Dataset for use in data poor methods

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MYDAS

Task 5 of the MYDAS project https://github.com/laurieKell/mydas requires a review of data avialble on length composition, mean size, catch and indices of abudance (commercial or survey).

Data are available from the MI or from collective sources such as DATRAS http://www.ices.dk/marine-data/data-portals/Pages/DATRAS.aspx for survey data and the STECF https://stecf.jrc.ec.europa.eu/data-dissemination for commercial data.

Work plan

- Condition the operating model using life histories (from table above) from brill, turbot, skate and Pollack as per the Mydas project (see the quick start). Will have to use MI estimates for sprat. Use estimates of length (brill, sprat, skate). Obtain length frequencies for turbot and pollack from MI.
- With further investigation look at predicted abundance estimates for brill, sprat (although on high side) and skate (abundance was for all species of skates and rays, will have to make consistent with commercial species… maybe use thornback only). Pollack and turbot catches are greater than abundance so cannot use these.
- With such good time series of survey length data for brill, sprat and skate it would good to sim test the mean size by using the mlz package https://cran.r-project.org/web/packages/MLZ/vignettes/MLZ.html#introduction. This would give an estimate of Z (assuming constant M) and thus look at changes in F.
- It may also be worth pursuing the LBSR for length-based composition for the above (and compare) with life-history parameters M/K ratio and Linf to estimate F/M and F/FMSY. With SPR being the biological reference point. https://cran.r-project.org/web/packages/LBSPR/vignettes/LBSPR.html
- For turbot and pollack it maybe beneficially to use and empirical approach (as survey info pretty poor) based on the commercial cpue (biomass index from MI lengths or estimated by weights) such as the ICES 2/3 rule (as per Simon Fischer).

For the observation model commercial cpues could be used.

Further: Need to discuss with MI what data we can get for Lobsters and Razors in terms of lengths. We have 1 set of priors from Iyves.

Database connection

Survey data extraction

Extract via sql the case study stocks from Mydas survey database and get numbers at length

For more in depth detail of the data see https://data.marine.gov.scot/sites/default/files//SMFS%200816.pdf

Calculate weighted mean length for case study species

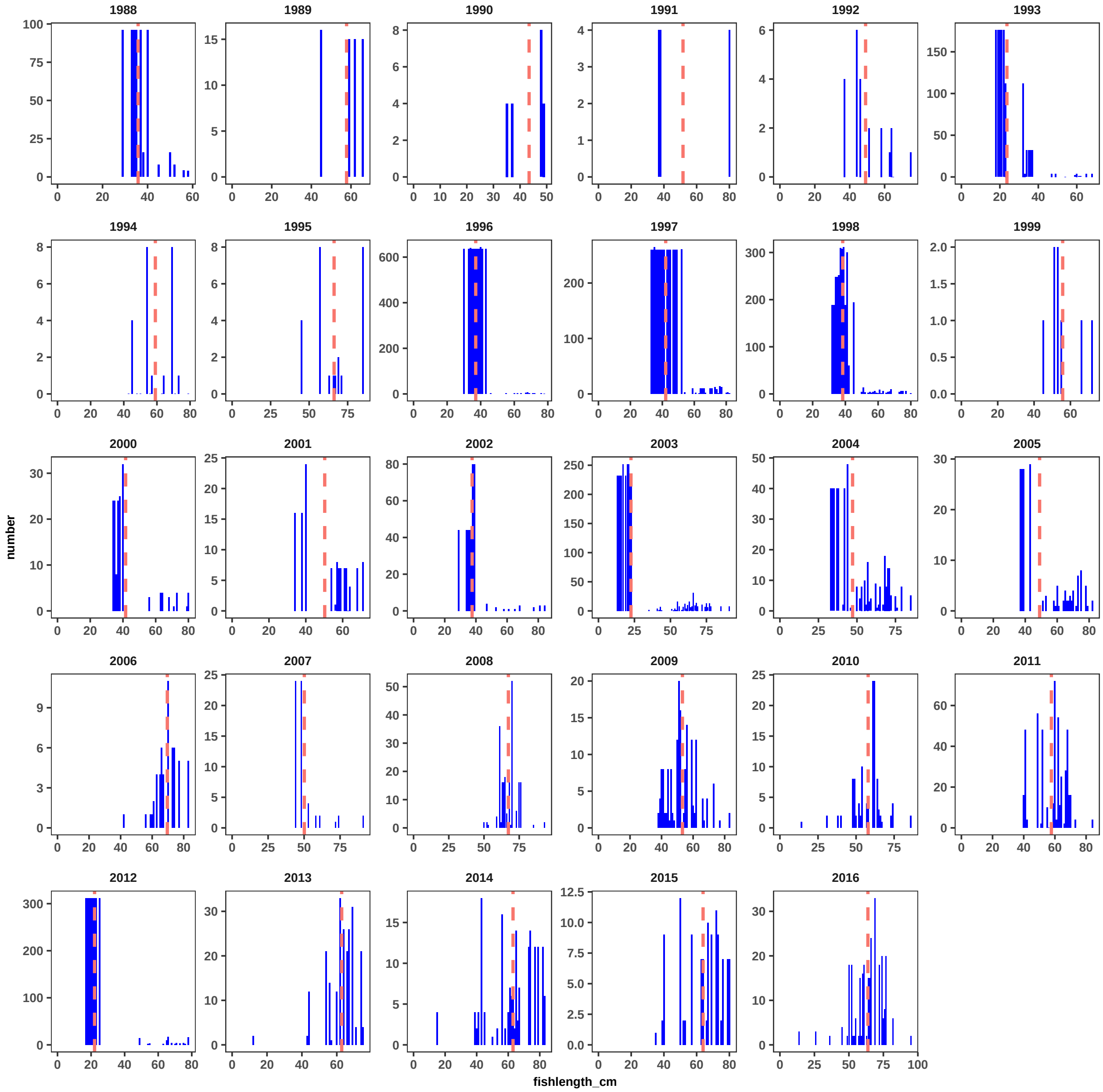


Figure 1 Plot of numbers at length for pollock with weighted mean length represented by dashed red line.

