Update of standardized Japanese longline CPUE for yellowfin tuna in the Indian Ocean and consideration of standardization methods

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Abstract

Japanese longline CPUE for yellowfin tuna in the main fishing ground and whole Indian Ocean, as well as area-specific CPUE in each areas was standardized up to 2014 by GLM. In order to avoid the bias of data, the scenarios without Area 2, with including area 3' that combined area 2 and 3, and standardization from whole catch data were also considered. Basically, these standardized CPUEs showed similar trends. CPUE continuously decreased from early 1960s to 1974, and was kept in the same level until 1990. Thereafter, it declined to historical low level in recent years. The stable trend in recent years at all models indicate decreased effort caused by piracy activity on area 2 have little effect on overall CPUE trends. Trends of area-specific CPUEs were similar among areas (2-5, and 3'). Applying 5 degrees latitude/longitude effect showed large effect on the CPUE trend for Area 3 and 4. Trends of CPUEs from whole data showed steeper declining in area 4. The standardized CPUE in area 3' showed intermediate trend between area 2 and 3.

1. Introduction

Yellowfin tuna is one of main target species for Japanese longline fishery in the Indian Ocean. Its abundance indices are very important for stock assessment of this species. Yellowfin tuna is mainly caught in the tropical and subtropical areas especially in the western Indian Ocean (Matsumoto and Satoh, 2012; Matsumoto, 2014). Since 2007, piracy activities off Somalia has increased and spread to whole northwestern Indian Ocean. Japanese longline effort in the Indian Ocean, especially in the northwestern part, has rapidly decreased to avoid the piracy attack. In the IOTC WPTT meeting in 2010, a concern about the effect of the decreased effort on the CPUE trend of the longline fishery was recognized. Okamoto (2011b) estimated the regional effect of the decreased longline effort on the CPUE trend in the Indian Ocean, and suggested that the decreased effort in northwestern Indian Ocean has no more have been able to represent the CPUE trend in this region. Therefore, Okamoto (2011a) calculated CPUE trends for both scenarios including and excluding Area 2 (northwestern area) and found that the trends were similar. At 2012 - 2014 IOTC WPTT meetings, Matsumoto et al. (2012, 2013) and Ochi et al (2014) conducted CPUE standardization by using area rate without northwest area for 2011 because no effort was observed in this area in 2011 due to piracy activities, and the indices were used for stock assessment in 2012.

In this study, Japanese longline CPUE for yellowfin tuna in the Indian Ocean was standardized by Generalized Linear Model which is equivalent to those by Okamoto and Shono (2010) used for 2010-2012 yellowfin assessments or provided for stock indicator, respectively. Considering the missing data on area 2, alternative area 3' that combined area 2 and 3 (Fig. 1) was defined and applied for this analysis. In addition, alternative standarization method for area specific CPUEs, which calculate standardized CPUE with whole catch and effort data, was also examined to confirm if the trend of CPUE differs depending on standardization methods.

2. Materials and methods

Generalized linear model (GLM) was applied to standardize the Japanese longline CPUE for yellowfin tuna. Principally, the model used for the standardization in this paper is equivalent to that used in the previous studies (Okamoto and Shono, 2010; Okamoto, 2011a; Matsumoto et al., 2012; 2013; Ochi et al, 2014) but some modifications about area definition and calculation of standardized CPUEs. In the standardization, no environmental factor was applied in the model.

Area definition:

Area definition in this study which consists of five areas is the same as that used in the yellowfin assessment in IOTC WPTT 2010 – 2012 or the analyses in 2013 and 2014 (Fig. 1), although Area 1 was not used because of too little

effort. CPUE was standardized for main fishing ground (Area 2, 3 and 5) and whole fishing grounds (Area 2, 3, 4 and 5) and for both areas excluding Area 2. In addition of that, alternative area 3', combined area 2 and 3, was used for standardization in whole fishing ground and for area specific CPUE standardization.

Catch and effort data used:

The Japanese longline catch (in number) and effort statistics from 1963 up to 2014 were used. Data in this study are the catch and effort data sets aggregated by month, 1x1 degrees square, NHF (the number of hooks between floats), and main and branch line materials. As the NHF information is not available for the period before 1975, NHF was regarded to be 5 in this period because NHF around 1975 was almost 5-7. Main and branch line material was classified into two categories, 1 = Nylon and 2 = other. Although the 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 around the late 1980s and spread quickly in the early 1990s (Okamoto, 2005). And it seems that the NHF larger than 17 or 18 would have 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 catch in number was used. CPUE is calculated as "the number of fish caught / the number of hooks * 1000". As the model for standardizing CPUE, GLM-LogNormal error structure was used. The followings are the initial model for each analysis. Based on the result of ANOVA (type III SS), non-significant effects were removed in backward stepwise from the initial model based on the F-value ($p < 0.05$). In the cases in which the factor is not significant as main factor but is significant as interaction with other factor, the main factor was kept in the model.

Annual and quarterly CPUE was standardized for main (Area 2, 3 and 5) and whole (Area 2-5 or Area 3', 4 and 5) fishing grounds for 1963-2014. In addition, area specific annual and quarterly CPUE was also standardized for data subsets of each five areas (area 2-5 and 3') in order to provide CPUE index used for assessment using Multifan-CL software and Stock Synthesis 3 (SS3). In this case, the model in which explanatory factor of each 5 degree latitude and longitude square (LT5LN5) was also applied. As another method, area specific CPUEs was standardized for the data for the whole area by using lsmeans of one GLM.

- Initial Model for Year based CPUE standardization

Log (CPUE+const)=μ+YR +QT +AREA +NHFCL +ML +BL +YR*QT +QT*AREA +YR*AREA +AREA*NHFCL +NHFCL*ML +NHFCL*BL + e

- Initial Model for Quarter based CPUE standardization

Log (CPUE+const)=μ+YR +QT +AREA +NHFCL +ML +BL +YR*QT*AREA +AREA*NHFCL +NHFCL*ML +NHFCL*BL + e

- Initial Model for year or quarter based CPUE standardization with data subsets in each area (excluding explanatory factor of each latitude 5 degree and longitude 5 degree square)

Log (CPUE+const)=μ+YR +QT + NHFCL +ML +BL +YR*QT +NHFCL*ML +NHFCL*BL + e

- Initial Model for year or quarter based CPUE standardization with data subsets in each area (including explanatory factor of each latitude 5 degree and longitude 5 degree square)

Log (CPUE+const)=μ+YR +QT+AREA + NHFCL +ML +BL +LT5LN5 +YR*QT +NHFCL*ML +NHFCL*BL + e

- Initial Model for year or quarter based CPUE standardization in each area with whole data

Log (CPUE+const)=μ+YR +QT + NHFCL +ML +BL +YR*QT*AREA +YR*QT +NHFCL*ML +NHFCL*BL + e

where Log : natural logarithm,
CPUE : catch in number of yellowfin per 1000 hooks,
const : 10% of overall mean of CPUE

μ : over all mean (intercept),
YR : effect of year,
QT : effect of fishing season (quarter),
Area: effect of area,
NHFCL : effect of number of hooks between floats (categorized),
ML : effect of material of main line,
BL : effect of material of branch line,
LT5LN5: effect of each latitude 5 degree and longitude 5 degree square
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 number of hooks between floats,
NHFCL*ML: interaction term between effect of number of hooks between floats and main line material,
NHFCL*BL: interaction term between effect of number of hooks between floats and branch line material,
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.

$CPUE_{ij} = W_j * (\exp(\text{lsmean}(\text{Year}_i * \text{Area}_j)) - \text{const})$
$CPUE_i = \Sigma\, CPUE_{ij}$
where $CPUE_i$ = CPUE in year i, and $CPUE_{ij}$ = CPUE of area j in year i,
W_j = Area proportion of Area j , ($\Sigma Wj = 1$),
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),
const= 10% of overall mean of CPUE.

As for standardized CPUE in the main and whole fishing grounds which includes Area 2, CPUE in 2011 was calculated using area rate without Area 2 because no effort was observed in the Area 2 due to piracy activities. The yellowfin CPUEs (catch in number per 1000 hooks) in year and quarter bases were standardized by GLM (CPUE-LogNormal error structured model) for each of area categories, main (Area 2, 3 and 5 or Area 3 and 5) and whole (Areas 2, 3, 4 and 5 or area 3, 4 and 5) fishing grounds. To see effects of each component (fishing gear, season and area), the model for year based CPUE in the whole fishing ground without 2011 data was used.

These results were compared with those by the same methods in the previous studies.

3. Results and discussion

CPUE standardizations by GLM:

Trends of annual CPUEs for main and whole fishing grounds (with and without Area 2, and with Area 3' respectively) standardized from 1963 to 2014 are shown in Fig. 2 in real scale overlaying nominal CPUE and in relative scale. Basically, standardized CPUE including and excluding Area 2, and including area 3' in the model showed similar trend. In the main fishing ground, CPUE continuously decreased from around 15 (real scale) in early 1960s to around 5.0 in 1974, and kept in the same level until 1990 with jump to 11.0 in 1977. Thereafter, it declined to about 3.1 in 1994 and has been kept in a low level with fluctuation between about 2 and 3 until 2007. After that, the CPUE declined to historical low level, 1.18-1.58 during 2008-2014. As this declining trend in the resent years was detected in all models where the

piracy activity had been increasing since 2007, the recent declining trend would be reflecting actual change in abundance rather than change in CPUE derived from shift of fishing ground and/or decreased effort caused by increased piracy activity. The results also indicate that sharp decline in fishing effort in area 2 in the recent years didn't have large effect on the trend of CPUE. The trend of standardized CPUE for whole fishing ground was similar to that of main fishing ground. The quarterly CPUE trends for main and whole fishing grounds were basically similar to that of annual CPUE (Fig. 3).

Results of ANOVA and distributions of the standardized residual for both annual and quarterly CPUE for main and whole fishing grounds are shown in Table 1 and Fig. 5 (annual base) and

Table **2** and **Error! Reference source not found.** (quarterly base), respectively. As all explanatory factors included in the initial models were effective significantly in all cases, the final models were equal to the initial models as a result. In all cases, standardized residuals did not show remarkable difference from the normal distribution.

The annual and quarterly CPUEs for each area standardized by the model with and without LT5LN5, and with using whole data are shown in **Error! Reference source not found.** and **Error! Reference source not found.**, respectively, in real scale and in relative scale. ANOVA tables and standardized residuals are shown in Table -5 and Fig. -10, respectively. Trends of CPUEs of each area were relatively similar, i.e. large decline until middle 1970s, relatively stable trend until around 1991 and steadily declining trend thereafter. Applying LT5LN5 factor in the model showed relatively large effect on the CPUE trend for area 3 and 4 in which the declining trend until around 1990 was steeper in the model without LT5LN5. Then, the CPUE trend derived from the model with LT5LN5 caused relatively flat trend throughout period analyzed. Trends of CPUEs from one model showed steeper declining in area 4. Fig. indicates that distribution of fishing efforts differs depending on period especially in the Area 3 and 4. It may have caused large difference of CPUE between with and without LT5LN5. Fig. indicates that the proportion of fishing effort in each area differs depending on period. The standardized CPUE in area 3' showed intermediate trend between area 2 and 3

Standarized CPUE indices for each scenario was shown in Appendix 1-8.

Effect of each explanatory factor in the model

Historical changes in the proportion of effort by fishing gear (NHFCL and gear materials) are shown in Fig. 3. NHFCL 5-7 was dominant in each area in the early period. NHF increased with time and sudden increase occurred during early 1990s in each area. In recent years, NHFCL 11-13 is dominant in Area 3 and 4, and NHFCL 17-19 and 20-21 in Area 2 and 5. Nylon material for both main and branch lines developed rapidly around mid-1990s, which almost coincided with the change in NHF. Trends of CPUE standardized for each of quarter, NHFCL, gear (main-line and branch-line) materials, interaction of NHFCL and gear materials, and area are shown in Fig. 14. CPUE was highest in 1st quarter followed by 4th quarter. CPUE showed increasing trend with NHFCL, although not fully consistent. As for the gear materials of both of branch and main-lines, nylon showed about 10% higher CPUE than other material. CPUE by NHFCL demonstrated increasing trend for each gear material. CPUE in area 2 was highest followed by area 3, and CPUE in area 4 was the lowest.

Large difference between nominal and standardized CPUEs was observed after 1990s, in which nominal CPUE was higher than standardized one. Development of fishing gear (NHF and materials) may be one of the causes, which was also demonstrated by GLM analyses (Ochi et al. 2013). Also, it appears that the proportion of fishing effort has become higher in the area where yellowfin tuna CPUE is high (in the tropical and subtropical areas of western Indian Ocean; Matsumoto and Satoh, 2012). In addition, Fig. indicates that the proportion of fishing effort in Area 2 and 3, where yellowfin CPUE was higher (Fig. 144), was larger during early to mid-2000s than during other period. It may also be the cause of the difference of two CPUEs.

4. References

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Table 1. ANOVA table of GLM for year based CPUE standardization for main and whole fishing grounds (with and without Area2, and with area 3') for 1963-2014.

1963-2014 Year based (1x1 degree per month)
Main fishing ground (Area 2, 3 & 5)

Source	DF	Type III SS	Mean Square	F Value	Pr > F	R-Square
Model	343	73335.2	213.8	256.2	<.0001	0.322
						CV
yr	51	11863.1	232.6	278.8	<.0001	60.786
qt	3	3145.3	1048.4	1256.6	<.0001	
area	2	2618.2	1309.1	1569.0	<.0001	
nhfcl	5	568.9	113.8	136.4	<.0001	
bl	1	19.1	19.1	22.9	<.0001	
ml	1	153.9	153.9	184.5	<.0001	
yr*qt	153	4953.1	32.4	38.8	<.0001	
qt*area	6	5337.8	889.6	1066.2	<.0001	
yr*area	101	5445.0	53.9	64.6	<.0001	
area*nhfcl	10	755.1	75.5	90.5	<.0001	
nhfcl*ml	5	295.9	59.2	70.9	<.0001	
nhfcl*bl	5	58.9	11.8	14.1	<.0001	

1963-2014 Year based (1x1 degree per month)
Whole IO (Area 2, 3, 4 & 5)

Source	DF	Type III SS	Mean Square	F Value	Pr > F	R-Square
Model	403	176220.3	437.3	510.4	<.0001	0.460
						CV
yr	51	14543.4	285.2	332.8	<.0001	83.600
qt	3	3848.5	1282.8	1497.2	<.0001	
area	3	10462.8	3487.6	4070.4	<.0001	
nhfcl	5	558.6	111.7	130.4	<.0001	
bl	1	43.4	43.4	50.6	<.0001	
ml	1	95.0	95.0	110.9	<.0001	
yr*qt	153	5538.6	36.2	42.3	<.0001	
qt*area	9	6908.3	767.6	895.9	<.0001	
yr*area	152	8391.0	55.2	64.4	<.0001	
area*nhfcl	15	1017.2	67.8	79.1	<.0001	
nhfcl*ml	5	409.1	81.8	95.5	<.0001	
nhfcl*bl	5	90.9	18.2	21.2	<.0001	

1963-2014 Year based (1x1 degree per month)
Main fishing ground (Area 3 & 5)

Source	DF	Type III SS	Mean Square	F Value	Pr > F	R-Square
Model	284	46740.3	164.6	181.8	<.0001	0.321
						CV
yr	51	7278.9	142.7	157.7	<.0001	73.956
qt	3	4501.0	1500.3	1657.7	<.0001	
area	1	1791.5	1791.5	1979.4	<.0001	
nhfcl	5	416.6	83.3	92.1	<.0001	
bl	1	13.9	13.9	15.4	<.0001	
ml	1	93.1	93.1	102.9	<.0001	
yr*qt	153	3748.2	24.5	27.1	<.0001	
qt*area	3	3735.4	1245.1	1375.7	<.0001	
yr*area	51	2993.6	58.7	64.9	<.0001	
area*nhfcl	5	655.3	131.1	144.8	<.0001	
nhfcl*ml	5	222.8	44.6	49.2	<.0001	
nhfcl*bl	5	36.7	7.3	8.1	<.0001	

1963-2014 Year based (1x1 degree per month)
Whole IO (Area 3, 4 & 5)

Source	DF	Type III SS	Mean Square	F Value	Pr > F	R-Square
Model	344	133102.0	386.9	405.0	<.0001	0.456
						CV
yr	51	11343.1	222.4	232.8	<.0001	134.927
qt	3	5558.3	1852.8	1939.2	<.0001	
area	2	8346.1	4173.1	4367.6	<.0001	
nhfcl	5	517.0	103.4	108.2	<.0001	
bl	1	40.3	40.3	42.1	<.0001	
ml	1	36.9	36.9	38.6	<.0001	
yr*qt	153	4898.4	32.0	33.5	<.0001	
qt*area	6	5731.9	955.3	999.8	<.0001	
yr*area	102	5202.6	51.0	53.4	<.0001	
area*nhfcl	10	931.2	93.1	97.5	<.0001	
nhfcl*ml	5	291.7	58.3	61.1	<.0001	
nhfcl*bl	5	66.5	13.3	13.9	<.0001	

1963-2014 Year based (1x1 degree per month)
Whole fishing ground (Area 3'(2+3) 4 & 5)

Source	DF	Type III SS	Mean Square	F Value	Pr > F	R-Square
Model	284	64546.567	227.2766	257.78	<.0001	0.28373
						CV
yr	51	10666.988	209.15662	237.23	<.0001	
qt	3	2009.6264	669.87546	759.78	<.0001	
area	1	2502.7	2502.7	2838.6	<.0001	
nhfcl	5	586.2	117.2	133.0	<.0001	
bl	1	12.3	12.3	13.9	0.0	
ml	1	222.5	222.5	252.3	<.0001	
yr*qt	153	5024.0	32.8	37.2	<.0001	
qt*area	3	1829.3	609.8	691.6	<.0001	
yr*area	51	2712.3	53.2	60.3	<.0001	
area*nhfcl	5	354.1	70.8	80.3	<.0001	
nhfcl*ml	5	456.6	91.3	103.6	<.0001	
nhfcl*bl	5	84.6	16.9	19.2	<.0001	

Table 2. ANOVA table of GLM for quarter based CPUE standardization for main and whole fishing ground (with and without Area2, and with area 3') for 1963-2014.

1963-2014 Quarter based (1x1 degree per quarter)
Main fishing ground (Area 2, 3 & 5)

Source	DF	Type III SS	Mean Square	F Value	Pr > F	R-Square
Model	642	79368.3	123.6	154.0	<.0001	0.349
						CV
yr	51	9888.0	193.9	241.4	<.0001	59.633
qt	3	2010.2	670.1	834.4	<.0001	
area	2	1790.3	895.1	1114.7	<.0001	
nhfcl	5	519.6	103.9	129.4	<.0001	
bl	1	15.9	15.9	19.8	<.0001	
ml	1	144.8	144.8	180.3	<.0001	
yr*qt*area	559	23083.0	41.3	51.4	<.0001	
area*nhfcl	10	746.7	74.7	93.0	<.0001	
nhfcl*ml	5	254.3	50.9	63.3	<.0001	
nhfcl*bl	5	46.7	9.3	11.6	<.0001	

1963-2014 Quarter based (1x1 degree per quarter)
Whole IO (Area 2, 3, 4 & 5)

Source	DF	Type III SS	Mean Square	F Value	Pr > F	R-Square
Model	855	186714.6	218.4	268.0	<.0001	0.487
						CV
yr	51	11220.9	220.0	270.0	<.0001	81.531
qt	3	2730.2	910.1	1116.8	<.0001	
area	3	8679.4	2893.1	3550.2	<.0001	
nhfcl	5	462.5	92.5	113.5	<.0001	
bl	1	36.4	36.4	44.7	<.0001	
ml	1	95.8	95.8	117.6	<.0001	
yr*qt*area	766	32841.9	42.9	52.6	<.0001	
area*nhfcl	15	1021.8	68.1	83.6	<.0001	
nhfcl*ml	5	339.7	67.9	83.4	<.0001	
nhfcl*bl	5	79.8	16.0	19.6	<.0001	

1963-2014 Quarter based (1x1 degree per month)
Whole fishing ground (Area 3'(2+3) 4 & 5)

Source	DF	Type III SS	Mean Square	F Value	Pr > F	R-Square
Model	649	172884.04	266.3853	305.66	<.0001	0.450961
						CV
yr	51	10209.416	200.18463	229.7	<.0001	84.313
qt	3	1669.5	556.5	638.6	<.0001	
area	2	8465.2	4232.6	4856.7	<.0001	
nhfcl	5	342.7	68.5	78.7	<.0001	
bl	1	37.6	37.6	43.1	<.0001	
ml	1	161.9	161.9	185.7	<.0001	
yr*qt*area	566	22359.1	39.5	45.3	<.0001	
area*nhfcl	10	662.2	66.2	76.0	<.0001	
nhfcl*ml	5	577.9	115.6	132.6	<.0001	
nhfcl*bl	5	133.6	26.7	30.7	<.0001	

1963-2014 Quarter based (1x1 degree per quarter)
Main fishing ground (Area 3 & 5)

Source	DF	Type III SS	Mean Square	F Value	Pr > F	R-Square
Model	436	50191.9	115.1	131.6	<.0001	0.344
						CV
yr	51	6501.5	127.5	145.7	<.0001	72.705
qt	3	2793.8	931.3	1064.6	<.0001	
area	1	1361.4	1361.4	1556.4	<.0001	
nhfcl	5	394.8	79.0	90.3	<.0001	
bl	1	10.5	10.5	12.0	0.0	
ml	1	96.8	96.8	110.6	<.0001	
yr*qt*area	359	15561.7	43.3	49.6	<.0001	
area*nhfcl	5	681.9	136.4	155.9	<.0001	
nhfcl*ml	5	220.6	44.1	50.4	<.0001	
nhfcl*bl	5	30.0	6.0	6.9	<.0001	

1963-2014 Quarter based (1x1 degree per quarter)
Whole IO (Area 3, 4 & 5)

Source	DF	Type III SS	Mean Square	F Value	Pr > F	R-Square
Model	649	141279.5	217.7	239.8	<.0001	0.484
						CV
yr	51	8845.8	173.4	191.0	<.0001	131.531
qt	3	3700.8	1233.6	1358.6	<.0001	
area	2	7449.5	3724.8	4102.3	<.0001	
nhfcl	5	437.8	87.6	96.4	<.0001	
bl	1	31.2	31.2	34.4	<.0001	
ml	1	41.5	41.5	45.7	<.0001	
yr*qt*area	566	25617.6	45.3	49.9	<.0001	
area*nhfcl	10	972.4	97.2	107.1	<.0001	
nhfcl*ml	5	271.2	54.2	59.7	<.0001	
nhfcl*bl	5	64.7	12.9	14.3	<.0001	

Table 3. ANOVA table of GLM for quarterly based area specific CPUE standardization for each area for 1963-2014.

1963-2014 MODEL2010
Area 2

Source	DF	Type III SS	Mean Square	F Value	Pr > F	R-Square
Model	217	23977.9	110.5	151.1	<.0001	0.304
						CV
yr	50	7523.9	150.5	205.8	<.0001	47.817
qt	3	444.8	148.3	202.8	<.0001	
nhfcl	5	140.1	28.0	38.3	<.0001	
bl	1	11.3	11.3	15.5	<.0001	
ml	1	0.4	0.4	0.5	0.5	
yr*qt*area	147	3979.0	27.1	37.0	<.0001	
nhfcl*ml	5	47.0	9.4	12.9	<.0001	
nhfcl*bl	5	51.9	10.4	14.2	<.0001	

1963-2014 MODEL2010 + LT5LN5
Area 2

Source	DF	Type III SS	Mean Square	F Value	Pr > F	R-Square
Model	247	28717.0	116.3	173.9	<.0001	0.364
						CV
yr	50	6448.0	129.0	192.9	<.0001	45.721
qt	3	223.0	74.3	111.2	<.0001	
nhfcl	5	138.6	27.7	41.5	<.0001	
bl	1	9.3	9.3	13.9	0.0	
ml	1	0.1	0.1	0.1	0.7	
LT5LN5	30	4739.1	158.0	236.3	<.0001	
yr*qt*area	147	3241.2	22.0	33.0	<.0001	
nhfcl*ml	5	48.2	9.6	14.4	<.0001	
nhfcl*bl	5	27.19161	5.438323	8.14	<.0001	

1963-2014 MODEL2010
Area 3

Source	DF	Type III SS	Mean Square	F Value	Pr > F	R-Square
Model	224	23409.7	104.5	99.2	<.0001	0.280
						CV
yr	51	5081.1	99.6	94.6	<.0001	71.850
qt	3	7054.0	2351.3	2232.7	<.0001	
nhfcl	5	356.7	71.3	67.7	<.0001	
bl	1	0.1	0.1	0.1	0.8	
ml	1	14.1	14.1	13.4	0.0	
yr*qt*area	153	5249.4	34.3	32.6	<.0001	
nhfcl*ml	5	265.7	53.1	50.5	<.0001	
nhfcl*bl	5	25.7	5.1	4.9	0.0	

1963-2014 MODEL2010 + LT5LN5
Area 3

Source	DF	Type III SS	Mean Square	F Value	Pr > F	R-Square
Model	259	37061.5	143.1	175.7	<.0001	0.444
						CV
yr	51	2541.5	49.8	61.2	<.0001	63.183
qt	3	1922.1	640.7	786.7	<.0001	
nhfcl	5	159.8	32.0	39.2	<.0001	
bl	1	1.0	1.0	1.2	0.3	
ml	1	3.8	3.8	4.7	0.0	
LT5LN5	35	13651.8	390.1	479.0	<.0001	
yr*qt*area	153	2562.6	16.7	20.6	<.0001	
nhfcl*ml	5	123.7	24.7	30.4	<.0001	
nhfcl*bl	5	19.40329	3.88066	4.77	0.0002	

1963-2014 MODEL2010
Area 4

Source	DF	Type III SS	Mean Square	F Value	Pr > F	R-Square
Model	224	31226.7	139.4	90.4	<.0001	0.263
						CV
yr	51	8862.6	173.8	112.6	<.0001	-116.809
qt	3	2069.8	689.9	447.2	<.0001	
nhfcl	5	834.7	166.9	108.2	<.0001	
bl	1	17.0	17.0	11.0	0.0	
ml	1	41.1	41.1	26.6	<.0001	
yr*qt*area	153	10009.5	65.4	42.4	<.0001	
nhfcl*ml	5	78.6	15.7	10.2	<.0001	
nhfcl*bl	5	142.9	28.6	18.5	<.0001	

1963-2014 MODEL2010 + LT5LN5
Area 4

Source	DF	Type III SS	Mean Square	F Value	Pr > F	R-Square
Model	290	64868.2	223.7	235.0	<.0001	0.545
						CV
yr	51	3018.4	59.2	62.2	<.0001	-91.761
qt	3	473.3	157.8	165.7	<.0001	
nhfcl	5	81.2	16.2	17.1	<.0001	
bl	1	6.1	6.1	6.4	0.0	
ml	1	2.6	2.6	2.7	0.1	
LT5LN5	66	33641.5	509.7	535.4	<.0001	
yr*qt*area	153	2829.1	18.5	19.4	<.0001	
nhfcl*ml	5	66.5	13.3	14.0	<.0001	
nhfcl*bl	5	152.4974	30.49947	32.04	<.0001	

1963-2014 MODEL2010
Area 5

Source	DF	Type III SS	Mean Square	F Value	Pr > F	R-Square
Model	223	27027.6	121.2	190.7	<.0001	0.449
						CV
yr	51	4215.7	82.7	130.0	<.0001	70.807
qt	3	214.8	71.6	112.6	<.0001	
nhfcl	5	67.0	13.4	21.1	<.0001	
bl	1	16.3	16.3	25.7	<.0001	
ml	1	4.4	4.4	6.9	0.0	
yr*qt*area	152	1593.6	10.5	16.5	<.0001	
nhfcl*ml	5	24.9	5.0	7.8	<.0001	
nhfcl*bl	5	26.8	5.4	8.4	<.0001	

1963-2014 MODEL2010 + LT5LN5
Area 5

Source	DF	Type III SS	Mean Square	F Value	Pr > F	R-Square
Model	255	28156.3	110.4	179.7	<.0001	0.468
						CV
yr	51	4101.5	80.4	130.9	<.0001	69.613
qt	3	146.9	49.0	79.7	<.0001	
nhfcl	5	41.0	8.2	13.4	<.0001	
bl	1	9.9	9.9	16.1	<.0001	
ml	1	4.2	4.2	6.8	0.0	
LT5LN5	32	1128.6	35.3	57.4	<.0001	
yr*qt*area	152	1538.1	10.1	16.5	<.0001	
nhfcl*ml	5	27.4	5.5	8.9	<.0001	
nhfcl*bl	5	23.39342	4.678684	7.61	<.0001	

1963-2014 MODEL2010
Area 3'

Source	DF	Type III SS	Mean Square	F Value	Pr > F	R-Square
Model	224	38403.6	171.4	180.9	<.0001	0.234
						CV
yr	51	13909.1	272.7	287.8	<.0001	59.445
qt	3	5355.5	1785.2	1883.5	<.0001	
nhfcl	5	755.8	151.2	159.5	<.0001	
bl	1	4.0	4.0	4.2	0.0	
ml	1	171.1	171.1	180.6	<.0001	
yr*qt	153	5849.8	38.2	40.3	<.0001	
nhfcl*ml	5	456.6	91.3	96.4	<.0001	
nhfcl*bl	5	87.3	17.5	18.4	<.0001	

1963-2014 MODEL2010 + LT5LN5
Area 3'

Source	DF	Type III SS	Mean Square	F Value	Pr > F	R-Square
Model	290	62127.7	214.2	278.5	<.0001	0.379
						CV
yr	51	8270.9	162.2	210.9	<.0001	53.551
qt	3	1274.0	424.7	552.1	<.0001	
nhfcl	5	564.8	113.0	146.9	<.0001	
LT5LN5	66	23724.0	359.5	467.3	<.0001	
bl	1	0.5	0.5	0.6	0.4	
ml	1	96.5	96.5	125.4	<.0001	
yr*qt	153	3897.8	25.5	33.1	<.0001	
nhfcl*ml	5	243.8	48.8	63.4	<.0001	
nhfcl*bl	5	72.46881	14.49376	18.84	<.0001	

Table 4. ANOVA table of GLM for year based area specific CPUE standardization for each area for 1963-2014.

