CPUE standardization up to 2009 data

2009 年までのデータによる CPUE 標準化

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Objectives

This working paper describe making of standardized CPUE series up to 2009 data. The CPUE series up to 2009 will not be used for OM conditioning, but will be used for MP testing.

本文書は、2009 年までの標準化した CPUE の作成について記す。2009 年までの CPUE は OM 条件付けには使用されないが、MP 試験には用いられる。

Data and method

The dataset used was added NZ charter vessel data of catch and effort in shot-by-shot resolution provided from New Zealand into the dataset previously used. Proportion of age 4 plus calculated from CCSBT database was applied. In addition, Japanese 2009 data mainly comprised with RTMP data were added. From this dataset, a set of core vessels were nominated with condition of Area 4-9, Month 4-9, x (top rank of SBT catch in a year) = 52 and y (number of years in the top ranks) = 3 (Table 1). It chose 118 vessels as the core vessels and subset data in total of 130,830 records were made.

Some correction was made as in previous, including deleted records operated south of 50 degree S, combined Area 5 and Area 6 into Area 56, and deleted operations with extremely high CPUE (>120). The shot-by-shot data were aggregated into 5x5 degree and month. Aggregated data with little effort (<10,000 hooks) were deleted. Small constant of 0.2 was added into CPUE age 4+ before log transform.

CPUE were standardized using SAS (version 9.1.3) by following three models, and area weighted.

Base: The agreed model shown in Attachment 5 of SAG 9 Report

$$log(CPUE+0.2) = Intercept + Year + Month + Area + Lat5 + BET\_CPUE + YFT\_CPUE + (Month*Area) + (Year*Lat5) + (Year*Area) + Error,$$

Run-03 : Add % of hauls with presence of by-catch for each 5*5 cell into (Base - BET_CPUE - YFT_CPUE) as categorical variables. From the frequency distribution of the % hauls, four categories were determined as follows; category 1: 0%>= and <25%,

category 2: 25%> and <= 50%, category 3: >50 and <= 75%, and category 4: >75% and <= 100%.

*log(CPUE+0.2) = Intercept + Year + Month + Area + Lat5 + %hauls_BETYFT + (Month*Area) + (Year*Lat5) + (Year*Area) + Error,*

Run-06 : Use the 5x5 month records of pure SBT (not including BET or YFT catch). The GLM model used was that includes main effects only.

log(CPUE+0.2) = Intercept + Year + Month + Area + Lat5 + Error,

The area weighted CPUE series between 1986 and 2009 were applied to the historical time series since 1969 based on the agreed method (SAG9 Report in 2008, attachment 5). The value in 2009, which was mainly from RTMP, was corrected with the constant of 0.925 (CPUE2010-a2.1).

用いたデータセットは、2008 年までのデータに NZ から提供された NZ チャーター船によるレコードを加えた。NZ データに対しては、CCSBT データベースから 4 歳以上の割合を計算して当てはめた。また、ほとんどが RTMP から構成される日本の 2009 年データを加えた。このデータセットから 4 月から 9 月、4 海区から 9 海区に限定し（表 1)、さらに x=52、y=3 の条件でコア船を抽出した結果、118 隻が該当し、それらの船のデータ（合計 130,830 レコード）を用いた。

CPUE の標準化はこれまでと同様に実施した。すなわち、50°S 以南の操業は削除し、5 海区と 6 海区は 56 海区として統合した。ミナミマグロ 4+歳の CPUE は、対数変換の前に 0.2 を加えた。ミナミマグロ 4+歳の CPUE が 120 より大きいものは削除。5x5 月の合計 hook 数が 10,000 未満は削除。

SAS（version 9.1.3）を使用して年トレンドを計算した。ベースケース（合意された CPUE 標準化モデル（SAG9 レポートの Attachment 5 参照))、Run3（キハダ･メバチの混獲割合のカテゴリカル変数を使用)、Run6（混獲のないデータセットのみを使用）の 3 通りを求めた。

