CCSBT-MPTM/0502/05

CSIRO
MARINE RESEARCH

Updated estimates of tag reporting rates for the 1990s tagging experiments.

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Prepared for the CCSBT Special Management Procedure Technical Meeting (MPTM)
15-19 February 2005, Seattle, USA

Introduction

Tag release and return data from juvenile southern bluefin tuna (SBT) from tagging experiments conducted in the 1990s have been one of the primary data sources for recent SBT stock assessments and for conditioning the operating model being developed for evaluating management procedures for SBT. Estimates of reporting rates are integral for the use of the tagging data within these contexts. Estimates of tag reporting rates for the 1990s tagging experiments were first developed in 1996 (Polacheck et al. 1996) and were subsequently updated to incorporate new, updated and revised data (Polacheck et al. 1997, 1998; Preece et al. 2001). In particular, estimates of the catch by year, age and fishery are critical for the estimation of reporting rates for SBT, and there have been substantive changes to these data over the years reflecting improvements in the estimation of SBT growth and revisions to the estimation of total catch and/or its size distribution. The latest update to the reporting rate estimates was made in 2001 (Preece et al. 2001). Since then, there have been further revisions to the catch data, and, in addition, the operating model used for management procedures evaluation does not use catch data compiled by calendar year, which was the basis for the previous reporting rates, but by fishing seasons instead. At the 2004 CCSBT Scientific Committee meeting, it was agreed that the tag release and recapture data should be re-compiled to reflect the non-calendar year fishing seasons used in the operating model (Anon. 2004, Annex 5). Updated tagging data reflecting this change were provided by CSIRO to the CCSBT in September 2004. However, no provision was made for updating the reporting rate estimates to reflect the most recent catch estimates and the change in the definition of year.

This paper presents updated estimates of reporting rates that use the most recent catch estimates and are consistent with the definitions of fishing seasons used in the operating model. These updated reporting rates were calculated in a similar manner to the way they were calculated for the 2001 assessment, as documented in Appendix 2 of CCSBT-SC/0108/21 (Preece et al. 2001). A few changes were made to the way in which the data were compiled and to the reporting rate options; these changes are described in the present document.

Material and Methods

Definition of Fisheries

Reporting rates are first calculated for separate fishery components and then combined to provide an overall estimate for each fishing season. The fishery definitions used here remained the same as those used previously:

Fishery 1. Australian domestic longline and other miscellaneous catch outside South Australia (there are a few troll and purse seine operations outside SA)

Fishery 2. South Australia surface fishery (mainly pole and line and purse seine, but also a handful of trolling operations)
Fishery 3. Australian farm fishery
Fishery 4. Japanese longline catch *inside* the AFZ on vessels *with* observers
Fishery 5. Japanese longline catch *outside* the AFZ on vessels *with* observers in statistical areas 3-9
Fishery 6. Japanese longline catch *inside* the AFZ on vessels *without* observers
Fishery 7. Japanese longline catch *outside* the AFZ on vessels *without* observers in statistical areas 3-8
Fishery 8. Japanese longline catch *outside* the AFZ on vessels *without* observers in statistical area 9

Note that the Japanese longline fisheries include Australian and New Zealand joint venture operations.

Tag Return Data

The criteria used to filter the release and recapture records remained the same as described in CCSBT-SC/0108/21. The only difference to way in which the tag return data was compiled is that recapture year is defined as November 1 of the previous year to October 31 of the given year, rather than calendar year (which was used in the 2001 analysis).[1] The tag-return data provided by CSIRO to the CCSBT in September 2004 were also compiled using this adjusted year definition. This change was made so that the reporting rates would better correspond to fishing seasons. For example, using January 1 as the start of a year (i.e. calendar year) splits the surface fishing season into two years, whereas using July 1 as the start of a year splits the longline fishing season into two years; using November 1 is a reasonable compromise.

