

REVISION TO THE CATCH-AT-SIZE AND CATCH-AT-AGE ESTIMATES OF WESTERN ATLANTIC BLUEFIN TUNA USED IN THE 2014 UPDATE ASSESSMENT

Matthew Lauretta¹

SUMMARY

An error in the 2011 discard catch-at-size information submitted by the U.S.A. was documented during construction of the fleet partial catch-at-ages used in the 2014 assessment. This report provides the corrected partial catch-at-age, total catch-at-age, and weight-at-age estimates produced using the Ageit_BFT_ver4 script. Comparisons to the previous assessment partial catch-at-ages and total catch-at-age are also provided for validation of model continuity.

RÉSUMÉ

Une erreur concernant l'information sur la prise par taille des rejets de 2011 soumise par les États-Unis a été documentée pendant l'élaboration de la prise par âge partielles de la flottille utilisée dans l'évaluation de 2014. Le présent rapport fournit la prise par âge partielle corrigée, la prise par âge totale et les estimations du poids par âge élaborées au moyen de Ageit_BFT_ver4 script. Des comparaisons avec l'estimation antérieure de la prise par âge partielle et de la prise par âge totale sont également fournies aux fins de la validation de la continuité du modèle.

RESUMEN

Durante la construcción de la captura por edad parcial de la flota usada en la evaluación de 2014, se documentó un error en la información sobre captura por talla de los descartes de 2011 presentada por Estados Unidos. Este informe presenta la captura por edad parcial corregida, la captura por edad total y las estimaciones de peso por edad producidas usando Ageit_BFT_ver4 script. Se facilitan también las comparaciones con la captura por edad parcial y la captura por edad total de la evaluación anterior para validar la continuidad del modelo.

KEYWORDS

Statistics, Bluefin tuna

1. Introduction

In the process of constructing partial catch-at-age information that corresponded to the U.S.A. indices of abundance of western Atlantic bluefin tuna, an error in the discard estimates from 2011 was observed. Here we present the corrected 2011 partial catch-at-age, total catch-at-age, and weight-at-age matrices that were used in the 2014 VPA. We also present comparisons with the prior assessment inputs for validation of estimate accuracy and to ensure model replication.

2. Material and methods

Catch-at-age estimates provided by the ICCAT Secretariat were compared with estimates from the previous assessment. The results demonstrated considerable differences in the partial catch-at-age estimates for the U.S.A. fleet in 2011, but also showed agreement in estimates across other years and fleets. It was determined that the difference in estimates was a result of an error in the catch-at-size estimates of discarded fish from the U.S.A.

¹ U.S. National Marine Fisheries Service, Southeast Fisheries Center, Sustainable Fisheries Division, 75 Virginia Beach Drive, Miami, FL, 33149-1099, USA. E-mail: matthew.lauretta@noaa.gov

longline fleet. Quality control measures were then implemented to ensure the catch-at-age estimates used in the 2014 assessment were accurate, which involved reproducing the catch-at-size estimates for the fleet and the corresponding catch-at-age estimates from the Ageit_BFT_ver4 R script.

3. Results and discussion

The revised 2011 U.S.A. catch-at-size data, corrected for errors in the estimates of longline discards, are available on the ICCAT website (<http://www.iccat.es/en/accesingdb.htm>). **Tables 1 to 7** list the revised partial catch-at-ages by fleet for the updated indices in the 2014 base VPA. **Table 8** lists the revised total catch-at-age for western Bluefin tuna. **Table 9** lists the revised weight-at-age matrix of western Bluefin tuna used in the 2014 VPA, calculated from the yield-at-age and catch-at-age output of the Ageit_BFT_ver4 script. Comparisons of all updated fleet partial catch-at-ages produced from the Ageit_BFT_ver4 script using the revised catch-at-size information were made between the 2012 base and 2014 continuity and base model inputs (**Figures 1 to 7**). Comparison of the total catch-at-age estimates between the 2012 base and 2014 continuity and base models are provided in **Figure 8**. Comparison of the weight-at-age estimates between the 2012 base and 2014 base and continuity models are provided in **Figure 9**. The accuracy of these estimates was verified by the assessment team, prior to completion of the work on the 2014 continuity and base VPAs, as well as for all sensitivity analyses. Lastly, a script for creating partial catch-at-age information from output of the Ageit_BFT_ver4 R program is included as **Appendix A** with documented changes to the Canadian fisheries partial catch-at-ages for the continuity and base VPAs.

Table 1. Partial catch-at-age estimates of the Canadian Gulf of St. Lawrence fishery used in the 2014 base VPA.

Index_ID	Year	Age1	Age2	Age3	Age4	Age5	Age6	Age7	Age8	Age9	Age10	Age11	Age12	Age13	Age14	Age15	Age16+
1	1970	0	0	0	0	0	0	0	0	2	1	2	7	39	51	68	0
1	1971	0	0	0	0	0	0	0	0	0	0	1	5	11	35	37	0
1	1972	0	0	0	0	0	0	0	1	0	0	0	1	5	28	46	0
1	1973	0	0	0	0	0	0	0	0	1	0	0	6	3	21	44	0
1	1974	0	0	0	0	0	3	0	0	0	0	0	1	5	15	52	0
1	1975	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	0
1	1976	0	0	0	0	0	0	0	0	0	0	1	0	0	2	11	0
1	1977	0	0	0	0	0	0	0	0	0	0	1	0	1	5	6	0
1	1978	0	0	0	0	0	0	0	0	0	1	1	0	0	3	6	0
1	1979	0	0	0	0	0	0	0	0	0	0	0	0	0	1	6	0
1	1980	0	0	0	0	0	0	0	0	0	0	0	1	0	4	5	0
1	1981	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0
1	1982	0	0	0	0	0	0	0	0	0	0	0	0	0	3	6	0
1	1983	0	0	0	0	0	0	0	0	0	0	0	0	0	28	10	0
1	1984	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0
1	1985	0	0	0	0	0	0	0	0	0	0	0	0	1	1	3	0
1	1986	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
1	1987	0	0	0	0	0	2	1	2	2	0	1	1	1	1	2	0
1	1988	0	1	0	0	1	6	22	64	34	140	331	156	42	29	29	0
1	1989	0	0	0	0	0	1	22	399	508	391	270	210	138	118	76	0
1	1990	0	0	0	0	0	1	49	275	550	385	142	94	63	66	81	0
1	1991	0	0	0	0	0	0	0	0	0	0	2	1	21	27	10	0
1	1992	0	0	0	0	2	0	0	2	1	1	2	4	5	11	9	0
1	1993	0	0	0	0	0	0	0	0	1	1	7	4	7	4	10	0
1	1994	0	0	0	0	0	1	0	2	0	1	3	6	2	6	7	0
1	1995	0	0	0	0	0	0	2	3	1	14	12	12	12	16	16	0
1	1996	0	0	0	0	0	0	1	0	0	0	0	0	1	1	3	0
1	1997	0	0	0	0	0	0	0	0	0	0	0	1	0	2	2	0
1	1998	0	0	0	0	0	0	0	0	0	0	0	0	0	3	3	0
1	1999	0	0	1	0	1	0	0	0	1	0	2	12	6	2	7	0
1	2000	0	0	0	0	1	0	0	1	0	1	2	8	20	28	22	0
1	2001	0	0	0	0	0	0	0	0	0	0	4	1	18	37	34	0
1	2002	0	0	0	0	0	0	0	1	7	0	5	9	25	49	79	0
1	2003	0	0	0	0	0	0	0	1	8	7	14	15	17	39	51	0
1	2004	0	0	0	0	0	0	2	1	2	10	28	40	32	29	63	0
1	2005	0	0	0	0	0	0	0	0	4	6	25	60	57	49	70	0
1	2006	0	0	0	0	0	0	1	0	2	11	19	47	64	80	77	0
1	2007	0	0	0	0	0	0	0	1	2	3	12	22	41	51	58	0
1	2008	0	0	0	0	0	0	0	0	0	5	11	14	42	63	72	0
1	2009	0	0	0	0	0	5	9	6	21	21	27	29	38	62	69	0
1	2010	0	0	0	0	0	0	14	19	5	19	22	11	17	39	43	0
1	2011	0	0	0	0	1	0	1	15	42	16	19	22	44	60	50	0
1	2012	0	0	0	0	0	0	1	7	43	100	82	47	35	47	93	0
1	2013	0	0	0	0	0	0	0	0	8	24	70	86	72	60	53	0

Table 2. Partial catch-at-age estimates of the Canadian Southwest Nova Scotia fishery used in the 2014 base VPA.

