SEDAR 49 Assessment Results

Southeast Fisheries Science Center,
Sustainable Fisheries Division,
Miami, FL

SEDAR 49 Review Workshop

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Outline

Review of Terms of Reference

Results

- DLMtool application
  1. Management strategy evaluation of feasible methods
  2. Catch recommendations

- Mean length estimator

- Catch curve analysis

Assessment Workshop Terms of Reference

1. ***Develop population assessment models*** that are compatible with available data and document input data, model assumptions and configuration for each model considered.
2. ***Provide estimates of population benchmarks or management criteria*** consistent with available data, applicable FMPs, proposed FMPs and Amendments, other ongoing or proposed management programs, and National Standards (e.g. OFL, ABC) or other indicators (e.g. trends in F or Z, probability of overfishing) that may be used to inform managers about stock trends and conditions.
3. ***Characterize uncertainty*** in the assessment and estimated values.
    - Consider uncertainty in input data, modeling approach, and model configuration.
    - Provide appropriate measures of model performance, reliability, and 'goodness of fit'.
    - Provide measures of uncertainty for estimated parameters.
4. ***Provide recommendations*** for future research to improve stock assessment (e.g. sampling, fishery monitoring, methodological enhancements.)
5. ***Prepare an Assessment Process report*** providing complete documentation of workshop actions and decisions in accordance with project schedule deadlines (Section III of the SEDAR assessment report)

Data-Limited Methods Toolkit (DLMtool)

version 3.2.1

DLMtool framework

1. Feasible methods determined
   - Based on data availability and quality

2. Method performance evaluated using MSE
   - Tradeoffs
   - Trajectory plots (e.g., Biomass, B/BMSY, etc.)
   - Sensitivity to operating model assumptions

3. Catch recommendations for viable methods
   - Sensitivities to data inputs

DLMtool stock evaluation

Part 1 & 2: feasibility and management strategy evaluation

Feasible methods

Tradeoffs in performance metrics

Viable methods for setting catch recommendations

Sensitivity of method performance to assumptions in operating model

Lane Snapper: feasible methods

Method	Data Inputs		
	Total Removals	Index of Abundance	Mean length
Catch-based			
CC1_Ref			
Tier3AStatusQuo _ABC*			
Index-based			
Islope0			
Itarget0			
Length-based			
LstepCC0			
Ltarget0			

*ABC = Mean + 1 SD for historic period (1999-2008) (GMFMC 2011)

Lane Snapper: guidance table

Method	Data Requirement	Reliability Score
Tier 3AStatusQuo_ABC	Total removals: Known and informative for 1999-2008	Good
CC1_Ref	Total removals: Known and informative for 1999-2008	Good
Islope0	Total removals: Known and informative for 1999-2008	Good
	Index: Headboat index representative of trend in population abundance (2010-2014)	Good
Itarget0	Total removals: Known and informative for 1999-2008	Good
	Index: Headboat index representative of population abundance; uses trend over reference period (1999-2008) and recent period (2010-2014)	Good
LstepCC0 / Ltarget0	Total removals: Known and informative for 1999-2008	Good
	Mean Length: Mean length of catch from recreational private and headboat fleets an indirect and informative indicator of the trend in resource abundance; uses mean length over reference period (1999-2008) and over recent period (2010-2014)	Good

Review of performance metrics

1. Probability of not overfishing (PNOF)
2. Probability of the biomass remaining above half BMSY (B50):
3. Average annual variability in yield to remain within 15% (VY15):
   - Criteria of > 50% chosen for each

- Long-term yield (LTY)
- Short-term yield (STY)
- Probability of reducing the stock below 20%BMSY (Bbelow20)

Lane Snapper: tradeoffs

Above criteria (>50%)

Below criteria (≤ 50%)

Method	PNOF	B50	VY15
Tier3AStatusQuo_ABC*	29.1	45.4	53.3
Islope0	69.0	75.5	87.9
Itarget0	84.9	87.6	94.3
Ltarget0	66.4	74.0	86.7
LstepCC0	70.4	76.3	88.1

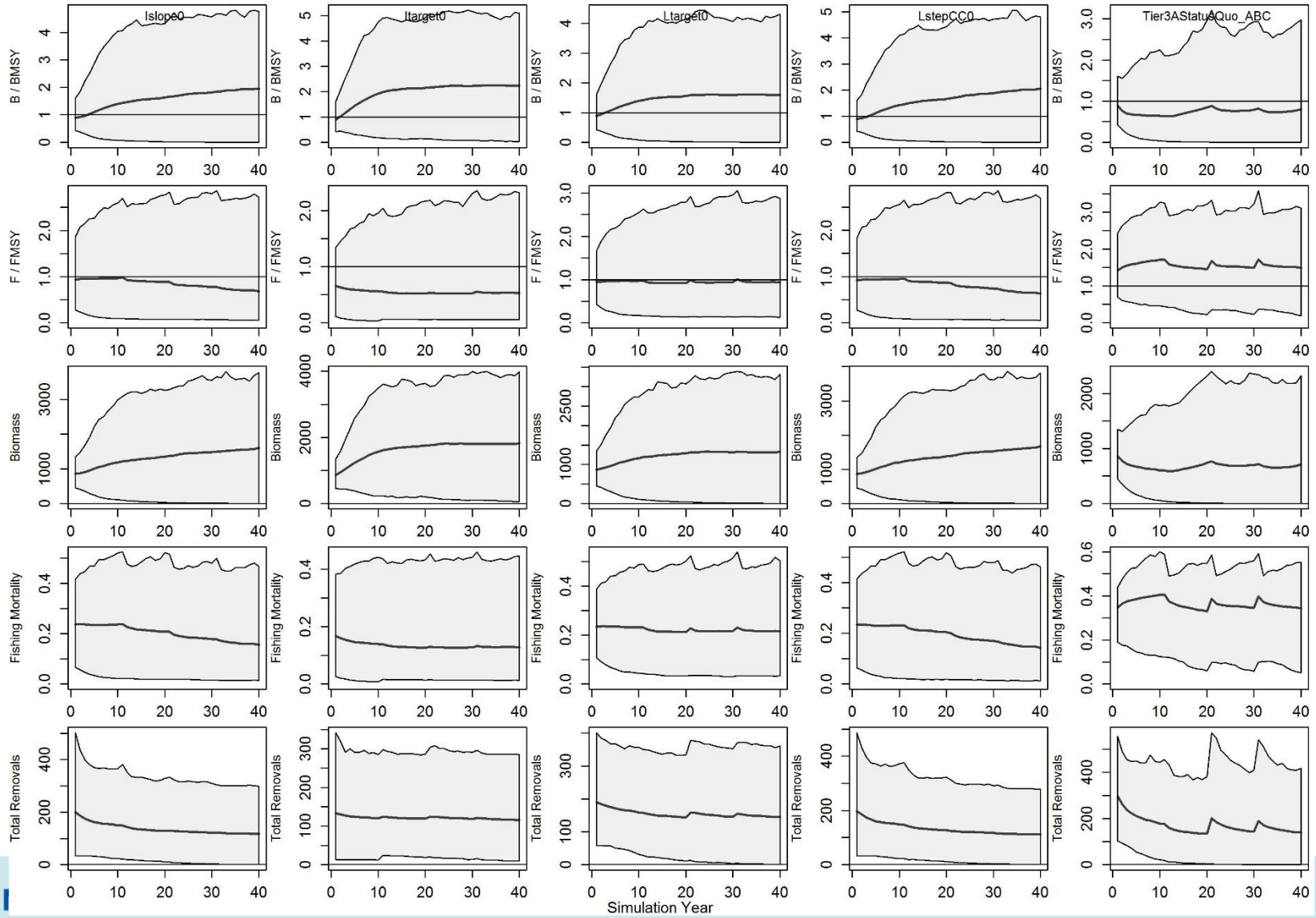
*ABC = Mean + 1 SD for historic period (1999-2008)

Of six applicable methods, four meet performance criteria:

- Index-based (Islope0, Itarget0)
- Length-based (LstepCC0, Ltarget0)
- Tier3AStatusQuo_ABC shown for comparison of current method

Lane Snapper: trajectory

- Lines identify means across simulations (1,000)
- Shaded regions bound the 5th and 95th percentiles



Lane Snapper: tradeoffs Sorted from highest to lowest LTY

Method	PNOF	B50	VY15	LTY	STY	Bbelow20
Ltarget0	**66.4**	**74.0**	**86.7**	**66.1**	**84.6**	**15.0**
Tier3AStatusQuo_ABC	29.1	45.4	53.3	55.4	92.4	33.0
Itarget0	**84.9**	**87.6**	**94.3**	**52.3**	**59.3**	**6.1**
Islope0	69.0	75.5	87.9	49.2	73.6	14.4
LstepCC0	70.4	76.3	88.1	46.3	73.7	14.0

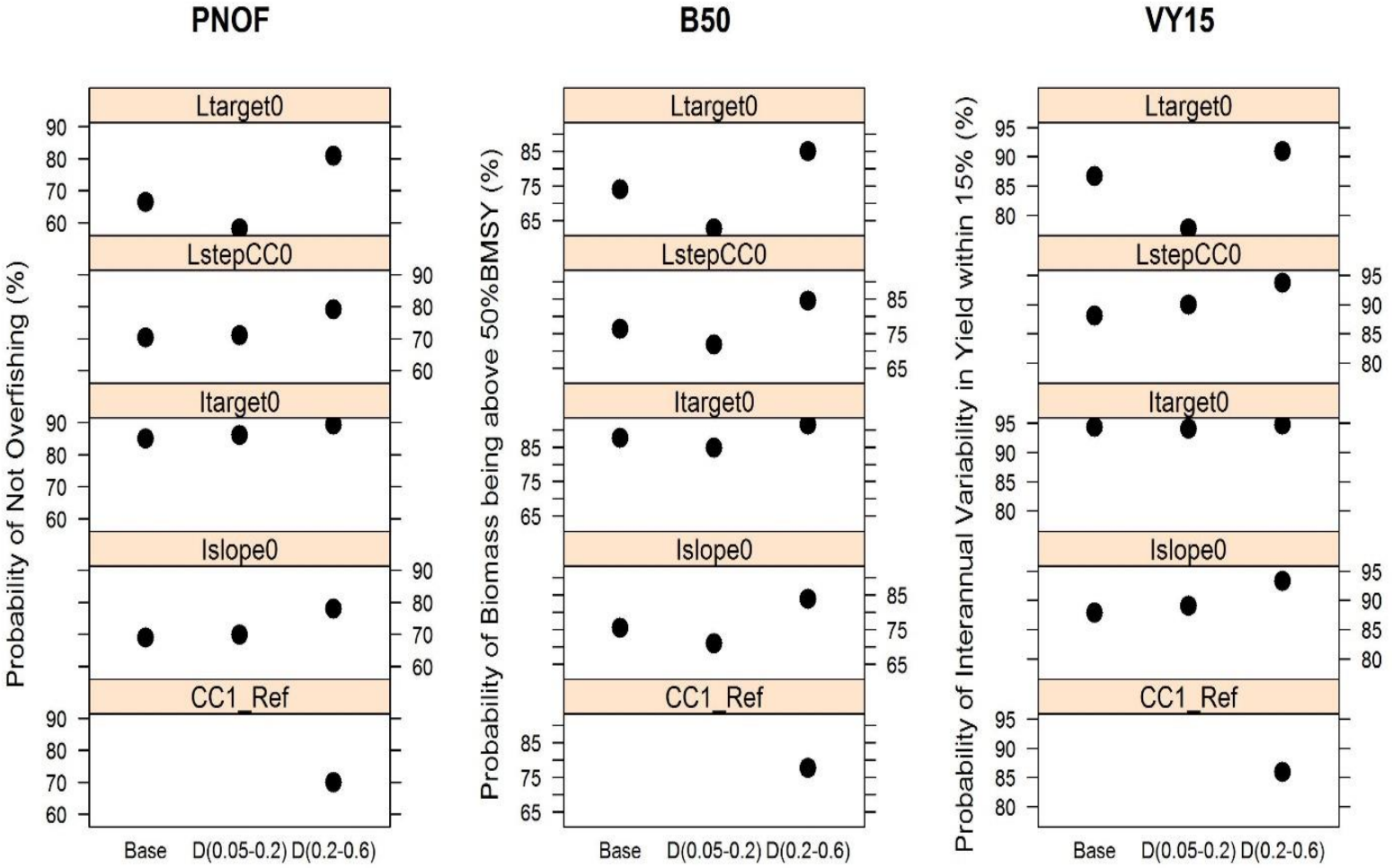
Recommend weighted average of Itarget0 and Ltarget0

- Relatively better performance in terms of yield
- Equal weighting (similar data quality)

Good (67-100%)
Fair (33-67.0%)
Poor (0-33.0%)

Lane Snapper: sensitivity to assumptions in MSE

- Base: depletion (D) = 0.12 – 0.31 based on other Lutjanidae



- Recommended methods (Itarget0, Ltarget0) remain viable

Wenchman: feasible methods

Method	Data Inputs		
	Total Removals	Index of Abundance	Mean length
Catch-based			
CC1_Ref			
Tier3AStatusQuo _ABC*			
Index-based			
Islope0			
Itarget0			
Length-based			
LstepCC0			
Ltarget0			

*ABC = Mean + 1 SD for historic period (1999-2008) (GMFMC 2011)

Wenchman: guidance table

Method	Data Requirements	Reliability Score
CC1_Ref	Total removals: Known and informative for 1999-2008	Fair
Tier3AStatusQuo_ABC	Total removals: Known and informative for 1999-2008	Fair
Islope0	Total removals: Known and informative for 1999-2008	Fair
	Index: Small pelagics index representative of trend in population abundance (2010-2014)	Good
Itarget0	Total removals: Known and informative for 1999-2008	Fair
	Index: Small pelagics index representative of population abundance; uses trend from reference period (1999-2008) and recent period (2010-2014)	Good
LstepCC0 / Ltarget0	Total removals: Known and informative for 1999-2008	Fair
	Mean Length: Mean length of catch from small pelagics an indirect and informative indicator of the trend in resource abundance; uses mean length over reference period (1999-2008) and mean length over recent period (2010-2014)	Good

Wenchman: tradeoffs

Above criteria (>50%)
Below criteria (≤ 50%)

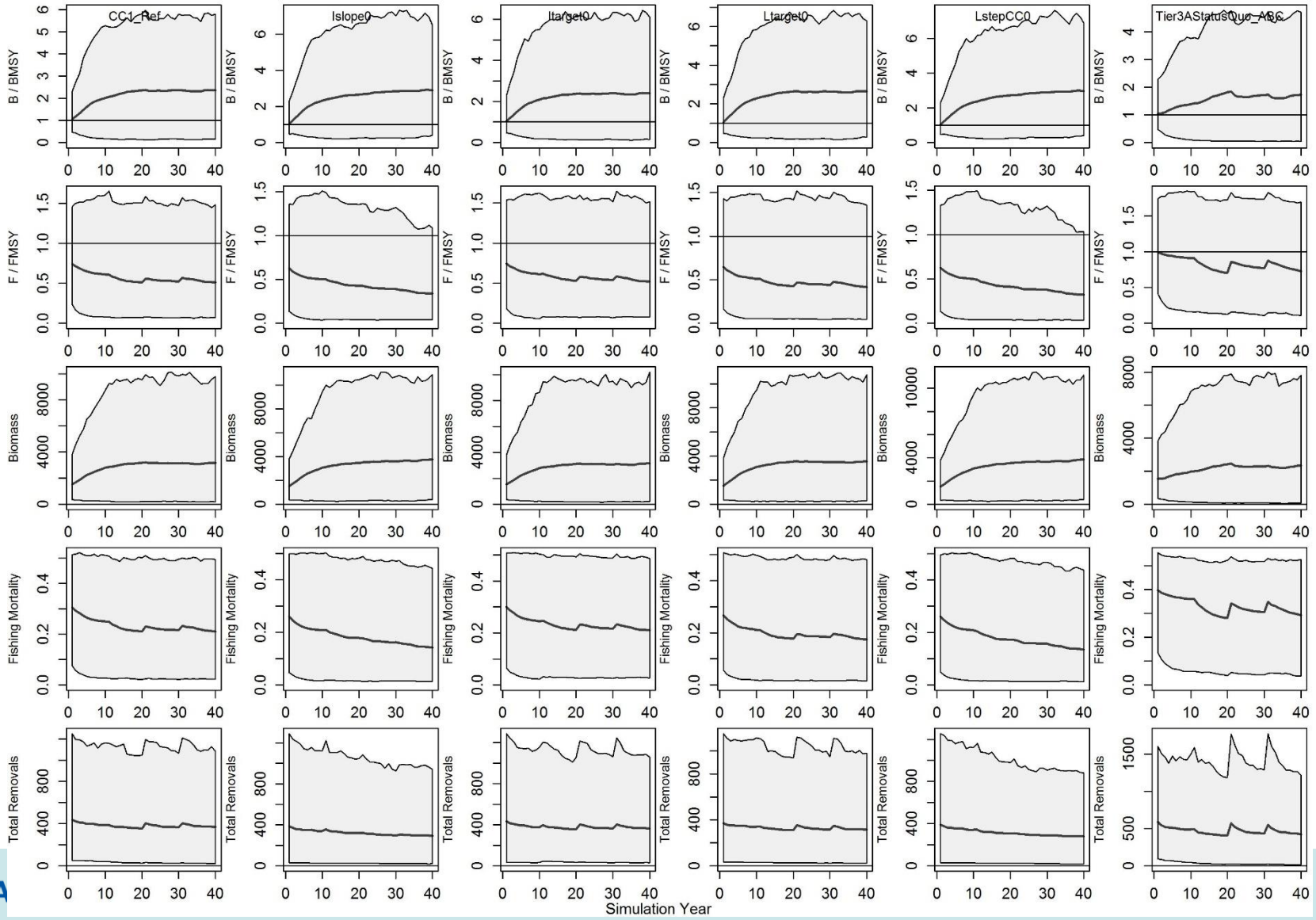
Method	PNOF	B50	VY15
Tier3AStatusQuo_ABC	66.9	76.7	60.8
CC1_Ref	83.9	87.4	85.5
Itarget0	81.9	86.6	85.2
Ltarget0	87.7	90.2	87.6
Islope0	88.8	90.9	92.5
LstepCC0	89.2	91.2	93.3

*ABC = Mean + 1 SD for historical period: 1999-2008

All methods, including the Tier3AStatusQuo_ABC, meet the performance criteria

Wenchman: trajectory

- Lines identify means across simulations (1,000)
- Shaded regions bound the 5th and 95th percentiles



Wenchman: tradeoffs

Sorted from highest to lowest LTY

Method	PNOF	B50	VY15	LTY	STY	Bbelow20
Tier3AStatusQuo_ABC	66.9	76.7	60.8	70.5	82.3	9.8
CC1_Ref	83.9	87.4	85.5	59.6	65.2	5.4
Itarget0	**81.9**	**86.6**	**85.2**	**58.6**	**62.7**	**5.4**
Ltarget0	**87.7**	**90.2**	**87.6**	**49.6**	**55.1**	**4.2**
Islope0	88.8	90.9	92.5	43.4	50.1	3.6
LstepCC0	89.2	91.2	93.3	40.0	50.6	3.4

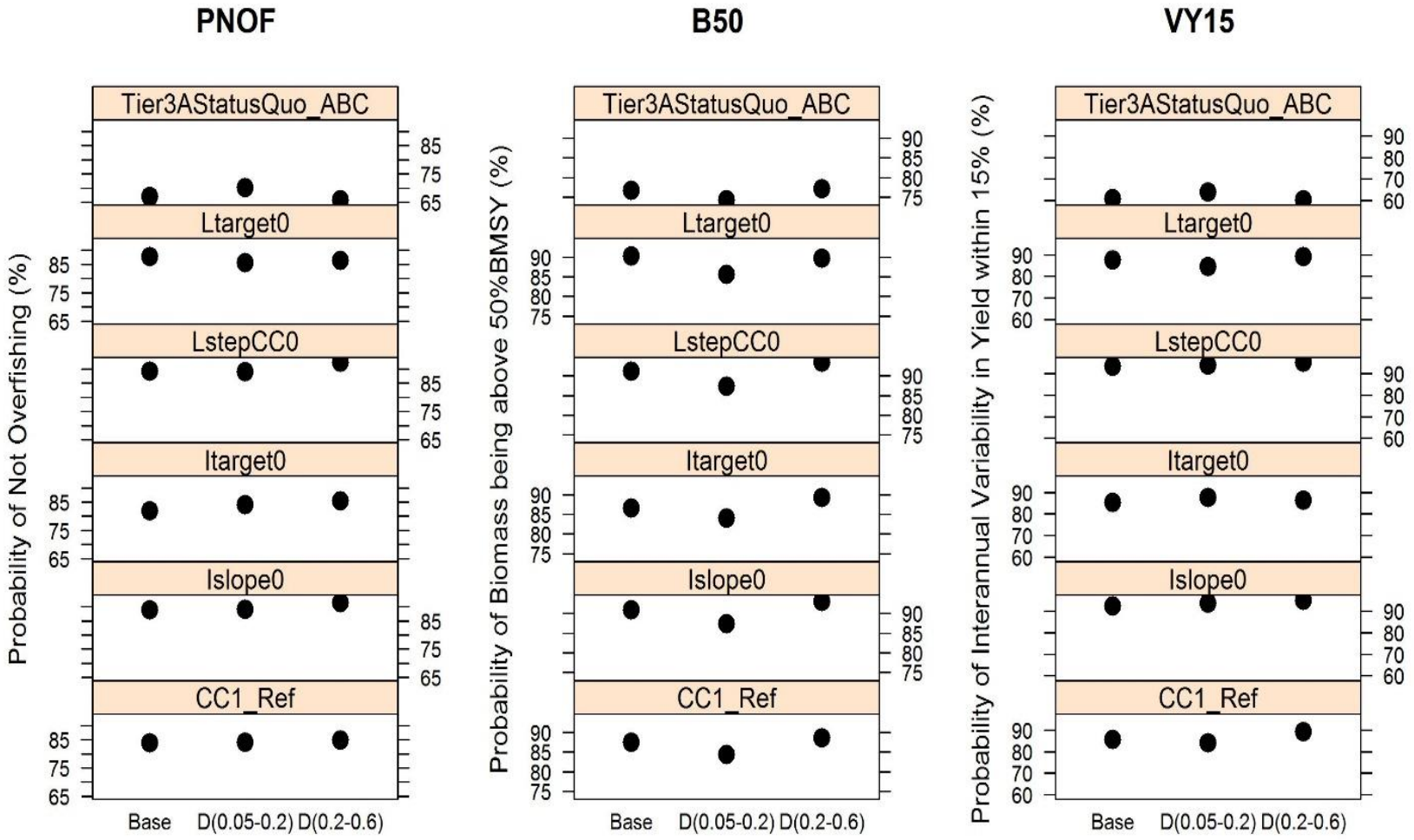
Recommend weighted average of Itarget0 and Ltarget0