Table 1 gives an updated summary of the number of tags released by year and cohort, and the corresponding number of tags recaptured by year.

Catch Data

The catch data were generally compiled in the same way as described in CCSBT-SC/0108/21. The biggest difference is that catches were compiled by adjusted year (starting November 1), rather than calendar year, for reasons already discussed for the tag return data. A few more minor differences are as follows:

- Some of the historical catch data was updated for the 2004 CCSBT data exchange; in particular, Japan provided updated longline data for the early 1990s and New Zealand provided updated joint venture data.

[1] This adjusted year definition has always been used for release year and cohort (in both the present analysis and in past analyses).

- Two alternatives are presented for the observer catch data (Fisheries 4 and 6) because of uncertainty about the return of tags when observers were on board a vessel, but not actually observing the catch. This issue arises because a significant percentage of the catch was not actually observed while observers were aboard vessels (~30% for observer vessels within the AFZ and ~17% for RTMP observer vessels). In the first alternative, we assume that all tags are returned from all catches on observer vessels. In the second alternative, we assume that that the reporting rate is 100% only for the catches actually observed by the observer, and when the observer is not observing the catch that the reporting rate is the same as for unobserved vessels. In reality, the reporting rates for the unobserved catch while an observer is on board is likely to be somewhere in between 100% and the rate for vessels without observers as the presence of observers is likely to promote tag returns.

  Unfortunately the tag data base does not provide any insight into this issue because it only contains information on whether the tag came from a vessel with an observer, not on whether the fish from which the tag came was actually observed. Furthermore, the observer data base does not contain information on when and which tags were recovered while an observer was on board observing the catch. This means that no matter which assumption is used there may be some miss-assignment of tags to whether they came from the observed component. If we assume that 100% of tags are returned from all catches when an observer was on board a vessel, then the age distribution of the observer catches (determined from fish whose lengths were measured) needs to be scaled up to the total number of fish caught on observer vessels. If we assume that tags are only returned from catches actually observed by the observer, then essentially no scaling up is necessary because the number of fish measured for length is almost the same as the number of fish actually observed (a very small number of observed fish are not measured, so we scale up the age distribution to account for these fish)[2].

Reporting Rate Options

In calculating a final reporting rate for each year and age class, we first need to calculate the reporting rate for each fishery. The options considered for each fishery are given in Table 2. There are only minimal changes from 2001, as follows:

- Option b) for Fisheries 2 and 3 (Australian surface and farm fisheries, respectively) is now based on tag seeding data instead of relative returns rates compared to Fishery 1 (Australian longline catches). Using the relative return rate to Fishery 1 did not have a very scientific basis given the small sample size for this fishery and thus high variances. Furthermore, the reporting rates calculated this way tended to

[2] Note that in previous estimates of reporting rates, option 2 (un-scaled data) was used because the problem of determining which catch data within the observer data base to use as the "observed" catch had not been fully recognized or addressed. nor the issue of which tags were "observer reported tags". Thus, the un-scaled catch (i.e. catches that were actually observed) had been used while the apparent intention was that the scaled catch should have been used.

be equal or close to 100%. On the other hand, recent analyses of data from tag seeding experiments suggest that reporting rates may have been substantially less than 100% for the Australian farm fishery during the 1990s. Thus, tag seeding experiments conducted in the farms in 1996 and 1997 suggested significantly lower levels of reporting: 76% and 86% respectively (Polacheck 2004). We took the average (81%) and assumed that it is representative of the reporting rates in years 1991 to 1997 in both the farm fishery and the surface fishery.

- Option b) for Fishery 7 (out-of-zone Japanese longline fishery without observers) in 1997 now uses all ages, rather than just ages 5 and older, because the Japanese industry policy of non-retention of fish less than 25kg on unobserved vessels, which was in place in 1995 and 1996, was abandoned in 1997. This change should provide for a more precise estimate of the reporting rate in 1997 (i.e. as a result of the additional tag return data), although the previous exclusion should not have biased the estimate.

