

Proposed Mortality Estimates Reflecting the Use of Descending Devices in the Recreational Fishery

Groundfish Management Team

Methodological Overview

Components of Mortality Estimates

- Short-term Mortality
 - 0 - 2 or 4 day – cage studies
 - species specific and proxies for other species – varies by depth
- Long-term Mortality
 - 3-10+ day – acoustic tagging, proxies for other species
 - species specific and proxies for other species = 15%
- Unaccounted for Mortality
 - Account for differences in outcomes between studies and anglers
 - research review in BB Attachment 1 Appendix A
 - 5% for cage studies in 0-50 fm
 - 10% for acoustic studies 50+fm
- Buffers for Management Uncertainty
 - Selected by Council on Upper Confidence Limits

Cumulative Mortality

Multiplicative combination of mortality components

Species	Depth (fm)	Short-Term Mortality	Long-Term Mortality	Additional Unaccounted for Mortality	Cumulative Mortality
Canary	0-10	NA	NA	NA	NA
	10-30	1%	15%	5%	20% ¹
	30-50	17%	15%	5%	33% ¹
	>50	23%	NA	10%	31% ²
Yelloweye	0-10	NA	NA	NA	NA
	10-30	1%	15%	5%	20% ¹
	30-50	3%	15%	5%	22% ¹
	>50	23%	NA	10%	31% ²
Cowcod	0-10	NA	NA	NA	NA
	10-30	22%	15%	5%	37% ¹
	30-50	22%	15%	5%	37% ¹
	>50	23%	NA	10%	31% ²

¹.M = 1 – (1–Short-Term Mortality) x (1–Long-Term Mortality) x (1-Unaccounted for Mortality)

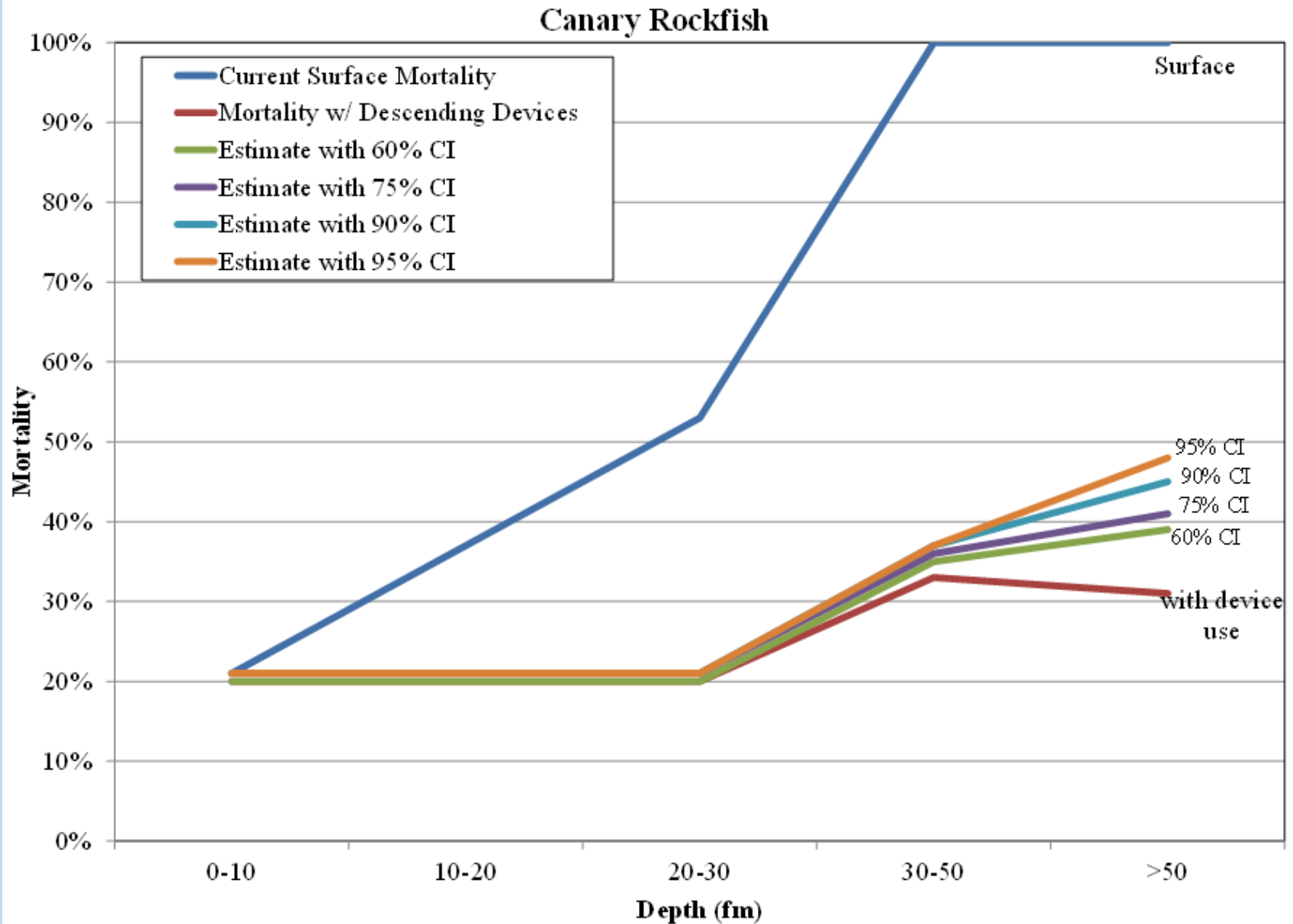
².M = 1 – (1- 0.23 Wegner All RF 10+ Days) x (1-Unaccounted for Mortality))

