Japanese longline CPUE for yellowfin tuna in the Indian Ocean up to 2005 standardized by GLM

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Abstract

Japanese longline CPUE for yellowfin tuna from 1960 to 2005 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 was applied in the model as fishing gear information. In order to remove the effect of shift of gear configuration accompanied with change in gear material which occurred in the end of 1980s through early 1990s, information of main line materials was newly applied in the standardization model for yellowfin CPUE.

In the all Indian area, CPUE continuously decreased from around 17.0 (real scale) in 1960 to around 6 in 1973, and was kept in the same level until 1988. Thereafter, it declined to about 4.0 in 1993 and has been kept in the low level with fluctuation between 2.7 and 4.4. CPUE trend for tropical area of this ocean is basically similar to that of all Indian Ocean. In the quarterly CPUE, seasonal oscillation was observed. CPUE is highest in the 1st quarter while lowest CPUE is not always fixed through the analyzed period.

1. Introduction

In the end of 1980s through early 1990s, increase in the number of hooks between floats (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). This big shift in the gear configuration in 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, and that CPUE may be different between same NHF of different material. Therefore, in the last stock assessment of bigeye in 2006 (Okamoto and Shono, 2006), gear material information was applied into model to standardize the difference in catch rate brought by targeting more appropriately. In this paper, the same approach using gear material information combined with that of gear configuration is applied to the yellowfin CPUE standardization.

2. Materials and methods

In the previous standardization of longline CPUE for bigeye, MLD (Mixing Layer Depth) was applied in the model. Although MLD data had been downloaded from JEDAC (Joint Environmental Data Analysis Center) website of Scripps Institution of Oceanography, the data source of MLD stopped to supply the data for 2004 and after. Recently, new source of MLD data became available by Japan-France collaborative research project for the data from 1980 to 2005. Because the data processing way to compile the MLD data is different between two data sources, only new MLD data was used in this study to standardize CPUE from 1980 to 2005. That is, MLD data was not used for the analyses of another period from 1960 to 2005.

Area definition:

Area definition used in this study was the same as that agreed in the IOTC WPTT meeting in 2002 (Fig. 1). Main fishing ground of Japanese longline fishery was divided into five sub-areas and CPUE standardization was done for two cases of the sub-area combinations, Tropical (sub-areas 2 and 5) and ALL (sub-areas 1-5) Indian Ocean.

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.

In the analyses from 1980 to 2005, MLD (Mixing Layer Depth) which was supplied from Japan-France collaborative research project, was also applied.

Catch and effort data used:

The Japanese longline catch (in number) and effort statistics from 1960 up to 2005 were used. 2005 data is preliminary. The catch and effort data set 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 classified into two categories, 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 it seems that the larger number of NHF than 17 or 18 would become possible to be used as a result of introduction of the new material. Therefore, the material of NHF 17 or larger was assumed to be nylon since 1990.

GLM (Generalized Linear Model):

CPUE based on the number of catch was used. CPUE is calculated as "the number of caught fish / the number of hooks * 1000"

As the model for standardizing CPUE, CPUE-LogNormal error structured model was used. The followings was the initial model for each analysis. Basing on the result of ANOVA (type III SS), non-significant effects were removed in step-wise from the initial model based on the F-value ($p<0.05$).

- Initial Model for Year based CPUE standardization for 1960 through 2005

Log (CPUE+const)= μ +YR +QT +AREA +NHFCL +ML +BL +SST +SST2 +SST3 +YR*QT +QT*AREA +YR*AREA +AREA*NHFCL +NHFCL*ML +NHFCL*BL +AREA*SST +YR*SST

- Initial Model for Year based CPUE standardization for 1980 through 2005

Log (CPUE+const)= μ +YR +QT +AREA +NHFCL +ML +BL +SST +SST2 +SST3 +MLD +YR*QT +QT*AREA +YR*AREA +AREA*NHFCL +NHFCL*ML +NHFCL*BL +AREA*SST +YR*SST +AREA*MLD +SST*MLD +YR+MLD

- Initial Model for quarter based CPUE standardization for 1960 through 2005

Log (CPUE+const)= μ +YR +QT +AREA +NHFCL +ML +BL +SST +SST2 +SST3 +YR*QT*AREA +AREA*NHFCL +NHFCL*ML +NHFCL*BL +AREA*SST +YR*SST

- Initial Model for quarter based CPUE standardization for 1980 through 2005

Log (CPUE+const)= μ +YR +QT +AREA +NHFCL +ML +BL +SST +SST2 +SST3 +MLD +YR*QT*AREA +AREA*NHFCL +NHFCL*ML +NHFCL*BL +AREA*SST +YR*SST +AREA*MLD +SST*MLD +YR+MLD

Where Log : natural logarithm,
CPUE : catch in number of bigeye per 1000 hooks,
Const : 10% of overall mean of CPUE
μ : overall mean,
YR : effect of year,
QT : effect of fishing season (quarter)
Area: effect of area,
NHFCL : effect of gear type (category of the number of hooks between floats),
SST : effect of SST (as a continuous variable),
SST2 : effect of SST2 (=SST x SST, as a continuous variable),
SST3 : effect of SST3 (=SST x SST x SST, as a continuous variable),
MLD: effect of MLD (mixing layer depth),
ML : effect of material of main line,
BL : effect of material of branch line,
YR*QT : interaction term between year and quarter,
QT*Area: interaction term between quarter and area,
YR*Area: interaction term between year and area,
Area*NHFCL: interaction term between area and gear type,
NHFCL*ML: interaction term between material of gear type and main line,
NHFCL*BL: interaction term between material of gear type and branch line,
Area*SST : interaction term between area and SST,
YR*SST : interaction term between year and SST,
YR*QT*Area : interaction term between year, quarter and Area,
e : 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.

CPUEi = Σ Wj * (exp(lsmean(Year i*Area j))-constant)
Where CPUEi = CPUE in year i,
Wj = Area rate of Area j , (ΣWj = 1),
lsmean(Year*Areaij) = least square mean of Year-Area interaction in Year i and Area j (As for the quarter based CPUE, least square mean of Year*Quarter*Area was used instead),
constant = 10% of overall mean of CPUE.

3. Results and discussion

CPUE standardizations by GLM:

The yellowfin CPUE (catch in number per 1000 hooks) was standardized by GLM (CPUE-LogNormal error structured model) for both of area categories, Tropical (sub-area 2 and 5) and All Indian Ocean (Areas 1 – 5), as described in the materials and method section.

Trends of CPUE for 1960 through in each area category were shown in Fig. 2 in real scale overlaying nominal CPUE and in relative scale. CPUEs of both area categories for the same period were overlaid in Fig. 3 in relative scale. Standardized CPUEs for 1980 through 2005 were shown in Fig. 4 and 5 in the same arrangement as that for 1960-2005. ANOVA table of GLM for the final model was shown in Table 1 for the period from 1960 to 2005 and in Table 2 for the period from 1980 to 2005. In the all Indian area, CPUE continuously decreased from around 17.0 (real scale) in 1960 to around 6 in 1973, and was kept in same level until 1988. Thereafter, it declined to about 4.0 in 1993 and has been kept in the low level with fluctuation between 2.7 and 4.4. CPUE trend for tropical area is basically similar to that of all Indian Ocean (Fig. 3). In all year based standardizations, distributions of the standard residual did not show remarkable difference from the normal distribution (Fig. 6).

Quarterly trends of CPUEs from 1960 to 2005 in number for all Indian and tropical areas were shown in Fig. 7 overlaying nominal annual CPUE and both CPUE in relative scale were overlaid in Fig. 8 for comparison. As in the case of tear based CPUE, quarterly CPUE for the period from 1980 to 2005 was also calculated and the results were shown in Fig. 9 and 10. Results of ANOVA and distributions of the standard residual in each analysis for quarterly CPUE were shown in Table 3 and 4 and Fig. 11, respectively. Naturally, trends of the quarterly CPUE in each area category (all Indian and tropical areas) were similar to those of year based CPUE. In the quarterly CPUE, seasonal oscillation was observed. Highest CPUE is mainly observed in the 1st quarter while lowest CPUE is not always fixed through the analyzed period.

Annual values of standardized CPUE in number for all Indian and tropical area definitions were listed in Appendix Table 1 for 1960 through 2005 in real scale with variation and in Appendix Table 2 for 1960-2005 and 1980-2005 in relative scale. Quarterly CPUEs in number standardized for all and tropical Atlantic area definitions were also listed in Appendix Table 3 and 4 in the same manner as year based CPUEs.

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

Okamoto, H. and Shono, H. (2006): Japanese longline CPUE for bigeye tuna in the Indian Ocean up to 2004 standardized by GLM applying gear material information in the model. IOTC/WPTT/06/17. 16 pp.

