Finding Dead Birds:

Comparison of Beach Search Methodologies

Glenn Ford
Mike Szumski
Wendy Williams
Deborah Jaques
Janet Casey

Portland, OR

Presented in
Phoenix, 2010

“Calibrating Seabird Mortality Data”

A NFWF Funded Study sponsored by Mike Szumski USFWS

Beached birds are obviously important to a seabird damage assessment. After a spill, people try to recover as many birds as they can find to document the injury. Most seabird damage assessments start with birds recovered on the beach. This talk is about:

- Alternative ways to estimate the number of beached birds
- How many birds are missed
- Where birds are found
- Implications for beach monitoring programs such as COASST, SeaNet, BeachWatch, etc.

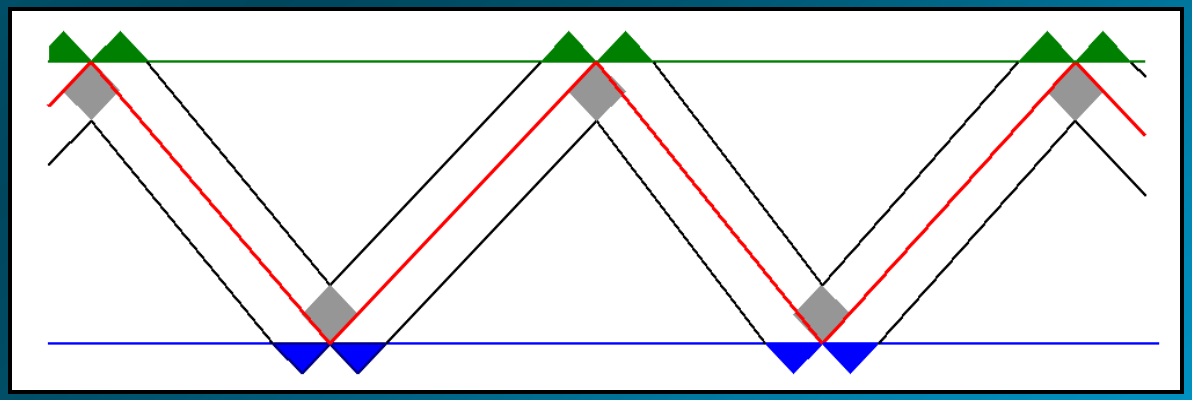
Carcass Census Techniques

Enumeration: The beach monitoring protocol used by programs such as COASST and is similar to what is often done during spill response. Two searchers walk the length of the beach, one low and one high on the beach, recording all carcasses as they go. We also recorded GPS locations for all birds so we could tell how many observers found them.

Mark-Recapture: Observers made 2 passes, switching sides at the end of the beach. This allowed us to use mark-recapture estimates based on the numbers of carcasses found by 1 or 2 observers.

Estimating the Number of Carcasses on Beaches (cont.)

Line Transect: Two observers walked the beach in a broad zigzag pattern, making 90º turns at the edge of the upper beach and at the water line. One observer scanned for carcasses to the limits of their vision, the other focused on the area near the transect to ensure that no carcasses were missed on the midline. Distances from carcasses to the transect line were measured using a laser range finder. The position of each carcass was recorded using a GPS.



Study Area

Ten beaches were studied in southern WA and northern OR. All were wide sandy beaches backed by vegetation and low sandy bluffs. Field work was in 2008-2009.

Upper and Lower Beach

Wide sandy beaches can be divided into two habitats, upper beach and lower beach. The lower beach is tidal, the upper beach is not. The upper beach is often full of flotsam, the lower beach is swept clean.

Burial

In the upper beach, carcasses are old and the sand is dry. Many carcasses in the upper beach are partially covered by drifting sand. This makes carcass detection *much* more difficult than when the birds are just lying about on the surface.

Live Birds: The 2009 Die-Off

Normally it's very rare to see live beached birds. But in fall 2009, there was a die-off caused by surfactants from a widespread algal bloom. This was very sad to watch, but provided an opportunity to compare the visibility of live and dead birds.

