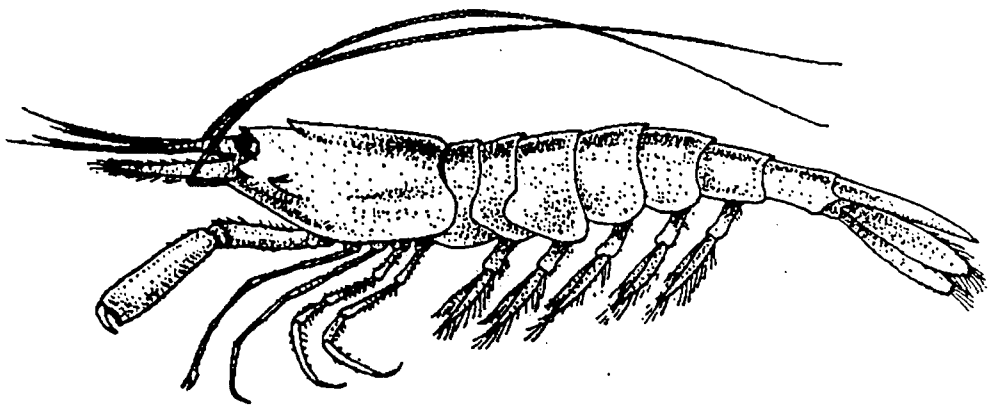
ICES CM 1995/K:6

REPORT OF THE
WORKING GROUP ON *CRANGON* FISHERIES AND LIFE HISTORY



International Council for the Exploration of the Sea
Conseil International pour l'Exploration de la Mer

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1 INTRODUCTION

At the 1992 Statutory Meeting, the Shellfish Committee recommended that a Study Group on the Life History, Population Biology and Assessment of *Crangon* be established to address concerns raised about the instability of *Crangon crangon* landings and uncertainties of the causes of this observation. This recommendation was approved and the Study Group met in 1993 and 1994 and presented reports at the 1993 and 1994 Statutory meetings, respectively.

As it became clear that, despite the good progress in gathering data concerning the objectives of the Study Group, there are considerable gaps in knowledge about the life cycle of *Crangon* in its range of distribution and that continuous work is required for obtaining sound databases, it was recommended by the Shellfish Committee at the 1994 Statutory Meeting to terminate the Study Group and to establish a Working Group on *Crangon* Fisheries and Life History (WGCRAN). This recommendation was approved by the Council.

The Working Group met by correspondence in 1995 as assessment matters were transferred to the Study Group on the Assessment of Shellfish Stocks in the North Atlantic.

The terms of reference given to the Working Group on *Crangon* Fisheries and Life History in 1994 (C.Res. 1994/2:46) were to:

a) update a time series of data on landings efforts and LPUE by functional unit and country;

b) analyse time series on the abundance of *Crangon* and its predators, using data from appropriate bottom trawl surveys;

c) review investigations on the *Crangon* life cycle, including studies on the timing of reproduction and settlement;

d) develop data analyses and methods for estimating the mortality of *Crangon* due to predators;

e) analyse eventual changes in environmental parameters which can have an impact on shrimps, their predators, or food organisms;

f) review the status of investigations improving the selectivity of shrimp trawls for fish and shrimps;

g) develop priorities for future work;

h) plan for a meeting in 1996.

The following members were nominated to the Working Group on *Crangon* Fisheries and Life History:

Bennett	(UK)
Breckling	(D)
Cascalho	(P)
Chapman	(UK)
Damm	(D)
Kinnear	(UK)
Knust	(D)
Sand Kristensen	(DK)
Meixner	(D)
Neudecker (Chairman)	(D)
Richard	(USA)
Temming	(D)
Tetard	(F)
Wienbeck	(D)

2 THE FISHERIES

2.1 General Information

All members of WGCRAN were informed by the ICES Secretariat or the Chairman about the terms of reference of the group. The requested information on data by functional unit and country as recommended by the former Study Group were presented by correspondence as far as it was available. However, the status of these data is rather variable and incomplete. This may be due to a number factors, for example, some countries did not nominate members to the Working Group; there is a general lack of manpower to computerize existing data; the retirement of the person responsible for the data or an unstable job situation; the lack of an accessible and standardized European brown shrimp database; and the general trend of increasing duties which reduces the capability of individual members to devote time to a specific job (such as WGCRAN) and its requirements. Thus, it seems inevitable that members are motivated to acquire external funds for projects that enable them to work on specific tasks. See chapters 3 to 7.

Concerning functional units (FU), it is obvious that some overlapping occurs. This seems to be tolerable in those instances where vessels from neighbouring harbours catch similar amounts in the respective neighbouring FU. Nevertheless the actual amounts should be known. This is of special importance in those cases where long-distance fishery takes place, e.g., the "Sylt Area" in FU 3 and FU 2. Here catches are attributed to the home port of the vessel which may be far away from the fishing ground. The catch will then be shifted to a far away FU biasing area-based fishery information. Another problem that occurs and will probably continue to occur is unallocated catches.

In addition, it has not been possible to standardize fishing effort. It still varies from hp-corrected fishing hours per day to number of boats operating or numbers of cruises, if data are given at all. As a consequence the information on LPUE is highly variable and not directly comparable.

2.2 Functional Units

The functional units were agreed on at the 1994 meeting of the *Crangon* Study Group (see ICES, 1994; Figs. 3.1.1 and 3.1.2, p. 19). It is believed that they serve as the smallest managable unit for statistical and biological matters dealt with by this Working Group, aside from case studies.

The data presented to WGCRAN are listed in Tables 1–9 and Figures 1–33. They appear in the same order as in the 1994 report of the Study Group: long-term data on landings, effort and LPUE and seasonal data on landings, effort and LPUE for 1994 and the last ten years (1985 to 1994).

2.3 Countries

2.3.1 Denmark

2.3.1.1 Areas fished

No change of information. (See p. 4, ICES, 1994.)

2.3.1.2 Long-term trends in landings, effort and LPUE

The Danish brown shrimp fisheries data were given by quarter, year, FU and fleets. Unallocated data (area not specified) could not be used for the part of the functional units but were integrated in the national Danish statistics, while German and Dutch landings were neglected. According to official information these data are incorporated in the foreign fleets statistics respectively. They would be accounted for twice as it was erroneously done in 1993 for total Danish landings.

All recent data concerning landings, effort and LPUE aggregated from each FU plus foreign fleets are listed in Tables 10, 11 and 12 and plotted in Figures 34, 35 and 41.They are newly recalculated data and differ slightly from the 1994 report (ICES, 1994).

German vessels landed 222 tonnes of brown shrimps in Danish harbours in 1994, while 375 tonnes were reported for Dutch landings caught in Danish waters and landed in Danish harbours. The 1994 landings for Danmark (Danish fleet only) are 1574 tonnes, caught within 3468 fishing days. This gives a LPUE value of 454 kg/day, while the reported CPUE value is 1642 kg/day, which requires further discussion.

Industrial shrimps are not fished for by Danish vessels.

2.3.1.3 Seasonal fluctuations in landings, effort and LPUE

There was no further information on changes in seasonality (refer to Tables 13–15 and Figures 47–52). However, recent data are given quarterly.

2.3.2 Germany

2.3.2.1 Areas fished

No changes in fishing grounds were observed for 1994 meaning that the "SYLT AREA" was fished by some larger vessels doing "long distance fishing" while the majority of the fleet stayed in the vicinity of their base harbours. The existing catch statistics were worked up backwards to 1985 and it was possible to attribute landings, effort (number of trips) and LPUE (tonnes per trip) to functional units 3 to 6. The data are preliminary, however, as it appears that they are combined fish and shrimping trips for some harbours. The effort data must be checked for this type of bias. This may be possible within a general effort study before older data are included in the time series. The uncertainty due to the above mentioned long distance fishery which is done by some cutters at certain times will also be dealt with in an effort study. It should give some information on the extent of this fishing practice and its share of the landings of certain ports and functional units.

2.3.2.2 Long-term trends in landings, effort and LPUE

Landings (11358 tonnes in 1994) rose to a higher level again matching parts of the 80th (Table 10 and Figure 34). Effort can still only be roughly estimated from the number of trips reported to the authorities (Table 11 and Figure 36). The total number of trips (25564) was in the same order of magnitude as in previous years. Fishermen are complaining about the enormous strain encountered by fishing an increased number of fishing hours in addition to the use of improved technical equipment. This ultimately means an increase of fishing effort which still needs to be documented. Data prior to 1984 are available until about 1954 but have not been processed yet. LPUE data (Table 12 and Figure 42) are consequently misleading because of inadequate units.

No foreign landings in German ports are known.

2.3.2.3 Seasonal fluctuations in landings, effort and LPUE

Seasonal changes in landings showed an average pattern. (Table 13 and Figures 47 and 48).

Seasonal effort and LPUE are plotted in Figures 49–52.

2.3.3 The Netherlands

The Netherlands did not nominate a member to the Working Group; consequently, no official data were reported.

2.3.3.1 Areas fished

No change of information (ICES, 1993; Figs. 2.3 and 2.3.3.1; ICES, 1994). No information on functional units was available.

2.3.3.2 Long-term trends in landings, effort and LPUE

Only the 1994 data for landings, effort and LPUE were presented for total fleet because the scientist in charge of the crangon fisheries retired and a replacement has not been chosen yet.

The work up and computerization of available high quality data is neccessary.

2.3.4 Belgium

The Belgian reporting system is known to be the best in shrimp fisheries statistics. In 1995, however, Belgium did not nominate a member to the Working Group; consequently, no official data were reported.