Table 1. ANOVA table of GLM for year based CPUE from 1960 to 2005 in all Indian Ocean (left) and Tropical area (right)

All Indian 1960-2005 Year base

Source	DF	Type III SS	Mean Square	F Value	Pr > F	R-Square= 0.56101
Model	468	33659.430	71.922	116.560	<.0001	CV = 57.89557
yr	45	323.227	7.183	11.640	<.0001	
qt	3	31.354	10.451	16.940	<.0001	
area	4	507.214	126.803	205.510	<.0001	
nhfcl	5	109.877	21.975	35.620	<.0001	
bl	1	9.409	9.409	15.250	<.0001	
ml						
sst	1	13.896	13.896	22.520	<.0001	
sst2	1	19.840	19.840	32.160	<.0001	
sst3	1	30.035	30.035	48.680	<.0001	
yr*qt	135	671.843	4.977	8.070	<.0001	
qt*area	12	669.920	55.827	90.480	<.0001	
yr*area	180	1714.199	9.523	15.430	<.0001	
area*nhfcl	20	223.109	11.155	18.080	<.0001	
nhfcl*ml	6	107.436	17.906	29.020	<.0001	
nhfcl*bl	5	43.151	8.630	13.990	<.0001	
sst*area	4	337.391	84.348	136.700	<.0001	
sst*yr	45	457.562	10.168	16.480	<.0001	

Tropical 1960-2005 Year base

Source	DF	Type III SS	Mean Square	F Value	Pr > F	R-Square= 0.432109
Model	257	7820.797	30.431	65.780	<.0001	CV = 37.19181
yr	45	1620.279	36.006	77.830	<.0001	
qt	3	18.924	6.308	13.630	<.0001	
area	1	223.644	223.644	483.420	<.0001	
nhfcl	5	67.853	13.571	29.330	<.0001	
bl	1	5.425	5.425	11.730	0.0006	
ml						
sst	1	11.238	11.238	24.290	<.0001	
sst2	1	11.191	11.191	24.190	<.0001	
sst3	1	11.107	11.107	24.010	<.0001	
yr*qt	135	633.934	4.696	10.150	<.0001	
qt*area	3	156.457	52.152	112.730	<.0001	
yr*area	45	384.477	8.544	18.470	<.0001	
area*nhfcl	5	11.960	2.392	5.170	<.0001	
nhfcl*ml	6	58.210	9.702	20.970	<.0001	
nhfcl*bl	5	18.663	3.733	8.070	<.0001	
sst*area						
sst*yr						

Table 2. ANOVA table of GLM for year based CPUE from 1980 to 2005 in all Indian Ocean (left) and Tropical area (right)

All Indian 1980-2005 Year base

Source	DF	Type III SS	Mean Square	F Value	Pr > F	R-Square=
Model	319	23192.480	72.704	100.640	<.0001	0.511006
						CV =
yr	25	204.752	8.190	11.34	<.0001	80.63149
qt	3	10.243	3.414	4.73	0.0027	
area	4	336.074	84.019	116.31	<.0001	
nhfcl	5	112.018	22.404	31.01	<.0001	
bl	1	9.799	9.799	13.56	0.0002	
ml						
sst	1	59.558	59.558	82.45	<.0001	
sst2	1	75.637	75.637	104.7	<.0001	
sst3	1	86.296	86.296	119.46	<.0001	
mld	1	63.848	63.848	88.38	<.0001	
yr*qt	75	410.450	5.473	7.58	<.0001	
qt*area	12	395.967	32.997	45.68	<.0001	
yr*area	100	948.109	9.481	13.12	<.0001	
area*nhfcl	20	230.440	11.522	15.95	<.0001	
nhfcl*ml	6	112.650	18.775	25.99	<.0001	
nhfcl*bl	5	49.003	9.801	13.57	<.0001	
sst*area	4	288.080	72.020	99.7	<.0001	
sst*yr	25	199.441	7.978	11.04	<.0001	
mld*area	4	303.854655	75.964	105.16	<.0001	
sst*mld	1	32.2285751	32.229	44.61	<.0001	
mld*yr	25	150.694093	6.028	8.34	<.0001	

Tropical 1980-2005 Year base

Source	DF	Type III SS	Mean Square	F Value	Pr > F	R-Square=
Model	184	3665.819	19.923	36.050	<.0001	0.304322
						CV =
yr	25	173.135	6.925	12.53	<.0001	48.90243
qt	3	38.962	12.987	23.5	<.0001	
area	1	33.760	33.760	61.09	<.0001	
nhfcl	5	75.216	15.043	27.22	<.0001	
bl	1	7.401	7.401	13.39	0.0003	
ml						
sst	1	7.795	7.795	14.1	0.0002	
sst2	1	8.125	8.125	14.7	0.0001	
mld	1	84.114	84.114	152.21	<.0001	
yr*qt	75	465.447	6.206	11.23	<.0001	
qt*area	3	126.830	42.277	76.5	<.0001	
yr*area	25	257.743	10.310	18.66	<.0001	
area*nhfcl	5	12.751	2.550	4.61	0.0003	
nhfcl*ml	6	63.085	10.514	19.03	<.0001	
nhfcl*bl	5	20.585	4.117	7.45	<.0001	
sst*area	1	21.673	21.673	39.22	<.0001	
sst*yr						
mld*area	1	20.316	20.316	36.76	<.0001	
mld*yr	25	107.323	4.293	7.77	<.0001	

Table 3. ANOVA table of GLM for quarter based CPUE from 1960 to 2005 in all Indian Ocean (left) and Tropical area (right)

All Indian 1960-2005 Quarter base

Source	DF	Type III SS	Mean Square	F Value	Pr > F	
Model	934	35077.511	37.556	63.630	<.0001	R-Square= 0.584646
						CV = 56.62537
yr	45	309.939	6.888	11.670	<.0001	
qt	3	55.004	18.335	31.060	<.0001	
area	4	466.880	116.720	197.750	<.0001	
nhfcl	5	87.391	17.478	29.610	<.0001	
bl	1	7.995	7.995	13.550	0.0002	
ml	1	1.632	1.632	2.760	0.0964	
sst	1	16.595	16.595	28.120	<.0001	
sst2	1	21.826	21.826	36.980	<.0001	
sst3	1	31.358	31.358	53.130	<.0001	
yr*qt*area	793	4706.222	5.935	10.050	<.0001	
area*nhfcl	20	219.607	10.980	18.600	<.0001	
nhfcl*ml	5	77.764	15.553	26.350	<.0001	
nhfcl*bl	5	38.030	7.606	12.890	<.0001	
sst*area	4	316.113	79.028	133.890	<.0001	
sst*yr	45	432.351	9.608	16.280	<.0001	

Tropical 1960-2005 Quarter base

Source	DF	Type III SS	Mean Square	F Value	Pr > F	
Model	391	8194.905	20.959	46.730	<.0001	R-Square= 0.452779
						CV = 36.61928
yr	45	1535.121	34.114	76.060	<.0001	
qt	3	15.713	5.238	11.680	<.0001	
area	1	67.255	67.255	149.950	<.0001	
nhfcl	5	61.810	12.362	27.560	<.0001	
bl	1	6.127	6.127	13.660	0.0002	
ml						
sst						
sst2						
sst3						
yr*qt*area	318	1492.074	4.692	10.460	<.0001	
area*nhfcl	5	13.151	2.630	5.860	<.0001	
nhfcl*ml	6	51.604	8.601	19.180	<.0001	
nhfcl*bl	5	16.307	3.261	7.270	<.0001	
sst*area	2	68.365	34.182	76.210	<.0001	
sst*yr						

Table 4. ANOVA table of GLM for quarter based CPUE from 1980 to 2005 in all Indian Ocean (left) and Tropical area (right)

All Indian 1980-2005

Source	DF	Type III SS	Mean Square	F Value	Pr > F	R-Square=
Model	579	24184.421	41.769	60.010	<.0001	0.532862
						CV =
yr	25	183.889	7.356	10.57	<.0001	79.14459
qt	3	29.328	9.776	14.05	<.0001	
area	4	333.534	83.383	119.8	<.0001	
nhfcl	5	92.285	18.457	26.52	<.0001	
bl	1	9.485	9.485	13.63	0.0002	
ml						
sst	1	65.983	65.983	94.8	<.0001	
sst2	1	80.771	80.771	116.05	<.0001	
sst3	1	90.609	90.609	130.19	<.0001	
mld	1	61.680	61.680	88.62	<.0001	
yr*qt*area	447	2792.509	6.247	8.98	<.0001	
area*nhfcl	20	220.450	11.023	15.84	<.0001	
nhfcl*ml	6	93.918	15.653	22.49	<.0001	
nhfcl*bl	5	42.879	8.576	12.32	<.0001	
sst*area	4	323.235	80.809	116.1	<.0001	
sst*yr	25	154.741	6.190	8.89	<.0001	
mld*area	4	318.630	79.657	114.45	<.0001	
sst*mld	1	30.217	30.217	43.41	<.0001	
mld*yr	25	122.111	4.884	7.02	<.0001	

Tropical 1980-2005

Source	DF	Type III SS	Mean Square	F Value	Pr > F	R-Square=
Model	259	3875.455	14.963	27.630	<.0001	0.321725
						CV =
yr	25	129.544	5.182	9.57	<.0001	48.40674
qt	3	22.478	7.493	13.84	<.0001	
area	1	37.842	37.842	69.89	<.0001	
nhfcl	5	70.796	14.159	26.15	<.0001	
bl	1	7.676	7.676	14.18	0.0002	
ml						
sst	1	5.887	5.887	10.87	0.001	
sst2	1	6.135	6.135	11.33	0.0008	
sst3						
mld	1	73.724	73.724	136.15	<.0001	
yr*qt*area	178	1056.781	5.937	10.96	<.0001	
area*nhfcl	5	13.168	2.634	4.86	0.0002	
nhfcl*ml	6	55.077	9.179	16.95	<.0001	
nhfcl*bl	5	19.968	3.994	7.38	<.0001	
sst*area	1	25.947	25.947	47.92	<.0001	
sst*yr						
mld*area	1	16.556	16.556	30.57	<.0001	
sst*mld						
mld*yr	25	86.019	3.441	6.35	<.0001	

