Sea Otter Decoy Aerial Count Study

Aerial survey data is affected by different viewing conditions such as flight speed, height, corridor width, sea conditions, cloud cover, and other factors. This presentation covers findings from the analysis of sea otter decoy survey data with wind velocity, cloud cover, corridor width, and viewer elevation as variables. It also presents a model that generates a distribution (with associated confidence limits) of possible decoy population size estimates for the various viewing conditions encountered.

Sea Otter Decoy Aerial Count Study:

Using surveys of sea otter decoys to help interpret range widesurveys of real sea otters

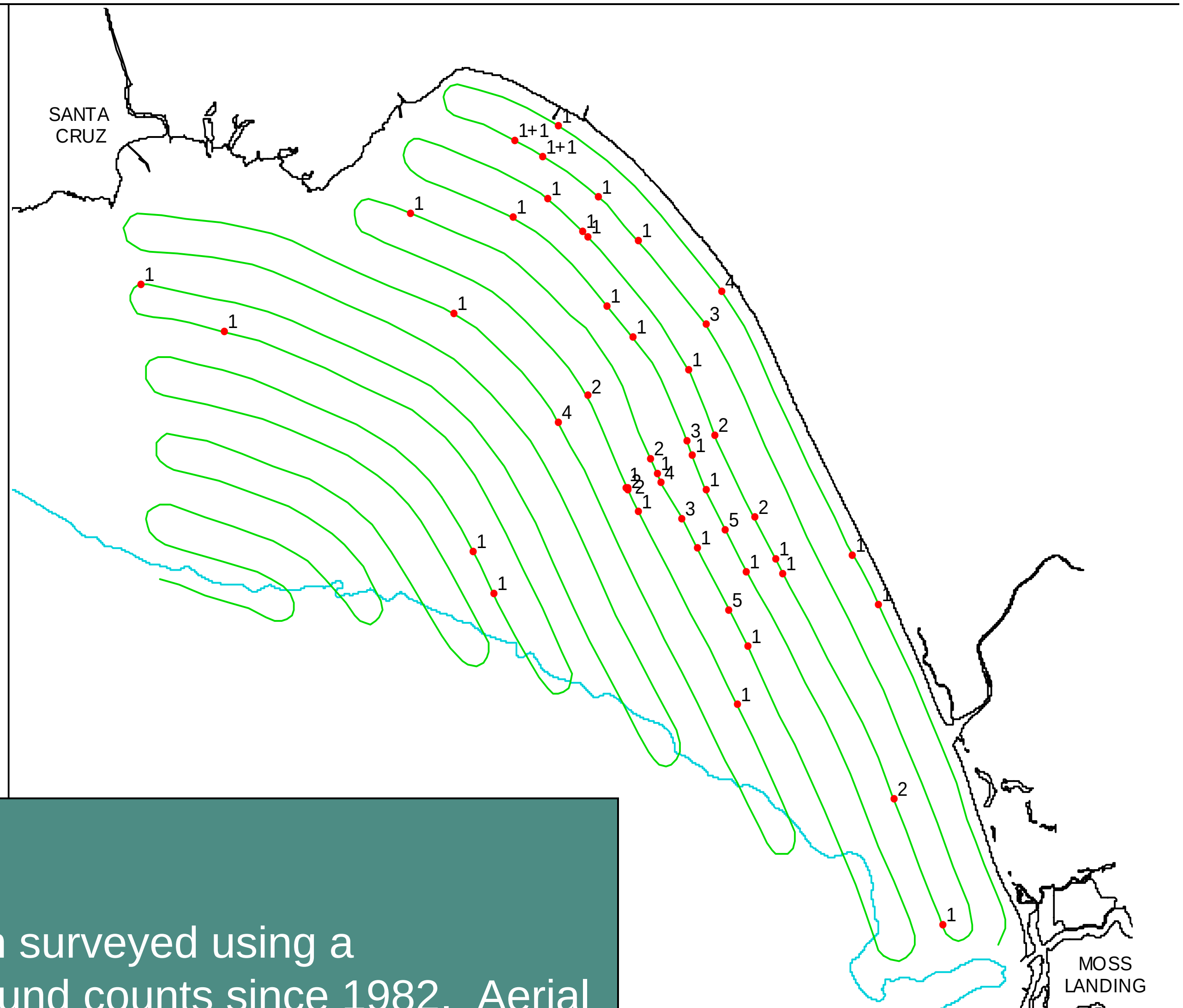
R. Glenn Ford
Jack A. Ames
Michael D. Harris
Wendy A. Williams

SEA OTTER AERIAL COUNTS — NORTH MONTEREY BAY

04 NOV 2003
1151hrs - 1318hrs

TOTAL COUNT = 77 + 2 = 79

CONDITIONS:
OVERALL: F+ (4.55)
RANGE: G(7) to F-(3)



