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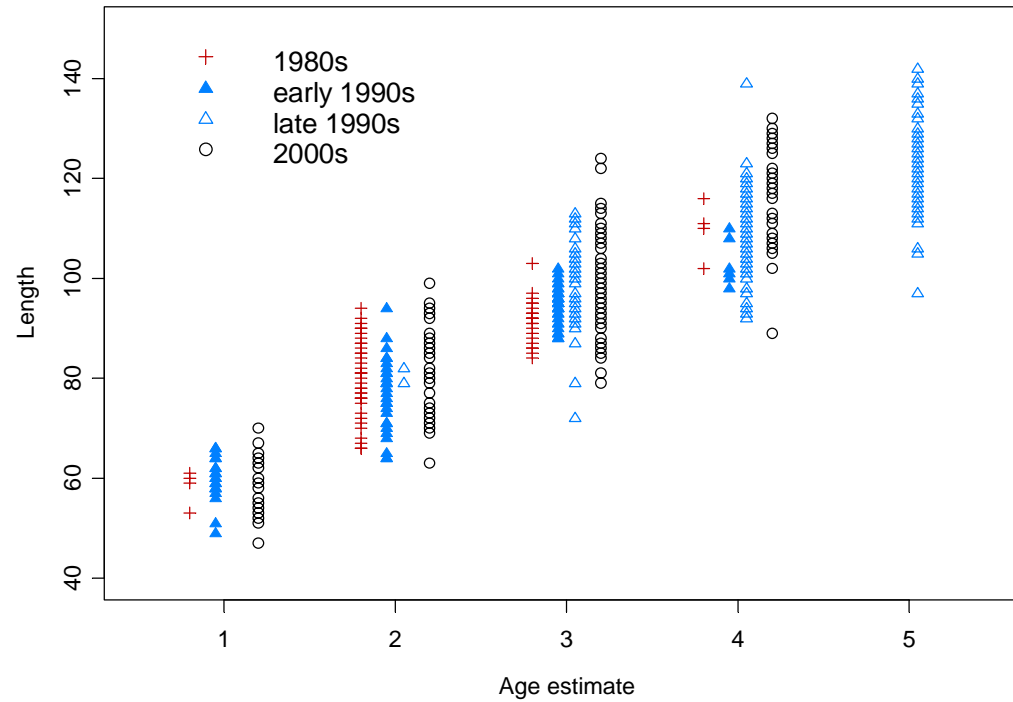
**ARCHIVAL HARD PARTS. A basis for routine ageing of
tuna and billfish**

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FRONTPIECE. RESULTS FROM RECENT AGEING OF MATERIAL COLLECTED IN THE GREAT AUSTRALIAN BIGHT AREA.

Fork length (cm) versus age, as estimated from otoliths, for fish born in different time periods.
Only data from fish caught in the Great Australian Bight are included.



ARCHIVAL HARD PARTS. A basis for routine ageing of tuna and billfish

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Non-technical Summary

In continuing support of the SBTMAC priority 1 aim to develop and maintain a system for otolith sampling and routine aging of all components of the commercial catch, this grant is aimed at providing and extending a properly maintained physical archive of sampled otoliths and a supporting database which includes all relevant information necessary for routine ageing procedures.

In the last year another 2079 otolith samples have been added to this archive, the collection sources being –

1. the Indonesian domestic fishery that operates on mature adult fish
2. the Australian domestic fishery of South Australia that operates on immature 2 to 5 year old fish
3. tagging operations in South Australia where 1 to 5 year old fish are caught
4. tagging operations in Western Australian where immature 1 and 2 year old fish are caught
5. tagging operations in New South Wales where non spawning adult fish are caught

Background and Need

In recent years much attention has been paid by CSIRO via various grant applications to the problem of accurate ageing of southern bluefin tuna from hard parts. This has resulted in a re assessment of the age structure and growth rates of this species (Anon 2002; Clear et al 2000; Gunn et al in press).

To support this work and to ensure that hard parts collected were properly archived a series of grant applications were made with the sole object of providing a proper archiving system from which properly preserved material could be used in the future. As a consequence many thousands

of hard parts have been archived and made available to scientists working on continuing ageing of this species. In addition CSIRO is also responsible for the correct archiving and storage of southern bluefin tuna otoliths collected as part of the Australian obligations to CCSBT and maintaining such a system is listed under the SBTMAC Priority 1 research objectives.

This material has been and will be used on a yearly basis to provide age/lengths keys for each section of the exploited stock as it is essential to continually monitor the age structure of the stock while the population biomass is at the present historically low level.

