REVIEW OF THE CATCH AND CATCH-AT-AGE ESTIMATION FOR THE E-BFT CATCH INFLATED ESTIMATES 1998 - 2007

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SUMMARY

During the 2022 Eastern Atlantic and Mediterranean Bluefin Tuna Data Preparatory Meeting, the Bluefin Species Group (BFTSG) agreed to revise the assumptions and update the catch-at-size/catch-at-age (CAS/CAA) intersessionally by replacing the "NEI (inflated)" partial catches component (1998-2007) with a new set of combined Mediterranean size samples. An ad-hoc small group was formed to carry out this task and proposed an alternative CAS/CAA for the 2022 E-BFT stock assessment, this document summarizes these analyses. This document provides the revised CAS (version 2b), and two CAA based on the von Bertalanffy and the Richards growth curves. The small group agreed that this revised CAS is a better estimate of the size distribution for the NEI-inflated catch and proposed to be adopted by the BFTSG, and aso recommended that this revision would be applied only to VPA (Virtual Population Analysis) and possibly ASAP (Age Structured Assessment Program).

KEYWORDS

Atlantic bluefin tuna, Catch at size, Catch at age, inflated catch

Introduction

The ICCAT Eastern Atlantic and Mediterranean Bluefin tuna (E-BFT) stock assessments since 2010 have included historical the estimated non-reported IUU (Illegal, Unreported and Unregulated) catches covering the period 1982-2007. The SCRS agreed to include them in the ICCAT database Task 1 as four NEI (not elsewhere included) flags (NEI (ETRO), NEI (Flag related), NEI (combined), NEI (inflated)). The flag "NEI (inflated)" represents the largest portion of NEI estimated catches reaching 30 to 40% of the total E-BFT catches between 2000 and 2007, and the assumptions of the size distribution of this IUU catch to produce the Catch-at-Size (CAS) and the Catch-at-Age (CAA) for a large amount of the total catch has been an important source of uncertainty of the stock assessment. During the 2022 Eastern Atlantic and Mediterranean Bluefin Tuna Data Preparatory Meeting (Anon., 2022, section 4.3.3), the Bluefin Species Group (BFTSG) agreed to revise the assumptions and update the CAS/CAA intersessionally by replacing the "NEI (inflated)" partial catches component (1998-2007) with a new set of combined Mediterranean size samples (various gears and Flags). An *ad-hoc* small group was formed to carry out this task and proposed an alternative CAS/CAA for the 2022 E-BFT stock assessment, this document summarizes these analyses.

In 2012 the SCRS and the BFTSG provided estimates of IUU catches of eastern bluefin tuna for the Mediterranean Fisheries for the period 1998 – 2007 that were adopted by the SCRS and included in the E-BFT catch series as NEI-inflated. The BFTSG agreed to assign these IUU catches to the main gear-fleet operating during these years, the PS-MED fleet. Based on this decision, the NEI-inflated catch was converted to CAS and CAA assuming the same size distribution of the PS-MED fleet. However, in reviewing the destination of the E-BFT IUU catches, auxiliary information indicated that most of this catch was destined for export to international markets, and were preferentially medium and large size fish that reached better prices. Hence, using only the PS-MED size distribution of small/juvenile fish was considered inconsistent. Thus, the size distributions of the IUU catches were reviewed and alternative estimates of CAS/CAA are produced for the evaluation models to better integrated this important component of the catch series.

Materials and Methods

The proposed methodology is based on the assumption that all the active bluefin tuna fisheries during this period have unreported catches, with larger proportion of those fisheries that could target medium and large bluefin tuna. Following this assumption, it was used all the size sampling available during this period for all fisheries that reported officially Task 1 NC (Task I nominal catches). The unreported catch NEI was allocated among main gears and quarters using the proportions of reported catch by gear/year/quarter (CATDIS) and given higher percent allocation to the gears with catches of medium and large fish including longline, traps, and hand lines. In the case of the purse seine (PS) fisheries, it was only used the size distribution of quarter 2 (Apr-Jun). This period coincided with the transition of the PS fisheries toward medium and larger fish particularly during the spawning period, fish that were primarily taken for the farming operations. It was also noted that since 2015 when the initial CAS was produced for the IUU component, the overall size-frequency samples and distributions of the PS Mediterranean fleets have been thoroughly reviewed and updated mainly for the EU-France and EU-Spanish fleets (Ref to Tristan, Gordoa paper).

The small group provided the revised CAS (version 2b), and two CAA based on the von Bertalanffy and the Richards growth curves.