1963-2014 MODEL2010
Area 2

Source	DF	Type III SS	Mean Square	F Value	Pr > F	R-Square
Model	217	23977.9	110.5	151.1	<.0001	0.304
						CV
yr	50	7523.9	150.5	205.8	<.0001	47.817
qt	3	444.8	148.3	202.8	<.0001	
nhfcl	5	140.1	28.0	38.3	<.0001	
bl	1	11.3	11.3	15.5	<.0001	
ml	1	0.4	0.4	0.5	0.5	
yr*qt	147	3979.0	27.1	37.0	<.0001	
nhfcl*ml	5	47.0	9.4	12.9	<.0001	
nhfcl*bl	5	51.9	10.4	14.2	<.0001	

1963-2014 MODEL2010 + LT5LN5
Area 2

Source	DF	Type III SS	Mean Square	F Value	Pr > F	R-Square
Model	247	28717.0	116.3	173.9	<.0001	0.364
						CV
yr	50	6448.0	129.0	192.9	<.0001	45.721
qt	3	223.0	74.3	111.2	<.0001	
nhfcl	5	138.6	27.7	41.5	<.0001	
bl	1	9.3	9.3	13.9	0.0	
ml	1	0.1	0.1	0.1	0.7	
LT5LN5	30	4739.1	158.0	236.3	<.0001	
yr*qt	147	3241.2	22.0	33.0	<.0001	
nhfcl*ml	5	48.2	9.6	14.4	<.0001	
nhfcl*bl	5	27.19161	5.438323	8.14	<.0001	

1963-2014 MODEL2010
Area 3

Source	DF	Type III SS	Mean Square	F Value	Pr > F	R-Square
Model	224	23409.7	104.5	99.2	<.0001	0.280
						CV
yr	51	5081.1	99.6	94.6	<.0001	71.850
qt	5	356.7	71.3	67.7	<.0001	
nhfcl	1	0.1	0.1	0.1	0.8	
bl	1	14.1	14.1	13.4	0.0	
ml	153	5249.4	34.3	32.6	<.0001	
yr*qt	153	5282.5	34.5	32.8	<.0001	
nhfcl*ml	5	265.7	53.1	50.5	<.0001	
nhfcl*bl	5	25.7	5.1	4.9	0.0	

1963-2014 MODEL2010 + LT5LN5
Area 3

Source	DF	Type III SS	Mean Square	F Value	Pr > F	R-Square
Model	259	37061.5	143.1	175.7	<.0001	0.444
						CV
yr	51	2541.5	49.8	61.2	<.0001	63.183
qt	3	1922.1	640.7	786.7	<.0001	
nhfcl	5	159.8	32.0	39.2	<.0001	
bl	1	1.0	1.0	1.2	0.3	
ml	1	3.8	3.8	4.7	0.0	
LT5LN5	35	13651.8	390.1	479.0	<.0001	
yr*qt	153	2562.6	16.7	20.6	<.0001	
nhfcl*ml	5	123.7	24.7	30.4	<.0001	
nhfcl*bl	5	19.40329	3.88066	4.77	0.0002	

1963-2014 MODEL2010
Area 4

Source	DF	Type III SS	Mean Square	F Value	Pr > F	R-Square
Model	224	31226.7	139.4	90.4	<.0001	0.263
						CV
yr	51	8862.6	173.8	112.6	<.0001	-116.809
qt	3	2069.8	689.9	447.2	<.0001	
nhfcl	5	834.7	166.9	108.2	<.0001	
bl	1	17.0	17.0	11.0	0.0	
ml	1	41.1	41.1	26.6	<.0001	
yr*qt	153	10009.5	65.4	42.4	<.0001	
nhfcl*ml	5	78.6	15.7	10.2	<.0001	
nhfcl*bl	5	142.9	28.6	18.5	<.0001	

1963-2014 MODEL2010 + LT5LN5
Area 4

Source	DF	Type III SS	Mean Square	F Value	Pr > F	R-Square
Model	290	64868.2	223.7	235.0	<.0001	0.545
						CV
yr	51	3018.4	59.2	62.2	<.0001	-91.761
qt	3	473.3	157.8	165.7	<.0001	
nhfcl	5	81.2	16.2	17.1	<.0001	
bl	1	6.1	6.1	6.4	0.0	
ml	1	2.6	2.6	2.7	0.1	
LT5LN5	66	33641.5	509.7	535.4	<.0001	
yr*qt	153	2829.1	18.5	19.4	<.0001	
nhfcl*ml	5	66.5	13.3	14.0	<.0001	
nhfcl*bl	5	152.4974	30.49947	32.04	<.0001	

1963-2014 MODEL2010
Area 5

Source	DF	Type III SS	Mean Square	F Value	Pr > F	R-Square
Model	223	27027.6	121.2	190.7	<.0001	0.449
						CV
yr	51	4215.7	82.7	130.0	<.0001	70.807
qt	3	214.8	71.6	112.6	<.0001	
nhfcl	5	67.0	13.4	21.1	<.0001	
bl	1	16.3	16.3	25.7	<.0001	
ml	1	4.4	4.4	6.9	0.0	
yr*qt	152	1593.6	10.5	16.5	<.0001	
nhfcl*ml	5	24.9	5.0	7.8	<.0001	
nhfcl*bl	5	26.8	5.4	8.4	<.0001	

1963-2014 MODEL2010 + LT5LN5
Area 5

Source	DF	Type III SS	Mean Square	F Value	Pr > F	R-Square
Model	255	28156.3	110.4	179.7	<.0001	0.468
						CV
yr	51	4101.5	80.4	130.9	<.0001	69.613
qt	3	146.9	49.0	79.7	<.0001	
nhfcl	5	41.0	8.2	13.4	<.0001	
bl	1	9.9	9.9	16.1	<.0001	
ml	1	4.2	4.2	6.8	0.0	
LT5LN5	32	1128.6	35.3	57.4	<.0001	
yr*qt	152	1538.1	10.1	16.5	<.0001	
nhfcl*ml	5	27.4	5.5	8.9	<.0001	
nhfcl*bl	5	23.39342	4.678684	7.61	<.0001	

1963-2014 MODEL2010
Area 3'

Source	DF	Type III SS	Mean Square	F Value	Pr > F	R-Square
Model	224	38403.6	171.4	180.9	<.0001	0.234
						CV
yr	51	13909.1	272.7	287.8	<.0001	59.445
qt	3	5355.5	1785.2	1883.5	<.0001	
nhfcl	5	755.8	151.2	159.5	<.0001	
bl	1	4.0	4.0	4.2	0.0	
ml	1	171.1	171.1	180.6	<.0001	
yr*qt*area	153	5849.8	38.2	40.3	<.0001	
nhfcl*ml	5	456.6	91.3	96.4	<.0001	
nhfcl*bl	5	87.3	17.5	18.4	<.0001	

1963-2014 MODEL2010 + LT5LN5
Area 3'

Source	DF	Type III SS	Mean Square	F Value	Pr > F	R-Square
Model	290	62127.7	214.2	278.5	<.0001	0.379
						CV
yr	51	8270.9	162.2	210.9	<.0001	53.551
qt	3	1274.0	424.7	552.1	<.0001	
nhfcl	5	564.8	113.0	146.9	<.0001	
LT5LN5	66	23724.0	359.5	467.3	<.0001	
bl	1	0.5	0.5	0.6	0.4	
ml	1	96.5	96.5	125.4	<.0001	
yr*qt*area	153	3897.8	25.5	33.1	<.0001	
nhfcl*ml	5	243.8	48.8	63.4	<.0001	
nhfcl*bl	5	72.46881	14.49376	18.84	<.0001	

Table 5. ANOVA table of GLM for integreated CPUE standardization with year, quarter and area on whole IO for 1963-2014.

1963-2014 Integreated (1x1 degree per quarter)
Whole fishing ground (Area 2, 3, 4 & 5)

Source	DF	Type III SS	Mean Square	F Value	Pr > F	R-Square
Model	855	186714.6	218.4	268.0	<.0001	0.487
						CV
yr	51	11229.2	220.2	270.2	<.0001	81.531
qt	3	2479.5	826.5	1014.2	<.0001	
area	3	8788.3	2929.4	3594.7	<.0001	
nhfcl	5	462.5	92.5	113.5	<.0001	
bl	1	36.4	36.4	44.7	<.0001	
ml	1	95.8	95.8	117.6	<.0001	
yr*qt	153	4178.5	27.3	33.5	<.0001	
qt*area	9	4138.3	459.8	564.2	<.0001	
yr*area	152	7961.4	52.4	64.3	<.0001	
yr*qt*area	452	10494.3	23.2	28.5	<.0001	
area*nhfcl	15	1021.8	68.1	83.6	<.0001	
nhfcl*ml	5	339.7	67.9	83.4	<.0001	
nhfcl*bl	5	79.80037	15.96007	19.58	<.0001	

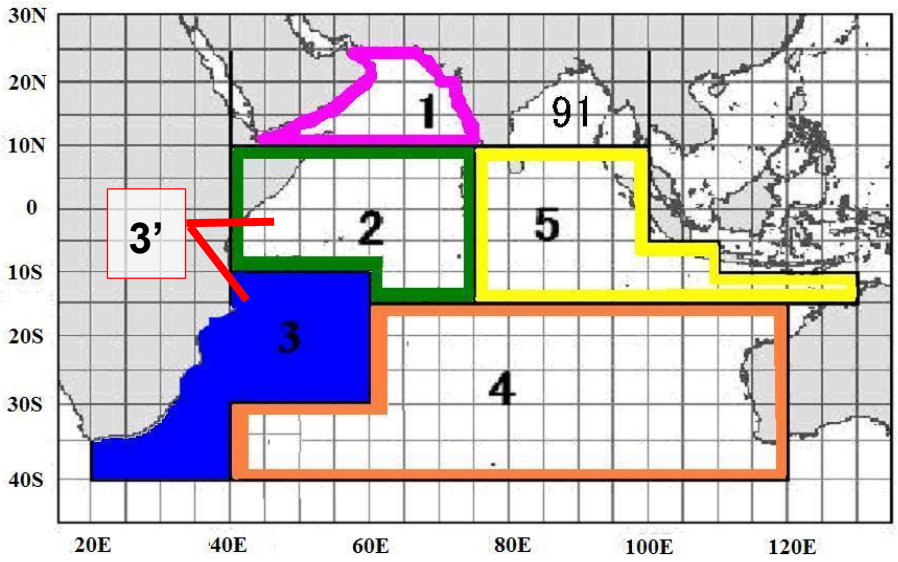


Fig. 1. Definition of areas used in this study. Main (areas 2, 3 and 5) and whole (areas 2-5) fishing ground categories in this paper. Alternative area 3' means combined area 2 and 3.

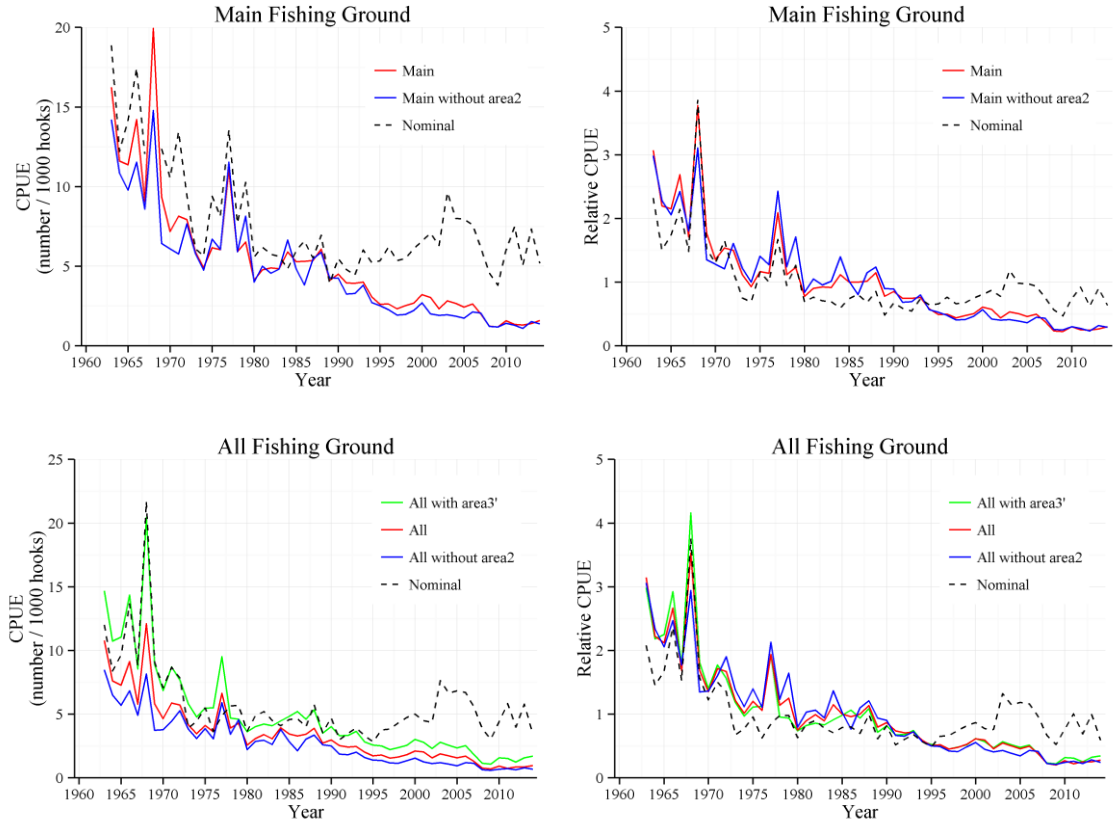


Fig. 2. Annual based area aggregated CPUE in number for 1963-2014 standardized for main (top) and whole (bottom) fishing grounds expressed in real (left figure) and relative (right figure) scale overlaid with nominal CPUE.

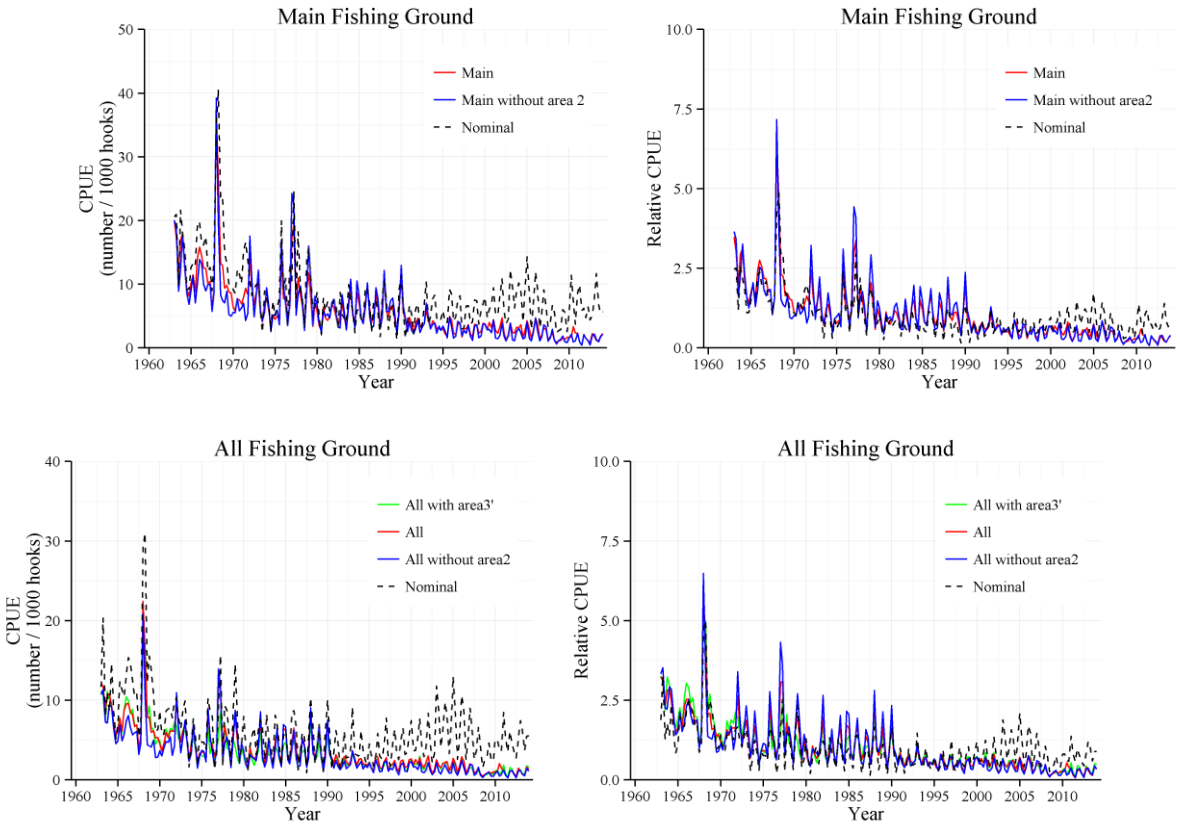


Fig. 3. Quarter based CPUE in number for 1963-2014 standardized for main and whole (with and without area 2, and with area 3') fishing grounds expressed in real scale overlaid with nominal CPUE.

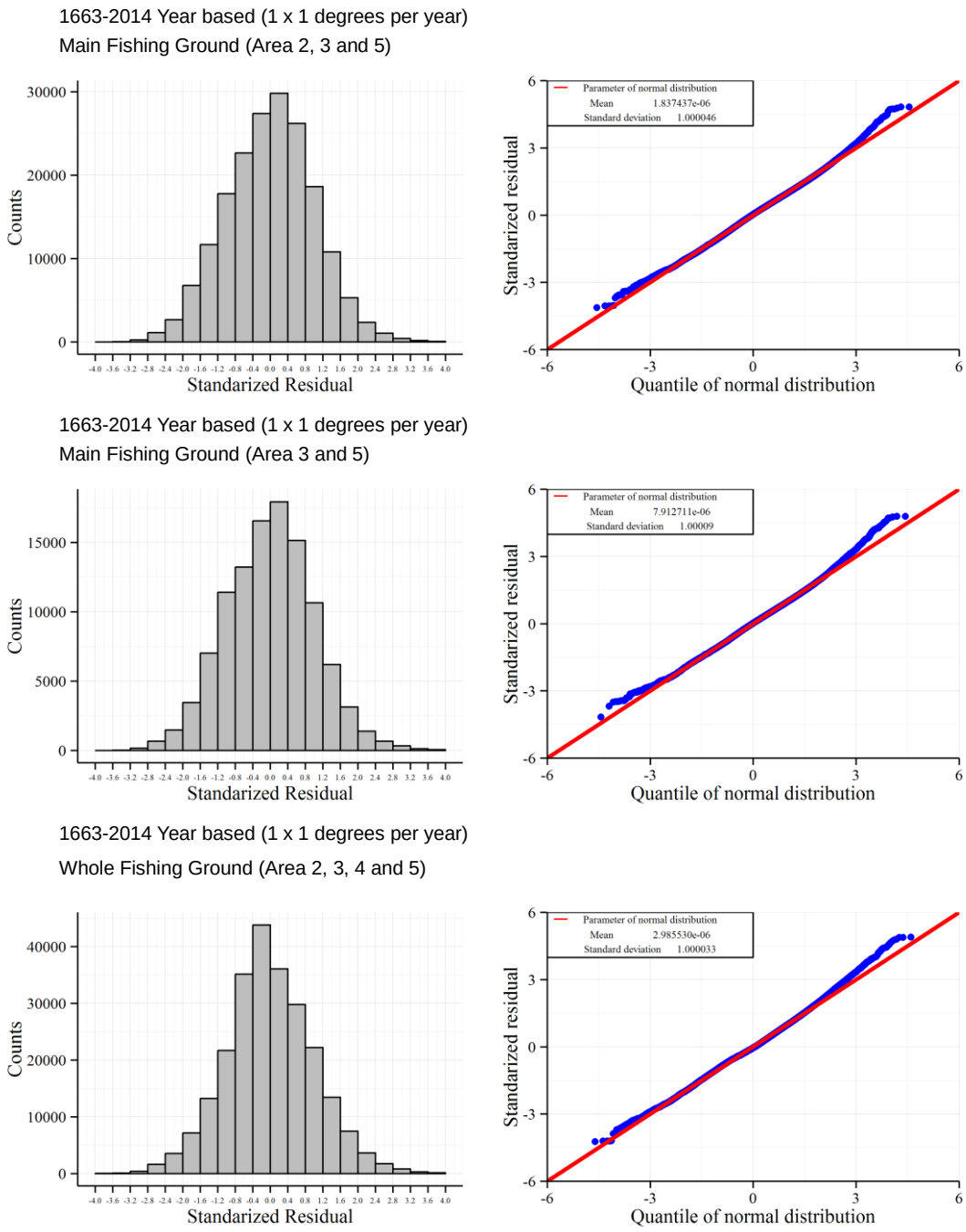
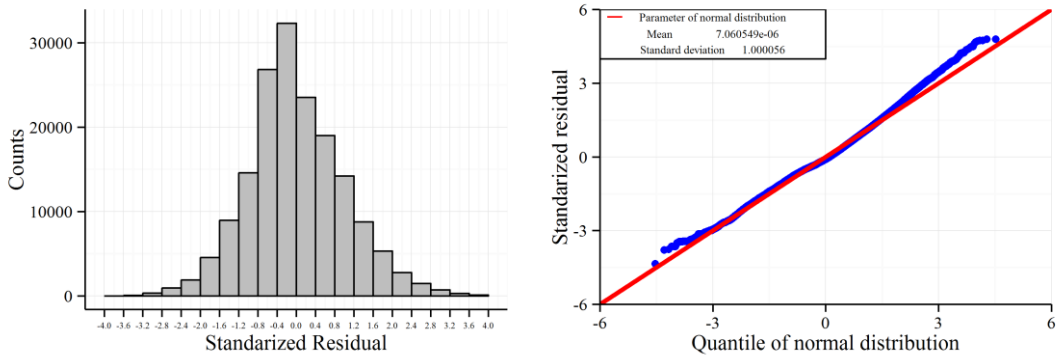


Fig. 4. Standardized residuals of annual based CPUE standardization for main and whole (with and without area 2) fishing ground.

1663-2014 Year based (1 x 1 degrees per year)

Whole Fishing Ground (Area 3, 4 and 5)



1663-2014 Year based (1 x 1 degrees per year)

Whole Fishing Ground (Area 3'(=2+3), 4 and 5)

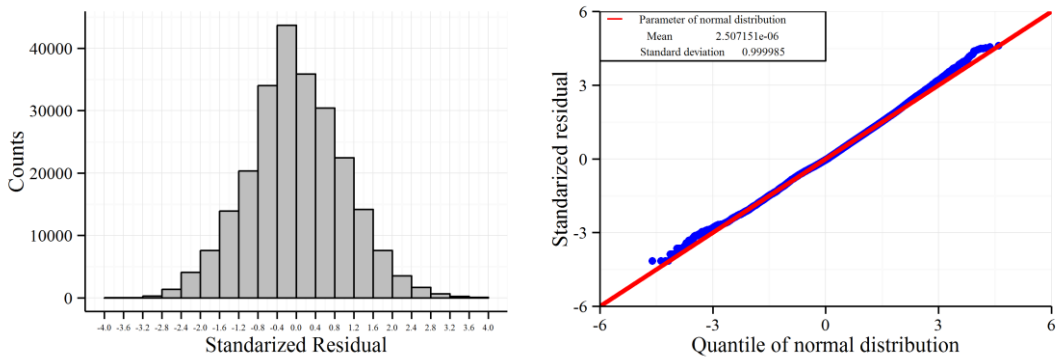
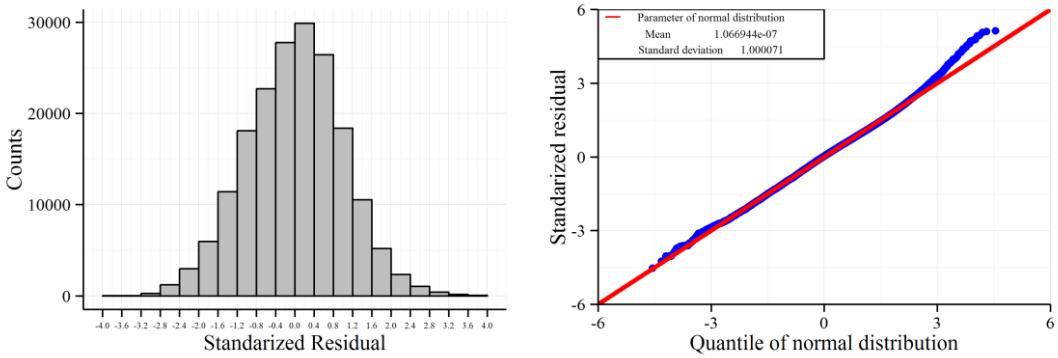
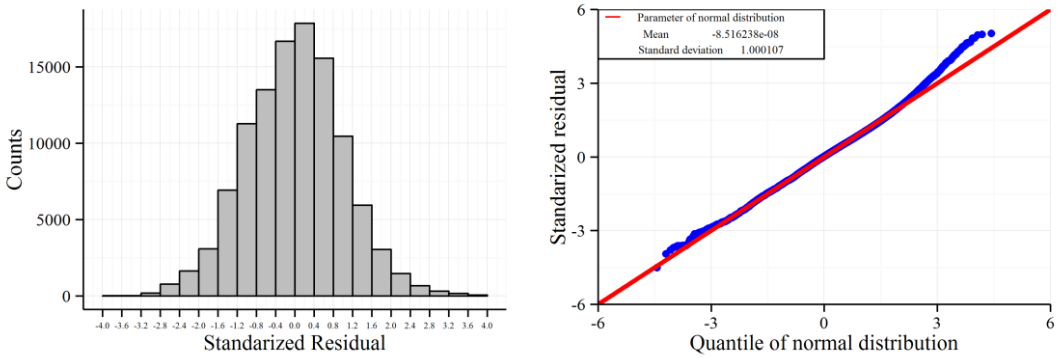


Fig. 5. Continued.

1663-2014 Quarter based (1 x 1 degrees per quarter)
Main Fishing Ground (Area 2, 3 and 5)



1663-2014 Quarter based (1 x 1 degrees per quarter)
Main Fishing Ground (Area 3 and 5)



1663-2014 Quarter based (1 x 1 degrees per quarter)
Whole Fishing Ground (Area 2, 3, 4 and 5)

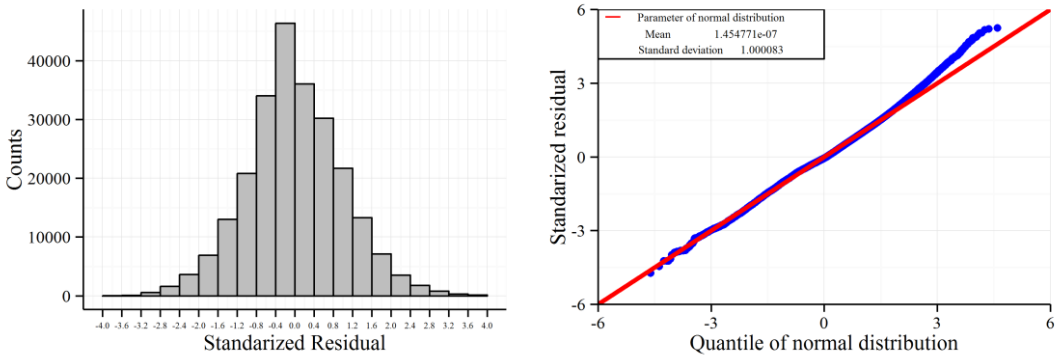
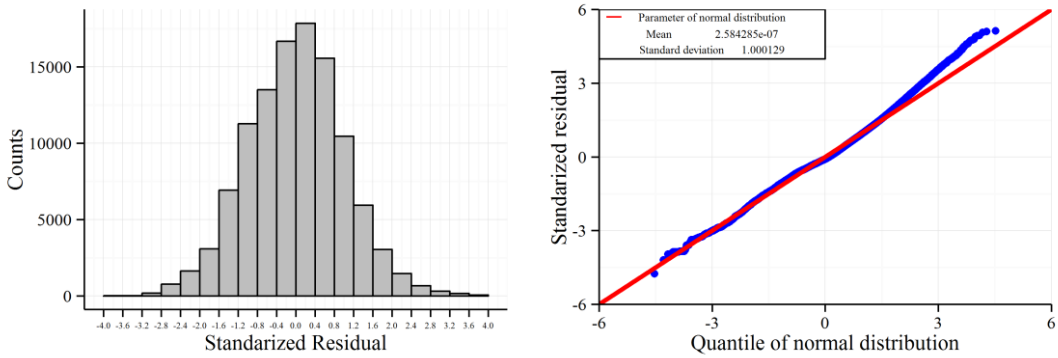


Fig. 6. Standardized residuals of quarter based CPUE standardization for main and whole (with and without area 2, and with area 3') fishing grounds.

1663-2014 Quarter based (1 x 1 degrees per quarter)

Whole Fishing Ground (Area 3, 4 and 5)



1663-2014 Quarter based (1 x 1 degrees per quarter)

Whole Fishing Ground (Area 3'(=2+3), 4 and 5)

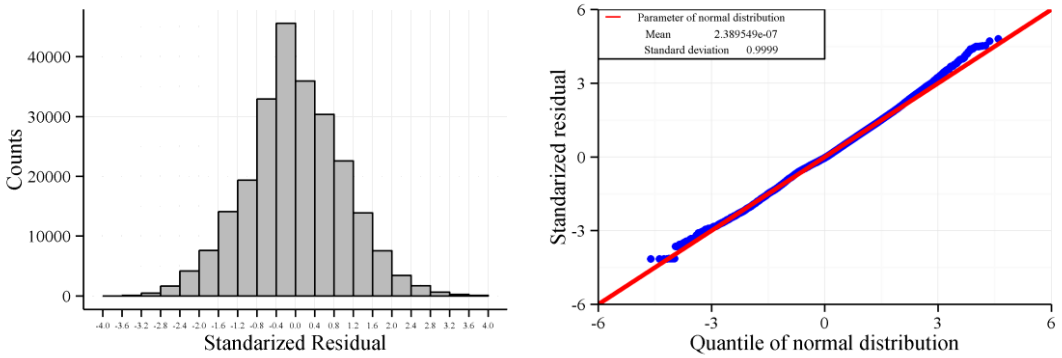


Fig. 7 Continued.

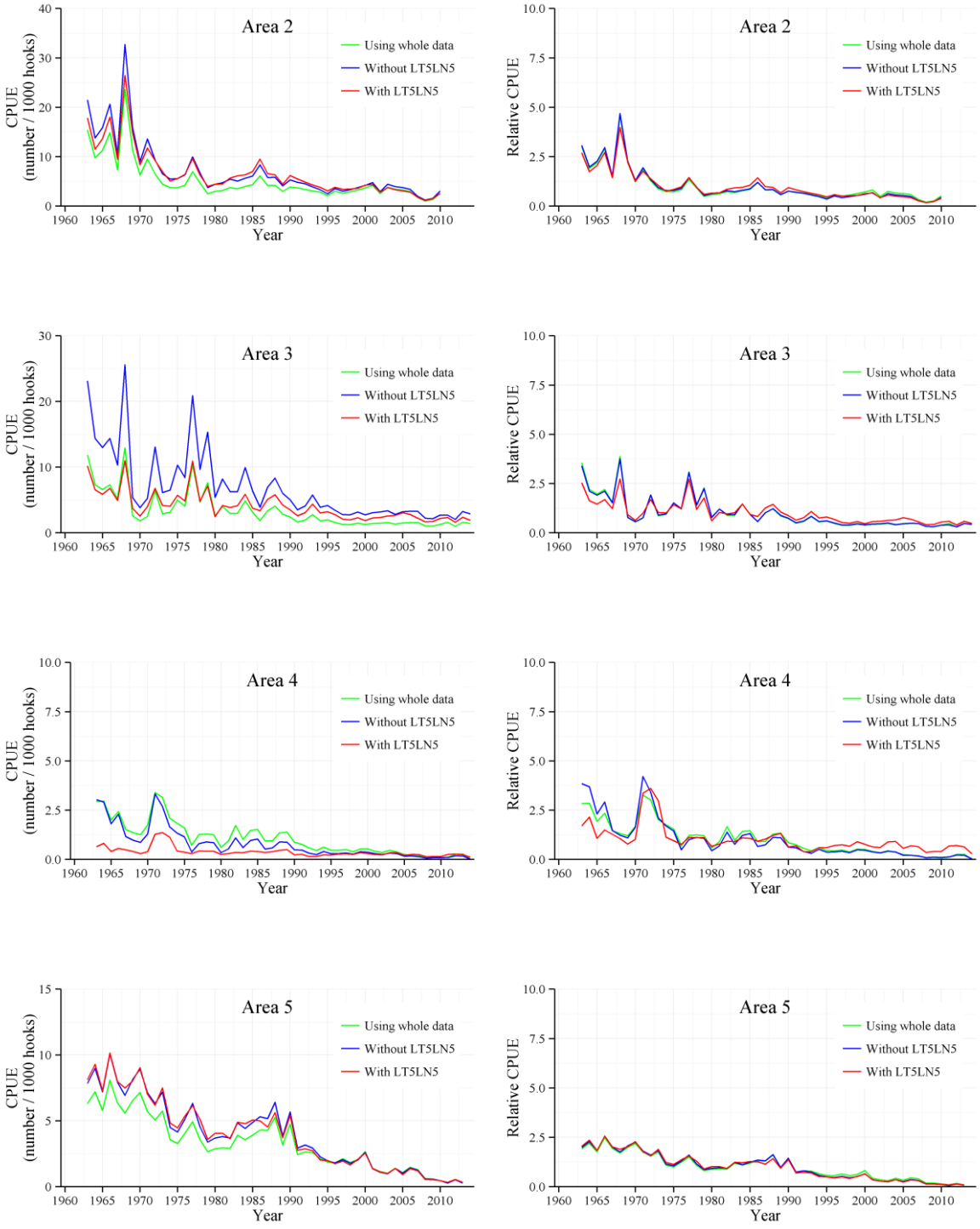


Fig. 6. Standardized year based CPUE in number for 1963-2014 for each five areas (with and without LT5LN5 and calcurated with whole data without LT5LN5) expressed in relative (left figure) and real

(right figure) scale.

