

# False Killer Whale

## Take Reduction Team Meeting #3

June 14-18, 2010 - Oahu, Hawaii

Overview of the predictive model  
for evaluating potential mitigation  
strategies

Developed in consultation with the  
TRT's Predictive Model Working Group



Presented by :

Karin Forney (Southwest Fisheries Science Center)

# Modeling approach

- ◆ **Bootstrap simulation** using 2003-2009 observer data (excluding vessels during and after their involvement in experimental trips)
- ◆ **Subset** data by fishery (DS/SS) to use only sets that meet specified constraints:
  - **Geographic** (EEZ, lat/long, quadrant, any polygon)
  - **Seasonal** (month, quarter)
  - **Gear/set characteristics** (e.g. hook types, etc)
- ◆ Specify other parameters:
  - **Number of sets** by fishery
  - **MSI rate** (Mortality & Serious Injury when caught)

# Sample output

Simulation 001 (n=1000): 17200DS, 1600SS, MSI=0.89 (1-yr)

DS: 2003-09, Small Circle Hooks Only, SS: 2003-09

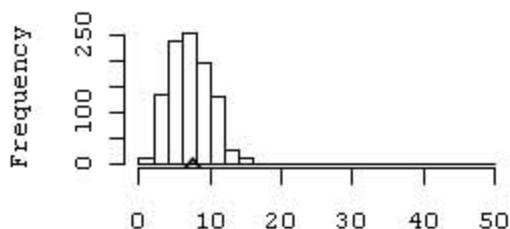
Mon Jun 14 17:19:27 2010

	BaseDS	SimDS	BaseSS	SimSS	EEZ FKW M&SI:	BaseDS	SimDS	BaseSS	SimSS
EEZ Sets:	8502	1468	1132	1132	12	2	1	1	1
HiSeas(HS) Sets:	11778	2524	5096	5096	12	3	0	0	0
# TgtCatch:	171472	40476	81306	81306	EEZFKW1000Sets:	1.41	1.36	0.88	0.88
TgtCtchperSet:	8.46	10.14	13.05	13.05	HS FKW1000Sets:	1.02	1.19	0.00	0.00

## Simulation Results

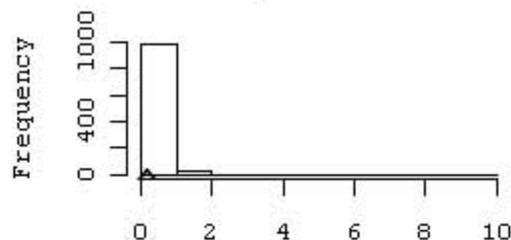
FKW M&SI:	HI EEZ	HiSeas
Target:	2.5	5.4
Sim. Results:	7.9	11.5

**DS, HI EEZ**



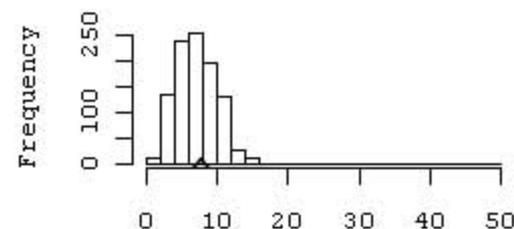
FKW M&SI (Avg=7.7)

**SS, HI EEZ**



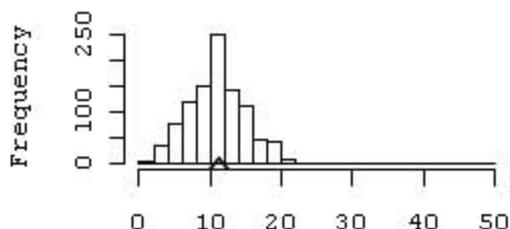
FKW M&SI (Avg=0.2)

