

Indicator testing framework and responsiveness of indicators to pressures

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- DEVOtool collected information on ~550 indicators available for marine biodiversity assessments
- A preliminary evaluation revealed that several of these lacked essential properties to be used for MSFD assessments
- An objective framework to test the suitability of indicators under a standardized approach
 - Krause-Jensen et al. 2015 (DEVOTES Deliverable 3-2), Queiros et al. subm.



1. Scientific basis
2. Ecosystem relevance
3. Responsiveness to pressure
4. Possibility to set targets within the indicator response
5. Precautionary capacity/early warning/anticipatory capability
6. Quality of sampling method: measureable, accurate and precise outputs
7. Cost-effective implementation
8. Part of an existing or current ongoing monitoring or data



ES1 states the null hypothesis associated with the IQ tested

ES2 defines which assessment approach should be employed to test the hypothesis, i.e. qualitative or quantitative, and is conditional to its nature

ES3 states the type of evidence required to undertake the assessment

ES4 defines the methodology (e.g. type of statistical analysis or otherwise) undertaken to test the hypothesis considered and its outcome

ES5 states the quality score for the particular IQ tested given ES4



Aim: Objective, Transparent and Repeatable Assessment of Quality of Candidate Indicators	CANDIDATE INDICATORS ↓
INDICATOR QUALITY CRITERIA (IQ)	EVALUATION STEPS (ES)
IQ1. Scientific basis	ES1 – ES5
IQ2. Ecosystem relevance	ES1 – ES5
IQ3. Responsiveness to pressure	ES1 – ES5
IQ4. Possibility to set targets within the indicator response	ES1 – ES5
IQ5. Precautionary capacity/early warning/anticipatory capability	ES1 – ES5
IQ6. Quality of sampling method: measurable, accurate and precise outputs	ES1 – ES5
IQ7. Cost-effective implementation	ES1 – ES5
IQ8. Part of an existing or current ongoing monitoring or data	ES1 – ES5
ES6. Sum of quality scores across IQs, per indicator	$\sum_{i=1}^8 IQ_i$ (ES5)
Comparison of ES6 Scores For Candidate Indicators	↓ SELECTION OF HIGHEST SCORING INDICATOR



IQ 4: Possibility to set targets

IQ4 - ES1: a clear and unambiguous target cannot be defined for the indicator within a range with defined units of measurement

IQ4 – ES2: both expert judgement/ qualitative approach and a quantitative approach can be adequate, depending on the indicator.

IQ4 – ES3: information about the range of natural variability of the system is required, against which the target level is defined.

IQ4 – ES4: the method of analysis must consider the impact/influence of natural variability (if any) on the response of the indicator (identify, estimate and diagnose). The analysis must be appropriate for the type of data at hand (qualitative c.f. quantitative).

IQ4 – ES5: the indicator scores 1 if a clear and unambiguous target can be defined with clear units of measurement, and 0 if: i) a clear and unambiguous target cannot be defined; or ii) there is not sufficient background information to define the range of the natural variability of the system (i.e. habitat and scale) within which the indicator is to be implemented. The three-way scoring system could be applied to IQ4.

- Indicators reflect the environmental status but there is always some uncertainty
- Signal detection theory provide a method to quantify the uncertainty, and can assist in setting indicator threshold values