Objectives

Archive about 1000 sets of Southern Bluefin otoliths from the Indonesian spawning grounds

Archive up to 300-600 sets of Southern Bluefin otoliths from Australian juvenile stocks in Western and Southern Australia

On opportunity Archive any otoliths collected during CCSBT tagging operations in areas other than Western or South Australia

Continue to maintain and check the database and update when necessary previously archived material

In collaboration with the CSIRO database manager continue to expand the capabilities of the database systems.

Results/Discussion

The objectives as regards the number of samples archived were more than achieved. It should be noted that the peak collecting season is from December to March, and thus it is not possible to

archive all of the samples in the same grant year. Thus there is always an overrun of samples that are dealt with under the succeeding grant for the next year's archiving.

In total 2079 samples were archived from 4 major collection areas, the Indonesian domestic fishery on mature fish, the Australian domestic fishery in SA, tagging operations in New South Wales, and from tagging operations in WA (Table 1). The resulting total length frequency distribution of 45 to 200cm (Fig 1) reflects these four areas with peaks between 45 and 166cm for WA and SA (last year the range was only from 45 to 95cm), between 127 and 195cm for NSW (last year no fish longer than 125cm were sampled), and between 135 and 200cm for Indonesia (this year some fish between 115 and 125cm were sampled, the result of the extension of the Indonesian fishery to the south of the spawning grounds). The total number of samples archived now stands at 21 400 (Table 2). It should be noted that there are some small discrepancies in this table when compared to previous grant reports. The reason for these minor discrepancies is a result of the grant objective aimed at the continual maintenance and checking of the database and the updating of previously archived material.

The number of otoliths collected in Indonesia this year was again greater than normal. The collection system is functioning well and the contractor continues to be highly successful in drilling otoliths with minimum damage. The Indonesian material is aged each year and the results reported to CCSBT. The latest report is by Farley and Davis (2005), which includes data relating to the annual age structure of the stock from 1995 to 2004 (fig 2).

Collection details of the Australian material are also reported annually to CCSBT (Stanley and Polacheck (2005)). Following the preparation of a manual for age determination (Anon (2002)), the ageing of the accumulated South Australian material has started and has been reported to CCSBT (Eveson et al 2005, Basson et al 2005).

Collection of otoliths by the contactors, Protec Marine, from the South Australian farms is still working well with the stipulated target of 10 samples per tow cage being met for all tow cages. As for the last few years the bulk of samples have been obtained from post tow mortalities, up to 2 to 3 weeks after the fish have been transferred to stationary cages. The system of obtaining samples from mortalities during the tow in phase never worked satisfactorily, mainly due to the lack of freezer storage on the tow vessels. However this year otolith samples were obtained from two tow cage by AFMA observers during the tow in phase.

Satisfactory numbers of samples were also collected from troll caught fish obtained during tagging operations. 75 samples were collected from Western Australia, giving a good coverage of the 1+ and 2+ fish that occur in this state, and 101 samples were collected in South Australia.

With the continuation of tagging operations in New South Wales samples were again obtained from this area. During the period of this grant 93 samples collected in the 2004/05 season were archived. It is noticeable that all fish sampled this year were between 127 and 195cm long, compared with 105 to 125cm last season.

Benefits/Management outcomes

The collection and archiving of tuna hardparts has, and will continue to, underpin a number of research projects relating to the ageing of this species by CSIRO staff.. The various resulting reports are now beginning to include appreciable information on the age structure of the stock over ever increasing time periods. The benefits are thus both the development of a reliable ageing technique, and in the longer term the assisting of the management of the species both in Australian waters by SBTMAC and on the high seas by CCSBT via a series of annual reports both to CCSBT and AFMA

References

- Anon. (2002). A manual for the age determination of southern bluefin tuna *Thunnus maccoyii*. Otolith sampling, preparation and interpretation. The Direct Age Estimation Workshop of the CCSBT, 11-14 June 2002. Queenscliff, Australia. 36pp
- Basson, M., Bravington, M., Peel, S., and Farley, J.H. (2005) Estimates of proportions at age in the Australian surface fishery catch from otolith ageing and size frequency data.. CCSBT Scientific Meeting: 5-8 September 2005, Tapei, Taiwan. CCSBT-ESC/0509/19.
- Clear, N. P., Gunn, J.S., and Rees, A.J. (2000). Direct validation of annual increments in the otoliths of juvenile southern bluefin tuna, *Thunnus maccoyii*, through a large-scale mark-and-recapture experiment using strontium chloride. Fish. Bull. 98:25-40.
- Eveson, J.P., Polacheck, T., and Farley, J. (2005). Updated estimates of growth rates for juvenile SBT using tag-recapture and otolith direct ageing data up to 2005. CCSBT-ESC/0509/32.
- Farley, J.H. and Davis, T.L.O. (2005). Developing age length keys for the Australian SBT surface fishery based on direct age estimations using otoliths. AFMA research grant R04/1063.
- Farley, J.H. and Davis, T.L.O. (2005). Update on the length and age distribution of SBT in the Indonesian longline catch on the spawning ground. CCSBT Scientific Meeting: 5-8 September 2005, Tapei, Taiwan. CCSBT-ESC/0509/16.
- Gunn, J.S., Clear, N.P., Carter, T.I., Stanley, C.A., and Farley, J.H. (in press). The direct estimation of age and growth in Southern Bluefin Tuna, *Thunnus maccoyii*, using otoliths, scales and vertebrae. Fish. Bull.

