FAO review : Data-poor assessment and management methods

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Categorisation of data-poor methods: data requirements

- Qualitative and semi-quantitative: FK, PSA and RVA
- Per-Recruit: Biological life-history data
- Length-based: Mean length of catch data
- Catch-based: Catch time series
- Index-based: CPUE or survey index of abundance
- MPA-based: Survey sampling in and out of reserve

Qualitative and semi-quantitative methods

Productivity: *r*, a_{max}, a_{mat}, L_{max}, *M*, *κ*

Susceptibility: *F/M*, *B/K*

Assessment models:

Fisher's Knowledge (FK)

Productivity and Susceptibility Analysis (PSA)

Decision trees (RVA)

Caddy's traffic light system

Rapid visual assessment

Includes von Bertalanffy size-based limit reference points:

$$Z = \frac{k(L_\infty - L_m)}{L_m - L_c}$$

Qualitative and semi-quantitative methods

Assumptions:

Qualitative information
nd/or scoring of
ibutes and

Advantages:

- A partnership approach;
- Combine expertise;
- Qualitative knowledge for Bayesian priors;
- Reconstruct time series data.

Disadvantages:

- Subjective rather than objective feedback;
- Misinformation and hidden agendas;
- Difficult to quantify qualitative information;
- High levels of variability and bias;
- Qualitative approaches difficult to simulation test.

Per-Recruit methods

Assessment models:

- Beverton-Holt
- Spawning Potential Ratio (LB-
- Length-based Per Recruit

Yield-per recruit and

Spawning biomass-per-recruit

Size-based reference points:

$$Z = \frac{k(L_\infty - L_m)}{L_m - L_c}$$

SPR based on life-history ratios:

$$M / k \quad L_m / L_\infty \quad F / M$$

Allows for change in *F*

Per-Recruit methods

Assumptions:

Advantages:

- Applied when time-serie
  are sparse and only kn
  of growth parameter
- Provides estimate of
  mortality;
- Provides basic refer
- Use in combination
  approaches.
- Cost-effective manage
  data-poor stocks;

Disadvantages:

- Does not take dynamic effects into account;
- Equilibrium conditions not likely to hold;
- Not suitable for species with high recruitment variability;
- Relies on accurate estimates of growth parameters and *M*

Length-based methods

Assessment models:

Decision tree with Length-based indicators

$$P_{obj} = P_{mat} + P_{opt} + P_{mega}$$

Harvest control rules:

$$TAC_{y+1} = TAC_y \pm \text{step}$$

Stepwise Constant Catch MP (LstepCC):

Target-type MP (Ltarget):

$$TAC_{y+1} = 0.5TAC^* \left[1 + \left(\frac{L_y^{recent} - L^0}{L^{target} - L^0} \right) \right]$$

Length-based methods

Ass

- C

Disadvantages:

- Mean size can be imprecise indicator of stock depletion;
- For low h: not sufficient contrast between length-based indicators at different depletion levels;
- Lag in feedback from mean length data;
- Need extra precaution at low levels of depletion;
- HCRs not able to distinguish between noise and trend in mean length data.

Advantages:

- Length data easy and cheap to collect;
- Simple approaches encourage participat stakeholders;
- Length-based indicat can be used in HCRs
- Mean length HCRs are simple and intuitive

Catch-based methods

Assessm

Bayesian Schaefer

Effort Schaefer

- Catch-MSY (CMSY)
- Catch-only model (COM-SIR)
- Depletion-Based Stock Reduction Analysis (D
- Catch-Curve Stock ysis (CC-SRA)
- State-Space Catch-Only Model (SS-

Bayesian ASPM

Effort Schaefer

$$TAC_{y+1} = \frac{s}{y_2 - y_1 + 1} \sum_{y=y1}^{y2} C_y$$

Harvest control rules:

- Depletion Adjusted Catch Scalar (DACS):
- Depletion corrected Average

$$TAC_{y+1} = \frac{\sum C_y}{n + \Delta / (MSYL \times c \times M)}$$

Catch-based methods

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- Catch t
  genera
  fisher
- The H
  easy t
  requir
  current

Disadvantages:

- Catch time series is not informative about stock productivty and size;
- For data-poor fisheries, the total removals are not well-known;
- Catch time series effected by changes in effort regulations, markets, catchability…;
- HCRs incorporate no feedback about trends in biomass and these rules need to be very conservative to satisfy risk criteria;
- Catch-only methods provide short-term TAC advice until additional data (eg a reliable index) are available;

Index-based methods

Assessment models:

Bayesian S[illegible] [illegible]ducti[illegible])

An In[illegible]

RY model

Schaefer

Linear model

Bayesian RY

Harvest control rules:

Shepherd Hangover TAC (SHOT):

$$TAC_{y+1} = (1-\tilde{F})C_y + \frac{R_y}{\bar{R}}\left(\tilde{F}\,\bar{C} + C_y\frac{(1-\Delta)}{(n-1)}\right)$$

Slope-type MP (Islope):

$$TAC_{y+1} = TAC_y(1 + / s_y)$$

Index ratio (Iratio):

$$TAC_{y+1} = TAC_{y-1}\left(1/2\sum_{y-2}^{y-1} I_y\right) / \left(1/3\sum_{y-5}^{y-3} I_y\right)$$

Target-type MP (Itarget):

$$TAC_{y+1} = 0.5TAC^{*}\left[1 + \left(\frac{I_y^{recent} - I^0}{I^{target} - I^0}\right)\right]$$

Index-based methods

Assumptions:

The index of abundance ...liable indicator of ... biomass; ...atchability, *q*.

Advantages:

- Biomass dynamics models provides reliable estimates of stock-status and management quantities;
- Index-based methods have good track record;
- Index-based HCRs can track trends in biomass;
- Simple rules demonstrate robustness to uncertainty

Disadvantages:

- Noisy data obscure trends in biomass
- Need good contrast in data to be able to estimate model parameters.

MPA-based methods

Harvest control rules:

$$D = \frac{\sum \tilde{N}_{out} / n_{out}}{\sum \tilde{N}_{in} / n_{in}}$$

Density-Ratio Control Rule (DRCR):

MPA-based slope to target rule:

$$C_{y+1} = C_y (1 + kV_y)$$

MPA-based methods

Assumptions:

- The MPA represents the unfished population
amics;
e of the reserve is

Advantages:

- No historical data are required;
- The density ratio rule provides a simple mult species approach .

Disadvantages:

- These methods apply only to near-sedentary species
- Difficulty to obtain unbiased density estimates
- MPA must be well monitored and long-established .

Thank you

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