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STANDARDIZED CATCH RATE IN NUMBER AND WEIGHT OF YELLOWFIN TUNA (*THUNNUS ALBACARES*) FROM THE JAPANESE LONGLINE FISHERY UP TO 2014

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SUMMARY

*Catch and effort data from the Japanese longline fishery operating in the Atlantic Ocean from 1965 to 2014 were used to standardize the abundance index of yellowfin tuna (*Thunnus albacares*). This document is the respond for the recommendations for redevelopment of the Japanese abundance indices from the ICCAT data preparatory meeting for yellowfin tuna stock assessment held at San Sebastian in March 2016. Three new indices were presented as 1) annual index from 1971 to 2014 in weight, 2) annual index from 1965 to 2014 in number and 3) quarterly index from 1965 to 2014 in number. As factors in the models, the standardization procedure evaluated year, season (quarter), sub-area, number of hooks between floats, materials of main line, materials of branch line, sea surface temperature and sea floor depth. Model selection was performed according to the reduction in explained deviance, with factors being retained if they result in greater than a 5% reduction in explained deviance.*

RÉSUMÉ

*Les données de prise et d'effort de la pêcherie palangrière japonaise opérant dans l'océan Atlantique entre 1965 et 2014 ont servi à standardiser l'indice d'abondance de l'albacore (*Thunnus albacores*). Ce document est la réponse aux recommandations formulées en vue de redévelopper des indices d'abondance japonais dans le contexte de la réunion de préparation des données pour l'évaluation du stock d'albacore tenue à St Sébastien au mois de mars 2016. Trois nouveaux indices ont été présentés comme 1) indice annuel de 1971 à 2014 en poids ; 2) indice annuel de 1965 à 2014 en nombre ; et 3) indice trimestriel de 1965 à 2014 en nombre. Comme facteurs dans les modèles, la procédure de standardisation a évalué : année, saison (trimestre), sous-zone, nombre d'hameçons entre flotteurs, matériel de la ligne principale, matériel de l'avançon, température à la surface de la mer et profondeur du fond marin. La sélection des modèles a été réalisée en fonction de la réduction dans la déviance expliquée, les facteurs qui entraînaient une réduction supérieure à 5% dans la déviance expliquée ayant été retenus.*

RESUMEN

*Se utilizaron los datos de captura y esfuerzo de la pesquería de palangre japonesa que operó en el Atlántico entre 1965 y 2014 para estandarizar el índice de abundancia del rabil (*Thunnus albacares*). Este documento es la respuesta a las recomendaciones para volver a elaborar los índices de abundancia japoneses que se formularon en la reunión de preparación de datos sobre rabil para la evaluación del stock rabil celebrada en San Sebastián en marzo de 2016. Se presentaron tres índices nuevos como 1) índice anual desde 1971 a 2014 en peso, 2) índice anual desde 1965 a 2014 en número y 3) índice trimestral desde 1965 a 2014 en número. Como factores de los modelos, el procedimiento de estandarización evaluó el año, la temporada (trimestre), subárea, número de anzuelos entre flotadores, materiales de la línea madre, materiales de la brazolada, temperatura de la superficie del mar y profundidad del suelo marino. La selección del modelo se llevó a cabo de acuerdo con la reducción en la devianza explicada, y se retuvieron los factores si tenían como resultado una reducción superior al 5% en la devianza explicada.*

KEYWORDS

Yellowfin tuna, longline, stock assessment, catch/effort, pelagic fisheries, logbooks

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1. Introduction

Longline is the only tuna-fishing gear deployed by Japan at present in the Atlantic Ocean, and yellowfin tuna is one of the target species (Anonymous, 2013). Fishing effort for Japanese longline fishery covers almost entire Atlantic (Error! Reference source not found.), and yellowfin tuna is mainly caught in the tropical area (Error! Reference source not found.).

Standardization of raw (nominal) catch per unit effort (cpue) is commonly applied to remove the effects of factors that bias cpue as an index of abundance of fish stock. In the previous cpue standardization analyses (Okamoto and Satoh, 2008, Satoh et al., 2012, Matsumoto and Satoh, 2015) of yellowfin tuna in the Atlantic Ocean, the factors caused the bias are usually fishing location, fishing gear configuration and environmental factors.

The standardized cpue of yellowfin tuna caught by Japanese longline in the Atlantic Ocean (Satoh and Matsumoto, SCRS/2016/035) was reported in the ICCAT data preparatory meeting for yellowfin tuna stock assessment held at San Sebastian in March 2016. The working group recommended for redevelopment of standardized cpue from this fishery, including 1) move to 1°X1° analysis [e.g. latitude, longitude], to allow better resolution of spatial factors in the analysis, 2) use sea floor depth as a factor in the analysis, modelled as a categorical or polynomial variable in the analysis, and 3) use deviance tables to develop final indices (meeting report). The third recommendation was also mentioned in the report of the bigeye tuna data preparatory meeting in 2015 for the concern of over-parameterization of the model. It was noted that many factors might be regarded as significant based on the F value, due to the large sample sizes, yet have little influence on the standardized trend. After the preparatory meeting the WG also requested alternative indices which used the short analytical period (1976-2014), and different weighting method using the unique number of 1X1 squares fished in each area (over the entire time series).

The aim of this study is 1) to address these three recommendations and additional requests, 2) to compare previous indices (Satoh and Matsumoto, SCRS/2016/035) and the present one. We provided nine indices as follows;

Longer period (1965-2014), weighing by the size of area
1) Annual index in weight from 1965 to 2014 weighting the area-specific indices by the unique size of each area (size of area),
2) Annual index in number from 1965 to 2014 using weighting factor of the size of area,
3) Quarterly index in number from 1965 to 2014 using weighting factor of the size of area,

Longer period (1965-2014), weighing by the number of fished area
4) Annual index in weight from 1965 to 2014 weighting the area-specific indices by the area-specific indices by the unique number of 1X1 squares fished in each area (number of fished area),
5) Annual index in number from 1965 to 2014 weighting by the number of fished area,
6) Quarterly index in number from 1965 to 2014 weighting by the number of fished area,

Shorter period (1976-2014), weighing by the number of fished area
7) Annual index in weight from 1976 to 2014 weighting by the number of fished area,
8) Annual index in number from 1976 to 2014 weighting by the number of fished area, and
9) Quarterly index in number from 1976 to 2014 weighting by the number of fished area.

2. Materials and methods

The differences of materials and methods between previous study (Satoh and Matsumoto, SCRS/2016/035) and present study was summarized in **Table 1**. Previous study provided five indices as 1) annual index from 1971 to 2014 in weight (top), 2) annual index from 1965 to 2014 in number (middle) and 3) quarterly index from 1965 to 2014 in number (bottom), 4) quarterly index for eastern Atlantic Ocean in number and 5) quarterly index for western Atlantic Ocean in number. The latter two indices were not provided because the working group of the yellowfin tuna data preparatory meeting needed the entire Atlantic index only.

2.1 Data

The Japanese longline catch (in number and in weight) and effort statistics from 1965 (from 1971 for weight data) to 2014 were used. Data for 2014 are preliminary. For indices 7 to 9 the catch and effort data before 1975 was not

used. The catch and effort data set was aggregated by month, 1-degree square and the number of hooks between floats (NHBF), which is not raised to total number of catch.
As environmental factor, the monthly sea surface temperature for 1-degree latitude and 1-degree longitude was obtained from NEAR-GOOS Regional Real Time Data Base of Japan Meteorological Agency (JMA; Monthly Mean Global Sea Surface Temperatures (COBE-SST), http://ds.data.jma.go.jp/gmd/goos/data/database.html). The depth of sea floor is compiled by methodology in Pante E, Simon-Bouhet B (2013).

In previous study the area definition for the quarterly indices compose of two sub area (east and west), while in present study, the definition of three sub-areas for annual indices (**Fig. 1**) is also used for the quarterly index.

2.2 Explanatory variables

As factors in the models, the standardization procedure evaluated year, season (quarter), sub-area, number of hooks between floats, materials of main line, materials of branch line, sea surface temperature and sea floor depth. The number and kind of explanatory variables is different from previous study.

In order to avoid over parameterization and to keep consistency of the methodology as possible between the annual and the quarterly indices, several covariates in the previous studies were omitted. In order to avoid multicollinearity among the three kind of factors regarding to the sea surface temperature (SST, SST2 (SST x SST) and SST3 (SST x SST x SST), the cube of sea surface temperature (SST3) only remained because the SST3 showed largest deviance in preliminary analysis. All factors regarding to the latitude and location (Lat2, Lat-Lon, Lon2, Lat3, Lat2-Lon, Lat-Lon2, Lon3, which are the products of latitude (Lat) and longitude (Lon)) were used only for the analysis for the quarterly indices in previous study. These all factors were omitted in present study. After these treatments, the standardization procedure evaluated year, season (quarter), sub-area, number of hooks between floats, materials of main line, materials of branch line, sea surface temperature and sea floor depth as factors in the models. The NHBF from 1965 to 1974 is not available from logbook, therefore the NHBF was regarded to be 5 for these years. The materials of main and branch lines composed of Nylon and others, which are available since 1994. The number of hooks between float (NHBF) were categorized into 5 classes (CNHBF 1: <=5, CNHBF 2: 6-8, CNHBF 3: 9-12, CNHBF 4: 13-16, CNHBF 5: >=17). The materials before 1993 was assumed as “others” except for the set with the NHBF being more than 18 from 1991 to 1993 was assumed as “Nylon”. In preliminary analysis the sea floor depths were modelled as a raw data, a categorical and polynomial variable, the model using the raw sea floor depth showed the largest explained deviance. Thus the factor is treated as the raw sea floor depth.

2.3 Response variable

The effects of factors were assessed using GLM procedure (log normal error structure model, SAS ver. 9.4, SAS Inst., Inc.). To stabilize the variance, natural log-transformations were conducted for independent variables. In order to avoid to be unable to calculate natural logarithm for the set with zero catch of yellowfin, the 1/10 of the average catch for whole period was added to all catch. The data in which the number of hooks was less than 10,000 in a stratum were not used for analyses.

2.4 Model selection

Final selection of explanatory factors was conditional to a) the relative percent of deviance explained by the added factor, factors that explained more than 5% of deviance were included (SCRS/2016/041, Walter) instead of using the backward stepwise F test with a criterion of P-value = 0.05 in previous study. There are three steps for the model selection. First main factors were chosen if each single factor model (e.g., cpue = year, cpue = NHBF) presented the total deviance being greater than 5%. In addition, in order to get annual, quarterly and area specific indices, year, quarter and area were always remained in the models even though they did not meet the 5% criteria. Then testing the remaining main factors one by one, the factor showing the largest explained deviance which is larger than 5% is included in the model. (e.g., cpue = year + quarter + area + NHBF, cpue = year + quarter + area + SST3). If the percentage of the largest explained deviance is less than 5% then moved to the next step. Next, all two-way interactions were tested one by one using the explained deviance criteria. If the percentage of the largest explained deviance is less than 5% then the procedure of the model selection ended. In addition, the explained deviance = {sum of square of each factor / (total sum of square of NULL model – total sum of square of the tested model)} *100, and the total deviance = (sum of square of each factor / total sum of square of NULL model) * 100. The tested model means the model included factors be tested, instead of the model included all candidate factors. Although the periods for analysis was different for annual indices in number and weight, the same model factors in the number index was used for the weight one, it is likely there is no change of factors between the two cpues.

2.5 Annual and quarterly indices

The least square means and standard error is obtained each model run. During the process making input data the cpue is conducted by natural log-transformations, and also added constant value (10% of overall mean of cpue). Thus, the least square means is converted by exponential to scale to original unit and also subtracted the constant value (10% of overall mean of cpue) (cpue = exp (lsmean) - 1/10 of average cpue). The 95% confidential interval is also calculated as exp (lsmean±1.96*standard error) - 1/10 of average cpue.

The annual index is obtained by the method used in Ogura and Shono (1999) as follows;
$CPUE_i = \Sigma W_j * (\exp(lsmean(year_i * sub\text{-}area_j)) - constant\ value)$,
where $CPUE_i$ = CPUE in year i, Wj = area size rate of area j for indices from 1 to 3; (sub-area 1: 0.342 (5,387/15,749), sub-area 2: 0.417 (6,566/15,749) and sub-area 3: 0.241 (3,796/15,749), which are corresponding area of sea), the unique number of 1X1 squares fished in each area j for indices from 4 to 9; (sub-area 1: 0.333 (830/2,489), sub-area 2: 0.454 (1,132/2,489) and sub-area 3: 0.211 (527/2,489), lsmean ($year_i$ * $sub\text{-}area_j$) = least square mean of year * sub-area interaction in year i and sub-area j, constant value = 10% of overall mean of CPUE. The quarterly index, least square mean of year * quarter * sub-area was used instead.

3. Results and discussion

3.1 Distribution of model factors

Distribution of number of hooks by model factors (number of hooks between floats, materials of main line, materials of branch line) were showed in **Figure 2**. Natural log transformed Nominal cpue (number of yellowfin / 1000 hooks) by model factors (sea surface temperature and sea floor depth) were shown in **Figure 3**.

3.2 Deviance analysis

Deviance analysis for the indices 1 to 6 (**Table 2**) indicated that the factors in the annual cpue were the categorical number of hooks between floats (CNHBF), sea floor depth (SFD), the interactions (year * sub-area, sst3 * sub-area) were selected. The number of factors were considerably smaller than the previous study (SCRS/2016/035). The deviance analysis improved over parameterization in the standardized cpues. The interaction of the quarterly based cpue was year * quarter * sub-area. The annual indices 7 and 8 of the short period (1976-2014) included fixed variable quarter, and interaction of year * quarter, year * sub-area, and year * SFD, which had not been included in the longer period model (1965-2014) (**Table 3**). The quarterly index 9 included the interaction of year * SFD and sst3 * sub-area.

Standardized CPUEs

Standardized cpues of annual in number and weigh, and quarterly cpue in number with nominal cpue (indices 1 to 3) were showed in **Figure 4**. Diagrams of diagnosis of these standardization were provided as residual distribution and Q-Q plots (**Figures 5-1, 5-2 and 5-3**), which showed that the assumption of normal error structure were not violated for every cpue standardizations even though the residual distributions were slightly skewed in left. Previous study found the significant differences in the levels of standardized cpue among periods as before 1979 (high), 1980-1991 (middle), 1992-2005 (low) and after 2006 (low to middle). However present study did not detect these significant differences between the periods of 1992-2005 and after 2006, and 1980-1991 and after 2006.

The annual standardized cpues in number by the sub-area showed differences among them. The sub-area 2 shown decreasing trend after around 2005 while the other two sub-areas presented increasing trend (**Figure 6**). The standardized cpue by factors, categorical number of hooks between floats and sub-area from the model of annual cpue in number were shown in **Figures 7-1, 7-2 and 7-3**. The effect of categorical number of hooks between floats for the index 2 and 5 was different from others, which derived from the assumption for the NHBF before 1974. The NHBF from 1965 to 1974 is not available from logbook, therefore the NHBF was regarded to be 5 for these years. The assumption should be evaluated in future.

The comparison annual standardized cpues in number and weight between previous study (SCRS/2016/035) and present study showed the annual trends were similar especially recent five years however there were substantial differences in around 1980s (**Figure 8**), which may partially result from the differences between the data source (raised (previous) and non-raised catch and effort data(present)).

Impact of changing analytical period and weighting method on standardized CPUEs

The standardized cpues were presented in Appendix index 1 to 9. Comparison among indices 2, 5 and 8 showed the influence of the different weighting method (index 2 and 5) the alternative short analytical period (index 5 and 8) (**Figure 9**). The influence of changing weighting method could be very small. While the effect of shortening analytical period showed great impact on annual index from 1976 to late 1980s. In this period the categorical number of hooks between float (CNHBF) were mainly 1 to 3 (**Figure 2**). The effect of CNHBF between two model (indices 5 and 8) are clearly different from each other (**Figures 7-1 and 7-2**), which indicated that the effect of CNHBF 1-3 in the model for the index 5 is higher than those of the index 8. According to the stronger effect of CNHBF of the index 5, the annual index of the model could be more depressed than that of index 8.

The strong drop of standardized cpue in the earlier period (1965 to around 1975) was observed for the longer period indices (1-6). In this period the target species of Japanese longline had been changed from albacore to other species mainly bigeye. The influence of assumption of NHBF during earlier period (before 1974) could be very strong on the annual index estimation. Thus until the appropriate treatment for NHBF before 1974 is developed, we should not use the earlier period for the stock assessment of yellowfin tuna. We recommend to use the indices 7-9 for the yellowfin stock assessment.

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Table 1. Difference of materials and methods of previous study and this study for standardized catch rate in number and weight of yellowfin tuna from the Japanese longline fishery.

section	item	Previous study (SCRS/2016/035)	Present study indices 1 to 3	Present study for additional request
2.1 Data	Duration for index in weight	1970-2014	1971-2014 (The weight data in 1x1 data is available from 1971)	←(index 4 to 6) 1976-2014 for index 7 to 9
	Resolution in latitude and longitude	5° x 5°	1° x 1°	←
	Raised to total catch according to coverage of logbook	YES	NO	←
	Resolution of sea surface temperature in latitude and longitude	5° x 5°	1° x 1°	←
	Area definition in quarterly based index	2 sub-areas (west and east)	3 sub-areas, which is used for annual index	←
2.2 ***Explanatory variables***	Fixed candidate factors for annual index	year, month, sub-area, NHBF (number of hooks between floats), SST (sea surface temperature), SST^2, SST^3, materials of main line and materials of branch line	year, ~~month,~~ **quarter**, sub-area, NHBF, ~~SST (sea surface temperature), SST^2,~~ SST^3, materials of main line and materials of branch line**, sea floor depth**	←
	Fixed candidate factors for quarterly index	year, quarter, latitude and longitude related factors (Lat, Lon, Lat2, Lat-Lon, Lon2, Lat3, Lat2-Lon, Lat-Lon2, Lon3), CNHBF, SST, SST^2, SST^3, materials of main line and materials of branch line	year, quarter, ~~latitude and longitude related factors (Lat, Lon, Lat2, Lat-Lon, Lon2, Lat3, Lat2-Lon, Lat-Lon2, Lon3),~~ CNHBF, ~~SST, SST^2,~~ SST^3, materials of main line and materials of branch line**, sea floor depth**	←
2.3 Response variable	NO change			
2.4 Model selection		backward stepwise F test	Deviance table analysis	←
2.5 Annual and quarterly indices	Sub-area weighting for quarterly index	NO	YES	←
	Sub-area weighting method	unique size of each area	←	← (index 4 to 6) for index 7 to 9, unique number of 1X1 squares fished in each area (over the entire time series)

Table 2. Deviance analysis tables of yellowfin catch rates in 1) annual index from 1971 to 2014 in weight (top; for indices 1 and 4), 2) annual index from 1965 to 2014 in number (middle; for indices 2 and 5) and 3) quarterly index from 1965 to 2014 in number (bottom; for indices 3 and 6). The explained deviance = {sum of square (deviance) of each factor / (total sum of square (residual deviance) of NULL model – total sum of square (residual deviance) of the tested model)} *100, and the total deviance = (sum of square (deviance) of each factor / total sum of square (deviance) of NULL model) * 100. The tables are only shown for the final models but model selections were conducted by stepwise addition of a single factor. SFD; sea floor depth (m), CNHBF; categorized number of hooks between floats (CNHBF 1: <=5, CNHBF 2: 6-8, CNHBF 3: 9-12, CNHBF 4: 13-16, CNHBF 5: >=17).

