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Conversion Factors for Yellowtail Flounder Survey Indices Derived from Comparative Fishing Trials between the Engel 145 Otter Trawl and the Campelen 1800 Shrimp Trawl.

by

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Introduction

In 1996, multi-species comparative fishing trials were carried out between the *FRV Alfred Needler* using the "old standard " survey trawl, Engel 145 high lift otter trawl and her sister ship the *FRV Wilfred Templeman* using the "new standard" survey trawl, Campelen 1800 shrimp trawl. The objective of these comparative fishing trials was to derived conversion factors to re-calculate the 1984-95 spring and 1990-94 fall Div. 3LNO bottom trawl indices from Engel trawl units to Campelen trawl units. These survey trawls are described in detail in McCallum and Walsh (1996). An analysis of these comparative experiments produced conversion factors for five groundfish species (Warren et al. 1997). A total of 154 successful paired tows were conducted during February and March of 1996 in which one or the other trawl caught yellowtail flounder.

This paper illustrates the effect of the converting yellowtail flounder Engel trawl indices into Campelen trawl units for the NAFO Div. 3LNO survey data for the period 1984-95.

Methods

Length frequencies of yellowtail flounder were standardized for towing distance for data from the 1984-1995 Engel spring trawl and 1990-94 fall trawl surveys and converted into Campelen trawl indices. Conversion factors calculated by Warren et al. (1997) were applied as follows:

The new numbers at length y_i

$$y_i = R*n_i$$

where R = ratio of Campelen/Engel catch in numbers at each length
n_i is the number at length in the fishing set

where $\log R = a+b[x- x_o \log(x)]$ when $22<=x<=39$cm

and $\log R = a+bx_o [1-\log(x_o)]$ when $x>39$ cm

and $R = 7.6$ when $x<22$ cm

where x is the length class mid-point
$x_o = 39$ cm
$a = 38.851584$; $b = 0.3767125$

The converted length frequencies were summed to give converted number of yellowtail flounder for each set in both the spring and fall time series. Annual length-weight regression parameters were applied to the converted length frequencies to estimate converted weights at age for each set. A tow distance of 0.8 nm, a wing spread of 55.25 ft (16.84 m) and a tow duration of 15 minutes were the standardized parameters used to calculate swept area indices of abundance and biomass of Div 3LNO spring and fall yellowtail flounder.

Results

Tables 1 and 2 and Figures 1 and 2 give the population abundance indices at age of yellowtail flounder for the spring (1984-95) and fall (1990-94) surveys for both the Engel and converted Campelen trawl units. Up to and including age 4, the indices show the differences between the two sampling trawls. From age 5 onward, both indices show similar trends until oldest ages are reached and the data are sometimes more variable.

The age 1+ spring abundance and biomass indices for the Campelen trawl units show greater variability in the 1980's than in the Engel series (Figs. 3 and 4). The fall indices seem to track each other well.

Discussion

A length based conversion between the Engel and Campelen for yellowtail flounder has been derived for NAFO Div. 3LNO spring (1984-95) and fall (1990-94) time series. Engel trawl surveys that are dominated by small fish will show greater Campelen numbers, for example 1989 spring survey and 1991 fall survey.

As age increases, the discrepancy between the two gears decreases. At age 8 in the spring survey we start to see some overlap in the indices, especially at age 10. However, in the fall there is no overlap at older ages. There is greater variability in the indices of younger ages. The lack of small fish in the converted data is the result of the poor efficiency of the Engel 145 otter trawl in catching small yellowtail flounder when compared to the Campelen 1800 shrimp trawl (see Fig. 5). Walsh (1992) demonstrated that 95% of yellowtail flounder under 23 cm (~age 3 yr.) escaped under the footgear of the Engel survey trawl used onboard the *FRV Wilfred Templeman*. Interpretation of year class strength below age 3 in the new converted time series should be treated with caution.

