

NOAA
FISHERIES
SEFSC

Overview of modeling approaches and data requirements

Meaghan D. Bryan

September 16, 2014

Goals of presentation

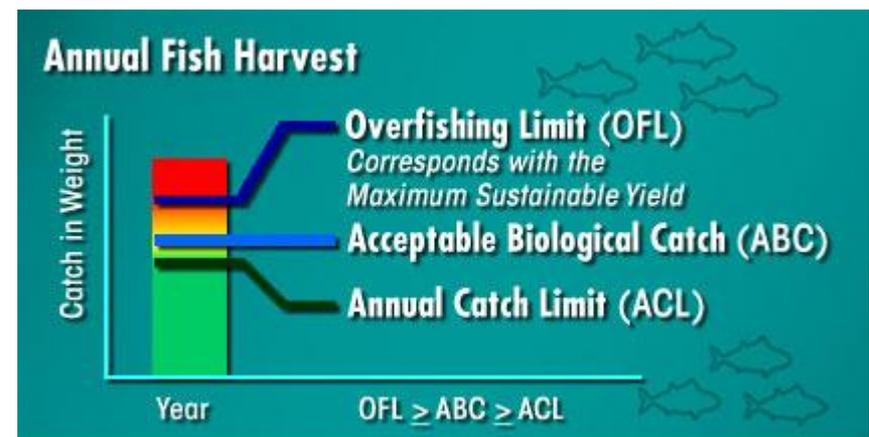
- Role of stock assessment in fisheries management
- Provide an overview of existing modeling approaches (examples)
 - Focus on data requirements and outcomes
- Modeling approach that is currently used
 - Why is this approach used?
 - Management advice that has been provided
 - Challenges
- How can fishery-independent data be used in the short- and long-term?

Definitions

- Data-poor /data-limited
 - Lacking sufficient information to conduct a traditional stock assessment
 - Few data
 - Large quantities of data containing limited information about the population of interest
 - Temporal or spatial constraints or narrow segment of the population is represented
- Data-rich
 - Data to conduct traditional stock assessments
 - Data contains information to obtain an unbiased estimate of abundance

Stock assessment and fisheries management

- Determine current stock status relative to established measures of sustainability
 - Experiencing overfishing? Overfished?
- Provide quantitative management advice with regard to long-term sustainability
 - Overfishing Limits (OFL)



Examples of assessment models and their data requirements

Increasing model complexity and information requirements 

Data requirements	Models			
	Mean length estimator	Depletion-based methods	Surplus production	Integrated stock assessment
Annual length data	X			X
Defined growth relationship	X			X
Natural mortality		X		X
Catch		X	X	X
Index of abundance			X	X
Depletion		X		
Fmsy		X		
Age composition				X

Examples of assessment models and their data requirements

Increasing model complexity and information requirements 

	Models			
Data requirements	Mean length estimator	Depletion-based methods	Surplus production	Integrated stock assessment
Annual length data	X			X
Defined growth relationship	X			X
Natural mortality		X		X
Catch		X	X	X
Index of abundance			X	X
Depletion		X		X
Fmsy		X		
Age composition				X
Outcomes	Total mortality	OFL	MSY	MSY

Examples of assessment models and their data requirements

Increasing model complexity and information requirements 

	Models			
Data requirements	Mean length estimator	Depletion-based methods	Surplus production	Integrated stock assessment
Annual length data	X			X
Defined growth relationship	X			X
Natural mortality		X		X
Catch		X	X	X
Index of abundance			X	X
Depletion		X		X
Fmsy		X		
Age composition				X
Outcomes	Total mortality	OFL	MSY	MSY

Current assessment approach in US Caribbean

- Mean length estimator (Gedamke and Hoenig, 2006):
 - Minimal data requirements as compared to traditional stock assessment methods making it an attractive approach for data-limited situations.
 - Most consistently sampled species-specific data are annual length-frequency data
 - Trip Interview Program: fishery-dependent data collection program
- Provided advice about overfishing status
 - Derive an estimate of fishing mortality from total and natural mortality ($F = Z - M$)
 - Compare estimate of F to F_{MSY} -proxy from per-recruit analysis
- Limitation
 - Have not provided advice about the OFL/ABC/ACL

Assessment challenges

- Annual landings
 - In Puerto Rico known problem with underreporting and misreporting: derive and apply expansion factors
 - Species-specific reporting
 - In the USVI landings are assumed to be a census
 - Reporting has been an evolving process
 - By gear groupings (1974-2000), species groups (2000-July, 2011), species-specific (July, 2011)
- Few available indices
- Adequacy of length composition varies among islands and over time
 - Known selectivity issues in the USVI, target plate size fish
- Life history parameters from the literature are often variable

How can fishery-independent data be used to improve our stock assessments?

- Short – term
 - Continue to use the mean length estimator and per-recruit analyses to determine overfishing status
 - Length-frequency data
 - Life history information

How can fishery-independent data be used to improve our stock assessments?