1) Annual index from 1971 to 2014 in weight	*Df*	*sum of square (deviance)*	*Residual Df*	*Residual deviance*	*% Explained deviance*	*% Total deviance*
NULL	NA	NA	58420	89620.457	NA	NA
year	43	4271.038	58377	85349.419	14.656	4.766
sub-area	2	5892.619	58375	79456.800	20.220	6.575
sst3	1	8879.899	58374	70576.901	30.471	9.908
CNHBF	4	1480.916	58370	69095.984	5.082	1.652
SFD	1	1653.648	58369	67442.336	5.674	1.845
year * sub-area	86	3225.406	58283	64216.930	11.068	3.599
sst3 * sub-area	2	3738.555	58281	60478.375	12.829	4.172

The explained deviance for year = {4271.038/ (89620.457 – 60478.375)} *100 = 14.656
The total deviance for year = {4271.038/ 89620.457} * 100 = 4.766

2) Annual index from 1965 to 2014 in number	*Df*	*sum of square (deviance)*	*Residual Df*	*Residual deviance*	*% Explained deviance*	*% Total deviance*
NULL	NA	NA	64019	100627.351	NA	NA
year	43	11854.782	63976	88772.569	29.070	11.781
sub-area	2	5875.575	63974	82896.994	14.408	5.839
sst3	1	8583.827	63973	74313.167	21.049	8.530
CNHBF	4	2903.542	63969	71409.625	7.120	2.885
SFD	1	1442.317	63968	69967.308	3.537	1.433
year * sub-area	86	6724.747	63882	63242.561	16.490	6.683
sst3 * sub-area	2	3394.949	63880	59847.612	8.325	3.374

3) Quarterly index from 1965 to 2014 in number	*Df*	*sum of square (deviance)*	*Residual Df*	*Residual deviance*	*% Explained deviance*	*% Total deviance*
NULL	NA	NA	64019	100627.351	NA	NA
year	49	11854.782	63970	88772.569	25.013	11.781
quarter	3	963.180	63967	87809.389	2.032	0.957
sub-area	2	5647.059	63965	82162.330	11.915	5.612
sst3	1	8795.965	63964	73366.365	18.559	8.741
CNHBF	4	2858.111	63960	70508.254	6.030	2.840
SFD	1	1589.680	63959	68918.574	3.354	1.580
year * sub-area *quarter	542	15686.423	63417	53232.151	33.097	15.589

Table 3. Deviance analysis tables of yellowfin catch rates in 1) annual index from 1976 to 2014 in weight (top; for index 7), 2) annual index from 1976 to 2014 in number (middle; for index 8) and 3) quarterly index from 1976 to 2014 in number (bottom; for index 9). The explained deviance = {sum of square (deviance) of each factor / (total sum of square (residual deviance) of NULL model – total sum of square (residual deviance) of the tested model)} *100, and the total deviance = (sum of square (deviance) of each factor / total sum of square (deviance) of NULL model) * 100. The tables are only shown for the final models but model selections were conducted by stepwise addition of a single factor. SFD; sea floor depth (m), CNHBF; categorized number of hooks between floats (CNHBF 1: <=5, CNHBF 2: 6-8, CNHBF 3: 9-12, CNHBF 4: 13-16, CNHBF 5: >=17).

7) Annual index from 1976 to 2014 in weight	*Df*	*sum of square (deviance)*	*Residual Df*	*Residual deviance*	*% Explained deviance*	*% Total deviance*
NULL	NA	NA	55406	83227.73	NA	NA
year	38	3777.36	55368	79450.37	13.11	4.54
sub-area	2	4810.77	55366	74639.60	16.69	5.78
sst3	1	6458.19	55365	68181.41	22.41	7.76
CNHBF	4	1028.72	55361	67152.69	3.57	1.24
SFD	1	1592.22	55360	65560.47	5.52	1.91
quarter	3	825.27	55357	64735.19	2.86	0.99
year * quarter	114	2965.98	55243	61769.21	10.29	3.56
year * sub-area	76	1934.22	55167	59834.99	6.71	2.32
year * SFD	38	1846.66	55129	57988.33	6.41	2.22
sst3 * sub-area	2	3579.51	55127	54408.83	12.42	4.30

8) Annual index from 1976 to 2014 in number	*Df*	*sum of square (deviance)*	*Residual Df*	*Residual deviance*	*% Explained deviance*	*% Total deviance*
NULL	NA	NA	55406	82672.32	NA	NA
year	38	2601.05	55368	80071.27	9.90	3.15
sub-area	2	2791.24	55366	77280.03	10.62	3.38
sst3	1	4876.36	55365	72403.67	18.55	5.90
CNHBF	4	1364.99	55361	71038.68	5.19	1.65
SFD	1	1828.75	55360	69209.93	6.96	2.21
quarter	3	869.84	55357	68340.09	3.31	1.05
year * quarter	114	3262.97	55243	65077.12	12.41	3.95
year * sub-area	76	2454.98	55167	62622.14	9.34	2.97
year * SFD	38	2373.20	55129	60248.94	9.03	2.87
sst3 * sub-area	2	3860.90	55127	56388.04	14.69	4.67

9) Quarterly index from 1976 to 2014 in number	*Df*	*sum of square (deviance)*	*Residual Df*	*Residual deviance*	*% Explained deviance*	*% Total deviance*
NULL	NA	NA	55406	82672.32	NA	NA
year	38	2601.05	55368	80071.27	8.84	3.15
quarter	3	814.84	55365	79256.43	2.77	0.99
sub-area	2	2608.17	55363	76648.26	8.87	3.15
sst3	1	5168.12	55362	71480.14	17.57	6.25
CNHBF	4	1515.83	55358	69964.31	5.15	1.83
SFD	1	1624.21	55357	68340.09	5.52	1.96
year * SFD	38	1685.02	55319	66655.07	5.73	2.04
sst3 * sub-area	2	2047.81	55317	64607.26	6.96	2.48
year * quarter * sub-area	421	11349.66	54896	53257.59	38.58	13.73

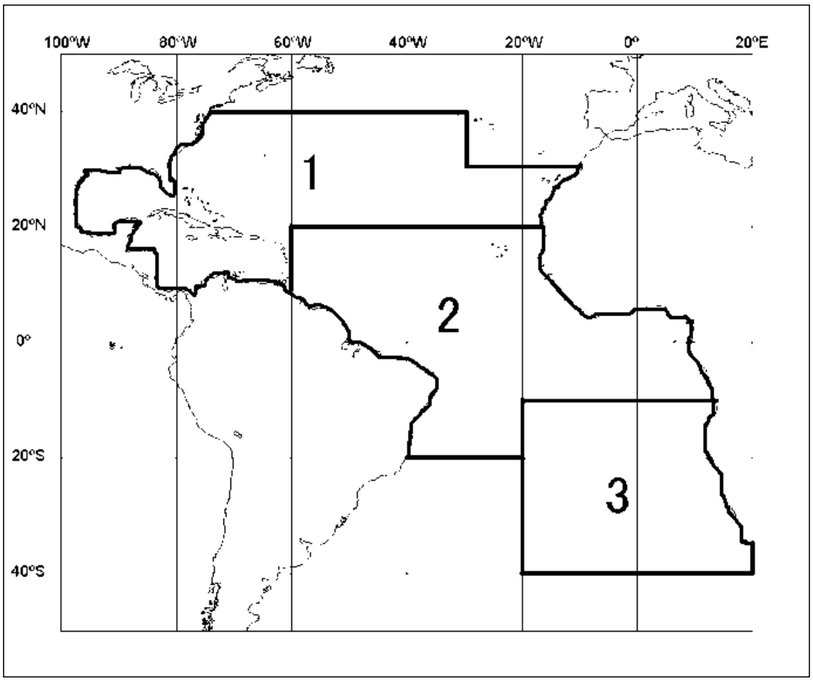

Figure 1. Sub-area definitions used for Japanese longline CPUE standardization, which is the same as that in last yellowfin assessment (Okamoto and Satoh, 2008; Satoh et al., 2012; Matsumoto and Satoh, 2015 and previous study (SCRS/2016/035).

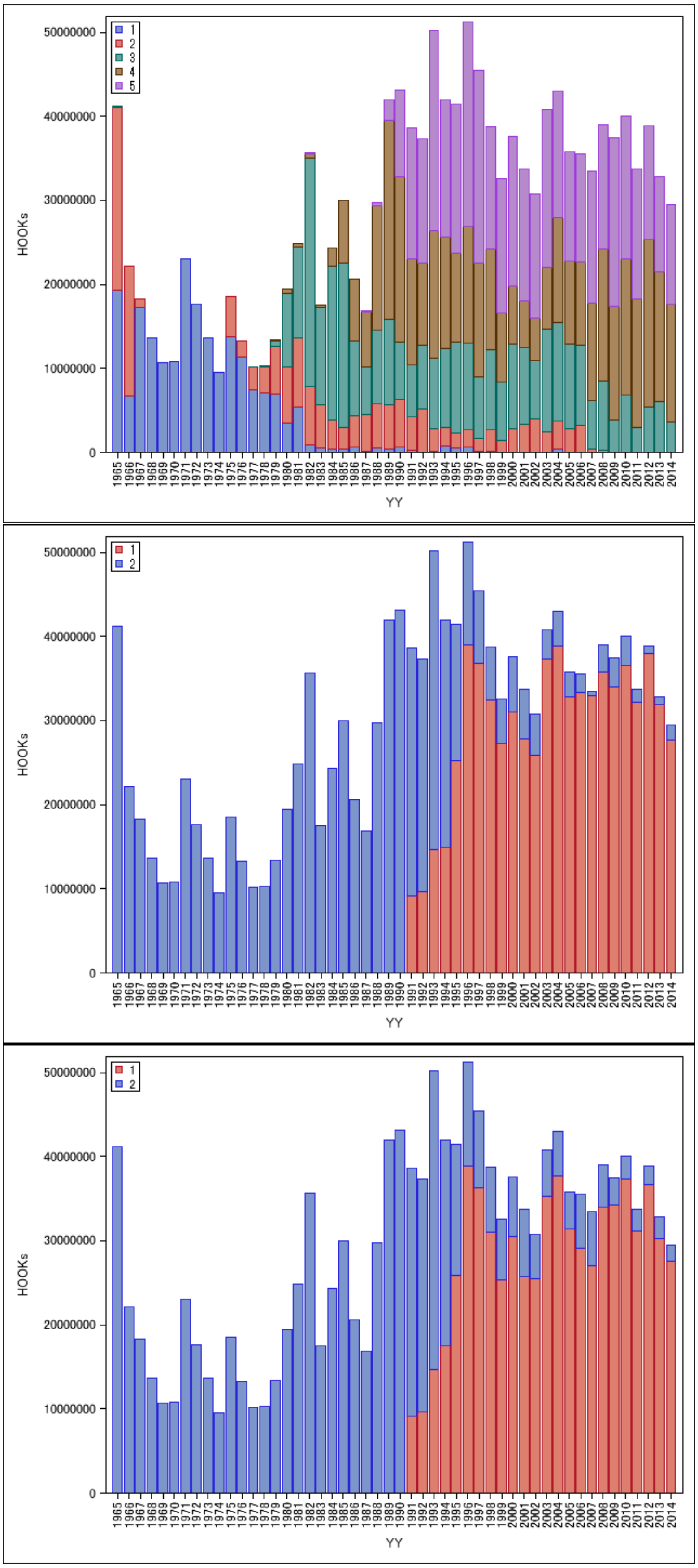

Figure 2. Distribution of number of hooks by model factors. Categorical number of hooks between floats (top; CNHBF 1: <=5, CNHBF 2: 6-8, CNHBF 3: 9-12, CNHBF 4: 13-16, CNHBF 5: >=17), materials of main line (middle; 1: Nylon, 2: Others) and material of branch line (bottom; 1: Nylon, 2: Others).

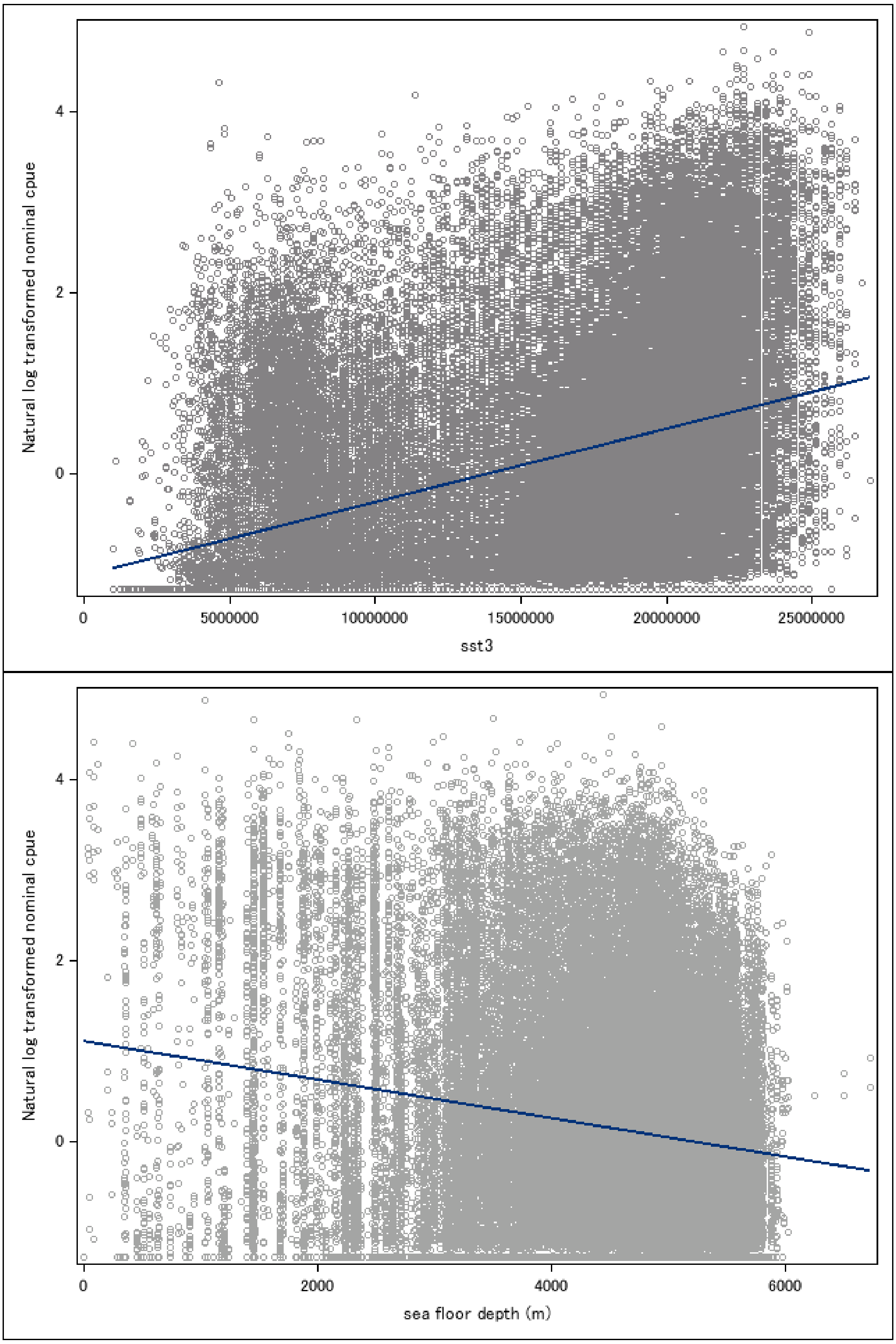

Figure 3. Relationship between natural log transformed nominal cpue (number of yellowfin per 1000 hooks) and SST3 (top; cubic of sea surface temperature) and sea floor depth (bottom; SFD). Solid blue lines in each panel showed the regression line.

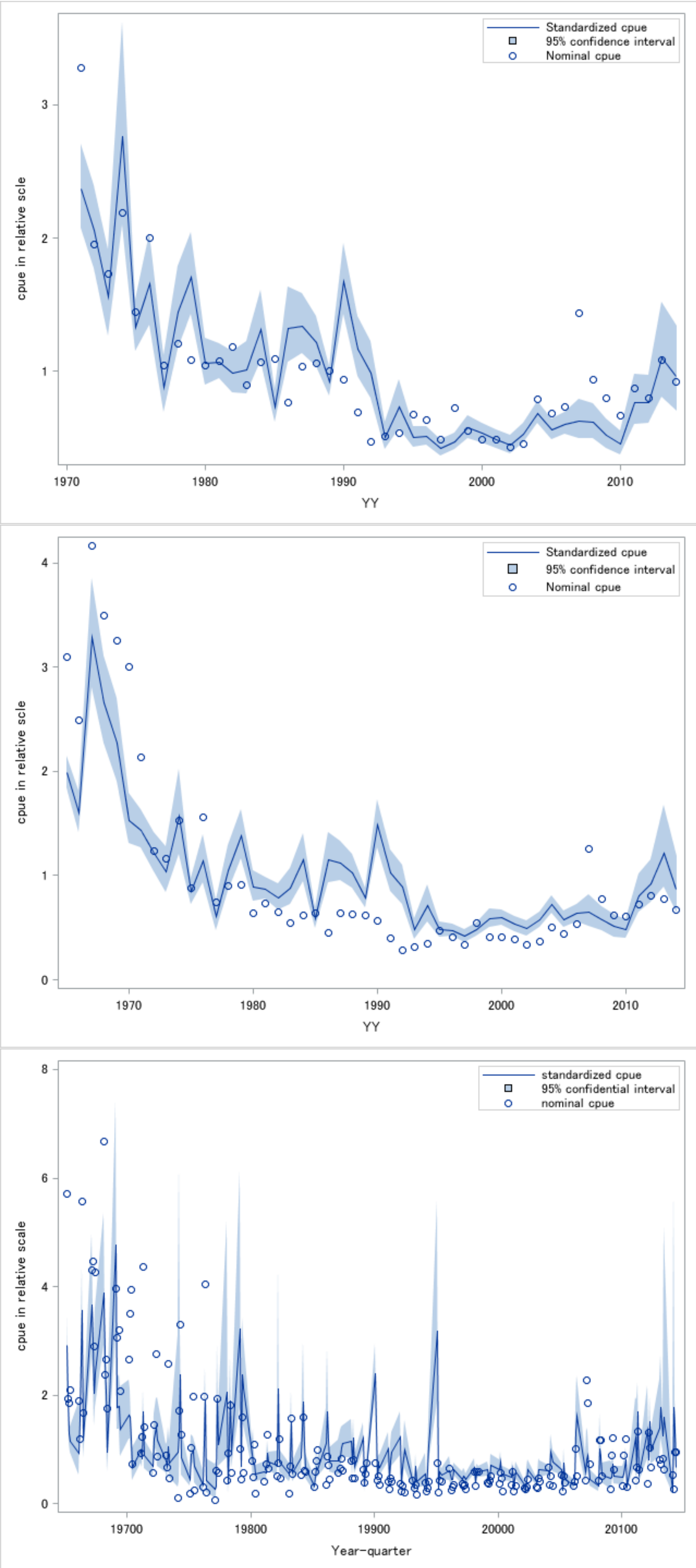

Figure 4. Standardized (solid line) and nominal (open circle) cpues for annual CPUE in weight (top) and number (middle) and quarterly in number (bottom) expressed in relative scale in which the average from 1971 (1965) to 2014 is 1.0.