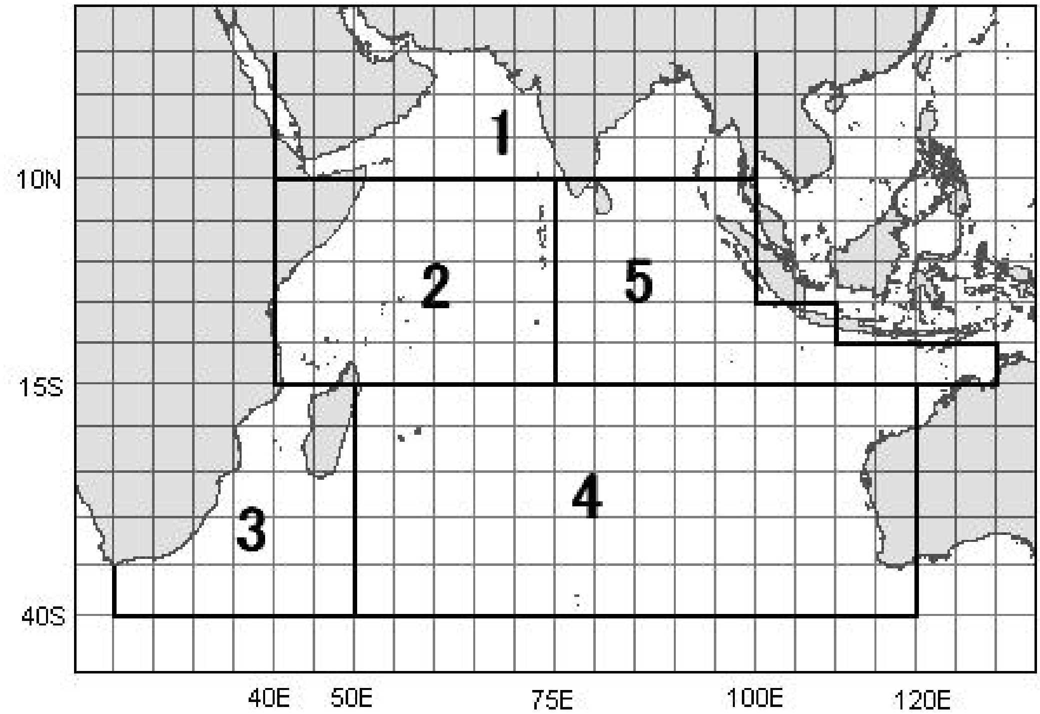

Fig. 1 Definition of sub-areas used in this study. TROPICAL and ALL INDIAN area categories in this paper consist of sub-areas 2 and 5, and sub-areas1-7, respectively.

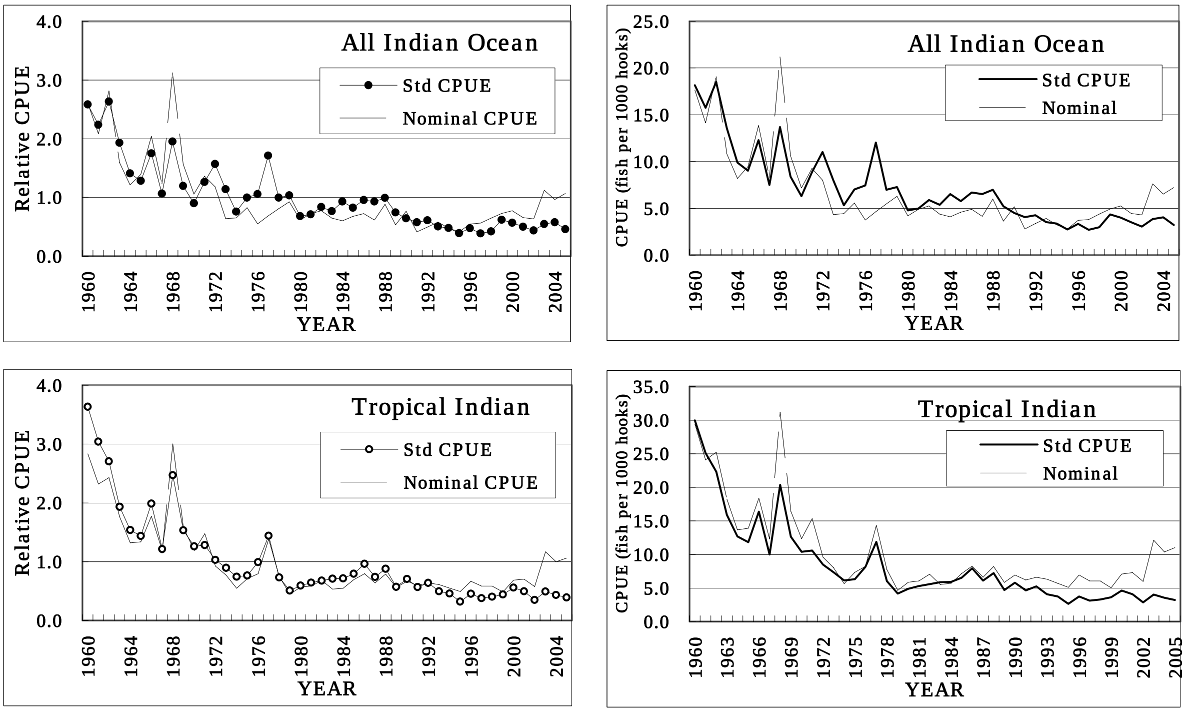

Fig. 2. Standardized annual based CPUE in number from 1960 to 2005 for all Indian area (top figure) and for tropical area (bottom figure) expressed in relative (left figure) and real (right figure) scale overlaid with nominal CPUE.

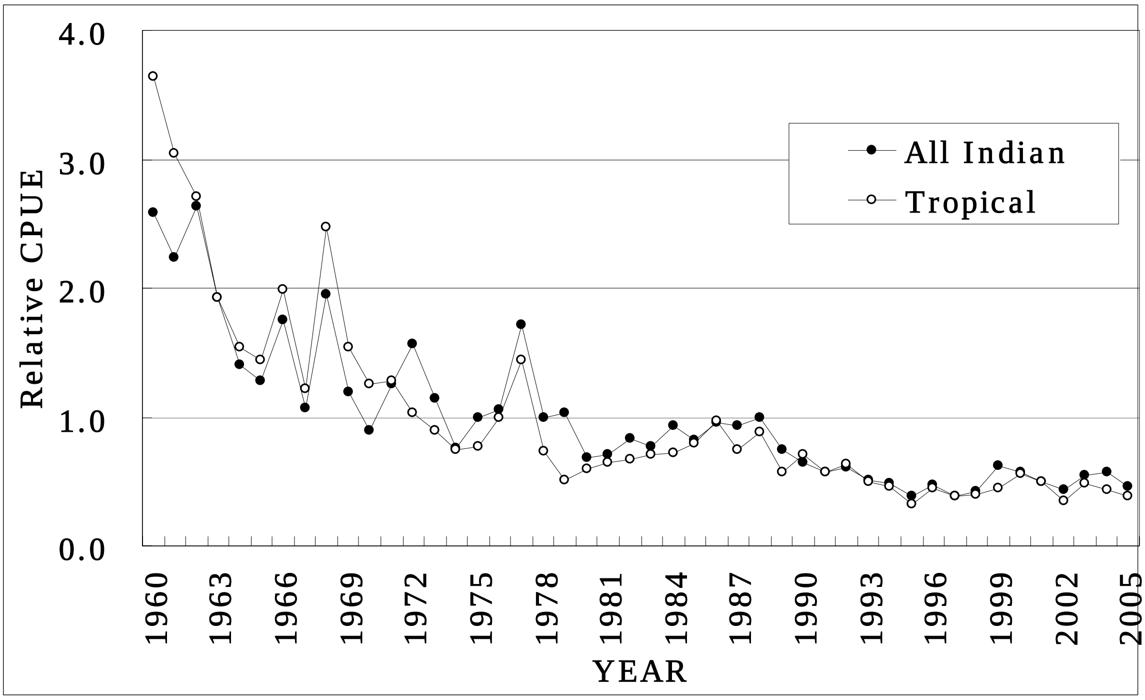

Fig. 3. Standardized annual based CPUE in number from 1960 to 2005 for all Atlantic area and tropical area expressed in relative scale.

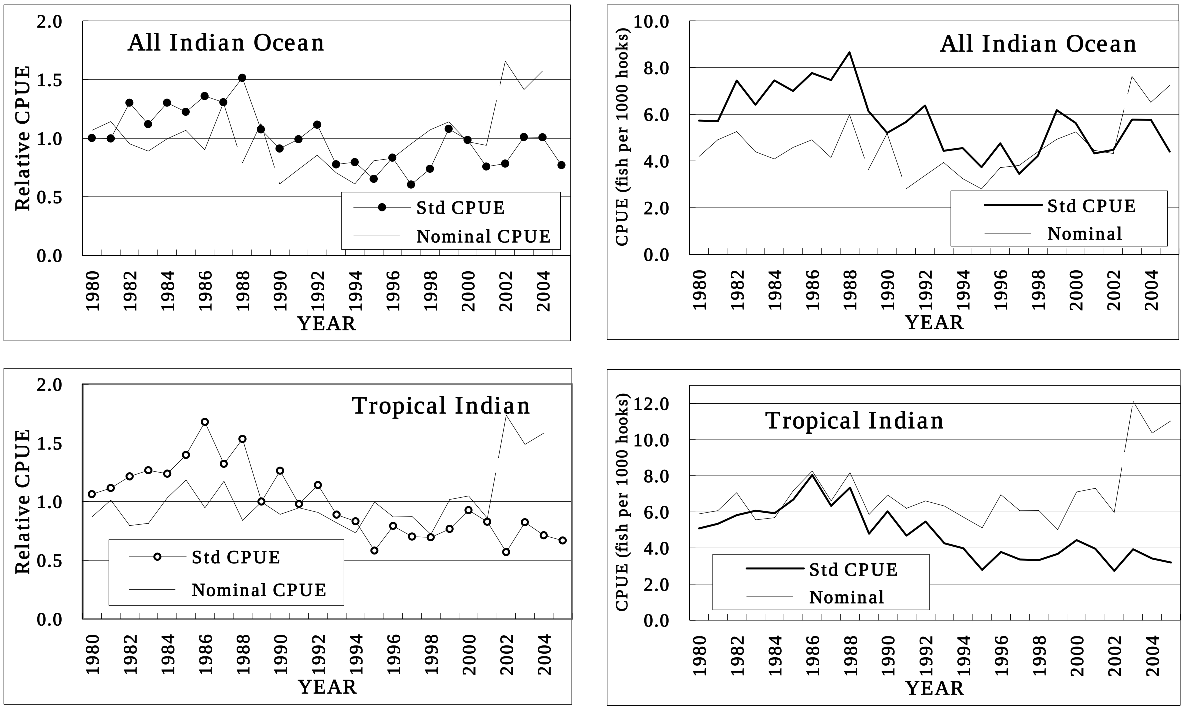

Fig. 4. Standardized annual based CPUE in number from 1980 to 2005 for all Indian area (top figure) and for tropical area (bottom figure) expressed in relative (left figure) and real (right figure) scale overlaid with nominal CPUE.

