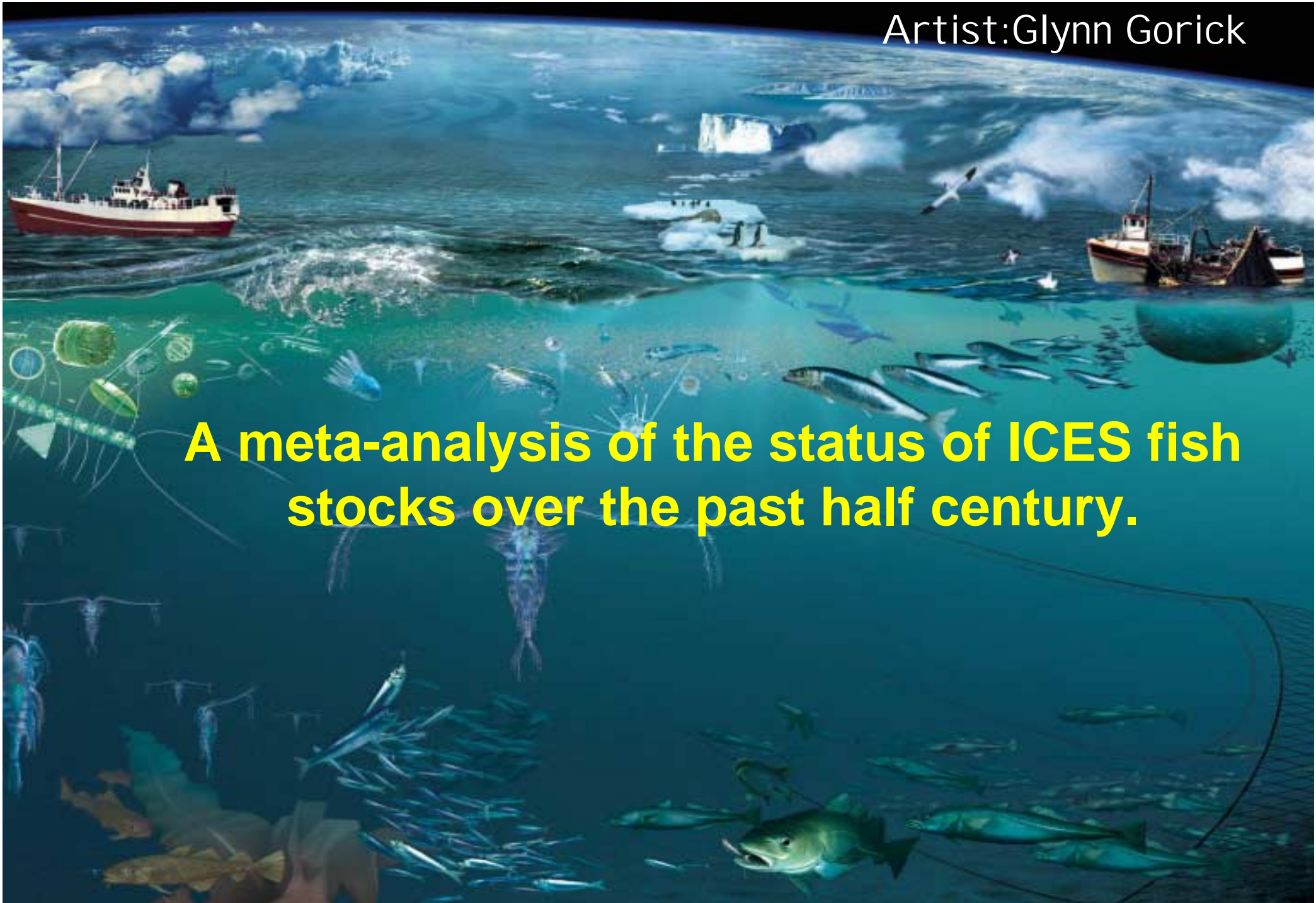


Artist: Glynn Gorick

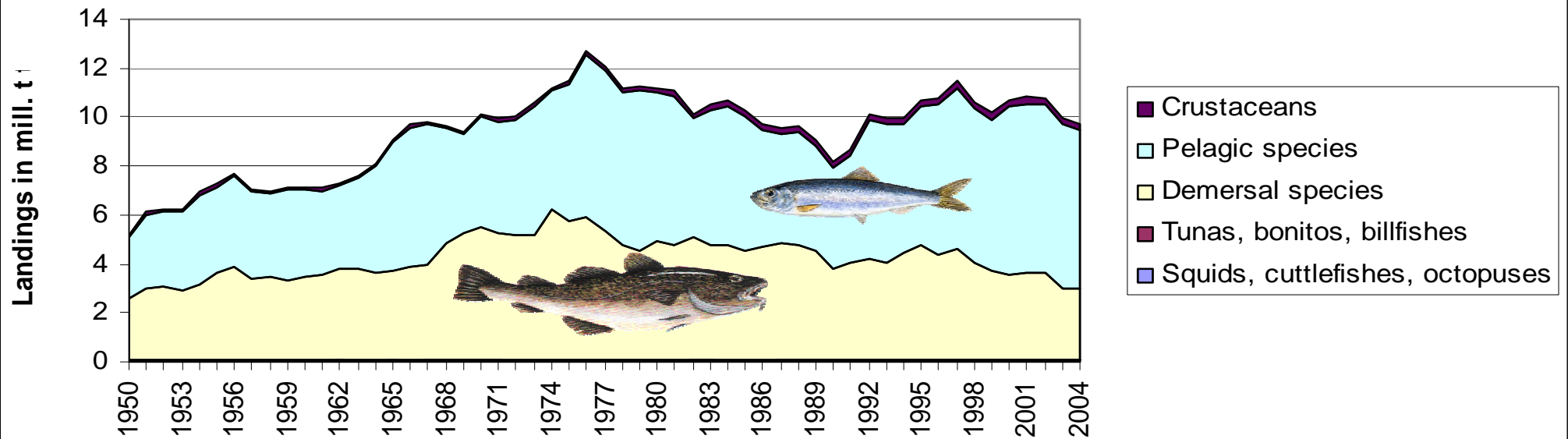
A meta-analysis of the status of ICES fish stocks over the past half century.



