Col.Vol.Sci.Pap. ICCAT, 26 (2) : 293-299 (1987)

PROJECTION OF THE WESTERN ATLANTIC BLUEFIN TUNA STOCK

T. Nagai
Far Seas Fisheries Research Laboratory
5-7-1 Orido, 424 Shimizu, Shizuoka Pref., Japan

SUMMARY

Based on the re-assessment of the western Atlantic bluefin tuna stock (SCRS/86/41), a projection was made to examine the future stock status assuming three catch levels after 1987. In the case of 3,850 MT, fishing mortality coefficients of age 13+ do not exceed Fmax (0.209), while in the case of a catch level of 5,000 MT, Fmax is exceeded, without decreasing population biomass.

RESUME

Une projection a été effectuée, à partir de la ré-évaluation du stock de thon rouge ouest-atlantique (SCRS/86/41), pour examiner l'état futur du stock en supposant trois niveaux de prise après 1987. Dans le cas de 3.850 TM, le coefficient de mortalité de pêche des âges 13+ ne dépasse pas le Fmax (0.209), alors que dans le cas de 5.000 TM le Fmax est dépassé, sans baisse de la biomasse de la population.

RESUMEN

En base a la reevaluación de la población del atún rojo del Atlántico Oeste (SCRS/86/41) se hizo una proyección para examinar la futura condición de la población suponiendo tres niveles de captura a partir de 1987. En el caso de 3.850 t, los coeficientes de mortalidad por pesca de la edad 13+ no exceden de Fmax (0.209), mientras que con un nivel de captura de 5.000 t, se sobrepasa Fmax sin disminuir la biomasa de la población.

In the 1985 Miami meeting, the bluefin tuna scientists of ICCAT conducted VPA using several CPUE series on the bluefin tuna stock, as well as making a projection on the stock (ICCAT, 1986). However, as cleared by Nagai and Miyabe (1986), when the selection of CPUE used by the Miami meeting is changed, the terminal F (fishing mortality) of 1984 can be estimated smaller and the population number can be estimated larger. The purpose of this report is to make a projection of this stock based on the bluefin tuna stock re-evaluation mentioned above.

Materials and methods

The Parrack's VPA tuning procedure (Parrack, 1986) was used in the Miami meeting. However, according to Nagai and Miyabe (1986), who have reviewed the CPUE series selected by the meeting, no correlation is recognized between the estimated population number and CPUE when Medium fish (5B) and West 2 are compared as the abundance indices of medium fish. Accordingly, it is difficult to determine which index would be better, but Nagai and Miyabe thought that the latter would rather be better. Then, they estimated Ft (fishing mortality at terminal age) as 0.113 instead of 0.209 by using the full series of West 2 instead of Medium fish (5B).

On the assumption of natural mortality being 0.1, a projection was made for the period 1984 through 1993 by using the estimates of population number and fishing mortality coefficients in 1984 obtained from the re-evaluation mentioned-above. In so doing, the annual partial recruitment was assumed to be the same as that of 1984. Since it was clear that the catch in 1985 would not exceed 2,660 ton at the largest and the catch in 1986 was not known, the catch in each of these two years was assumed to be 2,660 ton (catch for monitoring). The catch from 1987 onwards was assumed to remain constant and the following

three values were set: 2,660 ton which is the current catch for monitoring, 5,000 ton which is about equal to the actual catch in the ten years up to 1982 when the monitoring system was introduced, and 3,850 ton which is the mean value of the two values mentioned above. To calculate the population biomass, the body length at the time of full age was calculated first using the growth equation of Parrack and Pharse (1979), and the weight by ages was calculated by applying the length-weight relationship. To calculate the catch weight, the mean weight value by ages, which was used in the Miami meeting, was used. Table 1 shows the parameters and data used.

Result and discussions

Table 2 and Fig. 1 show the estimated values of population number and fishing morrality obtained by projecting the stock with 1984 as the starting year. The following can be cited based on the contents of the table and figure in all cases of the catch in 1987 and succeeding years being 2,660 ton, 3,850 ton and 5,000 ton: The population number of medium fish of 6-year to 9-year old will increase by about five times, from 58,000 in 1984 to about 300,000 in 1989, but the number will slightly decrease after that; the population number of adult of 10-year old or older, which is estimated to be about 65,000 in 1984, will take a decreasing trend down to 48,000 in 1987. However, it will make a turn to increase, reaching to about 200,000 in 1993, quickly recovering to the level of 1970; the population biomass of fishes from 1-year old to 30-year old will continue to increase from 1985 since the increase of abundant medium fish will make up the decrease of adult.