Sea Otter Range Surveys

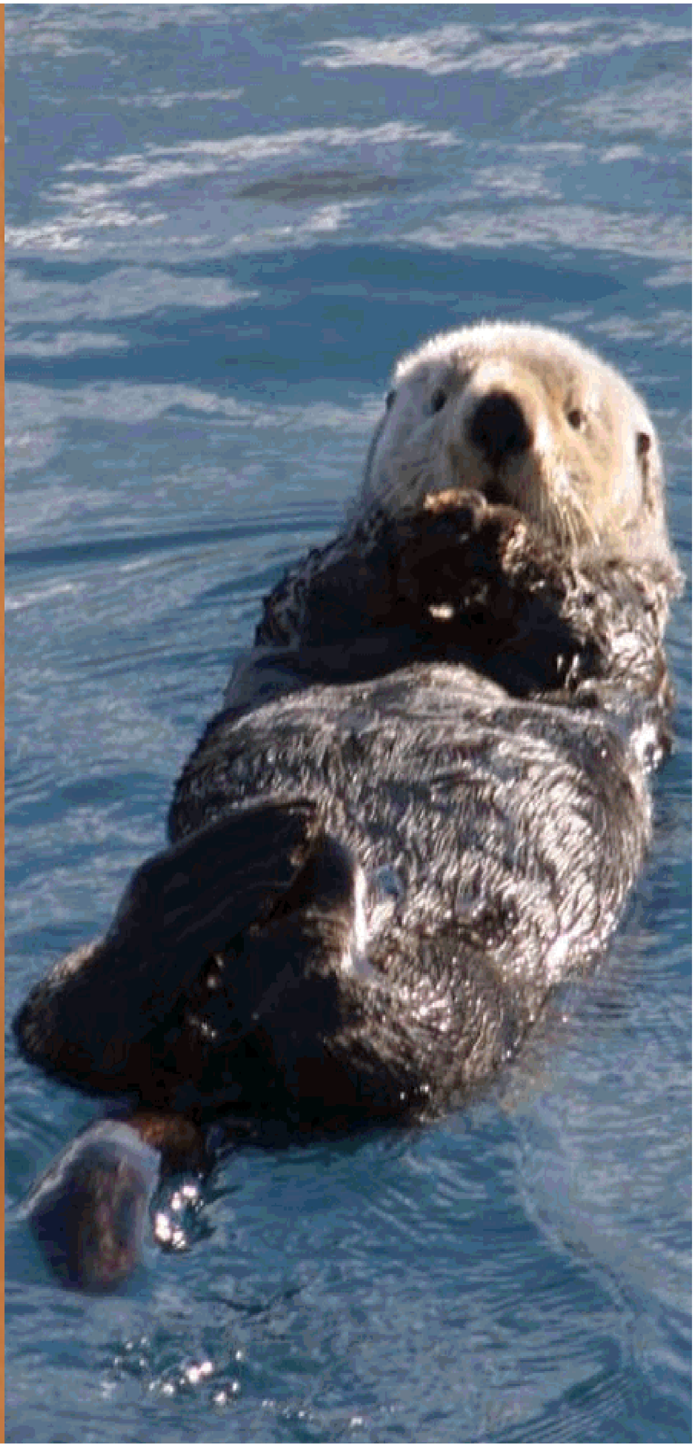
The sea otter range has been surveyed using a combination of aerial and ground counts since 1982. Aerial counts are the only effective way to census otters beyond about 900m from shore. Recognizing that some otters will inevitably be missed, aerial counts represent a minimum estimate of the population size.

Sea Otter Decoys

It's difficult to determine how effective observers are in locating sea otters from an aircraft since you never actually *know* how many were sighted and how many were missed.

A way to approach this problem is to set decoys in known locations, and to survey the area using methods similar to those used during regular surveys.

Comparing observer sighting records with known locations allowed us to characterize the efficiency of observers.