Buffers based on Upper Confidence Intervals of Mortality Estimates

Selected by the Council to address:

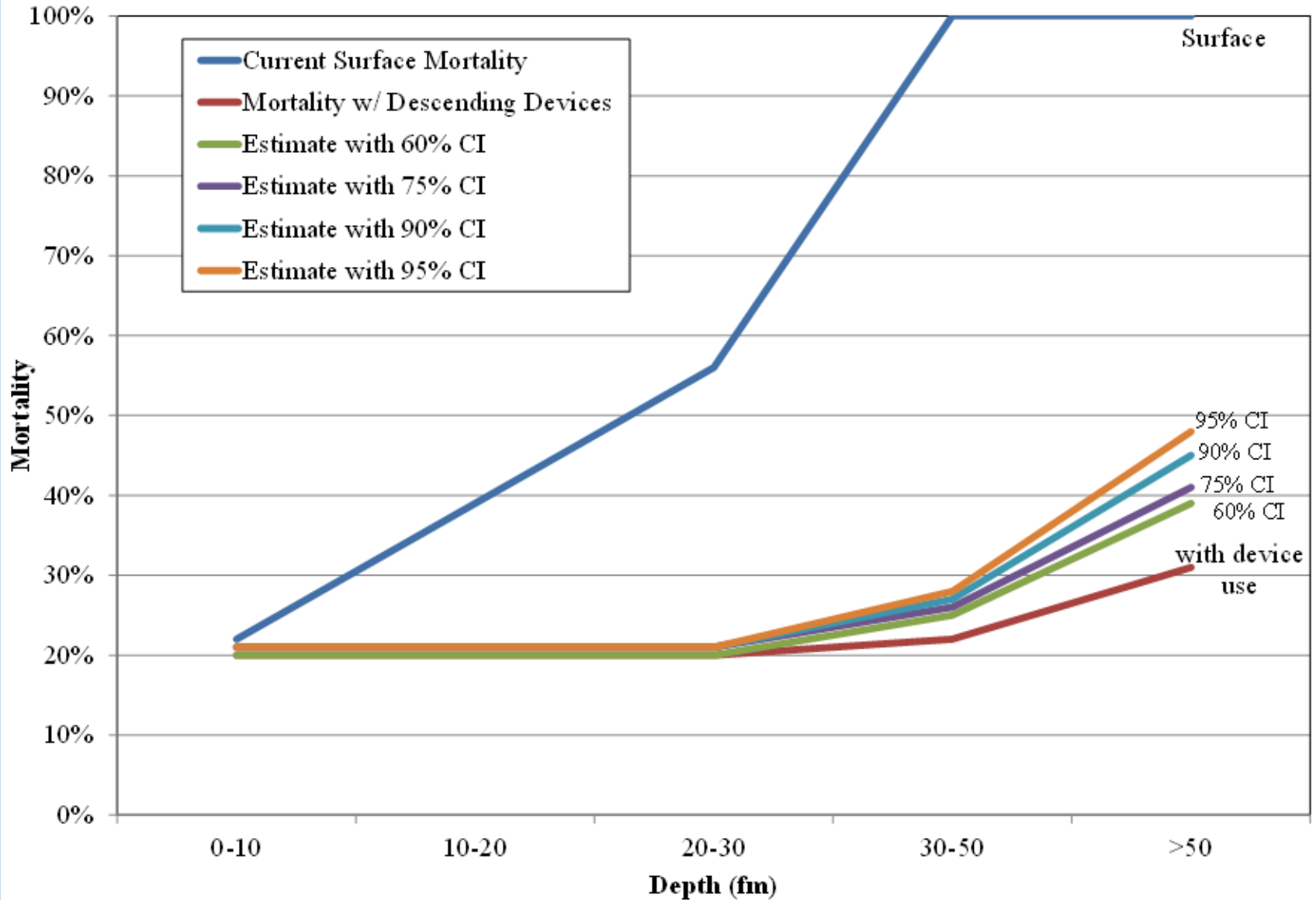
- Management uncertainty
- Risk associated with potential underestimation of mortality
- Comfort with methods employed
- Uncertainty from low sample size in greater than 50 fm