Index_ID	Year	Age1	Age2	Age3	Age4	Age5	Age6	Age7	Age8	Age9	Age10	Age11	Age12	Age13	Age14	Age15	Age16+
2	1970	0	0	0	0	0	0	0	0	2	1	2	7	39	51	68	170
2	1971	0	0	0	0	0	0	0	0	0	0	1	5	11	35	37	136
2	1972	0	0	0	0	0	0	1	0	0	0	1	5	28	46	312	
2	1973	0	0	0	0	0	0	0	0	1	0	0	6	3	21	44	489
2	1974	0	0	0	0	0	3	0	0	0	0	0	1	5	15	52	748
2	1975	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	535
2	1976	0	0	0	0	0	0	0	0	0	0	1	0	0	2	11	842
2	1977	0	0	0	0	0	0	0	0	0	0	1	0	1	5	6	729
2	1978	0	0	0	0	0	0	0	0	0	1	1	0	0	3	6	468
2	1979	0	0	0	0	0	0	0	0	0	0	0	0	0	1	6	476
2	1980	0	0	0	0	0	0	0	0	0	0	0	1	0	4	5	620
2	1981	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	626
2	1982	0	0	0	0	0	0	0	0	0	0	0	0	0	3	6	506
2	1983	0	0	0	0	0	0	0	0	0	0	0	0	0	28	10	1012
2	1984	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	546
2	1985	0	0	0	0	0	0	0	0	0	0	0	0	1	1	3	266
2	1986	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	93
2	1987	0	0	0	0	0	2	1	2	2	0	1	1	1	1	2	41
2	1988	0	1	0	0	1	6	22	64	34	140	331	156	42	29	29	261
2	1989	0	0	0	0	0	1	22	399	508	391	270	210	138	118	76	524
2	1990	0	0	0	0	0	1	49	275	550	385	142	94	63	66	81	348
2	1991	0	0	0	0	0	1	76	288	378	500	299	116	65	45	25	16
2	1992	0	0	0	0	1	2	32	147	187	182	238	237	152	90	78	90
2	1993	0	0	0	0	0	0	15	18	107	216	162	129	127	104	60	105
2	1994	0	0	0	0	0	3	16	102	88	152	186	139	103	74	49	66
2	1995	0	0	0	0	1	12	13	18	83	268	262	183	117	87	63	102
2	1996	0	0	0	0	0	0	14	40	54	70	149	207	145	103	77	258
2	1997	0	0	0	0	1	12	28	85	172	148	109	89	104	91	80	269
2	1998	0	0	0	0	0	10	12	51	226	372	328	166	154	120	93	170
2	1999	0	0	0	0	1	1	31	122	177	372	383	306	155	70	33	71
2	2000	0	0	0	0	0	3	4	20	111	142	141	159	137	99	56	56
2	2001	0	0	0	0	3	19	278	289	103	213	255	181	147	116	63	53
2	2002	0	0	0	0	0	2	42	395	483	133	129	167	130	103	47	36
2	2003	0	0	0	0	0	1	12	231	666	435	109	26	16	16	8	12
2	2004	0	0	0	0	7	21	101	345	357	264	122	99	56	18	18	5
2	2005	0	0	0	2	23	20	23	79	131	200	261	234	123	71	75	107
2	2006	0	0	0	0	12	24	133	138	209	296	283	260	187	91	46	77
2	2007	0	0	0	0	2	28	56	116	156	106	119	120	97	66	32	45
2	2008	0	2	2	63	390	774	495	374	212	67	20	2	2	0	0	0
2	2009	0	0	0	0	0	37	23	67	88	90	50	59	50	66	42	48
2	2010	0	0	0	0	0	3	22	26	38	70	71	60	68	70	54	101
2	2011	0	0	0	0	0	0	38	104	75	56	85	72	49	34	36	85
2	2012	0	0	0	0	0	5	12	52	126	66	47	47	51	41	36	72
2	2013	0	0	0	0	0	1	7	30	37	34	60	79	55	39	28	142

Table 3. Partial catch-at-age estimates of the U.S.A. rod and reel 66 to 114 cm fishery used in the 2014 base VPA.

Index_ID	Year	Age1	Age2	Age3	Age4	Age5	Age6	Age7	Age8	Age9	Age10	Age11	Age12	Age13	Age14	Age15	Age16+
4	1980	161	4119	290	34	0	0	0	0	0	0	0	0	0	0	0	0
4	1981	1702	1484	409	7	0	0	0	0	0	0	0	0	0	0	0	0
4	1982	117	3009	619	50	0	0	0	0	0	0	0	0	0	0	0	0
4	1983	344	2344	813	30	0	0	0	0	0	0	0	0	0	0	0	0
4	1984	192	5543	1085	54	0	0	0	0	0	0	0	0	0	0	0	0
4	1985	198	5267	5482	0	0	0	0	0	0	0	0	0	0	0	0	0
4	1986	383	5764	5250	20	0	0	0	0	0	0	0	0	0	0	0	0
4	1987	889	12228	6631	264	0	0	0	0	0	0	0	0	0	0	0	0
4	1988	0	8903	7322	0	0	0	0	0	0	0	0	0	0	0	0	0
4	1989	66	12589	1186	246	0	0	0	0	0	0	0	0	0	0	0	0
4	1990	919	2066	13030	140	0	0	0	0	0	0	0	0	0	0	0	0
4	1991	1634	11614	8493	153	0	0	0	0	0	0	0	0	0	0	0	0
4	1992	429	5813	1424	0	0	0	0	0	0	0	0	0	0	0	0	0
4	1993	121	1016	3660	650	0	0	0	0	0	0	0	0	0	0	0	0
4	1994	37	645	913	257	0	0	0	0	0	0	0	0	0	0	0	0
4	1995	283	1288	2957	340	0	0	0	0	0	0	0	0	0	0	0	0
4	1996	184	9166	1104	458	0	0	0	0	0	0	0	0	0	0	0	0
4	1997	38	1095	6174	112	0	0	0	0	0	0	0	0	0	0	0	0
4	1998	80	880	3231	674	0	0	0	0	0	0	0	0	0	0	0	0
4	1999	29	507	1805	339	0	0	0	0	0	0	0	0	0	0	0	0
4	2000	0	249	572	47	0	0	0	0	0	0	0	0	0	0	0	0
4	2001	37	327	2345	571	0	0	0	0	0	0	0	0	0	0	0	0
4	2002	549	5477	4026	235	0	0	0	0	0	0	0	0	0	0	0	0
4	2003	121	2085	3481	347	0	0	0	0	0	0	0	0	0	0	0	0
4	2004	518	2631	6704	44	0	0	0	0	0	0	0	0	0	0	0	0
4	2005	372	4819	1866	582	0	0	0	0	0	0	0	0	0	0	0	0
4	2006	129	436	859	105	0	0	0	0	0	0	0	0	0	0	0	0
4	2007	9	210	3958	1755	0	0	0	0	0	0	0	0	0	0	0	0
4	2008	19	684	1994	118	0	0	0	0	0	0	0	0	0	0	0	0
4	2009	26	191	1905	123	0	0	0	0	0	0	0	0	0	0	0	0
4	2010	12	990	734	71	0	0	0	0	0	0	0	0	0	0	0	0
4	2011	0	393	1443	456	0	0	0	0	0	0	0	0	0	0	0	0
4	2012	25	385	1787	401	0	0	0	0	0	0	0	0	0	0	0	0
4	2013	4	265	550	329	0	0	0	0	0	0	0	0	0	0	0	0

Table 4. Partial catch-at-age estimates of the U.S.A. rod and reel 115 to 144 cm fishery used in the 2014 base VPA.

Index_ID	Year	Age1	Age2	Age3	Age4	Age5	Age6	Age7	Age8	Age9	Age10	Age11	Age12	Age13	Age14	Age15	Age16+
5	1980	0	0	0	126	67	1	0	0	0	0	0	0	0	0	0	0
5	1981	0	0	13	53	20	0	0	0	0	0	0	0	0	0	0	0
5	1982	0	0	0	67	50	0	0	0	0	0	0	0	0	0	0	0
5	1983	0	0	0	85	38	0	0	0	0	0	0	0	0	0	0	0
5	1984	0	0	0	246	186	0	0	0	0	0	0	0	0	0	0	0
5	1985	0	0	0	85	50	0	0	0	0	0	0	0	0	0	0	0
5	1986	0	0	0	659	48	0	0	0	0	0	0	0	0	0	0	0
5	1987	0	0	581	1929	669	0	0	0	0	0	0	0	0	0	0	0
5	1988	0	0	0	74	148	0	0	0	0	0	0	0	0	0	0	0
5	1989	0	0	0	1697	1596	3	0	0	0	0	0	0	0	0	0	0
5	1990	0	0	0	505	584	0	0	0	0	0	0	0	0	0	0	0
5	1991	0	0	0	1349	418	0	0	0	0	0	0	0	0	0	0	0
5	1992	0	0	0	122	256	0	0	0	0	0	0	0	0	0	0	0
5	1993	0	0	0	1333	1005	0	0	0	0	0	0	0	0	0	0	0
5	1994	0	0	0	317	653	0	0	0	0	0	0	0	0	0	0	0
5	1995	0	0	0	1495	2171	0	0	0	0	0	0	0	0	0	0	0
5	1996	0	0	0	2810	2155	0	0	0	0	0	0	0	0	0	0	0
5	1997	0	0	0	213	580	0	0	0	0	0	0	0	0	0	0	0
5	1998	0	0	0	1684	116	0	0	0	0	0	0	0	0	0	0	0
5	1999	0	0	0	664	514	0	0	0	0	0	0	0	0	0	0	0
5	2000	0	0	0	331	256	2	0	0	0	0	0	0	0	0	0	0
5	2001	0	0	0	3660	768	0	0	0	0	0	0	0	0	0	0	0
5	2002	0	0	0	4200	4436	0	0	0	0	0	0	0	0	0	0	0
5	2003	0	0	0	1409	808	1	0	0	0	0	0	0	0	0	0	0
5	2004	0	0	0	1992	1136	0	0	0	0	0	0	0	0	0	0	0
5	2005	0	0	0	1329	302	0	0	0	0	0	0	0	0	0	0	0
5	2006	0	0	0	931	1942	9	0	0	0	0	0	0	0	0	0	0
5	2007	0	0	0	5076	1173	1	0	0	0	0	0	0	0	0	0	0
5	2008	0	0	0	1099	4555	6	0	0	0	0	0	0	0	0	0	0
5	2009	0	0	0	864	722	4	0	0	0	0	0	0	0	0	0	0
5	2010	0	0	0	1393	410	0	0	0	0	0	0	0	0	0	0	0
5	2011	0	0	0	641	600	3	0	0	0	0	0	0	0	0	0	0
5	2012	0	0	0	692	375	0	0	0	0	0	0	0	0	0	0	0
5	2013	0	0	0	920	167	0	0	0	0	0	0	0	0	0	0	0

Table 5. Partial catch-at-age estimates of the U.S.A. rod and reel >177 cm fishery used in the 2014 base VPA.