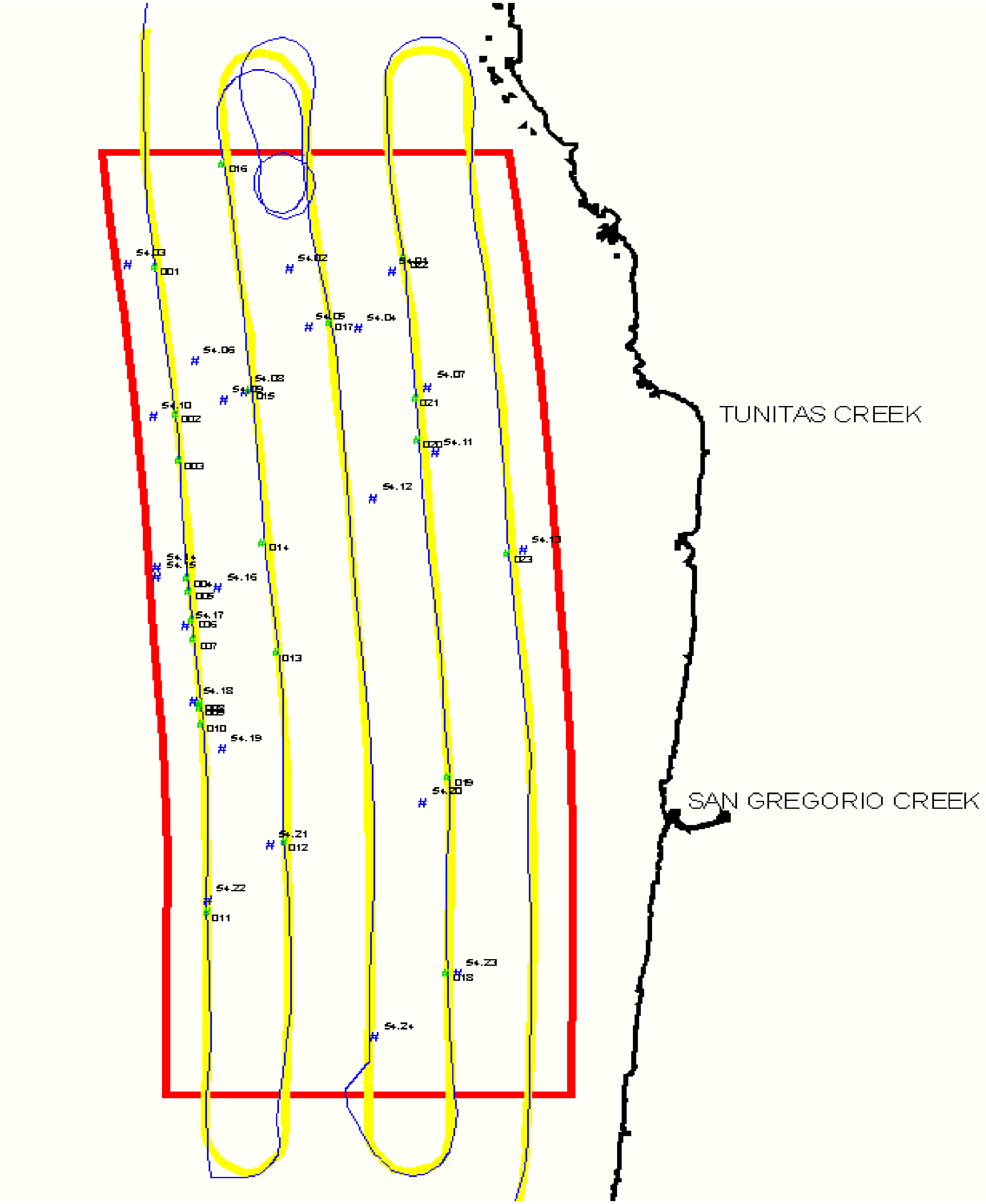
Typical Decoy Setup

Red box indicates study area, about 14km x 4 km. Survey lines are spaced about 800m apart.

Decoy groups (indicated by the blue # symbol) were distributed uniform random across the study area.

The planned trackline shows as a yellow line, actual trackline as the narrow blue line

Green # symbols along the trackline indicate where observers recorded otter sightings.



Objectives (1)

To characterize the relationship between the proportion of sea otter decoys detected, missed, or falsely identified, and the factors affecting observer efficiency. Important factors include:

- Viewing condition
- Observer
- Location
- Aircraft altitude

Objectives (2)

- To use the decoy study results to help interpret the rangewide surveys
- To provide guidance regarding alternative survey methodologies that might be used in the future


Clear
Overcast
Foggy
Viewing conditions are highly variable, but they are the most important factor determining how successful observers are in locating otters or otter decoys...

VIEWING CONDITIONS WITH MOSTLY SUNNY TO SUNNY SKY

CODE	**BEAUFORT**	**WIND**	**DESCRIPTIONS**
good+ (8)	0	<1	calm
good (7)	1	1 to 3	ripples
good- (6)	2	4 to 6	sm wavelets, crests of glassy appearance, not breaking
fair+ (5)	2	4 to 6	sm wavelets, crests of glassy appearance, not breaking
fair (4)	3	7 to 10	lg wavelets, crests begin to break, scattered white caps
fair- (3)	3	7 to 10	lg wavelets, crests begin to break, scattered white caps
poor+ (2)	4	11 to 16	sm waves (0.5 to 1.25m), numerous white caps
Poor (1)	5	17 to 21	mod waves (1.25 to 2.5 m), many white caps, some spray