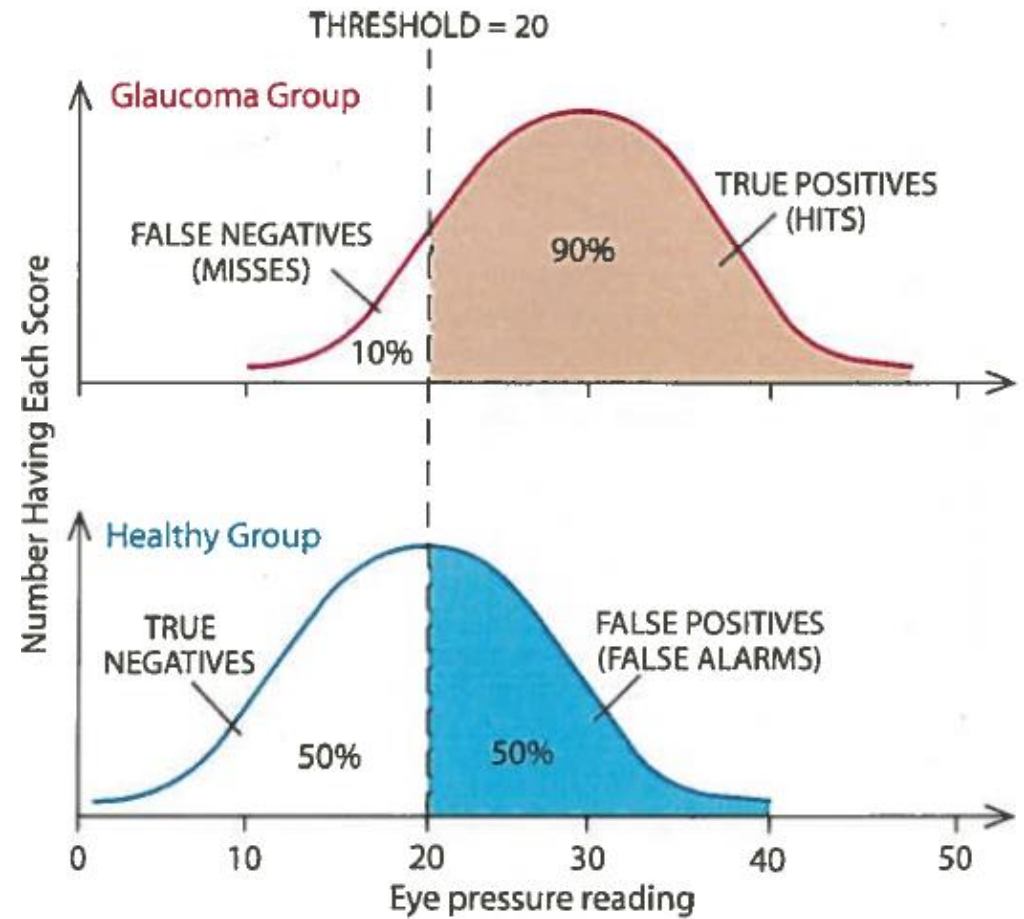
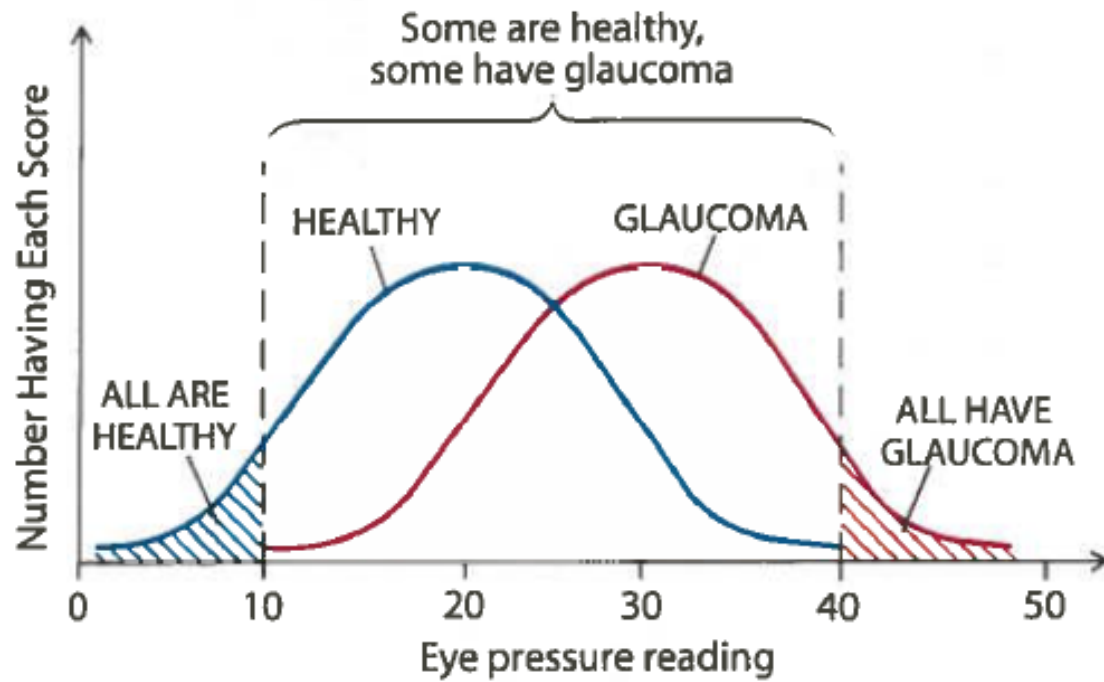
True environmental status