Index_ID	Year	Age1	Age2	Age3	Age4	Age5	Age6	Age7	Age8	Age9	Age10	Age11	Age12	Age13	Age14	Age15	Age16+
9	1980	0	0	0	0	0	0	0	9	72	51	28	26	37	22	21	297
9	1981	0	0	0	0	0	0	0	1	45	139	180	127	67	45	49	249
9	1982	0	0	0	0	0	0	0	11	56	101	210	157	135	42	34	198
9	1983	0	0	0	0	0	0	0	37	127	82	110	91	143	185	141	440
9	1984	0	0	0	0	0	0	0	41	68	64	102	130	168	168	143	307
9	1985	0	0	0	0	0	0	0	55	56	54	70	82	145	136	164	288
9	1986	0	0	0	0	0	0	0	45	44	34	32	51	36	55	54	135
9	1987	0	0	0	0	0	0	0	42	42	54	46	43	47	51	43	159
9	1988	0	0	0	0	0	0	0	26	64	57	43	40	33	45	39	181
9	1989	0	0	0	0	0	0	0	197	148	58	42	62	48	46	47	207
9	1990	0	0	0	0	0	0	0	144	136	119	47	58	47	70	85	399
9	1991	0	0	0	0	0	0	0	26	61	63	73	112	76	89	105	251
9	1992	0	0	0	0	0	0	0	112	209	60	72	117	128	119	84	352
9	1993	0	0	0	0	0	0	0	104	124	200	136	78	70	75	73	252
9	1994	0	0	0	0	0	0	0	296	526	163	122	192	107	115	76	199
9	1995	0	0	0	0	0	0	0	147	232	361	258	163	138	144	157	450
9	1996	0	0	0	0	0	0	0	620	253	121	139	167	127	111	98	262
9	1997	0	0	0	0	0	0	0	448	658	406	190	210	278	277	233	477
9	1998	0	0	0	0	0	0	0	280	787	243	232	155	188	225	198	392
9	1999	0	0	0	0	0	0	0	378	290	289	452	471	276	264	253	475
9	2000	0	0	0	0	0	0	0	37	204	232	345	348	345	366	195	337
9	2001	0	0	0	0	0	0	0	308	122	185	455	435	648	566	401	658
9	2002	0	0	0	0	0	0	0	401	281	131	285	272	415	595	516	681
9	2003	0	0	0	0	0	0	0	184	212	144	156	121	226	266	318	503
9	2004	0	0	0	0	0	0	0	101	73	90	129	88	72	84	85	226
9	2005	0	0	0	0	0	0	0	30	95	69	77	79	80	61	38	123
9	2006	0	0	0	0	0	0	0	61	12	22	27	42	34	34	24	149
9	2007	0	0	0	0	0	0	0	42	60	20	39	35	30	17	19	95
9	2008	0	0	0	0	0	0	0	147	39	26	18	19	15	33	22	106
9	2009	0	0	0	0	0	0	0	68	108	64	59	61	34	43	46	379
9	2010	0	0	0	0	0	0	0	557	220	283	304	140	89	107	127	261
9	2011	0	0	0	0	0	0	0	381	480	194	141	179	169	116	87	244
9	2012	0	0	0	0	0	0	0	128	375	442	232	141	116	71	75	159
9	2013	0	0	0	0	0	0	0	74	56	78	90	61	40	40	40	72

Table 6. Partial catch-at-age estimates of the Japanese longline fishery used in the 2014 base VPA.

Index_ID	Year	Age1	Age2	Age3	Age4	Age5	Age6	Age7	Age8	Age9	Age10	Age11	Age12	Age13	Age14	Age15	Age16+
10	1970	0	0	0	0	0	0	0	0	12	43	61	43	55	59	28	14
10	1971	13	244	31	132	89	272	830	1525	1114	699	679	538	393	229	112	240
10	1972	27	49	52	15	131	50	41	94	327	188	46	66	67	60	24	108
10	1973	84	427	543	458	666	250	218	572	1077	670	170	276	301	261	86	237
10	1974	104	2549	2669	1556	494	97	449	599	517	493	439	419	388	247	257	324
10	1975	2	37	54	76	187	20	16	159	335	614	1146	910	855	821	842	1837
10	1976	175	1176	5491	2375	2502	982	173	104	617	570	346	676	1462	1817	1664	4157
10	1977	58	411	5173	9269	2230	1777	1702	394	152	239	208	331	467	929	1351	5898
10	1978	79	187	1392	2719	2454	2611	967	385	309	169	172	316	453	460	906	6193
10	1979	47	332	1410	1209	669	1537	2513	1713	510	299	296	390	650	910	1105	4976
10	1980	134	477	1753	2661	1222	1322	2257	4582	3070	768	484	454	511	594	980	6883
10	1981	354	1453	8404	3335	4345	3033	2514	2043	1679	1005	439	655	578	545	442	5211
10	1982	14	78	156	225	152	352	370	280	136	186	126	97	124	87	40	101
10	1983	6	120	2151	577	550	774	560	922	529	365	223	114	113	47	35	44
10	1984	56	1523	602	1189	1805	1481	767	352	308	277	179	103	61	109	2	110
10	1985	35	128	6653	2013	3463	3695	1740	590	358	245	155	112	180	67	239	332
10	1986	4	133	1222	2210	1340	1043	972	496	326	271	72	39	55	38	28	73
10	1987	7	346	1436	1959	3020	3437	1023	990	720	621	165	108	18	27	30	61
10	1988	56	260	3309	3227	2768	2413	2486	1133	741	332	159	80	84	23	56	134
10	1989	0	177	129	461	633	749	730	764	519	205	90	72	64	42	18	95
10	1990	0	92	698	329	1225	1187	740	574	599	388	211	73	73	9	23	103
10	1991	0	148	461	822	1385	1179	1370	908	421	302	184	165	92	22	7	109
10	1992	10	14	255	284	743	803	525	811	843	201	139	74	80	63	38	87
10	1993	0	10	323	861	1009	1283	1183	490	540	444	188	69	38	29	13	97
10	1994	0	73	240	1221	1811	1555	535	419	439	217	64	62	23	9	0	5
10	1995	54	54	121	390	605	2448	995	50	200	90	0	0	0	0	0	0
10	1996	6	176	408	697	1021	525	886	655	235	44	107	95	70	49	21	63
10	1997	0	0	66	132	635	496	825	464	506	116	34	26	16	32	8	16
10	1998	0	0	143	714	462	841	602	680	837	1134	302	141	24	94	4	106
10	1999	0	25	27	398	1062	533	573	580	294	110	73	57	87	34	12	18
10	2000	0	11	14	232	1909	1285	731	446	271	77	12	28	8	19	9	32
10	2001	24	6	15	29	101	214	812	842	296	269	172	256	103	73	73	88
10	2002	11	21	31	82	35	68	284	1128	968	769	285	140	108	43	9	74
10	2003	0	10	10	158	203	163	88	51	25	15	10	10	0	0	0	0
10	2004	0	0	0	231	1378	2208	1047	488	200	238	70	85	15	46	1	15
10	2005	0	40	590	606	641	396	500	580	304	108	176	116	43	9	28	24
10	2006	0	128	271	542	328	1141	586	549	905	563	271	236	148	85	115	245
10	2007	0	3	2430	1895	666	604	365	214	153	66	70	80	32	29	15	58
10	2008	0	3	4	215	573	345	833	715	561	392	311	238	217	68	73	103
10	2009	2	0	6	0	0	0	0	65	194	169	107	75	34	26	20	38
10	2010	0	0	0	35	78	16	129	224	263	437	359	207	121	63	59	102
10	2011	0	0	0	42	953	414	289	1323	933	192	161	162	159	98	53	111
10	2012	0	0	0	73	50	219	213	44	188	456	226	80	78	51	47	79
10	2013	0	0	0	0	7	5	37	73	48	145	297	328	212	124	76	86

Table 7. Partial catch-at-age estimates of the U.S.A. larval and Gulf of Mexico longline fishery used in the 2014 base VPA.

Index_ID	Year	Age1	Age2	Age3	Age4	Age5	Age6	Age7	Age8	Age9	Age10	Age11	Age12	Age13	Age14	Age15	Age16+
13 and 14	2004	0	0	0	0	0	0	0	6	18	12	11	17	53	33	7	46
13 and 14	2005	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13 and 14	2006	0	0	0	0	0	0	0	0	0	33	53	6	22	10	140	28
13 and 14	2007	0	0	0	1	1	12	0	13	9	16	52	11	41	18	54	55
13 and 14	2008	0	0	0	0	1	1	0	23	21	48	77	29	9	12	83	66
13 and 14	2009	0	0	0	2	0	3	0	22	2	11	51	30	26	27	64	109
13 and 14	2010	0	0	0	0	0	12	0	2	4	0	20	14	21	25	23	80
13 and 14	2011	0	0	0	0	0	0	0	1	1	1	7	1	3	3	8	13
13 and 14	2012	0	0	0	0	0	1	0	18	17	11	65	8	41	29	60	119
13 and 14	2013	0	0	0	0	0	1	0	1	0	0	13	2	16	14	12	41

Table 8. Total catch-at-age estimates of western Bluefin Tuna used in the 2014 base VPA.

Year	Age1	Age2	Age3	Age4	Age5	Age6	Age7	Age8	Age9	Age10	Age11	Age12	Age13	Age14	Age15	Age16+
1970	58920	104298	127233	17510	6528	1430	463	161	43	259	435	436	655	732	593	1299
1971	62033	152003	37948	46241	456	865	1357	1661	1180	758	805	797	1030	1090	968	2078
1972	45351	98312	33605	2514	3963	1222	92	470	465	292	185	403	730	1053	929	2372
1973	5065	73591	29957	5877	2254	2443	387	652	1270	829	265	506	643	696	587	2103
1974	55806	19939	20430	5639	2972	1448	640	739	595	609	869	516	600	2027	1425	7855
1975	43303	147653	6554	13155	907	709	283	253	419	775	1290	1058	1080	1202	1395	4813
1976	5532	19427	71850	2576	2743	1062	200	117	702	679	480	844	1802	2179	2176	6992
1977	1508	22182	9014	28496	7931	2699	2592	546	309	607	947	971	830	1157	1619	8751
1978	5564	10530	18969	4889	8281	7341	1392	447	405	252	208	348	536	588	1181	9324
1979	2828	10585	15537	8581	9754	1861	2843	1946	554	349	359	458	771	1137	1525	8423
1980	3246	16081	9991	8124	4129	1552	2327	4658	3447	973	599	584	620	685	1088	9286
1981	6290	9814	16530	3729	5692	3462	2613	2191	2271	2470	1392	1101	833	737	611	7370
1982	3608	3652	1517	523	245	460	490	391	297	500	662	600	458	239	176	1603
1983	3474	2463	3091	771	615	860	705	1102	953	773	682	585	739	705	463	2717
1984	1126	7240	1691	1493	2005	1577	927	451	521	642	702	743	676	858	551	1775
1985	776	5395	12162	2131	3523	3880	1957	728	480	436	457	612	834	794	1066	2194
1986	967	5898	6478	2914	1437	1177	1136	657	436	381	303	366	607	670	863	2701
1987	2326	12579	8766	4517	3830	3741	1240	1316	985	1037	507	414	441	492	501	1578
1988	4935	9303	11087	3821	3362	3299	3132	1575	1064	926	902	619	546	523	526	1765
1989	842	12925	1542	3104	2519	1480	1621	2160	1615	1090	835	900	716	641	575	1921
1990	2993	3583	17800	1798	2207	2135	1141	1308	1646	1534	885	681	611	522	531	1789
1991	4111	14055	10072	3081	1944	1484	1836	1727	1536	1457	1110	902	628	583	544	1514
1992	589	6088	1922	1053	1187	1332	871	1639	1723	935	932	980	849	663	481	1577
1993	416	1066	4385	3482	2276	1429	1644	1232	1749	1641	831	569	472	360	286	1326
1994	2052	720	1235	2140	2516	1828	1154	1519	2232	1082	937	793	469	399	257	1076
1995	933	1347	3242	2979	2860	4258	1310	609	883	1584	1015	637	505	402	366	1549
1996	526	9349	1676	4657	3341	1122	1385	2318	806	636	1015	909	671	502	429	1522
1997	249	1103	6392	928	1338	1502	1357	1816	1851	1138	605	609	736	672	537	1548
1998	341	889	3486	3483	652	1136	756	1436	2321	2586	1353	725	681	731	486	1437
1999	102	560	1946	1849	1760	799	743	1817	1402	1803	1879	1677	1096	735	577	1583
2000	98	287	1053	1174	3599	3127	1661	1321	1275	1204	1051	1140	1093	824	489	1497
2001	1430	361	2402	4352	987	1303	1748	2227	735	960	1193	1319	1282	1068	753	1481
2002	847	5559	4081	4528	4581	1305	990	2962	2542	1576	1124	949	1124	1056	957	1632
2003	283	2704	4521	3661	1874	1466	327	1314	2155	1633	853	444	585	570	648	1424
2004	814	2674	6944	2586	2752	2907	1454	1522	999	1018	769	582	492	336	331	1139
2005	721	4890	2470	2561	1083	840	688	977	840	703	992	1041	653	424	405	1146
2006	211	630	1245	1746	2452	2004	1063	1073	1373	1253	914	775	572	397	520	1380
2007	65	258	6687	9284	2119	1794	1214	664	575	353	469	402	341	270	253	856
2008	85	788	2292	2102	6401	1614	1797	1829	1190	850	677	415	376	272	364	1059
2009	72	222	2192	1194	987	4540	1559	713	986	876	705	476	337	387	409	1217
2010	66	1097	840	1830	635	632	691	1901	730	995	1094	629	439	438	471	1262
2011	3	560	1617	1592	2055	1261	556	2789	2172	643	624	614	540	431	343	1178
2012	110	404	1854	1212	466	606	692	718	1231	1614	1144	476	489	388	419	1143
2013	48	268	557	1254	196	555	588	957	601	599	923	792	509	352	354	999

