Japanese longline CPUE for bigeye tuna in the Indian Ocean up to 2004 standardized by GLM applying gear material information in the model

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Abstract

Japanese longline CPUE for bigeye tuna from 1960 to 2004 was standardized by GLM (CPUE-LogNormal error structured model) which SST (Sea Surface Temperature) was included in the model as oceanographic factor. NHF (Number of Hooks between Float) which was divided into six classes and main-line materials was applied in the model as fishing gear information. In the early 1990s, quick shift of longline gear configuration to larger NHF occurred. This shift of configuration seems to be derived from the introduction of Nylon material into longline gears. In order to remove the effect of the gear shift accompanied with change in gear material, information of main line materials was newly applied in the standardization model.

In the tropical area, the main longline fishing ground for bigeye, the CPUE which has continuously declined since 1960 until 2002 except for 1977 and 1978, showed a little increase in 2003 and 2004. Although the relative CPUE fluctuated drastically, and no clear trend was observed in the temperate area, obvious declining trend has been observed since 1994. By applying gear material information in the model after 1989, declining trend in 1994 and after was slightly weakened. Since Catch model with Negative Binomial error structure also applied for comparison, the relative trend was quite similar to that from CPUE-LogNormal model.

1. Introduction

The number of hooks between float (NHF) is one of the important indicator to know the targeting of the longline operation and has been used to standardize longline CPUE. It is well known that NHF increased quickly in the middle of 1970s at the tropical area according to the shift of targeting from yellowfin to bigeye tuna (Suzuki et al, 1977). In the end of 1980s through early 1990s, similar sort of increase in NHF was observed in tropical and temperate areas, that is, from NHF=13 to NHF=20 in the tropical and from NHF=7 to NHF=10 in the temperate (Okamoto et al., 2004). The big shift in the gear configuration of this time, however, seems not to be brought by target shifting but by the introduction of new material, Nylon mono-filament, for longline gear (Okamoto, 2005). It is naturally supposed that the different gear material may cause the difference in catch ability. That is, CPUE may be different between same NHF of different material. For example, NHF 15 with mainline of previous material might have different catchability from that of NHF 15 with nylon main line. Therefore, it is desirable to include gear material information in the model to standardize the targeting more appropriately.

2. Materials and methods

In the previous standardization of longline CPUE for bigeye, MLD (Mixing Layer Depth) was applied in the model. MLD data had been downloaded from JEDAC (Joint

Environmental Data Analysis Center) website of Scripps Institution of Oceanography. However, because the data source of MLD stopped to supply it, MLD was not be able to be used this time.

Area definition:

Area definition used in this study was changed from that used in the last bigeye assessment (Okamoto et al, 2004) to the new area definition which was discussed and agreed at the IOTC WPTT meeting in 2005. Previous and new area definitions were shown in Fig. 1. Main fishing ground of Japanese longline fishery was divided into seven sub-areas and CPUE standardization was done for three cases of the sub-area combinations, Tropical (sub-areas 1-5), South (sub-areas 6 & 7) and ALL (sub-areas 1-7) Indian Ocean. Area 67 in the south area was not used in this study.

Environmental factors:

As environmental factors, which are available for the analyzed period from 1960 to 2004, SST (Sea Surface Temperature) was applied. The original SST data, whose resolution is 2-degree latitude and 2-degree longitude by month from 1946 to 2004, was downloaded from NEAR-GOOS Regional Real Time Data Base of Japan Meteorological Agency (JMA).

http://goos.kishou.go.jp/rrtdb/database.html

It is necessary to get password to access the data retrieving system. The original data was recompiled into 5-degree latitude and 5-latitude longitude by month from 1960 to 2004 using the procedures described in Okamoto et al. (2001), and used in the analyses.

Catch and effort data used:

The Japanese longline catch (in number) and effort statistics from 1960 up to 2004 were used. 2004 data is preliminary. The catch and effort data set from aggregated by month, 5-degree square, NHF (the number of hooks between floats, and main line material, was used for the analysis. Data in strata in which the number of hooks was less than 5000 were not used for analyses. As the NHF information does not available for the period from 1960 to 1974, NHF was regarded to be 5 in this period. Main line material was categorized in to two, 1 = Nylon and 2 = other. Although this information on the materials has been collected since 1994, the nylon material was started to be used by distant water longliner in the tropical Indian Ocean in around the late 1980s and spread quickly in the early 1990s (Okamoto 2005). And as a result of introduction of the new material, the larger number of NHF than 17 or 18 would become possible to be used. Therefore, the material of NHF 17 or larger was assumed to be nylon since 1990.

GLM (Generalized Linear Model):

CPUEs based on the number of catch was used;

The number of caught fish / the number of hooks * 1000

The model used for GLM analyses (CPUE-LogNormal error structured model) with SST was as follows.

Model (CPUE-LogNormal error structured model):

$$\text{Log}(CPUE_{ijkl}+const)=\mu+YR_{(i)}+MN_{(j)}+AREA_{(k)}+NHFCL_{(l)}+SST(m)+ML(n)+YR(i)*AREA_{(k)}+MN(j)*AREA_{(k)}+AREA(k)*NHFCL(l)+AREA(k)*SST(m)+NHFCL(l)*ML(n)+e_{(ijkl....)}$$

Where Log : natural logarithm,

CPUE : catch in number of bigeye per 1000 hooks,

Const : 10% of overall mean of CPUE

μ : overall mean (i.e. intercept),

$YR_{(i)}$: effect of year,

MN(j) : effect of fishing season (month),
AREA(k) : effect of sub-area,
NHFCL(l) : effect of gear type (class of the number of hooks between floats),
SST(m) : effect of SST,
ML(n) : effect of material of main line,
YR (i)*AREA (k) : interaction term between year and sub-area,
MN (j)*AREA (k) : interaction term between fishing season and sub-area,
AREA (k)*NHFCL (l) : interaction term between sub-area and gear type,
AREA(k)*SST (m) : interaction term between sub-area and SST,
NHFCL(l)*ML(n) : interaction term between sub-area and MLD,
e(ijkl..) : error term.

The number of hooks between float (NHF) was divided into 6 classes (NHFCL 1: 5-7, NHFCL 2: 8-10, NHFCL 3: 11-13, NHFCL 4: 14-16, NHFCL 5: 17-19, NHFCL 6: 20-21) as later explanation.

Effect of year was obtained by the method used in Ogura and Shono (1999) that uses lsmean of Year-Area interaction as the following equation.

$$CPUE_i = \Sigma \ W_j * (\exp(\text{lsmean}(Year\ i*Area\ _j))\text{-constant})$$

Where $CPUE_i$ = CPUE in year i,
W_j = Area rate of Area j , ($\Sigma W_j = 1$),
lsmean($Year*Area_{ij}$) = least square mean of Year-Area interaction in Year i and Area j,
constant = 10% of overall mean of CPUE.