Results and discussions

The revised CAS and consequently updated CAA with the von Bertalanffy growth curve indicated a lower proportion of ages 2, and 3 in the NEI-"inflated catch" and increased the proportion of ages 4, 5, and older compared to the previous version (**Figures 1** and **2**). It was also estimated catches of smaller fish of age 1. However, in general the CAA composition indicates that about 50% of the total catches were of ages 1 to 4. Only after 2009, was observed the full shift in the fisheries towards medium and larger fish when about 70% of the catch is of ages 5 and older.

The catch-at-age estimates from cohort slicing associated with changing the growth curve model from von Bertalanffy (**Table 1**) to the Richards model (**Table 2**) are shown in **Figure 3**. The main difference in estimated numbers was observed for age classes 1 to 6 and 12 to 15. The Richards model estimated fewer catches of fish ages 12 to 15 compared to the von Bertalanffy, but similar estimates of fish 16 and older. In general, the von Bertalanffy model was shown to be more accurate for younger age classes but overestimated the size-at-age of older fish (Allloud et al. 2017). It is recommended to use the Richards growth estimates for VPA runs that assume a plus-group at age 16, but to use the von Bertalanffy estimates for runs with a plus-group at age 10.

The small group agreed that this revised CAS is a better estimate of the size distribution for the NEI-inflated catch and proposed to be adopted by the BFTSG. The small group recommended that this revision would be applied only to estimate CAS and CAA (VPA and possibly ASAP).

The small group also considered the size distribution and CAS for the reported Task 1 NC, during this period, highlighting that PS accounts for 80-90% of the reported catch. In view of the size distribution review carried out on the NEI catch, the need to review the CAS for the reported catch from PS fleet is evident, since the size distributions may not include the medium and larger size fish. However, further review of size distribution of the PS reported catch will require a more in depth analyses and evaluation and will be investigated by the BFTSG for future assessments and MSE reconditioning.

References

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Table 1. Catch-at-age estimates in numbers of East Atlantic bluefin tuna based on cohort slicing assuming a von Bertalanffy growth model with the revised catch-at-size.