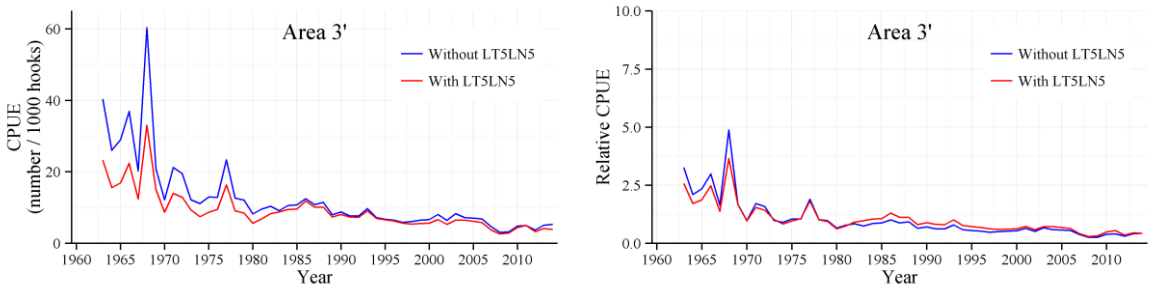


Fig. 8. Continued.

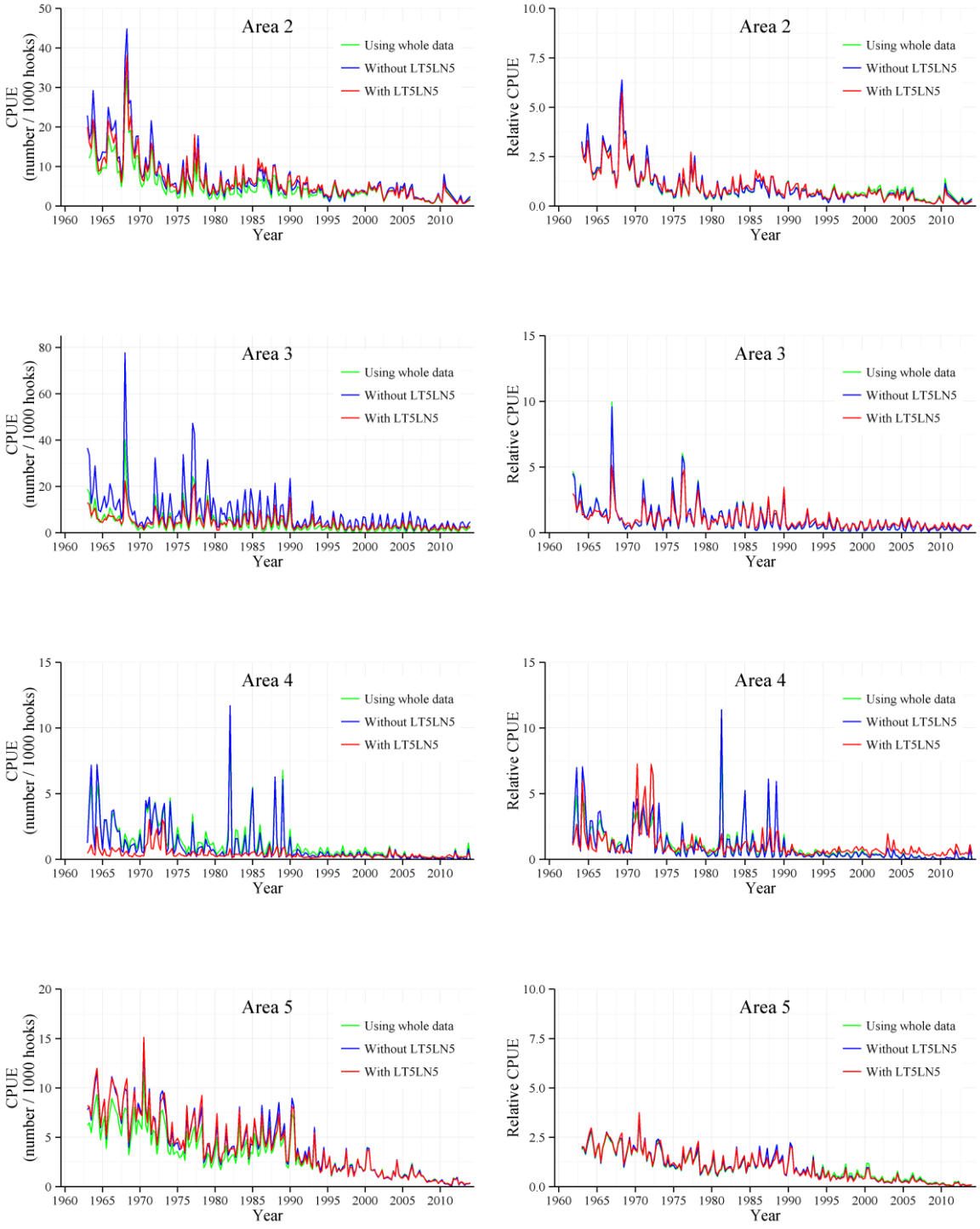


Fig. 7. Standardized quarter based CPUE in number for 1963-2014 (without 2011 – 2012Q1 and 2013Q3 for Area 2; because of no data) for each five areas with and without LT5LN5, and calculated

by with using whole data without LT5LN5 expressed in relative (left figure) and real (right figure) scale.

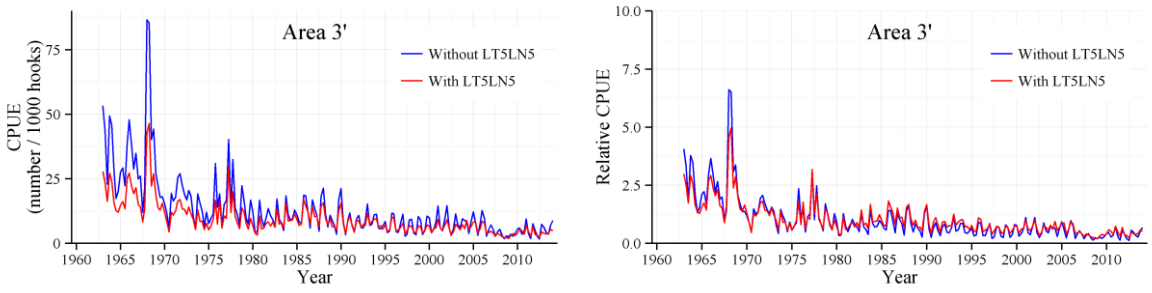


Fig. 9 Continued

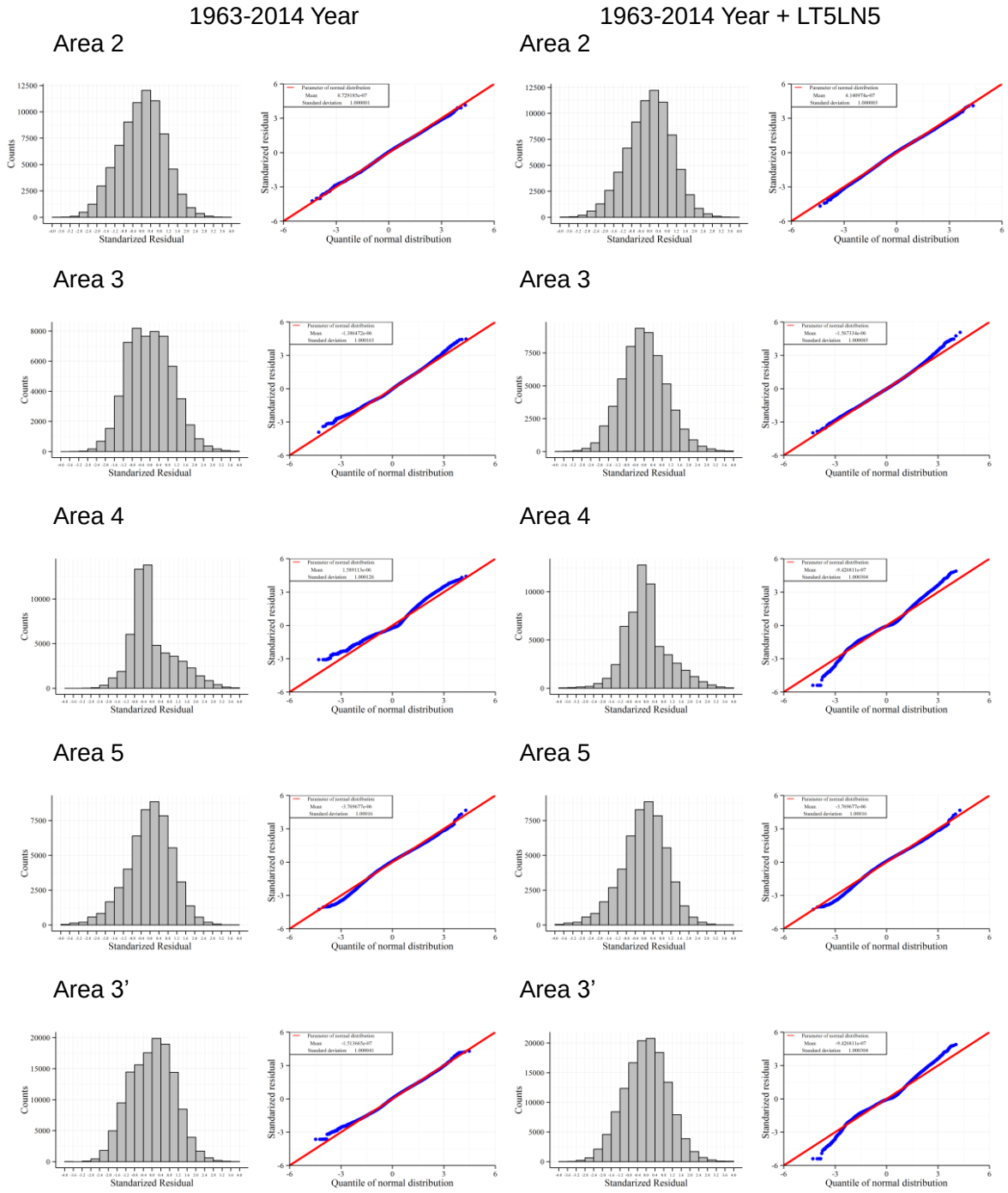


Fig. 8. Standardized residuals of year based CPUE standardization for each of four areas with and without LT5LN5 expressed as histograms and QQ plots.

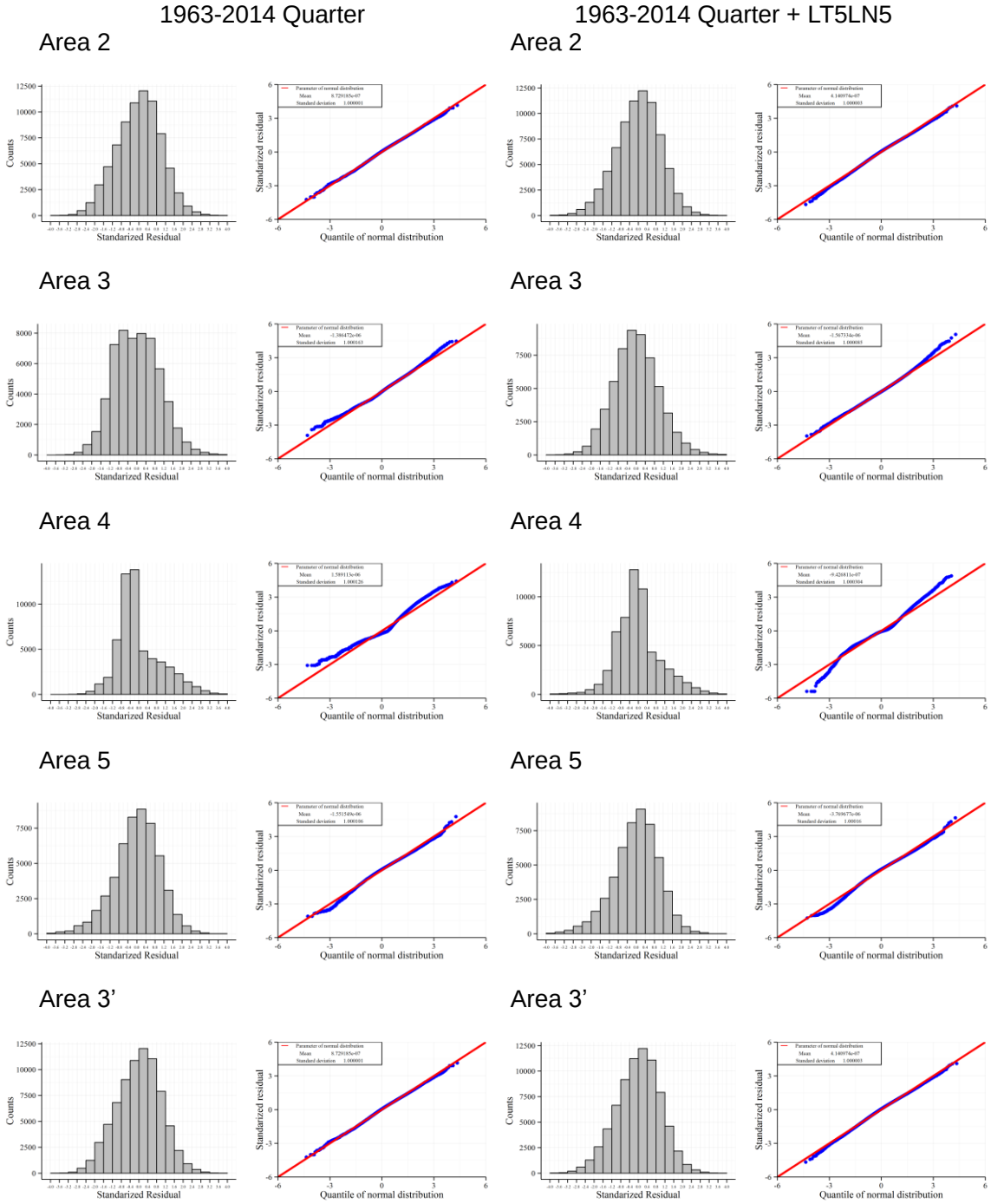


Fig. 9. Standardized residuals of quarter based CPUE standardization for each of five areas with and without LT5LN5 expressed as histograms and QQ plots.

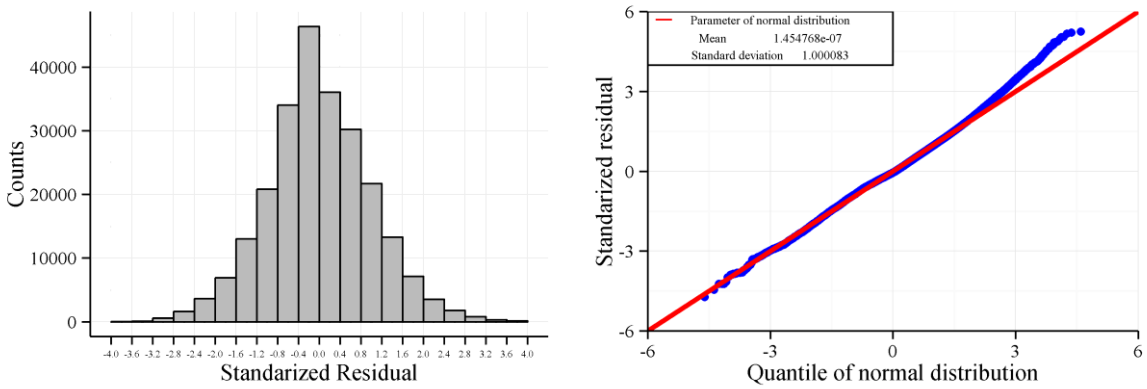


Fig. 10. Standardized residuals of area and quarter based CPUE standardization for each of five areas calcurated with using whole data expressed as histograms and QQ plots.

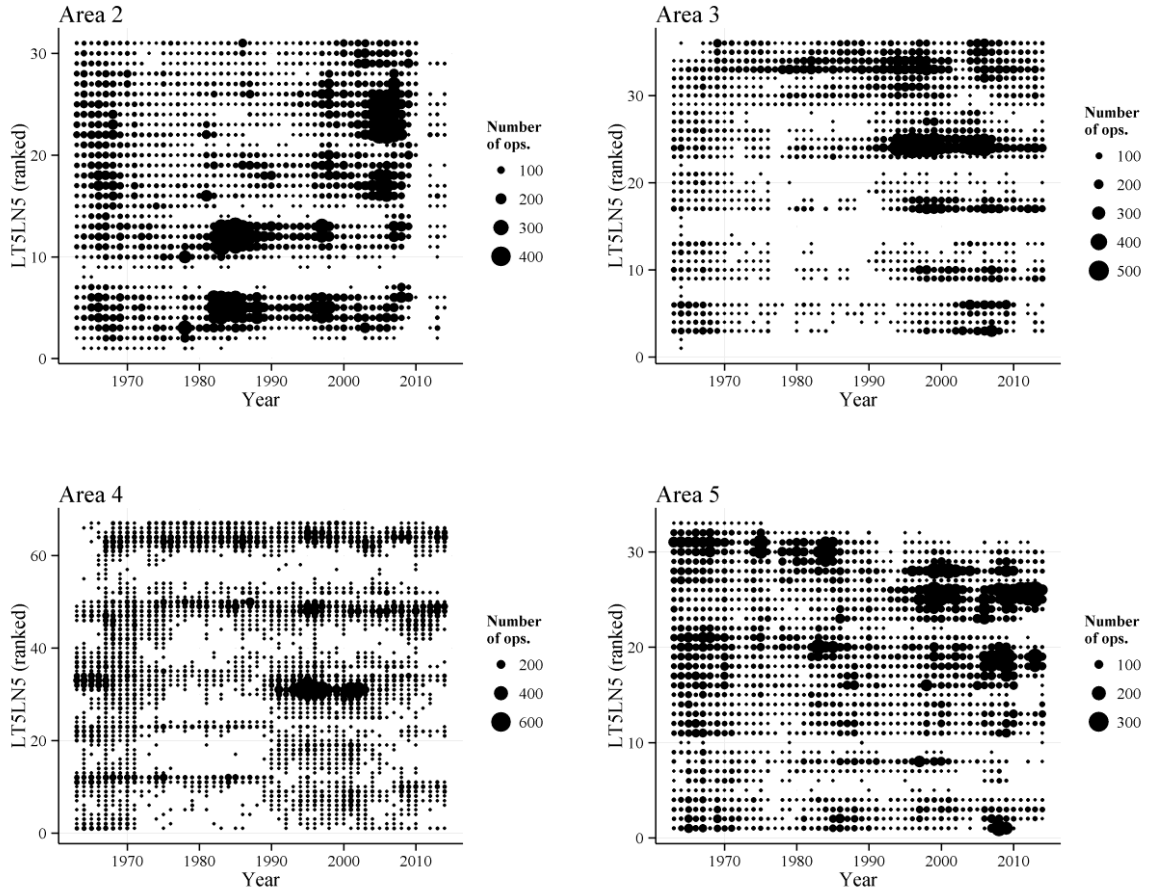


Fig. 11. Historical change in the number of observation of each LT5LN5 factor in each area.

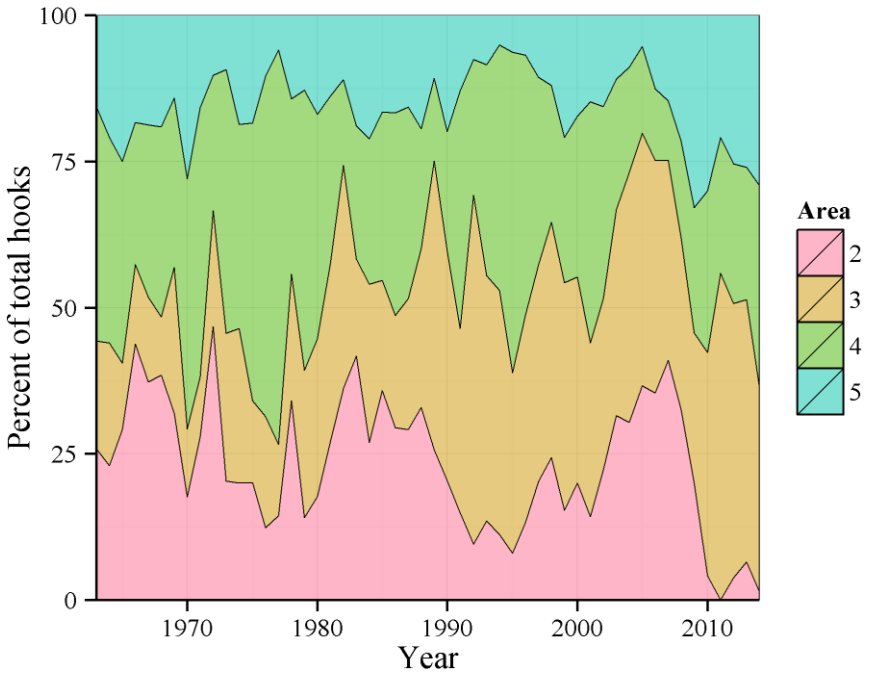


Fig. 10. Historical change in the proportion of fishing effort (number of hooks) in each area.

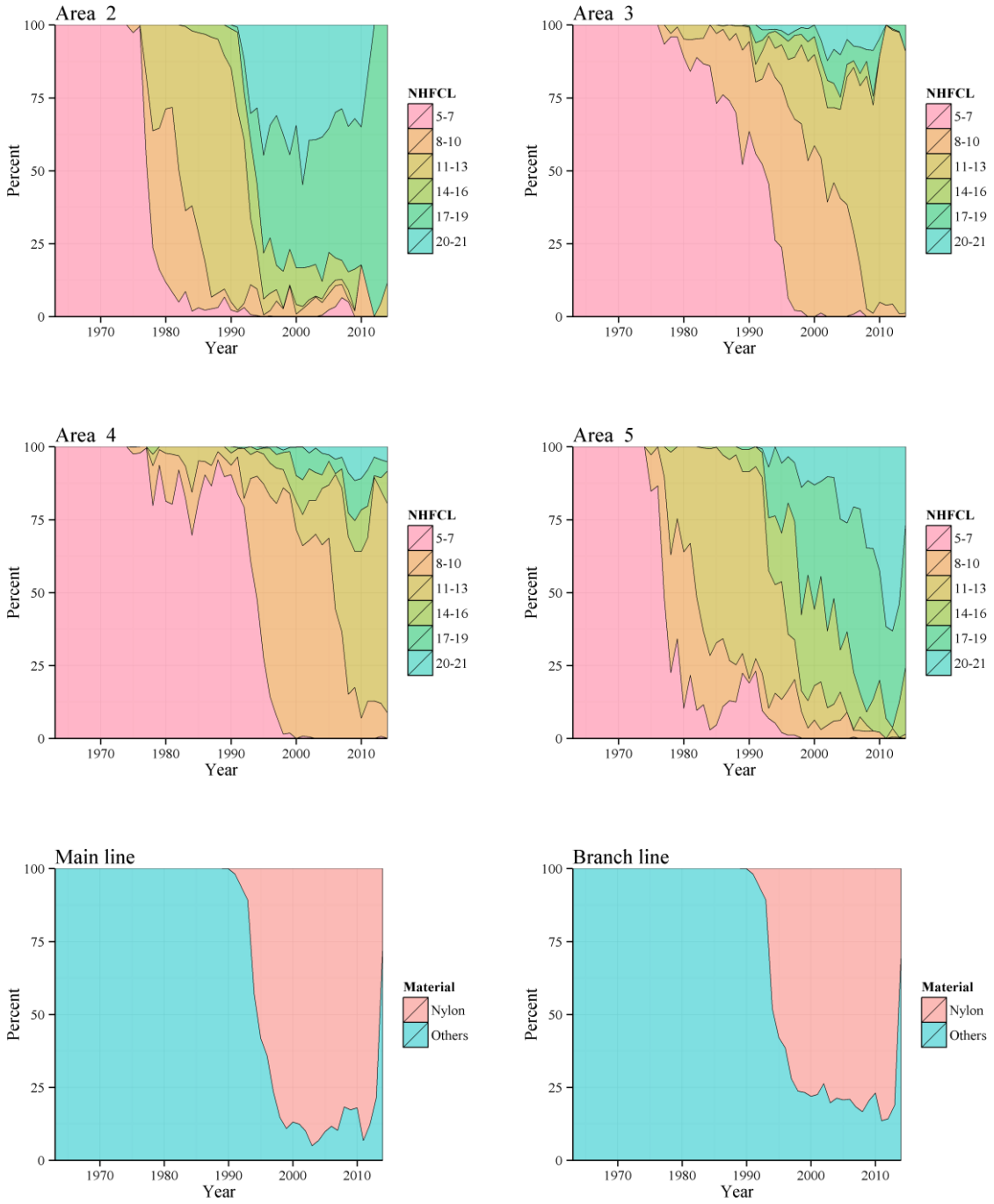
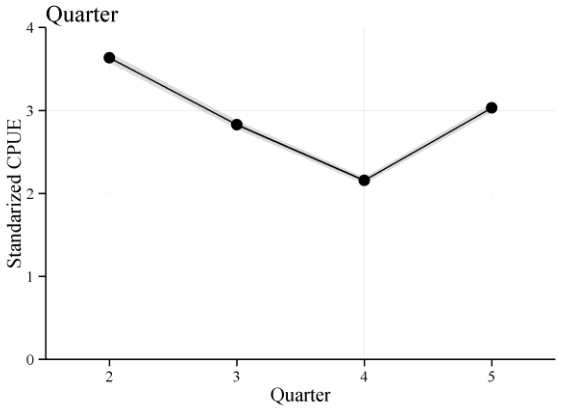
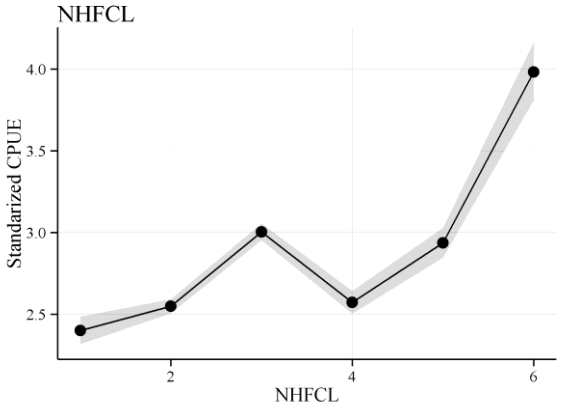
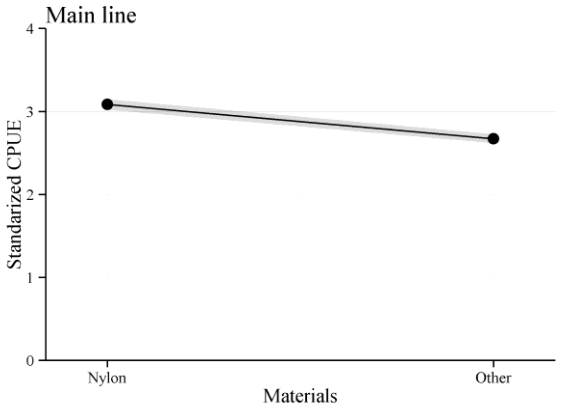
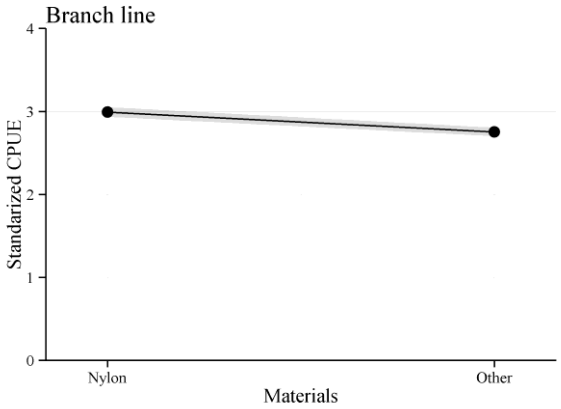


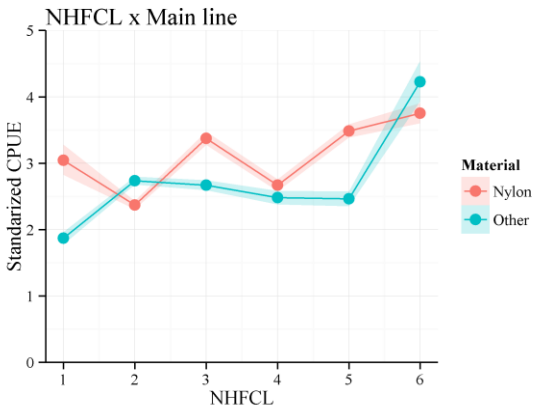
Fig. 13. Historical changes in the proportion of fishing effort by fishing gear (NHFCL and gear materials (main-line and branch-line).

