IEc

Data Report for Objective #2: From the Work Plan "Assessing Bird Mortality Using Data From Response Operations and Boat-Based NRDA Surveys in the Northern Gulf of Mexico Near the Mississippi Canyon 252 Oil Spill"

Final - May 24, 2013

prepared by:

Michael Donlan, Nadia Martin, Sarah Bolthrunis and James Dwyer
Industrial Economics, Incorporated
2067 Massachusetts Avenue
Cambridge, MA 02140

Sara Ward
US Fish and Wildlife Service Raleigh Ecological Services Field Office
P.O. Box 33726
Raleigh, NC 27636

Glenn Ford
R. G. Ford Consulting
2735 NE Weidler Street
Portland, OR 97232

INDUSTRIAL ECONOMICS, INCORPORATED

TABLE OF CONTENTS

LIST OF APPENDICES

LIST OF TABLES

LIST OF FIGURES

1.0 INTRODUCTION

This report provides the data obtained from implementation of the Natural Resource Damage Assessment Work Plan For Assessing Bird Mortality Using Data From Response Operations And Boat-Based NRDA Surveys In The Northern Gulf Of Mexico Near the Mississippi Canyon 252 Oil Spill (Bird Study #19) (Appendix A - henceforth referred to as the 'Work Plan'). The Work Plan was developed and implemented by the Natural Resource Trustees as part of the Deepwater Horizon Natural Resource Damage Assessment (NRDA) and was divided into two main objectives: Objective 1 was to identify and compile appropriate Deepwater Horizon (DWH) Response data[1] to refine DWH spill-related bird mortality not addressed by NRDA specific studies; Objective 2 was to estimate searcher efficiency (i.e., bird carcass detection) and carcass persistence in spill-affected areas that were not addressed by Bird Study #1. The following data report provides general summary information and data associated with Objective 2. This report does not provide interpretation or analysis regarding bird mortality estimates. It also does not compare the data presented here to other searcher efficiency or carcass persistence data that has been published in the scientific literature. BP chose not to participate in this Work Plan.

The Trustees developed several NRDA work plans to evaluate potential Oil Spill related injuries to different avian guilds including Bird Study #1 and Supplements A-D (*Work Plan for Estimating Mortality of Birds Using Beached Bird Surveys in the Gulf of Mexico Near the Mississippi Canyon 252 Oil Spill* [Beached Bird Study]), which were designed to estimate bird mortalities related to the Oil Spill through surveys conducted in beach habitats (i.e., hard or walkable, sandy coastal shorelines). The Beached Bird Model is effective and appropriate for estimating avian mortality in areas of walkable beaches. Coastal marsh habitats, however, primarily consist of non-walkable marsh edge shorelines including vegetated edges (robust emergent vegetation) of bays, estuaries, and marshes accessible by motorized boat, and sandbars or other "strandland" within the estuarine environment that were not addressed by Bird Study #1. Response activities and Bird Study #10 (*Work Plan for Estimating Wintering Waterfowl Oiling and Mortality*) produced bird carcass deposition data for both beach and marsh habitats, but concentrated on marsh habitats.

Estimating total spill-related avian mortalities from carcass recovery numbers requires accounting for the number of carcasses missed by observers due to 1) incomplete spatial coverage of the affected area; 2) less than 100 percent carcass detection (Byrd and Reynolds 2006; Byrd et al. 2009); and 3) scavenging and other losses of carcasses prior to and between carcass surveys (i.e., carcass persistence). The compilation of Response data and spatial coverage of the affected area is being studied as part of Objective 1 of this study, whereas Objective 2 addresses carcass detection and persistence.

Carcass detection varies with a range of local factors, making it preferable to document detection on a site-specific basis (Van Pelt and Piatt 1995, Flint and Fowler 1998, Ford 2006, Byrd et al. 2009). Bird Study #11 (*Estimating Carcass Detection in Priority*

[1] Response data are those observations collected by individuals during conductance of Response Operations.

Waterfowl Habitats Impacted by the Deepwater Horizon MC252 Oil Spill), a time-critical NRDA feasibility study, was implemented primarily to guide injury assessment methodologies for use in Bird Study #10 and to confirm that, under ideal circumstances, carcasses could be detected from boat platforms in dense marsh habitats.

In addition to carcass detection variability, carcass persistence rates are also known to vary substantially among sites (Ford 2006), and can be affected by scavenging (Byrd et al. 2009, Ford and Zafonte 2009, Ford 2006, Ford et al. 2002, Flint and Fowler 1997, Van Pelt and Piatt 1995), season, location, habitat type, carcass size, scavenger abundance, scavenger type, weather, tidal conditions and other factors (Byrd et al. 2009, Ford and Zafonte 2009, Ford 2006, Flint and Fowler 1997). Because carcass persistence may differ between walkable beach and marsh or other habitats in the northern Gulf of Mexico area, determining more site-specific carcass persistence may help to reduce mortality estimate uncertainty.

The purpose of this activity was to develop site-specific data on bird carcass detection and persistence rates for habitats affected by the DWH Spill that were not addressed by Bird Study #1, including vegetated edges of bays, estuaries, and marshes accessible by motorized boat, and sandbars or other "strandland" within the estuarine environment. Results from this study complement other NRDA bird study plans and provide information that can help refine overall estimates of avian mortality associated with the DWH Spill. *Spartina*-dominated and *Phragmites*-dominated marshes were the primary vegetation types used in the assessment.

2.0 STUDY TIMING

The Carcass Detection Probability (also known as searcher efficiency) and Persistence Studies were implemented simultaneously beginning in late October, 2011. Study personnel began to arrive at the staging location in Port Sulphur, Louisiana on October 19 and conducted various mobilization tasks through October 21. Work Plan methods were evaluated under field conditions and assessment personnel were trained from October 22 to October 24. Bird carcasses were deployed on *Spartina*-dominated transects within the Barataria Bay area in Louisiana from October 25 to October 27 and then again on November 4, and on *Phragmites*-dominated transects within the Birdsfoot Delta area in Louisiana on October 28 and 30. Searcher efficiency data collection took place from October 25 to October 28 and carcass persistence data collection took place from October 25 to November 10. Bird carcasses were also deployed on two sandbar transects on October 26 and October 30. The sandbar searcher efficiency surveys immediately followed deployment, and carcass persistence data collection took place from October 26 to November 11. Study personnel departed at various times, as their assignments and demobilization activities were completed.

3.0 METHODS

Study methods are described in detail in the Work Plan (included as Appendix A to this document). In summary, unoiled and un-scavenged bird carcasses obtained from government agencies, research organizations, and other sources were subtly marked and placed on transects in *Spartina*- and *Phragmites*-dominated marsh habitat as well as

sandbar habitat. Transects were assigned within these dominant marsh habitat types, representative of areas searched by Response personnel, with no overlapping use of "hard" or "walkable" shorelines identified in Bird Study #1. Carcass size, density, and position relative to vegetation edge or land/water interface were selected for this study based on interviews with Wildlife Operations Responders and NRDA study personnel, a review of available data for dead bird recoveries stored in ERDC, and descriptions of carcass detection scenarios observed by Response personnel. Carcass location selections were also consistent with carcass deposition observations on marsh edges during the drift study (Bird Study #1D - *Using Telemetry to Determine Fates of Bird Carcasses Drifting in the Northern Gulf of Mexico*). Null transects, in which no carcasses were deployed, were also identified for the searcher efficiency portion of the assessment.

Searcher efficiency and carcass persistence teams were comprised of DOI and Louisiana Department of Wildlife and Fisheries personnel and Trustee representatives. Carcasses were deployed by the persistence teams. Searcher efficiency teams were kept away from the area during carcass deployment and these teams were unaware of which transects were null transects and which transects had been seeded with bird carcasses. Following seeding of a transect with bird carcasses (or delays approximating that activity for null transects), a total of three separate searcher efficiency teams evaluated each transect by boat. Searcher efficiency teams photographed each bird carcass they located and recorded the species, condition and location of the carcass, along with any other notes.

After the last searcher efficiency team examined a transect, the carcass persistence teams returned to confirm that deployed carcasses were still present (approximately 2-6 hours after carcasses were deployed). At this point, persistence teams marked the location of the remaining bird carcasses using flagging in order to expedite subsequent persistence checks. Following the initial day of carcass deployment, persistence teams visited each seeded transect once a day for five continuous days and then again on day 8 and day 11 post-deployment (barring weather conditions that precluded persistence surveys) until all bird carcasses on a transect were missing or the evaluation period ended (i.e., day 11).[2] During each persistence check, teams took photographs to document bird carcass presence/absence, recorded the location and scavenging state of the carcass, as well as any other observations.

The following sections provide additional methodological information and identify major changes or additions to the original study design or design details not included in the Work Plan that were necessary to address issues that arose in the field. Other changes or exceptions to the Work Plan are identified in Appendices E and F.

3.1 TRANSECTS

During the assessment, carcasses were placed on 23 transects in marsh habitat and on two transects in sandbar habitat. For the marsh habitat, searcher efficiency teams searched 17 of those seeded transects and two null transects, and the carcass persistence teams checked all 23 seeded transects. Marsh transects were located in two focal areas, *Spartina*-dominated habitat in the Barataria Bay area (16 seeded transects, one null transect) and *Phragmites*-dominated habitat in the Birdsfoot Delta area (seven seeded

[2] Sandbar transects were checked for five consecutive days, and then again on day 10 and day 12.

transects, one null transect), in southern Louisiana. Marsh transects were selected randomly within 21 cells selected based on the 5 minute Global Area Reference System (GARS).[3] We selected GARS quadrants that met the following criteria: 1) consisted of representative *Spartina* or *Phragmites*-dominated habitats; 2) were the site of carcass recoveries during 2010 and 2011; and 3) were accessible by boat and within reasonable range of field operation positions. The precise location of transects was determined by selecting a two km stretch of suitable habitat within each of the cells.[4] In addition to the marsh placements, carcasses were placed on two transects in sandbar habitat; one in Scofield Bay (Transect 2, T2) and the other within the Pass a Loutre Wildlife Management Area (Transect 3, T3).

In the original Work Plan, 14 transects were identified within the *Spartina*-dominated habitat in the Barataria Bay area and seven in the *Phragmites*-dominated habitat in the Birdsfoot Delta area; in the field two more transects were added opportunistically in Barataria Bay, to make up for data collection opportunities missed during small craft advisories. The original Work Plan also identified three null transects for use in searcher efficiency efforts within each focal area; however, due to timing constraints, only one null transect was utilized in each focal area. Consistent with the Work Plan, Louisiana Trustee personnel identified two transects on sandbar habitat; one in Scofield Bay and one in the Pass a Loutre Wildlife Management Area. Maps illustrating the location of all of the transects are provided in Figures 1A, B, and C, and photos illustrating habitat types (*Spartina*, *Phragmites*, and sandbars) are provided in Figures 2A, B, and C.

Before deployment of bird carcasses, transects were visited in the field. During reconnaissance, investigators determined that some modifications to protocols outlined in the Work Plan were necessary to adjust to field conditions (e.g., relocation of transect locations due to the availability of viable land for surveys). Major changes or additions are identified below. Other changes or exceptions to the Work Plan are identified in Appendix E and F.

- Due to a lack of continuous accessible habitat, transect lengths were reduced to one km. The number of carcasses per transect were not reduced thereby increasing the density of bird carcasses per transect.
- Small inaccessible inlets were identified and marked using PVC pipe, and were not included in the total length of a transect to avoid delays and potential for damage to search team vessels.
- Transect 9 in *Spartina* habitat was excluded from the study because very little land existed at its designated location and the GARS grid did not contain sufficient contiguous land to assign a replacement transect.
- During methods testing, transects were difficult to find in the dense vegetation and with inlets common in the area; therefore, the start and end of transects were marked using buoys and/or 5' long 1" PVC pipe with distinctive markings of

[3] GARS is a geospatial reference system that divides the earth's surface into standardized quadrants.
[4] See the Work Plan for additional detail on how the location of transects was determined within each GARS cell.

either tape or flagging to reduce the time required for search teams to locate transects.

- Due to time constraints (i.e., travel time between the staging area and search areas as well as time required for search teams to examine a transect), the number of null transects was reduced to one in each of the focal areas.[5]
- The precise GPS location of most transects was adjusted slightly after field reconnaissance. Actual transect locations used in the study are shown in Table 1, and appear on the maps provided in Figure 1.

[5] The null transects utilized in the study were transect 25 in the *Spartina* habitat and transect 28 in the *Phragmites* habitat.

