North WesternWorking Group 2004. working paper no

INFORMATION ON THE ICELANDIC FISHERY OF PELAGIC REDFISH (*S.MENTELLA* TRAVIN); INFORMATION BASED ON LOG-BOOK DATA AND SAMPLING FROM THE COMMERCIAL FISHERY

BY
THORSTEINN SIGURÐSSON
Marine Research Institute
Skúlagata 4; P.O.Box 1390
121 Reykjavík
Iceland

1. **Description of the Icelandic fishery**.

The Icelandic fleet caught total of 48.398 t. in 2003, compared with 44.491 tonnes in 2002. 22 vessels reported catches, which is similar number as has been during the last years. The catches are usually concentrated in the area between the Greenland EEZ and the Reykjanes Ridge, and since 1996 the catches have mostly been taken close to or inside the 200 mile boundary Southwest of Iceland, except for 2001 and 2002 where 1/3 and 15% of the catch were caught south of Cape Farewell respectively. The reason was changes in effort regulation for the fishery. Each vessel was forced to fish given proportion of its catches south of ca. 62°N in order to spread the effort. In 2003, nearly 90% where caught within the Icelandic EEZ and about 8% of the catches south of Cape Farewell in ICES Division XII and NAFO subdivision 1 (Table 1).

In recent years the fishery have started in late April- early May close to the Icelandic 200 mile boundary and then moved in northward direction in May-July. Then, if the TAC was not reached, the fleet moved to southwest in late summer – autumn. Figure 1 shows the activity in 2003 by month and Figure 2 shows the activity of the fleet 1997-2003 combined by month. In Figure 3 the activity in 2003 is shown by week. The general trend in since 1997 is the same. For the first months the Icelandic fleet fished high proportion of their catches within the Icelandic EEZ. The fishing area in June-July inside the Icelandic EEZ did overlap with the fishing grounds where *S.mentella* is fished with bottom trawls, and have been considered as the deep-sea *S.mentella* on the shelf. The vessel that were fishing in July, moved to south-west, to the area SA of Cape Farewell, where they fished above 500 m depth yielding a smaller redfish, classified as “oceanic redfish” in late July-October. The overview of the fishery by year is shown in Figure 4.

In the Icelandic legislation it is set whether the captain shall report their catch as an oceanic redfish or as a deep-sea redfish. According to this “law”, all catch outside the Icelandic EEZ shall be reported as oceanic and in addition west of a line which is drawn approximately over the 1000-m isoline. This line is, on Figure 5, drawn as a red line west of the Reykjanes Ridge. The figures also show the fishery of deep-sea redfish with bottom trawl within the Icelandic EEZ.

Based on figures mentioned above describing the movement of the fishing fleet, it can not be excluded that the redfish caught as “deep sea redfish on the shelf” in recent years might originate from the same school as the fish caught in the oceanic redfish fishery in the same years. The fishery expanded northward in June/July, and the fishing areas at that time are overlapping important redfish areas on the shelf of Iceland. At the time when the fishing

areas are closest to each other, the fishing effort towards the "oceanic quota" has been low, as by then, most of the fishing vessel had reached their allowable catch in the last years. Based on the data described above, the future analysis of the data is based on two areas, north and south, according to the division shown in Figure 6.

2. Catch composition in the oceanic redfish fishery.

During the last years, the Icelandic oceanic redfish fishery has shifted towards greater depths, especially after 1993 (Figure 7 - Figure 8). As the depth has increased, the vessels are yielding larger redfish (Figure 9 - Figure 11), which a large proportion of has been classified as a deep see type. Based on this classification (which is questionable), the proportion of each type has been calculated. Table 2 and Table 3 gives the results of this calculation based on the samples taken from the fishery since 1995. The mean proportion oceanic redfish in each sample is also shown in Figure 12. As can be seen, the proportion at given depth interval can bee highly variable. However, based on this data, the results show that the proportion oceanic redfish has decreased from around 70% in 1995 and down to only 5% in 2000 (Table 3), but increased again in 2001 as the effort was spread. In 2002-2003 the proportion was 16%. Based on the samples, the results indicate that above 600-m depth, the proportion "oceanic" is between 85-100%, as the proportion below 600 m is usually between 0-20% (Figure 12). Table 4 gives the proportion of males in the catches by months since 1995, divided by possible stocks and also for the total. As seen, the average proportion of males in the samples is usually higher in the first months of each fishing season and the fishery is then more concentrated on newly spawned females. The proportion of immature fish has been relatively low during the, but has increased since 1999 as there seems to be incoming recruitment (Table 5). The proportion immature is however still less than 10% of the catches.

3. Effort and catch per unit effort by depth and time of year.

Figure 13,Figure 14 and Figure 15 shows the effort and catch as well as CPUE for the Icelandic fleet during the period 1989-2003. The development of unstandardized CPUE in three depth intervals is illustrated graphically. In general a downward trend is shown in the data from 1994 to 1997 but CPUE seems to have been relatively stable since then. As can been in Figure 15, about 75-90% of the Icelandic catches since 1998 were taken below 600 m depth except for 2001 when about 34% of the catches are taken at depths shallower than 400 m. These changes from previous years are due to changes in the regulations as described above.

Standardised CPUE using the Icelandic logbooks is given in Figure 16-Figure 21. The model takes into account year, month, vessel and area (ICES Northern area (north of 60°30 and southern area (south of 60°30)). The model was run within Splus 5 (S-Plus 5 for UNIX Guide to Statistics, p 248). The model run output from three run and tests for differences between models (chi-square tests) is given in Appendix 1, and diagnostic shown in figures Figure 16-Figure 21 for the three different runs. The model shows that the index is fluctuating both for the south-western and northeastern fishing area, but no downward trend is observed.

The value in 2003 has increased for the norheastern part but remains similar for the southwestern area, compares with previous years. Overall, the GLM model indicates a relatively stable CPUE since 1995 both in the northern and southern area.

4. Discard

Discard has been estimated during the last years. In 2003 observations were made on several cruises. On these cruises the observers did not record any significant discard unless of some few fishes that were damaged. Therefore, it is assumed that the discard of the Icelandic fleet in 2003 was negligible.

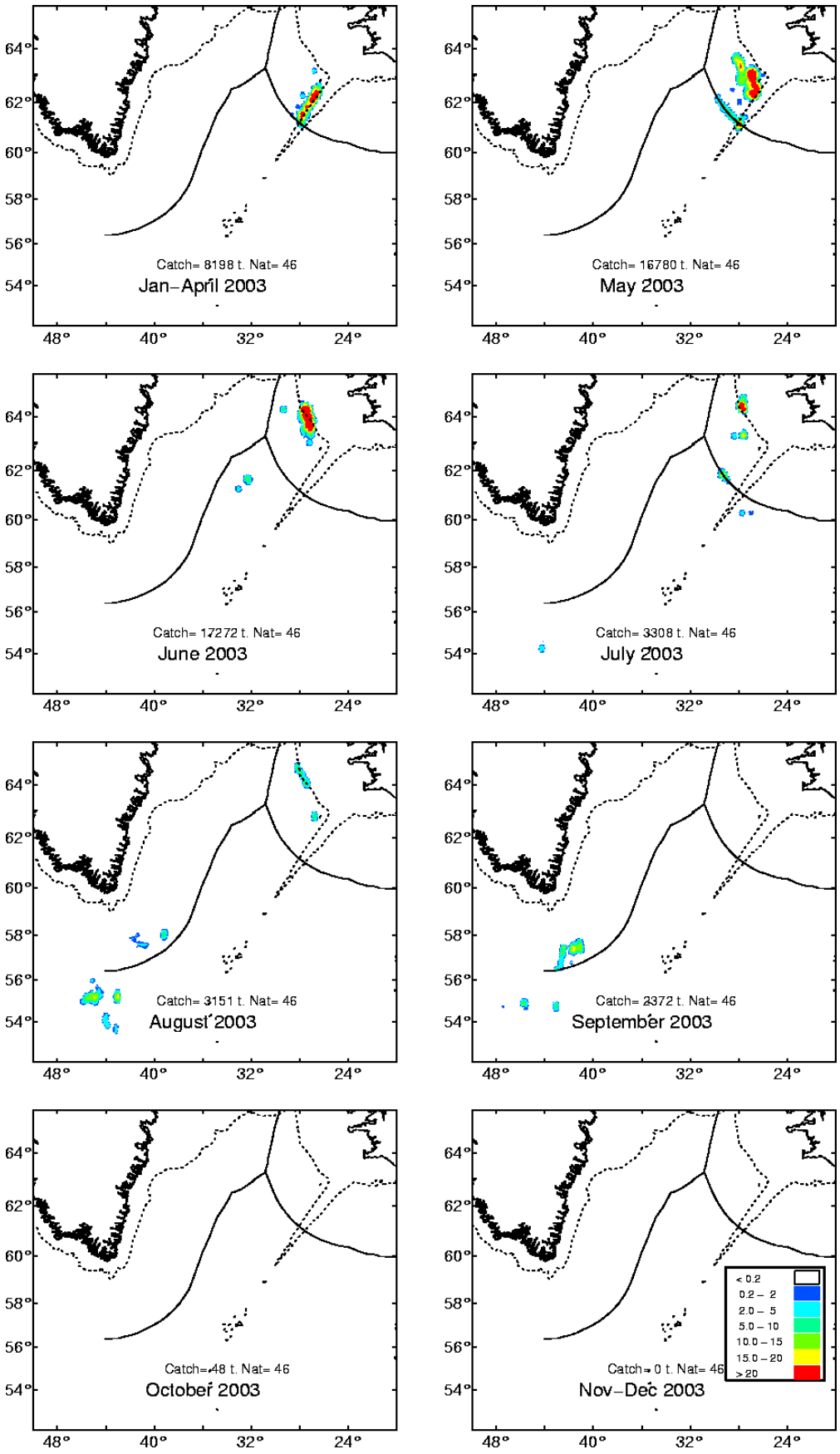


Figure 1. Monthly catch of Irminger Sea redfish in 2003. The figures are based on records from fishing vessel logbooks.

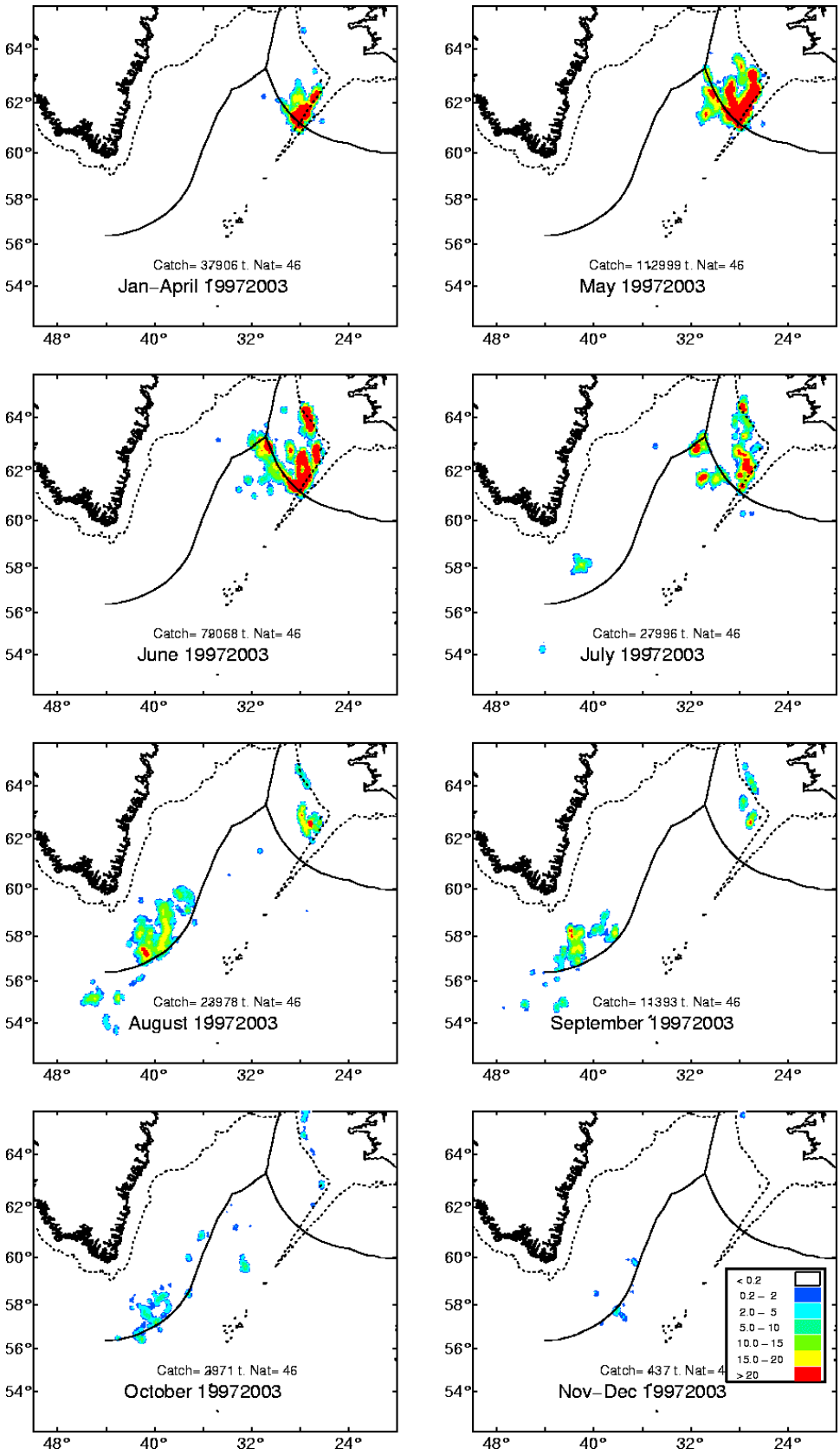


Figure 2. Monthly catch of Irminger Sea redfish in 1997-2003. The figures are based on records from fishing vessel logbooks.