2.3.5 France

2.3.5.1 Areas fished

The information reported in ICES (1993, 1994) is still valid. However, data were presented by FU as far as possible. Areas with very small landings did not report (FU 16 to FU 19). France did however report its landings, effort and LPUE off the Belgian coast (FU 10) by year which are listed in Tables 1–3 and plotted in Figures 3, 7 and 11, respectively.

2.3.5.2 Long-term trends in landings, effort and LPUE

Landings data for the French shrimp fisheries (Table 10) are available from 1970, effort data from 1985 (Tables 11 and 12). However, they are preliminary and only contain information from ICES areas IV and VIId, the most important areas (Figures 34, 39 and 45).

2.3.5.3 Seasonal fluctuations in landings, effort and LPUE

No seasonal data were reported for 1994. (Refer to the relevant chapters of ICES, 1993, 1994.)

2.3.6 United Kingdom

2.3.6.1 England and Wales

No data were reported for 1994.

2.3.6.2 Scotland

Complete data were presented and are incorporated in Tables 10–12 and Figures 34, 40 and 46.

3 TIME SERIES ON ABUNDANCE OF *CRANGON* AND ITS PREDATORS

No information was reported except from Germany where a national research project has been started to computerize historic by-catch data from the shrimp fisheries. This project may continue until the end of 1997 making available on computer a set of data containing information on shrimp and by-catch from a total of 13000 hauls in three different regions from 1955 to 1994. The sampling programme is intended to continue but suffers from discontinuity. It may be combined with the area-based Demersal Young Fish Survey and be merged in a trilateral Danish-German-Dutch Monitoring Programme of the Wadden Sea. It is evident that the lack of manpower hampers progress in the evaluation and continuation of analysing existing time series data.

Damm *et al.* (1995) have analysed part of the forty years time series of *Crangon* data and found a reduced average length in the consumption size of shrimps which might be related to higher mortality. Reproductive potential of the stock decreases with decreasing size of the shrimps but no effect on landings was found.

4 *CRANGON* LIFE CYCLE

No progress was made scientifically. However, the outcome of the *Crangon* Study Group was used to formulate an EU-proposed project called CRANGON which covers all aspects of concern under this topic. It is unclear, though, when and if the project will be approved.

5 MORTALITY ESTIMATES

No activities were reported for developing data analyses and methods for estimating the mortality of *Crangon* due to predators. Activities may be started in the course of the intended CRANGON project.

6 ENVIRONMENTAL PARAMETERS

As part of an ongoing national project (see chapter 3) environmental aspects like water temperature, winter conditions, weather and wind situations may be linked with the abundance of brown shrimp and its predators, etc., in a scientific study of the German coast. No further activities or planned projects were reported.

7 SELECTIVITY OF SHRIMP TRAWLS

Efforts are being made in Denmark, Germany, The Netherlands, Belgium, France and Great Britain through an EU-funded study called RESCUE to assess the technical status of shrimp fleets in those countries and, eventually, to determine differences in discards within the fleets for future technical improvements for ecological and economical benefits in these fisheries. This EU-study will be terminated in spring 1997.

National projects deal with improvements of selectivity of shrimp gears in some countries.

8 RECOMMENDATIONS

As not all brown shrimp fishing countries appointed members to the Working Group for 1994/1995, it is recommended that participants are nominated in future from these countries.

Due to the slow progress made in 1994/1995 the recommendations from 1994 are still valid:

8.1 Research

Topics for research:

1) Trends in population levels of shrimp and predator fish.

2) Changes in the exploitation patterns on *Crangon*, by-catch fish, and discards.

3) The level and pattern of predation mortality on *Crangon*.

4) Changes in environmental parameters which could have an impact on the productivity of food species of *Crangon*.

5) Resolve certain conflicting aspects of the life cycle of *Crangon* taking into account geographic and hydrographic differences.

6) Assess the possible effects of changes in exploitation activity and pattern on *Crangon* size composition and consequent recruitment potential.

7) Evaluate the role of *Crangon* in the ecology of North Sea estuarine and coastal areas.

8) Develop fishing and handling techniques to reduce the numbers of by-caught fish and small shrimps, and improve the survival of discards.

8.2 Action List

1) Analyse the demersal young fish and brown shrimp survey data series for trends in *Crangon* and predator abundance.

2) Analyse existing effort data series to calculate LPUE time trends, allowing for documented changes in fishing power.

3) Examine existing data series for trends in *Crangon* size composition.

4) Initiate the collection of full fishery statistics by FU.

5) Examine the possible impact of the Danish closed nursery area and limited entry fishery on productivity of *Crangon*.

6) Investigate the timing of larval production and settlement to identify the relative importance recruitment of summer and winter egg production.

7) Continue the studies of the *Crangon* life cycle, paying particular attention to aspects of reproduction, recruitment, and growth.

8) Analyse changes in environmental parameters believed to have an impact on shrimps and their food organisms and predators.

9) Improve fish and shrimp selectivity in shrimp trawls by the study of (a) square meshes in codends, (b) sorting grids, (c) sieve (veil) net size and shape, (d) whole net mesh size, (e) ground rope and tickler chain configurations.

9 FUTURE MEETING

A meeting of four working days is recommended for early June 1996.

10 LITERATURE

ICES. 1993. Report of the Study Group on the Life History, Population Biology and Assessment of *Crangon*. ICES CM 1993/K: 8.

ICES. 1994. Report of the Study Group on the Life History, Population Biology and Assessment of *Crangon*. ICES CM 1994/ K: 3.

Damm, U.,. Neudecker, T., and Temming, A. Trends in the stock of brown shrimp (*Crangon crangon* L.) off the German coast. ICES Århus Symposium revisited, poster-paper submitted for publication.

Table 1: Long term landings of Brown Shrimp per Functional Unit and years 1985 to 1994

Country	Denmark		Germany				The Netherlands			Belgium	England
tons	FU 1	FU2	FU 3	FU 4	FU 5	FU 6	FU 7	FU 8	FU 9	FU 10	FU 11
85			2709	3835	2563	3107				80	
86	103	76	2700	3155	2100	3269				45	
87	218	999	2731	3591	1976	3369				41	
88	55	1127	2586	3660	2005	2250				82	
89	289	853	2079	2867	1812	2138				123	
90	239	339	1004	1282	1257	1180				49	
91	252	542	1912	2913	2022	2102				58	
92	514	1791	1929	2590	1645	1545				51	
93	293	1118	2073	2593	1820	2602				58	
94	400	1138	2448	3470	2416	3024					
mean	263	887	2217	2996	1962	2458				65	

Country	England		France						UK Irish Sea		Total
tons	FU 12	FU 13	FU 14	FU 15	FU 16	FU 17	FU 18	FU 19	FU 20	FU 21	
85			300	198	0					14	12805
86			279	355	0					19	12100
87			287	256	0					28	13496
88			172	199	0					27	12163
89				268	0					31	10460
90			82	92	0					49	5574
91			128	69	0					54	10052
92			100	91	0					64	10319
93			72	136	0					146	10911
94					0					146	13041
mean			178	185	0					58	11268

Table 2: Long term effort of Brown Shrimp Fisheries per Functional Unit and years 1985 to 1994
NOTE: Effort units differ considerably among countries FU10 data: only French effort in FU10

Country	Denmark		Germany				The Netherlands			Belgium	England
Unit:	days		No. of Trips							boat-mont	
	FU 1	FU2	FU 3	FU 4	FU 5	FU 6	FU 7	FU 8	FU 9	FU 10	FU 11
85			5026	6210	6313	11681				115	
86	230	72	5122	6147	6191	12513				86	
87	476	1512	5584	6469	6872	11506				57	
88	188	1864	5427	6595	7362	11249				99	
89	573	2347	5429	6027	7071	12829				133	
90	671	1353	3498	3970	6380	11233				52	
91	1008	1733	3613	4215	6790	11961				49	
92	766	3140	3290	3901	6830	9389				36	
93	754	2696	3499	4199	6746	12330					
94	857	2611	3473	4366	6553	11172					
Mean	614	1925	4396	5210	6711	11586				78	

Country	England		France						UK Irish Sea		Total
Unit:			boat-month							hours	
	FU 12	FU 13	FU 14	FU 15	FU 16	FU 17	FU 18	FU 19	FU 20	FU 21	
85			567	485	31					437	
86			489	467	28					362	Not compar-
87			378	556	25					1848	able
88			315	548	30					2669	effort
89			287	533	5					808	units
90			182	364	13					1686	
91			146	285	8					3390	
92			198	346	4					1364	
93										11360	
94										9580	
Mean			320	448	18					3350	

Table 3: Long term LPUE/CPUE of Brown Shrimp Fisheries per Functional Unit and years 1985 to 1994
NOTE: Effort units differ considerably among countries FU10 data: only French effort in FU10

Country	Denmark		Germany				The Netherlands			Belgium	England
	CPUE (kg/day)		tons / No. of trips							see FU14	
tons	FU 1	FU2	FU 3	FU 4	FU 5	FU 6	FU 7	FU 8	FU 9	FU 10	FU 11
85			0,54	0,62	0,41	0,27				696	
86	1725	3377	0,53	0,51	0,34	0,26				523	
87	2017	2176	0,49	0,56	0,29	0,29				719	
88	1156	2215	0,48	0,55	0,27	0,20				828	
89	1526	1529	0,38	0,48	0,26	0,17				925	
90	979	708	0,29	0,32	0,20	0,11				942	
91	1297	1274	0,53	0,69	0,30	0,18				1184	
92	2271	2199	0,59	0,66	0,24	0,16				1417	
93	1456	1400	0,59	0,62	0,27	0,21					
94	1642	1536	0,70	0,79	0,37	0,27					
Mean	1563	1824	0,51	0,58	0,29	0,21				904	