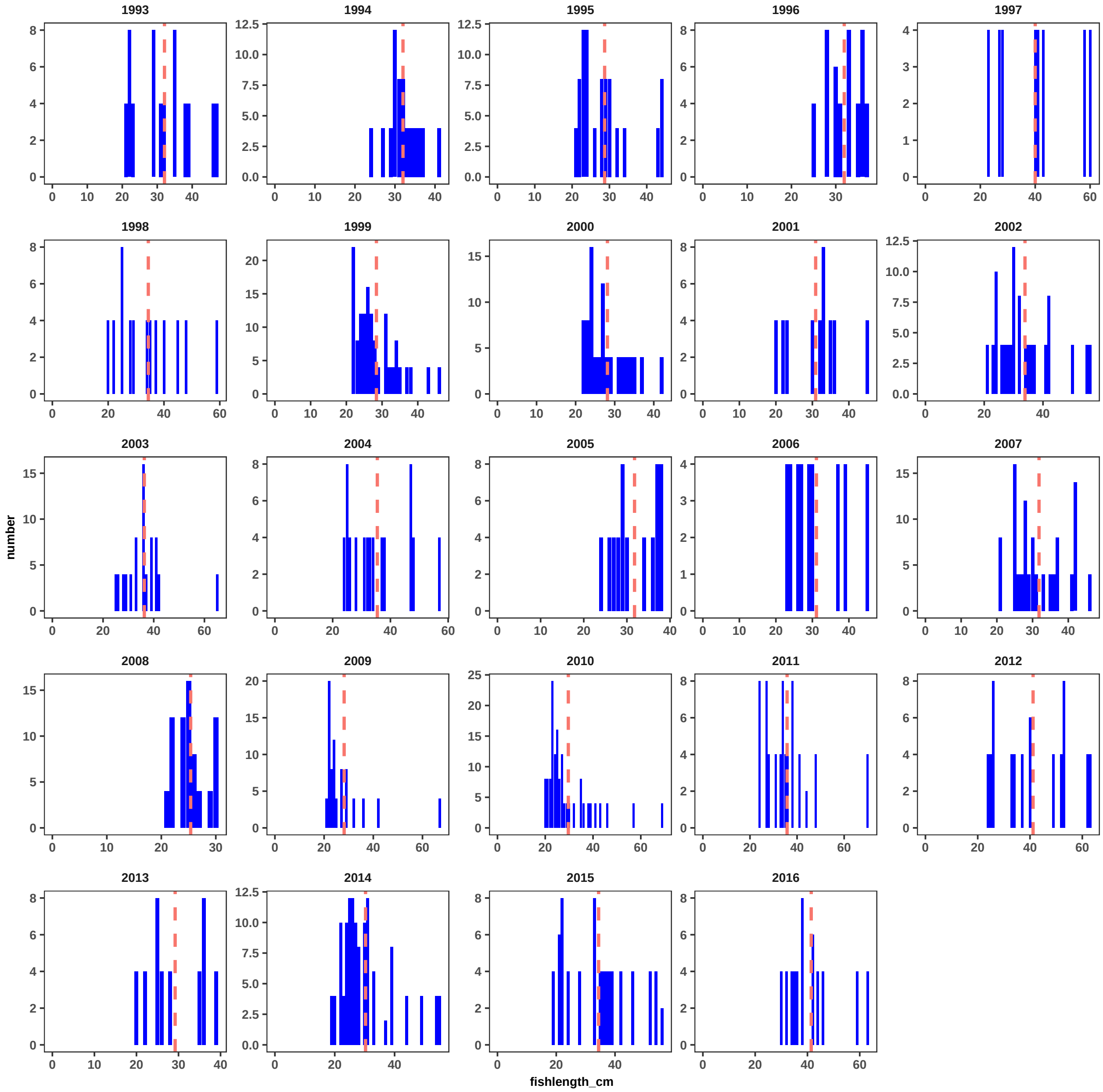


Figure 2 Plot of numbers at length for turbot with weighted mean length represented by dashed red line.

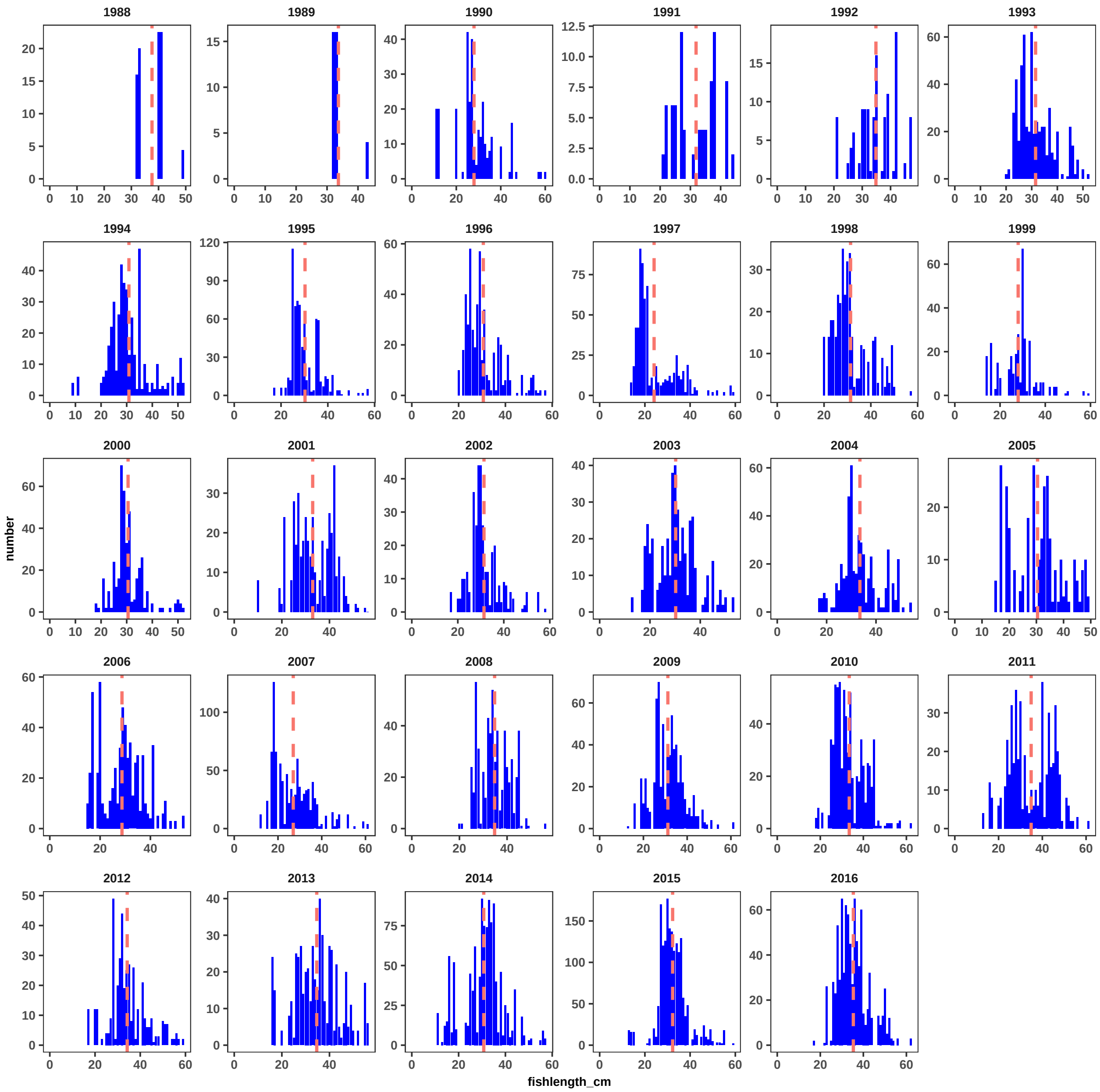


Figure 3 Plot of numbers at length for brill with weighted mean length represented by dashed red line.