VIEWING CONDITIONS WITH BRIGHT OVERCAST

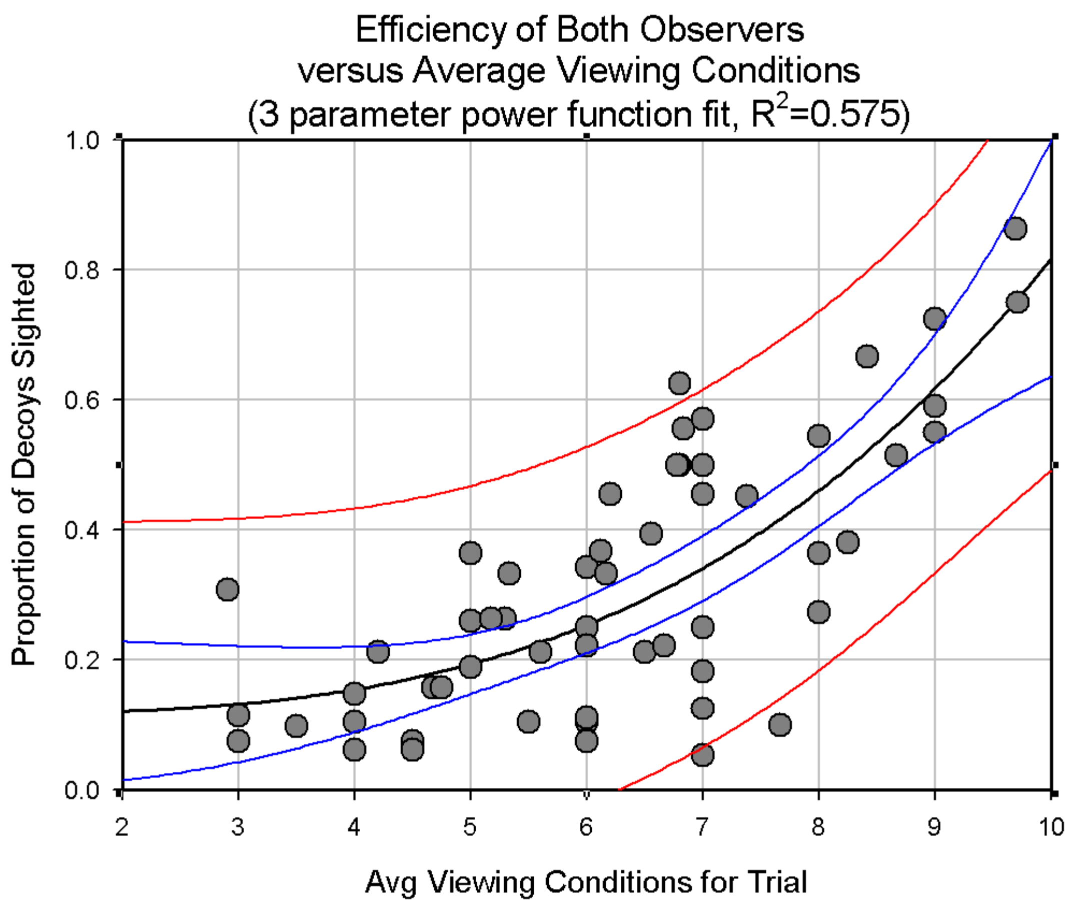
CODE	**BEAUFORT**	**WIND**	**DESCRIPTIONS**
excellent (10)	0	<1	calm
excellent- (9)	1	1 to 3	ripples
good+ (8)	2	4 to 6	sm wavelets, crests of glassy appearance, not breaking
good (7)	2	4 to 6	sm wavelets, crests of glassy appearance, not breaking
good- (6)	3	7 to 10	lg wavelets, crests begin to break, scattered white caps
fair+ (5)	3	7 to 10	lg wavelets, crests begin to break, scattered white caps
fair (4)	4	11 to 16	sm waves (0.5 to 1.25m), numerous white caps
fair- (3)	4	11 to 16	sm waves (0.5 to 1.25m), numerous white caps
poor+ (2)	5	17 to 21	mod waves (1.25 to 2.5 m), many white caps, some spray
poor (1)	6	22 to 27	lg waves (2.5 to 4 m), white caps everywhere, spray

Observer Efficiency and Viewing Conditions

The most important factor determining the number of decoys sighted is the viewing condition.

The relationship between the proportion of decoys sighted and viewing conditions is curvilinear, and efficiency increases rapidly as conditions approach optimal.

Viewing conditions seeem to be a less accurate predictor of observer efficiency under fair and good conditions (5-8) than under poor (1-4) or excellent (9-10) conditions.