Year	Age0	Age1	Age2	Age3	Age4	Age5	Age6	Age7	Age8	Age9	Age10	Age11	Age12	Age13	Age14	Age15	Age16+
1950	2789	20227	36719	114063	21673	18649	39821	32572	23582	38793	28652	11389	4939	2117	1410	887	630
1951	464	28232	53299	182595	29382	20005	31855	56699	31148	32241	22931	11020	4984	2826	1859	1132	786
1952	1596	30457	54567	187950	27738	13533	29015	50286	64276	58126	28423	11538	6268	4435	3911	2517	1853
1953	2539	39346	71906	210548	33474	21149	23868	49656	51367	56341	38145	15049	6933	3505	2423	1407	1001
1954	674	37717	69333	186026	24779	20227	17586	21903	21206	37970	39628	34518	20007	7077	3259	1697	1600
1955	1660	5175	15183	4935	8559	55916	84842	43874	36349	45688	37798	27957	19722	12790	5998	2945	1653
1956	705	406	2711	3384	5576	26315	39053	31425	26876	42493	31554	14993	10399	8463	5168	3045	2296
1957	6	685	7335	5753	10565	44913	55404	52726	37492	23103	28329	22790	14153	10010	5726	4590	2596
1958	1068	14146	9284	8045	8193	54549	54651	31032	31388	26148	15943	15873	16995	10874	7686	6184	4994
1959	449	1752	10784	11352	6713	30620	27426	15961	12814	18748	18915	14778	14402	15483	9954	5331	3008
1960	238	919	5196	6051	5586	14771	14014	17103	19347	24160	24143	17981	17261	11920	7672	4006	2591
1961	1858	1458	7821	9067	5615	13286	19648	11792	14643	27689	22827	17516	16676	15966	9325	5880	5166
1962	201	2012	10561	11957	6161	13765	21562	12411	16444	27995	21109	13745	15790	17318	11485	7415	7255
1963	910	2266	11258	12760	7319	13991	18522	12998	9381	7387	15951	10840	8959	7364	2988	1859	3741
1964	1355	2870	13437	15099	8076	7568	10073	16085	8294	4576	8098	12093	14818	8074	4287	3714	6512
1965	121	5504	24950	28459	13722	10011	10058	11856	5146	2233	3587	4201	9165	13006	9101	6218	8285
1966	1061	6821	61373	69121	34813	7727	9879	7914	5310	5616	4966	4718	5876	6455	4486	3773	7381
1967	3801	4478	28707	43357	12481	5760	7774	11050	5700	9011	12189	6900	5906	7772	6911	6253	15532
1968	7241	4238	35220	72828	42601	9370	3377	7303	4791	3150	3852	4440	6002	5613	2946	2935	7120
1969	529	16105	119385	37067	9230	11283	9141	5452	8470	6937	5986	4394	5891	6146	3979	3157	8368
1970	1140	54268	116394	17771	5010	5764	9738	6794	9995	5077	4956	2982	2583	3251	1724	1403	6083
1971	794	35312	122193	9665	7580	3039	1642	4180	8064	16772	3604	2049	2063	1930	1938	2040	7176
1972	15	6154	158919	62718	15748	2131	3051	3864	3594	7059	2450	3820	2803	2324	826	1201	6638
1973	141	23588	162990	34494	5969	2998	2235	3748	9561	14694	2372	1744	2617	1770	936	1024	6482
1974	3413	48640	112723	45470	63284	9030	5723	1378	11267	20150	9824	5102	5935	5914	3268	2514	8336
1975	537	45130	175240	17287	11143	12202	5849	4163	5279	4615	5826	7554	10148	9169	7742	4738	16747
1976	182	8403	81637	74982	31728	16487	9665	6188	7544	7107	7053	7969	12136	9943	9227	5773	9821
1977	182570	18762	153927	34994	30218	6877	8219	5831	3124	3602	4648	4758	4918	5586	5272	5447	16998
1978	99670	87245	101706	39150	16482	10505	3458	2741	2581	3637	3760	4026	4131	4478	4545	5290	13194
1979	88680	9347	51442	37240	23408	5180	3635	3733	5241	4719	4781	3537	2686	3661	3724	3205	9394
1980	60342	56538	29648	43421	22459	7998	5215	5019	4041	3838	5771	5952	6696	5361	4845	3725	8197
1981	50274	85165	131964	31586	7878	7589	5681	7286	8988	7364	6268	7694	7228	4362	2353	1848	4792
1982	163936	188722	116117	96917	24830	10051	9167	9259	10593	9688	8827	10080	11380	7097	6205	3152	7527
1983	3808	397318	139548	47518	21681	15087	7284	7827	8747	10179	12756	9809	9822	7744	5990	3713	4485
1984	232	64407	252948	46407	39127	26691	14307	10651	10436	12565	14261	9789	10202	9649	4522	3486	5736
1985	5	46720	196754	165416	46050	23977	10434	5534	4668	5461	7327	7492	10622	8730	5753	3619	4531