If the catch in 1987 and succeeding years is 2,660 ton, the fishing mortality of 13-year old or older fish (full F) will be the largest, or 0.115 in 1987. If the catch from 1987 onwards is 3,850 ton, full F of 1988 will be 0.177 and this will be the largest. If the catch in 1987 and succeeding years is 5,000 ton, full F of 1987 will be 0.221 and this will be the largest.

Since Fmax is 0.209 (ICCAT, 1986) according to the yield per recruit analysis in the Miami meeting, if 5,000 ton is set as the catch in 1987 and succeeding years, full F exceeds Fmax in 1987. However, if it is set to 3,850 ton, full F will not exceed Fmax since the largest full F is 0.177.

The population biomass of 1-year to 30-year old fish in 1970 is calculated as 67,000 ton when the population number determined by Nagai and Miyabe (1986) is used. The year in which the stock recovers to the level of 1970 is projected as 1991 if the catch for monitoring is set to 2,660 ton, 1992 if it is set to 3,850 ton, and 1994 if it is set to 5,000 ton (Fig. 1).

Conclusion

Based on the projection of Western Atlantic bluefin tuna stock as described above, it is predicted that the fishing mortality of 13-year old and older fishes would not exceed Fmax if the catch for monitoring in 1987 and succeeding years is set to 3,850 ton and that the population biomass will consistently increase and not decrease even if the catch for monitoring is set to 5,000 ton.

References

ICCAT 1986: Report of the meeting of the bluefin working group, Miami, Florida, U.S.A., September, 1985. Int. Comm. for the Conserv. of Atlantic Tunas, CVSP XXIV: 1-254.

Nagai, T. and N. Miyabe 1986: Comments on the Parrack's VPA tuning program. Int. Comm. for the Conserv. of Atlantic Tunas, SCRS Doc. 86/41, 13 p.

Parrack, M. L. 1986: A method of analyzing catches and abundance indices from a fishery. Int. Comm. for the Conserv. of Atlantic Tunas, CVSP XXIV: 209-221.

Parrack, M. L. and P. L. Pharse 1979: Aspects of the growth of Atlantic bluefin tuna determined from mark-recapture data. Int. Comm. for the Conserv. of Atlantic Tunas, CVSP VIII: 356-366.

Table 1. The input parameter and data for projection of the western Atlantic bluefin tuna.

♦ INPUT 1984 N-DATA:

AGE	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
NUMBER	196188	156503	140600	118666	70523	30163	16710	5609	5575	5979	6888	6417	8126	7320	7831

AGE	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
NUMBER	4864	2388	197	757	305	449	757	757	452	1670	2889	2741	1975	1061	757

♦ INPUT DATA OF F BY AGE IN 1984

AGE	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
INP-F	.0049	.0519	.0124	.0113	.0226	.0452	.0452	.0452	.0678	.0791	.0904	.1017	.1130	.1130	.1130

AGE	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
INP-F	.1130	.1130	.1130	.1130	.1130	.1130	.1130	.1130	.1130	.1130	.1130	.1130	.1130	.1130	.1130

♦ RECRUIT IS AGE 1 FISH OF PAST YEARS

RECRUIT AT AGE 1 = 150000

♦ NATURAL MORTALITY COEFFICIENT (M) = .1

♦ INPUT OF AGE-WEIGHT RELATIONSHIP

WEIGHT-AT-AGE IN THE BEGINNING OF THE YEAR ($W = 0.2861 \times 10^{-4} L^{2.929}$)

AGE	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
KG	2.8	8.3	17.3	29.5	44.8	62.6	82.4	103.8	126.4	149.6	173.1	196.5	219.7	242.5	264.5

AGE	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
KG	285.8	306.2	325.7	344.1	361.6	378.1	393.5	408.0	421.6	434.2	446.0	456.9	467.0	476.4	485.1

WEIGHT-AT-AGE FOR COMPUTAION OF CATCH IN WEIGHT (1985 Miami meeting)

AGE	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
KG	0.9	4.7	11.4	36.6	53.7	74.2	95.6	115.1	132.7	155.7	180.7	203.3	227.6	251.5	277.6

AGE	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
KG	301.0	322.5	345.0	363.9	389.2	402.8	429.2	438.0	470.9	468.6	472.3	500.8	492.0	517.8	467.3

Table 2. The projection for western Atlantic bluefin tuna with fixing the 1984 fishing pattern.