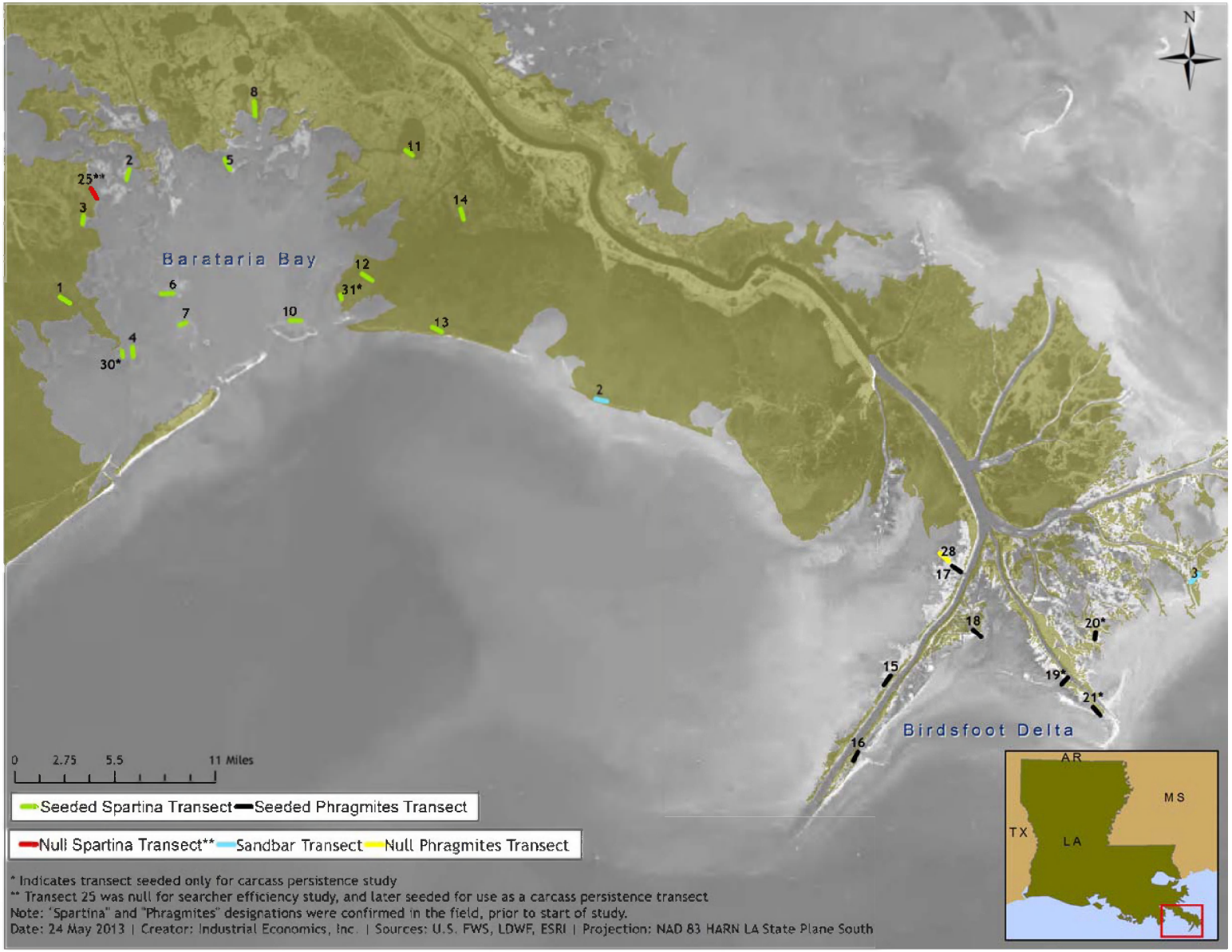
TABLE 1. TRANSECTS USED FOR THE CARCASS DETECTION AND PERSISTENCE STUDIES

TRANSECT ID	GARS CELL	START LATITUDE	START LONGITUDE	END LATITUDE	END LONGITUDE
SPARTINA					
1	180KY25	29.3356	-90.0829	29.34056	-90.0915
2	180KY23	29.43465	-90.0295	29.4428	-90.0271
3	180KY26	29.39948	-90.0701	29.40522	-90.0695
4	180KY29	29.2937	-90.0252	29.30058	-90.0258
5	181KY11	29.45033	-89.9402	29.44182	-89.9356
6	181KY14	29.34272	-89.9991	29.34286	-89.9884
7	181KY17	29.31771	-89.9828	29.31945	-89.9773
8	181KY12	29.48457	-89.912	29.49599	-89.9126
10	181KY18	29.32003	-89.8728	29.32024	-89.8831
11	181KY13	29.4554	-89.7748	29.45125	-89.7683
12	181KY16	29.35142	-89.8068	29.35689	-89.8158
13	181KY19	29.31345	-89.7526	29.3098	-89.7442
14	181KY24	29.39923	-89.7228	29.40771	-89.7255
25*	180KY23	29.41942	-90.0565	29.42777	-90.0616
30**	180KY29	29.29776	-90.0356	29.29341	-90.0354
31**	181KY15	29.34043	-89.836	29.33671	-89.8349
PHRAGMITES					
15	182KY38	29.02242	-89.3472	29.02956	-89.341
16	182KX12	28.96279	-89.3761	28.96978	-89.3718
17	182KY36	29.11199	-89.2763	29.11662	-89.2839
18	182KY39	29.05957	-89.2589	29.06529	-89.2659
19	182KY47	29.02528	-89.1809	29.02041	-89.1866
20	182KY48	29.05604	-89.1557	29.06167	-89.1549
21	182KX22	28.99527	-89.1521	29.00185	-89.1584
28*	182KY36	29.12704	-89.2948	29.12083	-89.2873
SANDBAR					
2	N/A	29.25454	-89.60541	29.25277	-89.5952
3	N/A	29.10022	-89.06734	29.10663	-89.05950

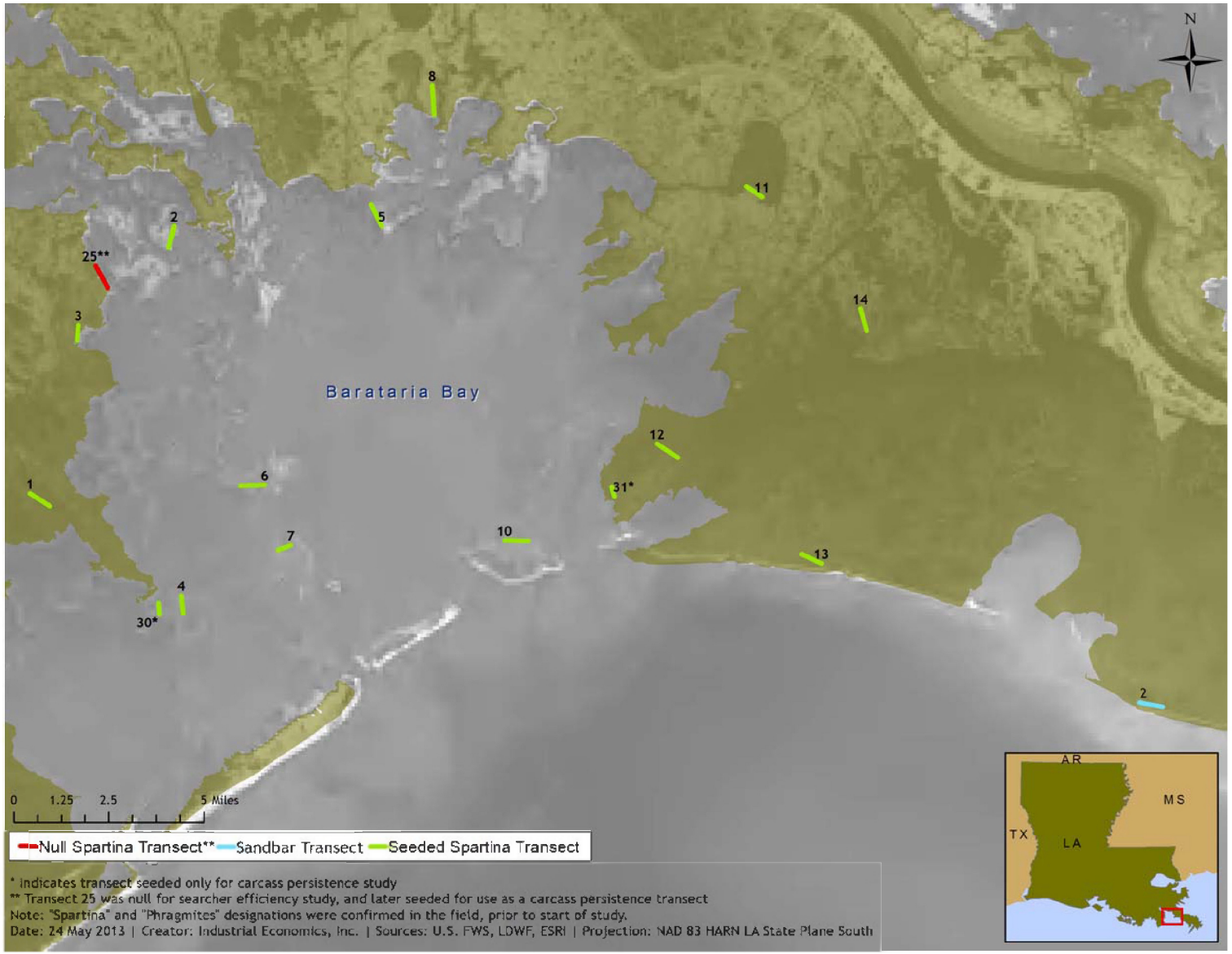
Note:
* Transect 25 was used as a null transect on 10/26 and then seeded for use in the persistence portion of the study on 11/4. Transect 28 was only used as a null transect.
** Transects 30 and 31 were used for persistence only.
All transects locations and habitat types, listed above, were confirmed during field reconnaissance.

FIGURE 1. MAPS OF TRANSECT LOCATIONS (A: ALL TRANSECTS; B: BARATARIA BAY; C: BIRDSFOOT DELTA)

A)



B)


N
Barataria Bay
8
11
2
5
25**
14
3
12
6
1
31*
7
10
13
4
30*
2
0 1.25 2.5 5 Miles
Null Spartina Transect**
Sandbar Transect
Seeded Spartina Transect
* Indicates transect seeded only for carcass persistence study
** Transect 25 was null for searcher efficiency study, and later seeded for use as a carcass persistence transect
Note: "Spartina" and "Phragmites" designations were confirmed in the field, prior to start of study.
Date: 24 May 2013 | Creator: Industrial Economics, Inc. | Sources: U.S. FWS, LDWF, ESRI | Projection: NAD 83 HARN LA State Plane South
AR
MS
TX
LA

C)

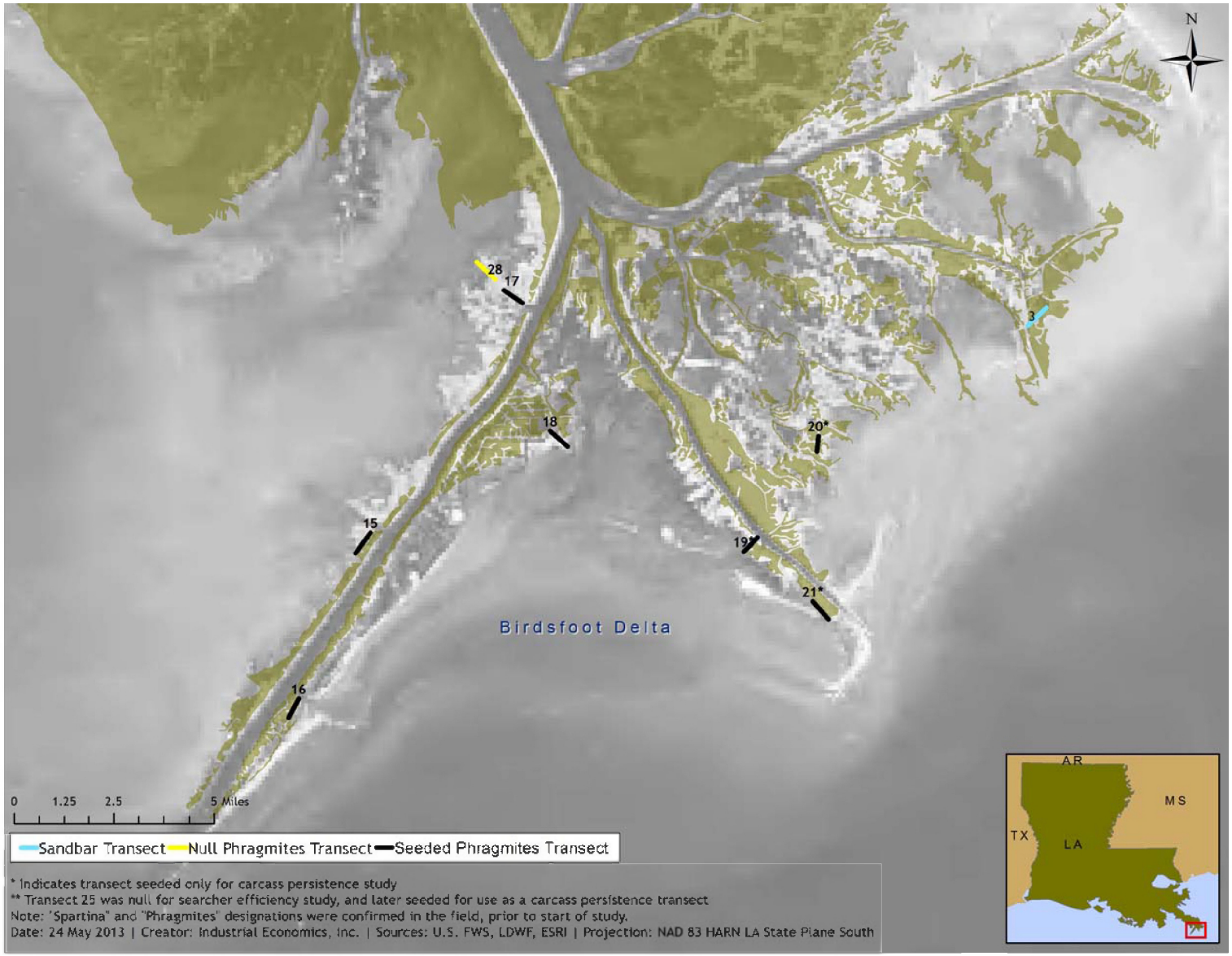

N
28
17
3
18
20*
15
19*
21*
Birdsfoot Delta
16
0 1.25 2.5 5 Miles
Sandbar Transect
Null Phragmites Transect
Seeded Phragmites Transect
* Indicates transect seeded only for carcass persistence study
** Transect 25 was null for searcher efficiency study, and later seeded for use as a carcass persistence transect
Note: "Spartina" and "Phragmites" designations were confirmed in the field, prior to start of study.
Date: 24 May 2013 | Creator: Industrial Economics, Inc. | Sources: U.S. FWS, LDWF, ESRI | Projection: NAD 83 HARN LA State Plane South
AR
MS
TX
LA

FIGURE 2. PHOTOS OF EXAMPLE HABITAT TYPES: A) SPARTINA, B) PHRAGMITES, C) SANDBARS

A)

B)

C)

3.2 BIRD CARCASS PREPARATION

Details on the bird carcass preparation protocol can be found in the Work Plan. Bird carcasses used for the study were stored in a freezer at the U.S. Fish and Wildlife Service (FWS) Field Office in Fairhope, AL prior to the assessment or provided by the Louisiana Department of Wildlife and Fisheries. Consistent with the Work Plan, bird carcasses were sorted into four size classes: small (less than 200g), medium (200g-500g), large (501g-1,000g) and extra-large (greater than 1,000g). Before beginning the assessment, the number of bird carcasses per transect, bird carcass size distribution and carcass location on a transect were assigned. This allowed for a unique carcass identification (ID) to be determined prior to field work. Some bird carcasses had evidence of slight prior damage due to collection techniques (e.g., decaying eyes, wounds from gunshots). No birds were oiled.

Prior to transport to the field for deployment, all carcasses were labeled with two small tags. Each tag was labeled with the carcass's ID and attached in a location unlikely to affect visibility (patagium and upper leg). The tags were semi-translucent nylon cable clamps and were attached to the carcass with plastic zip ties. Both items were obtained from local hardware stores. The carcass ID number was written on the rings using permanent black marker. Carcass ID numbers consisted of the transect number followed by a consecutive number, such that three bird carcasses on transect 1 would be numbered T1-1, T1-2, and T1-3. All bird carcasses to be deployed on a single transect were placed in a large plastic bag with the transect number indicated on the bag. In addition, each carcass was tagged with a small laminated card that stated "TAGGED CARCASS STUDY, PLEASE DO NOT REMOVE BIRD. If questions, please CALL XXX-XXX-XXXX".

3.3 CARCASS NUMBERS, SIZE, DENSITY, STATE, AND DISTANCE FROM EDGE

Modest adjustments to bird carcass size and placement characteristics specified in the original Work Plan were made in the field. Final placement characteristics as well as bird carcass size, weight, species, and identification number are presented in Appendix B of this document.

As mentioned previously, transects were reduced from two km to one km. However, the number of carcasses per transect was not changed, thereby increasing the density of carcasses on each transect. This was necessary to maintain a sufficient number of bird carcasses for discovery by search teams. Field verification during preliminary tests indicated that due to the density of vegetation, study personnel could not see bird carcasses farther than approximately three meters into the vegetation; therefore, the maximum distance carcasses were placed from the edge of the marsh was also reduced from five meters to three meters.

