Summer School in Quantitative Fisheries Stock Assessment

Day 1: Data-rich and data-limited stocks

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The stocks for which advice is provided were categorized as either **data-rich** or **data-poor**. For data-rich stocks full analytical stock assessments can be performed, while data-poor stocks are without quantitative assessments and forecasts. The availability of data for these data-poor stocks and possibilities for assessment can vary greatly among stocks.

For example, ICES (2012) identified **six categories** of data-limited stocks ranging from data-rich to truly data-poor. Together with data coming from commercial fisheries, various other types of data and information may be relevant to assess the state of a stock:

- life-history traits,
- gear selectivity,
- fishing effort,
- genetic stock structure,
- environmental drivers (e.g. temperature, salinity, etc.).

Category 1

Data-rich stocks with full analytical assessments and forecasts as well as stocks with quantitative assessments based on production models.

Category 2

Stocks with quantitative assessments and forecasts which are indicative of trends only (fishing mortality, recruitment, biomass).

Category 3

Stocks for which survey indices (or other indicators of stock size such as reliable fishery-dependent indices: e.g. lpue, cpue, mean length in the catch) are available that provide reliable indications of trends in stock metrics such as mortality, recruitment, and biomass.

Category 4

This category includes stocks for which a time-series of catch can be used to approximate MSY.

Category 5

Data-poor stocks for which only landings data are available.

Category 6

For these stocks, landings are negligible compared with discards. It also includes stocks that are primarily caught as bycatch in other targeted fisheries. The development of indicators may be most appropriate to such stocks.

Summary of the main assessment methods and data requirements (source: Report of STECF EWG 16-05).

Catch	Effort	Abundance indexes from scientific surveys (biomass and density indexes)	Catch number at age or length	Age/length structured tuning indexes	Natural mortality	Biological parameters (proportion of mature, LW parameters, ect)	Example models	Comments
Yes							Catch MSY, DCAC, SRA	Enough long time series, and enough contrast are needed In some cases series must include pristine situation
Yes		Yes					AIM (time series models)	Enough long time series, enough contrast is needed
Yes	Yes	Yes					Biomass dynamic model e.g. ASPIC, SPICT, state-space Schaefer	Production models can be fitted with catch and index of biomass that can not necessarily be CPUE
Yes			Yes		Yes		SepVPA	Useful for trends and not for absolute values
				Yes	Yes	Yes	Fishery independent assessment models (e.g. SURBA)	Strong assumptions on selectivity at age
Yes		Yes	Yes	Yes	Yes	Yes	VPA models (XSA, ADAPT, ecc)	Time series of biomass and fishing mortality and if a spawners recruitment function is fitted to model outputs, complete advice on status determination and forecasts of limit and target catch levels can be provided
Yes		Yes	Yes	Yes	Yes	Yes	SCAA models (A4A,ICA ecc)	Generally complete advice on status determinations and forecasts of limit and target catch levels are attainable if spawner-recruitment dynamics are embedded. Otherwise, advice is limited to estimates of biomass and fishing mortality time series
Yes		Yes	Yes	Yes	Yes	Yes	IA models (SS3)	Generally complete advice on status determinations and forecasts of limit and target catch levels are attainable if spawner-recruitment dynamics are embedded. Otherwise, advice is limited to estimates of biomass and fishing mortality time series. Can also provide advice on size and spatial stock structure.

Empirical and length-based indicators

Listed below are some possible indicators based both on fishery-independent (scientific surveys) and fishery-dependent (commercial catches/landings) data commonly used in situation of data-limited stocks:

- trends in mean age/length/weight of the stock
- trends in catch or catch per unit of effort;
- estimation of and changes of area distribution (stock or specific life-stages)
- proportion by weight of large fish in the stock
- trends in the average maximum length.

In the following table some length-based indicators (ICES, 2015) are compared to appropriate reference points related to conservation, optimal yield and length distribution relative to expectations under MSY assumptions. Such an approach can be used when at least length-frequency data is available, which is often the case in data-limited stocks stocks.

Empirical and length-based indicators (continue)

Indicators, reference points, indicator ratios and their expected values grouped in terms of i) conservation/sustainability; ii) optimal yield; and iii) MSY considerations (ICES, 2015).

Indicator	Calculation	Reference point	Indicator ratio	Expected value	Notes
Lmax5%	Mean length of largest 5%	Linf	Lmax%%/Linf	> 0.8	Conservation (large individuals)
L95%	95th percentile		L95%/Linf		
Pmega	Proportion of individuals above Lopt+10%	0.3-0.4	Pmega	> 0.3	
L25%	25th percentile of length distribution	Lmat	L25%/Lmat	> 1	Conservation (immatures)
Lc	Length at first catch (length at 50% of mode)	Lmat	Lc/Lmat	> 1	
Lmean	Mean length of individuals larger Lc	Lopt = 2/3 Linf	Lmean/Lopt	~ 1	Optimal yield
Lmaxy	Length class with maximum biomass in catch	Lopt = 2/3 Linf	Lmaxy/Lopt	~ 1	
Lmean	Mean length of individuals larger Lc	LF=M=(0.75Lc+0.25Linf)	Lmean/LF=M	≥ 1	MSY

References

- ICES 2012. ICES Implementation of Advice for Data-limited Stocks in 2012 in its 2012 Advice. ICES CM 2012/ACOM 68. 42 pp.
- ICES 2015. Report of the Fifth Workshop on the Development of Quantitative Assessment Methodologies based on Life-history Traits, Exploitation Characteristics and other Relevant Parameters for Data-limited Stocks (WKLIFE V), 5–9 October 2015, Lisbon, Portugal. ICES CM 2015/ACOM:56. 157 pp.