

Altamont Pass Fatality Monitoring QAQC 2010 Interim Report

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Overview

- Introduction
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- Discussion and Conclusions
- Recommendations

Table 1. Types of Searches Conducted in the APWRA QAQC Study

Search Type	Definition	Search Order
Clearing search	A search at turbines that have not been surveyed in more than 90 days, and which might include placed or naturally found bird fatalities left for detection by subsequent searches	0
Incidental discovery	A detection outside of the standard search procedure	0
Wildlife Response and Reporting System	A detection by owner/operators of turbines	0
Pre-search	A search by a supervisor prior to a primary search which may leave placed or naturally found bird fatalities	1
Primary search	A standard search	2
Secondary search	A standard search that follows a primary search within the standard 35-day rotation	3
Post-search	A search by the field supervisor or assistant after a primary or secondary search	4
Fatality check	An examination of a known fatality by the field supervisor or assistant	4

Table 2. Criteria Used to Include or Exclude Records for Evaluating QAQC Results

Status ID	Included in Detection Probability Analyses	Description
0	N/A	Not reviewed
1	Yes	Valid turbine-related fatality
2	No	Fatality cannot be assigned to an animal group or size
3	No	Does not have an associated turbine ID
4	No	Is not within 125 m of the turbine
5	Yes	Cause of death is not turbine-related
6	Yes	Is >90 days dead, aged, or unknown
7	Yes	Incidental or WRRS find except golden eagles
8	No	Injured fatality except golden eagles
9	No	Fatality without a valid search (search ID) or valid detection
10	Yes	Offsite fatality used for placement only
11	Yes	Placed

Table 3. Types of Search Sequences Used in the Analyses of Detection Probability

Search Sequence Type	Search Sequence Type Description
Primary only ^a	Includes only a primary search
Not a valid sequence ^a	Missed a primary search or primary search interval
Primary and secondary	Includes a primary and secondary search
Primary and post-	Includes a primary and post-search
Pre-, primary, and post-	Includes a pre- (or clearing), primary, and a post-search
Primary, secondary, and post-	Includes a primary search, secondary, and post-search
Pre-, primary, and secondary	Includes a pre- (or clearing) search, primary, and secondary search
Pre-, primary, secondary, and post-	Includes a pre- (or clearing) search, primary, secondary, and post-search
Primary and multiple secondaries	Includes a primary search and multiple secondary searches
^a Not used in the QAQC analysis.	

Table 4. Sample Size, Number of Events, and Intervals between Events

Search Sequence Types	Number of Sequences	Average Number of Events in Sequence	Average Interval Between Events	Average of Total Sequence Interval	Average of Interval to Next Primary
Not used for QAQC					
Not a valid sequence	21	1.3	1.0	2.4	2.4
Primary only	1,094	1.0	0.0	0.0	26.8
With pre-searches					
Pre-, primary, and post-	2	3.0	3.8	11.5	46.5
Pre-, primary, and secondary	10	3.0	8.9	26.6	35.9
Pre-, primary, secondary, and post-	63	4.0	3.4	13.6	41.0
Pre- and primary	33	2.0	7.0	13.9	15.2
Total with pre-searches	108				
Without pre-searches					
Primary and multiple secondaries	9	6.4	1.4	8.4	30.8
Primary and post-	11	2.0	3.1	6.2	26.1
Primary and secondary	79	2.0	4.0	8.0	38.6
Primary, secondary, and post-	45	3.0	4.2	12.5	35.1
Total without pre-searches	144				
Grand Total	1,367	1.4	0.8	2.2	27.9

Key Terms

- **Searcher efficiency:** the probability of a searcher detecting a carcass given that it is present and available for detection.
- **Simple detection probability:** the probability of detecting a fatality across an interval, or the probability a single fatality would remain and be detected.
- **Cumulative detection probability:** the detection probability for an interval, which incorporates all sources of error. Essentially equivalent to the adjustment factor and analogous to the cumulative probability of a carcass remaining multiplied by searcher efficiency for a given bird group or size class.
- **Aggregate detection probability:** either simple or cumulative detection probability or the combination of searcher efficiency and cumulative percent of carcasses remaining from a carcass removal trial.