1986	359	239952	112323	68713	40757	10259	12869	7736	4862	4390	6456	5948	8392	8576	6488	3776	5283
1987	19	125799	257424	86756	33731	17327	12224	7569	5602	5653	6960	8229	7278	5613	3929	2450	3234
1988	10	384438	144732	179456	37270	13767	13187	12599	9792	7831	9184	8933	8576	8445	5679	3263	4252
1989	4580	250077	282293	61073	53856	27628	7692	11868	10673	6271	6556	5813	7324	6284	3996	2635	5327
1990	5437	205617	179407	118920	84223	49383	12775	10345	11193	9747	8922	9999	6151	5799	3544	2473	4962
1991	124505	125237	242156	150865	75322	54860	14395	8831	8152	13277	13735	17044	9491	3629	1599	1310	3120
1992	3210	184589	453575	288267	78141	26743	15735	13488	8719	9070	12793	12034	9525	6249	4308	2665	4374
1993	6648	212791	626549	362744	92818	42943	18556	15252	9743	8238	10075	9973	8054	4417	2277	1765	6160
1994	433907	423325	440338	198031	61790	38728	33174	27971	25084	18645	22252	23493	25917	14184	4291	4051	5832
1995	30971	474475	310169	213040	78837	43128	40251	25290	21496	18138	14523	18148	22989	20063	8829	3444	10036
1996	656	608295	409166	336316	226973	62133	22608	14956	15653	16869	16593	18770	19301	12776	7001	3639	12327
1997	134	408588	421348	296290	144844	65473	35254	20675	21745	23555	26082	28666	17925	10489	4062	2354	7498
1998	310024	257011	290426	344292	200105	80628	32834	15669	19088	16689	20838	17237	13073	9786	6252	4012	13605
1999	390939	277948	212829	206915	151242	59416	26611	29929	17612	22217	31310	30182	12190	10959	7118	3504	11493
2000	36	100683	191900	146688	117335	65805	38826	27723	26458	35332	37764	39584	16310	7434	4119	3275	8204
2001	1	11883	286976	155060	149201	55593	45657	32897	25878	29260	29535	31628	26115	9520	5978	3202	6180
2002	3874	54594	291498	184543	81092	47385	37287	22639	26210	24824	25926	26491	31193	14113	8389	6238	10134
2003	4453	32471	265984	128908	51631	64897	47289	32528	27302	28800	28570	31203	29481	16122	6956	3427	6820
2004	6068	132585	210851	138105	53588	38489	32150	42748	23609	18987	37986	40591	28168	12305	6095	4663	10219
2005	1726	160575	160833	91986	59730	38357	33293	27659	24904	19368	28638	44549	32259	21756	9170	4176	8191
2006	2825	51757	82948	139023	71491	42720	42940	27321	26934	41246	39272	24281	23557	15611	9054	6867	10375
2007	3370	48323	133872	81714	145057	65376	43580	36544	33664	39505	30414	40723	40875	18461	10118	5708	13535
2008	0	2434	129548	51539	67073	68421	29971	19667	16877	13968	13776	6491	5712	5110	2828	2219	4089
2009	926	2550	26678	21714	26425	24638	43536	32594	12905	12011	10329	7502	7792	4647	2881	1917	2214
2010	117	1190	19306	20795	24742	30245	17482	19064	9535	7420	4832	3139	2645	1623	1058	645	1038
2011	0	0	5907	7438	13427	23419	9613	5856	6842	6693	4695	4362	4484	3577	2278	1342	2049
2012	6	16	510	7468	12705	15798	7652	6087	7283	10277	7547	5783	5307	4190	2337	1482	2231
2013	170	43	23157	6870	15351	14800	9022	11234	11571	10248	9922	8426	6494	4433	2268	1287	2070
2014	0	0	22783	7444	18882	10862	3735	2746	4770	10730	13535	13267	8473	4705	2552	1201	1727
2015	46	17	32000	17407	26847	17948	7972	7290	6667	11887	12894	11351	10180	5985	3472	1821	2934
2016	594	17	32254	22096	27423	21628	12314	11889	12704	17085	17158	12109	8133	5344	3227	1632	3001
2017	96	1774	53312	18050	47936	27219	14409	12398	12662	21056	21021	15691	12196	7262	4587	2117	2054
2018	762	591	56222	10805	30430	29955	13136	12199	16599	27575	28985	19026	14296	9915	5611	2892	1976
2019	52	707	31940	35693	26785	26422	14817	11769	17553	36916	27763	23256	17712	10739	5894	2988	2697
2020	828	862	51511	24237	58878	41185	17150	18630	42639	41939	31051	19101	14595	8748	4612	1981	2089