Catch level after 1987; 2,660 MT

AGE\YEAR	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993
1	196188	150000	150000	150000	150000	150000	150000	150000	150000	150000
2	156503	176658	135026	135055	135053	135117	135197	135270	135334	135388
3	140600	134452	151685	116186	115888	116481	117270	118017	118681	119242
4	118666	125649	120072	135551	103801	103662	104350	105202	106000	106704
5	70523	106167	112343	107412	121242	92948	92950	93684	94553	95359
6	30163	62386	93826	99384	94969	107437	82590	82799	83638	84570
7	16710	26087	53911	81243	85863	82417	93747	72428	72933	73945
8	5609	14452	22542	46689	70190	74514	71915	82213	63798	64481
9	5575	4851	12488	19522	40337	60913	65019	63067	72417	56405
10	5979	4714	4103	10596	16481	34282	52195	56135	54811	63287
11	6888	4999	3946	3448	8842	13861	29110	44712	48460	47624
12	6417	5694	4143	3285	2844	7360	11664	24742	38340	41862
13	8126	5245	4673	3418	2679	2343	6137	9836	21074	32929
14	7320	6567	4263	3822	2755	2183	1936	5135	8322	17996
15	7831	5916	5338	3488	3081	2246	1804	1620	4345	7106
16	4864	6329	4809	4367	2812	2511	1856	1510	1371	3710
17	2388	3931	5144	3934	3520	2292	2075	1553	1277	1170
18	197	1930	3195	4209	3171	2869	1894	1736	1314	1091
19	757	159	1568	2614	3393	2585	2371	1585	1469	1122
20	305	612	129	1282	2107	2765	2136	1984	1341	1254
21	449	246	497	105	1033	1718	2285	1787	1679	1145
22	757	363	200	406	85	842	1419	1912	1512	1433
23	757	612	295	163	327	69	696	1188	1618	1291
24	452	612	497	241	131	267	57	582	1005	1381
25	1670	365	497	406	194	107	220	48	493	858
26	2889	1350	297	406	327	158	88	184	40	421
27	2741	2335	1096	243	327	267	131	74	156	34
28	1975	2215	1897	896	196	267	220	109	63	133
29	1061	1596	1800	1552	722	160	220	184	93	53
30	757	857	1297	1472	1251	589	132	184	156	79
TOTAL	805117	857345	901577	941395	973622	1003230	1031680	1059480	1086290	1112070

