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Update of CPUE Standardizations of striped marlin caught by Japanese coastal longliners in the northwest Pacific[1]

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Introduction

Japan Fishery Agency started to collect the log book of Japanese coastal longliners (defined as the longliners less than 20 tons) in 1994. Yokawa and Yamada (2002) standardized CPUE of Pacific bluefin tuna caught by Japanese coastal longliners using this log book data, and suggested that this fishery should be treated as separate from Japanese offshore and distant-water longliners, because they used different fishing strategy, different gear configuration, and many log book not reported the number of hooks per basket. Following this recommendation, Yokawa standardized CPUE of striped marlin caught by Japanese coast longliners in the period between 1994 and 2004 for an input to the stock assessment models without using information of the number of hooks between floats. In the present study, it was updated to 2005 with some modification in the method.

Materials and Methods

Japan Fishery Agency started to collect the log book of Japanese coastal longliners (defined as the longliners less than 20 tons) in 1994. Though the coverage of log book is not precisely known, it is roughly estimated to be between 80 – 95 %. Set by set data is used in this study for the analysis of CPUE because no aggregation of data is conducted.

In the statistic of Japanese coastal longliners, the limited information about the number of hooks between floats (HPB) was available and it was decided to use in the CPUE standardization of striped marlin with some selection of data. The major problem of the HPB information was that there are many unrealistic high (more than 30) or low (less than 3). Figure 1 shows CPUE of striped marlin by HPB estimated by a simple GLM model with the fixed factors of year, quarter, area and HPB (0 – 50). Unrealistic up and down trend of CPUE were observed in sets with 0 – 9 HPB and 37 – 50 HPB. Also, the observed increasing trend of CPUE in sets with 26- 37 HPB seemed unrealistic when because generally the increase of HPB value means set depth of hooks going deeper and striped marlin is known to stay in the surface layers almost all day. Based on these rough analyses on the relationship between CPUE of striped marlin and HPB, only data with 10 – 25 HPB was used in this study, and they are classified into 3 categories (10 – 15, 15 – 20, and 21 – 25).

As a result of the elimination of the data of shallow sets whose HPB values were less than 10 from the CPUE analysis, the ratio of sets with zero catch of striped marlin to the total number of data increased (Fig. 2). Then, the model used in the CPUE analysis were changed form the catch model with Negative Binominal error structure in the last analysis in 2005 (Yokawa, 2005) to the delta lognormal approach with binomial distribution for the model of proportion of positive catch sets and lognormal distribution for the model of positive CPUE sets (Lo et al, 1992).

In the model of the proportion positive catch sets, effects of year, area, quarter, gear configuration classified by HPB were included as main factors, the interaction term between year and quarter was included as fixed factors and, interaction terms between year and area, quarter and area were included as random effects. In the model of positive CPUE sets, effects of year, area, quarter, gear configuration was included as fixed factors, and interaction terms between year and quarter, year and area, and area and quarter were included as random effects.

The area stratification used in this study (Fig. 3) was same one used in the CPUE analysis of striped marlin caught by Japanese offshore and distant-water longliners (only for the part of the northwest Pacific, areas 1 – 5)(Yokawa and Clark, 2005). Because longline operations in area 1 and 2 were assumed to be a different fishery for the operation in areas 3 – 5 in the stock assessment with an integrated model (stock synthesis II)(Piner et al., 2006), data in areas 1 and 2 were analyzed separately from the ones in areas 3 -5. Analysis was made though the GLM and

GENMOD procedure of computer software, “SAS Ver. 9.1”.

Results and Discussions

In the northern part of the northwest Pacific (areas 1 and 2), trends of both the ratio of zero striped marlin catch sets and the CPUE of sets with positive striped marlin catch showed decreasing trend in the period analyzed (Figs. 4 and 5). The frequency distribution of log(CPUE) seemed bit different from the normal distribution, and the pattern of residuals of proportion positive catches and log(CPUE) also seemed bit skewed (Fig. 6). This would be caused by following reasons;

a) The data of shallower longline sets (HPB=<9), which supposed to be more effective in catching striped marlin than deeper sets, were deleted.
b) Most of shallower longline sets were conducted in areas 1 and 2, which were not used in the analysis.
c) Many data which used in the last analysis were not used in this analysis, and this cause luck of data coverage. As a result of this, most of interaction terms introduced into the model of CPUE standardization as random effects.

