

Management Strategy Evaluations

The Caribbean Experience

National Meeting of the Scientific Coordination Subcommittee

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SEDAR 46

Introduction to Data Limited Models (DLMs)
and the
DLM Toolkit

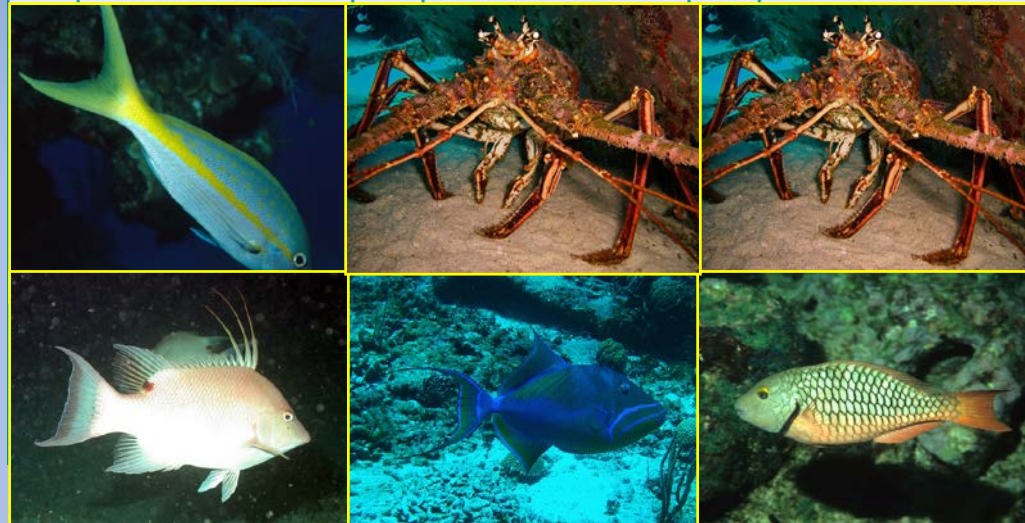
SEDAR 46

Species evaluated

- 6 species-island units
 - 2 per island unit
- Species selection decided by SEDAR process
- Designed to present a range of data quality & quantity

Species sorted by average annual commercial landings for each island unit

Puerto Rico		St. Thomas		St. Croix	
1	Yellowtail snapper	1	Spiny lobster	1	Spiny lobster
2	Spiny lobster	2	Queen triggerfish	2	Queen conch
3	Silk snapper	3	Red hind	3	Dolphin
4	Queen conch	4	Yellowtail snapper	4	Stoplight parrotfish
5	Lane snapper	5	White grunt	5	Queen parrotfish
6	White grunt	6	Blue tang	6	Queen triggerfish
7	King mackerel			7	Redtail parrotfish
8	Dolphin			8	White grunt
9	Queen snapper				
0	Mutton snapper				
11	Queen triggerfish				
12	Hogfish				
13	Red hind				



Steps to MSE

- Evaluate available data (Data triage)
 - Life history
 - Landings
 - Catch and Effort
 - Length data
 - Fishery Independent surveys
- Select target species for evaluation
- Review species-specific data
- Simulate population
- Define management objectives → Performance metrics
- Conduct MSE of potential DLMs using simulated populations
(40-yr runs, 1000 replications)

Variable Parameters

Randomly drawn for each replicate run

Life History

- Natural mortality rate
- Steepness
- K, L_{∞}, t_0
- Current level of stock depletion
- Length at 50% maturity
- Length increment from 50% to 95% maturity
- Process error in recruitment deviations
- Autocorrelation in recruitment deviations

Fleet

- Length at full selectivity
- Length at 5% selectivity
- Vulnerability of oldest age class
- Interannual variability in Fishing Mortality

Types of DLMs Evaluated using MSE

Index-based

- CPUE Slope
 - Catch and trend in slope based on last 5 years (2010-2014) or last 10 years (2005-2014)
- CPUE Target (near optimum)
 - Catch and target CPUE based on Council years, reference mean index assumed an appropriate target

Length-based

- Stepwise Constant Catch with Mean Length
 - Catch and target length based on Council years
- Length Target (near optimum)
 - Catch and target length based on Council years
- Length at maturity Target
 - Catch and target length based on Council years, target based on length at maturity (95% of maturity) rather than an arbitrary multiplicative of mean length

Multi-indicator-base

- Multi-indicator
 - Indicator reference conditions based on Council years, trends in catch, mean length in catch, and CPUE based on previous year

Catch-only

- Status Quo
 - Status quo over FMC years = ACL (assuming catch = ACL each year)

Performance Metrics

- PNOF = Probability of not overfishing
- B50 = Probability of the biomass being above 50% B_{MSY}
- AAVY15 = Probability of the interannual variability in yield remaining within 15%
- LTY = Probability in terms of long-term yields achieving 50% yield relative to F_{MSY}
- STY = Probability in terms of short-term yields achieving 50% yield relative to F_{MSY}
- B20 = Probability of the biomass being above 20% B_{MSY}

Performance Metrics (% of runs)

Yellowtail Snapper PR

$$D^* = 0.36 - 0.59$$

MODEL	PNOF	B50	B20	LTY	STY	AAVY15
CPUE target (near optimum)	61	72	89	40	50	56
Multi-indicator	73	81	94	38	42	71
Length at Maturity Target	69	79	92	38	44	66
Length target (near optimum)	72	80	93	37	43	68
CPUE Slope (10 yrs)	88	90	98	21	30	88
CPUE slope (5 yrs)	88	90	98	20	30	86
Stepwise Constant Catch with Mean Length	88	90	98	16	30	88
Status Quo	78	84	96	34	38	76

*Base Depletion Level (D) = Ratio of current to unfished biomass