f,y,a} \quad a = 3, \dots, 15 \quad y = 1951, 1955, \dots$	曲p率のペナルティ $N(0, \sigma_{sf}^2)$

CPUE	$\ln(q_{1951})$ σ_1	$U(-15, -10)$ $U(0.2, 2)$
	n^f σ_T	