Previous model, in which MLD is included and a model, in which ML factor and its relating interactions were not included, were also applied to know effect of lack of the MLD and effect of newly applied ML on the results of the standardization.

Negative Binomial error structure assumption was also applied for comparison. In order to get quarterly abundance index as input data for SS2 (Stock Synthesis 2), one another model in which quarter was included in the model instead of month was run. In this case, area weighting was not done.

3. Results and discussion

CPUE standardizations by GLM:

The bigeye CPUE (catch in number per 1000 hooks) was standardized by GLM (CPUE-LogNormal error structured model) for each of three area categories, Tropical (Areas 1 – 5), South (Areas 6 & 7) and All Indian Ocean (Areas 1 – 7), as described in the materials and method section.

Trends of CPUE in each area category (Tropical, South and All Indian Ocean) were shown in Fig. 2 overlaying Nominal CPUE in real scale and relative scale. In the tropical area, CPUE continuously decreased from around 9.0 (real scale) in 1960 to 3.0 in 2002 with exception of abrupt high value in 1977 and 1978. In 2003 and 2004, it has slightly increased into about 4.0. Standardized CPUE in the south area which didn't show clear trend during the period between 1984 and 2000 (CPUE was 3.5 on average), decreased to 2.3 in 2003 and increased to 3.0 in 2004. As a result, CPUE in all Indian Ocean, which had decreased until 2002, increased a little in 2003 and 2004. Results of ANOVA and distributions of the standard residual in each analysis were shown in Table 1 and Fig. 3, respectively. Distributions of the standard residual did not show remarkable difference from the normal distribution. F test showed that the effects of all explanatory variables included in the model were significant in the standardization for tropical Indian Ocean, but Area, ML, AREA*NHFCL, and SST*AREA were not significant in the south area, and ML was not significant in the all Indian Ocean.

CPUE trends described above (CASE 3) were presented in Fig. 4 overlaying with the results from previous model in which MLD was included (CASE 1) and from a model in which ML was not included (CASE 2). There was not remarkable difference in CPUE trend between including or not-including MLD in the model. In the case of main line materials, the CPUE standardized by the model, in which ML was included, tend to be relatively a little bit higher than that from model without ML in the tropical area while no difference was shown in the south area.

Annual values of standardized CPUE by area were listed in Appendix Table 1. Standardized CPUE of each month and each NHFCL by material were compared for tropical and temperate area in Fig. 5 and 6, respectively. In the temperate, CPUE was highest in summer (Jun–Sep) and lowest in winter (Nov-Feb). Although the seasonal trend in tropical was not so clear, that in winter was highest in winter and lowest in March and April. Regarding the combination of NHFCL with main line materials, larger NHFCL shows higher CPUE in the case of non-nylon main line, while smallest (NHFCL1) and largest (NHFCL 6) classes were rather low in CPUE than other NHFCL 2 - 4. In the latter case, the CPUEs of NHFCL 2 through NHFCL 5 were about the same level each other. Standardized CPUE of non-nylon main line in tropical area was lower than nylon main line for all NHFCL except for NHFCL 6.

The results of the standardization applying Catch model with Negative Binomial error structure were shown in Fig. 7 overlaid with those from CPUE-LogNormal error structured model just for comparison. In the Negative Binomial model, the same explanatory variables as that used in lognormal model were used without careful examine. Basic structure of the model was as follows.

E[Catch] = Effort * exp(Intercept + each explanatory valuables)

where, Catch ~ Negative Binomial(α,β)

Their trends were almost same each other in tropical and south Indian Ocean.

Finally, quarterly CPUE trend from 1960 to 2004 were shown in Fig. 8 overlaid with year trend. As described in Method section, area weighting was not done for quarterly CPUE. Nevertheless, quarterly CPUE showed very similar trend to annual CPUE. The values of quarterly CPUE were listed in Appendix Table 2.

4. Recerences

Shono, H. and M. Ogura, M. (1999): The standardized skipjack CPUE including the effect of searching devices, of the Japanese distant water pole and line fishery in the Western Central Pacific Ocean. ICCAT-SCRS/99/59. 18p

Okamoto, H., Miyabe, N., and Matsumoto, T. (2001): GLM analyses for standardization of Japanese longline CPUE for bigeye tuna in the Indian Ocean applying environmental factors. IOTC/TTWP/01/21, 38p.

Okamoto, H. Miyabe, N., and Shono, H. (2004): Standardized Japanese longline CPUE for bigeye tuna in the Indian Ocean up to 2002 with consideration on gear categorization. IOTC/WPTT/04/18. 14 pp.

Okamoto, H. (2005): Recent trend of Japanese longline fishery in the Indian Ocean with special reference to the targeting. IOTC/WPTT/05/11, 15pp.

Suzuki Z., Warashina Y., and Kishida M., 1977: The comparison of catches by regular and deep tuna longline gears in the western and central equatorial Pacific. Bull. *Far Seas Fish. Res. Lab.*, 15, 51-89.

Table 1. ANOVA table of GLM.

	Source	D.F.	S.S.	M.S.	F Value	Pr>F	R-Square
	Model	315	3717.94	11.80	37.41	<.0001	0.351646
	Year	44	487.79	11.09	35.14	<.0001	
	Month	11	80.78	7.34	23.28	<.0001	
	Area	4	62.99	15.75	49.92	<.0001	
	NHFCL	5	24.57	4.91	15.58	<.0001	
TROPICAL	SST	1	17.68	17.68	56.03	<.0001	
	ML	1	1.90	1.90	6.04	0.014	
	Year*Area	176	403.52	2.29	7.27	<.0001	
	Month*Area	44	137.29	3.12	9.89	<.0001	
	Area*NHFCL	20	65.26	3.26	10.34	<.0001	
	Area*SST	4	57.27	14.32	45.38	<.0001	
	NHFCL*ML	5	19.75	3.95	12.52	<.0001	
	Model	129	3940.91	30.55	53.82	<.0001	0.351732
	Year	44	405.09	9.21	16.22	<.0001	
	Month	11	444.38	40.40	71.18	<.0001	
	Area	1	0.05	0.05	0.09	0.76	
	NHFCL	5	30.97	6.19	10.91	<.0001	
SOUTH	SST	1	259.93	259.93	457.96	<.0001	
	ML	1	0.02	0.02	0.04	0.838	
	Year*Area	44	154.10	3.50	6.17	<.0001	
	Month*Area	11	67.47	6.13	10.81	<.0001	
	Area*NHFCL	5	4.29	0.86	1.51	0.1822	
	Area*SST	1	0.57	0.57	1.01	0.315	
	NHFCL*ML	5	13.38	2.68	4.72	0.0003	
	Model	439	10742.51	24.47	63.59	<.0001	0.447026
	Year	44	653.99	14.86	38.63	<.0001	
	Month	11	76.61	6.96	18.10	<.0001	
	Area	6	81.00	13.50	35.08	<.0001	
	NHFCL	5	35.47	7.09	18.44	<.0001	
ALL_IND	SST	1	7.44	7.44	19.33	<.0001	
	ML	1	0.40	0.40	1.04	0.3089	
	Year*Area	264	921.60	3.49	9.07	<.0001	
	Month*Area	66	534.57	8.10	21.05	<.0001	
	Area*NHFCL	30	81.81	2.73	7.09	<.0001	
	Area*SST	6	106.08	17.68	45.95	<.0001	
	NHFCL*ML	5	19.33	3.87	10.04	<.0001	

