Ecosystem-based Management: A Step Toward More Holistic Management

Dr. Charles W. Fowler
Leader, Systemic Management Studies Program
National Marine Mammal Laboratory
Alaska Fisheries Science Center, Seattle, WA

Dr. Andrea Belgrano and Dr. Michele Casini
Swedish Board of Fisheries
Institute of Marine Research, Lysekil, Sweden

November 10, 2009
Lowell Wakefield Symposium
Ecosystems 2010: Global Progress on Ecosystem-based Fisheries Management
Ecosystem-based Management: A Step Toward More Holistic Management

Holistic Management or Reality-based Management (ecosystems are part of reality)

Pattern-Based Management

Macroeocological Patterns
Holistic Management (examples)

Harvests
- Single species application
- Multispecies application
- Ecosystem application
- Oceanic application
- Refined/extrapolated single species application

Selectivity
- Evosystem-based application
- Single species application

MPAs
- Ecosystem application
Holistic Management (examples)

Harvests
- Single species application
- Multispecies application
- Ecosystem application
- Oceanic application
- Refined/extrapolated single species application

Selectivity
- Evosystem-based application
- Single species application

MPAs
- Ecosystem application
Single-species application

Pollock in eastern Bering Sea

Six species of marine mammals – late 1980s
OI (overfishing index) = 16
Multi-species application

Hake, mackerel, and herring in the northwest Atlantic

Ten species of marine mammals – late 1980s
OI = 14
Ecosystem application

Eastern Bering Sea

Twenty species of marine mammals – late 1980s
OI = 7
Full marine environment application

World’s Oceans

Sixteen species of marine mammals – late 1990s
OI = 23
Holistic Management (examples)

Harvests
  Single species application
  Multispecies application
  Ecosystem application
  Oceanic application
  Refined/extrapolated single species application

Selectivity
  Evosystem-based application
  Single species application

MPAs
  Ecosystem application
Extrapolation to other resource species

-------

Makes use of macroecological pattern relating sustainable consumption rates to $M$ (total natural mortality)
Species-specific predation rates compared to 44 empirically observed fishing rates

\[ F_{es} = 0.168 M \]

Mertz and Meyers 1998
Belgrano and Fowler 2011
Species-specific predation rates compared to 44 empirically observed fishing rates

\[ F_{es} = 0.168 \, M \]
Species-specific predation rates compared to 44 empirically observed fishing rates

\[ F_{es} = 0.168 \text{ M} \]
**Herring Fishery, Baltic Sea**

**Total Natural Mortality (M)**

- **F_{ob} (•) and F_{es} (○)**
  - \( F_{es} = 0.168 M \)

**Comparison of Observed (F_{ob}) and Sustainable (F_{es}) Fishing Rates**

**Overfishing Index (OI)**
Sprat Fishery, Baltic Sea

Total Natural Mortality (M)

\[ F_{es} = 0.168 \, M \]

Comparison of Observed (\( F_{ob} \)) and Sustainable (\( F_{es} \)) Fishing Rates

Overfishing Index (OI)
Holistic Management (examples)

Harvests
- Single species application
- Multispecies application
- Ecosystem application
- Oceanic application
- Refined/extrapolated single species application

Selectivity
- Evosystem-based application
- Single species application

MPAs
- Ecosystem application
Evosystem-based management

Etnier and Fowler 2010
Evosystem-based management (single-species application)

Cod (northwest Atlantic)

- Graph showing portion of species across different lengths (cm) with fisheries indicated.
Holistic Management (examples)

Harvests
- Single species application
- Multispecies application
- Ecosystem application
- Oceanic application
- Refined/extrapolated single species application

Selectivity
- Evosystem-based application
- Single species application

MPAs
- Ecosystem application
Ringed Seal 56% (0.56)
Marine Protected Areas (ecosystem application)
Ribbon Seal 11% (0.11)
Ribbon Seal/Ringed Seal = 21% (of Ringed Seal's geographic range)
Holistic Management (examples)

Harvests
  - Single species application
  - Multispecies application
  - Ecosystem application
  - Oceanic application
  - Refined/extrapolated single species application

Selectivity
  - Evosystem-based application
  - Single species application

MPAs
  - Ecosystem application
Thank You!

Charles.Fowler@noaa.gov