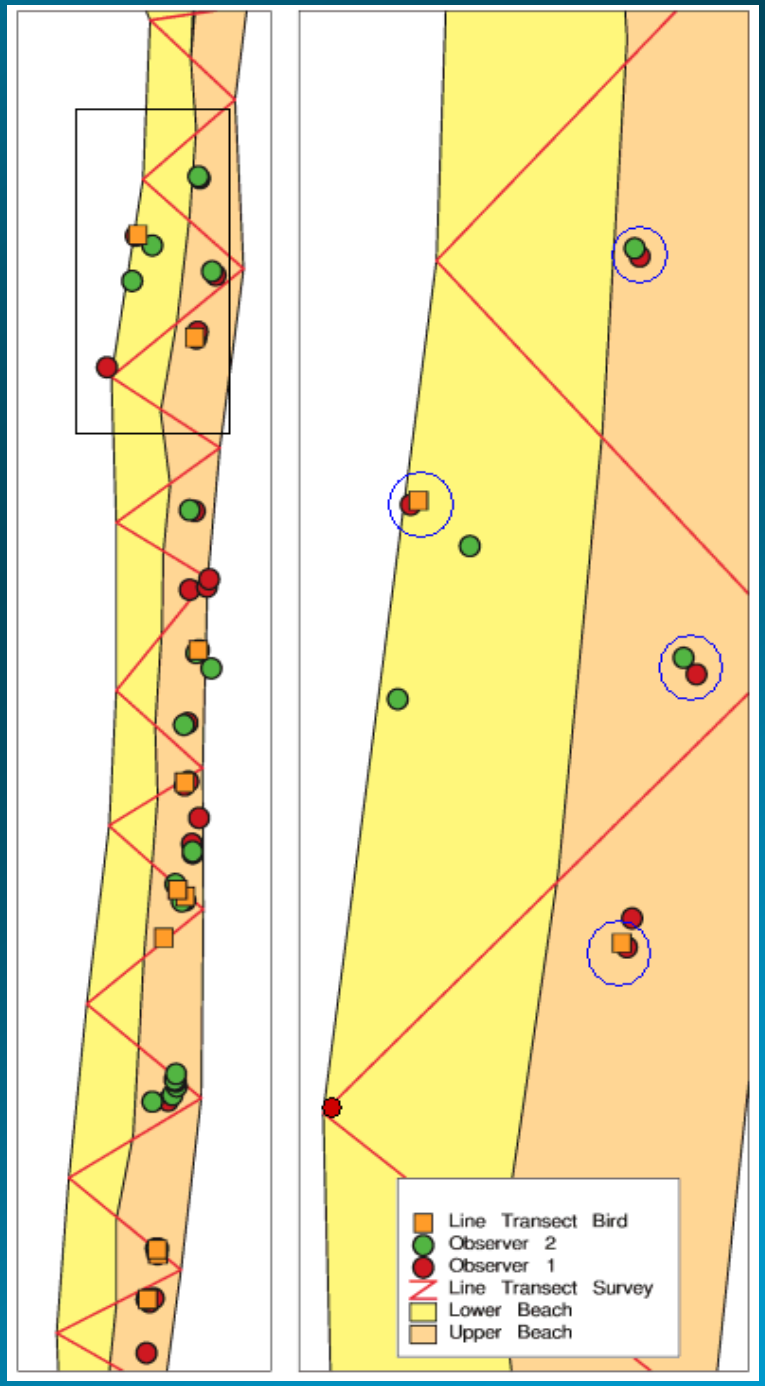
Movements of Live Birds

Data for live birds were difficult to analyze because birds would skitter tens of meters along the beach to avoid observers, making GPS fixes useless. We therefore could not use the mark-recapture technique on live birds.

We also observed a number of instances where live birds moved up the beach, presumably to hide in the vegetation...