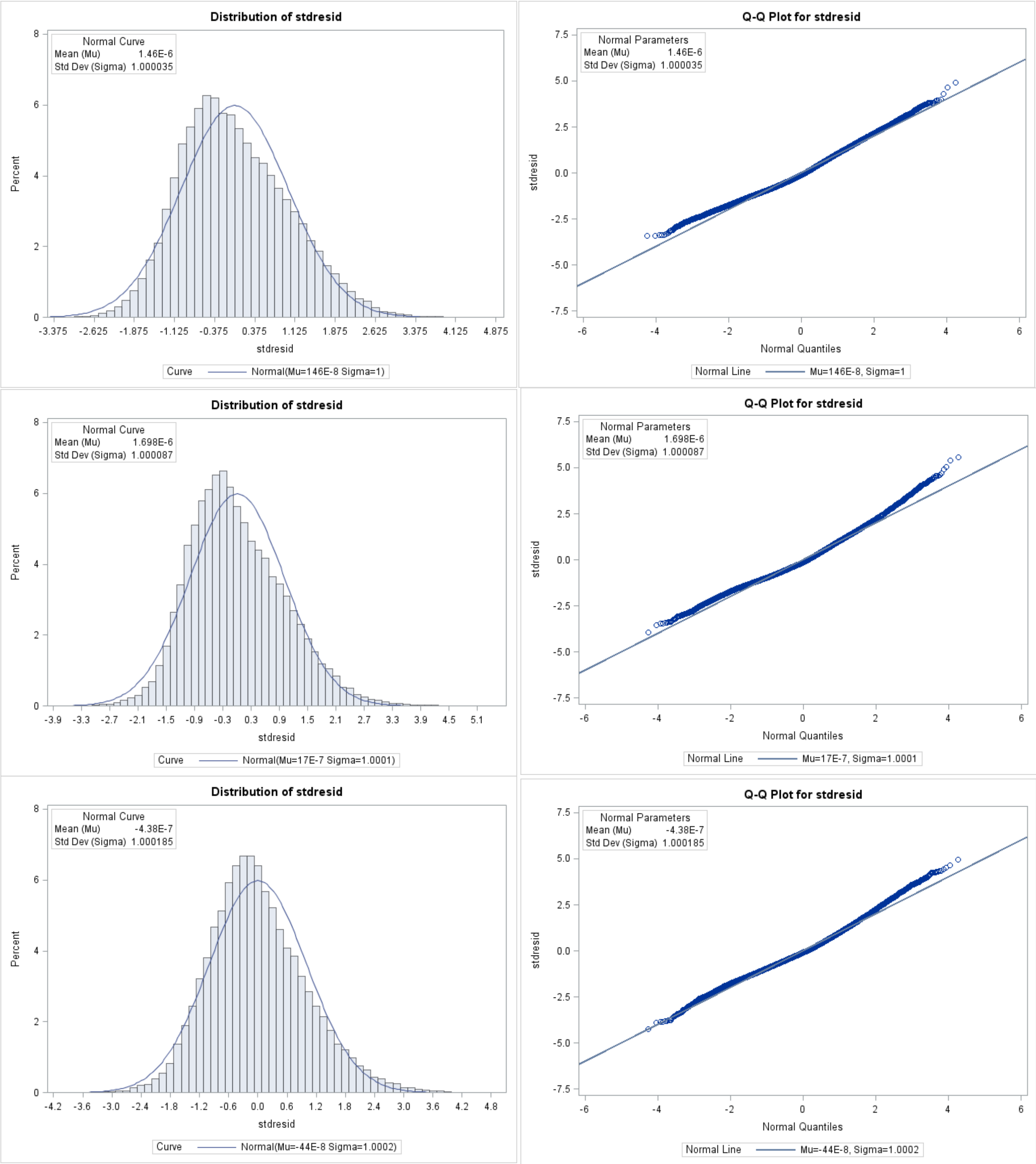

Figure 5-1. Diagnosis of standardized cpue of distribution of residuals and Q-Q plots for annual CPUEs in number (top; index 1) and weight (middle; index 2) and quarterly cpue (bottom; index 3).

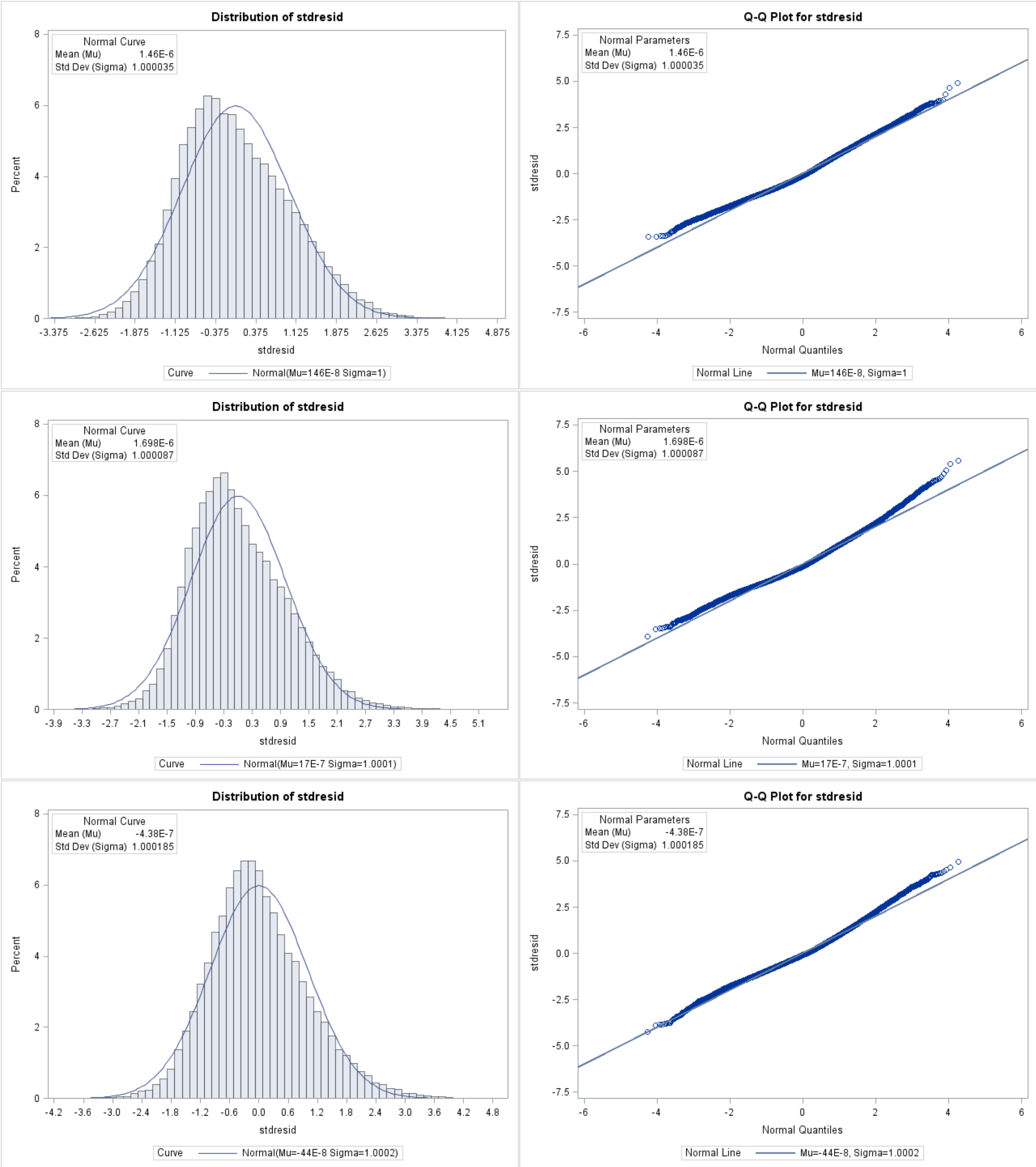

Figure 5-2. Diagnosis of standardized cpue of distribution of residuals and Q-Q plots for annual CPUEs in number (top; index 4) and weight (middle; index 5) and quarterly cpue (bottom; index 6).

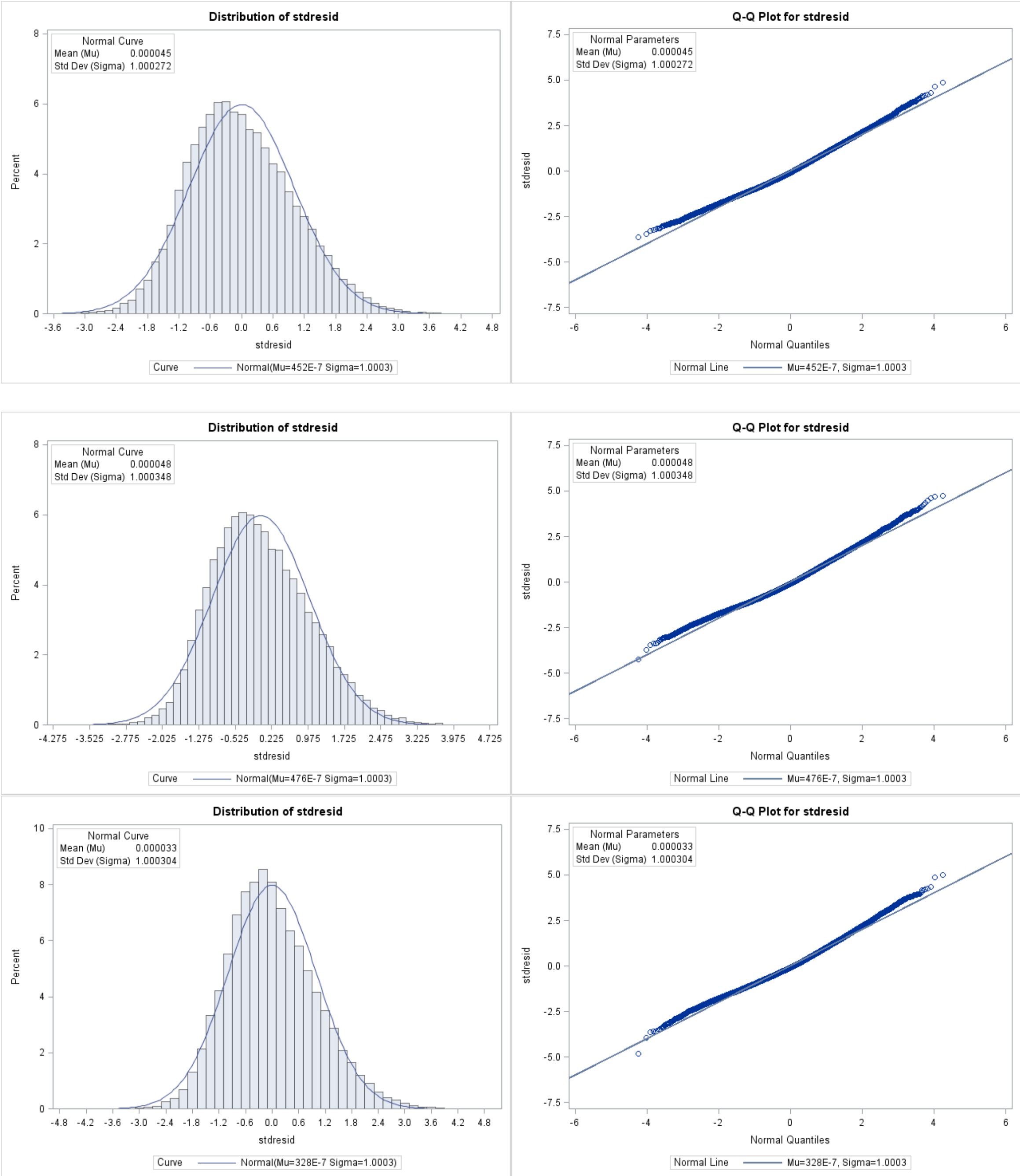

Figure 5-3. Diagnosis of standardized cpue of distribution of residuals and Q-Q plots for annual CPUEs in number (top; index 7) and weight (middle; index 8) and quarterly cpue (bottom; index 9).

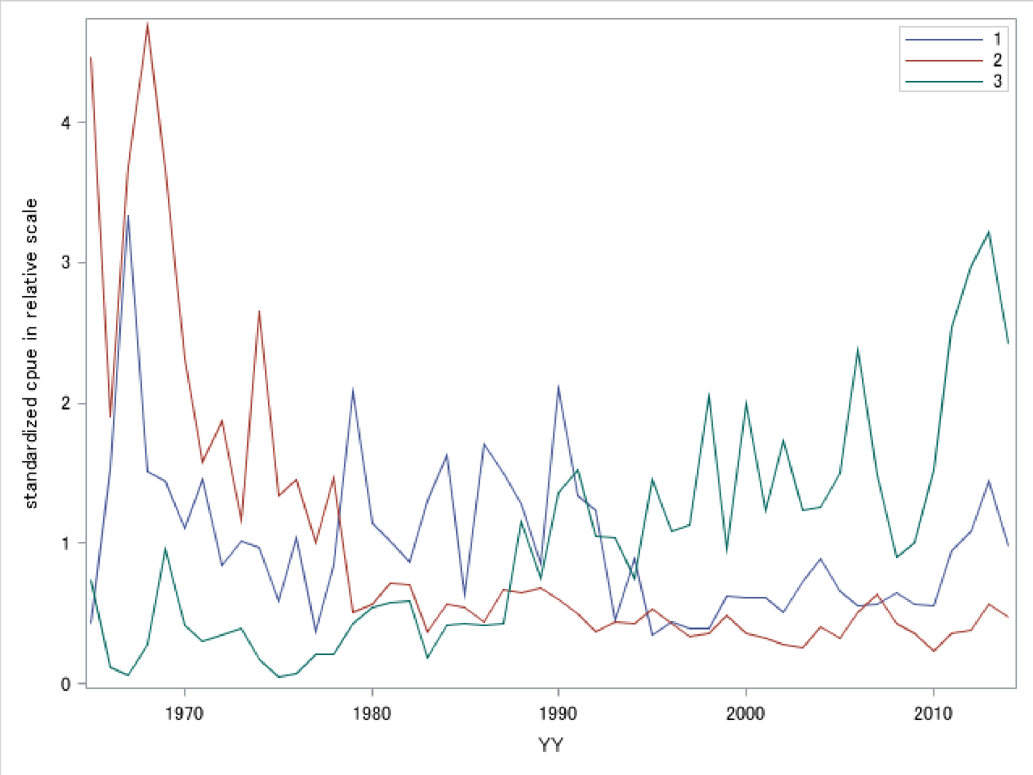

Figure 6-1. Standardized annual CPUE in number (indices 2, 5) by sub-area expressed in relative scale in which the average from 1965 to 2014 is 1.0.

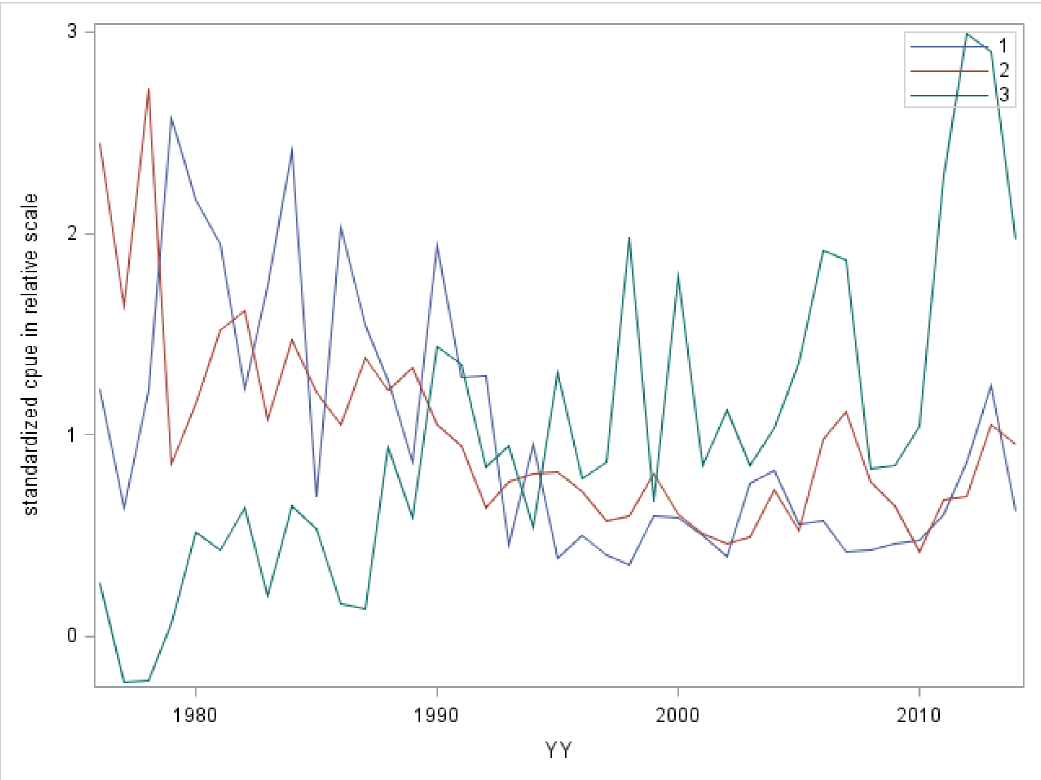

Figure 6-2. Standardized annual CPUE in number (index 8) by sub-area expressed in relative scale in which the average from 1976 to 2014 is 1.0.