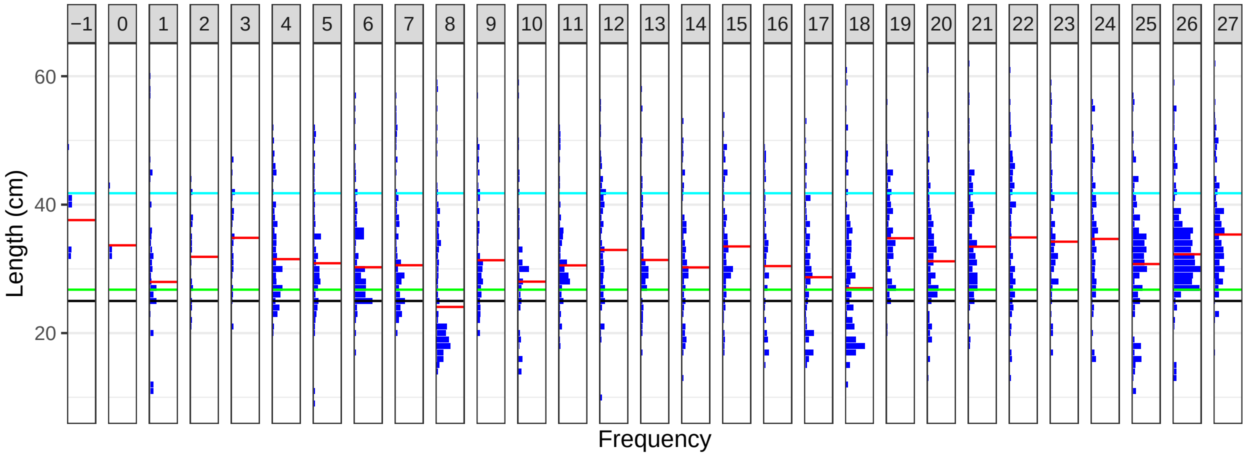


Figure 4 Plot of numbers at length for brill with weighted mean length represented by dashed red line.

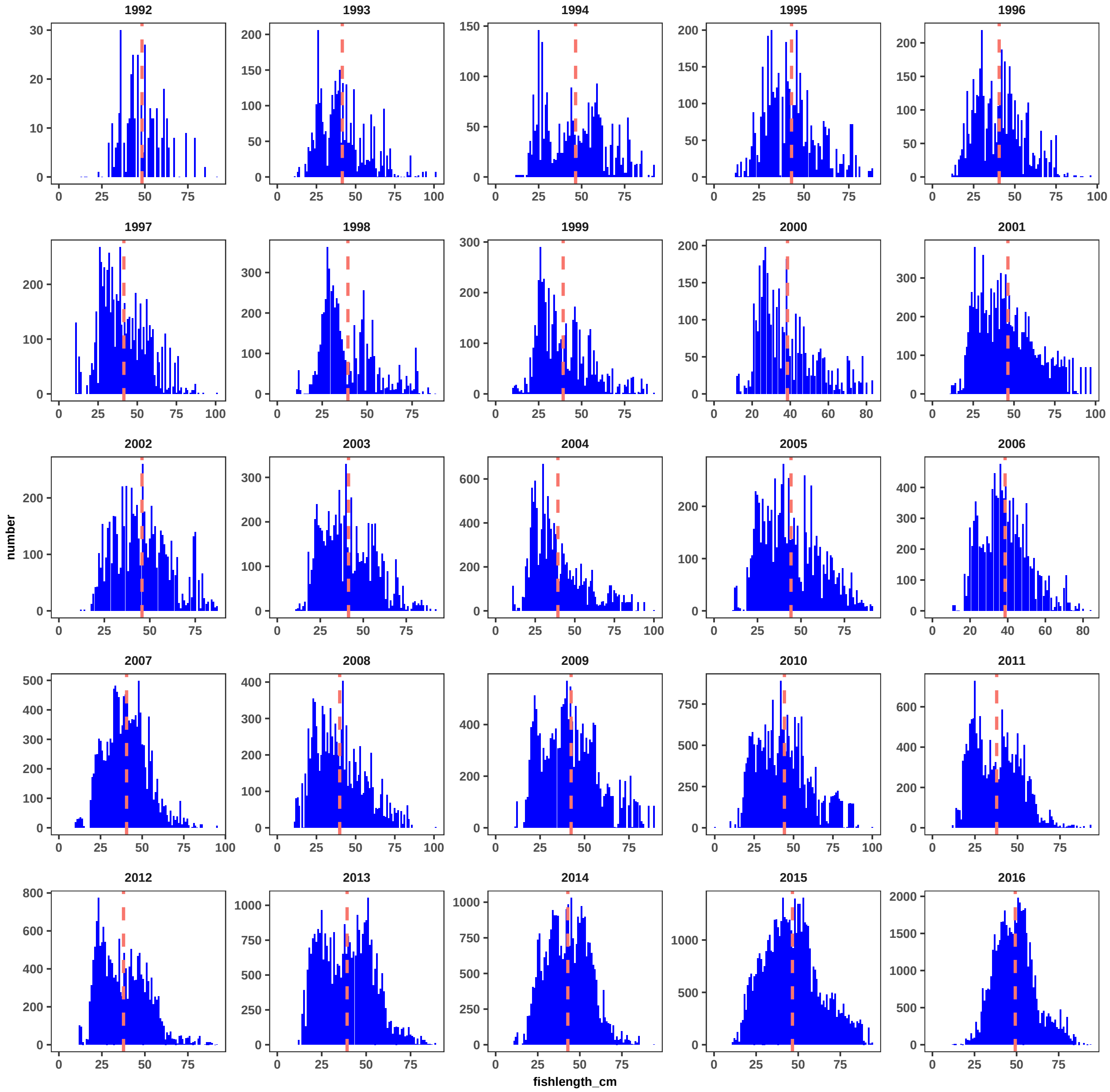


Figure 5 Plot of numbers at length for skate with weighted mean length represented by dashed red line.