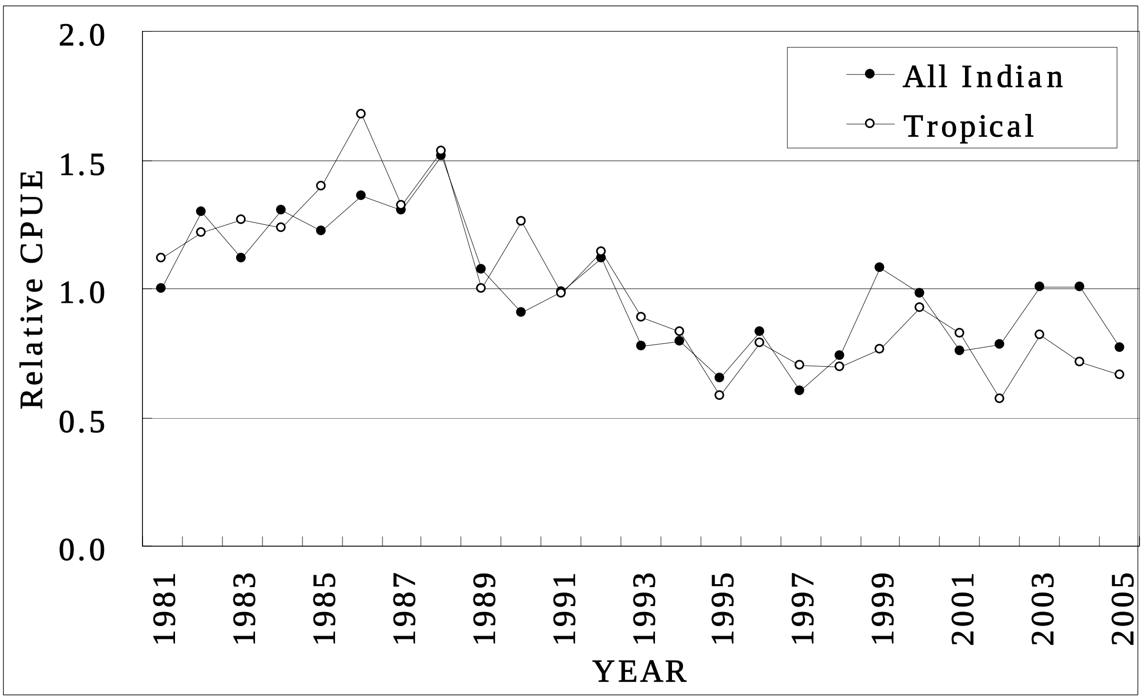

Fig. 5. Standardized annual based CPUE in number from 1980 to 2005 for all Atlantic area and tropical area expressed in relative scale.

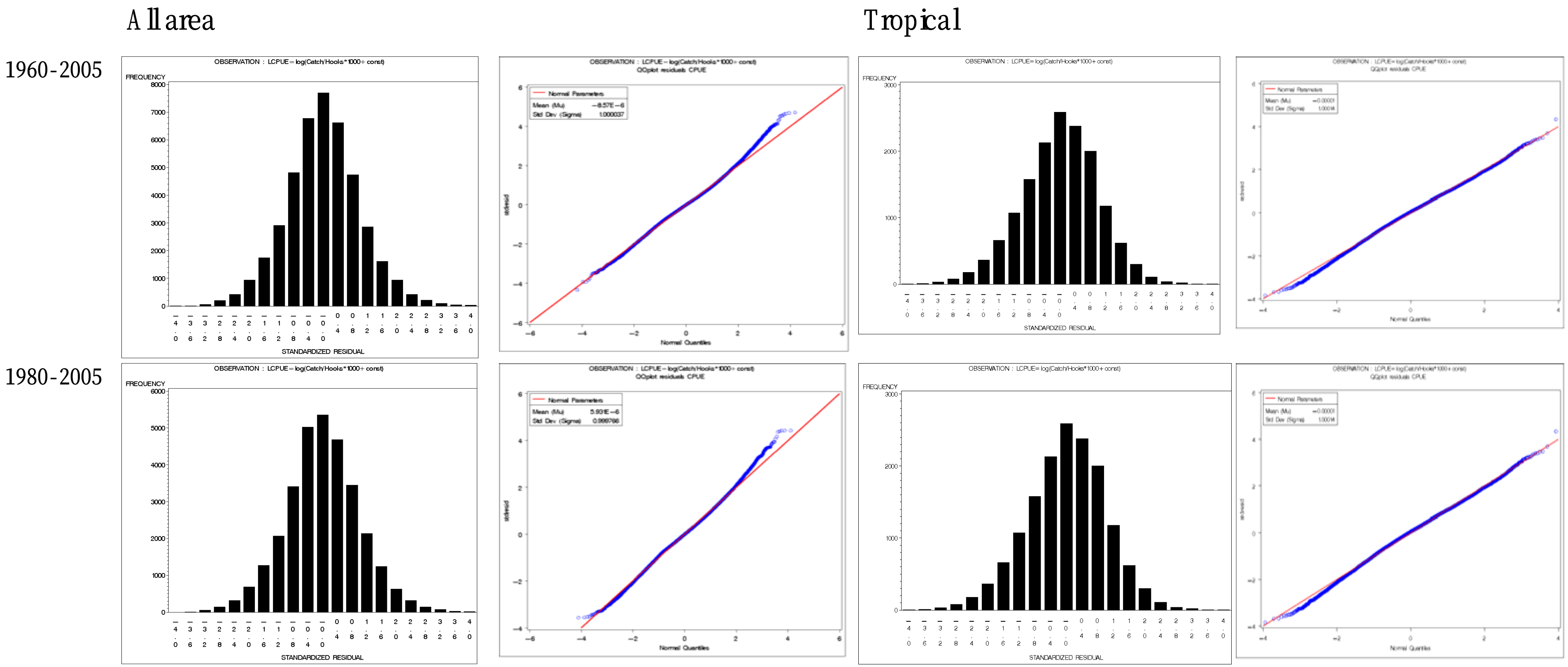

Fig. 6. Standardized residuals of annual based standardization for each area and period expressed as histograms and QQ plots.

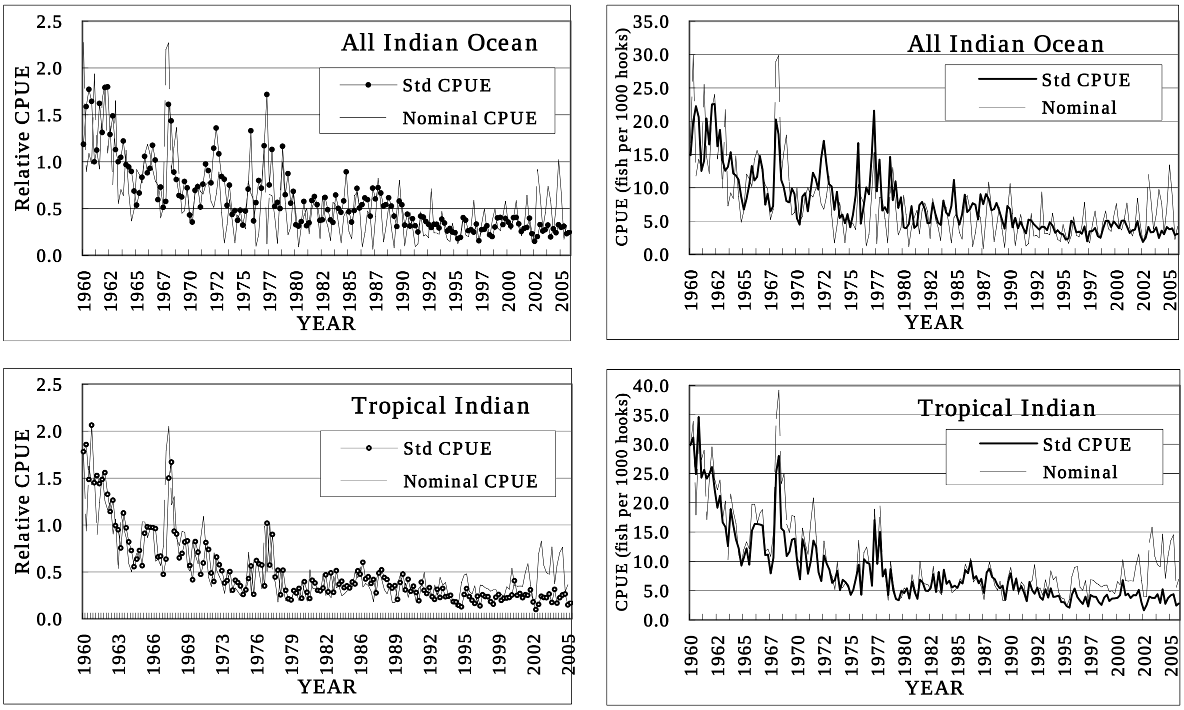

Fig. 7. Standardized quarterly based CPUE in number from 1960 to 2005 for all Indian area (top figure) and for tropical area (bottom figure) expressed in relative (left figure) and real (right figure) scale overlaid with nominal CPUE.