At this point in time, the spring survey trawl indices of Grand Bank yellowtail flounder for 1971-1982 derived from a Yankee 41 otter trawl (see McCallum and Walsh 1996) have not been converted into Campelen trawl units. The index of abundance has been converted from Yankee units into Engel trawl units but not the biomass. Double conversions of this data into Campelen units will be explored at a later date.

References

Brodie, W.B. and S. J. Walsh 1988. An update on the status of the yellowtail flounder stock in Division 3LNO NAFO SCR Doc. 88/38:42p

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Table 1. Abundance index [1](millions) of yellowtail flounder from Canadian spring groundfish surveys in Div. 3LNO based on the Engel 145 high lift otter trawl.

Age/year	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995
1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	0.0	0.0	0.0	0.6	0.0	0.2	0.0	0.1	0.1	0.0	0.0	0.0
3	0.3	1.3	0.1	1.8	0.3	2.4	0.7	0.4	1.1	0.2	0.3	0.1
4	3.2	4.2	1.2	5.2	2.3	23.8	7.5	5.9	5.2	4.1	1.1	2.8
5	27.0	12.7	10.8	9.2	3.1	25.7	20.2	27.1	10.9	13.7	9.2	8.1
6	83.2	53.9	30.3	31.5	10.6	28.8	28.6	39.5	26.6	30.0	24.2	32.5
7	127.6	91.7	96.6	71.6	41.3	38.5	44.0	39.2	25.8	47.3	30.3	38.6
8	60.6	38.6	44.7	45.0	43.0	16.9	35.1	19.4	11.9	25.5	14.0	19.4
9	4.6	2.9	6.7	4.8	6.7	2.0	5.4	2.9	2.7	3.7	1.0	0.2
10	0.1	0.3	0.4	0.3	0.3	0.2	0.4	0.0	0.0	0.0	0.0	0.0
Total												
1+	306.6	205.6	190.8	169.9	107.5	138.7	141.8	134.5	84.3	124.4	80.2	101.7
1 to 4	3.56	5.55	1.33	7.54	2.58	26.46	8.20	6.34	6.37	4.28	1.41	2.92
5+	303.0	200.1	189.5	162.4	104.9	112.2	133.6	128.1	77.9	120.1	78.8	98.8
7+	192.9	133.4	148.3	121.7	91.2	57.7	84.8	61.5	40.3	76.4	45.4	58.1

[1] In previous assessments of this species the population numbers at age from 1984-87 were derived from selected strata, instead of all of the strata in Div. 3LNO, to account for missing strata in those years when survey coverage was poor. These selected strata were in Div. 3LN and consisted of 350, 361, 362, 363, 372, 373, and 375. From 1988-93,a multiplicate model was used to account for missing strata in the annual assessment of the spring surveys (see Brodie and Walsh 1988 for details). Here, we have used the actual data from these surveys with no attention to missing strata problem

Table 2. Abundance index (millions) of yellowtail flounder from Canadian spring groundfish surveys in Div. 3LNO converted to Campelen shrimp trawl units.

Age	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995
1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	0.0	0.2	0.0	10.2	0.7	4.0	0.2	1.7	1.0	0.3	0.0	0.0
3	6.7	17.1	1.7	30.8	4.7	40.1	12.6	7.2	17.9	3.5	5.9	1.6
4	32.9	37.5	11.2	80.0	25.9	250.9	78.4	57.2	55.6	35.3	7.2	19.9
5	85.1	35.4	39.5	37.9	15.0	97.9	93.1	89.4	36.5	43.5	26.8	24.5
6	141.0	89.8	57.5	55.8	20.7	54.6	58.4	74.0	46.9	52.0	42.3	57.4
7	184.5	133.6	141.7	105.4	62.8	56.3	64.4	57.9	38.0	69.4	44.3	55.7
8	86.9	55.3	63.6	66.6	63.0	25.6	52.3	28.2	17.3	36.7	20.3	28.0
9	7.0	4.3	10.1	7.0	9.7	3.1	7.4	4.5	4.4	5.6	1.6	0.3
10	0.1	0.5	0.7	0.5	0.0	0.4	0.7	0.0	0.0	0.0	0.0	0.0
Total												
1+	544.2	373.8	326.1	394.2	202.6	532.9	367.4	320.2	217.5	246.3	148.4	187.3
1 to 4	39.5	54.8	12.9	121.0	31.2	295.0	91.2	66.1	74.4	39.2	13.1	21.5
5+	504.7	319.0	313.1	273.2	171.3	237.9	276.2	254.0	143.1	207.1	135.3	165.8
7+	278.6	193.7	216.2	179.5	135.6	85.4	124.8	90.6	59.6	111.6	66.2	83.9