Stanley, C. and Polacheck, T. (2005). An update on Australian Otolith Collection Activities:
2004/05. CCSBT Scientific Meeting: 5-8 September 2005, Tapei, Taiwan. CCSBT-
ESC/0509/18.

Table 1. Collection sources for samples added to the archives since July 2005 (* denotes that not all samples collected were processed during the term of this grant).

Collection area	Samples added
Indonesia	
2004/2005 season	903
2005/2006 season	525*
South Australia	
Farm mortalities, 2004/2005 season	191
Farm mortalities, 2005/2006 season	191*
Tagging, 2005/2006	101
Western Australia	
Tagging, 2005/2006	75
New South Wales	
Tagging, 2004/2005	93
Total	2079

Table 2. Numbers of samples included in the archive by year of collection compared to last year's report.

Year	This report	Last report
1962 ⁽¹⁾	9	9
1963 ⁽¹⁾	32	32
1964 ⁽¹⁾	155	155
1965 ⁽¹⁾	12	12
	0	0
1983	20	20
1984	69	69
1985	777	777
1986	47	47
1987	1	1
1988	198	198
1989	487	487
1990	620	620
1991	563	563
1992	1140	1140
1993	1277	1277
1994	1434	1434
1995	1612	1612
1996	1109	1109
1997	1038	1038
1998	1518	1518
1999	1007	1007
2000	867	868
2001	1110	1110
2002	1539	1889
2003	1589	1437
2004	2284	300
2005	292	
Unknown	594	594
Total	21400	19323

⁽¹⁾The material collected between 1962 and 1965 consists of scale samples only

Fig 1. Length frequency distribution (LCF) of samples archived this year.

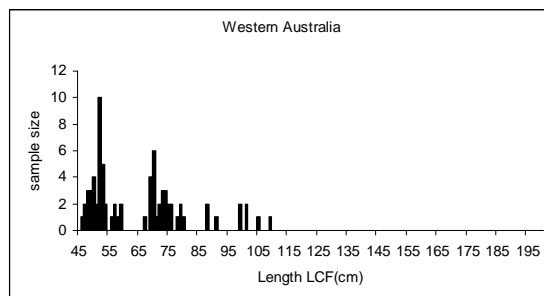
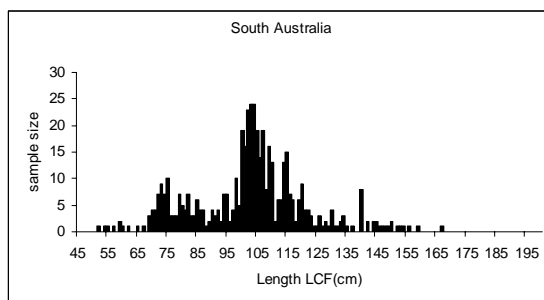
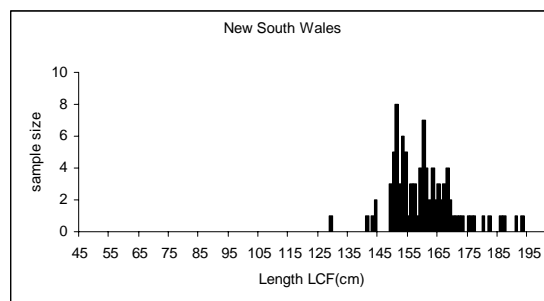
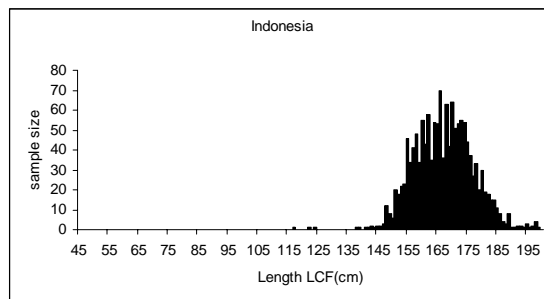
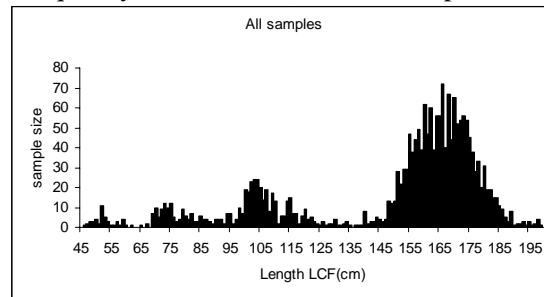