**SS&DS, HI EEZ**



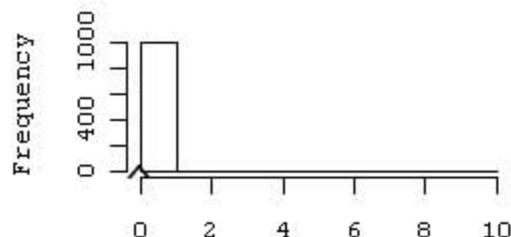
FKW M&SI (Avg=7.9)

**DS, High Seas**



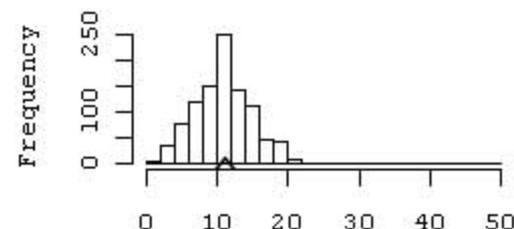
FKW M&SI (Avg=11.5)

**SS, High Seas**



FKW M&SI (Avg=0)

**SS&DS, High Seas**



FKW M&SI (Avg=11.5)

# Sample output

Simulation 001 (n=1000): 17200DS, 1600SS, MSI=0.89 (1-yr)  
 DS: 2003-09, Small Circle Hooks Only, SS: 2003-09

Mon Jun 14 17:19:27 2010

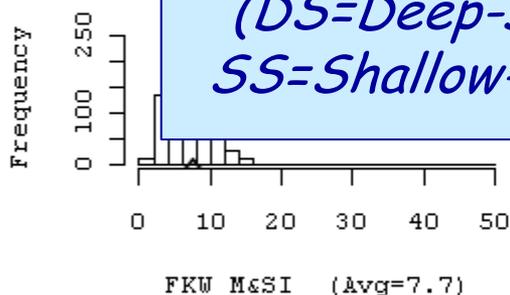
	BaseDS	SimDS	BaseSS	SimSS	EEZ FKW M&SI:	BaseDS	SimDS	BaseSS	SimSS
EEZ Sets:	8502	1	1132	1132	12	2	1	1	1
HiSeas(HS) Sets:	11778	4	5096	5096	12	3	0	0	0
# TgtCatch:	171472	6	81306	81306	EEZFKW1000Sets:	1.41	1.36	0.88	0.88
TgtCtchperSet:	8.46	14	13.05	13.05	HS FKW1000Sets:	1.02	1.19	0.00	0.00

*Header with  
summary of input  
selections  
(DS=Deep-set;  
SS=Shallow-set)*

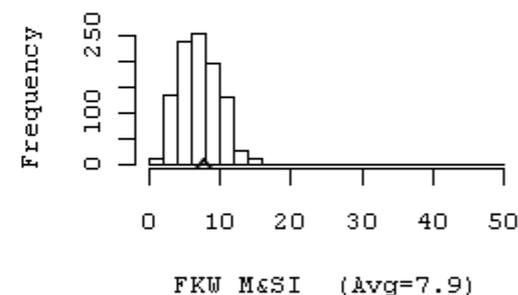
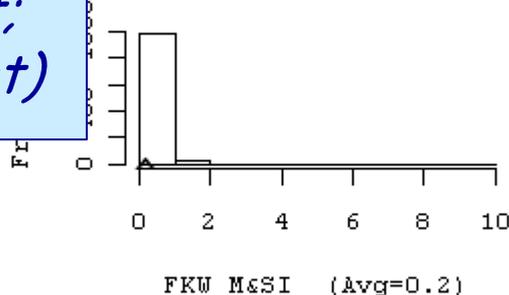
## Simulation Results

MSI:            HI EEZ      HiSeas  
 Results:        2.5        5.4  
                  7.9        11.5