Viewing Condition Codes

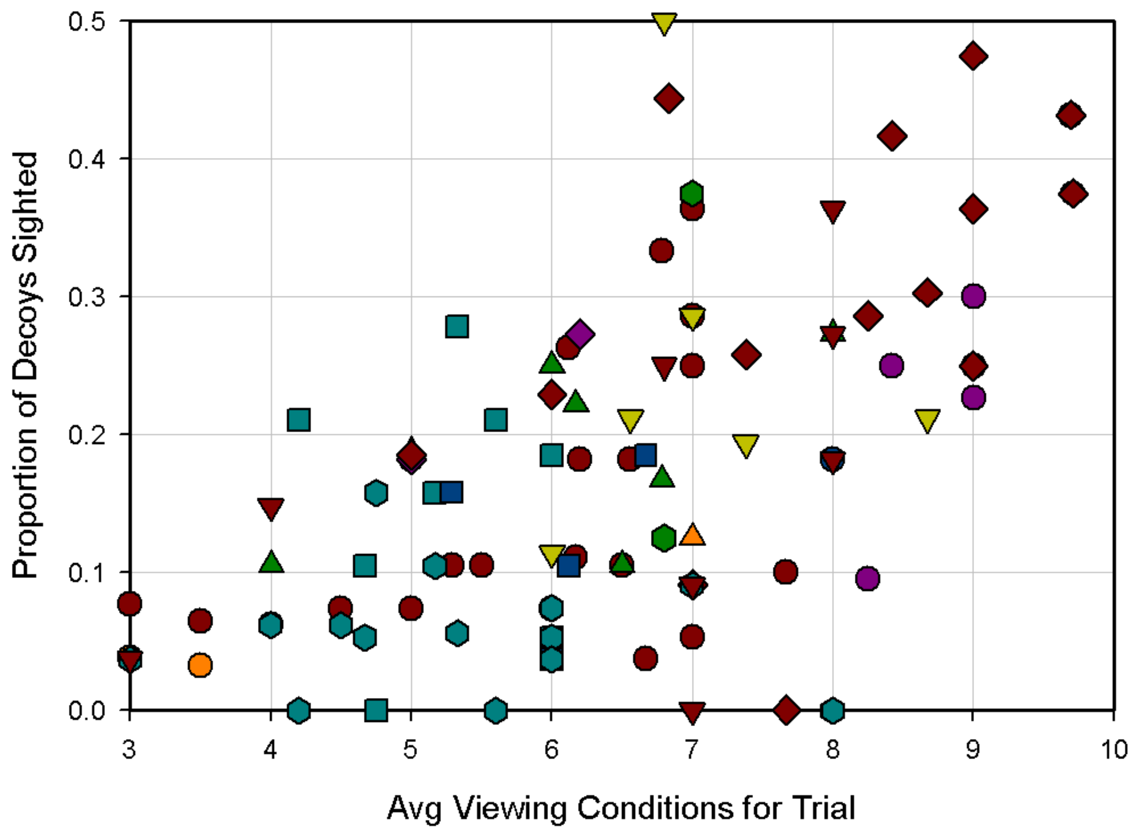
The viewing codes used here are based on the observers assessment of conditions, taking into account sun state and wind speed. Using a 3 parameter power function model, these viewing codes can account for 57.5% of the variation in the proportion of decoys sighted.

We tested a similar but non-subjective method of characterizing viewing conditions using environmental parameters. A regression model using Beaufort as a continuous variable and Clear/Overcast as a binary variable can account for 55.1% of the variation in proportion of decoys sighted.

Observer Effect

Observers can vary widely in terms of their efficiency, but all observers showed wide variation. This plot is based on the number of sightings per observer per trial divided by the number of decoys deployed for that trial. On any given trial, more or less than half the decoys may have been accessible to one observer, but the expected proportion would be 50%.

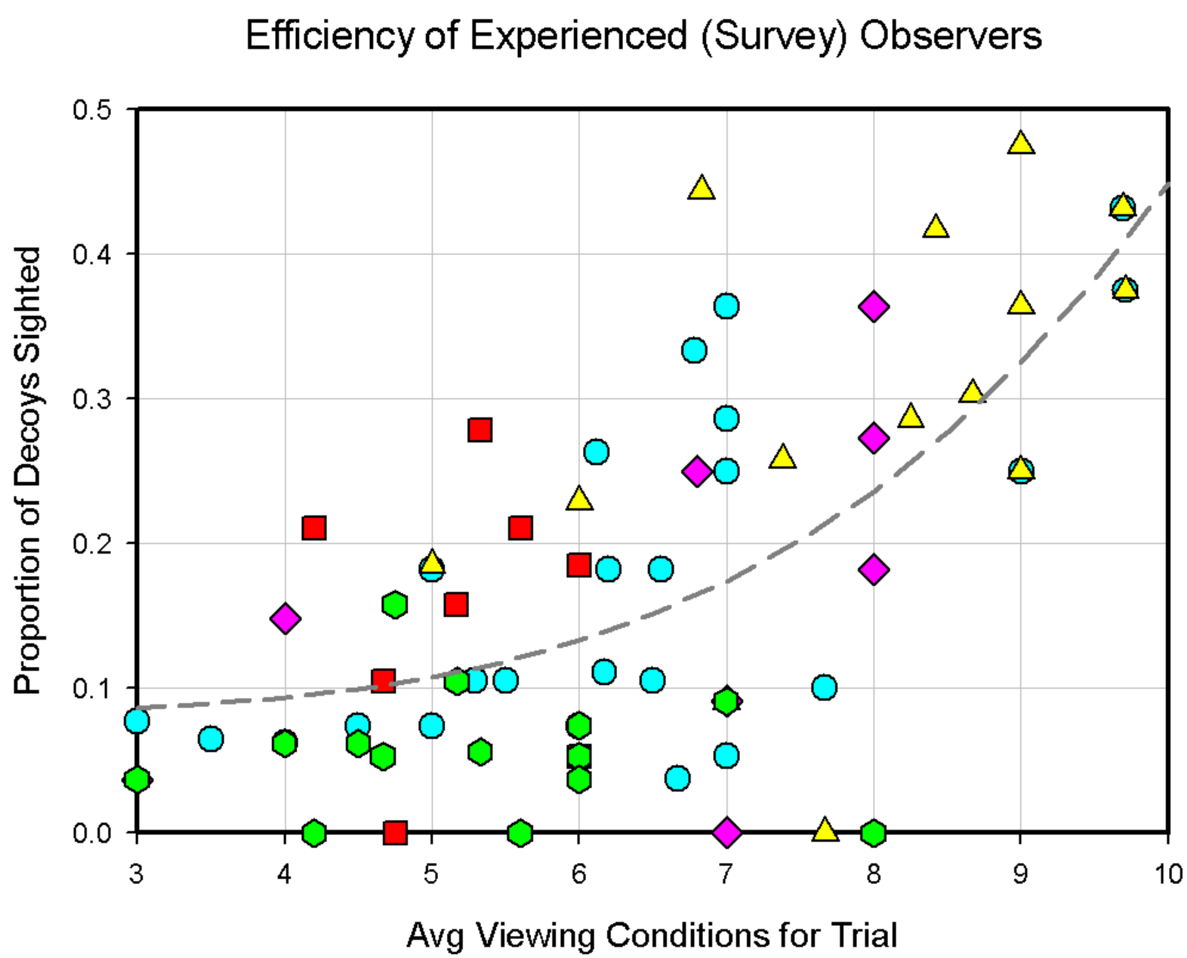
In this graph, different point styles and colors indicate different observers.