Estimating Searcher Efficiency

- Number Detected/Number Available
- Regression (simple and nominal logistic) against interval

Estimating Simple Detection Probability

- Kaplan-Meier survival analysis
- Lognormal regression of interval versus percent detected

Cumulative Detection Probability

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$$R_{agc} = \frac{\sum_{i=1}^{I-1} R_{agi}}{I \times 100}$$

where R_{ag} is the aggregate probability of detecting a fatality for the i th day between detection and the subsequent search

Table 5. Fatality Detections and Placed Carcasses Included in the Analyses of Detection Probability by Size Class

Detection Status	Size			Grand Total
	Large	Medium	Small	
Valid detection	325 (40%)	207 (25%)	281 (35%)	813 (94%)
Placed bird	26 (49%)	5 (9%)	22 (42%)	53 (6%)
Grand total	351 (41%)	212 (24%)	303 (35%)	866

Table 7. Number of Detections by Search Type and Size Class for Sequences Used in the QAQC Analysis

Search Type	Search Sub-Type	Small	Medium	Large
Pre-	Clearing	13	10	29
	Pre-search	25	5	28
Primary	QAQC primary	45	33	53
	Primary only	120	103	112
Secondary		33	22	51
Post-	Post-search	37	19	29
	Fatality check	11	2	10

Table 8. Number of Detections Placed and Found by Bird Group and Search Type for Placed Birds

	Large Non-raptors	Large Raptors	Medium Raptors	Medium Non-raptors	Small Non-Raptors	Native Small Raptors	Nonnative Medium Non-Raptors	Nonnative Small Non-Raptors
Placed during pre-search	6	20	0	2	11	10	3	2
Primary search	3	13	0	2	4	10	3	0
Secondary search	2	20	0	1	2	5	4	0
Post-search	2	13	0	1	8	3	2	0

Table 9. Searcher Efficiency Estimates by Bird Size Based on Fatalities Available for Detection

Found by		Small					Medium ^a			Large ^a		
		n	Percent	Std Dev	R ² with interval	P	n	Percent	Std Dev	n	Percent	Std Dev
Primary	Placed	15	.40	.51	0.04	0.53						
	Not placed	7	.57	.53	0.35	0.16						
	Both	22	.50	.51	0.10	0.17						
Secondary	Placed	13	.39	.51	0.15	0.19						
	Not placed	14	.40	.51	0.01	0.69						
	Both	27	.41	.50	0.02	0.46						
Primary or secondary		47	.57	.51								
Primary and secondary		14	.14	.36								

^a Results will be included in the next draft.

Figure 2. Nominal Logistic Regression between Search Interval Length and Searcher Efficiency for Detected and Placed Small Birds