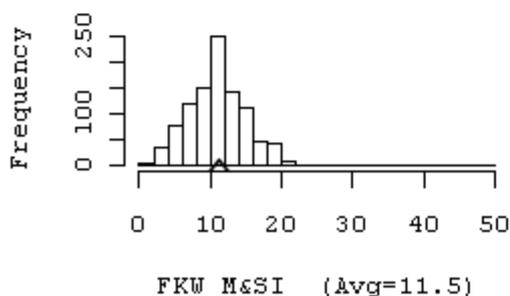
**SS, HI EEZ**



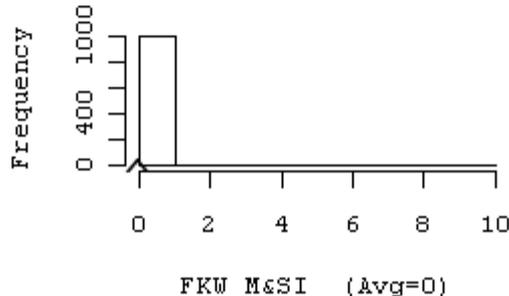
**SS&DS, HI EEZ**



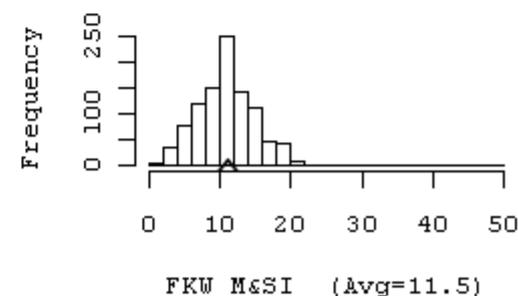
**DS, High Seas**



**SS, High Seas**



**SS&DS, High Seas**



# Sample output

Simulation 001 (n=1000): 17200DS, 1600SS, MSI=0.89 (1-yr)  
 DS: 2003-09, Small Circle Hooks Only, SS: 2003-09

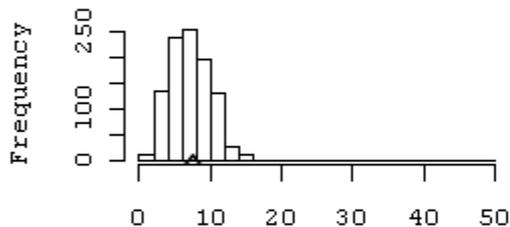
Mon Jun 14 17:19:27 2010

	BaseDS	SimDS	BaseSS	SimSS	EEZ FKW M&SI:	BaseDS	SimDS	BaseSS	SimSS
EEZ Sets:	8502	1468	1132	1132	12	2	1	1	1
HiSeas(HS) Sets:	11778	2524	5096	5096	12	3	0	0	0
# TgtCatch:	171472	40472	81306	81306	1.11	1.36	0.88	0.88	0.88
TgtCtchperSet:	8.46	10.14	13.05	13.05	1.02	1.19	0.00	0.00	0.00

## Simulation Results

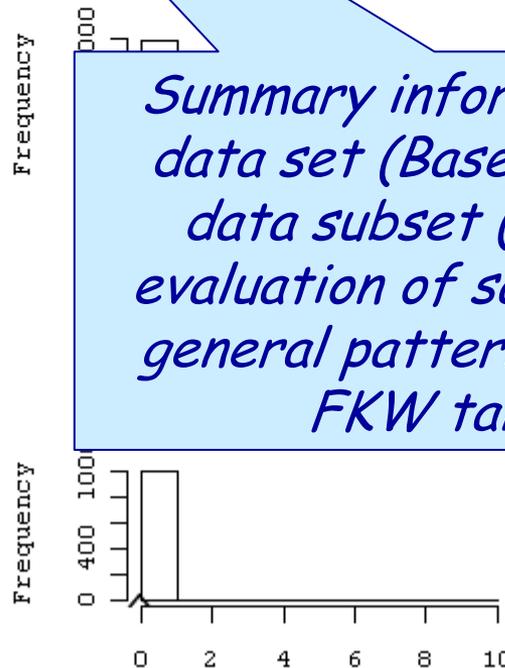
FKW M&SI:            HI EEZ    HiSeas  
 Targ                2.5        5.4  
 Sim.                7.9        11.5