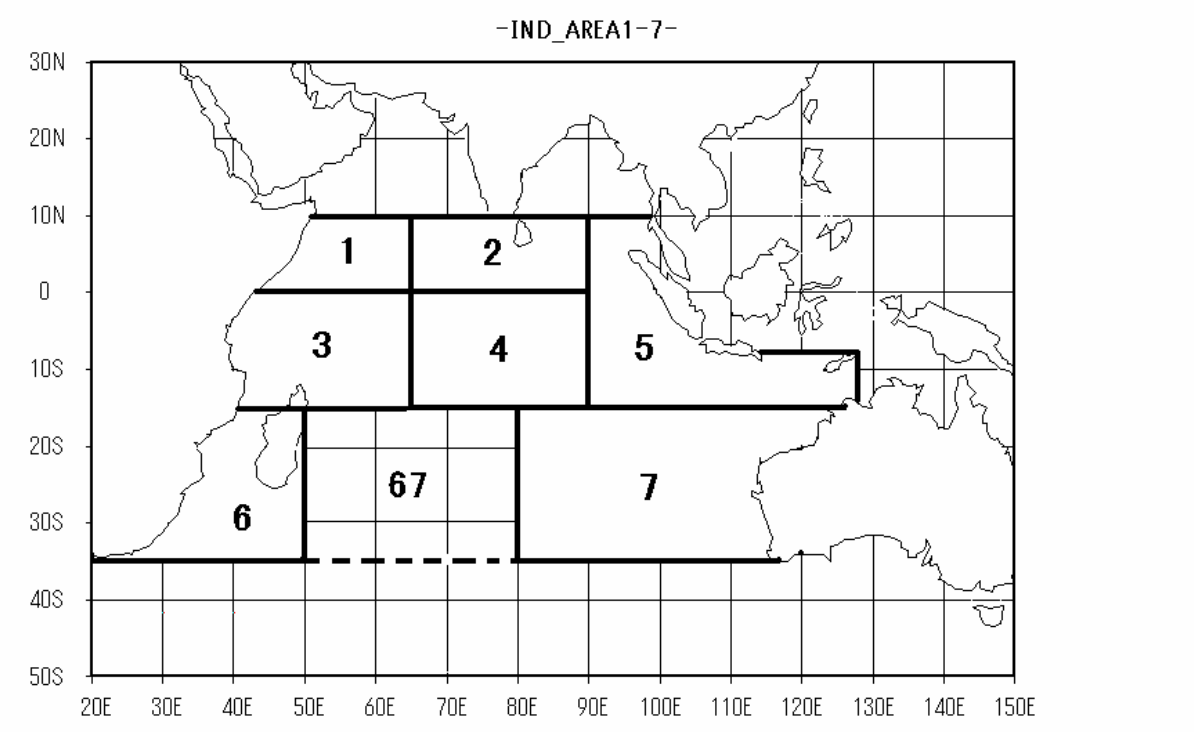


Fig. 1 Definition of sub-areas used in this study. TROPICAL, SOUTH and ALL INDIAN area categories in this paper consist of sub-areas 1-5, sub-areas 6-7 and sub-areas1-7, respectively. Area67 was not used in this study.

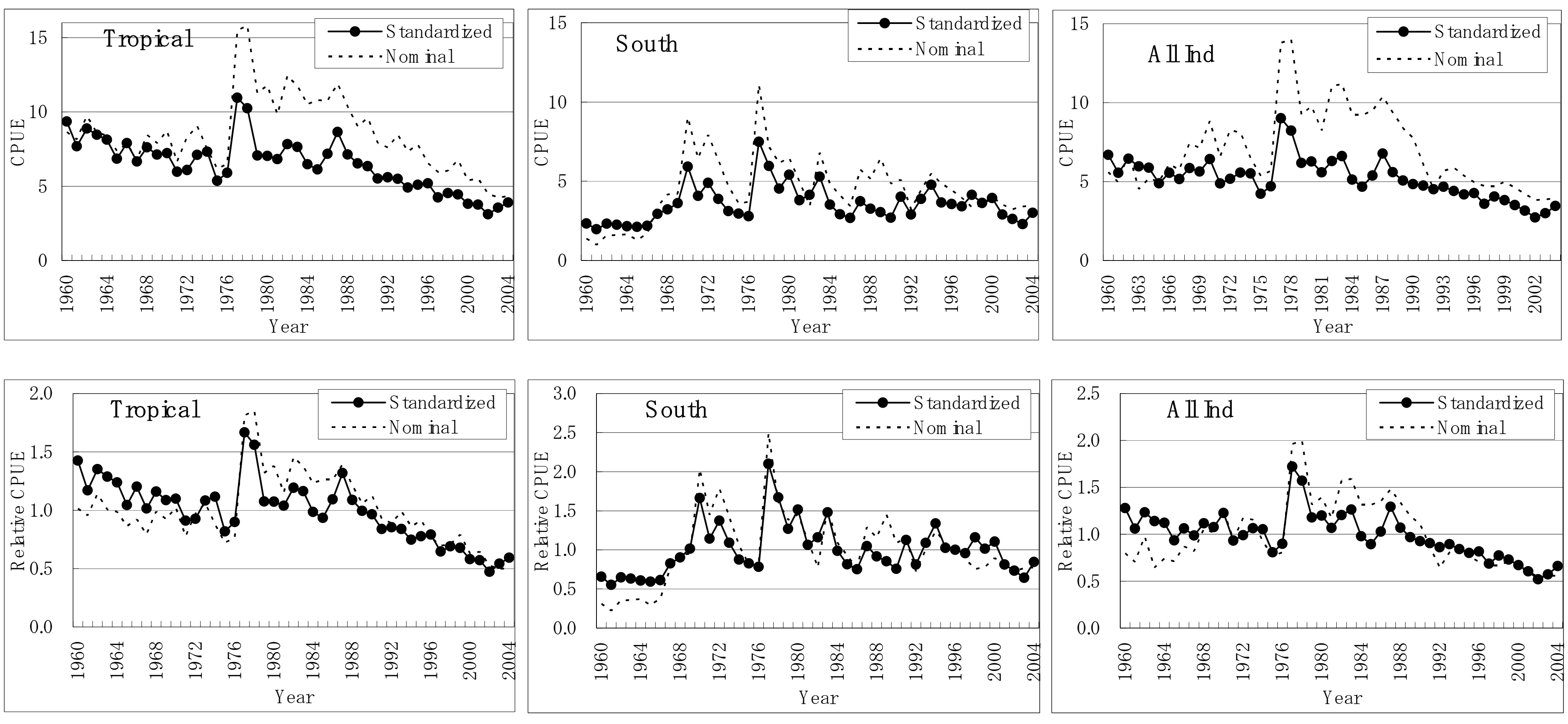


Fig. 2. Standardized CPUEs in real (A) and relative (B) scales for ALL Indian, Tropical and South areas derived from new model with ML (Main line material) overlaid with Nominal CPUE.