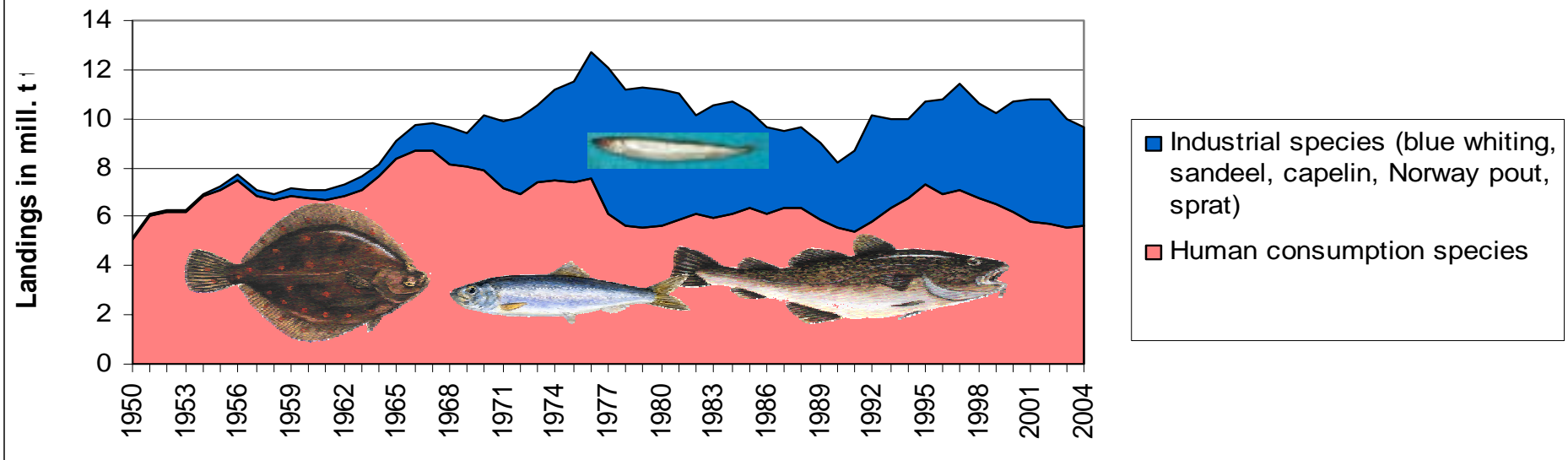
Why a meta analysis?

- The “big picture” can be difficult to see when looking on individual stocks:
 - S-R spurious correlation, etc. [Gilbert and Myers 1997],
 - regime shifts,
 - species interactions,
 - density dependent growth,
- In a meta analysis everything is “included”

Total landings by category



Total landings for human consumption and for fish meal & oil (industrial)



ICES FishStat Plus

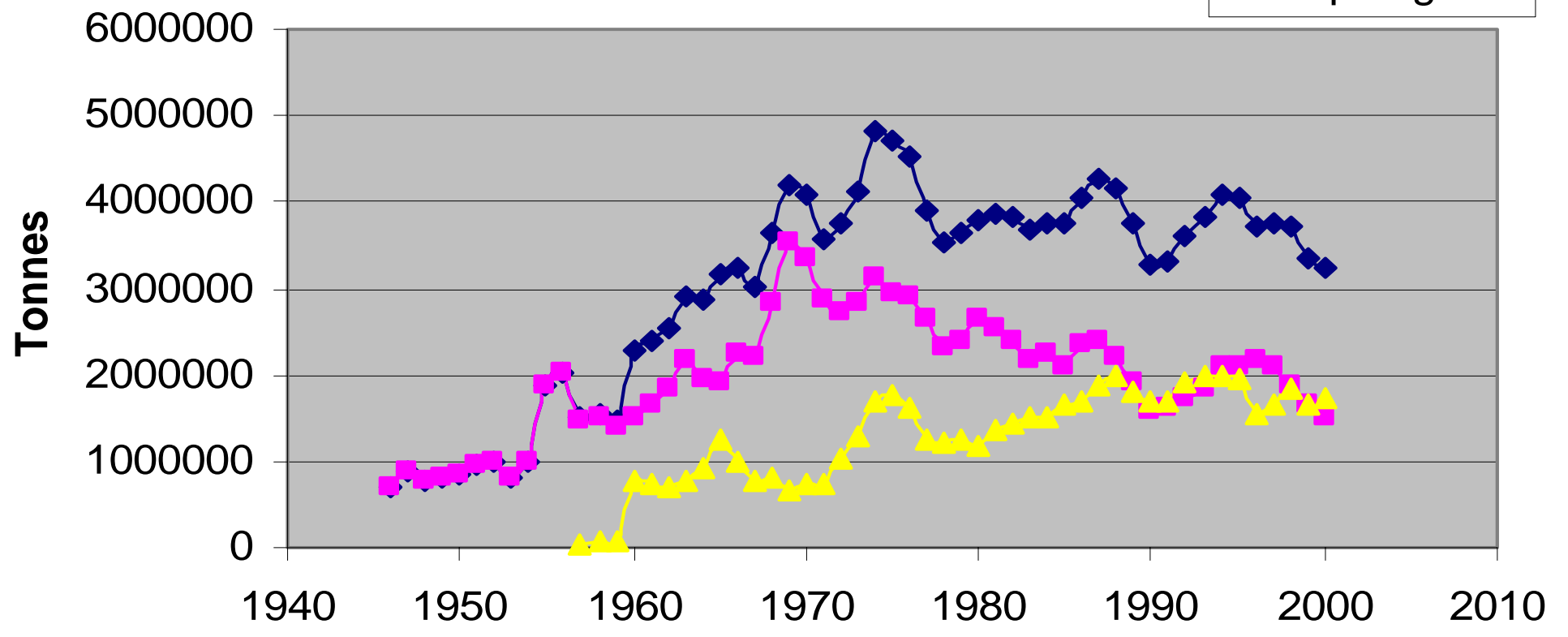
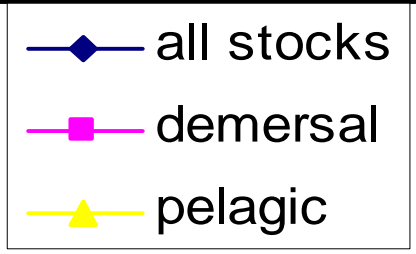
Time series of SSB, R, F