- Relatively better performance in terms of yield
- Equal weighting (similar data quality)

Good (67-100%)
Fair (33-67.0%)
Poor (0-33.0%)

Wenchman: sensitivity to assumptions in MSE

- Base: depletion (D) = 0.12 – 0.31 based on other Lutjanidae



- Recommended methods (Itarget0, Ltarget0) remain viable

Snowy Grouper: feasible methods

Method	Data Inputs
	Total Removals
Catch-based	
CC1	
CC1_Ref	
Tier3AStatusQuo _ABC*	

*ABC = Mean for historic period (1992-2008) (GMFMC 2011)

CC1 is based on a recent catch history (2010-2014) and is derived from Geromont and Butterworth (2014)

Snowy Grouper: guidance table

Method	Data Requirements	Reliability Score
CC1	Total removals: Known and informative for 2010-2014	Good
CC1_Ref	Total removals: Known and informative for 1992-2008	Good
Tier3BStatusQuo_ABC	Total removals: Known and informative for 1992-2008	Good

Snowy Grouper: tradeoffs

Above criteria (>50%)
Below criteria (≤ 50%)

Method	PNOF	B50	VY15
CC1	58.6	73.5	91.8
Tier3BStatusQuo_ABC*	23.9	46.7	72.5

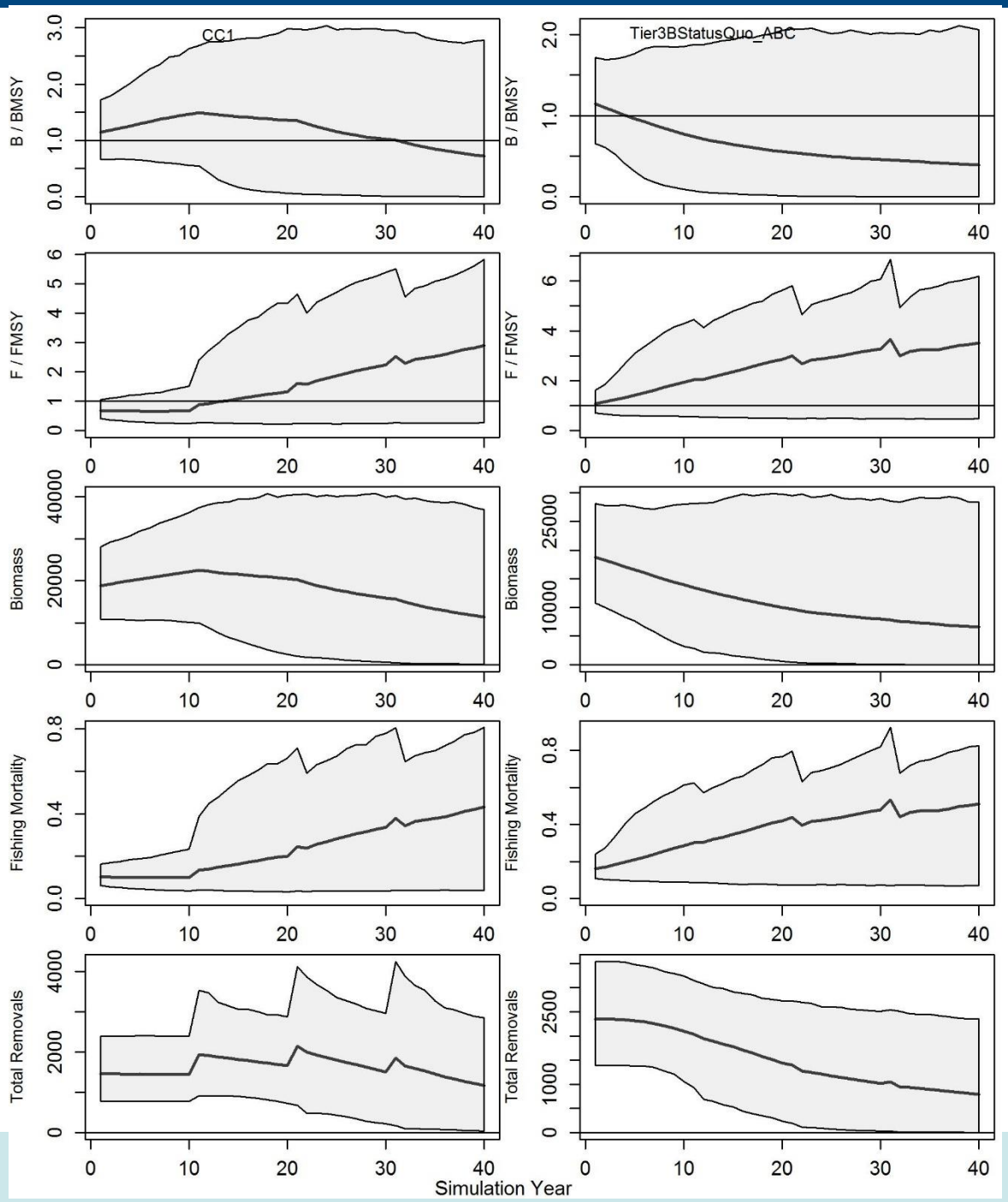
*ABC = Mean for historical period: 1992-2008 (GMFMC 2011)

Of three applicable methods, one meets performance criteria

- CC1
- Tier3BStatusQuo_ABC shown for comparison of current method

Snowy Grouper: trajectory

- Lines identify means across simulations (1,000)
- Shaded regions bound the 5th and 95th percentiles



Snowy Grouper: tradeoffs

Sorted from highest to lowest LTY

Method	PNOF	B50	VY15	LTY	STY	Bbelow20
CC1	58.6	73.5	91.8	57.0	86.1	20.8
Tier3BStatusQuo_ABC	23.9	46.7	72.5	37.0	99.6	42.2

One potential method but:

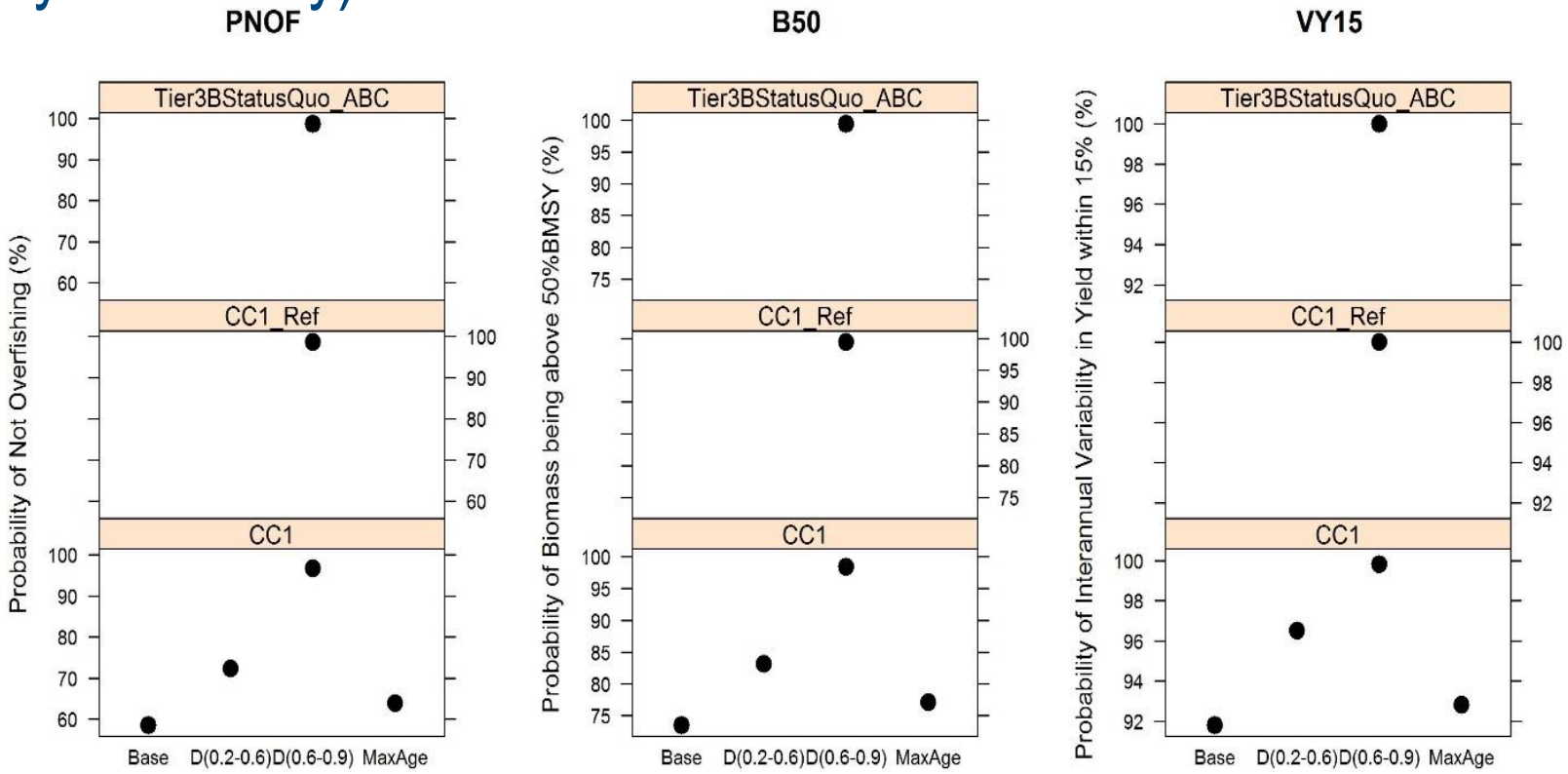
- *Assumes a reference period of recent catch (2010-2014) that does not match reference period defined in GMFMC (2011)*

Therefore **not recommended for use** in providing management advice

Good (67-100%)
Fair (33-67.0%)
Poor (0-33.0%)

Snowy Grouper: sensitivity to assumptions in MSE

- Base: depletion (D) = 0.15 – 0.40 derived using current mean length and the ML2D function in DLMtool, maximum age = 35 y (44 y sensitivity)



- No recommended method

Speckled Hind: feasible methods

Method	Data Inputs
	Total Removals
Catch-based	
CC1	
CC1_Ref	
Tier3AStatusQuo _ABC*	

*ABC = Mean for historic period (1992-2008) (GMFMC 2011)

CC1 is based on a recent catch history (2010-2014) and is derived from Geromont and Butterworth (2014)

Speckled Hind: guidance table

Method	Data Requirements	Reliability Score
CC1	Total removals: Known and informative for 2010-2014	Good
CC1_Ref	Total removals: Known and informative for 1992-2008	Good
Tier3BStatusQuo_ABC	Total removals: Known and informative for 1992-2008	Good

Speckled Hind: tradeoffs

Above criteria (>50%)
Below criteria (≤ 50%)

Method	PNOF	B50	VY15
CC1	73.0	77.2	87.9
Tier3BStatusQuo _ABC*	33.1	45.1	60.6

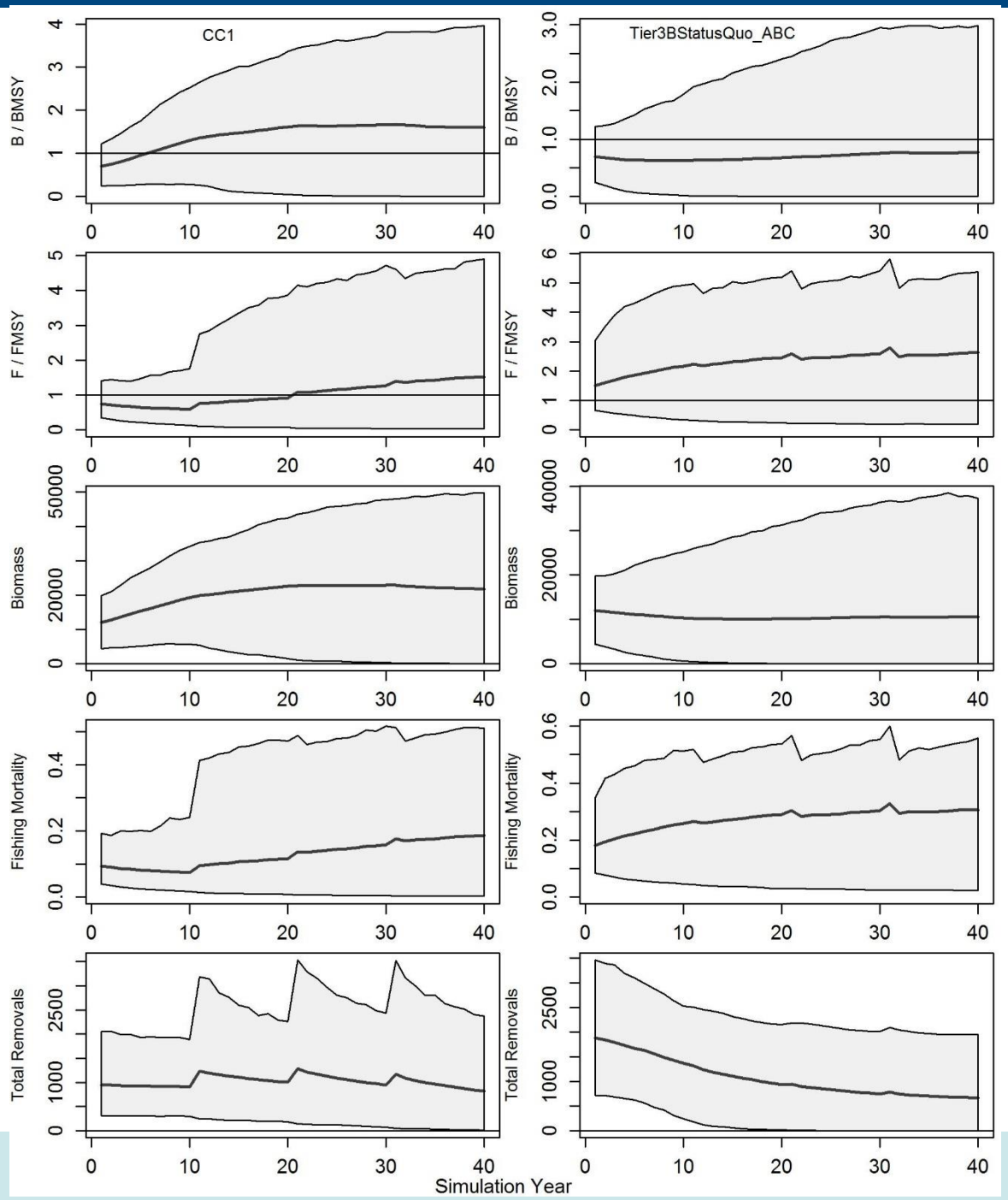
*ABC = Mean for historical period: 1992-2008 (GMFMC 2011)

Of three applicable methods, one meets performance criteria

- CC1
- Tier3BStatusQuo_ABC shown for comparison of current method

Speckled Hind: trajectory

- Lines identify means across simulations (1,000)
- Shaded regions bound the 5th and 95th percentiles



Speckled Hind: tradeoffs

Sorted from highest to lowest LTY

Method	PNOF	B50	VY15	LTY	STY	Bbelow20
CC1	73.0	77.2	87.9	41.3	50.9	14.8
Tier3BStatusQuo_ABC	33.1	45.1	60.6	37.4	89.3	43.8

One potential method but:

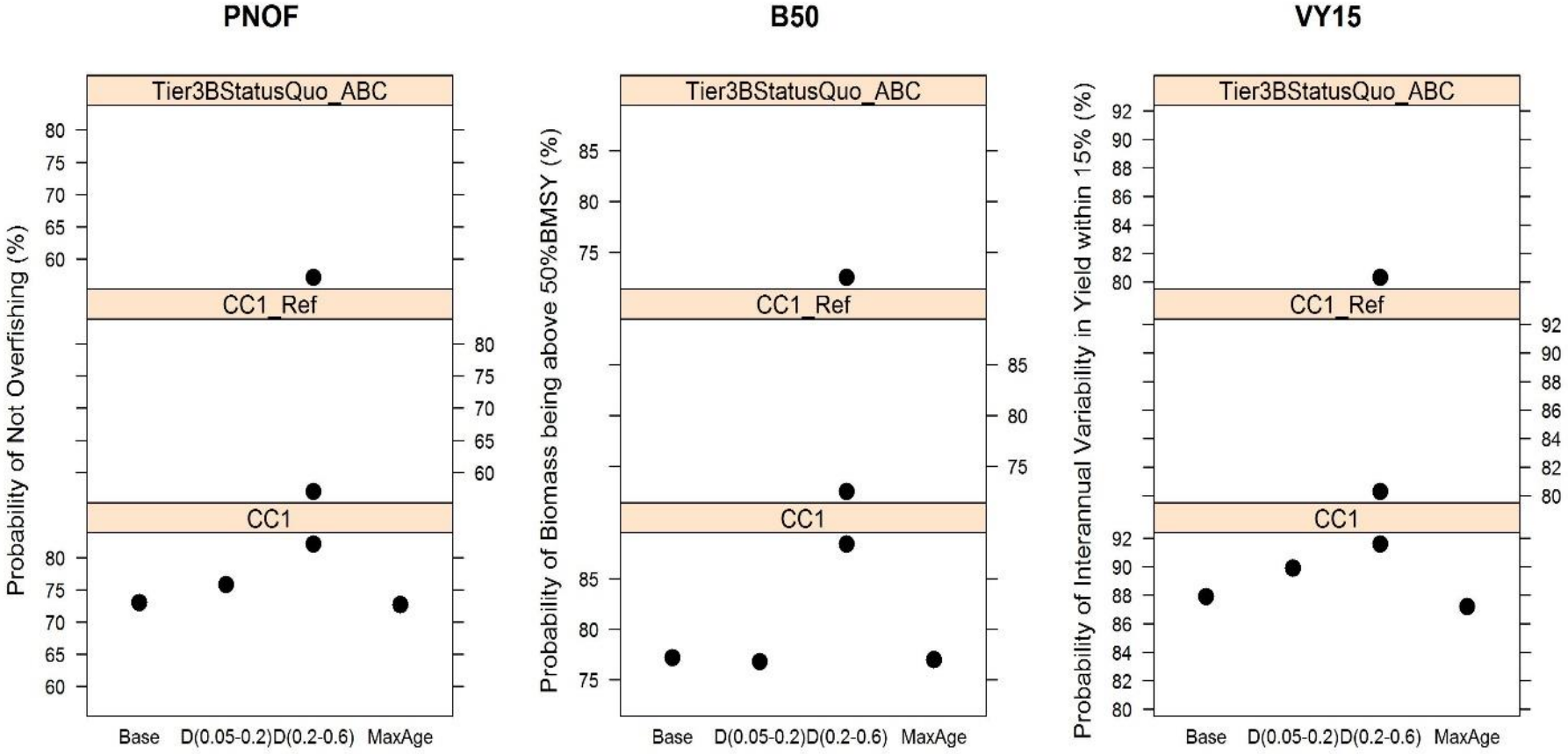
- *Assumes a reference period of recent catch (2010-2014) that does not match reference period defined in GMFMC (2011)*

Therefore **not recommended for use** in providing management advice

Good (67-100%)
Fair (33-67.0%)
Poor (0-33.0%)

Speckled Hind: sensitivity to assumptions in MSE

- Base: depletion (D) = 0.05 – 0.3 based on other deep-water grouper; maximum age = 45 y (35 y sensitivity)



- No recommended method

Lesser Amberjack: feasible methods

Method	Data Inputs		
	Total Removals	Index of Abundance	Mean length
Catch-based			
CC1_Ref			
Tier3AStatusQuo _ABC*			
Index-based			
Islope0			
Itarget0			

*ABC = Mean + 1 SD for historic period (2000-2008) (GMFMC 2011)

Lesser Amberjack: guidance table

Method	Data Requirements	Reliability Score
CC1_Ref	Total removals: Known and informative for 2000-2008	Fair
Tier3AStatusQuo_ABC	Total removals: Known and informative for 2000-2008	Fair
Islope0	Total removals: Known and informative for 2000-2008	Fair
	Index: SEAMAP video index representative of trend in population abundance (2005-2009; using 2009 as terminal year in base as recommended by Total Removals Working Group)	Fair
Itarget0	Total removals: Known and informative for 2000-2008	Fair
	Index: SEAMAP video index representative of population abundance; uses trend from reference period (2000-2008) and recent period (2005-2009; using 2009 as terminal year in base)	Fair

Lesser Amberjack: tradeoffs

Above criteria (>50%)

Below criteria (≤ 50%)

Method	PNOF	B50	VY15
Tier3AStatusQuo_ABC*	52.4	59.4	67.3
CC1_Ref	76.5	78.8	88.7
Islope0	61.5	64.1	84.9
Itarget0	70.7	73.5	85.8

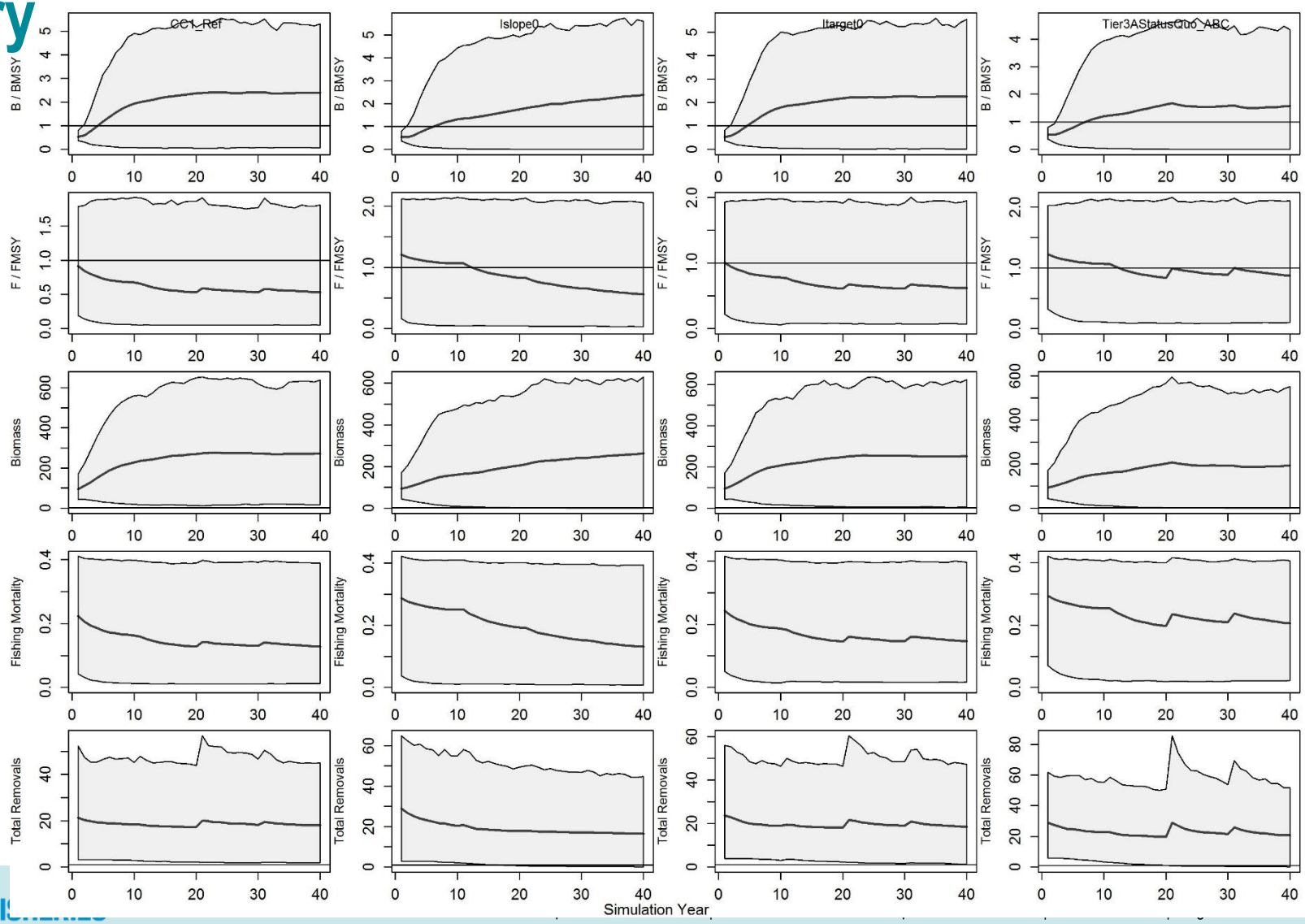
*ABC = Mean + 1SD for historical period: 2000-2008