Comparison to Surface Mortality



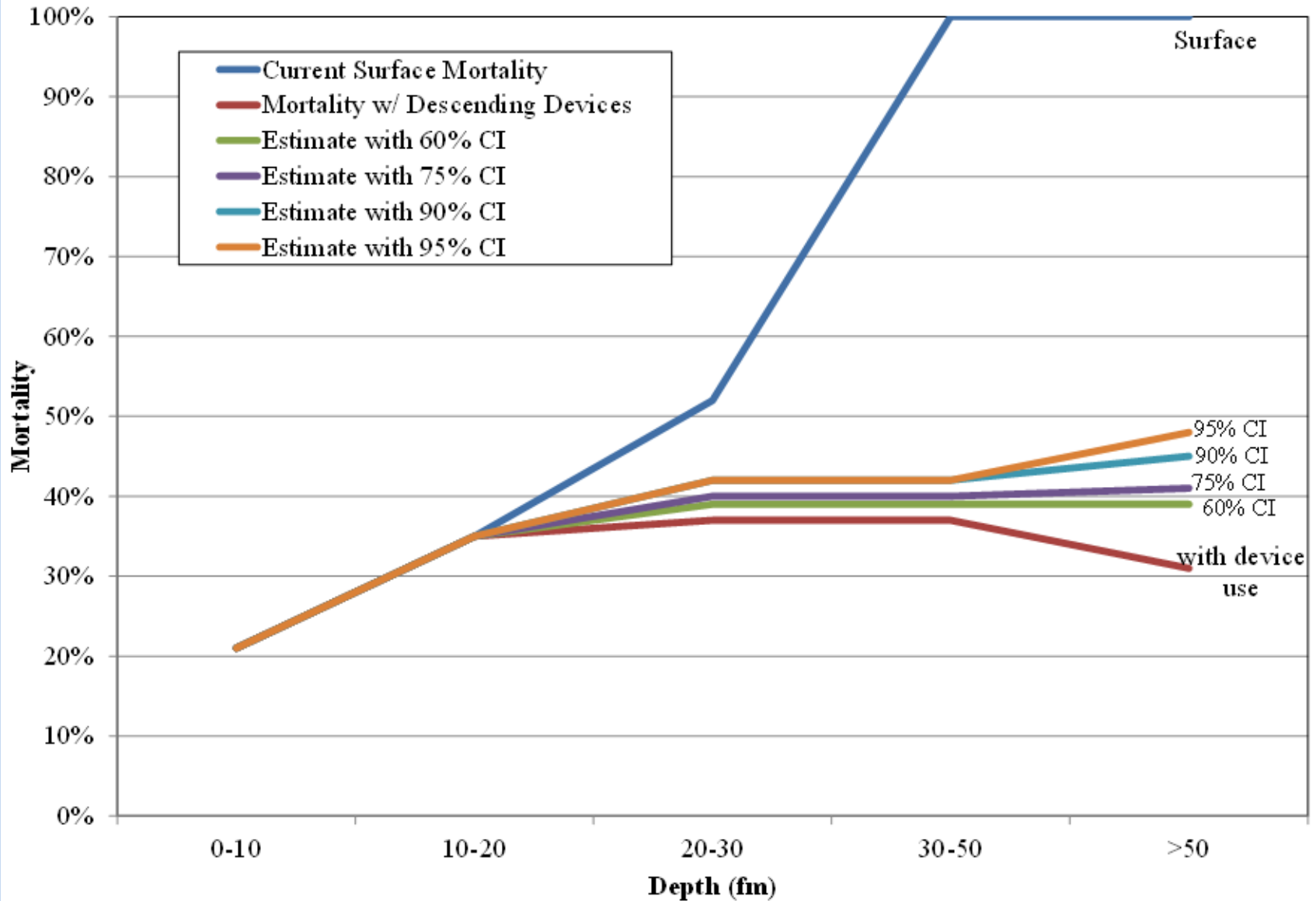
Comparison to Surface Mortality

Yelloweye Rockfish



Comparison to Surface Mortality

Cowcod



Next Steps in Implementation

- Each state has submitted state reports regarding the methods of applying mortality rates
- Apportion catch by proportion of fish released using descending devices and depth then apply mortality estimate
- Sample programs augmented to provide data on frequency of use
- Application retrospectively to 2013 allowing analyses of statistical properties of direct estimation methods, proxies and pooling rules
- Further review of the methods proposed by each state to be conducted by the RecFIN Technical Subcommittee as well as the GMT and SSC as needed

Implications for Rebuilding and Management

Implications for Rebuilding

- Marginal reduction in total mortality estimate relative to the ACL
i.e. Oregon 2011 = <0.58 mt reduction vs 17 mt ACL in 2011

Implications for Management

- Reduction in mortality relative to low harvest guidelines
- Avoid inseason closure and allow longer seasons with tangible economic effects
- Council policy decision regarding how to use the savings

Questions?

Buffers based on Upper Confidence Intervals of Mortality Estimates