Country	England		France						UK Irish Sea		Total
			kg / boat - month							catch/h	
tons	FU 12	FU 13	FU 14	FU 15	FU 16	FU 17	FU 18	FU 19	FU 20	FU 21	
85			529	408						32	
86			571	760						52,5	Not
87			759	460						15,2	compar-
88			546	363						10,1	able
89				503						38,4	effort
90			451	253						29,1	units
91			877	242						15,9	
92			505	263						46,9	
93										12,9	
94										15,2	
Mean			605	407						27	

Table 4: Seasonal landings of Brown Shrimp Fisheries per Functional Unit and years 1985 to 1994

	tons	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
*	FU 1			36			159			30			37
*	FU2			74			370			237			205
	FU 3	10,23	3,89	46,51	156,86	175,99	198,63	204,92	250,58	398,84	431,77	258,66	80,21
	FU 4	24,11	17,35	70,32	205,15	174,99	202,63	242,91	427,24	606,78	615,56	309,96	98,63
	FU 5	5,88	25,33	295,43	1108,86	1220,71	1674,78	2160,25	3076,37	4031,66	3791,71	1803,87	367,24
	FU 6	3,96	0,83	26,44	151,65	158,79	188,72	233,82	292,27	450,82	555,68	321,05	74,36
	FU 7												
	FU 8												
	FU 9												
	FU 10												
	FU 11												
	FU 12												
	FU 13												
	FU 14												
**	FU 15	5,77	2,63	4,3	8,83	8,1	6,04	7,14	12,36	38,12	44,51	31,31	15,8
	FU 16												
	FU 17												
	FU 18												
	FU 19												
	FU 20												
	FU 21	1	1,5	1,3	3,2	6,1	4,3	5,1	4,8	7,5	9,8	10,3	2,9
	Mean	8,49	8,59	69,29	272,42	290,78	350,51	475,69	677,27	725,09	908,17	455,86	110,14
	Total	50,95	51,52	554,28	1634,54	1744,69	2804,10	2854,14	4063,62	5800,71	5449,03	2735,15	881,14

* Danish data quarterl ** average 1985 - 93

Table 5: Seasonal effort of Brown Shrimp Fisheries per Functional Unit and years 1985 to 1994
NOTE: Effort units differ considerably among countries

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	Units
* FU 1			120			305			81			108	days
* FU2			223			723			547			432	
FU 3	16	5	83	374	488	521	544	566	689	591	396	124	No. of
FU 4	36	25	142	448	456	519	614	819	847	736	442	127	trips
FU 5	30	18	164	596	743	829	884	950	983	877	548	89	
FU 6	15	13	123	1139	1447	1445	1538	1443	1574	1533	1045	272	
FU 7													
FU 8													
FU 9													
FU 10													
FU 11													
FU 12													
FU 13													
FU 14													
** FU 15	26	24	31	36	36	33	33	40	51	49	46	39	boat-mon
FU 16													
FU 17													
FU 18													
FU 19													
FU 20													
FU 21	106,8	101,4	123,5	161,8	475,6	397,2	310	248,9	432	502,6	319,7	170,9	hours

* Danish data quarterl ** average 1985 - 93

Table 6: Seasonal LPUE/CPUE of Brown Shrimp Fisheries per Functional Unit and years 1985 to 1994
NOTE: Effort units differ considerably among countries

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	Units
* FU 1			277			507			340			439	kg/day
* FU2			269			543			441			571	
FU 3	0,64	0,78	0,56	0,42	0,36	0,38	0,38	0,44	0,58	0,73	0,65	0,64	tons/
FU 4	0,68	0,70	0,49	0,46	0,38	0,39	0,40	0,52	0,72	0,84	0,70	0,78	No. of trip
FU 5	0,20	1,38	1,80	1,86	1,64	2,02	2,44	3,24	4,10	4,32	3,29	4,13	
FU 6	0,27	0,06	0,22	0,13	0,11	0,13	0,15	0,20	0,29	0,36	0,31	0,27	
FU 7													
FU 8													
FU 9													
FU 10													
FU 11													
FU 12													
FU 13													
FU 14													
** FU 15	184	99	125	223	227	182	209	307	785	878	605	365	kg/boat-m
FU 16													
FU 17													
FU 18													
FU 19													
FU 20													
FU 21	9,4	14,8	10,5	19,8	12,8	10,8	16,5	19,3	17,4	19,5	32,2	17	catch/h

* Danish data quarterl ** average 1985 - 93

Table: 7 Seasonal landings of Brown Shrimp Fisheries per Functional Unit 1994

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	Total
FU 1			31,00			265,00			78,00			26,00	400,00
FU2			33,00			447,00			431,00			227,00	1138,00
FU 3	0,06	0,13	18,88	188,23	219,52	238,11	241,42	306,65	361,88	479,25	325,04	68,49	2447,66
FU 4	12,26	9,55	53,16	321,21	264,77	242,53	305,43	489,73	662,31	678,51	356,00	74,10	3469,55
FU 5	0,48	0,10	27,92	156,93	165,99	225,26	289,39	385,44	528,32	410,50	188,71	37,08	2416,11
FU 6	0,00	0,16	25,07	234,56	140,78	186,42	228,38	366,93	567,29	758,78	442,51	72,72	3023,58
FU 7													0,00
FU 8													0,00
FU 9													0,00
FU 10													0,00
FU 11													0,00
FU 12													0,00
FU 13													0,00
FU 14													0,00
FU 15													0,00
FU 16													0,00
FU 17													0,00
FU 18													0,00
FU 19													0,00
FU 20													0,00
FU 21	2,00	4,00	1,00	0,00	19,00	16,00	15,00	20,00	24,00	31,00	14,00	0,00	146,00
Mean	2,96	2,79	27,15	180,18	162,01	231,47	215,92	313,75	378,97	471,61	265,25	72,20	
Total	14,80	13,94	190,04	900,92	810,06	1620,32	1079,62	1568,75	2652,80	2358,04	1326,26	505,39	

Table : 8 Seasonal effort of Brown Shrimp Fisheries per Functional Unit 1994
NOTE: Effort units differ considerably among countries

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	Total	Units
FU 1			162			435			203			57	857	days
FU2			185			985			919			522	2611	
FU 3	1	1	48	309	424	354	495	485	477	443	327	109	3473	No. of
FU 4	22	22	118	492	528	425	502	648	621	523	360	105	4366	trips
FU 5	14	26	172	674	698	879	902	945	877	757	501	108	6553	
FU 6	0	2	176	1473	1364	1162	1358	1385	1438	1469	1162	183	11172	
FU 7													0	
FU 8													0	
FU 9													0	
FU 10													0	
FU 11													0	
FU 12													0	
FU 13													0	
FU 14													0	
FU 15													0	boat-mon
FU 16													0	
FU 17													0	
FU 18													0	
FU 19													0	
FU 20													0	
FU 21	0	0	0	0	1200	1800	1200	1280	1300	1300	1500	0	9580	hours
Mean														
Total														

Table : 9 Seasonal LPUE of Brown Shrimp Fisheries per Functional Unit 1994
NOTE: Effort units differ considerably among countries

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	Total	Units
FU 1			191			609			385			457	1642,00	kg/day
FU2			178			454			469			435	1536,00	
FU 3	0,06	0,13	0,39	0,61	0,52	0,67	0,49	0,63	0,76	1,08	0,99	0,63	6,96	tons/
FU 4	0,56	0,43	0,45	0,65	0,50	0,57	0,61	0,76	1,07	1,30	0,99	0,71	8,59	No. of trip
FU 5	0,03	0,00	0,16	0,23	0,24	0,26	0,32	0,41	0,60	0,54	0,38	0,34	3,52	
FU 6	0,00	0,08	0,14	0,16	0,10	0,16	0,17	0,26	0,39	0,52	0,38	0,40	2,77	
FU 7													0,00	
FU 8													0,00	
FU 9													0,00	
FU 10													0,00	
FU 11													0,00	
FU 12													0,00	
FU 13													0,00	
FU 14													0,00	
FU 15													0,00	kg/boat-m
FU 16													0,00	
FU 17													0,00	
FU 18													0,00	
FU 19													0,00	
FU 20													0,00	
FU 21	0	0	0	0	15,8	8,9	12,5	15,6	18,5	23,8	9,3	0	104,40	catch/h
Mean														
Total														

Table 10:
Long term landings, tons of consumption shrimp as presented to the Crangon Working Group

Tons	Denmark	Germany	Netherlan	Belgium	France	UK	Europe	
Year	total	total	total	total	total	total	total	
50		2637	2657				5294	
51		3302	4734				8036	
52		3286	4224				7510	
53		4295	4157				8452	
54		4456	3437				7893	
55		5641	6358				11999	
56		5412	5933				11345	
57		5689	4401				10090	
58		6501	4201				10702	
59		4431	4726				9157	
60		3603	4296				7899	
61		4496	5587				10083	
62		4012	5287				9299	
63	67	7240	8045				15352	
64	63	6800	8886				15749	
65	131	5714	8047				13892	
66	85	7576	7386				15047	
67	100	4674	7405				12179	
68	110	7807	6559				14476	
69	175	8790	6749				15714	
70	69	9668	7135	1363	2700	0	20935	
71	57	6706	4243	903	2800	13	14722	
72	54	7702	3893	867	2900	10	15426	
73	143	6743	5102	1615	3000	7	16610	
74	176	9483	6096	1264	2041	9	19069	
75	329	8773	5832	1565	1922	1488	19909	
76	660	13446	4908	1607	1632	1546	23799	
77	720	7836	3440	900	1272	1095	15263	
78	1419	9211	3692	614	1443	1367	17746	
79	1252	12264	4933	909	1890	1535	22782	
80	2140	12952	4927	930	1608	1140	23697	
81	2821	10990	4380	808	1407	1202	21607	
82	3107	14060	6074	1407	1157	1435	27240	
83	1972	8777	5994	645	1029	1490	19906	
84	770	8253	4180	641	1313	788	15945	
85	744	13250	6199	588	997	803	22581	
86	1138	11249	7078	491	1327	1901	23184	
87	1734	11698	7789	533	956	3970	26680	
88	1050	10500	6233	498	908	2188	21377	
89	1467	8819	6975	749	757	1939	20706	
90	652	4701	4760	446	502	1221	12283	
91	855	8949	6896	454	259	1001	18414	
92	2409	7705	6934	578	246	1033	18906	*
93	1510	9090	8126	520	268	1783	21297	*
94	1538	11358	8505			146	21547	*