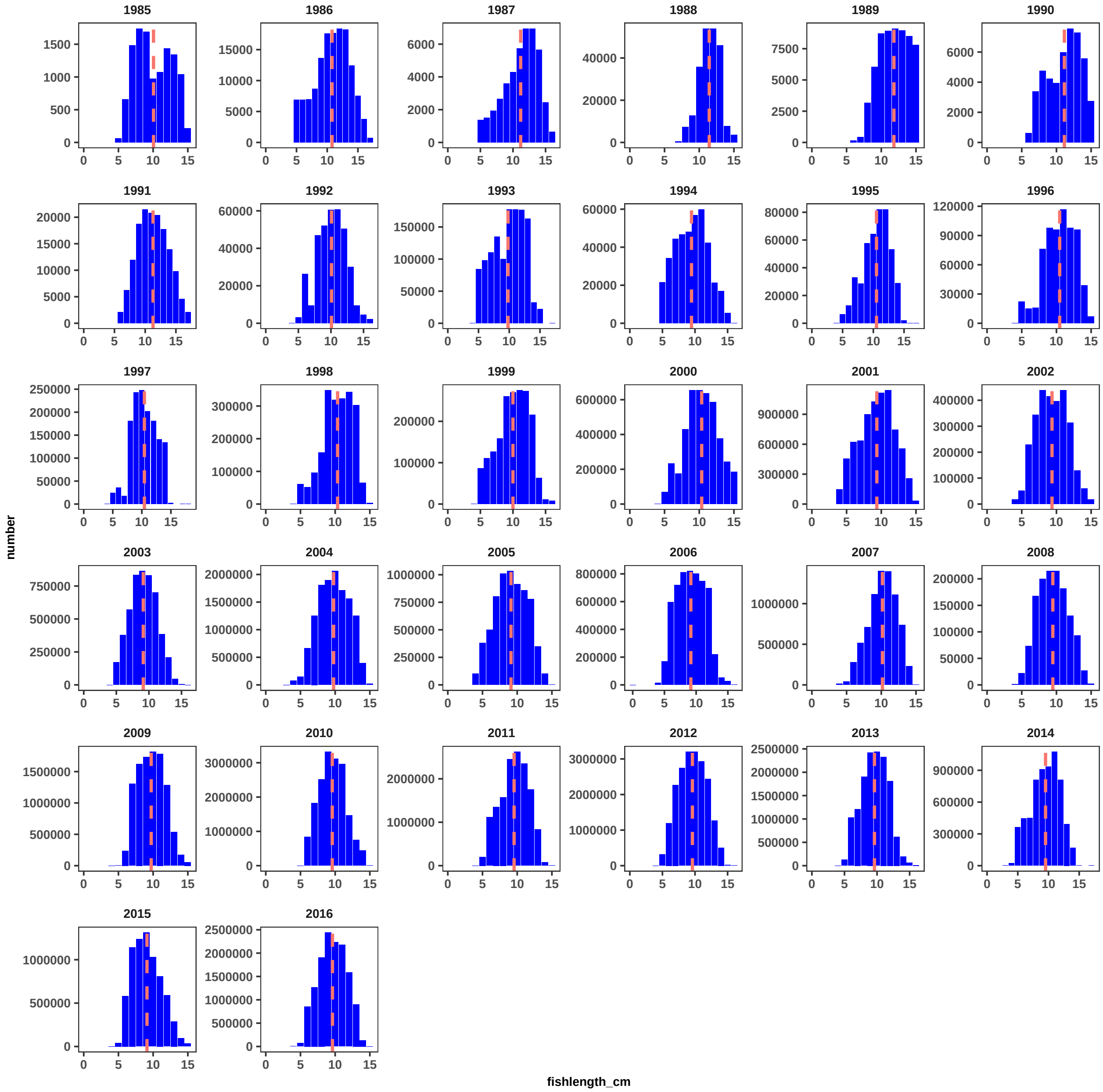


Figure 6 Plot of numbers at length for sprat with weighted mean length represented by dashed red line.

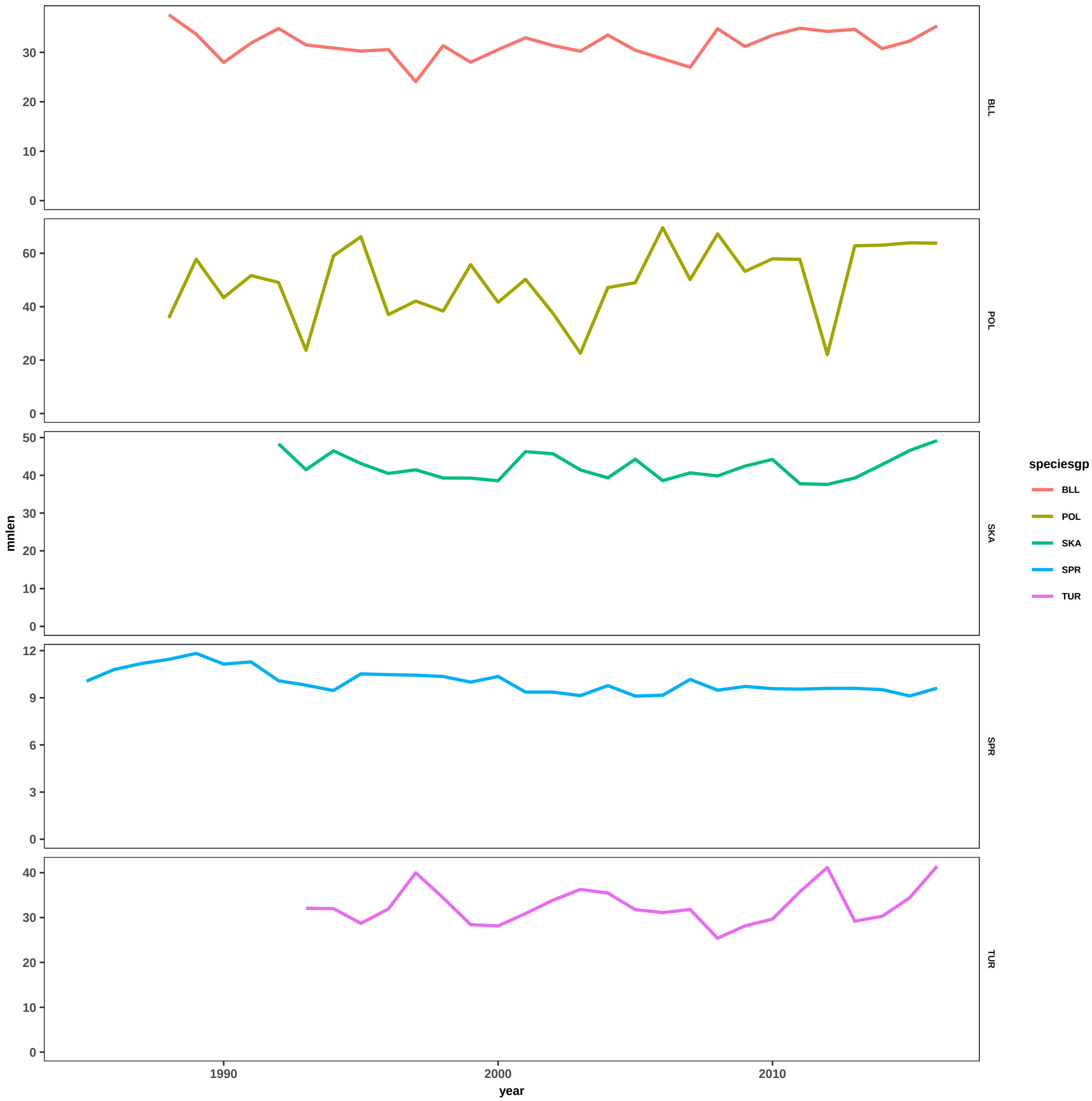


Figure 7 Time series of weighted mean length.