AGE\YEAR	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993
1	0.005	0.005	0.005	0.005	0.004	0.004	0.003	0.003	0.003	0.002
2	0.052	0.052	0.050	0.053	0.048	0.042	0.036	0.031	0.027	0.023
3	0.012	0.013	0.012	0.013	0.012	0.010	0.009	0.007	0.006	0.006
4	0.011	0.012	0.011	0.012	0.010	0.009	0.008	0.007	0.006	0.005
5	0.023	0.024	0.023	0.023	0.021	0.018	0.016	0.013	0.012	0.010
6	0.045	0.046	0.044	0.046	0.042	0.036	0.031	0.027	0.023	0.020
7	0.045	0.046	0.044	0.046	0.042	0.036	0.031	0.027	0.023	0.020
8	0.045	0.046	0.044	0.046	0.042	0.036	0.031	0.027	0.023	0.020
9	0.068	0.067	0.064	0.069	0.063	0.055	0.047	0.040	0.035	0.031
10	0.079	0.078	0.074	0.081	0.073	0.064	0.055	0.047	0.041	0.036
11	0.090	0.088	0.083	0.092	0.084	0.073	0.062	0.054	0.047	0.041
12	0.102	0.098	0.092	0.104	0.094	0.082	0.070	0.060	0.053	0.046
13	0.113	0.107	0.101	0.115	0.105	0.091	0.078	0.067	0.058	0.051
14	0.113	0.107	0.101	0.115	0.105	0.091	0.078	0.067	0.058	0.051
15	0.113	0.107	0.101	0.115	0.105	0.091	0.078	0.067	0.058	0.051
16	0.113	0.107	0.101	0.115	0.105	0.091	0.078	0.067	0.058	0.051
17	0.113	0.107	0.101	0.115	0.105	0.091	0.078	0.067	0.058	0.051
18	0.113	0.107	0.101	0.115	0.105	0.091	0.078	0.067	0.058	0.051
19	0.113	0.107	0.101	0.115	0.105	0.091	0.078	0.067	0.058	0.051
20	0.113	0.107	0.098	0.115	0.105	0.091	0.078	0.067	0.058	0.051
21	0.113	0.106	0.100	0.115	0.105	0.091	0.078	0.067	0.058	0.051
22	0.113	0.107	0.099	0.115	0.105	0.091	0.078	0.067	0.058	0.051
23	0.113	0.107	0.101	0.115	0.105	0.091	0.078	0.067	0.058	0.051
24	0.113	0.107	0.100	0.115	0.105	0.091	0.078	0.067	0.058	0.051
25	0.113	0.106	0.100	0.115	0.105	0.091	0.078	0.067	0.058	0.051
26	0.113	0.107	0.100	0.115	0.105	0.091	0.078	0.067	0.058	0.051
27	0.113	0.107	0.101	0.115	0.105	0.091	0.078	0.067	0.058	0.051
28	0.113	0.107	0.100	0.115	0.105	0.091	0.078	0.067	0.058	0.051
29	0.113	0.107	0.101	0.115	0.105	0.091	0.078	0.067	0.058	0.051
30	0.113	0.107	0.101	0.115	0.105	0.091	0.078	0.067	0.058	0.051

Table 2 (Continued)

Catch level after 1987; 3,850 MT

AGE\YEAR	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993
1	196188	150000	150000	150000	150000	150000	150000	150000	150000	150000
2	156503	176658	135026	135055	134734	134801	134902	135000	135089	135166
3	140600	134452	151685	116186	113004	113336	114301	115274	116171	116963
4	118666	125649	120072	135551	103176	100478	100967	102015	103056	104011
5	70523	106167	112343	107412	120578	91886	89639	90227	91303	92358
6	30163	62386	93826	99384	93932	105691	80821	79111	79874	81043
7	16710	26087	53911	81243	83998	79759	90370	69572	68518	69550
8	5609	14452	22542	46689	68666	71324	68197	77791	60256	59662
9	5575	4851	12488	19522	39461	58305	60985	58705	67375	52468
10	5979	4714	4103	10596	15947	32459	48462	51203	49744	57551
11	6888	4999	3946	3448	8509	12910	26600	40185	42916	42085
12	6417	5694	4143	3285	2722	6780	10431	21783	33314	35961
13	8126	5245	4673	3418	2550	2135	5401	8436	17862	27648
14	7320	6567	4263	3822	2608	1968	1677	4314	6843	14683
15	7831	5916	5338	3488	2916	2013	1546	1339	3499	5625
16	4864	6329	4809	4367	2661	2251	1581	1235	1086	2876
17	2388	3931	5144	3934	3332	2054	1768	1263	1001	893
18	197	1930	3195	4209	3002	2572	1614	1412	1024	823
19	757	159	1568	2614	3211	2317	2020	1289	1145	842
20	305	612	129	1282	1994	2479	1820	1614	1045	942
21	449	246	497	105	978	1540	1947	1454	1309	859
22	757	363	200	406	80	755	1209	1555	1179	1076
23	757	612	295	163	310	62	593	966	1261	969
24	452	612	497	241	124	239	49	474	783	1037
25	1670	365	497	406	184	96	188	39	384	644
26	2889	1350	297	406	310	142	75	150	31	316
27	2741	2335	1096	243	310	239	111	60	122	26
28	1975	2215	1897	896	185	239	188	89	49	100
29	1061	1596	1800	1552	684	143	188	150	72	40
30	757	857	1297	1472	1184	528	112	150	122	59
TOTAL	805117	857345	901577	941395	961351	979501	997761	1016850	1036430	1056280