(ACFM Summary tables)

7 pelagic stocks

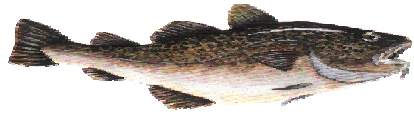
27 demersal stocks

Catch in tonnes

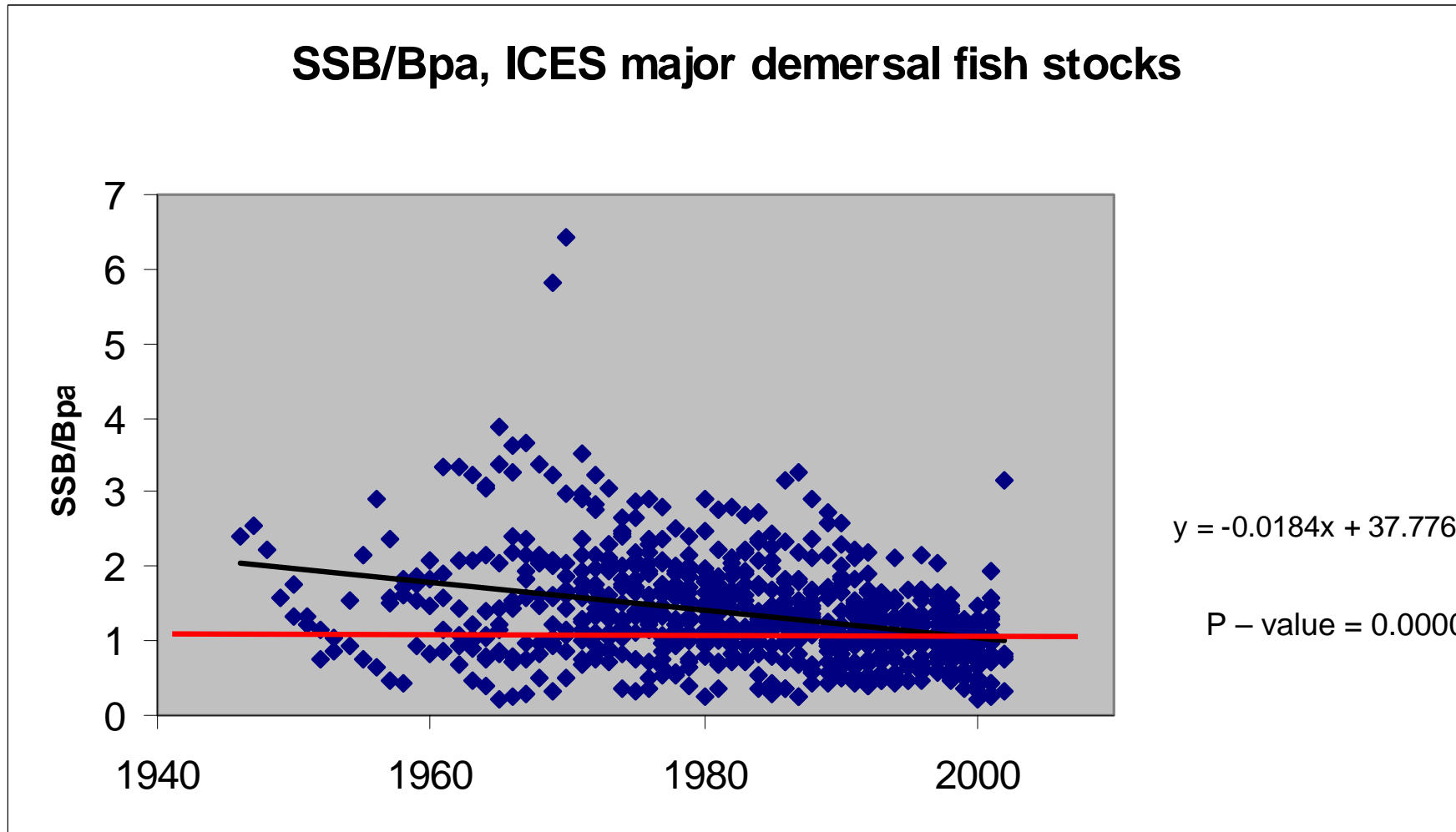


Standardisation