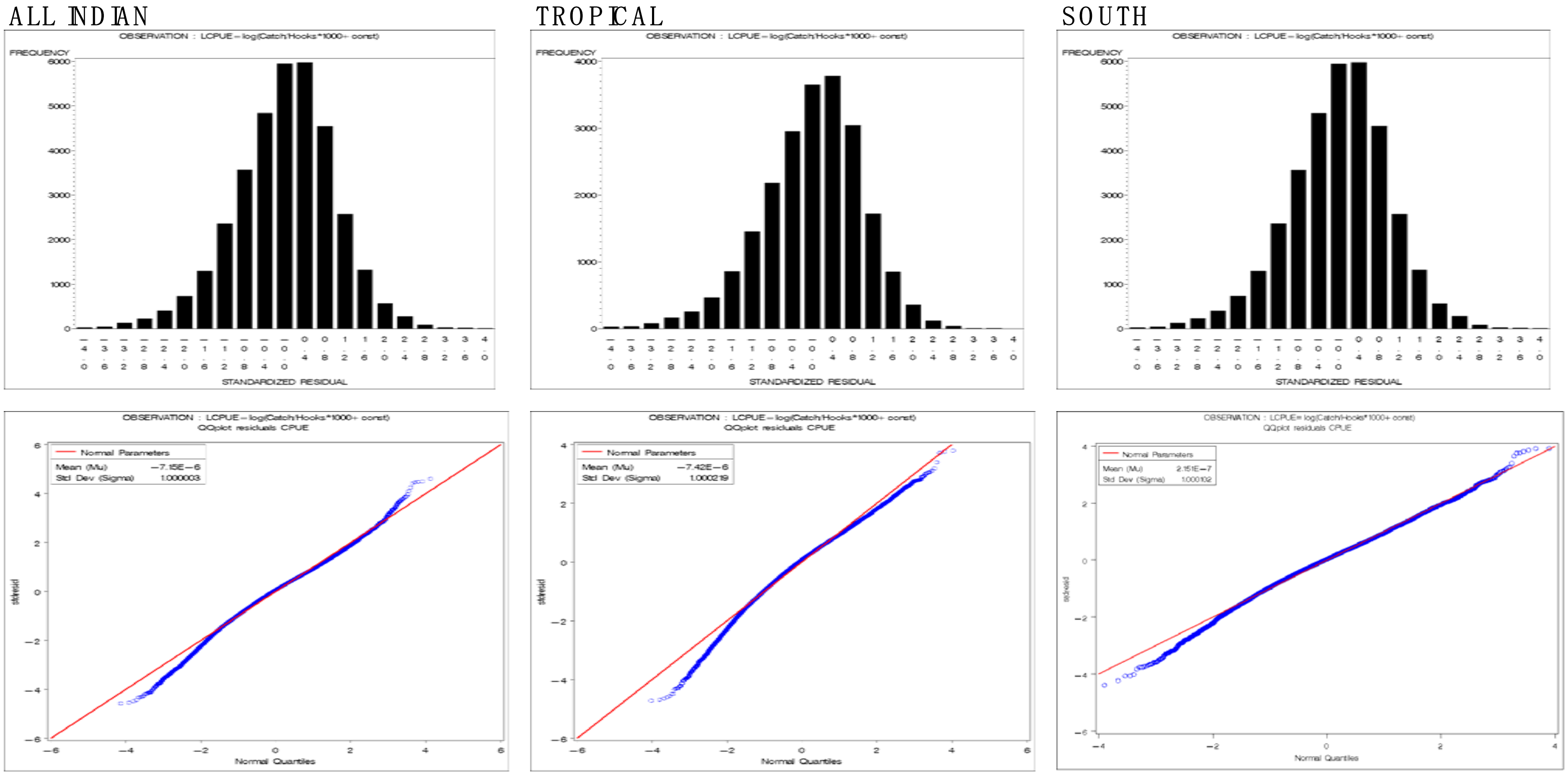


Fig. 3. Standardized residuals of year based standardization for each area expressed as histograms (upper figures) and QQ plots (bottom figures)..