- Long – term
 - Relative index of abundance
 - Statistically rigorous
 - Use in a more traditional stock assessment framework
 - Data Improvement Project
 - Improve reporting
 - Territorial Initiative
 - Verify landings

Divider Title

Additional Divider Information

Commercial landings

- Puerto Rico
 - Electronic database started in 1983 (30 year time-series)
 - Species-specific reporting
 - Known problems with reporting. Expansions factors used to estimate total landings
- USVI
 - Landings are assumed to represent a census
 - Reporting has been an evolving process
 - 1974-2000 (26 years) – Reported according to gear groupings (e.g., “potfish”)
 - 2000-July, 2011 (11.5 years) – Reported as species group (e.g., grouper)
 - July, 2011- Species-specific reporting commenced

Recreational landings

- Recreational Landings (MRFSS/MRIP)
 - Data have been collected in **Puerto Rico** since 2000
 - Data are not collected in the USVI

Year	AB1	B2	Positive trips	Trips	Proportion positive	Angler hours
2000	5	0	4	628	0.006	2850
2001	18	0	10	656	0.015	3161
2002	2	0	2	419	0.005	2121
2003	5	0	5	657	0.008	3412.5
2004	2	1	3	520	0.006	2682.5
2005	4	1	4	378	0.011	1854.5
2006	2	0	2	287	0.007	1384
2007	2	0	1	450	0.002	2106.5
2008	22	2	12	547	0.022	2665
2009	23	3	16	513	0.031	2668
2010	8	0	4	485	0.008	2215
2011	2	0	2	723	0.003	3124.5

- Recreational landings on intercepted trips expanded using a statistical survey of fishing effort by coastal residents. **High coefficient of variation!**

Indices

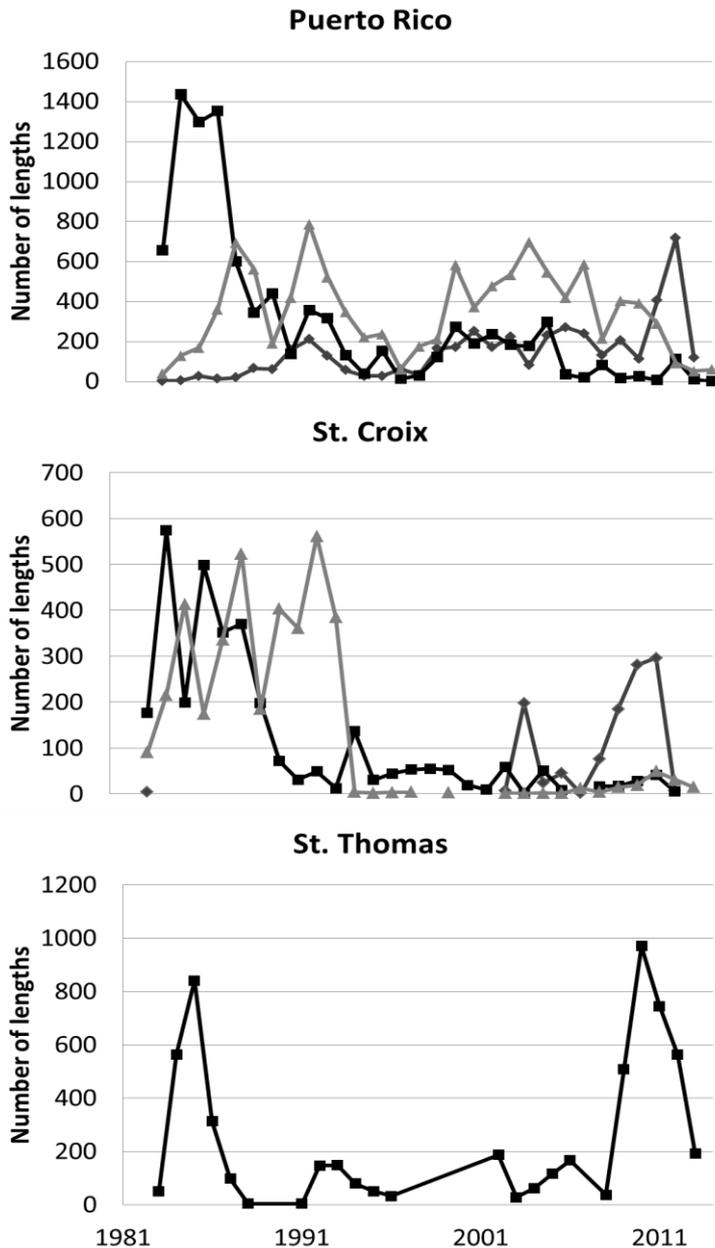
- Fishery dependent
 - Puerto Rico
 - Trip is often the best defined unit of effort
 - Few trips report hours fished
 - USVI
 - At the moment we can develop indices for species groups

Composition data

Island	Fleet	Intercepts per year	Lengths per year	Number of years
Puerto Rico	Diving	2-137	3-719	28
	Pot and trap	1-231	1-1436	28
	Vertical line	6-128	38-787	28
St. Croix	Diving	1-46	1-296	11
	Pot and trap	1-112	2-574	28
	Vertical line	1-32	1-561	25
St. Thomas	Pot and trap	2-116	4-971	23

- Main source of data: Trip Interview Program (**lengths only**)
- The number of intercepts and lengths and temporal scale seems adequate when looking at the range of values

Length composition data



- Number of lengths have declined to a low in the most recent years for many fleets
 - Time period of most interest
- Main data input for assessments

Life history

- Life history parameters come from literature and FishBase.
 - Growth relationship can vary greatly among the reviewed studies