DS, HI EEZ



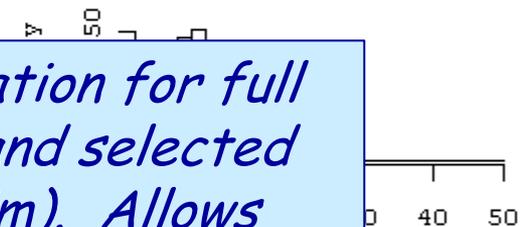
FKW M&SI (Avg=7.7)

SS&DS, HI EEZ



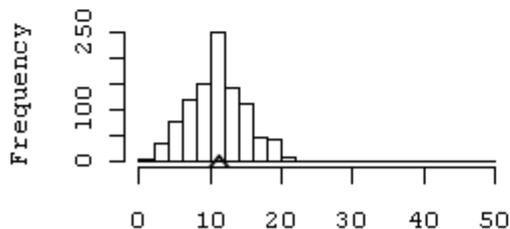
FKW M&SI (Avg=0)

SS&DS, HI EEZ



FKW M&SI (Avg=11.5)

DS, High Seas



FKW M&SI (Avg=11.5)

DS, High Seas

*Summary information for full data set (Base) and selected data subset (Sim). Allows evaluation of sample sizes and general patterns in catch and FKW take rates*

# Sample output

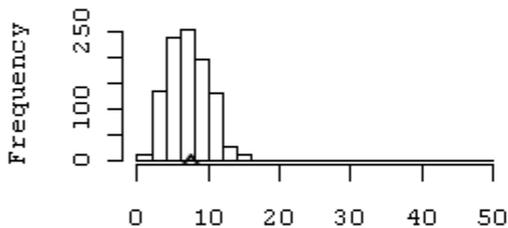
- 6 histograms showing the number of false killer whale M&SI across all (e.g. 1000) simulation runs.
- Top row is for HI EEZ, bottom row is for High Seas.
- Three columns are for Deep-set (DS), Shallow-set (SS), and combined DS&SS.
- Averages are shown with ^ and printed below x-axis.

SimSS
1
0
0.88
0.00

```

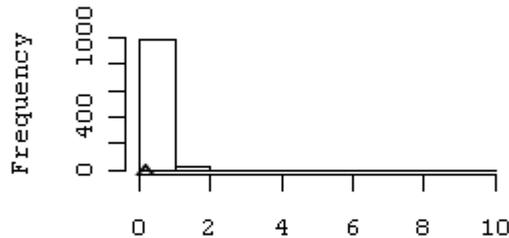
Results:      2.5      5.4
            7.9      11.5
    
```

**DS, HI EEZ**



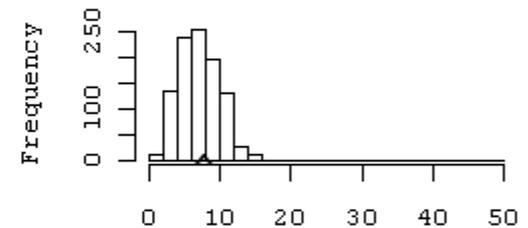
FKW M&SI (Avg=7.7)

**SS, HI EEZ**



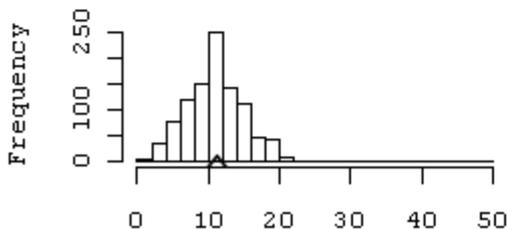
FKW M&SI (Avg=0.2)

**SS&DS, HI EEZ**



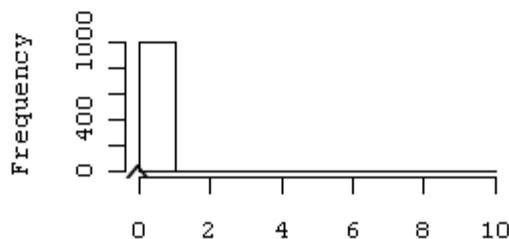
FKW M&SI (Avg=7.9)