Table 3. Abundance index (millions) of yellowtail from Canadian fall groundfish surveys in Div. 3LNO based on Engel 145 high lift otter trawl units, 1990-94

Age	1990	1991	1992	1993	1994
1	0.0	0.0	0.0	0.0	0.0
2	0.1	0.1	0.1	0.0	0.1
3	2.2	2.4	1.2	0.7	0.4
4	5.9	6.6	5.9	22.3	4.6
5	16.9	15.1	10.0	35.6	15.4
6	22.9	33.8	18.5	46.2	39.8
7	30.3	36	31.1	40.6	48.2
8	13.4	20.9	17.6	13.8	35.5
9	1.4	2.2	2.8	0.8	1.0
10	0.0	0.0	0.0	0.0	0.0
Total					
1+	93.1	117.1	87.2	160.0	145.0
1 to 4	8.2	9.1	7.2	23.0	5.1
5+	84.9	108.0	80.0	137.0	139.9
7+	45.1	59.1	51.5	55.2	84.7

Table 4. Abundance index (millions) of yellowtail from Canadian fall groundfish surveys in Div. 3LNO converted to Campelen trawl units, 1990-94

Age	1990	1991	1992	1993	1994
1	0.0	0.0	0.0	0.0	0.0
2	1.3	1.6	1.2	0.9	2.3
3	11.3	37.2	18.6	6.6	5.9
4	28.9	64.5	53.5	74.4	38.5
5	44.3	46.9	34.0	104.5	48.4
6	38.5	61.2	33.7	77.5	70.9
7	45.0	52.4	45.6	67.3	69.8
8	19.9	29.8	25.0	36.4	50.5
9	2.2	3.4	4.2	3.8	1.7
Total					
1+	191.4	297.0	215.9	371.5	288.0
1 to 4	41.5	103.3	73.4	82.0	46.7
5+	149.9	193.7	142.5	289.5	241.3
7+	67.1	85.6	74.8	107.5	121.9