TROPICAL SOUTH

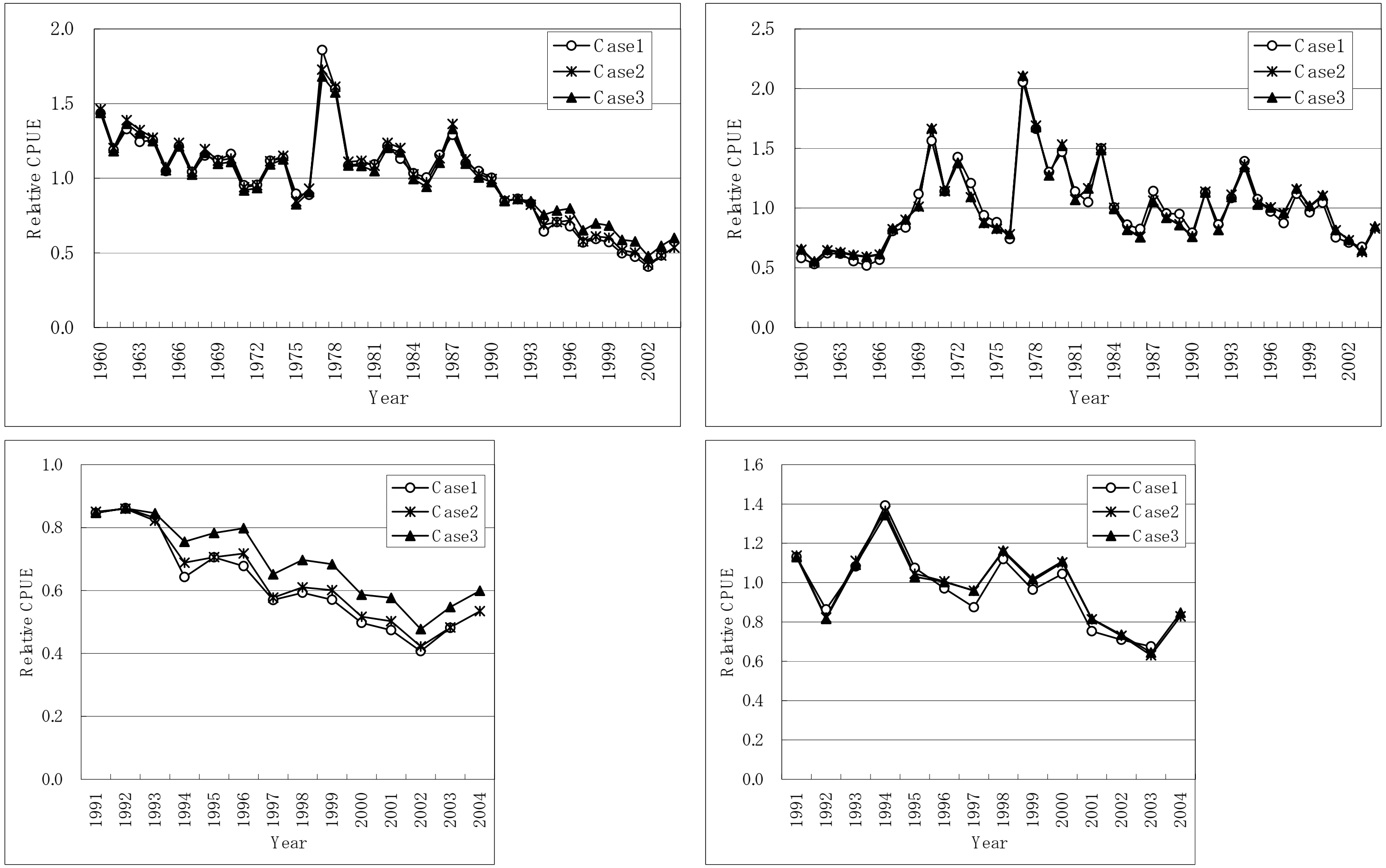


Fig. 4. CPUE trends derived from new model with ML (Main line material、CASE3) overlaid with the results from previous model in which MLD was included (CASE 1) and from a model in which ML was not included (CASE 2). In the CASE1, 2004 was not included because mixing layer depth data in 2004 was not available. Bottom figures were magnified view of upper figures for the period from 1991 to 2004.

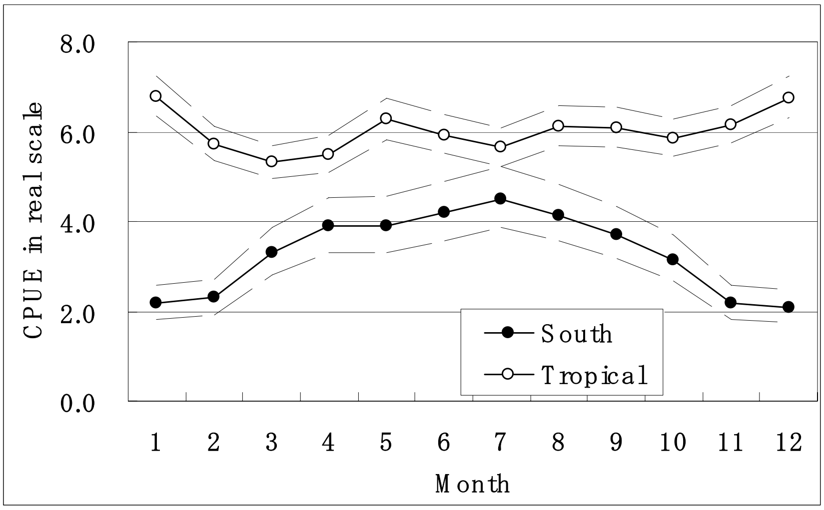
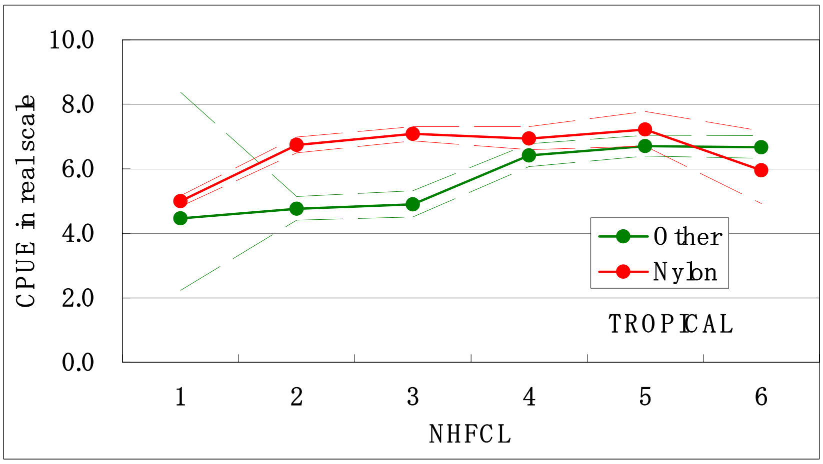


Fig. 5. Standardized CPUE in real scale by month for Tropical and Temperate Indian Ocean. Unit of CPUE is catch in number per 1000 hooks.



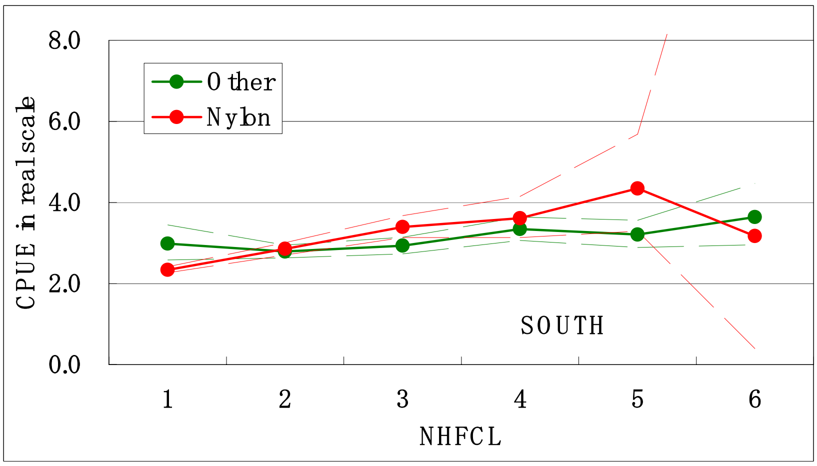
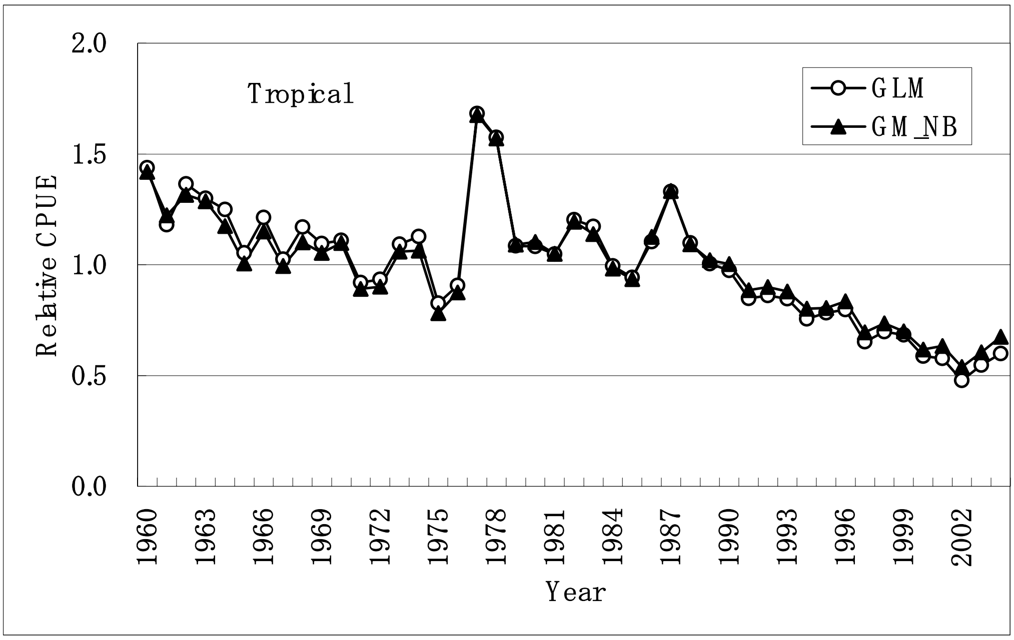