Table 9. Weight-at-age estimates of western Bluefin Tuna used in the 2014 base VPA.

Year	Age1	Age2	Age3	Age4	Age5	Age6	Age7	Age8	Age9	Age10	Age11	Age12	Age13	Age14	Age15	Age16+
1970	3.20	8.32	16.89	35.53	47.69	67.01	85.42	113.30	145.53	154.62	173.72	198.66	223.25	247.98	264.63	327.72
1971	3.48	8.30	20.89	31.44	51.20	69.88	86.65	106.89	126.82	149.12	172.48	198.50	224.12	248.76	272.98	317.23
1972	4.39	9.67	19.16	37.67	51.60	62.39	90.02	112.49	129.30	149.55	176.77	202.21	227.65	246.89	271.55	330.94
1973	3.74	8.86	20.70	38.19	47.93	69.19	89.03	115.65	134.10	152.95	179.96	208.23	230.76	249.75	277.68	333.91
1974	3.64	10.04	17.09	34.89	49.38	64.21	87.67	101.47	131.83	151.27	169.97	196.81	219.92	247.50	263.25	323.11
1975	3.86	8.63	22.42	32.61	47.14	66.90	83.76	110.46	134.72	152.31	168.00	193.83	216.42	243.31	264.63	321.65
1976	4.01	10.20	18.75	32.08	45.09	64.23	91.77	113.95	144.21	160.36	176.03	195.67	218.10	236.65	256.84	322.16
1977	4.77	10.26	20.48	33.84	45.65	63.04	81.33	102.93	128.31	150.47	172.98	195.58	218.15	241.28	258.37	325.90
1978	5.14	10.94	21.48	30.99	47.02	64.38	83.55	108.92	138.73	163.12	185.70	200.09	219.03	242.24	259.19	339.25
1979	5.29	11.23	21.63	35.67	44.23	65.72	84.76	108.11	133.88	160.37	183.17	202.12	220.03	239.99	260.03	337.85
1980	5.03	12.21	20.70	32.53	46.78	69.48	91.69	112.92	136.22	167.63	191.76	215.43	237.19	255.17	267.43	343.01
1981	5.57	11.05	21.53	32.18	45.47	65.46	85.67	108.94	133.87	158.13	183.98	205.00	226.06	240.89	259.84	371.83
1982	4.12	10.81	20.79	31.57	52.63	68.14	89.17	113.21	139.44	160.58	186.81	208.75	233.71	250.95	271.81	392.38
1983	3.99	10.10	19.59	33.63	50.48	66.93	91.45	115.44	140.46	163.89	188.31	213.90	236.55	257.03	279.26	377.54
1984	5.27	11.31	22.88	35.72	50.98	74.31	92.85	114.86	139.74	162.14	186.85	208.02	234.01	262.67	281.77	382.24
1985	4.57	10.21	17.17	31.22	43.60	61.94	79.63	101.58	125.71	152.56	178.75	201.84	223.01	246.50	265.01	337.83
1986	5.28	10.27	19.68	38.09	50.58	70.12	91.86	114.91	137.95	162.73	182.25	204.62	229.21	253.11	278.64	350.40
1987	5.08	9.82	22.26	36.63	49.94	67.19	85.61	109.71	130.38	155.50	180.41	202.51	230.00	258.81	279.73	349.06
1988	3.87	11.19	20.06	34.56	49.80	67.74	86.98	110.54	132.99	157.72	182.83	208.51	232.25	251.74	280.53	354.36
1989	4.53	11.06	21.45	35.96	47.78	68.37	89.97	111.91	133.99	160.88	182.93	205.20	229.78	254.88	277.00	356.31
1990	5.24	12.23	18.84	35.12	47.04	66.41	85.78	112.04	138.01	162.77	185.16	206.44	231.34	253.26	278.50	347.01
1991	5.38	13.46	19.63	36.89	53.42	70.16	93.31	114.29	142.16	166.12	184.45	205.67	232.92	255.70	277.58	348.73
1992	5.94	12.72	19.04	35.88	50.11	71.08	88.61	110.29	134.87	160.84	183.60	205.63	231.70	252.07	275.39	347.62
1993	5.10	11.57	23.82	33.36	51.24	66.94	89.28	110.87	135.71	157.85	182.17	204.81	227.22	250.52	275.46	364.06
1994	4.71	12.03	22.14	31.87	45.52	62.76	82.88	109.25	132.38	157.32	183.82	203.76	226.70	249.73	269.64	350.71
1995	4.90	13.62	22.44	35.13	48.60	71.02	89.57	109.22	137.50	160.01	182.17	204.74	228.28	251.22	273.36	369.78
1996	5.15	11.08	22.82	34.79	48.72	69.94	92.56	113.19	137.70	159.85	187.90	209.75	234.84	257.75	282.53	361.90
1997	5.05	12.66	20.26	36.31	51.22	68.43	91.24	112.02	135.70	157.20	183.61	207.67	233.38	257.23	276.85	356.01
1998	4.99	11.75	20.51	32.71	52.63	68.77	90.94	116.61	139.29	162.02	182.95	207.52	233.18	254.40	275.06	352.47
1999	5.42	11.22	21.77	35.53	53.96	71.60	93.71	113.88	136.24	159.02	184.11	206.73	230.95	254.11	276.93	355.41
2000	4.81	11.79	19.09	34.07	46.49	73.15	90.76	110.77	138.97	159.48	188.69	211.82	236.15	264.28	284.54	376.50
2001	4.72	12.80	22.48	33.89	49.13	68.23	95.00	116.01	141.83	166.01	190.73	215.14	242.84	265.54	289.89	352.62
2002	6.33	10.93	19.91	35.15	48.00	63.66	90.69	114.11	137.95	160.88	186.75	209.61	238.08	265.79	284.83	352.40
2003	5.66	11.51	21.60	34.02	50.70	69.17	92.12	115.31	137.43	158.80	184.14	210.24	241.65	265.21	286.90	342.31
2004	6.33	11.94	21.93	35.51	46.15	64.95	89.10	111.40	134.73	158.94	184.57	210.08	230.56	259.66	277.51	344.93
2005	5.38	9.80	19.79	30.70	47.55	62.27	82.59	105.75	132.23	160.12	183.99	207.86	231.99	254.63	276.59	349.01
2006	5.52	12.63	17.81	33.27	46.90	64.04	84.60	109.63	128.02	155.10	182.21	206.80	231.96	255.90	269.42	348.34
2007	4.51	11.76	22.41	30.40	49.64	63.54	82.38	111.84	136.63	162.07	186.44	211.78	237.65	262.72	278.79	365.83
2008	4.56	11.92	21.83	36.66	49.11	70.13	93.26	114.70	138.27	157.86	179.43	207.84	231.34	259.44	278.87	377.80
2009	5.39	13.24	21.76	34.43	51.29	69.43	83.92	112.09	133.36	156.42	180.31	207.54	235.55	260.51	277.31	372.46
2010	5.12	11.01	22.02	35.60	49.02	67.91	89.40	112.96	133.56	157.33	182.60	210.61	237.15	264.11	286.54	366.28
2011	4.88	10.77	23.04	31.74	48.20	63.95	87.78	110.99	135.13	159.59	184.86	211.25	239.99	263.70	286.75	361.16
2012	5.19	13.07	21.96	34.06	47.77	73.65	89.05	114.08	137.19	163.41	185.83	212.36	236.08	262.05	283.80	359.29
2013	5.24	12.22	22.48	32.68	47.83	64.47	90.57	111.06	133.01	161.57	188.18	216.72	241.04	266.07	282.79	362.64