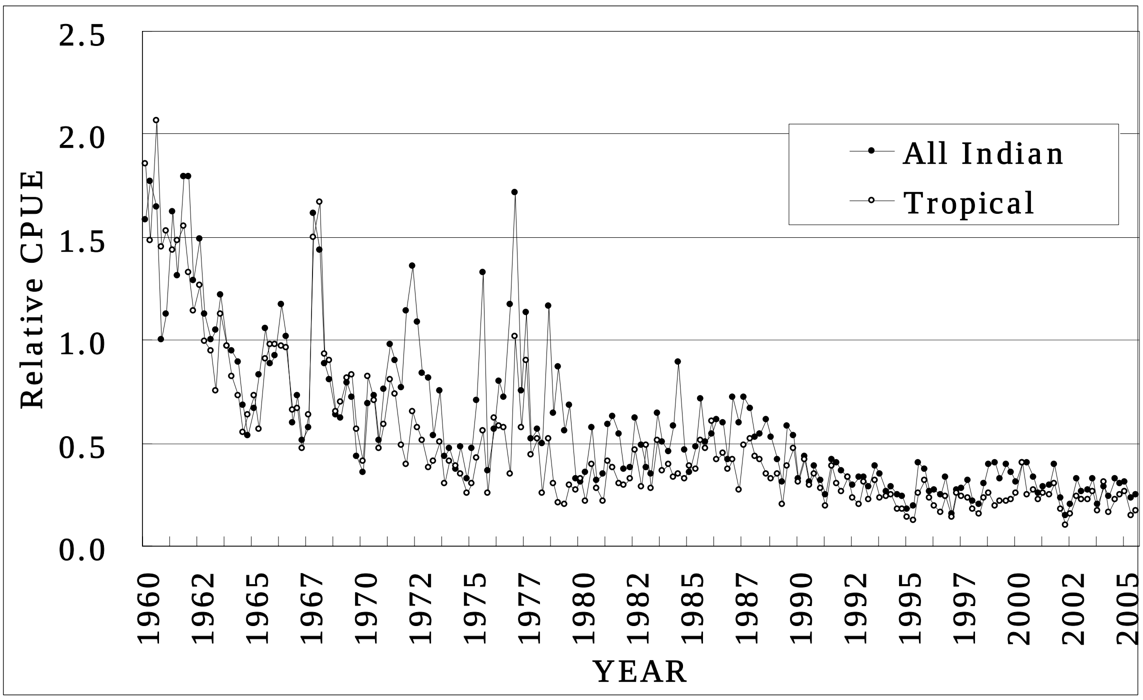

Fig. 8. Standardized quarterly based CPUE in number from 1960 to 2005 for all Atlantic area and tropical area expressed in relative scale.

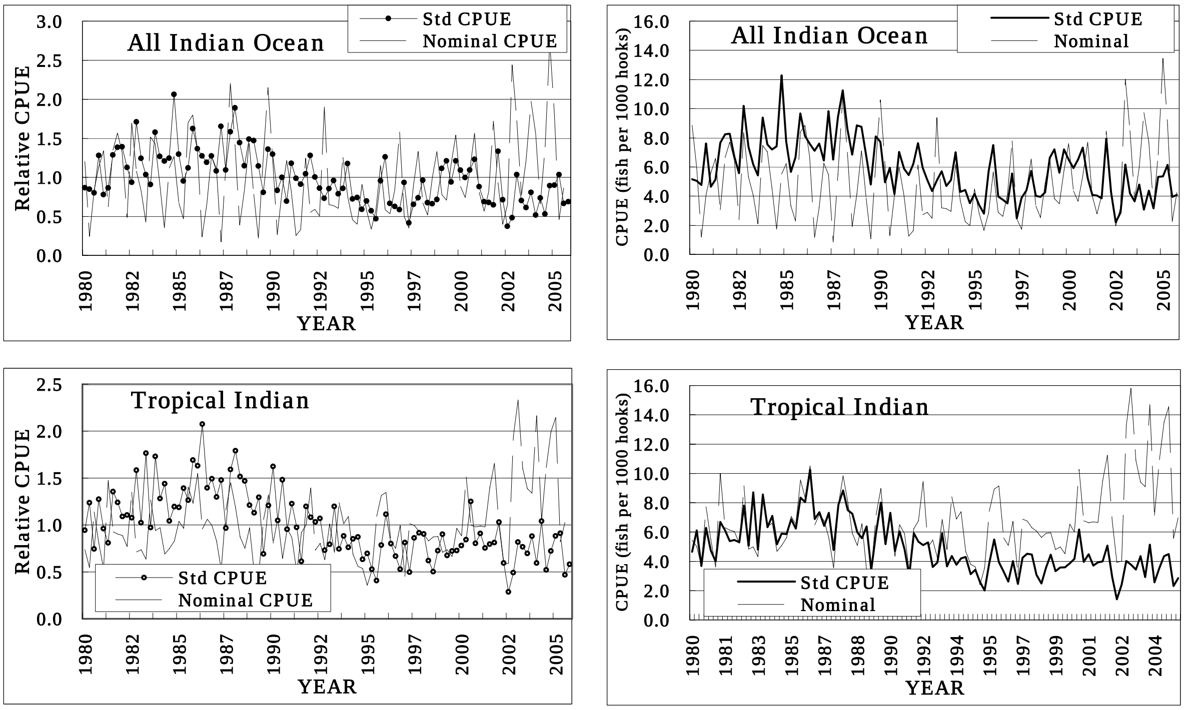

Fig. 9. Standardized quarterly based CPUE in number from 1980 to 2005 for all Indian area (top figure) and for tropical area (bottom figure) expressed in relative (left figure) and real (right figure) scale overlaid with nominal CPUE.

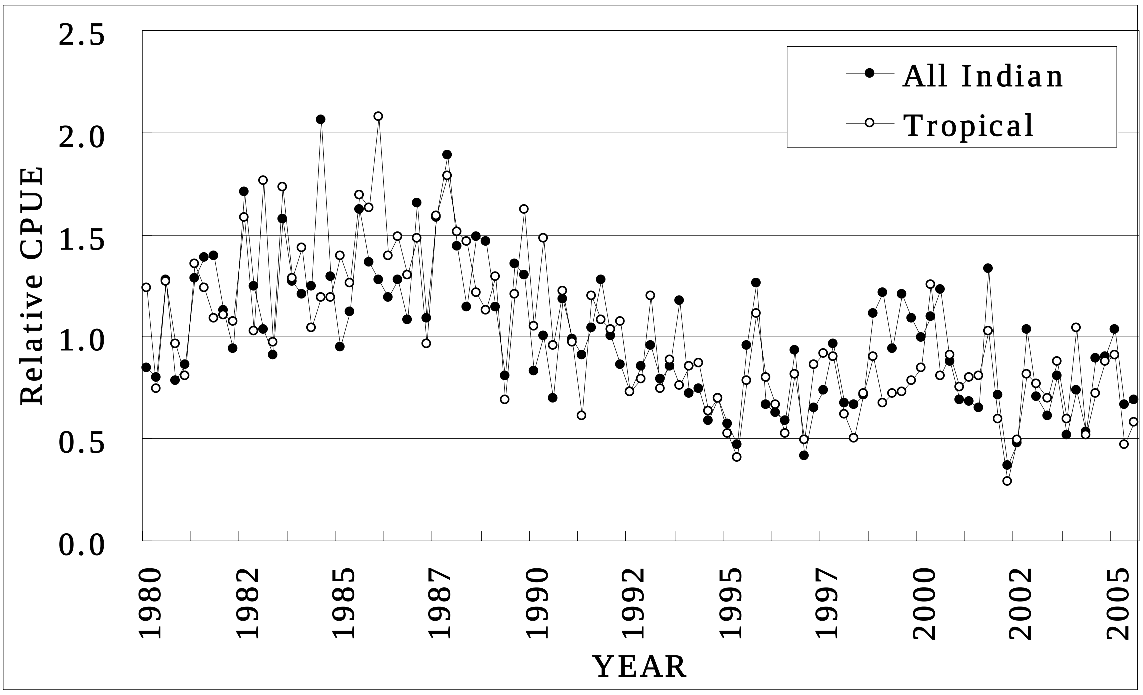

Fig. 10. Standardized quarterly based CPUE in number from 1980 to 2005 for all Atlantic area and tropical area expressed in relative scale.