Fig. 6. Standardized CPUE expressed in real scale by NHFCL and mainline materials for Tropical and Temperate Indian Ocean. Unit of CPUE is catch in number per 1000 hooks.



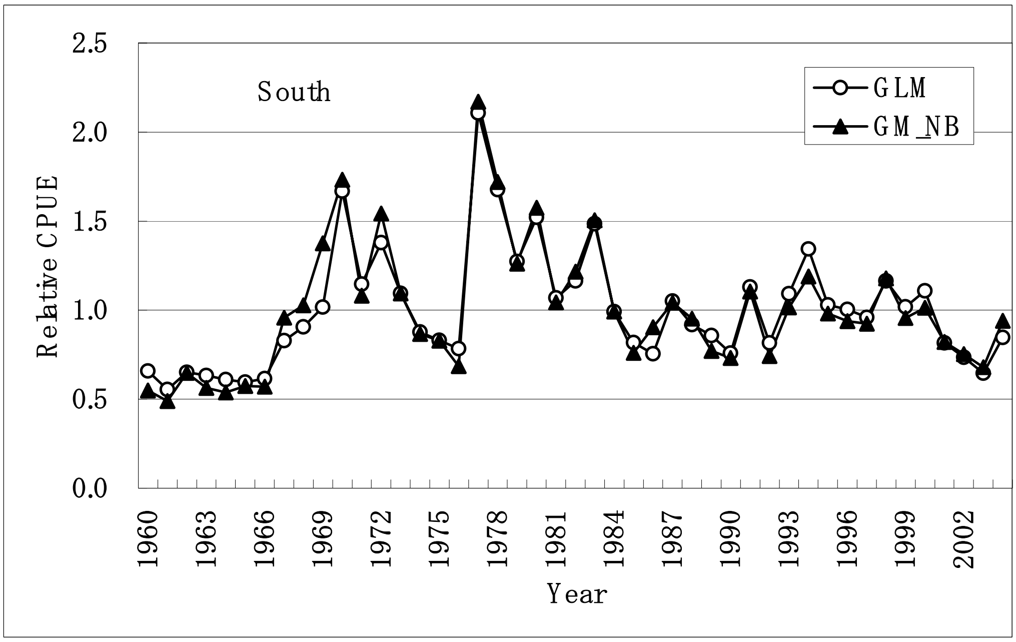
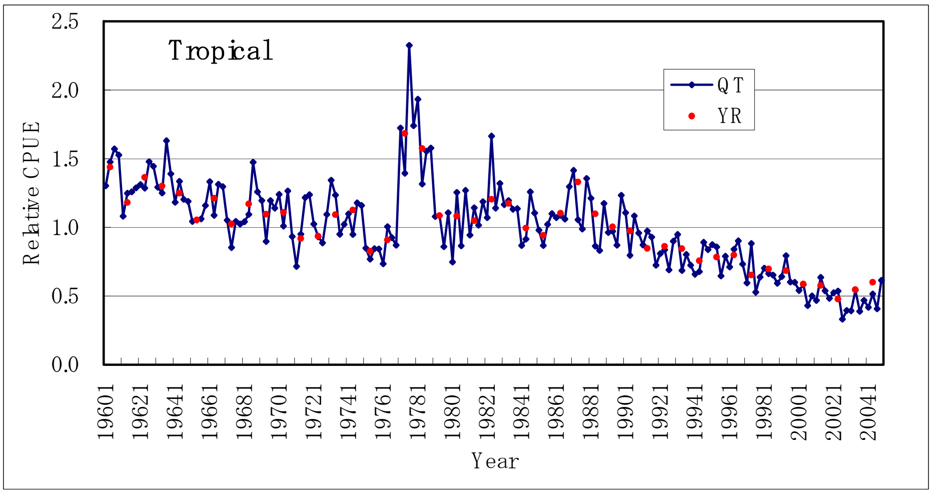
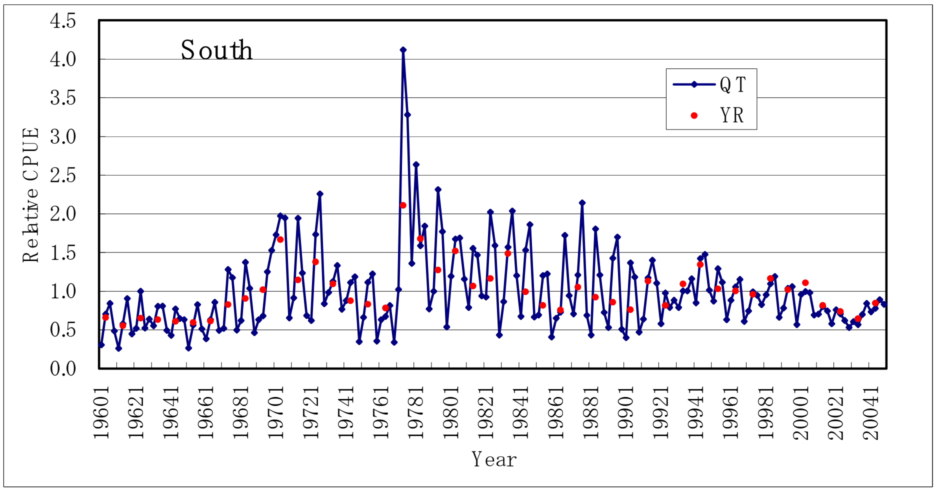


Fig. 7. Bigeye CPUE standardized by Catch-Negative Binomial model (GM_NB) and CPUE-LogNormal model (GLM).