In the southern part of the northwest Pacific (areas 3, 4 and 5), trends of both the ratio of zero striped marlin catch sets and the CPUE of sets with positive striped marlin catch showed decreasing trend in the period analyzed as in the northern part (Figs. 7 and 8). Observed pattern of frequency distribution of log(CPUE) in areas 3 – 5 seemed more close to the normal distribution than the one in areas 1 and 2, and the residual pattern also not so skewed as the one in areas 1 and 2 (Fig. 9). This would be because the operations with deeper gear (HPB>=10) are the main style in these areas, and the coverage of data would be better in areas 3 – 5 than in areas 1 and 2.

The results of this study indicate the necessity of improve the quality of HPB information in the log-book system of Japanese coastal longliners to decrease the number of screened out data. Detailed analysis about gear configuration of Japanese coastal longliner would be helpful for the better understanding of the effect of HPB on striped marlin CPUE.

Figure 10 shows the estimated yearly trend of standardized CPUEs in areas 1 and 2, areas 3 – 5, areas 1 – 5 for 1994 -2005, and the standardized CPUE for 1994 – 2004 obtained by the last study (Yokawa 2005). The trends of standardized CPUE in areas 1 and 2, areas 3 – 5, and areas 1 – 5 were quite similar with each other, and these trends are also similar to the one obtained by the last study. This should indicate the fact that abundance of striped marlin in the northwest Pacific declined in the period analyzed in this study.

Reference

Piner, K., R. Conser and G. DiNardo 2006. Stock Status of Striped Marlin in the North Pacific Ocean in 2005.
no pagination. ISC/06/MAR&SWO-WG/07, 40p.

Lo, N. C., L. D. Jacobson and J. L. Squire 1992: Indices of relative abundance from fish spotter data based on delta-lognormal models. Can. J. Fish. Aquat. Sci., Vol. 49. 2515-2527.

Yokawa, K. and H. Yamada. 2002. Preliminary analysis of CPUE of Pacific Bluefin Tuna Caught by Japanese coastal longliners in the spawning ground. ISC/BWG/02/12. 10p.

Yokawa, K. 2003. Preliminary results of study on the effect of gear configuration in CPUE standardization by GLM methods. ICCAT SCRS DOC, SCRS/2003/035, 19p.

Yokawa, K. 2005. Standardizations of CPUE of striped marlin caught by Japanese coastal longliners in the northwest Pacific. 8pp. ISC/05/MARWG/04.

Yokawa, K. and S. Clarke: Standardizations of CPUE of striped marlin caught by Japanese offshore and distant water longliners in the North Pacific. ISC/05/MARWG/03, 9p.

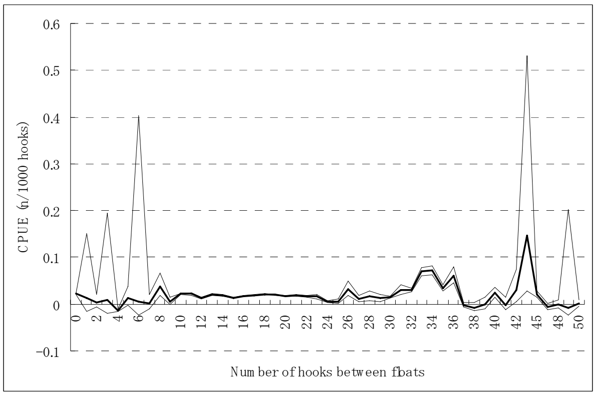

Fig. 1. CPUE (number / 1000 hooks) of striped marlin caught by Japanese coastal longliners by the number of hooks between floats which was estimated by a simple GLM model.