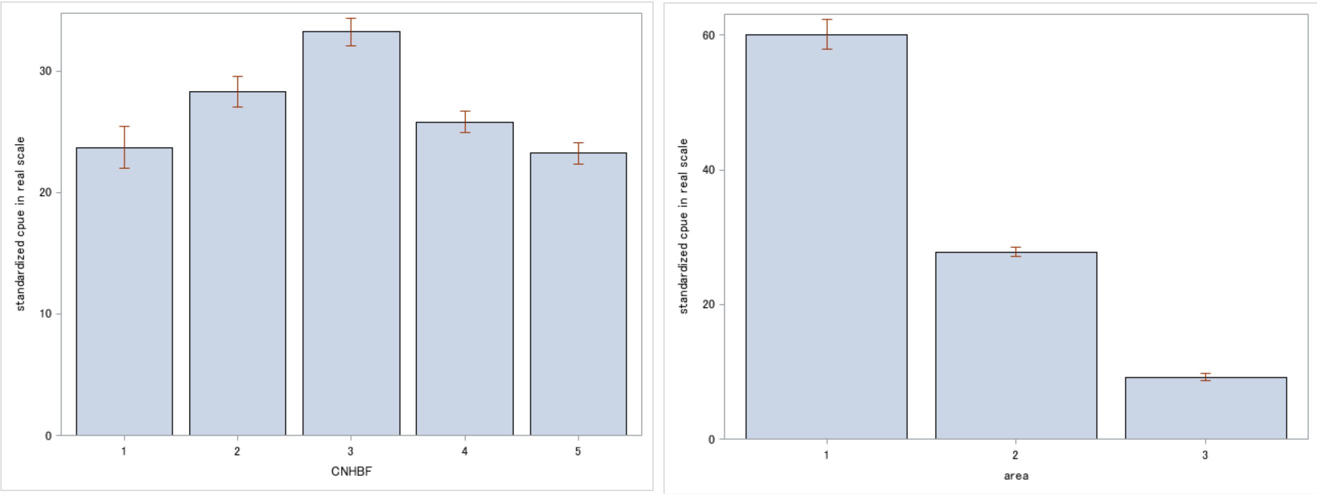

Figure 7-1. Standardized CPUE by factors (left; categorical number of hooks between floats (CNHBF 1: <=5, CNHBF 2: 6-8, CNHBF 3: 9-12, CNHBF 4: 13-16, CNHBF 5: >=17) , right; sub-area) from the model of annual cpue in number (indices 1, 4)

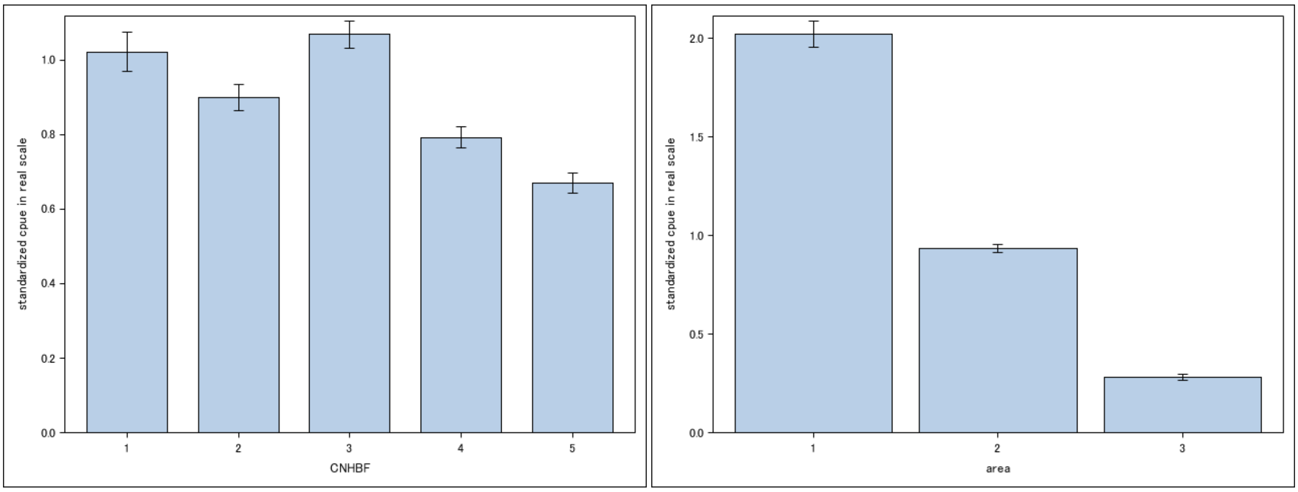

Figure 7-2. Standardized CPUE by factors (left; categorical number of hooks between floats (CNHBF 1: <=5, CNHBF 2: 6-8, CNHBF 3: 9-12, CNHBF 4: 13-16, CNHBF 5: >=17) , right; sub-area) from the model of annual cpue in number (indices 2, 5).

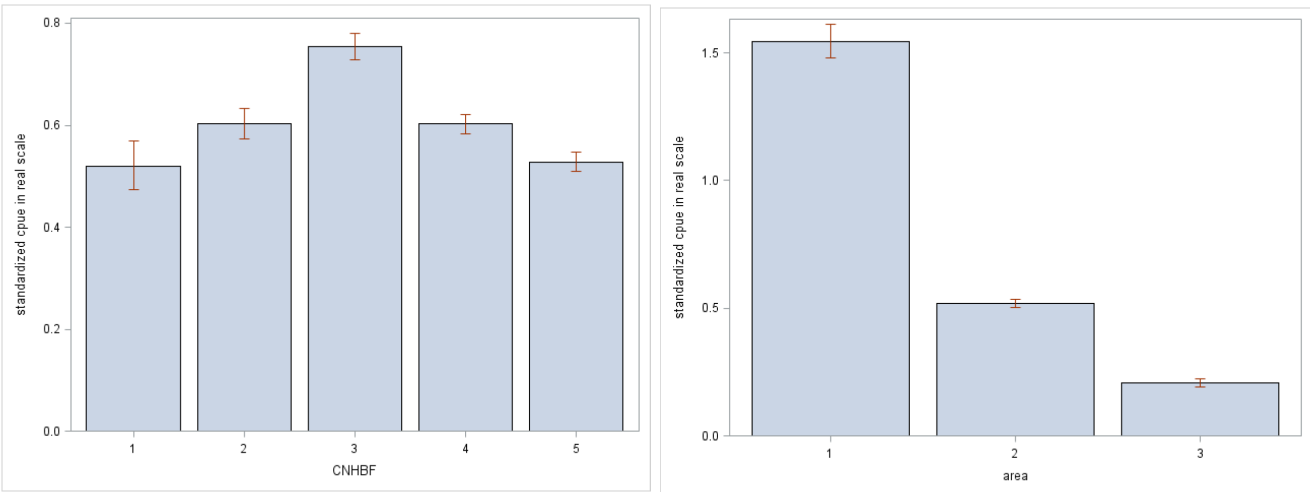

Figure 7-3. Standardized CPUE by factors (left; categorical number of hooks between floats (CNHBF 1: <=5, CNHBF 2: 6-8, CNHBF 3: 9-12, CNHBF 4: 13-16, CNHBF 5: >=17), right; sub-area) from the model of annual cpue in number (index 8).

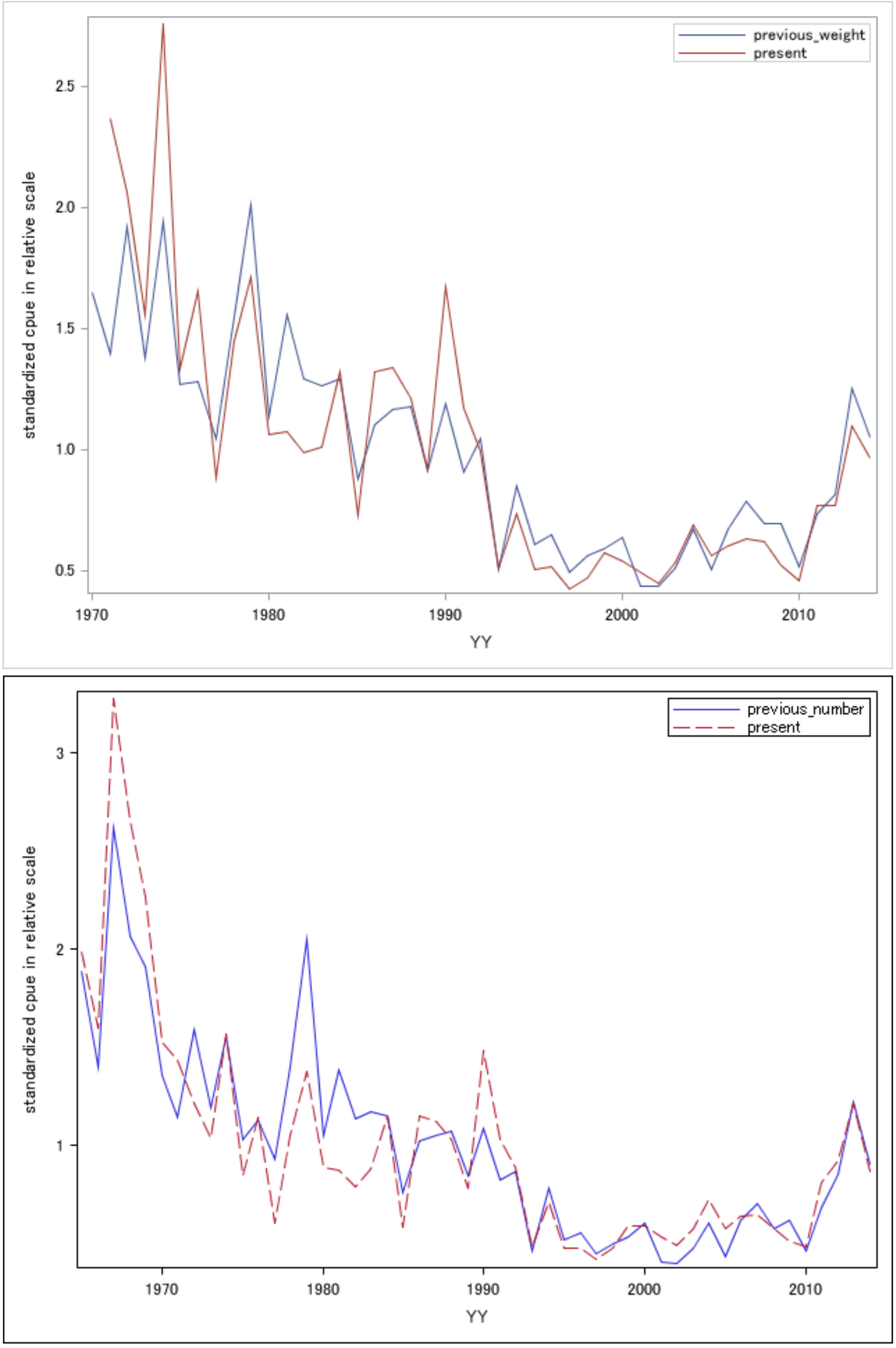

Figure 8. Comparison of standardized CPUE between previous study (SCRS/2016/035; blue line) and present study (red line). Annual CPUE in weight (top; index 1) and in number (bottom, index 2).

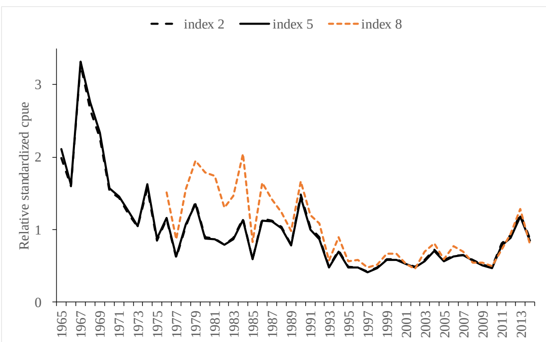

Figure 9. Comparison of standardized CPUE among indices 2, 5 and 8

Appendix index 1. Annual CPUE. Standardized and nominal cpue in weight (kg) per 1000 hooks. Standardized cpues are presented as Lsmean (least square means of "year effect") with standard error, and point estimate in real scale. The point in real scale is calculated by exp (Lsmean)-overall mean/10, the upper is calculated as exp (lsmean+1.96*standard error)-overall mean/10, the lower is calculated by exp (lsmean-1.96 standard error)-overall mean/10. The cpues are also expressed in relative scale in which the average from 1971 (1965) to 2014 is 1.0. These values are conditioned by the area effect as mentioned in the text.

CPUE in weight

Year	standardized								nominal	
	LS-means	stdandard error	real scale			relative scale			real scale	relative scale
			upper	point	lower	upper	point	lower		
1965										
1966										
1967										
1968										
1969										
1970										
1971	4.148	0.044	109.407	95.877	83.917	2.702	2.368	2.073	275.139	3.271
1972	4.040	0.051	97.003	83.423	71.638	2.396	2.060	1.769	163.961	1.949
1973	3.900	0.057	77.336	62.978	51.105	1.910	1.556	1.262	145.824	1.734
1974	4.145	0.070	146.484	111.632	85.044	3.618	2.757	2.101	184.326	2.192
1975	3.644	0.044	62.181	53.904	46.614	1.536	1.331	1.151	121.721	1.447
1976	3.794	0.065	82.187	66.973	54.507	2.030	1.654	1.346	168.304	2.001
1977	3.428	0.058	45.311	35.761	27.947	1.119	0.883	0.690	87.869	1.045
1978	3.763	0.055	72.417	58.595	47.185	1.789	1.447	1.165	101.786	1.210
1979	3.753	0.047	82.566	69.178	57.778	2.039	1.709	1.427	91.111	1.083
1980	3.618	0.040	50.431	42.911	36.409	1.246	1.060	0.899	87.649	1.042
1981	3.661	0.033	49.029	43.445	38.418	1.211	1.073	0.949	90.593	1.077
1982	3.627	0.040	46.740	39.968	34.183	1.154	0.987	0.844	99.583	1.184
1983	3.416	0.044	49.690	41.013	33.719	1.227	1.013	0.833	75.812	0.901
1984	3.680	0.046	65.211	53.372	43.666	1.611	1.318	1.079	90.123	1.072
1985	3.409	0.045	34.969	29.611	25.031	0.864	0.731	0.618	92.179	1.096
1986	3.603	0.047	65.973	53.554	43.386	1.629	1.323	1.072	64.194	0.763
1987	3.676	0.050	63.983	54.185	45.805	1.580	1.338	1.131	87.434	1.040
1988	3.757	0.039	57.327	49.109	42.029	1.416	1.213	1.038	89.261	1.061
1989	3.543	0.033	41.954	37.223	32.995	1.036	0.919	0.815	84.257	1.002
1990	3.906	0.038	79.191	67.700	57.867	1.956	1.672	1.429	78.682	0.936
1991	3.757	0.043	57.240	47.301	39.098	1.414	1.168	0.966	58.007	0.690
1992	3.567	0.045	49.634	40.093	32.352	1.226	0.990	0.799	40.036	0.476
1993	3.248	0.047	25.147	20.579	16.842	0.621	0.508	0.416	43.221	0.514
1994	3.384	0.052	38.059	29.648	23.146	0.940	0.732	0.572	45.572	0.542
1995	3.271	0.038	23.832	20.383	17.408	0.589	0.503	0.430	56.669	0.674
1996	3.265	0.030	23.785	20.892	18.299	0.587	0.516	0.452	53.326	0.634
1997	3.132	0.032	19.759	17.146	14.806	0.488	0.423	0.366	40.951	0.487
1998	3.282	0.030	21.801	19.109	16.678	0.538	0.472	0.412	61.153	0.727
1999	3.301	0.034	26.970	23.314	20.082	0.666	0.576	0.496	46.842	0.557
2000	3.307	0.031	24.812	21.713	18.927	0.613	0.536	0.467	41.478	0.493
2001	3.222	0.035	22.917	19.877	17.160	0.566	0.491	0.424	41.208	0.490
2002	3.197	0.036	21.215	18.145	15.418	0.524	0.448	0.381	36.151	0.430
2003	3.213	0.029	24.644	21.572	18.800	0.609	0.533	0.464	38.289	0.455
2004	3.378	0.030	31.358	27.836	24.644	0.775	0.688	0.609	66.524	0.791
2005	3.329	0.035	26.131	22.820	19.859	0.645	0.564	0.490	57.943	0.689
2006	3.431	0.033	27.959	24.497	21.390	0.691	0.605	0.528	61.772	0.734
2007	3.415	0.057	32.197	25.513	20.291	0.795	0.630	0.501	120.612	1.434
2008	3.318	0.044	30.746	25.008	20.282	0.759	0.618	0.501	78.730	0.936
2009	3.226	0.047	26.039	21.187	17.149	0.643	0.523	0.424	67.551	0.803
2010	3.135	0.038	22.425	18.608	15.324	0.554	0.460	0.378	56.139	0.667
2011	3.517	0.050	39.503	31.179	24.562	0.976	0.770	0.607	73.279	0.871
2012	3.537	0.049	39.346	31.164	24.654	0.972	0.770	0.609	66.920	0.796
2013	3.845	0.073	61.404	44.471	32.722	1.517	1.098	0.808	91.220	1.085
2014	3.696	0.071	54.177	38.968	28.299	1.338	0.962	0.699	77.258	0.919

Appendix index 2. Annual CPUE. Standardized and nominal cpue in number (number of fish per 1000 hooks.

CPUE in number

Year	standardized									nominal	
	LS-means	stdandard error	real scale			relative scale				real scale	relative scale
			upper	point	lower	upper	point	lower			
1965	0.451	0.029	2.974	2.759	2.559	2.146	1.991	1.846		10.380	3.097
1966	0.387	0.035	2.507	2.213	1.952	1.809	1.597	1.408		8.335	2.487
1967	0.815	0.048	5.327	4.545	3.885	3.844	3.280	2.803		13.953	4.163
1968	0.712	0.052	4.310	3.680	3.148	3.110	2.655	2.271		11.694	3.489
1969	0.778	0.058	3.742	3.139	2.637	2.700	2.265	1.903		10.907	3.254
1970	0.436	0.051	2.474	2.120	1.812	1.785	1.530	1.307		10.056	3.000
1971	0.374	0.039	2.261	1.991	1.750	1.632	1.437	1.263		7.144	2.131
1972	0.276	0.046	1.951	1.678	1.438	1.408	1.211	1.038		4.122	1.230
1973	0.205	0.052	1.762	1.437	1.165	1.272	1.037	0.841		3.889	1.160
1974	0.368	0.065	2.805	2.169	1.673	2.024	1.565	1.207		5.105	1.523
1975	-0.025	0.041	1.352	1.168	1.006	0.975	0.843	0.726		2.947	0.879
1976	0.172	0.061	1.925	1.581	1.295	1.389	1.141	0.934		5.241	1.564
1977	-0.171	0.054	1.067	0.837	0.648	0.770	0.604	0.467		2.484	0.741
1978	0.162	0.052	1.789	1.452	1.171	1.291	1.048	0.845		3.031	0.904
1979	0.217	0.044	2.269	1.912	1.605	1.637	1.379	1.158		3.044	0.908
1980	0.089	0.038	1.445	1.231	1.044	1.042	0.888	0.754		2.154	0.643
1981	0.115	0.032	1.360	1.207	1.068	0.982	0.871	0.770		2.458	0.733
1982	0.070	0.038	1.279	1.089	0.926	0.923	0.786	0.668		2.189	0.653
1983	-0.066	0.042	1.477	1.221	1.004	1.065	0.881	0.725		1.812	0.541
1984	0.163	0.044	1.946	1.593	1.302	1.404	1.150	0.939		2.083	0.622
1985	-0.126	0.042	0.961	0.810	0.681	0.693	0.584	0.491		2.159	0.644
1986	0.121	0.044	1.955	1.591	1.290	1.411	1.148	0.931		1.527	0.456
1987	0.184	0.048	1.837	1.557	1.315	1.326	1.123	0.949		2.132	0.636
1988	0.276	0.036	1.666	1.429	1.223	1.202	1.031	0.882		2.118	0.632
1989	0.095	0.031	1.225	1.086	0.961	0.884	0.783	0.693		2.057	0.614
1990	0.443	0.035	2.393	2.052	1.758	1.727	1.481	1.269		1.910	0.570
1991	0.284	0.041	1.720	1.422	1.174	1.241	1.026	0.847		1.332	0.397
1992	0.118	0.042	1.522	1.233	0.997	1.099	0.890	0.719		0.959	0.286
1993	-0.133	0.044	0.814	0.665	0.542	0.587	0.480	0.391		1.068	0.318
1994	-0.001	0.049	1.256	0.981	0.766	0.906	0.708	0.553		1.176	0.351
1995	-0.092	0.036	0.775	0.663	0.566	0.559	0.479	0.409		1.584	0.473
1996	-0.134	0.028	0.748	0.658	0.577	0.540	0.475	0.416		1.367	0.408
1997	-0.205	0.030	0.663	0.577	0.500	0.478	0.416	0.361		1.126	0.336
1998	-0.065	0.028	0.752	0.662	0.580	0.543	0.478	0.419		1.839	0.549
1999	-0.039	0.032	0.940	0.815	0.704	0.678	0.588	0.508		1.387	0.414
2000	0.042	0.029	0.932	0.821	0.720	0.673	0.592	0.519		1.383	0.412
2001	-0.085	0.033	0.846	0.740	0.643	0.611	0.534	0.464		1.308	0.390
2002	-0.093	0.033	0.784	0.676	0.580	0.566	0.488	0.418		1.110	0.331
2003	-0.078	0.028	0.903	0.796	0.699	0.652	0.575	0.504		1.224	0.365
2004	0.074	0.028	1.122	1.001	0.891	0.810	0.722	0.643		1.690	0.504
2005	-0.025	0.033	0.909	0.798	0.698	0.656	0.576	0.503		1.490	0.445
2006	0.134	0.031	1.008	0.886	0.777	0.727	0.639	0.560		1.799	0.537
2007	0.088	0.054	1.126	0.895	0.713	0.812	0.646	0.515		4.212	1.256
2008	-0.068	0.042	0.976	0.799	0.652	0.704	0.577	0.470		2.582	0.770
2009	-0.122	0.044	0.867	0.708	0.574	0.626	0.511	0.414		2.076	0.619
2010	-0.130	0.036	0.799	0.670	0.558	0.577	0.483	0.402		2.024	0.604
2011	0.224	0.048	1.402	1.121	0.895	1.012	0.809	0.646		2.409	0.719
2012	0.318	0.047	1.590	1.277	1.026	1.147	0.921	0.740		2.696	0.804
2013	0.519	0.069	2.317	1.680	1.232	1.672	1.212	0.889		2.590	0.773
2014	0.287	0.067	1.644	1.204	0.888	1.186	0.869	0.641		2.239	0.668

Appendix index 3. Quarterly CPUE by sub-area. Standardized and nominal cpue in number (number of fish per 1000 hooks by sub-area. Explanations are same for Appendix index 1.