As outlined in CCSBT-SC/0108/21, option b) for Fishery 7 would ideally be calculated as the relative return rate compared to Fishery 5; however, lack of RTMP data makes this unfeasible (RTMP data were not made available for 1996 and 1997 and are fairly sparse in other years of the program, i.e. 1992 to 1995). This fact, along with the non-retention of small fish in Fishery 7 in 1995 and 1996, leads to the rather complicated option b) for Fishery 7.

Eight combinations of the reporting rate options for the eight fisheries were considered. Fisheries 1, 4, 5, and 6 have only one option. For the remaining fisheries, the combinations of options that we considered are summarized in Table 3. These are the same combinations presented in CCSBT-SC/0108/21. Now, however, we have the added complexity that we can use either the scaled or un-scaled data for the observer catches in calculating the reporting rates corresponding to these eight options. Until a decision has been reached on which of these two alternatives is believed to be more valid, the eight reporting rate options have been calculated using both the scaled and un-scaled data.

Combining Fishery Specific Reporting Rates

Using the reporting rates calculated for all of the fisheries, we then calculated age-specific reporting rates for each year as a weighted average of the reporting rates for all fisheries (Polacheck et al. 1997; Hearn et al. 1999). The reporting rate for each fishery is weighted by the proportion of catch at age in each fishery. Note that ‘all fisheries’ includes any catches not accounted for in Fisheries 1 to 8, for which the reporting rate is assumed to be zero.

Results

Table 4 presents updated year-specific reporting rate estimates for the fisheries and reporting rate options specified in Table 2. Results are presented using both the scaled and un-scaled observer catch data. Table 5 provides estimates of the year- and age-specific reporting rates (averaged over fisheries) for each of the eight reporting rate options given in Table 3. Again, results are presented using both the scaled and un-scaled observer catch data.

Discussion

The first eight reporting rate options presented here are analogous to those presented previously for the SBT tagging experiments conducted in the 1990s (Polacheck et al. 1996, 1998; Preece et al. 2001). They have been updated (1) to incorporate recent updates to the estimates of SBT catches and their size distributions; (2) to include corrected estimates of the SBT catches while observers were on board vessels; (3) to include tag seeding estimates of reporting rates for the Australian surface fishery and (4) to estimate the reporting rates for a fishing year (in contrast to previous calendar year estimates). It should be noted that among the eight options only option 8 is actually information based for the major non-observed fisheries for which a non-zero reporting rate is estimated (i.e. the Australian surface fishery, the Japanese longline fishery in the AFZ, the Japanese longline fishery in Areas 3-8 outside the AFZ and the Japanese longline fishery in Area 9). For the other seven options, the reporting rate for at least one of these fisheries is based on what can be considered the most optimistic assumption for that fishery (e.g. 100% reporting rates for the Australian surface, out-of-zone reporting rates are the same as in-zone, etc.). In this sense, option 8 could be considered the most “realistic” or plausible.

It should be emphasized that the eight reporting options do not span the range of uncertainty in the actual reporting rates. The eight options originally provided a measure of the sensitivity/robustness of the resulting mortality rate estimates and fishing rate mortality rate trends over time to uncertainty in the reporting rates. In particular, they provided a measure of the sensitivity of having direct information for each of the major fishery components contributing to the overall reporting rate in contrast to what would be the most optimistic assumption in the absence of any direct information or data. As such, a comparison of the two sets of four options for each major fishery provides a measure of its contribution to the uncertainty (i.e. options 1-4 relative to options 4-8 for the Australian surface and farm fisheries; options 1,2,5,6 versus 3,4,7,8 for the Japanese longline fishery areas 3 to 8; odd versus even options for the Japanese South African longline fishery (area 9)). In this sense, option 1 could be considered a reasonable upper bound for the reporting rates. However, none of the options could be considered as a reasonable lower bound. Conditional on the available data and information, option 8 could be considered as a “best” estimate (although they are the lowest) as it uses the “best” direct information for each of the main fishery components. However, it should be stressed that there is large uncertainty about these reporting rate estimates as the information/data available for their estimation is quite limited. Even in those cases where direct data are used, rather restrictive assumptions are required (e.g. no temporal changes in the reporting rates in the surface fishery over time). Finally, it should also be noted that these estimates of reporting rates are dependent upon the estimates of the catch at age for all of the different SBT fisheries. Large uncertainty is associated with these in some cases and this uncertainty is not reflected within any of the options presented.