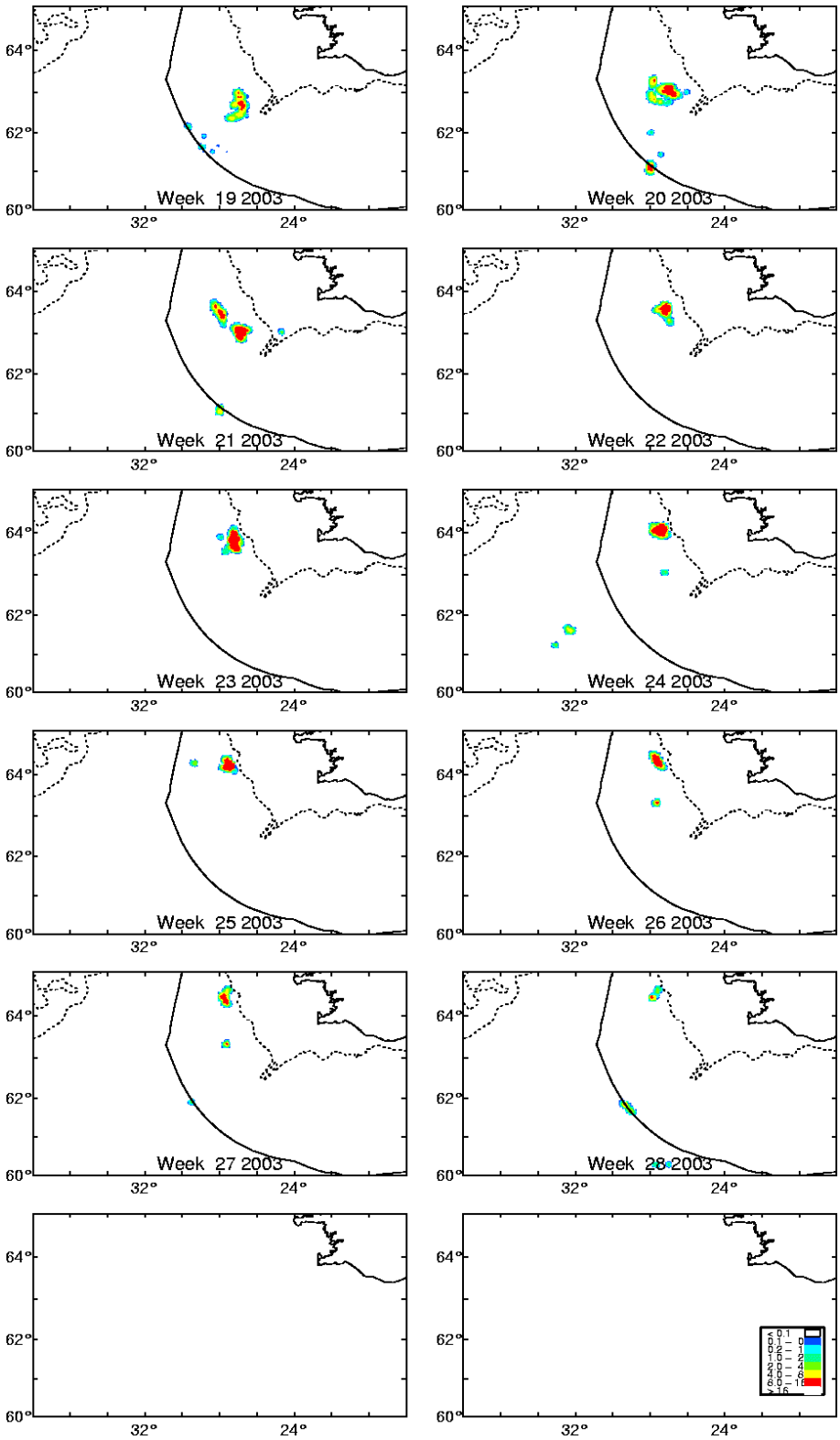


Figure 3. Weekly catches of Irminger Sea redfish in 2003 in the area north of 60°N. The figures are based on records from fishing vessel logbooks.

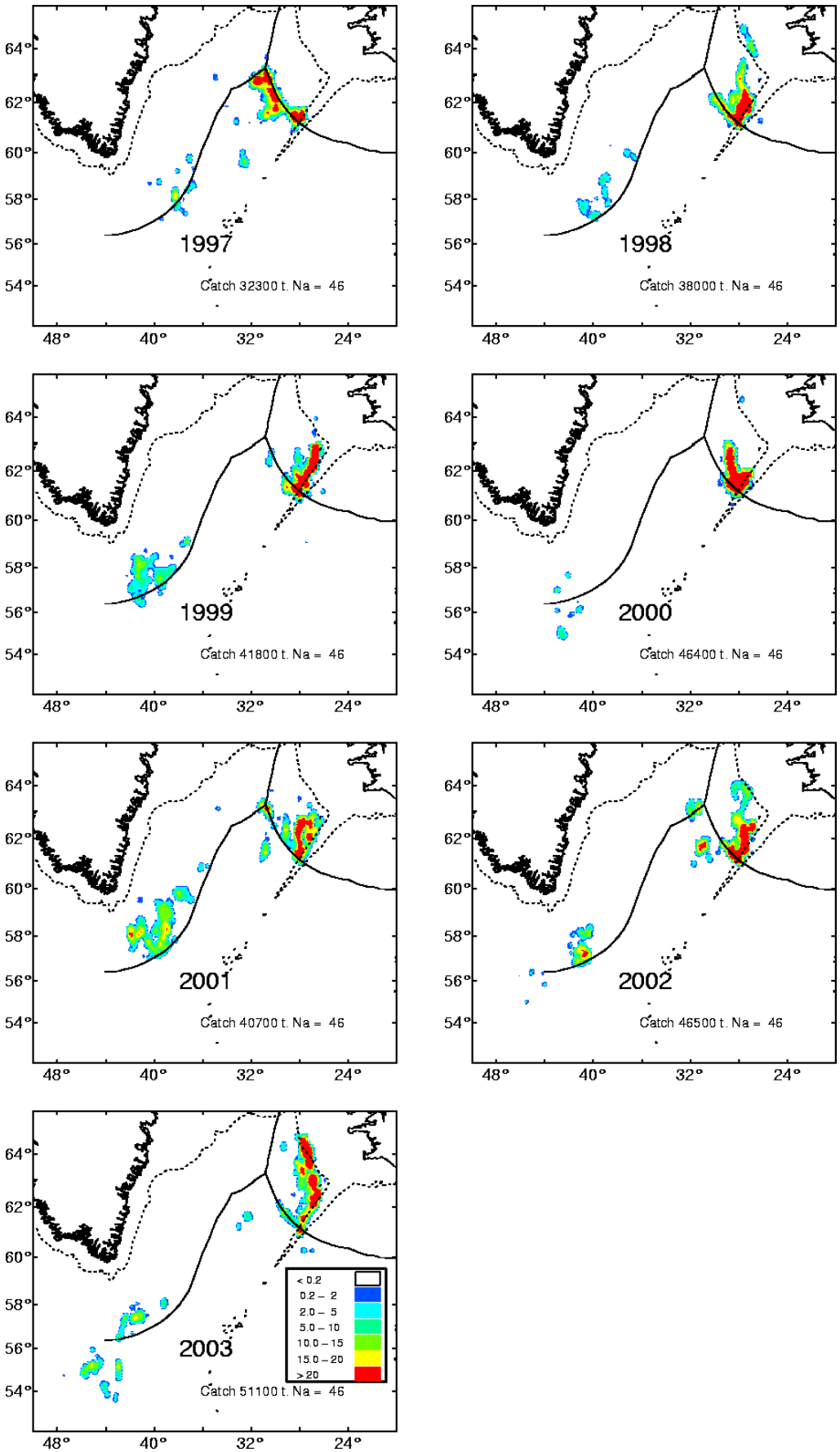


Figure 4. Annual Icelandic catch of redfish in the Irminger Sea 1997-2003 (tonnes per square mile). The figures are based on records from fishing vessel logbooks.

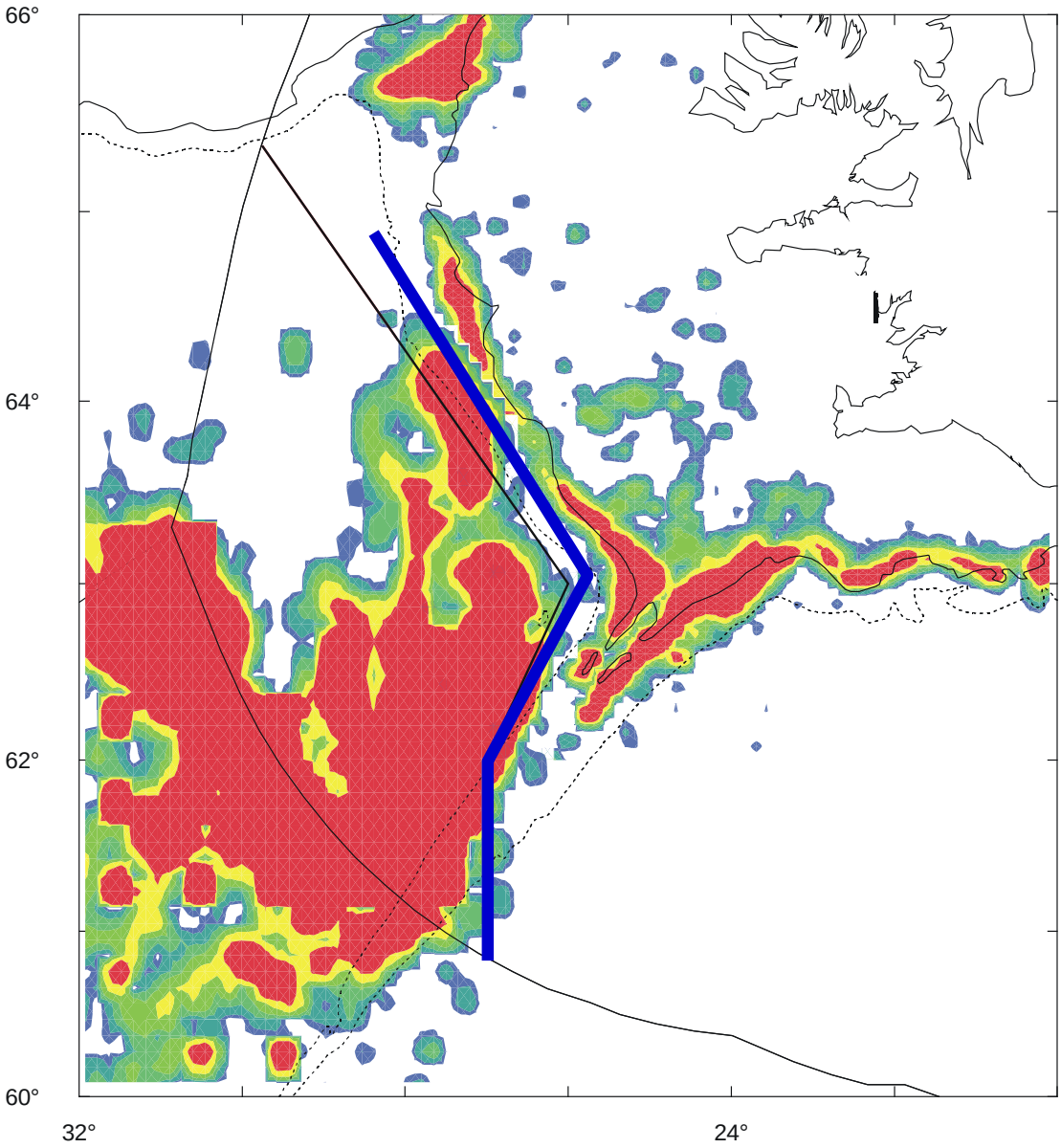


Figure 5. Icelandic redfish catch southwest of Iceland in 2001-2003. The catch west of the “redfish line” (blue line) is form the pelagic redfish as the catch north and east of the line is of “shelf type”). The thin line is the "old redfish line"; the blue one is the line set in 2003.