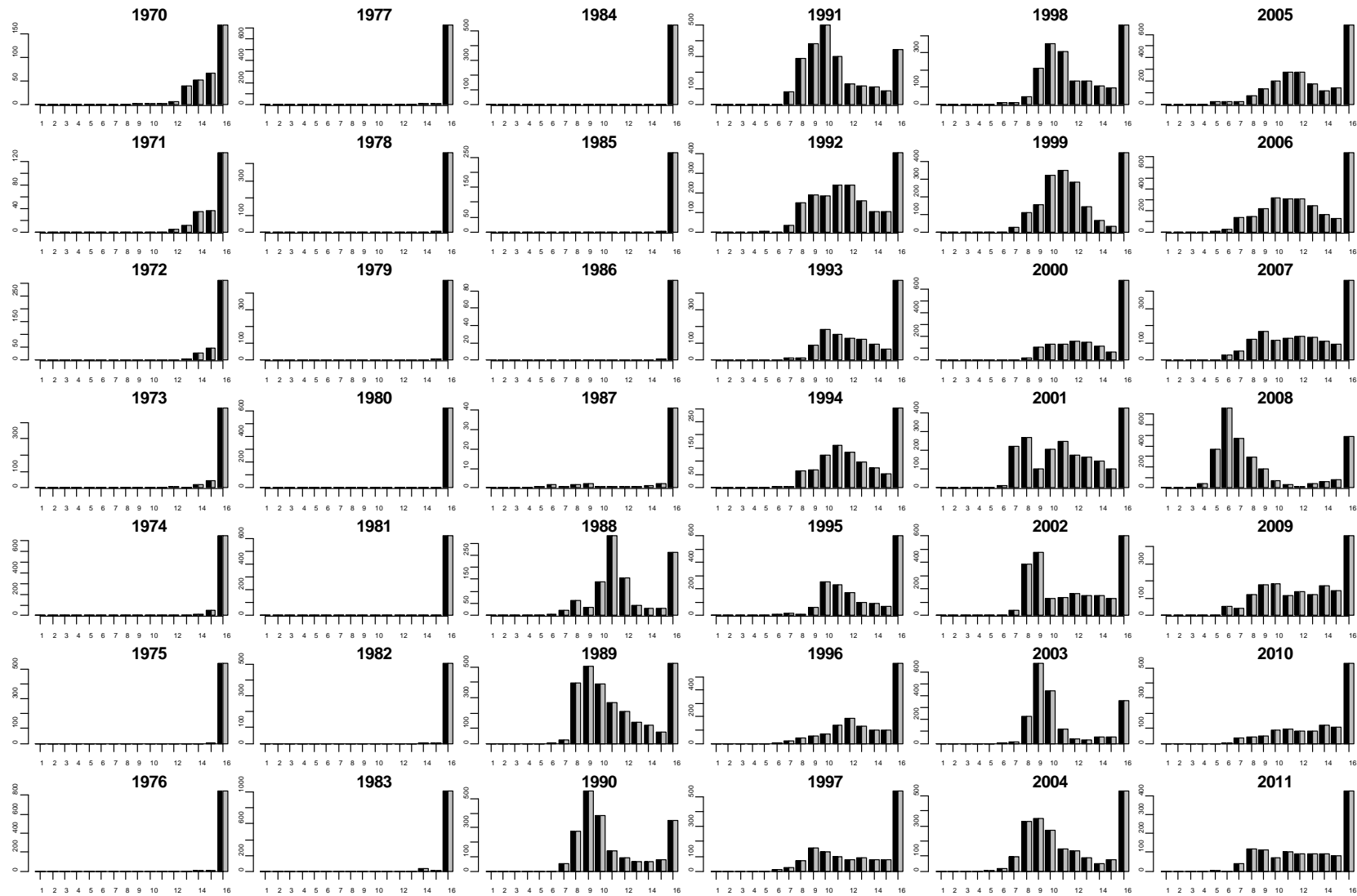


Figure 1. Partial catch-at-age of the Canadian Gulf of St. Lawrence fishery. The black bars are the catch estimates from the 2012 base VPA and the gray bars are the estimates for the 2014 continuity VPA. The x-axis is age-class and the y-axis is catch in number of fish.

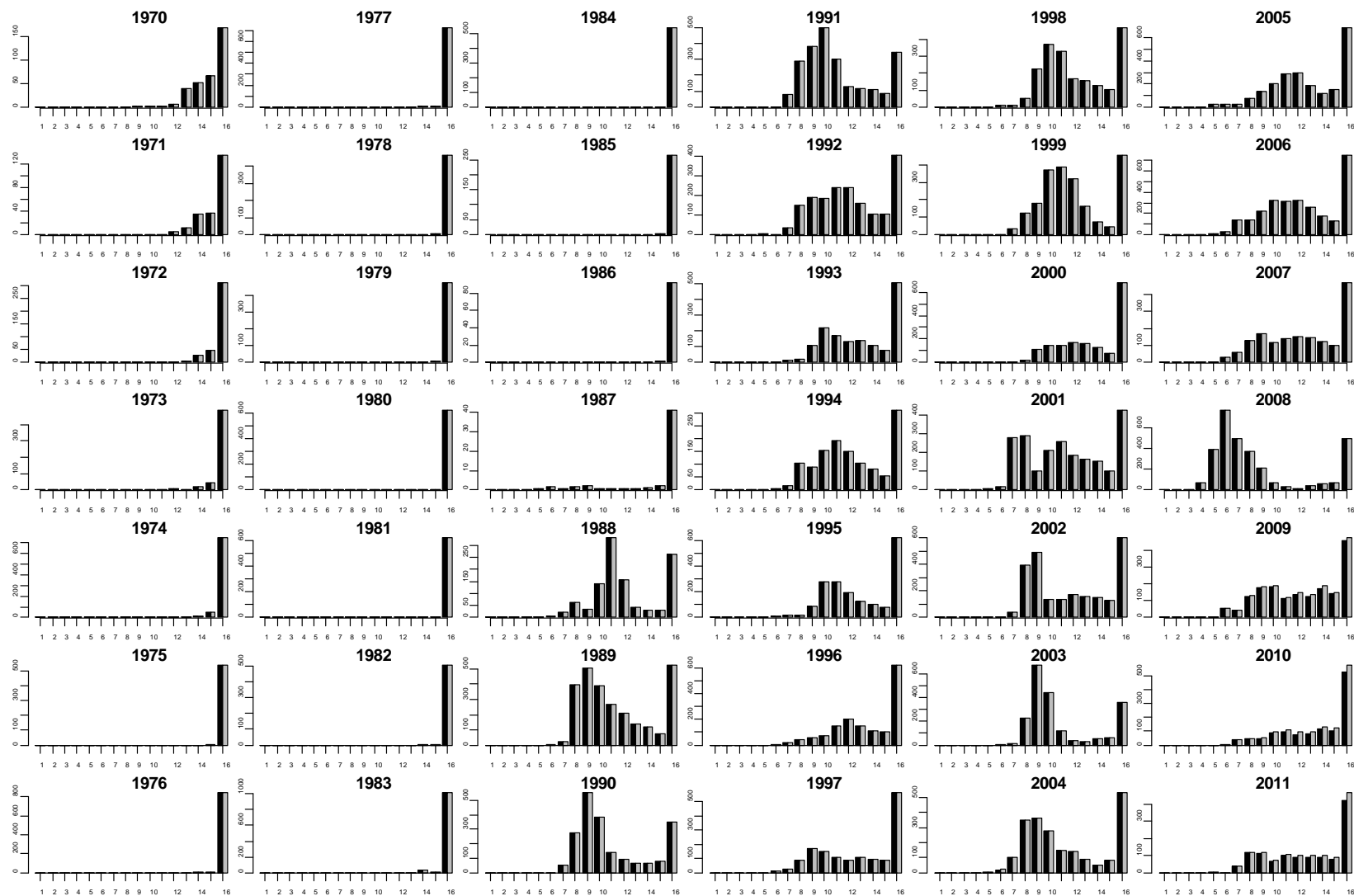


Figure 2. Partial catch-at-age of the Canadian Southwest Nova Scotia fishery. The black bars are the catch estimates from the 2012 base VPA and the gray bars are the estimates for the 2014 continuity VPA. The x-axis is age-class and the y-axis is catch in number of fish.

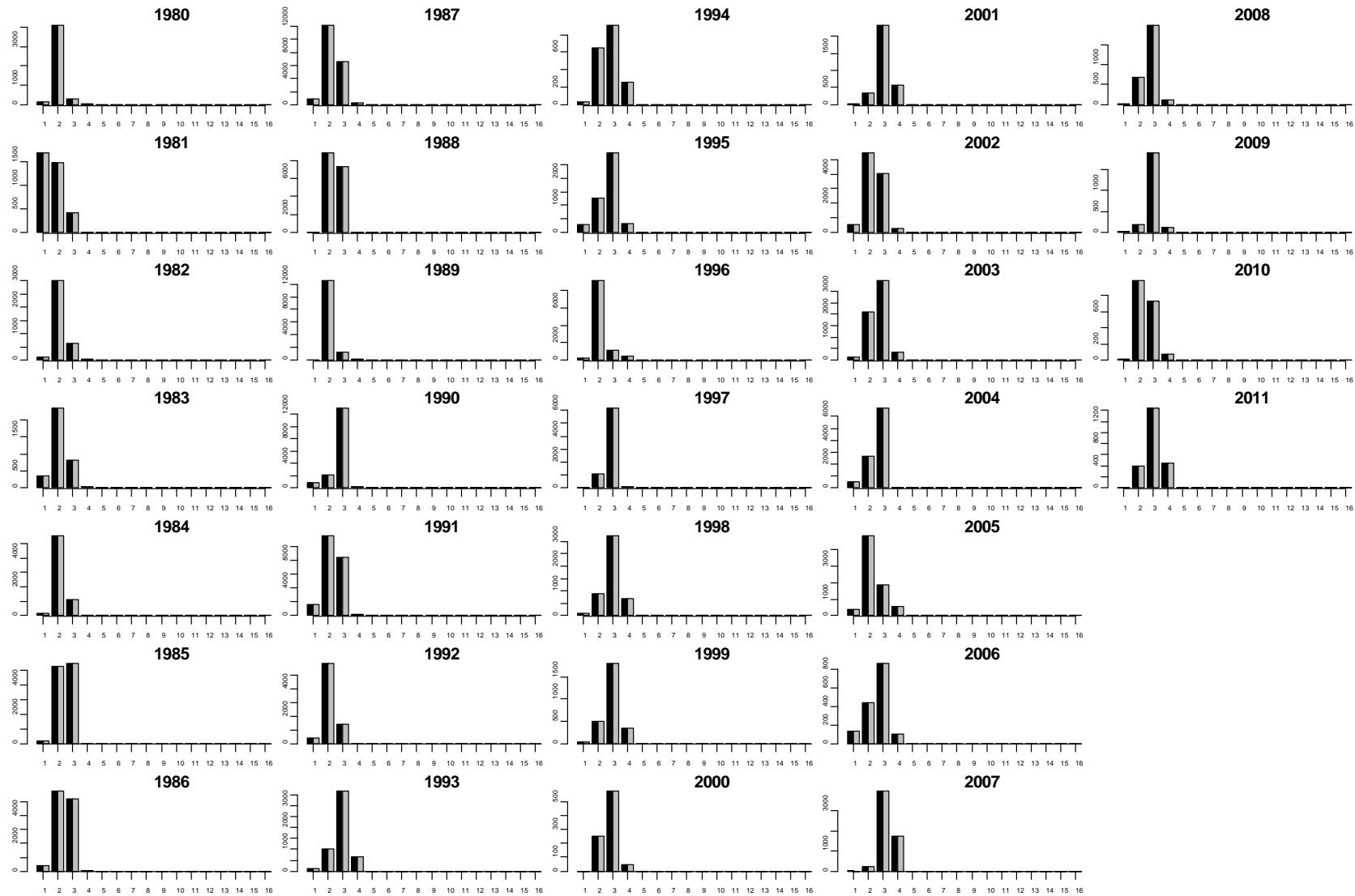


Figure 3. Partial catch-at-age of the U.S.A. rod and reel 66 to 114 cm fishery. The black bars are the catch estimates from the 2012 base VPA and the gray bars are the estimates for the 2014 continuity and VPAs. The x-axis is age-class and the y-axis is catch in number of fish.