France: 91,92,93 preliminary because some data are missing
U.K.: '74 to '83 and '94 Scotland only, rest including The Wash

Table 11:
Long term effort data as presented to the Crangon Working Group
Note the different units of effort in countries which are not comparable

	Denmark	Germany	Nederlan	Belgium	France	U.K.	Europe
Year	No.vess.		total	total	total	total	total
Units	Fishdays	No.Trips	Fishdays	HPhours	Boat - Mo	Fishhours	
60							
61							
62							
63	3						
64	3						
65	3						data
66	3						in
67	3						this
68	5						form
69	7		28738				not
70	5		21041				compar-
71	2		18554				able
72	5		21685				
73	6		19977	10057,9			
74	8		22868	11137,6		978	
75	10		26185	13782,9		1218	
76	14		16928	12040,2		2476	
77	19		18710	9500,7		1685	
78	33		15899	5642,9		2184	
79	31		15949	6241,9		2294	
80	31		12882	7616		1492	
81	31		12531	6972,8		1552	
82	31		14757	6954,4		1319	
83	22		16317	6302,8		750	
84	23	27404	17740	7531,9		6062	
85	24	29291	16228	6028,5	1198	14137	
86	412	30012	18564	5875,8	1070	15584	
87	2227	30490	17689	5839,2	1016	27001	
88	2216	30641	20060	6248,6	992	21200	
89	3166	31356	22070	7646,1	958	25782	
90	2024	25081	22172	7559,1	611	27713	
91	2765	24561	21748	6984,3	488	21668	
92	4004	24840	21175	7898	584	12566	
93	3522	26837	26086	7055		31849	
94	3558	25564				9580	

Danish effort data from 86 onwards: Fishing days
France: ICES IV and VII d only
U.K.: '74 to '83 and '94 Scotland only, rest including The Wash

Table 12:
Long term CPUE data as presented to the Crangon Working Group
Note the different,not comparable effort units between countries

	Denmark	Germany	Netherlan	Belgium	France	U.K.	Europe
Year	t/vessel	total	total	total	total	total	total
Units	kg/day	t/trip	t/f.day	kg/hph	kg/b.mont	kg/h	
60							
61							
62							
63	22,3						
64	21						
65	43,7						data
66	28,3						in
67	33,3						this
68	22						form
69	25		584,1				not
70	13,8		798				compar-
71	28,5		498				able
72	10,8		477,5				
73	23,8		343,3	0,161			
74	22		671,7	0,114		9,2	
75	32,9		741,5	0,114		10,67	
76	47,1		1057,6	0,133		8,48	
77	37,9		475	0,095		13,64	
78	43		472,9	0,109		9,16	
79	40,4		584,2	0,146		17,22	
80	69		981,4	0,122		20,91	
81	91		886,2	0,116		15,98	
82	100,6		797,5	0,202		20,32	
83	89,6		555,6	0,102		14,27	
84	33,5	0,3	592,3	0,085		27,32	
85	31	0,4524	573,3	0,098	1633	25,00	
86	10496	0,3748	775,2	0,084	1854	48,25	
87	11594	0,3837	736,9	0,091	1938	37,05	
88	8431	0,3427	659,5	0,08	1737	21,60	
89	6976	0,2813	595,3	0,098	1428	32,90	
90	2787	0,1874	453	0,059	1646	21,85	
91	4718	0,3644	740,7	0,065	2303	17,50	
92	9349	0,3102	810,5	0,073	2185	41,65	
93	6169	0,3387	709,5	0,074		24,45	
94	6176	0,4443				15,2	

DK: From 1986 CPUE (kg/day)
F: ICES area IV and VII d only
U.K.: '74 to '83 and '94 Scotland only, rest including The Wash

Table 13:
Seasonal Landings (tons) of consumption shrimp as presented to the Crangon Working Group
A: Data for 1994

tons	Denmark	Germany	Nederlan	Belgium	France	U.K.	Europe
Month	quarterly	total	total	total	total	total	total
Jan		13				2	
Feb		10				4	
Mar	70	125				1	
Apr		901				0	no
May		791				19	data
Jun	730	892				16	
Jul		1065				15	
Aug		1549				20	
Sep	518	2120				24	
Oct		2327				31	
Nov		1312				14	
Dec	256	252				0	

B: 10 years average 1985 - 1994

tons	Denmark	Germany	Nederlan	Belgium	France	U.K.	Europe
Month	quarterly	total	total	total	total	total	total
Jan	*	44				1	
Feb		51				1,5	
Mar	114,8	173				1,3	
Apr		625				3,2	no
May		632				6,1	data
Jun	562	716				4,3	
Jul		901				5,1	
Aug		1277				4,8	
Sep	296	1860				7,5	
Oct		1982				9,8	
Nov		1070				10,3	
Dec	261	294				2,9	

* Danish data: Mean 1986 - 94

Table 14:
Seasonal effort data as presented to the Crangon Study Group
A: Data for 1994

	DK	Germany	Nederlan	Belgium	France	U.K.	Europe
Month	quarterly	total	total	total	total	total	total
Units	Fishdays	No.Trips	Fishdays	HPhours		Fishhours	
Jan		37				0	
Feb		51				0	
Mar	373	342				0	no
Apr		2274				0	compar-
May		2316				1200	able
Jun	1455	1941				1800	data
Jul		2355				1200	
Aug		2518				1280	
Sep	1145	2536				1300	
Oct		2435				1300	
Nov		1849				1500	
Dec	588	397				0	

B: 10 years average 1985 - 1994

	Denmark	Germany	Nederlan	Belgium	France	U.K.	Europe
Month	quarterly	total	total	total	total	total	total
Units	Fishdays	No.Trips	Fishdays	HPhours		Fishhours	
Jan	*	96				106,8	
Feb		61				101,4	
Mar	354	512				123,5	no
Apr		2556				161,8	compar-
May		3135				475,6	able
Jun	1075	3314				397,2	data
Jul		3579				310	
Aug		3778				248,9	
Sep	665	4092				432	
Oct		3737				502,6	
Nov		2431				319,7	
Dec	562	612				170,9	

* average 1986-1994

Table 15:
Seasonal LPUE data as presented to the Crangon Working Group
A: data for 1994

	DK	Germany	Nederlan	Belgium	France	U.K.
Month	quarterly	total	total	total	total	total
Units	kg/Fi.day	t/trip	t/f.day	kg/HPh		kg/h
Jan		0,35				0
Feb		0,19				0
Mar	190	0,37				0
Apr		0,40				0
May		0,34				15,8
Jun	2051	0,46				8,9
Jul		0,45				12,5
Aug		0,62				15,6
Sep	1665	0,84				18,5
Oct		0,96				23,8
Nov		0,71				9,3
Dec	1699	0,64				0

B: 10 years average 1984 - 1993

	Denmark	Germany	Nederlan	Belgium	France	U.K.
Month	DK	total	total	total	total	total
Units	kg/Fi.day	t/trips	t/f.day	kg/HPh		kg/h
Jan	*	0,46				9,40
Feb		0,83				14,80
Mar	288	0,34				10,50
Apr		0,24				19,80
May		0,20				12,80
Jun	558	0,22				10,80
Jul		0,25				16,50
Aug		0,34				19,30
Sep	435	0,45				17,40
Oct		0,53				19,50
Nov		0,44				32,20
Dec	571	0,48				17,00

* average 1986-1994 (Mean of single FU data)