Species	Depth (fm)	Current Surface Mortality	Cumulative Mortality w/ Devices	Estimate with 60% CI	Estimate with 75% CI	Estimate with 90% CI	Estimate with 95% CI
Canary Rockfish	0-10	21%	20%	20%	21%	21%	21%
	10-20	37%	20%	20%	21%	21%	21%
	20-30	53%	20%	20%	21%	21%	21%
	30-50	100%	33%	35%	36%	37%	37%
	>50	100%	31%	39%	41%	45%	48%
Yelloweye Rockfish	0-10	22%	20%	20%	21%	21%	21%
	10-20	39%	20%	20%	21%	21%	21%
	20-30	56%	20%	20%	21%	21%	21%
	30-50	100%	22%	25%	26%	27%	28%
	>50	100%	31%	39%	41%	45%	48%
Cowcod	0-10	21%	21%	21%	21%	21%	21%
	10-20	35%	35%	35%	35%	35%	35%
	20-30	52%	37%	39%	40%	42%	42%
	30-50	100%	37%	39%	40%	42%	42%
	>50	100%	31%	39%	41%	45%	48%

Short-Term Mortality

- **Species-specific estimates**
 - **Limited sample size**
 - **Combine Depths**
 - **Proxy Species**
 - **Proxy data <10 fm**
 - **Lower of surface mortality or next deeper bin**

Cowcod

Capture Depth (fm)	Alive	Dead	Total	Mortality (%)
0-50	NA	NA	NA	NA
51-70	11	5	16	31%
70-100	4	0	4	0%
Grand Total	15	5	20	25%

Canary Rockfish

Capture depth (fm)	Alive	Dead	Total	Mortality (%)
0-10	NA	NA	NA	NA
10-20	15	0	15	0%
20-30	30	0	30	0%
30-40	5	1	6	17%
40-50	4	1	5	20%
Grand Total	54	2	56	4%

Yelloweye Rockfish

Capture depth (fm)	Alive	Dead	Total	Mortality (%)
0-10	NA	NA	NA	NA
10-20	5	0	5	0%
20-30	31	0	31	0%
30-40	43	1	44	2%
40-50	18	1	19	5%
Grand Total	97	2	99	2%