Observer Variation

The decoy study utilized observers with a range of experience at aerial surveys. Observers who would be used on range-wide surveys are the most experienced.

These data are from five very experienced observers who participated in range wide surveys. Their efficiency is considered to be representative of efficiency in the range wide surveys.

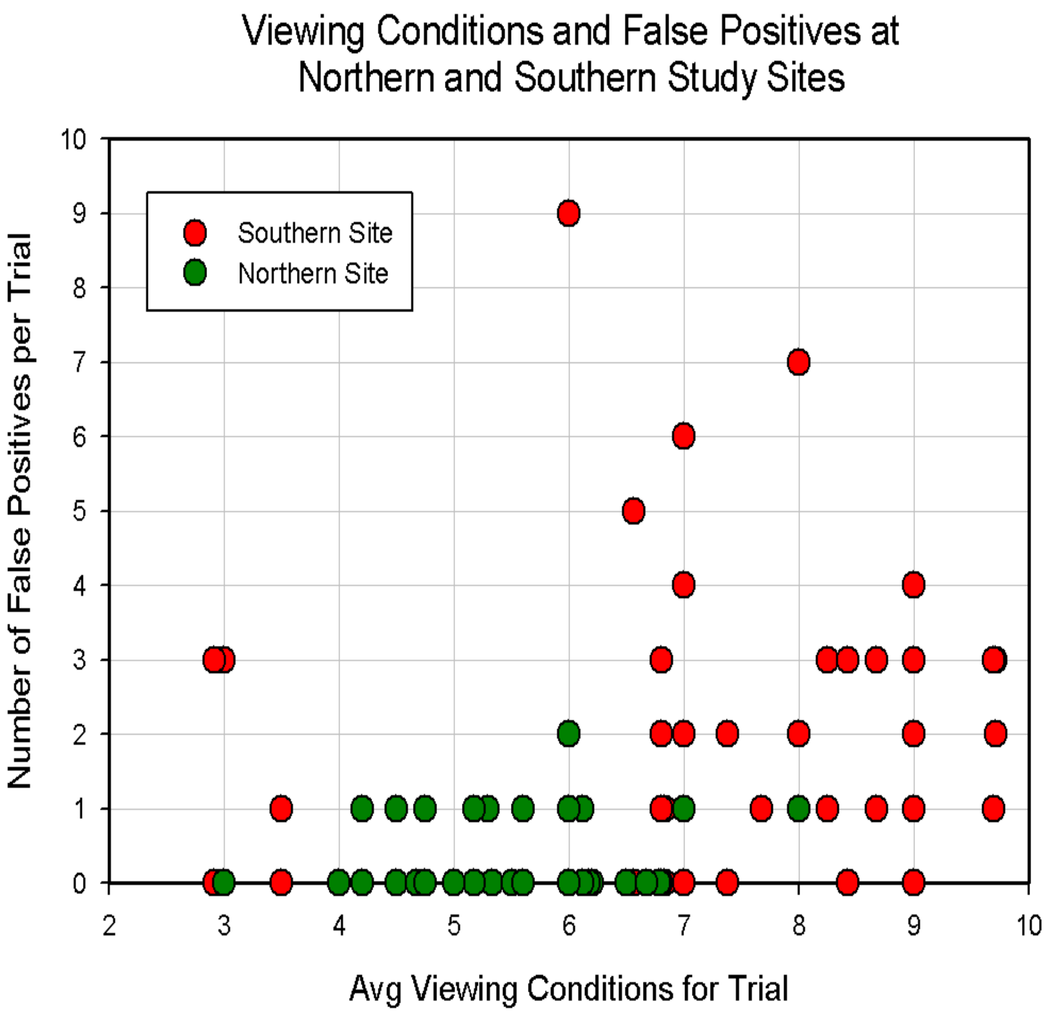


False Positives

Sometimes observers think they've sighted a sea otter, but in fact mistook an object such as an old crab pot buoy. Since we know the locations of the decoys, we can recognize these false sightings.