Table 2. Catch-at-age estimates in numbers of East Atlantic bluefin tuna based on cohort slicing assuming the Richards growth model with the revised catch-at-size.

Year	Age0	Age1	Age2	Age3	Age4	Age5	Age6	Age7	Age8	Age9	Age10	Age11	Age12	Age13	Age14	Age15	Age16+
1950	2789	4329	34036	26744	119776	20425	35424	41225	31143	42786	26612	7631	2235	1717	859	551	630
1951	464	6705	47782	39347	193899	17640	29741	65732	38353	33895	22490	7687	2783	2338	1108	708	786
1952	1596	6915	51133	39644	197819	14518	21893	60355	84262	50989	24549	8291	4402	4182	2492	1596	1853
1953	2539	8168	66457	51666	220863	20799	25620	54569	63589	60539	33640	10263	3684	2998	1338	923	1001
1954	674	7640	63798	48430	194721	17190	18152	26308	28646	45322	47957	27610	9896	4435	1771	1056	1600
1955	1660	452	11861	10570	4555	24292	114824	50265	44098	53242	38657	27080	14191	8029	3879	1738	1653
1956	705	34	1860	2403	3682	12242	51375	35355	35116	47089	29797	12755	8415	6442	3452	1846	2296
1957	6	92	4012	5292	7345	21394	73221	63674	43956	29268	32979	16730	11480	6905	4086	3139	2596
1958	1068	8021	10314	6941	8399	21534	83655	39440	37502	27884	18278	18871	11826	8518	5632	4175	4994
1959	449	239	6300	8347	12037	10437	45559	21086	15454	23114	19890	17506	13436	11413	7175	3040	3008
1960	238	126	3036	4113	6811	8002	20010	20725	23496	28936	25172	21037	12826	8480	4883	2479	2591
1961	1858	200	4566	6253	9625	7508	22825	17395	19669	33333	22295	18814	14862	11237	6821	3806	5166
1962	201	282	6134	8476	12067	8114	25409	17623	21267	32774	20048	15319	15877	12971	8834	4534	7255
1963	910	310	6565	9110	12791	9626	24505	15724	10699	11024	18466	9423	8235	4202	2162	999	3741
1964	1355	383	7972	10847	15836	7101	12484	17042	10352	6361	11995	17576	8072	5488	3214	2439	6512
1965	121	732	14881	20159	28193	13609	12931	13793	5546	3659	4339	7763	10341	11271	6029	3969	8285
1966	1061	2141	37997	60886	50406	25385	10823	9725	6287	6896	5312	6268	5580	5550	3041	2551	7381
1967	3801	701	11926	39743	31155	7790	9262	12826	7172	11911	12183	6512	6326	7172	5258	4312	15530
1968	7241	1298	4293	73550	54152	28212	5013	8238	5431	3855	5118	6078	5442	3759	1995	2406	6946
1969	529	5831	32812	119485	17585	10945	13897	6784	10034	7545	6782	5617	5244	5128	2737	2269	8295
1970	1140	6810	97856	76787	8750	6400	9607	9260	11121	6389	4596	3048	2803	2154	1133	997	6083
1971	794	14189	49345	94677	11966	6106	2645	4616	12021	14278	3293	2322	1722	2006	1401	1484	7176
1972	15	5178	19939	143261	65748	10212	3006	5043	4402	7069	4316	2686	3294	937	609	961	6638
1973	141	3091	93774	95559	32221	3736	2961	4660	12948	11853	2883	2684	1761	1257	512	840	6482
1974	329	30689	61614	88622	47349	49563	9714	1746	13521	24769	5024	6908	5519	4542	2042	1705	8314
1975	537	10384	92593	120622	17882	15935	7926	5649	6424	5364	7625	10831	8799	8222	4899	3111	16567
1976	182	1738	23248	115392	31848	33939	14489	8414	9306	8118	8379	12252	9872	9301	6063	3800	9503
1977	173134	20161	38669	128276	53588	11270	8325	7835	3786	4559	5903	5148	5181	5000	4280	3605	17030
1978	94501	23270	117985	71394	25400	19884	4937	3558	3115	4223	5476	4123	3683	4700	3500	3805	13046
1979	86382	2752	12990	64132	32144	14579	4817	4778	6402	5494	4872	3279	2776	4232	2436	2171	9378
1980	59790	19895	47307	23885	45498	21307	6736	6072	4957	4947	7231	6983	5311	5163	3331	2464	8190
1981	50274	21356	112763	85628	32010	8217	8556	8378	10905	7809	8544	8244	5293	2888	1488	1216	4750
1982	163829	53323	156793	143240	55770	23991	9754	11998	12796	10980	11462	11803	8415	6573	3018	2300	7503
1983	0	172879	251007	142561	30612	24649	8383	9885	10247	14222	12441	11357	7796	6759	3365	2688	4465
1984	175	19348	77794	226053	63822	35752	17930	13737	12351	15981	15080	10615	10950	4671	3026	2407	5724