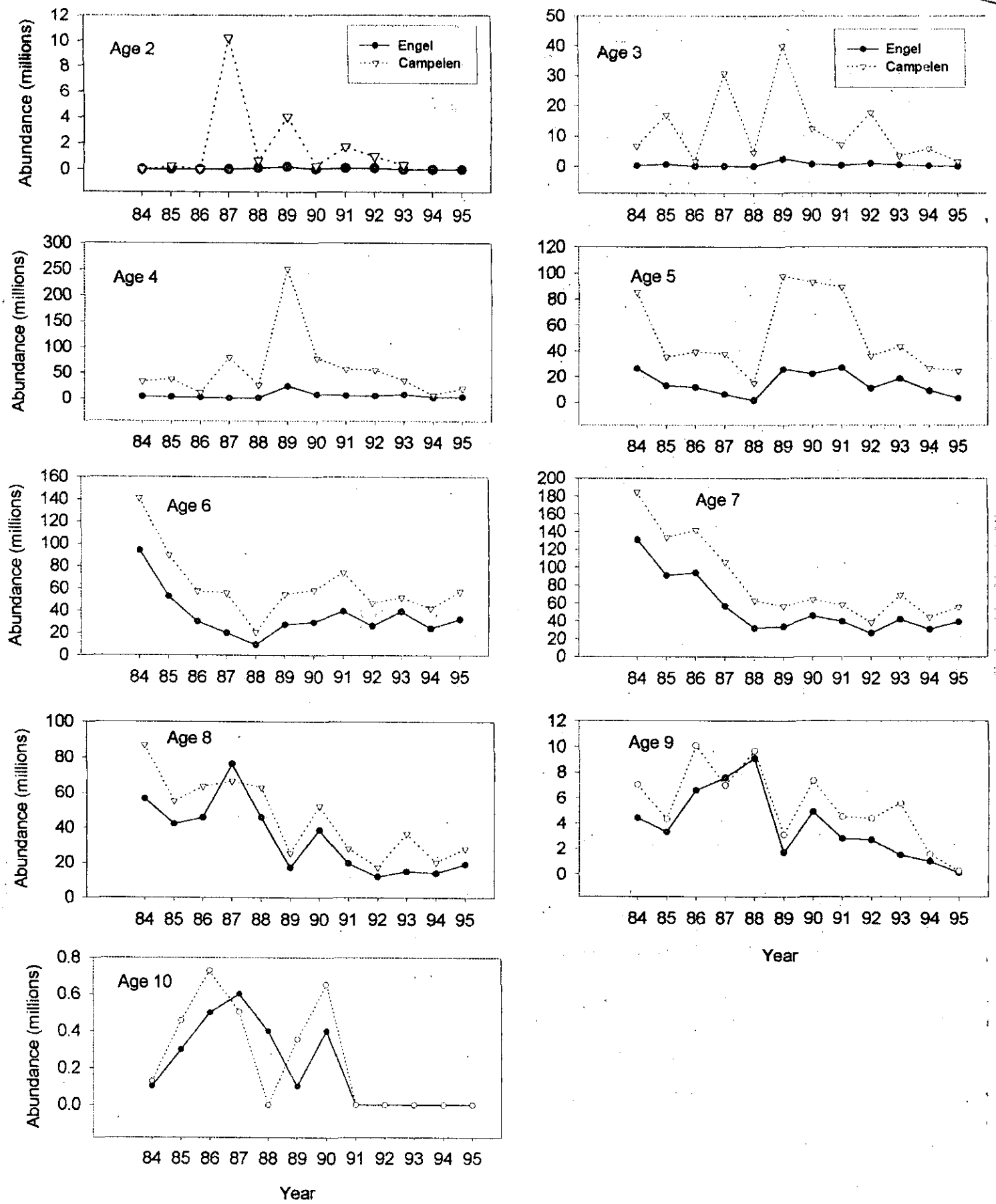

Fig. 1. Comparison of population abundance estimates from Engel 145 otter trawl surveys with converted Campelen 1800 shrimp trawl units, 1984-95 spring survey.