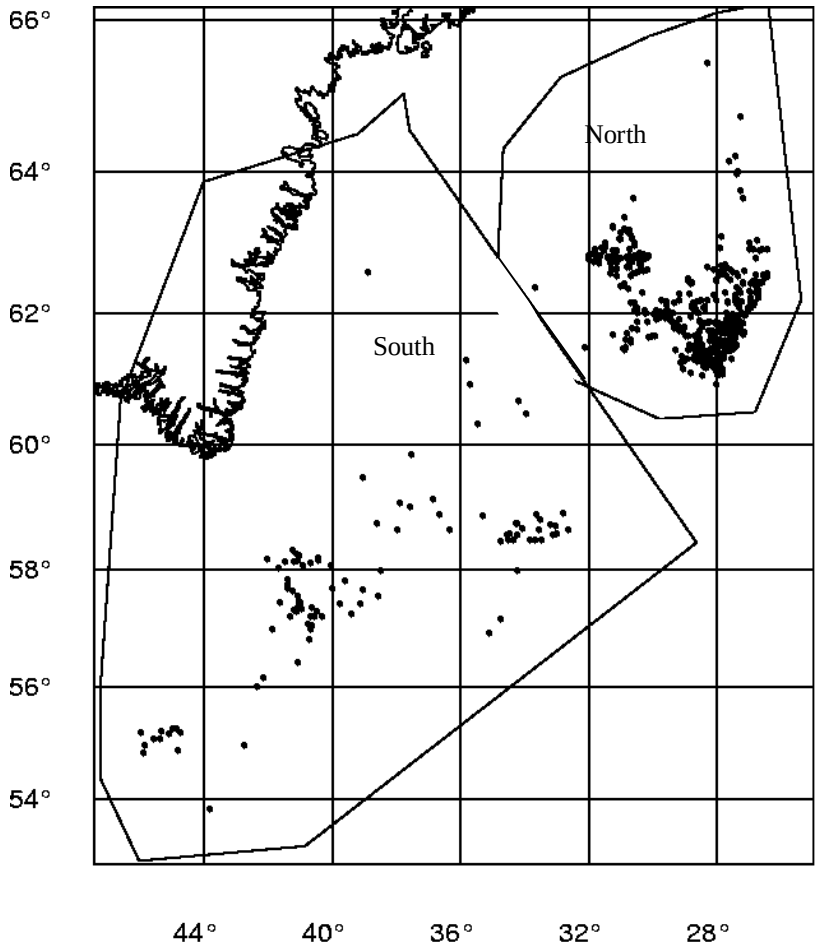


Figure 6. Division of areas between south an north. The points indicate positions of available samples from the catches.

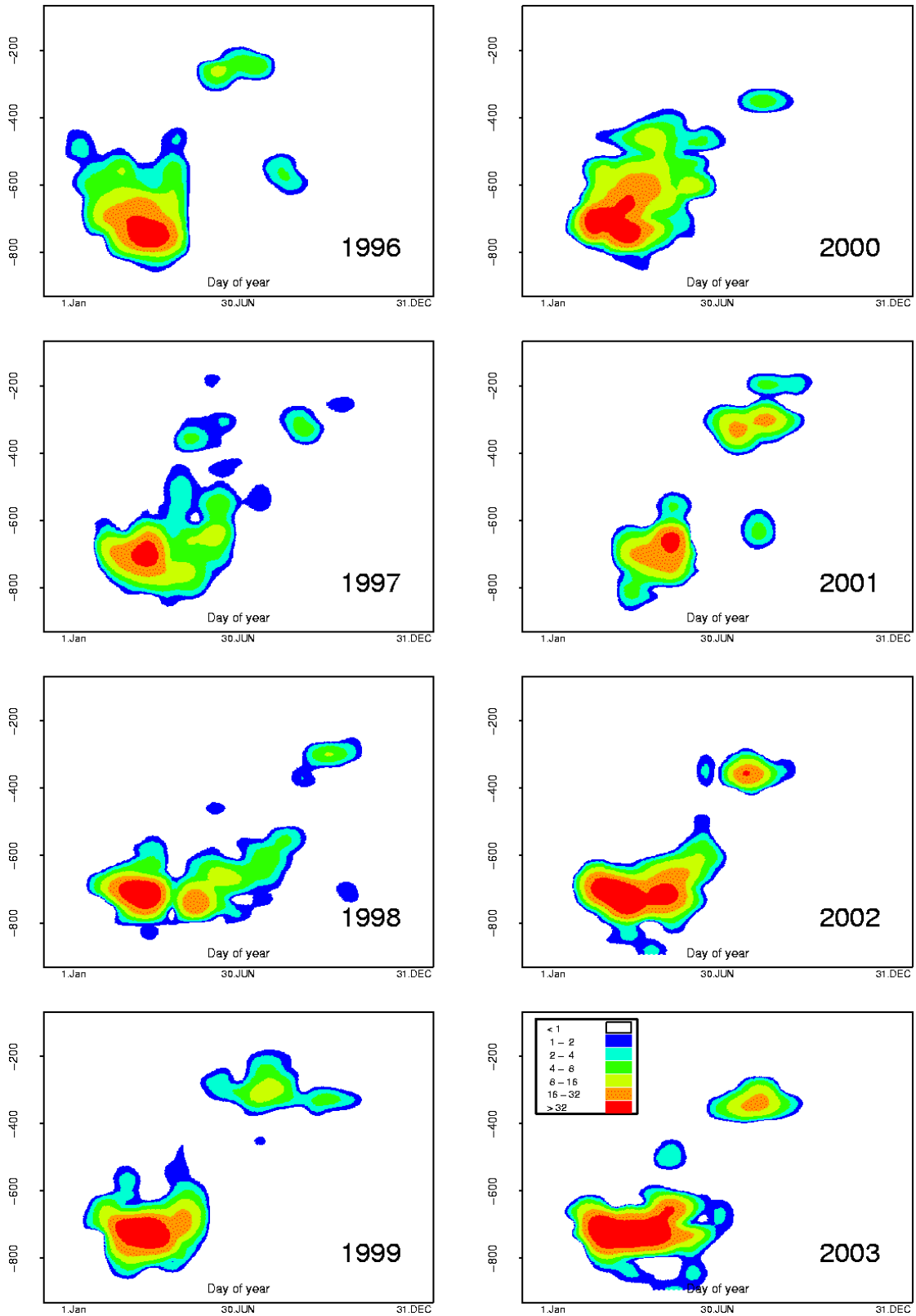


Figure 7. Depth distribution of Icelandic trawl hauls for oceanic redfish as reported in the logbooks since 1997. X-axis = day of year; Y-axis = depth.

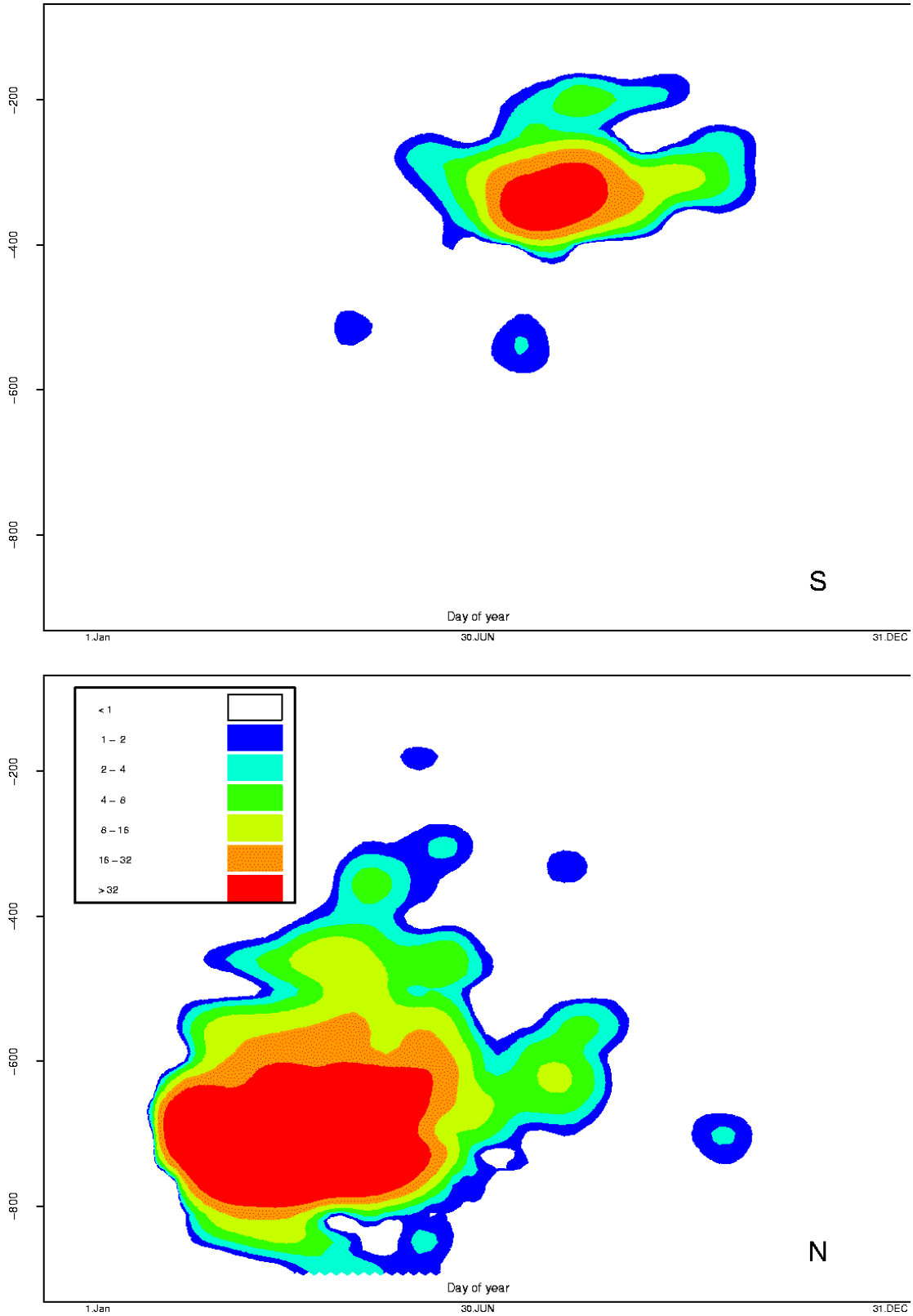


Figure 8. Depth distribution of Icelandic trawl hauls for oceanic redfish as reported in the log-divided by geographical area (see figure 1). Data combined for the whole period since 1997. X-axis = day of year; Y axis = dept

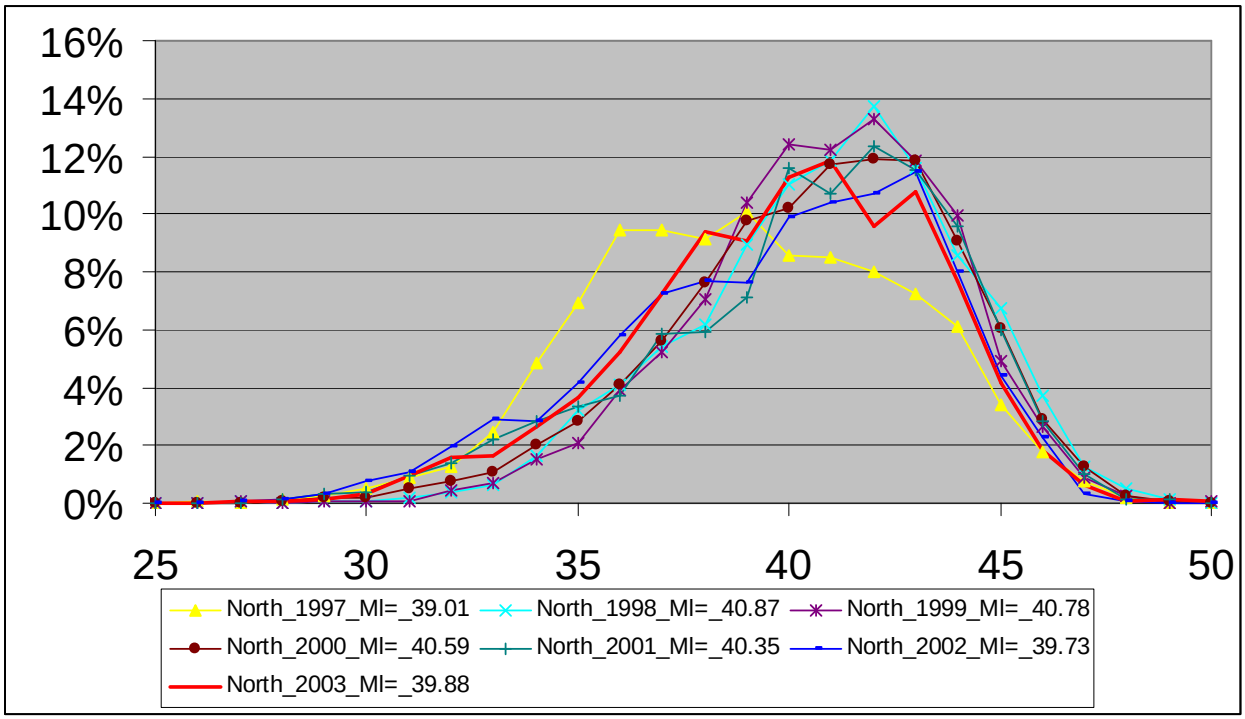


Figure 9. Length distribution of pelagic redfish caught north of 60°N, since 1995. Data from commercial fishery.