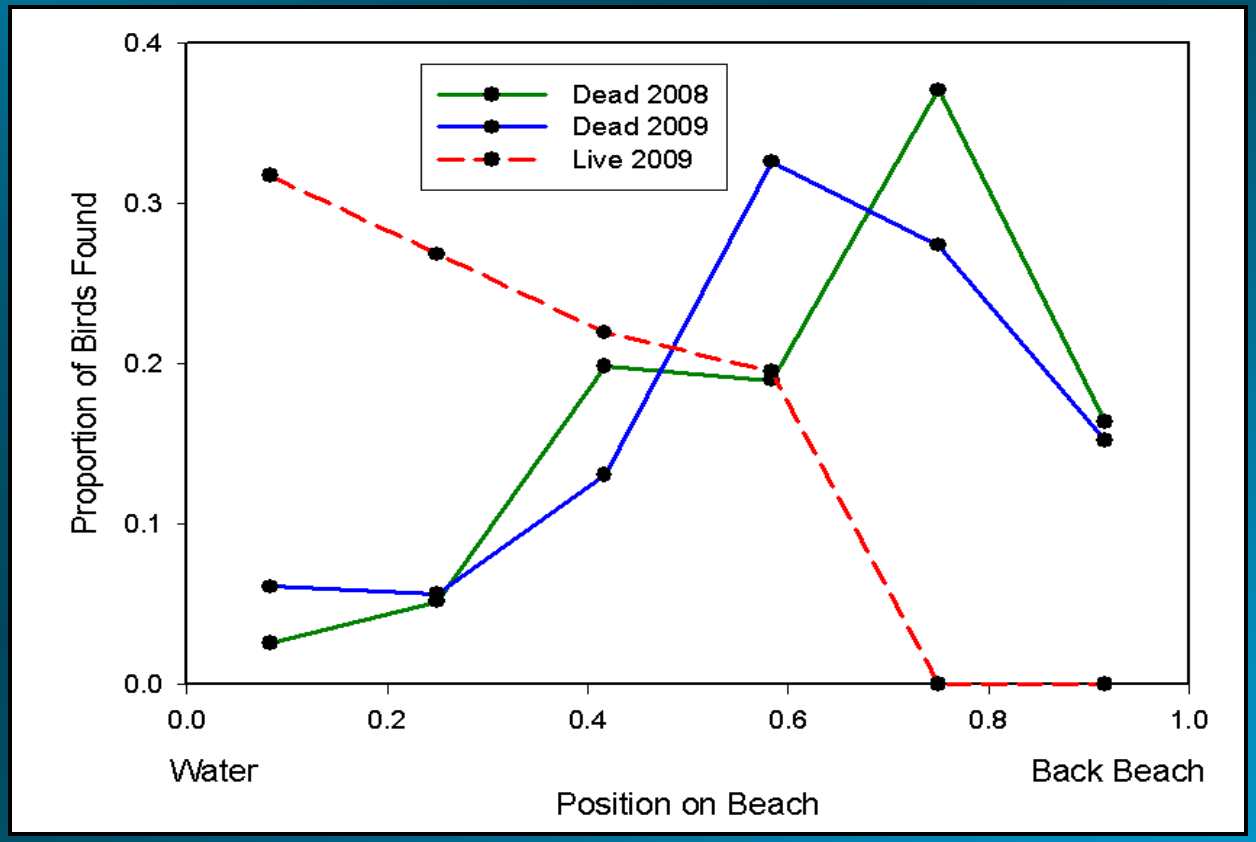
Survey Results

The diagram shows the line-transect track and the location of birds found by all observers. Yellow and tan regions indicate lower and upper beach respectively. The red line shows the path of the line-transect observers. Birds found by Observer 1 and Observer 2 are shown as red and green circles and birds found by line-transect observers are shown as orange squares. In the detail at right, birds found by more than one observer are circled.



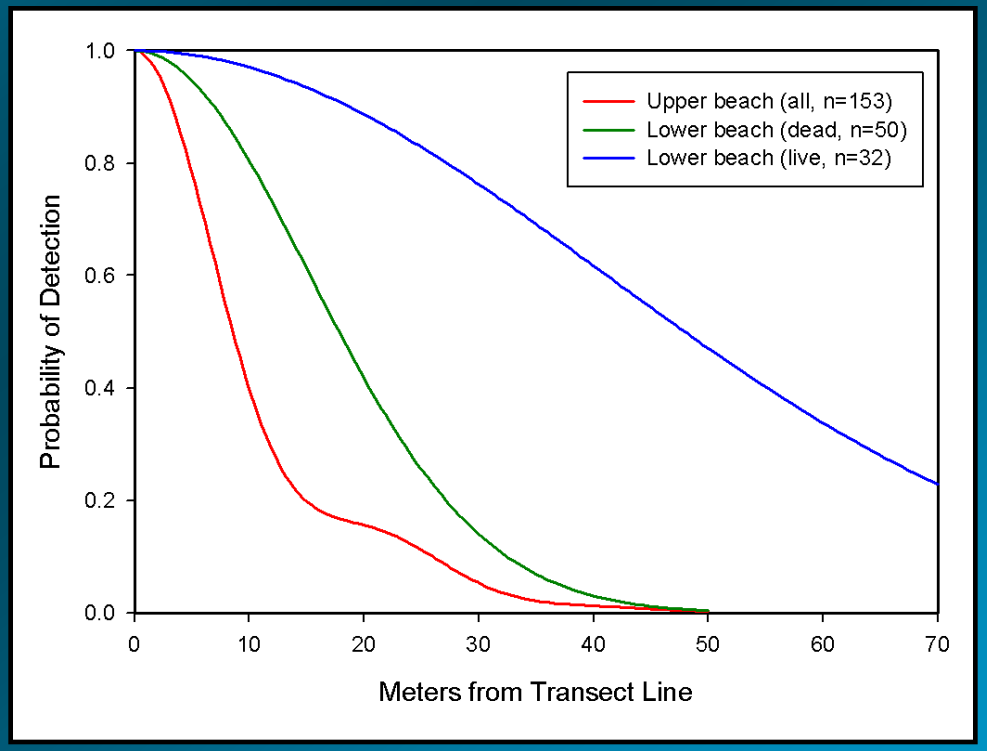
Where Are Beached Birds Found?