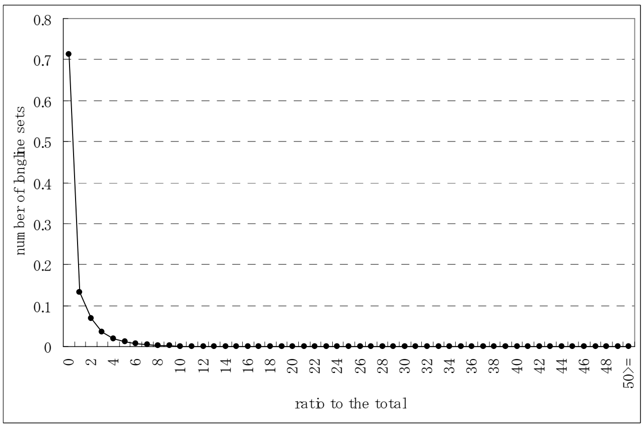

Fig. 2. Frequency distribution of catch number per set of striped marlin caught by Japanese coastal longliners in the period of 1994 – 2005. Data not used in the CPUE analysis were not included.

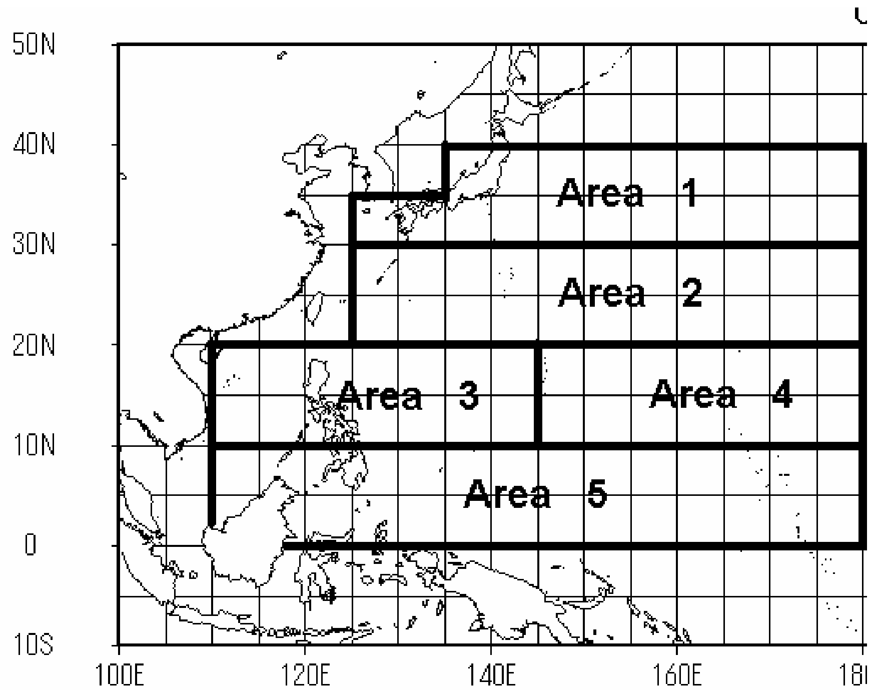

Fig. 3. Area stratification used in this study.