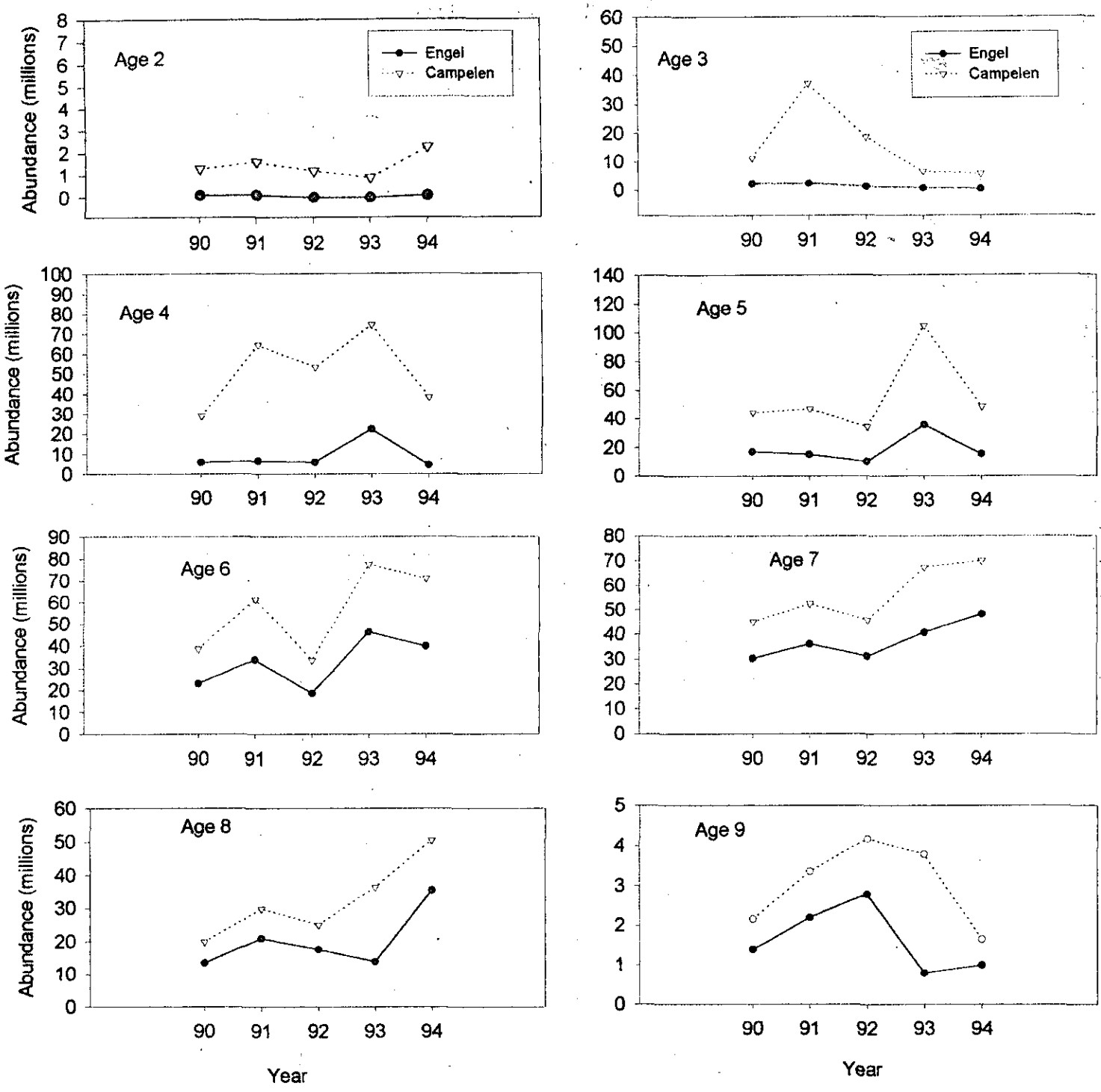

Fig. 2. Comparison of population abundance estimates from Engel 145 otter trawl surveys with converted Campelen 1800 shrimp trawl units, 1984-95 fall survey.