We have also included in this paper are eight additional reporting rate options which take into account the uncertainty about tag reporting when observers are on board a vessel but not actually in the act of observing the catch (i.e. the un-scaled estimates). It should be noted that if 100% of the tags were returned while an observer was on board, independent of whether he was actually observing, then the scaled and un-scaled estimates would be expected to be the same if returned tags could be correctly assigned to whether in fact they came from a fish when the observer was observing or not. In this case, the un-scaled estimates would be preferable as any non-reporting of tags when the observer was not observing would introduce a positive bias into the reporting rates (e.g. the assumption of 100% reporting rates for the observed fishery would be violated), while the un-scaled estimates would be unbiased. However, as noted above, given the way the data have been compiled, it is not possible to determine which tags returned from observer vessels came from fish that were actually observed. If some tags came from the unobserved catches, this would introduce a negative bias into the un-scaled estimates (e.g. too many tags would be considered to have been returned from the observed portion of the catch and too few from the unobserved). It is undoubtedly the case that at least some tags from the unobserved portion of the catch were returned to the observers while they were on board. Thus, both the un-scaled and scaled estimates potentially contain negative or positive biases respectively. The difference between the two provides a measure of the extent of the possible bias but the data by themselves do not allow the extent of actual bias to be determined. The differences between the scaled and un-scaled estimates are substantive. These differences emphasize the importance of ensuring that detailed and accurate data from observers are recorded and made available if observer data are to be used for the estimation of reporting rates.

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Table 1. Summary of release and recapture numbers used in the reporting rate analysis.

Cohort	Release Year	# of Releases	# of Recaptures by Year						
			1991	1992	1993	1994	1995	1996	1997
1988	1991	810	63	8	16	7	1	4	1
1988	1992	1	0	0	0	0	0	0	1
1989	1991	3127	102	147	58	34	21	7	5
1989	1992	1097	0	57	18	11	10	4	2
1989	1993	22	0	0	2	0	0	1	0
1989	1994	4	0	0	0	0	0	0	0
1990	1991	3299	20	40	46	23	15	4	4
1990	1992	4646	0	88	157	100	33	12	9
1990	1993	2777	0	0	65	78	31	15	15
1990	1994	111	0	0	0	4	2	0	0
1990	1995	3	0	0	0	0	0	0	0
1991	1992	2144	0	1	21	56	37	12	7
1991	1993	2937	0	0	60	68	69	21	11
1991	1994	3640	0	0	0	77	146	30	41
1991	1995	101	0	0	0	0	1	3	1
1991	1996	1	0	0	0	0	0	0	0
1992	1993	4898	0	0	2	40	202	93	63
1992	1994	3158	0	0	0	29	167	77	55
1992	1995	2629	0	0	0	0	54	102	75
1992	1996	24	0	0	0	0	0	1	1
1993	1994	9003	0	0	0	4	110	399	370
1993	1995	5899	0	0	0	0	83	396	367
1993	1996	1511	0	0	0	0	0	115	205
1993	1997	17	0	0	0	0	0	0	7
1994	1995	8585	0	0	0	0	0	87	637
1994	1996	2518	0	0	0	0	0	75	344
1994	1997	526	0	0	0	0	0	0	91
1995	1996	82	0	0	0	0	0	0	3
1995	1997	592	0	0	0	0	0	0	15
1996	1997	884	0	0	0	0	0	0	1

Table 2. Summary of the reporting rate options considered for each fishery.