Of three applicable methods, three meet the performance criteria

- Index-based (Islope0, Itarget0)
- Catch-based (CC1_Ref)
- Tier3AStatusQuo_ABC shown for comparison of current method

Lesser Amberjack: trajectory

- Lines identify means across simulations (1,000)
- Shaded regions bound the 5th and 95th percentiles



Lesser Amberjack: tradeoffs

Sorted from highest to lowest LTY

Method	PNOF	B50	VY15	LTY	STY	Bbelow20
Tier3AStatusQuo_ABC	52.4	59.4	67.3	56.2	72.2	21.0
Itarget0	**70.7**	**73.5**	**85.8**	**51.0**	**58.4**	**13.0**
CC1_Ref	76.5	78.8	88.7	47.3	53.0	9.8
Islope0	61.5	64.1	84.9	42.9	67.4	20.2

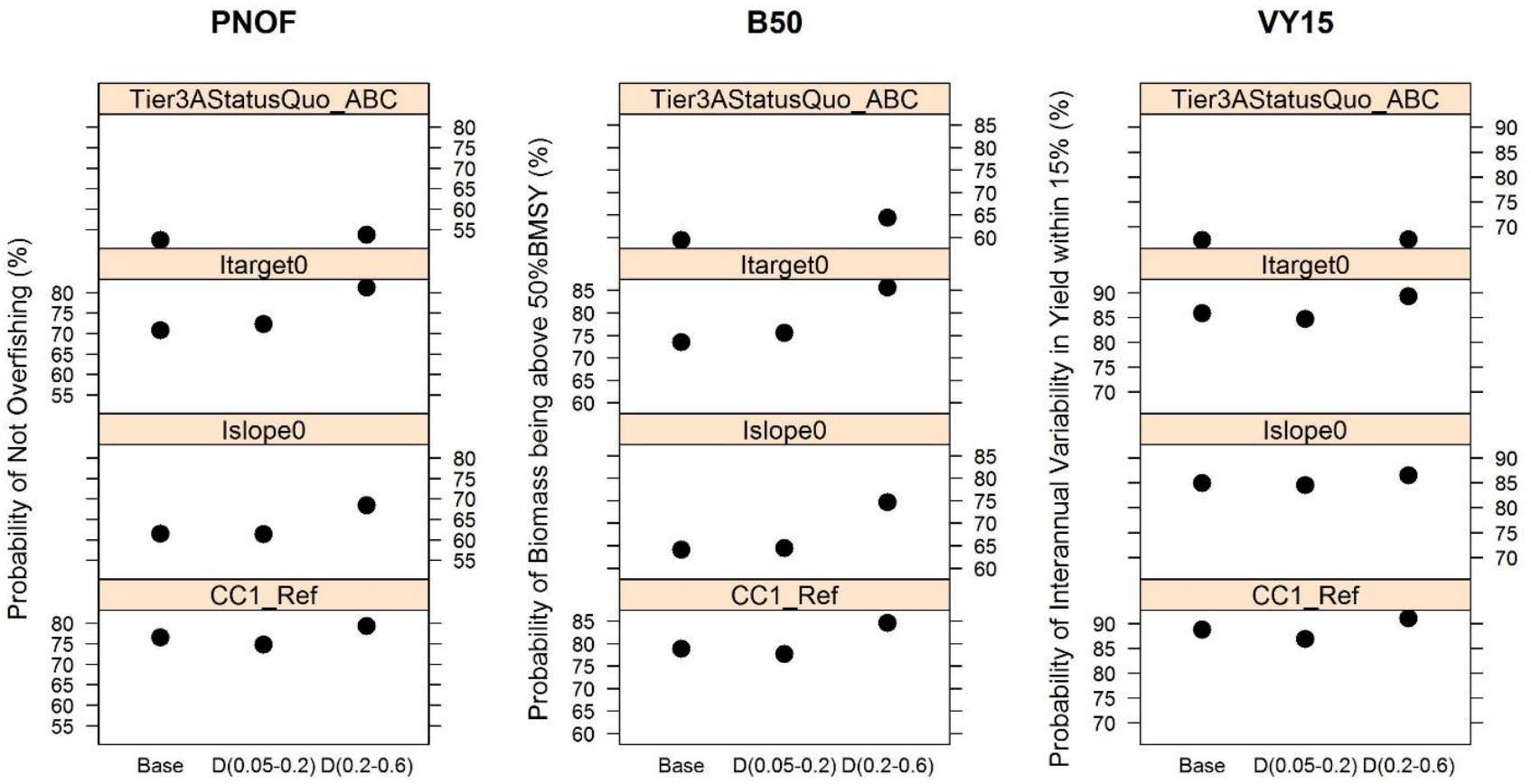
Recommend Itarget0

- Incorporates feedback
  - Uses index of abundance to scale catch recommendation
  - Allows catch recommendation to exceed average catch if index is increasing and vice versa

Good (67-100%)
Fair (33-67.0%)
Poor (0-33.0%)

Lesser Amberjack: sensitivity to assumptions in MSE

- Base: depletion (D) = 0.10 – 0.13 based on recent depletion estimated for Greater Amberjack from SEDAR 33



- Recommended method (Itarget0) remains viable

Almaco Jack: feasible methods

Method	Data Inputs		
	Total Removals	Index of Abundance	Mean length
Catch-based			
CC1_Ref			
Tier3AStatusQuo _ABC*			
Index-based			
Islope0			
Itarget0			
Length-based			
LstepCC0			
Ltarget0			

*ABC = Mean + 1 SD for historic period (2000-2008) (GMFMC 2011)

Almaco Jack: guidance table

Method	Data Requirement	Reliability Score
CC1_Ref	Total removals: Known and informative for 2000-2008	Good
Tier3AStatusQuo_ABC	Total removals: Known and informative for 2000-2008	Good
Islope0	Total removals: Known and informative for 2000-2008	Good
	Index: SEAMAP Video index representative of trend in population abundance (2010-2014)	Good
Itarget0	Total removals: Known and informative for 2000-2008	Good
	Index: SEAMAP Video index representative of population abundance; uses trend from reference period (2000-2008) and trend from recent period (2010-2014)	Good
LstepCC0 / Ltarget0	Total removals: Known and informative for 2000-2008	Good
	Mean Length: Mean length of catch from recreational private, headboat, and charterboat fishing modes an indirect and informative indicator of the trend in resource abundance; uses mean length over reference period (2000-2008) and over recent period (2010-2014)	Fair

Almaco Jack: tradeoffs

Above criteria (>50%)
Below criteria (≤ 50%)

Method	PNOF	B50	VY15
Islope0	69.0	72.8	85.5
Itarget0	82.1	84.5	91.9
LstepCC0	68.9	72.9	84.6
Tier3AStatusQuo_ABC*	16.2	24.1	34.4

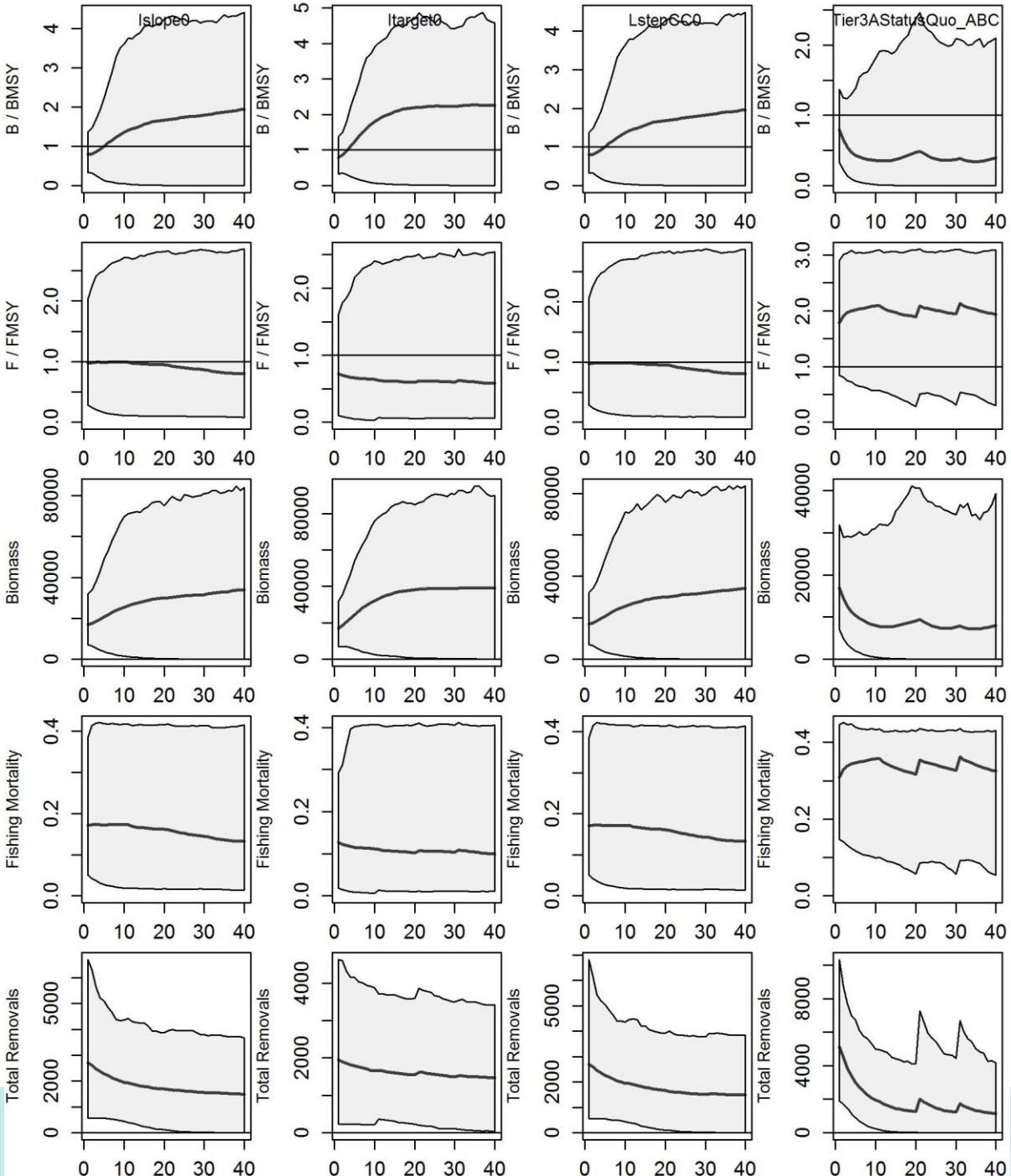
*ABC = Mean + 1SD for historical period: 2000-2008

Of six applicable methods, three meet performance criteria

- Index-based (Islope0, Itarget0)
- Length-based (LstepCC0)
- Tier3AStatusQuo_ABC shown for comparison of current method

Almaco Jack: trajectory

- Lines identify means across simulations (1,000)
- Shaded regions bound the 5th and 95th percentiles



Almaco Jack: tradeoffs

Sorted from highest to lowest LTY

Method	PNOF	B50	VY15	LTY	STY	Bbelow20
Islope0	**69.0**	**72.8**	**85.5**	**45.3**	**68.7**	**19.9**
Itarget	82.1	84.5	91.9	43.2	56.6	10.9
LstepCC0	**68.9**	**72.9**	**84.6**	**42.2**	**69.1**	**20.2**
Tier3AStatusQuo_ABC	16.2	24.1	34.4	30.9	93.1	62.4

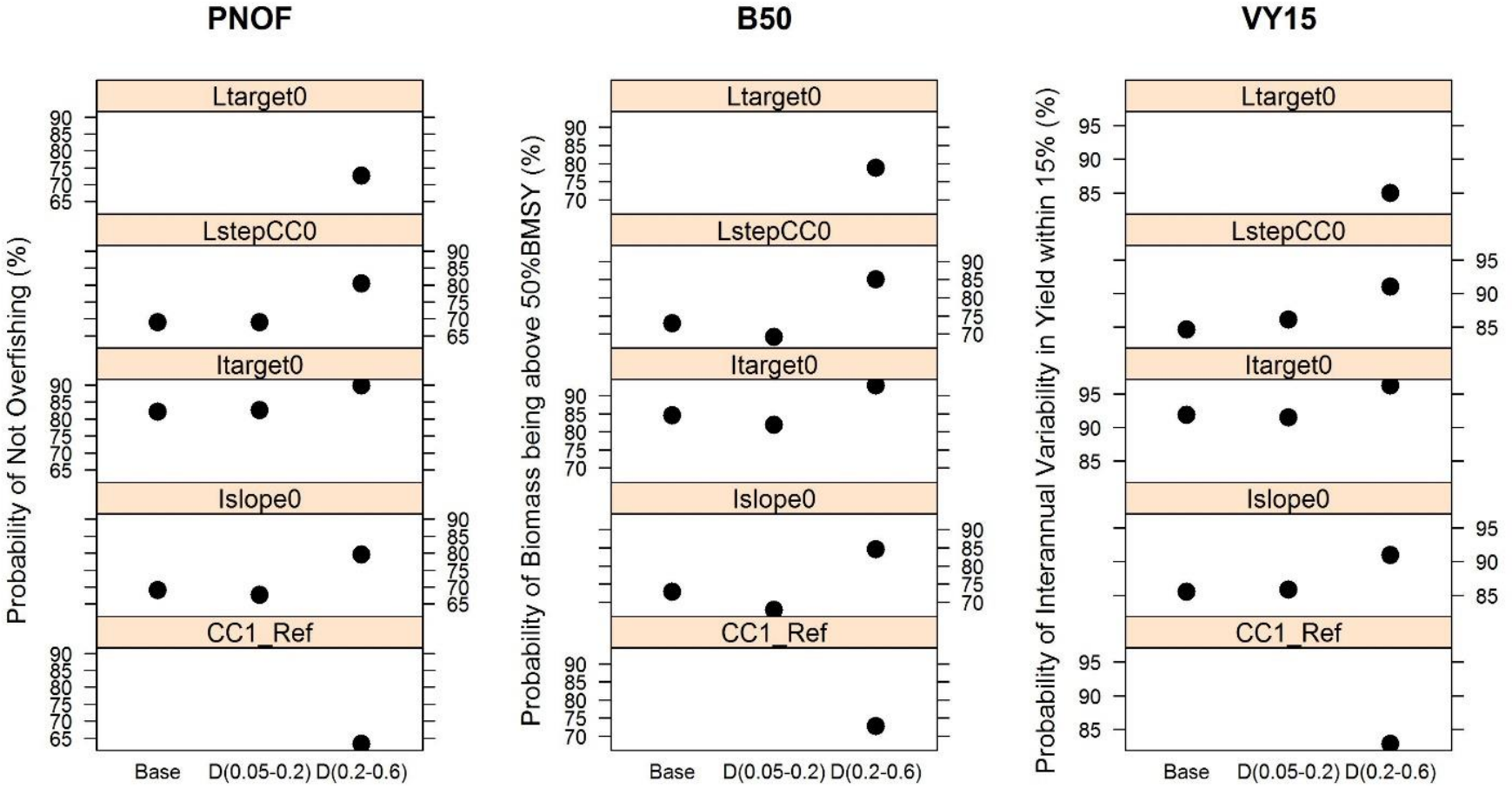
Recommend weighted average of Islope0 and LstepCC0:

- Relatively comparable performance
- Unequal weighting
  - Weight Islope0 higher than LstepCC0 due to data quality

Good (67-100%)
Fair (33-67.0%)
Poor (0-33.0%)

Almaco Jack: sensitivity to assumptions in MSE

- Base: depletion (D) = 0.08 – 0.32 based on current mean length and the ML2D function in DLMtool



- Recommended method (Islope0) remains viable

Red Drum: feasible methods

Method	Data Inputs													
	Mort	FMSY_M	vbLinf	vbK	vbt0	wla	wlb	steep	MaxAge	Cat	Ind	LFC	LFS	CAA
Catch-based														
CC1										■				
Index-based														
Islope0										■	■			
Age-based														
Fratio_CC	■	■								■				■
BK_CC_LVBcor	■		■	■						■		■		■
YPR_CC_LVBcor	■		■	■	■	■	■		■	■			■	■
Fdem_CC_LVBcor	■		■	■	■			■	■	■				■

No OFL, ABC or reference period specified for Red Drum

Red Drum: guidance table

Method	Data Requirement	Reliability Score
CC1	**Total removals**: Known and informative for 2010-2014	Good
Islope0	**Total removals**: Known and informative for 2010-2014	Good
	Index: DISL bottom longline representative of population abundance	Good
Fratio_CC	**Total removals:** Known and informative for 2014	Good
	Natural Mortality (Mort): Known and constant across ages	Fair
	FMSY_M: Meta-analysis value derived from Zhou et al. (2012) appropriate; includes very few southeast US species (groupers, snappers, red drum and greater amberjack)	Fair
	Catch-at-age (CAA): Combined Purse Seine surveys accurately represent historical extractions	Good
BK_CC _LVBcor	**Mort**: Known and constant across ages	Fair
	Growth: representative of stock (derived from various gears, see Table 2.12.3 in DW Report)	Good
	Total removals: Known and informative for 2014	Good
	Length at first capture (LFC): Representative of selectivity	Good
	CAA: Combined Purse Seine surveys accurately represent historical extractions by age	Good
YPR_CC	**Total removals:** Known and informative for 2014	Good
_LVBcor	**Mort**: Known and constant across ages	Fair
	Growth: representative of stock (derived from various gears, see Table 2.12.3 in DW Report)	Good
	Length-Weight: representative of stock (SEDAR49 data)	Good
	LFC: Representative of selectivity	Good
	CAA: Combined Purse Seine surveys accurately represent historical extractions by age	Good
Fdem_CC	**Total removals:** Known and informative for 2014	Good
_LVBcor	**Mort**: Known and constant across ages	Fair
	Growth: representative of stock (derived from various gears, see Table 2.12.3 in DW Report)	Good
	Steepess: Known and representative of stock (mid-point of range from previous Red Drum assessments [FL, Atlantic])	Fair
	CAA: Combined Purse Seine surveys accurately represent historical extractions by age	Good

Red Drum: tradeoff

Above criteria (>50%)
Below criteria (≤ 50%)

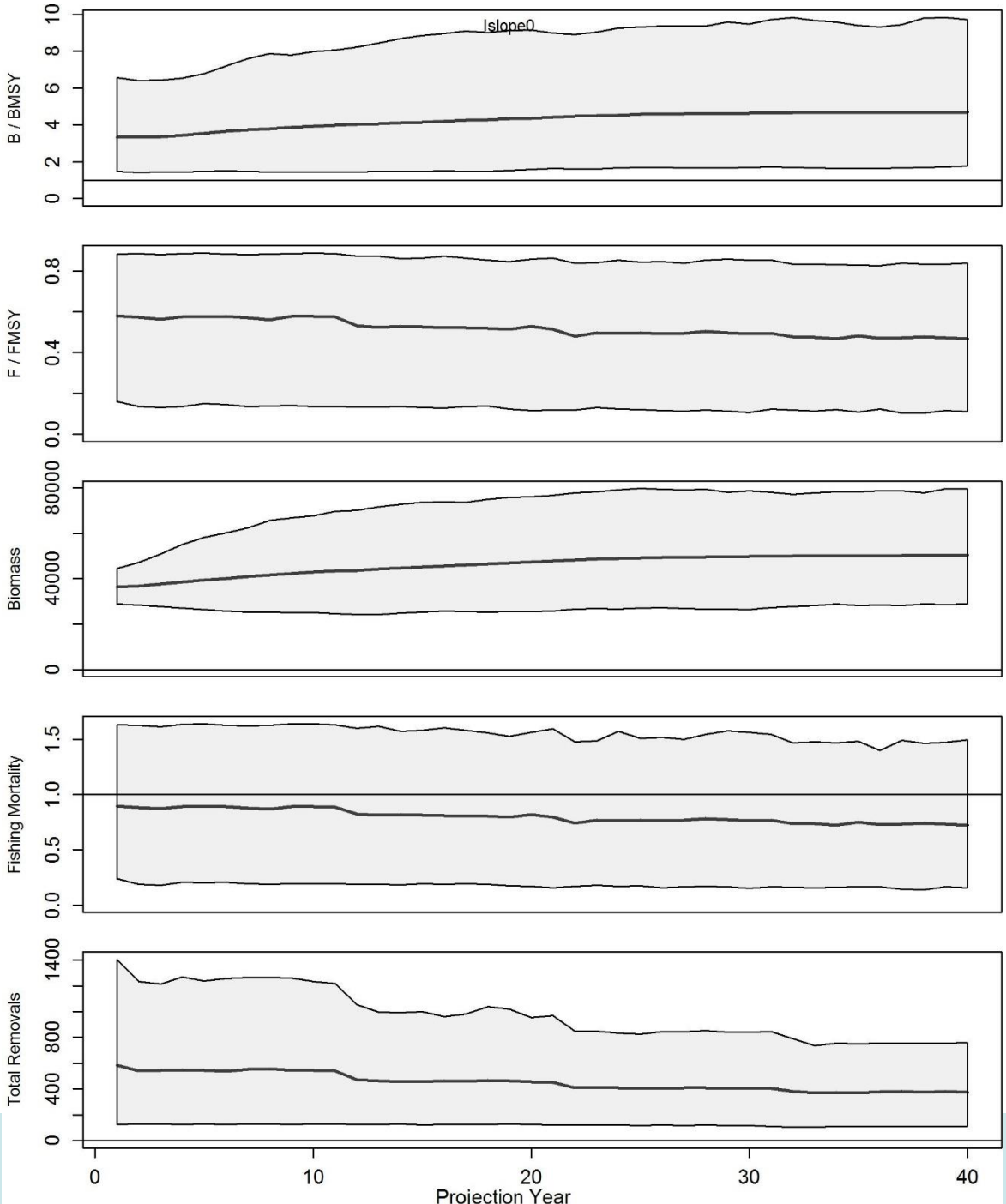
Method	PNOF	B50	VY15
Islope0	99.5	99.8	54.3