**DS, High Seas**



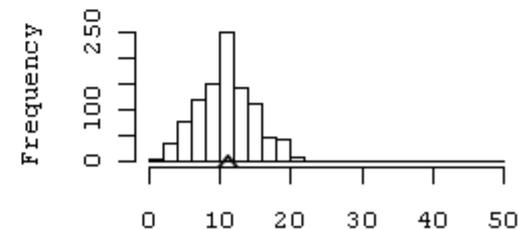
FKW M&SI (Avg=11.5)

**SS, High Seas**



FKW M&SI (Avg=0)

**SS&DS, High Seas**



FKW M&SI (Avg=11.5)

# Sample output

Simulation 001 (n=1000): 17200DS, 1600SS, MSI=0.89 (1-yr)

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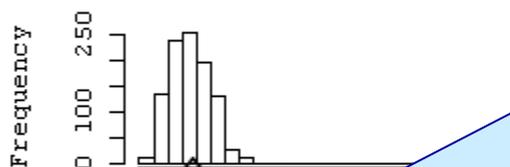
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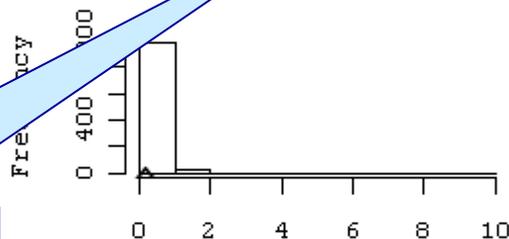
## Simulation Results

FKW M&SI:            HI EEZ        HiSeas  
 Target:                2.5            5.4  
 Sim. Results:         7.9            11.5

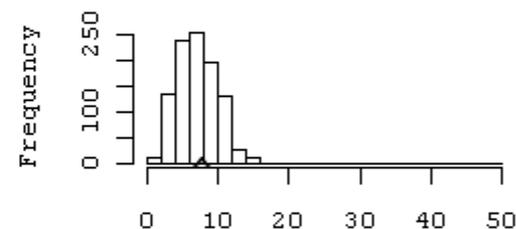
DS, HI EEZ



SS, HI EEZ



SS&DS, HI EEZ



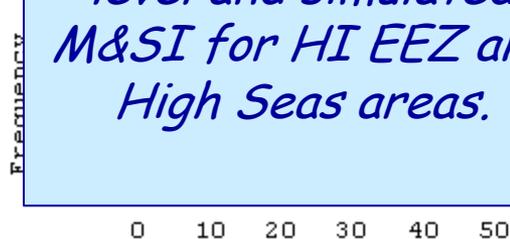
### Output Summary:

*Shows Target M&SI level and simulated M&SI for HI EEZ and High Seas areas.*

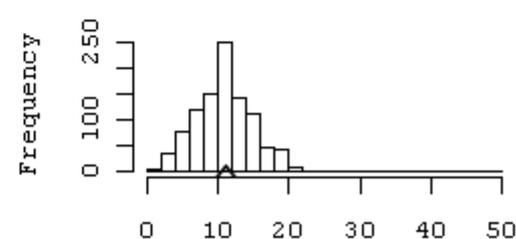
FKW M&SI (Avg=0.2)

FKW M&SI (Avg=7.9)

SS, High Seas



SS&DS, High Seas



FKW M&SI (Avg=11.5)

FKW M&SI (Avg=0)

FKW M&SI (Avg=11.5)