Finally, the distribution of bird carcass sizes among transects was modified from the distribution developed in the original Work Plan. The distribution of bird carcass sizes among transects in the original Work Plan was developed based on the available carcasses in the FWS Fairhope Field Office freezer. There were very few small bird carcasses in the collection of carcasses held at the Fairhope Field Office. However, additional small bird carcasses were obtained following completion of the Work Plan but

prior to the start of the assessment, and therefore the size distribution among transects was adjusted to accommodate these newly acquired small carcasses. Additionally, all carcasses were weighed on-site and distributed into the specified size classes. During on-site weighing of bird carcasses, sometimes a carcass was placed into a different size class than that which was originally assumed during Work Plan development when size distribution was based solely on the species designation and estimated species weights. Distribution of carcass sizes was changed from the original Work Plan and was randomly assigned to match those available at the time of implementation.

3.4 BIRD CARCASS DEPLOYMENT AND SURVEYS

All teams (searcher efficiency and carcass persistence) consisted of two assessment personnel and a boat captain. However, towards the end of the assessment study, when there were fewer transects and carcasses on transects to be checked, to reduce costs, one-person teams and a boat captain were used.[6] The teams that conducted the carcass persistence checks were also those that deployed the bird carcasses. Team members and dates of deployments, persistence checks, and searcher efficiency surveys are presented in Appendix C.

Modest adjustments and additions were made to the deployment methods, searcher efficiency surveys, and carcass persistence checks as described below.

Carcass Deployment

After methods were tested in the field, some changes were made to the deployment methodology. Bird carcasses placed farther into the marsh were deployed either using a long pole outfitted with a rope noose while standing in the boat or by walking into the marsh without disturbing the vegetation. Carcass placement as either breast up or breast down was determined in the field by the flip of a coin. In addition, to prevent bird carcasses deployed at the marsh edge from floating away before search teams were able to survey the transect, carcasses were tied to nearby vegetation using thread or light fishing line for the duration of the searcher efficiency team surveys. The strength of the ties was sufficiently light to allow scavenging to occur with minimal hindrance, and ties were broken immediately following the completion of searcher efficiency surveys. Bird carcasses were never tied for more than three hours.

Searcher Efficiency

A small craft advisory occurred on October 29 during the time of a scheduled search, and therefore the searcher efficiency surveys scheduled for that day (transects 19, 20, and 21) were cancelled and were not rescheduled due to schedule limitations for some of the team personnel.

The Work Plan stated that if possible, searcher efficiency teams would survey transects a second time, after deployed carcasses were in the field one night, to obtain searcher efficiency information for scavenged bird carcasses. However, these surveys were not

[6] Nate Wintle checked transect 5 on November 5, transects 1, 4, 6, 19, 30, and 16 on November 7, and transect 19 on November 10, and Sarah Flaherty checked transect 31 on November 7.

conducted due to logistical constraints including the limited time available for searcher efficiency teams to conduct first time surveys on the transects.

Carcass Persistence Checks

Due to time and logistical constraints, as well as the rapid loss of carcasses on many transects, persistence checks were reduced to five continuous days after deployment followed by two consecutive three day interval searches.[7] Transects were checked until all bird carcasses were missing or the end of the evaluation period (day 11 post-deployment). When a carcass was missing from its last known location, teams searched a minimum of five meters into the marsh edge and up to 300 meters along the marsh edge adjacent to the location.

On October 28, due to weather conditions and boat captain concerns, first day persistence observations were not obtained for transects 1, 6, and 7. Also due to a small craft advisory on October 29, study personnel were unable to obtain the fourth day persistence checks for transects 12, 13, and 14; third day observations for transects 2, 3, 5, and 8; and, second day observations for transects 1, 4, 6, 7, and 10. Since some early observations in the *Spartina*-dominated habitat were missed due to weather-related constraints, and the first few days of observations are important when estimating carcass persistence, three additional transects (T25 – used as a null transect during searcher efficiency, T30 and T31) were identified and carcasses were deployed on these transects. For these additional transects, bird carcass numbers, sizes and placements were identified using previously described approaches. The additional transects were checked for three consecutive days post-deployment to provide additional data on short-term persistence.

Due to time constraints, persistence teams were unable to re-sight deployed bird carcasses between searcher efficiency surveys, and instead attempted to re-sight carcasses after all three detection surveys had been completed. Field testing prior to the study verified that limited or no scavenging occurred in the period during which the searcher efficiency teams surveyed the transects, so re-sighting after the searcher efficiency surveys was determined to be sufficient.[8]

Robel pole measurements were taken by the persistence teams to estimate vegetation density in the general proximity where bird carcasses were deployed. An addendum to carcass persistence team protocols was drafted in the field (Appendix E), which included a methodology for robel pole measurements. The new protocol stated that robel measurements should be taken on the second day of persistence checks. Measurements were to be made four meters into the marsh and perpendicular to the marsh margin associated with the bird carcass deployment location. Robel measurements were taken in the *Spartina*-dominated habitat. In the *Phragmites*-dominated habitat, measurements were initiated, but not completed because vegetation was frequently higher than the robel pole, and the density of the vegetation made it difficult to take measurements without trampling the surrounding area.

[7] The only exception was for transects 25, 30, and 31, which were checked for three consecutive days post-deployment since they were added towards the end of the study to provide additional data on short term persistence.

[8] A total of six carcasses went missing during the search team surveys (i.e., were not re-sighted).

Some carcass persistence teams did not place the robel pole four meters into the marsh, and instead took measurements at the carcass deployment location. Due to the inconsistency in methods, no summary of the robel data has been made but the raw data is presented in Appendix D.

3.5 DATA COLLECTION AND MANAGEMENT

Prior to initiation of the assessment, the original Work Plan Appendices 'D' and 'E' SOPs, which applied to both searcher efficiency and carcass persistence efforts, were modified. The original appendices had text removed so that searcher efficiency teams were not informed of the procedures used or activities conducted by the persistence teams. Additionally an 'Addendum to Persistence Protocols (10/23/2011)' - outlining the necessary protocol modifications based on the rationale discussed previously in this report - was developed and provided to the carcass persistence teams. The persistence addendum and the revised Appendices are included in Appendix E of this report.

Searcher Efficiency

Details on data collection and management procedures can be found in the Work Plan. Search teams remained in boats for all searcher efficiency activities. Searcher efficiency study data sheets were developed for search team personnel to document any bird carcasses located on a transect, including carcass species, a visual estimation of bird size, scavenging state, estimated distance from the edge as well as the date and time, team members, transect, photographs and any other notes. Procedures were developed to collect searcher efficiency photographs.

Search efficiency teams took two searcher photographs. One photo was taken at one meter and a second at five meters from any carcasses located on the transects. Each of the search teams renamed their search photographs according to the naming convention specified in the Work Plan; however, instead of renaming copies of the photos as intended, the original files were renamed, and therefore photo IDs documented on the data sheets cannot be readily cross-referenced with the photograph files.

Carcass Persistence

Carcass persistence study data sheets were developed to document the date and time, team members, and the initial carcass deployment (Appendix B) as well as carcass checks including the species, presence or absence of carcasses, distance from the start of transect, and position relative to the marsh edge. Carcass state was documented at the time of deployment and again when subsequently checked. Carcasses were classified as 'missing' if a wing, feathers attached to skin fragments, or only feathers from the bird carcass remained. Although the Work Plan notes that a missing bird is defined as "carcass is missing, and no part of carcass remains", the practical definition above was used during the study since parts of a wing, or feathers and skin fragments would not likely be considered a bird that would have been collected during spill response efforts. Procedures were developed to collect and manage photographs taken of both bird carcass placements and the condition of carcasses on subsequent days of the study (copies of bird carcass photographs from this study are provided in Appendix F).

At deployment, carcass persistence teams typically took three persistence photographs. The first photo was taken at one meter, the second at five meters, and the third at 25 meters from the deployed carcass. However, there were some deployment photograph deviations, which are documented in Appendix F.

All carcasses that were not determined to be 'missing' during persistence checks were photographed again to document carcass condition. Two persistence photographs were taken; one photo at one meter and the second photo at five meters. There were a few occasions when two persistence photos were not taken and those exceptions are documented in Appendix F. When persistence teams determined a bird carcass was missing, the original Work Plan procedure did not require that photos be taken, but some teams did photograph the area to document potential scavenger tracks or disturbed habitat.

3.6 DATA MANAGEMENT

Details on data management procedures can be found in the Work Plan. Data sheets were signed by field teams at the end of each day. Original data sheets from the marsh habitat transects remained in the possession of the FWS Trustee or the designated Trustee representatives (Industrial Economics, Inc. (IEc) or their subcontractors) for the duration of the study. On the last day of the assessment, a representative of the FWS, Fairhope, Alabama Field Office arrived at the staging location in Port Sulphur, Louisiana and collected all original documents, following Chain of Custody procedures. In addition, at the end of the study, all data sheets were scanned and stored on CDs or external jump drives. One set of CDs/drives was mailed to Trustee contractor Nadia Martin of IEc and one set was mailed to Trustee contractor Glenn Ford of R.G. Ford Consulting, both following Chain of Custody procedures. Study photographs were downloaded to a computer, re-named following the convention specified in the Work Plan, saved onto CDs/drives, and mailed with the data sheets. Original data sheets from the sandbar habitat transects remained in the possession of Louisiana Trustee study personnel for the duration of the study. Upon completion of the sandbar transect portion of the assessment, data sheets were scanned and saved onto a CD along with the study photographs,[9] and mailed to the Fairhope, AL field office and to Trustee contractor Nadia Martin of IEc and Glenn Ford of R.G. Ford Consulting following Chain of Custody procedures.

4.0 RESULTS

A table of results documenting bird carcasses utilized in the study and their placement characteristics is provided in Appendix B. Details on the study personnel and dates each transect was surveyed for search efficiency and carcass persistence are provided in Appendix C. Copies of study photographs and data sheets can be found in Appendices F and G, respectively. A table illustrating marsh searcher efficiency by transect and searcher team are provided in Appendix H. Appendix J illustrates the sandbar searcher efficiency by transect and searcher team. Tables illustrating number and percentage of bird carcasses remaining after each day (i.e., carcass persistence) by transect are provided in Appendix I.

[9] Sandbar habitat study photographs were not re-named.

4.1 SEARCHER EFFICIENCY

Table 2 presents summary results by habitat type and search team. A total of 87 carcasses were deployed for detection in marsh habitat, with about 80 percent of the carcasses deployed in *Spartina*-dominated habitat. Each of three searcher efficiency teams searched each transect for bird carcasses, resulting in a total of three potential observations (or passes) per carcass. A total of six bird carcasses were not re-sighted by carcass persistence teams following completion of the searcher team surveys. These carcasses were removed from the searcher efficiency study results, resulting in 243 total bird carcass observations (3*81 carcasses) as opposed to 261 total bird observations (3*87 carcasses).[10] While a few of these bird carcasses were located by one or more of the search teams, these results were eliminated from the analysis since it could not be positively determined when a carcass disappeared between search team passes and was therefore unavailable for observation by the remaining search teams.

Marsh searcher efficiency generally did not vary by searcher team. Each team had similar searcher efficiency in both types of habitat. Generally, searcher efficiency was higher in the *Phragmites* habitat (about two-thirds of bird carcasses were sighted, as compared to one-third in *Spartina* habitat).

Nine bird carcasses were seeded in sandbar habitat. Two bird carcasses were located by the searcher team, for a searcher efficiency of about 22 percent.

TABLE 2. SEARCHER EFFICIENCY BY HABITAT TYPE AND SEARCHER TEAM

HABITAT TYPE	TOTAL PASSES	DETECTS	DETECTS BY SEARCHER TEAM		
			S1	S2	S3
Spartina	192	64 (33%)	22 (34%)	21 (33%)	21 (33%)
Phragmites	51	34 (67%)	11 (65%)	12 (71%)	11 (65%)
Sandbar Habitat	9	2			2 (22%)

Note: 'Passes' refers to the total number of potential observations (i.e., since the three searcher teams surveyed each transect, each bird had the potential to be observed by three teams, and therefore there were a total of three passes for each bird).

Tables 3 and 4 present searcher efficiency by size class and species, respectively. Across the marsh study areas, searcher efficiency generally increases as carcass size increases. While this trend did not hold for the *Phragmites* transects (medium sized carcasses had the highest searcher efficiency and extra-large carcasses were detected less often than medium and large carcasses), the relatively small number of bird carcasses deployed in *Phragmites* habitat for each size class (four small, seven medium, three large, and three extra-large) does not provide sufficient statistical power to meaningfully test for differences.

[10] These bird carcasses included carcass 5, 6 and 7 from transect 5 and carcass 4 and 5 from transect 6 (all *Spartina* habitat). Additionally, only the leg of bird 1 from transect 11 (*Spartina* habitat) was present. No search teams had sighted the bird. For the purposes of this analysis, it was considered missing and removed from the searcher efficiency analysis.

Overall, as carcass distance from the marsh edge increases, searcher efficiency decreases (see Table 5 and Figure 3). Again, *Phragmites* transects are an exception to this trend; 100 percent of carcasses farthest from the edge were detected, while only 70 percent of carcasses on the marsh edge were detected. However, there was only one extra-large bird placed three meters deep in the *Phragmites* habitat (bird T19-8; Appendix B). The 100 percent searcher observation might have been different if the search included more and smaller sized bird carcasses. Small sample sizes do not allow for differences to be meaningfully determined by statistical testing. The searcher efficiency results for all marsh habitats indicate that approximately seven percent of birds were detected at three meters from the edge; therefore, search teams are likely to find few bird carcasses at depths greater than three meters from the edge.

The same number of medium, large, and extra-large bird carcasses (three each) were placed in sandbar habitat transects. Carcass distributions were determined for the marsh bird assessment first, and due to the limited number of small carcasses, no small bird carcasses were available for sandbar transects. One large and one extra-large bird carcass were located, suggesting that larger carcasses are more likely to be detected, although the small sample size does not allow for meaningful statistical testing. One of five carcasses placed above the wrack was detected (20 percent detection), one of two at the wrack was detected (50 percent detection), and neither of the two below the wrack were detected (0 percent detection). The lack of small birds may overestimate the sandbar searcher efficiency because, as shown by the marsh data, smaller birds are not as frequently found by search teams.

TABLE 3. SEARCHER EFFICIENCY BY SIZE CLASS

SIZE CLASS	TOTAL PASSES	DETECTS (PERCENT)
SPARTINA		
S	42	1 (2%)
M	57	18 (32%)
L	45	20 (44%)
XL	48	25 (52%)
***Spartina* Total**	**192**	**64 (33%)**
PHRAGMITES		
S	12	3 (25%)
M	21	18 (86%)
L	9	7 (78%)
XL	9	6 (67%)
***Phragmites* Total**	**51**	**34 (67%)**
SANDBAR		
S	0	0
M	3	0
L	3	1 (33%)
XL	3	1 (33%)
Sandbar Habitat Total	**9**	**2 (22%)**

Note: 'Passes' refers to the total number of potential observations (i.e., since the three searcher teams surveyed each transect, each bird had the potential to be observed by three teams, and therefore there were a total of three passes for each bird).