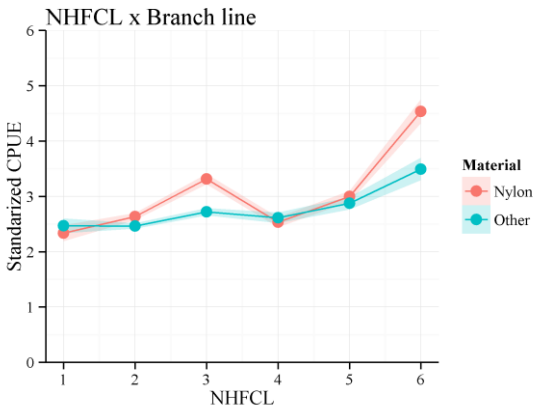

Quarter
Standarized CPUE
Quarter


NHFCL
Standarized CPUE
NHFCL


Main line
Standarized CPUE
Nylon
Other
Materials


Branch line
Standarized CPUE
Nylon
Other
Materials


NHFCL x Main line
Standarized CPUE
NHFCL
Material
Nylon
Other


NHFCL x Branch line
Standarized CPUE
NHFCL
Material
Nylon
Other

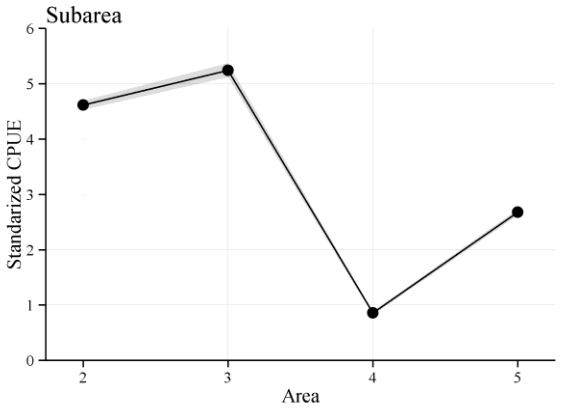


Fig. 14. Trends of CPUE standardized for each of quarter, NHFCL, gear (main-line and branch-line) materials and interaction of NHFCL gear materials, and area (whole fishing ground, 1963-2014).

Appendix table 1. Annual value of yellowfin CPUE for main and whole fishing grounds with and without area 2 for 1963-2014.

	Main fishing ground						Whole Indian Ocean							
	CPUE (real scale)			Relative CPUE			CPUE (real scale)				Relative CPUE			
Year	Nominal	stdCPUE	stdCPUE without Area2	Nominal	stdCPUE	stdCPUE without Area2	Nominal	Std CPUE	stdCPUE without Area2	stdCPUE with Area3'	Nominal	Std CPUE	stdCPUE without Area2	stdCPUE with Area3'
1963	18.870	16.238	14.206	2.320	3.070	2.986	12.014	10.777	8.481	14.672	2.078	3.146	3.063	2.987
1964	12.217	11.611	10.843	1.502	2.195	2.279	8.388	7.621	6.486	10.729	1.451	2.225	2.342	2.184
1965	14.170	11.377	9.781	1.742	2.151	2.056	9.650	7.265	5.695	11.044	1.669	2.121	2.057	2.248
1966	17.436	14.210	11.526	2.144	2.687	2.423	13.663	9.132	6.833	14.354	2.363	2.666	2.468	2.922
1967	12.046	9.044	8.582	1.481	1.710	1.804	8.810	5.771	4.909	8.558	1.524	1.685	1.773	1.742
1968	31.382	19.937	14.779	3.859	3.769	3.107	21.696	12.086	8.137	20.429	3.752	3.528	2.939	4.159
1969	12.362	9.350	6.436	1.520	1.768	1.353	9.079	5.800	3.726	8.925	1.570	1.693	1.346	1.817
1970	10.557	7.172	6.095	1.298	1.356	1.281	7.077	4.636	3.772	6.855	1.224	1.353	1.362	1.395
1971	13.433	8.132	5.762	1.652	1.537	1.211	8.674	5.874	4.433	8.703	1.500	1.715	1.601	1.772
1972	9.445	7.924	7.652	1.161	1.498	1.608	7.826	5.714	5.266	7.677	1.353	1.668	1.902	1.563
1973	6.109	5.905	5.798	0.751	1.116	1.219	3.905	4.156	3.818	5.812	0.675	1.213	1.379	1.183
1974	5.646	4.908	4.747	0.694	0.928	0.998	4.431	3.467	3.089	4.767	0.766	1.012	1.116	0.970
1975	9.394	6.155	6.687	1.155	1.164	1.406	5.522	4.109	3.865	5.471	0.955	1.199	1.396	1.114
1976	8.129	6.031	6.059	1.000	1.140	1.274	3.619	3.627	3.064	5.502	0.626	1.059	1.107	1.120
1977	13.559	11.058	11.540	1.667	2.090	2.426	4.868	6.635	5.898	9.504	0.842	1.937	2.130	1.935
1978	7.696	5.907	5.912	0.946	1.117	1.243	5.656	3.900	3.407	4.691	0.978	1.138	1.230	0.955
1979	10.264	6.520	8.134	1.262	1.233	1.710	5.665	4.278	4.545	4.605	0.980	1.249	1.642	0.937
1980	5.597	4.119	3.995	0.688	0.779	0.840	3.641	2.575	2.204	3.618	0.630	0.752	0.796	0.736
1981	6.195	4.774	4.991	0.762	0.903	1.049	4.864	3.074	2.849	4.027	0.841	0.897	1.029	0.820
1982	5.752	4.898	4.548	0.707	0.926	0.956	5.210	3.389	2.939	4.213	0.901	0.989	1.062	0.858
1983	5.625	4.843	4.826	0.692	0.916	1.014	4.502	3.056	2.606	4.088	0.779	0.892	0.941	0.832
1984	4.838	5.896	6.638	0.595	1.115	1.395	4.087	3.930	3.787	4.469	0.707	1.147	1.368	0.910
1985	5.986	5.282	4.823	0.736	0.999	1.014	4.571	3.431	2.845	4.825	0.791	1.001	1.028	0.982
1986	6.587	5.297	3.814	0.810	1.001	0.802	4.633	3.287	2.117	5.211	0.801	0.960	0.765	1.061
1987	5.526	5.356	5.448	0.679	1.013	1.145	4.018	3.424	3.045	4.603	0.695	0.999	1.100	0.937
1988	6.948	6.067	5.878	0.854	1.147	1.236	5.746	3.883	3.346	5.337	0.994	1.133	1.209	1.086
1989	3.916	4.103	4.272	0.482	0.776	0.898	3.542	2.722	2.593	3.508	0.613	0.795	0.936	0.714
1990	5.481	4.504	4.256	0.674	0.852	0.895	4.716	2.962	2.494	4.014	0.816	0.865	0.901	0.817
1991	4.783	3.954	3.247	0.588	0.748	0.682	2.996	2.520	1.847	3.304	0.518	0.736	0.667	0.673
1992	4.448	3.933	3.292	0.547	0.744	0.692	3.477	2.421	1.805	3.334	0.601	0.707	0.652	0.679
1993	6.012	4.008	3.800	0.739	0.758	0.799	3.926	2.446	2.003	3.637	0.679	0.714	0.723	0.740
1994	5.229	3.073	2.706	0.643	0.581	0.569	3.292	2.020	1.576	2.815	0.569	0.590	0.569	0.573
1995	5.340	2.606	2.513	0.657	0.493	0.528	2.826	1.729	1.387	2.567	0.489	0.505	0.501	0.523
1996	6.221	2.634	2.276	0.765	0.498	0.478	3.760	1.778	1.361	2.512	0.650	0.519	0.492	0.511
1997	5.358	2.314	1.934	0.659	0.437	0.407	3.819	1.550	1.165	2.220	0.660	0.452	0.421	0.452
1998	5.485	2.511	1.961	0.674	0.475	0.412	4.307	1.635	1.139	2.371	0.745	0.477	0.411	0.483
1999	6.093	2.675	2.209	0.749	0.506	0.464	4.733	1.812	1.348	2.543	0.819	0.529	0.487	0.518
2000	6.585	3.217	2.698	0.810	0.608	0.567	5.008	2.102	1.535	3.019	0.866	0.614	0.554	0.615
2001	7.071	3.032	1.999	0.870	0.573	0.420	4.478	2.031	1.242	2.783	0.774	0.593	0.449	0.566
2002	6.304	2.319	1.916	0.775	0.438	0.403	4.364	1.562	1.127	2.304	0.755	0.456	0.407	0.469
2003	9.635	2.821	1.949	1.185	0.533	0.410	7.631	1.867	1.188	2.782	1.320	0.545	0.429	0.566
2004	8.001	2.662	1.854	0.984	0.503	0.390	6.642	1.721	1.068	2.548	1.149	0.502	0.386	0.519
2005	7.967	2.437	1.728	0.980	0.461	0.363	6.837	1.562	0.948	2.349	1.182	0.456	0.343	0.478
2006	7.579	2.626	2.121	0.932	0.496	0.446	6.699	1.701	1.183	2.518	1.159	0.497	0.427	0.512
2007	6.154	1.999	2.056	0.757	0.378	0.432	5.571	1.308	1.146	1.834	0.963	0.382	0.414	0.373
2008	4.570	1.235	1.208	0.562	0.233	0.254	3.842	0.760	0.625	1.137	0.664	0.222	0.226	0.232
2009	3.799	1.174	1.184	0.467	0.222	0.249	3.031	0.694	0.579	1.084	0.524	0.203	0.209	0.221
2010	6.022	1.578	1.415	0.741	0.298	0.298	4.404	0.916	0.663	1.567	0.762	0.267	0.239	0.319
2011	7.493	1.336	1.295	0.921	0.253	0.272	5.819	0.747	0.715	1.517	1.006	0.218	0.258	0.309
2012	5.049	1.303	1.096	0.621	0.246	0.230	3.972	0.856	0.624	1.229	0.687	0.250	0.225	0.250
2013	7.046	1.395	1.515	0.903	0.264	0.318	5.771	0.860	0.777	1.570	0.998	0.251	0.281	0.320
2014	5.174	1.592	1.375	0.636	0.301	0.289	3.409	0.953	0.674	1.697	0.590	0.278	0.243	0.345

Appendix table 2. Quarterly value of yellowfin CPUE for main and whole fishing grounds with and without area 2 for 1963-2014.

		Main Area			Whole Area			
Year	QT	Nominal	stdCPUE	stdCPUE without Area2	Nominal	stdCPUE	stdCPUE without Area2	stdCPUE with Area3'
1963	1	20.559	20.032	19.976	11.656	12.207	10.718	11.192
1963	2	20.916	17.378	18.657	20.307	11.696	11.317	10.608
1963	3	9.788	11.519	8.894	7.887	8.868	7.235	7.477
1963	4	21.614	16.890	12.287	10.957	10.596	7.158	11.092
1964	1	17.978	17.882	17.838	8.573	10.769	9.380	10.224
1964	2	15.375	12.289	12.749	14.612	9.319	9.130	9.188
1964	3	9.143	9.096	8.577	8.858	7.074	6.534	6.510
1964	4	9.246	8.115	6.842	5.146	5.608	4.530	5.544
1965	1	12.657	10.103	9.047	6.816	6.158	4.867	6.552
1965	2	13.205	11.479	11.184	12.341	7.705	6.876	7.750
1965	3	12.753	8.734	7.063	11.294	6.156	4.887	5.870
1965	4	18.973	14.033	9.906	10.425	8.711	5.694	8.901
1966	1	19.844	15.813	13.887	13.232	9.543	7.400	10.427
1966	2	16.237	14.508	13.265	15.370	9.576	8.077	9.967
1966	3	16.173	12.564	9.991	14.644	8.590	6.615	8.291
1966	4	17.447	12.407	8.918	12.471	8.146	5.632	8.848
1967	1	12.027	10.131	9.922	10.439	6.669	5.906	6.824
1967	2	12.616	10.384	10.018	10.756	6.899	6.055	6.784
1967	3	8.970	5.960	5.710	5.397	3.743	3.174	3.604
1967	4	13.805	9.155	8.693	6.738	5.565	4.605	5.659
1968	1	34.880	36.865	39.212	29.374	22.436	20.847	17.637
1968	2	40.506	26.569	19.780	30.976	15.883	10.513	17.142
1968	3	23.444	13.318	8.345	12.210	7.870	4.397	7.880
1968	4	23.701	12.882	7.401	15.536	7.869	4.237	9.244
1969	1	14.726	9.397	7.043	13.699	5.954	4.105	6.655
1969	2	13.429	9.789	8.892	10.704	6.143	4.971	6.200
1969	3	10.061	8.768	5.211	6.001	5.239	2.792	4.469
1969	4	9.851	8.639	4.975	6.309	5.323	2.866	4.990
1970	1	9.192	6.451	5.520	8.679	4.508	3.643	4.939
1970	2	8.512	5.758	5.485	5.628	3.601	3.010	3.643
1970	3	12.332	7.598	7.746	5.757	4.610	4.028	3.934
1970	4	11.687	7.553	5.787	8.628	5.929	4.804	6.378
1971	1	10.086	6.892	6.242	8.914	5.286	4.714	5.423
1971	2	15.068	7.927	7.029	8.977	6.120	5.397	6.463
1971	3	16.599	9.337	4.273	7.781	6.160	3.060	6.111
1971	4	13.847	8.333	5.430	9.773	6.060	4.236	7.271
1972	1	10.371	14.064	17.556	10.329	9.958	10.927	6.781
1972	2	8.204	9.329	10.538	7.800	6.575	6.613	5.189
1972	3	9.336	6.724	4.886	6.398	4.735	3.388	4.850
1972	4	9.856	8.585	8.134	8.612	5.925	5.127	6.261
1973	1	10.031	10.210	12.178	9.883	7.095	7.474	6.106
1973	2	6.171	5.649	5.979	5.684	4.809	4.818	4.934
1973	3	2.393	4.082	4.179	1.593	2.613	2.330	2.569
1973	4	8.942	6.971	5.648	4.322	4.459	3.284	4.545
1974	1	7.537	7.796	9.430	7.715	6.372	6.944	5.201
1974	2	6.973	5.840	6.390	5.398	4.180	4.104	3.951
1974	3	2.546	3.381	2.559	1.721	2.136	1.475	2.077
1974	4	7.343	5.096	5.015	5.650	3.326	2.904	3.247
1975	1	4.977	4.479	5.332	4.702	3.488	3.683	3.026
1975	2	6.392	4.954	5.900	4.703	3.445	3.576	2.898
1975	3	7.715	4.600	3.633	3.745	3.073	2.264	3.110
1975	4	19.998	14.721	16.921	10.213	8.987	8.913	6.513
1976	1	9.196	7.757	10.203	8.735	4.904	5.527	3.301
1976	2	10.913	7.484	6.922	7.998	4.379	3.453	4.681
1976	3	3.775	4.658	3.476	1.281	2.944	2.012	2.298
1976	4	13.052	6.537	7.031	2.904	3.862	3.519	3.688
1977	1	10.554	17.115	24.227	9.245	11.510	13.916	5.335
1977	2	24.648	19.402	22.362	15.636	11.698	11.642	8.649
1977	3	7.910	6.178	5.125	1.675	3.579	2.495	3.117
1977	4	18.206	10.915	8.382	9.309	6.747	4.598	7.044
1978	1	9.155	8.360	9.683	8.720	5.328	5.356	3.965
1978	2	7.599	6.560	7.186	5.667	4.203	3.982	3.749
1978	3	3.202	3.290	2.740	1.985	2.108	1.551	1.817
1978	4	13.653	9.230	8.898	8.629	6.077	5.201	5.031
1979	1	15.742	11.771	15.993	14.505	7.514	8.719	4.062
1979	2	10.340	7.667	10.274	7.359	4.873	5.541	2.695
1979	3	6.070	3.343	3.517	2.324	2.275	2.084	2.039
1979	4	6.460	6.993	8.084	4.059	4.574	4.585	3.905
1980	1	8.749	5.732	6.808	7.977	3.544	3.604	3.052
1980	2	4.966	3.464	3.968	4.129	2.080	2.009	1.981
1980	3	2.050	2.698	2.411	1.242	1.718	1.347	1.456
1980	4	7.813	6.453	5.758	4.141	4.007	3.145	3.456

Appendix table 2. Quarterly value of yellowfin CPUE for main and whole fishing grounds with and without area 2 for 1963-2014.(continued)

		Main Area			Whole Area			
Year	QT	Nominal	stdCPUE	stdCPUE without Area2	Nominal	stdCPUE	stdCPUE without Area2	stdCPUE with Area3'
1981	1	5.766	4.690	4.990	5.452	3.071	2.135	2.588
1981	2	7.313	4.278	5.302	6.525	2.567	1.083	1.829
1981	3	5.751	4.926	4.629	3.096	2.995	1.023	2.741
1981	4	6.705	6.711	7.079	6.513	4.743	2.106	3.680
1982	1	7.455	6.362	7.657	7.555	7.433	2.290	6.197
1982	2	6.750	5.015	5.519	6.505	2.982	1.623	2.362
1982	3	3.027	3.507	3.202	2.415	2.089	1.630	1.929
1982	4	8.699	5.111	3.116	8.203	3.748	1.288	4.197
1983	1	5.234	6.895	8.335	5.203	4.854	2.260	3.141
1983	2	4.553	4.933	5.429	4.026	3.012	0.987	3.049
1983	3	3.926	2.894	2.813	2.239	1.751	0.893	1.602
1983	4	9.916	7.456	6.688	8.099	4.715	1.173	4.217
1984	1	7.157	8.660	10.755	7.093	6.034	2.144	3.761
1984	2	5.889	5.156	5.466	4.435	3.120	1.137	2.762
1984	3	2.357	4.249	3.093	1.716	2.608	0.656	2.245
1984	4	5.909	8.643	10.481	5.481	6.476	0.961	4.339
1985	1	6.058	6.949	8.055	6.178	6.183	2.103	4.735
1985	2	4.483	4.631	4.658	3.282	2.941	1.058	2.901
1985	3	4.098	4.114	3.807	2.305	2.508	0.724	2.366
1985	4	9.556	7.278	6.490	8.455	4.742	1.327	4.254
1986	1	9.129	9.423	10.162	8.661	6.504	1.887	4.839
1986	2	7.036	6.040	4.828	6.762	3.851	1.309	3.926
1986	3	2.339	4.028	3.146	1.249	2.399	0.835	2.041
1986	4	7.529	5.171	3.415	3.448	3.101	0.856	3.661
1987	1	7.237	8.257	9.420	5.924	5.180	2.155	3.482
1987	2	5.727	6.756	7.685	5.476	4.390	1.002	3.735
1987	3	1.635	2.982	3.114	0.885	1.808	0.587	1.655
1987	4	7.980	6.364	4.749	5.465	4.093	1.213	4.245
1988	1	10.399	11.215	12.135	10.279	8.979	2.427	6.973
1988	2	7.598	5.715	5.744	6.831	3.738	1.575	3.571
1988	3	2.841	4.913	5.664	1.942	2.906	0.619	2.772
1988	4	5.789	6.421	7.431	4.144	3.890	0.974	2.870
1989	1	6.772	6.446	7.806	6.940	6.275	1.938	5.048
1989	2	3.794	4.535	5.363	3.701	3.033	1.827	2.834
1989	3	1.248	2.271	2.091	1.056	1.390	0.572	1.171
1989	4	8.953	6.121	5.425	6.040	3.734	0.806	3.398
1990	1	11.266	11.340	12.944	10.041	7.535	1.565	5.330
1990	2	6.200	5.638	6.512	5.911	3.339	0.593	3.218
1990	3	1.460	4.478	4.790	1.289	2.808	0.301	2.376
1990	4	4.152	3.206	2.554	3.518	2.052	0.591	2.143
1991	1	6.658	4.769	4.054	6.182	3.160	0.813	3.056
1991	2	5.235	3.685	2.664	4.469	2.445	0.965	2.023
1991	3	2.206	2.275	2.256	1.277	1.468	0.457	1.377
1991	4	6.091	3.886	3.050	2.099	2.412	0.432	2.265
1992	1	6.890	4.628	4.307	6.117	2.942	0.774	2.769
1992	2	3.017	3.537	2.429	2.757	2.265	1.060	1.823
1992	3	3.745	3.179	3.306	2.875	1.917	0.460	1.868
1992	4	6.941	3.816	3.750	3.124	2.314	0.634	1.957
1993	1	10.313	5.842	7.015	9.116	3.583	1.218	3.118
1993	2	3.621	4.302	4.643	3.262	2.631	0.539	2.567
1993	3	5.021	3.112	2.940	3.105	1.876	0.243	1.775
1993	4	7.727	4.266	3.642	2.960	2.605	1.074	2.520
1994	1	8.276	3.900	3.867	6.190	2.643	1.136	2.593
1994	2	4.689	3.019	2.264	3.725	2.018	0.631	1.698
1994	3	4.096	3.055	3.403	2.364	1.934	0.237	1.943
1994	4	4.546	2.839	2.731	2.013	1.867	1.104	1.766
1995	1	5.853	3.050	3.401	4.488	2.168	1.180	2.256
1995	2	3.927	2.159	2.563	2.858	1.408	0.668	1.469
1995	3	3.970	1.874	1.553	1.722	1.247	0.502	1.175
1995	4	9.131	4.917	4.845	2.861	3.055	1.424	2.502
1996	1	8.449	4.438	3.336	5.821	2.818	1.066	2.627
1996	2	4.166	2.334	1.544	2.959	1.605	0.825	1.324
1996	3	4.857	2.025	1.820	2.602	1.376	0.399	1.282
1996	4	7.563	3.616	4.152	4.097	2.265	0.690	1.757
1997	1	8.164	3.930	3.815	7.741	2.740	2.135	2.760
1997	2	2.966	1.696	1.896	2.497	1.147	1.083	1.141
1997	3	3.118	2.975	2.721	1.729	1.866	1.023	1.598
1997	4	6.552	2.997	2.285	4.403	1.930	2.106	1.928
1998	1	6.606	3.616	3.539	6.320	2.424	2.290	2.358
1998	2	3.742	2.107	1.731	3.321	1.442	1.623	1.367
1998	3	4.086	1.732	1.146	2.541	1.091	1.630	0.886
1998	4	7.486	3.669	3.346	4.827	2.326	1.288	2.296

Appendix table 2. Quarterly value of yellowfin CPUE for main and whole fishing grounds with and without area 2 for 1963-2014.(continued)

		Main Area			Whole Area			
Year	QT	Nominal	stdCPUE	stdCPUE without Area2	Nominal	stdCPUE	stdCPUE without Area2	stdCPUE with Area3'
1999	1	7.367	3.607	3.612	6.458	2.450	2.135	2.475
1999	2	3.718	2.273	1.584	3.176	1.618	1.083	1.273
1999	3	5.799	2.595	1.857	3.435	1.647	1.023	1.357
1999	4	6.869	3.845	3.710	5.693	2.525	2.106	2.381
2000	1	7.952	3.734	3.719	7.433	2.622	2.290	2.510
2000	2	4.706	2.901	2.804	3.657	1.935	1.623	1.812
2000	3	6.006	3.966	2.920	3.670	2.546	1.630	2.009
2000	4	6.938	3.160	2.365	5.259	2.002	1.288	1.935
2001	1	9.427	4.417	4.318	7.694	2.748	2.260	2.958
2001	2	5.276	2.746	1.521	4.119	1.849	0.987	1.599
2001	3	5.105	2.303	1.417	2.887	1.551	0.893	1.268
2001	4	8.069	3.216	1.892	4.092	2.136	1.173	2.008
2002	1	10.789	4.688	3.848	8.361	3.005	2.144	2.987
2002	2	5.782	2.380	1.849	4.751	1.617	1.137	1.592
2002	3	3.805	1.167	1.066	2.104	0.809	0.656	0.815
2002	4	4.448	2.017	1.774	3.282	1.282	0.961	1.210
2003	1	12.269	3.880	3.825	11.744	2.495	2.103	2.338
2003	2	9.474	2.365	1.219	8.685	1.788	1.058	1.746
2003	3	6.234	2.344	1.135	4.069	1.539	0.724	1.314
2003	4	8.771	3.223	2.483	6.066	2.009	1.327	2.062
2004	1	10.197	3.137	3.032	9.750	2.193	1.887	2.034
2004	2	9.130	3.621	2.352	7.991	2.285	1.309	2.218
2004	3	4.083	1.720	1.399	3.296	1.154	0.835	1.085
2004	4	9.445	2.789	1.623	7.042	1.715	0.856	1.729
2005	1	14.289	4.263	4.031	12.974	2.681	2.155	2.420
2005	2	8.557	2.940	1.496	8.158	1.995	1.002	1.858
2005	3	2.889	1.485	1.083	2.581	0.935	0.587	0.836
2005	4	6.744	2.654	2.349	4.815	1.633	1.213	1.507
2006	1	11.927	4.670	4.663	10.559	2.881	2.427	2.598
2006	2	9.255	3.711	2.702	9.021	2.410	1.575	2.417
2006	3	3.147	1.480	1.098	2.512	0.950	0.619	0.824
2006	4	5.413	1.961	1.757	4.916	1.266	0.974	1.223
2007	1	9.172	3.135	3.618	9.024	1.988	1.938	1.589
2007	2	6.426	2.857	3.283	6.027	1.873	1.827	1.431
2007	3	3.274	1.296	1.024	2.564	0.836	0.572	0.762
2007	4	3.986	1.762	1.546	3.629	1.090	0.806	1.066
2008	1	6.707	2.411	2.909	6.561	1.541	1.565	1.184
2008	2	5.677	1.231	1.201	4.470	0.731	0.593	0.635
2008	3	2.355	0.847	0.590	1.549	0.516	0.301	0.466
2008	4	2.676	1.075	1.143	2.474	0.659	0.591	0.624
2009	1	2.846	1.170	1.360	2.867	0.823	0.813	0.700
2009	2	5.980	1.590	1.844	4.613	0.989	0.965	0.799
2009	3	5.562	1.286	0.936	2.513	0.766	0.457	0.637
2009	4	2.547	1.641	0.829	2.365	0.996	0.432	0.768
2010	1	5.323	1.614	1.530	4.997	0.969	0.774	1.085
2010	2	11.395	1.742	2.084	5.053	1.060	1.060	1.202
2010	3	7.338	3.322	0.898	3.717	2.027	0.460	0.709
2010	4	3.716	2.332	1.091	3.626	1.479	0.634	0.952
2011	1	8.679	2.269	2.261	8.458	1.231	1.218	1.830
2011	2	9.878	0.957	0.950	5.062	0.550	0.539	0.766
2011	3	5.871	0.427	0.413	3.511	0.253	0.243	0.360
2011	4	6.213	2.086	2.060	6.062	1.095	1.074	1.538
2012	1	4.720	1.504	1.491	4.672	1.167	1.136	1.354
2012	2	6.368	1.059	1.127	3.439	0.701	0.631	0.732
2012	3	4.395	0.819	0.453	2.745	0.508	0.237	0.355
2012	4	5.130	2.221	1.964	5.130	1.449	1.104	1.475
2013	1	7.598	1.731	2.167	7.420	1.111	1.180	1.224
2013	2	11.635	1.163	1.282	6.166	0.727	0.668	0.800
2013	3	6.854	0.974	0.952	3.646	0.523	0.502	0.726
2013	4	5.399	1.826	1.745	5.482	1.579	1.424	1.759
2014	1	5.679	2.228	2.134	5.536	1.332	1.066	1.628
2014	2	8.995	1.889	2.674	2.643	0.913	0.825	1.127
2014	3	4.803	1.509	0.776	1.561	0.953	0.399	0.646
2014	4	3.909	1.337	1.333	3.859	0.687	0.690	1.036

Appendix table 3. Annual value of yellowfin CPUE for 1963-2014 for data subsets in each of five areas without LT5LN5 expressed in real and relative scale with standard error of log CPUE. Dev: square of CV (std_err).