1969 年からの歴史的タイムシリーズに当てはめた（2008 年 SAG9 レポートの attachment 5)。RTMP データが主体となる 2009 年には、係数 0.925（CPUE2010-a2.1）を掛けた。

Result

Fig. 1 shows the year trend with 95% confidence interval from GLM and Fig. 2 shows Q-Q plots. Fig.3 shows the area weighted CPUE series (w0.8 and w0.5). CPUE increased from 2007 to 2008 and further to 2009. Fig. 4 shows the area weighted CPUE series (w0.8 and w0.5) both the core vessel data and the data aggregated by five degree and month by all vessels, which used in the data exchange of CCSBT. Both series show same trend in both area weightings.

Fig. 5 shows the nominal CPUE by age and Area for four years. All months between April and September were combined. For age 4 and more, which recruitment into the Japanese longline has completed, CPUE in 2009 were very large in age 4 (and age 5). The high CPUE in 2009, and also 2008, is due to relatively high level of recruitment into the stock for longline. The values of CPUE are available in another Excel sheet (OMMP1006_08a_CPUEupto2009withRun36.xls).

GLM で推定された年トレンドを図 1 に、その Q-Q プロットを図 2 に示す。操業海域面積で重み付けしたインデックス（w0.8 及び w0.5）を Fig.1 に示す。CPUE 値は 2007 年から 2008 年、2009 年と増加している。インデックスを、コア船データと CCSBT データ交換で使用している 5 度月別データで作成した場合を図 4 に示す。両者のトレンドは同じであった。

海区、年齢別の Nominal CPUE を図 5 に示す。日本延縄への加入が完了する 4 歳以上の年齢において、4 歳、5 歳魚の CPUE が 2009 年に高くなっている。標準化 CPUE の 2009 年値が高くなったのは、加入魚のレベルが高かったためと解釈される。CPUE 値はエクセルシートで利用可能である（表 2)。