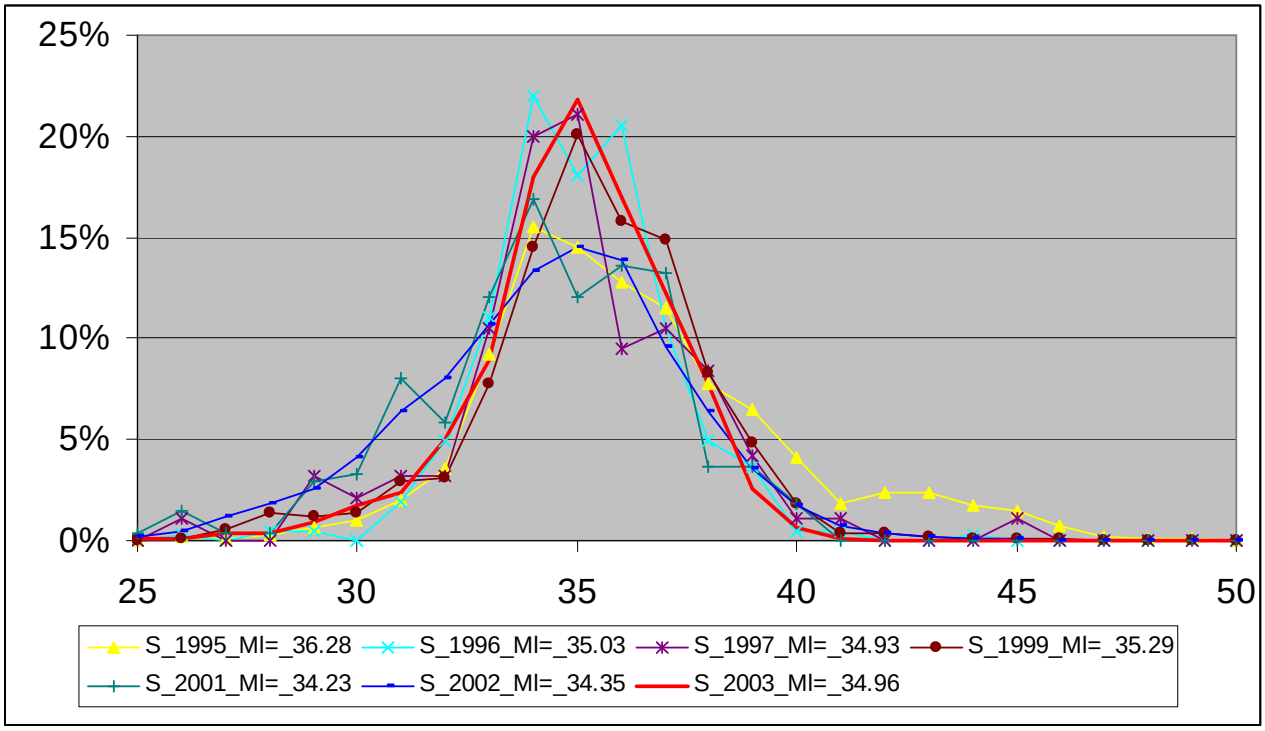


Figure 10. . Length distributions of pelagic redfish caught in the southern area (see figure 1.1).

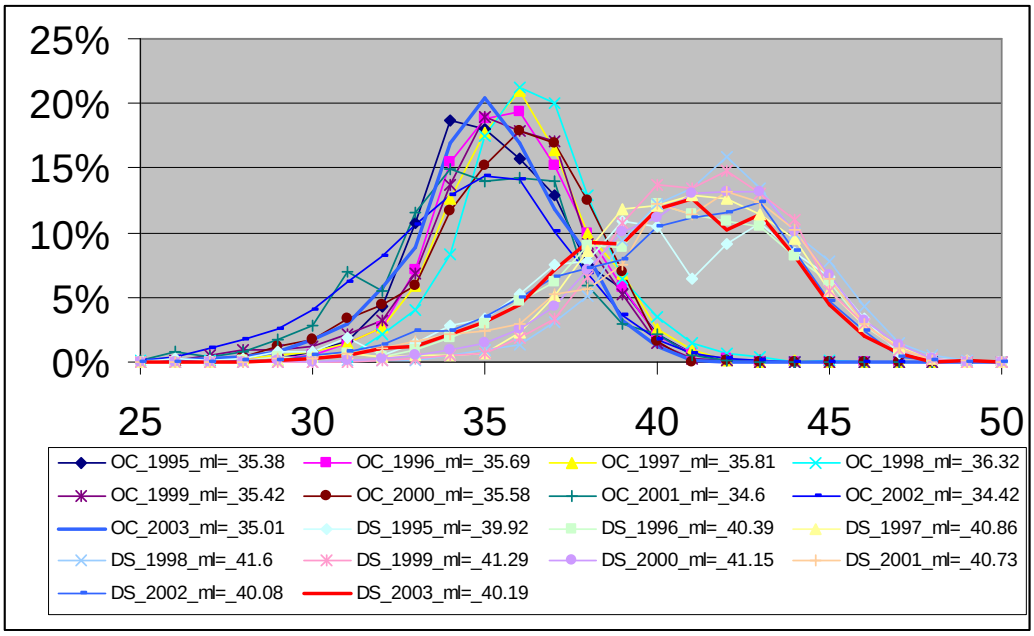


Figure 11. Length distribution of redfish caught in the oceanic redfish fishery 1995-2002. Samples from commercial fishery, divided by stocks.

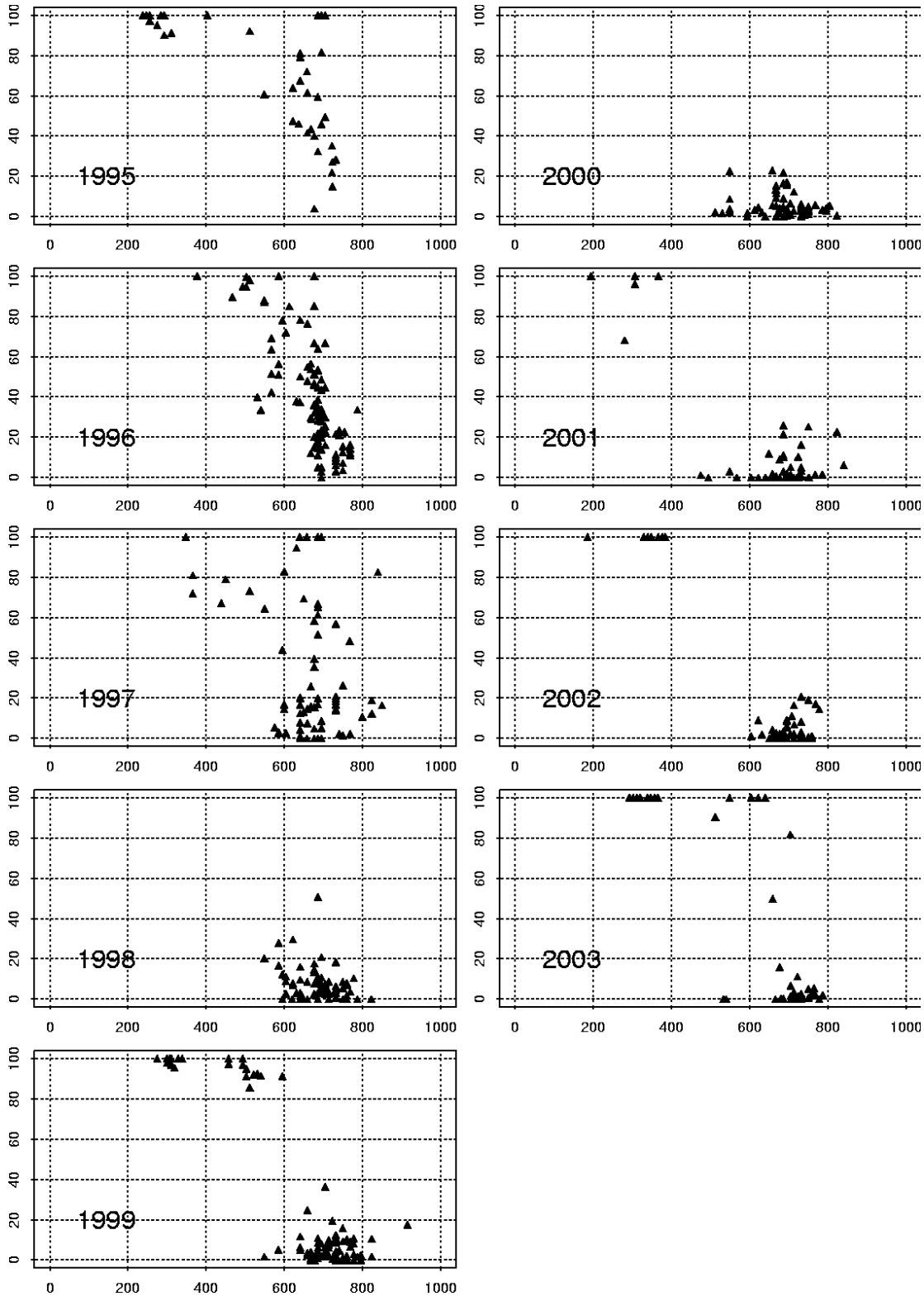


Figure 12. Proportion of oceanic type redfish in the Icelandic pelagic redfish catches fishery since 1995. Data collected from commercial fishery. Each point in the figures denotes sample size of 50-100 fishes.

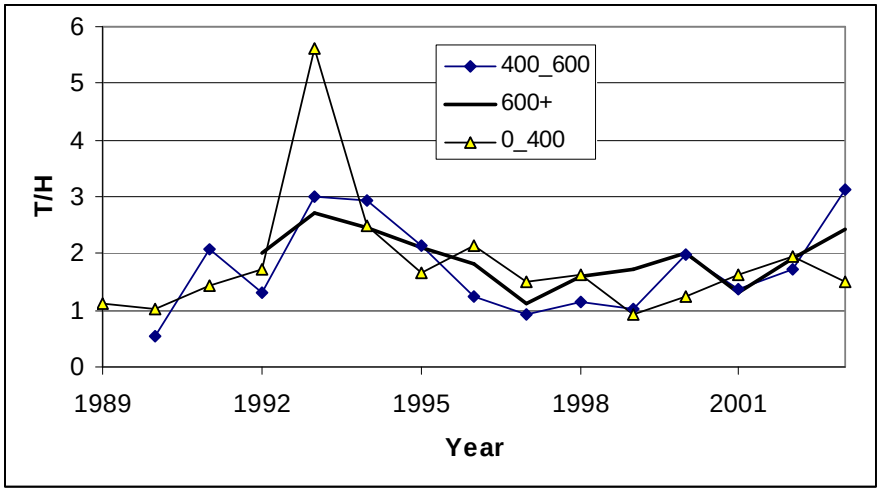


Figure 13. Unstandardized catch per unit effort in the pelagic redfish fishery for the Icelandic fleet for different depth intervals.

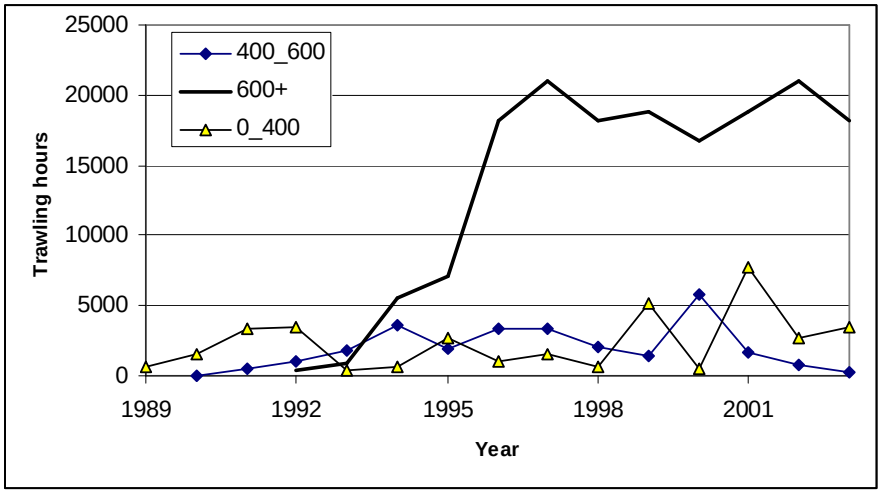


Figure 14. Hours trawled at different depth intervals.