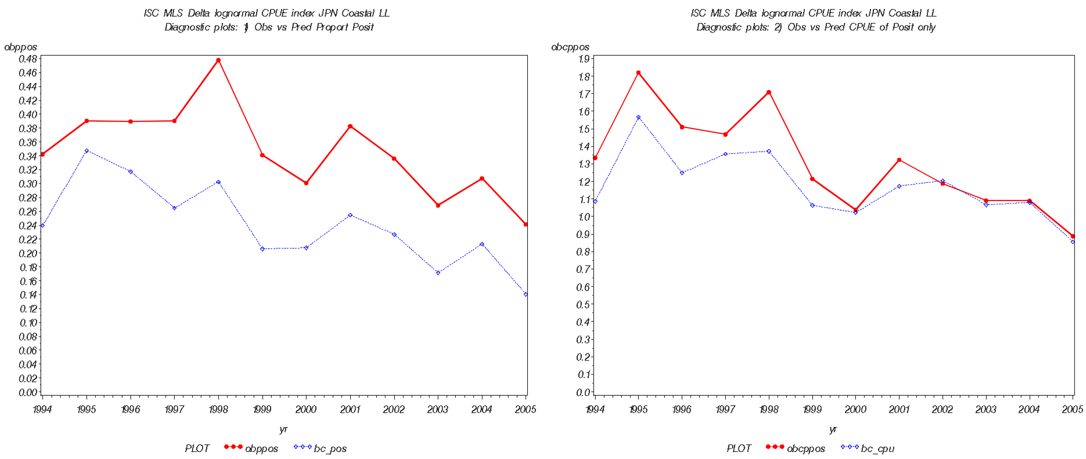

Fig. 4. Observed (red) and predicted (blue) trend of the proportion of sets of positive striped marlin catch (left) and of the CPUE of striped marlin caught by positive striped marlin catch sets of Japanese coastal longliners (right) in areas 1 and 2 in the period of 1994 - 2005.

Fig. 5. Observed (red) and predicted (blue) trend of standardized CPUE of striped marlin caught by Japanese coastal longliners in areas 1 and 2 in the period of 1994 – 2005.