Figure 1

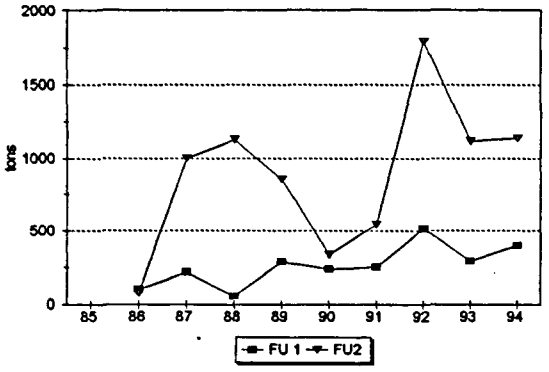


Figure 2

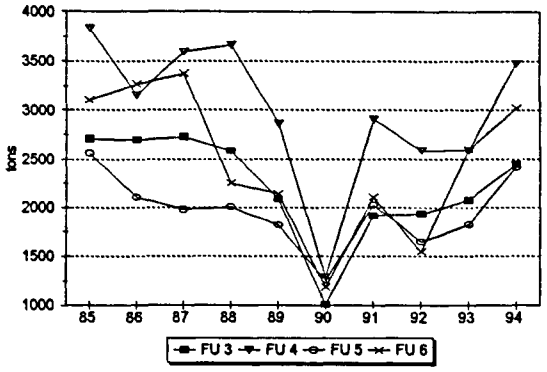


Figure 3

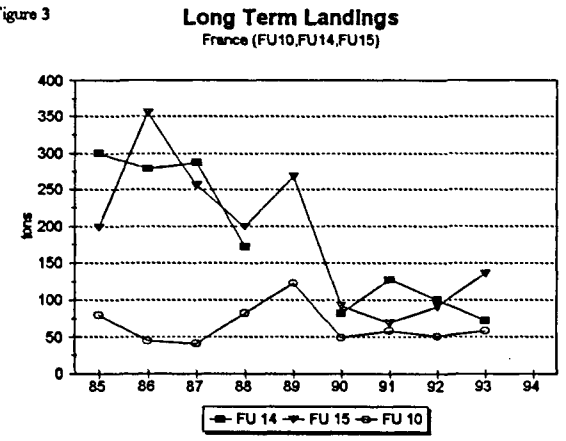


Figure 4

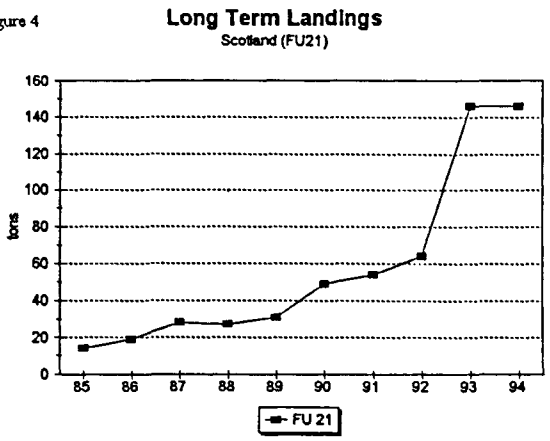


Figure 5

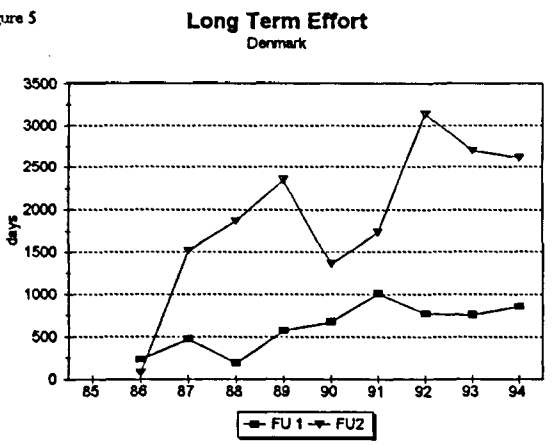


Figure 6

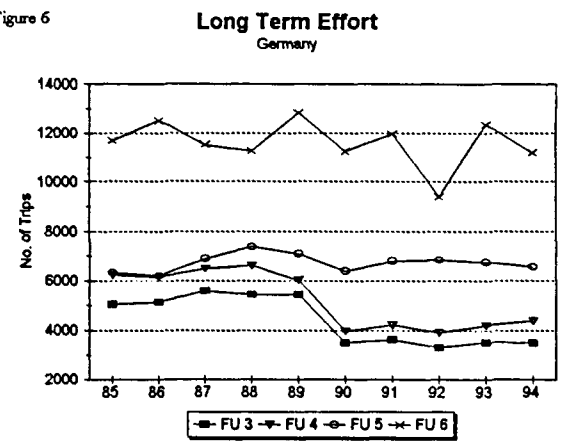


Figure 7

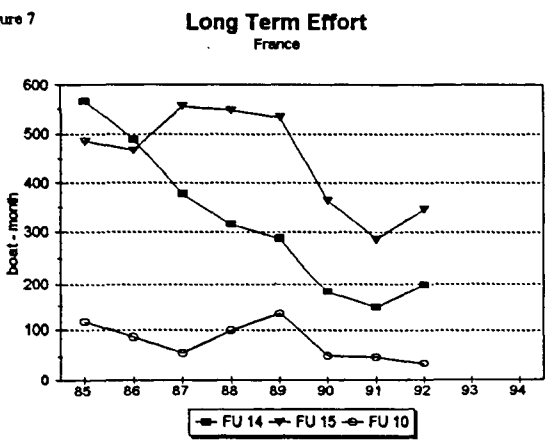


Figure 8

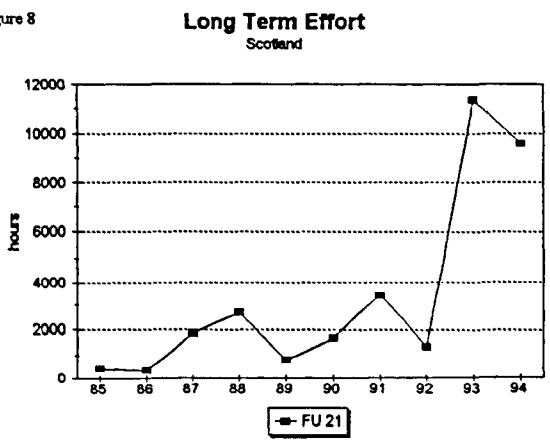


Figure 9

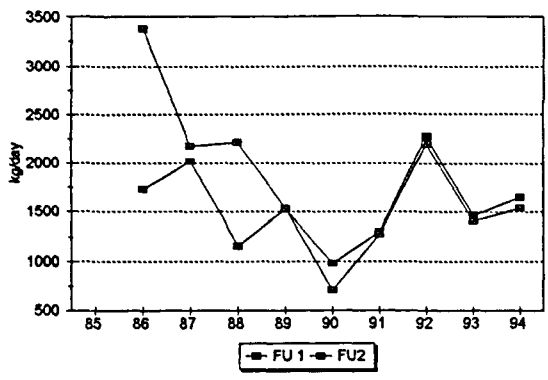


Figure 10

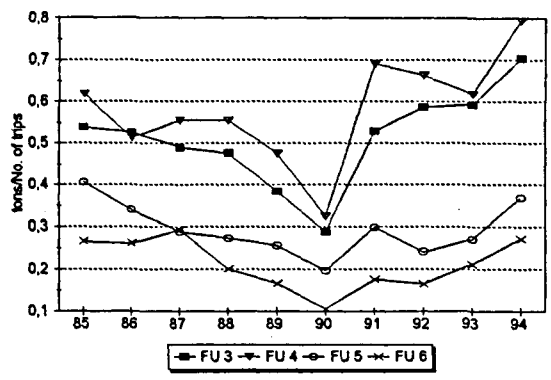


Figure 11

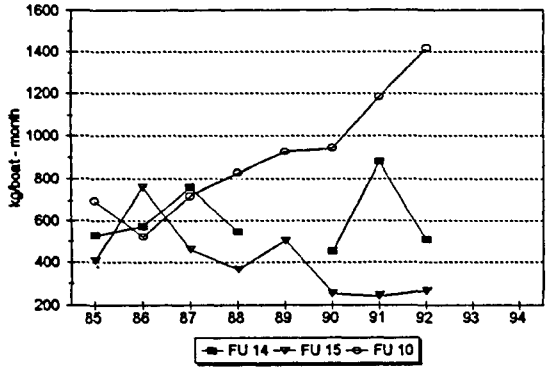


Figure 12

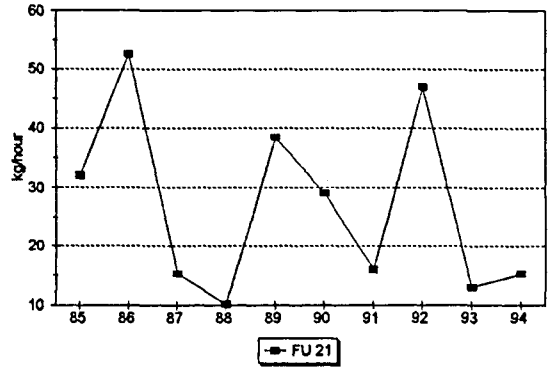


Figure 13

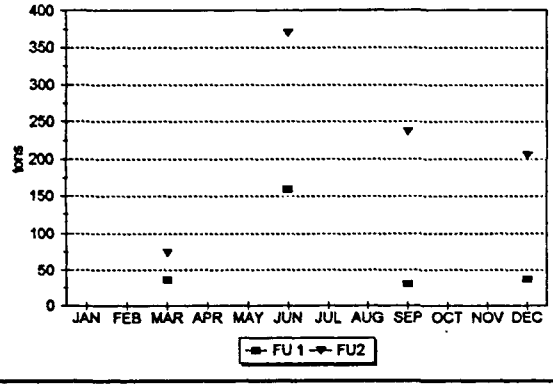


Figure 14