AGE\YEAR	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993
1	0.005	0.005	0.005	0.007	0.008	0.006	0.005	0.005	0.004	0.004
2	0.052	0.052	0.050	0.079	0.081	0.065	0.058	0.050	0.044	0.039
3	0.012	0.013	0.012	0.019	0.019	0.016	0.014	0.012	0.010	0.009
4	0.011	0.012	0.011	0.017	0.018	0.014	0.013	0.011	0.009	0.009
5	0.023	0.024	0.023	0.034	0.035	0.028	0.025	0.022	0.019	0.017
6	0.045	0.046	0.044	0.068	0.071	0.057	0.050	0.044	0.038	0.034
7	0.045	0.046	0.044	0.068	0.071	0.057	0.050	0.044	0.038	0.034
8	0.045	0.046	0.044	0.068	0.071	0.057	0.050	0.044	0.038	0.034
9	0.068	0.067	0.064	0.103	0.106	0.085	0.075	0.066	0.057	0.051
10	0.079	0.078	0.074	0.120	0.124	0.099	0.088	0.077	0.066	0.060
11	0.090	0.088	0.083	0.137	0.141	0.113	0.101	0.088	0.076	0.068
12	0.102	0.098	0.092	0.154	0.159	0.128	0.113	0.099	0.085	0.077
13	0.113	0.107	0.101	0.171	0.177	0.142	0.126	0.110	0.095	0.086
14	0.113	0.107	0.101	0.171	0.177	0.142	0.126	0.110	0.095	0.086
15	0.113	0.107	0.101	0.171	0.177	0.142	0.126	0.110	0.095	0.086
16	0.113	0.107	0.101	0.171	0.177	0.142	0.126	0.110	0.095	0.086
17	0.113	0.107	0.101	0.171	0.177	0.142	0.126	0.110	0.095	0.086
18	0.113	0.107	0.101	0.171	0.177	0.142	0.126	0.110	0.095	0.086
19	0.113	0.107	0.101	0.171	0.177	0.142	0.126	0.110	0.095	0.086
20	0.113	0.107	0.098	0.171	0.177	0.142	0.126	0.110	0.095	0.086
21	0.113	0.106	0.100	0.171	0.177	0.142	0.126	0.110	0.095	0.086
22	0.113	0.107	0.099	0.171	0.177	0.142	0.126	0.110	0.095	0.086
23	0.113	0.107	0.101	0.171	0.177	0.142	0.126	0.110	0.095	0.086
24	0.113	0.107	0.100	0.171	0.177	0.142	0.126	0.110	0.095	0.086
25	0.113	0.106	0.100	0.171	0.177	0.142	0.126	0.110	0.095	0.086
26	0.113	0.107	0.100	0.171	0.177	0.142	0.126	0.110	0.095	0.086
27	0.113	0.107	0.101	0.171	0.177	0.142	0.126	0.110	0.095	0.086
28	0.113	0.107	0.100	0.171	0.177	0.142	0.126	0.110	0.095	0.086
29	0.113	0.107	0.101	0.171	0.177	0.142	0.126	0.110	0.095	0.086
30	0.113	0.107	0.101	0.171	0.177	0.142	0.126	0.110	0.095	0.086

Table 2. (Continued)