Fishery	Description	Reporting Rate
1	AUS LL & misc.	100%
2	AUS surface	a) 100% b) 81% (based on tag seeding experiments[3])
3	AUS farm	a) 100% except in 1996 where it is estimated as 53% due to the mass farm deaths[4]. b) 81% (based on tag seeding experiments) except in 1996 where it is estimated as 53% of 81%.
4	JPN in-AFZ with observers	100%
5	JPN out-of-AFZ with observers	100%
6	JPN in-AFZ without observers	Calculated as the relative return rate compared to Fishery 4.
7	JPN out-of-AFZ without observers areas 3 to 8	a) Same as Fishery 6. b) 1991-1994: calculated as the relative return rate compared to Fisheries 4 and 5 combined; 1995: same as 1991-1994 except only using fish 5 years of age and older; 1996: calculated as the relative return rate for Fisheries 5 and 7 combined compared to Fishery 4, and only using fish 5 years of age and older; 1997: same as 1996 but using all ages.
8	JPN out-of-AFZ without observers area 9	a) Same as Fishery 7a) b) 40% of Fishery 7b) [5] c) Same as Fishery 7a) d) 40% of Fishery 7b)

Table 3. The 8 combinations of the reporting rate options presented in Table 2 that we considered.

Fishery	Combination							
	1	2	3	4	5	6	7	8
2	a	a	a	a	b	b	b	b
3	a	a	a	a	b	b	b	b
7	a	a	b	b	a	a	b	b
8	a	b	c	d	a	b	c	d

[3] See Polacheck et al. 2004 for further information.
[4] See Polacheck et al. 1998 for further information.
[5] See Polacheck et al. 1996 for reasoning behind 40%.

Table 4. Year-specific reporting rate estimates for the fisheries and options presented in Table 2.

a) Results using scaled up observer data (assumes 100% of tags are returned from observer vessels regardless of whether all catches are directly observed).

Fishery	Option	1991	1992	1993	1994	1995	1996	1997
1	-	1	1	1	1	1	1	1
2	a	1	1	1	1	1	1	1
2	b	0.81	0.81	0.81	0.81	0.81	0.81	0.81
3	a	1	1	1	1	1	0.529	1
3	b	0.81	0.81	0.81	0.81	0.81	0.429	0.81
4	-	1	1	1	1	1	1	1
5	-	1	1	1	1	1	1	1
6	-	0.371	0.363	0.687	0.83	0.313	0.707	1
7	a	0.371	0.363	0.687	0.83	0.313	0.707	1
7	b	0.331	0.415	0.492	0.327	0.177	0.413	1
8	a	0.371	0.363	0.687	0.83	0.313	0.707	1
8	b	0.331	0.415	0.492	0.327	0.177	0.413	1
8	c	0.148	0.145	0.275	0.332	0.125	0.283	0.4
8	d	0.132	0.166	0.197	0.131	0.071	0.165	0.4

b) Results using un-scaled observer data (assumes 100% of tags are returned from observer vessels when the observer is actually observing catches, and that the reporting rate is the same as for unobserved vessels when the observer is not observing).

Fishery	Option	1991	1992	1993	1994	1995	1996	1997
1	-	1	1	1	1	1	1	1
2	a	1	1	1	1	1	1	1
2	b	0.81	0.81	0.81	0.81	0.81	0.81	0.81
3	a	1	1	1	1	1	0.529	1
3	b	0.81	0.81	0.81	0.81	0.81	0.429	0.81
4	-	1	1	1	1	1	1	1
5	-	1	1	1	1	1	1	1
6	-	0.234	0.237	0.45	0.524	0.209	0.408	0.957
7	a	0.234	0.237	0.45	0.524	0.209	0.408	0.957
7	b	0.231	0.295	0.363	0.243	0.134	0.285	0.772
8	a	0.234	0.237	0.45	0.524	0.209	0.408	0.957
8	b	0.231	0.295	0.363	0.243	0.134	0.285	0.772
8	c	0.094	0.095	0.18	0.21	0.084	0.163	0.383
8	d	0.092	0.118	0.145	0.097	0.053	0.114	0.309