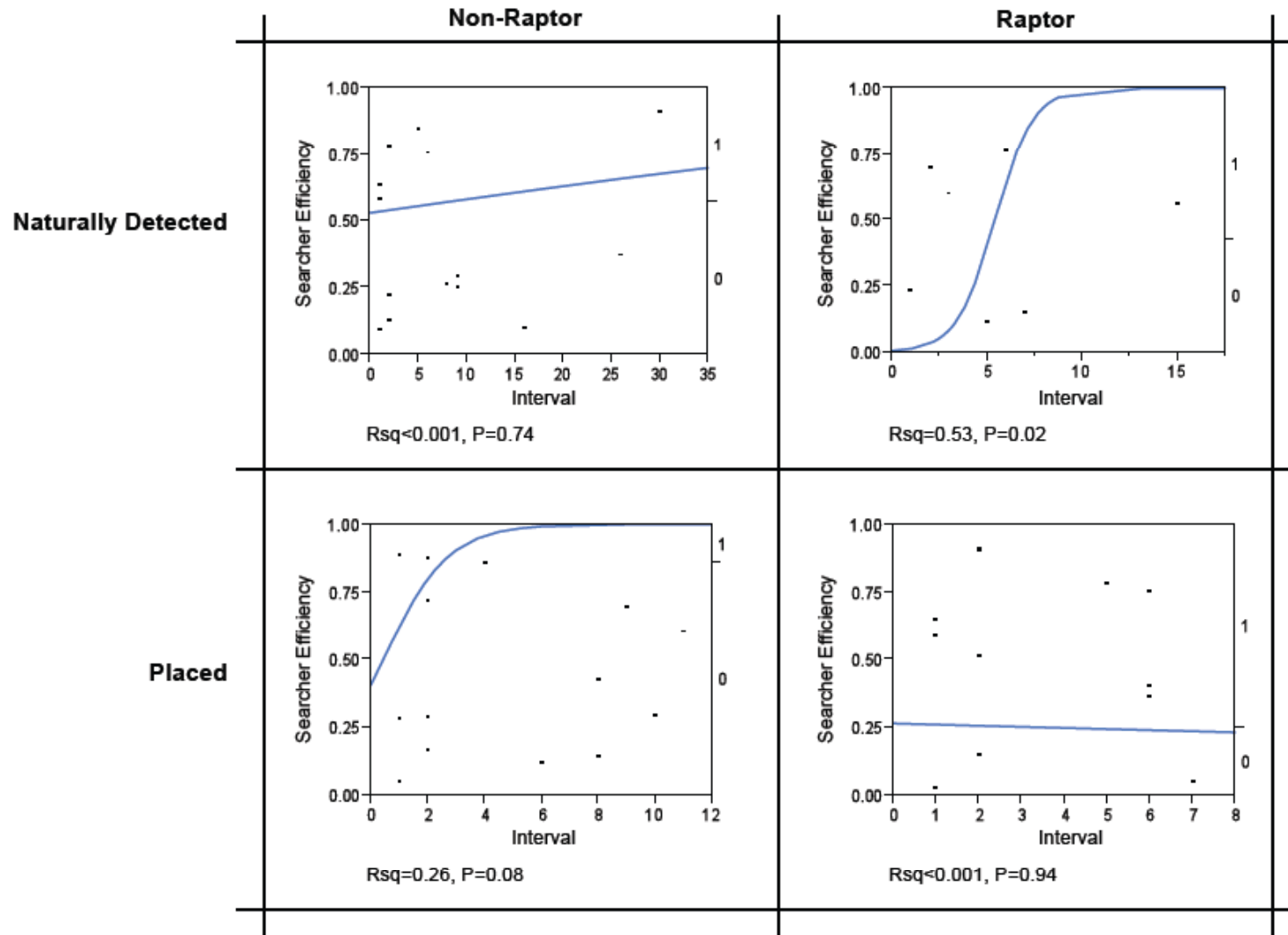


Figure 3. Small Raptor Simple Aggregate Detection Probabilities