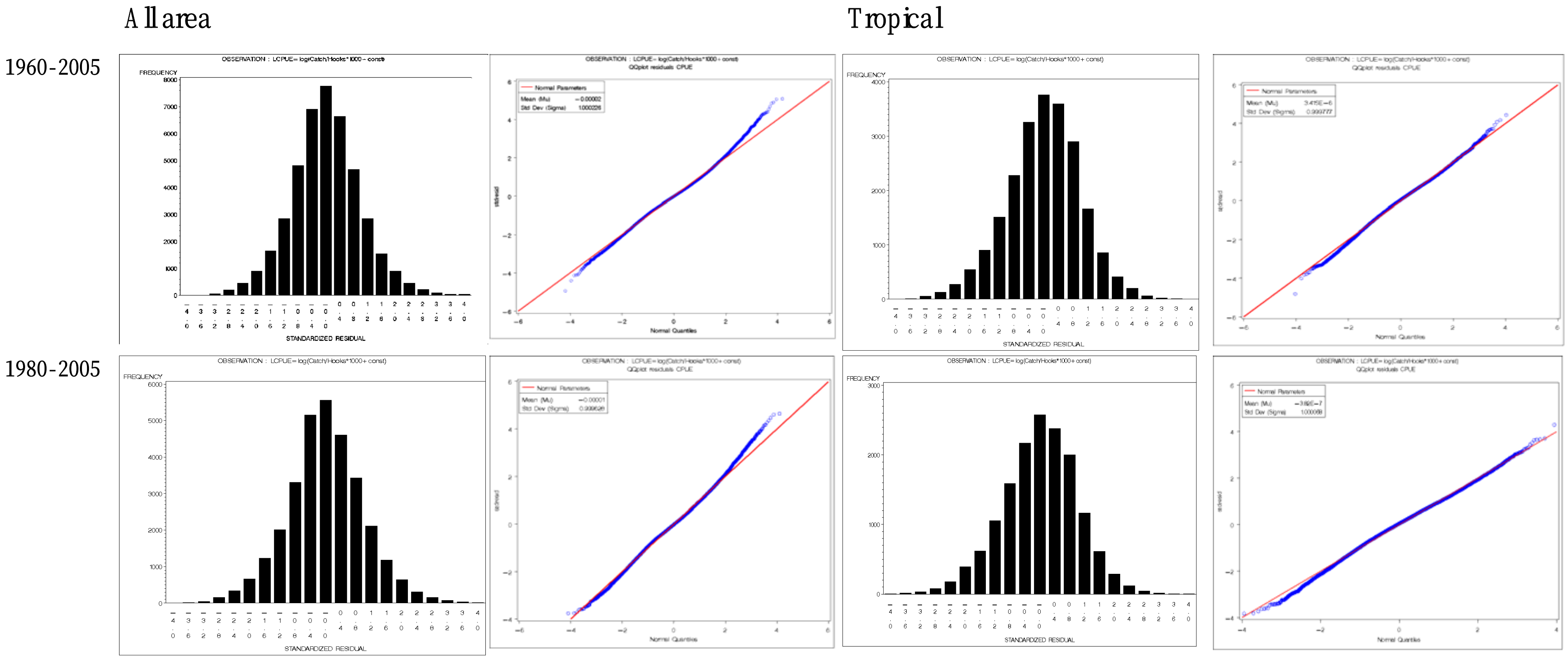

Fig. 11. Standardized residuals of quarter based standardization for each area and period expressed as histograms and QQ plots.

Appendix Table 1. Annual value of standardized Bigeye CPUE in all and tropical Indian Ocean from 1960-2005 expressed in real scale and variance.

	All Indian		Tropical	
Year	CPUE	variance	CPUE	variance
1960	18.1657	1.3249	29.9754	2.7271
1961	15.7498	1.2026	25.1024	2.1648
1962	18.5188	1.0382	22.3300	1.2262
1963	13.5650	0.6414	15.9262	0.8448
1964	9.8963	0.2455	12.6912	0.4405
1965	9.0245	0.2113	11.8396	0.3641
1966	12.2965	0.3563	16.3956	0.6469
1967	7.4910	0.0940	10.0085	0.2358
1968	13.7124	0.4578	20.3728	1.2915
1969	8.3916	0.1689	12.6532	0.4218
1970	6.3203	0.1008	10.3886	0.3199
1971	8.8619	0.1995	10.5822	0.3300
1972	11.0225	0.9288	8.4843	0.2625
1973	8.0190	0.3417	7.3644	0.2215
1974	5.3255	0.0883	6.1292	0.1346
1975	7.0130	0.1674	6.3222	0.1218
1976	7.4370	0.3333	8.1750	0.3430
1977	12.0370	1.2809	11.8829	0.8854
1978	7.0024	0.2248	6.0214	0.1012
1979	7.2898	0.2708	4.1851	0.0737
1980	4.7907	0.0945	4.8877	0.0807
1981	4.9890	0.0674	5.2899	0.0717
1982	5.8816	0.1155	5.5722	0.0674
1983	5.3967	0.0875	5.8711	0.0660
1984	6.5254	0.0999	5.9023	0.0742
1985	5.7877	0.0803	6.5370	0.0813
1986	6.7060	0.1404	7.9414	0.1139
1987	6.5244	0.1226	6.1134	0.0887
1988	6.9855	0.1888	7.2257	0.1169
1989	5.2273	0.1267	4.7087	0.0668
1990	4.5168	0.0654	5.8178	0.0956
1991	4.0613	0.0560	4.6792	0.0765
1992	4.2801	0.2632	5.2650	0.1269
1993	3.5473	0.0389	4.0949	0.0521
1994	3.3732	0.0349	3.7682	0.0409
1995	2.7404	0.0160	2.6345	0.0214
1996	3.3409	0.0949	3.7377	0.0292
1997	2.7073	0.0125	3.1346	0.0175

1998	2.9718	0.0173	3.3127	0.0184
1999	4.3440	0.1049	3.6507	0.0255
2000	4.0048	0.0416	4.6163	0.0345
2001	3.5081	0.0270	4.0887	0.0390
2002	3.0658	0.0457	2.8661	0.0162
2003	3.8575	0.3395	4.0436	0.0341
2004	4.0400	3.7253	3.5686	0.0244
2005	3.2105	0.0362	3.2210	0.0233

Appendix Table 2. Annual value of standardized Bigeye CPUE in all and tropical Indian Ocean from 1960 to 2005 and from 1980 to 2005 expressed in relative scale in which the average of each period is 1.0.

	1960-2005		1980-2005	
	All Indian	Tropical	All Indian	Tropical
Year	CPUE	CPUE	CPUE	CPUE
1960	2.5829	3.6345		
1961	2.2394	3.0437		
1962	2.6331	2.7075		
1963	1.9287	1.9311		
1964	1.4071	1.5388		
1965	1.2831	1.4356		
1966	1.7484	1.9880		
1967	1.0651	1.2135		
1968	1.9497	2.4702		
1969	1.1932	1.5342		
1970	0.8986	1.2596		
1971	1.2600	1.2831		
1972	1.5672	1.0287		
1973	1.1402	0.8929		
1974	0.7572	0.7432		
1975	0.9971	0.7666		
1976	1.0574	0.9912		
1977	1.7115	1.4408		
1978	0.9956	0.7301		
1979	1.0365	0.5074		
1980	0.6812	0.5926	1.0017	1.0620
1981	0.7094	0.6414	0.9972	1.1153
1982	0.8363	0.6756	1.3012	1.2146
1983	0.7673	0.7119	1.1194	1.2673
1984	0.9278	0.7157	1.3022	1.2378
1985	0.8229	0.7926	1.2231	1.3980
1986	0.9535	0.9629	1.3590	1.6796
1987	0.9277	0.7413	1.3053	1.3223
1988	0.9932	0.8761	1.5136	1.5346
1989	0.7432	0.5709	1.0736	1.0010
1990	0.6422	0.7054	0.9097	1.2620
1991	0.5775	0.5674	0.9902	0.9796
1992	0.6086	0.6384	1.1150	1.1406
1993	0.5044	0.4965	0.7756	0.8890
1994	0.4796	0.4569	0.7957	0.8318
1995	0.3896	0.3194	0.6528	0.5809

1996	0.4750	0.4532	0.8321	0.7912
1997	0.3849	0.3801	0.6040	0.7025
1998	0.4225	0.4017	0.7382	0.6960
1999	0.6176	0.4426	1.0795	0.7664
2000	0.5694	0.5597	0.9843	0.9265
2001	0.4988	0.4958	0.7568	0.8279
2002	0.4359	0.3475	0.7832	0.5704
2003	0.5485	0.4903	1.0093	0.8228
2004	0.5744	0.4327	1.0074	0.7124
2005	0.4565	0.3905	0.7699	0.6675

Appendix Table 3. Quarterly value of standardized Bigeye CPUE in all and tropical Indian Ocean from 1960-2005 expressed in real scale and variance.

Year	Quarter	1960-2005 All Indian		Tropical	
		CPUE	Variation	CPUE	Variation
1960	1	14.9068	2.3415	29.8613	6.3566
1960	2	19.9420	17.4279	31.1202	7.2492
1960	3	22.2638	4.7954	24.8828	6.1201
1960	4	20.6295	3.8696	34.6088	8.8486
1961	1	12.5448	2.0812	24.2882	4.5162
1961	2	14.0944	3.0904	25.5728	5.7185
1961	3	20.3848	4.5225	24.1059	6.8922
1961	4	16.4715	2.7302	24.8732	5.5521
1962	1	22.5002	6.1658	26.0810	3.6342
1962	2	22.5730	3.7751	22.2135	2.6134
1962	3	16.2103	1.7468	19.1425	3.0312
1962	4	18.6858	2.0207	21.1891	2.3304
1963	1	14.1657	1.8799	16.6562	1.5579
1963	2	12.5581	1.4457	15.8847	1.8686
1963	3	13.1467	2.2015	12.6460	3.3635
1963	4	15.3230	1.9504	18.8914	2.8581
1964	1	12.1558	1.7582	16.2366	1.8668
1964	2	11.8599	1.0966	13.7483	1.0658
1964	3	11.2486	0.9065	12.2094	1.2043
1964	4	8.6285	0.3975	9.2863	0.5911
1965	1	6.7209	0.3555	10.6378	0.5597
1965	2	8.3600	0.5598	12.2148	0.8182
1965	3	10.4645	0.7025	9.4684	0.6341
1965	4	13.2786	1.7898	15.2599	1.5420
1966	1	11.0744	0.9014	16.4053	1.4171
1966	2	11.6420	0.8708	16.3396	1.4280
1966	3	14.7747	1.1673	16.3041	1.5961
1966	4	12.7636	0.8166	16.1179	1.3449
1967	1	7.4619	0.2295	11.0416	0.5649
1967	2	9.1422	0.3232	11.1617	0.6087
1967	3	6.4311	0.2647	7.9204	0.3981
1967	4	7.2355	0.2636	10.6317	0.6467
1968	1	20.2516	27.6381	25.1525	4.3207
1968	2	18.0240	1.8832	27.9751	5.3521
1968	3	11.1461	0.8289	15.6313	2.3258
1968	4	10.1643	0.5687	15.1571	1.4330
1969	1	8.0259	0.4140	10.8941	0.6159
1969	2	7.8104	0.3112	11.6585	0.8786
1969	3	9.9033	0.5162	13.7087	1.3614
1969	4	9.0555	0.5249	13.9284	1.2910