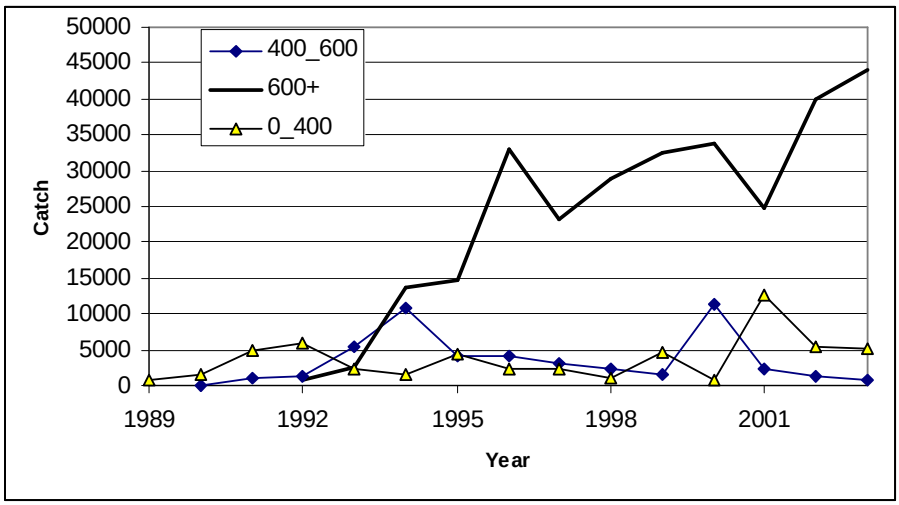


Figure 15. Reported catch in the logbooks by different depth intervals.

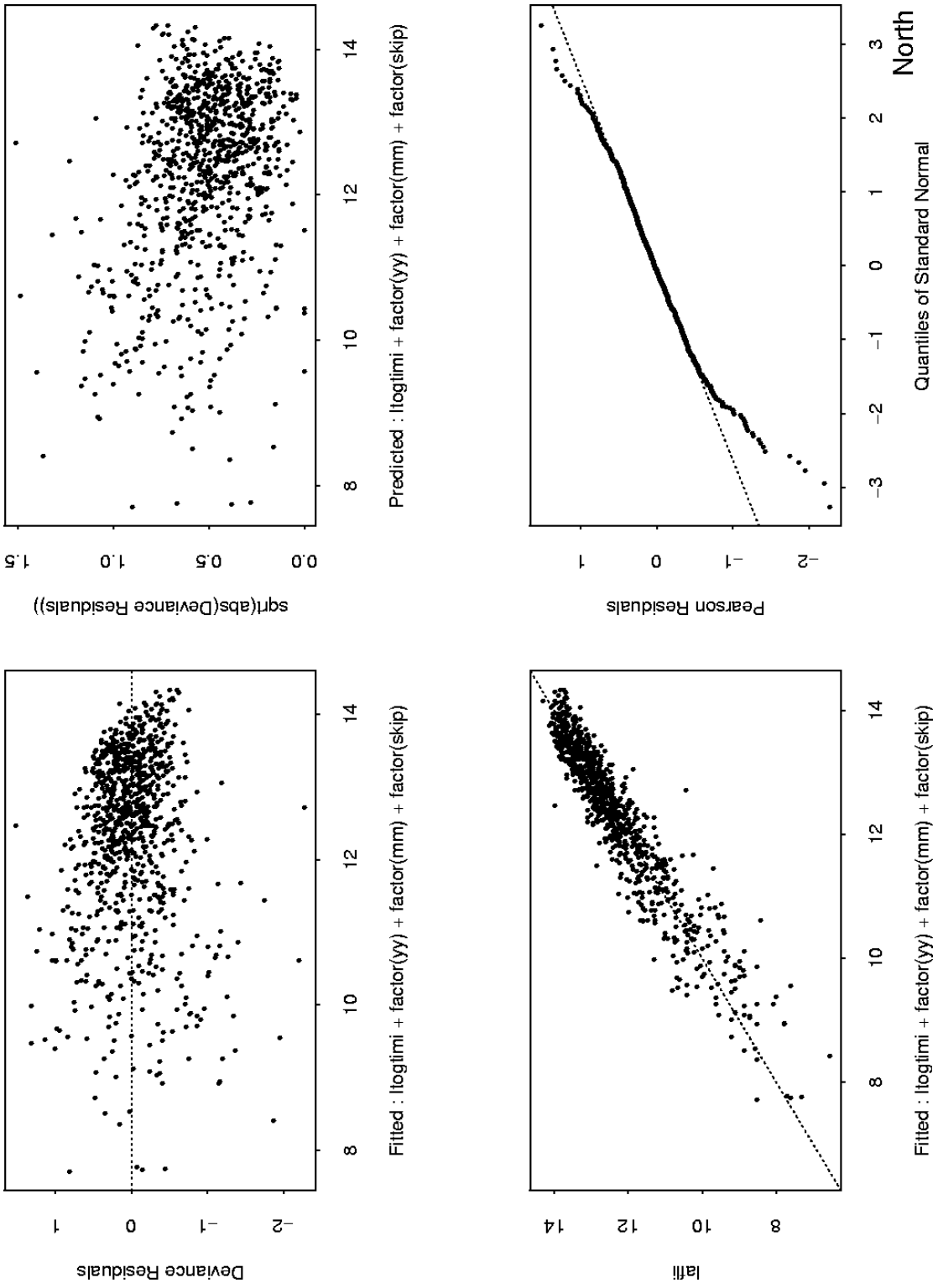


Figure 16. Icelandic data, northern area. Glm CPUE model. Graphical display of the fitted values and residuals. a) plot of deviance rsiduals versus the fitted values, b) plot of the square root of the absolute deviance residuals versus the linear predictor values.

c) plot of the response versus the fitted values and d) normal quantile plot of the Pearson residuals.

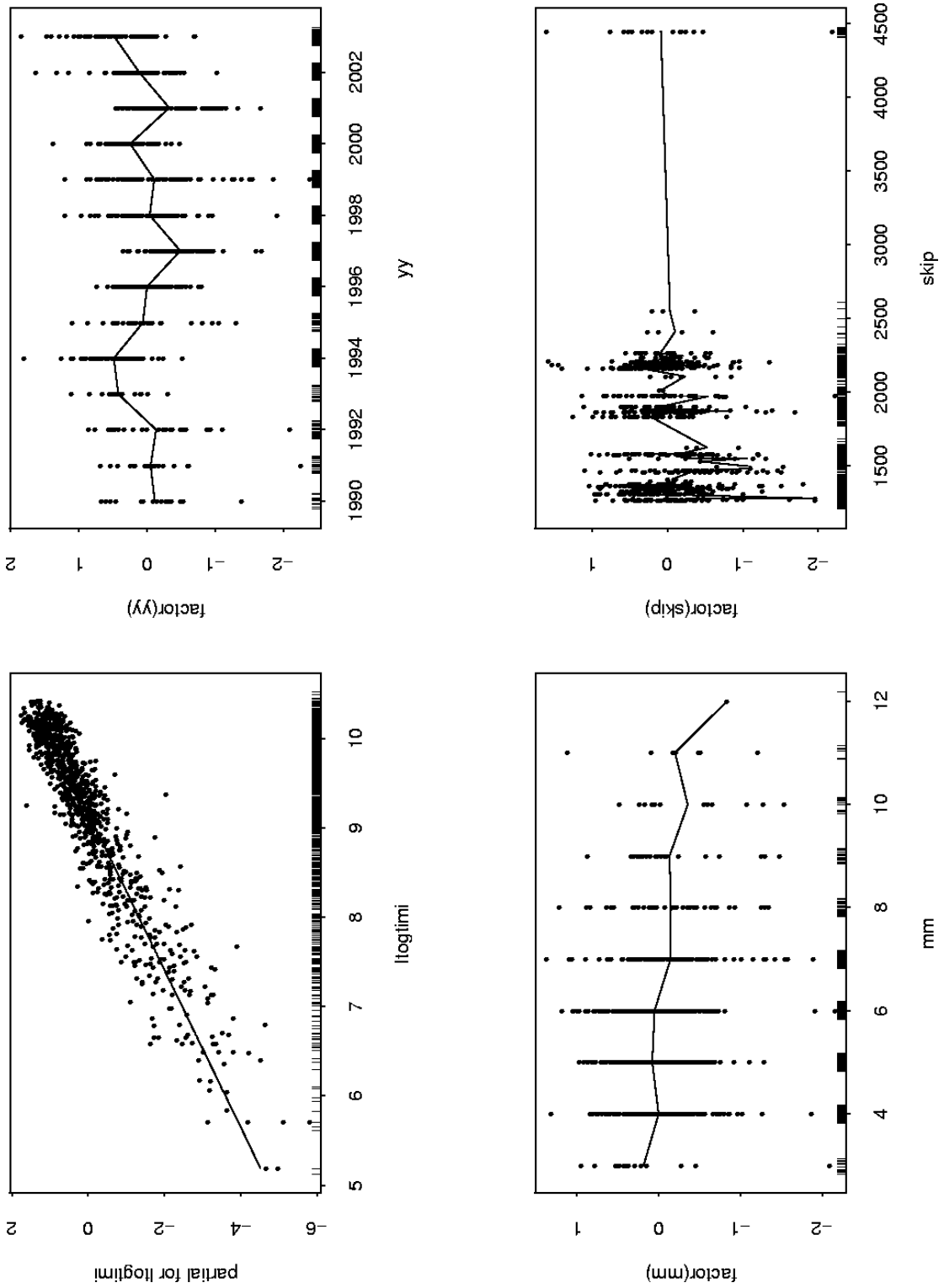


Figure 17. Diagnostic of the Icelandic CPUE data, northern area. Glm CPUE model. Graphical display of the fitted values and residuals. Estimated relationship between the individual fitted terms and each of the corresponding prdictors.

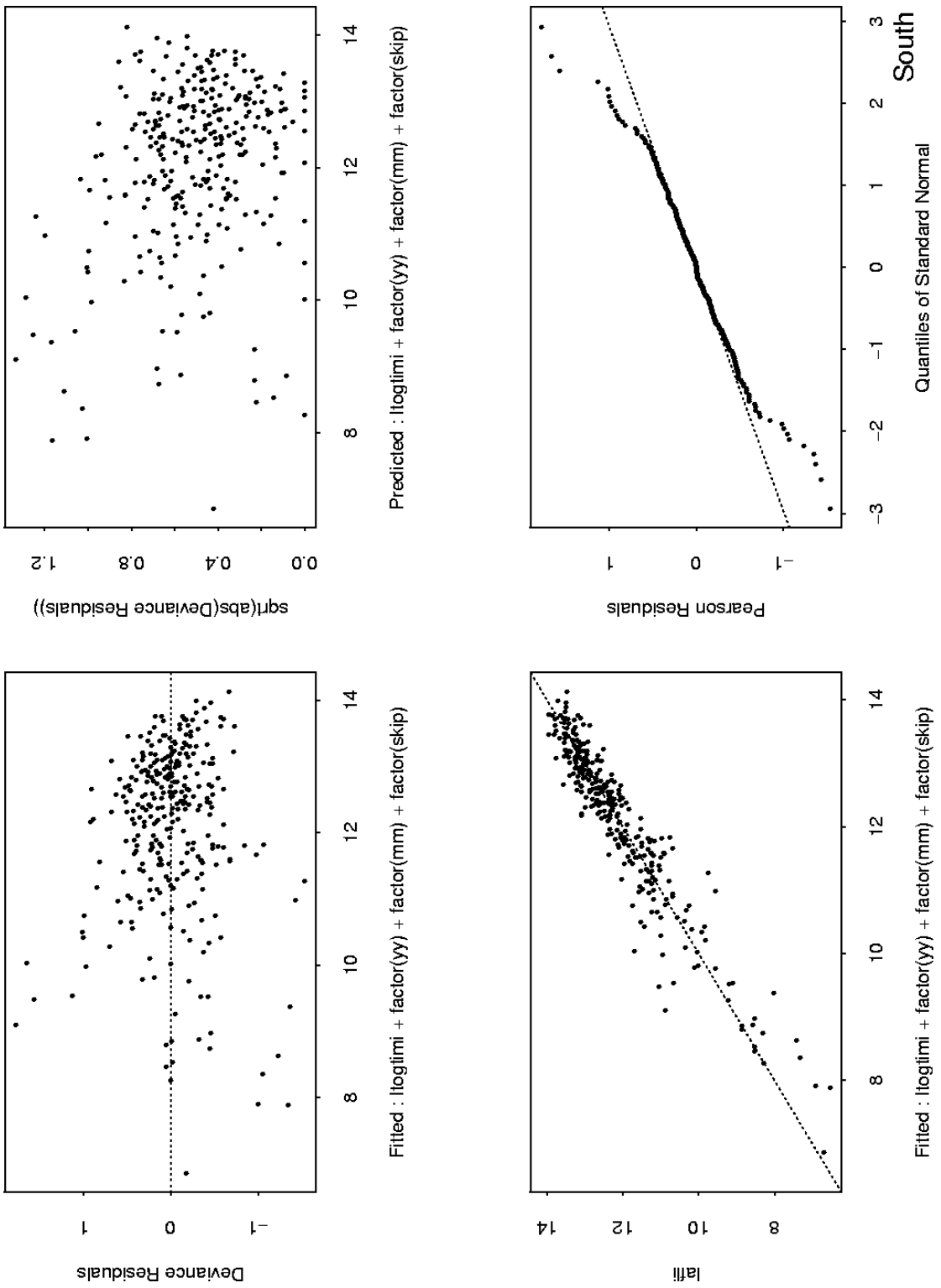


Figure 18. Icelandic data, southern area. Glm CPUE model. Graphical display of the fitted values and residuals. a) plot of deviance rsiduals versus the fitted values, b) plot

of the square root of the absolute deviance rsiduals vesus the linear predictor values. c) plot of the response versus the fitted values and d) normal quantile plot of the Pearson rsiduals.