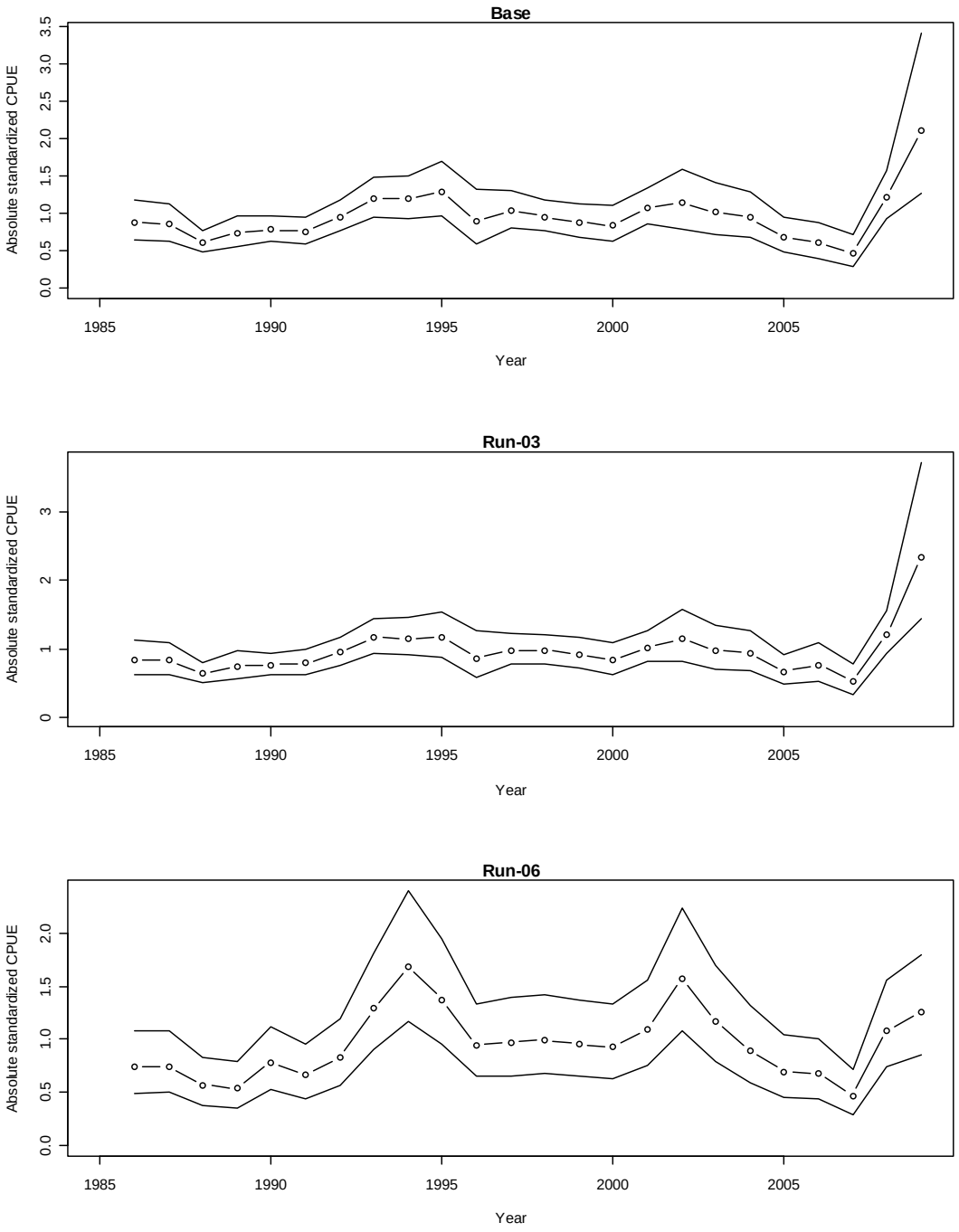

Fig. 1. Standardized CPUE (mean with 95% confidence interval) of base model, Run-03 and Run-06 for the core vessel data up to 2009.