Get all survey data from sql query

Estimate fish weight in kgs

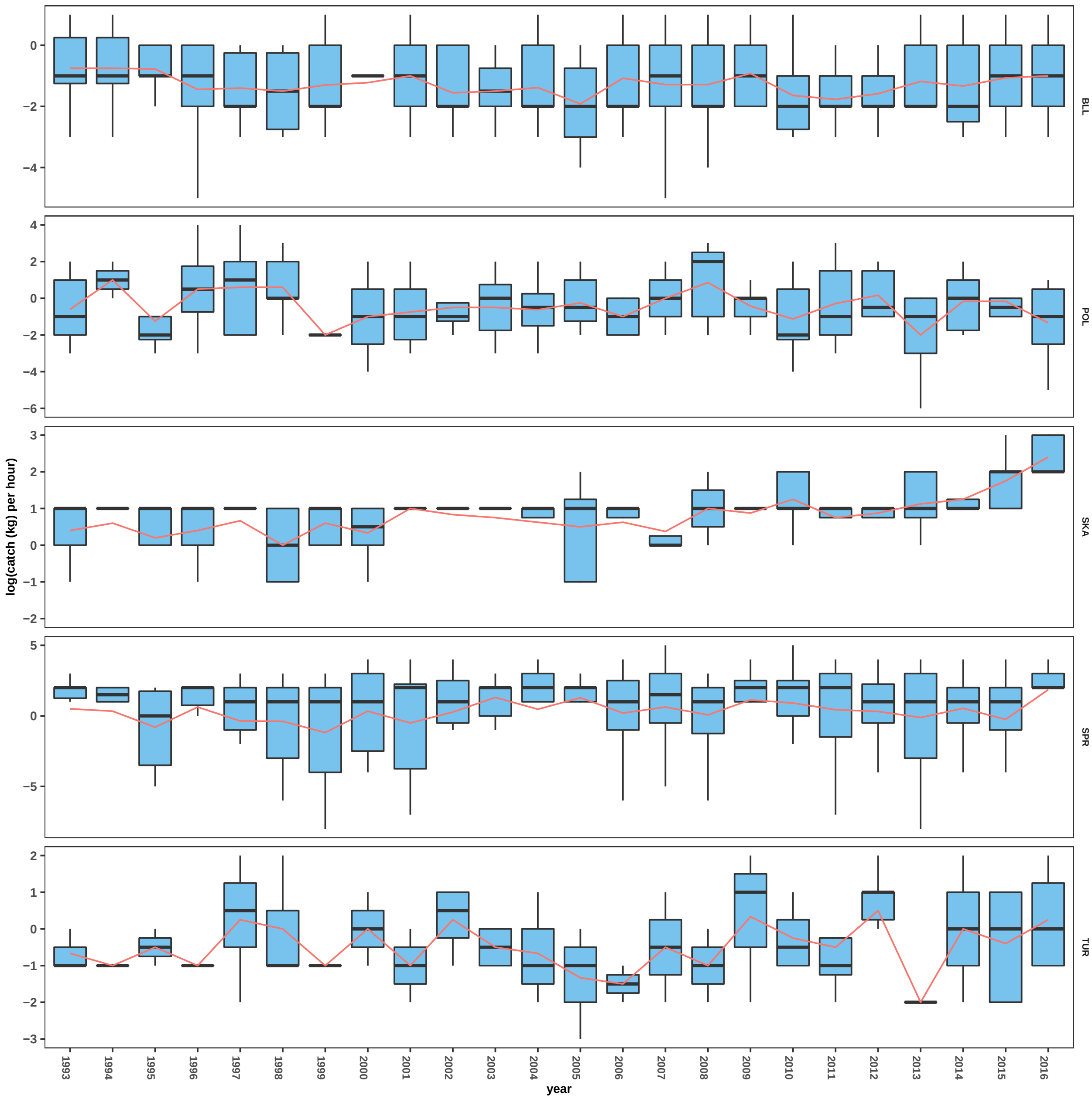


Figure 8 Catch per unit effort in kgs (CPUE) time series with red line depicting mean cpue.