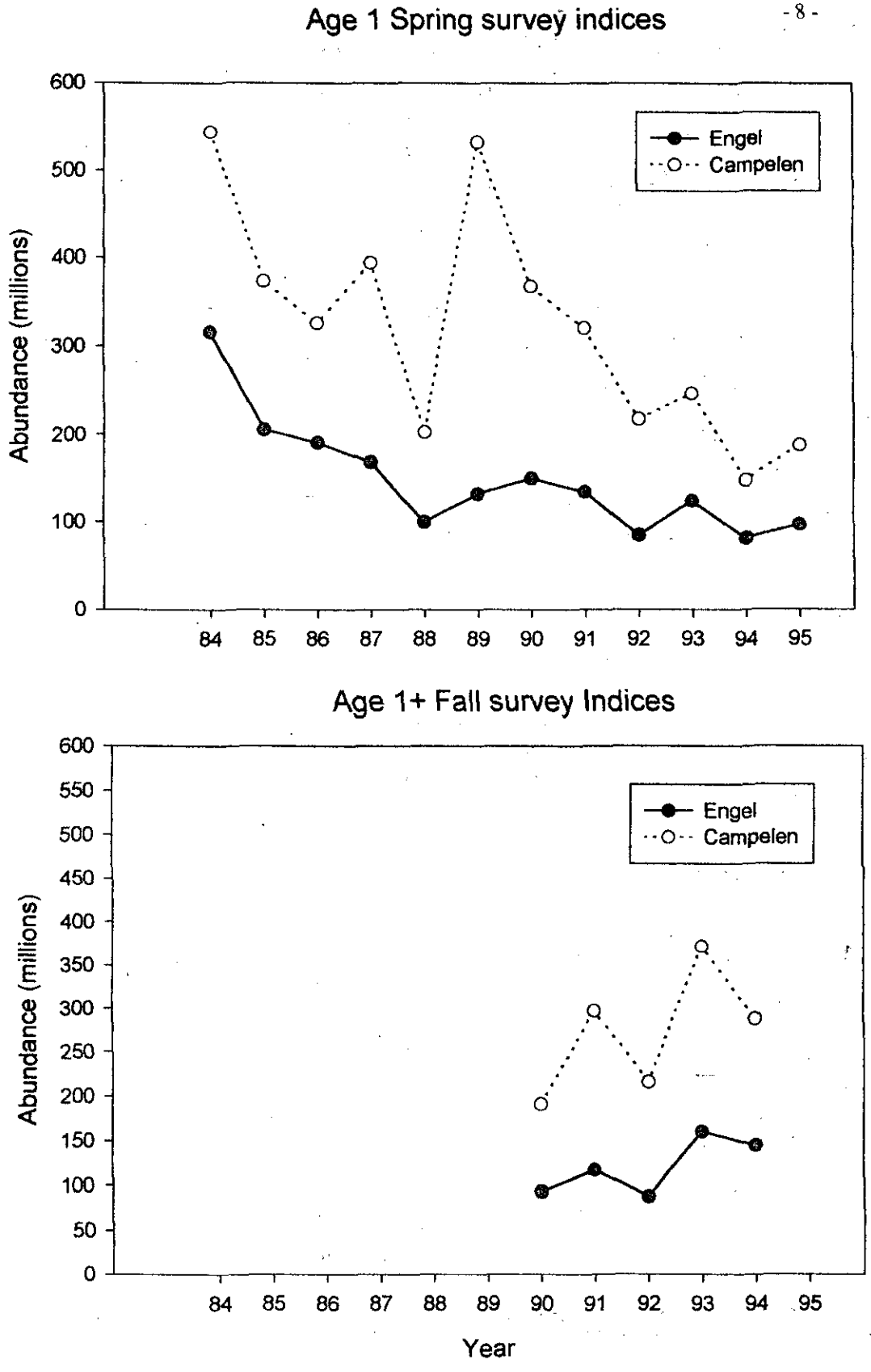

Fig. 3. Abundance indices at age 1+ for yellowtail flounder from 1990-94 Engel 145 otter trawl survey and converted into Campelen Trawl units, Div 3LNO.