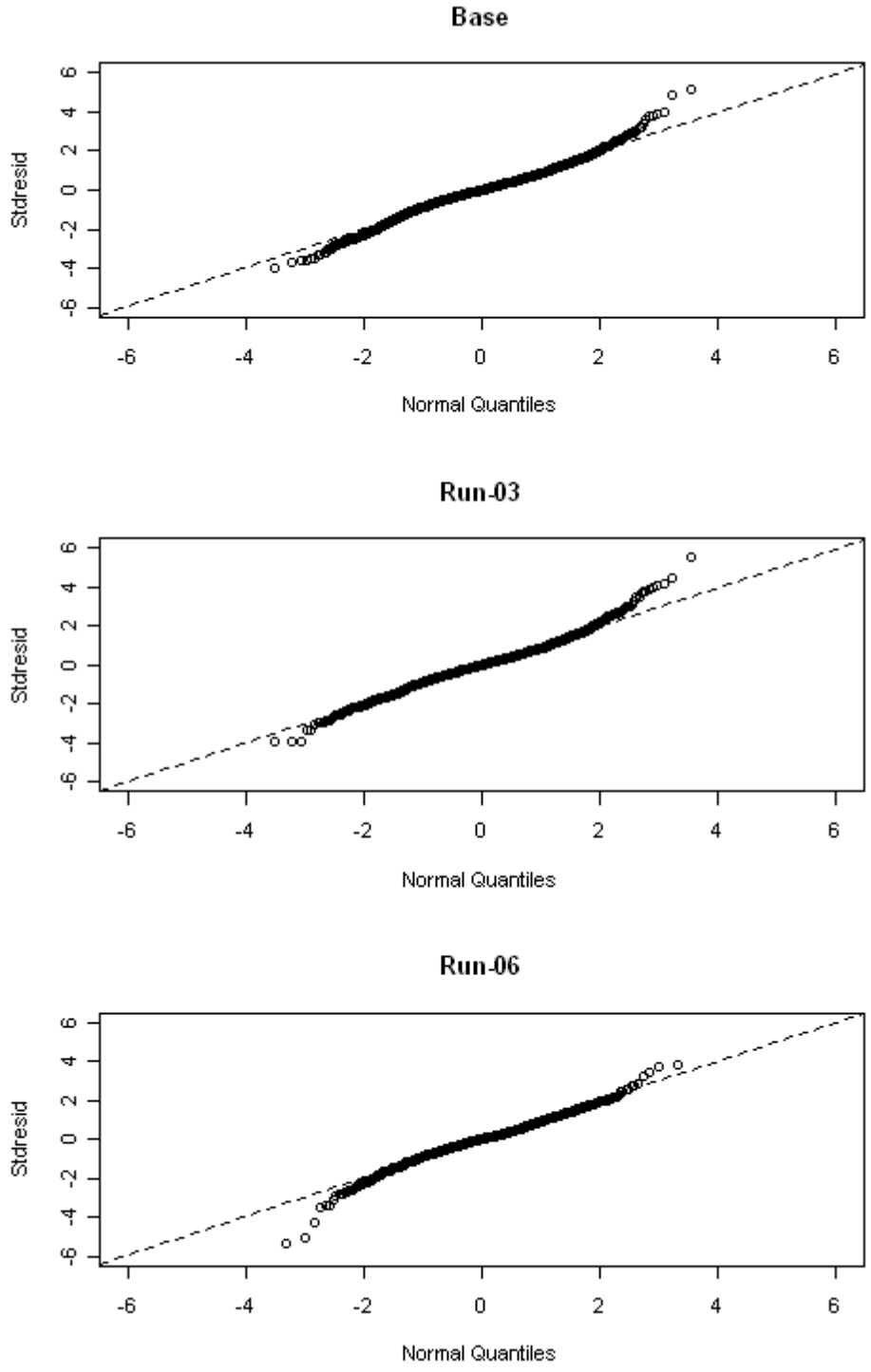

Fig. 2. Q-Q plots for the GLM standardization of base model, Run-03 and Run-06 for the core vessel data up to 2009.