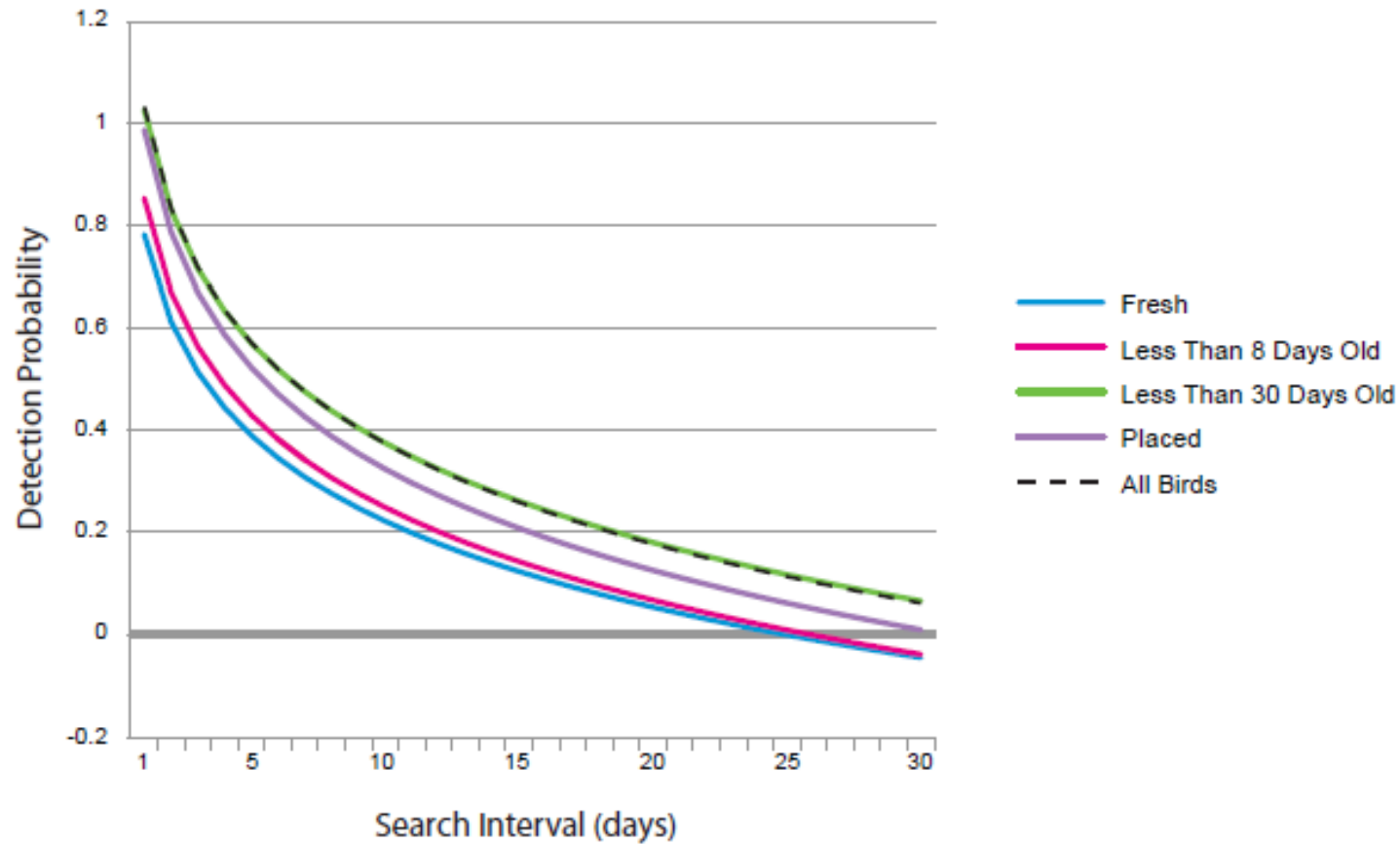


Figure 4. Small Raptor Cumulative Detection Probabilities