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Biological and catch and effort data from the Norwegian Fishery for Shrimp on  
Flemish Cap, 1995-1996.

by

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### INTRODUCTION

Norwegian trawlers have conducted a fishery on 3-M shrimp since 1993. In addition to the observer reports given to Canadian authorities, the vessels have to complete standard log books which are routinely submitted to the Directorate of Fishery. This paper update information from this fishery. A time series model is proposed to account for seasonal effects in the catch per unit effort data, which can be used to resolve a time trend in the data.

### MATERIAL AND METHODS

The catch and effort data are collected by haul, but are available on an electronic format by day. Thus, for every day total catch (kg) and effort (hours trawling) make up the basic data for further analysis.

The catches are known to show substantial seasonal variation. If effort to some extent change between years and/or shift among seasons, a misleading trend in CPUE (catch per hour trawling) may arise. Therefore, a model for isolating the seasonal effect has been tried. Due to the lack of data in some months of the year, the data has been pooled by quarter before analysis. The PROC X11 was used to isolate seasonal effects. Analysis was performed by the SAS system.

Canadian observers on board Norwegian shrimp trawlers obtained set and catch and length composition data in Div. 3M in both 1995 and 1996. This program is funded and the data made available by the Government of Norway.

### RESULTS

The seasonal effect in the CPUE data are demonstrated in Table 1 and Figure 1. After the initial drop in the CPUE during the first months of the fishery, catches have regularly been highest during the spring-early summer. With the lack of data in 1996, it is difficult to predict trends. By removing the seasonal effect, the time series analysis may assist in understanding changes in CPUE towards the end of the time series. Figure 2 shows observations, seasonal trend and finally the adjusted time series. As can be seen, after the reduction of the high "virgin stock" level arising from the strong 1988 year class, there are no apparent trend in the CPUE data (adjusted in Fig. 2) in recent years.

Figure 3 shows the distribution of fishing activity by month and year. Effort was spread over a wider range in 1996, compared to 1995, and was concentrated in the north in April and May. Also, the eastern slope was fished more extensively in 1996.

Sampling data for 1996 (Fig. 4) show the dominance of a single mode of male shrimp at 20 mm and female mode at 25 mm. The 1995 catches were composed primarily of male shrimp forming prominent modes at 16 and 21 mm.

Table 1. Catch (tonnes) and effort (hours) data by month as reported in Norwegian log books  
The SAS System 13:01 Friday, September 6, 1996

OBS	DATE	CATCH	EFFORT	CPUE
1	MAY93	235	428	548
2	JUN93	1753	4180	419
3	JUL93	1729	5652	306
4	AUG93	1270	4906	259
5	SEP93	893	3544	252
6	OCT93	789	3429	230
7	NOV93	362	1931	187
8	DEC93	152	582	262
9	JAN94	456	1816	251
10	FEB94	786	2798	281
11	MAR94	456	2547	179
12	APR94	349	1590	219
13	MAY94	843	2883	293
14	JUN94	2145	8412	255
15	JUL94	1555	6484	240
16	AUG94	1031	5486	188
17	SEP94	533	3108	171
18	OCT94	256	1755	146
19	DEC94	50	204	247
20	JAN95	28	149	189
21	FEB95	112	455	247
22	MAR95	139	483	288
23	APR95	396	1566	253
24	MAY95	1504	4996	301
25	JUN95	2621	8839	297
26	JUL95	2548	9734	262
27	AUG95	1319	6247	211
28	SEP95	548	3316	165
29	OCT95	277	1474	188
30	NOV95	32	292	110
31	DEC95	10	82	125
32	APR96	253	1251	202
33	MAY96	492	2159	228
34	JUN96	578	2470	234