TABLE 4. SEARCHER EFFICIENCY BY SPECIES

SPECIES (SIZE CLASS)	SPARTINA		PHRAGMITES		SANDBAR	
	TOTAL PASSES	DETECTS (PERCENT)	TOTAL PASSES	DETECTS (PERCENT)	TOTAL PASSES	DETECTS (PERCENT)
AMRO (S)	3	0 (0%)				
BLGR (S)	3	0 (0%)				
HOSP (S)	12	0 (0%)	3	0 (0%)		
INBU (S)	3	0 (0%)	3	0 (0%)		
MODO (S)	6	0 (0%)				
RUTU (S)			3	3 (100%)		
Sparrow spp. (S)	6	1 (17%)				
SUTA (S)	3	0 (0%)				
YBCU (S)	3	0 (0%)				
Warbler spp. (S)			3	0 (0%)		
LAGU (M, XL)	54	16 (30%)	24	18 (75%)	3	
RBGR (M)	3	0 (0%)				
RBGU (M, L)	6	5 (83%)				
GADW (L)					1	
HEGU (L, XL)	57	30 (53%)	9	7 (78%)	3	1 (33%)
LESC (L)	3	0 (0%)				
MALL (L, XL)	6	4 (67%)			1	
BDOW (L)			3	3 (100%)		
BRPE (XL)	3	1 (33%)				
DCCO (XL)	9	4 (44%)			1	1 (33%)
GRSC (XL)	9	0 (0%)	3	3 (100%)		
NOPI (XL)	3	3 (100%)				
Total	192	64 (33%)	51	34 (67%)	**9**	**2 (22%)**

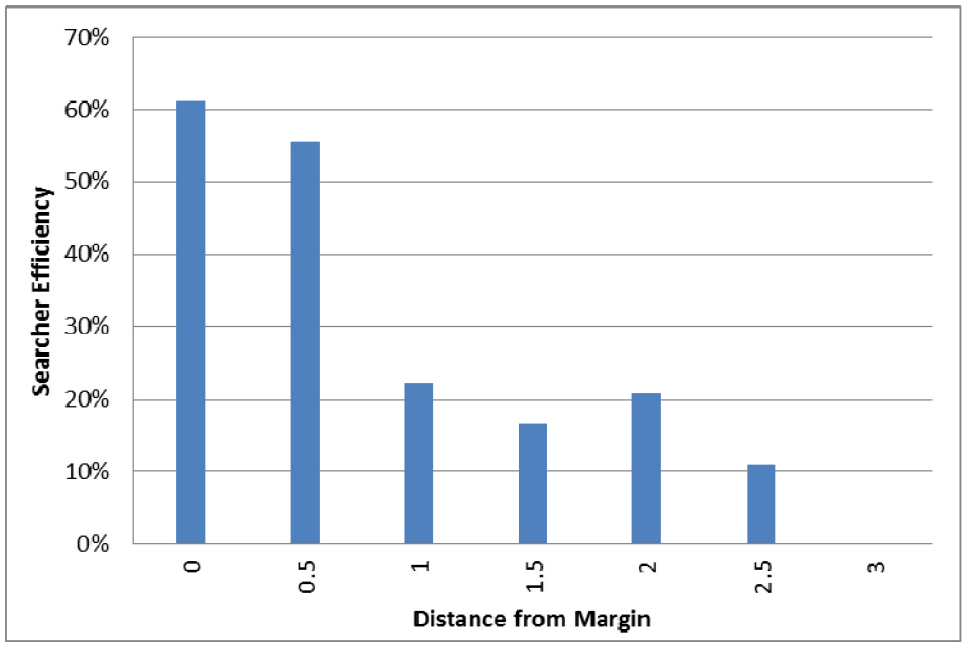
Note: 'Passes' refers to the total number of potential observations (i.e., since the three searcher teams surveyed each transect, each bird had the potential to be observed by three teams, and therefore there were a total of three passes for each bird).

TABLE 5. SEARCHER EFFICIENCY BY DISTANCE FROM EDGE IN MARSH HABITAT

DISTANCE FROM EDGE	TOTAL PASSES	DETECTS (PERCENT)
SPARTINA		
0	81	47 (58%)
0 up to 1 m	36	10 (28%)
1 m up to 2 m	33	7 (21%)
2 m up to 3 m	42	0 (0%)
***Spartina* Total**	**192**	64 (33%)
PHRAGMITES		
0	30	21 (70%)
0 up to 1 m	9	9 (100%)
1 m up to 2 m	9	1 (11%)
2 m up to 3 m	3	3 (100%)
***Phragmites* Total**	**51**	34 (67%)

Note: 'Passes' refers to the total number of potential observations (i.e., since the three searcher teams surveyed each transect, each bird had the potential to be observed by three teams, and therefore there were a total of three passes for each bird).

FIGURE 3. SEARCHER EFFICIENCY BY DISTANCE FROM EDGE (AVERAGE OF HABITATS)



4.2 CARCASS PERSISTENCE

Summary results of carcass persistence by habitat type, showing the percentage of carcasses remaining after 24 hours, three days, eight or ten days (eight for marsh habitat, ten days for sandbar habitat), and on the last day of the study (day 11 for marsh habitat, day 12 for sandbar habitat) are presented in Table 6. Additional summaries of study results are presented later in this section.[11]

TABLE 6. SUMMARY OF CARCASS PERSISTENCE RESULTS BY HABITAT TYPE

TRANSECT LOCATION	NO. PLACED	PERCENTAGE REMAINING X DAYS AFTER PLACEMENT			
		DAY 1	DAY 3	DAY 8 OR 10	DAY 11 OR 12 (LAST)
Spartina	85	53%	35%	22%	22%
Phragmites	32	34%	19%	9%	3%
Sandbar Habitat Total	9	67%	44%	22%	22%

Overall, over half of all carcasses across the marsh habitat study area were missing within 24 hours of deployment. In the first 72 hours, approximately two-thirds of all carcasses were missing, and 17 percent of carcasses remained at the end of the study period.

Persistence was generally higher in the *Spartina*-dominated habitat than in *Phragmites* habitat. For example, in the *Phragmites* habitat, two-thirds of carcasses were removed within the first 24 hours, as compared to just over 40 percent in the *Spartina* habitat.

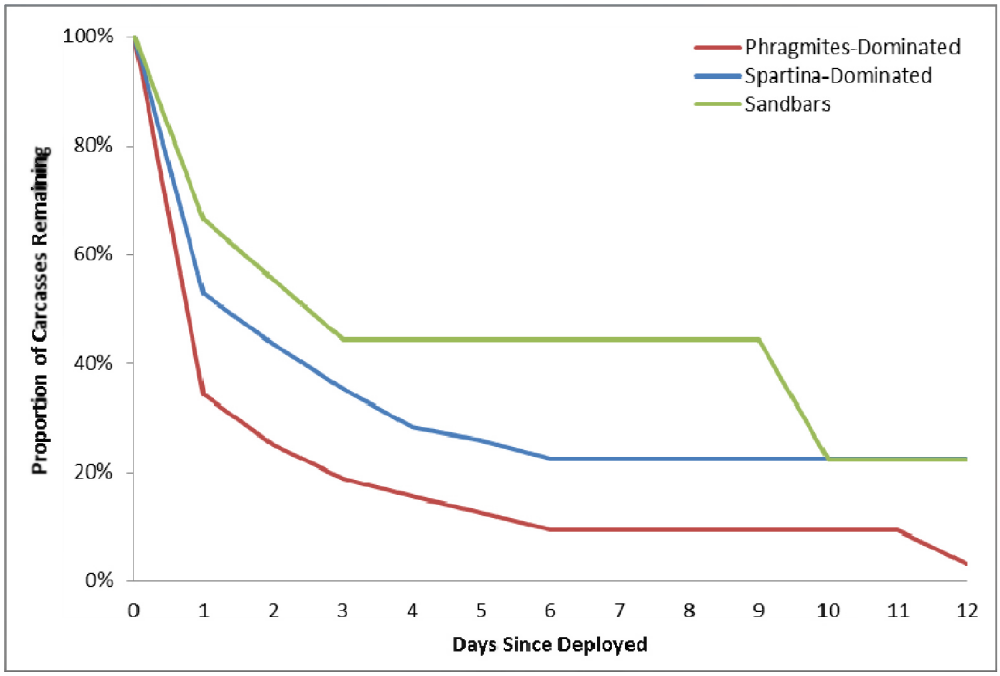
In sandbar habitat, two-thirds of carcasses remained after the initial 24 hours, and just under half remained after 72 hours. On the last day of the study, approximately one-quarter of carcasses remained. Figure 4 graphically presents carcass persistence over time for each habitat type.

As shown in Table 7, a relatively even number of each size class of carcass was deployed across each study area. In marsh habitat, 25 small (21 percent), 35 medium (30 percent), 31 large (26 percent), and 26 extra-large (22 percent) bird carcasses were deployed. Overall, small and medium bird carcasses had lower persistence than larger bird carcasses. For example, 16 percent of small and 43 percent of medium bird carcasses remained after 24 hours compared to 65 percent persistence in the larger bird carcass categories. Persistence over time by species and species size is summarized in Table 8.

In sandbar habitat, three each of medium, large, and extra-large bird carcasses were deployed. After 24 hours, one-third of medium sized bird carcasses remained, and all extra-large bird carcasses remained; however, the relatively small sample size does not allow for meaningful statistical testing of these findings.

[11] Carcasses were deployed on 11/4/2011 on transects 25, 30, and 31 in order to make up for short-term persistence data missed on other transects due to weather constraints; the first few days are the most important estimation period for carcass persistence. Carcasses deployed on these transects were followed for three days (no observations were made on day 8 or 11). When summarizing data for this report, we used the final state of each carcass on day 3 as the status of the carcass for days 8 and 11 in order to calculate persistence percentages at the same scale as other transects.

FIGURE 4. PROPORTION OF CARCASSES REMAINING BY HABITAT TYPE



Note: In order to display graphically, this graph uses the persistence data from the last day for which data is available for days on which no data was collected. For example, in sandbar habitat, data was collected on days 1, 2, 3, 4, 5 and day 10. In order to plot the data for days 6 through 9, the day 5 persistence data is used, and for day 11 the day 10 data was used.

TABLE 7. CARCASS PERSISTENCE OVER TIME BY CARCASS SIZE

SIZE CLASS	NO. PLACED	PERCENTAGE REMAINING X DAYS AFTER PLACEMENT			
		DAY 1	DAY 3	DAY 8 OR 10	DAY 11 OR 12 (LAST)
SPARTINA					
S	19	21%	11%	11%	11%
M	25	52%	28%	20%	20%
L	24	67%	50%	38%	38%
XL	17	71%	53%	18%	18%
***Spartina* Total**	**85**	**53%**	**35%**	**22%**	**22%**
PHRAGMITES					
S	6	0%	0%	0%	0%
M	10	20%	20%	10%	0%
L	7	43%	14%	14%	0%
XL	9	67%	33%	11%	11%
***Phragmites* Total**	**32**	**34%**	**19%**	**9%**	**3%**
SANDBAR					
S	0	-	-	-	-
M	3	67%	67%	0%	0%
L	3	33%	33%	33%	33%
XL	3	100%	33%	33%	33%
Sandbar Habitat Total	**9**	**67%**	**44%**	**22%**	**22%**

TABLE 8. CARCASS PERSISTENCE BY SPECIES

SPECIES (SIZE CLASS)	SPARTINA					PHRAGMITES					SANDBAR				
	NO.	DAY 1	DAY 3	DAY 8	DAY 11 (LAST)	NO. PLACED	DAY 1	DAY 3	DAY 8	DAY 11 (LAST)	NO. PLACED	DAY 1	DAY 3	DAY 10	DAY 12 (LAST)
AMRO (S, L)	1	0%	0%	0%	0%	0									
BLGR (S)	1	0%	0%	0%	0%	0									
COYE (S)	1	0%	0%	0%	0%	0									
HOSP (S)	4	0%	0%	0%	0%	1	0%	0%	0%	0%					
INBU (S)	1	100%	0%	0%	0%	2	0%	0%	0%	0%					
MODO (S)	4	50%	25%	25%	25%	0									
NOCA (S)	1	100%	100%	100%	100%	0									
RUTU (S)	0					1	0%	0%	0%	0%					
SASP (S)	1	0%	0%	0%	0%	0									
Sparrow spp. (S)	2	0%	0%	0%	0%	0									
SUTA (S)	1	0%	0%	0%	0%	0									
YBCU (S)	1	0%	0%	0%	0%	0									
Warbler spp. (S)	0					1	0%	0%	0%	0%					
WOTH (S)	0					1	0%	0%	0%	0%					
LAGU (M, XL)	22	45%	18%	14%	14%	10	30%	20%	10%	0%	3	67%	67%	0%	0%
RBGR (S)	1	0%	0%	0%	0%	0									
RBGU (M, L)	4	75%	75%	50%	50%	0									
GADW (L)	0					0					1	0%	0%	0%	0%
HEGU (L, XL)	25	79%	58%	38%	38%	11	45%	27%	18%	9%	3	67%	67%	67%	67%
LESC (L)	2	50%	0%	0%	0%	1	0%	0%	0%	0%					
MALL (L, XL)	4	50%	25%	25%	25%	1	100%	0%	0%	0%	1	100%	0%	0%	0%
RSHA (L)	1	0%	0%	0%	0%	0									
BDOW (L)	0					1	100%	0%	0%	0%					
BRPE (XL)	1	100%	100%	0%	0%	1	100%	100%	0%	0%					
DCCO (XL)	3	100%	100%	67%	67%	0					1	100%	0%	0%	0%
GRSC (XL)	3	67%	67%	0%	0%	1	0%	0%	0%	0%					
NOPI (XL)	1	0%	0%	0%	0%	0									
Total	**85**	**53%**	**35%**	**22%**	**22%**	**32**	**34%**	**19%**	**9%**	**3%**	**9**	**67%**	**44%**	**22%**	**22%**

Table 9 summarizes the percentage of carcasses remaining by distance from the edge throughout the study period. In marsh habitat, 52 carcasses (44 percent) were deployed on the edge of the shore (zero m from edge), and about 20 carcasses were deployed at each of the interior distances from the shore. Carcasses deployed on the marsh edge had generally lower persistence than carcasses placed within the marsh. For carcasses placed within the marsh, the actual distance from the edge seemed to have little or no effect.

In sandbar habitat, carcasses placed above the wrack line (i.e., further from the shoreline) appeared to be more persistent than those placed at increasingly closer distances to the water's edge (i.e., at wrack line, and lower than the wrack line). However, the relatively small sample size limits interpretation at this level of detail.

Since both 'distance from the edge' and 'carcass size' have been shown to influence carcass persistence, Table 10 summarizes the number of bird carcasses placed by both distance from the edge and carcass size class. As shown, carcasses of different size categories are relatively evenly distributed at different distances from the edge.