The original study area south of Halfmoon Bay had a high frequencies of false positives, 1.77 per observer per trial. Moving the study area north of Halfmoon bay reduced that by 84%, to 0.29 false positives per observer per trial.

The northern area is considered to be more representative of the range a whole.



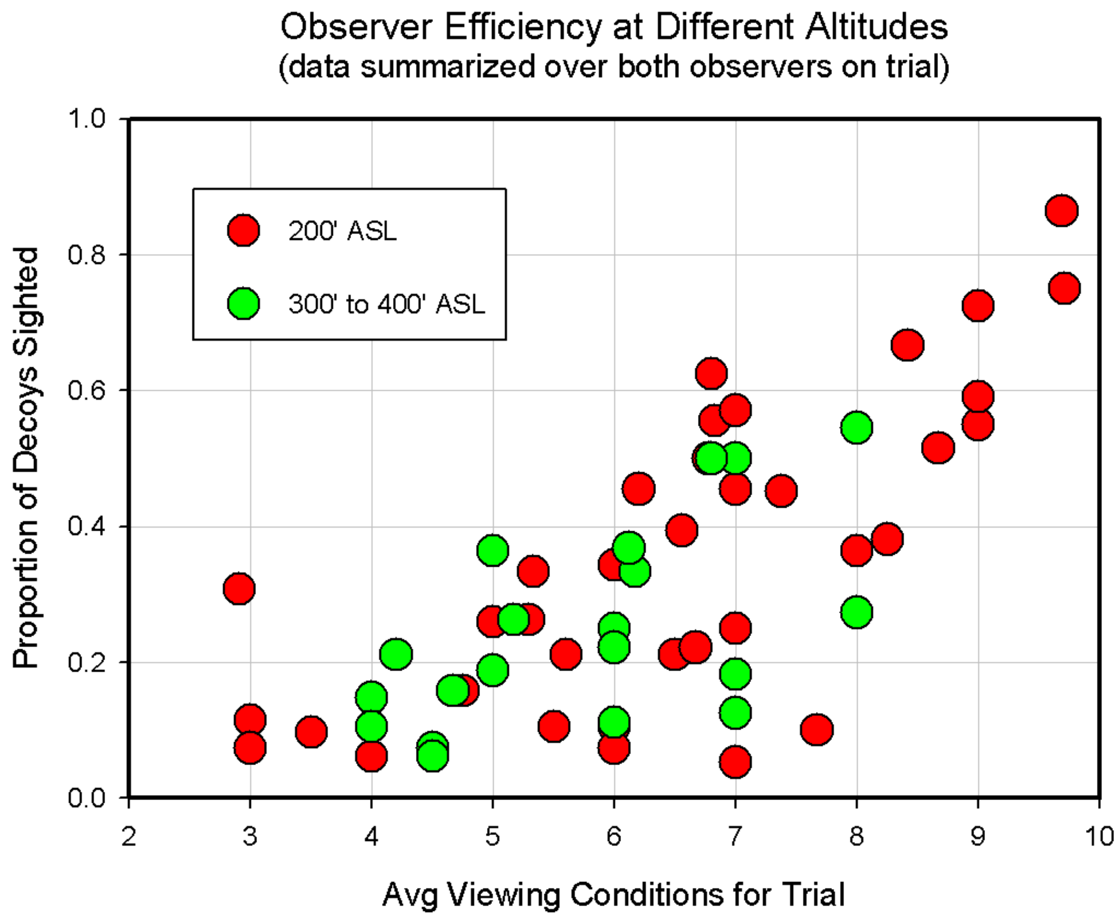
Observer Efficiency and Survey Altitude

Survey altitude obviously affects observers ability to detect decoys or real otters.

At higher altitudes, otters remain in view for longer, but they appear smaller and may be harder to see.

Surveys have traditionally been done at 200' ASL. But we found no difference between efficiency at 200' ASL compared to 300'-400' ASL.