Fish numbers

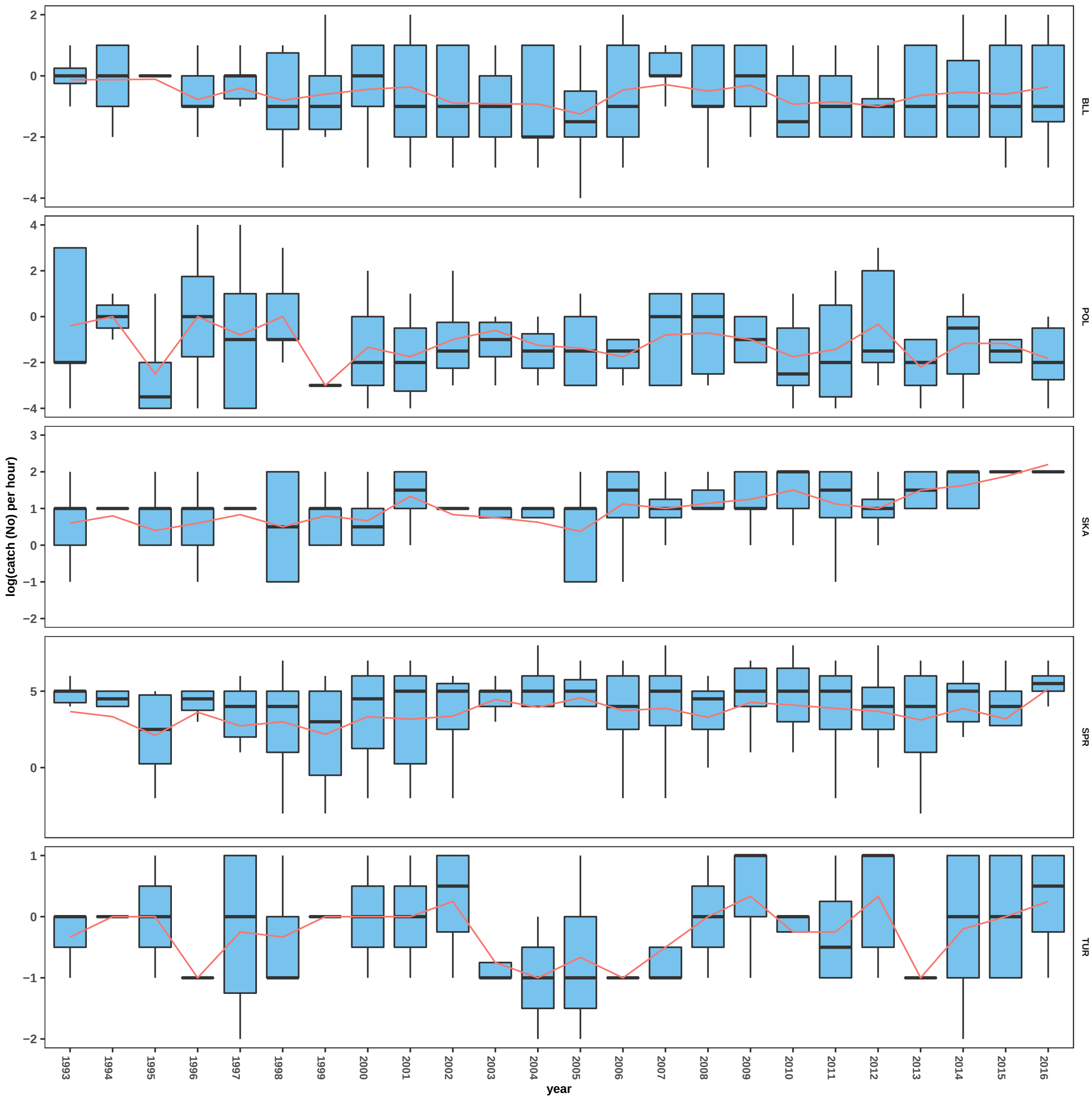


Figure 9 Catch per unit effort in numbers (CPUE) time series with red line depicting mean cpue.

Commercial data

Part of the issues with the main catch data in the stecf database is that the effort does not match up by gear and area with the effort estimations. Here the STECF Annual Economic Report database is used.

Extract the data via sql

Estimate catch in kgs per day

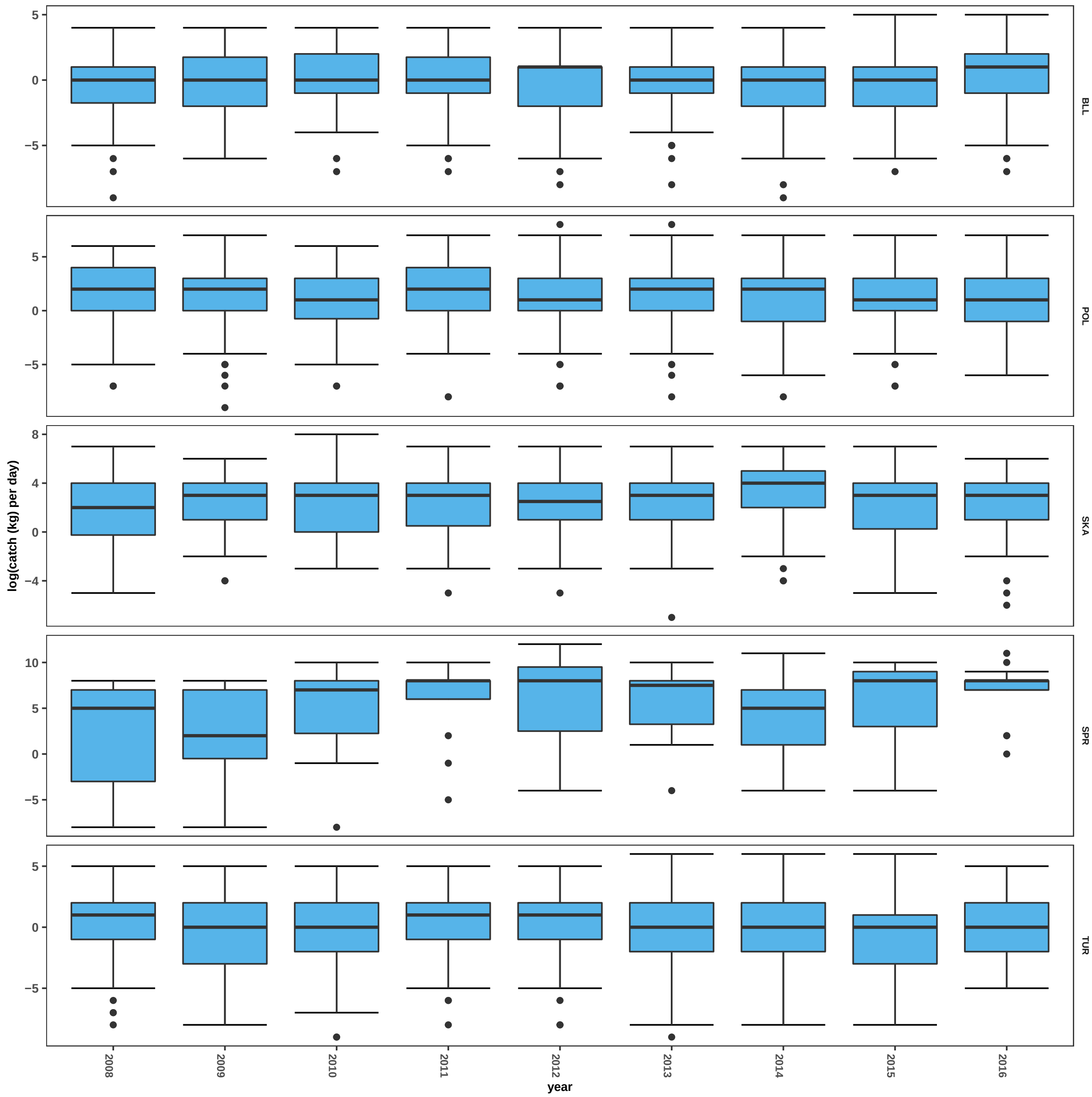


Figure 10 Time series of commercial cpue.