TABLE 9. CARCASS PERSISTENCE BY DISTANCE FROM EDGE

DISTANCE FROM EDGE	NO. PLACED	PERCENTAGE REMAINING X DAYS AFTER PLACEMENT			
		DAY 1	DAY 3	DAY 8 OR 10	DAY 11 OR 12 (LAST)
SPARTINA					
0 m	36	39%	22%	6%	6%
0 up to 1 m	15	67%	40%	33%	33%
1 m up to 2 m	13	62%	46%	31%	31%
2 m up to 3 m	21	62%	48%	38%	38%
***Spartina* Total**	**85**	**53%**	**35%**	**22%**	**22%**
PHRAGMITES					
0 m	16	31%	13%	6%	0%
0 up to 1 m	7	14%	14%	0%	0%
1 m up to 2 m	6	67%	50%	33%	17%
2 m up to 3 m	3	33%	0%	0%	0%
***Phragmites* Total**	**32**	**34%**	**19%**	**9%**	**3%**
SANDBAR					
Lower	2	100%	100%	50%	50%
Wrack	2	100%	50%	0%	0%
Upper	5	40%	20%	20%	20%
Sandbar Habitat Total	**9**	**67%**	**44%**	**22%**	**22%**

TABLE 10. DEPLOYMENT DISTANCE FROM EDGE AND CARCASS SIZE IN EACH HABITAT TYPE

DISTANCE FROM EDGE	PERCENTAGE OF CARCASSES IN EACH SIZE CLASS				
	S	M	L	XL	TOTAL
SPARTINA					
0 m	8%	9%	14%	11%	42%
0 up to 1 m	7%	5%	4%	2%	18%
1 m up to 2 m	1%	7%	2%	5%	15%
2 m up to 3 m	6%	8%	8%	2%	25%
***Spartina* Total**	**22%**	**29%**	**28%**	**20%**	**100%**
PHRAGMITES					
0 m	16%	13%	6%	16%	50%
0 up to 1 m	0%	9%	6%	6%	22%
1 m up to 2 m	3%	6%	6%	3%	19%
2 m up to 3 m	0%	3%	3%	3%	9%
***Phragmites* Total**	**19%**	**31%**	**22%**	**28%**	**100%**
SANDBAR					
Lower	-	33%	0%	33%	22%
Wrack	-	33%	100%	33%	56%
Upper	-	33%	0%	33%	22%
Sandbar Habitat Total	-	**33%**	**33%**	**33%**	**100%**

All carcasses were unscavenged when deployed. However, some bird carcasses were recorded as being in a "disturbed" state by the deployment team because of the condition of the carcasses (e.g., decaying eyes, wounds from gunshots, etc.).[12] Table 11 shows the percentage of bird carcasses remaining in each scavenging category throughout the assessment period.

[12] "Disturbed" conditions were recorded for six bird carcasses upon deployment, and four additional carcasses were noted as having some apparent injury. On day 1, four of these bird carcasses were recorded as "intact", two were missing, three were heavily scavenged, and one was "disturbed".

TABLE 11. CARCASS SCAVENGING CONDITION OVER TIME

SCAVENGING CATEGORY	PERCENTAGE IN EACH STATE X DAYS AFTER PLACEMENT			
	DAY 1	DAY 3	DAY 8 OR 10	DAY 11 OR 12 (LAST)
SPARTINA				
Unscavenged	38%	14%	2%	1%
Lightly scavenged	4%	11%	11%	11%
Heavily scavenged	5%	6%	0%	1%
Carcass gone	45%	58%	75%	75%
No Data[1]	9%	12%	12%	12%
PHRAGMITES				
Unscavenged	31%	16%	6%	0%
Lightly scavenged	3%	3%	3%	0%
Heavily scavenged	0%	0%	0%	3%
Carcass gone	66%	81%	91%	97%
No Data	-	-	-	-
SANDBARS				
Unscavenged	44%	11%	0%	0%
Lightly scavenged	11%	33%	22%	22%
Heavily scavenged	11%	0%	0%	0%
Carcass gone	33%	56%	78%	78%
No Data	-	-	-	-

[1] "No Data" refers to days during which birds were not checked for carcass state.

5.0 REFERENCES

Byrd, G.V. and J.H. Reynolds. 2006. Detection probabilities for bird carcasses on beaches of Unalaska Island, Alaska, following the wreck of the M/V *Selendang Ayu*. U.S. Fish and Wildlife Service, Alaska Maritime National Wildlife Refuge, Homer, AK.

Byrd, G.V., J.H. Reynolds, and P.L. Flint. 2009. Persistence rates and detection probabilities of bird carcasses on beaches of Unalaska Island, Alaska, following the wreck of the M/V *Selendang Ayu*. *Marine Ornithology*, 37: 197-204.

Flint, P. L., and A. C. Fowler. 1998. A drift experiment to assess the influence of wind on recovery of oiled seabirds. *Marine Pollution Bulletin*, 36: 165-166.

Ford, R.G., J.C. Ward, G.K. Himes Boor, and J.D. Storm. Final Report: Carcass Scavenging Rates Study for the M/V KURE/Humboldt Bay Oil Spill. Prepared for California Department of Fish and Game, Office of Spill Prevention and Response, April 2002.

Ford, R.G. 2006. Using beached bird monitoring data for seabird damage assessment: The importance of search interval. *Marine Ornithology*, 34: 91-98.

Ford, R.G. and M.A. Zafonte. 2009. Scavenging of seabird carcasses at oil spill sites in California and Oregon. *Marine Ornithology*, 37: 205–211.

Fowler, A.C. and P.L. Flint. 1997. Persistence rates and detection probabilities of oiled King Eider carcasses on St Paul Island, Alaska. *Marine Pollution Bulletin*, 34: 522-526.

Van Pelt, T.I. and J.F. Piatt. 1995. Deposition and persistence of beachcast seabird carcasses. *Marine Pollution Bulletin*, 30: 794-802.

APPENDIX A

[WORK PLAN PROVIDED ON DVD]

APPENDIX B
MASTER LIST OF BIRDS USED IN STUDY AND PLACEMENT DETAILS

TRANSECT ID	BIRD ID	BIRD SIZE	SPECIES	WEIGHT (g)	DISTANCE FROM ORIGIN	DISTANCE FROM EDGE	BIRD LAT	BIRD LONG
SPARTINA								
1	T1B4	M	LAGU	258	161	1.95	29.33543	-90.0837
1	T1B2	XL	HEGU	1055	561.5	0	29.33632	-90.08745
1	T1B3	XL	DCCO	1744	680.5	0.3	29.33727	-90.08884
1	T1B1	M	LAGU	284	848.5	0.9	29.33859	-90.09032
1	T1B5	L	HEGU	926	968	2.25	29.3392	-90.09111
2	T2B1	L	HEGU	925	11	0.15	29.434773	-90.029972
2	T2B2	XL	DCCO	1582	78	1.05	29.43518	-90.03003
2	T2B3	M	LAGU	284	147.5	0.75	29.43571	-90.03059
3	T3B1	S	Sparrow sp.	24	13	0	29.39969	-90.07021
3	T3B2	M	LAGU	252	383	1.95	29.40254	-90.06856
4	T4B1	XL	HEGU	1019	135.5	2.85	29.29435	-90.0267
4	T4B2	M	LAGU	249	200.5	0	29.29495	-90.02638
4	T4B3	L	LESC	714	332	2.7	29.29598	-90.02755
4	T4B4	S	BLGR	28	351.5	0.75	29.29622	-90.02773
4	T4B5	L	HEGU	816	448.5	0	29.29685	-90.02798
4	T4B6	M	LAGU	265	481	0.15	29.29724	-90.02805
4	T4B7	L	HEGU	842	518.5	1.95	29.29739	-90.02805
4	T4B8	S	YBCU	59	698.5	0	29.29887	-90.02825
4	T4B9	XL	HEGU	1231	752	0	29.29914	-90.02821
4	T4B10	S	MODO	107	838.5	1.65	29.3	-90.02742
4	T4B11	M	LAGU	233	964	0	29.30043	-90.02637
5	T5B1	L	HEGU	838	207.5	0	29.44877	-89.9389
5	T5B2	S	MODO	120	224.5	0	29.4486	-89.9387
5	T5B3	M	LAGU	310	354.5	1.05	29.4477	-89.93793
5	T5B4	M	LAGU	266	498.5	2.85	29.44674	-89.93739
5	T5B5	L	RSHA	508	582.5	0	29.44541	-89.93681
5	T5B6	XL	MALL	1024	902.5	0	29.44369	-89.93558
5	T5B7	L	MALL	919	955	0	29.44301	-89.93552
6	T6B1	XL	MALL	1042	11.5	0.15	29.34278	-89.99889
6	T6B2	M	LAGU	287	105.5	2.25	29.34229	-89.99805
6	T6B3	S	HOSP	28	126.5	2.1	29.34171	-89.99768
6	T6B4	S	MODO	122	184.5	0	29.34165	-89.99768
6	T6B5	L	LESC	823	239	0	29.34171	-89.99718
6	T6B6	L	HEGU	914	389.5	2.25	29.34218	-89.99541
6	T6B7	M	LAGU	249	530.5	0	29.34265	-89.99492

TRANSECT ID	BIRD ID	BIRD SIZE	SPECIES	WEIGHT (g)	DISTANCE FROM ORIGIN	DISTANCE FROM EDGE	BIRD LAT	BIRD LONG
6	T6B8	L	HEGU	882	897	2.1	29.34464	-89.99182
7	T7B1	M	LAGU	254	15.5	0	29.31769	-89.98255
7	T7B2	M	LAGU	277	147.5	1.35	29.31725	-89.98141
7	T7B3	S	RBGR	41	389.5	2.1	29.31378	-89.97996
7	T7B4	S	AMRO	83	630	0.9	29.31633	-89.97772
7	T7B5	S	HOSP	25	749.5	0	29.31662	-89.97664
7	T7B6	M	LAGU	331	856.5	2.25	29.31601	-89.97607
7	T7B7	S	HOSP	28	958.5	0.75	29.31713	-89.97506
8	T8B1	XL	HEGU	1001	74.5	0	29.48486	-89.91203
8	T8B2	M	LAGU	346	678.5	0.15	29.48993	-89.91203
8	T8B3	S	INBU	26	682.5	0.45	29.48997	-89.912
8	T8B4	M	LAGU	296	723	0	29.49028	-89.91173
8	T8B5	S	Sparrow sp.	26	855.5	0	29.49129	-89.91122
10	T10B1	S	SUTA	39	196.5	0.45	29.31935	-89.87737
10	T10B2	L	MALL	924	261	0	29.3201	-89.8752
10	T10B3	S	HOSP	29	467.5	0	29.31935	-89.87737
10	T10B4	XL	NOPI	1015	534.5	0	29.32017	-89.87859
10	T10B5	XL	DCCO	1736	569.5	0	29.32016	-89.87879
11	T11B1	S	SASP	19	29	0.15	29.4554	-89.7748
11	T11B2	L	HEGU	932	405	2.55	29.455	-89.7721
11	T11B3	L	HEGU	924	759	0	29.4558	-89.7674
11	T11B4	L	RGBU	512	896.5	0	29.4529	-89.7688
11	T11B5	M	LAGU	233	907.5	1.65	29.45281	-89.76886
11	T11B6	L	HEGU	888	945.5	0	29.4524	-89.7687
12	T12B1	M	RBGU	397	74.5	0	29.35623	-89.81458
12	T12B2	XL	GRSC	1116	96.5	1.65	29.35601	-89.81526
12	T12B3	XL	BRPE	2762	186	0	29.35519	-89.81466
12	T12B4	L	HEGU	950	262	0	29.35495	-89.81432
12	T12B5	XL	HEGU	1156	335.5	1.95	29.3524	-89.80968
12	T12B6	XL	HEGU	1146	909.5	0	29.35201	-89.80875
13	T13B1	XL	GRSC	1197	177	2.1	29.31302	-89.75087
13	T13B2	M	LAGU	283	191	2.85	29.31298	-89.75059
13	T13B3	XL	HEGU	1098	498.5	0	29.31237	-89.74766
14	T14B1	XL	GRSC	1144	385.5	1.2	29.4076	-89.72491
14	T14B2	L	HEGU	973	980.5	3	29.40244	-89.7236
25	T25B1	M	LAGU	226	121	2.2	29.42072	-90.05903
25	T25B2	L	HEGU	932	347	0	29.42244	-90.05775
25	T25B3	S	MODO	100	449	2.1	29.42306	-90.05894
30	T30B1	M	LAGU	248	75	0	29.29707	-90.03516

TRANSECT ID	BIRD ID	BIRD SIZE	SPECIES	WEIGHT (g)	DISTANCE FROM ORIGIN	DISTANCE FROM EDGE	BIRD LAT	BIRD LONG
30	T30B2	L	HEGU	248	226	2	29.29577	-90.03413
30	T30B3	L	HEGU	749	790	0.5	29.29387	-90.03640
30	T30B4	M	LAGU	900	806	0	29.29402	-90.03660
30	T30B5	S	NOCA	290	980	2.4	29.29429	-90.03855
31	T31B1	M	LAGU	43	87	2.4	29.33938	-89.83576
31	T31B2	L	HEGU	261	123	0	29.33903	-89.83614
31	T31B3	L	HEGU	837	410	0.7	29.33739	-89.83656
31	T31B4	M	RBGU	966	465	1.2	29.33660	-89.83665
31	T31B5	L	HEGU	307	662	2.1	29.33625	-89.83611
31	T31B6	S	COYE	833	753	2.9	29.33684	-89.83582
31	T31B7	M	RBGU	11	906	2.8	29.33708	-89.83469
PHRAGMITES								
15	T15B1	XL	HEGU	1007	239.5	0	29.02404	-89.34599
15	T15B2	L	BDOW	522	421.5	0	29.02502	-89.34537
15	T15B3	M	LAGU	293	514	2.25	29.02615	-89.34432
16	T16B1	L	HEGU	915	113	1.8	28.96361	-89.37531
16	T16B2	S	Warbler	9	151.5	0	28.96389	-89.37508
16	T16B3	XL	GRSC	1034	307.5	0	28.96522	-89.37358
16	T16B4	M	LAGU	288	361	0	28.96549	-89.37331
16	T16B5	M	LAGU	293	405.5	1.5	28.96572	-89.3731
16	T16B6	S	HOSP	28	668	1.35	28.96753	-89.37193
17	T17B1	L	HEGU	930	54.5	0.45	29.11249	-89.27612
17	T17B2	M	LAGU	319	185.5	0.3	29.1132	-89.27739
17	T17B3	XL	HEGU	1069	365.5	0	29.11419	-89.27885
17	T17B4	M	LAGU	297	832	0	29.11696	-89.28236
17	T17B5	S	INBU	17	941	0	29.11681	-89.28337
18	T18B1	M	LAGU	276	34.5	0.75	29.0598	-89.25905
18	T18B2	S	RUTU	89	141	0	29.06148	-89.25954
18	T18B3	M	LAGU	245	825.5	0	29.06488	-89.26411
19	T19B1	M	LAGU	302	100.5	0	29.02448	-89.1805
19	T19B2	S	WOTH	45	218.5	0	29.02337	-89.1806
19	T19B3	XL	BRPE	2437	223.5	0	29.02316	-89.1806
19	T19B4	L	HEGU	939	329.5	0.3	29.02241	-89.18099
19	T19B5	M	LAGU	282	416.5	1	29.02198	-89.18168
19	T19B7	L	MALL	963	501	1.6	29.02175	-89.1324
19	T19B6	XL	HEGU	1060	542	1.6	29.02171	-89.18271
19	T19B8	XL	HEGU	1026	571.5	2.9	29.02153	-89.18317
20	T20B1	M	LAGU	336	62	1.8	29.05661	-89.15595
20	T20B2	L	LESC	801	227	2.55	29.05737	-89.15556
20	T20B3	XL	HEGU	1052	535.5	0.9	29.05837	-89.15591