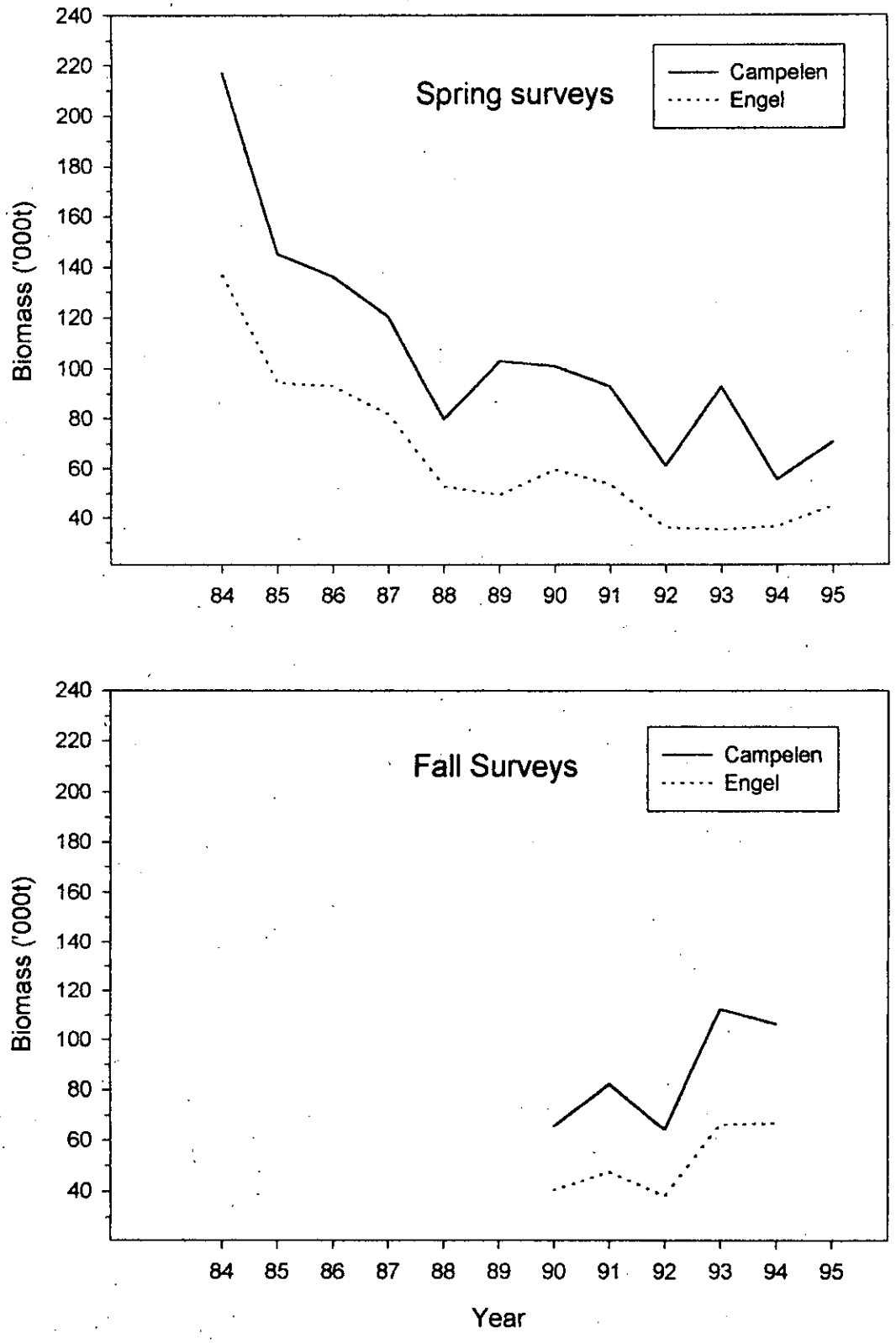

Fig. 4. Comparison of yellowatil flounder survey indices from the Engel trawl with converted indices from the Campelen trawl, Div. 3LNO.