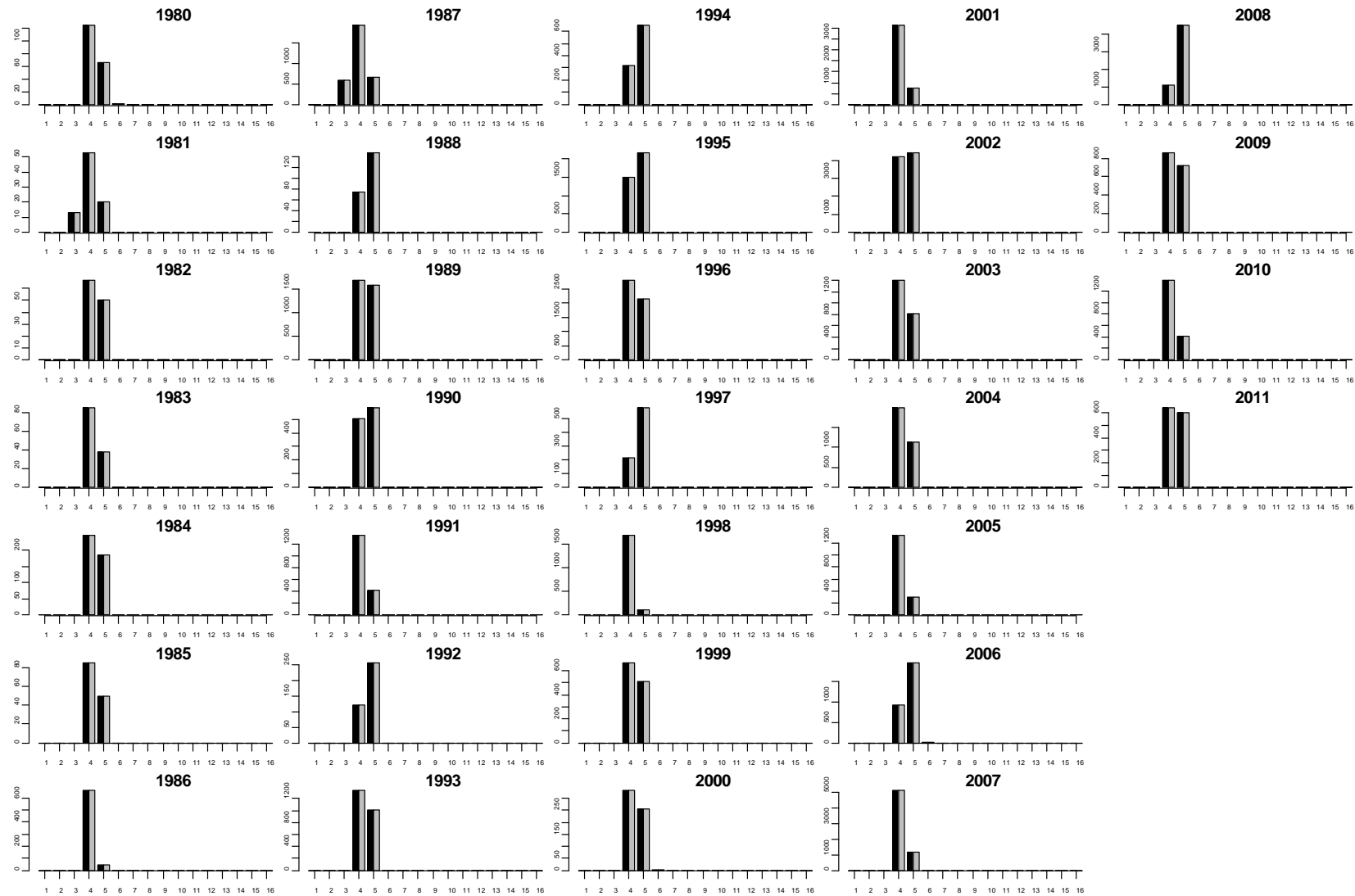


Figure 4. Partial catch-at-age of the U.S.A. rod and reel 115 to 144 cm fishery. The black bars are the catch estimates from the 2012 base VPA and the gray bars are the estimates for the 2014 continuity and base VPAs. The x-axis is age-class and the y-axis is catch in number of fish.

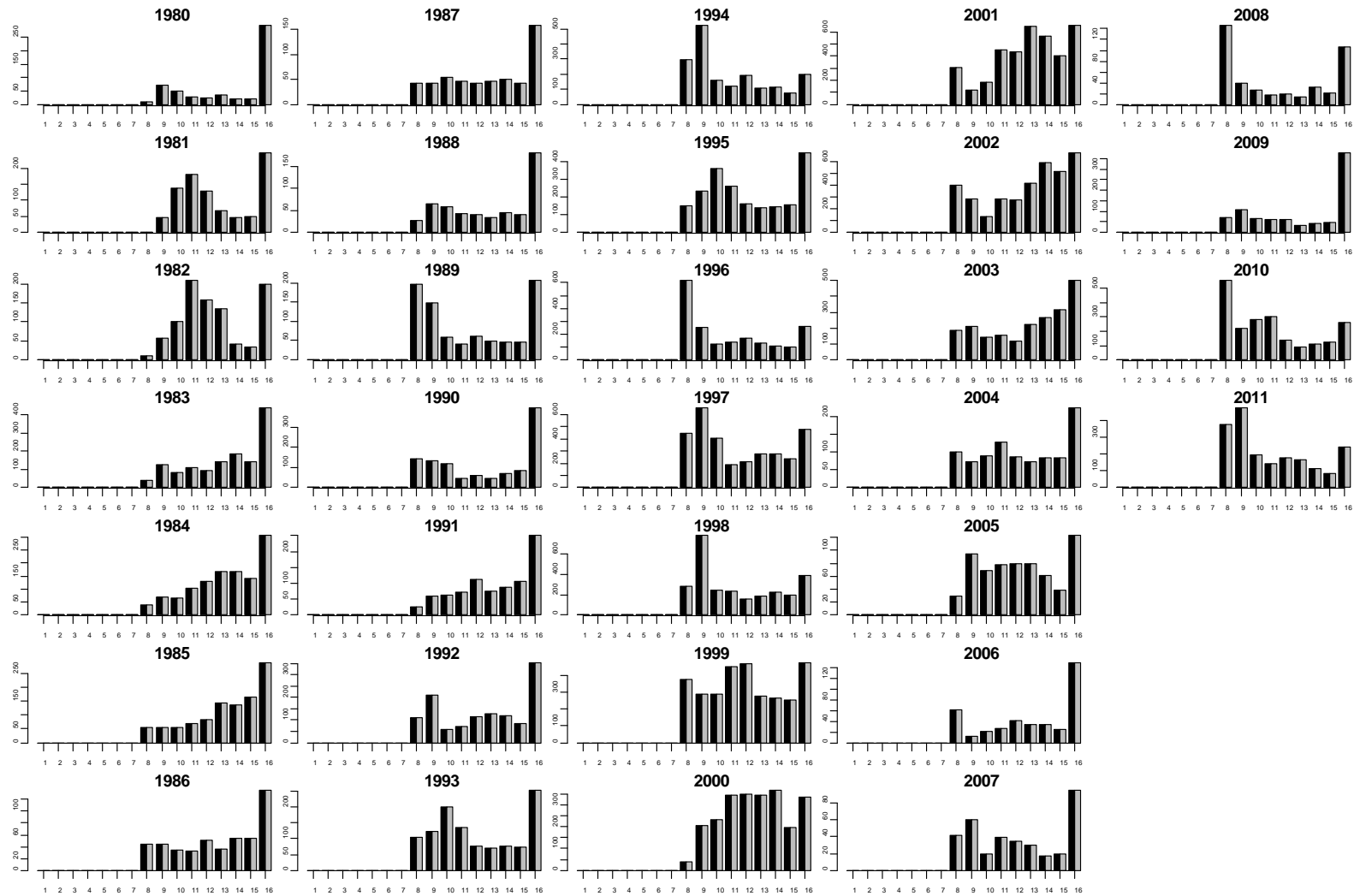


Figure 5. Partial catch-at-age of the U.S.A. rod and reel > 177 cm fishery. The black bars are the catch estimates from the 2012 base VPA and the gray bars are the estimates for the 2014 continuity and base VPAs. The x-axis is age-class and the y-axis is catch in number of fish.