TRANSECT ID	BIRD ID	BIRD SIZE	SPECIES	WEIGHT (g)	DISTANCE FROM ORIGIN	DISTANCE FROM EDGE	BIRD LAT	BIRD LONG
20	T20B4	XL	HEGU	1243	826	0	29.06027	-89.1553
20	T20B5	L	HEGU	931	998.5	0	29.0616	-89.15495
21	T21B1	XL	HEGU	1107	31	0.6	28.99542	-89.1524
21	T21B2	S	INBU	17	787.5	0	29.0006	-89.15699

TRANSECT ID	BIRD ID	BIRD SIZE	SPECIES	WEIGHT (g)	DISTANCE FROM ORIGIN	RELATIVE TO SURF	BIRD LAT	BIRD LONG
SANDBAR								
2	T2B1	XL	HEGU	1074	59	LOWER	29.25435	-89.60489
2	T2B2	L	GADW	716	155	UPPER	29.25436	-89.60386
2	T2B3	L	HEGU	955	229	UPPER	29.25416	-89.60312
2	T2B4	M	LAGU	324	303	LOWER	29.25377	-89.60248
2	T2B5	XL	MALL	1219	521	UPPER	29.2534	-89.60015
2	T2B6	M	LAGU	267	752	WRACK	29.25271	-89.59792
3	T3B1	XL	DBCO	2393	147	WRACK	29.10151	-89.06736
3	T3B2	M	LAGU	261	597	UPPER	29.10474	-89.06405
3	T3B3	L	HEGU	846	795	UPPER	29.10575	-89.06219

APPENDIX C
CARCASS DEPLOYMENTS, PERSISTENCE, AND SEARCHER EFFICIENCY SURVEY DATES AND TEAMS

DEPLOYMENT DATES AND TEAMS

DATE	LOCATION	TRANSECT	DEPLOYMENT TEAM
MARSH HABITAT			
25-Oct	*Spartina*	11	M. Pixley, N. Wintle
25-Oct	*Spartina*	12	S. Bolthrunis, M. Parker
25-Oct	*Spartina*	13	S. Ward, R. Christophersen, G. Ford
25-Oct	*Spartina*	14	S. Ward, R. Christophersen, G. Ford
26-Oct	*Spartina*	2	M. Pixley, S. Flaherty
26-Oct	*Spartina*	3	S. Bolthrunis, M. Parker
26-Oct	*Spartina*	5	R. Christophersen N. Strom
26-Oct	*Spartina*	8	S. Bolthrunis, M. Parker
27-Oct	*Spartina*	1	M. Pixley, S. Ward
27-Oct	*Spartina*	4	S. Bolthrunis, M. Parker
27-Oct	*Spartina*	6	N. Strom, R. Christophersen
27-Oct	*Spartina*	7	M. Pixley, S. Ward
27-Oct	*Spartina*	10	S. Flaherty, N. Wintle
28-Oct	*Phragmites*	15	S. Bolthrunis, M. Parker
28-Oct	*Phragmites*	16	S. Ward, N. Martin
28-Oct	*Phragmites*	17	S. Ward, N. Martin
28-Oct	*Phragmites*	18	S. Bolthrunis, M. Parker
30-Oct	*Phragmites*	19	M. Parker, G. Ford
30-Oct	*Phragmites*	20	M. Parker, G. Ford
30-Oct	*Phragmites*	21	M. Parker, G. Ford
4-Nov	*Spartina*	25	N. Wintle, J. Schoenfelder
4-Nov	*Spartina*	30	N. Wintle, J. Schoenfelder
4-Nov	*Spartina*	31	N. Wintle, J. Schoenfelder
SANDBAR HABITAT			
26-Oct	PALWMA	3	C. Wright, D. Cassady
30-Oct	Scofield Bay	2	C. Wright, D. Cassady

CARCASS PERSISTENCE CHECKS AND TEAMS

DATE	LOCATION	TRANSECT	TEAM
MARSH HABITAT			
26-Oct	*Spartina*	11	G. Ford, N. Wintle
26-Oct	*Spartina*	12	G. Ford, N. Wintle
26-Oct	*Spartina*	13	G. Ford, N. Wintle
26-Oct	*Spartina*	14	G. Ford, N. Wintle
27-Oct	*Spartina*	2	G. Ford, J. Schoenfelder
27-Oct	*Spartina*	3	G. Ford, J. Schoenfelder
27-Oct	*Spartina*	5	G. Ford, J. Schoenfelder
27-Oct	*Spartina*	8	G. Ford, J. Schoenfelder
27-Oct	*Spartina*	12	S. Flaherty, N. Wintle
27-Oct	*Spartina*	13	S. Flaherty, N. Wintle
27-Oct	*Spartina*	14	S. Flaherty, N. Wintle
28-Oct	*Spartina*	2	R. Christophersen, N. Storm
28-Oct	*Spartina*	4	G. Ford, J. Schoenfelder
28-Oct	*Spartina*	5	R. Christophersen, N. Storm
28-Oct	*Spartina*	8	R. Christophersen, N. Storm
28-Oct	*Spartina*	10	S. Flaherty, N. Wintle
28-Oct	*Spartina*	12	S. Flaherty, N. Wintle
28-Oct	*Spartina*	13	S. Flaherty, N. Wintle
28-Oct	*Spartina*	14	S. Flaherty, N. Wintle
29-Oct	*Phragmites*	15	G. Ford, S. Ward, M. Parker, N. Wintle
29-Oct	*Phragmites*	16	G. Ford, S. Ward, M. Parker, N. Wintle
29-Oct	*Phragmites*	17	G. Ford, S. Ward, M. Parker, N. Wintle
29-Oct	*Phragmites*	18	G. Ford, S. Ward, M. Parker, N. Wintle
30-Oct	*Spartina*	1	R. Christophersen, N. Storm
30-Oct	*Spartina*	2	R. Christophersen, N. Storm
30-Oct	*Spartina*	4	J. Schoenfelder S., N. Martin
30-Oct	*Spartina*	5	R. Christophersen, N. Storm
30-Oct	*Spartina*	6	J. Schoenfelder S., N. Martin
30-Oct	*Spartina*	7	J. Schoenfelder S., N. Martin
30-Oct	*Spartina*	8	R. Christophersen, N. Storm
30-Oct	*Spartina*	10	J. Schoenfelder S., N. Martin
30-Oct	*Spartina*	12	J. Schoenfelder S., N. Martin
30-Oct	*Spartina*	13	J. Schoenfelder S., N. Martin
30-Oct	*Spartina*	14	J. Schoenfelder S., N. Martin
30-Oct	*Spartina*	15	S. Flaherty, N. Wintle
30-Oct	*Phragmites*	16	S. Flaherty, N. Wintle
30-Oct	*Phragmites*	17	S. Flaherty, N. Wintle
30-Oct	*Phragmites*	19	G. Ford, M. Parker

DATE	LOCATION	TRANSECT	TEAM
31-Oct	*Spartina*	1	R. Christophersen, N. Wintle
31-Oct	*Spartina*	2	R. Christophersen, N. Wintle
31-Oct	*Spartina*	4	M. Parker, J. Schoenfelder
31-Oct	*Spartina*	6	R. Christophersen, N. Wintle
31-Oct	*Spartina*	10	M. Parker, J. Schoenfelder
31-Oct	*Phragmites*	15	N. Storm, S. Flaherty
31-Oct	*Phragmites*	16	N. Storm, S. Flaherty
31-Oct	*Phragmites*	17	N. Storm, S. Flaherty
31-Oct	*Phragmites*	19	N. Storm, S. Flaherty
31-Oct	*Phragmites*	20	N. Storm, S. Flaherty
31-Oct	*Phragmites*	21	N. Storm, S. Flaherty
1-Nov	*Spartina*	1	J. Schoenfelder, S. Flaherty
1-Nov	*Spartina*	4	J. Schoenfelder, S. Flaherty
1-Nov	*Spartina*	6	J. Schoenfelder, S. Flaherty
1-Nov	*Spartina*	16	R. Christophersen, N. Wintle
1-Nov	*Phragmites*	19	R. Christophersen, N. Wintle
1-Nov	*Phragmites*	21	R. Christophersen, N. Wintle
2-Nov	*Spartina*	12	R. Christophersen
2-Nov	*Spartina*	13	R. Christophersen
2-Nov	*Spartina*	14	R. Christophersen
2-Nov	*Phragmites*	16	J. Schoenfelder, N. Wintle
2-Nov	*Phragmites*	19	J. Schoenfelder, N. Wintle
2-Nov	*Phragmites*	21	J. Schoenfelder, N. Wintle
3-Nov	*Spartina*	2	S. Flaherty, R. Christophersen
3-Nov	*Phragmites*	19	J. Schoenfelder, N. Wintle
3-Nov	*Phragmites*	21	J. Schoenfelder, N. Wintle
4-Nov	*Spartina*	1	J. Schoenfelder, N. Wintle
4-Nov	*Spartina*	4	J. Schoenfelder, N. Wintle
4-Nov	*Spartina*	6	J. Schoenfelder, N. Wintle
4-Nov	*Phragmites*	19	S. Flaherty, R. Christophersen
5-Nov	*Spartina*	5	N. Wintle
5-Nov	*Spartina*	12	R. Christophersen, J. Schoenfelder
5-Nov	*Spartina*	25	R. Christophersen, J. Schoenfelder
5-Nov	*Spartina*	30	R. Christophersen, J. Schoenfelder
5-Nov	*Spartina*	31	R. Christophersen, J. Schoenfelder
6-Nov	*Spartina*	2	S. Flaherty, N. Wintle
6-Nov	*Spartina*	25	S. Flaherty, N. Wintle
6-Nov	*Spartina*	30	S. Flaherty, N. Wintle
6-Nov	*Spartina*	31	S. Flaherty, N. Wintle
7-Nov	*Spartina*	1	N. Wintle
7-Nov	*Spartina*	4	N. Wintle

DATE	LOCATION	TRANSECT	TEAM
7-Nov	*Spartina*	6	N. Wintle
7-Nov	*Phragmites*	19	N. Wintle
7-Nov	*Spartina*	30	N. Wintle
7-Nov	*Spartina*	31	S. Flaherty
8-Nov	*Phragmites*	16	N. Wintle
9-Nov	NO TRANSECTS CHECKED TODAY		
10-Nov	*Phragmites*	19	N. Wintle
SANDBAR HABITAT			
26-Oct	PALWMA	3	C. Wright, D. Cassady
27-Oct	PALWMA	3	C. Wright, D. Cassady
28-Oct	PALWMA	3	C. Wright, D. Cassady
30-Oct	Scofield Bay	2	C. Wright, D. Cassady
31-Oct	Scofield Bay	2	C. Wright, D. Cassady
1-Nov	Scofield Bay	2	C. Wright, D. Cassady
1-Nov	Scofield Bay	2	C. Wright, D. Cassady
1-Nov	Scofield Bay	2	C. Wright, D. Cassady
1-Nov	Scofield Bay	2	C. Wright, D. Cassady
1-Nov	Scofield Bay	2	C. Wright, D. Cassady
1-Nov	Scofield Bay	2	C. Wright, D. Cassady

SEARCHER EFFICIENCY SURVEYS AND TEAMS

DATE	LOCATION	TRANSECT	SEEDED/NULL
MARSH HABITAT			
25-Oct	*Spartina*	11	Seeded
25-Oct	*Spartina*	12	Seeded
25-Oct	*Spartina*	13	Seeded
25-Oct	*Spartina*	14	Seeded
26-Oct	*Spartina*	2	Seeded
26-Oct	*Spartina*	6	Seeded
26-Oct	*Spartina*	5	Seeded
26-Oct	*Spartina*	8	Seeded
26-Oct	*Spartina*	25	Null
27-Oct	*Spartina*	1	Seeded
27-Oct	*Spartina*	4	Seeded
27-Oct	*Spartina*	6	Seeded
27-Oct	*Spartina*	7	Seeded
27-Oct	*Spartina*	10	Seeded
28-Oct	*Phragmites*	15	Seeded
28-Oct	*Phragmites*	16	Seeded
28-Oct	*Phragmites*	17	Seeded
28-Oct	*Phragmites*	18	Seeded
28-Oct	*Phragmites*	28	Null
SANDBAR HABITAT			
26-Oct	PALWMA	3	Seeded
30-Oct	Scofield Bay	2	Seeded

Notes:
There were three searcher efficiency teams surveying the marsh habitat transects, and each team surveyed each of the marsh transects once. The team members were as follows: Team 1: Deb Rudis and Chris Reighn; Team 2: Felix Lopez and Terry Adelsbach; Team 3: Brittany Petersen and Steve Mars. There was one team surveying the sandbar transects, Megan Smith and Todd Credeur.

APPENDIX D
ROBEL POLE DATA

SITE	GARS CELL ID	TRANSECT ID	BIRD ID	DIST FROM MARGIN (M)	ACTUAL BIRD LATITUDE	ACTUAL BIRD LONGITUDE	DATE	ROBEL 1	ROBEL 2	ROBEL 3	ROBEL 4
Barataria Bay	180KY25	1	T1B4	1.95	29.33543	-90.0837	10/30	27	32	29	30
Barataria Bay	180KY25	1	T1B2	0	29.33632	-90.08745	10/30	31	28	29	30
Barataria Bay	180KY25	1	T1B3	0.3	29.33727	-90.08884	10/30	25	33	33	33
Barataria Bay	180KY25	1	T1B1	0.9	29.33859	-90.09032	10/30	33	31	29	water
Barataria Bay	180KY25	1	T1B5	2.25	29.3392	-90.09111	10/30	33	28	28	water
Barataria Bay	180KY23	2	T2B1	0.15	29.43477	-90.029972	10/27	15	14	15	15
Barataria Bay	180KY23	2	T2B2	1.05	29.43518	-90.03003	10/27	12	13	13	10
Barataria Bay	180KY23	2	T2B3	0.75	29.43571	-90.03059	10/27	11	16	15	16
Barataria Bay	180KY26	3	T3B1	0	29.39969	-90.07021	10/27	19	16	14	13
Barataria Bay	180KY26	3	T3B2	1.95	29.40254	-90.06856	10/27	25	24	25	30
Barataria Bay	180KY29	4	T4B1	2.85	29.29435	-90.0267	10/28	19	23	20	25
Barataria Bay	180KY29	4	T4B2	0	29.29495	-90.02638	10/28	18	26	22	22
Barataria Bay	180KY29	4	T4B3	2.7	29.29598	-90.02755	10/28	35	18	21	39
Barataria Bay	180KY29	4	T4B4	0.75	29.29622	-90.02773	10/28*	35	18	21	39
Barataria Bay	180KY29	4	T4B5	0	29.29685	-90.02798	10/28	19	22	31	19
Barataria Bay	180KY29	4	T4B6	0.15	29.29724	-90.02805	10/28	11	15	21	11
Barataria Bay	180KY29	4	T4B7	1.95	29.29739	-90.02805	10/28	8	14	7	2
Barataria Bay	180KY29	4	T4B8	0	29.29887	-90.02825	10/28	2	7	8	8
Barataria Bay	180KY29	4	T4B9	0	29.29914	-90.02821	10/28	12	11	11	11
Barataria Bay	180KY29	4	T4B10	1.65	29.3	-90.02742	10/28	18	22	26	32
Barataria Bay	180KY29	4	T4B11	0	29.30043	-90.02637	10/28	17	18	16	17
Barataria Bay	181KY11	5	T5B1	0	29.44877	-89.9389	10/27	13	11	14	6
Barataria Bay	181KY11	5	T5B2	0	29.4486	-89.9387	10/27	18	21	23	27
Barataria Bay	181KY11	5	T5B3	1.05	29.4477	-89.93793	10/27	0	11	0	0