Catch level after 1987; 5,000 MT

AGE\YEAR	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993
1	196188	150000	150000	150000	150000	150000	150000	150000	150000	150000
2	156503	176658	135026	135055	134418	134466	134571	134683	134787	134881
3	140600	134452	151685	116186	110206	110103	111067	112143	113164	114101
4	118666	125649	120072	135551	102558	97368	97472	98535	99686	100774
5	70523	106167	112343	107412	119921	90068	86369	86629	87730	88900
6	30163	62386	93826	99384	92912	103904	78966	75397	75896	77111
7	16710	26087	53911	81243	82183	77085	86836	66506	63957	64801
8	5609	14452	22542	46689	67182	68184	64422	73134	56415	54607
9	5575	4851	12488	19522	38608	55738	56983	54257	62037	48168
10	5979	4714	4103	10596	15432	30672	44768	46301	44563	51453
11	6888	4999	3946	3448	8190	11997	24151	35729	37419	36427
12	6417	5694	4143	3285	2606	6239	9261	18932	28413	30147
13	8126	5245	4673	3418	2427	1940	4715	7131	14815	22562
14	7320	6567	4263	3822	2469	1768	1439	3566	5490	11594
15	7831	5916	5338	3488	2761	1799	1312	1088	2745	4297
16	4864	6329	4809	4367	2520	2011	1334	992	838	2149
17	2388	3931	5144	3934	3155	1836	1492	1009	764	656
18	197	1930	3195	4209	2842	2298	1362	1128	777	598
19	757	159	1568	2614	3041	2070	1705	1030	869	608
20	305	612	129	1282	1888	2215	1536	1289	793	680
21	449	246	497	105	926	1376	1643	1162	993	621
22	757	363	200	406	76	675	1021	1243	894	777
23	757	612	295	163	293	55	500	772	957	700
24	452	612	497	241	118	214	41	379	594	749
25	1670	365	497	406	174	86	159	31	291	465
26	2889	1350	297	406	293	127	64	120	24	228
27	2741	2335	1096	243	293	214	94	48	92	19
28	1975	2215	1897	896	176	214	159	71	37	72
29	1061	1596	1800	1552	647	128	159	120	55	29
30	757	857	1297	1472	1121	472	95	120	92	43
TOTAL	805117	857345	901577	941395	949437	956051	963693	973543	985188	998215

AGE\YEAR	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993
1	0.005	0.005	0.005	0.009	0.009	0.009	0.008	0.007	0.006	0.006
2	0.052	0.052	0.050	0.101	0.100	0.093	0.083	0.074	0.066	0.061
3	0.012	0.013	0.012	0.024	0.024	0.022	0.020	0.018	0.016	0.015
4	0.011	0.012	0.011	0.022	0.022	0.020	0.018	0.016	0.014	0.013
5	0.023	0.024	0.023	0.044	0.043	0.041	0.036	0.032	0.029	0.026
6	0.045	0.046	0.044	0.088	0.087	0.081	0.072	0.065	0.058	0.053
7	0.045	0.046	0.044	0.088	0.087	0.081	0.072	0.065	0.058	0.053
8	0.045	0.046	0.044	0.088	0.087	0.081	0.072	0.065	0.058	0.053
9	0.068	0.067	0.064	0.132	0.130	0.122	0.108	0.097	0.087	0.079
10	0.079	0.078	0.074	0.154	0.152	0.142	0.126	0.113	0.101	0.092
11	0.090	0.088	0.083	0.177	0.174	0.162	0.144	0.129	0.116	0.105
12	0.102	0.098	0.092	0.199	0.196	0.183	0.162	0.145	0.130	0.119
13	0.113	0.107	0.101	0.221	0.217	0.203	0.180	0.162	0.145	0.132
14	0.113	0.107	0.101	0.221	0.217	0.203	0.180	0.162	0.145	0.132
15	0.113	0.107	0.101	0.221	0.217	0.203	0.180	0.162	0.145	0.132
16	0.113	0.107	0.101	0.221	0.217	0.203	0.180	0.162	0.145	0.132
17	0.113	0.107	0.101	0.221	0.217	0.203	0.180	0.162	0.145	0.132
18	0.113	0.107	0.101	0.221	0.217	0.203	0.180	0.162	0.145	0.132
19	0.113	0.107	0.101	0.221	0.217	0.203	0.180	0.162	0.145	0.132
20	0.113	0.107	0.098	0.221	0.217	0.203	0.180	0.162	0.145	0.132
21	0.113	0.106	0.100	0.221	0.217	0.203	0.180	0.162	0.145	0.132
22	0.113	0.107	0.099	0.221	0.217	0.203	0.180	0.162	0.145	0.132
23	0.113	0.107	0.101	0.221	0.217	0.203	0.180	0.162	0.145	0.132
24	0.113	0.107	0.100	0.221	0.217	0.203	0.180	0.162	0.145	0.132
25	0.113	0.106	0.100	0.221	0.217	0.203	0.180	0.162	0.145	0.132
26	0.113	0.107	0.100	0.221	0.217	0.203	0.180	0.162	0.145	0.132
27	0.113	0.107	0.101	0.221	0.217	0.203	0.180	0.162	0.145	0.132
28	0.113	0.107	0.100	0.221	0.217	0.203	0.180	0.162	0.145	0.132
29	0.113	0.107	0.101	0.221	0.217	0.203	0.180	0.162	0.145	0.132
30	0.113	0.107	0.101	0.221	0.217	0.203	0.180	0.162	0.145	0.132

