Why Multispecies model  Case study  Simulation  Next steps

Same data different story:
guidelines for data weighting in a multispecies statistical catch-at-age stock assessment framework

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1. Why

2. Multispecies model

3. Case study

4. Simulation

5. Next steps
Why perform stock assessments

- Goal of stock assessment models:
  "... understand, and inform decision-makers of, the consequences of possible fishing activities." (Hollowed et al., 2000)
Why perform stock assessments

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- Ecosystem based management
  "... shorthand for more holistic approaches to resource management." (Larkin, 1996)
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Goal of **multispecies** stock assessment models:
explicitly represent species interactions, providing a framework for evaluating ecosystem properties and improved estimates of management quantities.
Barriers to multispecies stock assessments

- increased data requirements
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- increased uncertainty in model output
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Statistical catch-at-age multispecies models

- age-structured forward projection
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- maximum likelihood
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admb
FAST, ACCURATE, STABLE OPTIMIZATION
Statistical catch-at-age multispecies models

- age-structured forward projection
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![admb](https://example.com/admb.png)
Statistical catch-at-age multispecies models

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Assessment Method for Alaska (AMAK; J. Ianelli)
Statistical catch-at-age multispecies models

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Kinzey and Punt, 2009
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Kinzey and Punt, 2009

Van Kirk et al., 2010, 2012, 2015
Statistical catch-at-age multispecies models

- age-structured forward projection
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Assessment Method for Alaska (AMAK; J. Ianelli)

Kinzey and Punt, 2009 → Van Kirk et al., 2010, 2012, 2015 → Curti et al., 2013
Statistical catch-at-age multispecies models

- age-structured forward projection
- maximum likelihood

- Assessment Method for Alaska (AMAK; J. Ianelli)

- Kinzey and Punt, 2009
- Van Kirk et al., 2010, 2012, 2015
- Curti et al., 2013

- Johnson et al., 201?
Case study

- Aleutian Islands, Alaska
Case study

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  - walleye pollock (*Theragra chalcogramma*)
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  - Pacific cod (*Gadus macrocephalus*)
Case study

- Aleutian Islands, Alaska
  - walleye pollock (*Theragra chalcogramma*)
  - Atka mackerel (*Pleurogrammus monopterygius*)
  - Pacific cod (*Gadus macrocephalus*)

- foodweb (blue = predator)
Fixed inputs

- Pacific cod
  - Atka mackerel
  - walleye pollock
Fixed inputs

- Pacific cod
  - Atka mackerel
  - walleye pollock

Steepness: fixed at individual assessment values (0.7, 0.8, & 1.0)
Fixed inputs

- Pacific cod
  - Atka mackerel
  - Walleye pollock

Steepness: fixed at individual assessment values (0.7, 0.8, & 1.0)
Data 'moderate' system
Operating model

- Fishery
- Survey
- Diet

Graphs showing changes in biomass over time for pollock, mackerel, and cod.
## Methods

### Weighting

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<th>distribution</th>
<th>weight</th>
<th>types</th>
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<td>lognormal</td>
<td>$cv$</td>
<td>catch</td>
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<tr>
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### Data

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<td>200</td>
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<td>0.01</td>
<td>1</td>
<td>2</td>
<td>10</td>
</tr>
<tr>
<td>survey</td>
<td>age &amp; length</td>
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<td>1</td>
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<tr>
<td>survey</td>
<td>diet weight</td>
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Model performance metrics

- Unfished spawning biomass
- Unfished recruitment
- Biomass available to survey
- Spawning biomass
- Annual recruitment
- Fishing mortality
Results

Box plots showing the distribution of multivariate data for different species:

- **Pollock**
- **Mackerel**
- **Cod**

The plots display the data range, median, quartiles, and outliers for each species.
Results

[Box plots for pollock, mackerel, and cod showing distribution of data points and outliers across different categories such as om, 1, 100, 200, and 1000.]
Results

[Box plots showing data distribution for different species (pollock, mackerel, cod).]
Results

[Graphs showing time series data for different species, labeled om, pollock, mackerel, and cod. Each graph represents data over years with a y-axis ranging from 0 to 2500 and an x-axis representing years from 0 to 250.]
Results

- **Why Multispecies model**
- **Case study**
- **Simulation**
- **Next steps**

Johnson & Punt

Multispecies data weighting
Results
Results

Graphs showing results for different species and years.

- Species: pollock, mackerel, cod trawl, cod pot, cod longline.
- Years: om, 1, 100, 200, 1000.
- Y-axis: Fully selected F.
- X-axis: Year.

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Next steps

- Coding tasks
Next steps

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  - Initial conditions
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- Add 2004:2015 data
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- Add 2004:2015 data
- Add OMs and EMs
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- Add 2004:2015 data
- Add OMs and EMs
  - Add process error
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- Tasks for others or post-doc
  - Two species model
  - Move beyond self-test and estimate using Atlantis data
Acknowledgements

- Dr. Doug Kinzey (SWFSC)
- Alaska Fisheries Science Center
- Northwest Fisheries Science Center
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