This suggests that for the current range wide surveys, altitude can be varied within this range without altering observer efficiency

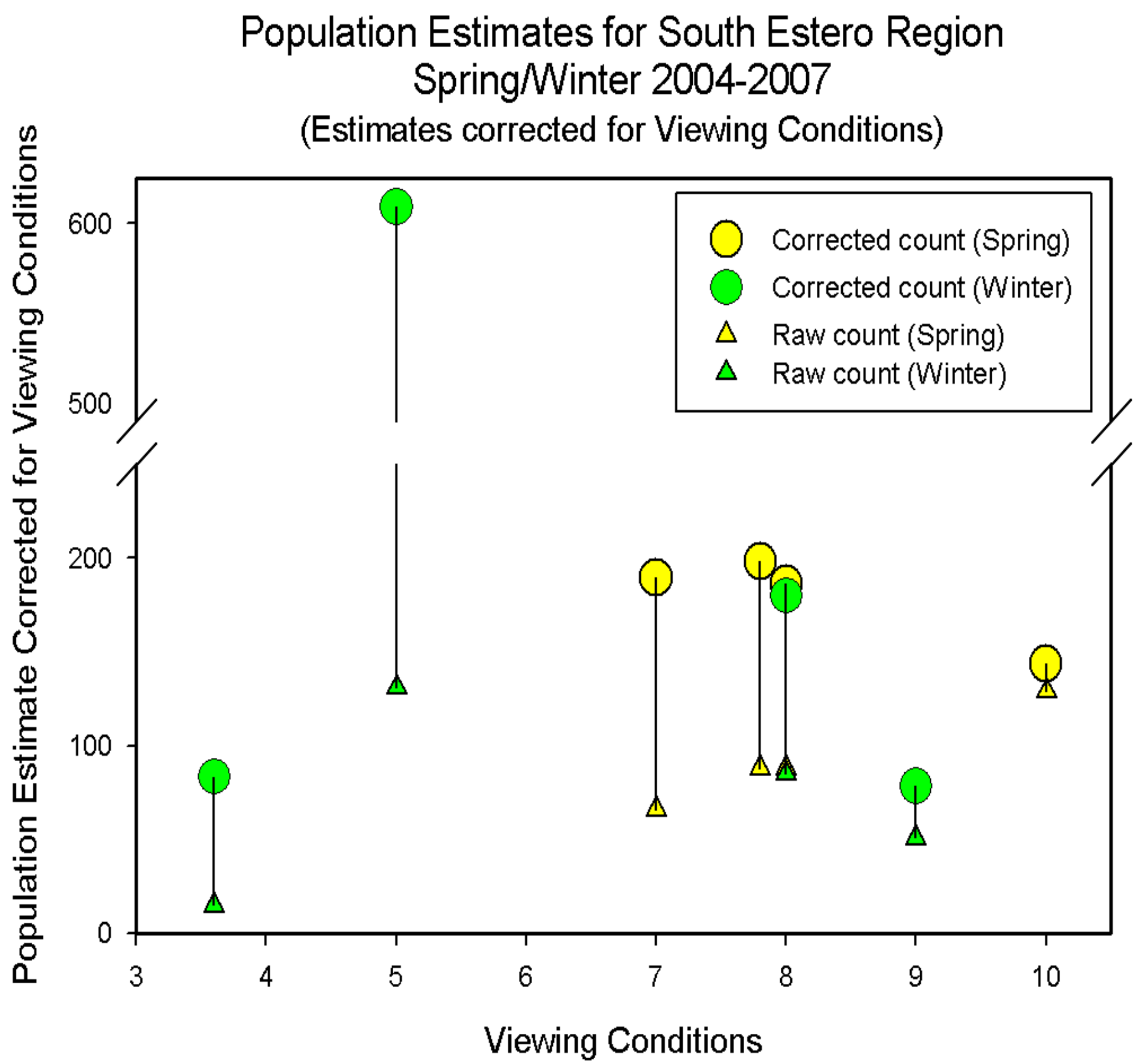


Proportion of Otters Counted on Rangewide Surveys

The exhaustive counting method currently used for aerial census is understood to be biased, but provides a very good long term standard for detecting trends in population size.

It may also useful to know how many otters are present. Using correction factors based on the viewing condition model for experienced observers, a substantial numbers of otters will be missed when surveys must be completed under less than perfect conditions.

For the South Estero Region over a 4 year period froom 2004 through 2007 we estimate that 38% of the otters were enumerated during winter surveys, and 54% during spring surveys.



Applying Line Transect Methodology to Aerial Sea Otter Counts

Distance sampling is the obvious way to approach sea otter counts if estimmates of absolute population size are required. For Sea Otter censusing in California, this methodology involves at least three significant technical issues:

Data recording-- Otters are often concentrated, and recording distance bins as well as other relevant data will be a burden on both observers and data recorders.

Overlap with shore counts-- The area surveyed by the aircraft will overlap with the shore based surveys. The areas sampled will need to be kept separate and the line transect estimators corrected for this overlap.

Detection on the MidLine-- Distance sampling requires that ***ALL*** the individuals along the inner edge of the transect be enumerated. Analysis of the detection function for the current method (right) shows a 'flat' detection curve, indicating that individuals were missed with equal likelihood at all distances. Observer protocols will need to be adjusted so that greater effort is expended near the inner edge of the transect .