This graph shows where birds were found based on their positions relative to the back beach and the water line. We divided the beach into six 'bins' of equal size, and calculated the proportion of birds falling into each category.



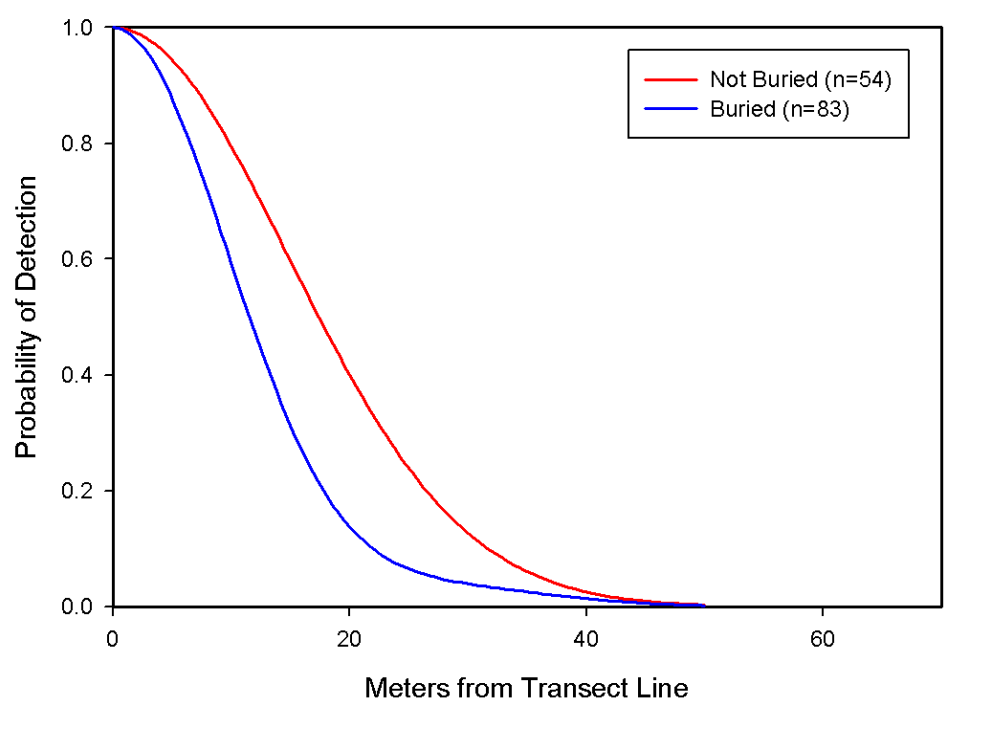
Detection Functions for Upper and Lower Beach

A detection function shows how the probability of sighting a carcass declines with distance. Detection functions are for dead birds found in the upper beach (red), dead birds found in the lower beach (green) and live birds found in the lower beach (blue). Curves are based on detection functions fitted by DISTANCE software using the Half-normal/Cosine function.