		CPUE in number												
		standardized								nominal			
Year	quarter	LS-means	stdandard error	real scale			relative scale			real scale	relative scale	Number of hooks	Number of yellowfin tuna
				upper	point	lower	upper	point	lower				
1965	1			6.131	5.137	4.363	2.916	3.479	2.476	19.523	5.708	12,039,764	235,055
1965	2			3.945	3.451	3.016	1.959	2.239	1.712	6.572	1.922	11,354,487	74,627
1965	3			2.651	2.279	1.961	1.293	1.505	1.113	6.303	1.843	11,399,209	71,847
1965	4			2.476	2.023	1.659	1.148	1.405	0.941	7.172	2.097	6,356,417	45,589
1966	1			3.310	1.626	0.936	0.923	1.879	0.531	6.496	1.899	6,917,413	44,933
1966	2			3.293	2.742	2.277	1.556	1.869	1.292	4.036	1.180	7,578,982	30,590
1966	3			7.706	6.285	5.118	3.567	4.374	2.905	19.059	5.572	4,908,615	93,552
1966	4			2.867	2.079	1.493	1.180	1.627	0.847	5.698	1.666	2,781,284	15,848
1967	1			8.755	6.460	4.787	3.666	4.969	2.717	14.711	4.301	6,709,217	98,698
1967	2			6.351	5.152	4.181	2.924	3.605	2.373	15.268	4.464	4,485,660	68,486
1967	3			5.218	3.573	2.511	2.028	2.962	1.425	9.898	2.894	3,288,717	32,553
1967	4			6.333	4.244	3.114	2.409	3.594	1.767	14.571	4.260	3,820,432	55,668
1968	1			9.411	6.844	5.124	3.884	5.341	2.908	22.827	6.674	3,250,000	74,188
1968	2			5.879	4.608	3.611	2.615	3.336	2.049	8.113	2.372	4,402,056	35,714
1968	3			4.941	3.652	2.714	2.073	2.804	1.540	9.068	2.651	4,362,068	39,554
1968	4			2.883	1.677	1.025	0.952	1.636	0.582	6.017	1.759	1,577,971	9,494
1969	1			13.081	8.398	5.467	4.766	7.424	3.103	13.569	3.967	2,340,565	31,758
1969	2			4.037	3.118	2.419	1.769	2.291	1.373	10.424	3.047	4,091,948	42,654
1969	3			4.193	3.163	2.395	1.795	2.380	1.359	10.936	3.197	3,067,947	33,552
1969	4			3.784	2.398	1.510	1.361	2.148	0.857	7.081	2.070	1,134,359	8,032
1970	1			3.998	2.865	2.076	1.626	2.269	1.178	9.061	2.649	2,784,695	25,231
1970	2			3.728	2.788	2.087	1.582	2.115	1.184	11.958	3.496	2,905,585	34,745
1970	3			2.706	2.080	1.588	1.181	1.536	0.901	13.499	3.946	3,315,372	44,754
1970	4			1.821	1.177	0.744	0.668	1.034	0.422	2.509	0.734	1,878,199	4,713
1971	1			2.297	1.751	1.322	0.993	1.303	0.750	3.197	0.935	3,902,651	12,478
1971	2			1.799	1.460	1.177	0.829	1.021	0.668	4.232	1.237	6,554,792	27,739
1971	3			3.686	2.984	2.410	1.693	2.092	1.368	14.943	4.369	6,321,769	94,464
1971	4			2.111	1.556	1.146	0.883	1.198	0.650	4.803	1.404	6,326,210	30,382
1972	1			1.608	1.202	0.901	0.682	0.913	0.511	1.924	0.562	6,906,608	13,288
1972	2			2.901	2.107	1.552	1.196	1.646	0.881	4.936	1.443	4,322,545	21,337
1972	3			3.413	2.497	1.811	1.417	1.937	1.028	9.399	2.748	2,959,073	27,811
1972	4			3.422	2.055	1.212	1.166	1.942	0.688	2.966	0.867	3,419,254	10,143
1973	1			1.904	1.400	1.013	0.795	1.081	0.575	3.013	0.881	3,841,947	11,574
1973	2			1.972	1.220	0.720	0.692	1.119	0.409	2.283	0.667	1,817,282	4,149
1973	3			2.475	1.850	1.373	1.050	1.405	0.779	8.837	2.584	3,380,833	29,878
1973	4			2.013	1.312	0.868	0.745	1.142	0.493	1.620	0.474	4,601,731	7,457
1974	1			5.441	1.683	0.526	0.955	3.088	0.298	0.377	0.110	3,234,436	1,219
1974	2			10.938	2.358	0.720	1.338	6.208	0.409	5.853	1.711	1,524,781	8,925
1974	3			5.645	4.199	3.107	2.383	3.204	1.764	11.282	3.298	2,560,021	28,883
1974	4			2.457	1.502	0.935	0.852	1.394	0.530	4.362	1.275	2,239,124	9,767
1975	1			1.055	0.792	0.587	0.450	0.599	0.333	0.606	0.177	6,429,815	3,894
1975	2			2.242	1.597	1.144	0.907	1.273	0.649	3.526	1.031	3,847,977	13,569
1975	3			2.151	1.713	1.356	0.972	1.220	0.770	6.730	1.968	5,169,339	34,790
1975	4			2.016	1.191	0.670	0.676	1.144	0.380	0.801	0.234	3,133,890	2,511
1976	1			1.049	0.603	0.340	0.342	0.595	0.193	1.055	0.309	5,567,268	5,876
1976	2			2.881	1.947	1.310	1.105	1.635	0.744	6.730	1.968	2,934,831	19,752
1976	3			4.424	3.373	2.593	1.914	2.511	1.472	13.817	4.039	3,085,687	42,634
1976	4			1.444	0.749	0.354	0.425	0.820	0.201	0.700	0.205	1,658,196	1,160
1977	1			1.265	0.451	0.180	0.256	0.718	0.102	0.228	0.067	3,041,103	693
1977	2			1.358	0.586	0.194	0.332	0.771	0.110	2.087	0.610	1,860,286	3,883
1977	3			5.226	3.396	2.193	1.928	2.966	1.244	6.632	1.939	2,233,693	14,814
1977	4			3.055	1.923	1.194	1.091	1.734	0.678	1.930	0.564	3,012,258	5,813
1978	1			9.175	3.598	1.484	2.042	5.207	0.842	1.441	0.421	2,096,340	3,021
1978	2			1.514	0.663	0.315	0.376	0.859	0.179	3.183	0.930	1,570,725	4,999
1978	3			4.734	3.322	2.323	1.885	2.687	1.318	6.204	1.814	2,428,018	15,064
1978	4			2.569	1.693	1.135	0.961	1.458	0.644	1.952	0.571	4,270,247	8,336
1979	1			10.786	5.663	3.158	3.214	6.121	1.792	3.469	1.014	3,510,623	12,180
1979	2			2.345	1.213	0.591	0.688	1.331	0.335	1.535	0.449	1,456,454	2,236
1979	3			6.013	4.179	2.885	2.372	3.412	1.637	5.425	1.586	2,933,703	15,915
1979	4			5.469	3.741	2.545	2.123	3.104	1.444	1.906	0.557	5,523,558	10,528
1980	1			2.110	1.581	1.171	0.898	1.197	0.664	2.686	0.785	3,955,596	10,625
1980	2			2.408	1.294	0.686	0.734	1.366	0.389	1.629	0.476	2,213,739	3,606
1980	3			1.679	1.305	1.007	0.740	0.953	0.572	3.708	1.084	6,308,553	23,391
1980	4			1.256	0.950	0.706	0.539	0.713	0.401	0.619	0.181	7,001,927	4,336
1981	1			1.335	1.033	0.797	0.587	0.757	0.452	1.410	0.412	7,153,391	10,088
1981	2			1.377	1.004	0.721	0.570	0.782	0.409	2.461	0.720	3,263,477	8,033
1981	3			2.017	1.637	1.322	0.929	1.145	0.750	4.347	1.271	5,288,371	22,988
1981	4			1.665	1.360	1.104	0.772	0.945	0.627	2.183	0.638	9,085,054	19,837
1982	1			1.690	1.239	0.906	0.703	0.959	0.514	1.699	0.497	14,850,100	25,232
1982	2			7.674	3.707	1.861	2.104	4.355	1.056	2.549	0.745	3,817,938	9,732
1982	3			1.704	1.357	1.079	0.770	0.967	0.612	4.076	1.192	6,545,480	26,681
1982	4			1.693	1.304	1.000	0.740	0.961	0.568	1.573	0.460	10,460,559	16,452
1983	1			1.320	0.967	0.696	0.549	0.749	0.395	0.646	0.189	7,703,419	4,975
1983	2			2.369	1.396	0.790	0.792	1.344	0.448	2.339	0.684	481,777	1,127
1983	3			3.647	2.631	1.889	1.493	2.070	1.072	5.396	1.578	2,396,570	12,932
1983	4			1.347	0.986	0.713	0.560	0.764	0.405	1.833	0.536	6,898,323	12,644
1984	1			2.028	1.506	1.112	0.855	1.151	0.631	1.795	0.525	8,691,392	15,605
1984	2			5.230	3.301	2.104	1.874	2.968	1.194	5.404	1.580	1,034,773	5,592
1984	3			2.986	1.917	1.229	1.088	1.695	0.697	2.077	0.607	4,813,132	9,999
1984	4			1.630	1.164	0.829	0.660	0.925	0.470	1.991	0.582	9,809,302	19,532
1985	1			0.849	0.587	0.397	0.333	0.482	0.225	1.057	0.309	12,469,453	13,175
1985	2			1.254	0.844	0.558	0.479	0.711	0.316	2.017	0.590	2,824,255	5,697
1985	3			1.694	1.176	0.816	0.667	0.961	0.463	2.715	0.794	5,934,119	16,113
1985	4			1.387	1.094	0.861	0.621	0.787	0.489	3.399	0.994	8,750,915	29,742
1986	1			3.072	1.938	1.214	1.100	1.744	0.689	1.161	0.339	11,090,960	12,872
1986	2			5.019	2.979	1.740	1.691	2.849	0.987	2.949	0.862	1,700,999	5,016
1986	3			3.075	2.045	1.339	1.161	1.745	0.760	2.409	0.704	2,120,257	5,108
1986	4			1.819	1.387	1.047	0.787	1.032	0.594	1.487	0.435	5,630,406	8,374
1987	1			2.061	1.374	0.938	0.780	1.169	0.533	1.928	0.564	6,648,390	12,821
1987	2			2.390	1.542	0.981	0.875	1.356	0.557	2.192	0.641	1,602,426	3,512
1987	3			2.480	1.797	1.286	1.020	1.408	0.730	2.822	0.825	2,355,954	6,649
1987	4			2.516	1.952	1.507	1.108	1.428	0.855	2.073	0.606	6,230,147	12,913
1988	1			2.715	2.008	1.487	1.140	1.541	0.844	2.694	0.787	8,863,817	23,875
1988	2			1.982	1.300	0.837	0.738	1.125	0.475	1.557	0.455	3,650,469	5,685
1988	3			2.764	2.135	1.640	1.212	1.569	0.931	2.754	0.805	5,044,430	13,891
1988	4			1.545	1.217	0.954	0.691	0.877	0.542	1.605	0.469	12,233,566	19,640
1989	1			2.636	2.132	1.726	1.210	1.496	0.980	2.111	0.617	13,767,178	29,068
1989	2			0.796	0.558	0.388	0.317	0.452	0.220	1.283	0.375	7,805,230	10,016
1989	3			1.401	1.120	0.890	0.636	0.795	0.505	1.875	0.548	7,714,394	14,464
1989	4			1.340	1.125	0.941	0.638	0.760	0.534	2.584	0.755	12,688,563	32,784
1990	1			5.185	4.207	3.417	2.387	2.943	1.939	2.532	0.740	18,526,064	46,916
1990	2			1.415	0.869	0.545	0.493	0.803	0.310	1.481	0.433	7,481,670	11,080
1990	3			1.609	1.257	0.980	0.713	0.913	0.556	1.715	0.502	7,738,818	13,275
1990	4			1.577	1.185	0.890	0.672	0.895	0.505	1.184	0.346	9,403,073	11,132