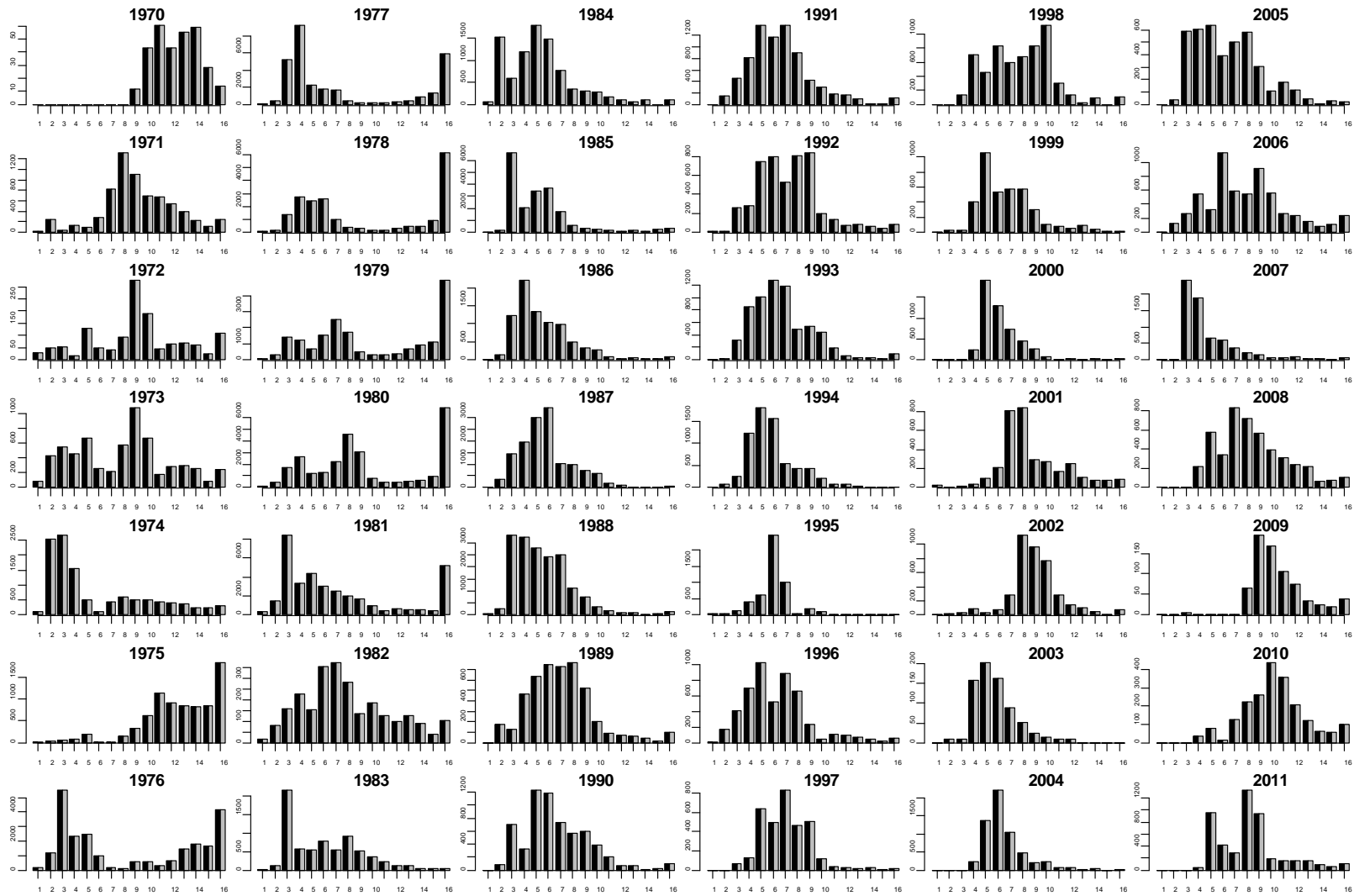


Figure 6. Partial catch-at-age of the Japanese longline fishery. The black bars are the catch estimates from the 2012 base VPA and the gray bars are the estimates for the 2014 continuity and VPAs. The x-axis is age-class and the y-axis is catch in number of fish.

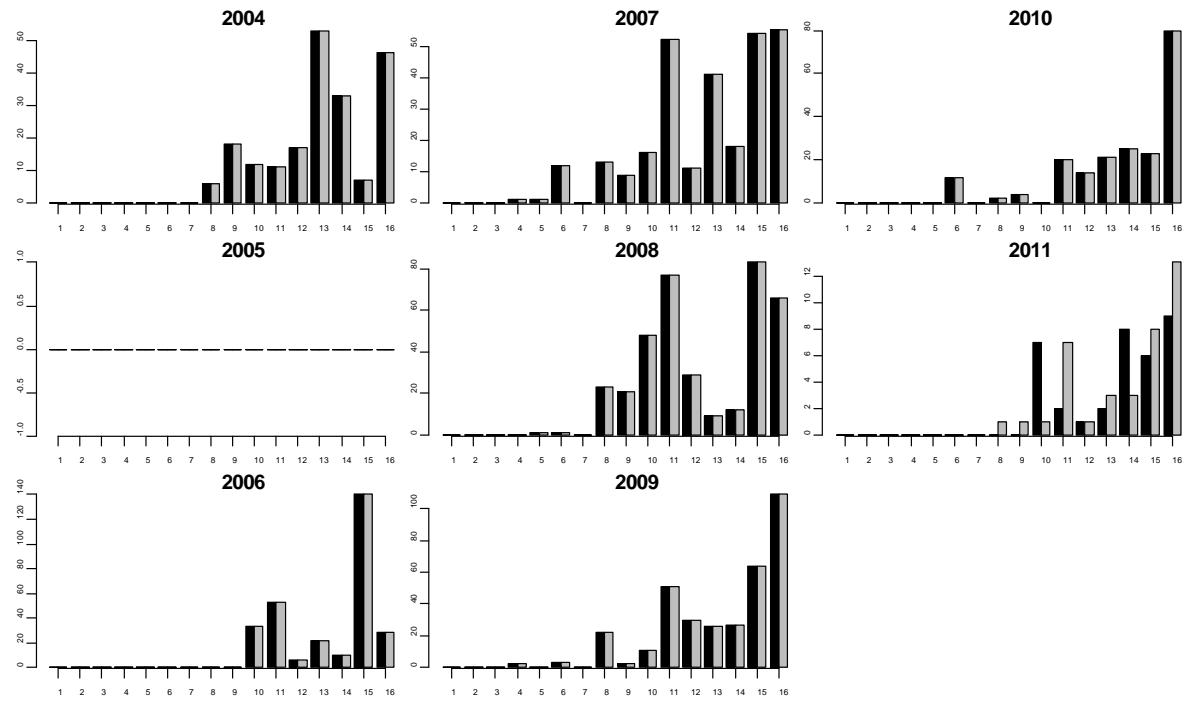


Figure 7. Partial catch-at-age of the U.S.A. Gulf of Mexico longline fishery. The black bars are the catch estimates from the 2012 base VPA and the gray bars are the estimates for the 2014 continuity and base VPAs. The x-axis is age-class and the y-axis is catch in number of fish.

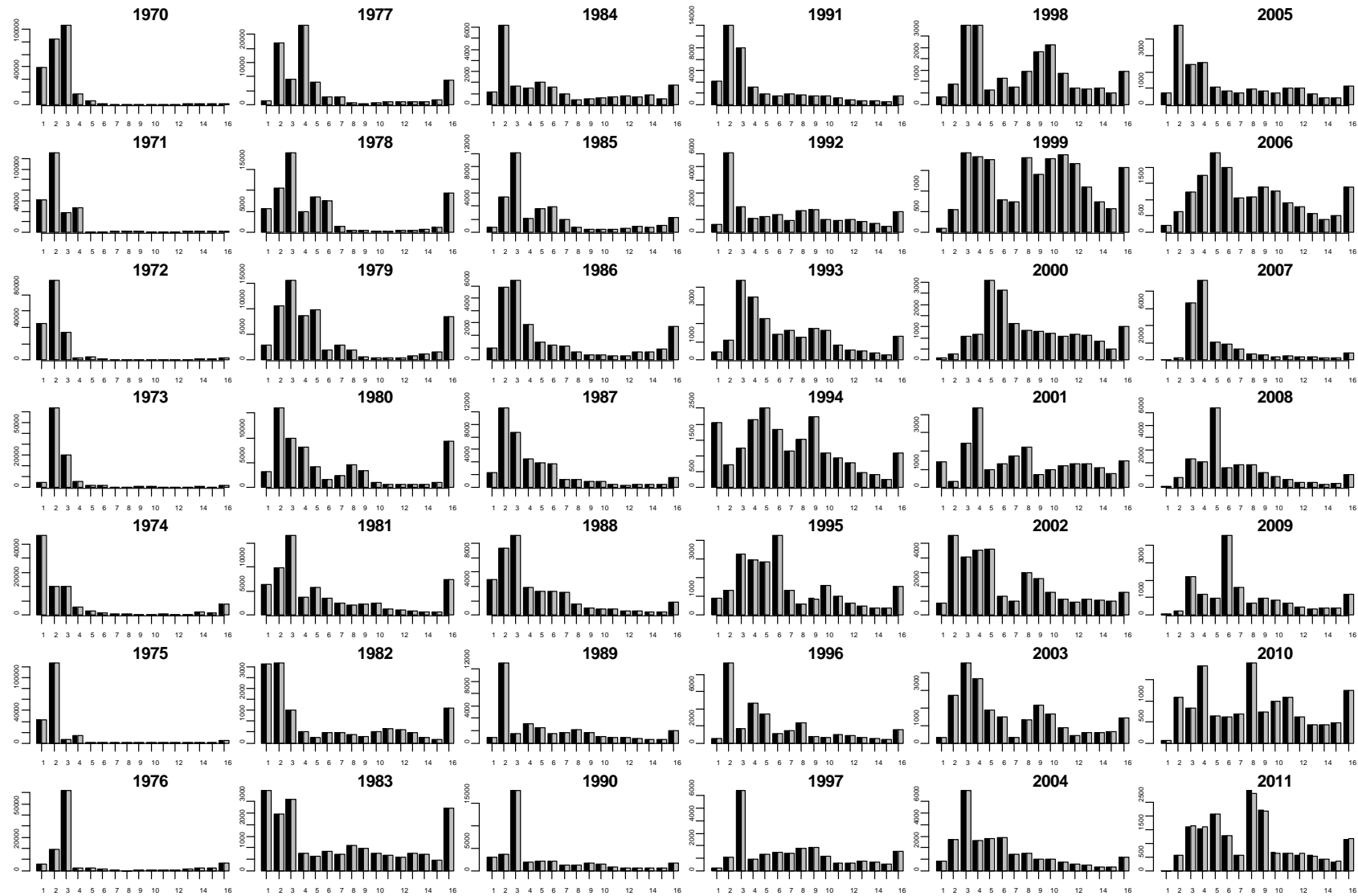


Figure 8. Total catch-at-age estimates of western Bluefin Tuna. The black bars are the catch estimates from the 2012 base VPA and the gray bars are the estimates for the 2014 continuity and base VPAs. The x-axis is age-class and the y-axis is catch in number of fish.