	AREA2			AREA3			AREA4			AREA5			AREA3'		
YEAR	CPUE	Dev	Relative	CPUE	Dev	Relative	CPUE	Dev	Relative	CPUE	Dev	Relative	CPUE	Dev	Relative
1963	21.48	0.0022	3.07	23.13	0.0020	3.39	3.03	0.0046	3.84	7.84	0.0014	1.99	40.40	0.0034	3.27
1964	13.78	0.0015	1.97	14.36	0.0017	2.11	2.91	0.0033	3.69	8.98	0.0013	2.28	25.98	0.0026	2.10
1965	15.88	0.0013	2.27	13.00	0.0021	1.91	1.81	0.0032	2.30	7.21	0.0012	1.83	28.95	0.0027	2.34
1966	20.64	0.0012	2.95	14.39	0.0023	2.11	2.29	0.0033	2.91	10.09	0.0013	2.56	36.88	0.0022	2.98
1967	10.51	0.0012	1.50	10.31	0.0015	1.51	1.16	0.0017	1.47	7.92	0.0012	2.01	20.29	0.0022	1.64
1968	32.69	0.0012	4.68	25.57	0.0023	3.75	0.97	0.0017	1.23	6.93	0.0014	1.76	60.29	0.0025	4.88
1969	15.88	0.0013	2.27	5.36	0.0018	0.79	0.86	0.0020	1.09	8.14	0.0015	2.06	20.90	0.0026	1.69
1970	8.97	0.0021	1.28	3.83	0.0027	0.56	1.28	0.0023	1.63	8.92	0.0013	2.26	12.18	0.0044	0.99
1971	13.60	0.0015	1.95	5.23	0.0031	0.77	3.32	0.0021	4.21	7.13	0.0016	1.81	21.21	0.0037	1.72
1972	9.30	0.0016	1.33	13.07	0.0044	1.92	2.69	0.0140	3.41	6.31	0.0026	1.60	19.52	0.0043	1.58
1973	6.51	0.0020	0.93	6.12	0.0040	0.90	1.65	0.0069	2.10	7.18	0.0025	1.82	12.14	0.0054	0.98
1974	5.48	0.0018	0.78	6.53	0.0030	0.96	1.34	0.0026	1.70	4.49	0.0017	1.14	11.14	0.0044	0.90
1975	5.54	0.0017	0.79	10.31	0.0041	1.51	1.14	0.0025	1.44	4.15	0.0014	1.05	12.92	0.0046	1.05
1976	6.30	0.0035	0.90	8.39	0.0047	1.23	0.38	0.0060	0.48	5.13	0.0024	1.30	12.83	0.0080	1.04
1977	9.97	0.0032	1.43	20.87	0.0094	3.06	0.80	0.0067	1.01	6.34	0.0072	1.61	23.37	0.0103	1.89
1978	6.71	0.0015	0.96	9.64	0.0040	1.41	0.88	0.0040	1.12	4.53	0.0025	1.15	12.59	0.0042	1.02
1979	3.72	0.0021	0.53	15.31	0.0035	2.25	0.85	0.0050	1.07	3.39	0.0019	0.86	12.03	0.0058	0.97
1980	4.41	0.0018	0.63	5.39	0.0032	0.79	0.35	0.0054	0.44	3.70	0.0016	0.94	8.18	0.0043	0.66
1981	4.69	0.0011	0.67	8.19	0.0026	1.20	0.53	0.0037	0.68	3.80	0.0018	0.96	9.57	0.0031	0.77
1982	5.46	0.0008	0.78	6.27	0.0025	0.92	1.09	0.0071	1.39	3.70	0.0015	0.94	10.37	0.0023	0.84
1983	5.06	0.0009	0.72	6.26	0.0039	0.92	0.60	0.0041	0.76	4.84	0.0014	1.23	9.17	0.0025	0.74
1984	5.62	0.0010	0.80	9.93	0.0036	1.46	0.96	0.0025	1.21	4.43	0.0011	1.12	10.53	0.0029	0.85
1985	6.08	0.0008	0.87	6.36	0.0029	0.93	1.04	0.0028	1.32	4.87	0.0012	1.24	10.75	0.0022	0.87
1986	8.37	0.0008	1.20	3.90	0.0037	0.57	0.52	0.0031	0.66	5.31	0.0014	1.35	12.49	0.0023	1.01
1987	5.77	0.0010	0.83	6.95	0.0030	1.02	0.58	0.0036	0.74	5.17	0.0052	1.31	10.79	0.0027	0.87
1988	5.85	0.0010	0.84	8.34	0.0028	1.22	0.88	0.0043	1.12	6.40	0.0046	1.62	11.43	0.0026	0.92
1989	4.09	0.0023	0.59	6.01	0.0028	0.88	0.87	0.0060	1.11	3.82	0.0021	0.97	7.96	0.0033	0.64
1990	5.29	0.0017	0.76	5.04	0.0033	0.74	0.49	0.0058	0.62	5.68	0.0025	1.44	8.77	0.0034	0.71
1991	4.83	0.0021	0.69	3.49	0.0022	0.51	0.47	0.0031	0.60	2.93	0.0032	0.74	7.69	0.0042	0.62
1992	4.50	0.0025	0.64	4.08	0.0029	0.60	0.32	0.0031	0.41	3.17	0.0089	0.80	7.64	0.0032	0.62
1993	3.88	0.0011	0.56	5.75	0.0028	0.84	0.24	0.0040	0.31	2.93	0.0034	0.74	9.71	0.0028	0.79
1994	3.31	0.0010	0.47	3.91	0.0011	0.57	0.40	0.0014	0.51	2.28	0.0154	0.58	7.19	0.0017	0.58
1995	2.48	0.0015	0.36	4.15	0.0014	0.61	0.29	0.0009	0.37	1.98	0.0021	0.50	6.73	0.0018	0.54
1996	3.55	0.0006	0.51	3.43	0.0008	0.50	0.30	0.0009	0.38	1.80	0.0031	0.46	6.46	0.0013	0.52
1997	3.01	0.0004	0.43	2.76	0.0007	0.40	0.32	0.0017	0.41	2.06	0.0024	0.52	5.88	0.0010	0.48
1998	3.30	0.0004	0.47	2.73	0.0007	0.40	0.26	0.0022	0.34	1.77	0.0012	0.45	6.11	0.0010	0.49
1999	3.72	0.0008	0.53	3.16	0.0008	0.46	0.39	0.0019	0.49	2.03	0.0009	0.51	6.44	0.0014	0.52
2000	4.19	0.0006	0.60	2.75	0.0010	0.40	0.37	0.0018	0.47	2.61	0.0008	0.66	6.64	0.0016	0.54
2001	4.77	0.0008	0.68	3.05	0.0010	0.45	0.30	0.0013	0.38	1.37	0.0009	0.35	8.01	0.0018	0.65
2002	2.92	0.0005	0.42	3.16	0.0012	0.46	0.26	0.0014	0.33	1.10	0.0011	0.28	6.38	0.0016	0.52
2003	4.41	0.0005	0.63	3.36	0.0013	0.49	0.32	0.0030	0.41	0.98	0.0021	0.25	8.25	0.0017	0.67
2004	3.91	0.0005	0.56	2.81	0.0010	0.41	0.29	0.0034	0.37	1.39	0.0015	0.35	7.16	0.0013	0.58
2005	3.75	0.0003	0.54	3.19	0.0008	0.47	0.16	0.0026	0.21	1.02	0.0020	0.26	7.03	0.0010	0.57
2006	3.41	0.0003	0.49	3.30	0.0007	0.48	0.17	0.0029	0.21	1.42	0.0008	0.36	6.80	0.0009	0.55
2007	1.94	0.0003	0.28	3.27	0.0009	0.48	0.14	0.0035	0.18	1.26	0.0008	0.32	4.66	0.0009	0.38
2008	1.20	0.0004	0.17	2.23	0.0010	0.33	0.06	0.0024	0.08	0.59	0.0008	0.15	3.10	0.0012	0.25
2009	1.54	0.0013	0.22	2.13	0.0012	0.31	0.09	0.0037	0.11	0.56	0.0007	0.14	3.14	0.0022	0.25
2010	3.06	0.0083	0.44	2.69	0.0014	0.40	0.08	0.0042	0.10	0.46	0.0016	0.12	4.79	0.0040	0.39
2011				2.71	0.0020	0.40	0.09	0.0064	0.12	0.27	0.0250	0.07	4.99	0.0071	0.40
2012				2.05	0.0018	0.30	0.18	0.0173	0.23	0.53	0.0055	0.13	3.71	0.0053	0.30
2013				3.25	0.0013	0.48	0.17	0.0145	0.21	0.28	0.0038	0.07	5.08	0.0035	0.41
2014				2.89	0.0026	0.42	0.02	0.0521	0.02				5.31	0.0088	0.43

Appendix table 4. Annual value of yellowfin CPUE for 1963-2014 for data subsets in each of five areas with LT5LN5 expressed in real and relative scale with standard error of log CPUE. Dev: square of CV (std_err).

	AREA2			AREA3			AREA4			AREA5			AREA3'		
YEAR	CPUE	Dev	Relative	CPUE	Dev	Relative	CPUE	Dev	Relative	CPUE	Dev	Relative	CPUE	Dev	Relative
1963	17.88	0.0022	2.69	10.20	0.0036	2.54	0.64	0.0031	1.69	8.12	0.0014	2.05	23.28	0.0058	2.57
1964	11.51	0.0016	1.73	6.54	0.0032	1.63	0.81	0.0022	2.15	9.31	0.0013	2.35	15.51	0.0049	1.71
1965	13.62	0.0015	2.05	5.85	0.0037	1.46	0.40	0.0022	1.07	7.28	0.0012	1.84	16.86	0.0052	1.86
1966	17.99	0.0013	2.71	6.77	0.0039	1.69	0.56	0.0022	1.49	10.15	0.0013	2.56	22.38	0.0049	2.47
1967	9.47	0.0014	1.43	4.91	0.0032	1.22	0.48	0.0012	1.27	7.98	0.0012	2.01	12.40	0.0048	1.37
1968	26.44	0.0014	3.98	10.97	0.0039	2.73	0.40	0.0012	1.05	7.49	0.0014	1.89	33.07	0.0051	3.66
1969	14.81	0.0015	2.23	3.73	0.0034	0.93	0.29	0.0014	0.78	8.03	0.0015	2.03	15.03	0.0051	1.66
1970	8.33	0.0022	1.25	2.56	0.0041	0.64	0.39	0.0016	1.02	9.05	0.0013	2.28	8.66	0.0065	0.96
1971	11.72	0.0017	1.77	3.98	0.0044	0.99	1.27	0.0014	3.37	7.03	0.0016	1.77	14.00	0.0061	1.55
1972	9.23	0.0017	1.39	6.77	0.0054	1.69	1.36	0.0088	3.60	6.18	0.0026	1.56	12.85	0.0066	1.42
1973	6.96	0.0021	1.05	4.15	0.0051	1.03	1.13	0.0044	2.98	7.49	0.0025	1.89	9.33	0.0074	1.03
1974	5.04	0.0019	0.76	4.06	0.0043	1.01	0.43	0.0018	1.13	4.85	0.0017	1.22	7.44	0.0066	0.82
1975	5.61	0.0018	0.84	5.72	0.0052	1.42	0.36	0.0017	0.95	4.45	0.0014	1.12	8.70	0.0069	0.96
1976	6.43	0.0034	0.97	4.86	0.0057	1.21	0.29	0.0039	0.77	5.38	0.0024	1.36	9.51	0.0095	1.05
1977	9.61	0.0032	1.45	10.90	0.0094	2.71	0.42	0.0043	1.11	6.15	0.0070	1.55	16.31	0.0114	1.80
1978	6.27	0.0016	0.94	4.80	0.0052	1.20	0.42	0.0027	1.11	5.11	0.0024	1.29	9.09	0.0063	1.01
1979	3.99	0.0022	0.60	7.10	0.0048	1.77	0.42	0.0032	1.10	3.58	0.0019	0.90	8.46	0.0077	0.94
1980	4.40	0.0019	0.66	2.43	0.0046	0.61	0.25	0.0035	0.67	4.05	0.0016	1.02	5.64	0.0064	0.62
1981	4.46	0.0013	0.67	4.16	0.0041	1.04	0.29	0.0024	0.78	4.06	0.0018	1.02	6.75	0.0054	0.75
1982	5.66	0.0010	0.85	3.88	0.0040	0.97	0.35	0.0046	0.92	3.65	0.0015	0.92	8.28	0.0048	0.92
1983	6.11	0.0011	0.92	4.11	0.0051	1.02	0.34	0.0027	0.89	4.89	0.0014	1.23	8.74	0.0050	0.97
1984	6.32	0.0012	0.95	5.87	0.0049	1.46	0.41	0.0017	1.09	4.79	0.0011	1.21	9.44	0.0053	1.04
1985	7.00	0.0010	1.05	3.76	0.0043	0.94	0.40	0.0019	1.07	5.06	0.0012	1.28	9.54	0.0047	1.05
1986	9.54	0.0010	1.44	3.34	0.0049	0.83	0.35	0.0020	0.92	5.01	0.0014	1.27	11.80	0.0048	1.30
1987	6.54	0.0012	0.99	5.08	0.0044	1.27	0.39	0.0024	1.03	4.54	0.0051	1.15	10.06	0.0051	1.11
1988	6.32	0.0012	0.95	5.78	0.0042	1.44	0.46	0.0028	1.21	5.63	0.0045	1.42	10.12	0.0050	1.12
1989	4.41	0.0023	0.66	4.22	0.0042	1.05	0.50	0.0039	1.33	3.72	0.0021	0.94	7.31	0.0056	0.81
1990	6.17	0.0018	0.93	3.50	0.0046	0.87	0.24	0.0037	0.63	5.42	0.0024	1.37	8.02	0.0056	0.89
1991	5.46	0.0022	0.82	2.58	0.0038	0.64	0.26	0.0020	0.68	2.76	0.0032	0.70	7.33	0.0063	0.81
1992	4.86	0.0026	0.73	3.06	0.0043	0.76	0.15	0.0020	0.39	2.88	0.0087	0.73	7.28	0.0054	0.81
1993	4.30	0.0013	0.65	4.36	0.0042	1.09	0.15	0.0026	0.39	2.73	0.0033	0.69	9.09	0.0052	1.00
1994	3.78	0.0012	0.57	3.02	0.0029	0.75	0.23	0.0010	0.60	2.03	0.0150	0.51	6.97	0.0042	0.77
1995	3.06	0.0016	0.46	3.21	0.0031	0.80	0.23	0.0007	0.60	1.99	0.0020	0.50	6.52	0.0043	0.72
1996	3.78	0.0009	0.57	2.76	0.0027	0.69	0.27	0.0007	0.70	1.76	0.0031	0.44	6.21	0.0039	0.69
1997	3.42	0.0007	0.51	2.08	0.0026	0.52	0.28	0.0012	0.74	1.95	0.0024	0.49	5.60	0.0037	0.62
1998	3.43	0.0006	0.52	1.96	0.0026	0.49	0.25	0.0015	0.67	1.63	0.0012	0.41	5.35	0.0037	0.59
1999	3.59	0.0010	0.54	2.31	0.0027	0.57	0.34	0.0013	0.89	2.07	0.0009	0.52	5.52	0.0040	0.61
2000	4.21	0.0008	0.63	1.84	0.0028	0.46	0.29	0.0013	0.77	2.56	0.0008	0.65	5.57	0.0041	0.62
2001	4.36	0.0010	0.66	2.27	0.0028	0.57	0.24	0.0010	0.63	1.39	0.0010	0.35	6.61	0.0043	0.73
2002	2.81	0.0008	0.42	2.34	0.0030	0.58	0.23	0.0010	0.60	1.12	0.0011	0.28	5.27	0.0041	0.58
2003	3.73	0.0008	0.56	2.54	0.0031	0.63	0.34	0.0020	0.89	1.01	0.0021	0.26	6.50	0.0042	0.72
2004	3.31	0.0007	0.50	2.64	0.0028	0.66	0.34	0.0022	0.91	1.38	0.0015	0.35	6.44	0.0039	0.71
2005	3.06	0.0006	0.46	3.06	0.0027	0.76	0.21	0.0018	0.56	0.91	0.0020	0.23	6.17	0.0037	0.68
2006	2.82	0.0006	0.42	2.79	0.0026	0.70	0.26	0.0019	0.69	1.36	0.0008	0.34	5.76	0.0036	0.64
2007	1.79	0.0005	0.27	2.23	0.0027	0.56	0.24	0.0023	0.65	1.20	0.0008	0.30	3.72	0.0036	0.41
2008	1.11	0.0006	0.17	1.68	0.0028	0.42	0.14	0.0016	0.36	0.55	0.0009	0.14	2.60	0.0038	0.29
2009	1.51	0.0015	0.23	1.71	0.0030	0.42	0.15	0.0025	0.40	0.53	0.0007	0.13	2.86	0.0047	0.32
2010	2.56	0.0079	0.39	2.18	0.0031	0.54	0.15	0.0028	0.40	0.46	0.0017	0.11	4.39	0.0061	0.48
2011				2.34	0.0036	0.58	0.26	0.0041	0.68	0.34	0.0243	0.08	4.94	0.0086	0.55
2012				1.60	0.0035	0.40	0.27	0.0109	0.70	0.55	0.0054	0.14	3.22	0.0072	0.36

2013			2.37	0.0031	0.59	0.24	0.0092	0.63	0.32	0.0038	0.08	4.12	0.0057	0.46
2014			1.91	0.0040	0.48	0.11	0.0324	0.28				3.85	0.0100	0.42

Appendix table 5. Annual value of yellowfin CPUE for 1963-2014 for each of four areas calculated from whole data expressed in real and relative scale with standard error of log CPUE. Dev: square of CV (std_err).

	AREA2			AREA3			AREA4			AREA5		
YEAR	CPUE	Dev	Relative	CPUE	Dev	Relative	CPUE	Dev	Relative	CPUE	Dev	Relative
1963	15.46	0.0001	3.02	11.86	0.0001	3.56	2.95	0.0004	2.84	6.29	0.0001	1.92
1964	9.75	0.0000	1.90	7.31	0.0000	2.19	2.97	0.0002	2.85	7.20	0.0001	2.19
1965	11.27	0.0000	2.20	6.58	0.0001	1.97	2.01	0.0002	1.93	5.78	0.0000	1.76
1966	14.83	0.0000	2.89	7.32	0.0001	2.19	2.43	0.0002	2.34	8.10	0.0001	2.47
1967	7.35	0.0000	1.43	5.18	0.0000	1.55	1.52	0.0001	1.46	6.36	0.0000	1.94
1968	23.58	0.0000	4.60	12.93	0.0001	3.88	1.36	0.0001	1.31	5.58	0.0001	1.70
1969	11.33	0.0000	2.21	2.57	0.0000	0.77	1.25	0.0001	1.20	6.52	0.0001	1.99
1970	6.28	0.0001	1.22	1.82	0.0001	0.55	1.75	0.0002	1.68	7.16	0.0001	2.18
1971	9.53	0.0000	1.86	2.48	0.0001	0.74	3.39	0.0001	3.26	5.71	0.0001	1.74
1972	6.50	0.0000	1.27	6.37	0.0001	1.91	3.14	0.0011	3.02	5.05	0.0001	1.54
1973	4.44	0.0001	0.87	2.89	0.0001	0.87	2.10	0.0005	2.02	5.75	0.0001	1.75
1974	3.72	0.0000	0.73	3.14	0.0001	0.94	1.84	0.0002	1.77	3.57	0.0001	1.09
1975	3.70	0.0000	0.72	5.01	0.0001	1.50	1.60	0.0002	1.54	3.28	0.0001	1.00
1976	4.22	0.0001	0.82	4.03	0.0001	1.21	0.72	0.0005	0.69	4.07	0.0001	1.24
1977	6.93	0.0001	1.35	10.33	0.0003	3.10	1.26	0.0005	1.21	4.94	0.0005	1.51
1978	4.65	0.0000	0.91	4.65	0.0001	1.39	1.29	0.0003	1.24	3.56	0.0001	1.09
1979	2.48	0.0001	0.48	7.61	0.0001	2.28	1.25	0.0004	1.20	2.65	0.0001	0.81
1980	2.96	0.0001	0.58	2.57	0.0001	0.77	0.61	0.0004	0.58	2.88	0.0001	0.88
1981	3.17	0.0000	0.62	4.01	0.0001	1.20	0.93	0.0003	0.90	2.95	0.0001	0.90
1982	3.75	0.0000	0.73	2.96	0.0001	0.89	1.72	0.0006	1.66	2.92	0.0001	0.89
1983	3.50	0.0000	0.68	2.94	0.0001	0.88	1.01	0.0003	0.97	3.91	0.0001	1.19
1984	3.98	0.0000	0.78	4.88	0.0001	1.46	1.47	0.0002	1.42	3.57	0.0000	1.09
1985	4.30	0.0000	0.84	3.12	0.0001	0.94	1.52	0.0002	1.46	3.91	0.0001	1.19
1986	6.10	0.0000	1.19	1.85	0.0001	0.55	0.94	0.0002	0.90	4.30	0.0001	1.31
1987	4.17	0.0000	0.81	3.34	0.0001	1.00	0.95	0.0003	0.91	4.27	0.0003	1.30
1988	4.19	0.0000	0.82	4.07	0.0001	1.22	1.34	0.0003	1.29	5.26	0.0003	1.60
1989	2.95	0.0001	0.58	2.85	0.0001	0.86	1.39	0.0005	1.33	3.17	0.0001	0.97
1990	3.84	0.0000	0.75	2.39	0.0001	0.72	0.88	0.0005	0.85	4.75	0.0001	1.45
1991	3.70	0.0001	0.72	1.63	0.0001	0.49	0.77	0.0002	0.74	2.43	0.0002	0.74
1992	3.36	0.0001	0.66	1.92	0.0001	0.58	0.58	0.0002	0.56	2.63	0.0006	0.80
1993	3.06	0.0000	0.60	2.77	0.0001	0.83	0.45	0.0003	0.44	2.59	0.0002	0.79
1994	2.83	0.0000	0.55	1.81	0.0000	0.54	0.63	0.0001	0.60	2.15	0.0010	0.66
1995	2.08	0.0001	0.41	1.98	0.0000	0.59	0.46	0.0001	0.44	1.86	0.0001	0.57
1996	3.01	0.0000	0.59	1.58	0.0000	0.47	0.46	0.0001	0.44	1.82	0.0002	0.56
1997	2.58	0.0000	0.50	1.28	0.0000	0.38	0.49	0.0001	0.48	2.12	0.0001	0.65
1998	2.87	0.0000	0.56	1.25	0.0000	0.38	0.40	0.0002	0.38	1.84	0.0001	0.56
1999	3.24	0.0000	0.63	1.47	0.0000	0.44	0.54	0.0001	0.52	2.05	0.0000	0.62
2000	3.66	0.0000	0.71	1.30	0.0000	0.39	0.53	0.0001	0.51	2.67	0.0000	0.81
2001	4.17	0.0000	0.81	1.42	0.0000	0.42	0.42	0.0001	0.40	1.38	0.0000	0.42
2002	2.51	0.0000	0.49	1.48	0.0000	0.44	0.36	0.0001	0.34	1.14	0.0001	0.35
2003	3.79	0.0000	0.74	1.58	0.0000	0.47	0.46	0.0002	0.44	1.02	0.0001	0.31
2004	3.38	0.0000	0.66	1.32	0.0000	0.40	0.38	0.0003	0.37	1.40	0.0001	0.43
2005	3.24	0.0000	0.63	1.50	0.0000	0.45	0.25	0.0002	0.24	1.07	0.0001	0.33
2006	2.97	0.0000	0.58	1.58	0.0000	0.47	0.22	0.0002	0.21	1.47	0.0000	0.45
2007	1.71	0.0000	0.33	1.58	0.0000	0.47	0.19	0.0003	0.18	1.30	0.0000	0.40
2008	1.01	0.0000	0.20	1.05	0.0000	0.32	0.07	0.0002	0.07	0.61	0.0000	0.19
2009	1.31	0.0000	0.26	1.02	0.0000	0.30	0.11	0.0003	0.10	0.59	0.0000	0.18
2010	2.59	0.0003	0.51	1.29	0.0000	0.39	0.08	0.0003	0.08	0.46	0.0001	0.14

2011		1.60	0.0001	0.48	0.11	0.0007	0.11	0.34	0.0025	0.10
2012		0.98	0.0000	0.30	0.27	0.0014	0.26	0.54	0.0004	0.17
2013		1.59	0.0000	0.48	0.27	0.0012	0.26	0.29	0.0002	0.09
2014		1.41	0.0001	0.42	0.01	0.0042	0.01			

Appendix table 6. Quarterly value of yellowfin CPUE standardized from 1963-201 for data subsets in each of five areas without LT5LN5 expressed in real scale and relative scale with standard error of log CPUE. Dev: square of CV (std_err).

		AREA2			AREA3			AREA4			AREA5			AREA3'		
YEAR	QT	CPUE	Dev	Relative	CPUE	Dev	Relative	CPUE	Dev	Relative	CPUE	Dev	Relative	CPUE	Dev	Relative
1963	1	22.93	0.0026	3.26	36.59	0.0066	4.51	1.24	0.0062	1.21	7.80	0.0025	1.94	53.30	0.0083	4.07
1963	2	16.89	0.0039	2.40	33.36	0.0068	4.12	4.38	0.0449	4.27	8.09	0.0032	2.01	43.72	0.0116	3.34
1963	3	18.75	0.0142	2.67	12.72	0.0042	1.57	7.17	0.0073	6.99	6.75	0.0035	1.68	22.89	0.0133	1.75
1963	4	29.22	0.0030	4.16	18.19	0.0063	2.24	2.08	0.0052	2.03	8.85	0.0030	2.20	49.39	0.0092	3.77
1964	1	20.41	0.0028	2.91	28.92	0.0073	3.57	0.65	0.0058	0.64	10.45	0.0029	2.60	45.73	0.0090	3.49
1964	2	12.88	0.0021	1.83	16.22	0.0055	2.00	7.23	0.0217	7.04	11.65	0.0030	2.90	27.86	0.0065	2.13
1964	3	11.40	0.0057	1.62	9.78	0.0026	1.21	5.55	0.0113	5.41	8.89	0.0021	2.21	17.38	0.0072	1.33
1964	4	11.97	0.0027	1.70	9.09	0.0037	1.12	2.47	0.0039	2.41	5.97	0.0021	1.48	20.24	0.0067	1.55
1965	1	13.71	0.0021	1.95	12.17	0.0067	1.50	0.74	0.0049	0.72	7.79	0.0020	1.94	27.61	0.0065	2.11
1965	2	13.60	0.0023	1.94	15.77	0.0089	1.95	3.02	0.0229	2.94	8.85	0.0018	2.20	29.15	0.0079	2.23
1965	3	13.57	0.0034	1.93	10.81	0.0036	1.33	3.00	0.0091	2.92	4.85	0.0027	1.21	22.27	0.0076	1.70
1965	4	24.98	0.0029	3.56	13.72	0.0053	1.69	1.53	0.0041	1.49	8.03	0.0026	2.00	39.03	0.0084	2.98
1966	1	22.19	0.0019	3.16	21.19	0.0164	2.61	0.75	0.0053	0.73	9.39	0.0022	2.34	47.79	0.0064	3.65
1966	2	19.06	0.0018	2.71	17.97	0.0048	2.22	3.65	0.0229	3.56	11.13	0.0029	2.77	38.59	0.0052	2.95
1966	3	19.82	0.0027	2.82	11.34	0.0034	1.40	3.77	0.0104	3.67	10.37	0.0027	2.58	28.74	0.0065	2.19
1966	4	21.66	0.0019	3.08	9.83	0.0040	1.21	2.53	0.0037	2.47	9.57	0.0023	2.38	34.80	0.0051	2.66
1967	1	11.87	0.0017	1.69	12.58	0.0047	1.55	2.11	0.0047	2.05	9.14	0.0019	2.27	24.85	0.0047	1.90
1967	2	12.50	0.0020	1.78	14.60	0.0031	1.80	2.17	0.0050	2.11	7.54	0.0017	1.87	25.99	0.0050	1.98
1967	3	7.25	0.0030	1.03	5.96	0.0031	0.74	0.67	0.0039	0.66	6.41	0.0027	1.59	12.00	0.0066	0.92
1967	4	11.26	0.0023	1.60	10.15	0.0042	1.25	0.55	0.0031	0.53	8.86	0.0030	2.20	21.48	0.0063	1.64
1968	1	36.74	0.0021	5.23	77.67	0.0117	9.58	1.52	0.0054	1.48	9.94	0.0019	2.47	86.52	0.0072	6.61
1968	2	44.84	0.0022	6.38	34.52	0.0058	4.26	1.13	0.0050	1.10	9.66	0.0036	2.40	85.34	0.0067	6.52
1968	3	25.94	0.0027	3.69	14.73	0.0044	1.82	0.49	0.0034	0.47	3.99	0.0037	0.99	40.14	0.0074	3.06
1968	4	26.66	0.0021	3.79	10.44	0.0062	1.29	1.01	0.0038	0.99	5.91	0.0028	1.47	44.24	0.0064	3.38
1969	1	15.72	0.0020	2.24	7.66	0.0052	0.94	1.11	0.0079	1.08	7.81	0.0022	1.94	26.87	0.0058	2.05
1969	2	12.90	0.0028	1.84	9.37	0.0047	1.16	1.21	0.0058	1.18	10.05	0.0026	2.50	22.11	0.0077	1.69
1969	3	17.62	0.0029	2.51	4.80	0.0036	0.59	0.49	0.0037	0.47	6.60	0.0044	1.64	17.76	0.0070	1.36
1969	4	17.77	0.0030	2.53	2.20	0.0062	0.27	0.80	0.0049	0.78	8.45	0.0038	2.10	18.01	0.0090	1.38
1970	1	9.19	0.0030	1.31	4.14	0.0095	0.51	1.90	0.0126	1.85	7.88	0.0025	1.96	15.44	0.0104	1.18
1970	2	7.01	0.0043	1.00	4.64	0.0077	0.57	0.59	0.0056	0.58	7.24	0.0033	1.80	11.53	0.0129	0.88
1970	3	8.08	0.0129	1.15	2.26	0.0084	0.28	0.47	0.0043	0.46	14.13	0.0025	3.51	6.06	0.0231	0.46
1970	4	12.34	0.0032	1.76	4.81	0.0091	0.59	4.48	0.0043	4.37	7.82	0.0027	1.94	19.33	0.0110	1.48
1971	1	9.17	0.0029	1.31	6.84	0.0060	0.84	3.87	0.0079	3.77	6.88	0.0027	1.71	16.39	0.0088	1.25
1971	2	10.85	0.0042	1.54	5.41	0.0118	0.67	4.73	0.0049	4.61	9.90	0.0031	2.46	17.82	0.0150	1.36
1971	3	21.60	0.0038	3.07	4.21	0.0088	0.52	1.86	0.0035	1.81	5.29	0.0042	1.32	25.50	0.0125	1.95
1971	4	15.71	0.0030	2.24	4.77	0.0148	0.59	3.54	0.0069	3.44	7.13	0.0050	1.77	26.98	0.0114	2.06
1972	1	8.25	0.0035	1.17	32.30	0.0172	3.99	4.29	0.1723	4.18	6.88	0.0045	1.71	22.35	0.0138	1.71
1972	2	7.61	0.0040	1.08	19.79	0.0227	2.44	2.96	0.0192	2.88	4.19	0.0050	1.04	18.90	0.0166	1.44
1972	3	11.36	0.0035	1.62	4.97	0.0072	0.61	1.88	0.0085	1.83	5.82	0.0083	1.45	16.78	0.0110	1.28
1972	4	10.43	0.0040	1.48	8.62	0.0142	1.06	2.16	0.0146	2.11	9.34	0.0144	2.32	20.42	0.0151	1.56
1973	1	6.99	0.0062	0.99	17.26	0.0218	2.13	3.62	0.0743	3.52	9.70	0.0055	2.41	18.19	0.0244	1.39
1973	2	5.44	0.0061	0.77	4.58	0.0172	0.56	4.27	0.0145	4.16	8.47	0.0087	2.11	10.34	0.0224	0.79
1973	3	4.32	0.0047	0.62	1.81	0.0072	0.22	0.49	0.0067	0.48	7.17	0.0108	1.78	5.64	0.0133	0.43

1973	4	10.68	0.0045	1.52	8.28	0.0091	1.02	0.86	0.0052	0.84	4.47	0.0051	1.11	19.09	0.0144	1.46
1974	1	5.27	0.0042	0.75	16.94	0.0108	2.09	4.41	0.0118	4.30	4.09	0.0029	1.02	15.46	0.0146	1.18
1974	2	5.25	0.0051	0.75	8.74	0.0146	1.08	1.96	0.0064	1.91	5.52	0.0063	1.37	12.34	0.0187	0.94
1974	3	5.61	0.0039	0.80	1.43	0.0070	0.18	0.42	0.0056	0.41	4.10	0.0044	1.02	6.55	0.0117	0.50
1974	4	5.82	0.0048	0.83	6.88	0.0067	0.85	0.76	0.0085	0.74	4.37	0.0027	1.09	11.98	0.0131	0.91

Appendix table 6. Quarterly value of yellowfin CPUE standardized from 1963-201 for data subsets in each of five areas without LT5LN5 expressed in real scale and relative scale with standard error of log CPUE. Dev: square of CV (std_err).
(continued)