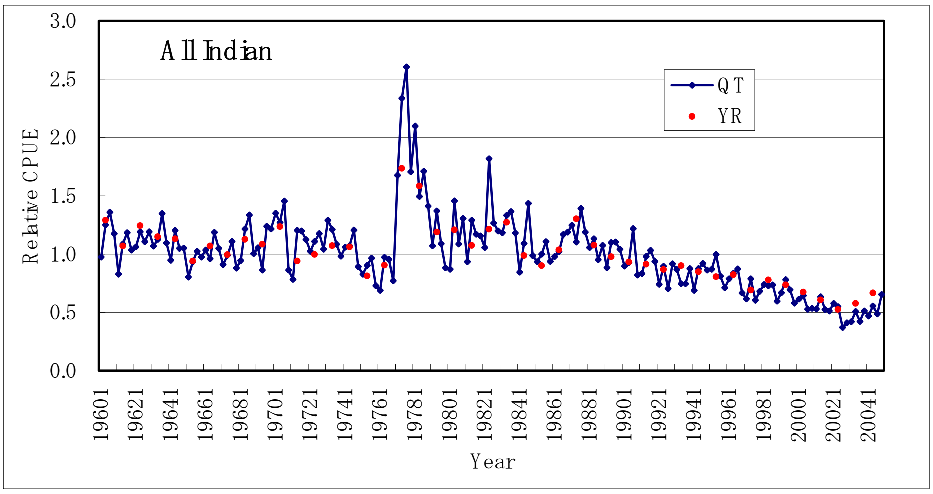


Fig. 8. Quarterly CPUE trend (blue line and dot) from 1960 to 2004 overlaid with yearly CPUE (red dot). Area weighting was not done for quarterly CPUE.

Appendix Table 1. Annual value of standardized Bigeye CPUE in All, Tropical and Temperate Indian Ocean from 1960-2004 expressed in relative scale in which the average from 1960 to 2004 is 1.0.

YEAR	ALL_IND	TROPICAL	SOUTH
1960	1.2791	1.4248	0.6554
1961	1.0599	1.1698	0.5519
1962	1.2326	1.3517	0.6493
1963	1.1390	1.2879	0.6304
1964	1.1222	1.2373	0.6069
1965	0.9335	1.0433	0.5926
1966	1.0619	1.2020	0.6131
1967	0.9858	1.0149	0.8252
1968	1.1166	1.1591	0.9027
1969	1.0765	1.0856	1.0142
1970	1.2269	1.0992	1.6616
1971	0.9319	0.9105	1.1424
1972	0.9886	0.9259	1.3742
1973	1.0641	1.0819	1.0905
1974	1.0538	1.1162	0.8742
1975	0.8065	0.8181	0.8271
1976	0.8986	0.8990	0.7810
1977	1.7210	1.6669	2.0994
1978	1.5708	1.5597	1.6717
1979	1.1787	1.0754	1.2695
1980	1.1983	1.0724	1.5159
1981	1.0667	1.0378	1.0651
1982	1.2039	1.1927	1.1596
1983	1.2625	1.1625	1.4806
1984	0.9783	0.9859	0.9874
1985	0.8927	0.9337	0.8152
1986	1.0282	1.0933	0.7527
1987	1.2927	1.3180	1.0479
1988	1.0678	1.0876	0.9159
1989	0.9686	0.9949	0.8540
1990	0.9241	0.9656	0.7567
1991	0.9055	0.8395	1.1254
1992	0.8609	0.8531	0.8130
1993	0.8931	0.8379	1.0879
1994	0.8410	0.7481	1.3385
1995	0.8003	0.7760	1.0257
1996	0.8153	0.7904	1.0000
1997	0.6855	0.6458	0.9561
1998	0.7723	0.6909	1.1594
1999	0.7294	0.6774	1.0156
2000	0.6694	0.5813	1.1046
2001	0.6030	0.5711	0.8135
2002	0.5207	0.4729	0.7331
2003	0.5716	0.5423	0.6430
2004	0.6605	0.5936	0.8442

Appendix Table 2. Quarterly value of standardized Bigeye CPUE from 1960-2004 expressed in relative scale in which the average from 1960 to 2004 is 1.0.

YEAR	QT	All ind	Tropic.	South	YEAR	QT	All ind	Tropic.	South
1960	1	0.9746	1.3020	0.3083	1971	1	0.7839	0.7149	0.9153
1960	2	1.2496	1.4758	0.7033	1971	2	1.2021	0.9505	1.9446
1960	3	1.3601	1.5717	0.8439	1971	3	1.1992	1.2167	1.2356
1960	4	1.1766	1.5261	0.4859	1971	4	1.1233	1.2370	0.6835
1961	1	0.8269	1.0814	0.2613	1972	1	1.0239	1.0242	0.6209
1961	2	1.0869	1.2482	0.5807	1972	2	1.1083	0.9310	1.7331
1961	3	1.1838	1.2591	0.9058	1972	3	1.1760	0.8875	2.2581
1961	4	1.0334	1.2882	0.4485	1972	4	1.0425	1.0937	0.8404
1962	1	1.0604	1.3111	0.5203	1973	1	1.2899	1.3433	0.9850
1962	2	1.1901	1.2863	0.9984	1973	2	1.2108	1.2355	1.1274
1962	3	1.1070	1.4786	0.5225	1973	3	1.0838	0.9505	1.3335
1962	4	1.1904	1.4438	0.6415	1973	4	0.9814	1.0222	0.7681
1963	1	1.0683	1.2931	0.5530	1974	1	1.0585	1.0972	0.8806
1963	2	1.1258	1.2492	0.8063	1974	2	1.0710	0.9485	1.1107
1963	3	1.3482	1.6304	0.8091	1974	3	1.2067	1.1791	1.1885
1963	4	1.0956	1.3890	0.4952	1974	4	0.8914	1.1585	0.3467
1964	1	0.9459	1.1819	0.4304	1975	1	0.8281	0.8487	0.6615
1964	2	1.2021	1.3353	0.7720	1975	2	0.9019	0.7680	1.1164
1964	3	1.0495	1.2027	0.6492	1975	3	0.9640	0.8449	1.2256
1964	4	1.0519	1.1893	0.6312	1975	4	0.7278	0.8431	0.3557
1965	1	0.8023	1.0423	0.2662	1976	1	0.6878	0.7346	0.6325
1965	2	0.9326	1.0544	0.5599	1976	2	0.9714	1.0056	0.6742
1965	3	1.0230	1.0623	0.8268	1976	3	0.9534	0.9257	0.8144
1965	4	0.9750	1.1586	0.5128	1976	4	0.7700	0.8698	0.3394
1966	1	1.0335	1.3320	0.3842	1977	1	1.6759	1.7235	1.0205
1966	2	0.9584	1.0867	0.6310	1977	2	2.3360	1.3946	4.1166
1966	3	1.1860	1.3124	0.8584	1977	3	2.6060	2.3238	3.2791
1966	4	1.0499	1.2966	0.4925	1977	4	1.7056	1.7396	1.3580
1967	1	0.9092	1.0515	0.5214	1978	1	2.0967	1.9324	2.6367
1967	2	0.9897	0.8521	1.2801	1978	2	1.4932	1.3152	1.5865
1967	3	1.1079	1.0431	1.1737	1978	3	1.7094	1.5547	1.8431
1967	4	0.8790	1.0237	0.4997	1978	4	1.4126	1.5765	0.7722
1968	1	0.9451	1.0415	0.6227	1979	1	1.0706	1.0789	1.0003
1968	2	1.2156	1.0929	1.3753	1979	2	1.3685	1.0855	2.3151