1985	5	19942	90835	176234	134664	51055	14726	7279	5843	6907	8422	10774	9356	6707	3473	2355	4516
1986	27	115890	142122	106317	84347	18792	14614	10749	5734	5886	7318	8104	8803	6336	4376	2859	4863
1987	19	34688	173759	212128	62054	32297	15810	9361	7588	6665	9336	8098	6360	4487	2259	1703	3183
1988	0	183202	236039	173644	124940	37512	13745	15976	11402	9851	10577	9743	8283	6963	3019	2297	4221
1989	4580	34081	330627	175510	76759	54240	8978	13985	12283	7385	7503	7264	6776	4686	2171	1854	5268
1990	5155	98623	158561	192836	77037	101784	18703	13126	13145	11873	12490	6676	6056	4081	2077	1728	4947
1991	116347	57409	157063	197298	150109	75113	30978	11724	10243	16298	18539	13783	5216	2437	1039	808	3123
1992	1658	109520	168672	490958	196339	52322	26797	16688	11082	11805	14142	13526	6750	4936	2404	1537	4349
1993	5365	132303	295109	621150	211847	56874	36795	18152	11357	10534	10939	11739	5622	2356	1523	1205	6133
1994	423769	96029	560911	321356	127214	49857	41122	36554	28446	21751	29158	28623	17285	8091	2010	3075	5761
1995	25974	110922	477051	278633	174950	58931	55756	33493	25045	20185	18184	24702	20278	12690	4730	2536	9766
1996	322	151022	790765	285046	270733	125997	37048	20031	18447	20268	20274	23073	13297	8509	4407	2732	12063
1997	67	94342	465097	458485	190490	100284	54906	28771	26431	26371	34749	24358	13453	5931	2177	1766	7302
1998	278099	126481	278357	321478	280979	171099	53847	20285	21927	19991	25293	16192	9541	7507	4259	2913	13320
1999	266241	168682	307196	185433	255480	94487	42272	34458	22174	33070	37121	18576	11389	6909	5174	2302	11453
2000	36	10190	140509	196834	146649	100664	58234	34920	34565	44210	45155	28648	9243	4516	3159	1883	8061
2001	0	1150	113478	236118	189303	94285	57597	43531	32523	34921	36238	34612	12729	5795	4178	2191	5916
2002	1071	15725	98217	338438	119839	66064	51665	31219	32344	31577	26370	37991	16336	9361	6423	3826	9963
2003	2518	7544	140867	221818	79826	61316	72382	41319	34034	33516	33166	37630	19297	8805	4055	1980	6770
2004	3496	32591	200318	166511	112768	48041	40875	49597	27527	30620	44166	42627	13108	7570	4671	2548	10172
2005	1506	11638	216734	147755	72033	45162	43644	35482	29270	24584	43263	44349	22855	11661	6358	3149	7728
2006	2100	4954	72357	136737	95177	62410	49504	37577	34163	53078	33059	29456	16576	9695	7295	3763	10319
2007	1460	27526	42512	123436	140202	117346	58287	45837	43587	43269	40934	46147	26907	9294	6051	4563	13477
2008	0	1512	63101	87363	55689	82315	54861	23852	19563	18113	10398	6799	4772	3953	1795	1562	4077
2009	828	1401	1984	34824	24856	27123	40942	46282	16503	12444	10816	10143	4454	3423	1871	1248	2118
2010	65	739	3087	23349	22894	33397	26017	22690	11195	8430	4835	3085	1735	1243	714	381	1019
2011	0	0	1032	5664	12325	21211	16807	8291	9210	6307	5289	5121	3709	2680	1463	936	1939
2012	0	15	77	1002	12994	14930	13947	6961	9888	11022	7755	6147	4192	3144	1519	1001	2085
2013	170	43	7455	17334	9045	21052	11990	13035	13317	13823	10193	7827	4943	2949	1443	839	1906
2014	0	0	7377	17142	11493	20357	6345	3710	6283	13560	17254	11504	5275	3090	1582	793	1646
2015	45	18	14749	25509	17962	29973	12164	9033	8653	14635	15092	11444	7093	4184	2122	1166	2877
2016	591	8	13603	25627	25792	30284	17686	14496	15733	20845	17981	10284	5965	3825	1837	1078	2971
2017	87	520	17654	40892	30481	49138	20562	15710	16311	25610	22083	14985	8460	5308	2861	1198	1979
2018	1	1332	5644	52784	18288	39862	21130	14878	20965	35129	29004	17036	10904	6879	3432	1786	1922
2019	52	170	10209	36449	29939	33905	22562	14709	21829	43185	30861	22413	12187	7210	3500	2030	2495
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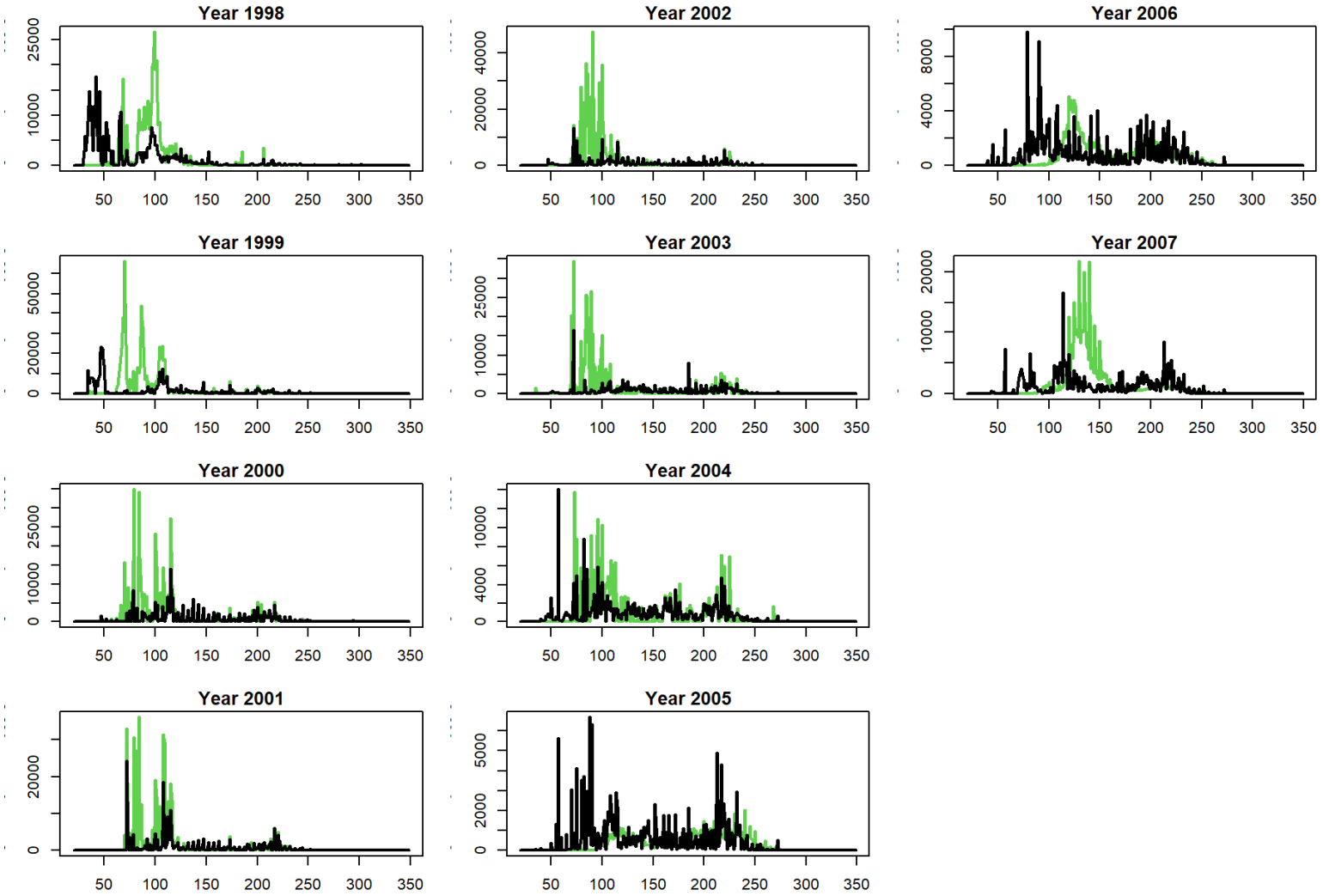