Partially Buried Birds

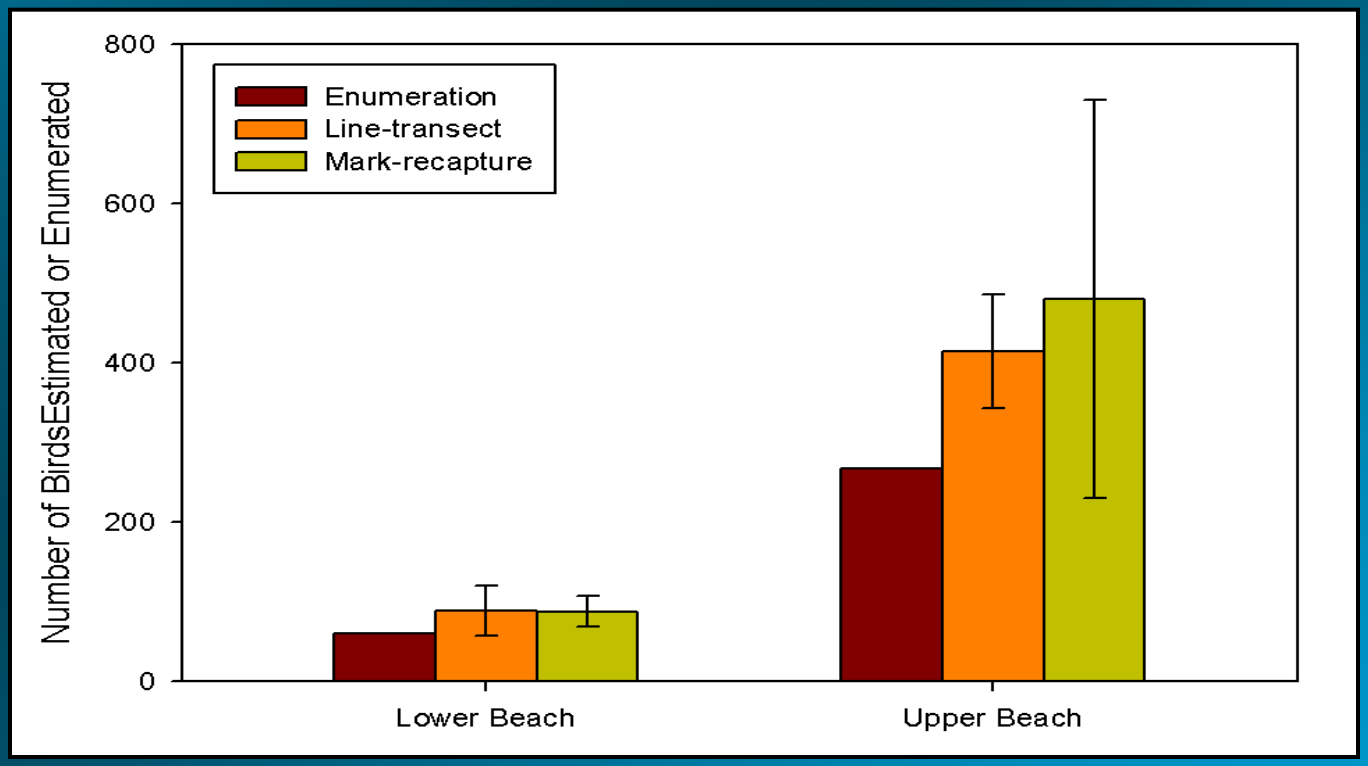
The majority of the birds in the upper beach are partially buried which makes them harder to find. Below are detection functions for buried (blue) and unburied (red) dead birds found in the upper beach. Curves are based on detection functions fitted by DISTANCE software using the Half-normal/Cosine function



Searcher Efficiency

We estimated the number of carcasses on the lower and upper beaches based on enumeration, line-transect analysis, and mark-recapture techniques. Error bars indicate the variance of the line-transect and mark-recapture estimators.

Overall, searchers detected about 2/3 of the carcasses.



Background Deposition

Birds die all the time regardless of oil spills. But it is difficult or impossible to tell the cause of death by examining the bird. Whether spill related or natural, most birds die of hypothermia which leaves no recognizable sign on the carcass. We estimated that 36% of the birds recovered during the *New Carissa* response were background mortality.