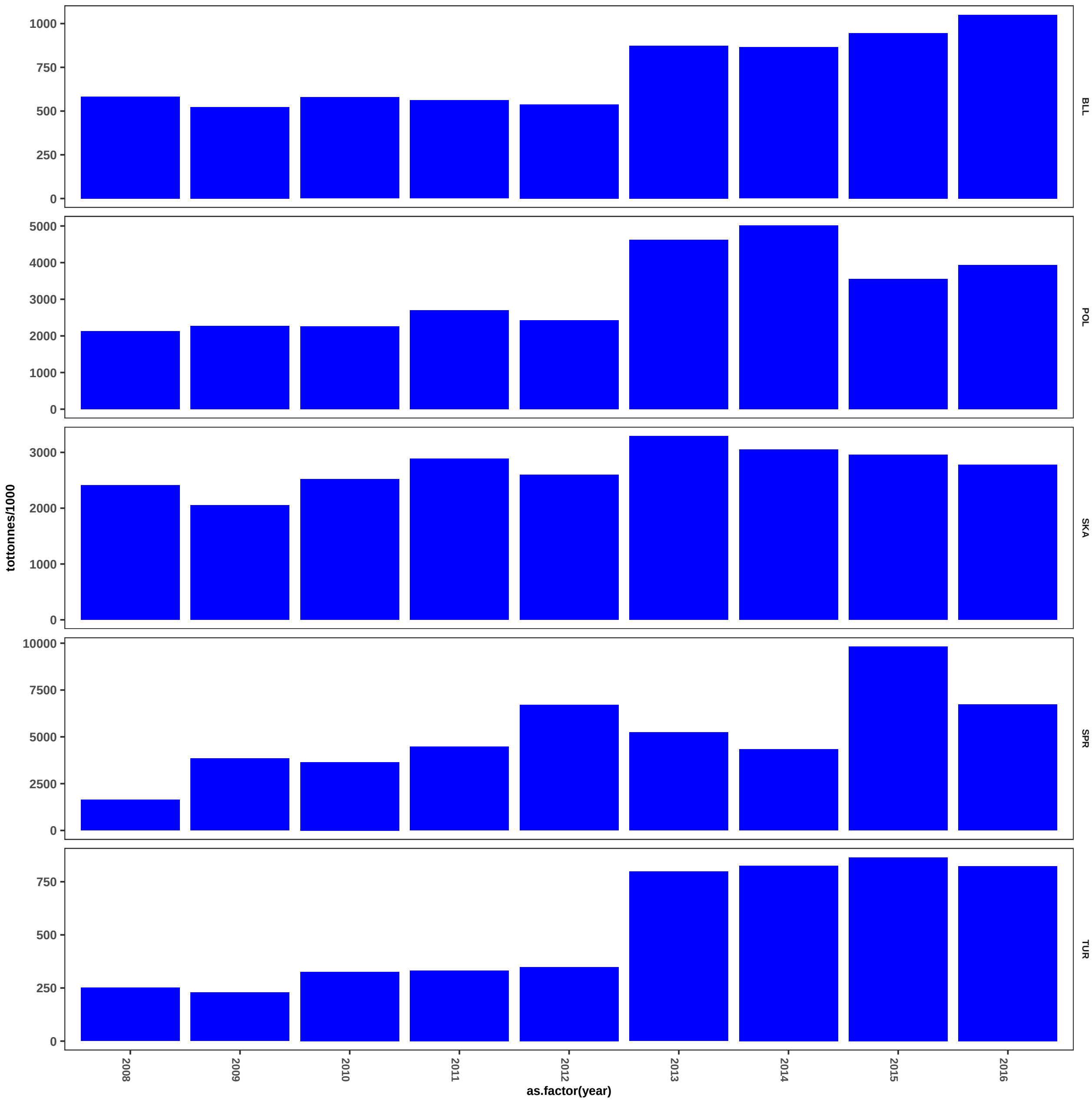


Figure 11 Time series of total catch in tonnes.

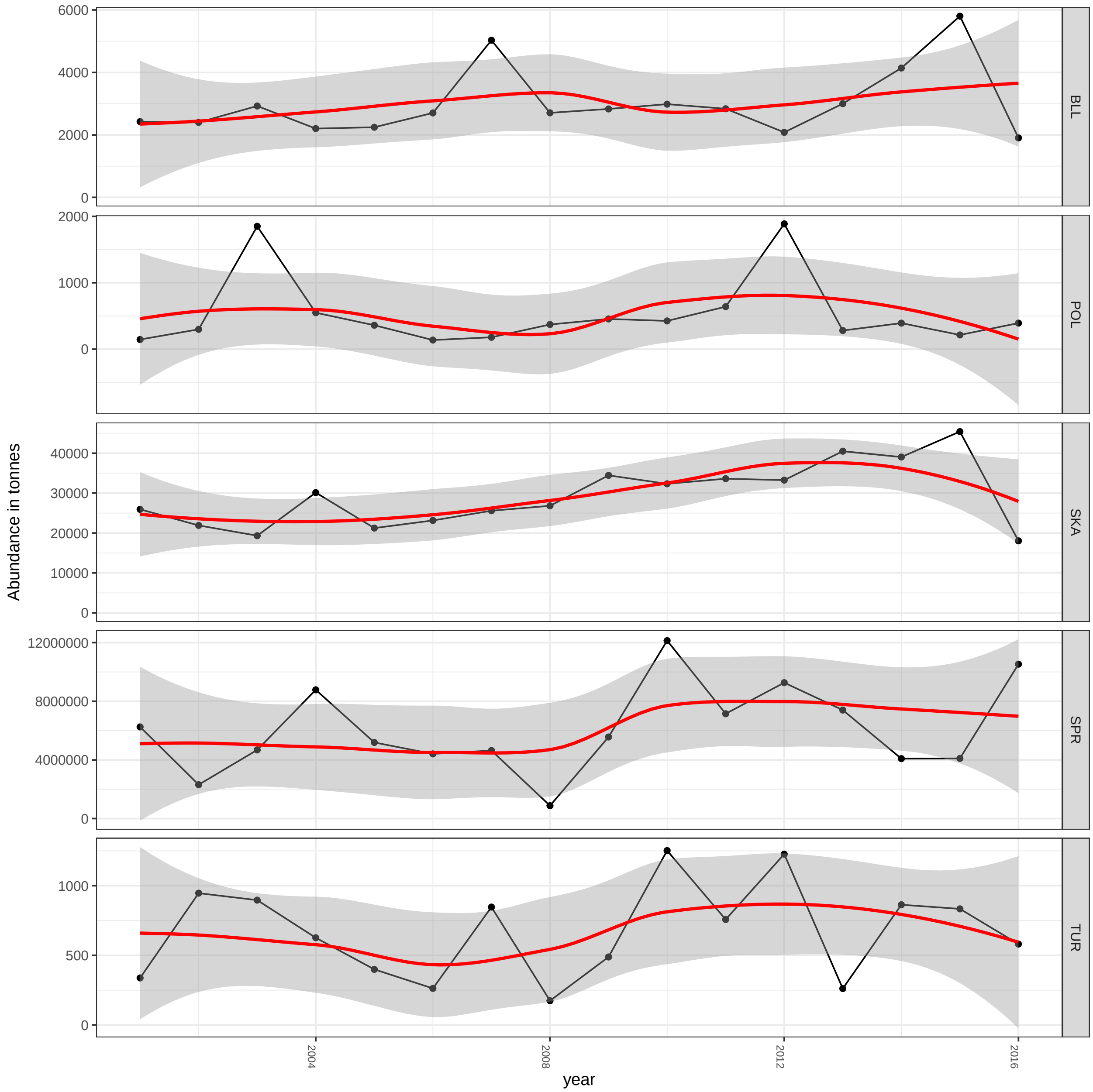
Estimate abundance from survey data

See http://www.fao.org/docrep/w5449e/w5449e0f.htm section 13.7

Get survey stations

Calculate total area/total number of stations the survey covered by division and merge with catch tonnes perkm2

Biomass = totalsurveyarea x 1/total number of stations within the survey area x sum of catch