		AREA2			AREA3			AREA4			AREA5			AREA3'		
YEAR	QT	CPUE	Dev	Relative	CPUE	Dev	Relative	CPUE	Dev	Relative	CPUE	Dev	Relative	CPUE	Dev	Relative
1975	1	3.11	0.0046	0.44	7.42	0.0236	0.92	1.89	0.0128	1.84	4.47	0.0023	1.11	7.65	0.0190	0.58
1975	2	3.35	0.0060	0.48	9.61	0.0149	1.19	1.26	0.0060	1.23	3.73	0.0043	0.93	9.61	0.0211	0.73
1975	3	7.14	0.0030	1.02	4.36	0.0055	0.54	0.97	0.0045	0.94	3.92	0.0026	0.98	11.52	0.0088	0.88
1975	4	11.63	0.0036	1.66	33.76	0.0130	4.17	0.70	0.0067	0.69	4.54	0.0037	1.13	30.90	0.0134	2.36
1976	1	3.41	0.0044	0.48	19.53	0.0078	2.41	0.56	0.0523	0.54	3.41	0.0040	0.85	13.99	0.0133	1.07
1976	2	9.45	0.0056	1.34	8.49	0.0258	1.05	0.26	0.0185	0.26	7.04	0.0072	1.75	19.16	0.0231	1.46
1976	3	7.85	0.0142	1.12	2.63	0.0083	0.32	0.54	0.0063	0.52	4.96	0.0092	1.23	6.42	0.0237	0.49
1976	4	5.98	0.0207	0.85	10.27	0.0252	1.27	0.25	0.0097	0.24	5.76	0.0089	1.43	15.05	0.0557	1.15
1977	1	3.78	0.0143	0.54	47.19	0.0465	5.82	2.83	0.0506	2.75	6.98	0.0097	1.74	16.59	0.0577	1.27
1977	2	15.28	0.0129	2.17	42.67	0.0561	5.26	0.69	0.0300	0.67	7.96	0.0642	1.98	40.23	0.0557	3.07
1977	3	8.98	0.0133	1.28	6.87	0.0093	0.85	0.20	0.0074	0.19	4.96	0.0091	1.23	13.35	0.0252	1.02
1977	4	17.78	0.0037	2.53	13.02	0.0307	1.61	0.81	0.0098	0.79	5.83	0.0242	1.45	32.47	0.0172	2.48
1978	1	6.61	0.0015	0.94	14.92	0.0107	1.84	0.93	0.0279	0.91	6.75	0.0065	1.68	13.76	0.0061	1.05
1978	2	5.76	0.0021	0.82	8.04	0.0172	0.99	0.99	0.0099	0.97	8.17	0.0188	2.03	11.12	0.0092	0.85
1978	3	4.78	0.0107	0.68	3.88	0.0096	0.48	0.41	0.0069	0.39	2.43	0.0023	0.60	7.04	0.0239	0.54
1978	4	10.89	0.0049	1.55	17.51	0.0188	2.16	1.53	0.0111	1.49	2.98	0.0048	0.74	22.32	0.0205	1.70
1979	1	4.05	0.0035	0.58	31.60	0.0075	3.90	1.01	0.0350	0.99	4.32	0.0052	1.07	16.43	0.0117	1.25
1979	2	2.56	0.0067	0.36	19.55	0.0174	2.41	1.02	0.0156	1.00	3.99	0.0067	0.99	9.87	0.0251	0.75
1979	3	3.21	0.0054	0.46	5.67	0.0075	0.70	0.63	0.0067	0.61	2.40	0.0069	0.60	7.47	0.0152	0.57
1979	4	5.58	0.0133	0.79	15.01	0.0145	1.85	0.77	0.0131	0.75	3.17	0.0048	0.79	16.76	0.0335	1.28
1980	1	4.04	0.0042	0.58	11.08	0.0056	1.37	0.51	0.0393	0.50	4.31	0.0049	1.07	12.18	0.0113	0.93
1980	2	2.71	0.0044	0.39	2.44	0.0158	0.30	0.22	0.0244	0.21	6.39	0.0055	1.59	4.29	0.0176	0.33
1980	3	3.63	0.0126	0.52	2.49	0.0067	0.31	0.29	0.0079	0.28	2.97	0.0037	0.74	4.50	0.0194	0.34
1980	4	8.89	0.0030	1.26	10.85	0.0161	1.34	0.42	0.0065	0.41	2.22	0.0044	0.55	16.68	0.0129	1.27
1981	1	4.65	0.0017	0.66	7.91	0.0048	0.98	0.59	0.0166	0.58	3.31	0.0035	0.82	9.68	0.0059	0.74
1981	2	2.40	0.0043	0.34	8.50	0.0106	1.05	0.23	0.0226	0.22	3.59	0.0053	0.89	6.48	0.0153	0.49
1981	3	6.13	0.0040	0.87	5.18	0.0049	0.64	0.32	0.0051	0.31	5.45	0.0095	1.35	9.70	0.0104	0.74
1981	4	6.71	0.0024	0.96	12.69	0.0144	1.57	1.52	0.0074	1.48	3.19	0.0031	0.79	13.48	0.0103	1.03
1982	1	4.37	0.0016	0.62	13.58	0.0047	1.68	11.69	0.0213	11.39	3.74	0.0034	0.93	10.75	0.0055	0.82
1982	2	4.34	0.0030	0.62	8.51	0.0096	1.05	0.22	0.0580	0.22	4.06	0.0065	1.01	9.21	0.0115	0.70
1982	3	4.51	0.0022	0.64	3.02	0.0042	0.37	0.19	0.0086	0.19	4.10	0.0038	1.02	6.59	0.0068	0.50
1982	4	10.06	0.0016	1.43	4.09	0.0144	0.50	1.58	0.0171	1.54	2.99	0.0032	0.74	17.13	0.0067	1.31
1983	1	4.54	0.0011	0.65	14.21	0.0113	1.75	1.58	0.0303	1.54	4.37	0.0022	1.09	9.30	0.0046	0.71
1983	2	4.26	0.0015	0.61	3.40	0.0210	0.42	0.43	0.0124	0.42	8.08	0.0092	2.01	7.76	0.0068	0.59
1983	3	3.33	0.0043	0.47	2.54	0.0052	0.31	0.22	0.0063	0.22	3.72	0.0018	0.93	4.95	0.0112	0.38
1983	4	9.70	0.0022	1.38	11.09	0.0173	1.37	0.71	0.0090	0.70	4.10	0.0027	1.02	18.40	0.0099	1.40
1984	1	5.15	0.0016	0.73	18.60	0.0119	2.30	1.83	0.0118	1.79	5.20	0.0022	1.29	11.09	0.0069	0.85
1984	2	4.80	0.0025	0.68	6.25	0.0202	0.77	0.40	0.0076	0.39	6.01	0.0038	1.49	9.00	0.0114	0.69
1984	3	7.15	0.0041	1.02	4.12	0.0049	0.51	0.31	0.0065	0.30	2.81	0.0022	0.70	9.50	0.0106	0.73
1984	4	5.62	0.0024	0.80	18.93	0.0133	2.34	2.96	0.0070	2.88	4.31	0.0027	1.07	12.92	0.0104	0.99
1985	1	5.32	0.0016	0.76	13.70	0.0116	1.69	5.38	0.0180	5.24	4.21	0.0015	1.05	11.12	0.0065	0.85
1985	2	4.96	0.0021	0.71	3.35	0.0085	0.41	0.68	0.0053	0.66	6.85	0.0038	1.70	8.36	0.0083	0.64
1985	3	5.20	0.0022	0.74	3.05	0.0039	0.38	0.29	0.0047	0.28	5.08	0.0026	1.26	7.51	0.0066	0.57
1985	4	9.80	0.0015	1.39	10.59	0.0148	1.31	0.88	0.0092	0.86	3.81	0.0046	0.95	18.52	0.0064	1.41
1986	1	8.82	0.0012	1.26	18.29	0.0073	2.26	2.02	0.0084	1.97	4.40	0.0013	1.09	18.49	0.0048	1.41
1986	2	9.20	0.0019	1.31	2.12	0.0078	0.26	0.73	0.0213	0.71	8.23	0.0083	2.05	12.41	0.0077	0.95
1986	3	6.34	0.0030	0.90	1.43	0.0046	0.18	0.17	0.0054	0.16	5.25	0.0040	1.30	5.96	0.0087	0.45
1986	4	9.48	0.0018	1.35	3.16	0.0325	0.39	0.21	0.0057	0.20	4.14	0.0025	1.03	16.84	0.0088	1.29

Appendix table 6. Quarterly value of yellowfin CPUE standardized from 1963-201 for data subsets in each of five areas without LT5LN5 expressed in real scale and relative scale with standard error of log CPUE. Dev: square of CV (std_err).
(continued)

		AREA2			AREA3			AREA4			AREA5			AREA3'		
YEAR	QT	CPUE	Dev	Relative	CPUE	Dev	Relative	CPUE	Dev	Relative	CPUE	Dev	Relative	CPUE	Dev	Relative
1987	1	6.53	0.0013	0.93	15.74	0.0118	1.94	0.56	0.0066	0.54	5.06	0.0017	1.26	13.57	0.0053	1.04
1987	2	5.25	0.0019	0.75	8.97	0.0106	1.11	1.18	0.0293	1.15	7.79	0.0583	1.94	10.85	0.0080	0.83
1987	3	2.97	0.0053	0.42	2.50	0.0038	0.31	0.19	0.0057	0.19	4.00	0.0153	0.99	4.68	0.0099	0.36
1987	4	10.29	0.0028	1.46	6.00	0.0155	0.74	0.75	0.0073	0.73	4.49	0.0021	1.12	18.12	0.0123	1.38
1988	1	10.44	0.0013	1.49	21.32	0.0127	2.63	6.28	0.0183	6.12	5.77	0.0017	1.43	21.31	0.0056	1.63
1988	2	6.02	0.0021	0.86	5.51	0.0081	0.68	1.24	0.0228	1.21	6.84	0.0584	1.70	11.11	0.0083	0.85
1988	3	3.74	0.0046	0.53	3.27	0.0038	0.40	0.16	0.0077	0.16	8.51	0.0052	2.12	6.34	0.0094	0.48
1988	4	4.80	0.0026	0.68	11.51	0.0142	1.42	0.29	0.0104	0.28	4.97	0.0022	1.24	10.81	0.0112	0.83
1989	1	4.08	0.0014	0.58	12.25	0.0162	1.51	6.09	0.0209	5.93	5.49	0.0032	1.37	8.62	0.0062	0.66
1989	2	2.98	0.0030	0.42	5.05	0.0075	0.62	1.05	0.0462	1.02	6.38	0.0138	1.59	7.00	0.0108	0.53
1989	3	2.77	0.0231	0.39	1.84	0.0036	0.23	0.17	0.0106	0.16	2.56	0.0064	0.64	3.50	0.0125	0.27
1989	4	7.84	0.0045	1.12	9.90	0.0117	1.22	0.34	0.0099	0.33	2.26	0.0048	0.56	16.84	0.0167	1.29
1990	1	8.74	0.0022	1.24	23.45	0.0096	2.89	1.69	0.0087	1.65	5.18	0.0019	1.29	21.14	0.0092	1.61
1990	2	4.03	0.0037	0.57	4.71	0.0083	0.58	0.19	0.0579	0.18	8.95	0.0225	2.23	8.29	0.0129	0.63
1990	3	4.33	0.0135	0.62	1.59	0.0035	0.20	0.39	0.0056	0.38	8.07	0.0061	2.01	3.32	0.0113	0.25
1990	4	4.99	0.0030	0.71	2.88	0.0250	0.36	0.36	0.0119	0.35	2.67	0.0029	0.66	8.72	0.0144	0.67
1991	1	6.59	0.0020	0.94	5.08	0.0076	0.63	0.79	0.0127	0.77	3.89	0.0023	0.97	11.67	0.0081	0.89
1991	2	5.79	0.0096	0.82	2.97	0.0057	0.37	0.64	0.0203	0.63	2.87	0.0250	0.71	6.97	0.0161	0.53
1991	3	2.35	0.0099	0.33	2.39	0.0031	0.30	0.31	0.0036	0.30	2.44	0.0138	0.61	4.30	0.0098	0.33
1991	4	5.74	0.0095	0.82	3.98	0.0141	0.49	0.30	0.0036	0.29	2.69	0.0043	0.67	9.42	0.0284	0.72
1992	1	5.41	0.0039	0.77	6.03	0.0048	0.74	0.51	0.0165	0.50	3.58	0.0040	0.89	10.83	0.0103	0.83
1992	2	5.99	0.0057	0.85	2.41	0.0040	0.30	0.44	0.0116	0.42	2.76	0.1065	0.69	6.18	0.0107	0.47
1992	3	3.06	0.0247	0.44	3.15	0.0022	0.39	0.19	0.0065	0.19	4.02	0.0178	1.00	5.95	0.0076	0.45
1992	4	4.04	0.0036	0.58	5.76	0.0306	0.71	0.22	0.0066	0.21	2.51	0.0078	0.62	8.36	0.0179	0.64
1993	1	3.31	0.0046	0.47	13.74	0.0057	1.69	0.31	0.0304	0.30	2.00	0.0037	0.50	15.16	0.0123	1.16
1993	2	3.43	0.0035	0.49	3.48	0.0047	0.43	0.27	0.0184	0.26	5.99	0.0322	1.49	6.91	0.0098	0.53
1993	3	3.59	0.0059	0.51	4.05	0.0025	0.50	0.17	0.0036	0.16	2.24	0.0082	0.56	7.45	0.0073	0.57
1993	4	5.47	0.0024	0.78	5.31	0.0268	0.65	0.25	0.0043	0.24	2.61	0.0060	0.65	11.06	0.0126	0.84
1994	1	3.91	0.0023	0.56	7.20	0.0031	0.89	0.58	0.0073	0.57	1.56	0.0032	0.39	11.26	0.0065	0.86
1994	2	4.49	0.0032	0.64	2.62	0.0018	0.32	0.49	0.0050	0.48	2.18	0.2145	0.54	6.04	0.0048	0.46
1994	3	2.31	0.0077	0.33	2.91	0.0017	0.36	0.26	0.0032	0.25	3.97	0.0223	0.99	5.63	0.0052	0.43
1994	4	2.88	0.0022	0.41	4.07	0.0069	0.50	0.34	0.0024	0.33	1.92	0.0044	0.48	6.78	0.0089	0.52
1995	1	2.31	0.0036	0.33	5.28	0.0024	0.65	0.61	0.0032	0.59	2.16	0.0028	0.54	8.46	0.0062	0.65
1995	2	1.16	0.0058	0.16	2.33	0.0019	0.29	0.26	0.0040	0.25	3.03	0.0168	0.75	4.11	0.0058	0.31
1995	3	2.46	0.0118	0.35	2.32	0.0023	0.29	0.25	0.0018	0.24	1.14	0.0066	0.28	4.66	0.0077	0.36
1995	4	5.02	0.0020	0.71	9.32	0.0123	1.15	0.16	0.0018	0.15	1.94	0.0030	0.48	11.72	0.0093	0.89
1996	1	6.54	0.0022	0.93	4.89	0.0019	0.60	0.32	0.0031	0.31	2.32	0.0025	0.58	11.31	0.0045	0.86
1996	2	3.79	0.0029	0.54	1.55	0.0020	0.19	0.43	0.0031	0.42	1.49	0.0280	0.37	4.34	0.0051	0.33
1996	3	2.47	0.0033	0.35	1.91	0.0017	0.24	0.31	0.0022	0.30	1.90	0.0126	0.47	4.25	0.0046	0.32
1996	4	2.45	0.0012	0.35	8.06	0.0039	0.99	0.16	0.0024	0.16	1.59	0.0029	0.39	7.75	0.0047	0.59
1997	1	4.10	0.0013	0.58	6.59	0.0017	0.81	0.61	0.0131	0.59	1.97	0.0013	0.49	11.21	0.0034	0.86
1997	2	1.24	0.0013	0.18	1.40	0.0019	0.17	0.31	0.0056	0.30	2.10	0.0259	0.52	2.79	0.0036	0.21
1997	3	3.33	0.0024	0.47	1.18	0.0018	0.15	0.23	0.0019	0.22	3.88	0.0055	0.96	3.56	0.0044	0.27
1997	4	4.27	0.0009	0.61	4.19	0.0028	0.52	0.24	0.0030	0.23	1.02	0.0020	0.25	9.06	0.0033	0.69
1998	1	3.64	0.0008	0.52	5.62	0.0015	0.69	0.48	0.0168	0.47	2.15	0.0013	0.53	9.25	0.0024	0.71
1998	2	2.73	0.0010	0.39	1.14	0.0018	0.14	0.36	0.0071	0.35	2.18	0.0074	0.54	3.96	0.0031	0.30
1998	3	2.82	0.0021	0.40	1.07	0.0018	0.13	0.12	0.0034	0.11	1.23	0.0045	0.31	3.25	0.0042	0.25
1998	4	4.20	0.0017	0.60	5.95	0.0024	0.73	0.20	0.0040	0.20	1.67	0.0019	0.42	10.38	0.0047	0.79

Appendix table 6. Quarterly value of yellowfin CPUE standardized from 1963-201 for data subsets in each of five areas without LT5LN5 expressed in real scale and relative scale with standard error of log CPUE. Dev: square of CV (std_err).
(continued)

		AREA2			AREA3			AREA4			AREA5			AREA3'		
YEAR	QT	CPUE	Dev	Relative	CPUE	Dev	Relative	CPUE	Dev	Relative	CPUE	Dev	Relative	CPUE	Dev	Relative
1999	1	3.44	0.0020	0.49	5.09	0.0019	0.63	0.53	0.0099	0.52	2.78	0.0016	0.69	9.09	0.0044	0.69
1999	2	3.56	0.0039	0.51	1.24	0.0021	0.15	0.56	0.0056	0.54	1.96	0.0053	0.49	3.40	0.0058	0.26
1999	3	3.99	0.0040	0.57	1.88	0.0024	0.23	0.19	0.0032	0.18	1.96	0.0021	0.49	4.85	0.0065	0.37
1999	4	3.93	0.0012	0.56	6.92	0.0026	0.85	0.36	0.0074	0.35	1.56	0.0012	0.39	10.45	0.0040	0.80
2000	1	3.70	0.0011	0.53	6.59	0.0023	0.81	0.62	0.0110	0.60	1.70	0.0015	0.42	9.99	0.0037	0.76
2000	2	3.00	0.0028	0.43	1.28	0.0037	0.16	0.40	0.0047	0.39	3.90	0.0016	0.97	4.06	0.0077	0.31
2000	3	5.87	0.0030	0.84	1.62	0.0025	0.20	0.36	0.0030	0.35	3.88	0.0026	0.97	5.47	0.0061	0.42
2000	4	4.61	0.0018	0.66	3.47	0.0030	0.43	0.19	0.0059	0.18	1.71	0.0028	0.43	8.31	0.0054	0.63
2001	1	4.50	0.0032	0.64	8.34	0.0023	1.03	0.13	0.0065	0.13	1.63	0.0014	0.41	14.41	0.0060	1.10
2001	2	5.06	0.0024	0.72	1.39	0.0040	0.17	0.40	0.0055	0.39	1.75	0.0028	0.44	5.99	0.0074	0.46
2001	3	3.99	0.0037	0.57	1.82	0.0025	0.22	0.34	0.0021	0.33	1.25	0.0036	0.31	4.86	0.0065	0.37
2001	4	5.66	0.0023	0.80	3.40	0.0037	0.42	0.37	0.0024	0.36	0.96	0.0036	0.24	9.23	0.0070	0.71
2002	1	6.17	0.0015	0.88	7.77	0.0020	0.96	0.35	0.0055	0.34	1.21	0.0037	0.30	14.52	0.0039	1.11
2002	2	3.31	0.0022	0.47	2.20	0.0045	0.27	0.37	0.0081	0.36	1.65	0.0061	0.41	5.89	0.0074	0.45
2002	3	1.27	0.0027	0.18	1.60	0.0030	0.20	0.22	0.0024	0.21	0.80	0.0031	0.20	3.12	0.0066	0.24
2002	4	2.41	0.0010	0.34	3.21	0.0056	0.40	0.14	0.0029	0.14	0.89	0.0013	0.22	5.44	0.0045	0.42
2003	1	3.83	0.0013	0.55	8.15	0.0025	1.01	0.32	0.0213	0.31	0.96	0.0020	0.24	11.38	0.0042	0.87
2003	2	4.58	0.0020	0.65	1.93	0.0047	0.24	0.88	0.0140	0.85	0.84	0.0176	0.21	7.04	0.0071	0.54
2003	3	4.65	0.0030	0.66	1.82	0.0037	0.23	0.25	0.0038	0.25	0.68	0.0081	0.17	5.97	0.0079	0.46
2003	4	4.61	0.0011	0.66	3.91	0.0058	0.48	0.12	0.0045	0.11	1.58	0.0027	0.39	9.46	0.0048	0.72
2004	1	3.24	0.0010	0.46	6.00	0.0025	0.74	0.75	0.0307	0.73	1.05	0.0033	0.26	8.69	0.0036	0.66
2004	2	5.95	0.0018	0.85	2.13	0.0042	0.26	0.32	0.0106	0.31	2.73	0.0103	0.68	8.67	0.0064	0.66
2004	3	2.30	0.0022	0.33	1.62	0.0018	0.20	0.24	0.0038	0.23	1.31	0.0044	0.33	3.86	0.0043	0.30
2004	4	5.01	0.0013	0.71	2.73	0.0033	0.34	0.09	0.0048	0.09	0.90	0.0024	0.22	8.57	0.0048	0.65
2005	1	4.64	0.0009	0.66	8.56	0.0023	1.06	0.17	0.0114	0.17	0.94	0.0030	0.23	12.11	0.0032	0.92
2005	2	5.76	0.0012	0.82	1.95	0.0026	0.24	0.43	0.0138	0.42	1.23	0.0085	0.31	7.87	0.0041	0.60
2005	3	2.27	0.0014	0.32	1.03	0.0016	0.13	0.10	0.0079	0.09	1.13	0.0119	0.28	3.09	0.0034	0.24
2005	4	3.08	0.0009	0.44	4.65	0.0033	0.57	0.06	0.0044	0.06	0.80	0.0039	0.20	7.44	0.0037	0.57
2006	1	4.59	0.0008	0.65	9.19	0.0020	1.13	0.08	0.0084	0.07	1.52	0.0018	0.38	12.68	0.0029	0.97
2006	2	5.52	0.0007	0.79	3.38	0.0020	0.42	0.39	0.0203	0.38	2.24	0.0032	0.56	9.83	0.0027	0.75
2006	3	2.18	0.0018	0.31	0.97	0.0017	0.12	0.14	0.0046	0.14	1.22	0.0024	0.30	2.77	0.0038	0.21
2006	4	2.27	0.0009	0.32	3.03	0.0021	0.37	0.14	0.0083	0.14	0.94	0.0017	0.23	5.33	0.0032	0.41
2007	1	2.08	0.0007	0.30	7.08	0.0019	0.87	0.13	0.0265	0.13	1.26	0.0014	0.31	7.06	0.0025	0.54
2007	2	1.85	0.0006	0.26	5.69	0.0028	0.70	0.29	0.0102	0.28	1.65	0.0025	0.41	5.28	0.0025	0.40
2007	3	1.76	0.0015	0.25	0.94	0.0019	0.12	0.12	0.0041	0.12	1.11	0.0034	0.28	2.59	0.0038	0.20
2007	4	2.10	0.0011	0.30	2.29	0.0036	0.28	0.06	0.0105	0.06	1.06	0.0017	0.26	4.53	0.0044	0.35
2008	1	1.30	0.0012	0.19	6.04	0.0026	0.74	0.15	0.0166	0.15	0.74	0.0014	0.18	5.37	0.0039	0.41
2008	2	1.26	0.0009	0.18	2.28	0.0038	0.28	0.04	0.0049	0.04	0.51	0.0036	0.13	3.10	0.0038	0.24
2008	3	1.33	0.0019	0.19	0.59	0.0025	0.07	0.03	0.0035	0.03	0.62	0.0030	0.15	1.72	0.0050	0.13
2008	4	0.92	0.0014	0.13	2.09	0.0024	0.26	0.05	0.0103	0.05	0.50	0.0014	0.12	2.88	0.0044	0.22
2009	1	0.71	0.0010	0.10	2.47	0.0025	0.30	0.22	0.0377	0.21	0.61	0.0011	0.15	2.54	0.0035	0.19
2009	2	1.00	0.0018	0.14	3.50	0.0046	0.43	0.10	0.0053	0.09	0.73	0.0024	0.18	3.50	0.0067	0.27
2009	3	1.90	0.0099	0.27	1.41	0.0034	0.17	0.03	0.0030	0.03	0.64	0.0027	0.16	2.77	0.0106	0.21
2009	4	3.22	0.0075	0.46	1.59	0.0044	0.20	0.05	0.0124	0.05	0.33	0.0011	0.08	3.87	0.0124	0.30

Appendix table 6. Quarterly value of yellowfin CPUE standardized from 1963-201 for data subsets in each of five areas without LT5LN5 expressed in real scale and relative scale with standard error of log CPUE. Dev: square of CV (std_err).
(continued)

		AREA2			AREA3			AREA4			AREA5			AREA3'		
YEAR	QT	CPUE	Dev	Relative	CPUE	Dev	Relative	CPUE	Dev	Relative	CPUE	Dev	Relative	CPUE	Dev	Relative
2010	1	1.72	0.0103	0.25	3.00	0.0032	0.37	0.07	0.0134	0.07	0.56	0.0014	0.14	5.45	0.0101	0.42
2010	2	0.96	0.0111	0.14	4.16	0.0055	0.51	0.07	0.0034	0.07	0.70	0.0063	0.17	5.92	0.0164	0.45
2010	3	8.04	0.0733	1.14	1.75	0.0046	0.22	0.04	0.0044	0.04	0.34	0.0126	0.09	3.49	0.0173	0.27
2010	4	4.76	0.0367	0.68	2.31	0.0045	0.28	0.18	0.0438	0.17	0.28	0.0021	0.07	4.58	0.0163	0.35
2011	1				5.08	0.0084	0.63	0.11	0.0391	0.10	0.30	0.0028	0.08	9.44	0.0335	0.72
2011	2				2.09	0.0070	0.26	0.13	0.0047	0.13	0.20	0.0711	0.05	3.81	0.0279	0.29
2011	3				1.05	0.0040	0.13	0.07	0.0068	0.07	0.01	0.3185	0.00	1.83	0.0153	0.14
2011	4				4.04	0.0076	0.50	0.08	0.0475	0.07	0.73	0.0035	0.18	7.49	0.0303	0.57
2012	1				2.62	0.0061	0.32	0.67	0.0706	0.65	0.74	0.0030	0.18	4.78	0.0239	0.36
2012	2	0.87	0.0367	0.12	1.48	0.0053	0.18	0.15	0.0040	0.14	0.94	0.0494	0.23	2.63	0.0189	0.20
2012	3	1.50	0.0189	0.21	0.89	0.0040	0.11	0.03	0.0063	0.03	0.17	0.0280	0.04	1.68	0.0137	0.13
2012	4	2.68	0.0124	0.38	4.20	0.0087	0.52	0.12	0.1932	0.12	0.46	0.0029	0.11	7.28	0.0238	0.56
2013	1	0.81	0.0057	0.12	4.75	0.0034	0.59	0.16	0.0272	0.15	0.40	0.0027	0.10	6.21	0.0094	0.47
2013	2	0.86	0.0063	0.12	2.97	0.0037	0.37	0.04	0.0036	0.04	0.16	0.0402	0.04	4.25	0.0103	0.32
2013	3				1.93	0.0045	0.24	0.05	0.0052	0.04	0.29	0.0131	0.07	3.47	0.0173	0.26
2013	4	1.99	0.0164	0.28	3.92	0.0043	0.48	0.78	0.1935	0.76	0.30	0.0018	0.07	6.97	0.0143	0.53
2014	1	2.45	0.0338	0.35	4.80	0.0046	0.59	0.00	0.0486	0.00	0.34	0.0054	0.08	8.84	0.0164	0.68
2014	2	1.24	0.0249	0.18	2.88	0.0071	0.36	0.01	0.0036	0.01				4.98	0.0238	0.38
2014	3	2.90	0.0461	0.41	1.65	0.0073	0.20	0.02	0.0043	0.02	0.20	0.0145	0.05	3.21	0.0264	0.25
2014	4				2.87	0.0172	0.35	0.04	0.7746	0.04	0.27	0.0075	0.07	5.26	0.0701	0.40

Appendix table 7. Quarterly value of yellowfin CPUE for 1963-2014 for data subsets in each of five areas with LT5LN5 expressed in real scale and relative scale with standard error of log CPUE. Dev: square of CV (std_err).

		AREA2			AREA3			AREA4			AREA5			AREA3'		
YEAR	QT	CPUE	Dev	Relative	CPUE	Dev	Relative	CPUE	Dev	Relative	CPUE	Dev	Relative	CPUE	Dev	Relative
1963	1	20.04	0.0027	3.02	13.03	0.0072	2.98	0.45	0.0041	1.08	8.22	0.0025	2.04	27.87	0.0099	2.98
1963	2	15.97	0.0039	2.41	12.20	0.0074	2.79	0.71	0.0280	1.71	8.09	0.0031	2.01	23.62	0.0125	2.53
1963	3	14.53	0.0133	2.19	7.37	0.0053	1.69	1.11	0.0049	2.67	7.08	0.0035	1.76	16.29	0.0138	1.74
1963	4	21.92	0.0030	3.31	9.16	0.0071	2.10	0.45	0.0035	1.08	9.24	0.0029	2.29	27.20	0.0106	2.91
1964	1	17.60	0.0028	2.66	10.62	0.0077	2.43	0.33	0.0038	0.78	10.94	0.0029	2.71	24.04	0.0104	2.57
1964	2	12.13	0.0022	1.83	5.99	0.0063	1.37	2.48	0.0137	5.93	11.98	0.0030	2.97	15.55	0.0083	1.66
1964	3	8.78	0.0055	1.33	5.93	0.0036	1.36	0.89	0.0073	2.13	9.25	0.0021	2.30	12.70	0.0079	1.36
1964	4	9.25	0.0027	1.40	4.78	0.0049	1.09	0.53	0.0027	1.26	6.15	0.0021	1.53	12.03	0.0085	1.29
1965	1	11.74	0.0022	1.77	4.40	0.0073	1.01	0.31	0.0033	0.75	7.75	0.0020	1.92	14.61	0.0084	1.56
1965	2	12.40	0.0024	1.87	5.99	0.0090	1.37	0.80	0.0144	1.91	8.80	0.0018	2.18	16.22	0.0096	1.73
1965	3	10.81	0.0033	1.63	5.63	0.0048	1.29	0.34	0.0059	0.81	5.09	0.0027	1.26	13.35	0.0091	1.43
1965	4	21.70	0.0029	3.27	7.84	0.0063	1.79	0.29	0.0028	0.70	8.04	0.0026	2.00	25.30	0.0100	2.70
1966	1	20.06	0.0020	3.03	7.19	0.0148	1.65	0.25	0.0035	0.59	9.40	0.0021	2.33	27.22	0.0084	2.91
1966	2	17.88	0.0019	2.70	7.05	0.0058	1.61	0.91	0.0145	2.18	11.00	0.0029	2.73	22.29	0.0073	2.38
1966	3	15.98	0.0027	2.41	7.27	0.0047	1.66	0.71	0.0068	1.71	10.30	0.0027	2.56	19.18	0.0083	2.05
1966	4	18.26	0.0020	2.75	5.68	0.0053	1.30	0.58	0.0024	1.39	9.98	0.0023	2.48	21.51	0.0073	2.30
1967	1	11.58	0.0018	1.75	5.17	0.0057	1.18	0.72	0.0031	1.72	9.19	0.0019	2.28	15.04	0.0069	1.61
1967	2	10.97	0.0021	1.65	5.96	0.0045	1.37	0.87	0.0033	2.08	7.39	0.0017	1.83	14.14	0.0071	1.51
1967	3	6.06	0.0030	0.91	3.70	0.0045	0.85	0.27	0.0025	0.65	6.76	0.0026	1.68	8.28	0.0084	0.88
1967	4	10.33	0.0023	1.56	5.07	0.0054	1.16	0.28	0.0021	0.68	8.80	0.0030	2.18	13.24	0.0082	1.42
1968	1	29.22	0.0022	4.41	22.39	0.0113	5.13	0.54	0.0035	1.29	10.16	0.0019	2.52	42.67	0.0090	4.56
1968	2	38.03	0.0023	5.74	14.12	0.0065	3.23	0.63	0.0032	1.51	10.93	0.0035	2.71	46.42	0.0086	4.96
1968	3	19.23	0.0028	2.90	7.45	0.0055	1.71	0.27	0.0023	0.64	4.55	0.0037	1.13	22.20	0.0091	2.37
1968	4	22.76	0.0022	3.43	5.94	0.0069	1.36	0.26	0.0026	0.62	6.13	0.0027	1.52	26.94	0.0083	2.88
1969	1	15.85	0.0021	2.39	4.65	0.0060	1.06	0.19	0.0051	0.46	7.92	0.0022	1.97	18.59	0.0078	1.99
1969	2	12.06	0.0028	1.82	4.70	0.0056	1.08	0.47	0.0038	1.14	9.74	0.0025	2.42	13.69	0.0093	1.46
1969	3	14.52	0.0029	2.19	3.47	0.0048	0.79	0.29	0.0025	0.70	6.70	0.0044	1.66	12.90	0.0086	1.38
1969	4	17.30	0.0030	2.61	2.50	0.0068	0.57	0.27	0.0032	0.64	8.04	0.0037	1.99	15.49	0.0103	1.66
1970	1	10.02	0.0030	1.51	3.29	0.0094	0.75	0.22	0.0081	0.54	7.48	0.0025	1.86	12.06	0.0116	1.29
1970	2	6.84	0.0042	1.03	3.16	0.0080	0.72	0.30	0.0036	0.71	7.20	0.0032	1.79	8.30	0.0135	0.89
1970	3	6.33	0.0121	0.96	1.40	0.0085	0.32	0.27	0.0028	0.65	15.12	0.0025	3.75	4.40	0.0217	0.47
1970	4	10.98	0.0032	1.66	2.78	0.0091	0.64	1.06	0.0029	2.54	8.16	0.0027	2.02	12.01	0.0120	1.28
1971	1	8.61	0.0029	1.30	4.29	0.0067	0.98	1.23	0.0051	2.94	6.48	0.0027	1.61	10.96	0.0102	1.17
1971	2	10.03	0.0041	1.51	4.28	0.0112	0.98	3.03	0.0032	7.27	9.62	0.0031	2.39	12.50	0.0152	1.34
1971	3	15.98	0.0038	2.41	3.53	0.0089	0.81	0.85	0.0023	2.03	5.47	0.0041	1.36	16.39	0.0132	1.75
1971	4	13.57	0.0030	2.05	3.87	0.0133	0.89	0.80	0.0045	1.91	7.11	0.0049	1.77	16.97	0.0123	1.81
1972	1	8.27	0.0035	1.25	11.64	0.0154	2.67	1.85	0.1066	4.43	6.47	0.0044	1.60	13.30	0.0144	1.42
1972	2	8.70	0.0040	1.31	8.91	0.0196	2.04	2.32	0.0120	5.55	4.24	0.0049	1.05	13.09	0.0167	1.40
1972	3	9.81	0.0035	1.48	3.39	0.0076	0.77	1.10	0.0054	2.63	6.18	0.0081	1.53	11.12	0.0120	1.19
1972	4	10.25	0.0040	1.55	5.72	0.0131	1.31	0.71	0.0092	1.69	8.53	0.0140	2.12	14.05	0.0154	1.50
1973	1	7.63	0.0060	1.15	6.88	0.0189	1.57	3.02	0.0473	7.24	8.92	0.0054	2.21	11.49	0.0229	1.23
1973	2	7.35	0.0058	1.11	3.26	0.0153	0.75	2.67	0.0092	6.40	9.51	0.0085	2.36	9.17	0.0213	0.98
1973	3	4.84	0.0045	0.73	1.78	0.0076	0.41	0.35	0.0043	0.84	7.47	0.0105	1.85	5.32	0.0138	0.57
1973	4	8.51	0.0044	1.28	6.66	0.0091	1.53	0.46	0.0034	1.11	4.93	0.0050	1.22	12.95	0.0147	1.38
1974	1	4.83	0.0041	0.73	6.90	0.0105	1.58	0.58	0.0076	1.40	4.24	0.0029	1.05	8.43	0.0149	0.90
1974	2	5.66	0.0050	0.85	4.86	0.0133	1.11	0.83	0.0041	1.99	6.52	0.0062	1.62	8.54	0.0183	0.91
1974	3	4.85	0.0038	0.73	1.66	0.0075	0.38	0.25	0.0036	0.61	4.32	0.0043	1.07	5.38	0.0125	0.58
1974	4	4.86	0.0047	0.73	4.39	0.0072	1.00	0.24	0.0054	0.57	4.60	0.0026	1.14	7.81	0.0136	0.83