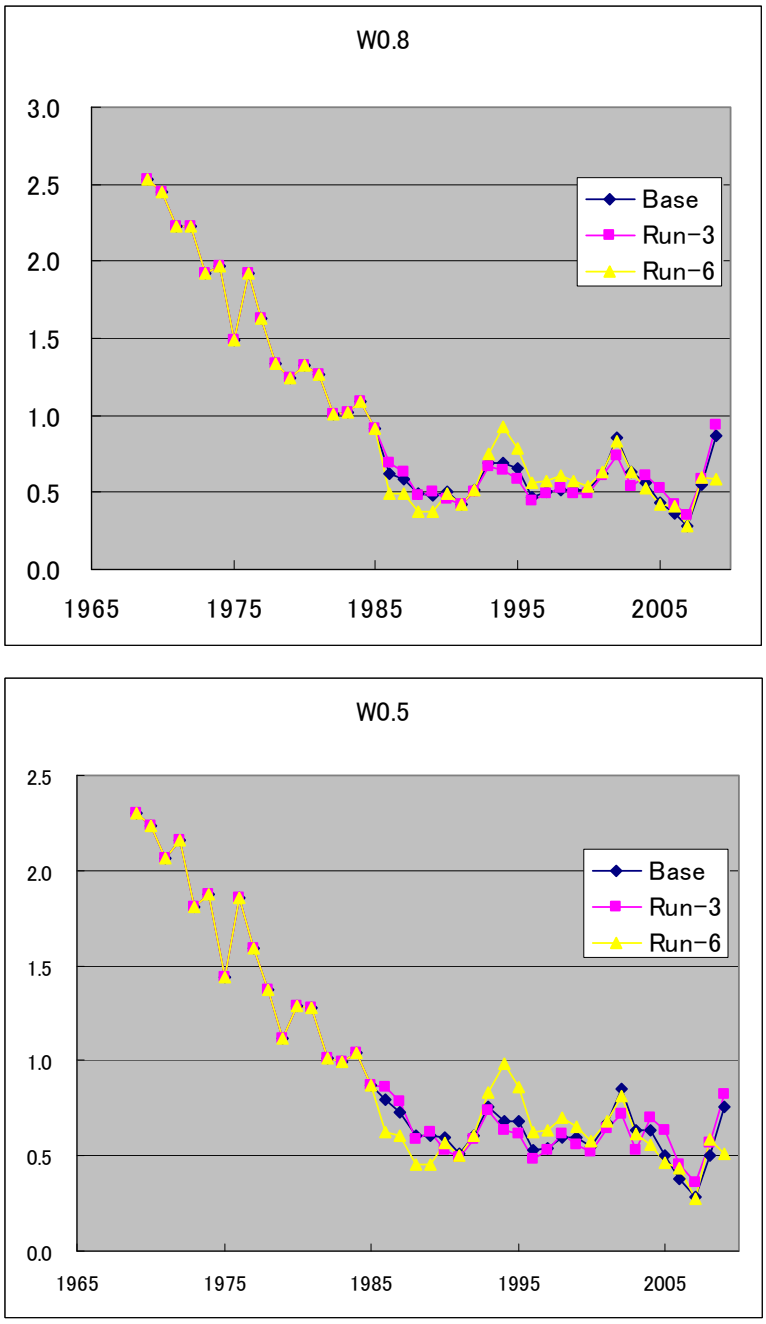

Fig. 3. Area weighted standardized CPUE series for w0.8 and w0.9 up to 2009.