CPUE in number

Year	quarter	standardized								nominal		Number of hooks	Number of yellowfin tuna
		LS-means	stdandard error	real scale			relative scale			real scale	relative scale		
				upper	point	lower	upper	point	lower				
1991	1			2.299	1.761	1.346	1.000	1.305	0.764	1.403	0.410	12,942,848	18,162
1991	2			1.409	0.834	0.500	0.473	0.800	0.284	0.891	0.261	8,244,537	7,349
1991	3			1.934	1.395	1.012	0.792	1.098	0.574	1.592	0.465	7,061,008	11,238
1991	4			2.319	1.674	1.215	0.950	1.316	0.690	1.416	0.414	10,357,942	14,666
1992	1			2.973	2.155	1.557	1.223	1.687	0.883	1.218	0.356	13,145,639	16,017
1992	2			1.054	0.649	0.396	0.369	0.598	0.225	0.746	0.218	4,846,527	3,614
1992	3			1.570	1.166	0.860	0.662	0.891	0.488	1.102	0.322	7,110,926	7,837
1992	4			2.704	1.752	1.141	0.994	1.534	0.647	0.681	0.199	12,205,142	8,314
1993	1			1.220	0.792	0.526	0.449	0.692	0.299	1.451	0.424	18,893,063	27,422
1993	2			0.796	0.536	0.352	0.304	0.452	0.200	0.937	0.274	8,661,920	8,114
1993	3			1.599	1.213	0.921	0.689	0.907	0.523	1.153	0.337	9,173,681	10,576
1993	4			1.000	0.699	0.487	0.396	0.567	0.276	0.554	0.162	13,438,762	7,445
1994	1			1.644	0.970	0.581	0.550	0.933	0.330	1.330	0.389	12,316,813	16,381
1994	2			0.835	0.418	0.234	0.237	0.474	0.133	0.761	0.222	8,588,601	6,532
1994	3			1.461	1.082	0.807	0.614	0.829	0.458	0.999	0.292	7,753,671	7,743
1994	4			2.672	1.877	1.330	1.065	1.516	0.755	1.406	0.411	13,256,353	18,639
1995	1			9.836	5.603	3.246	3.180	5.582	1.842	2.530	0.740	11,681,939	29,560
1995	2			0.654	0.452	0.306	0.256	0.371	0.174	0.705	0.206	7,829,653	5,518
1995	3			1.282	1.028	0.822	0.584	0.728	0.467	1.433	0.419	8,431,319	12,081
1995	4			1.137	0.938	0.772	0.533	0.645	0.438	1.370	0.400	13,553,502	18,564
1996	1			1.512	1.063	0.762	0.603	0.858	0.433	2.176	0.636	14,834,688	32,287
1996	2			1.070	0.778	0.562	0.441	0.607	0.319	0.864	0.253	10,230,624	8,843
1996	3			1.007	0.789	0.611	0.448	0.572	0.347	1.019	0.298	10,226,473	10,423
1996	4			1.303	1.097	0.919	0.622	0.739	0.521	1.158	0.339	15,937,950	18,455
1997	1			1.030	0.799	0.615	0.454	0.585	0.349	1.270	0.371	16,214,470	20,596
1997	2			1.154	0.901	0.696	0.511	0.655	0.395	1.111	0.325	10,015,296	11,127
1997	3			1.107	0.871	0.677	0.494	0.628	0.384	1.176	0.344	8,847,189	10,407
1997	4			0.974	0.774	0.607	0.439	0.553	0.344	0.874	0.255	10,407,107	9,091
1998	1			1.452	1.175	0.948	0.667	0.824	0.538	2.007	0.587	11,458,029	22,998
1998	2			0.933	0.693	0.504	0.393	0.529	0.286	1.111	0.325	6,960,294	7,732
1998	3			1.296	1.038	0.823	0.589	0.736	0.467	2.027	0.593	7,639,846	15,488
1998	4			1.203	1.015	0.852	0.576	0.683	0.484	1.975	0.577	12,666,220	25,011
1999	1			1.347	1.086	0.872	0.616	0.764	0.495	1.297	0.379	12,496,776	16,206
1999	2			1.208	0.890	0.650	0.505	0.685	0.369	1.224	0.358	8,175,230	10,007
1999	3			0.939	0.716	0.535	0.406	0.533	0.304	1.483	0.433	5,787,889	8,582
1999	4			1.586	1.240	0.960	0.704	0.900	0.545	1.695	0.496	6,172,875	10,466
2000	1			1.436	1.119	0.878	0.635	0.815	0.498	1.276	0.373	12,823,898	16,358
2000	2			1.669	1.339	1.068	0.760	0.947	0.606	1.902	0.556	9,483,274	18,040
2000	3			1.178	0.939	0.740	0.533	0.669	0.420	1.556	0.455	7,301,398	11,364
2000	4			1.217	0.955	0.741	0.542	0.691	0.420	0.775	0.227	7,943,143	6,155
2001	1			1.076	0.868	0.701	0.493	0.611	0.398	1.174	0.343	15,287,748	17,946
2001	2			1.396	1.117	0.885	0.634	0.792	0.502	2.005	0.586	7,537,440	15,115
2001	3			0.864	0.580	0.371	0.329	0.490	0.210	0.793	0.232	3,932,785	3,117
2001	4			1.341	1.034	0.786	0.587	0.761	0.446	1.136	0.332	6,934,129	7,878
2002	1			0.750	0.603	0.483	0.342	0.426	0.274	0.965	0.282	13,383,021	12,908
2002	2			0.643	0.423	0.265	0.240	0.365	0.151	0.873	0.255	4,450,490	3,884
2002	3			1.157	0.763	0.495	0.433	0.657	0.281	1.031	0.301	4,229,172	4,361
2002	4			1.406	1.119	0.882	0.635	0.798	0.501	1.494	0.437	8,684,663	12,978
2003	1			0.870	0.724	0.598	0.411	0.494	0.339	1.039	0.304	13,577,219	14,100
2003	2			0.950	0.733	0.557	0.416	0.539	0.316	0.990	0.289	7,808,165	7,730
2003	3			1.453	1.096	0.829	0.622	0.825	0.471	1.574	0.460	8,303,738	13,069
2003	4			1.376	1.086	0.850	0.616	0.781	0.482	1.352	0.395	11,171,434	15,101
2004	1			1.252	1.072	0.916	0.608	0.710	0.520	2.253	0.659	17,632,669	39,734
2004	2			1.184	0.934	0.728	0.530	0.672	0.413	1.197	0.350	8,369,937	10,017
2004	3			2.237	1.663	1.226	0.944	1.270	0.696	1.716	0.502	6,356,093	10,907
2004	4			1.725	1.340	1.033	0.760	0.979	0.586	1.129	0.330	10,654,501	12,024
2005	1			1.297	1.086	0.912	0.617	0.736	0.518	1.821	0.533	14,803,717	26,964
2005	2			0.632	0.424	0.281	0.241	0.359	0.159	0.760	0.222	6,940,947	5,273
2005	3			1.768	1.317	0.970	0.747	1.003	0.551	1.756	0.513	5,415,857	9,511
2005	4			1.022	0.791	0.602	0.449	0.580	0.341	1.343	0.393	8,590,954	11,536
2006	1			0.775	0.614	0.492	0.348	0.440	0.279	1.132	0.331	12,876,523	14,572
2006	2			0.886	0.656	0.476	0.372	0.503	0.270	1.402	0.410	7,095,460	9,945
2006	3			3.128	2.295	1.718	1.302	1.775	0.975	3.425	1.001	7,423,567	25,424
2006	4			4.142	2.832	1.934	1.607	2.351	1.098	1.720	0.503	8,113,470	13,957
2007	1			1.593	1.033	0.669	0.586	0.904	0.380	1.422	0.416	10,244,031	14,567
2007	2			2.438	1.426	0.889	0.809	1.384	0.505	7.753	2.267	8,654,087	67,092
2007	3			2.345	1.549	1.065	0.879	1.331	0.605	6.345	1.855	5,922,109	37,578
2007	4			1.096	0.791	0.567	0.449	0.622	0.322	2.513	0.735	8,656,877	21,756
2008	1			0.815	0.572	0.396	0.325	0.462	0.225	1.454	0.425	11,376,971	16,544
2008	2			2.905	1.763	1.073	1.001	1.649	0.609	4.014	1.174	8,801,162	35,332
2008	3			1.989	1.504	1.137	0.854	1.129	0.645	3.968	1.160	7,374,151	29,261
2008	4			1.315	0.936	0.661	0.531	0.746	0.375	1.712	0.501	11,494,642	19,684
2009	1			1.398	0.821	0.478	0.466	0.794	0.272	0.887	0.259	15,114,735	13,401
2009	2			1.306	0.869	0.568	0.493	0.741	0.322	3.044	0.890	7,659,991	23,316
2009	3			1.775	1.291	0.927	0.733	1.007	0.526	4.147	1.212	4,736,227	19,641
2009	4			1.216	0.889	0.640	0.504	0.690	0.363	2.152	0.629	9,928,570	21,364
2010	1			1.221	0.856	0.588	0.486	0.693	0.334	1.118	0.327	12,934,427	14,463
2010	2			1.330	0.964	0.686	0.547	0.755	0.389	3.060	0.895	7,384,244	22,599
2010	3			1.819	1.422	1.109	0.807	1.032	0.629	4.090	1.196	7,628,942	31,202
2010	4			0.785	0.587	0.428	0.333	0.446	0.243	1.057	0.309	12,110,395	12,801
2011	1			3.434	2.140	1.328	1.215	1.949	0.753	1.468	0.429	11,695,283	17,164
2011	2			3.376	1.073	0.379	0.609	1.916	0.215	2.290	0.670	6,440,525	14,751
2011	3			3.932	2.968	2.270	1.685	2.232	1.288	4.559	1.333	6,713,388	30,609
2011	4			1.352	0.962	0.673	0.546	0.767	0.382	2.107	0.616	8,834,074	18,609
2012	1			3.838	2.359	1.446	1.339	2.178	0.820	1.243	0.363	11,356,081	14,118
2012	2			2.063	1.415	0.967	0.803	1.171	0.549	4.483	1.311	9,129,311	40,931
2012	3			3.466	2.643	2.079	1.500	1.967	1.180	3.480	1.017	6,837,394	23,796
2012	4			2.327	1.727	1.288	0.980	1.321	0.731	2.248	0.657	11,547,455	25,957
2013	1			3.990	2.451	1.532	1.391	2.265	0.869	2.775	0.811	12,093,157	33,563
2013	2			4.814	3.106	2.112	1.763	2.732	1.199	2.494	0.729	6,920,344	17,257
2013	3			2.924	2.208	1.756	1.253	1.659	0.997	2.793	0.817	6,901,459	19,278
2013	4			8.994	2.797	0.986	1.587	5.104	0.560	2.156	0.630	6,850,730	14,767
2014	1			0.478	0.401	0.334	0.228	0.271	0.190	1.821	0.532	9,725,257	17,708
2014	2			10.358	3.108	1.011	1.764	5.878	0.574	0.895	0.262	6,606,444	5,914
2014	3			3.376	2.328	1.685	1.321	1.916	0.956	3.237	0.946	6,859,843	22,207
2014	4			1.738	1.187	0.804	0.674	0.986	0.456	3.216	0.940	6,229,548	20,034

Appendix index 4

Year	CPUE in weight									
	standardized								nominal	
	LS-means	stdandard error	real scale			relative scale			real scale	relative scale
			upper	point	lower	upper	point	lower		
1965										
1966										
1967										
1968										
1969										
1970										
1971	4.148	0.044	112.323	98.436	86.162	2.742	2.403	2.103	275.139	3.271
1972	4.040	0.051	97.003	83.423	71.638	2.396	2.060	1.769	163.961	1.949
1973	3.900	0.057	79.039	64.253	52.049	1.929	1.568	1.270	145.824	1.734
1974	4.145	0.070	97.003	83.423	71.638	2.396	2.060	1.769	184.326	2.192
1975	3.644	0.044	65.070	56.481	48.912	1.588	1.379	1.194	121.721	1.447
1976	3.794	0.065	97.003	83.423	71.638	2.396	2.060	1.769	168.304	2.001
1977	3.428	0.058	47.513	37.520	29.350	1.160	0.916	0.716	87.869	1.045
1978	3.763	0.055	97.003	83.423	71.638	2.396	2.060	1.769	101.786	1.210
1979	3.753	0.047	81.659	68.419	57.144	1.993	1.670	1.395	91.111	1.083
1980	3.618	0.040	97.003	83.423	71.638	2.396	2.060	1.769	87.649	1.042
1981	3.661	0.033	49.551	43.950	38.904	1.210	1.073	0.950	90.593	1.077
1982	3.627	0.040	97.003	83.423	71.638	2.396	2.060	1.769	99.583	1.184
1983	3.416	0.044	49.417	40.871	33.679	1.206	0.998	0.822	75.812	0.901
1984	3.680	0.046	97.003	83.423	71.638	2.396	2.060	1.769	90.123	1.072
1985	3.409	0.045	35.311	30.043	25.531	0.862	0.733	0.623	92.179	1.096
1986	3.603	0.047	97.003	83.423	71.638	2.396	2.060	1.769	64.194	0.763
1987	3.676	0.050	64.127	54.447	46.151	1.565	1.329	1.127	87.434	1.040
1988	3.757	0.039	97.003	83.423	71.638	2.396	2.060	1.769	89.261	1.061
1989	3.543	0.033	42.470	37.789	33.598	1.037	0.922	0.820	84.257	1.002
1990	3.906	0.038	97.003	83.423	71.638	2.396	2.060	1.769	78.682	0.936
1991	3.757	0.043	56.798	47.071	39.035	1.386	1.149	0.953	58.007	0.690
1992	3.567	0.045	97.003	83.423	71.638	2.396	2.060	1.769	40.036	0.476
1993	3.248	0.047	25.297	20.816	17.145	0.617	0.508	0.419	43.221	0.514
1994	3.384	0.052	97.003	83.423	71.638	2.396	2.060	1.769	45.572	0.542
1995	3.271	0.038	24.141	20.729	17.782	0.589	0.506	0.434	56.669	0.674
1996	3.265	0.030	97.003	83.423	71.638	2.396	2.060	1.769	53.326	0.634
1997	3.132	0.032	19.734	17.174	14.878	0.482	0.419	0.363	40.951	0.487
1998	3.282	0.030	97.003	83.423	71.638	2.396	2.060	1.769	61.153	0.727
1999	3.301	0.034	27.139	23.524	20.323	0.662	0.574	0.496	46.842	0.557
2000	3.307	0.031	97.003	83.423	71.638	2.396	2.060	1.769	41.478	0.493
2001	3.222	0.035	22.678	19.718	17.068	0.554	0.481	0.417	41.208	0.490
2002	3.197	0.036	97.003	83.423	71.638	2.396	2.060	1.769	36.151	0.430
2003	3.213	0.029	24.288	21.276	18.556	0.593	0.519	0.453	38.289	0.455
2004	3.378	0.030	97.003	83.423	71.638	2.396	2.060	1.769	66.524	0.791
2005	3.329	0.035	25.781	22.568	19.687	0.629	0.551	0.481	57.943	0.689
2006	3.431	0.033	97.003	83.423	71.638	2.396	2.060	1.769	61.772	0.734
2007	3.415	0.057	32.386	25.824	20.687	0.791	0.630	0.505	120.612	1.434
2008	3.318	0.044	97.003	83.423	71.638	2.396	2.060	1.769	78.730	0.936
2009	3.226	0.047	25.974	21.235	17.286	0.634	0.518	0.422	67.551	0.803
2010	3.135	0.038	97.003	83.423	71.638	2.396	2.060	1.769	56.139	0.667
2011	3.517	0.050	38.798	30.684	24.229	0.947	0.749	0.591	73.279	0.871
2012	3.537	0.049	97.003	83.423	71.638	2.396	2.060	1.769	66.920	0.796
2013	3.845	0.073	60.479	43.923	32.424	1.476	1.072	0.791	91.220	1.085
2014	3.696	0.071	97.003	83.423	71.638	2.396	2.060	1.769	77.258	0.919

Appendix index 5

Year	CPUE in number									
	standardized								nominal	
	LS-means	stdandard error	real scale			relative scale			real scale	relative scale
			upper	point	lower	upper	point	lower		
1965	0.451	0.029	3.184	2.958	2.748	2.266	2.105	1.956	10.380	3.097
1966	0.387	0.035	2.571	2.274	2.010	1.830	1.618	1.430	8.335	2.487
1967	0.815	0.048	5.440	4.657	3.995	3.872	3.315	2.843	13.953	4.163
1968	0.712	0.052	4.520	3.874	3.326	3.217	2.757	2.367	11.694	3.489
1969	0.778	0.058	3.893	3.279	2.766	2.770	2.334	1.969	10.907	3.254
1970	0.436	0.051	2.570	2.206	1.889	1.829	1.570	1.345	10.056	3.000
1971	0.374	0.039	2.312	2.036	1.790	1.646	1.449	1.274	7.144	2.131
1972	0.276	0.046	2.028	1.748	1.503	1.444	1.244	1.069	4.122	1.230
1973	0.205	0.052	1.805	1.470	1.190	1.285	1.046	0.847	3.889	1.160
1974	0.368	0.065	2.951	2.277	1.751	2.101	1.620	1.246	5.105	1.523
1975	-0.025	0.041	1.410	1.221	1.053	1.003	0.869	0.750	2.947	0.879
1976	0.172	0.061	1.988	1.630	1.333	1.415	1.160	0.949	5.241	1.564
1977	-0.171	0.054	1.115	0.877	0.679	0.794	0.624	0.483	2.484	0.741
1978	0.162	0.052	1.854	1.504	1.213	1.319	1.071	0.863	3.031	0.904
1979	0.217	0.044	2.245	1.891	1.588	1.598	1.346	1.130	3.044	0.908
1980	0.089	0.038	1.442	1.231	1.046	1.026	0.876	0.745	2.154	0.643
1981	0.115	0.032	1.369	1.216	1.077	0.975	0.865	0.766	2.458	0.733
1982	0.070	0.038	1.287	1.100	0.940	0.916	0.783	0.669	2.189	0.653
1983	-0.066	0.042	1.463	1.212	0.999	1.041	0.862	0.711	1.812	0.541
1984	0.163	0.044	1.930	1.585	1.299	1.374	1.128	0.924	2.083	0.622
1985	-0.126	0.042	0.968	0.820	0.692	0.689	0.584	0.493	2.159	0.644
1986	0.121	0.044	1.932	1.575	1.280	1.375	1.121	0.911	1.527	0.456
1987	0.184	0.048	1.831	1.555	1.318	1.303	1.107	0.938	2.132	0.636
1988	0.276	0.036	1.657	1.424	1.222	1.179	1.013	0.869	2.118	0.632
1989	0.095	0.031	1.232	1.095	0.971	0.877	0.779	0.691	2.057	0.614
1990	0.443	0.035	2.360	2.027	1.740	1.679	1.443	1.238	1.910	0.570
1991	0.284	0.041	1.696	1.406	1.163	1.207	1.000	0.828	1.332	0.397
1992	0.118	0.042	1.500	1.217	0.986	1.067	0.866	0.701	0.959	0.286
1993	-0.133	0.044	0.814	0.668	0.548	0.579	0.475	0.390	1.068	0.318
1994	-0.001	0.049	1.247	0.977	0.766	0.887	0.696	0.546	1.176	0.351
1995	-0.092	0.036	0.778	0.668	0.573	0.554	0.476	0.408	1.584	0.473
1996	-0.134	0.028	0.748	0.660	0.580	0.532	0.469	0.413	1.367	0.408
1997	-0.205	0.030	0.658	0.575	0.499	0.469	0.409	0.355	1.126	0.336
1998	-0.065	0.028	0.740	0.652	0.572	0.527	0.464	0.407	1.839	0.549
1999	-0.039	0.032	0.940	0.817	0.707	0.669	0.581	0.504	1.387	0.414
2000	0.042	0.029	0.916	0.807	0.709	0.652	0.574	0.505	1.383	0.412
2001	-0.085	0.033	0.835	0.731	0.638	0.595	0.521	0.454	1.308	0.390
2002	-0.093	0.033	0.767	0.663	0.570	0.546	0.472	0.405	1.110	0.331
2003	-0.078	0.028	0.887	0.783	0.688	0.632	0.557	0.489	1.224	0.365
2004	0.074	0.028	1.110	0.992	0.884	0.790	0.706	0.629	1.690	0.504
2005	-0.025	0.033	0.894	0.786	0.689	0.636	0.559	0.490	1.490	0.445
2006	0.134	0.031	0.996	0.877	0.770	0.709	0.624	0.548	1.799	0.537
2007	0.088	0.054	1.126	0.901	0.722	0.802	0.641	0.514	4.212	1.256
2008	-0.068	0.042	0.971	0.798	0.654	0.691	0.568	0.465	2.582	0.770
2009	-0.122	0.044	0.859	0.704	0.574	0.612	0.501	0.408	2.076	0.619
2010	-0.130	0.036	0.781	0.656	0.547	0.556	0.467	0.389	2.024	0.604
2011	0.224	0.048	1.369	1.096	0.876	0.974	0.780	0.623	2.409	0.719
2012	0.318	0.047	1.550	1.246	1.001	1.103	0.887	0.712	2.696	0.804
2013	0.519	0.069	2.270	1.648	1.211	1.616	1.173	0.862	2.590	0.773
2014	0.287	0.067	1.614	1.184	0.876	1.149	0.843	0.623	2.239	0.668