Proxy Estimates for Canary

Species	Depth (fm)	Source of Short Term Mortality Data	Reason for Use of Proxy Data	Sample Size	Lived	Died	Mortality
Canary Rockfish	0-10	Surface Release Mortality (PFMC 2009) or 10-30 fm	No data at this depth. Devices likely not needed	NA	NA	NA	NA
	10-30	Canary, yelloweye, copper and quillback rockfish (Hannah et al 2012)	Similar life history and anatomy	119	119	0	0%
	30-50	Bocaccio, flag and vermilion rockfish (Jarvis and Lowe 2008) / yelloweye and canary rockfish (ODFW unpublished data)	Only 11 samples for canary rockfish. Similar life history and anatomy.	256	212	44	17%
	>50	Cowcod, bocaccio, bank, sunset (Wegner et al. in prep)	No observations for subject species. Similar life history and anatomy.	30	23	7	23%

Proxy Estimates for Yelloweye RF

Species	Depth (fm)	Source of Short Term Mortality Data	Reason for Use of Proxy Data	Sample Size	Lived	Died	Mortality
Yelloweye Rockfish	0-10	Surface Release Mortality (PFMC 2009) or 10-30 fm	No data at this depth. Devices likely not needed	NA	NA	NA	NA
	10-30	Canary, yelloweye, copper and quillback rockfish (Hannah et al 2012)	Similar life history and anatomy	119	119	0	0%
	30-50	Yelloweye (Hannah et al. 2012, ODFW, unpublished data)	NA-Sample size sufficient.	63	61	2	3%
	>50	Cowcod, bocaccio, bank, sunset rockfish (Wegner et al. in prep)	No observations for subject species. Similar life history and anatomy.	30	23	7	23%

Proxy Estimates for Cowcod

Species	Depth (fm)	Source of Short Term Mortality Data	Reason for Use of Proxy Data	Sample Size	Lived	Died	Mortality
Cowcod	0-10	Surface Release Mortality (PFMC 2009) or 10-30 fm	No data at this depth. Devices likely not needed	NA	NA	NA	NA
	10-30	Bocaccio, flag and vermilion rockfish 30-50 fm (Jarvis and Lowe 2008)	No observations for subject species. Similar life history and anatomy.	NA	NA	NA	22%
	30-50	Flag, vermilion and bocaccio (Jarvis and Lowe 2008)	No observations for subject species. Similar life history and anatomy.	182	142	40	22%
	>50	Cowcod, bocaccio, bank, sunset rockfish (Wegner et al. in prep)	NA-Limited data available for subject species. Similar life history and anatomy.	30	23	7	23%

Long-Term Mortality

- 15% based on acoustic tagging study by Wegner et al. in prep
- 23 out of 27 fish in the array survived from day 3 to 10+ days
- No additional mortality observed beyond day six for fish remaining in the array
- Uncertainty in fate of the 20 fish that left the array, though behavior was similar prior.
- Appears conservative compared to some barometric chamber studies and 10 day mortality

Unaccounted for Mortality and Uncertainty

- Address negative bias in estimates compared to expected mortality when released by anglers
- Weighed potential sources of positive and negative bias.
- Detailed review in BB report Appendix A
 - 5% for cage studies in 0-50 fm
 - 10% for acoustic studies 50+fm

Data Sources

- **0 - 2 or 4 Day Cage Study Mortality Rates**
 - Hannah et al. 2012
 - Similar ODFW unpublished data
 - Jarvis and Lowe 2008
- **Long-Term Bottom Mortality**
 - Acoustic Tagging Data from Wegner et al. (in prep) presented to the Council in November 2012
- **Unaccounted for mortality**
 - Preponderance of bias and uncertainty between treatment by anglers and results of barotrauma studies informing estimates.
 - See references in BB report

Potential Biases and Sources of Uncertainty

- Addressed by unaccounted for mortality also accounting for potential positive biases.
- Sources evaluated for:
 - Cage studies
 - Acoustic tagging
 - General considerations
 - Water temperature
 - Use failure rates applied to frequency of use