## Not (yet?) included:

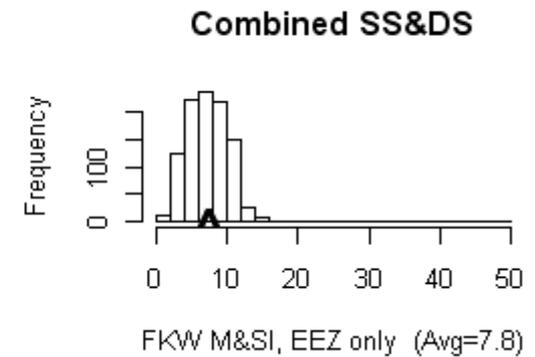
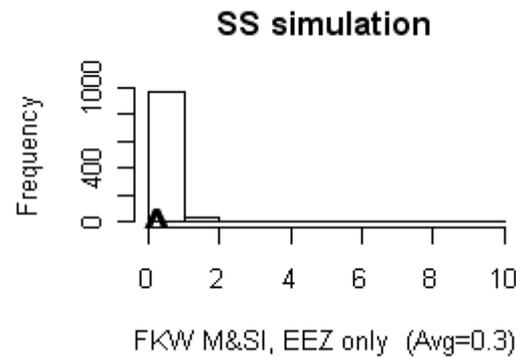
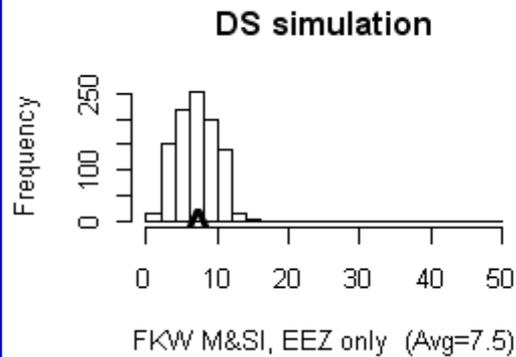
- ◆ Implementation of 'triggers and consequences'

### Different sampling units

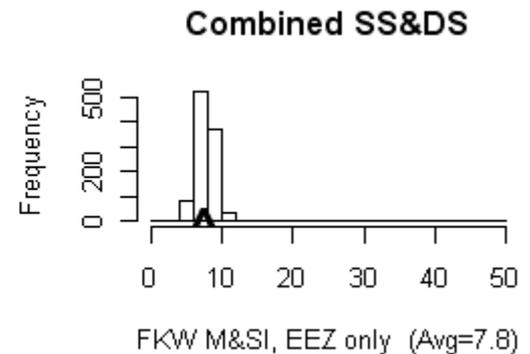
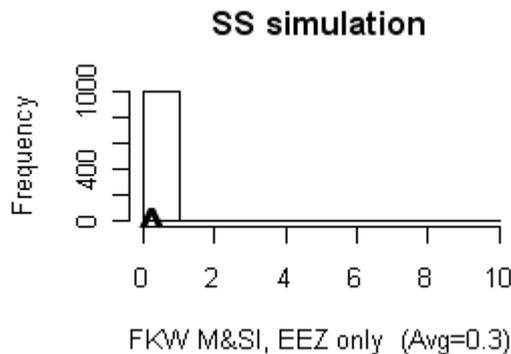
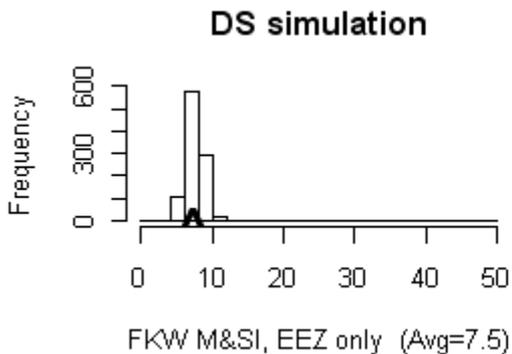
- ◆ Trip-based sampling (tricky to implement geographic constraints)
  - ◆ Sampling of full years to emulate inter-annual variability (limited sample sizes)
  - ◆ Simulating 5 years to estimate 5-yr average takes used for Stock Assessment Reports
- These increase run-time markedly, but are not expected to affect the average M&SI, just the variance.

# Sample output: 1-yr vs. 5-yr simulation

→ Averages are the same, variation differs



**1-yr: Simulations run much faster (<5 min); broader distribution of simulated results**



**5-yr: Simulations take much longer to run (~45 min hr); narrower distribution of simulated results**

Questions?

Suggestions?