Appendix table 7. Quarterly value of yellowfin CPUE for 1963-2014 for data subsets in each of five areas with LT5LN5 expressed in real scale and relative scale with standard error of log CPUE. Dev: square of CV (std_err).
(continued)

		AREA2			AREA3			AREA4			AREA5			AREA3'		
YEAR	QT	CPUE	Dev	Relative	CPUE	Dev	Relative	CPUE	Dev	Relative	CPUE	Dev	Relative	CPUE	Dev	Relative
1975	1	3.49	0.0045	0.53	3.99	0.0203	0.91	0.35	0.0082	0.84	4.90	0.0022	1.22	5.24	0.0188	0.56
1975	2	4.12	0.0058	0.62	4.45	0.0136	1.02	0.48	0.0039	1.15	4.43	0.0042	1.10	6.66	0.0203	0.71
1975	3	6.67	0.0030	1.01	4.12	0.0063	0.94	0.33	0.0029	0.78	3.85	0.0026	0.96	9.20	0.0102	0.98
1975	4	9.85	0.0036	1.49	13.81	0.0121	3.16	0.30	0.0043	0.72	4.70	0.0036	1.17	16.72	0.0140	1.79
1976	1	3.30	0.0043	0.50	7.40	0.0081	1.69	0.24	0.0327	0.57	3.53	0.0039	0.88	7.45	0.0138	0.80
1976	2	12.59	0.0054	1.90	5.39	0.0220	1.23	0.27	0.0116	0.64	8.21	0.0070	2.04	16.63	0.0221	1.78
1976	3	6.85	0.0133	1.03	2.08	0.0085	0.48	0.38	0.0040	0.90	4.75	0.0090	1.18	5.92	0.0221	0.63
1976	4	5.67	0.0192	0.85	6.23	0.0216	1.43	0.29	0.0062	0.70	5.98	0.0087	1.48	10.62	0.0483	1.14
1977	1	3.63	0.0133	0.55	18.76	0.0381	4.29	0.63	0.0315	1.50	6.94	0.0094	1.72	9.65	0.0500	1.03
1977	2	18.09	0.0121	2.73	21.07	0.0455	4.82	0.52	0.0188	1.24	7.70	0.0622	1.91	29.73	0.0484	3.18
1977	3	8.22	0.0125	1.24	5.28	0.0093	1.21	0.28	0.0048	0.68	4.56	0.0089	1.13	11.92	0.0234	1.27
1977	4	14.67	0.0036	2.21	6.42	0.0259	1.47	0.33	0.0062	0.78	5.86	0.0235	1.45	19.92	0.0170	2.13
1978	1	7.07	0.0017	1.07	6.29	0.0104	1.44	0.38	0.0176	0.92	7.93	0.0064	1.97	10.47	0.0081	1.12
1978	2	5.70	0.0022	0.86	3.59	0.0154	0.82	0.81	0.0063	1.93	9.23	0.0183	2.29	8.01	0.0105	0.86
1978	3	4.39	0.0101	0.66	2.48	0.0095	0.57	0.30	0.0044	0.72	2.73	0.0023	0.68	5.70	0.0223	0.61
1978	4	8.61	0.0048	1.30	8.87	0.0167	2.03	0.31	0.0071	0.75	3.24	0.0047	0.80	13.80	0.0196	1.48
1979	1	4.64	0.0035	0.70	14.24	0.0079	3.26	0.30	0.0219	0.72	4.38	0.0051	1.09	12.05	0.0126	1.29
1979	2	3.34	0.0064	0.50	8.92	0.0156	2.04	0.69	0.0099	1.64	4.38	0.0066	1.09	7.85	0.0234	0.84
1979	3	3.11	0.0052	0.47	3.25	0.0079	0.74	0.39	0.0043	0.93	2.40	0.0068	0.59	5.49	0.0153	0.59
1979	4	5.18	0.0125	0.78	5.80	0.0134	1.33	0.36	0.0083	0.86	3.52	0.0047	0.87	9.58	0.0302	1.02
1980	1	3.21	0.0041	0.48	4.95	0.0064	1.13	0.25	0.0247	0.59	4.44	0.0048	1.10	6.83	0.0121	0.73
1980	2	3.64	0.0043	0.55	1.16	0.0143	0.27	0.20	0.0153	0.49	7.40	0.0054	1.84	3.98	0.0173	0.43
1980	3	3.98	0.0118	0.60	1.17	0.0073	0.27	0.32	0.0050	0.76	3.22	0.0036	0.80	3.19	0.0187	0.34
1980	4	7.76	0.0030	1.17	4.15	0.0145	0.95	0.26	0.0041	0.61	2.46	0.0043	0.61	10.47	0.0134	1.12
1981	1	3.73	0.0019	0.56	3.43	0.0058	0.79	0.25	0.0105	0.60	3.33	0.0035	0.83	5.58	0.0078	0.60
1981	2	3.28	0.0042	0.50	4.47	0.0102	1.02	0.25	0.0142	0.61	3.57	0.0052	0.89	5.77	0.0154	0.62
1981	3	5.74	0.0040	0.87	3.34	0.0059	0.76	0.35	0.0033	0.83	6.37	0.0092	1.58	7.66	0.0114	0.82
1981	4	5.51	0.0025	0.83	5.77	0.0132	1.32	0.34	0.0048	0.81	3.52	0.0030	0.87	8.30	0.0113	0.89
1982	1	3.94	0.0017	0.59	5.50	0.0057	1.26	0.82	0.0136	1.97	3.79	0.0034	0.94	6.64	0.0074	0.71
1982	2	5.40	0.0031	0.81	4.77	0.0095	1.09	0.13	0.0360	0.30	3.81	0.0064	0.95	8.24	0.0123	0.88
1982	3	4.74	0.0023	0.72	2.52	0.0053	0.58	0.26	0.0055	0.61	3.91	0.0038	0.97	6.21	0.0085	0.66
1982	4	9.89	0.0017	1.49	3.31	0.0132	0.76	0.42	0.0108	1.01	3.12	0.0031	0.77	13.40	0.0084	1.43
1983	1	4.99	0.0013	0.75	6.14	0.0109	1.41	0.36	0.0190	0.87	4.39	0.0022	1.09	7.42	0.0067	0.79
1983	2	5.90	0.0017	0.89	2.26	0.0183	0.52	0.40	0.0079	0.96	7.79	0.0090	1.93	8.06	0.0086	0.86
1983	3	4.38	0.0042	0.66	2.50	0.0061	0.57	0.25	0.0040	0.59	3.67	0.0018	0.91	5.97	0.0120	0.64
1983	4	10.51	0.0023	1.59	7.51	0.0154	1.72	0.36	0.0057	0.86	4.50	0.0026	1.12	15.67	0.0110	1.68
1984	1	5.53	0.0018	0.83	8.51	0.0113	1.95	0.50	0.0075	1.20	5.53	0.0022	1.37	8.67	0.0086	0.93
1984	2	6.07	0.0025	0.92	3.98	0.0177	0.91	0.43	0.0049	1.04	6.33	0.0038	1.57	8.73	0.0123	0.93
1984	3	6.81	0.0040	1.03	3.62	0.0059	0.83	0.28	0.0042	0.67	2.95	0.0022	0.73	9.12	0.0115	0.97
1984	4	6.96	0.0025	1.05	9.28	0.0124	2.12	0.47	0.0046	1.13	4.99	0.0027	1.24	11.44	0.0114	1.22
1985	1	5.82	0.0017	0.88	8.07	0.0111	1.85	0.55	0.0114	1.32	4.20	0.0015	1.04	9.16	0.0083	0.98
1985	2	5.49	0.0022	0.83	1.80	0.0086	0.41	0.58	0.0035	1.39	6.91	0.0038	1.72	6.92	0.0098	0.74
1985	3	6.08	0.0023	0.92	2.47	0.0051	0.57	0.31	0.0031	0.73	5.24	0.0025	1.30	7.40	0.0083	0.79
1985	4	12.08	0.0016	1.82	4.92	0.0135	1.13	0.26	0.0059	0.62	4.28	0.0045	1.06	17.03	0.0082	1.82
1986	1	9.23	0.0014	1.39	9.70	0.0077	2.22	0.38	0.0054	0.91	4.19	0.0013	1.04	14.51	0.0068	1.55
1986	2	10.93	0.0020	1.65	1.87	0.0081	0.43	0.56	0.0133	1.34	7.38	0.0081	1.83	12.32	0.0092	1.32
1986	3	8.29	0.0031	1.25	1.62	0.0056	0.37	0.26	0.0035	0.62	5.04	0.0039	1.25	7.47	0.0100	0.80
1986	4	9.87	0.0020	1.49	3.54	0.0272	0.81	0.26	0.0037	0.61	4.01	0.0025	1.00	14.23	0.0101	1.52

Appendix table 7. Quarterly value of yellowfin CPUE for 1963-2014 for data subsets in each of five areas with LT5LN5 expressed in real scale and relative scale with standard error of log CPUE. Dev: square of CV (std_err).
(continued)

		AREA2			AREA3			AREA4			AREA5			AREA3'		
YEAR	QT	CPUE	Dev	Relative	CPUE	Dev	Relative	CPUE	Dev	Relative	CPUE	Dev	Relative	CPUE	Dev	Relative
1987	1	6.68	0.0014	1.01	7.52	0.0112	1.72	0.23	0.0044	0.54	4.60	0.0017	1.14	10.29	0.0072	1.10
1987	2	6.48	0.0020	0.98	6.30	0.0103	1.44	1.01	0.0183	2.43	5.91	0.0566	1.47	10.40	0.0094	1.11
1987	3	4.16	0.0051	0.63	2.73	0.0050	0.63	0.27	0.0037	0.65	3.70	0.0148	0.92	6.48	0.0110	0.69
1987	4	9.96	0.0028	1.50	4.93	0.0141	1.13	0.31	0.0047	0.75	4.18	0.0021	1.04	14.42	0.0128	1.54
1988	1	9.96	0.0015	1.50	12.01	0.0119	2.75	0.57	0.0117	1.37	5.14	0.0017	1.27	15.67	0.0075	1.68
1988	2	6.77	0.0022	1.02	3.63	0.0083	0.83	1.02	0.0143	2.45	5.64	0.0566	1.40	9.66	0.0097	1.03
1988	3	4.15	0.0045	0.63	3.23	0.0050	0.74	0.24	0.0049	0.58	7.37	0.0051	1.83	7.26	0.0105	0.78
1988	4	5.55	0.0026	0.84	7.41	0.0131	1.70	0.27	0.0066	0.65	4.69	0.0022	1.16	9.32	0.0120	1.00
1989	1	4.07	0.0015	0.61	7.26	0.0147	1.66	0.87	0.0132	2.09	5.00	0.0032	1.24	6.37	0.0080	0.68
1989	2	4.03	0.0030	0.61	3.24	0.0079	0.74	0.91	0.0287	2.19	5.67	0.0135	1.41	6.50	0.0117	0.70
1989	3	2.91	0.0214	0.44	2.02	0.0049	0.46	0.25	0.0067	0.60	2.58	0.0062	0.64	5.15	0.0131	0.55
1989	4	7.58	0.0044	1.14	6.15	0.0111	1.41	0.28	0.0062	0.66	2.54	0.0046	0.63	12.80	0.0165	1.37
1990	1	8.00	0.0023	1.21	15.15	0.0095	3.47	0.41	0.0056	0.97	4.95	0.0019	1.23	15.51	0.0104	1.66
1990	2	5.13	0.0036	0.77	2.96	0.0085	0.68	0.12	0.0360	0.30	8.10	0.0218	2.01	7.56	0.0134	0.81
1990	3	5.51	0.0126	0.83	1.26	0.0047	0.29	0.28	0.0036	0.68	7.87	0.0060	1.95	3.71	0.0120	0.40
1990	4	6.38	0.0031	0.96	1.99	0.0214	0.46	0.20	0.0075	0.47	2.63	0.0029	0.65	8.60	0.0147	0.92
1991	1	7.52	0.0021	1.13	3.30	0.0079	0.76	0.48	0.0080	1.15	3.47	0.0023	0.86	10.29	0.0095	1.10
1991	2	7.59	0.0091	1.14	2.34	0.0064	0.54	0.24	0.0128	0.56	3.02	0.0243	0.75	7.38	0.0160	0.79
1991	3	2.48	0.0093	0.37	1.81	0.0044	0.41	0.24	0.0023	0.58	2.21	0.0134	0.55	4.27	0.0108	0.46
1991	4	5.89	0.0089	0.89	3.09	0.0130	0.71	0.15	0.0024	0.35	2.49	0.0043	0.62	8.52	0.0259	0.91
1992	1	5.84	0.0038	0.88	3.71	0.0057	0.85	0.15	0.0105	0.37	3.21	0.0039	0.80	8.79	0.0113	0.94
1992	2	7.38	0.0055	1.11	1.95	0.0051	0.45	0.16	0.0074	0.38	2.31	0.1031	0.57	6.47	0.0115	0.69
1992	3	3.03	0.0228	0.46	2.89	0.0037	0.66	0.18	0.0042	0.44	3.68	0.0173	0.91	7.18	0.0090	0.77
1992	4	4.12	0.0035	0.62	4.06	0.0257	0.93	0.10	0.0043	0.23	2.51	0.0076	0.62	6.85	0.0174	0.73
1993	1	3.84	0.0044	0.58	8.02	0.0064	1.84	0.14	0.0189	0.32	1.87	0.0036	0.46	11.70	0.0129	1.25
1993	2	4.39	0.0035	0.66	2.74	0.0056	0.63	0.16	0.0115	0.37	5.47	0.0312	1.36	7.24	0.0108	0.77
1993	3	3.65	0.0056	0.55	3.81	0.0040	0.87	0.15	0.0024	0.35	2.13	0.0080	0.53	8.57	0.0088	0.92
1993	4	5.49	0.0025	0.83	4.13	0.0228	0.95	0.16	0.0029	0.38	2.44	0.0059	0.60	9.33	0.0131	1.00
1994	1	4.42	0.0024	0.67	4.89	0.0045	1.12	0.19	0.0047	0.45	1.44	0.0032	0.36	9.56	0.0081	1.02
1994	2	5.36	0.0032	0.81	2.27	0.0034	0.52	0.28	0.0033	0.68	1.60	0.2078	0.40	6.56	0.0068	0.70
1994	3	2.80	0.0073	0.42	2.78	0.0033	0.64	0.24	0.0021	0.58	3.74	0.0217	0.93	6.77	0.0071	0.72
1994	4	2.99	0.0023	0.45	2.63	0.0074	0.60	0.20	0.0016	0.48	1.86	0.0043	0.46	5.48	0.0101	0.59
1995	1	2.70	0.0035	0.41	3.56	0.0039	0.82	0.30	0.0021	0.72	2.02	0.0028	0.50	7.11	0.0079	0.76
1995	2	2.18	0.0056	0.33	1.97	0.0035	0.45	0.19	0.0026	0.45	3.09	0.0164	0.77	4.69	0.0076	0.50
1995	3	2.84	0.0111	0.43	1.99	0.0038	0.46	0.27	0.0012	0.64	1.20	0.0065	0.30	5.05	0.0091	0.54
1995	4	5.02	0.0021	0.76	6.87	0.0115	1.57	0.17	0.0013	0.40	2.01	0.0030	0.50	10.28	0.0104	1.10
1996	1	6.39	0.0023	0.96	3.61	0.0035	0.83	0.22	0.0021	0.52	2.15	0.0025	0.53	9.67	0.0066	1.03
1996	2	4.45	0.0029	0.67	1.38	0.0036	0.32	0.32	0.0021	0.76	1.57	0.0272	0.39	4.63	0.0070	0.49
1996	3	2.76	0.0033	0.42	2.07	0.0033	0.47	0.33	0.0015	0.80	1.75	0.0123	0.43	5.28	0.0066	0.56
1996	4	2.47	0.0013	0.37	5.01	0.0051	1.15	0.21	0.0016	0.51	1.60	0.0029	0.40	6.08	0.0067	0.65
1997	1	4.10	0.0014	0.62	3.51	0.0034	0.80	0.41	0.0083	0.98	1.77	0.0014	0.44	7.74	0.0056	0.83
1997	2	2.08	0.0015	0.31	1.46	0.0035	0.33	0.25	0.0036	0.60	1.95	0.0251	0.48	3.70	0.0058	0.40
1997	3	3.74	0.0025	0.56	1.53	0.0034	0.35	0.23	0.0013	0.54	3.65	0.0054	0.91	4.84	0.0064	0.52
1997	4	4.12	0.0010	0.62	2.24	0.0042	0.51	0.25	0.0020	0.61	1.07	0.0020	0.27	6.81	0.0055	0.73
1998	1	3.52	0.0009	0.53	2.97	0.0032	0.68	0.30	0.0106	0.71	1.97	0.0014	0.49	6.54	0.0048	0.70
1998	2	3.19	0.0012	0.48	1.24	0.0035	0.28	0.28	0.0046	0.67	1.94	0.0073	0.48	4.48	0.0053	0.48
1998	3	3.05	0.0022	0.46	1.23	0.0034	0.28	0.21	0.0022	0.51	1.06	0.0044	0.26	4.00	0.0063	0.43
1998	4	4.03	0.0018	0.61	2.90	0.0039	0.66	0.23	0.0026	0.55	1.71	0.0019	0.42	6.81	0.0066	0.73

Appendix table 7. Quarterly value of yellowfin CPUE for 1963-2014 for data subsets in each of five areas with LT5LN5 expressed in real scale and relative scale with standard error of log CPUE. Dev: square of CV (std_err).
(continued)

		AREA2			AREA3			AREA4			AREA5			AREA3'		
YEAR	QT	CPUE	Dev	Relative	CPUE	Dev	Relative	CPUE	Dev	Relative	CPUE	Dev	Relative	CPUE	Dev	Relative
1999	1	3.37	0.0021	0.51	2.91	0.0035	0.67	0.35	0.0063	0.84	2.80	0.0016	0.70	6.35	0.0064	0.68
1999	2	3.63	0.0038	0.55	1.29	0.0037	0.30	0.41	0.0036	0.98	2.07	0.0052	0.51	3.95	0.0076	0.42
1999	3	3.95	0.0039	0.60	1.75	0.0039	0.40	0.28	0.0021	0.67	1.99	0.0021	0.49	5.08	0.0082	0.54
1999	4	3.44	0.0014	0.52	3.92	0.0041	0.90	0.32	0.0047	0.78	1.57	0.0012	0.39	7.10	0.0061	0.76
2000	1	3.62	0.0013	0.55	3.12	0.0038	0.71	0.41	0.0070	0.97	1.72	0.0015	0.43	6.70	0.0058	0.72
2000	2	3.17	0.0028	0.48	1.19	0.0049	0.27	0.29	0.0031	0.70	3.64	0.0016	0.90	4.14	0.0091	0.44
2000	3	6.13	0.0030	0.93	1.49	0.0040	0.34	0.31	0.0020	0.75	3.72	0.0026	0.92	5.68	0.0078	0.61
2000	4	4.38	0.0019	0.66	1.94	0.0044	0.44	0.19	0.0038	0.44	1.75	0.0028	0.44	6.03	0.0073	0.64
2001	1	4.03	0.0032	0.61	4.52	0.0039	1.03	0.09	0.0042	0.23	1.66	0.0015	0.41	9.16	0.0077	0.98
2001	2	4.92	0.0024	0.74	1.39	0.0052	0.32	0.28	0.0036	0.66	1.67	0.0028	0.41	5.94	0.0089	0.64
2001	3	3.69	0.0037	0.56	1.74	0.0039	0.40	0.30	0.0014	0.72	1.31	0.0035	0.33	5.02	0.0081	0.54
2001	4	4.92	0.0024	0.74	2.23	0.0049	0.51	0.34	0.0017	0.83	1.01	0.0036	0.25	6.86	0.0086	0.73
2002	1	5.62	0.0016	0.85	3.76	0.0036	0.86	0.29	0.0036	0.70	1.20	0.0036	0.30	9.05	0.0061	0.97
2002	2	3.28	0.0023	0.50	2.16	0.0056	0.49	0.26	0.0052	0.61	1.66	0.0060	0.41	5.75	0.0089	0.61
2002	3	1.27	0.0027	0.19	1.54	0.0044	0.35	0.21	0.0016	0.50	0.83	0.0030	0.21	3.13	0.0082	0.33
2002	4	2.31	0.0012	0.35	2.28	0.0064	0.52	0.17	0.0019	0.40	0.91	0.0013	0.23	4.38	0.0066	0.47
2003	1	3.32	0.0015	0.50	4.02	0.0040	0.92	0.14	0.0134	0.34	1.02	0.0020	0.25	7.28	0.0063	0.78
2003	2	3.89	0.0021	0.59	2.02	0.0057	0.46	0.81	0.0088	1.94	0.89	0.0171	0.22	6.36	0.0086	0.68
2003	3	3.70	0.0030	0.56	1.73	0.0049	0.40	0.35	0.0025	0.84	0.73	0.0079	0.18	5.28	0.0093	0.56
2003	4	4.03	0.0012	0.61	2.82	0.0066	0.65	0.25	0.0030	0.61	1.52	0.0027	0.38	7.25	0.0068	0.78
2004	1	2.65	0.0012	0.40	3.28	0.0040	0.75	0.62	0.0192	1.48	1.14	0.0033	0.28	5.68	0.0058	0.61
2004	2	5.27	0.0019	0.80	2.83	0.0053	0.65	0.30	0.0070	0.71	2.65	0.0100	0.66	8.80	0.0080	0.94
2004	3	2.06	0.0023	0.31	2.38	0.0034	0.55	0.32	0.0025	0.76	1.22	0.0043	0.30	5.23	0.0063	0.56
2004	4	3.95	0.0015	0.60	2.18	0.0046	0.50	0.23	0.0032	0.55	0.91	0.0024	0.23	6.48	0.0068	0.69
2005	1	3.76	0.0011	0.57	5.03	0.0039	1.15	0.19	0.0073	0.44	0.87	0.0030	0.22	8.18	0.0055	0.87
2005	2	4.96	0.0014	0.75	2.70	0.0041	0.62	0.33	0.0089	0.79	1.09	0.0083	0.27	8.19	0.0062	0.88
2005	3	1.80	0.0016	0.27	1.55	0.0033	0.36	0.18	0.0051	0.43	1.04	0.0116	0.26	3.74	0.0056	0.40
2005	4	2.42	0.0011	0.37	3.83	0.0046	0.88	0.17	0.0029	0.41	0.69	0.0039	0.17	5.48	0.0058	0.59
2006	1	3.94	0.0010	0.59	5.02	0.0036	1.15	0.17	0.0054	0.40	1.43	0.0018	0.36	8.51	0.0052	0.91
2006	2	4.54	0.0010	0.68	2.87	0.0036	0.66	0.42	0.0128	1.01	2.10	0.0032	0.52	7.79	0.0050	0.83
2006	3	1.75	0.0019	0.26	1.58	0.0033	0.36	0.22	0.0030	0.52	1.17	0.0024	0.29	3.71	0.0060	0.40
2006	4	1.86	0.0011	0.28	2.49	0.0037	0.57	0.28	0.0053	0.67	0.93	0.0017	0.23	4.20	0.0054	0.45
2007	1	1.91	0.0009	0.29	3.47	0.0035	0.79	0.19	0.0166	0.46	1.24	0.0015	0.31	4.64	0.0049	0.50
2007	2	1.80	0.0008	0.27	3.02	0.0042	0.69	0.38	0.0065	0.90	1.47	0.0025	0.36	3.92	0.0049	0.42
2007	3	1.53	0.0017	0.23	1.09	0.0035	0.25	0.23	0.0027	0.55	1.06	0.0033	0.26	2.70	0.0060	0.29
2007	4	1.94	0.0013	0.29	1.96	0.0048	0.45	0.21	0.0067	0.49	1.07	0.0017	0.26	3.80	0.0065	0.41
2008	1	1.12	0.0013	0.17	2.99	0.0041	0.69	0.13	0.0105	0.30	0.74	0.0014	0.18	3.32	0.0061	0.36
2008	2	1.33	0.0011	0.20	1.66	0.0050	0.38	0.15	0.0032	0.36	0.44	0.0036	0.11	2.68	0.0060	0.29
2008	3	1.14	0.0020	0.17	0.98	0.0040	0.23	0.11	0.0024	0.27	0.52	0.0030	0.13	2.23	0.0070	0.24
2008	4	0.88	0.0016	0.13	1.48	0.0039	0.34	0.15	0.0066	0.37	0.52	0.0014	0.13	2.24	0.0064	0.24
2009	1	0.69	0.0012	0.10	1.63	0.0040	0.37	0.15	0.0237	0.36	0.61	0.0011	0.15	1.86	0.0057	0.20
2009	2	1.03	0.0019	0.16	2.72	0.0056	0.62	0.20	0.0035	0.48	0.61	0.0024	0.15	2.98	0.0083	0.32
2009	3	2.04	0.0093	0.31	1.60	0.0047	0.37	0.12	0.0020	0.30	0.63	0.0027	0.16	3.68	0.0115	0.39
2009	4	2.83	0.0072	0.43	1.12	0.0055	0.26	0.13	0.0078	0.32	0.33	0.0012	0.08	3.11	0.0129	0.33
2010	1	1.62	0.0097	0.24	1.91	0.0045	0.44	0.11	0.0085	0.26	0.54	0.0014	0.13	3.87	0.0111	0.41
2010	2	0.91	0.0105	0.14	3.46	0.0063	0.79	0.23	0.0023	0.54	0.57	0.0062	0.14	5.50	0.0162	0.59
2010	3	5.97	0.0675	0.90	2.00	0.0056	0.46	0.12	0.0029	0.30	0.44	0.0123	0.11	4.80	0.0169	0.51
2010	4	3.70	0.0340	0.56	1.63	0.0056	0.37	0.15	0.0276	0.37	0.30	0.0021	0.07	3.55	0.0161	0.38

Appendix table 7. Quarterly value of yellowfin CPUE for 1963-2014 for data subsets in each of five areas with LT5LN5 expressed in real scale and relative scale with standard error of log CPUE. Dev: square of CV (std_err).
(continued)

		AREA2			AREA3			AREA4			AREA5			AREA3'		
YEAR	QT	CPUE	Dev	Relative	CPUE	Dev	Relative	CPUE	Dev	Relative	CPUE	Dev	Relative	CPUE	Dev	Relative
2011	1				3.44	0.0086	0.79	0.29	0.0245	0.69	0.31	0.0028	0.08	6.77	0.0302	0.72
2011	2				2.06	0.0075	0.47	0.34	0.0031	0.83	0.23	0.0690	0.06	4.58	0.0256	0.49
2011	3				1.23	0.0051	0.28	0.26	0.0043	0.63	0.14	0.3082	0.03	2.82	0.0153	0.30
2011	4				3.14	0.0080	0.72	0.16	0.0298	0.37	0.79	0.0035	0.20	6.36	0.0276	0.68
2012	1				1.75	0.0068	0.40	0.48	0.0438	1.16	0.78	0.0029	0.19	3.42	0.0224	0.37
2012	2	0.50	0.0339	0.08	1.47	0.0061	0.34	0.33	0.0027	0.80	0.77	0.0479	0.19	3.03	0.0183	0.32
2012	3	1.51	0.0176	0.23	0.99	0.0052	0.23	0.15	0.0041	0.35	0.25	0.0272	0.06	2.27	0.0140	0.24
2012	4	1.75	0.0116	0.26	2.44	0.0088	0.56	0.18	0.1196	0.44	0.49	0.0029	0.12	4.41	0.0222	0.47
2013	1	0.66	0.0054	0.10	2.63	0.0047	0.60	0.17	0.0172	0.40	0.44	0.0026	0.11	3.82	0.0105	0.41
2013	2	0.67	0.0061	0.10	2.35	0.0049	0.54	0.22	0.0024	0.53	0.22	0.0390	0.06	3.63	0.0113	0.39
2013	3				1.78	0.0055	0.41	0.17	0.0034	0.40	0.32	0.0127	0.08	3.84	0.0170	0.41
2013	4	1.31	0.0154	0.20	2.82	0.0054	0.65	0.47	0.1201	1.12	0.33	0.0018	0.08	5.34	0.0145	0.57
2014	1	1.59	0.0312	0.24	2.48	0.0056	0.57	0.17	0.0303	0.40	0.36	0.0053	0.09	4.86	0.0163	0.52
2014	2	1.15	0.0230	0.17	2.34	0.0076	0.54	0.18	0.0024	0.43				4.58	0.0222	0.49
2014	3	2.45	0.0425	0.37	1.47	0.0077	0.34	0.10	0.0028	0.24	0.25	0.0141	0.06	3.30	0.0243	0.35
2014	4				1.52	0.0154	0.35	0.02	0.4790	0.05	0.29	0.0074	0.07	2.89	0.0599	0.31

Appendix table 8. Quarterly value of yellowfin CPUE for 1963-2014 for each of four areas calculated from whole data in real scale and relative scale with standard error of log CPUE. Dev: square of CV (std_err).