SITE	GARS CELL ID	TRANSECT ID	BIRD ID	DIST FROM MARGIN (M)	ACTUAL BIRD LATITUDE	ACTUAL BIRD LONGITUDE	DATE	ROBEL 1	ROBEL 2	ROBEL 3	ROBEL 4
Barataria Bay	181KY11	5	T5B4	2.85	29.44674	-89.93739	10/27	25	21	21	18
Barataria Bay	181KY11	5	T5B5	0	29.44541	-89.93681	10/27	25	18	19	19
Barataria Bay	181KY11	5	T5B6	0	29.44369	-89.93558	10/27	8	6	8	4
Barataria Bay	181KY11	5	T5B7	0	29.44301	-89.93552	10/27	5	9	6	10
Barataria Bay	181KY14	6	T6B1	0.15	29.34278	-89.99889	10/27	9	6	n/a	n/a
Barataria Bay	181KY14	6	T6B1	0.15	29.34278	-89.99889	10/30	11	22	26	21
Barataria Bay	181KY14	6	T6B2	2.25	29.34229	-89.99805	10/27	14	16	9	10
Barataria Bay	181KY14	6	T6B3	2.1	29.34171	-89.99768	10/27	11	17	n/a	14
Barataria Bay	181KY14	6	T6B4	0	29.34165	-89.99768	10/27	15	19	n/a	11
Barataria Bay	181KY14	6	T6B4	0	29.34165	-89.99768	10/30	13	12	12	8
Barataria Bay	181KY14	6	T6B5	0	29.34171	-89.99718	10/27	1	3	n/a	1
Barataria Bay	181KY14	6	T6B5	0	29.34171	-89.99718	10/30	13	12	12	8
Barataria Bay	181KY14	6	T6B6	2.25	29.34218	-89.99541	10/27	9	4	6	7
Barataria Bay	181KY14	6	T6B7	0	29.34265	-89.99492	10/27	4	3	n/a	6
Barataria Bay	181KY14	6	T6B7	0	29.34265	-89.99492	10/30	6	8	14	4
Barataria Bay	181KY14	6	T6B8	2.1	29.34464	-89.99182	10/27	0			
Barataria Bay	181KY14	6	T6B8	2.1	29.34464	-89.99182	10/31	1	2	2	3
Barataria Bay	181KY14	6	T6B8	2.1	29.34464	-89.99182	11/7	4	10	6	12
Barataria Bay	181KY17	7	T7B1	0	29.31769	-89.98255	10/30	18	14	15	12
Barataria Bay	181KY17	7	T7B2	1.35	29.31725	-89.98141	10/30 (mudflat)	0	0	0	0
Barataria Bay	181KY17	7	T7B3	2.1	29.31378	-89.97996	10/30	11	18	12	15
Barataria Bay	181KY17	7	T7B4	0.9	29.31633	-89.97772	10/30	27	24	23	23
Barataria Bay	181KY17	7	T7B5	0	29.31662	-89.97664	10/30	17	18	16	19
Barataria Bay	181KY17	7	T7B6	2.25	29.31601	-89.97607	10/30	24	24	22	21
Barataria Bay	181KY17	7	T7B7	0.75	29.31713	-89.97506	water too low to reach bird	n/a	n/a	n/a	n/a
Barataria Bay	181KY12	8	T8B1	0	29.48486	-89.91203	10/27	32	44	41	37

SITE	GARS CELL ID	TRANSECT ID	BIRD ID	DIST FROM MARGIN (M)	ACTUAL BIRD LATITUDE	ACTUAL BIRD LONGITUDE	DATE	ROBEL 1	ROBEL 2	ROBEL 3	ROBEL 4
Barataria Bay	181KY12	8	T8B2	0.15	29.48993	-89.91203	10/27	25	23	29	26
Barataria Bay	181KY12	8	T8B3	0.45	29.48997	-89.912	10/27	25	23	29	26
Barataria Bay	181KY12	8	T8B4	0	29.49028	-89.91173	10/27	18	28	29	26
Barataria Bay	181KY12	8	T8B5	0	29.49129	-89.91122	10/27	31	31	27	32
Barataria Bay	181KY18	10	T10B1	0.45	29.31935	-89.87737	10/27	12	55	>60	35
Barataria Bay	181KY18	10	T10B2	0	29.3201	-89.8752	10/27	10	>60	>60	>60
Barataria Bay	181KY18	10	T10B3	0	29.31935	-89.87737	10/27	1	55	>60	30
Barataria Bay	181KY18	10	T10B4	0	29.32017	-89.87859	10/27	1	>60	>60	>60
Barataria Bay	181KY18	10	T10B5	0	29.32016	-89.87879	10/27	1	>60	>60	>60
Barataria Bay	181KY13	11	T11B1	0.15	29.4554	-89.7748	ND	22	22	24	25
Barataria Bay	181KY13	11	T11B2	2.55	29.455	-89.7721	ND	27	28	25	29
Barataria Bay	181KY13	11	T11B3	0	29.4558	-89.7614	ND	21	17	19	20
Barataria Bay	181KY13	11	T11B4	0	29.4529	-89.7688	ND	29	27	25	27
Barataria Bay	181KY13	11	T11B5	1.65	29.45281	-89.76886	ND	29	27	25	27
Barataria Bay	181KY13	11	T11B6	0	29.4524	-89.7687	ND	28	27	23	29
Barataria Bay	181KY16	12	T12B1	0	29.35623	-89.81458	10/27	1	3	11	5
Barataria Bay	181KY16	12	T12B1	0	29.35623	-89.81458	10/28	15	16	12	16
Barataria Bay	181KY16	12	T12B2	1.65	29.35601	-89.81526	10/27	2	4	2	4
Barataria Bay	181KY16	12	T12B3	0	29.35519	-89.81466	10/27	4	17	0	4
Barataria Bay	181KY16	12	T12B3	0	29.35519	-89.81466	10/28	2	2	2	2
Barataria Bay	181KY16	12	T12B4	0	29.35495	-89.81432	10/27	4	6	4	6
Barataria Bay	181KY16	12	T12B4	0	29.35495	-89.81432	10/28	2	2	2	2
Barataria Bay	181KY16	12	T12B4	0	29.35495	-89.81432	10/30	11	12	15	9
Barataria Bay	181KY16	12	T12B5	1.95	29.3524	-89.80968	10/27	1	1	1	1
Barataria Bay	181KY16	12	T12B5	1.95	29.3524	-89.80968	10/30	20	19	22	21
Barataria Bay	181KY16	12	T12B6	0	29.35201	-89.80875	10/30	7	6	4	6
Barataria Bay	181KY19	13	T13B1	2.1	29.31302	-89.75087	10/28	15	13	10	10

SITE	GARS CELL ID	TRANSECT ID	BIRD ID	DIST FROM MARGIN (M)	ACTUAL BIRD LATITUDE	ACTUAL BIRD LONGITUDE	DATE	ROBEL 1	ROBEL 2	ROBEL 3	ROBEL 4
Barataria Bay	181KY19	13	T13B2	2.85	29.31298	-89.75059	10/28	10	16	12	4
Barataria Bay	181KY19	13	T13B3	0	29.31237	-89.74766	11/2	27	31	27	28
Barataria Bay	181KY24	14	T14B1	3	29.4076	-89.72491	10/27	16	13	24	20
Barataria Bay	181KY24	14	T14B1	3	29.4076	-89.72491	10/28	25	26	25	23
Barataria Bay	181KY24	14	T14B2	1.2	29.40244	-89.7236	10/27	13	22	18	22
Barataria Bay	181KY24	14	T14B2	1.2	29.4076	-89.72491	10/28	17	20	17	15
Barataria Bay	180KY23	25	T25B1	2.2	29.42072	-90.05903	11/4	18	20	20	17
Barataria Bay	180KY23	25	T25B2	0	29.42244	-90.05775	11/4	19	21	21	19
Barataria Bay	180KY23	25	T25B3	2.1	29.42306	-90.05894	11/4	26	28	29	27
Barataria Bay	180KY29	30	T30B1	0	29.29707	-90.03516	11/4	37	30	26	46
Barataria Bay	180KY29	30	T30B2	2	29.29577	-90.03413	11/4	18	16	22	15
Barataria Bay	180KY29	30	T30B3	0.5	29.29387	-90.0364	11/4	17	17	17	11
Barataria Bay	180KY29	30	T30B4	0	29.29402	-90.0366	11/4	10	7	11	6
Barataria Bay	180KY29	30	T30B5	2.4	29.29429	-90.03855	11/4	9	9	9	9
Barataria Bay	181KY15	31	T31B1	2.4	29.33938	-89.83576	11/4	12	12	15	15
Barataria Bay	181KY15	31	T31B2	0	29.33903	-89.83614	11/4	14	12	12	14
Barataria Bay	181KY15	31	T31B3	0.7	29.33739	-89.83656	11/4	12	14	11	18
Barataria Bay	181KY15	31	T31B4	1.2	29.3366	-89.83665	11/4	20	17	15	14
Barataria Bay	181KY15	31	T31B5	2.1	29.33625	-89.83611	11/4	14	13	14	15
Barataria Bay	181KY15	31	T31B6	2.9	29.33684	-89.83582	11/4	9	17	20	19
Birdsfoot Delta	182KX12	31	T31B7	2.8	29.33708	-89.83469	11/4	20	18	14	10
Birdsfoot Delta	182KY36	16	T16B5	1.5	28.96572	-89.3731	10/30; Robel > 60; photos 103&104				

Notes:
* Notes on datasheet indicate “same as T4B3”, therefore, we assumed the robel measurements are the same as those recorded for T4B3.
ND: Not documented.

APPENDIX E
ADDENDUM TO PROTOCOLS AND MODIFIED SOPS GIVEN TO STUDY PERSONNEL

ADDENDUM TO PERSISTENCE PROTOCOLS (10/23/2011)

Supplies:

Carcass Placement Table – Ap C Table 1
Table 1: Transect Start and End Point Table
Maps of transects
Transect specific bag containing pre-bagged and labeled birds
Pre programmed GPS for your transects
NOAA NRDA safety box
Robel pole (day 2 only)
Grapple Pole
Workplan and appendices
Digital cameras
String
Data forms

Persistence team prep work

1. Set GPS coordinates for Start and End of transect into GPS (e.g., T01S, T01E) from table provided
2. Set coordinates for each bird drop location B1 through B2.
3. Prepare transect bag

Day 1 Persistence Setters protocol

1. Go to start point based on programmed GPS coordinate.
2. Navigate to location of first carcass placement
    a. If you cannot reach shoreline at waypoint
        i. Proceed to nearest accessible point with access and move to waypoint by walking. If walking, proceed in manner to least disturb vegetation from shoreline vantage (e.g., entry from behind)
    b. If you reach waypoint and there is no access to shoreline and no alternative access (bullet a) is available within approximately 25 meters to either side of that point (for walking access) proceed by boat to next accessible shoreline and place bird. Using the notes field, indicate on data form ("Loc Mod").
    c. Save current bird location as waypoint

3. Refer to carcass placement description table and pull bird with appropriate ID from pre-prepared transect bag
    a. Determine distance from Margin from C Table 1. If non zero distance – use grapple pole to reach in bird from marsh edge using demarcations on pole as guide.
    b. If zero distance (marsh edge) – evaluate water level relative to vegetation.
        i. If vegetation is partially submerged, using thread tie leg of carcass to lower stalk allowing the carcass to float on the water
        ii. In some circumstances water levels may be sufficiently low that the marsh edge will be elevated or perched. If water level is below the vertical marsh plane (e.g., sediment exposed), tie leg of carcass to nearest available vegetation (e.g., stalk or dense exposed root mat) allowing sufficient slack (about 4 inches) in the thread for the carcass to maintained at the edge in contact with water.
4. Record Data on forms following Ap E (Bullet 7)
5. After each searcher team evaluates the transect, persistence teams will attempt to re-sight all birds. Fill out unique data form following Ap E (Bullet 7). In notes Field, indicate which team the resighting attempt followed. A total of 4 forms will be filled out for each transect on Day 1 one at time of setting and one each following SE Team A, B, and C.

Day 2 protocol:

1. Follow protocol in workplan re. resighting birds
2. Navigate to waypoint for bird drop location
    a. If carcass found, follow SOP in workplan for data collection
    b. Use Robel pole to take measurement as follows (whether or not bird is present):
        i. At the point where the bird was originally placed (regardless of whether the bird remains there on day 2), place a Robel pole at 4 meters depth perpendicularly from the marsh margin (zero distance).
        ii. The actual reading on the pole consists of identifying the last band visible on the pole before the pole disappears in the vegetation when viewed at a distance of 4 meters. The observer's eyes should be focused at the pole at a height of 1 meter above the ground guided by the 4 meter rope attached to the pole at 1 meters above its base.

iii. Robel pole readings should be recorded even if viewed through a hole in the vegetation and not at the top of the vegetation.

iv. At each sample point, four observations are made on the pole from opposing directions (the four cardinal directions with the first made perpendicular to the marsh edge and the remaining completed in a clockwise direction.

v. Record measurements on the persistence data form in the order in which they were made in the "Robel Pole" field.

3. Attempt to resight all birds following protocols in workplan
4. If bird is completely missing, search shoreline at least 300 meters to each side of original placement

MODIFIED SOPS GIVEN TO STUDY PERSONNEL

Appendix 'D' and 'E' SOP's from the Study Plan modified for training and assessment purposes so that detection (efficiency) teams were not informed of the procedures used, and activities conducted, by the deployment (persistence) teams.

Efficiency Working Appendix D: SOP for Deployment & Observation of Carcasses for Detection and Persistence

Use of two person teams is planned and is preferable for safety and other reasons. All detection teams will be comprised of a minimum of two individuals.

1. Ideally, persistence teams will deploy carcasses just before detection teams are scheduled to search that transect. Tidal timing should be considered (see below) to the extent feasible. Trustee representatives will discuss and agree to the following day's deployment schedule.
2. Transects will require boat access. Search teams will need to coordinate in advance with searcher efficiency and persistence project team personnel to determine logistics.
3. After Deployment teams have completed the carcass placement, the detection team will search the transect as soon as possible. Detection teams will be kept away from the area during the deployment, and efforts will be made to ensure that detection teams are unaware of which transects have been seeded. Detection teams will follow general methods utilized in both the Response efforts and during marsh edge beached bird searches for Bird Study #10. Shallow draft vessels will be utilized and will travel at the minimum safe speed to maintain steerage. Boat speed should be maintained at sufficiently low throttle to avoid generating wake (generally less than 5 mph). Shallow draft vessels should maintain the closest safe distance to the marsh edge allowable by the vessel draft and outboard motor depth (consistent with typical Response search methods). Teams of two searchers (plus boat driver) will be utilized. Teams will use a combination of binoculars and naked eye to as were used during the original spill response conduct searches of the vegetation. Detection teams will conduct searches from within the boat and will not search for birds by leaving the boat and wading/walking into marsh areas.