Potential Biases and Sources of Uncertainty

Cage Studies

Data Source	Affected Estimates	Uncertainty	Direction	Measure	Considerations
Cage Studies: Hannah et al. (2012), Jarvis and Lowe (2008)	All Species in <50 fm	Handling Bias	Neutral	Qualitative	Measuring and Tagging = Assumed Angler Treatment
	All Species in <50 fm	Time on Deck Bias	Negative	Data	Likely released using device immediately if at all.
	All Species in <50 fm	Cage Protection Bias	Negative	Data	Predation upon release at depth appears limited.
	All Species in <50 fm	Stress Induced Mortality from Captivity	Positive	Qualitative	Confined fish may be stressed or deprived of food.
	Canary Rockfish 30-50 fm	Jarvis and Lowe Conducted in Southern California	Positive	Qualitative	Temperature difference due to thermocline is typically lower north of Point Conception where canary rockfish are more common

Potential Biases and Sources of Uncertainty

Acoustic Tagging Studies

Data Source	Affected Estimates	Uncertainty	Direction	Measure	Considerations
Acoustic Tagging: Wegner et al. (in prep)	All Species >50 fm	Mortality Inside vs. Outside Array	Neutral	Qualitative	Behavior same as others before departing array
	All Species >50 fm	Mortality at 10 days = 4 month	Neutral	Data	No mortality in array beyond 6 days up to 4 months.
	Canary and Yelloweye >50 fm	Data collected in Southern California	Positive	Qualitative	Temperature difference due to thermocline is typically higher than north of Point Conception
	All Species >50 fm	Estimate Includes Less Robust Species	Positive	Data	Bank rockfish was included in estimate despite higher mortality rate than expected.
	Long-term Mortality All Species <50 fm	Depth of Estimate Greater than Depth Applied	Positive	Data	Rates were developed using data from greater than 70 fm, but is applied to shallower depths where mortality may be lower.