Figure 1. CAS Comparison between the origian CAS at the E-BFT data preparatory meeting (green) and the revised CAS (black) in this document by each inflated catch years.

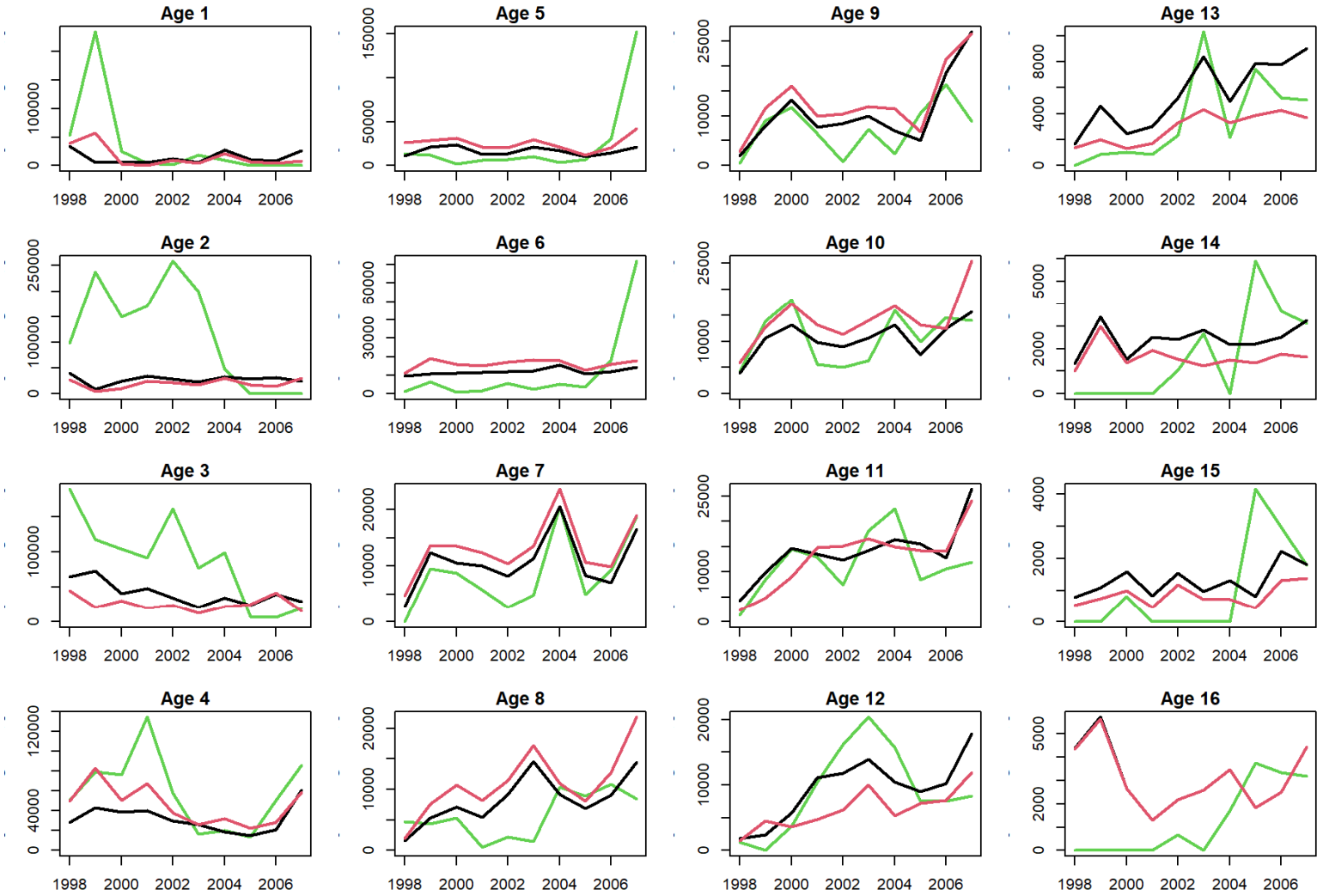

Figure 2. Comparison of CAA estimates of the inflated catch from cohort slicing assuming the von Bertalannfy growth model (black lines) versus the Richards growth assumption (red lines) using the revised CAS. The CAA estimates of the inflated catch from the E-BFT data preparatory meeting is shown in green.