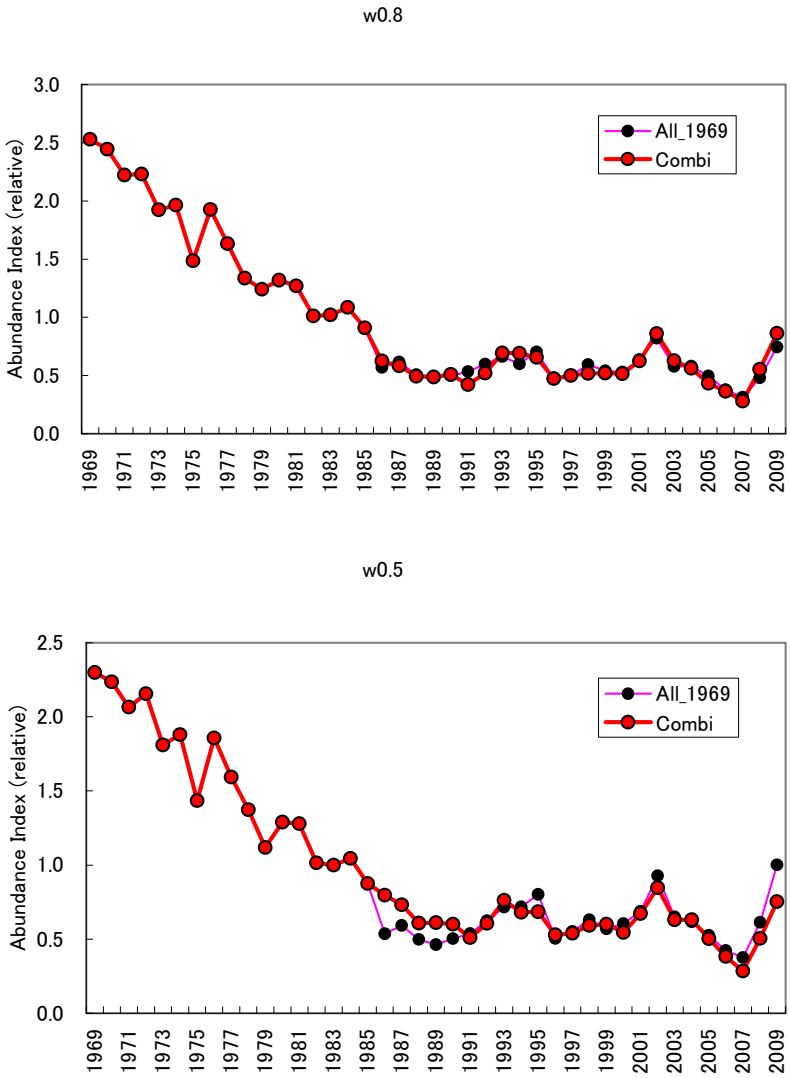

Fig. 4 Comparison of area weighted CPUE series between based on the shot-by-shot data of the core vessels (Combi) and based on aggregated in five degree squares and month of all vessels (All1969) for w0.8 and w0.5.

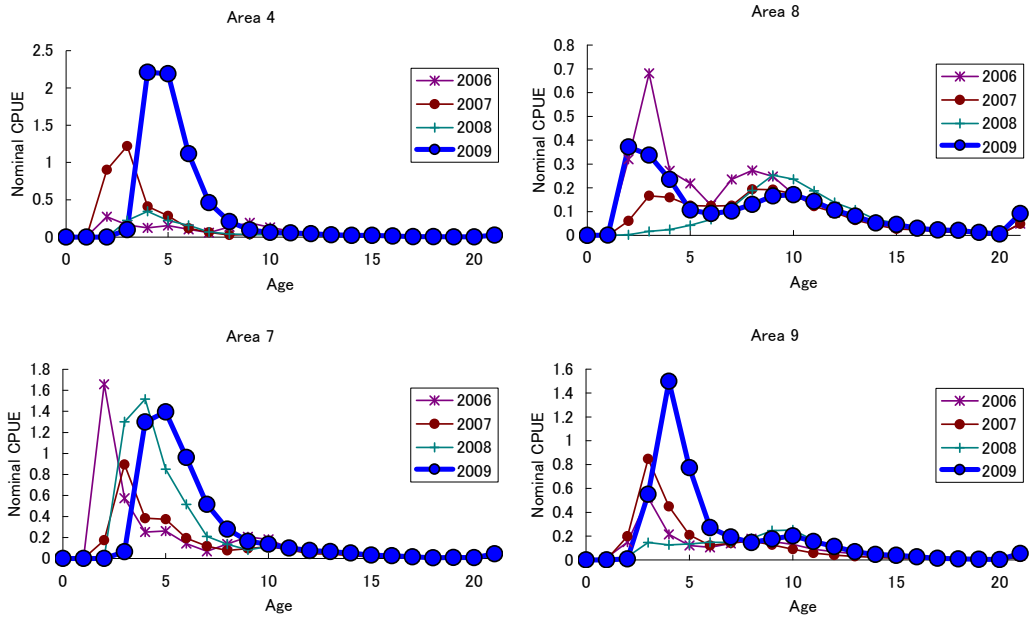

Fig. 5 Nominal CPUE by age and Area.

Month between 4 and 9 were combined.

Table 1. Number of records in the dataset used.

Vessels	All AU	All Japan	All NZ	All Total	Core Total
1986		27,043		27,043	3,612
1987		26,821		26,821	4,203
1988		24,418		24,418	4,895
1989	1,156	23,985		25,141	6,074
1990	504	19,865	475	20,844	5,710
1991	1,204	18,244	460	19,908	6,103
1992	1,717	17,168	499	19,384	6,036
1993	2,001	14,632	486	17,119	5,925
1994	1,436	12,267	268	13,971	5,031
1995	800	12,678	373	13,851	5,127
1996		14,854		14,854	5,950
1997		16,322	379	16,701	7,038
1998		16,310	310	16,620	7,143
1999		14,414	306	14,720	6,724
2000		11,745	265	12,010	6,247
2001		14,075	198	14,273	6,763
2002		10,693	228	10,921	5,159
2003		11,563	294	11,857	5,389
2004		13,101	349	13,450	6,714
2005		13,848	198	14,046	6,690
2006		9,124	183	9,307	4,938
2007		5,540	387	5,927	3,546
2008		6,841	167	7,008	3,786
2009		3,228	239	3,467	2,027
Total	8,818	358,779	6,064	373,661	130,830

Data are from Area 4-9 and month 4-9.