Life history parameters from the literature

Table 1: life history paramters

id	species	speciesgp	t.0	linf	k	lmat	tm	sex	area	source
1	Amblyraja radiata	SKA		66.00	0.2330	46.0	4.0	U	North Sea	[12]
7	Leucoraja circularis	SKA		98.80	0.1210	51.2	5.3	U	North Sea	[12]
8	Leucoraja fullonica	SKA		98.80	0.1210	51.2	5.3	U	North Sea	[12]
17	Pollachius pollachius	POL		85.60	0.1900	NA	NA	U	North Sea	[18]
18	Pollachius pollachius	POL		85.60	0.1860	44.8	3.7	U	North Sea	[12]
23	Psetta maxima	TUR	-0.05	64.80	0.2600	46.0	NA	F	North Sea	[15]
24	Psetta maxima	TUR	-0.51	49.20	0.3700	NA	NA	M	North Sea	[15]

id	species	speciesgp	t.0	linf	k	lmat	tm	sex	area	source
25	Psetta maxima	TUR		65.20	0.3240	49.0	NA	M	Bay of Biscay	[9], [7]
26	Psetta maxima	TUR		73.60	0.2770	49.0	NA	F	Bay of Biscay	[9], [7]
27	Psetta maxima	TUR	-1.79	69.60	0.2497	49.0	4.5	U	North Sea	[19], [8], [16], [17]
28	Psetta maxima	TUR		57.00	0.3200	46.0	4.5	U	North Sea	[12]
29	Psetta maxima	TUR		52.50	0.3200	NA	NA	M	North Sea	[17]
30	Psetta maxima	TUR	-1.79	70.00	0.1480	NA	NA	F	North Sea	[17]
31	Raja batis	SKA	-1.63	254.00	0.0600	130.0	11.0	U	North Sea	[11]
32	Raja batis	SKA		253.70	0.0570	155.0	15.0	U	North Sea	[12]
33	Raja brachyura	SKA		139.00	0.1200	100.0	9.3	U	North Sea	[12]
34	Raja brachyura	SKA	-0.8	118.00	0.1900	NA	NA	M	Irish Sea	[13]
35	Raja brachyura	SKA	-1.52	139.00	0.1200	NA	NA	F	Irish Sea	[13]
36	Raja clavata	SKA	-1.32	128.00	0.0900	NA	NA	F	Irish Sea	[13]
37	Raja clavata	SKA	-0.6	85.60	0.2100	NA	NA	M	Irish Sea	[13]
38	Raja clavata	SKA		105.00	0.2200	65.0	5.0	U	North Sea	[12]
39	Raja montagui	SKA	-0.37	72.80	0.1800	NA	NA	F	Irish Sea	[13]
40	Raja montagui	SKA	-0.56	68.70	0.1900	NA	NA	M	Irish Sea	[13]
41	Raja montagui	SKA		97.80	0.1480	67.0	6.0	U	North Sea	[12]
42	Raja naevus	SKA	-0.465	92.00	0.1100	59.0	9.0	U	North Sea	[11]
43	Raja naevus	SKA		91.60	0.1090	59.0	9.0	U	North Sea	[12]
44	Raja radiata	SKA		66.00	0.2300	46.0	4.0	U	North Sea	[22]
45	Raja undulata	SKA		112.00	0.1000	57.5	6.3	U	North Sea	[12]
46	Scophthalmus rhombus	BLL		74.88	0.1400	37.0	NA	M	Bay of Biscay	[9], [7]
47	Scophthalmus rhombus	BLL		85.23	0.1470	37.0	NA	F	Bay of Biscay	[9], [7]
48	Scophthalmus rhombus	BLL		50.00	0.2700	37.0	4.5	U	North Sea	[12]
49	Sprattus sprattus	SPR	*	16.00	0.6500	13.0	NA	U	North Sea	[20]

Conclusion from the above analysis for 5 of the 7 case studies

- Pollack and turbot have poor coverage in terms of numbers at length from the survey data and hence potentially poor abundance estimates.

- Brill, sprat and skates have long time series of numbers at length. Brill has adequate numbers from 1993 to 2016 as has skate, while sprat contains a longer time series from 1985-to 2016.

- Observations from the commercial time-series show that for all species there are 9 years of data.

- There are enough life history parameters from the literature to condition an operating model for all case-study species apart from sprat.

Software Versions

- R version 3.5.1 (2018-07-02)
- plyr: 1.8.4
- dplyr: 0.7.8
- ggplot2: 3.1.0
- DBI: 1.0.0
- RPostgreSQL: 0.6.2
- reshape 0.8.8
- **Compiled**: Fri Dec 14 11:54:18 2018

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Acknowledgements

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References

7. Deniel, C. (1981). Les poissons plats (TelCostCens, Pleuronecti- formes) en baie de Douarnenez. Reproduction croissance et migration des Bothidae, Scophthalmidae, Pleuronectidae et Soleidae. These, Universite Bretagne Occidentale, Brest. 476 PP.

8. Deniel, C. (1990). Comparative study of growth of flatfishes on the west coast of Brittany. Journal of Fish Biology, 37: 149–166.

9. Dorel, D. (1986). Poissons de l'Atlantique Nord-Est Relations tailles-poids.

10. Greenstreet, S.P.R., Rossberg, A.G., Fox, C.J., Le Quesne, W.J.F., Blasdale, T., Boulcott, P., Mitchell, I., Millar, C., Moffat, C.F. (2012). Demersal fish biodiversity: species- level indicators and trends-based targets for the Marine Strategy Framework Directive. ICES J. Mar. Sci. 69, 1789–1801.

11. Holden, M. J. (1972). The growth rates of R. brachyura, R. clavata and R. montagui as determined by tagging data. Journal du Conseil International pour l'Exploration de la Mer 34:161–168.

12. Jones, A. (1974). Sexual maturity, fecundity and growth of the turbot, Scophthalmus maximus L. Journal of the Marine Biological Association of the UK, 54: 109–125.

13. Knijn, R.J., Boon, T.W., Heessen, H.J.L., Hislop, J.F.G. (1993). "Atlas of North Sea Fishes" (ICES Coop. Res. Rep. 194, ICES, Copenhagen, 1993).

14. Mengi, T. (1963). Ber. Deut. Wiss. Komm. 7, 119.

15. Moreau, J. (1964). Contribution à l'étude du lieu jaune (Gadus pollachius L.). Revues de Traveaux Institut de Pêches Maritimes, 28:237–255.

16. Muus, B.J., Nielson, J. G. (1999). Sea Fish (Scandinavian Fishing Year Book, Hedehusene, Denmark.

17. Pauly, D. (1978). A preliminary compilation of fish length growth parameters. Berichte des Institut für Meereskunde an der Universität Kiel, 55. 200 pp.

18. Vinther, M. (1989). Some notes on the biology of the starry ray, Raja radiata, in the North Sea. Working document: ICES Study Group on Elasmobranch Fisheries, 4/1989, 1–20. mimeo.

Session Info

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Running under: Ubuntu 16.04.2 LTS

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LAPACK: /usr/lib/lapack/liblapack.so.3.6.0

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 [5] LC_MONETARY=en_GB.UTF-8    LC_MESSAGES=en_US.UTF-8
 [7] LC_PAPER=en_GB.UTF-8       LC_NAME=C
 [9] LC_ADDRESS=C               LC_TELEPHONE=C
[11] LC_MEASUREMENT=en_GB.UTF-8 LC_IDENTIFICATION=C

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[8] base

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