Appendix index 6

		CPUE in number									
		standardized								nominal	
Year	quarter	LS-means	stdandard error	real scale			relative scale			real scale	relative scale
				upper	point	lower	upper	point	lower		
1965	1			6.304	5.338	4.577	3.589	3.040	2.607	19.523	5.708
1965	2			4.203	3.683	3.225	2.394	2.097	1.836	6.572	1.922
1965	3			2.799	2.414	2.084	1.594	1.375	1.187	6.303	1.843
1965	4			2.556	2.103	1.737	1.456	1.198	0.989	7.172	2.097
1966	1			3.289	1.651	0.979	1.873	0.940	0.557	6.496	1.899
1966	2			3.497	2.916	2.425	1.991	1.660	1.381	4.036	1.180
1966	3			7.831	6.391	5.207	4.459	3.639	2.965	19.059	5.572
1966	4			2.859	2.077	1.494	1.628	1.183	0.851	5.698	1.666
1967	1			8.689	6.438	4.793	4.948	3.666	2.729	14.711	4.301
1967	2			6.619	5.389	4.390	3.769	3.069	2.500	15.268	4.464
1967	3			5.326	3.686	2.619	3.033	2.099	1.491	9.898	2.894
1967	4			6.596	4.498	3.344	3.756	2.562	1.904	14.571	4.260
1968	1			9.560	7.066	5.368	5.444	4.024	3.057	22.827	6.674
1968	2			6.207	4.881	3.836	3.534	2.779	2.184	8.113	2.372
1968	3			5.038	3.746	2.801	2.869	2.133	1.595	9.068	2.651
1968	4			2.929	1.730	1.075	1.668	0.985	0.612	6.017	1.759
1969	1			13.095	8.463	5.553	7.457	4.819	3.162	13.569	3.967
1969	2			4.181	3.251	2.540	2.381	1.851	1.446	10.424	3.047
1969	3			4.407	3.348	2.554	2.509	1.906	1.454	10.936	3.197
1969	4			3.863	2.475	1.577	2.200	1.409	0.898	7.081	2.070
1970	1			4.122	2.983	2.184	2.347	1.699	1.244	9.061	2.649
1970	2			3.806	2.865	2.158	2.167	1.632	1.229	11.958	3.496
1970	3			2.762	2.129	1.630	1.573	1.212	0.928	13.499	3.946
1970	4			1.855	1.192	0.749	1.056	0.679	0.427	2.509	0.734
1971	1			2.326	1.778	1.347	1.325	1.012	0.767	3.197	0.935
1971	2			1.876	1.526	1.234	1.068	0.869	0.703	4.232	1.237
1971	3			3.731	3.016	2.433	2.124	1.717	1.385	14.943	4.369
1971	4			2.125	1.556	1.139	1.210	0.886	0.648	4.803	1.404
1972	1			1.628	1.233	0.936	0.927	0.702	0.533	1.924	0.562
1972	2			2.949	2.173	1.623	1.679	1.237	0.924	4.936	1.443
1972	3			3.469	2.535	1.837	1.975	1.444	1.046	9.399	2.748
1972	4			3.436	2.048	1.198	1.956	1.166	0.682	2.966	0.867
1973	1			1.984	1.463	1.062	1.130	0.833	0.605	3.013	0.881
1973	2			2.073	1.284	0.761	1.181	0.731	0.433	2.283	0.667
1973	3			2.416	1.799	1.331	1.376	1.025	0.758	8.837	2.584
1973	4			2.001	1.286	0.841	1.139	0.732	0.479	1.620	0.474
1974	1			5.805	1.762	0.533	3.305	1.003	0.304	0.377	0.110
1974	2			11.766	2.463	0.716	6.700	1.403	0.407	5.853	1.711
1974	3			5.758	4.285	3.172	3.279	2.440	1.806	11.282	3.298
1974	4			2.447	1.474	0.905	1.393	0.839	0.515	4.362	1.275
1975	1			1.087	0.823	0.615	0.619	0.469	0.350	0.606	0.177
1975	2			2.345	1.683	1.212	1.336	0.958	0.690	3.526	1.031
1975	3			2.208	1.765	1.404	1.257	1.005	0.800	6.730	1.968
1975	4			1.972	1.162	0.649	1.123	0.661	0.370	0.801	0.234
1976	1			1.036	0.600	0.339	0.590	0.342	0.193	1.055	0.309
1976	2			3.054	2.054	1.375	1.739	1.170	0.783	6.730	1.968
1976	3			4.448	3.396	2.612	2.533	1.934	1.487	13.817	4.039
1976	4			1.466	0.748	0.346	0.835	0.426	0.197	0.700	0.205
1977	1			1.228	0.467	0.198	0.699	0.266	0.113	0.228	0.067
1977	2			1.429	0.616	0.206	0.814	0.351	0.117	2.087	0.610
1977	3			5.178	3.375	2.186	2.949	1.922	1.245	6.632	1.939
1977	4			3.088	1.929	1.188	1.758	1.098	0.676	1.930	0.564
1978	1			8.211	3.259	1.366	4.675	1.856	0.778	1.441	0.421
1978	2			1.534	0.706	0.347	0.874	0.402	0.197	3.183	0.930
1978	3			4.848	3.416	2.401	2.761	1.945	1.367	6.204	1.814
1978	4			2.569	1.672	1.108	1.463	0.952	0.631	1.952	0.571
1979	1			9.851	5.238	2.959	5.610	2.983	1.685	3.469	1.014
1979	2			2.488	1.299	0.641	1.417	0.740	0.365	1.535	0.449
1979	3			5.866	4.080	2.819	3.340	2.323	1.605	5.425	1.586
1979	4			5.365	3.671	2.497	3.055	2.090	1.422	1.906	0.557
1980	1			2.098	1.574	1.167	1.195	0.897	0.664	2.686	0.785
1980	2			2.383	1.292	0.694	1.357	0.735	0.395	1.629	0.476
1980	3			1.674	1.307	1.014	0.953	0.744	0.577	3.708	1.084
1980	4			1.233	0.933	0.695	0.702	0.531	0.396	0.619	0.181
1981	1			1.298	1.010	0.781	0.739	0.575	0.445	1.410	0.412
1981	2			1.400	1.029	0.746	0.797	0.586	0.425	2.461	0.720
1981	3			2.032	1.652	1.336	1.157	0.941	0.761	4.347	1.271
1981	4			1.669	1.365	1.110	0.950	0.777	0.632	2.183	0.638
1982	1			1.676	1.235	0.910	0.954	0.703	0.518	1.699	0.497
1982	2			7.531	3.661	1.857	4.289	2.085	1.058	2.549	0.745
1982	3			1.723	1.383	1.109	0.981	0.787	0.631	4.076	1.192
1982	4			1.672	1.291	0.994	0.952	0.735	0.566	1.573	0.460
1983	1			1.298	0.954	0.689	0.739	0.543	0.392	0.646	0.189
1983	2			2.426	1.429	0.808	1.382	0.814	0.460	2.339	0.684
1983	3			3.661	2.653	1.914	2.084	1.511	1.090	5.396	1.578
1983	4			1.335	0.980	0.710	0.760	0.558	0.404	1.833	0.536
1984	1			2.004	1.495	1.109	1.141	0.851	0.632	1.795	0.525
1984	2			5.294	3.374	2.170	3.014	1.921	1.236	5.404	1.580
1984	3			2.941	1.894	1.219	1.675	1.078	0.694	2.077	0.607
1984	4			1.611	1.157	0.831	0.917	0.659	0.473	1.991	0.582
1985	1			0.844	0.589	0.402	0.480	0.335	0.229	1.057	0.309
1985	2			1.255	0.857	0.576	0.715	0.488	0.328	2.017	0.590
1985	3			1.689	1.183	0.831	0.962	0.674	0.473	2.715	0.794
1985	4			1.389	1.105	0.877	0.791	0.629	0.500	3.399	0.994
1986	1			3.018	1.912	1.206	1.718	1.089	0.687	1.161	0.339
1986	2			4.931	2.934	1.719	2.808	1.671	0.979	2.949	0.862
1986	3			3.053	2.033	1.333	1.739	1.158	0.759	2.409	0.704
1986	4			1.807	1.380	1.044	1.029	0.786	0.595	1.487	0.435
1987	1			2.018	1.366	0.947	1.149	0.778	0.539	1.928	0.564
1987	2			2.346	1.522	0.974	1.336	0.867	0.555	2.192	0.641
1987	3			2.473	1.796	1.289	1.408	1.023	0.734	2.822	0.825
1987	4			2.504	1.949	1.510	1.426	1.110	0.860	2.073	0.606
1988	1			2.663	1.984	1.481	1.516	1.130	0.843	2.694	0.787
1988	2			1.948	1.281	0.827	1.109	0.729	0.471	1.557	0.455
1988	3			2.668	2.065	1.589	1.519	1.176	0.905	2.754	0.805
1988	4			1.529	1.209	0.953	0.871	0.689	0.543	1.605	0.469
1989	1			2.603	2.114	1.719	1.482	1.204	0.979	2.111	0.617
1989	2			0.795	0.563	0.396	0.453	0.320	0.226	1.283	0.375
1989	3			1.385	1.114	0.891	0.789	0.634	0.507	1.875	0.548
1989	4			1.348	1.136	0.956	0.768	0.647	0.544	2.584	0.755
1990	1			5.076	4.129	3.364	2.890	2.351	1.915	2.532	0.740
1990	2			1.371	0.847	0.536	0.781	0.482	0.305	1.481	0.433
1990	3			1.592	1.249	0.979	0.907	0.711	0.557	1.715	0.502
1990	4			1.512	1.136	0.853	0.861	0.647	0.486	1.184	0.346

Appendix index 6 (continued)

Year	quarter	CPUE in number									
		standardized								nominal	
		LS-means	stdandard error	real scale			relative scale			real scale	relative scale
				upper	point	lower	upper	point	lower		
1991	1			2.267	1.745	1.341	1.291	0.994	0.763	1.403	0.410
1991	2			1.368	0.809	0.485	0.779	0.461	0.276	0.891	0.261
1991	3			1.869	1.350	0.982	1.065	0.769	0.559	1.592	0.465
1991	4			2.239	1.617	1.174	1.275	0.921	0.669	1.416	0.414
1992	1			2.908	2.113	1.530	1.656	1.203	0.871	1.218	0.356
1992	2			1.022	0.630	0.383	0.582	0.359	0.218	0.746	0.218
1992	3			1.511	1.124	0.831	0.860	0.640	0.473	1.102	0.322
1992	4			2.626	1.699	1.105	1.495	0.968	0.629	0.681	0.199
1993	1			1.213	0.799	0.542	0.691	0.455	0.309	1.451	0.424
1993	2			0.777	0.527	0.349	0.442	0.300	0.199	0.937	0.274
1993	3			1.541	1.171	0.890	0.877	0.667	0.507	1.153	0.337
1993	4			0.968	0.676	0.471	0.551	0.385	0.268	0.554	0.162
1994	1			1.625	0.967	0.587	0.925	0.551	0.334	1.330	0.389
1994	2			0.822	0.415	0.235	0.468	0.236	0.134	0.761	0.222
1994	3			1.419	1.049	0.781	0.808	0.598	0.445	0.999	0.292
1994	4			2.608	1.834	1.301	1.485	1.044	0.741	1.406	0.411
1995	1			9.641	5.514	3.214	5.490	3.140	1.830	2.530	0.740
1995	2			0.643	0.444	0.301	0.366	0.253	0.172	0.705	0.206
1995	3			1.220	0.975	0.777	0.694	0.555	0.442	1.433	0.419
1995	4			1.069	0.881	0.723	0.609	0.502	0.412	1.370	0.400
1996	1			1.520	1.080	0.785	0.866	0.615	0.447	2.176	0.636
1996	2			1.055	0.769	0.557	0.601	0.438	0.317	0.864	0.253
1996	3			0.951	0.747	0.580	0.541	0.425	0.330	1.019	0.298
1996	4			1.230	1.035	0.866	0.700	0.589	0.493	1.158	0.339
1997	1			1.024	0.799	0.620	0.583	0.455	0.353	1.270	0.371
1997	2			1.135	0.889	0.689	0.646	0.506	0.392	1.111	0.325
1997	3			1.048	0.825	0.642	0.596	0.470	0.366	1.176	0.344
1997	4			0.905	0.718	0.562	0.516	0.409	0.320	0.874	0.255
1998	1			1.459	1.187	0.964	0.831	0.676	0.549	2.007	0.587
1998	2			0.914	0.680	0.496	0.521	0.387	0.283	1.111	0.325
1998	3			1.195	0.955	0.754	0.681	0.544	0.429	2.027	0.593
1998	4			1.108	0.934	0.782	0.631	0.532	0.445	1.975	0.577
1999	1			1.351	1.095	0.884	0.769	0.623	0.503	1.297	0.379
1999	2			1.189	0.879	0.644	0.677	0.500	0.367	1.224	0.358
1999	3			0.902	0.688	0.514	0.513	0.392	0.293	1.483	0.433
1999	4			1.512	1.179	0.910	0.861	0.671	0.518	1.695	0.496
2000	1			1.419	1.116	0.883	0.808	0.635	0.503	1.276	0.373
2000	2			1.605	1.289	1.027	0.914	0.734	0.585	1.902	0.556
2000	3			1.118	0.891	0.702	0.637	0.507	0.400	1.556	0.455
2000	4			1.135	0.890	0.689	0.647	0.507	0.392	0.775	0.227
2001	1			1.064	0.864	0.703	0.606	0.492	0.400	1.174	0.343
2001	2			1.370	1.097	0.871	0.780	0.625	0.496	2.005	0.586
2001	3			0.812	0.546	0.350	0.462	0.311	0.199	0.793	0.232
2001	4			1.240	0.956	0.727	0.706	0.544	0.414	1.136	0.332
2002	1			0.748	0.606	0.488	0.426	0.345	0.278	0.965	0.282
2002	2			0.632	0.421	0.268	0.360	0.240	0.153	0.873	0.255
2002	3			1.092	0.717	0.464	0.622	0.408	0.264	1.031	0.301
2002	4			1.326	1.054	0.829	0.755	0.600	0.472	1.494	0.437
2003	1			0.867	0.723	0.599	0.493	0.412	0.341	1.039	0.304
2003	2			0.925	0.716	0.545	0.527	0.408	0.310	0.990	0.289
2003	3			1.376	1.033	0.779	0.783	0.588	0.443	1.574	0.460
2003	4			1.324	1.043	0.813	0.754	0.594	0.463	1.352	0.395
2004	1			1.256	1.079	0.926	0.715	0.615	0.527	2.253	0.659
2004	2			1.140	0.902	0.705	0.649	0.513	0.402	1.197	0.350
2004	3			2.092	1.554	1.145	1.191	0.885	0.652	1.716	0.502
2004	4			1.675	1.300	1.001	0.954	0.740	0.570	1.129	0.330
2005	1			1.290	1.086	0.915	0.734	0.618	0.521	1.821	0.533
2005	2			0.619	0.423	0.285	0.353	0.241	0.162	0.760	0.222
2005	3			1.647	1.229	0.907	0.938	0.700	0.517	1.756	0.513
2005	4			0.966	0.746	0.565	0.550	0.425	0.322	1.343	0.393
2006	1			0.785	0.629	0.509	0.447	0.358	0.290	1.132	0.331
2006	2			0.870	0.650	0.476	0.496	0.370	0.271	1.402	0.410
2006	3			2.987	2.189	1.639	1.701	1.246	0.933	3.425	1.001
2006	4			4.026	2.751	1.876	2.293	1.566	1.068	1.720	0.503
2007	1			1.591	1.041	0.684	0.906	0.593	0.390	1.422	0.416
2007	2			2.440	1.450	0.922	1.389	0.826	0.525	7.753	2.267
2007	3			2.298	1.525	1.056	1.309	0.869	0.601	6.345	1.855
2007	4			1.040	0.748	0.534	0.592	0.426	0.304	2.513	0.735
2008	1			0.823	0.585	0.411	0.469	0.333	0.234	1.454	0.425
2008	2			2.845	1.736	1.066	1.620	0.989	0.607	4.014	1.174
2008	3			1.926	1.457	1.102	1.096	0.830	0.627	3.968	1.160
2008	4			1.279	0.910	0.643	0.728	0.518	0.366	1.712	0.501
2009	1			1.385	0.823	0.488	0.789	0.469	0.278	0.887	0.259
2009	2			1.294	0.869	0.575	0.737	0.495	0.327	3.044	0.890
2009	3			1.678	1.223	0.880	0.956	0.696	0.501	4.147	1.212
2009	4			1.175	0.860	0.621	0.669	0.490	0.353	2.152	0.629
2010	1			1.203	0.848	0.587	0.685	0.483	0.334	1.118	0.327
2010	2			1.299	0.945	0.675	0.740	0.538	0.384	3.060	0.895
2010	3			1.732	1.353	1.054	0.986	0.770	0.600	4.090	1.196
2010	4			0.753	0.562	0.409	0.429	0.320	0.233	1.057	0.309
2011	1			3.371	2.108	1.313	1.920	1.200	0.748	1.468	0.429
2011	2			3.296	1.051	0.375	1.877	0.599	0.213	2.290	0.670
2011	3			3.673	2.763	2.105	2.091	1.573	1.199	4.559	1.333
2011	4			1.302	0.931	0.655	0.741	0.530	0.373	2.107	0.616
2012	1			3.763	2.320	1.428	2.143	1.321	0.813	1.243	0.363
2012	2			1.990	1.366	0.935	1.133	0.778	0.533	4.483	1.311
2012	3			3.218	2.437	1.904	1.833	1.387	1.084	3.480	1.017
2012	4			2.216	1.638	1.215	1.262	0.933	0.692	2.248	0.657
2013	1			3.952	2.446	1.544	2.250	1.393	0.879	2.775	0.811
2013	2			4.526	2.889	1.943	2.577	1.645	1.107	2.494	0.729
2013	3			2.694	2.012	1.586	1.534	1.146	0.903	2.793	0.817
2013	4			8.766	2.723	0.956	4.991	1.550	0.544	2.156	0.630
2014	1			0.505	0.427	0.359	0.287	0.243	0.205	1.821	0.532
2014	2			10.073	3.010	0.969	5.736	1.714	0.552	0.895	0.262
2014	3			3.255	2.232	1.604	1.854	1.271	0.914	3.237	0.946
2014	4			1.706	1.167	0.793	0.971	0.665	0.452	3.216	0.940

Appendix index 7

Year	CPUE in weight										
	standardized									nominal	
	LS-means	stdandard error	real scale			relative scale				real scale	relative scale
			upper	point	lower	upper	point	lower			
1976	3.692	0.066	69.508	54.853	43.079	2.143	1.691	1.328		168.304	2.336
1977	3.172	0.062	43.837	32.492	23.713	1.351	1.002	0.731		87.869	1.220
1978	3.510	0.063	71.370	55.526	42.899	2.200	1.712	1.322		101.786	1.413
1979	3.534	0.057	68.622	55.028	43.887	2.115	1.696	1.353		91.111	1.265
1980	3.708	0.044	66.465	55.544	46.330	2.049	1.712	1.428		87.649	1.217
1981	3.756	0.038	65.584	57.462	50.268	2.022	1.771	1.550		90.593	1.257
1982	3.712	0.042	55.064	47.125	40.375	1.697	1.453	1.245		99.583	1.382
1983	3.549	0.059	58.390	47.919	39.171	1.800	1.477	1.207		75.812	1.052
1984	3.867	0.052	80.742	66.135	54.163	2.489	2.039	1.670		90.123	1.251
1985	3.423	0.047	36.167	30.832	26.265	1.115	0.950	0.810		92.179	1.279
1986	3.529	0.049	65.222	52.929	42.845	2.010	1.632	1.321		64.194	0.891
1987	3.517	0.053	56.752	48.097	40.672	1.749	1.483	1.254		87.434	1.214
1988	3.632	0.039	49.717	42.681	36.595	1.533	1.316	1.128		89.261	1.239
1989	3.433	0.033	38.127	33.961	30.229	1.175	1.047	0.932		84.257	1.170
1990	3.781	0.038	62.623	53.678	46.003	1.930	1.655	1.418		78.682	1.092
1991	3.631	0.043	47.926	39.877	33.197	1.477	1.229	1.023		58.007	0.805
1992	3.462	0.045	44.870	36.319	29.356	1.383	1.120	0.905		40.036	0.556
1993	3.158	0.046	22.887	18.766	15.383	0.706	0.578	0.474		43.221	0.600
1994	3.263	0.051	33.409	26.266	20.700	1.030	0.810	0.638		45.572	0.633
1995	3.192	0.038	22.217	18.873	15.999	0.685	0.582	0.493		56.669	0.787
1996	3.160	0.029	22.554	19.772	17.284	0.695	0.609	0.533		53.326	0.740
1997	3.017	0.031	17.817	15.493	13.406	0.549	0.478	0.413		40.951	0.568
1998	3.173	0.030	18.939	16.598	14.482	0.584	0.512	0.446		61.153	0.849
1999	3.156	0.033	23.578	20.363	17.514	0.727	0.628	0.540		46.842	0.650
2000	3.194	0.031	21.749	19.039	16.598	0.670	0.587	0.512		41.478	0.576
2001	3.024	0.036	17.905	15.431	13.217	0.552	0.476	0.407		41.208	0.572
2002	2.992	0.038	16.573	14.031	11.779	0.511	0.433	0.363		36.151	0.502
2003	3.101	0.030	22.766	19.869	17.263	0.702	0.612	0.532		38.289	0.531
2004	3.244	0.031	26.657	23.576	20.789	0.822	0.727	0.641		66.524	0.923
2005	3.188	0.037	21.487	18.655	16.129	0.662	0.575	0.497		57.943	0.804
2006	3.334	0.033	26.493	23.106	20.088	0.817	0.712	0.619		61.772	0.857
2007	3.309	0.057	27.043	21.832	17.701	0.834	0.673	0.546		120.612	1.674
2008	3.140	0.045	23.046	18.906	15.469	0.710	0.583	0.477		78.730	1.093
2009	3.086	0.047	21.696	17.737	14.427	0.669	0.547	0.445		67.551	0.938
2010	2.945	0.039	17.729	14.644	11.988	0.547	0.451	0.370		56.139	0.779
2011	3.302	0.052	27.625	21.919	17.365	0.852	0.676	0.535		73.279	1.017
2012	3.414	0.050	32.117	25.469	20.170	0.990	0.785	0.622		66.920	0.929
2013	3.696	0.073	50.173	36.598	27.121	1.547	1.128	0.836		91.220	1.266
2014	3.475	0.072	38.199	27.795	20.479	1.178	0.857	0.631		77.258	1.072