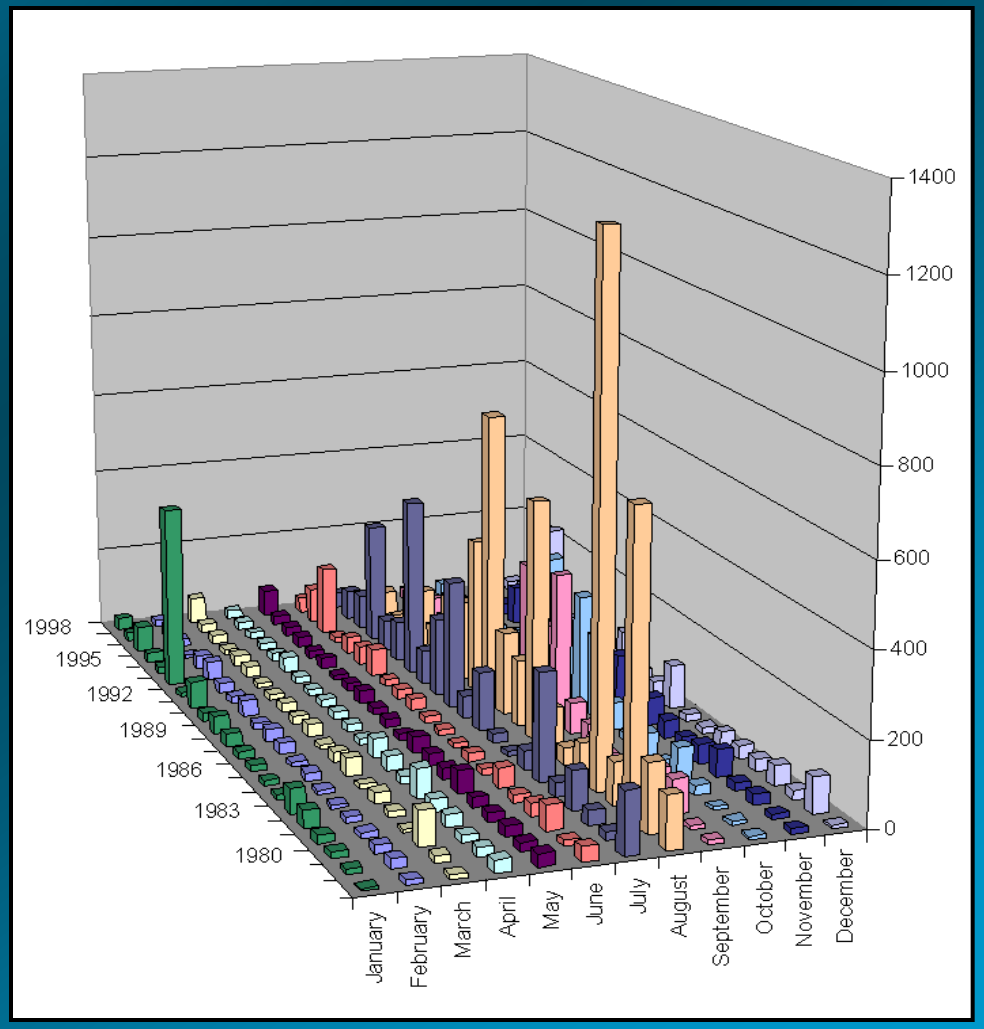
During a spill, this ‘background deposition’ is mixed with the spill related mortality. Background deposition must be therefore be measured at a site far away from the spill or during another year.

Background Deposition is Extremely Variable

Background deposition is characterized by large but infrequent spikes of deposition.

These data show monthly variation in deposition on a 1 km stretch of beach in Oregon over a 20 year period.

(Data from Bob Loeffel, ODFW ret.)



Using Beach Monitoring Program Data

Monitoring programs have the potential to provide stable data sets that cover wide geographic areas over long time periods. Averages based on these data would be more palatable to both parties than a ‘throw the dice’ sort of approach based on measuring only a few beaches during one year.

What Are the Differences Between Monitoring Program Data and Spill Response Data

1) Monitoring surveys are often carried out on a 4-6 week schedule, while spill surveys are usually carried out daily or every few days. Thus monitors mostly find older carcasses in the upper beach, and spill responders mostly find fresh carcasses in the lower beach.

2) Ideally, response surveys are a random or an exhaustive sample of beaches. But beach monitoring programs tend to emphasize high deposition beaches so as to maintain the interest of the participants.

What Are the Differences Between Monitoring Program Data and Spill Response Data (cont.)

3) Because they must visit multiple beaches, responders often have less time to search beaches than monitoring personnel.

Other things being equal, these differences bias monitoring surveys toward higher estimates of background carcass deposition than spill response surveys.