Of six feasible methods, one meets the performance criteria

- Index-based (Islope0)
- No method for comparison or reference period for average catch

Red Drum: trajectory

- Lines identify means across simulations (1,000)
- Shaded regions bound the 5th and 95th percentiles



Red Drum: tradeoff

Method	PNOF	B50	VY15	LTY	STY	Bbelow20
Islope0	99.5	99.8	54.3	12.7	30.4	0.0

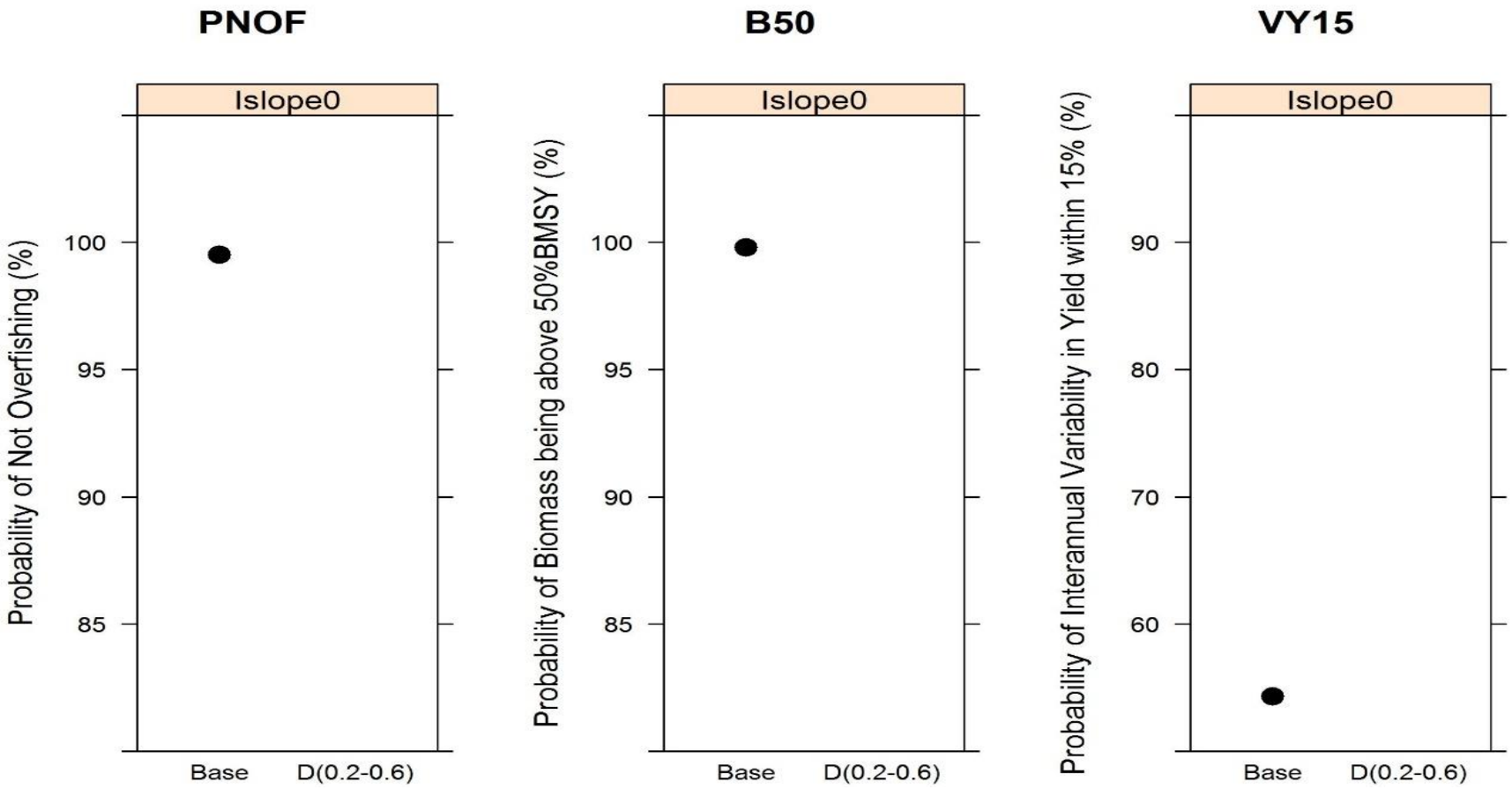
One potential method but:

- *Assumes a reference period of recent catch (2010-2014)*
- Additional discussion needed to determine reference period for catch

Good (67-100%)
Fair (33-67.0%)
Poor (0-33.0%)

Red Drum: sensitivity to assumptions in MSE

- Base: depletion (D) = 0.42 – 0.59 based on current mean length and the ML2D function in DLMtool



- No recommended method

MSE summary

- Helps eliminate methods with pathological behavior
- Method performance dependent upon the operating models (and assumptions) specified
  - Conditioned on stock depletion
  - Index of fishing effort driving stock dynamics at end of historical period
- Sensitivity analysis addresses whether methods will vary with different stock conditions (e.g., depletion)
  - In almost all cases, methods remain viable under different depletion scenarios

Viable method summary

- Methods meeting performance criteria

Meet performance criteria
Below performance criteria
- = not feasible

Species	Catch-based			Index-based		Length-based	
	Status Quo	CC1	CC1_Ref	Islope0	Itarget0	LstepCC0	Ltarget0
Lane Snapper		-					
Wenchman		-					
Snowy Grouper				-	-	-	-
Speckled Hind				-	-	-	-
Lesser Amberjack		-				-	-
Almaco Jack		-					
Red Drum	-		-		-	-	-

- When an index of abundance is available, Islope0 and Itarget0 often meet performance criteria

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DLMtool stock evaluation

Part 3: catch recommendations for management advice

Catch recommendations from viable methods

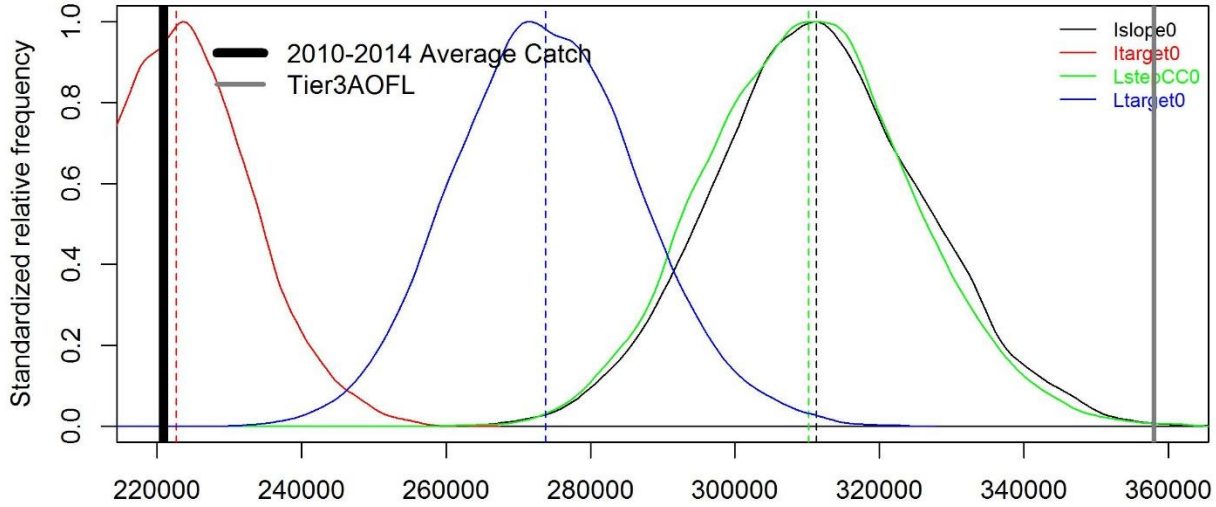
Sensitivity analysis

Lane Snapper: guidance table

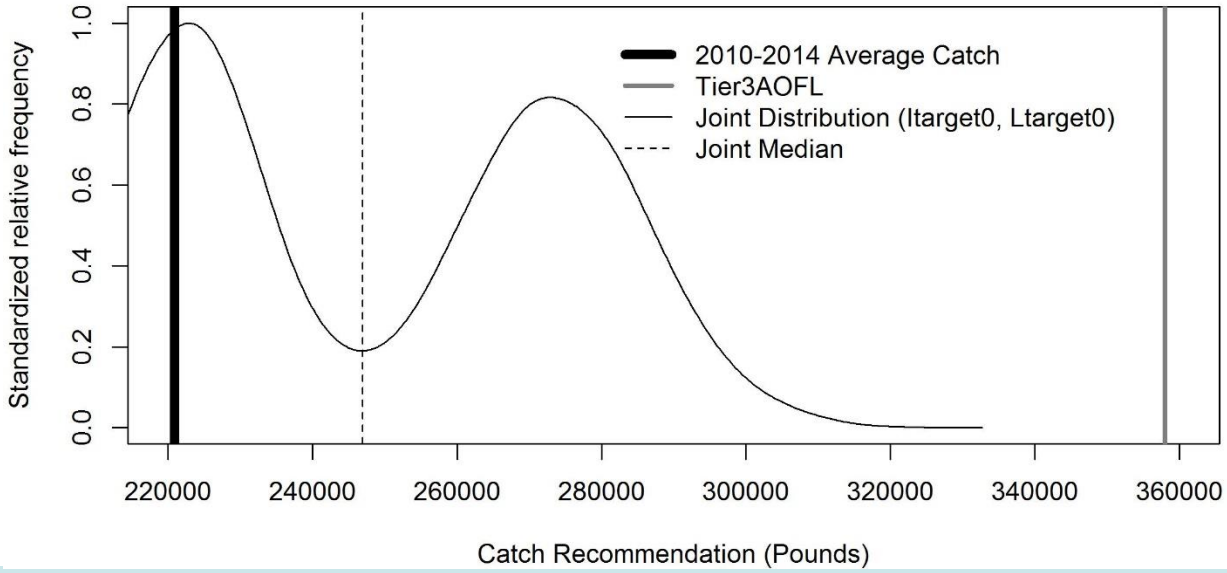
Method	Data Requirement	Reliability Score
Islope0	Total removals: Known and informative for 1999-2008	Good
	Index: Headboat index representative of trend in population abundance (2010-2014)	Good
Itarget0	Total removals: Known and informative for 1999-2008	Good
	Index: Headboat index representative of population abundance; uses trend over reference period (1999-2008) and recent period (2010-2014)	Good
LstepCC0 / Ltarget0	Total removals: Known and informative for 1999-2008	Good
	Mean Length: Mean length of catch from recreational private and headboat fleets an indirect and informative indicator of the trend in resource abundance; uses mean length over reference period (1999-2008) and over recent period (2010-2014)	Good

- Similar data quality score between index and mean length

Lane Snapper: catch recommendations



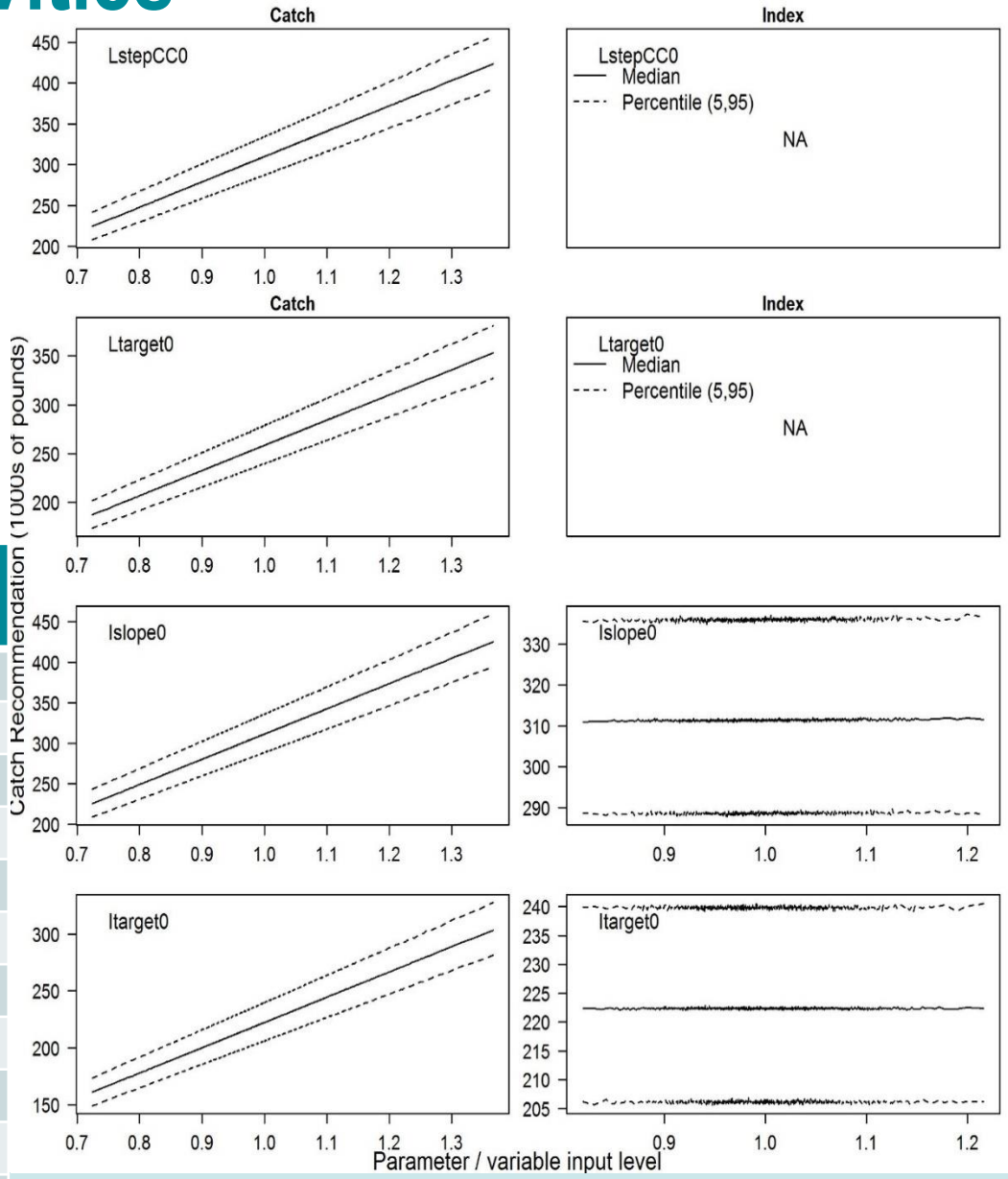
Recommend a joint distribution that assumes equal weighting of top performing index and length-based method



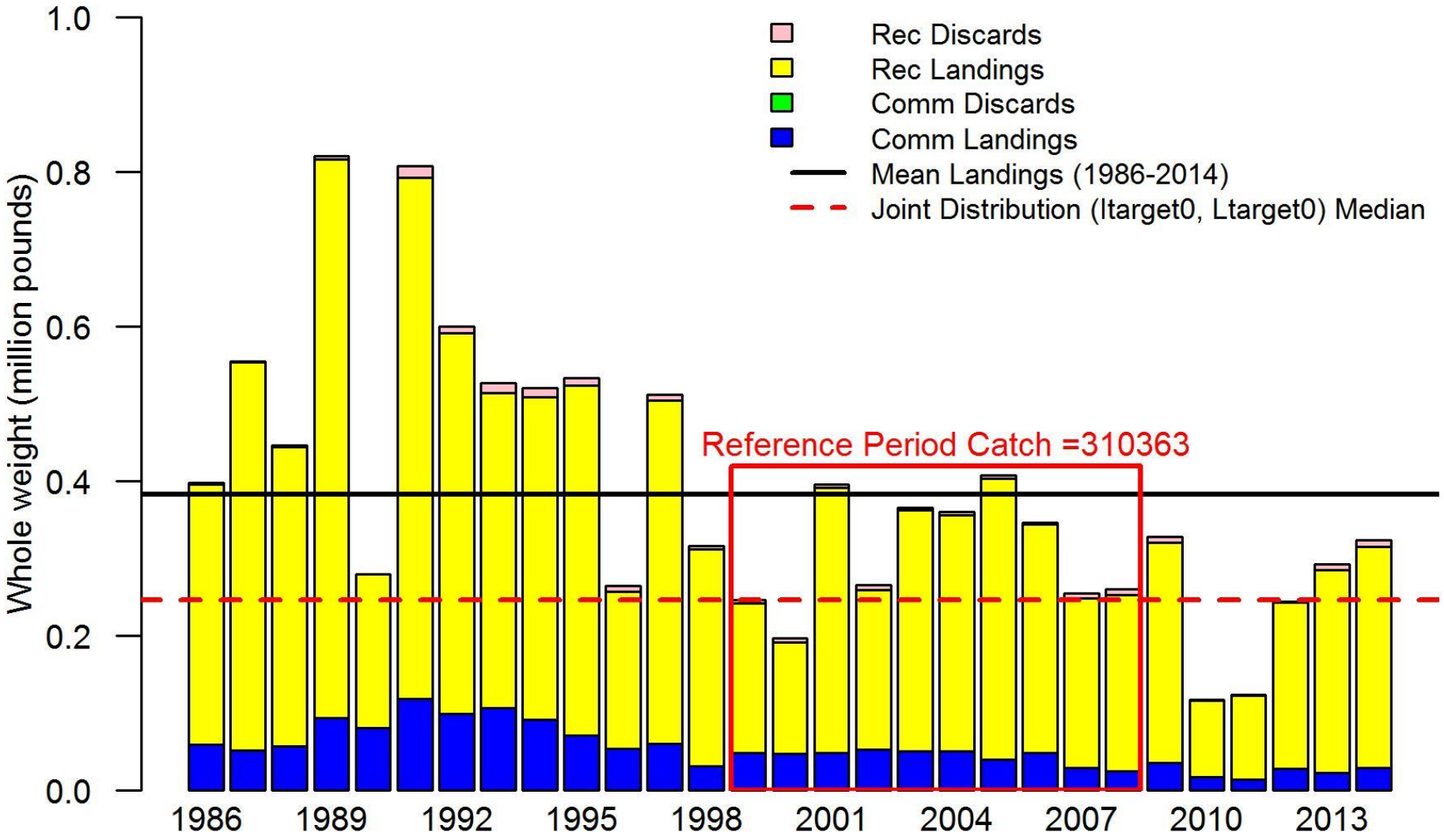
Lane Snapper: sensitivities

- Positive relationship between catch recommendations and catch time series

Method	Catch CV	Median	Mean	SD
Islope0	0.103	311,243	311,638	14,576
	0.206	310,367	311,417	28,544
Itarget0	0.103	222,623	222,702	10,334
	0.206	221,488	222,342	20,218
LstepCC0	0.103	310,367	310,476	14,407
	0.206	309,180	310,763	28,940
Ltarget0	0.103	273,738	274,093	12,861
	0.206	272,574	273,799	25,250



Lane Snapper: SEDAR 49 Landings

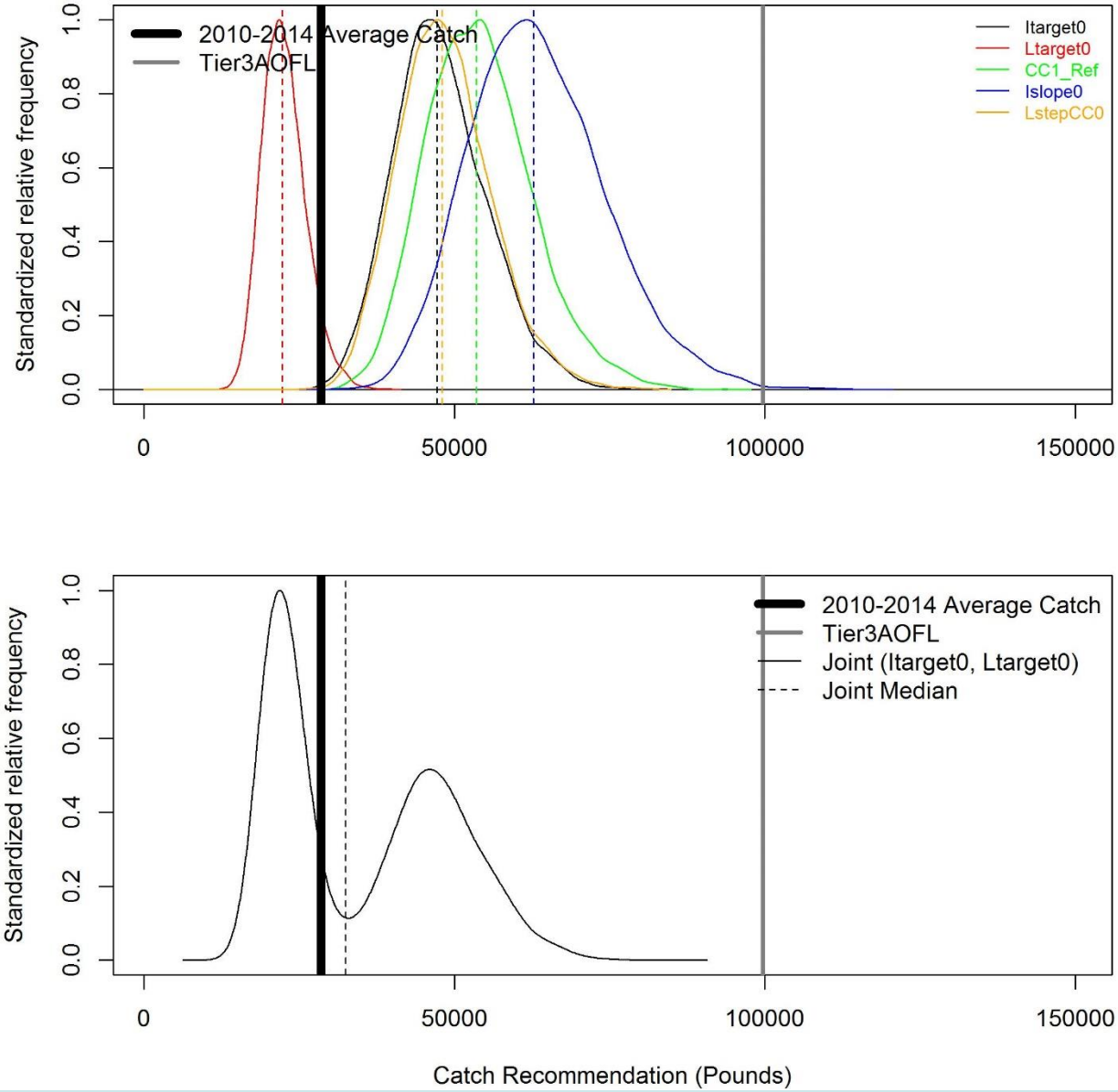


Wenchman: guidance table

Method	Data Requirements	Reliability Score
CC1_Ref	**Catch**: Known and informative for 1999-2008	Fair
Islope0	**Catch**: Known and informative for 1999-2008	Fair
	Index: Small Pelagics index representative of population abundance (2010-2014)	Good
Itarget0	**Catch**: Known and informative for 1999-2008	Fair
	Index: Small Pelagics index representative of population abundance; uses historical trend (1999-2008) and recent trend (2010-2014)	Good
Ltarget0 / LstepCC0	**Catch**: Known and informative for 1999-2008	Fair
	Mean Length: Mean length from Small Pelagics an indirect and informative indicator of the trend in resource abundance; uses historical ML (1999-2008) and recent ML (2010-2014)	Good