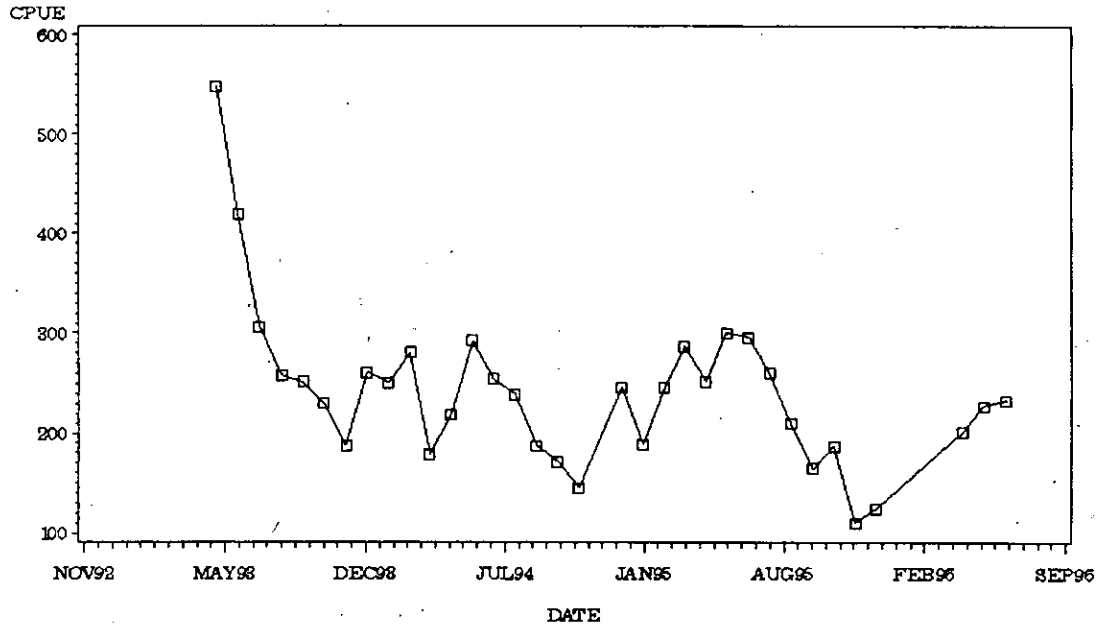


Fig. 1. Catch per hour trawling by month of Norwegian vessels as reported in log books.

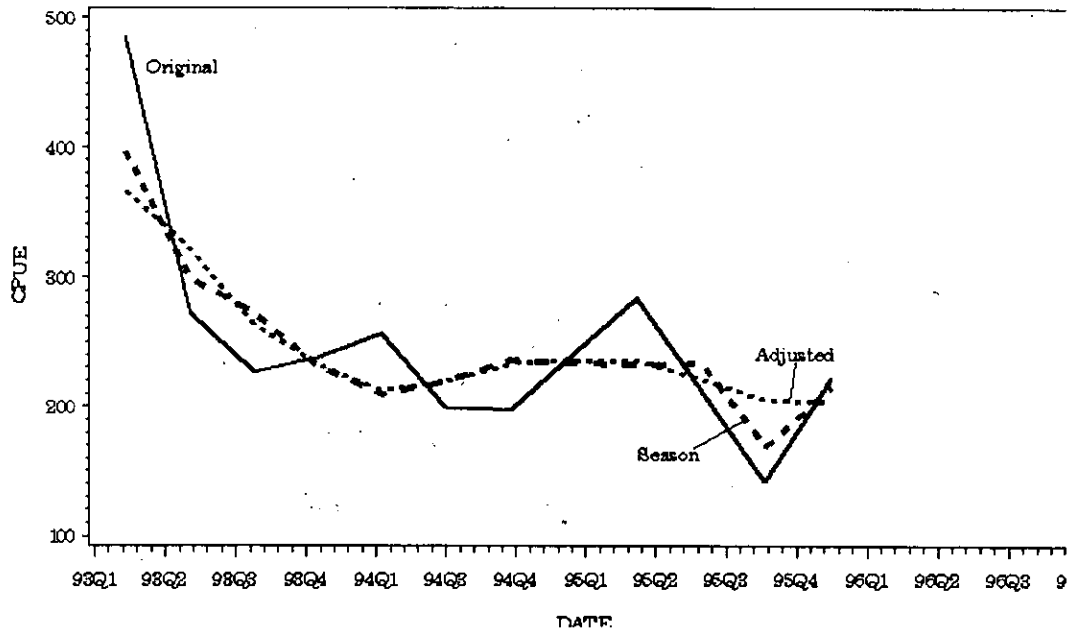


Fig. 2. Observations (Original) seasonal component (season) and adjusted time series of CPUE by quarter. Analysis by Proc X11 in the SAS system.