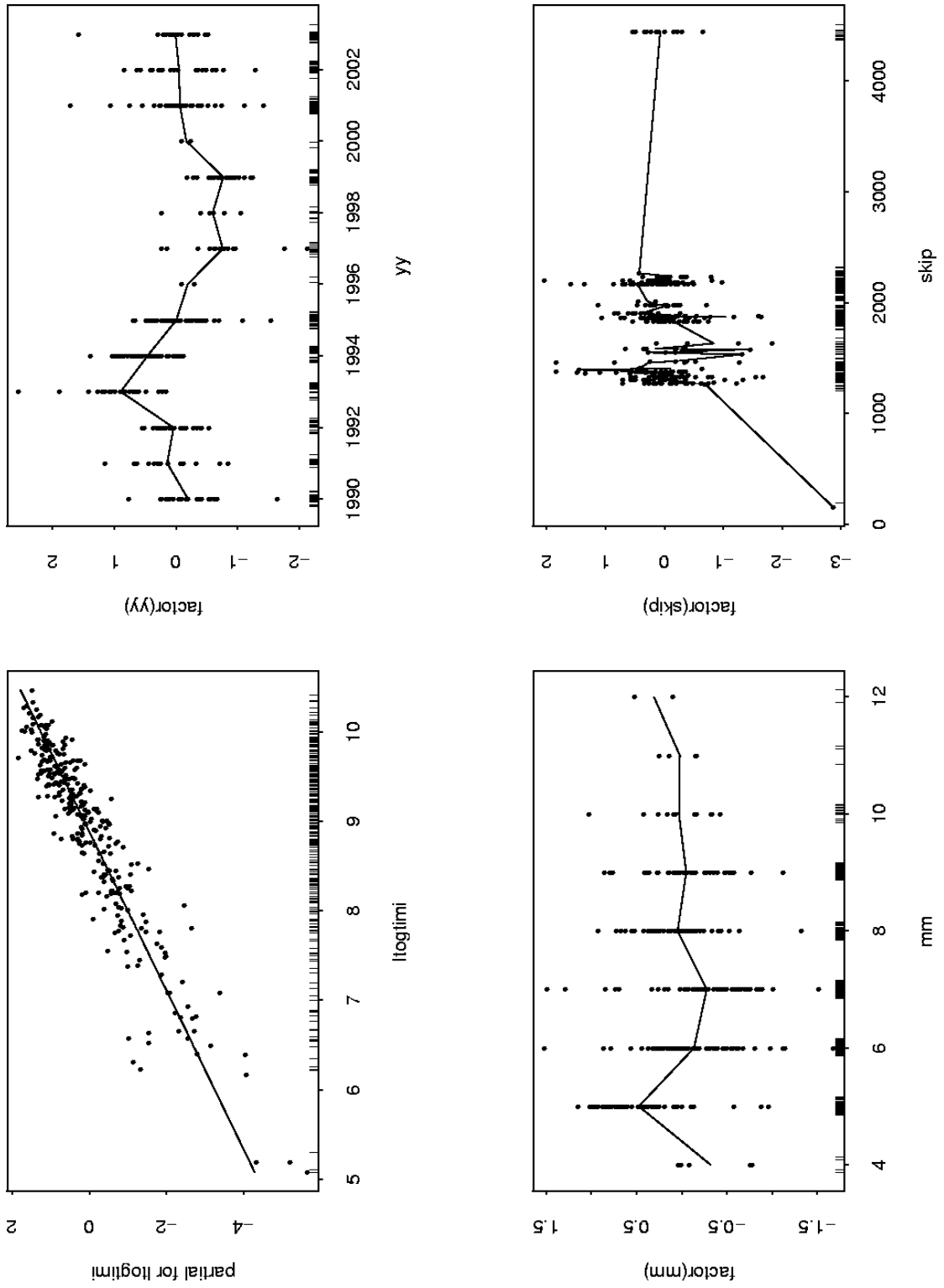


Figure 19. Diagnostic of the Icelandic CPUE data, southern area. Glm CPUE model. Graphical display of the fitted values and residuals. Estimated relationship between the individual fitted terms and each of the corresponding prdictors.

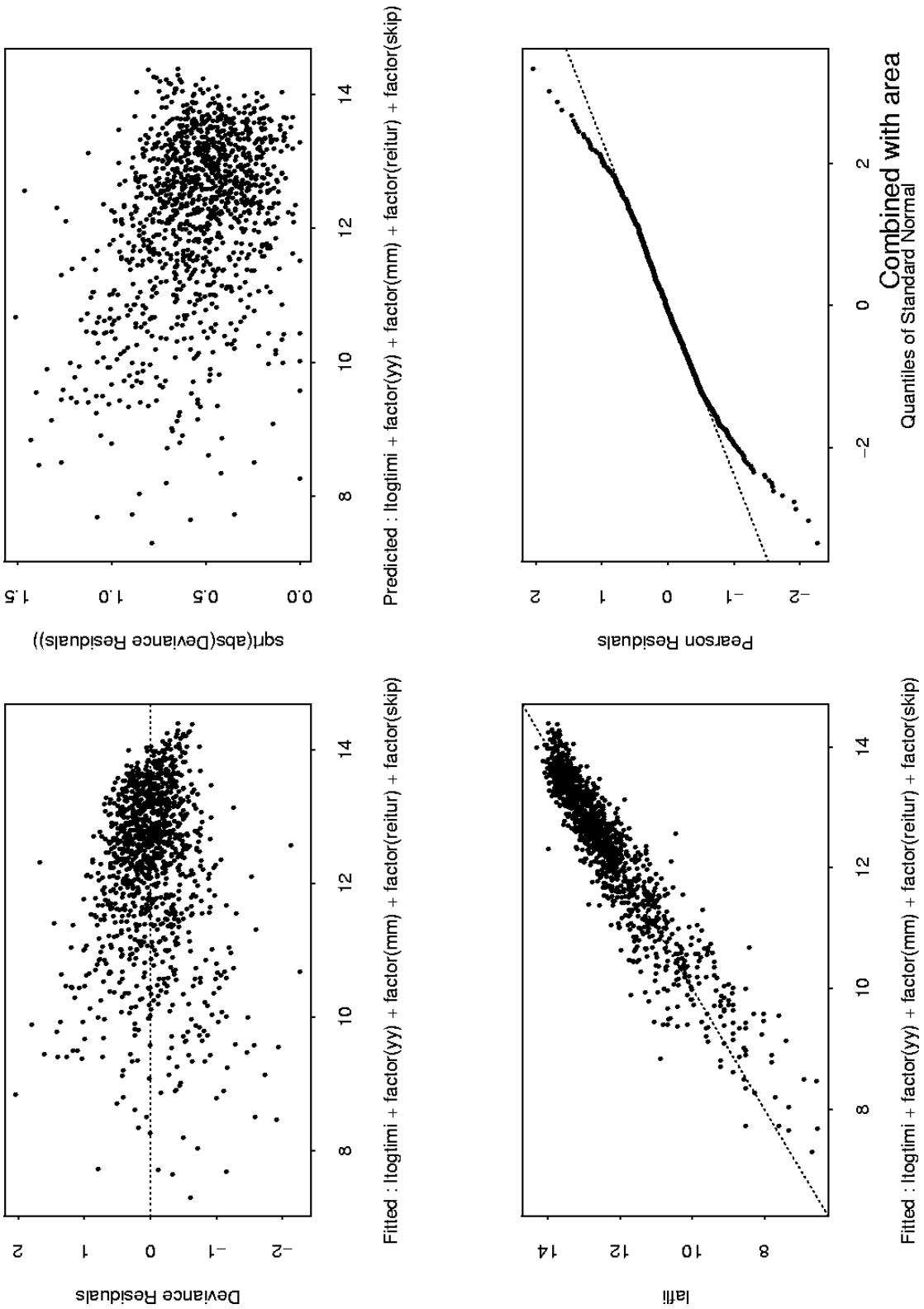


Figure 20.Icelandic data, combined. Glm CPUE model. Graphical display of the fitted values and residuals. a) plot of deviance rsiduals versus the fitted values, b) plot of the square root of the absolute deviance rsiduals vesus the linear predictor values. c) plot of the response versus the fitted values and d) normal quantile plot of the Pearson rsiduals.

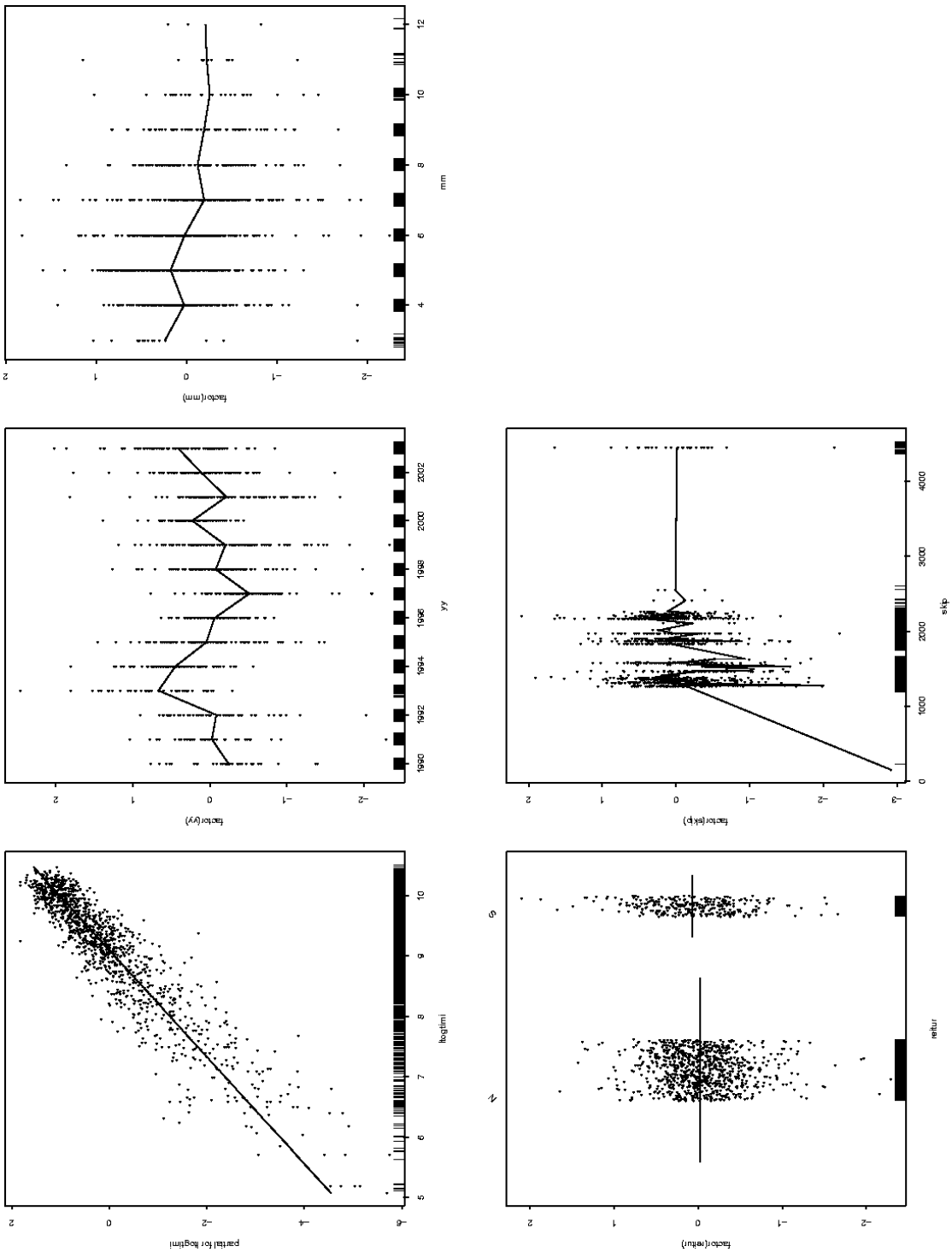


Figure 21. Diagnostic of the Icelandic CPUE data, combined data. Glm CPUE model. Graphical display of the fitted values and residuals. Estimated relationship between the individual fitted terms and each of the corresponding prdictors.