Potential Biases and Sources of Uncertainty

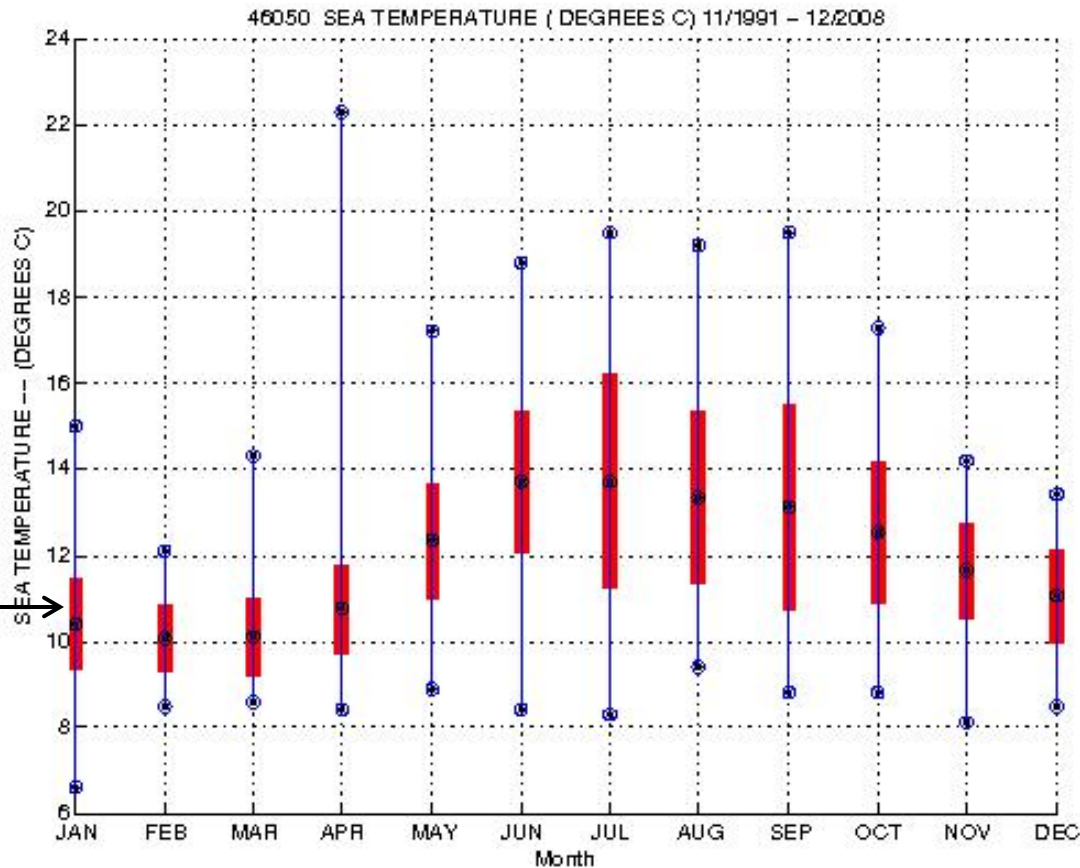
General Considerations

Data Source	Affected Estimates	Uncertainty	Direction	Measure	Considerations
General	All Species <50 fm	Overlap in Mortality between Estimates	Positive	Data	Overlap in time for 0-50 fm short-term and long-term mortality rates for days 3 and 4 included in both studies.
	All Species All Depths	Repeated Capture Bias	Negative	Qualitative	Depends marginal increase rates and probability of multiple encounters
	All Except Yelloweye 30-50 fm, Cowcod >50 fm	Use of Proxy Species	Neutral	Data	Appropriate species were selected as proxies, minimizing potential biases, which could be positive or negative.

- Use failure rates will be considered for application to frequency of use in applying mortality rates
- Water temperature at the time of the study vs. fishing

Hannah et al. (2012)

May – November, Average September, 2009-2012

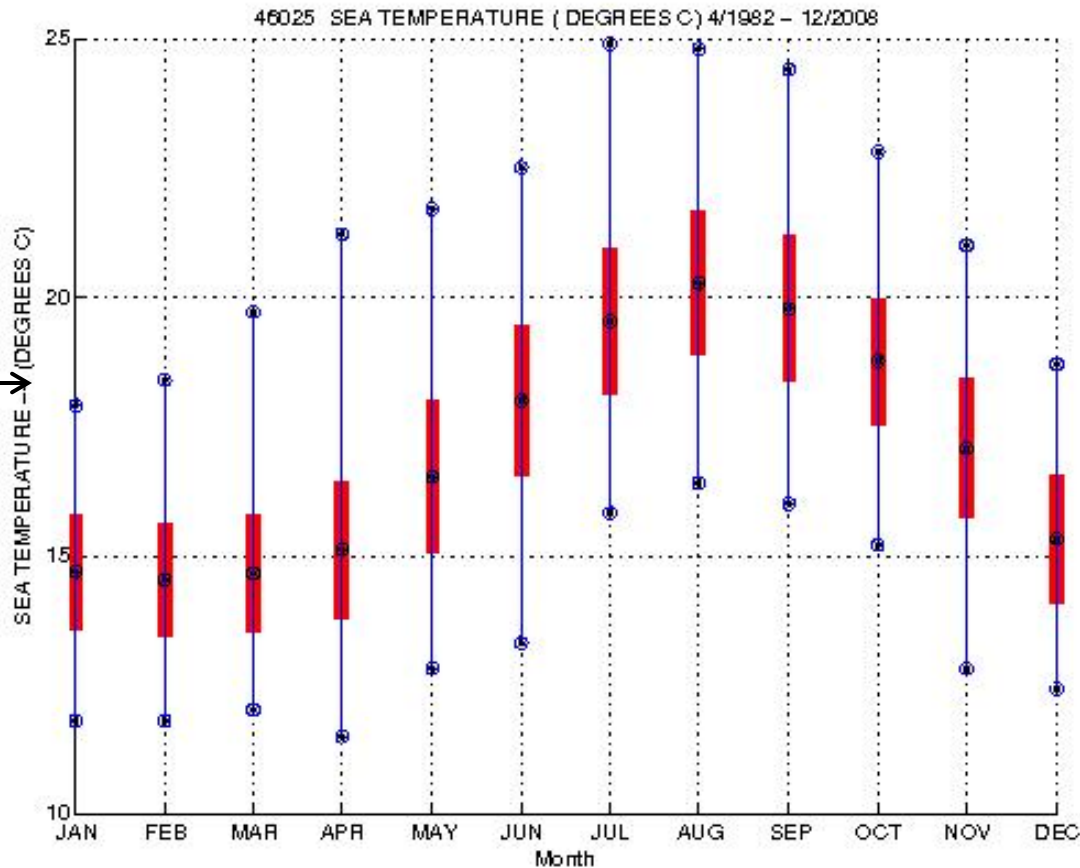


Mean Temp
= 11.9 C

STONEWALL BANK - 20NM West of Newport, OR

Jarvis and Lowe (2008)