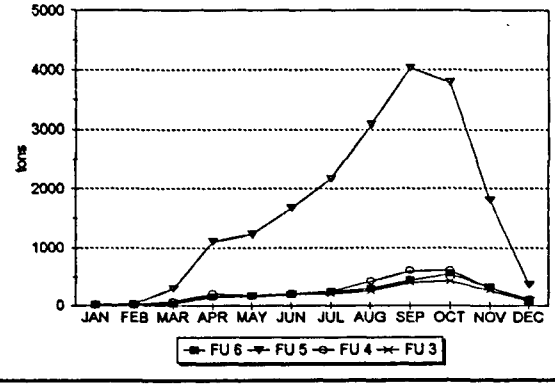


Figure 15

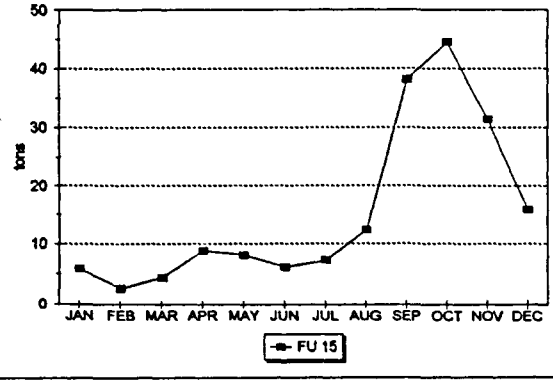


Figure 16

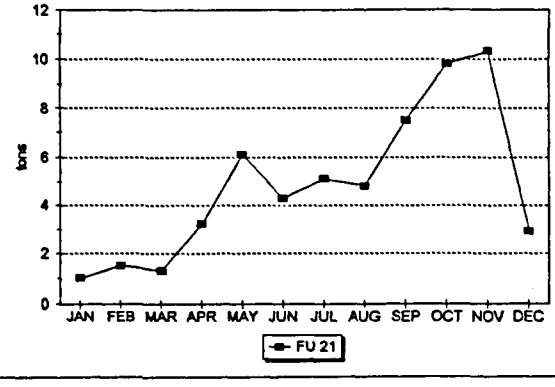


Figure 17

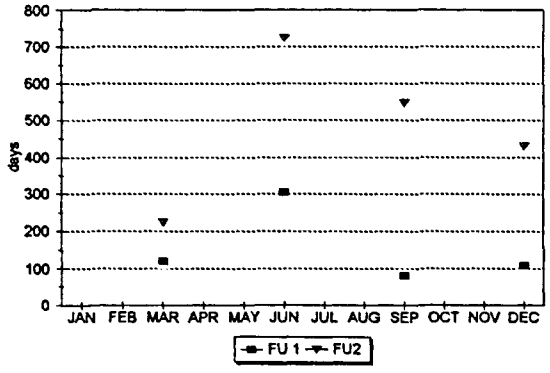


Figure 18

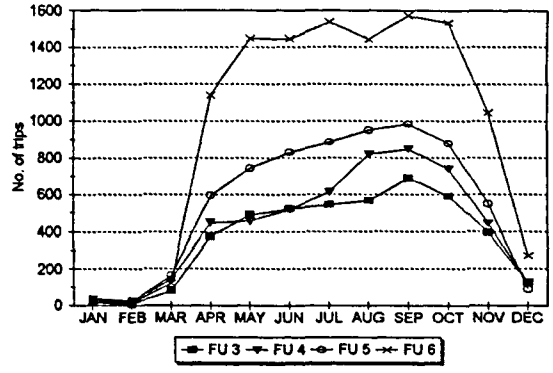


Figure 19

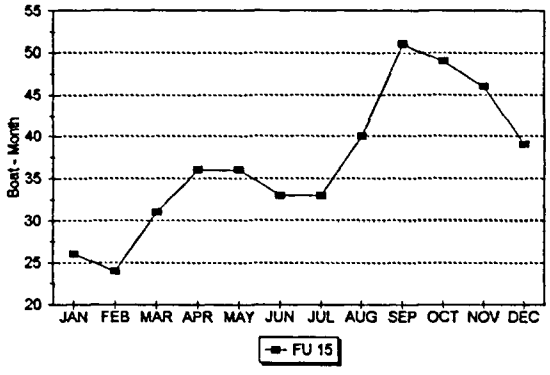


Figure 20

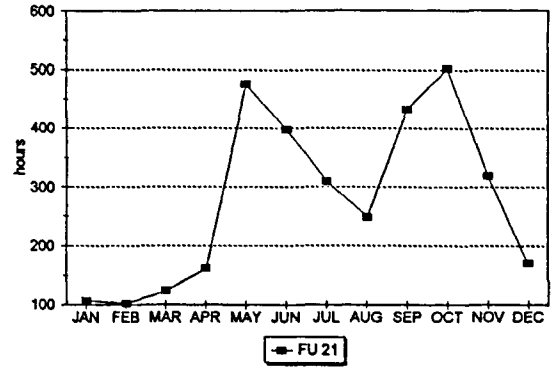


Figure 21

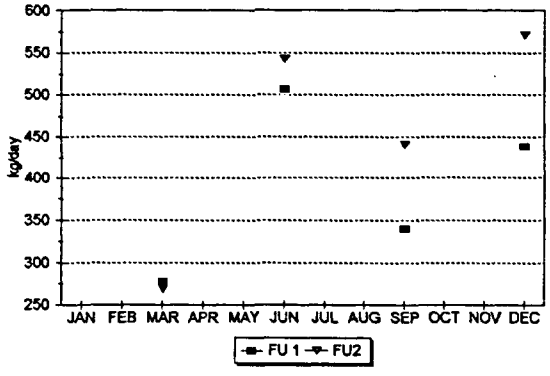


Figure 22

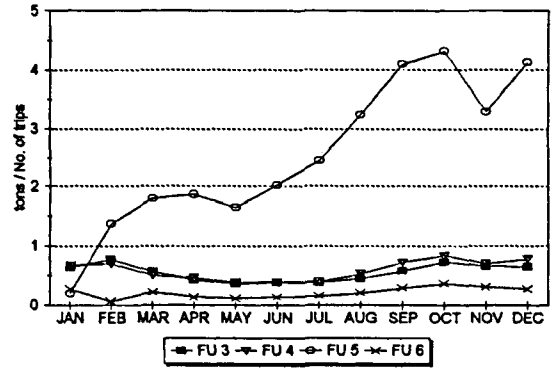


Figure 23

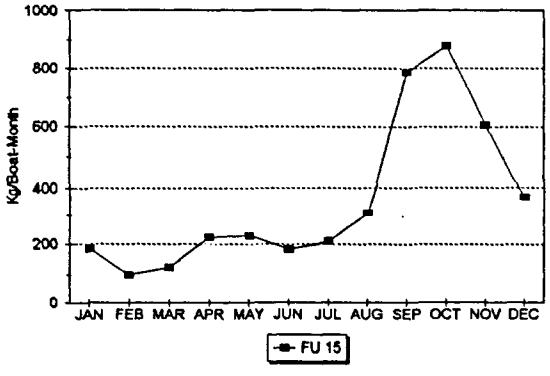


Figure 24

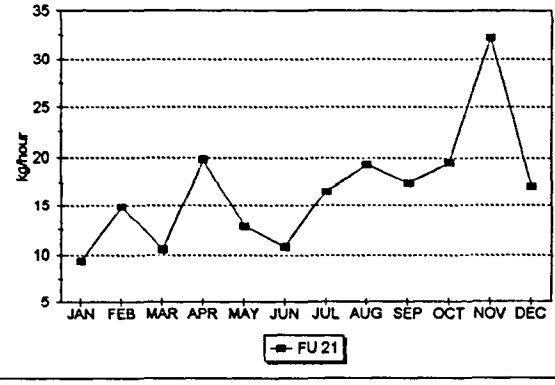


Figure 25

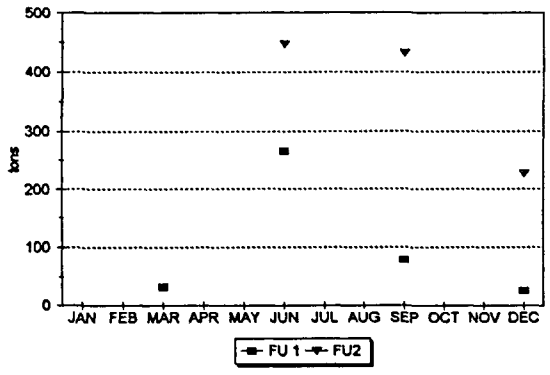


Figure 26

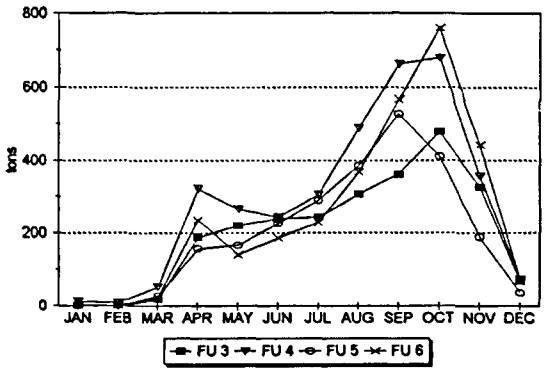
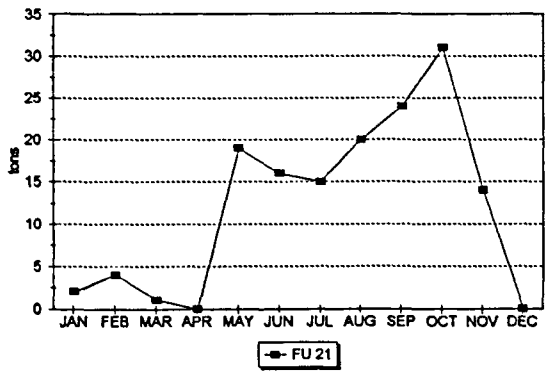