Wenchman: catch recommendations

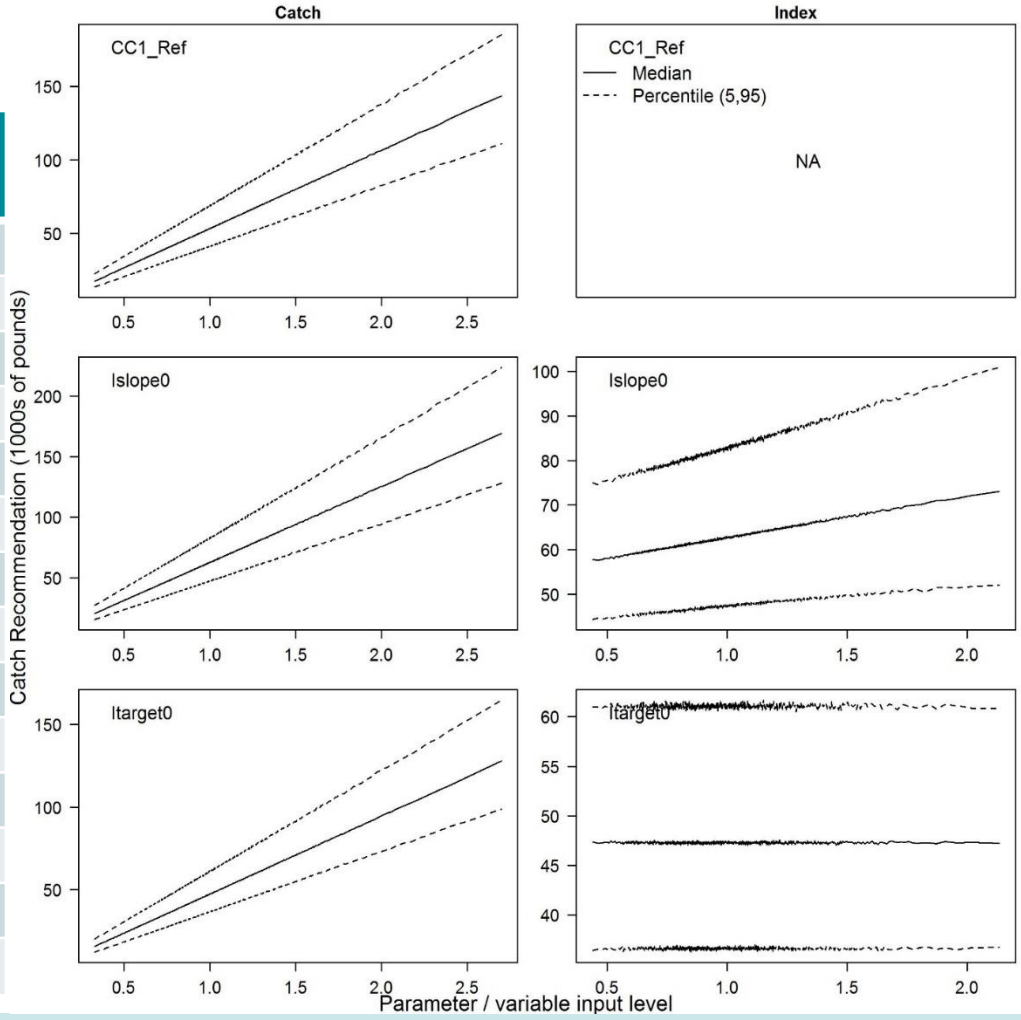
Recommend a joint distribution that assumes equal weighting of top index- and length-based method from MSE results



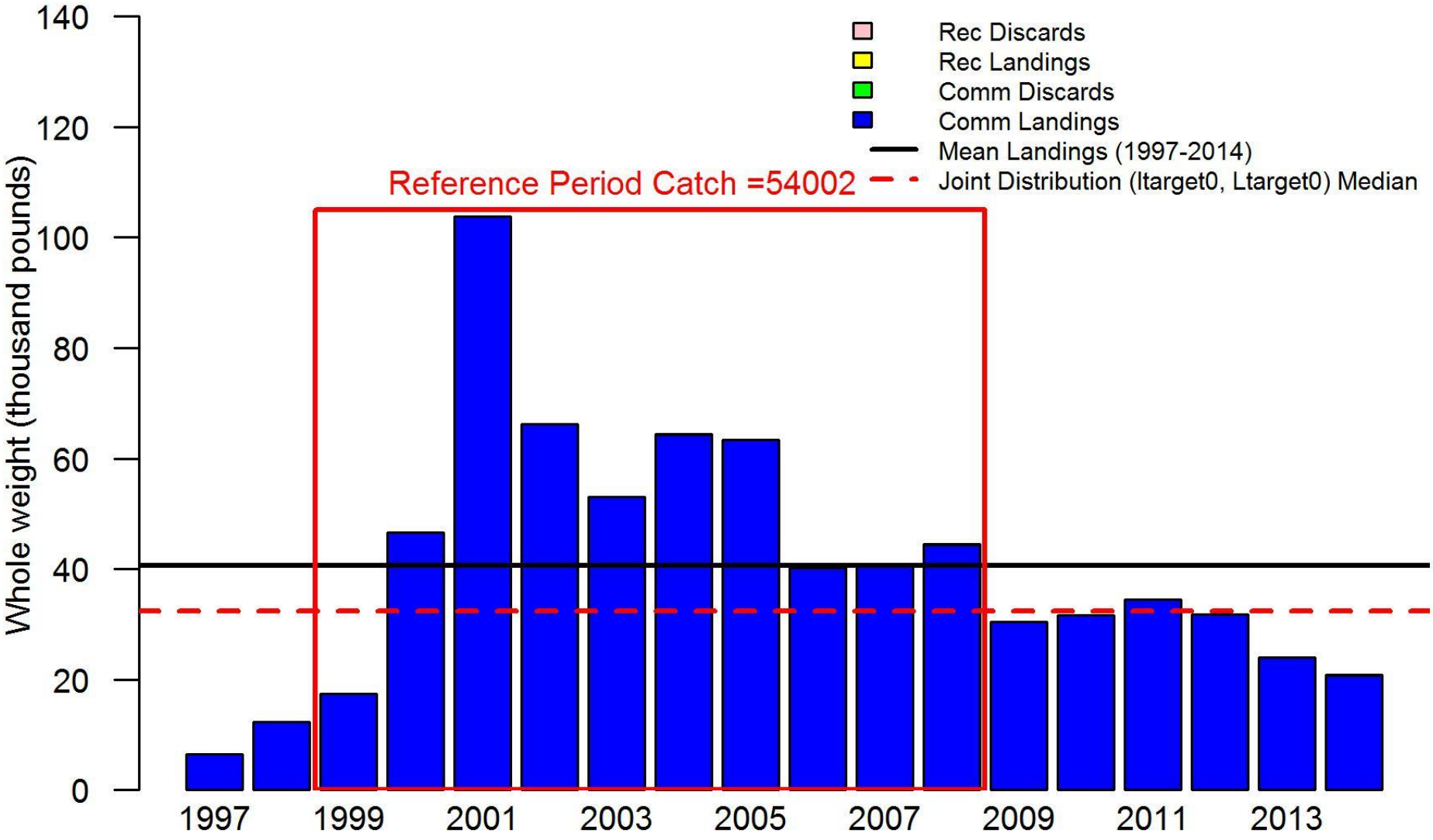
Wenchman: sensitivities

- Positive relationship between catch recommendations and catch time series

Method	Catch CV	Median	Mean	SD
Itarget0	0.35	47,167	47,825	7,563
	0.70	45,818	47,946	14,855
Ltarget0	0.35	22,272	22,591	3,521
	0.70	21,661	22,687	6,991
CC1_Ref	0.35	53,546	54,075	8,519
	0.70	51,420	53,939	16,630
Islope0	0.35	62,718	63,534	10,905
	0.70	60,555	63,796	20,527
LstepCC0	0.35	48,031	48,520	7,548
	0.70	46,573	48,639	15,144



Wenchman: SEDAR 49 Landings

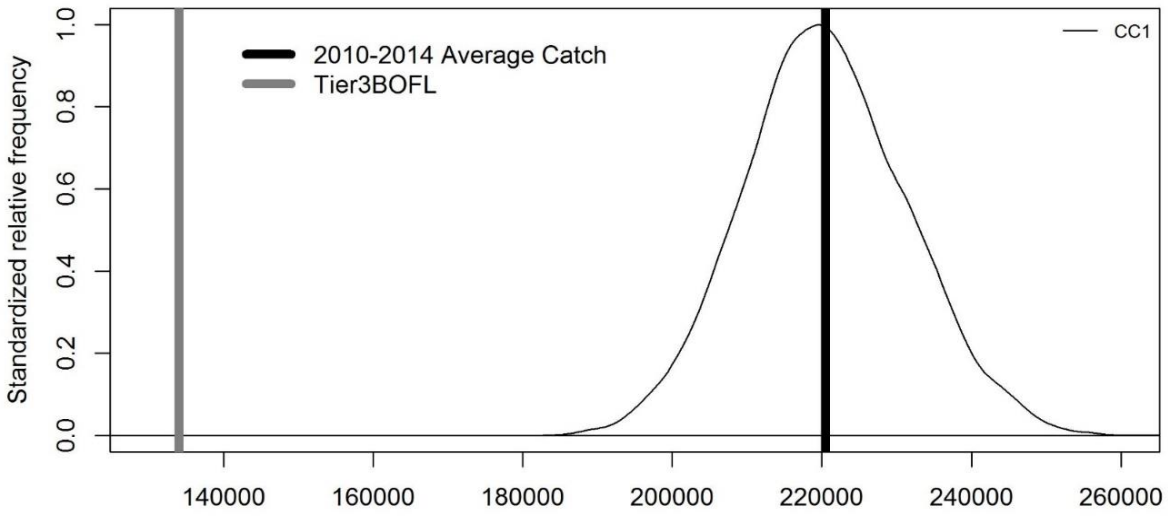


Snowy Grouper: guidance table

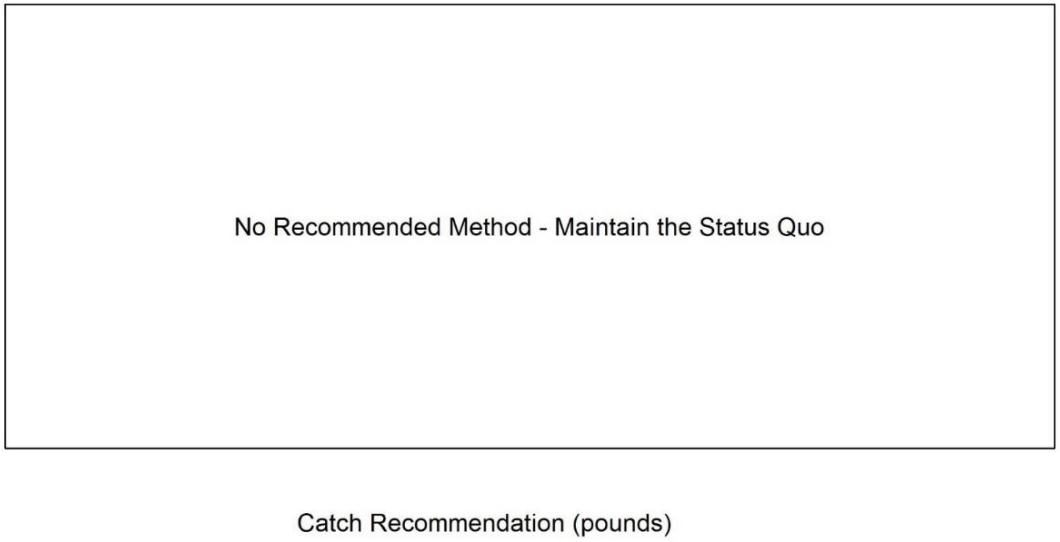
Method	Data Requirements	Reliability Score
CC1	**Catch**: Known and informative for 2010-2014	Good

Note that CC1_Ref was not a viable method based on performance in the MSE

Snowy Grouper: catch recommendations



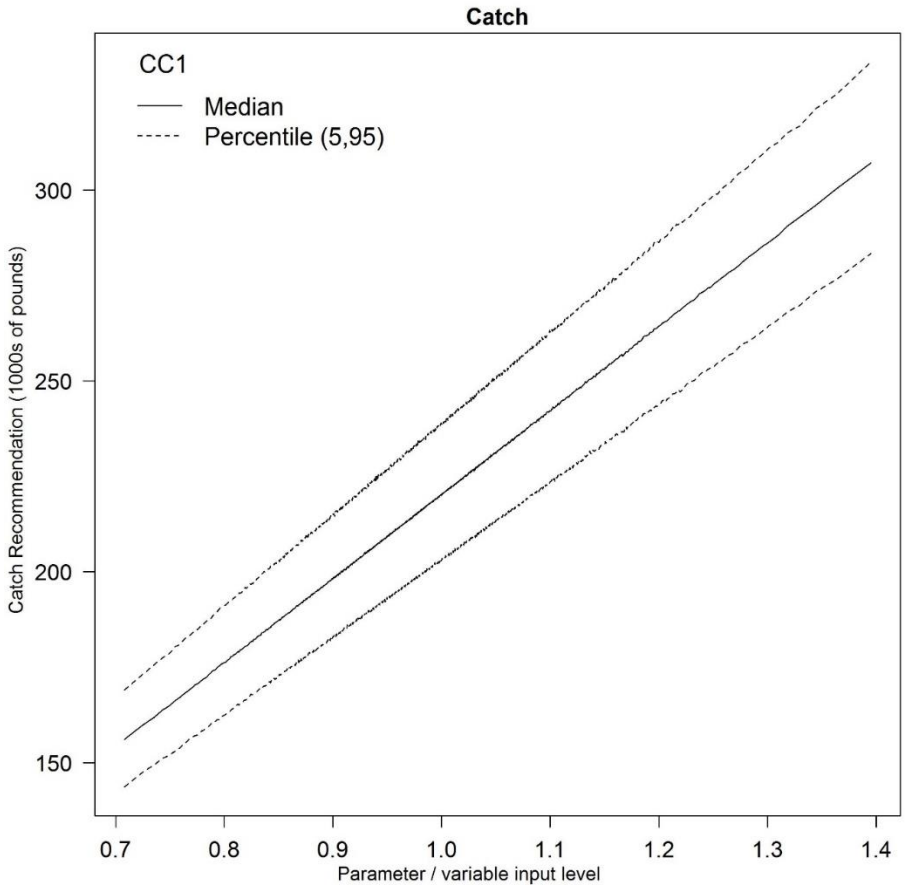
No method recommended due to concerns over the recent reference period used in CC1



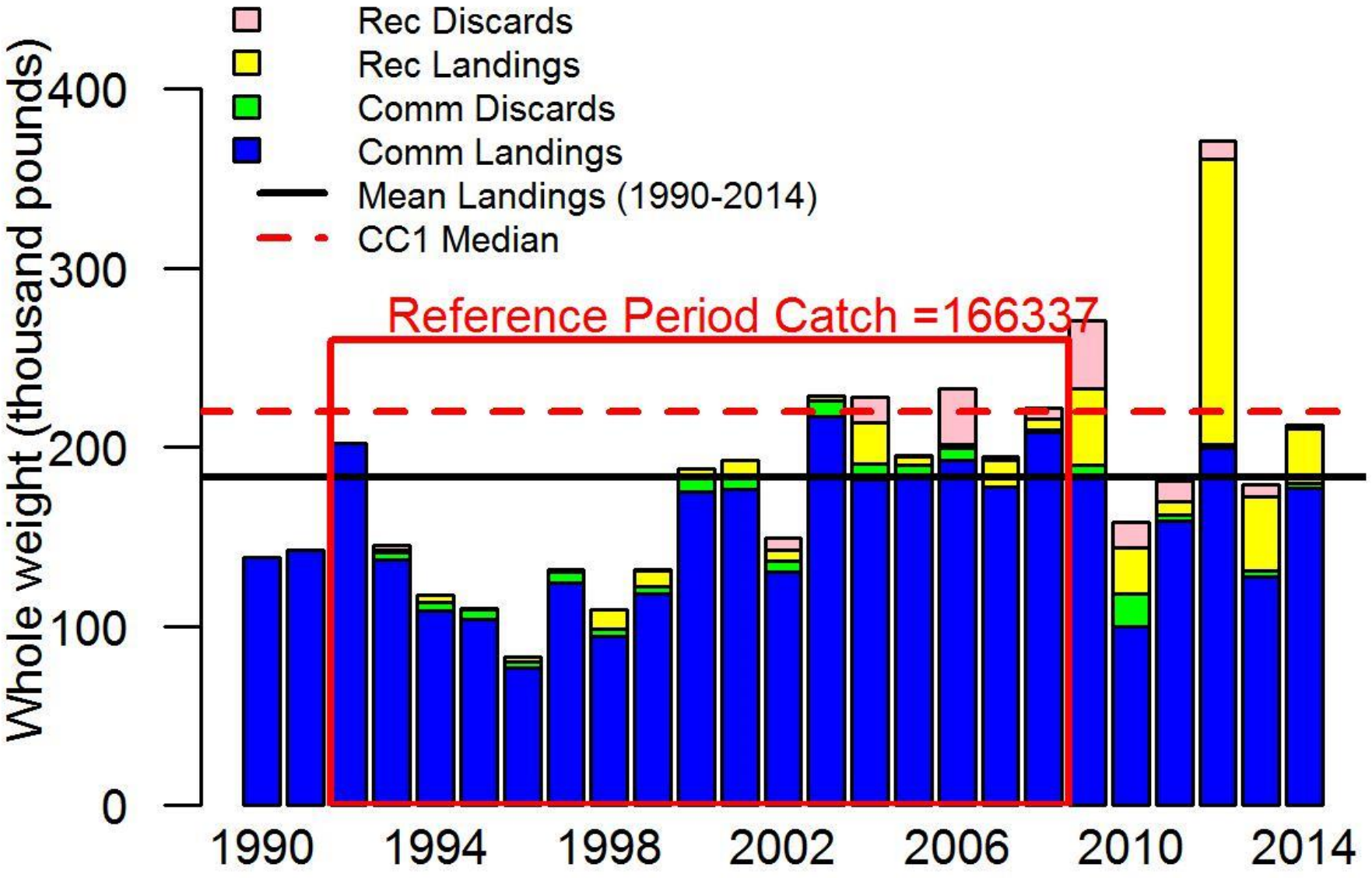
Snowy Grouper: sensitivities

- Positive relationship between catch recommendation and catch time series

Method	Catch CV	Median	Mean	SD
CC1	0.11	220,074	220,448	10,972
	0.22	219,681	220,389	21,645



Snowy Grouper: SEDAR 49 Landings

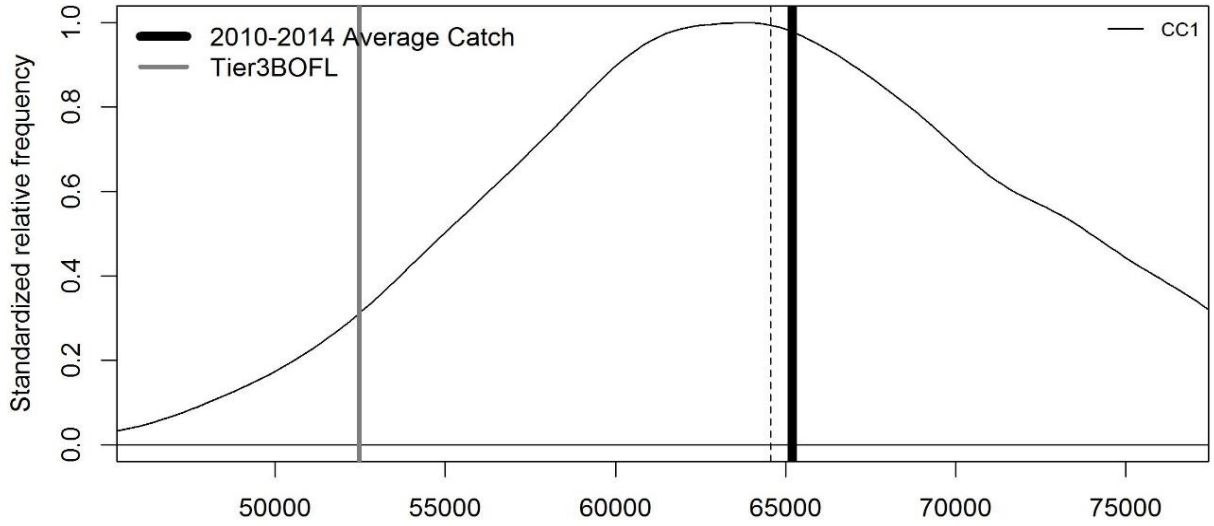


Speckled Hind: guidance table

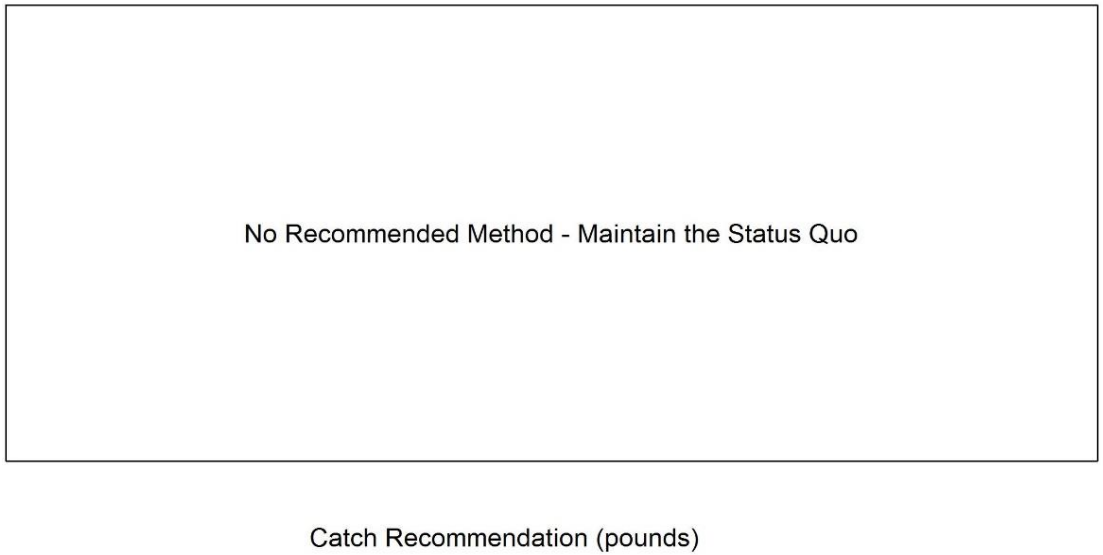
Method	Data Requirements	Reliability Score
CC1	**Catch**: Known and informative for 2010-2014	Good