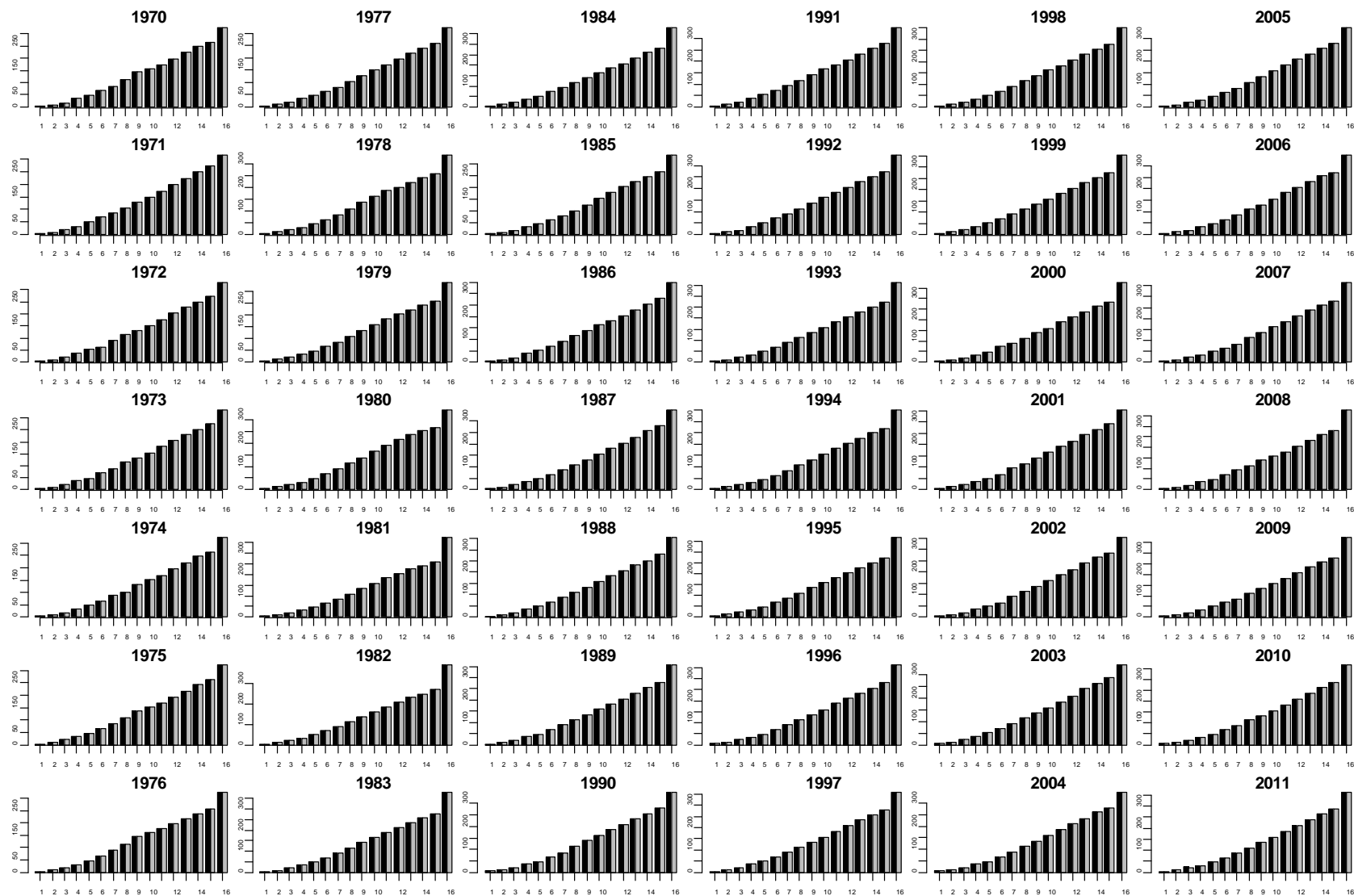


Figure 9. Weight-at-age estimates of western Bluefin Tuna. The black bars are the estimates from the 2012 base VPA and the gray bars are the estimates for the 2014 continuity and base VPAs. The x-axis is age-class and the y-axis is mean weight-at-age.

R Script to Generate PCAA for Western Bluefin Tuna from Ageit_BFT_ver4 Output BigFile

```

ATL_BFT=read.csv('BigF_casBFT5013upd_v3.csv')
WBFT=subset(ATL_BFT,StockID=='ATW')
write.csv(WBFT,'WBFT_CAS_CAA.csv')

JPN_LL_CAS_CAA=subset(WBFT,FlagName=='Japan')
JPN_LL=aggregate(JPN_LL_CAS_CAA$Catch,by=list(JPN_LL_CAS_CAA$YearC,JPN_LL_CAS_CAA$Age),sum)
colnames(JPN_LL)=c('Year','Age','Catch')
write.csv(JPN_LL,'JPN_LL_PCAA.csv',row.names=F)

USRR_66_114_CAS_CAA=subset(WBFT,FlagName=='U.S.A.'&GearGrpCode=='RR'&YearC>1979&Size%in%66:114&Monthc%in%c('Jun','Jul','Aug','Sep'))
USRR_66_114=aggregate(Catch~YearC+Age,data=USRR_66_114_CAS_CAA,sum)
colnames(USRR_66_114)=c('Year','Age','Catch')
write.csv(USRR_66_114,'USRR_66_114_PCAA.csv',row.names=F)

USRR_115_144_CAS_CAA=subset(WBFT,FlagName=='U.S.A.'&GearGrpCode=='RR'&YearC>1979&Size%in%115:144&Monthc%in%c('Jun','Jul','Aug','Sep'))
USRR_115_144=aggregate(Catch~YearC+Age,data=USRR_115_144_CAS_CAA,sum)
colnames(USRR_115_144)=c('Year','Age','Catch')
write.csv(USRR_115_144,'USRR_115_144_PCAA.csv',row.names=F)

USRR_177plus_CAS_CAA=subset(WBFT,FlagName=='U.S.A.'&GearGrpCode=='RR'&YearC>1979&Size>177&Monthc%in%c('Jul','Aug','Sep','Oct'))
USRR_177plus=aggregate(Catch~YearC+Age,data=USRR_177plus_CAS_CAA,sum)
colnames(USRR_177plus)=c('Year','Age','Catch')
write.csv(USRR_177plus,'USRR_177plus_PCAA.csv',row.names=F)

USLL_GOM_CAS_CAA=subset(WBFT,FlagName=='U.S.A.'&GearGrpCode=='LL'&YearC>2003&SampAreaCode=='BF60'&Monthc%in%c('Jan','Feb','Mar','Apr','May'))
USLL_GOM=aggregate(Catch~YearC+Age,data=USLL_GOM_CAS_CAA,sum)
colnames(USLL_GOM)=c('Year','Age','Catch')
write.csv(USLL_GOM,'USLL_GOM_PCAA.csv',row.names=F)

USLL_GOM_CAS_CAA_all2011=subset(WBFT,FlagName=='U.S.A.'&GearGrpCode=='LL'&YearC>2003&SampAreaCode=='BF60')
write.csv(USLL_GOM,'USLL_GOM_PCAA_all2011.csv',row.names=F)

# 2012 BASE USED THESE FILTER CRITERIA FOR BOTH CANADIAN PCAA, ASLO USED FOR 2014 CONTINUITY MODEL
CAN_GSL_CAS_CAA=subset(WBFT,FlagName=='Canada'&GearGrpCode%in%c('RR','TL')&Monthc%in%c('Aug','Sep','Oct'))
CAN_GSL=aggregate(Catch~YearC+Age,data=CAN_GSL_CAS_CAA,sum)
colnames(CAN_GSL)=c('Year','Age','Catch')
write.csv(CAN_GSL,'CAN_GSL_PCAA.csv',row.names=F)

CAN_SWNS_CAS_CAA=subset(WBFT,FlagName=='Canada'&GearGrpCode%in%c('RR','TL','HP')&Monthc%in%c('Aug','Sep','Oct'))
CAN_SWNS=aggregate(Catch~YearC+Age,data=CAN_SWNS_CAS_CAA,sum)
colnames(CAN_SWNS)=c('Year','Age','Catch')
write.csv(CAN_SWNS,'CAN_SWNS_PCAA.csv',row.names=F)

# Base Case PCAA for Canada. Using the ICCAT areas we try to associate the catch to the respective indices.
CAN_CAS_CAA_6090 = subset
(WBFT,FlagName=='Canada'&GearCode%in%c('RR','TL','RRFB')&Monthc%in%c('Aug','Sep','Oct')&YearC<1991)
CAN_CAS_CAA_91plus = subset (WBFT,FlagName=='Canada'&GearCode%in%c('RR','TL','RRFB','HARP','HP-E')&Monthc%in%c('Aug','Sep','Oct')&YearC>1990)
xtabs(Catch~YearC+GearCode,data=CAN_CAS_CAA_6090)
xtabs(Catch~YearC+GearCode,data=CAN_CAS_CAA_91plus)

CAN_GSL_CAS_CAA = rbind(CAN_CAS_CAA_6090,
subset (CAN_CAS_CAA_91plus, (Lat==45&Lon==60)&GearCode%in%c('RR','TL','RRFB')) )
CAN_GSL=aggregate(Catch~YearC+Age,data=CAN_GSL_CAS_CAA,FUN="sum")
colnames(CAN_GSL)=c('Year','Age','Catch')
write.csv(CAN_GSL,'CAN_GSL_PCAA_bc.csv',row.names=F)

CAN_SWNS_CAS_CAA = rbind(CAN_CAS_CAA_6090,
subset (CAN_CAS_CAA_91plus, (Lat==45&Lon==60)&GearCode%in%c('HARP','HP-E')),
subset (CAN_CAS_CAA_91plus, Lat==40&Lon==60) )
CAN_SWNS = aggregate(Catch~YearC+Age,data=CAN_SWNS_CAS_CAA,FUN="sum")
colnames(CAN_SWNS)=c('Year','Age','Catch')
write.csv(CAN_SWNS,'CAN_SWNS_PCAA_bc.csv',row.names=F)

```