What drives changes in stock assessments?

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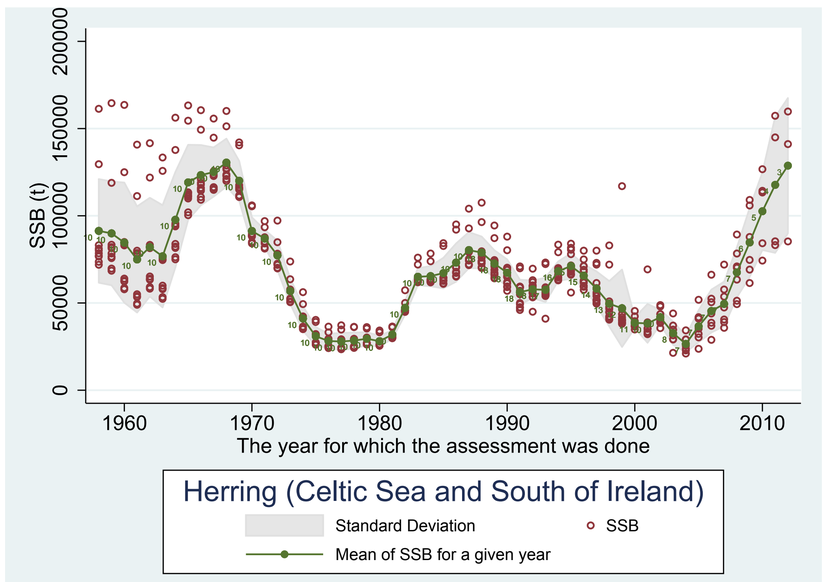
Changes of Assessment Models

Each year, stock assessments are done by ICES working groups. While the aim is to estimate the current biomass of a stock, the model is usually backdated. We combined all the assessments in a single database which gives us several estimates of SSB per fish stock and year. This is illustrated for the case of Herring in the Celtic Sea (see below) which documents substantial variation.

The question is: What drives these different assessments? In theory, adjustment of an assessment model should occur if there is new scientific knowledge which will improve the accuracy. Yet, when looking at the past assessment models it seems that there could be other factors like status of stock influencing the adjustment of the model as well.

SSB Assessements for Herring



Coefficient of Variation

We construct a measure to quantify how much assessments of stock biomass for a given stock in a given year have changed over time. A stock assessment gives estimates for several years which gives variation in biomass over time (called **Within Variation**). **Between Variation** describes the difference between different SSB estimates for a certain year. Hence, we distinguish variation between different assessments of the same year and variation between years in the same assessment.
In order to have a measure of the time-invariant variation we used the **Coefficient of Variation (CV)** per year for each stock. CV is defined as the mean of SSB divided by the standard deviation of SSB for each year. We use CV as dependent variable as it allows us to determine whether the new assessment increases or decreases the variation per year and stock. An increase in CV indicates that the adjustments in the model were rather large.

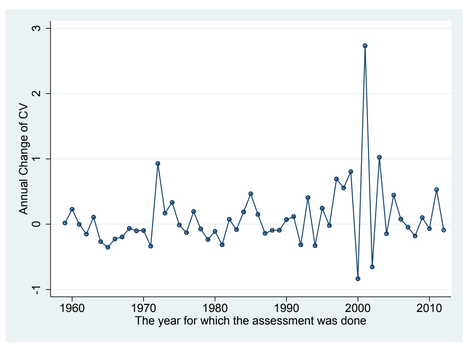
References

Froese & Proelß (2010) DOI: 10.1111/j.1467-2979.2009.00349.x
Froese et al. (2012) DOI: 10.1007/s00227-012-1909-6

Variation in SSB and CV

	All the Fish Stocks			
	SSB		CV	
	Mean	Std. Dev.	Mean	Std. Dev.
overall	385120.6	995687.1	.1130067	.1232503
between		805484.6		.0950538
within		559062.3		.0905736
	Herring			
overall	66451.36	30006.26	.1704968	.1000426
between		7938.69		.0308874
within		28647.73		.0982539

Within and Between Variation



Annual Change in CV for Herring

Status of Stock

Status of stock	$SSB/SSB_{0.1}$	Fishing Pressure	$F/F_{0.5}$
Developing	> 1.5	not overfished	≤ 1
Fully Exploited	≥ 0.5		
Overexploited	< 0.5	overfished	> 1
Collapsed	< 0.1		

The criteria are adapted from Froese et al. (2012) and Froese & Proelß (2010). $SSB_{0.1}$ is defined as 10% of the highest SSB and $F_{0.5}$ as 50% of the highest F.

Regression Results

	(1) Coefficient of Variation	(2) Coefficient of Variation
Declining SSB (4 years)	0.029***	0.027***
Number of Assessments done	-0.038***	-0.043***
Fully Exploited Fish stock	0.119***	
Overexploited Fish stock	0.105***	
Collapsed Fish stock	0.369***	
Overfishing	-0.062***	
Developing Fishstock, overfished		-0.049***
Fully Exploited Fishstock, overfished		0.072***
Fully Exloited Fishstock, not overfished		0.066***
Overexploited Fishstock, overfished		0.060***
Overexploited Fishstock, not overfished		0.081***
Collapsed Fishstock, not overfished		0.367***
Observations	30299	30299
Adjusted R^2	0.217	0.217

Standardized beta coefficients
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Conclusion

We have shown that stock assessments adaptation are partially driven by the status of the resource itself.

- The change in CV seems mainly driven by the biomass status of the stock and only secondary by fishing pressure. If SSB and F indicators are regressed independently the increase in CV is driven by critical biomass status.
- Consecutive decline of SSB over several years increases CV
- Number of assessments done does not increase CV

Stock Assessment Changes are Driven by Stock Status

Acknowledgements

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