Figure 27



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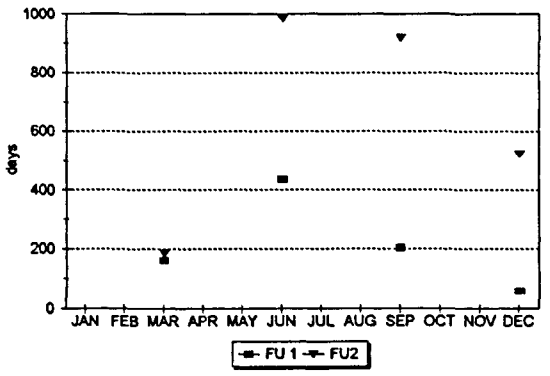
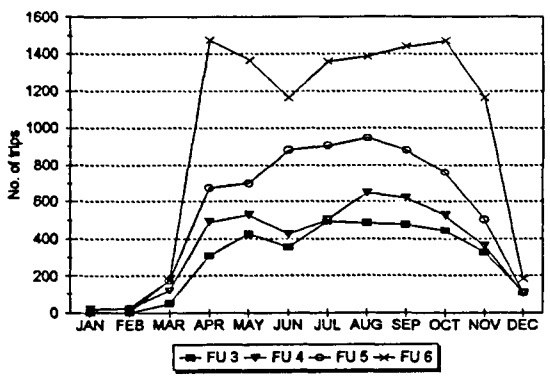


Figure 29



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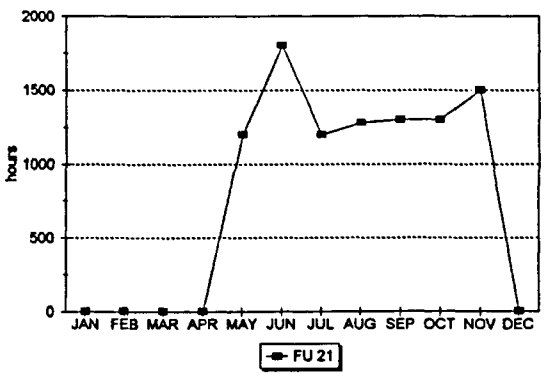
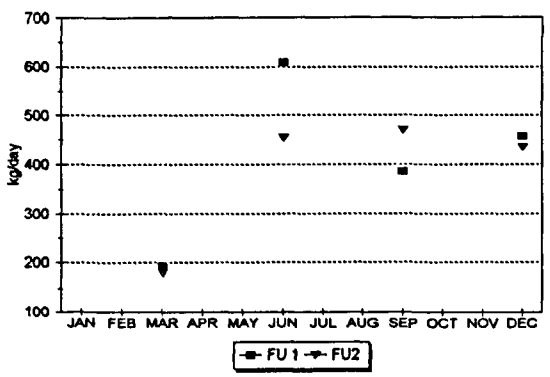


Figure 31



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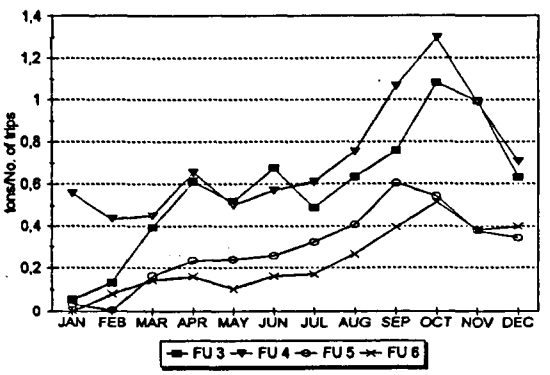


Figure 33

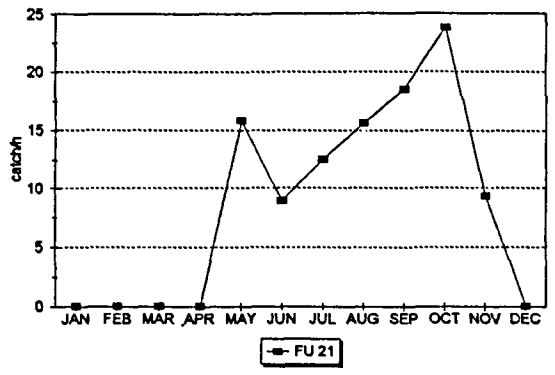
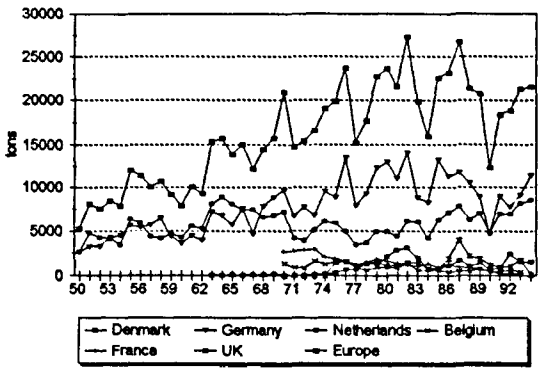


Figure 34



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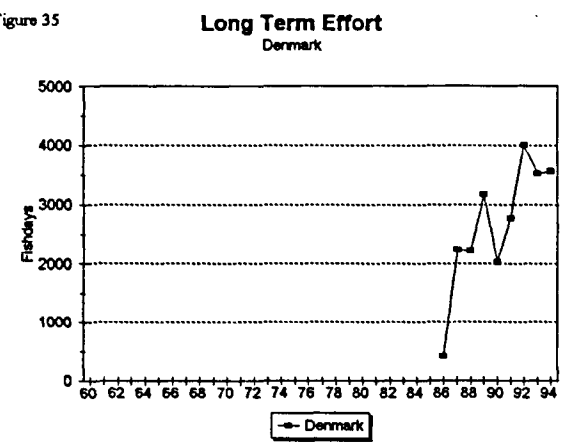


Figure 36

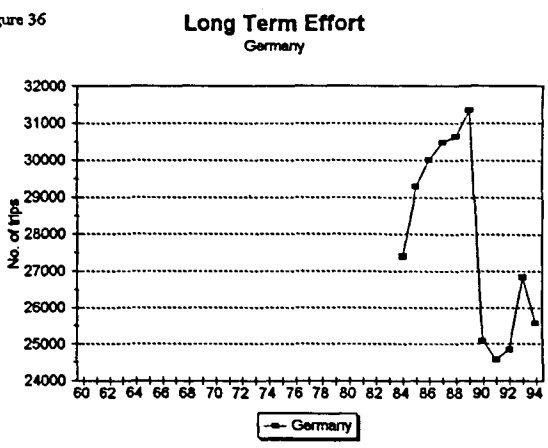
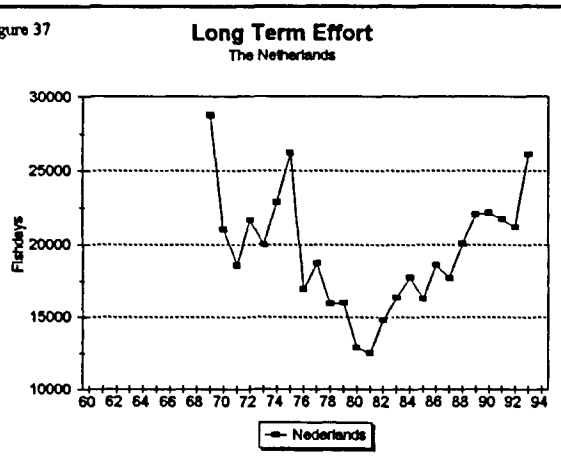


Figure 37



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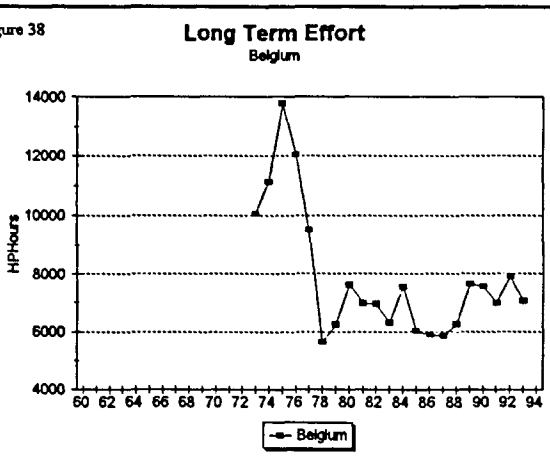

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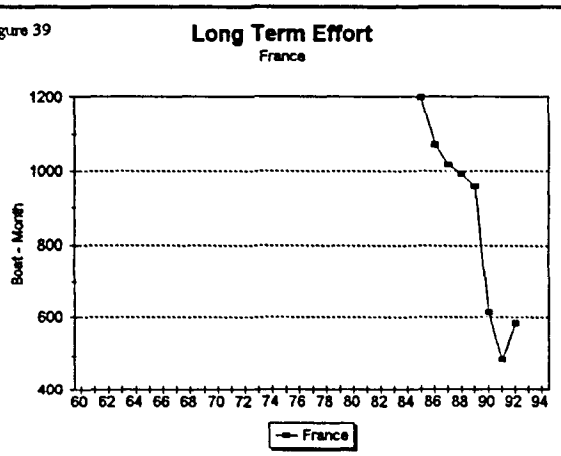

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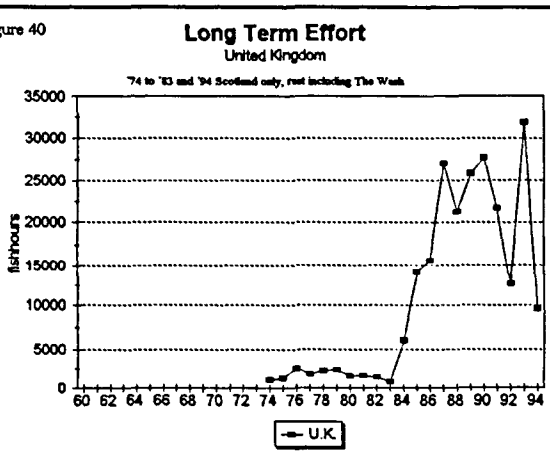