- SSB divided by $B_{pa/lim}$
- R divided by mean R for each time series

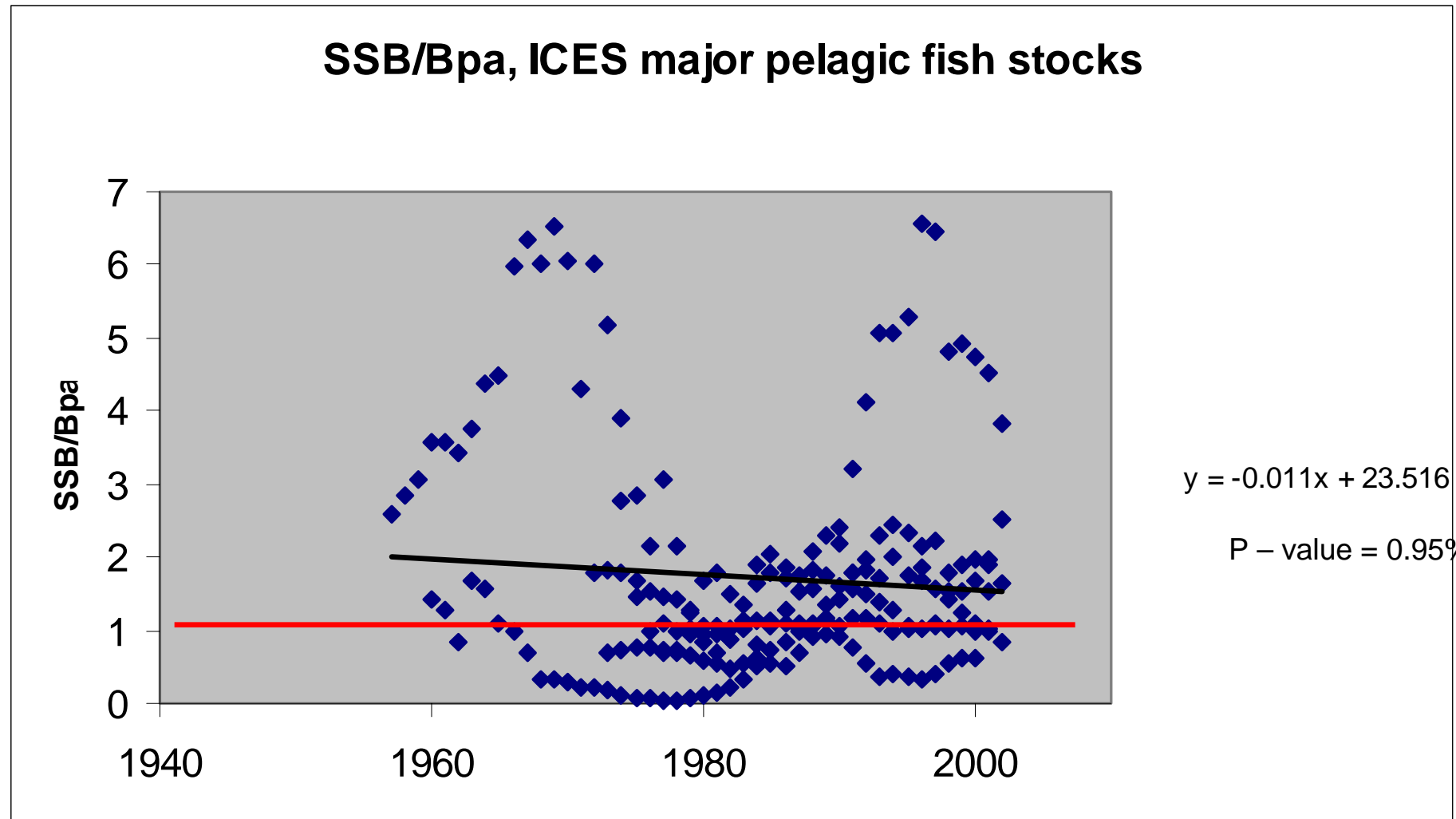


A 50% reduction

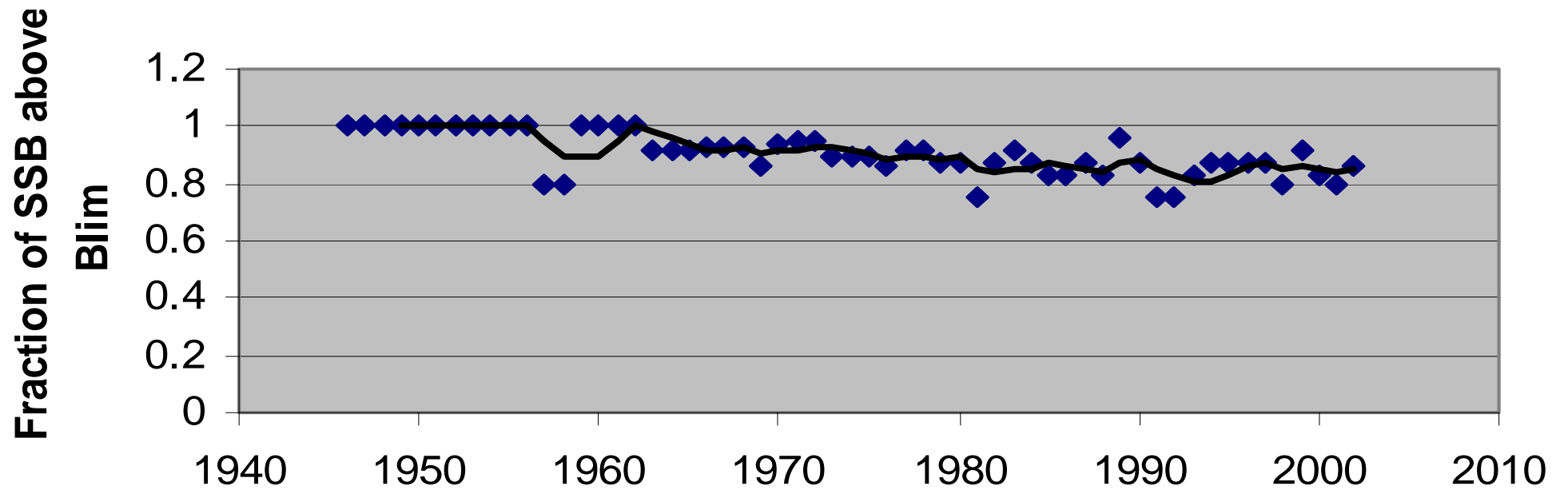




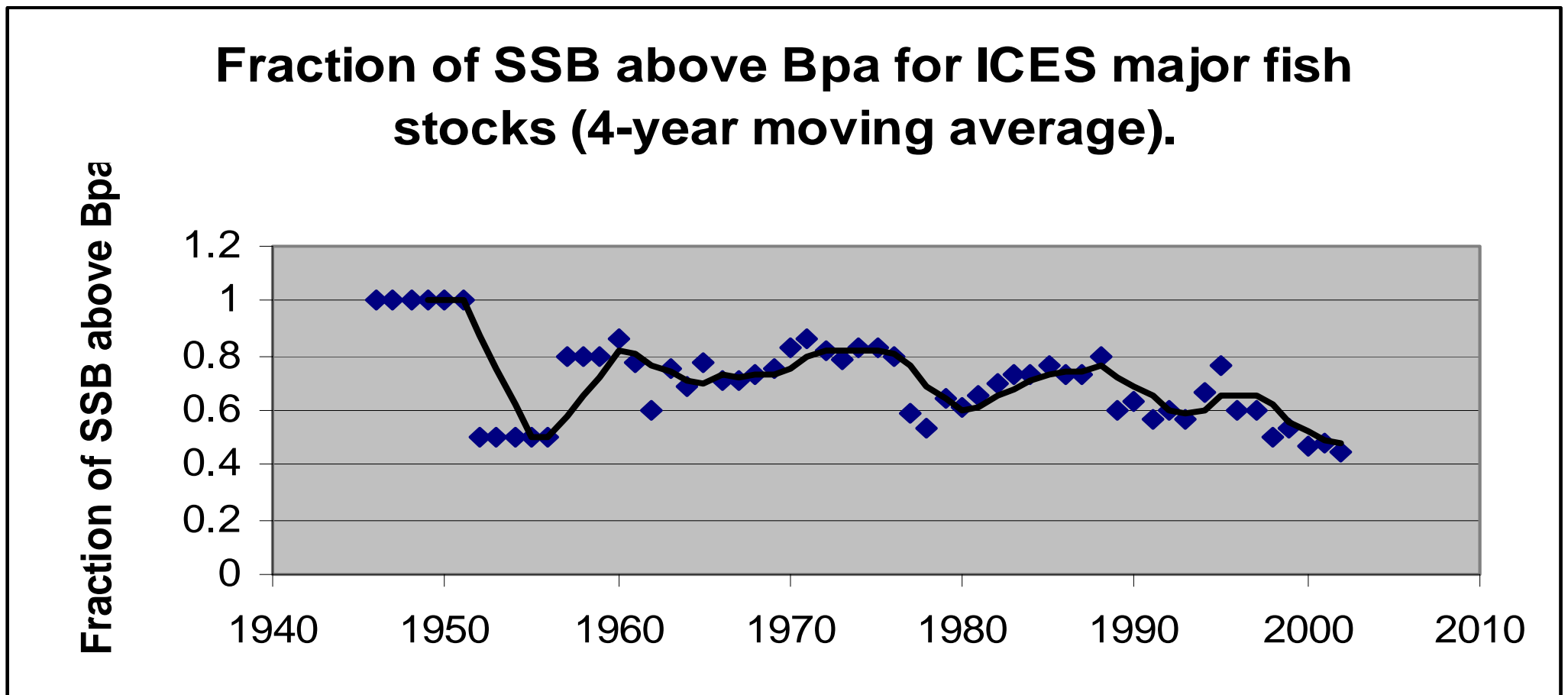
No clear trend

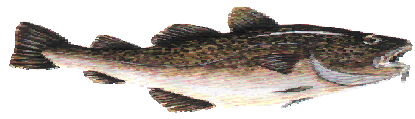


Fraction of SSB above Blim for ICES major fish stocks (4-year moving average).



Accelerated depletion?