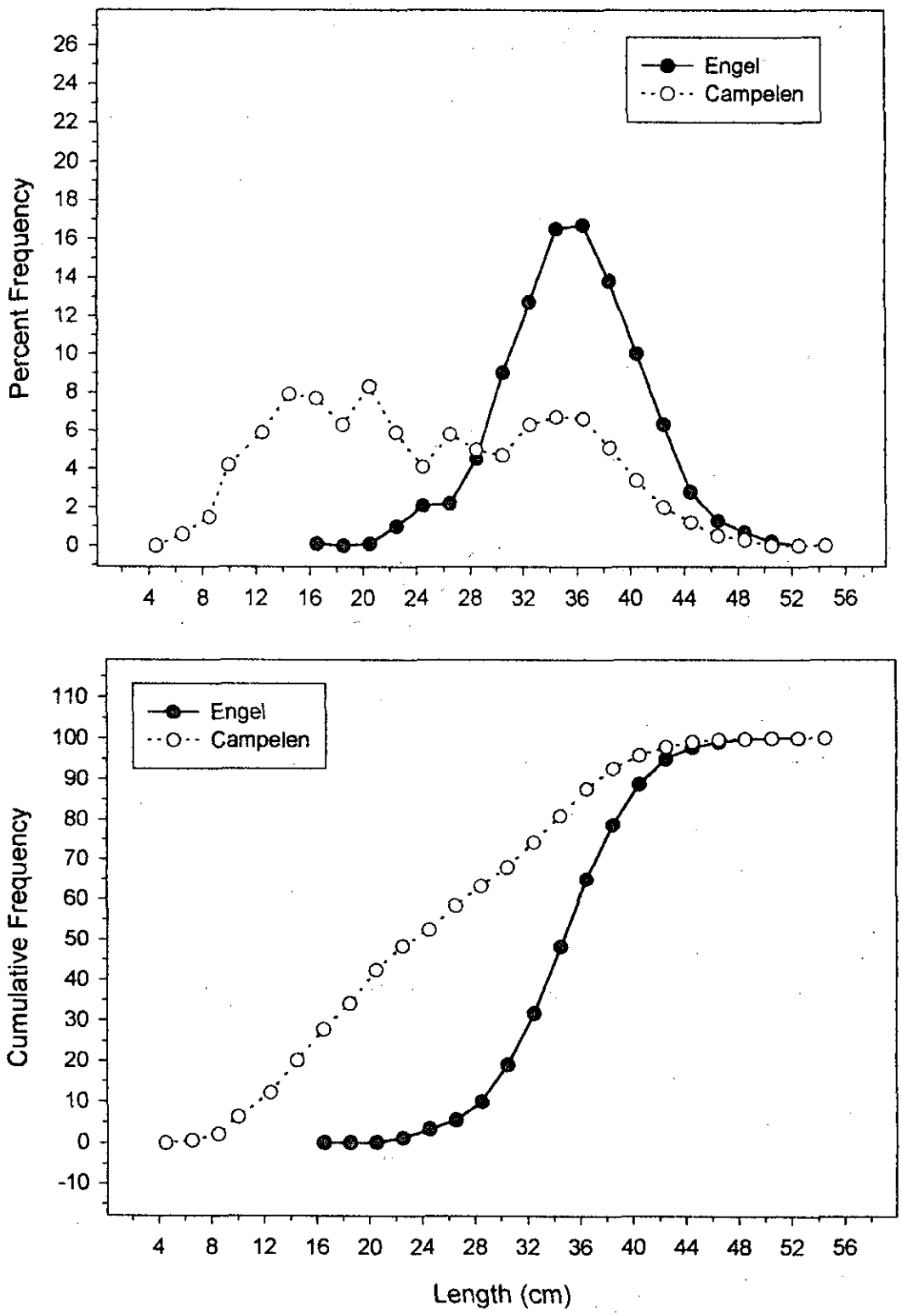

Fig. 5. A comparison of the relative efficiency of survey trawls in catching yellowtail flounder during the 1995 spring (Engel) and fall (Campelen) groundfish surveys of Div. 3LNO.