Appendix index 8

	CPUE in number									
Year	standardized								nominal	
	LS-means	stdandard error	real scale			relative scale			real scale	relative scale
			upper	point	lower	upper	point	lower		
1976	-0.020	0.068	1.743	1.375	1.079	1.917	1.512	1.187	5.241	2.585
1977	-0.551	0.063	1.080	0.788	0.564	1.188	0.867	0.621	2.484	1.225
1978	-0.208	0.064	1.832	1.413	1.082	2.014	1.554	1.189	3.031	1.495
1979	-0.145	0.058	2.212	1.770	1.410	2.432	1.946	1.551	3.044	1.501
1980	0.023	0.044	1.961	1.627	1.346	2.156	1.789	1.480	2.154	1.062
1981	0.037	0.038	1.816	1.584	1.380	1.997	1.742	1.517	2.458	1.213
1982	-0.035	0.043	1.399	1.184	1.003	1.538	1.302	1.103	2.189	1.080
1983	-0.161	0.060	1.631	1.330	1.079	1.794	1.462	1.187	1.812	0.894
1984	0.152	0.053	2.300	1.862	1.507	2.528	2.048	1.657	2.083	1.028
1985	-0.310	0.048	0.891	0.753	0.635	0.980	0.828	0.699	2.159	1.065
1986	-0.133	0.050	1.862	1.498	1.202	2.047	1.647	1.321	1.527	0.753
1987	-0.155	0.054	1.529	1.287	1.081	1.681	1.415	1.189	2.132	1.052
1988	-0.035	0.040	1.320	1.125	0.957	1.451	1.237	1.052	2.118	1.045
1989	-0.206	0.033	1.006	0.890	0.787	1.106	0.979	0.865	2.057	1.014
1990	0.144	0.038	1.775	1.510	1.284	1.951	1.660	1.412	1.910	0.942
1991	-0.024	0.043	1.322	1.086	0.892	1.454	1.194	0.981	1.332	0.657
1992	-0.207	0.046	1.228	0.983	0.785	1.350	1.081	0.863	0.959	0.473
1993	-0.450	0.047	0.637	0.517	0.420	0.700	0.569	0.462	1.068	0.527
1994	-0.315	0.052	1.043	0.809	0.628	1.147	0.889	0.691	1.176	0.580
1995	-0.415	0.039	0.600	0.507	0.427	0.660	0.557	0.470	1.584	0.781
1996	-0.471	0.030	0.601	0.525	0.458	0.661	0.578	0.503	1.367	0.674
1997	-0.563	0.032	0.498	0.432	0.373	0.547	0.475	0.410	1.126	0.555
1998	-0.414	0.031	0.535	0.468	0.407	0.588	0.514	0.448	1.839	0.907
1999	-0.418	0.034	0.699	0.602	0.516	0.768	0.661	0.567	1.387	0.684
2000	-0.297	0.032	0.686	0.600	0.523	0.754	0.660	0.575	1.383	0.682
2001	-0.533	0.037	0.548	0.473	0.407	0.603	0.520	0.447	1.308	0.645
2002	-0.563	0.039	0.487	0.412	0.347	0.535	0.453	0.381	1.110	0.548
2003	-0.419	0.031	0.718	0.627	0.546	0.789	0.690	0.601	1.224	0.604
2004	-0.275	0.031	0.830	0.734	0.648	0.913	0.808	0.712	1.690	0.833
2005	-0.405	0.037	0.620	0.538	0.465	0.682	0.592	0.512	1.490	0.735
2006	-0.173	0.034	0.801	0.697	0.604	0.881	0.766	0.664	1.799	0.888
2007	-0.237	0.058	0.788	0.631	0.508	0.867	0.694	0.558	4.212	2.077
2008	-0.489	0.045	0.606	0.496	0.404	0.667	0.545	0.444	2.582	1.274
2009	-0.501	0.048	0.601	0.488	0.393	0.660	0.536	0.433	2.076	1.024
2010	-0.545	0.040	0.540	0.447	0.367	0.594	0.492	0.404	2.024	0.998
2011	-0.204	0.053	0.825	0.655	0.520	0.908	0.720	0.572	2.409	1.188
2012	-0.026	0.051	1.074	0.852	0.677	1.181	0.937	0.744	2.696	1.330
2013	0.177	0.074	1.642	1.170	0.846	1.805	1.286	0.930	2.590	1.278
2014	-0.150	0.073	0.994	0.722	0.532	1.093	0.794	0.585	2.239	1.104

Appendix index 9

CPUE in number

Year	quarter	standardized								nominal	
		LS-means	stdandard error	real scale			relative scale			real scale	relative scale
				upper	point	lower	upper	point	lower		
1976	1			1.149	0.728	0.466	0.912	0.578	0.370	1.055	0.493
1976	2			3.417	2.235	1.457	2.713	1.774	1.156	6.730	3.143
1976	3			4.684	3.518	2.644	3.719	2.793	2.099	13.817	6.453
1976	4			1.733	0.860	0.399	1.376	0.683	0.317	0.700	0.327
1977	1			1.271	0.625	0.337	1.009	0.497	0.268	0.228	0.106
1977	2			1.420	0.616	0.227	1.128	0.489	0.180	2.087	0.975
1977	3			6.916	3.930	2.229	5.491	3.120	1.770	6.632	3.097
1977	4			4.262	2.521	1.470	3.384	2.001	1.167	1.930	0.901
1978	1			5.355	2.280	1.098	4.251	1.810	0.872	1.441	0.673
1978	2			1.540	0.742	0.382	1.223	0.589	0.303	3.183	1.486
1978	3			4.883	3.185	2.081	3.877	2.529	1.652	6.204	2.897
1978	4			3.524	2.258	1.461	2.798	1.793	1.160	1.952	0.912
1979	1			9.051	5.280	3.333	7.186	4.192	2.646	3.469	1.620
1979	2			2.567	1.352	0.691	2.038	1.074	0.549	1.535	0.717
1979	3			6.987	4.720	3.174	5.547	3.747	2.520	5.425	2.533
1979	4			8.055	5.250	3.409	6.395	4.168	2.706	1.906	0.890
1980	1			3.277	2.437	1.801	2.602	1.935	1.430	2.686	1.254
1980	2			2.721	1.398	0.720	2.160	1.110	0.572	1.629	0.761
1980	3			2.273	1.703	1.271	1.804	1.352	1.009	3.708	1.732
1980	4			2.471	1.818	1.328	1.962	1.444	1.055	0.619	0.289
1981	1			2.282	1.807	1.431	1.812	1.435	1.136	1.410	0.659
1981	2			1.972	1.447	1.056	1.566	1.149	0.838	2.461	1.150
1981	3			2.568	2.075	1.670	2.039	1.647	1.326	4.347	2.030
1981	4			2.410	1.929	1.538	1.913	1.531	1.221	2.183	1.020
1982	1			2.071	1.487	1.071	1.644	1.180	0.850	1.699	0.794
1982	2			8.174	3.657	1.705	6.489	2.904	1.354	2.549	1.190
1982	3			1.426	1.112	0.868	1.132	0.883	0.689	4.076	1.904
1982	4			1.802	1.347	1.005	1.431	1.070	0.798	1.573	0.735
1983	1			1.817	1.323	0.954	1.442	1.050	0.758	0.646	0.302
1983	2			2.928	1.693	0.955	2.325	1.344	0.759	2.339	1.092
1983	3			3.447	2.405	1.672	2.737	1.910	1.328	5.396	2.520
1983	4			1.309	0.917	0.635	1.039	0.728	0.504	1.833	0.856
1984	1			2.722	1.984	1.443	2.161	1.575	1.145	1.795	0.838
1984	2			5.380	3.253	1.987	4.271	2.583	1.578	5.404	2.524
1984	3			3.523	2.134	1.291	2.797	1.694	1.025	2.077	0.970
1984	4			2.261	1.523	1.028	1.795	1.209	0.816	1.991	0.930
1985	1			1.070	0.737	0.503	0.849	0.585	0.399	1.057	0.493
1985	2			1.200	0.804	0.534	0.953	0.638	0.424	2.017	0.942
1985	3			1.571	1.055	0.714	1.247	0.838	0.567	2.715	1.268
1985	4			1.143	0.907	0.718	0.907	0.720	0.570	3.399	1.587
1986	1			4.302	2.628	1.604	3.415	2.086	1.274	1.161	0.542
1986	2			5.406	3.095	1.752	4.292	2.457	1.391	2.949	1.377
1986	3			3.711	2.368	1.494	2.946	1.880	1.186	2.409	1.125
1986	4			1.739	1.288	0.946	1.381	1.022	0.751	1.487	0.695
1987	1			2.502	1.630	1.095	1.986	1.294	0.869	1.928	0.901
1987	2			2.401	1.543	0.981	1.906	1.225	0.779	2.192	1.024
1987	3			2.061	1.491	1.067	1.637	1.184	0.847	2.822	1.318
1987	4			2.685	2.044	1.550	2.132	1.622	1.230	2.073	0.968
1988	1			3.383	2.449	1.778	2.686	1.945	1.411	2.694	1.258
1988	2			1.741	1.097	0.678	1.382	0.871	0.538	1.557	0.727
1988	3			1.744	1.314	0.984	1.385	1.044	0.781	2.754	1.286
1988	4			1.420	1.088	0.830	1.128	0.863	0.659	1.605	0.750
1989	1			3.172	2.526	2.014	2.518	2.005	1.599	2.111	0.986
1989	2			0.837	0.550	0.361	0.665	0.437	0.287	1.283	0.599
1989	3			1.019	0.817	0.651	0.809	0.649	0.517	1.875	0.876
1989	4			1.004	0.829	0.683	0.797	0.658	0.542	2.584	1.207
1990	1			6.290	4.989	3.964	4.994	3.961	3.147	2.532	1.183
1990	2			1.354	0.742	0.418	1.075	0.589	0.332	1.481	0.692
1990	3			1.196	0.899	0.675	0.950	0.714	0.536	1.715	0.801
1990	4			1.052	0.739	0.516	0.835	0.586	0.410	1.184	0.553
1991	1			2.611	1.962	1.472	2.073	1.557	1.169	1.403	0.655
1991	2			1.468	0.771	0.402	1.165	0.612	0.319	0.891	0.416
1991	3			1.311	0.873	0.584	1.041	0.693	0.463	1.592	0.743
1991	4			1.766	1.192	0.808	1.402	0.947	0.641	1.416	0.661
1992	1			3.821	2.687	1.887	3.034	2.133	1.498	1.218	0.569
1992	2			0.770	0.416	0.215	0.612	0.330	0.171	0.746	0.348
1992	3			0.963	0.672	0.463	0.764	0.533	0.368	1.102	0.515
1992	4			2.490	1.498	0.896	1.977	1.189	0.712	0.681	0.318
1993	1			1.288	0.798	0.511	1.022	0.633	0.406	1.451	0.678
1993	2			0.580	0.368	0.225	0.460	0.292	0.179	0.937	0.437
1993	3			0.995	0.710	0.505	0.790	0.563	0.401	1.153	0.538
1993	4			0.775	0.496	0.313	0.615	0.394	0.248	0.554	0.259
1994	1			2.073	1.149	0.648	1.646	0.912	0.515	1.330	0.621
1994	2			1.074	0.392	0.149	0.852	0.312	0.118	0.761	0.355
1994	3			0.906	0.613	0.413	0.719	0.486	0.328	0.999	0.466
1994	4			2.454	1.623	1.077	1.949	1.288	0.855	1.406	0.657

Appendix index 9 (Continue)

				CPUE in number							
		standardized								nominal	
Year	quarter	LS-means	stdandard error	real scale			relative scale			real scale	relative scale
				upper	point	lower	upper	point	lower		
1995	1			13.217	7.096	3.863	10.493	5.634	3.067	2.530	1.182
1995	2			0.364	0.225	0.131	0.289	0.179	0.104	0.705	0.329
1995	3			0.597	0.439	0.316	0.474	0.348	0.251	1.433	0.669
1995	4			0.578	0.451	0.348	0.459	0.358	0.277	1.370	0.640
1996	1			1.514	1.014	0.695	1.202	0.805	0.552	2.176	1.016
1996	2			0.801	0.548	0.369	0.636	0.435	0.293	0.864	0.404
1996	3			0.463	0.353	0.263	0.368	0.281	0.209	1.019	0.476
1996	4			0.761	0.621	0.503	0.605	0.493	0.399	1.158	0.541
1997	1			0.938	0.714	0.541	0.745	0.567	0.429	1.270	0.593
1997	2			0.882	0.673	0.508	0.700	0.534	0.403	1.111	0.519
1997	3			0.512	0.387	0.287	0.406	0.308	0.228	1.176	0.549
1997	4			0.440	0.334	0.246	0.350	0.265	0.196	0.874	0.408
1998	1			1.449	1.153	0.916	1.150	0.915	0.727	2.007	0.937
1998	2			0.727	0.523	0.367	0.577	0.415	0.291	1.111	0.519
1998	3			0.520	0.393	0.290	0.413	0.312	0.230	2.027	0.947
1998	4			0.500	0.404	0.322	0.397	0.321	0.255	1.975	0.922
1999	1			1.337	1.060	0.839	1.062	0.842	0.666	1.297	0.606
1999	2			0.956	0.675	0.471	0.759	0.536	0.374	1.224	0.572
1999	3			0.448	0.320	0.220	0.356	0.254	0.175	1.483	0.692
1999	4			0.986	0.737	0.542	0.783	0.585	0.431	1.695	0.792
2000	1			1.486	1.141	0.885	1.179	0.906	0.703	1.276	0.596
2000	2			1.288	1.011	0.787	1.022	0.802	0.625	1.902	0.888
2000	3			0.551	0.425	0.321	0.438	0.337	0.255	1.556	0.727
2000	4			0.623	0.469	0.345	0.495	0.372	0.274	0.775	0.362
2001	1			1.067	0.858	0.691	0.847	0.681	0.549	1.174	0.548
2001	2			1.162	0.919	0.720	0.923	0.730	0.572	2.005	0.937
2001	3			0.326	0.200	0.108	0.259	0.159	0.086	0.793	0.370
2001	4			0.599	0.446	0.325	0.475	0.354	0.258	1.136	0.531
2002	1			0.697	0.557	0.443	0.553	0.442	0.352	0.965	0.450
2002	2			0.473	0.314	0.198	0.375	0.249	0.157	0.873	0.408
2002	3			0.549	0.303	0.154	0.436	0.240	0.123	1.031	0.482
2002	4			0.812	0.624	0.472	0.645	0.495	0.374	1.494	0.698
2003	1			0.860	0.711	0.584	0.683	0.564	0.464	1.039	0.485
2003	2			0.742	0.569	0.429	0.589	0.452	0.341	0.990	0.462
2003	3			0.654	0.439	0.289	0.520	0.348	0.230	1.574	0.735
2003	4			1.103	0.845	0.640	0.876	0.671	0.508	1.352	0.631
2004	1			1.275	1.082	0.917	1.012	0.859	0.728	2.253	1.052
2004	2			0.896	0.706	0.551	0.711	0.561	0.437	1.197	0.559
2004	3			0.990	0.695	0.479	0.786	0.552	0.381	1.716	0.801
2004	4			1.339	1.003	0.744	1.063	0.796	0.591	1.129	0.527
2005	1			1.412	1.175	0.981	1.121	0.933	0.779	1.821	0.851
2005	2			0.493	0.342	0.234	0.391	0.271	0.186	0.760	0.355
2005	3			0.641	0.459	0.320	0.509	0.364	0.254	1.756	0.820
2005	4			0.605	0.450	0.326	0.481	0.358	0.259	1.343	0.627
2006	1			0.744	0.591	0.474	0.591	0.469	0.377	1.132	0.529
2006	2			0.772	0.565	0.407	0.613	0.449	0.323	1.402	0.655
2006	3			1.776	1.179	0.806	1.410	0.936	0.640	3.425	1.599
2006	4			4.056	2.618	1.684	3.221	2.079	1.337	1.720	0.803
2007	1			1.833	1.167	0.751	1.455	0.926	0.597	1.422	0.664
2007	2			1.093	0.685	0.456	0.868	0.544	0.362	7.753	3.621
2007	3			0.899	0.599	0.414	0.714	0.476	0.329	6.345	2.963
2007	4			0.498	0.323	0.201	0.395	0.256	0.160	2.513	1.174
2008	1			0.816	0.565	0.389	0.648	0.449	0.309	1.454	0.679
2008	2			1.200	0.708	0.417	0.953	0.562	0.331	4.014	1.875
2008	3			0.742	0.539	0.387	0.589	0.428	0.307	3.968	1.853
2008	4			0.479	0.317	0.202	0.381	0.252	0.160	1.712	0.800
2009	1			1.344	0.771	0.445	1.067	0.612	0.353	0.887	0.414
2009	2			0.739	0.479	0.304	0.587	0.381	0.242	3.044	1.422
2009	3			0.568	0.389	0.256	0.451	0.308	0.203	4.147	1.937
2009	4			0.664	0.460	0.309	0.527	0.365	0.245	2.152	1.005
2010	1			1.210	0.838	0.572	0.961	0.665	0.454	1.118	0.522
2010	2			0.629	0.432	0.286	0.499	0.343	0.227	3.060	1.429
2010	3			0.654	0.477	0.343	0.519	0.379	0.272	4.090	1.910
2010	4			0.359	0.249	0.163	0.285	0.197	0.129	1.057	0.494
2011	1			2.854	1.728	1.044	2.266	1.372	0.829	1.468	0.685
2011	2			1.569	0.500	0.189	1.245	0.397	0.150	2.290	1.070
2011	3			1.409	1.004	0.725	1.118	0.797	0.576	4.559	2.129
2011	4			0.608	0.410	0.268	0.483	0.326	0.213	2.107	0.984
2012	1			2.057	1.233	0.739	1.633	0.979	0.586	1.243	0.581
2012	2			0.729	0.460	0.281	0.579	0.365	0.223	4.483	2.094
2012	3			1.288	0.925	0.684	1.023	0.734	0.543	3.480	1.625
2012	4			1.005	0.708	0.496	0.798	0.562	0.394	2.248	1.050
2013	1			3.126	1.850	1.121	2.482	1.469	0.890	2.775	1.296
2013	2			2.708	1.541	0.925	2.150	1.223	0.734	2.494	1.165
2013	3			1.125	0.720	0.499	0.893	0.572	0.397	2.793	1.305
2013	4			9.362	2.485	0.702	7.433	1.973	0.557	2.156	1.007
2014	1			0.438	0.362	0.298	0.348	0.288	0.237	1.821	0.850
2014	2			5.977	1.612	0.466	4.746	1.280	0.370	0.895	0.418
2014	3			1.685	1.059	0.698	1.338	0.841	0.554	3.237	1.512
2014	4			1.065	0.682	0.430	0.846	0.541	0.342	3.216	1.502