Table 2. Standardized CPUE (relative values) for two area weighting (w0.8 and w0.5) for three GLM models (Base, Run-3 and Run-6).

	Base	Base	Run-3	Run-3	Run-6	Run-6
Year	w08	w05	w08	w05	w08	w05
1969	2.5278	2.2998	2.5278	2.2998	2.5278	2.2998
1970	2.4443	2.2370	2.4443	2.2370	2.4443	2.2370
1971	2.2208	2.0654	2.2208	2.0654	2.2208	2.0654
1972	2.2306	2.1559	2.2306	2.1559	2.2306	2.1559
1973	1.9239	1.8107	1.9239	1.8107	1.9239	1.8107
1974	1.9629	1.8791	1.9629	1.8791	1.9629	1.8791
1975	1.4857	1.4349	1.4857	1.4349	1.4857	1.4349
1976	1.9264	1.8575	1.9264	1.8575	1.9264	1.8575
1977	1.6326	1.5936	1.6326	1.5936	1.6326	1.5936
1978	1.3372	1.3732	1.3372	1.3732	1.3372	1.3732
1979	1.2399	1.1181	1.2399	1.1181	1.2399	1.1181
1980	1.3185	1.2895	1.3185	1.2895	1.3185	1.2895
1981	1.2703	1.2784	1.2703	1.2784	1.2703	1.2784
1982	1.0127	1.0149	1.0127	1.0149	1.0127	1.0149
1983	1.0202	0.9991	1.0202	0.9991	1.0202	0.9991
1984	1.0853	1.0439	1.0853	1.0439	1.0853	1.0439
1985	0.9094	0.8750	0.9094	0.8750	0.9094	0.8750
1986	0.6248	0.7966	0.6972	0.8623	0.4967	0.6223
1987	0.5824	0.7320	0.6377	0.7846	0.4916	0.6054
1988	0.4948	0.6085	0.4779	0.5838	0.3806	0.4537
1989	0.4861	0.6107	0.5025	0.6268	0.3710	0.4556
1990	0.5084	0.6013	0.4621	0.5348	0.4899	0.5663
1991	0.4225	0.5095	0.4164	0.4960	0.4262	0.5005
1992	0.5197	0.6064	0.5035	0.5869	0.5194	0.6063
1993	0.6943	0.7614	0.6662	0.7358	0.7494	0.8378
1994	0.6916	0.6817	0.6481	0.6373	0.9284	0.9845
1995	0.6559	0.6850	0.5889	0.6191	0.7859	0.8631
1996	0.4732	0.5297	0.4428	0.4858	0.5624	0.6255
1997	0.5005	0.5402	0.4877	0.5336	0.5731	0.6341
1998	0.5176	0.5929	0.5314	0.6157	0.6071	0.7046
1999	0.5209	0.6004	0.4959	0.5624	0.5741	0.6498
2000	0.5162	0.5451	0.4914	0.5163	0.5382	0.5762
2001	0.6241	0.6734	0.6043	0.6455	0.6302	0.6785
2002	0.8611	0.8480	0.7422	0.7150	0.8305	0.8157
2003	0.6271	0.6301	0.5374	0.5257	0.6302	0.6144
2004	0.5637	0.6313	0.6118	0.6968	0.5232	0.5610
2005	0.4342	0.5037	0.5290	0.6306	0.4239	0.4623
2006	0.3648	0.3822	0.4223	0.4559	0.4089	0.4367
2007	0.2803	0.2839	0.3463	0.3587	0.2837	0.2776
2008	0.5537	0.5056	0.5889	0.5723	0.5938	0.5887
2009	0.8637	0.7535	0.9430	0.8254	0.5858	0.5122