Ecosystem Considerations in Fisheries Management

Linking Ecosystem-Based Management Goals with Ecosystem Research

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Outline

I. ECOSYSTEM ASSESSMENT

II. ECOSYSTEM STATUS INDICATORS

III. ECOSYSTEM-BASED MANAGEMENT INDICES AND INFORMATION

I. ECOSYSTEM ASSESSMENT

Organization:
- Recent Ecosystem Changes in the Bering Sea and Aleutian Islands
- Recent Ecosystem Changes in the Gulf of Alaska
- North Pacific Assessment (focus on Alaska)
- Multispecies statistical model
- Ecosystem modeling results

Model Progress (Aydin and Jurado-Molina)
- BS, GOA, and AI ecosystem model documentation and web access to data and results nearing completion
- Completion of prototype multispecies statistical model

II. ECOSYSTEM STATUS INDICATORS

- Physical Environment
  - GAK 1 MLD; EBS temp. and ice; drift trajectories; GOA pollock survival indices
- Habitat
  - AI and BS HAPC; Updated habitat research
- Forage Fish
  - AI and BS
- Herring
  - PWS herring
- Groundfish
  - R/S regime shift analysis; flatfish distribution and the cold pool
- Benthic Communities + Non-target Fish Species
  - AI and BS Misc. sp.; Grenadiers; crabs
- Marine Mammals
  - Updated
- Seabirds
  - Updated

BS Temperature (Rodionov et al.)

- May 1987
- December Alaska temperature
Habitat Research

Included to help inform assessment scientists and public about research results and progress

- Table of habitat research projects
- 4 summaries of EFH projects
- 17 research project summaries of Effects of Fishing Gear on Seafloor Habitat
- List of habitat research-related publications

AI Groundfish Survey Bottom Temperature (Zenger)

AI HAPC (Brown)

BS Forage (Walters)

PWS Herring (Moffitt)
Relative Location (SE <-> NW)
-2
-1
0
1
2

Flatfish Distribution (Spencer)

Flatfish Distribution (Spencer)

cold pool

Flathead sole

Snow crab

E. Bering Sea Crab (Otto and Turnock)

Snow C. opilio

E. Bering Sea Crab

Red King

Pribilof Is. Red King

Blue King

St. Matthew Blue King

Snow crab

Mature biomass (1,000 tons)

Recruits (millions)

Biomass (1,000s of mt)

Grenadiers in Alaska (Clausen and Gaichas)

BS

Western Al

S. BS

Central AI

Eastern AI

Giant

Pacific

Popeye

Steller sea lions (non-pups) (Sinclair et al.)

Sub-Areas

Eastern GOA

Central GOA

Western GOA

TOTAL

Eastern AI

Central AI

Western AI

TOTAL

0 20 40 60 80 100 120 140 160

0 2000 4000 6000 8000

0 20 40 60 80 100 120 140 160

Biomass (1,000s of mt)

1989 GOA Trawl Survey

1982 BS Trawl Survey

Recommendations
- Data analysis
  - Examine catch rates from ABL longline survey
  - Work up maturity and age samples collected to date
- Data collection
  - Maintain deep survey strata, extend deeper?
  - Identify grenadiers to species in fisheries
- Management
  - Monitor catches: total biomass, spatial distribution, sex ratio
  - Monitor survey trends in same things
  - Purpose of “assessment” is to put grenadiers on the radar...
N. Fur Seal Pups (Sinclair et al.)

Seabird longline bycatch (Fitzgerald et al.)

Longline effort and seabird bycatch (Fitzgerald et al.)

Trawl seabird bycatch (Fitzgerald et al.)

Future

- Timing of Ecosystem Considerations
- Include model projections in assessment including climate scenarios and suites mgt alternatives
- Bring lower trophic level models into assessment

Extra slides
Recent Changes
1999-2002
- Summer and annual PDO below average
- 3 other atmospheric indices show shift
- SLP reversed signs
- Decreased sea ice cover in BS
- Increased shrimp CPUE in GOA
- Strong 1999 yearclass of GOA pollock and cod

2003
- El Nino – BS and GOA warm

2004
- BS – warm; GOA - average

III. ECOSYSTEM-BASED MGNT. INDICES AND INFORMATION

- Maintain Diversity
  (bycatch, prohibited species, discards, non-target)
- Maintain and Restore Fish Habitats
  (areas closed, effort)
- Sustainability
  (trophic level of catch, stock status, size spectrum)
- Humans are part of ecosystem
  (fleet composition, overcapacity programs)

I. ECOSYSTEM ASSESSMENT

Goals:
- Summarize historical climate and fishing effects on BSAI and GOA (using Ecosystem Status Indicators section)
- Summarize possible future effects of climate and fishing on ecosystem structure and function (using a variety of models)

Focus for this draft:
- Historical responses of ecosystem components to climate regime shifts
- Expert judgement on the near-future state of climate
- Advances in Developing Predictive models
PDO and AO (Rodionov et al.)

Winter 500 hPa height-anomaly (Rodionov et al.)

Winter (DJFM) 2004 SST Anomalies (Rodionov et al.)

Ice Retreat Index Area

Papa Trajectory Index (PTI) Endpoint Latitudes (Winters 1902-2004)
Precipitation-based pollock survival index (Macklin)

```
1.0
1.5
2.0
2.5
3.0
```

Wind-mixing-based pollock survival index (Macklin)

```
1.0
1.5
2.0
2.5
3.0
```

Annual value

3-year running mean

Mixed Layer Depth at GAK1 (Sarkar et al.)

```
y = -0.225x + 284.88
R^2 = 0.0044
```

Chlorophyll – N.GOA

Forage – Age-0 Pollock (Middleton)

```
Forage
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- GOA spring ichthyoplankton (FOCI)
- BS age-0 pollock (BASIS)
- Bottom trawl surveys
- Herring (ADFG)
- Small mesh surveys (ADFG/NMFS)
**Alaska Native Traditional Environmental Knowledge of Climate Regimes (Lazrus)**

- **1947-1975**
  - Earlier and faster melt of sea ice
  - Declines in spotted seal populations
  - Bering sea ice, and coastal erosion - impact scallop harvest

- **1976/77-1988**
  - Increased wind frequency and intensity
  - Increased temperature
  - Sea ice melted earlier
  - Currents seemed to have shifted

- **1989-1998**
  - Significant decline in spotted seal populations in 1998
  - Decrease in Yukon River salmon populations
  - Decrease in Market Bay clam abundance
  - Ice formation delayed until early to mid-December (vs. October in previous years)
  - Poor health of walrus and young spotted seal populations

**Seabirds (Fitzgerald et al.)**

- Trawl (high)
- GOA Longline
- BSAI Longline

**Bycatch of Prohibited Species (Hiatt and Terry)**