Tables.

Table 1. Proportion catches by ICES Divisons and EEZ.

	ICES Division	Greenland EEZ	Iceland EEZ	Int. waters	Total
2000	Va		91.84%		91.84%
	XIVb			8.16%	8.16%
Total			91.84%	8.16%	100.00%
2001	1F	0.31%			0.31%
	Va		61.84%		61.84%
	XII	26.46%		0.52%	26.99%
	XIVb	7.01%		3.85%	10.86%
Total		33.78%	61.84%	4.38%	100.00%
2002	Va		76.32%		76.32%
	XII	11.46%			11.46%
	XIVb	1.98%		10.24%	12.22%
Total		13.44%	76.32%	10.24%	100.00%
2003	1F			3.85%	3.85%
	J2			0.04%	0.04%
	Va		89.39%		89.39%
	XII	3.83%		0.05%	3.87%
	XIVb	0.00%		2.84%	2.84%
Total		3.83%	89.39%	6.78%	100.00%

Table 2 Distribution of catch by depth, proportion of oceanic redfish, standard deviation of the mean proportion, reported catch of oceanic and deep sea redfish (only when depth is reported). Data based on samples from the commercial fishery and from the log-books. The catches as well as the samples are divided according to the areas shown in Figure 6.

Area	Year	Depth	Depth range	st.dev	prop. oceanic	Catch ocean	Catch deep	not classified
N	1995	200	200_400	6.910322	95.11367	1784	92	0
N	1995	400	400_600	22.16947	76.51548	2212	679	0
N	1995	600	600_800	29.86098	50.90504	1499	1446	0
N	1996	0	0_200	NA	NA	NA	NA	2
N	1996	200	200_400	NA	100	428	0	0
N	1996	400	400_600	21.9907	67.35884	3727	1806	0
N	1996	600	600_800	23.62558	33.04726	16583	33597	0
N	1996	600	600_800	NA	NA	NA	NA	2177
N	1997	0	0_200	NA	NA	NA	NA	174
N	1997	200	200_400	NA	80.98383	1197	281	0
N	1997	400	400_600	33.50257	42.34135	1745	2377	0
N	1997	600	600_800	30.71756	26.99528	8837	23898	0
N	1997	800	800_1000	30.62339	28.18951	189	481	0
N	1998	200	200_400	NA	NA	NA	NA	21
N	1998	400	400_600	10.38908	15.48376	499	2722	0
N	1998	600	600_800	8.354502	7.420919	3186	39744	0
N	1998	800	800_1000	NA	0	0	475	0
N	1999	400	400_600	NA	5.135785	60	1103	0
N	1999	600	600_800	6.144677	5.570596	1960	33221	0
N	1999	800	800_1000	7.968011	9.921077	169	1538	0
N	2000	200	200_400	NA	NA	NA	NA	42
N	2000	400	400_600	6.825973	4.502155	503	10672	0
N	2000	600	600_800	5.777098	5.676941	1858	30868	0
N	2000	800	800_1000	3.585344	2.948028	18	606	0
N	2001	200	200_400	NA	NA	NA	NA	155
N	2001	400	400_600	1.434913	1.060554	21	1999	0
N	2001	600	600_800	6.964432	4.008421	1033	24733	0
N	2001	800	800_1000	11.70242	14.36032	113	674	0
N	2002	400	400_600	NA	NA	NA	NA	911
N	2002	600	600_800	5.529085	3.965075	1474	35694	0
N	2002	800	800_1000	NA	NA	NA	NA	0
N	2003	400	400_600	52.235	30.15789	206	478	0
N	2003	600	600_800	15.44922	5.262831	2165	38976	0
N	2003	800	800_1000	NA	NA	NA	NA	1496
S	1995	200	200_400	3.268645	97.95441	4913	103	0
S	1995	400	400_600	NA	100	3184	0	0
S	1995	600	600_800	26.46846	55.68935	10383	8261	0
S	1995	600	600_800	NA	NA	NA	NA	74
S	1996	200	200_400	NA	NA	NA	NA	3411
S	1996	400	400_600	2.550625	98.57296	1155	17	0
S	1997	200	200_400	19.88272	85.94079	1413	231	0
S	1997	400	400_600	NA	NA	NA	NA	453
S	1998	200	200_400	NA	NA	NA	NA	1838
S	1998	400	400_600	NA	NA	NA	NA	11
S	1998	600	600_800	NA	NA	NA	NA	23
S	1999	0	0_200	NA	NA	NA	NA	34
S	1999	200	200_400	1.469208	99.22071	5663	44	0
S	1999	400	400_600	26.98803	86.29651	113	18	0
S	2000	200	200_400	NA	NA	NA	NA	664
S	2001	0	0_200	NA	100	618	0	0
S	2001	200	200_400	15.37215	91.07954	11908	1166	0
S	2001	400	400_600	NA	NA	NA	NA	50

Area	Year	Depth	Depth range	st.dev	prop. oceanic	Catch ocean	Catch deep	not classified
S	2001	600	600_800	NA	NA	NA	NA	2
S	2002	200	200_400	0	100	5093	0	0
S	2002	400	400_600	NA	NA	NA	NA	280
S	2003	200	200_400	0	100	4988	0	0
S	2003	400	400_600	NA	100	90	0	0

Table 3 Summary table for catch by stock.

Area	(All)			
	Data			
Year	Not classif.	Catch oceanic	Catch deep sea	Total catch	% ocanic
1995	74	23976	10581	34630	69%
1996	5590	21893	35420	62903	38%
1997	627	13381	27268	41276	33%
1998	1893	3685	42942	48519	8%
1999	34	7965	35924	43923	18%
2000	707	2379	42146	45232	5%
2001	207	13693	28572	42472	32%
2002	1190	6567	35694	43451	16%
2003	1496	7449	39453	48398	16%

Area	N			
	Data			
Year	Not classif.	Catch oceanic	Catch deep sea	Total catch
1995	0	5495	2216	7711
1996	2179	20738	35403	58320
1997	174	11968	27037	39179
1998	21	3685	42942	46647
1999	0	2189	35862	38050
2000	42	2379	42146	44568
2001	155	1167	27406	28728
2002	911	1474	35694	38079
2003	1496	2371	39453	43320

Area	S			
	Data			
Year	Not classif.	Catch oceanic	Catch deep sea	
1995	74	18480	8364	26919
1996	3411	1155	17	4583
1997	453	1413	231	2097
1998	1872	0	0	1872
1999	34	5776	62	5873
2000	664	0	0	664
2001	52	12526	1166	13744
2002	280	5093	0	5373
2003	0	5078	0	5078

Table 4 Proportion males in catches by month since 1995.

	April	May	June	July	August	Sept	Oct	Nov	Total
1995	37%	52%	48%	71%	73%	74%	70%	71%	53%
1996	28%	41%	37%	53%		61%			38%
1997	28%	26%	48%	53%	66%				42%
1998	31%	31%	37%	40%	47%				34%
1999	38%	35%	34%		64%	60%	55%		42%
2000	34%	42%	53%	49%					41%
2001		50%	52%	48%	63%	61%			51%
2002	27%	33%	51%	47%	69%				37%
2003	36%	45%	50%		65%	64%			50%
Overall	32%	38%	46%	51%	64%	63%	62%	71%	42%

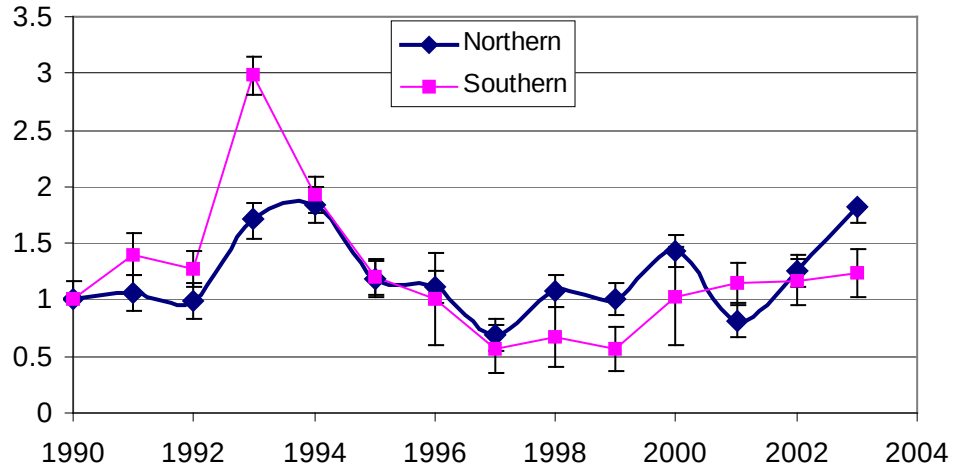
Table 5 Proportion of immature fish in the Icelandic pelagic redfish catches, by year and area since 1995.

	All data	Northern area	Southern area
1995	4%	5%	2%
1996	3%	1%	3%
1997	3%	5%	3%
1998	2%		2%
1999	2%	3%	2%
2000	6%	9%	6%
2001	10%	12%	10%
2002	12%	3%	12%
2003	7%	4%	9%

Table 6 Overall cpue in the Icelandic pelagic fishery (update for table 10.1.4).

Year	89	90	91	92	93	94	95	96	97	98	99	2000	01	02	03
t/h	1.11	1.02	1.50	1.66	3.27	2.64	2.00	1.74	1.11	1.55	1.52	1.98	1.40	1.90	2.28

Appendix 1. Results of the Glm models.




```
 [1] "fimmtudagur apríl 22 kl. 15:38:55 GMT 2004"
[1] "NORDURSVAEDI"
$call:
glm(formula = lafli ~ ltogtimi + factor(yy) + factor(mm) +
factor(skip), family = gaussian(), data = north)

$coefficients:
numeric matrix: 74 rows, 3 columns.
                        Value Std. Error       t value
     (Intercept)  1.902322905 0.29114522   6.533931414
        ltogtimi  1.135518501 0.02029936  55.938645003
  factor(yy)1991  0.065890323 0.15881626   0.414883996
  factor(yy)1992 -0.015601764 0.15370110  -0.101507172
  factor(yy)1993  0.536934476 0.16997769   3.158852670
  factor(yy)1994  0.604903418 0.15395608   3.929064880
  factor(yy)1995  0.175459056 0.15891969   1.104073728
  factor(yy)1996  0.113060914 0.14381667   0.786146096
  factor(yy)1997 -0.369436172 0.14385200  -2.568168510
  factor(yy)1998  0.078252167 0.14136732   0.553537871
  factor(yy)1999  0.008831501 0.14372332   0.061447931
  factor(yy)2000  0.360027884 0.14380435   2.503595219
  factor(yy)2001 -0.207930684 0.14485833  -1.435407183
  factor(yy)2002  0.229714141 0.14464801   1.588090561
  factor(yy)2003  0.597274528 0.14597416   4.091645612
     factor(mm)4 -0.182137523 0.13446348  -1.354550085
     factor(mm)5 -0.104253851 0.13643513  -0.764127589
     factor(mm)6 -0.132460145 0.13787581  -0.960720673
     factor(mm)7 -0.327786685 0.14064812  -2.330544349
     factor(mm)8 -0.332369732 0.15359209  -2.163976888
     factor(mm)9 -0.319647294 0.16613910  -1.923973905
    factor(mm)10 -0.539200380 0.18813543  -2.866022484
    factor(mm)11 -0.384179738 0.21706168  -1.769910448
    factor(mm)12 -1.018003749 0.49322865  -2.063959075
factor(skip)1268  0.284519096 0.37156194   0.765738008
factor(skip)1270  0.080442440 0.19885726   0.404523534
factor(skip)1273 -0.141827626 0.19753791  -0.717976743
factor(skip)1279 -0.193078264 0.26162753  -0.737989087
factor(skip)1281 -1.874691648 0.49514231  -3.786167324
factor(skip)1308  0.270361042 0.19055628   1.418798894
```

```
factor(skip)1328  0.093969805 0.19662128   0.477922864
factor(skip)1345 -0.165713218 0.20469989  -0.809542289
factor(skip)1351 -0.075031061 0.20225137  -0.370979248
factor(skip)1360  0.158659179 0.19828077   0.800174310
factor(skip)1365 -0.002010019 0.20275173  -0.009913694
factor(skip)1369  0.272830436 0.19702484   1.384751484
factor(skip)1376  0.142576791 0.19325318   0.737772040
factor(skip)1395 -0.011431772 0.29073701  -0.039319977
factor(skip)1412  0.018837945 0.37146532   0.050712528
factor(skip)1459 -0.241787150 0.19610399  -1.232953771
factor(skip)1471 -0.137606253 0.22140328  -0.621518594
factor(skip)1472 -0.214588525 0.21765523  -0.985910272
factor(skip)1473 -0.564060023 0.25013134  -2.255055335
factor(skip)1484 -1.027073350 0.49479495  -2.075755511
factor(skip)1497 -1.018177882 0.37146229  -2.740999278
factor(skip)1530 -0.364672568 0.49451047  -0.737441554
factor(skip)1552 -0.980836888 0.32114147  -3.054220540
factor(skip)1553 -0.15979486  0.2729613 -0.58541219
factor(skip)1578 -0.01887408  0.1997467 -0.09449010
factor(skip)1579  0.24837332  0.1977912  1.25573490
factor(skip)1585 -0.09688857  0.2182384 -0.44395754
factor(skip)1628 -0.45062858  0.3215860 -1.40126931
factor(skip)1833  0.29439294  0.1904524  1.54575595
factor(skip)1868  0.13651457  0.1899840  0.71855839
factor(skip)1872 -0.76574010  0.3847710 -1.99011905
factor(skip)1880 -0.04640104  0.1932386 -0.24012308
factor(skip)1902  0.18018989  0.1955287  0.92155201
factor(skip)1972 -0.46156642  0.2944605 -1.56749879
factor(skip)1976  0.21988863  0.2250302  0.97715176
factor(skip)1977  0.06271118  0.1995078  0.31432940
factor(skip)2013  0.16083294  0.3924859  0.40978022
factor(skip)2107 -0.16150928  0.2492732 -0.64792077
factor(skip)2165  0.44117419  0.1946613  2.26636822
factor(skip)2170  0.23621313  0.1913208  1.23464437
factor(skip)2182  0.06646572  0.1952351  0.34043944
factor(skip)2184  0.28101364  0.1979964  1.41928696
factor(skip)2203  0.06370199  0.1930394  0.32999477
factor(skip)2212  0.29486363  0.2386062  1.23577513
factor(skip)2236  0.01530497  0.2138372  0.07157300
factor(skip)2248 -0.12776638  0.3714122 -0.34400153
factor(skip)2265  0.16684294  0.2147676  0.77685355
factor(skip)2410 -0.02831744  0.2938695 -0.09636058
factor(skip)2549  0.04082278  0.3248729  0.12565770
factor(skip)4449  0.16116519  0.2138925  0.75348682

[1] "RESULTS nordursvaedi"
                     Value Std..Error     t.value   ar     index
factor(yy)1991  0.065890323  0.1588163  0.41488400 1991 1.0681096
factor(yy)1992 -0.015601764  0.1537011 -0.10150717 1992 0.9845193
factor(yy)1993  0.536934476  0.1699777  3.15885267 1993 1.7107545
factor(yy)1994  0.604903418  0.1539561  3.92906488 1994 1.8310754
factor(yy)1995  0.175459056  0.1589197  1.10407373 1995 1.1917932
factor(yy)1996  0.113060914  0.1438167  0.78614610 1996 1.1197001
factor(yy)1997 -0.369436172  0.1438520 -2.56816851 1997 0.6911239
factor(yy)1998  0.078252167  0.1413673  0.55353787 1998 1.0813953
factor(yy)1999  0.008831501  0.1437233  0.06144793 1999 1.0088706
factor(yy)2000  0.360027884  0.1438044  2.50359522 2000 1.4333694
factor(yy)2001 -0.207930684  0.1448583 -1.43540718 2001 0.8122633
factor(yy)2002  0.229714141  0.1446480  1.58809056 2002 1.2582403
factor(yy)2003  0.597274528  0.1459742  4.09164561 2003 1.8171594
```

```
[1] "SUDURSVAEDI"
[1] "results sudursvaedi"
```