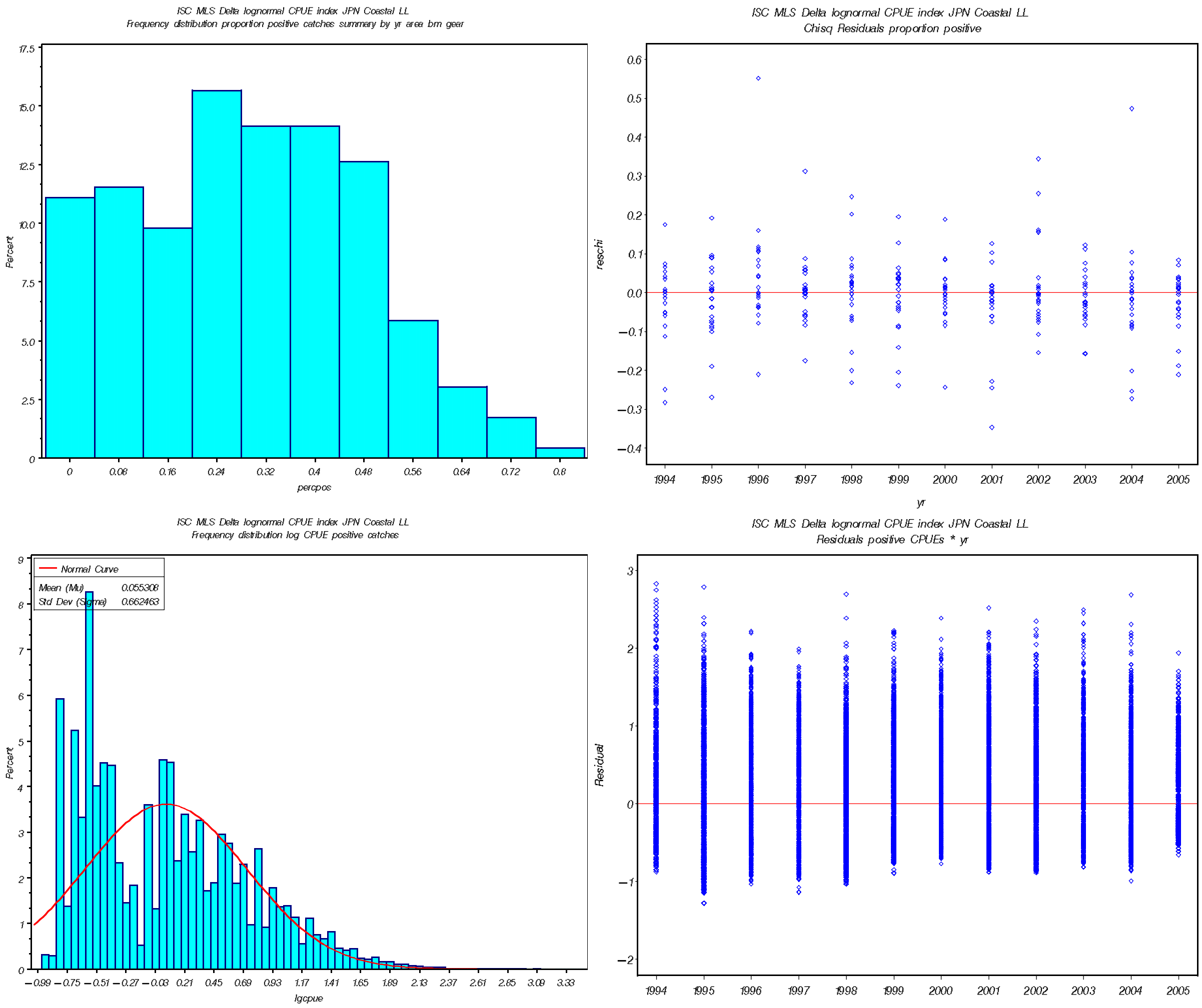

Fig. 6. Frequency distribution of proportion positive catches and chi-square residuals by year of them (left and right top), and frequency distribution of log(CPUE) of positive catches and their residuals by year (left and right bottom) in the CPUE analysis in areas 1 and 2.

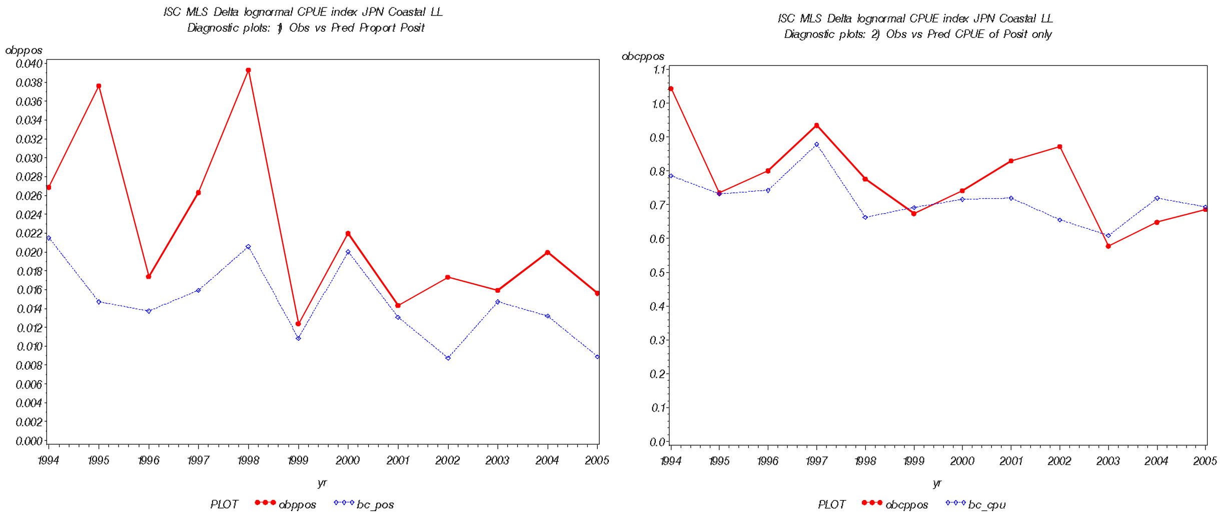

Fig. 7. Observed (red) and predicted (blue) trend of the proportion of sets of positive striped marlin catch (left) and of the CPUE of striped marlin caught by positive striped marlin catch sets of

Japanese coastal longliners (right) in areas 3, 4 and 5 in the period of 1994 - 2005.