Note that CC1_Ref was not a viable method based on performance in the MSE

Speckled Hind: catch recommendations



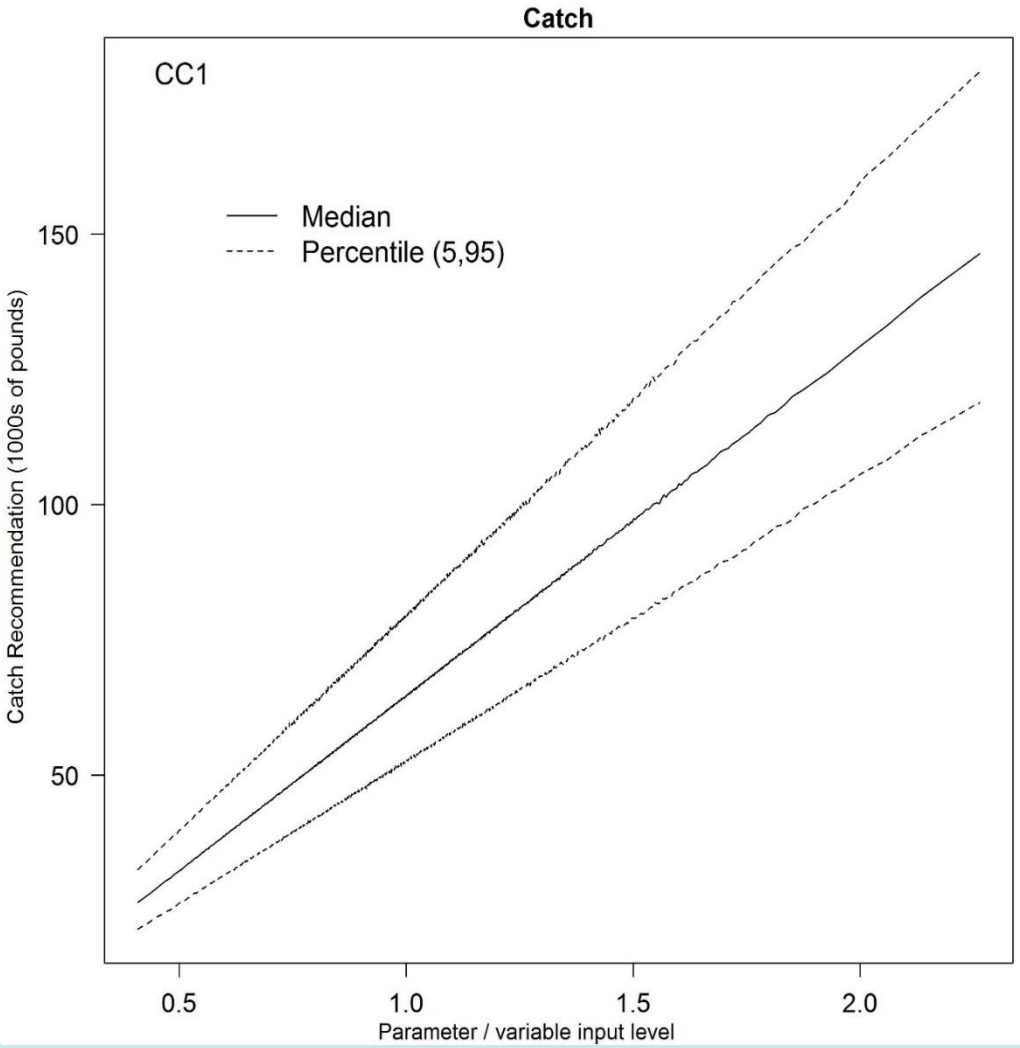
No method recommended due to concerns over the recent reference period used in CC1



Speckled Hind: sensitivities

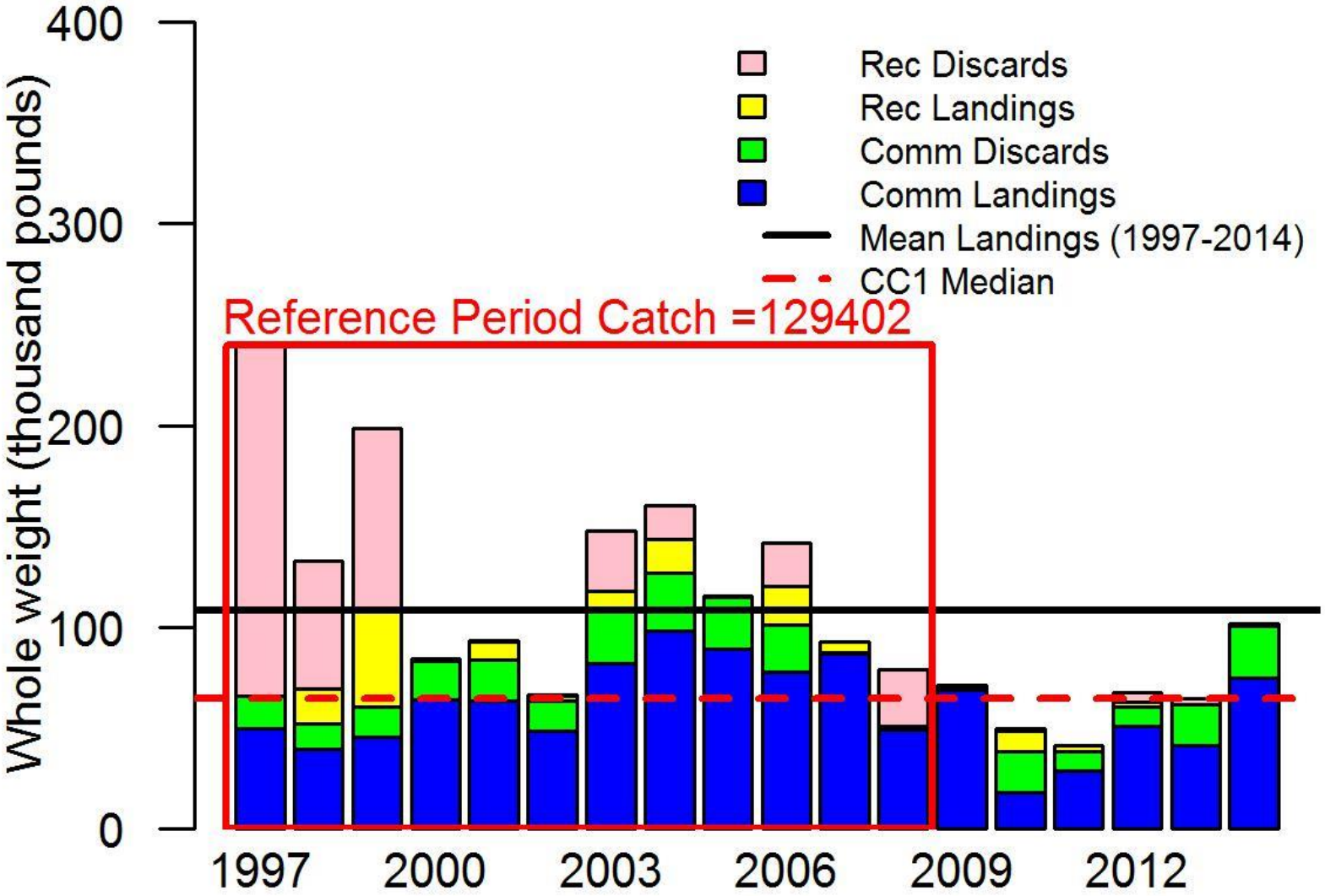
- Positive relationship between catch recommendation and catch time series

Method	Catch CV	Median	Mean	SD
CC1	0.282	64,563	65,164	8,306
	0.564	63,588	65,338	16,530



Speckled Hind: SEDAR 49 Landings

*Reference period begins prior to the data recommended for use in SEDAR49

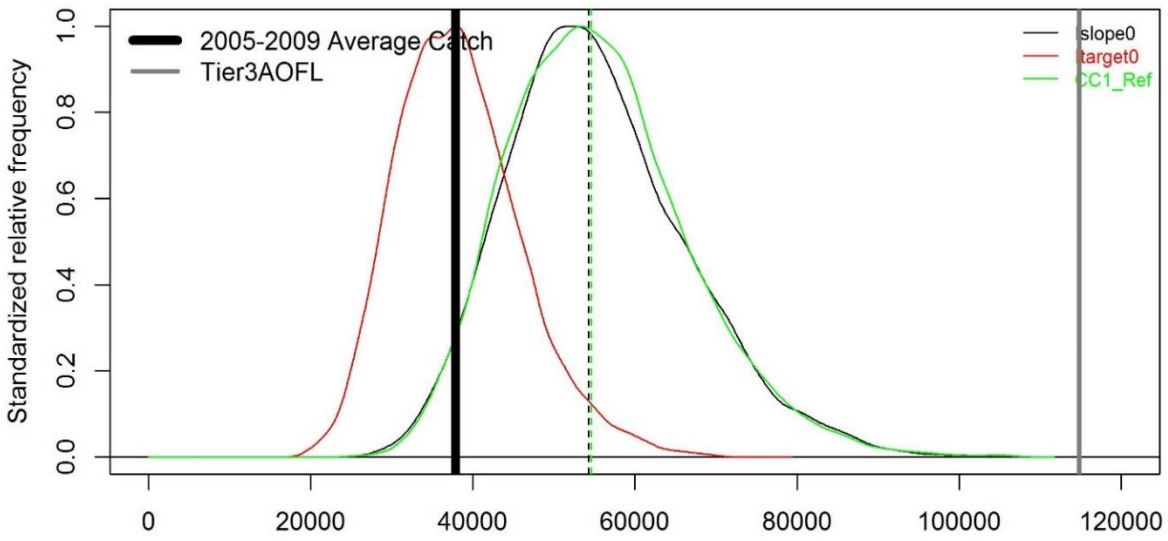


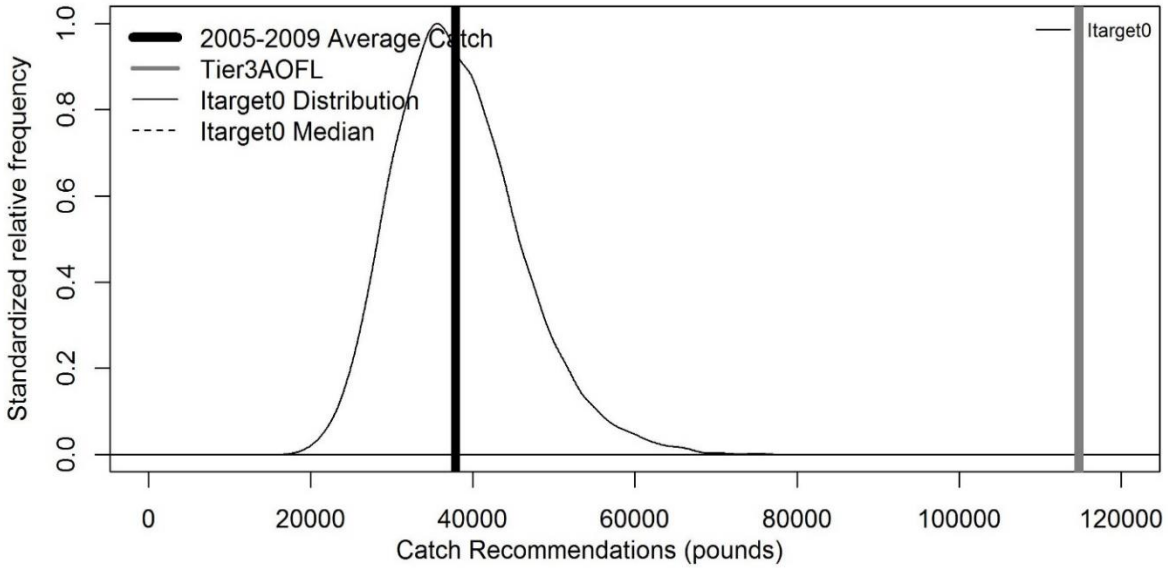
Lesser Amberjack: guidance table

Method	Data Requirements	Reliability Score
CC1_Ref	**Catch**: Known and informative for 2000-2008	Fair
Islope0	**Catch**: Known and informative for 2000-2008	Fair
	Index: SEAMAP Video index representative of population abundance (2005-2009; using 2009 as terminal year in base)	Fair
Itarget0	Total removals: Known and informative for 2000-2008	Fair
	Index: SEAMAP video index representative of population abundance; uses trend from reference period (2000-2008) and recent period (2005-2009; using 2009 as terminal year in base)	Fair

Lesser Amberjack: catch recommendations

Recommend Itarget0 because it incorporates feedback and allows the catch recommendation to vary with the trend in abundance



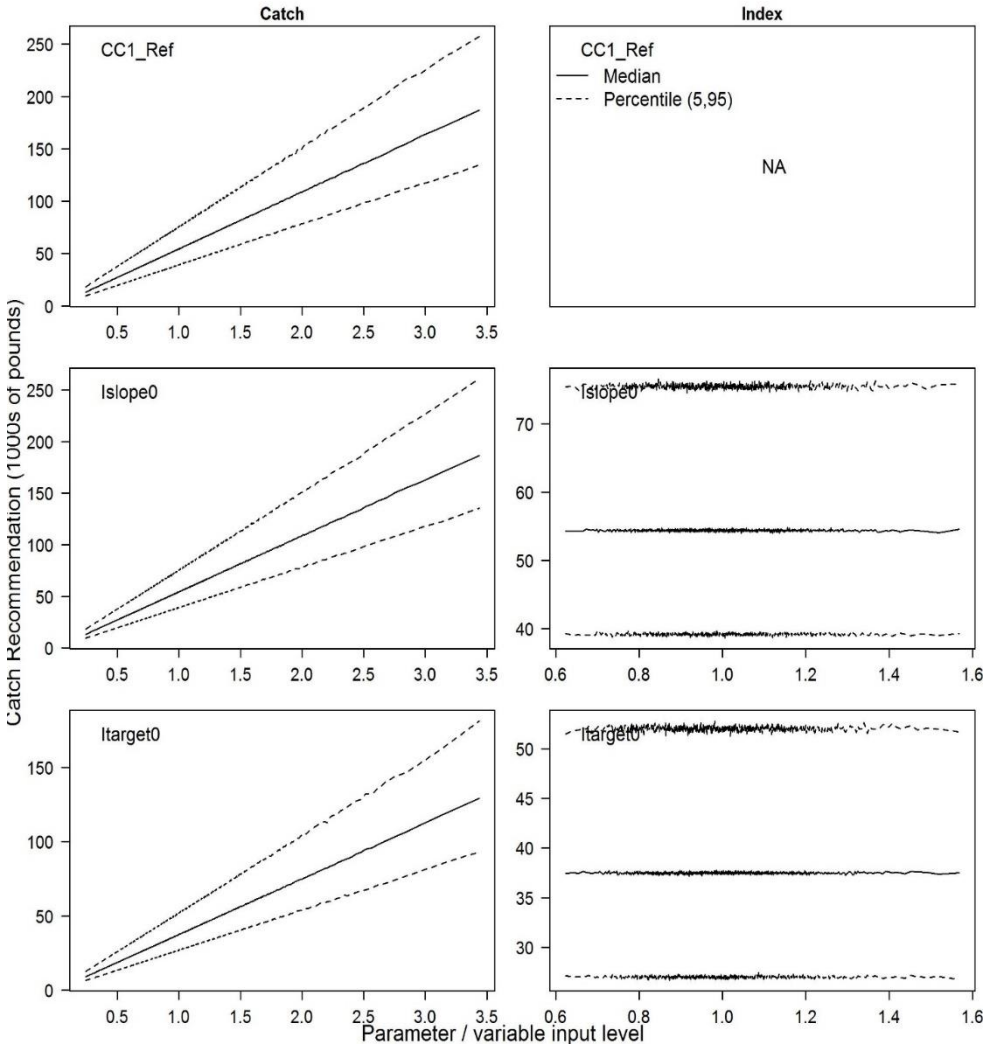


Lesser Amberjack: sensitivities

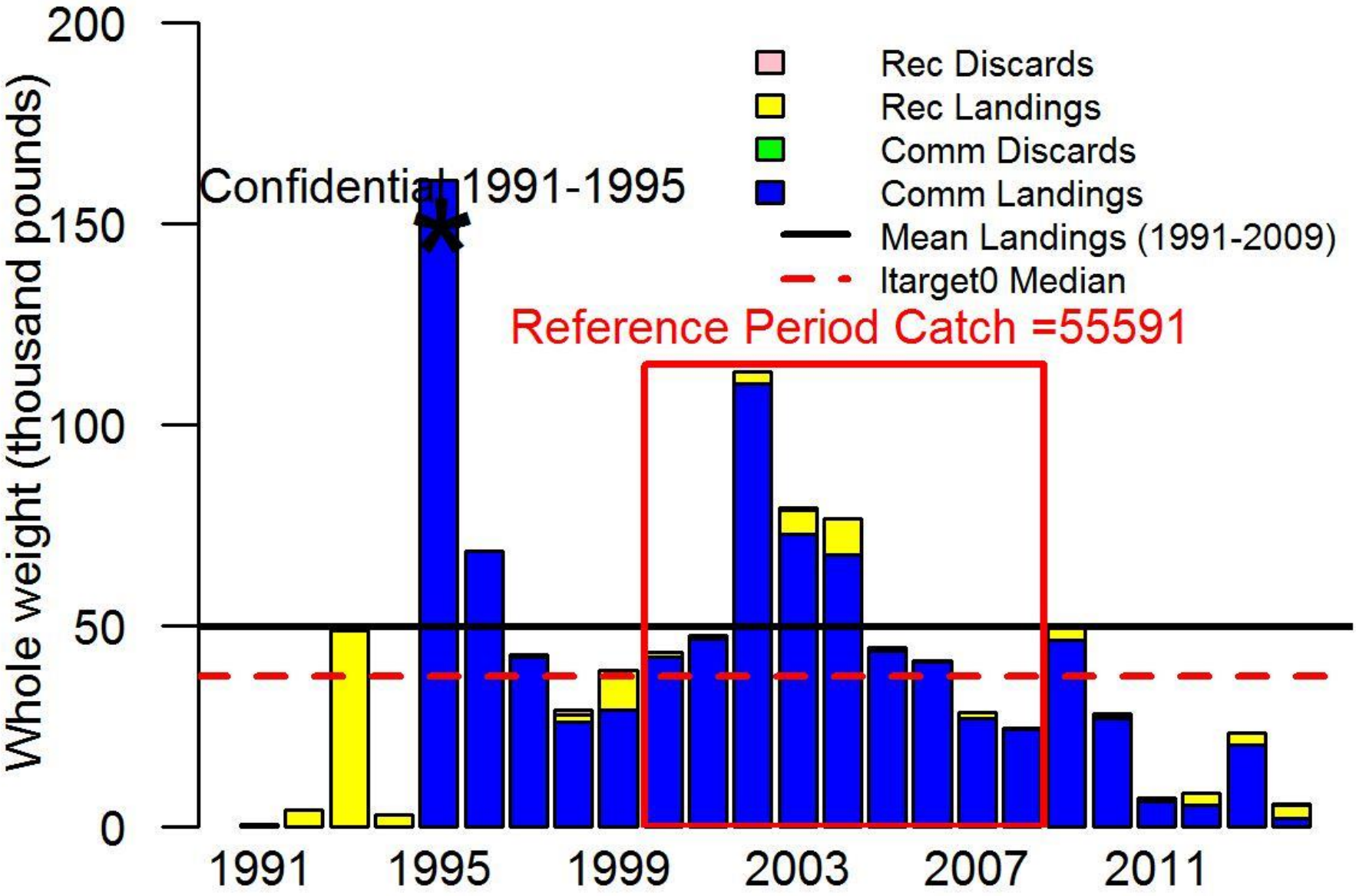
- Positive relationship between catch recommendations and catch time series

Method	Catch CV	Median	Mean	SD
Islope0	0.45	54,269	55,442	11,243
	0.90	51,342	55,064	21,374
Itarget0	0.45	37,654	38,298	7,746
	0.90	35,540	37,975	14,908
CC1_Ref	0.45	54,750	55,685	11,262
	0.90	51,559	55,142	21,571

Method	Terminal Year	Median	Mean	SD
Islope0	2009	54,269	55,442	11,243
	2014	27,855	28,420	5,769
Itarget0	2009	37,654	38,298	7,746
	2014	17,626	17,920	3,591