	Value	Std..Error	t.value	ar	index
factor(yy)1991	**0.339550415**	**0.1839141**	**1.84624447**	**1991**	**1.4043161**
factor(yy)1992	**0.239630186**	**0.1526520**	**1.56978049**	**1992**	**1.2707791**
factor(yy)1993	**1.092311926**	**0.1672072**	**6.53268432**	**1993**	**2.9811583**
factor(yy)1994	**0.656560258**	**0.1638399**	**4.00732760**	**1994**	**1.9281486**
factor(yy)1995	**0.189398851**	**0.1578530**	**1.19984324**	**1995**	**1.2085229**
factor(yy)1996	**0.005424871**	**0.4047563**	**0.01340281**	**1996**	**1.0054396**
factor(yy)1997	**-0.560927881**	**0.2084450**	**-2.69101123**	**1997**	**0.5706793**
factor(yy)1998	**-0.400895290**	**0.2616808**	**-1.53200091**	**1998**	**0.6697202**
factor(yy)1999	**-0.566749094**	**0.1985067**	**-2.85506251**	**1999**	**0.5673669**
factor(yy)2000	**0.030579592**	**0.4312145**	**0.07091504**	**2000**	**1.0310520**
factor(yy)2001	**0.135906513**	**0.1813463**	**0.74943087**	**2001**	**1.1455748**
factor(yy)2002	**0.150099330**	**0.2004841**	**0.74868439**	**2002**	**1.1619497**
factor(yy)2003	**0.206605388**	**0.2129435**	**0.97023583**	**2003**	**1.2294973**

```
Analysis of Deviance Table

Gaussian model

Response: lafli
```

Terms added sequentially (first to last)

	Df	Deviance	Resid. Df	Resid. Dev	F Value	Pr(F)
NULL			**302**	**559.2208**		
ltogtimi	**1**	**390.9546**	**301**	**168.2662**	**1575.839**	**0.000000e+00**
factor(yy)	**13**	**53.6238**	**288**	**114.6424**	**16.626**	**0.000000e+00**
factor(mm)	**8**	**22.4749**	**280**	**92.1675**	**11.324**	**1.400000e-13**
factor(skip)	**43**	**33.3695**	**237**	**58.7981**	**3.128**	**1.600384e-08**

```
[1] "COMBINED"
[1] "Tekið er tillit til norður suður svæðanna.."
$call:
glm(formula = lafli ~ ltogtimi + factor(yy) + factor(mm) +
factor(reitur) + factor(skip), family = gaussian(), data = testdata)

$coefficients:
numeric matrix: 80 rows, 3 columns.
```

	Value	Std. Error	t value
(Intercept)	-0.95090057	0.53154333	-1.7889427
ltogtimi	1.12913585	0.01655145	68.2197596
factor(yy)1991	0.21583762	0.12018220	1.7959201
factor(yy)1992	0.15868748	0.11014100	1.4407666
factor(yy)1993	0.91030617	0.11793525	7.7186943
factor(yy)1994	0.68848800	0.11061406	6.2242357
factor(yy)1995	0.28618983	0.10840979	2.6398892
factor(yy)1996	0.18283870	0.11003669	1.6616159
factor(yy)1997	-0.27067132	0.10711215	-2.5269900
factor(yy)1998	0.16543244	0.10704491	1.5454489
factor(yy)1999	0.03681316	0.10792883	0.3410874
factor(yy)2000	0.46708438	0.11078692	4.2160609
factor(yy)2001	0.02731403	0.10751622	0.2540457
factor(yy)2002	0.35501116	0.10842472	3.2742640
factor(yy)2003	0.65731372	0.11084040	5.9302719
factor(mm)4	-0.21347053	0.13999196	-1.5248771
factor(mm)5	-0.06622383	0.14005875	-0.4728290
factor(mm)6	-0.21640380	0.14091862	-1.5356650
factor(mm)7	-0.43248101	0.14362684	-3.0111433
factor(mm)8	-0.35990291	0.15102149	-2.3831238
factor(mm)9	-0.43363770	0.15554174	-2.7879185
factor(mm)10	-0.49824344	0.17230143	-2.8916965
factor(mm)11	-0.46159077	0.20389654	-2.2638480

factor(mm)12	-0.45045602	0.33243224	-1.3550311
factor(reitur)	0.09296233	0.04266219	2.1790330
factor(skip)1265	2.75739400	0.53481895	5.1557522
factor(skip)1268	3.14893363	0.61652062	5.1075885
factor(skip)1270	2.87787236	0.51104611	5.6313360
factor(skip)1273	2.70514207	0.51017434	5.3023876
factor(skip)1279	2.59843617	0.53472900	4.8593515
factor(skip)1281	0.92437825	0.70941630	1.3030124
factor(skip)1308	3.06764603	0.50720417	6.0481482
factor(skip)1328	2.85005536	0.50949641	5.5938674
factor(skip)1345	2.67801323	0.51503151	5.1997076
factor(skip)1351	2.77262609	0.51412364	5.3929169
factor(skip)1360	3.01356204	0.51345552	5.8691783
factor(skip)1365	2.86087559	0.51359791	5.5702633
factor(skip)1369	3.15741584	0.51119810	6.1765015
factor(skip)1376	3.02078192	0.50912364	5.9332973
factor(skip)1395	3.19043996	0.55243379	5.7752441
factor(skip)1408	2.89025474	0.61748995	4.6806506
factor(skip)1412	3.11013147	0.58124142	5.3508428
factor(skip)1459	2.65020735	0.51166034	5.1796224
factor(skip)1471	2.70292453	0.52016526	5.1962804
factor(skip)1472	2.62204674	0.52229971	5.0201957
factor(skip)1473	2.28700703	0.54013862	4.2341113
factor(skip)1484	1.89418755	0.70962313	2.6692866
factor(skip)1497	1.847232	0.6164517	2.996556
factor(skip)1530	2.558918	0.7094249	3.607032
factor(skip)1536	1.369718	0.7096103	1.930239
factor(skip)1552	2.258532	0.5636711	4.006826
factor(skip)1553	2.744295	0.5397638	5.084252
factor(skip)1578	2.759664	0.5142590	5.366292
factor(skip)1579	3.057610	0.5128698	5.961765
factor(skip)1585	2.864173	0.5187757	5.521023
factor(skip)1628	2.377488	0.5813653	4.089490
factor(skip)1634	1.976452	0.5567845	3.549761
factor(skip)1833	3.010849	0.5061534	5.948490
factor(skip)1868	2.978866	0.5058661	5.888644
factor(skip)1872	2.021549	0.5457374	3.704252
factor(skip)1880	2.778509	0.5080645	5.468811
factor(skip)1902	3.075650	0.5102617	6.027594
factor(skip)1972	2.560948	0.5396193	4.745842
factor(skip)1976	3.013978	0.5161721	5.839094
factor(skip)1977	2.961036	0.5106233	5.798866
factor(skip)2013	3.139456	0.5540024	5.666865
factor(skip)2107	2.685891	0.5392837	4.980479
factor(skip)2165	3.305882	0.5090303	6.494470
factor(skip)2170	3.034597	0.5088280	5.963896
factor(skip)2182	2.868193	0.5114370	5.608107
factor(skip)2184	3.100593	0.5123558	6.051640
factor(skip)2203	2.982457	0.5091912	5.857244
factor(skip)2212	3.070746	0.5257057	5.841188
factor(skip)2220	3.238599	0.7090110	4.567770
factor(skip)2236	2.857073	0.5159942	5.537025
factor(skip)2248	2.716018	0.6161075	4.408351
factor(skip)2265	3.028048	0.5202426	5.820454
factor(skip)2410	2.789142	0.5637898	4.947131
factor(skip)2549	2.922096	0.5827944	5.013939
factor(skip)4449	2.900449	0.5135728	5.647592

```
[1] "RESULTS combinded"
                   Value Std..Error    t.value   ar     index
factor(yy)1991  0.21583762  0.1201822  1.7959201 1991 1.2409009
factor(yy)1992  0.15868748  0.1101410  1.4407666 1992 1.1719716
factor(yy)1993  0.91030617  0.1179353  7.7186943 1993 2.4850833
factor(yy)1994  0.68848800  0.1106141  6.2242357 1994 1.9907033
factor(yy)1995  0.28618983  0.1084098  2.6398892 1995 1.3313452
factor(yy)1996  0.18283870  0.1100367  1.6616159 1996 1.2006207
factor(yy)1997 -0.27067132  0.1071121 -2.5269900 1997 0.7628672
factor(yy)1998  0.16543244  0.1070449  1.5454489 1998 1.1799032
factor(yy)1999  0.03681316  0.1079288  0.3410874 1999 1.0374992
factor(yy)2000  0.46708438  0.1107869  4.2160609 2000 1.5953360
factor(yy)2001  0.02731403  0.1075162  0.2540457 2001 1.0276905
factor(yy)2002  0.35501116  0.1084247  3.2742640 2002 1.4261966
factor(yy)2003  0.65731372  0.1108404  5.9302719 2003 1.9296019
Analysis of Deviance Table

Gaussian model

Response: lafli

Terms added sequentially (first to last)
              Df Deviance Resid. Df Resid. Dev  F Value      Pr(F)
          NULL                 1199   2105.364
      ltogtimi  1 1630.235      1198    475.129 6660.819 0.00000000
    factor(yy) 13  124.364      1185    350.765   39.087 0.00000000
    factor(mm)  9   14.215      1176    336.550    6.453 0.00000001
factor(reitur)  1    1.156      1175    335.394    4.724 0.02995024
  factor(skip) 55   61.274      1120    274.120    4.552 0.00000000
```