	Bad	Good
Bad	True positive "hits"	False positive "false alarm"
Good	False negative "miss"	True negative

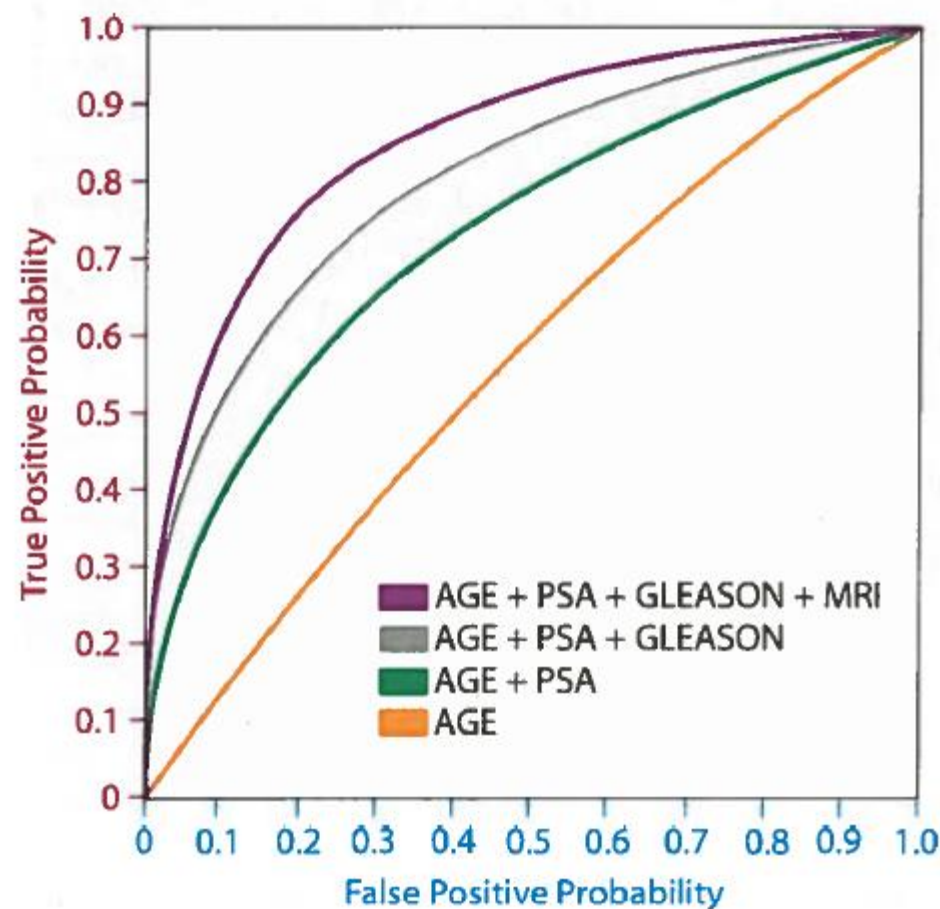
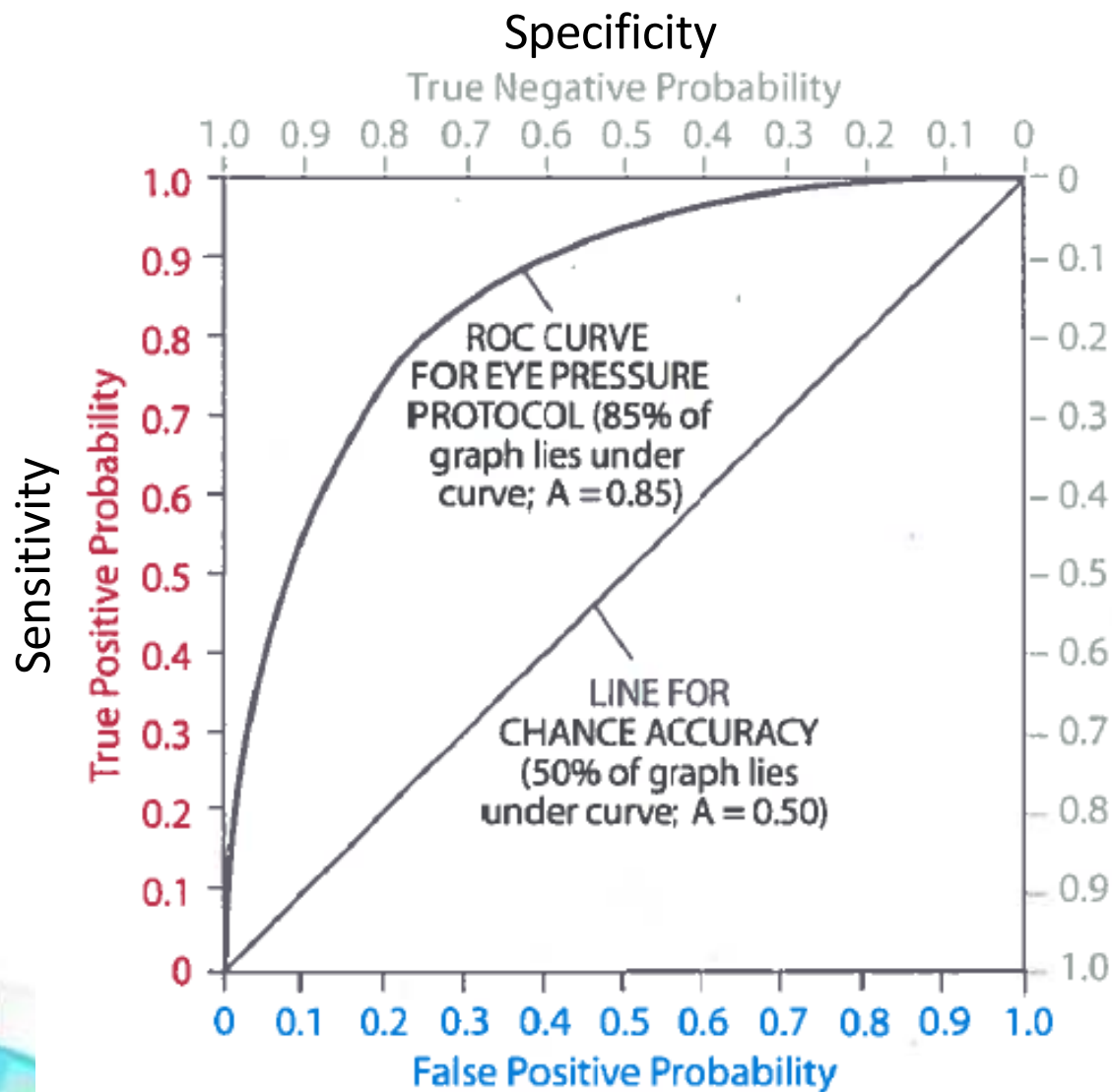
Status from
indicator