Table 5. Year- and age-specific reporting rate estimates (averaged over all fisheries) for the eight options presented in Table 3.

a) Results using scaled up observer data (assumes 100% of tags are returned from observer vessels regardless of whether all catches are directly observed).

Option 1:

Age	1991	1992	1993	1994	1995	1996	1997
1	0.988	0.971	0.937	0.692	0.89	0.546	0.99
2	0.785	0.617	0.865	0.717	0.735	0.504	0.951
3	0.734	0.648	0.769	0.814	0.767	0.589	0.906
4	0.307	0.413	0.657	0.773	0.492	0.557	0.841
5	0.305	0.346	0.659	0.749	0.355	0.523	0.814
6	0.249	0.31	0.632	0.711	0.289	0.488	0.751
7	0.276	0.304	0.635	0.725	0.292	0.502	0.754
8	0.309	0.332	0.651	0.746	0.304	0.511	0.755

Option 2:

Age	1991	1992	1993	1994	1995	1996	1997
1	0.987	0.971	0.937	0.692	0.916	0.538	0.988
2	0.779	0.616	0.85	0.695	0.776	0.494	0.946
3	0.72	0.634	0.731	0.765	0.775	0.587	0.89
4	0.216	0.337	0.547	0.71	0.477	0.522	0.753
5	0.213	0.255	0.477	0.658	0.315	0.36	0.638
6	0.185	0.257	0.451	0.597	0.251	0.375	0.54
7	0.195	0.255	0.481	0.611	0.238	0.395	0.568
8	0.202	0.268	0.5	0.635	0.25	0.386	0.596

Option 3:

Age	1991	1992	1993	1994	1995	1996	1997
1	0.987	0.973	0.926	0.522	0.911	0.324	0.99
2	0.779	0.626	0.849	0.521	0.759	0.469	0.951
3	0.729	0.654	0.729	0.721	0.77	0.585	0.906
4	0.285	0.438	0.574	0.641	0.467	0.51	0.841
5	0.28	0.38	0.535	0.501	0.29	0.35	0.814
6	0.229	0.339	0.511	0.436	0.215	0.333	0.751
7	0.253	0.333	0.521	0.45	0.209	0.338	0.754
8	0.281	0.365	0.531	0.462	0.217	0.327	0.755

Option 4:

Age	1991	1992	1993	1994	1995	1996	1997
1	0.986	0.973	0.926	0.522	0.911	0.32	0.988
2	0.773	0.624	0.838	0.512	0.758	0.469	0.946
3	0.717	0.638	0.703	0.702	0.769	0.584	0.89
4	0.204	0.352	0.495	0.616	0.456	0.491	0.753
5	0.198	0.276	0.405	0.465	0.267	0.255	0.638
6	0.171	0.278	0.381	0.391	0.193	0.267	0.54
7	0.18	0.277	0.411	0.405	0.179	0.275	0.568
8	0.186	0.292	0.423	0.418	0.187	0.254	0.596

Option 5:

Age	1991	1992	1993	1994	1995	1996	1997
1	0.934	0.885	0.937	0.692	0.753	0.545	0.808
2	0.666	0.57	0.777	0.704	0.65	0.414	0.78
3	0.614	0.553	0.691	0.712	0.638	0.479	0.743
4	0.299	0.388	0.633	0.716	0.438	0.477	0.726
5	0.305	0.346	0.656	0.741	0.346	0.517	0.773
6	0.249	0.31	0.632	0.711	0.288	0.487	0.747
7	0.276	0.304	0.635	0.725	0.292	0.502	0.754
8	0.309	0.332	0.651	0.746	0.304	0.511	0.755