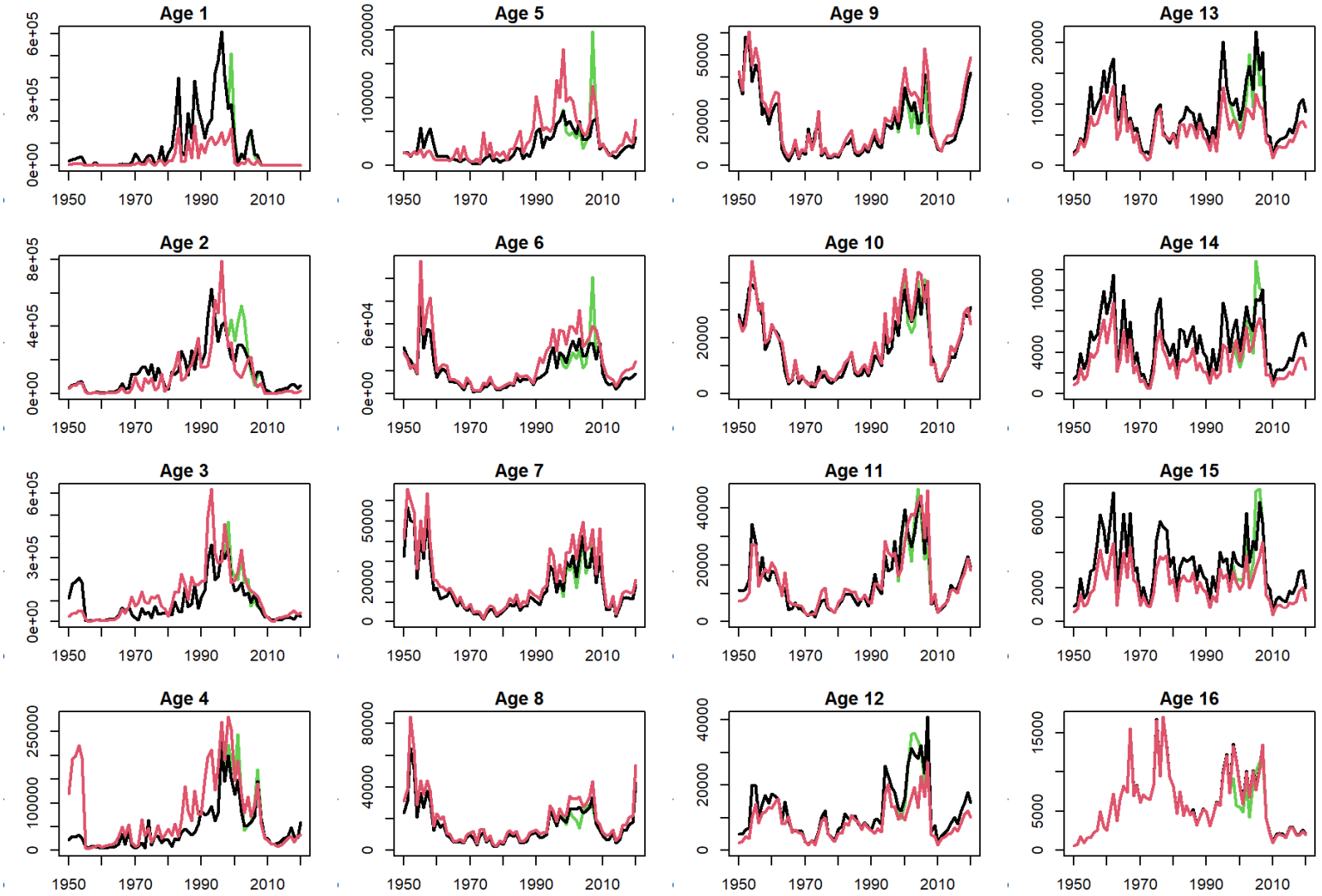

Figure 3. Comparison of total CAA estimates from cohort slicing assuming the von Bertalannfy growth model (black lines) versus the Richards growth assumption (red lines) using the revised CAS. The total CAA estimates from the E-BFT data preparatory meeting is shown in green.