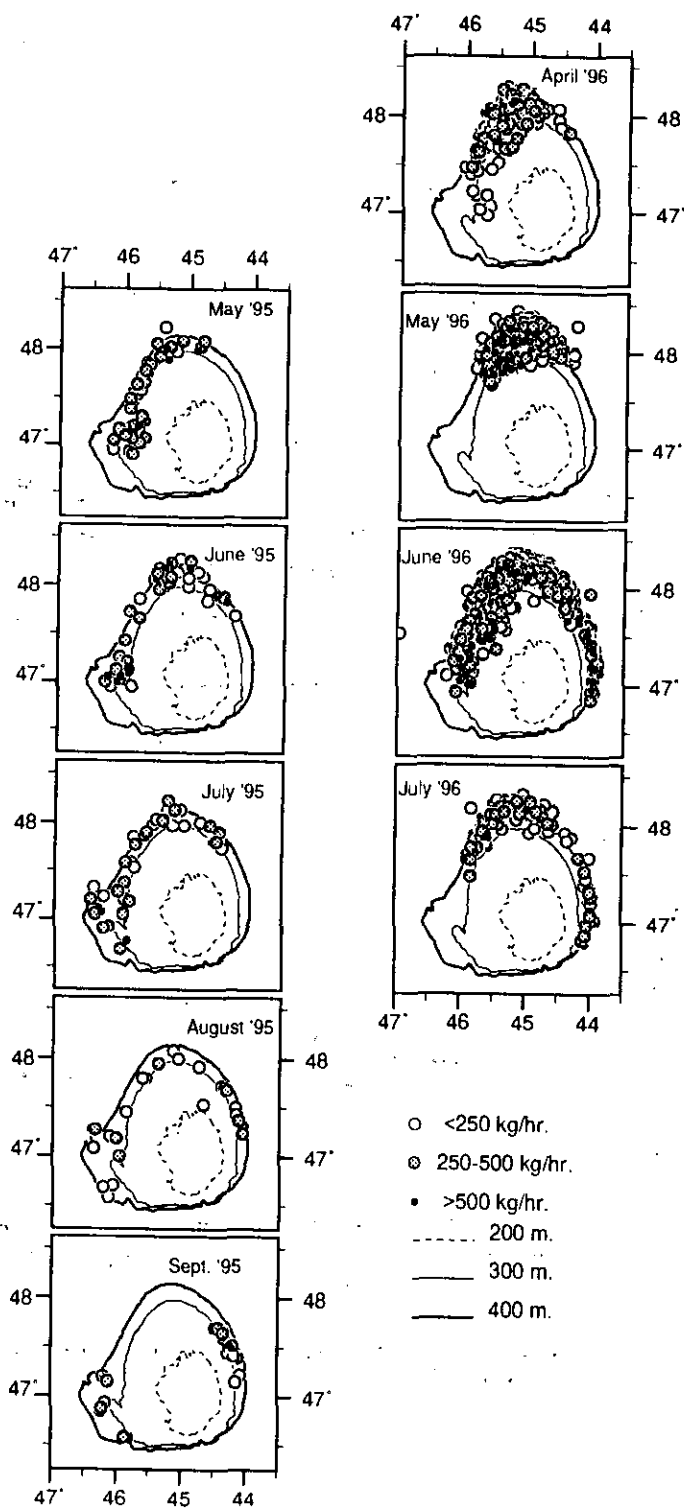


Fig. 3. Distribution of Norwegian fishing effort in NAFO Div. 3M, 1995-1996.