Option 6:

Age	1991	1992	1993	1994	1995	1996	1997
1	0.933	0.885	0.937	0.692	0.753	0.538	0.805
2	0.66	0.568	0.762	0.681	0.649	0.413	0.775
3	0.6	0.539	0.653	0.663	0.637	0.478	0.727
4	0.208	0.313	0.523	0.653	0.418	0.444	0.639
5	0.213	0.255	0.474	0.65	0.305	0.355	0.597
6	0.185	0.257	0.451	0.596	0.25	0.375	0.537
7	0.195	0.255	0.481	0.611	0.238	0.395	0.568
8	0.202	0.268	0.5	0.635	0.25	0.386	0.596

Option 7:

Age	1991	1992	1993	1994	1995	1996	1997
1	0.934	0.887	0.926	0.522	0.748	0.324	0.808
2	0.66	0.578	0.761	0.507	0.632	0.388	0.78
3	0.61	0.56	0.651	0.619	0.632	0.476	0.743
4	0.277	0.414	0.549	0.584	0.408	0.432	0.726
5	0.28	0.38	0.532	0.493	0.281	0.345	0.773
6	0.229	0.339	0.511	0.435	0.214	0.333	0.747
7	0.253	0.333	0.521	0.449	0.209	0.338	0.754
8	0.281	0.365	0.531	0.462	0.217	0.327	0.755

Option 8:

Age	1991	1992	1993	1994	1995	1996	1997
1	0.933	0.887	0.926	0.522	0.748	0.32	0.805
2	0.654	0.577	0.75	0.498	0.632	0.387	0.775
3	0.597	0.543	0.625	0.6	0.632	0.475	0.727
4	0.196	0.327	0.471	0.559	0.397	0.413	0.639
5	0.198	0.276	0.402	0.457	0.258	0.25	0.597
6	0.171	0.278	0.381	0.39	0.192	0.267	0.537
7	0.18	0.277	0.411	0.405	0.179	0.275	0.568
8	0.186	0.292	0.423	0.418	0.187	0.254	0.596

b) Results using un-scaled observer data (assumes 100% of tags are returned from observer vessels only when the observer is actually observing catches, and that the reporting rate is the same as for unobserved vessels when the observer is not observing).

Option 1:

Age	1991	1992	1993	1994	1995	1996	1997
1	0.985	0.965	0.88	0.456	0.902	0.317	0.989
2	0.74	0.536	0.773	0.517	0.75	0.467	0.949
3	0.702	0.603	0.671	0.732	0.763	0.583	0.904
4	0.213	0.321	0.497	0.633	0.452	0.504	0.831
5	0.197	0.235	0.456	0.524	0.277	0.338	0.791
6	0.161	0.213	0.433	0.48	0.212	0.315	0.724
7	0.177	0.208	0.434	0.484	0.209	0.32	0.726
8	0.198	0.226	0.446	0.497	0.216	0.312	0.726

Option 2:

Age	1991	1992	1993	1994	1995	1996	1997
1	0.985	0.965	0.88	0.456	0.902	0.312	0.987
2	0.736	0.535	0.763	0.503	0.75	0.467	0.944
3	0.693	0.594	0.647	0.701	0.763	0.583	0.889
4	0.155	0.272	0.425	0.593	0.438	0.485	0.747
5	0.139	0.175	0.336	0.466	0.25	0.244	0.623
6	0.12	0.178	0.314	0.407	0.186	0.25	0.522
7	0.126	0.175	0.333	0.412	0.172	0.258	0.548
8	0.131	0.185	0.346	0.426	0.18	0.24	0.573

Option 3:

Age	1991	1992	1993	1994	1995	1996	1997
1	0.985	0.967	0.875	0.358	0.899	0.224	0.984
2	0.739	0.545	0.766	0.403	0.74	0.457	0.94
3	0.702	0.61	0.654	0.679	0.76	0.582	0.895
4	0.211	0.35	0.46	0.558	0.434	0.485	0.791
5	0.195	0.274	0.4	0.384	0.241	0.265	0.693
6	0.159	0.246	0.379	0.324	0.171	0.25	0.608
7	0.175	0.24	0.382	0.329	0.162	0.251	0.606
8	0.195	0.264	0.392	0.337	0.167	0.235	0.602

Option 4:

Age	1991	1992	1993	1994	1995	1996	1997
1	0.985	0.967	0.875	0.358	0.899	0.221	0.982
2	0.735	0.544	0.758	0.397	0.74	0.456	0.936
3	0.693	0.599	0.634	0.665	0.759	0.581	0.883
4	0.154	0.288	0.402	0.54	0.426	0.472	0.723
5	0.138	0.199	0.304	0.357	0.223	0.2	0.557
6	0.119	0.202	0.282	0.291	0.154	0.205	0.445
7	0.125	0.2	0.301	0.295	0.139	0.208	0.462
8	0.129	0.212	0.312	0.304	0.144	0.185	0.479

Option 5:

Age	1991	1992	1993	1994	1995	1996	1997
1	0.932	0.879	0.88	0.456	0.739	0.317	0.806
2	0.621	0.488	0.686	0.503	0.624	0.386	0.778
3	0.583	0.509	0.593	0.63	0.625	0.474	0.741
4	0.205	0.297	0.473	0.576	0.392	0.426	0.717
5	0.197	0.235	0.453	0.516	0.268	0.332	0.751
6	0.161	0.213	0.433	0.479	0.211	0.315	0.72
7	0.177	0.208	0.434	0.484	0.209	0.32	0.726
8	0.198	0.226	0.446	0.497	0.216	0.312	0.726

Option 6:

Age	1991	1992	1993	1994	1995	1996	1997
1	0.932	0.879	0.88	0.456	0.739	0.312	0.804
2	0.617	0.487	0.676	0.489	0.624	0.386	0.773
3	0.574	0.499	0.569	0.599	0.625	0.474	0.726
4	0.148	0.247	0.401	0.536	0.378	0.407	0.633
5	0.139	0.175	0.334	0.459	0.241	0.238	0.582
6	0.12	0.178	0.314	0.406	0.185	0.25	0.519
7	0.126	0.175	0.333	0.412	0.172	0.258	0.548
8	0.131	0.185	0.346	0.426	0.18	0.24	0.573

Option 7:

Age	1991	1992	1993	1994	1995	1996	1997
1	0.932	0.882	0.875	0.358	0.736	0.224	0.802
2	0.62	0.498	0.678	0.39	0.614	0.376	0.769
3	0.582	0.516	0.576	0.577	0.622	0.473	0.733
4	0.203	0.326	0.436	0.501	0.375	0.407	0.676
5	0.195	0.273	0.398	0.376	0.232	0.259	0.653
6	0.159	0.246	0.378	0.323	0.17	0.25	0.604
7	0.175	0.24	0.382	0.329	0.162	0.251	0.606
8	0.195	0.264	0.392	0.337	0.167	0.235	0.602

Option 8:

Age	1991	1992	1993	1994	1995	1996	1997
1	0.932	0.881	0.875	0.358	0.736	0.221	0.8
2	0.616	0.497	0.67	0.383	0.613	0.375	0.765
3	0.573	0.504	0.556	0.562	0.621	0.472	0.721
4	0.147	0.264	0.377	0.483	0.366	0.394	0.608
5	0.138	0.199	0.301	0.35	0.214	0.194	0.516
6	0.119	0.202	0.282	0.29	0.153	0.205	0.441
7	0.125	0.2	0.301	0.295	0.139	0.208	0.462
8	0.129	0.212	0.312	0.304	0.144	0.185	0.479