1968	3	1.3346	1.4734	1.0374	1979	3	1.0885	0.8599	1.7697
1968	4	1.0039	1.2593	0.4634	1979	4	0.8823	1.1074	0.5383
1969	1	1.0543	1.1959	0.6311	1980	1	0.8711	0.7467	1.1960
1969	2	0.8630	0.8984	0.6805	1980	2	1.4555	1.2543	1.6743
1969	3	1.2379	1.1945	1.2493	1980	3	1.0866	0.8664	1.6884
1969	4	1.2157	1.1398	1.5267	1980	4	1.3045	1.2689	1.1576
1970	1	1.3496	1.2398	1.7312	1981	1	0.9347	0.9433	0.7910
1970	2	1.2738	1.0089	1.9744	1981	2	1.2909	1.1426	1.5529
1970	3	1.4533	1.2644	1.9481	1981	3	1.1708	1.0146	1.4679
1970	4	0.8630	0.9333	0.6560	1981	4	1.1569	1.1863	0.9409

Appendix Table 2. Continued.

YEAR	QT	All ind	Tropic.	South	YEAR	QT	All ind	Tropic.	South
1982	1	1.0556	1.0710	0.9246	1994	1	0.6886	0.6581	0.8509
1982	2	1.8171	1.6640	2.0221	1994	2	0.8760	0.6775	1.4219
1982	3	1.2656	1.1404	1.5923	1994	3	0.9190	0.8911	1.4748
1982	4	1.1979	1.3189	0.4346	1994	4	0.8630	0.8375	1.0142
1983	1	1.1840	1.1653	0.8644	1995	1	0.8698	0.8749	0.8716
1983	2	1.3314	1.1961	1.5671	1995	2	0.9970	0.8563	1.2932
1983	3	1.3634	1.1324	2.0380	1995	3	0.8096	0.6454	1.1140
1983	4	1.1806	1.1369	1.2028	1995	4	0.7100	0.7896	0.6333
1984	1	0.8445	0.8668	0.6723	1996	1	0.7885	0.7122	0.8830
1984	2	1.0918	0.9141	1.5324	1996	2	0.8351	0.8396	1.0569
1984	3	1.4337	1.2594	1.8616	1996	3	0.8735	0.9015	1.1539
1984	4	0.9860	1.1041	0.6661	1996	4	0.6654	0.7317	0.6103
1985	1	0.9337	0.9797	0.6940	1997	1	0.6173	0.5947	0.7445
1985	2	0.9998	0.8686	1.2010	1997	2	0.7871	0.8834	0.9931
1985	3	1.1052	1.0214	1.2224	1997	3	0.6039	0.5276	0.9459
1985	4	0.9381	1.1008	0.4094	1997	4	0.6803	0.6374	0.8284
1986	1	0.9781	1.0708	0.6518	1998	1	0.7379	0.7028	0.9534
1986	2	1.0209	1.0879	0.7292	1998	2	0.7281	0.6622	1.0953
1986	3	1.1686	1.0602	1.7206	1998	3	0.7366	0.6524	1.1901
1986	4	1.1874	1.2973	0.9447	1998	4	0.5967	0.5927	0.6631
1987	1	1.2468	1.4152	0.7072	1999	1	0.6698	0.6424	0.7808
1987	2	1.1026	1.0563	1.2081	1999	2	0.7813	0.7934	1.0367
1987	3	1.3912	0.9874	2.1411	1999	3	0.6928	0.6017	1.0587
1987	4	1.1877	1.3563	0.6885	1999	4	0.5803	0.5991	0.5684

1988	1	1.0565	1.2121	0.4331
1988	2	1.1317	0.8644	1.8030
1988	3	0.9511	0.8318	1.2080
1988	4	1.0736	1.1750	0.7281
1989	1	0.8816	0.9638	0.5303
1989	2	1.0981	0.9718	1.4250
1989	3	1.1045	0.8699	1.7014
1989	4	1.0419	1.2332	0.5073
1990	1	0.8969	1.1066	0.4006
1990	2	0.9276	0.7968	1.3664
1990	3	1.2186	1.0824	1.1843
1990	4	0.8194	0.9592	0.4712
1991	1	0.8336	0.8720	0.6414
1991	2	0.9787	0.9743	1.1725
1991	3	1.0312	0.9291	1.4015
1991	4	0.9364	0.7233	1.1058
1992	1	0.7416	0.8080	0.5796
1992	2	0.8946	0.8370	0.9760
1992	3	0.7035	0.6909	0.7904
1992	4	0.9164	0.8995	0.8829
1993	1	0.8681	0.9477	0.7904
1993	2	0.7465	0.6863	1.0046
1993	3	0.7456	0.8027	1.0037
1993	4	0.8758	0.7250	1.1610
2000	1	0.6138	0.5405	0.9578
2000	2	0.6445	0.5833	0.9966
2000	3	0.5266	0.4316	0.9796
2000	4	0.5345	0.5015	0.6930
2001	1	0.5297	0.4684	0.7041
2001	2	0.6332	0.6354	0.8002
2001	3	0.5248	0.5391	0.7432
2001	4	0.5114	0.4825	0.5818
2002	1	0.5761	0.5237	0.7601
2002	2	0.5502	0.5356	0.7092
2002	3	0.3697	0.3311	0.6201
2002	4	0.4102	0.3942	0.5334
2003	1	0.4195	0.3930	0.6083
2003	2	0.5063	0.5424	0.5681
2003	3	0.4222	0.3891	0.7004
2003	4	0.5110	0.4693	0.8438
2004	1	0.4698	0.4173	0.7355
2004	2	0.5554	0.5145	0.7771
2004	3	0.4874	0.4068	0.8908
2004	4	0.6542	0.6142	0.8293