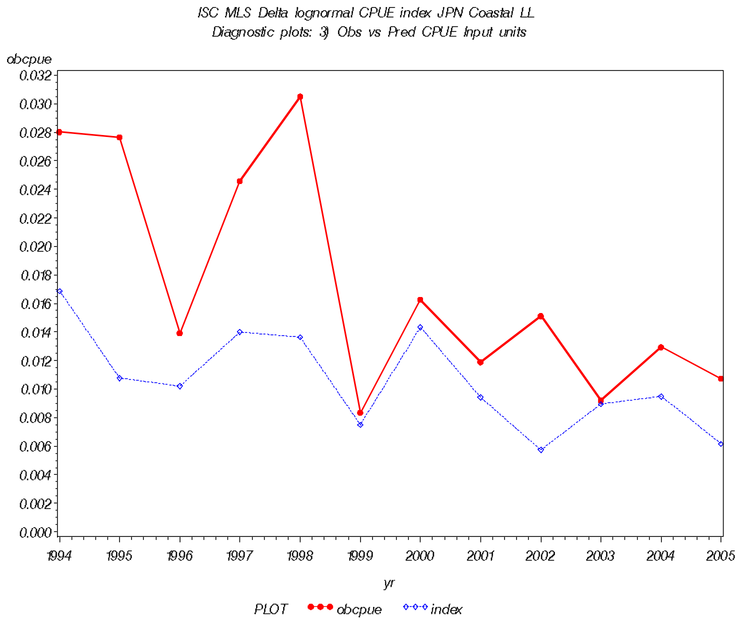

Fig. 8. Observed (red) and predicted (blue) trend of standardized CPUE of striped marlin caught by Japanese coastal longliners in areas 3, 4 and 5 in the period of 1994 – 2005.