by Sample

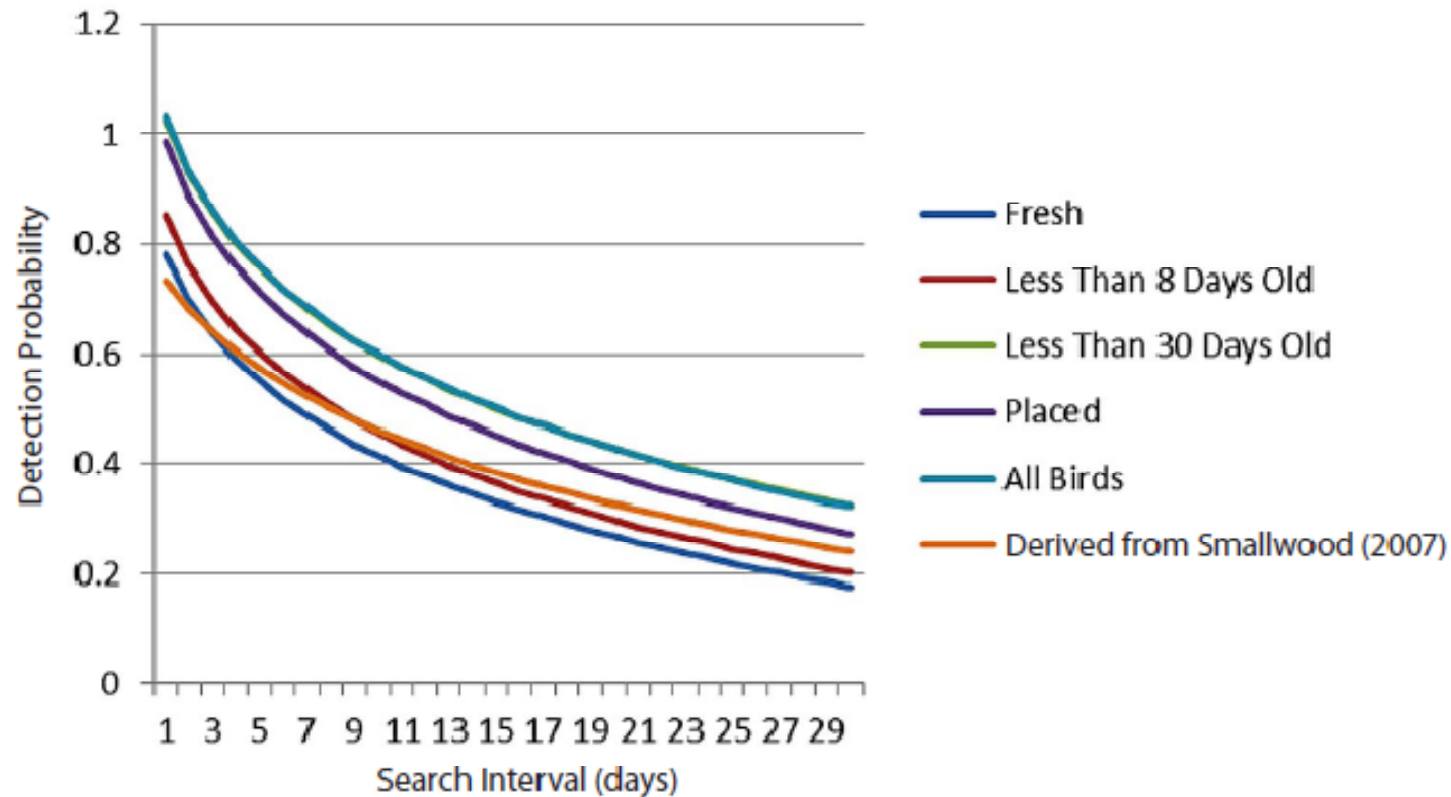
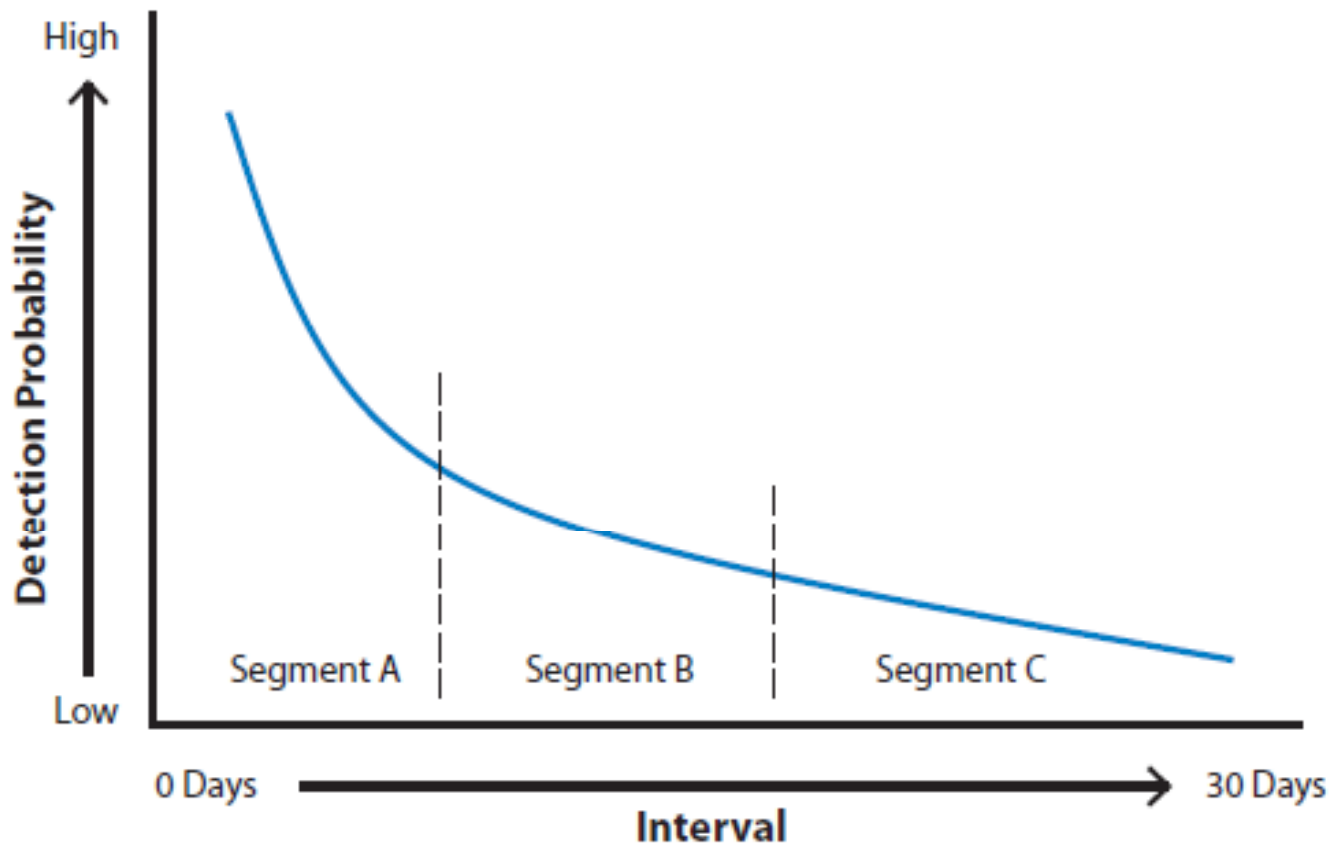