Responsiveness to pressures



ROC curves provide a visual evaluation of the output

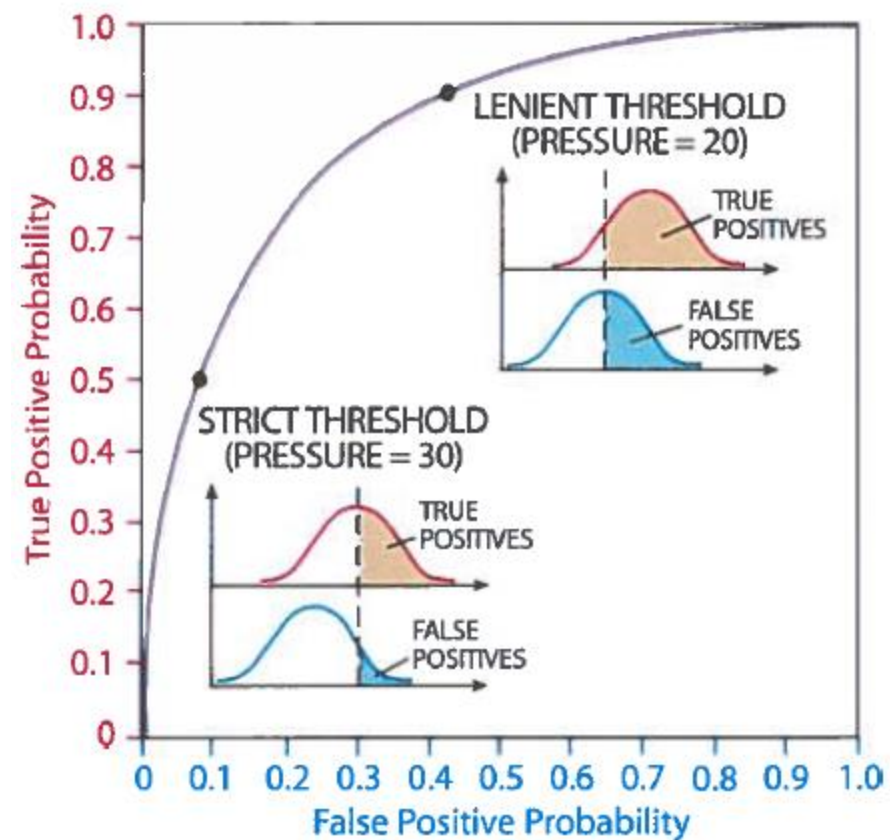


Needed to test the responsiveness of an indicator to a pressure:

- "Gold standard" → surrogate or best estimate of the environmental state
- Indicator values

To take into account when setting threshold level for the indicator:

- Prevalence of conditions
- Consequences of being wrong



Swets et al. 2000





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Contents lists available at ScienceDirect

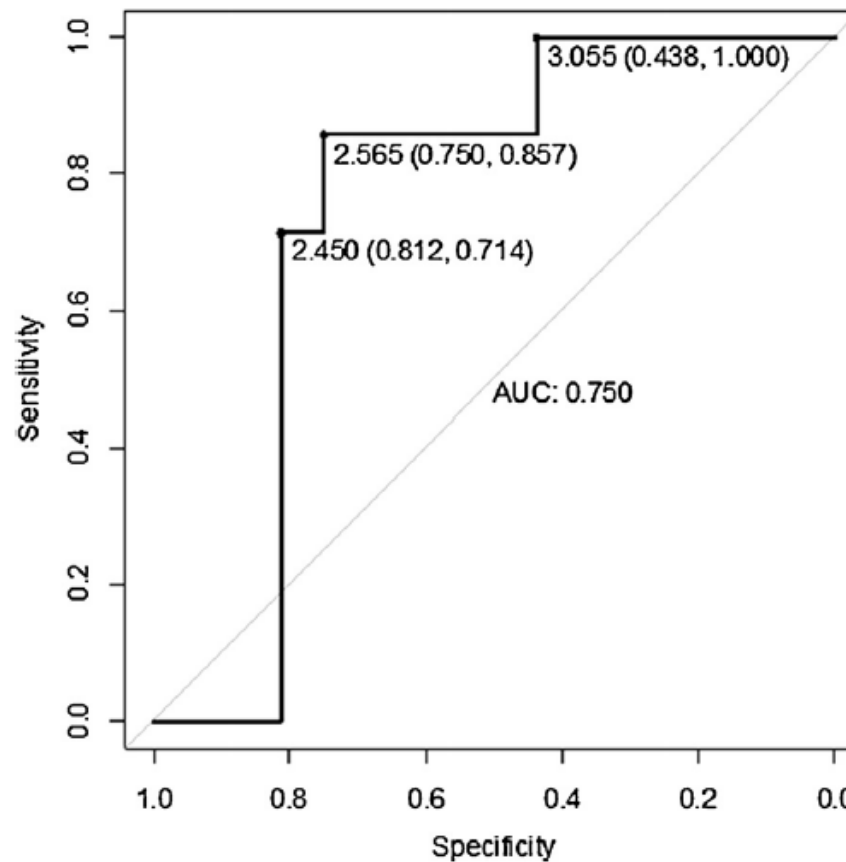
Ecological Indicators

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Application of signal detection theory approach for setting thresholds in benthic quality assessments



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Chuseve et al. 2016



DEVOTES

www.devotes-project.eu

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