Year	Quarter	1960-2005 All Indian		Tropical	
		CPUE	Variation	CPUE	Variation
1970	1	5.4248	0.1928	9.5079	0.5565
1970	2	4.4537	0.1413	6.9506	0.3982
1970	3	8.7018	0.7393	13.7722	2.1367
1970	4	9.2065	0.4722	11.8670	0.9867
1971	1	6.4767	0.2129	7.9103	0.3588
1971	2	9.5481	0.7223	9.9443	0.7356
1971	3	12.2530	1.9094	13.5815	2.0003
1971	4	11.3607	1.0734	12.3700	1.2031
1972	1	9.7040	11.5718	8.1350	0.5536
1972	2	14.3777	4.9064	6.6379	0.5394
1972	3	17.0569	5.4749	10.9904	1.1618
1972	4	13.6181	3.2438	9.6373	1.3531
1973	1	10.5523	4.5970	8.5625	0.7950
1973	2	10.2179	1.8556	6.3633	0.6937
1973	3	6.6998	0.5629	6.8329	0.7627
1973	4	9.4169	0.7512	8.4231	0.7237
1974	1	5.4883	0.2737	5.1013	0.2365
1974	2	5.9957	0.2988	6.8687	0.6925
1974	3	4.6815	0.1700	6.4568	0.3785
1974	4	6.0500	0.3114	5.8467	0.2955
1975	1	4.0753	0.2178	4.2944	0.1350
1975	2	5.9549	0.3152	5.1290	0.2981
1975	3	8.8931	0.4992	7.1942	0.3159
1975	4	16.6944	6.7149	9.4093	0.7218
1976	1	4.6221	0.2954	4.3377	0.1618
1976	2	7.0796	0.8442	10.3960	1.3545
1976	3	10.0473	1.6705	9.7756	2.4714
1976	4	9.0276	2.0750	9.5790	3.3319
1977	1	14.6956	22.5859	5.8613	0.5896
1977	2	21.5683	20.6500	17.0701	18.1549
1977	3	9.4508	1.9368	9.5813	2.5410
1977	4	14.2122	5.1093	15.0351	2.3545
1978	1	6.5798	0.3827	7.4262	0.3621
1978	2	7.0860	0.6780	8.6731	2.0865
1978	3	6.2612	0.5684	4.2594	0.2287
1978	4	14.6296	4.6819	8.6899	0.8089
1979	1	8.1294	0.6131	5.0770	0.2251
1979	2	10.9693	3.8834	3.5663	0.2298
1979	3	6.9977	0.6973	3.3540	0.1781
1979	4	8.5718	1.1348	5.0010	0.5982

Year	Quarter	1960-2005 All Indian		Tropical	
		CPUE	Variation	CPUE	Variation
1980	1	4.0826	0.2157	4.5650	0.2243
1980	2	3.9200	0.1943	5.4248	0.3769
1980	3	4.5302	0.3060	3.6441	0.2400
1980	4	7.2286	0.5347	6.6152	0.3033
1981	1	3.9763	0.1107	4.7310	0.1134
1981	2	4.3486	0.2410	3.6201	0.1527
1981	3	7.3753	0.4420	6.8800	0.5190
1981	4	7.8799	0.4789	6.3692	0.2172
1982	1	6.7983	0.4550	5.0594	0.1252
1982	2	4.7047	0.2567	4.9778	0.2328
1982	3	4.7643	0.2012	5.4668	0.1934
1982	4	7.7635	1.1646	7.8217	0.2686
1983	1	6.0990	0.3660	4.7924	0.0794
1983	2	4.7514	0.2365	8.1756	0.8267
1983	3	4.4321	0.1718	4.7113	0.1460
1983	4	8.0976	0.4292	8.5674	0.3819
1984	1	6.2923	0.2042	6.1619	0.1543
1984	2	5.7918	0.3290	6.6791	0.3078
1984	3	7.2942	0.4469	5.5342	0.2486
1984	4	11.1922	1.4816	5.8546	0.2147
1985	1	5.8614	0.2289	5.5154	0.1290
1985	2	4.4631	0.1139	6.5573	0.2800
1985	3	6.0133	0.2415	6.2221	0.2005
1985	4	8.9907	0.5457	8.5321	0.3547
1986	1	6.3502	0.1648	7.9746	0.1949
1986	2	6.8176	0.5345	10.0865	0.7189
1986	3	7.6788	1.0476	7.0751	0.3377
1986	4	7.4633	0.6554	7.4859	0.2243
1987	1	5.2579	0.1280	6.2782	0.1194
1987	2	9.0219	1.5080	7.0153	1.6379
1987	3	7.5572	1.0138	4.6191	0.4634
1987	4	9.0694	0.6981	8.1477	0.3225
1988	1	8.3544	0.5277	8.7293	0.2430
1988	2	6.6376	0.8183	7.3357	2.3874
1988	3	6.7995	0.7140	6.9794	0.5497
1988	4	7.7201	0.7352	5.9105	0.1696
1989	1	6.5927	0.5912	5.4377	0.1351
1989	2	5.2445	0.5121	5.9033	0.6700
1989	3	3.8800	0.7256	3.4260	0.3228
1989	4	7.2662	0.5529	6.4869	0.3643

Appendix Table 3. Continued.

Year	Quarter	1960-2005 All Indian CPUE	Variation	Tropical CPUE	Variation
1990	1	6.7540	0.2625	7.9681	0.3072
1990	2	4.0587	0.6605	5.1505	2.0300
1990	3	5.4998	0.3577	7.0506	0.7626
1990	4	3.9292	0.1907	4.8923	0.1596
1991	1	4.9203	0.1344	5.8031	0.1573
1991	2	3.9715	0.2220	4.6594	0.4284
1991	3	3.1504	0.6511	3.2010	0.2636
1991	4	5.2432	0.3849	6.5117	0.5783
1992	1	5.1180	0.6084	5.0789	0.2131
1992	2	4.5479	0.3793	4.4872	0.5426
1992	3	4.1501	0.4292	5.5383	1.1683
1992	4	3.7204	0.1247	3.9163	0.1536
1993	1	4.1618	0.1224	3.4359	0.1083
1993	2	4.1546	0.2897	5.2555	0.6929
1993	3	3.6567	0.1475	3.8036	0.2069
1993	4	4.8475	0.1735	5.4008	0.1819
1994	1	4.3402	0.2351	3.9315	0.0827
1994	2	3.2674	0.1162	4.0155	0.4031
1994	3	3.6084	0.1316	4.1626	0.3835
1994	4	3.1412	0.0376	3.0167	0.0522
1995	1	3.0313	0.0381	3.0062	0.0561
1995	2	2.2355	0.0580	2.3695	0.1316
1995	3	2.4099	0.0486	2.0978	0.0892
1995	4	5.0534	0.1254	4.3085	0.0777
1996	1	4.7124	0.3730	5.3765	0.1208
1996	2	3.3071	0.0818	3.9643	0.1906
1996	3	3.4232	0.0565	3.2927	0.1205
1996	4	3.1081	0.2315	2.7329	0.0285
1997	1	4.2059	0.1323	3.9958	0.0508
1997	2	1.9473	0.0363	2.3044	0.1541
1997	3	3.4241	0.0456	4.2539	0.1094
1997	4	3.5009	0.0338	3.9728	0.0469
1998	1	3.9666	0.0571	3.9300	0.0343
1998	2	2.7524	0.0340	3.0532	0.0568
1998	3	2.5199	0.1170	2.5779	0.0490
1998	4	3.8128	0.0449	3.8403	0.0592
1999	1	5.0104	0.1394	4.3130	0.0714
1999	2	5.0767	0.4387	3.2533	0.1066
1999	3	4.1235	3.4011	3.6381	0.0863
1999	4	4.9574	3.5069	3.6772	0.0413
2000	1	4.4712	0.0753	3.7973	0.0418
2000	2	3.9308	0.0837	4.2434	0.0731
2000	3	5.0556	0.2998	6.7947	0.2415
2000	4	5.0846	1.6633	4.1818	0.0805
2001	1	4.2245	0.0813	4.4906	0.1111
2001	2	3.2013	0.0783	3.7367	0.0872
2001	3	3.6143	0.0799	4.2623	0.1571
2001	4	3.7377	0.0903	4.1939	0.1019
2002	1	4.9805	0.2414	5.1383	0.1040
2002	2	2.9161	0.1051	2.9858	0.0577
2002	3	1.8690	0.0873	1.6345	0.0209
2002	4	2.5253	0.2379	2.5532	0.0223
2003	1	4.1366	0.6204	3.9944	0.0585
2003	2	3.2827	0.0775	3.7819	0.1254
2003	3	3.4182	0.0709	3.7265	0.1277
2003	4	4.0746	0.0710	4.4216	0.0683
2004	1	2.4928	0.0300	2.9050	0.0327
2004	2	3.5801	0.0824	5.2600	0.1904
2004	3	3.0375	0.0410	2.7554	0.0469
2004	4	4.1001	1.9887	3.7264	0.0565
2005	1	3.7787	0.1017	4.2156	0.0627
2005	2	3.9059	0.1206	4.3925	0.1133
2005	3	2.9193	0.6769	2.4625	0.0713
2005	4	3.1155	0.1429	2.8215	0.0844

Appendix Table 4. Quarterly value of standardized Bigeye CPUE in all and tropical Indian Ocean from 1960 to 2005 and from 1980 to 2005 expressed in relative scale in which the average of each period is 1.0.