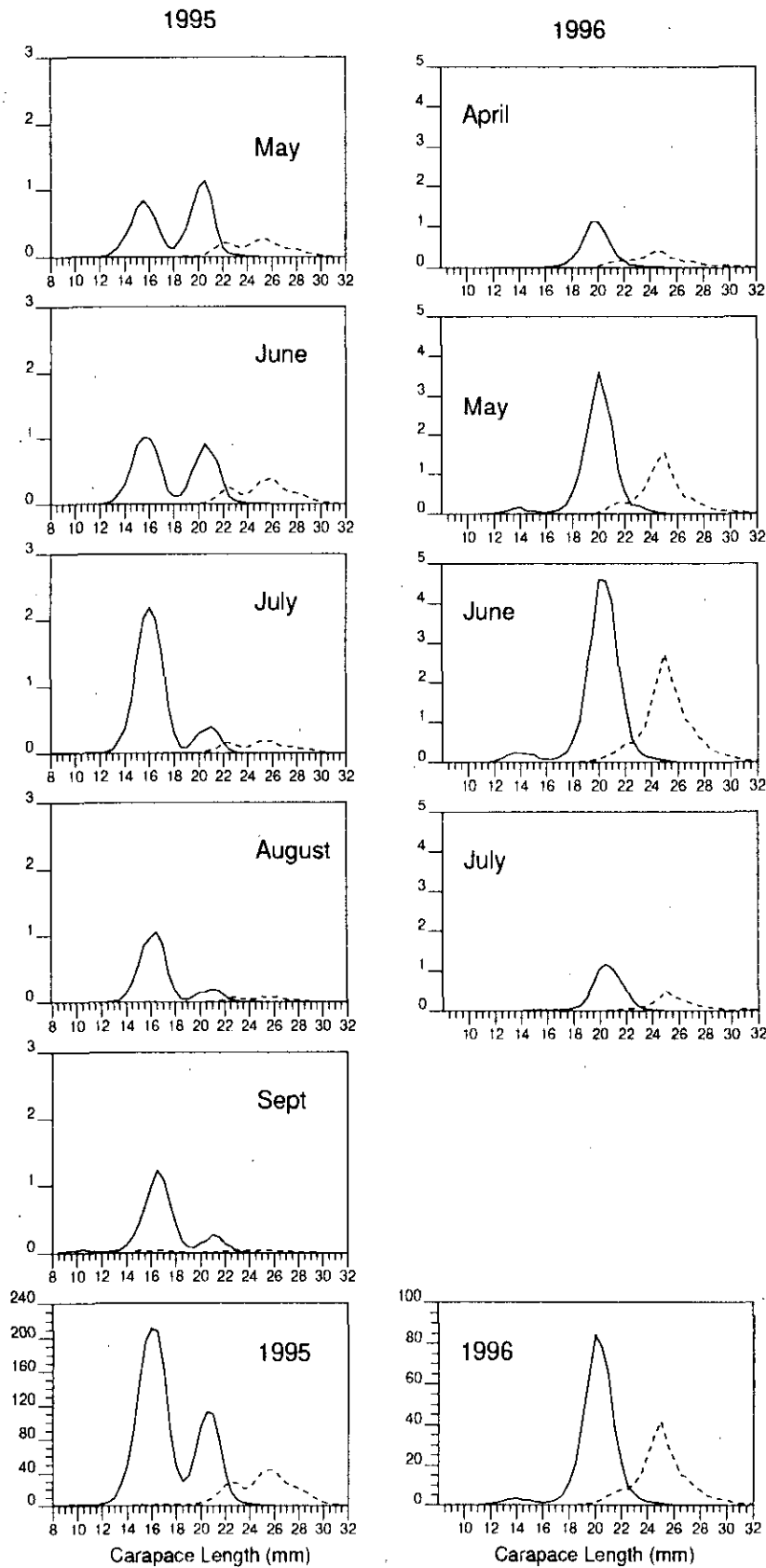


Fig. 4. Catch-at-length (millions) by Norway in NAFO Div. 3M, 1995 and 1996. Solid-line = males, broken line = females.