Fig 2. Age frequency structure of the Indonesian stock by spawning season. The grey bar shows the median age class.

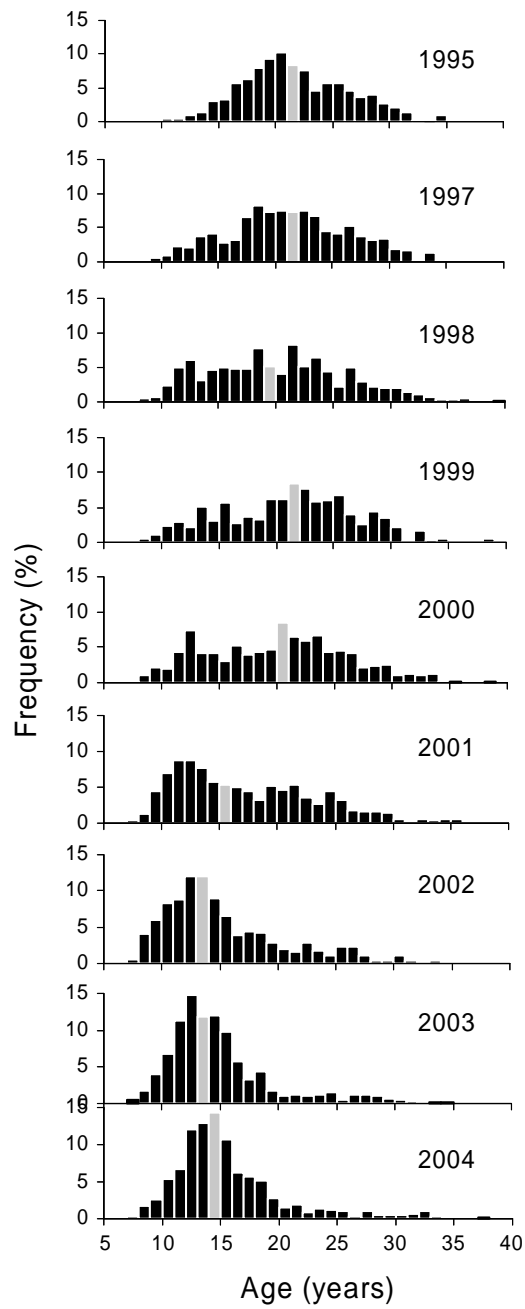


Fig 3. Age length keys by fishing season (2001/02, 2002/03 and 2003/04) for the GAB surface fishery. The upper length of each 5cm length bin is given in the first column (the lowest length bin is also a 5cm bin), and ages are shown across the top.

2001/02	1	2	3	4	5	6	7	8	Total
70		1							1
75		2	1						3
80		1	1						2
85		1							1
90			3						3
95		2	11	5					18
100			11	7	1				19
105			9	11					20
110			3	18					21
115			3	10	5				18
120				2	3	2			7
125					3				3
130					3	1			4
135					1		2		3
140						1			1
Total		7	42	53	16	4	2		124

2002/03	1	2	3	4	5	6	7	8	Total
65	1								1
70	1								1
75		2							2
80			1						1
85		4	4						8
90		4	7						11
95			3	3					6
100			7	3					10
105			6	3	1				10
110			3	6	1				10
115			2	7	1				10
120				8	2				10
125			1	3	6				10
130					11	1			12
135					1	3	2		6
140				1	1	3	1	2	8
145					1	1	1		3
150						2		1	3
Total	2	10	34	34	25	10	3	4	122

2003/04	1	2	3	4	5	6	7	8	Total
50	1								1
55	9								9
60	9								9
65	8	1							9
70	1	2							3
75		8							8
80		9							9
85		5	1						6
90		5	4	1					10
95		3	7						10
100		2	8						10
105			7	3					10
110			5	5					10
115			2	6	2				10
120				8	2				10
125			1	5	4				10
130				7	3	1			11
135				1	8	5			14
140					3		1		4
145						6			6
150						1			1
155									0
160							1		1
Total	28	35	35	36	22	13	2	0	171