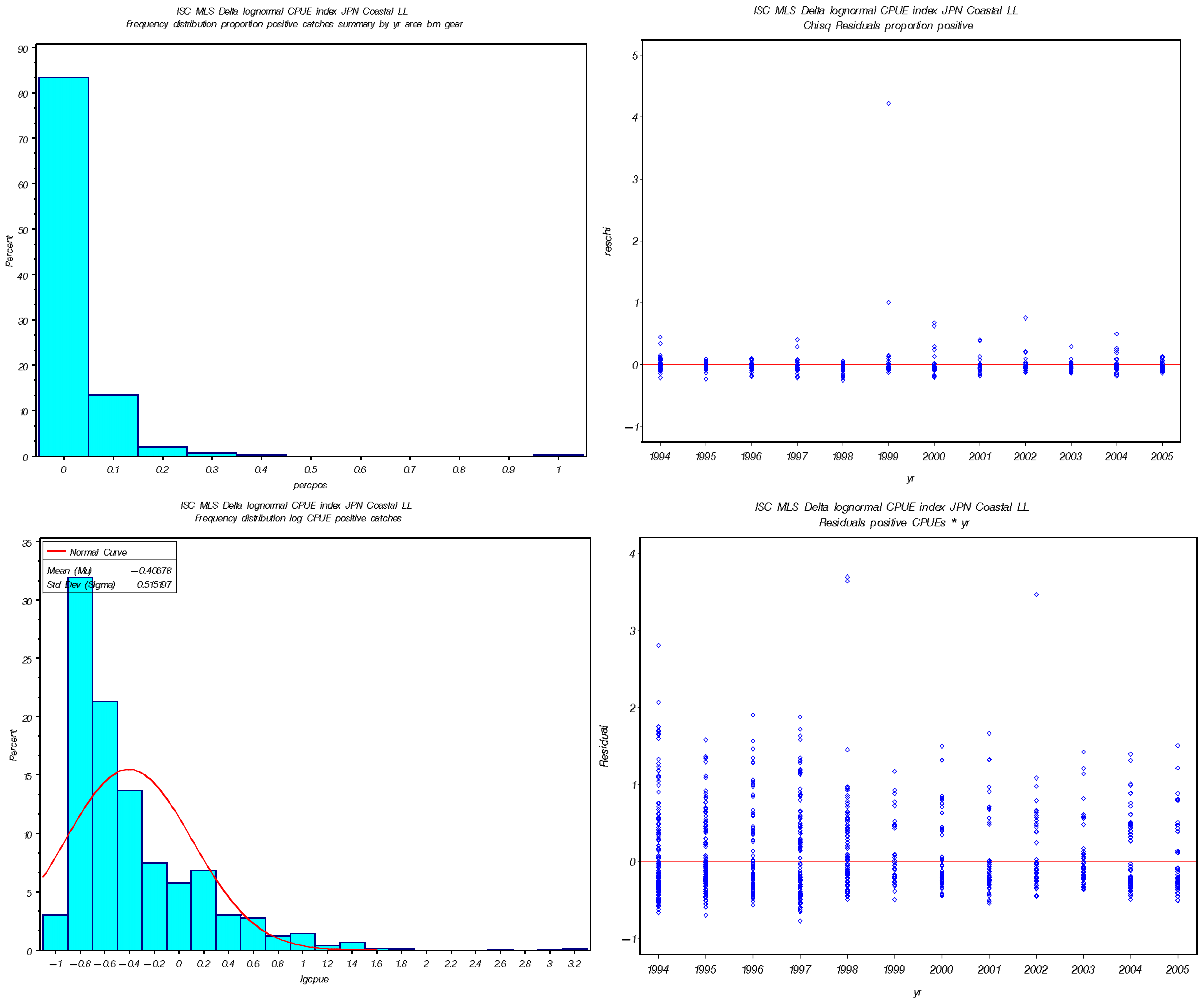

Fig. 9. Frequency distribution of proportion positive catches and chi-square residuals by year of them

(left and right top), and frequency distribution of log(CPUE) of positive catches and their residuals by year (left and right bottom) in the CPUE analysis in areas 3, 4 and 5.

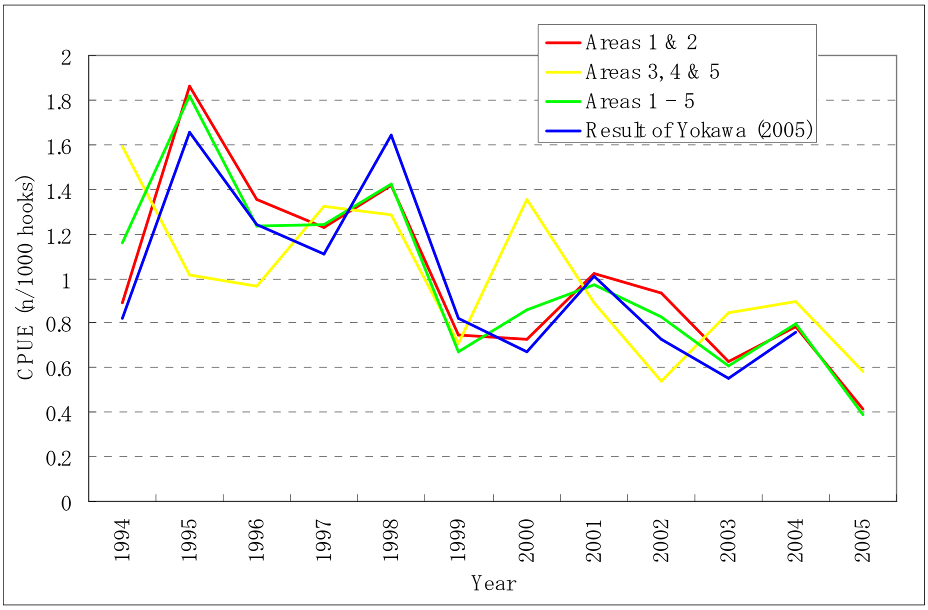

Fig. 10. Trend of standardized CPUE of striped marlin caught by Japanese coastal longliners in areas 1 – 2 (blue), areas 3 - 5 (yellow), and areas 1 – 5 (red) in the period of 1994 – 2005, and trend of CPUE estimated by the last study (Yokawa 2005).