Some Ways to Make Monitoring Data Compatible with Response Data

- Randomize the selection of beaches

- Collect data on the long term persistence of carcasses (i.e. covering a span of months rather than days) so that carcass age can be taken into account

- Carry out some searches within days of each other rather than separated by 4-6 weeks.

- Place time restrictions on searches

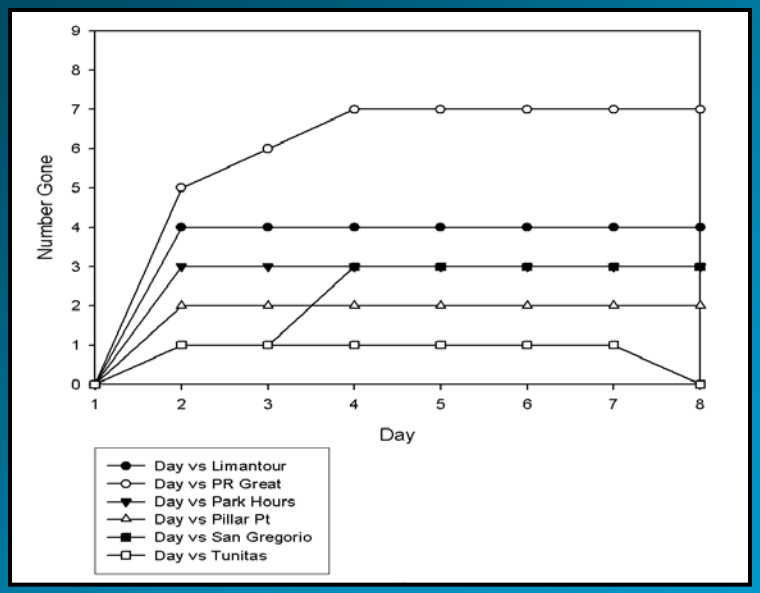
- Present deposition rates calculated *only* for birds recovered in the lower beach.

Birds Don't Remain Long in the Lower Beach

Because of previous studies with radio-tagged carcasses, we know that birds typically spend less than a day in the lower beach before they are either pushed up into the upper beach or washed back out to sea.

Searchers Go Where the Birds Are

Beach monitoring searchers spend most of their time in the upper beach where we found 85% of the carcasses. During a spill, searchers tend to concentrate on the lower beach where fresh carcasses are found.



Wrack Lines

The wrack line is the upper limit of wave action during the tidal cycle and is where flotsam is deposited. Its position varies with tidal height, and there may be multiple lines resulting from different tide heights. It separates the dynamic *lower beach* from the less active *upper beach*.

Efficiency of Beach Monitoring Searches

Enumeration using COASST protocols resulted in the detection of 60 birds in the lower beach and 268 birds in the upper beach.

Based on the mark-recapture analysis, searchers using beach monitoring protocols found 68% of the birds in the lower beach and 55% of the birds in the upper beach.

Based on the line-transect analysis, searchers found 67% of the birds in the lower beach and 64% of the birds in the upper beach.

Overall, searchers seem to detect about 2/3 of the carcasses.

Are All Birds Equally likely to be Found ?

We calculated the expectation that a bird would be found 0, 1, or 2 times by searchers if *all birds were equally likely to be found*. The calculations assume that the likelihood of finding any bird is P=0.625 (overall average). The sample was based on birds found by line-transect searchers on 17 beach surveys.

The observed and expected distributions of the number of birds found zero, one, and two times to differ significantly (p=0.014, X^2=8.48, γ=2, n=171), indicating that some birds are *more* and some birds are *less* difficult to find.

Times Found	Number Observed	Calculation	Probability if p=0.625	Number Expected (n=171)
0	34	$(1-p)^2$	0.144	24
1	54	$2p(1-p)$	0.469	80
2	83	p^2	0.391	67

Searcher Efficiency
(Probability of Finding a Carcass)

A study in and around Humboldt Bay after the 1997 MV Kure oil spill resulted in lower searcher efficiency rate estimates than we found.

	Small	Large
Rocky Beach	27.9%	55.3%
Marsh	24.0%	42.3%
Sandy Beach	12.5%	43.9%

In the MV Kure study, searchers rode in vehicles or drove ATV's. They were required to complete their searches within a certain time period. Monitoring searchers have no time limits.