Part I: Moving towards a sustainable fisheries framework for BC herring: data, models & alternative assumptions.
Part II: Stock assessment and management advice for BC Herring stocks (2011/2012)

Steven Martell, Jake Schweigert, Jaclyn Cleary, Vivian Haist

University of British Columbia

martell.steve@gmail.com

August 14, 2011

Moving towards the sustainable fisheries framework.

Overview

- ▶ Review of the HCAM model in June 17-18, 2010.
  - ▶ Model parameterization of q.
  - ▶ Parametrization of q, M, and selectivity is confounded.
- ▶ Development of a new integrated Statistical Catch Age Model (^{i}SCA$_M$).
- ▶ Data, assumptions and Analytical methods.
- ▶ Outstanding issues.

Introduction

- Current harvest control rule for BC herring:
  - Cuttoffs set at 0.25 B_0
  - 20% exploitation rate
  - Estimates of B_0 were last updated in 1996.
- HCAM model assumed $q = 1$ for the dive survey data.
- Natural mortality is modelled as a random-walk.
- Gill net selectivity is a function of weight-at-age.

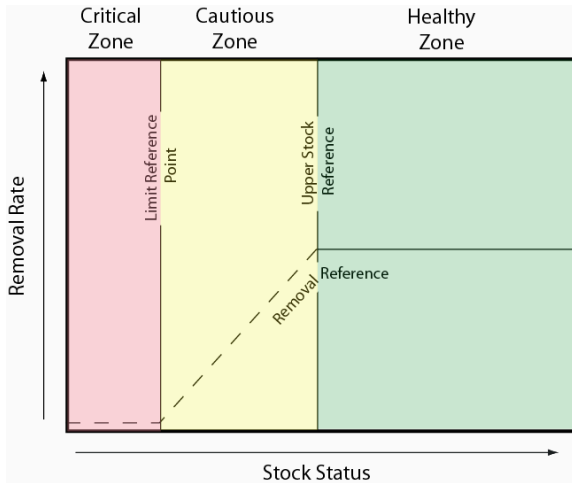# Harvest Strategy Compliant with Precautionary Approach

Figure: Fisheries management framework consistent with a precautionary approach.

Key elements for the new framework I

Reference points

- ▶ Limit Reference Point (LRP) & Upper Stock Reference (USR) requires knowledge of stock productivity and population scale.
- ▶ Removal Rate requires knowledge of stock productivity.
- ▶ MSY-based reference points require *a priori* allocation to different gears.

Risk & Decision making

- ▶ Onus on being able to reliably determine stock status (informative data).

Herring Stock Assessment Model Review I

Summary of Panel Recommendations

Herring Stock Assessment Model Review II

- ▶ Panel concluded that $q_2 = 1$ was inappropriate.
- ▶ CUTOFFS can be fixed or annually estimated (should be updated if management objective is 25% B_0)
- ▶ A model based approach to estimating B_0 and B_{MSY} is appropriate.
- ▶ Recruitment variation should be estimated within the model rather than fixing it at a pre-specified level.
- ▶ Issues regarding estimating selectivity vs. availability should be explored (data is limited to estimate availability).
- ▶ Science advice should be risk neutral.
- ▶ MSE should explore elements of the Sustainable Fisheries Framework (i.e., ensure that $B_t > 0.4B_{MSY}$ with 95% certainty over two generations.)
- ▶ ...

The input data for $^{i}\text{SCA}_{M}$ is the same as HCAM:

- Catch by gear,
- Spawn survey index,
- Age-composition data for all gears,
- Empirical weight-at-age data.

Analytical methods

Integrated Statistical Catch Age Model ($^{i}S_{CA_M}$)

- ▶ The model is based on a statistical catch-age framework first developed by Fournier and Archibald (1982).
- ▶ Flexible options for modelling selectivity, natural mortality, & survey catchability.
- ▶ Integrated framework: joint estimation of policy parameters (e.g., reference pionts).
- ▶ Bayesian implementation...

Assumptions

- Observation errors in catch is known

Assumptions

- Observation errors in catch is known
- Survey q is proportional

Bibliography

Fournier, D. and Archibald, C. (1982). A general theory for analyzing catch at age data. *Canadian Journal of Fisheries and Aquatic Sciences*, 39(8):1195–1207.