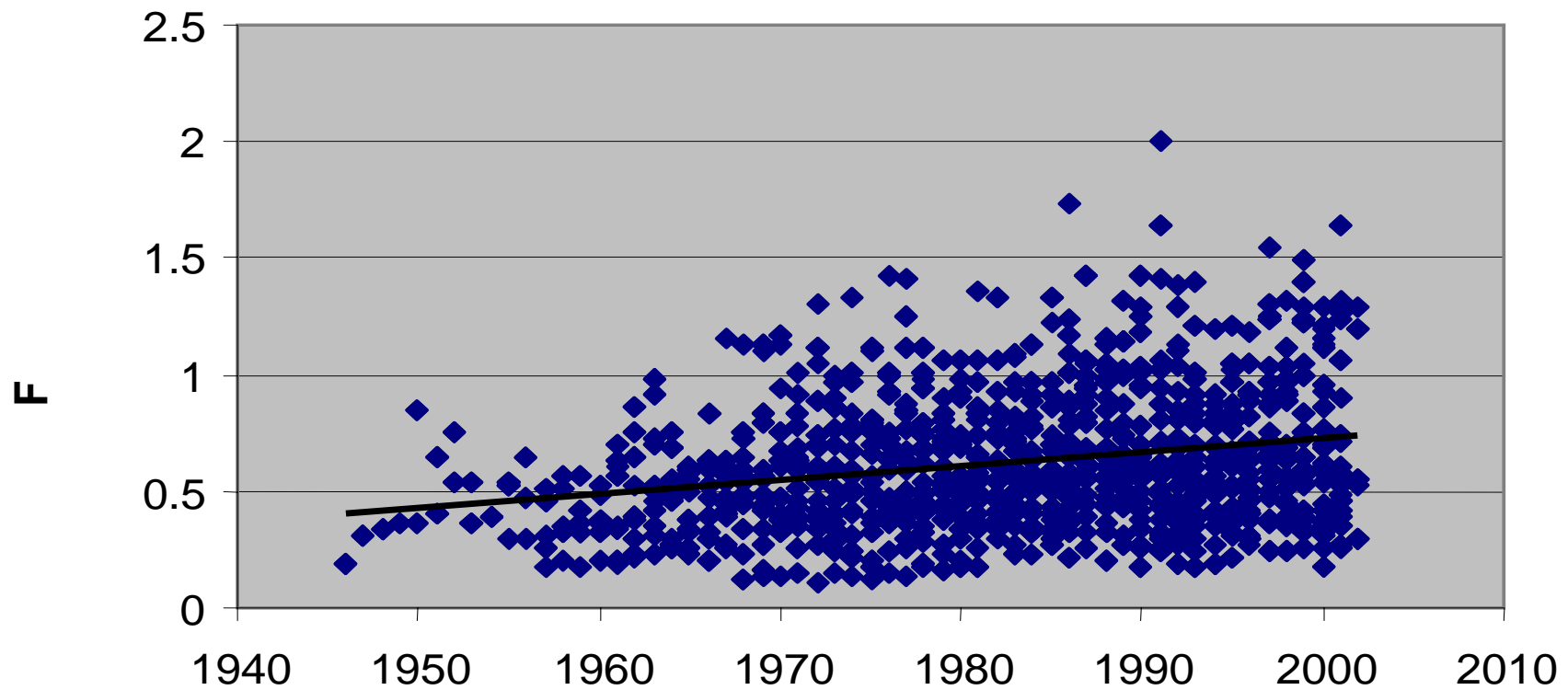
$F=0.4 \rightarrow F=0.75$



F for demersal stocks

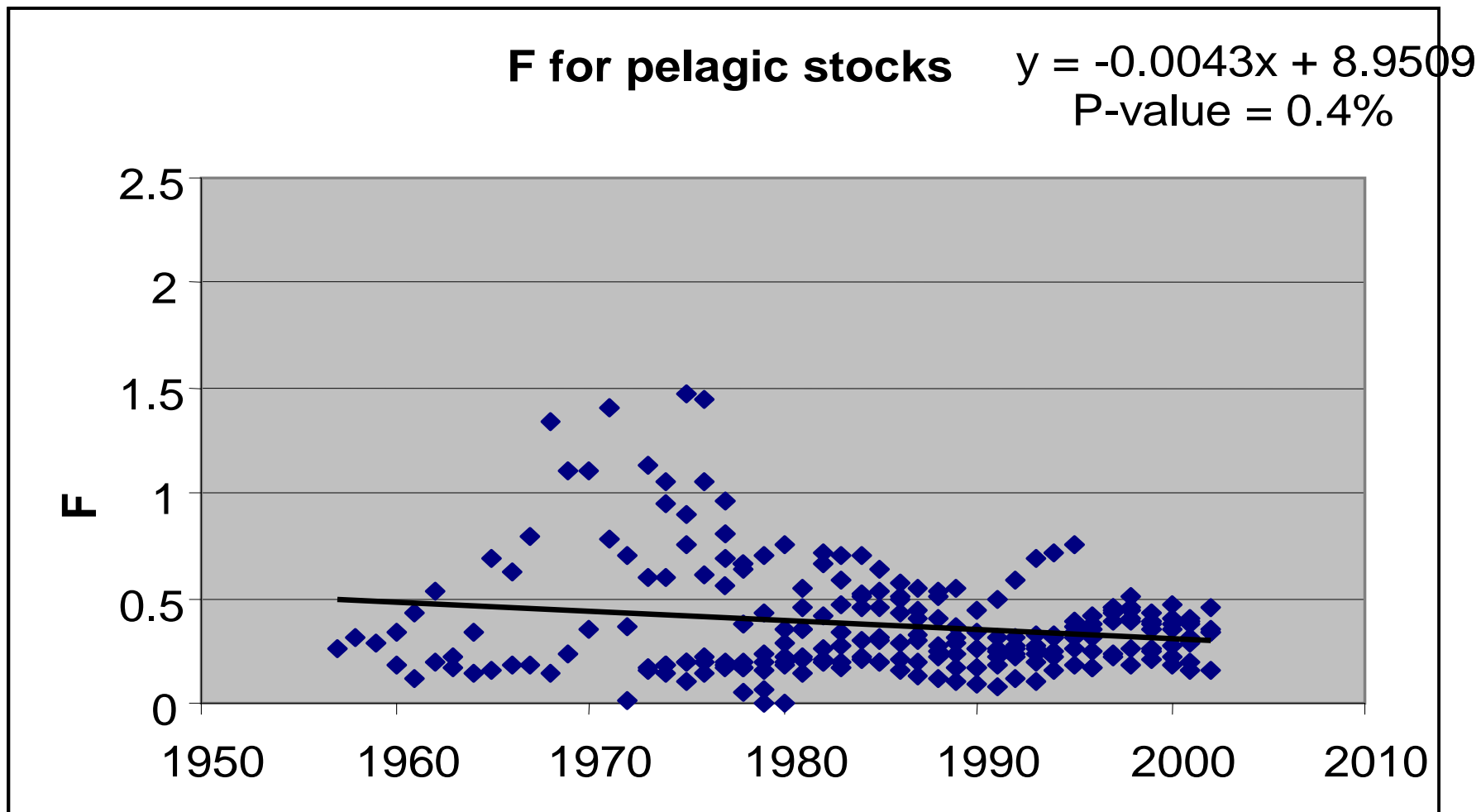
$$y = 0.0059x - 11.106$$

P-value <0.001%



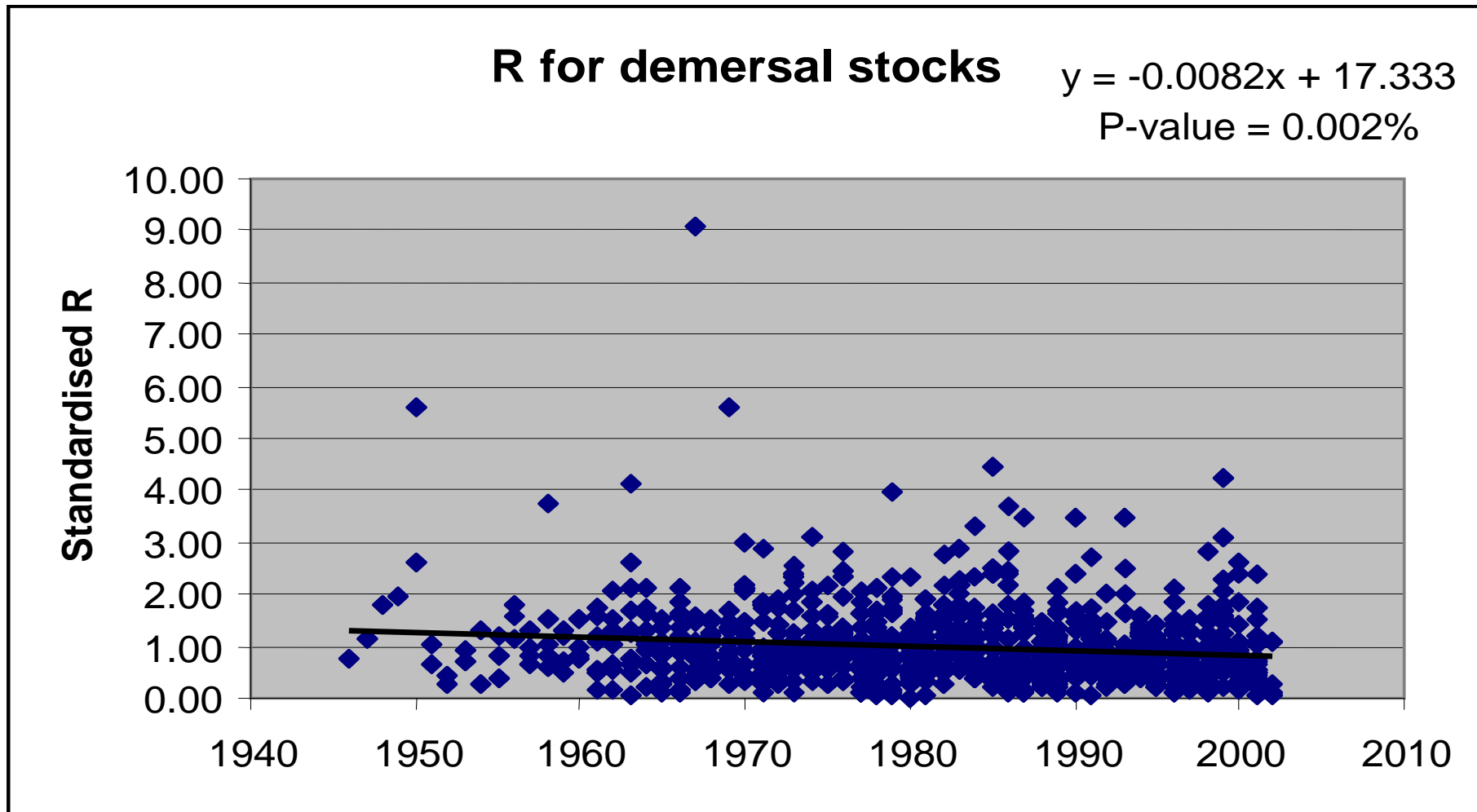


$F = 0.5 \rightarrow F = 0.3$



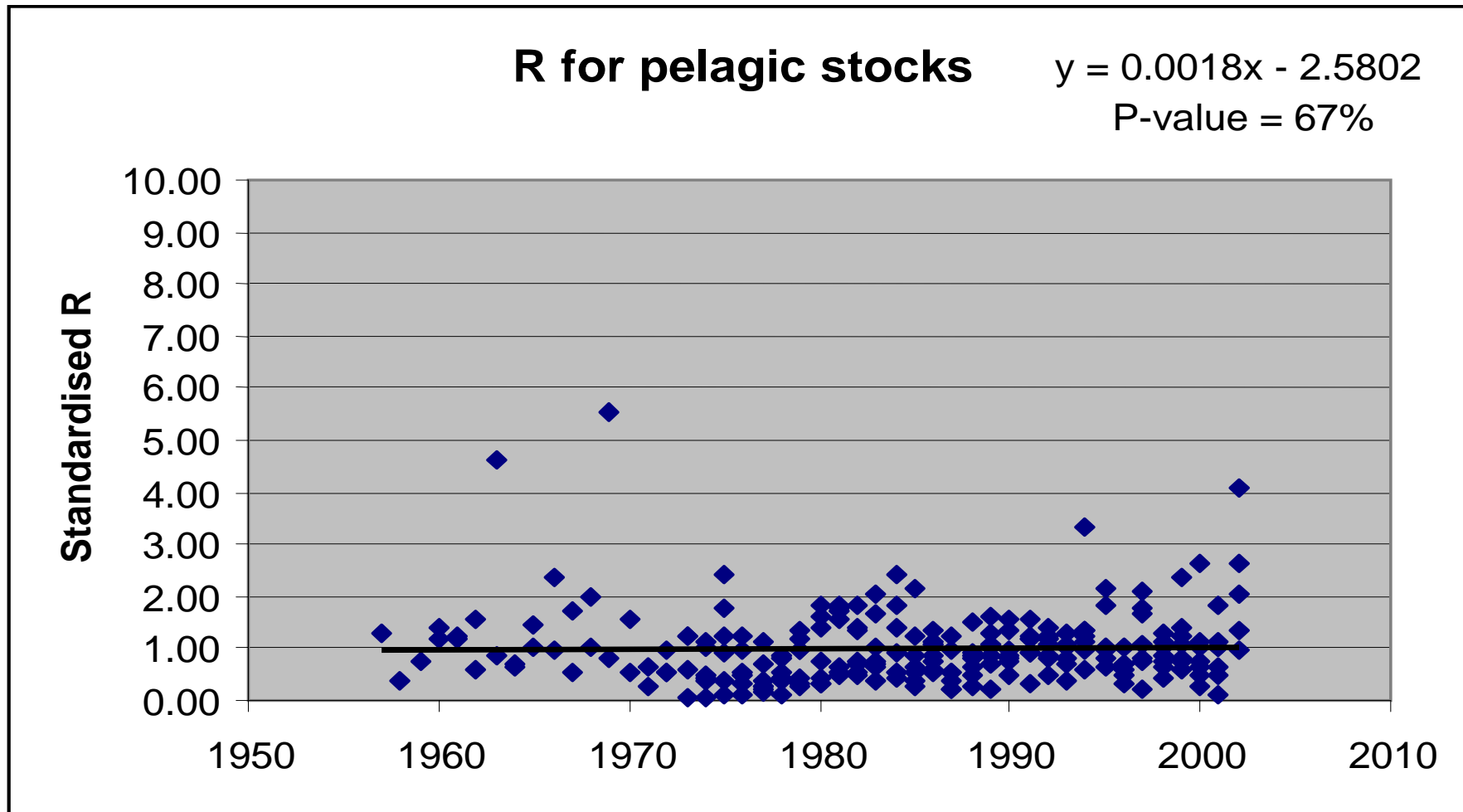


R decreased by 33%





No change in R



Demersal stocks



SSB reduced by 52% and R reduced by 33%

- support the classic S-R type relationship
- but only 1/3 of the reduction in SSB have been compensated (by increased R/S)

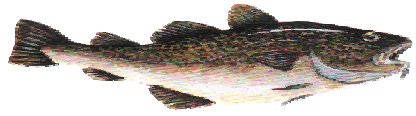


Demersal stocks



- Yield increased in late 1960s
- F increase from 0.4 to 0.5
- Yield decreased thereafter
- F increased further to about 0.75

→ $F_{MSY} = ? = 0.5$ ($\sim MSY = 1.7 * Yield_{current}$)



Demersal stocks



If recruitment overfishing is avoided for all stocks

$$\rightarrow \text{MSY} = 2 * \text{Yield}_{\text{current}}$$



Demersal stocks



In the late 1960s to mid-1970s when $F = 0.5$,
SSB was twice the present level.



Demersal stocks



Therefore in the “big picture”:

- F should be reduced by 1/3
- SSB increased by 2



Demersal stocks



Can meta-analysis results be used in practise ?

- for instance when ICES evaluate target F s and SSBs the overall average should match a 1/3 reduction in F and a doubling of SSB



B_{lim} set too low?



- 20% of demersal stocks below B_{lim}
- However, recruitment decreased by 33%
- For S-R data pairs, where $S > B_{lim}$ (and thus recruitment not impaired):
 - R still decreased over time (by 30%), simultaneously with a 31% decrease in SSB

→ Yes

Artist: Glynn Gorick

Thank you for listening