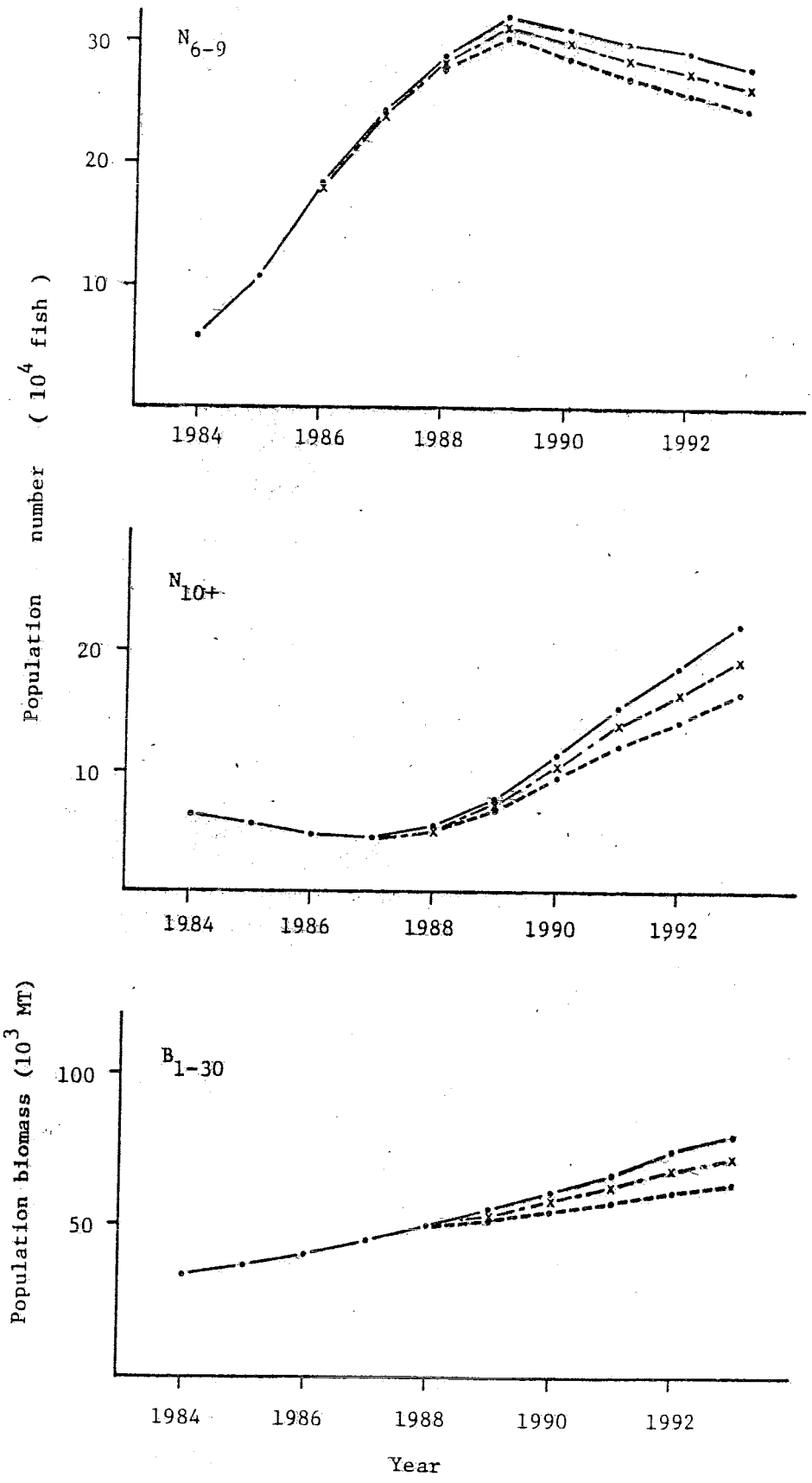

Fig. 1. The projection for western Atlantic bluefin tuna with fixing 1984 fishing pattern under three catch levels setted since 1987.
(Catch: —— ,2660 MT; –·– ,3850 MT; ---- ,5000 MT)