Year	Quarter	1960-2005 All Indian CPUE	1960-2005 Tropical CPUE	1980-2005 All Atlantic CPUE	1980-2005 Tropical CPUE
1960	1	1.1867	1.7815		
1960	2	1.5875	1.8566		
1960	3	1.7724	1.4845		
1960	4	1.6423	2.0647		
1961	1	0.9987	1.4490		
1961	2	1.1220	1.5256		
1961	3	1.6228	1.4381		
1961	4	1.3113	1.4839		
1962	1	1.7912	1.5559		
1962	2	1.7970	1.3252		
1962	3	1.2905	1.1420		
1962	4	1.4875	1.2641		
1963	1	1.1277	0.9937		
1963	2	0.9997	0.9477		
1963	3	1.0466	0.7544		
1963	4	1.2198	1.1270		
1964	1	0.9677	0.9686		
1964	2	0.9441	0.8202		
1964	3	0.8955	0.7284		
1964	4	0.6869	0.5540		
1965	1	0.5350	0.6346		
1965	2	0.6655	0.7287		
1965	3	0.8331	0.5649		
1965	4	1.0571	0.9104		
1966	1	0.8816	0.9787		
1966	2	0.9268	0.9748		
1966	3	1.1762	0.9727		
1966	4	1.0161	0.9616		
1967	1	0.5940	0.6587		
1967	2	0.7278	0.6659		
1967	3	0.5120	0.4725		
1967	4	0.5760	0.6343		
1968	1	1.6122	1.5006		
1968	2	1.4348	1.6689		
1968	3	0.8873	0.9325		
1968	4	0.8092	0.9042		
1969	1	0.6389	0.6499		
1969	2	0.6218	0.6955		
1969	3	0.7884	0.8178		
1969	4	0.7209	0.8309		

Year	Quarter	1960-2005 All Indian CPUE	1960-2005 Tropical CPUE	1980-2005 All Atlantic CPUE	1980-2005 Tropical CPUE
1970	1	0.4319	0.5672		
1970	2	0.3545	0.4147		
1970	3	0.6927	0.8216		
1970	4	0.7329	0.7080		
1971	1	0.5156	0.4719		
1971	2	0.7601	0.5933		
1971	3	0.9754	0.8102		
1971	4	0.9044	0.7380		
1972	1	0.7725	0.4853		
1972	2	1.1446	0.3960		
1972	3	1.3579	0.6557		
1972	4	1.0841	0.5749		
1973	1	0.8400	0.5108		
1973	2	0.8134	0.3796		
1973	3	0.5334	0.4076		
1973	4	0.7497	0.5025		
1974	1	0.4369	0.3043		
1974	2	0.4773	0.4098		
1974	3	0.3727	0.3852		
1974	4	0.4816	0.3488		
1975	1	0.3244	0.2562		
1975	2	0.4741	0.3060		
1975	3	0.7080	0.4292		
1975	4	1.3290	0.5613		
1976	1	0.3680	0.2588		
1976	2	0.5636	0.6202		
1976	3	0.7998	0.5832		
1976	4	0.7187	0.5715		
1977	1	1.1699	0.3497		
1977	2	1.7170	1.0184		
1977	3	0.7524	0.5716		
1977	4	1.1314	0.8970		
1978	1	0.5238	0.4430		
1978	2	0.5641	0.5174		
1978	3	0.4984	0.2541		
1978	4	1.1646	0.5184		
1979	1	0.6472	0.3029		
1979	2	0.8732	0.2128		
1979	3	0.5571	0.2001		
1979	4	0.6824	0.2984		

Year	Quarter	1960-2005 All Indian CPUE	1960-2005 Tropical CPUE	1980-2005 All Atlantic CPUE	1980-2005 Tropical CPUE
1980	1	0.3250	0.2723	0.8666	0.9432
1980	2	0.3121	0.3236	0.8494	1.2378
1980	3	0.3606	0.2174	0.8007	0.7440
1980	4	0.5755	0.3947	1.2809	1.2729
1981	1	0.3165	0.2822	0.7807	0.9601
1981	2	0.3462	0.2160	0.8631	0.8098
1981	3	0.5871	0.4104	1.2864	1.3548
1981	4	0.6273	0.3800	1.3857	1.2386
1982	1	0.5412	0.3018	1.3915	1.0895
1982	2	0.3745	0.2970	1.1265	1.1043
1982	3	0.3793	0.3261	0.9371	1.0764
1982	4	0.6180	0.4666	1.7107	1.5827
1983	1	0.4855	0.2859	1.2427	1.0252
1983	2	0.3782	0.4877	1.0359	1.7635
1983	3	0.3528	0.2811	0.9095	0.9723
1983	4	0.6446	0.5111	1.5777	1.7312
1984	1	0.5009	0.3676	1.2693	1.2822
1984	2	0.4611	0.3985	1.2094	1.4379
1984	3	0.5807	0.3302	1.2448	1.0428
1984	4	0.8910	0.3493	2.0638	1.1938
1985	1	0.4666	0.3290	1.2958	1.1877
1985	2	0.3553	0.3912	0.9518	1.3927
1985	3	0.4787	0.3712	1.1204	1.2620
1985	4	0.7157	0.5090	1.6246	1.6912
1986	1	0.5055	0.4758	1.3659	1.6311
1986	2	0.5427	0.6017	1.2758	2.0755
1986	3	0.6113	0.4221	1.1935	1.3938
1986	4	0.5941	0.4466	1.2760	1.4914
1987	1	0.4186	0.3745	1.0818	1.2981
1987	2	0.7182	0.4185	1.6524	1.4785
1987	3	0.6016	0.2756	1.0931	0.9654
1987	4	0.7220	0.4861	1.5844	1.5921
1988	1	0.6651	0.5208	1.8889	1.7902
1988	2	0.5284	0.4376	1.4436	1.5164
1988	3	0.5413	0.4164	1.1479	1.4670
1988	4	0.6146	0.3526	1.4875	1.2108
1989	1	0.5248	0.3244	1.4691	1.1289
1989	2	0.4175	0.3522	1.1449	1.2941
1989	3	0.3089	0.2044	0.8067	0.6907
1989	4	0.5784	0.3870	1.3592	1.2074

Appendix Table 4. Continued.

Year	Quarter	1960-2005 All Indian CPUE	1960-2005 Tropical CPUE	1980-2005 All Atlantic CPUE	1980-2005 Tropical CPUE
1990	1	0.5377	0.4754	1.2972	1.6226
1990	2	0.3231	0.3073	0.8326	1.0485
1990	3	0.4378	0.4206	1.0000	1.4811
1990	4	0.3128	0.2919	0.6938	0.9526
1991	1	0.3917	0.3462	1.1812	1.2253
1991	2	0.3162	0.2780	0.9863	0.9747
1991	3	0.2508	0.1910	0.9124	0.6115
1991	4	0.4174	0.3885	1.0434	1.1972
1992	1	0.4074	0.3030	1.2812	1.0812
1992	2	0.3620	0.2677	1.0022	1.0332
1992	3	0.3304	0.3304	0.8600	1.0700
1992	4	0.2962	0.2336	0.7304	0.7311
1993	1	0.3313	0.2050	0.8551	0.7924
1993	2	0.3307	0.3135	0.9581	1.1984
1993	3	0.2911	0.2269	0.7895	0.7431
1993	4	0.3859	0.3222	0.8569	0.8834
1994	1	0.3455	0.2345	1.1764	0.7605
1994	2	0.2601	0.2396	0.7219	0.8515
1994	3	0.2873	0.2483	0.7423	0.8715
1994	4	0.2501	0.1800	0.5893	0.6333
1995	1	0.2413	0.1793	0.6973	0.6949
1995	2	0.1780	0.1414	0.5708	0.5281
1995	3	0.1918	0.1252	0.4696	0.4073
1995	4	0.4023	0.2570	0.9564	0.7863
1996	1	0.3751	0.3208	1.2606	1.1126
1996	2	0.2633	0.2365	0.6654	0.8008
1996	3	0.2725	0.1964	0.6285	0.6678
1996	4	0.2474	0.1630	0.5867	0.5290
1997	1	0.3348	0.2384	0.9325	0.8125
1997	2	0.1550	0.1375	0.4165	0.4960
1997	3	0.2726	0.2538	0.6531	0.8612
1997	4	0.2787	0.2370	0.7375	0.9165
1998	1	0.3158	0.2345	0.9617	0.9044
1998	2	0.2191	0.1821	0.6758	0.6210
1998	3	0.2006	0.1538	0.6629	0.5020
1998	4	0.3035	0.2291	0.7155	0.7236
1999	1	0.3989	0.2573	1.1122	0.8998
1999	2	0.4041	0.1941	1.2125	0.6740
1999	3	0.3283	0.2170	0.9407	0.7230
1999	4	0.3946	0.2194	1.2105	0.7270
2000	1	0.3559	0.2265	1.0926	0.7810
2000	2	0.3129	0.2532	0.9967	0.8441
2000	3	0.4025	0.4054	1.0960	1.2510
2000	4	0.4048	0.2495	1.2304	0.8040
2001	1	0.3363	0.2679	0.8804	0.9090
2001	2	0.2548	0.2229	0.6867	0.7531
2001	3	0.2877	0.2543	0.6782	0.7963
2001	4	0.2975	0.2502	0.6479	0.8104
2002	1	0.3965	0.3065	1.3348	1.0289
2002	2	0.2321	0.1781	0.7142	0.5923
2002	3	0.1488	0.0975	0.3717	0.2865
2002	4	0.2010	0.1523	0.4818	0.4911
2003	1	0.3293	0.2383	1.0353	0.8166
2003	2	0.2613	0.2256	0.7048	0.7656
2003	3	0.2721	0.2223	0.6124	0.6966
2003	4	0.3244	0.2638	0.8069	0.8794
2004	1	0.1984	0.1733	0.5161	0.5928
2004	2	0.2850	0.3138	0.7339	1.0412
2004	3	0.2418	0.1644	0.5303	0.5193
2004	4	0.3264	0.2223	0.8930	0.7218
2005	1	0.3008	0.2515	0.8994	0.8811
2005	2	0.3109	0.2620	1.0331	0.9107
2005	3	0.2324	0.1469	0.6642	0.4681
2005	4	0.2480	0.1683	0.6870	0.5798