Table 11. Adjusted Fatality Estimates across Various Experimental Intervals Using Multiple Models and the Number of Initial (I), Primary (P), and Secondary (S) Detections and Their Corresponding Search Intervals

Initial Detection Type	Bird Group	Searches In Sequences			First Detections				Initial to Secondary Interval in Days		Adjusted Estimates from Secondary Detections					
		I	P	S	I	P	I+P	S	Mean	Std Dev	Smallwood	Placed	Fresh	< 7	< 30	All
Placed	Raptors	9	9	9	9		9	4	8.2	9.6	8.0	10.3	14.5	13.0	9.1	9.1
	Non-Raptors	8	8	8	8		8	1	6.8	3.4						
Fresh	Raptors	2	2	2	1	1	2	0	2	1.4						
	Non-Raptors	3	5	5	3	2	5	2	6.4	5.0						
Less than 8 days	Raptors	3	3	3	1	2	3	0	3.7	3.1						
	Non-Raptors	3	6	6	3	3	6	2	9.5	8.8						
Less than 30 days	Raptors	10	10	10	8	2	10	3	8.1	9.0	6.0	7.7	10.9	9.8	6.8	6.8
	Non-Raptors	8	11	11	7	4	11	4	7.6	7.0						
All records searched by the secondary	Raptors	14	16	16	11	5	16	6	7.3	7.6	11.5	14.1	19.4	17.5	12.6	12.6
	Non-Raptors	17	27	27	15	12	28	6	11.8	9.9						
All double-samples	Raptors		27	27			27	8	16.8	12.4	21.5	42.2	74.3	63.7	32.9	33.2
											CDP	18.4	25.4	22.9	16.5	16.5
	Non-Raptors		89	89			89	9	24.1	13.5						

The “three curve” theory for long intervals



Conclusions

- Searcher Efficiency
 - (even) More variable than expected
 - Possibly lower than predicted for small birds
 - Unreliable
 - Not independent from “removal rates”
- Detection Probabilities
 - Possibly lower for short intervals than previously predicted
 - Followed expected patterns
 - Predictable from “fresh fatalities”
 - Predictable in a mixed-age simple curve
 - Still under-estimated, but not for long...

Recommendations

- Complete the current bird year QAQC program as planned, and leave all fatalities in the field in all cases to allow for subsequent detection by primary searches.
- Focus QAQC efforts on longer intervals for the remainder of the year to help in the evaluation of the later portion of the CDP-interval relationship.
- Incorporate incidental and WRRS fatalities into the searcher efficiency and CDP estimates.
- Continue with placed fatalities, and focus placements towards the beginning of longer sequences.
- Evaluate the statistical power of the current level of the QAQC design, and conduct a power analysis to determine the level of effort needed to produce CDP estimates.
- Evaluate the statistical gains and losses of decreasing the overall sample size and decreasing the search interval to 2 weeks for long-term monitoring.
- Evaluate the financial costs and statistical benefits of incorporating dog searches into the design to minimize searcher bias and variability in searcher efficiency.