Lesser Amberjack: SEDAR 49 Landings

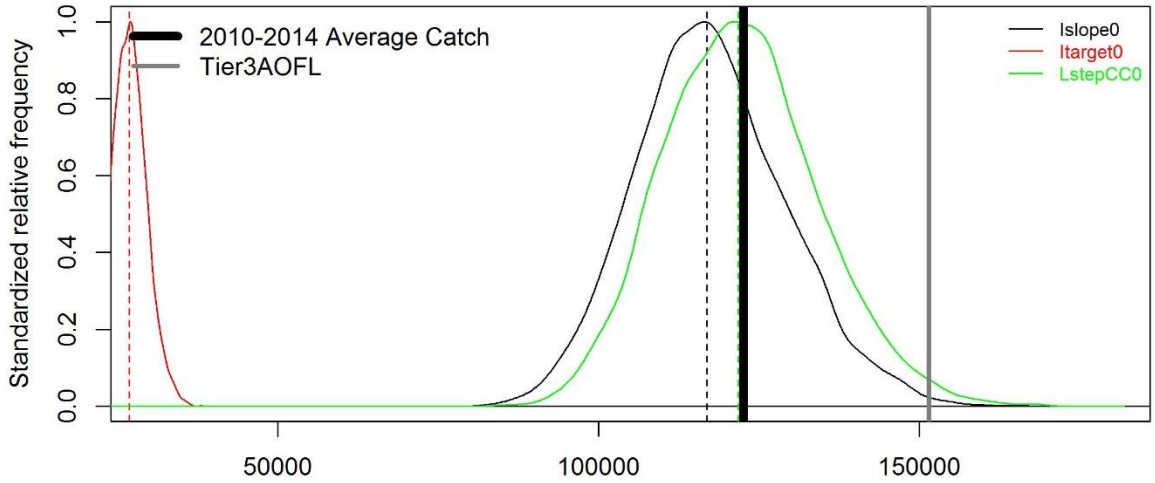


Almaco Jack: guidance table

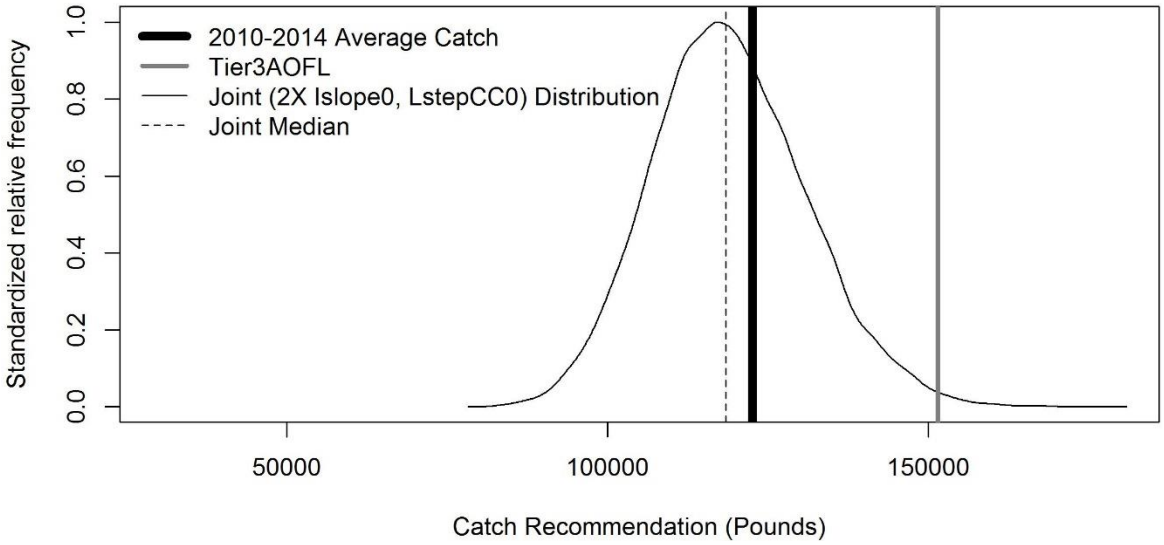
Method	Data Requirement	Reliability Score
Islope0	**Catch**: Known and informative for 2000-2008	Good
	Index: SEAMAP Video index representative of population abundance (2010-2014)	Good
Itarget0	**Catch**: Known and informative for 2000-2008	Good
	Index: SEAMAP Video index representative of population abundance; uses trend from reference period (2000-2008) and trend from recent period (2010-2014)	Good
LstepCC0	**Catch**: Known and informative for 2000-2008	Good
	Mean Length: Mean length of catch from Rec (PR, HB, CB) an indirect and informative indicator of the trend in resource abundance; uses historical ML (2000-2008) and recent ML (2010-2014)	Fair

- Index of abundance data scored higher than mean length

Almaco Jack: catch recommendations



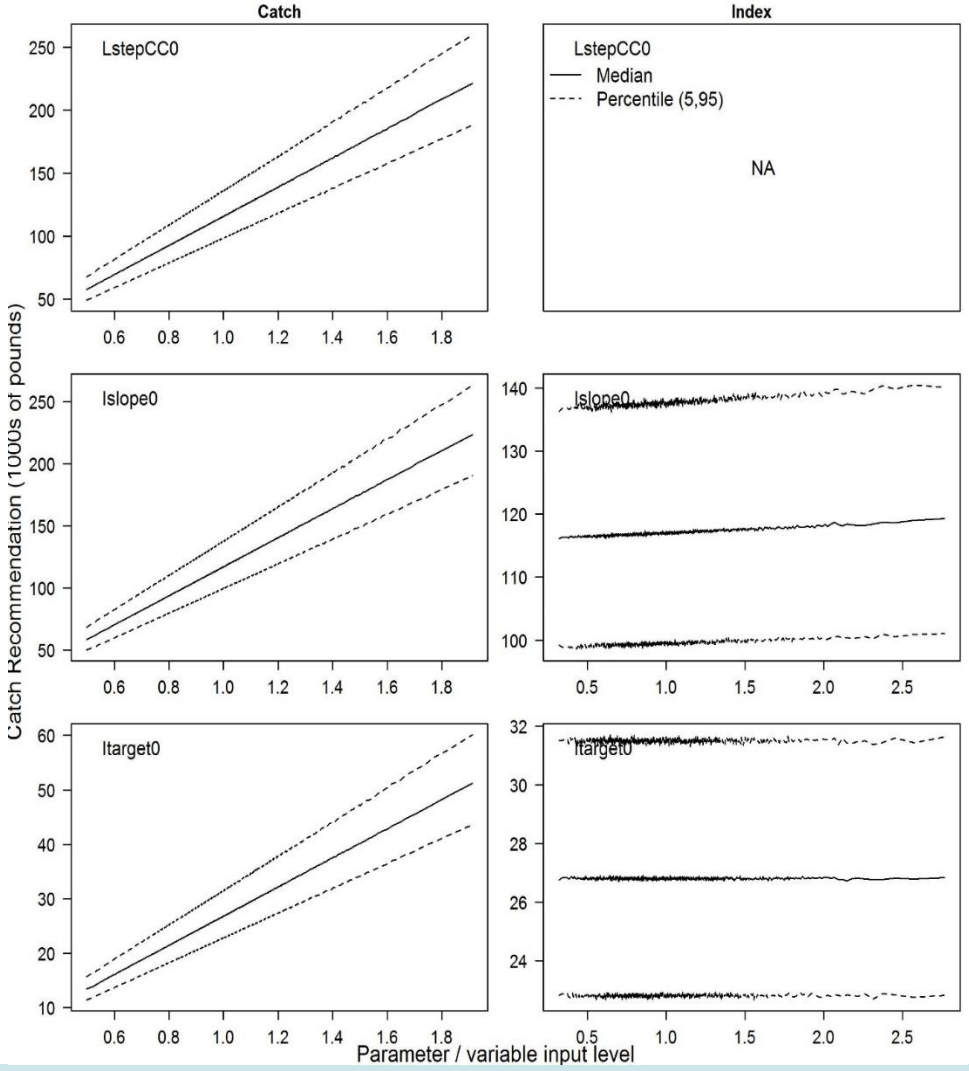
Recommend a joint distribution that assumes higher weighting of Islope0 due to higher data quality



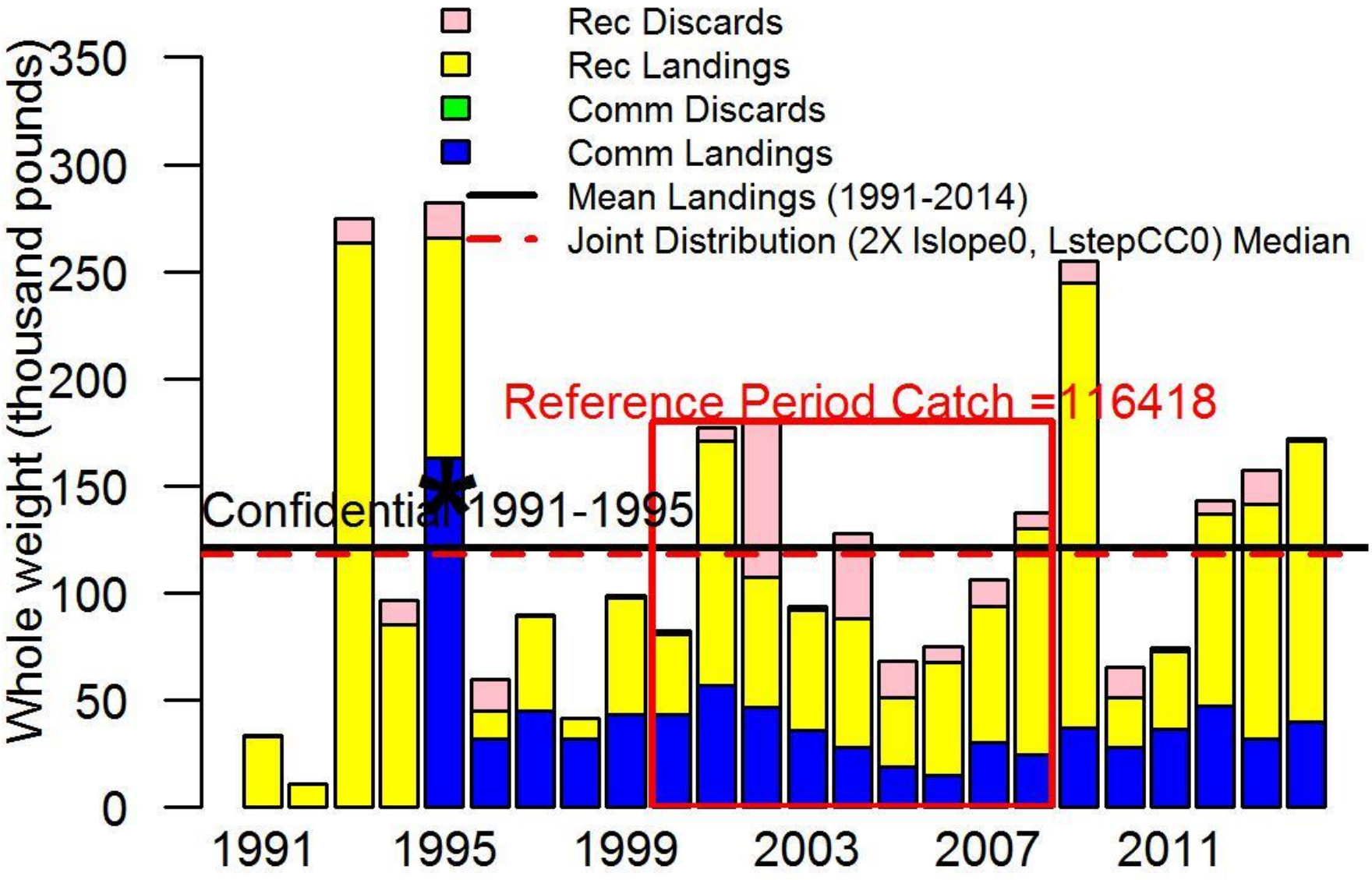
Almaco Jack: sensitivities

- Positive relationship between catch recommendations and catch time series

Method	Cat CV	Median	Mean	SD
Islope0	0.22	116,896	117,517	11,740
	0.44	115,421	117,401	23,134
Itarget0	0.22	26,869	26,959	2,671
	0.44	26,439	26,944	5,340
LstepCC0	0.22	121,930	122,338	12,121
	0.44	119,776	122,224	23,824



Almaco Jack: SEDAR 49 Landings

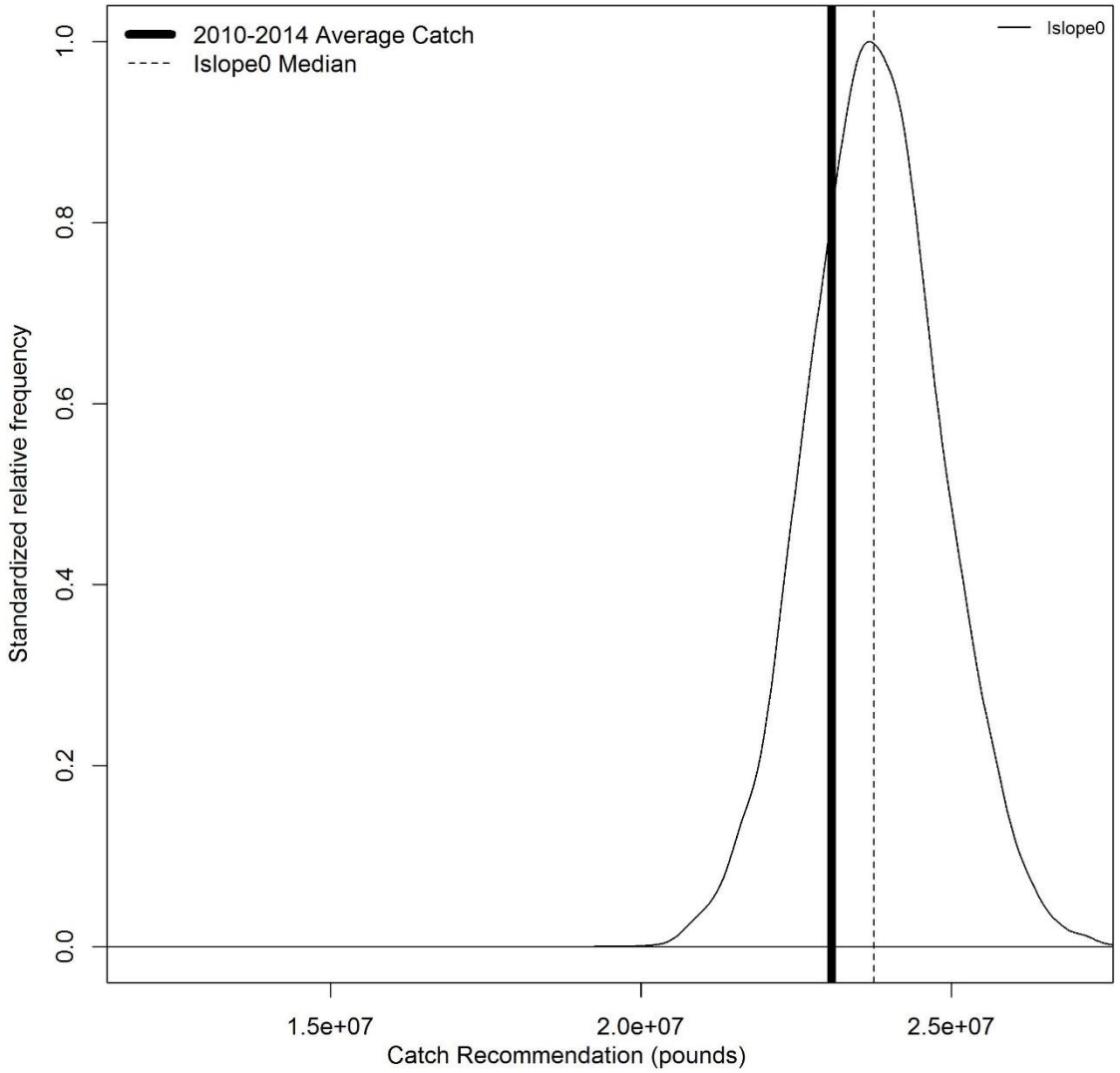


Red Drum: guidance table

Method	Data Requirement	Reliability Score
Islope0	**Catch**: Known and informative for 2010-2014	Good
	Index: Dauphin Island Sea Laboratory bottom longline representative of trend in population abundance (2010-2014)	Good

Red Drum: catch recommendations

Islope0 not recommended due to model assumptions, in particular the assumed reference period for average catch

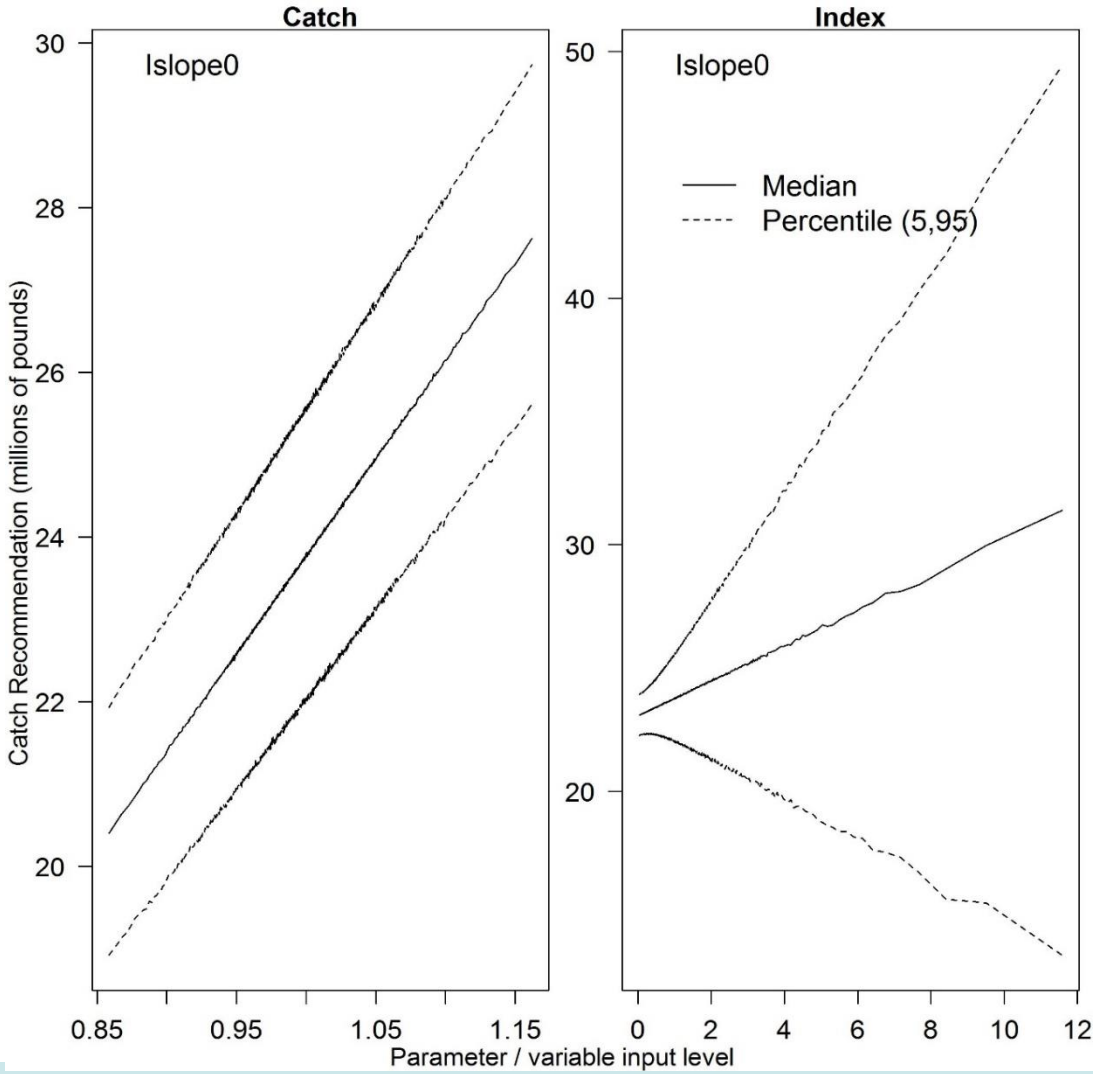


Red Drum: sensitivities

- Positive relationship between catch recommendation and catch time series

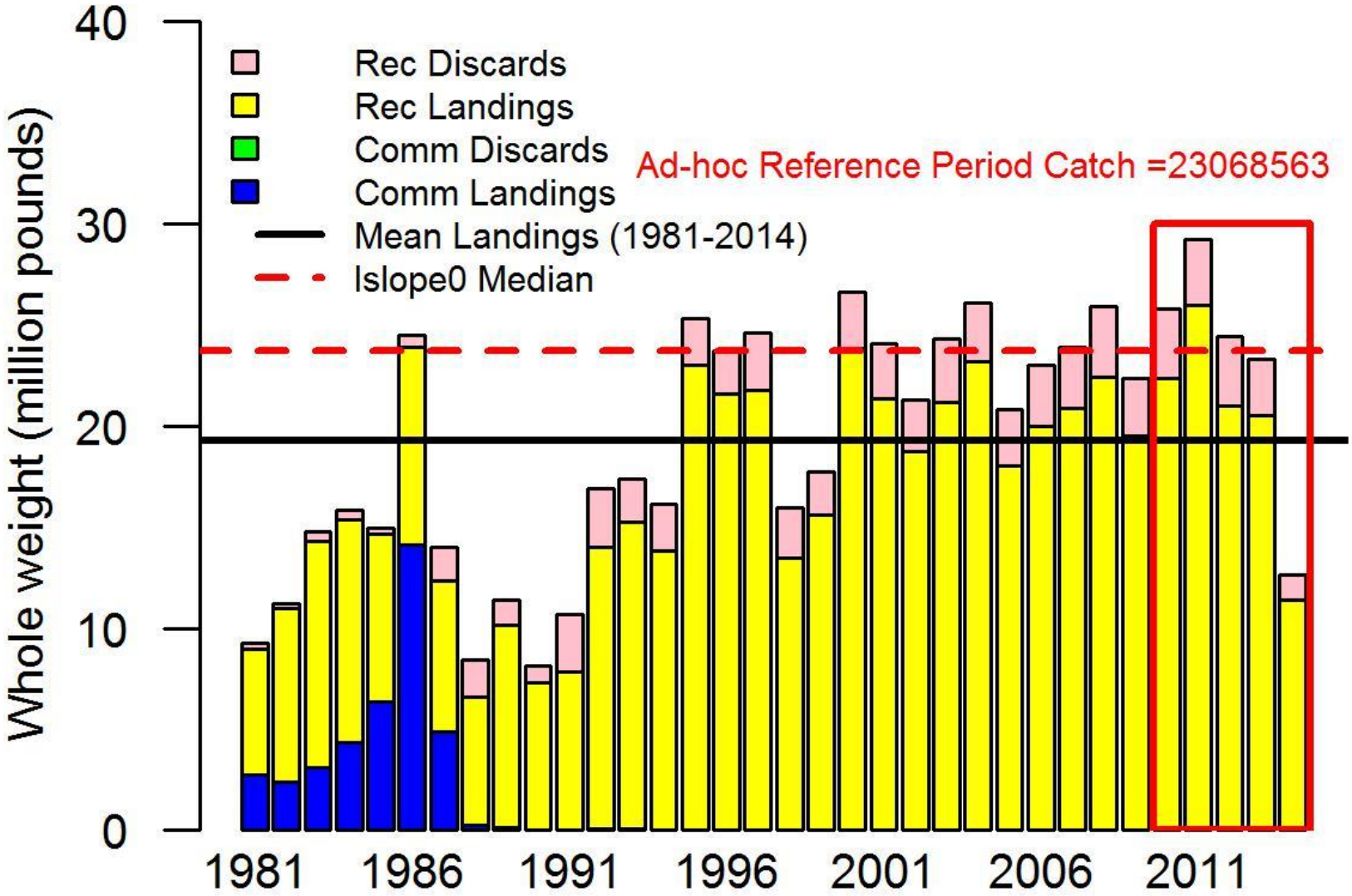
	Islope0	
Catch CV	0.049	0.098
Median	23,748,838	23,738,216
Mean	23,763,717	23,769,355
SD	1,073,038	1,406,690