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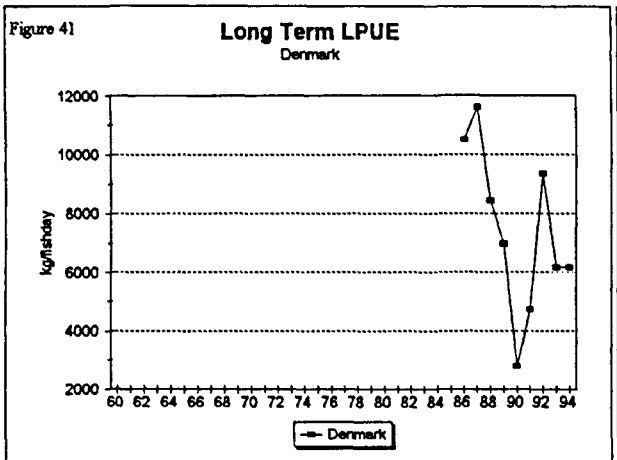
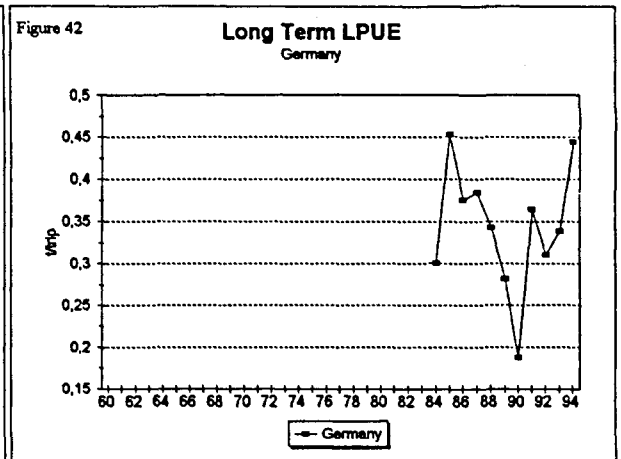


Figure 42



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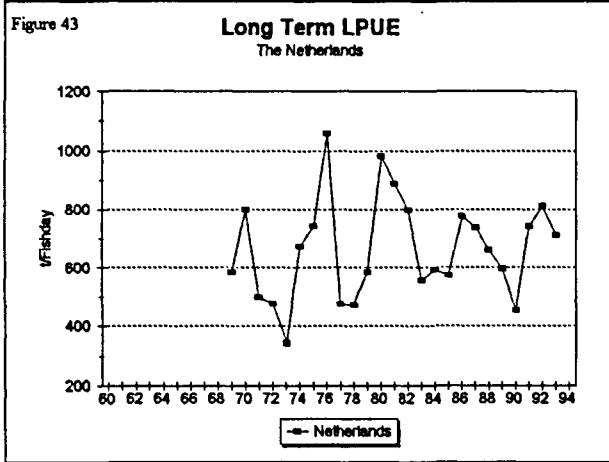

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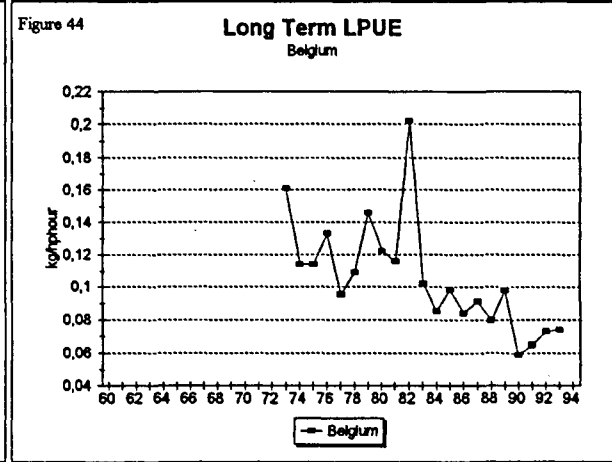

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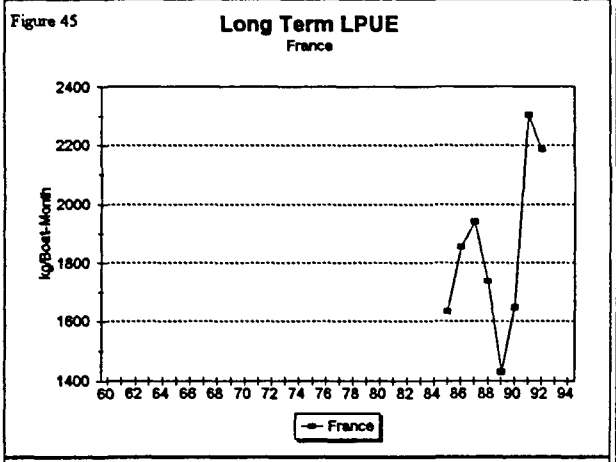

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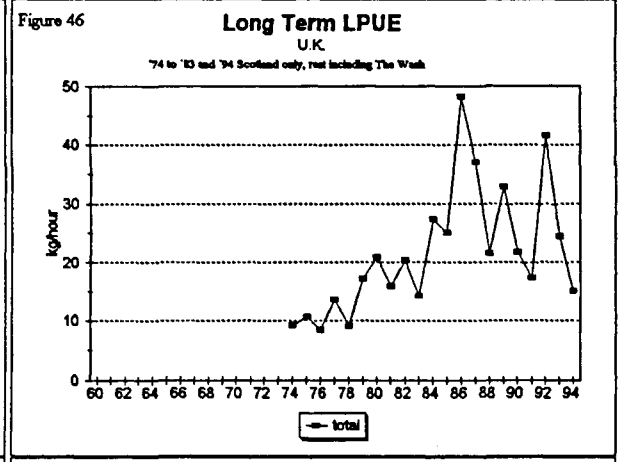
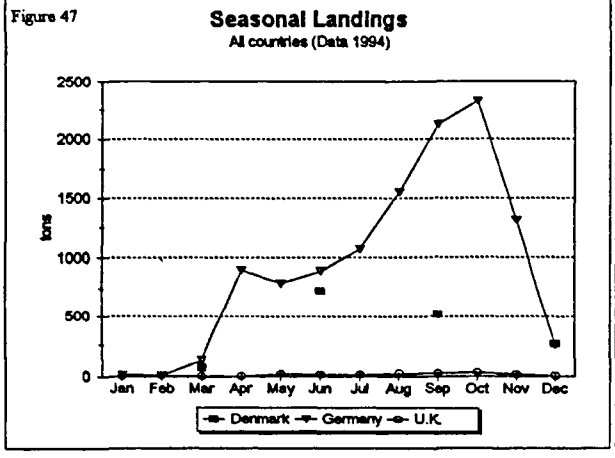


Figure 47



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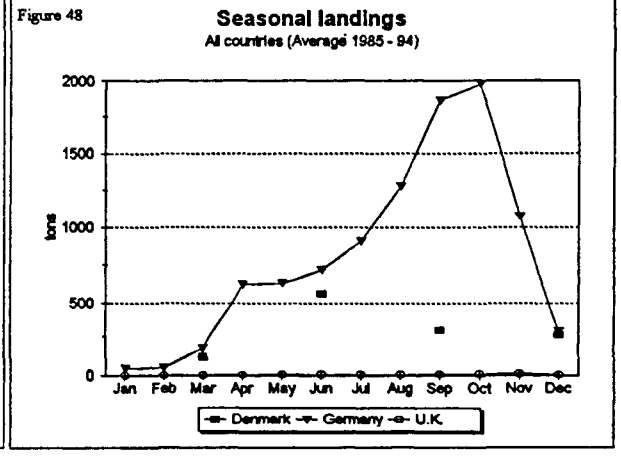

Figure 49

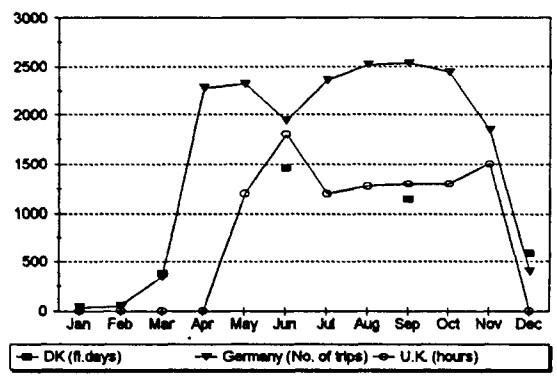

Figure 50

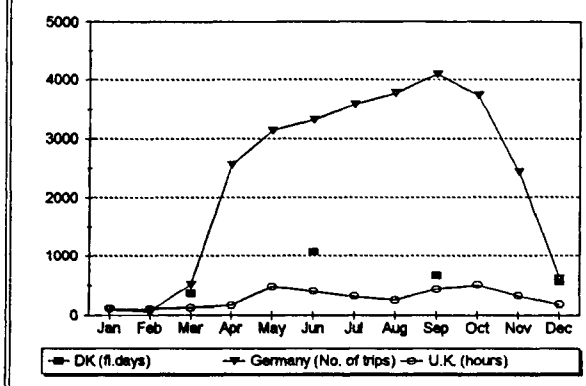

Figure 51

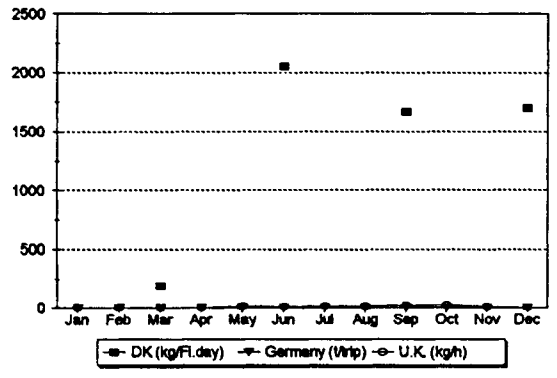

Figure 52