Summer 2005 and 2006

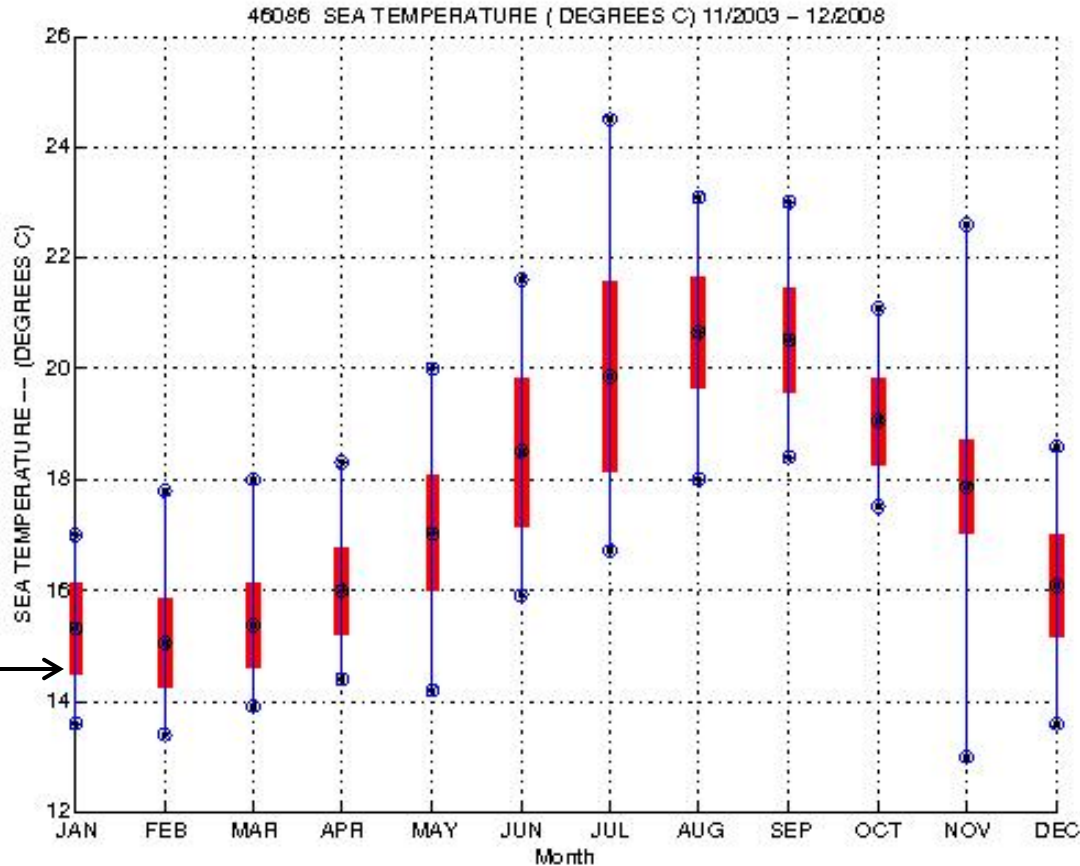


Mean Temp
= 17.9 C
Min = 11.6
Max = 26.1

Santa Monica Basin - 33NM WSW of Santa Monica, CA

Wegner et al. (in prep)

March 2012



Mean Temp
= 14.7 C
Min = 13.8
Max = 16.1

SAN CLEMENTE BASIN - 27NM SE OF San Clemente Is, CA

Total Mortality Estimates

- Total mortality estimates reflecting the 60%, 75%, 90% and 95% CI
- Includes upper CI short-term, long-term and unaccounted for mortality

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Methods of Applying Mortality Estimates in Catch Accounting

- General Method
 - Apportion catch to depth with proportion of catch by depth
 - Apply corresponding mortality estimates in each depth bin
- Current Management Measures Limit Sample Size
 - Current management measures minimize encounters limiting sample size for estimating frequency of use
- Solutions
 - Pooling across time or area
 - Proxies based on
 - other species
 - trip level use estimates