Note: large range on x-axis due to the large CV for the red drum index of abundance



Red Drum: SEDAR 49 Landings

No reference period specified in the Red Drum FMP



Catch recommendations summary

- For the majority of the SEDAR 49 species, methods exist that could provide management advice
  - Preferable to the status quo based on simulation analyses and all assumptions therein (e.g., stock/fleet dynamics)

- Data limitations remain, in particular:
  - Red drum – reference period for representative removals, age composition of adults
  - Deep-water groupers – Indices of abundance
  - *Seriola* spp.– age and growth information, species identification

Utility of DLMtool in U.S. fisheries management

- Status-quo approach as well as index- and length-based methods all aim to achieve some historical target (and not necessarily achieve BMSY in the long term)

- SEDAR 49 proposes alternative methods for many species that represent a small step towards data-limited management that is preferable to the status-quo
  - Attempted to produce adjusted mean catch outputs by using unbuffered methods to produce catch recommendations

Research recommendations

- Fine-tuning generic methods (e.g., Islope0, default lambda = 0.4)
  - Bounds on the scalar to be tested (e.g., 0 – 2, 0 – 5)?
- Examine full suite of methods (and scalars) under different stock conditions
- Model selection
    - Years for calculating performance metrics
    - Criteria (PNOF closest to 50%, highest LTY, highest STY)

Mean Length Estimator

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Results overview

Mean-length estimator

- Analysis carried out for 5 SEDAR49 species
- Results will not be presented due to concerns regarding estimated trends
  - e.g., Z < M resulting in F = 0 in most tested cases
- Recommend research into:
  - Vulnerabilities/limitations of the mean length estimator approach
  - Improved data collection (e.g., growth parameters)
  - Implications of age-based mortality estimator (Then et al. 2015)

Catch Curve Analysis

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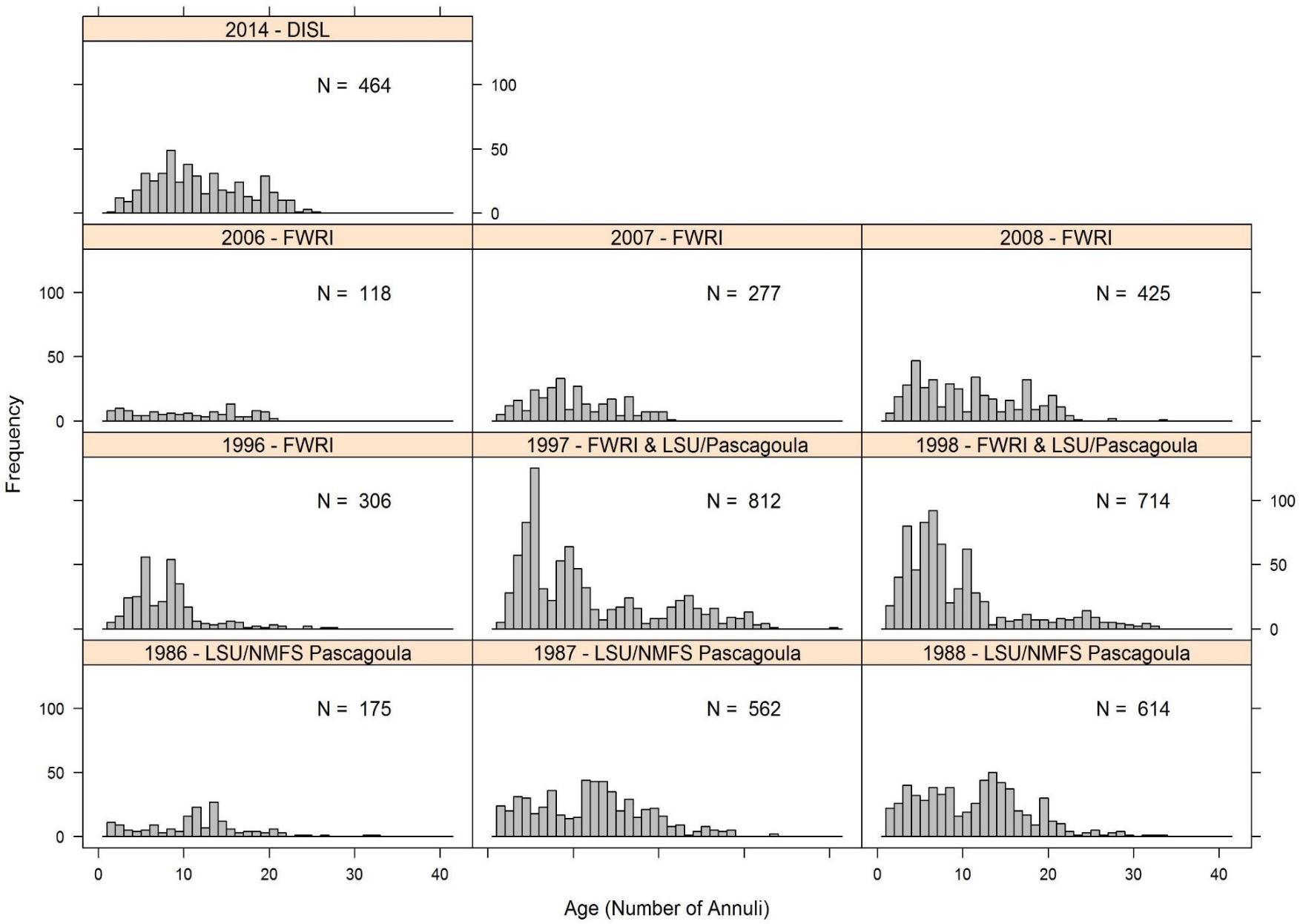
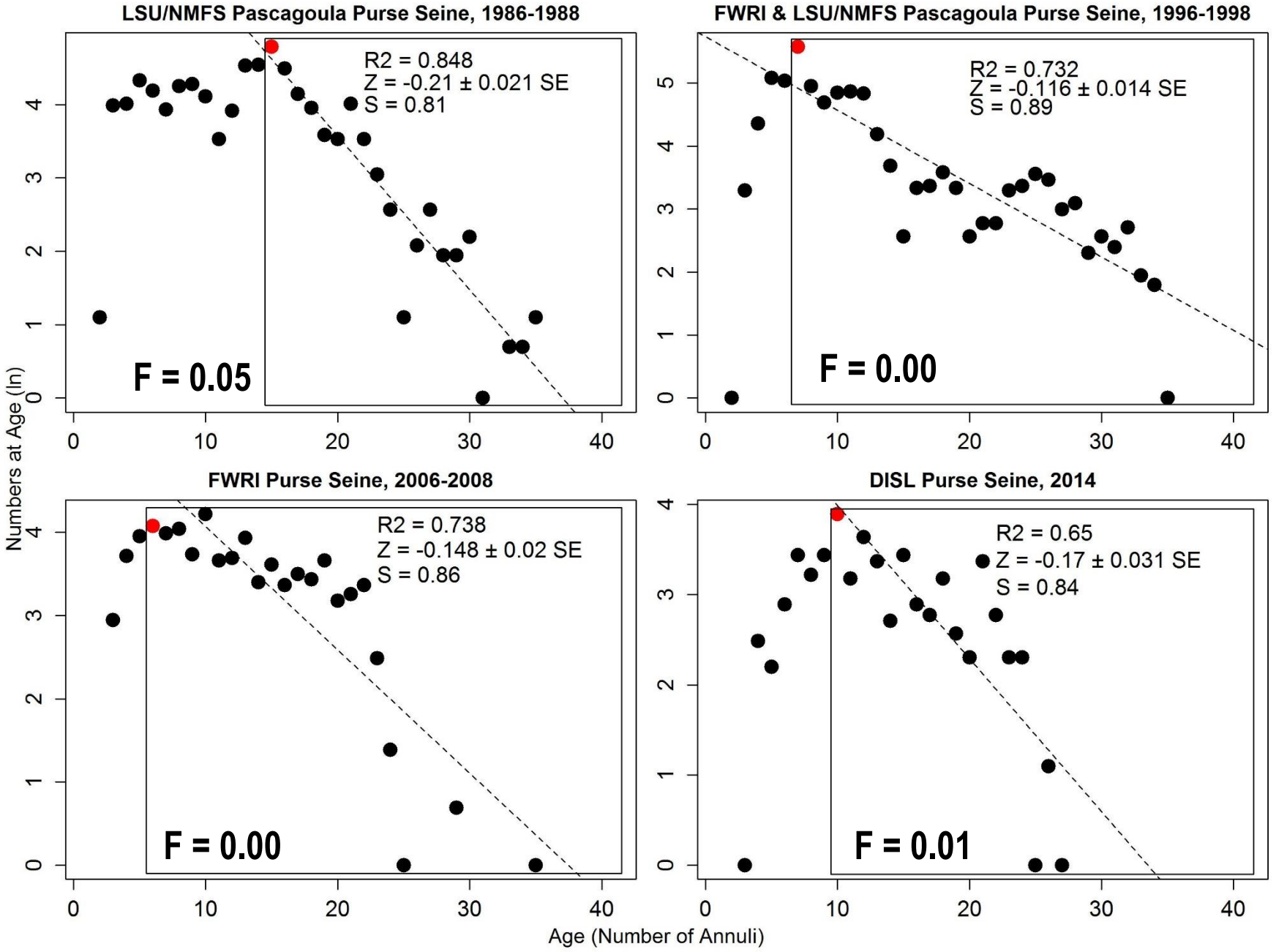
Red Drum Results

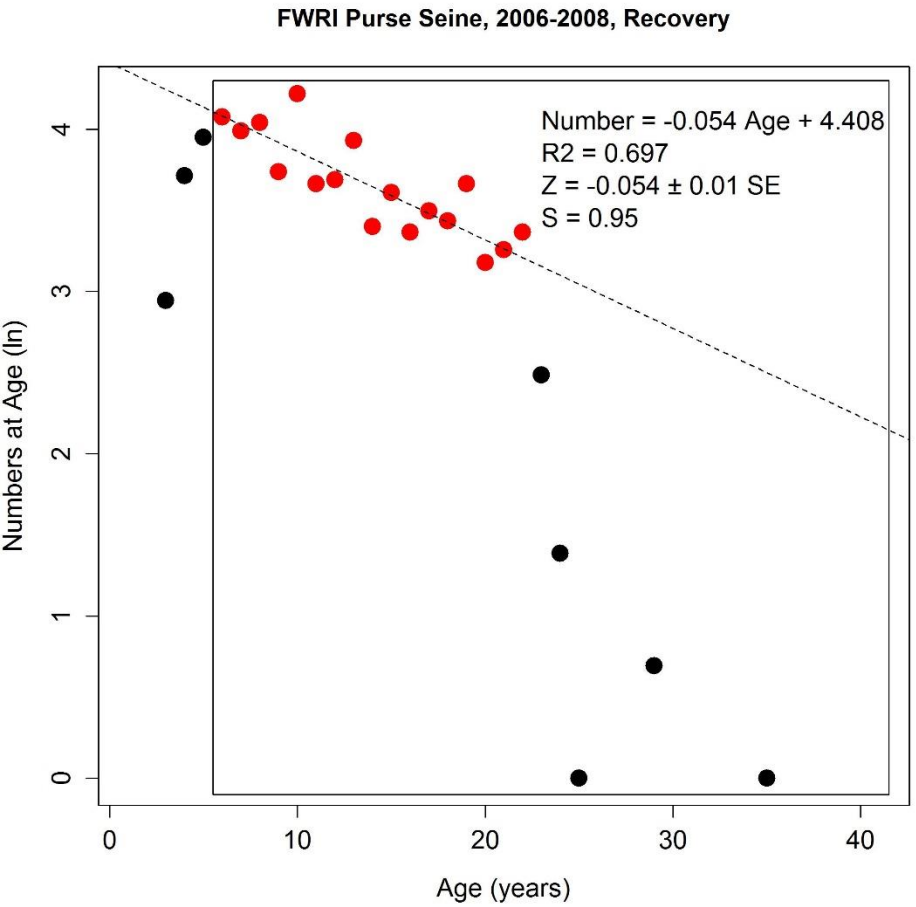
Red Drum: age composition (Purse Seine)

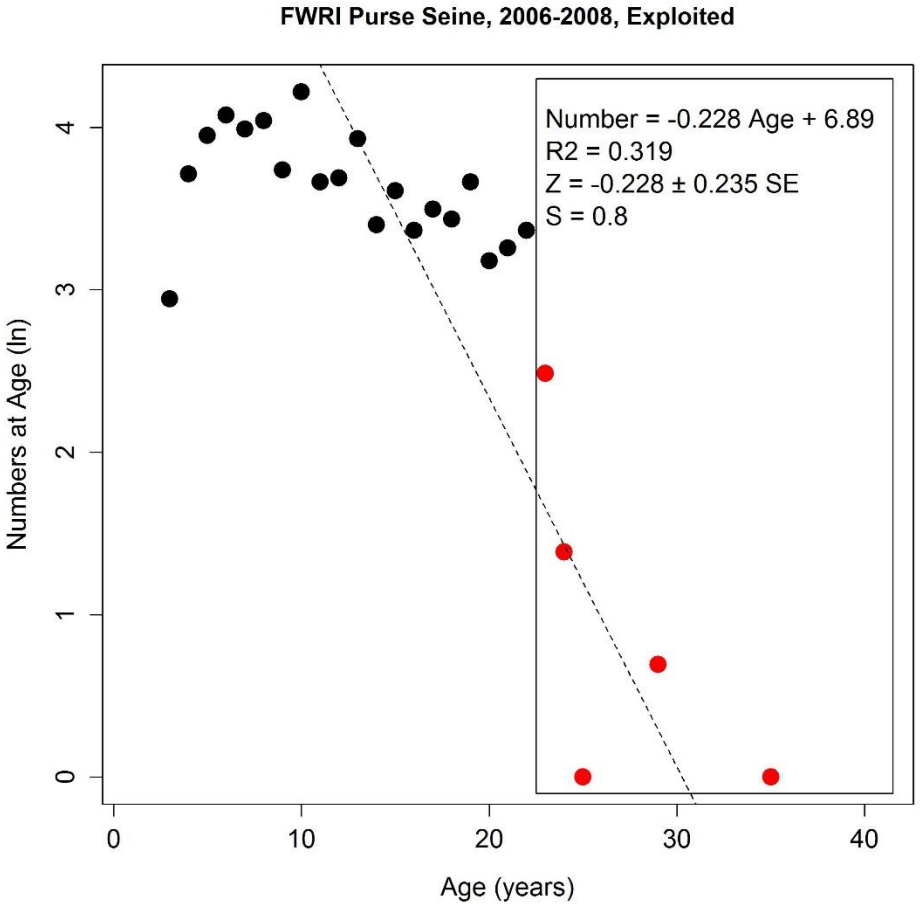


Red Drum: catch curve

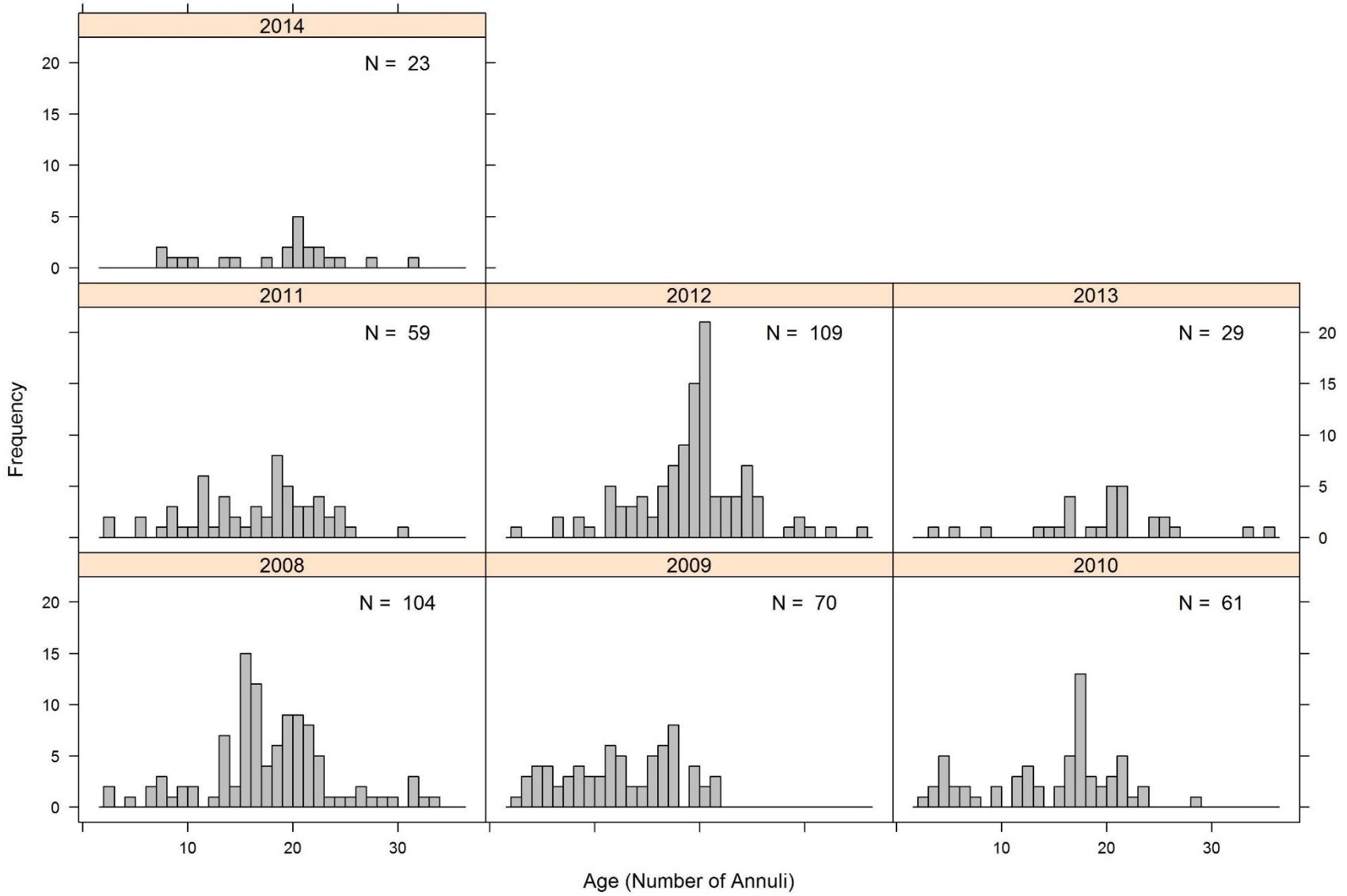


Red Drum: catch curve





Red Drum: age composition (bottom longline)

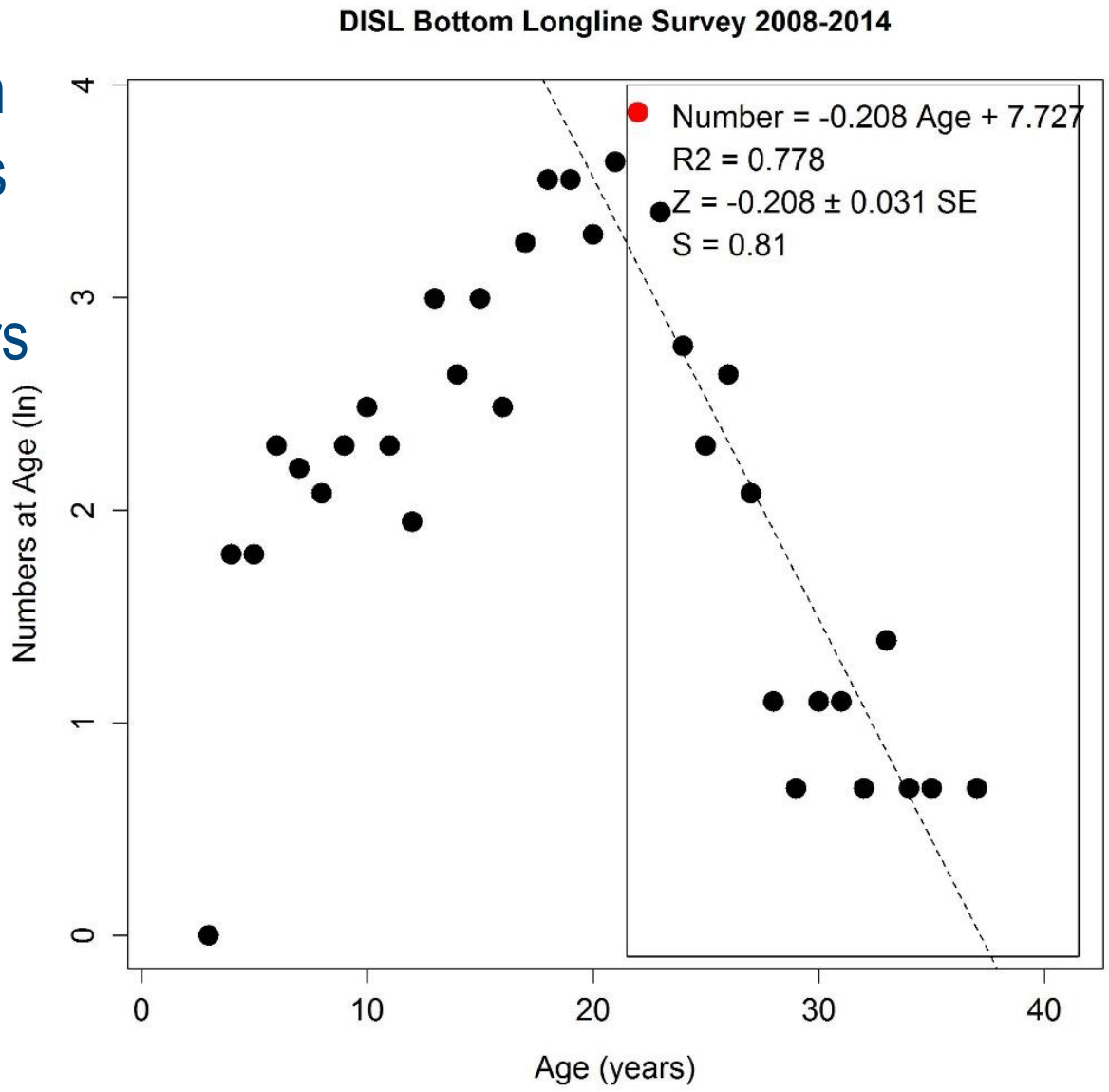


Red Drum: catch curve

Fitting a linear regression to the fully-recruited ages (22 yr) in a scatterplot of the natural log of numbers versus age

Mortality	Value
Z	0.21
M	0.16
F	0.05

Individuals captured in both inshore and federal waters



Questions and comments?

Extra slides