4. When detection teams observe carcasses, under no circumstances should detection teams attempt to retrieve the bird. Rather, records should be recorded on the Searcher Efficiency Data sheet (Exhibit #2) and photos should be taken (at 1 and 5 m) when possible. All GPS coordinates for bird locations and photos should be taken at the closest distance to the bird and marsh edge as possible without disturbing the bird or the marsh vegetation.

5. A total of three separate detection teams will be used, and all three teams will search each transect.

Appendix E: Data Collection SOP for Detection and Persistence

1. A copy of the data sheet to be used for the searcher efficiency study is included as Exhibit 2 to this SOP. One data sheet will be completed for each transect included in the searcher efficiency effort. The general purpose of the searcher efficiency data sheet is to document information about carcasses placed by the persistence teams that were subsequently "found" by detection teams. All data forms will be filled out on paper, in ink.

2. At the end of each day, each data sheet will be signed by Trustee representatives on each searcher efficiency or persistence team. Original data sheets will remain in the possession of the Department of Interior Trustee representative on each team until the team has completed their assigned transects. If present, the LA representative will be provided the opportunity to copy each data sheet after completion of transect observations each day. At the end of the study, the original data sheets will be provided to a designated Department of Interior representative. The DOI representative will scan all data sheets onto CDs; one set of CDs will be mailed to a designated LOSCO representative and one set to IEc under proper Chain of Custody procedures.

3. At the end of each day detection and persistence team photographs of each bird (as specified in the SOPs) will be downloaded to a computer, and given a name using the following conventions:

4. Detection Team photos: the first symbols will be the letters "BS19SEStudy" followed by an underscore; the next symbols will be the Transect number followed by an underscore; the next symbols will be the team identifier number; the next symbol will be the number given to each carcass found (in sequential order, for example if three birds are found on a transect, birds will simply be numbered one through three) followed by an underscore; the next symbols will be the date of sighting using 'mm-dd-yy' format followed by an underscore; and the last symbols will be '1', or '5' for the photos taken approximately 1, and 5 meters from the carcass, respectively. Surveyors should start the study using new/blank camera memory cards. Do not delete any photos from the memory cards. At the end of the study, the memory cards will be provided to a designated Department of Interior Trustee representative, using appropriate Chain of Custody procedures, for archiving.

5. Filling out the Searcher Efficiency Study data sheets:

    a. A copy of the data sheets to be used for the searcher efficiency study is

included as Exhibit 2. One data sheet will be completed for each detection team for each transect type (marsh edge, sandbar/spit) included in the searcher efficiency study, and will be filled out on paper, in ink.

b. All blanks in the data sheet should contain either data or an "X" (that would indicate that such blank was purposefully not filled in). Any data entry errors should be crossed out with a single thin line and initialed.

c. The start and end time of the survey should be recorded along with corresponding GPS coordinates of the start and end points of the transect surveyed.

d. Detection teams should not attempt to retrieve or handle carcasses found. While each carcass will be tagged with unique ID numbers, it is probable that detection teams will not be able to read them, so detection teams should fill out the "Carcass ID" field as follows: BS19SE_transectID#_teamID_Bird#, where the first symbols will be the letters "BS19SEStudy" followed by an underscore; the next symbols will be the Transect number followed by an underscore; the next symbols will be the team identifier number; the next symbol will be the number given to each carcass found (in sequential order, for example if three birds are found on a transect, birds will simply be numbered one through three).

e. The "Distance from Edge" field (marsh edge transects only) should be recorded as the estimated perpendicular distance from the marsh margin. Actual measurements should not be made in order to minimize disturbance to the marsh edge habitat.

f. The "Position relative to surf" field (sandbar/spit transects only) should be recorded as one of the following categories: low (wash zone), upper (high tide), or wrack.

g. After a datasheet is completed, the survey team members will sign the datasheet, indicating that they all agree that the data contained therein is correct.

6. Filling out the Chain of Custody form

a. When transferring custody of original data sheets or camera memory cards, such transfer must be documented using a Chain of Custody form (Exhibit 4).

i. Leave "Date and Time of Seizure" and "File No." blank.

ii. In "Evidence/Property Seized By" fill in the name of the person who has had custody of the item for the duration of the study. Fill in information in "Description of Evidence/Property." All items listed can be grouped as "Item No. 001"

iii. Enter the appropriate item number in the first column.

iv. The person releasing the evidence/property signs the "From" row, and

the person receiving the evidence/property signs the "To" row.

7. All persons signing the Chain of Custody form should keep a photocopy for his/her records. However, the original signature sheet remains with the evidence/property. Copies of the original signature sheet will be furnished to LOSCO at completion of the study, as such copies are part of the data transfer packages described above for transferring copies of data sheets and photographs.

APPENDIX F

FIELD STUDY PHOTOGRAPHS (PROVIDED ON DVD)

CARCASS PERSISTENCE PHOTOGRAPH EXCEPTIONS

The photograph exceptions listed below document when a persistence team did not take the required three photographs during carcass deployment, or the required one and/or five meter photographs during a persistence check.

TRANSECT ID	BIRD ID	DETAILS OR DATES OF PHOTO EXCEPTIONS				
Carcass Deployment Photograph Exceptions						
5	T5B1	The 25 meter photograph was not taken during deployment on 10/26/11.				
7	T7B4	The 25 meter photograph was not taken during deployment on 10/27/11.				
13	T13B1, T13B2	The 25 meter photograph was not taken during deployment on 10/25/11.				
13	T13B3	The 5 meter photograph was not taken during deployment on 10/25/11.				
14	All birds on transect	The 25 meter photograph was not taken during deployment on 10/25/11.				
19	All birds on transect	The 25 meter photograph was not taken during deployment on 10/30/11.				
20	All birds on transect	The 25 meter photograph was not taken during deployment on 10/30/11.				
21	All birds on transect	The 25 meter photograph was not taken during deployment on 10/30/11.				
Carcass Persistence Check Photograph Exceptions						
1	T1B4	10/30				
1	T1B3	10/30	10/31	11/1	11/4	
1	T1B1	10/30	10/31	11/1		
1	T1B5	10/30	10/31	11/1	11/4	
2	T2B1	10/27	10/30	10/31	11/3	11/6
2	T2B2	10/27	10/30	10/31	11/3	11/6
2	T2B3	10/27	10/30	10/31	11/3	
4	T4B1	10/28	11/1			
4	T4B3	10/28				
4	T4B9	10/28				
4	T4B10	10/28	11/1	11/4		
5	T5B3	10/27				
6	T6B1		10/31	11/1	11/4	

TRANSECT ID	BIRD ID	DETAILS OR DATES OF PHOTO EXCEPTIONS				
6	T6B2		10/31	11/1	11/4	
6	T6B6		10/31	11/1	11/4	
6	T6B8	10/30	10/31	11/1	11/4	
8	T8B2	10/27				
8	T8B3	10/27				
10	T10B5	10/28	10/31			
12	T12B1	10/26				
12	T12B3	10/26				
12	T12B4		10/30	11/2		
12	T12B5	10/26				
13	T13B1	10/26	10/28			
13	T13B2	10/26				
14	T14B1	10/26	10/28			
14	T14B2	10/26				
30	T30B2	11/5	11/6			
30	T30B5	11/5				
31	T31B5	11/5				
31	T31B6	11/5				
16	T16B1		10/30	10/31	11/2	11/5
16	T16B5	10/29	10/30	10/31	11/1	
17	T17B3	10/30				
19	T19B1	11/1	11/2	11/3	11/4	
19	T19B3	11/1	11/2	11/3	11/4	
19	T19B6			11/3	11/4	
19	T19B8	11/1				
21	T21B1	11/1	11/2			

APPENDIX G
FIELD STUDY DATA SHEETS (PROVIDED ON DVD)

APPENDIX H MARSH HABITAT RAW DATA, DETECTS, AND RATE OF DETECTION BY SEARCHER TEAM

HABITAT TYPE	TRANSECT	NO. CARCASSES PLACED	NO. CARCASSES FOUND ON RECHECK	NO. PASSES	DETECTS AND RATE OF DETECTION BY SEARCHER TEAM						TOTAL DETECTS	OVERALL SEARCHER EFFICIENCY
					S1		S2		S3			
Spartina-dominated Habitat	1	5	5	15	0	0%	1	20%	0	0%	1	7%
	2	3	3	9	2	67%	2	67%	2	67%	6	67%
	3	2	2	6	0	0%	0	0%	0	0%	0	0%
	4	11	11	33	6	55%	5	45%	5	45%	16	48%
	5	7	4	12	1	25%	1	25%	1	25%	3	25%
	6	8	6	18	1	17%	1	17%	1	17%	3	17%
	7	7	7	21	1	14%	1	14%	1	14%	3	14%
	8	5	5	15	3	60%	2	40%	2	40%	7	47%
	10	5	5	15	2	40%	2	40%	1	20%	5	33%
	11	6	5	15	3	60%	3	60%	3	60%	9	60%
	12	6	6	18	3	50%	2	33%	4	67%	9	50%
	13	3	3	9	0	0%	1	33%	1	33%	2	22%
	14	2	2	6	0	0%	0	0%	0	0%	0	0%
	25	0	-	-	-		-		-	-	-	
Spartina Habitat Total		70	64	192	22	34%	21	33%	21	33%	64	33%
Phragmites-dominated Habitat	15	3	3	9	2	67%	2	67%	2	67%	6	67%
	16	6	6	18	2	33%	3	50%	2	33%	7	39%
	17	5	5	15	4	80%	4	80%	4	80%	12	80%
	18	3	3	9	3	100%	3	100%	3	100%	9	100%
	28	0	-	-	-	-	-		-		-	
Phragmites Habitat Total		17	17	51	11	65%	12	71%	11	65%	34	67%

APPENDIX I MARSH HABITAT RAW DATA, NUMBER OF BIRD CARCASSES REMAINING PER TRANSECT AFTER EACH DAY

HABITAT TYPE	TRANSECT	NUMBER OF BIRD CARCASSES REMAINING AFTER X DAYS							
		DAY 0	DAY 1	DAY 2	DAY 3	DAY 4	DAY 5	DAY 8	DAY 11
Spartina-dominated Habitat	1	5	3	3	3	3	2	2	2
	2	3	3	3	3	3	3	3	3
	3	2	0						
	4	11	8	5	5	2	2	1	1
	5	7	3	3	0	0			
	6	8	4	4	4	4	4	4	4
	7	7	0						
	8	5	3	1	0				
	10	5	2	1	1	0			
	11	6	0						
	12	6	4	3	3	1	1	1	1
	13	3	3	2	1	1	1	0	
	14	2	2	2	2	1	1	0	
	25	3	1	1	1	1	1	1	1
	30	5	3	3	2	2	2	2	2
	31	7	6	6	5	5	5	5	5
***Spartina* Habitat Total**		85	45	37	30	23	22	19	19
Phragmites-dominated Habitat	15	3	2	1	0				
	16	6	2	2	2	2	1	1	0
	17	5	1	1	0				
	18	3	0						
	19	8	5	3	3	3	3	2	1
	20	5	0						
	21	2	1	1	1	0			
***Phragmites* Habitat Total**		32	11	8	6	5	4	3	1

Note: Numbers in RED depict carcasses that were not detected on the day specified, but were assumed to have been present due to the following day's observations, except for for Transects 25, 30, and 31, where the numbers in RED represent the final state as observed on day 3.

MARSH HABITAT RAW DATA, PERCENTAGE OF BIRD CARCASSES PER TRANSECT REMAINING AFTER EACH DAY

HABITAT TYPE	TRANSECT	PERCENTAGE OF CARCASSES REMAINING AFTER X DAYS							
		DAY 0	DAY 1	DAY 2	DAY 3	DAY 4	DAY 5	DAY 8	DAY 11
Spartina-dominated Habitat	1	100%	60%	60%	60%	60%	40%	40%	40%
	2	100%	100%	100%	100%	100%	100%	100%	100%
	3	100%	0%	0%	0%	0%	0%	0%	0%
	4	100%	73%	63%	45%	18%	18%	9%	9%
	5	100%	43%	43%	0%	0%	0%	0%	0%
	6	100%	50%	50%	50%	50%	50%	50%	50%
	7	100%	0%	0%	0%	0%	0%	0%	0%
	8	100%	60%	20%	0%	0%	0%	0%	0%
	10	100%	40%	20%	20%	0%	0%	0%	0%
	11	100%	0%	0%	0%	0%	0%	0%	0%
	12	100%	67%	50%	50%	25%	17%	17%	17%
	13	100%	100%	67%	33%	33%	33%	0%	0%
	14	100%	100%	100%	100%	100%	50%	0%	0%
	25	100%	33%	33%	33%	33%	33%	33%	33%
	30	100%	60%	60%	40%	40%	40%	40%	40%
	31	100%	86%	86%	71%	71%	71%	71%	71%
Spartina Habitat Total		100%	53%	44%	35%	27%	26%	22%	22%
Phragmites-dominated Habitat	15	100%	67%	33%	0%	0%	0%	0%	0%
	16	100%	33%	33%	33%	33%	17%	17%	0%
	17	100%	20%	20%	0%	0%	0%	0%	0%
	18	100%	0%	0%	0%	0%	0%	0%	0%
	19	100%	63%	38%	38%	38%	38%	25%	13%
	20	100%	0%	0%	0%	0%	0%	0%	0%
	21	100%	50%	50%	50%	0%	0%	0%	0%
Phragmites Habitat Total		100%	34%	25%	19%	16%	13%	9%	3%

APPENDIX J SANDBAR HABITAT SEARCHER EFFICIENCY AND CARCASS PERSISTENCE RAW DATA BY TRANSECT

HABITAT TYPE	TRANSECT	NO. CARCASSES PLACED	NO. CARCASSES FOUND ON RECHECK	NO. PASSES	TOTAL DETECTS	OVERALL SEARCHER EFFICIENCY
Sandbar	2	6	6	6	1	17%
	3	3	3	3	1	33%
Sandbar Habitat Total		**9**	**9**	**9**	**2**	**22%**

HABITAT TYPE	TRANSECT	NUMBER OF CARCASSES REMAINING AFTER X DAYS							
		DAY 0	DAY 1	DAY 2	DAY 3	DAY 4	DAY 5	DAY 10	DAY 12
Sandbar	2	6	5	5	4	4	4	2	2
	3	3	1	0	0	0	0	0	0
Sandbar Habitat Total		**9**	**6**	**5**	**4**	**4**	**4**	**2**	**2**

HABITAT TYPE	TRANSECT	PERCENT OF CARCASSES REMAINING AFTER X DAYS							
		DAY 0	DAY 1	DAY 2	DAY 3	DAY 4	DAY 5	DAY 10	DAY 12
Sandbar	2	100%	83%	83%	67%	67%	67%	33%	33%
	3	100%	33%	0%	0%	0%	0%	0%	0%
Sandbar Habitat Total		**100%**	**67%**	**56%**	**44%**	**44%**	**44%**	**22%**	**22%**