		AREA2			AREA3			AREA4			AREA5		
YEAR	QT	CPUE	Dev	Relative	CPUE	Dev	Relative	CPUE	Dev	Relative	CPUE	Dev	Relative
1963	1				18.89	0.0002	4.68	1.29	0.0005	1.08	6.23	0.0001	1.87
1963	2	12.10	0.0001	2.36	17.18	0.0002	4.26	3.92	0.0036	3.28	6.47	0.0002	1.94
1963	3	13.51	0.0005	2.63	6.49	0.0001	1.61	5.78	0.0006	4.84	5.45	0.0002	1.63
1963	4	21.11	0.0001	4.11	9.28	0.0002	2.30	2.30	0.0004	1.93	7.11	0.0002	2.13
1964	1	14.61	0.0001	2.85	14.90	0.0002	3.69	0.94	0.0004	0.79	8.37	0.0002	2.51
1964	2	9.06	0.0001	1.77	8.29	0.0002	2.05	5.70	0.0017	4.77	9.33	0.0002	2.79
1964	3	8.01	0.0002	1.56	4.95	0.0001	1.23	4.80	0.0009	4.02	7.13	0.0001	2.14
1964	4	8.49	0.0001	1.65	4.59	0.0001	1.14	2.49	0.0003	2.09	4.77	0.0001	1.43
1965	1	9.72	0.0001	1.89	6.13	0.0002	1.52	0.97	0.0004	0.81	6.22	0.0001	1.86
1965	2	9.62	0.0001	1.87	8.02	0.0003	1.99	2.81	0.0018	2.36	7.09	0.0001	2.12
1965	3	9.57	0.0001	1.86	5.45	0.0001	1.35	3.03	0.0007	2.53	3.88	0.0002	1.16
1965	4	17.93	0.0001	3.49	6.97	0.0002	1.73	1.78	0.0003	1.49	6.45	0.0001	1.93
1966	1	15.94	0.0000	3.11	10.89	0.0005	2.70	1.03	0.0004	0.86	7.52	0.0001	2.25
1966	2	13.68	0.0000	2.67	9.16	0.0001	2.27	3.11	0.0018	2.60	8.93	0.0002	2.67
1966	3	14.21	0.0001	2.77	5.76	0.0001	1.43	3.60	0.0008	3.01	8.34	0.0001	2.50
1966	4	15.58	0.0000	3.03	4.96	0.0001	1.23	2.74	0.0003	2.29	7.69	0.0001	2.30
1967	1	8.39	0.0000	1.64	6.39	0.0001	1.58	2.17	0.0004	1.82	7.32	0.0001	2.19
1967	2	8.86	0.0001	1.73	7.40	0.0001	1.84	2.37	0.0004	1.99	6.02	0.0001	1.80
1967	3	4.94	0.0001	0.96	2.97	0.0001	0.74	1.00	0.0003	0.83	5.17	0.0001	1.55
1967	4	7.88	0.0001	1.54	5.07	0.0001	1.26	0.92	0.0002	0.77	7.13	0.0002	2.13
1968	1	26.56	0.0001	5.17	40.10	0.0004	9.94	1.95	0.0004	1.64	7.95	0.0001	2.38
1968	2	32.52	0.0001	6.34	17.52	0.0002	4.35	1.51	0.0004	1.26	7.76	0.0002	2.32
1968	3	18.63	0.0001	3.63	7.37	0.0001	1.83	0.77	0.0003	0.65	3.23	0.0002	0.97
1968	4	19.17	0.0001	3.73	5.24	0.0002	1.30	1.42	0.0003	1.19	4.74	0.0002	1.42
1969	1	11.20	0.0001	2.18	3.77	0.0002	0.93	1.62	0.0006	1.36	6.24	0.0001	1.87
1969	2	9.15	0.0001	1.78	4.66	0.0001	1.16	1.46	0.0004	1.22	8.05	0.0001	2.41
1969	3	12.61	0.0001	2.46	2.28	0.0001	0.57	0.81	0.0003	0.68	5.30	0.0003	1.59
1969	4	12.74	0.0001	2.48	1.00	0.0002	0.25	1.20	0.0004	1.01	6.77	0.0002	2.03
1970	1	6.46	0.0001	1.26	1.95	0.0003	0.48	2.27	0.0010	1.90	6.30	0.0001	1.89
1970	2	4.84	0.0001	0.94	2.26	0.0002	0.56	0.93	0.0004	0.78	5.81	0.0002	1.74
1970	3	5.66	0.0004	1.10	1.05	0.0003	0.26	0.81	0.0003	0.68	11.34	0.0001	3.40
1970	4	8.71	0.0001	1.70	2.30	0.0003	0.57	4.29	0.0003	3.59	6.25	0.0002	1.87
1971	1	6.35	0.0001	1.24	3.36	0.0002	0.83	3.57	0.0006	2.99	5.50	0.0002	1.65
1971	2	7.40	0.0001	1.44	2.54	0.0004	0.63	4.34	0.0004	3.63	7.95	0.0002	2.38
1971	3	15.53	0.0001	3.02	1.94	0.0003	0.48	2.38	0.0003	1.99	4.22	0.0003	1.26
1971	4	11.16	0.0001	2.17	2.25	0.0005	0.56	3.55	0.0005	2.97	5.71	0.0003	1.71
1972	1	5.70	0.0001	1.11	16.58	0.0005	4.11	4.37	0.0140	3.66	5.48	0.0003	1.64
1972	2	5.28	0.0001	1.03	9.85	0.0007	2.44	3.13	0.0015	2.62	3.31	0.0003	0.99
1972	3	8.04	0.0001	1.57	2.28	0.0002	0.57	2.57	0.0007	2.15	4.72	0.0005	1.41
1972	4	7.36	0.0001	1.43	4.16	0.0004	1.03	2.73	0.0012	2.29	7.47	0.0010	2.24
1973	1	4.81	0.0002	0.94	8.67	0.0007	2.15	3.12	0.0060	2.61	7.77	0.0003	2.33
1973	2	3.68	0.0002	0.72	2.13	0.0005	0.53	4.23	0.0012	3.54	6.80	0.0006	2.03
1973	3	2.86	0.0001	0.56	0.80	0.0002	0.20	0.89	0.0005	0.75	5.73	0.0007	1.72
1973	4	7.49	0.0001	1.46	4.02	0.0003	1.00	1.37	0.0004	1.15	3.54	0.0003	1.06
1974	1	3.57	0.0001	0.69	8.67	0.0003	2.15	4.68	0.0009	3.92	3.24	0.0002	0.97
1974	2	3.55	0.0002	0.69	4.29	0.0004	1.06	2.24	0.0005	1.87	4.40	0.0004	1.32
1974	3	3.81	0.0001	0.74	0.63	0.0002	0.16	0.72	0.0004	0.60	3.28	0.0003	0.98
1974	4	3.98	0.0001	0.78	3.34	0.0002	0.83	1.18	0.0007	0.99	3.47	0.0001	1.04

Appendix table 7. Quarterly value of yellowfin CPUE for 1963-2014 for data subsets in each of five areas with LT5LN5 expressed in real scale and relative scale with standard error of log CPUE. Dev: square of CV (std_err).
(continued)

		AREA2			AREA3			AREA4			AREA5		
YEAR	QT	CPUE	Dev	Relative	CPUE	Dev	Relative	CPUE	Dev	Relative	CPUE	Dev	Relative
1975	1	1.99	0.0001	0.39	3.68	0.0007	0.91	2.43	0.0010	2.04	3.54	0.0001	1.06
1975	2	2.17	0.0002	0.42	4.73	0.0005	1.17	1.65	0.0005	1.38	2.94	0.0003	0.88
1975	3	4.91	0.0001	0.96	1.98	0.0002	0.49	1.39	0.0003	1.17	3.09	0.0001	0.93
1975	4	8.11	0.0001	1.58	17.08	0.0004	4.24	1.14	0.0005	0.95	3.61	0.0002	1.08
1976	1	2.16	0.0001	0.42	9.96	0.0002	2.47	0.98	0.0042	0.82	2.67	0.0002	0.80
1976	2	6.55	0.0002	1.28	4.07	0.0008	1.01	0.47	0.0015	0.40	5.58	0.0005	1.67
1976	3	5.33	0.0005	1.04	1.19	0.0003	0.30	0.98	0.0005	0.82	3.98	0.0006	1.19
1976	4	4.03	0.0007	0.78	4.92	0.0008	1.22	0.52	0.0008	0.44	4.52	0.0006	1.35
1977	1	2.50	0.0005	0.49	24.37	0.0014	6.04	3.42	0.0041	2.86	5.49	0.0006	1.64
1977	2	10.79	0.0004	2.10	21.77	0.0017	5.40	0.95	0.0024	0.80	6.06	0.0044	1.81
1977	3	6.26	0.0004	1.22	3.18	0.0003	0.79	0.40	0.0006	0.34	3.85	0.0006	1.15
1977	4	12.80	0.0001	2.49	6.45	0.0010	1.60	1.32	0.0008	1.10	4.62	0.0016	1.38
1978	1	4.53	0.0000	0.88	7.49	0.0003	1.86	1.28	0.0022	1.07	5.27	0.0004	1.58
1978	2	4.00	0.0001	0.78	3.90	0.0005	0.97	1.25	0.0008	1.04	6.30	0.0013	1.89
1978	3	3.30	0.0004	0.64	1.77	0.0003	0.44	0.76	0.0005	0.64	1.91	0.0001	0.57
1978	4	7.69	0.0002	1.50	8.58	0.0006	2.13	2.11	0.0009	1.76	2.36	0.0003	0.71
1979	1	2.68	0.0001	0.52	16.18	0.0002	4.01	1.49	0.0028	1.25	3.40	0.0003	1.02
1979	2	1.69	0.0002	0.33	9.75	0.0005	2.42	1.15	0.0012	0.96	3.04	0.0004	0.91
1979	3	2.09	0.0002	0.41	2.67	0.0002	0.66	1.12	0.0005	0.94	1.91	0.0004	0.57
1979	4	3.86	0.0004	0.75	7.66	0.0004	1.90	1.27	0.0010	1.07	2.45	0.0003	0.73
1980	1	2.69	0.0001	0.52	5.46	0.0002	1.35	0.70	0.0032	0.59	3.38	0.0003	1.01
1980	2	1.73	0.0001	0.34	1.13	0.0005	0.28	0.39	0.0020	0.32	4.93	0.0003	1.48
1980	3	2.42	0.0004	0.47	1.15	0.0002	0.28	0.60	0.0006	0.50	2.29	0.0002	0.69
1980	4	6.34	0.0001	1.23	5.40	0.0005	1.34	0.77	0.0005	0.64	1.72	0.0003	0.52
1981	1	3.14	0.0000	0.61	3.94	0.0001	0.98	1.02	0.0013	0.86	2.59	0.0002	0.77
1981	2	1.52	0.0001	0.30	4.13	0.0003	1.02	0.40	0.0018	0.33	2.80	0.0003	0.84
1981	3	4.20	0.0001	0.82	2.41	0.0001	0.60	0.62	0.0004	0.52	4.15	0.0006	1.24
1981	4	4.73	0.0001	0.92	6.46	0.0004	1.60	2.21	0.0006	1.85	2.49	0.0002	0.75
1982	1	2.91	0.0000	0.57	6.76	0.0001	1.68	9.63	0.0017	8.06	2.92	0.0002	0.87
1982	2	2.94	0.0001	0.57	4.11	0.0003	1.02	0.41	0.0047	0.34	3.18	0.0004	0.95
1982	3	3.07	0.0001	0.60	1.37	0.0001	0.34	0.39	0.0007	0.33	3.26	0.0002	0.98
1982	4	7.27	0.0000	1.42	1.86	0.0004	0.46	2.26	0.0014	1.89	2.37	0.0002	0.71
1983	1	3.16	0.0000	0.61	7.22	0.0003	1.79	2.19	0.0024	1.83	3.47	0.0001	1.04
1983	2	2.93	0.0000	0.57	1.54	0.0006	0.38	0.66	0.0010	0.55	6.70	0.0006	2.01
1983	3	2.20	0.0001	0.43	1.10	0.0002	0.27	0.45	0.0005	0.37	2.98	0.0001	0.89
1983	4	7.04	0.0001	1.37	5.38	0.0005	1.33	1.25	0.0007	1.04	3.29	0.0002	0.99
1984	1	3.61	0.0000	0.70	9.54	0.0004	2.36	2.47	0.0009	2.07	4.21	0.0001	1.26
1984	2	3.37	0.0001	0.66	2.95	0.0006	0.73	0.60	0.0006	0.50	4.75	0.0002	1.42
1984	3	5.14	0.0001	1.00	1.94	0.0001	0.48	0.60	0.0005	0.50	2.27	0.0001	0.68
1984	4	3.99	0.0001	0.78	9.77	0.0004	2.42	3.61	0.0005	3.02	3.47	0.0002	1.04
1985	1	3.70	0.0000	0.72	6.99	0.0004	1.73	5.52	0.0014	4.62	3.35	0.0001	1.00
1985	2	3.49	0.0001	0.68	1.62	0.0003	0.40	0.85	0.0004	0.71	5.39	0.0002	1.61
1985	3	3.63	0.0001	0.71	1.43	0.0001	0.35	0.54	0.0004	0.45	4.18	0.0001	1.25
1985	4	7.19	0.0000	1.40	5.36	0.0005	1.33	1.38	0.0007	1.16	3.06	0.0003	0.92
1986	1	6.40	0.0000	1.25	9.31	0.0002	2.31	2.63	0.0007	2.21	3.52	0.0001	1.06
1986	2	6.74	0.0001	1.31	0.98	0.0002	0.24	1.12	0.0017	0.94	6.57	0.0005	1.97
1986	3	4.56	0.0001	0.89	0.66	0.0001	0.16	0.36	0.0004	0.30	4.23	0.0002	1.27
1986	4	7.00	0.0001	1.36	1.50	0.0010	0.37	0.45	0.0004	0.38	3.43	0.0001	1.03

Appendix table 7. Quarterly value of yellowfin CPUE for 1963-2014 for data subsets in each of five areas with LT5LN5 expressed in real scale and relative scale with standard error of log CPUE. Dev: square of CV (std_err).

(continued)

		AREA2			AREA3			AREA4			AREA5		
YEAR	QT	CPUE	Dev	Relative	CPUE	Dev	Relative	CPUE	Dev	Relative	CPUE	Dev	Relative
1987	1	4.72	0.0000	0.92	8.08	0.0004	2.00	0.97	0.0005	0.81	4.10	0.0001	1.23
1987	2	3.83	0.0001	0.75	4.36	0.0003	1.08	1.36	0.0024	1.14	6.41	0.0040	1.92
1987	3	2.06	0.0002	0.40	1.13	0.0001	0.28	0.40	0.0004	0.33	3.41	0.0010	1.02
1987	4	7.69	0.0001	1.50	2.84	0.0005	0.70	1.26	0.0006	1.06	3.67	0.0001	1.10
1988	1	7.73	0.0000	1.50	10.69	0.0004	2.65	6.28	0.0015	5.26	4.67	0.0001	1.40
1988	2	4.33	0.0001	0.84	2.68	0.0002	0.66	1.33	0.0018	1.11	5.63	0.0040	1.68
1988	3	2.60	0.0001	0.51	1.55	0.0001	0.38	0.34	0.0006	0.29	7.09	0.0003	2.12
1988	4	3.42	0.0001	0.67	5.68	0.0004	1.41	0.55	0.0008	0.46	4.08	0.0001	1.22
1989	1	2.88	0.0000	0.56	5.66	0.0005	1.40	6.76	0.0017	5.66	4.43	0.0002	1.33
1989	2	2.10	0.0001	0.41	2.46	0.0002	0.61	1.23	0.0037	1.03	5.30	0.0009	1.59
1989	3	2.01	0.0008	0.39	0.85	0.0001	0.21	0.35	0.0008	0.29	2.15	0.0004	0.64
1989	4	5.91	0.0001	1.15	4.94	0.0004	1.22	0.63	0.0008	0.53	1.88	0.0003	0.56
1990	1	6.60	0.0001	1.29	12.08	0.0003	2.99	2.29	0.0007	1.92	4.27	0.0001	1.28
1990	2	2.92	0.0001	0.57	2.26	0.0003	0.56	0.41	0.0047	0.34	7.48	0.0015	2.24
1990	3	3.07	0.0005	0.60	0.73	0.0001	0.18	0.70	0.0004	0.59	6.79	0.0004	2.03
1990	4	3.60	0.0001	0.70	1.30	0.0008	0.32	0.67	0.0009	0.56	2.22	0.0002	0.66
1991	1	4.90	0.0001	0.95	2.42	0.0002	0.60	1.20	0.0010	1.00	3.16	0.0001	0.94
1991	2	4.62	0.0003	0.90	1.37	0.0002	0.34	0.93	0.0016	0.78	2.36	0.0017	0.71
1991	3	1.75	0.0003	0.34	1.09	0.0001	0.27	0.53	0.0003	0.45	2.07	0.0009	0.62
1991	4	4.48	0.0003	0.87	1.91	0.0004	0.47	0.52	0.0003	0.44	2.25	0.0003	0.68
1992	1	4.17	0.0001	0.81	2.82	0.0001	0.70	0.85	0.0013	0.71	2.95	0.0002	0.88
1992	2	4.55	0.0002	0.89	1.10	0.0001	0.27	0.76	0.0009	0.63	2.34	0.0073	0.70
1992	3	2.16	0.0008	0.42	1.45	0.0001	0.36	0.40	0.0005	0.33	3.32	0.0012	0.99
1992	4	3.04	0.0001	0.59	2.88	0.0009	0.71	0.39	0.0005	0.32	2.07	0.0005	0.62
1993	1	2.53	0.0002	0.49	6.93	0.0002	1.72	0.58	0.0024	0.48	1.76	0.0002	0.53
1993	2	2.80	0.0001	0.55	1.62	0.0001	0.40	0.52	0.0015	0.44	5.30	0.0022	1.59
1993	3	2.74	0.0002	0.53	1.90	0.0001	0.47	0.32	0.0003	0.27	2.01	0.0005	0.60
1993	4	4.48	0.0001	0.87	2.59	0.0008	0.64	0.41	0.0003	0.35	2.26	0.0004	0.68
1994	1	3.29	0.0001	0.64	3.44	0.0001	0.85	0.91	0.0006	0.76	1.52	0.0002	0.46
1994	2	3.79	0.0001	0.74	1.18	0.0000	0.29	0.72	0.0004	0.60	1.98	0.0146	0.59
1994	3	2.00	0.0003	0.39	1.33	0.0000	0.33	0.41	0.0002	0.34	3.70	0.0015	1.11
1994	4	2.54	0.0001	0.49	1.91	0.0002	0.47	0.52	0.0002	0.44	1.82	0.0003	0.55
1995	1	1.89	0.0001	0.37	2.58	0.0001	0.64	0.92	0.0002	0.77	2.11	0.0002	0.63
1995	2	1.05	0.0002	0.20	1.07	0.0001	0.27	0.40	0.0003	0.34	2.77	0.0011	0.83
1995	3	2.05	0.0004	0.40	1.10	0.0001	0.27	0.39	0.0001	0.32	1.07	0.0004	0.32
1995	4	4.24	0.0001	0.83	4.59	0.0004	1.14	0.24	0.0001	0.20	1.79	0.0002	0.54
1996	1	5.61	0.0001	1.09	2.29	0.0001	0.57	0.48	0.0002	0.40	2.40	0.0002	0.72
1996	2	3.23	0.0001	0.63	0.69	0.0001	0.17	0.61	0.0002	0.51	1.66	0.0019	0.50
1996	3	2.07	0.0001	0.40	0.86	0.0000	0.21	0.49	0.0002	0.41	1.78	0.0008	0.53
1996	4	2.07	0.0000	0.40	3.86	0.0001	0.96	0.29	0.0002	0.24	1.54	0.0002	0.46
1997	1	3.46	0.0000	0.67	3.15	0.0000	0.78	1.03	0.0010	0.86	1.99	0.0001	0.60
1997	2	1.08	0.0000	0.21	0.63	0.0001	0.16	0.40	0.0004	0.34	2.27	0.0018	0.68
1997	3	2.87	0.0001	0.56	0.54	0.0000	0.13	0.33	0.0001	0.28	3.84	0.0004	1.15
1997	4	3.76	0.0000	0.73	1.98	0.0001	0.49	0.34	0.0002	0.29	1.07	0.0001	0.32
1998	1	3.18	0.0000	0.62	2.68	0.0000	0.66	0.65	0.0013	0.54	2.25	0.0001	0.67
1998	2	2.37	0.0000	0.46	0.51	0.0000	0.13	0.50	0.0006	0.41	2.28	0.0005	0.68

1998	3	2.45	0.0001	0.48	0.47	0.0000	0.12	0.17	0.0003	0.15	1.28	0.0003	0.38
1998	4	3.64	0.0001	0.71	2.83	0.0001	0.70	0.33	0.0003	0.27	1.70	0.0001	0.51

Appendix table 7. Quarterly value of yellowfin CPUE for 1963-2014 for data subsets in each of five areas with LT5LN5 expressed in real scale and relative scale with standard error of log CPUE. Dev: square of CV (std_err).
(continued)

		AREA2			AREA3			AREA4			AREA5		
YEAR	QT	CPUE	Dev	Relative	CPUE	Dev	Relative	CPUE	Dev	Relative	CPUE	Dev	Relative
1999	1	2.98	0.0001	0.58	2.41	0.0001	0.60	0.72	0.0008	0.60	2.82	0.0001	0.85
1999	2	3.07	0.0001	0.60	0.55	0.0001	0.14	0.69	0.0004	0.58	1.94	0.0003	0.58
1999	3	3.43	0.0001	0.67	0.85	0.0001	0.21	0.28	0.0002	0.23	1.96	0.0001	0.59
1999	4	3.48	0.0000	0.68	3.35	0.0001	0.83	0.52	0.0006	0.44	1.61	0.0001	0.48
2000	1	3.23	0.0000	0.63	3.21	0.0001	0.80	0.91	0.0009	0.76	1.83	0.0001	0.55
2000	2	2.59	0.0001	0.50	0.59	0.0001	0.15	0.54	0.0004	0.45	3.99	0.0001	1.19
2000	3	5.18	0.0001	1.01	0.75	0.0001	0.19	0.50	0.0002	0.42	3.88	0.0002	1.16
2000	4	4.06	0.0001	0.79	1.67	0.0001	0.41	0.27	0.0005	0.23	1.68	0.0002	0.50
2001	1	3.93	0.0001	0.77	4.05	0.0001	1.00	0.18	0.0005	0.15	1.68	0.0001	0.50
2001	2	4.44	0.0001	0.87	0.63	0.0001	0.16	0.52	0.0004	0.44	1.74	0.0002	0.52
2001	3	3.44	0.0001	0.67	0.82	0.0001	0.20	0.48	0.0002	0.40	1.25	0.0002	0.37
2001	4	5.01	0.0001	0.98	1.61	0.0001	0.40	0.53	0.0002	0.44	0.96	0.0002	0.29
2002	1	5.43	0.0000	1.06	3.80	0.0001	0.94	0.44	0.0004	0.37	1.21	0.0002	0.36
2002	2	2.86	0.0001	0.56	1.02	0.0001	0.25	0.51	0.0006	0.43	1.75	0.0004	0.52
2002	3	1.10	0.0001	0.21	0.72	0.0001	0.18	0.30	0.0002	0.26	0.82	0.0002	0.24
2002	4	2.08	0.0000	0.40	1.49	0.0002	0.37	0.20	0.0002	0.17	0.93	0.0001	0.28
2003	1	3.30	0.0000	0.64	3.91	0.0001	0.97	0.42	0.0017	0.35	1.02	0.0001	0.31
2003	2	3.89	0.0001	0.76	0.89	0.0001	0.22	1.02	0.0011	0.85	0.81	0.0012	0.24
2003	3	4.04	0.0001	0.79	0.85	0.0001	0.21	0.37	0.0003	0.31	0.75	0.0005	0.22
2003	4	3.98	0.0000	0.78	1.87	0.0002	0.46	0.19	0.0003	0.16	1.62	0.0002	0.48
2004	1	2.82	0.0000	0.55	2.90	0.0001	0.72	0.76	0.0025	0.64	1.10	0.0002	0.33
2004	2	5.15	0.0001	1.00	0.98	0.0001	0.24	0.38	0.0008	0.32	2.64	0.0007	0.79
2004	3	2.00	0.0001	0.39	0.76	0.0000	0.19	0.35	0.0003	0.29	1.29	0.0003	0.39
2004	4	4.33	0.0000	0.84	1.30	0.0001	0.32	0.14	0.0004	0.11	0.94	0.0001	0.28
2005	1	4.00	0.0000	0.78	4.18	0.0001	1.04	0.25	0.0009	0.21	0.99	0.0002	0.30
2005	2	4.98	0.0000	0.97	0.90	0.0001	0.22	0.61	0.0011	0.51	1.29	0.0006	0.39
2005	3	1.95	0.0000	0.38	0.47	0.0000	0.12	0.13	0.0006	0.11	1.16	0.0008	0.35
2005	4	2.74	0.0000	0.53	2.25	0.0001	0.56	0.09	0.0003	0.07	0.86	0.0002	0.26
2006	1	4.01	0.0000	0.78	4.56	0.0001	1.13	0.09	0.0007	0.07	1.57	0.0001	0.47
2006	2	4.88	0.0000	0.95	1.67	0.0001	0.41	0.42	0.0016	0.35	2.37	0.0002	0.71
2006	3	1.89	0.0001	0.37	0.45	0.0000	0.11	0.19	0.0004	0.16	1.24	0.0001	0.37
2006	4	2.00	0.0000	0.39	1.45	0.0001	0.36	0.22	0.0007	0.19	0.96	0.0001	0.29
2007	1	1.80	0.0000	0.35	3.48	0.0001	0.86	0.21	0.0021	0.17	1.31	0.0001	0.39
2007	2	1.63	0.0000	0.32	2.81	0.0001	0.70	0.36	0.0008	0.30	1.70	0.0002	0.51
2007	3	1.56	0.0001	0.30	0.45	0.0000	0.11	0.15	0.0003	0.13	1.14	0.0002	0.34
2007	4	1.85	0.0000	0.36	1.11	0.0001	0.27	0.07	0.0008	0.06	1.11	0.0001	0.33
2008	1	1.15	0.0000	0.22	2.97	0.0001	0.74	0.21	0.0013	0.18	0.76	0.0001	0.23
2008	2	1.06	0.0000	0.21	1.06	0.0001	0.26	0.01	0.0004	0.01	0.51	0.0002	0.15
2008	3	1.11	0.0001	0.22	0.27	0.0001	0.07	0.04	0.0003	0.04	0.64	0.0002	0.19
2008	4	0.75	0.0000	0.15	1.00	0.0001	0.25	0.04	0.0008	0.03	0.54	0.0001	0.16
2009	1	0.63	0.0000	0.12	1.19	0.0001	0.30	0.31	0.0030	0.26	0.65	0.0001	0.19
2009	2	0.84	0.0001	0.16	1.70	0.0001	0.42	0.10	0.0004	0.08	0.77	0.0001	0.23
2009	3	1.66	0.0003	0.32	0.64	0.0001	0.16	0.02	0.0002	0.02	0.67	0.0002	0.20
2009	4	2.78	0.0003	0.54	0.76	0.0001	0.19	0.04	0.0010	0.03	0.33	0.0001	0.10
2010	1	1.45	0.0003	0.28	1.41	0.0001	0.35	0.06	0.0011	0.05	0.57	0.0001	0.17
2010	2	0.81	0.0004	0.16	2.01	0.0002	0.50	0.07	0.0003	0.06	0.69	0.0004	0.21
2010	3	7.13	0.0025	1.39	0.84	0.0001	0.21	0.02	0.0004	0.02	0.36	0.0008	0.11
2010	4	4.15	0.0013	0.81	1.12	0.0001	0.28	0.18	0.0035	0.15	0.28	0.0001	0.08

Appendix table 7. Quarterly value of yellowfin CPUE for 1963-2014 for data subsets in each of five areas with LT5LN5 expressed in real scale and relative scale with standard error of log CPUE. Dev: square of CV (std_err).
(continued)

		AREA2			AREA3			AREA4			AREA5		
YEAR	QT	CPUE	Dev	Relative	CPUE	Dev	Relative	CPUE	Dev	Relative	CPUE	Dev	Relative
2011	1				3.09	0.0004	0.77	0.14	0.0046	0.12	0.36	0.0003	0.11
2011	2				1.23	0.0003	0.30	0.15	0.0005	0.13	0.23	0.0072	0.07
2011	3				0.60	0.0002	0.15	0.09	0.0008	0.07	0.03	0.0322	0.01
2011	4				2.41	0.0003	0.60	0.07	0.0056	0.06	0.90	0.0003	0.27
2012	1				1.28	0.0002	0.32	0.82	0.0057	0.68	0.75	0.0002	0.22
2012	2	0.79	0.0013	0.15	0.69	0.0002	0.17	0.17	0.0003	0.14	0.94	0.0034	0.28
2012	3	1.35	0.0006	0.26	0.43	0.0001	0.11	0.02	0.0005	0.02	0.18	0.0019	0.05
2012	4	2.32	0.0004	0.45	2.07	0.0003	0.51	0.25	0.0157	0.21	0.46	0.0002	0.14
2013	1	0.66	0.0002	0.13	2.36	0.0001	0.59	0.14	0.0022	0.12	0.42	0.0002	0.12
2013	2				1.45	0.0001	0.36	0.04	0.0003	0.03	0.17	0.0027	0.05
2013	3	0.77	0.0002	0.15	0.95	0.0001	0.24	0.06	0.0004	0.05	0.31	0.0009	0.09
2013	4	1.62	0.0006	0.31	1.90	0.0001	0.47	1.24	0.0157	1.04	0.30	0.0001	0.09
2014	1	2.02	0.0011	0.39	2.31	0.0001	0.57	0.00	0.0039	0.00	0.33	0.0004	0.10
2014	2	0.96	0.0008	0.19	1.40	0.0002	0.35	0.00	0.0003	0.00			
2014	3	2.68	0.0016	0.52	0.81	0.0002	0.20	0.03	0.0003	0.02	0.20	0.0010	0.06
2014	4				1.44	0.0005	0.36	-0.01	0.0627	-0.01	0.27	0.0005	0.08