2011

Pre-assessment of Injury to Bald Eagles from the Deepwater Horizon (MC 252) Oil Spill: Final Report

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Pre-assessment of Injury to Bald Eagles from the Deepwater Horizon (MC 252) Oil Spill

Final Report
USFWS Contract # F11PC00050, Study # 9
Contract Title: William and Mary Osprey Study

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The Center for Conservation Biology
College of William and Mary & Virginia Commonwealth University
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The Center for Conservation Biology is an organization dedicated to discovering innovative solutions to environmental problems that are both scientifically sound and practical within today's social context. Our philosophy has been to use a general systems approach to locate critical information needs and to plot a deliberate course of action to reach what we believe are essential information endpoints

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INTRODUCTION

Context

The Deepwater Horizon (MC 252) oil spill began on April 20, 2010. Oil spill-related injury to wildlife is of major concern to the Natural Resource Trustees (Trustees), BP, and the American public. The study was performed under a contract with the U.S. Fish and Wildlife Service on behalf of the Natural Resource Trustees for the Deepwater Horizon natural resource damage assessment and restoration case. This End-of-Study Draft Summary Report is submitted in fulfillment of the reporting requirements in Contract # F11PC00050, Study # 9 and Title: William and Mary Osprey Study.

This study was designed to estimate breeding numbers and measure demographic parameters for Gulf Coast populations of bald eagles (*Haliaeetus leucocephalus*) to inform estimates of any potential spill-related changes in the number of nesting pairs and offspring. The bald eagle was chosen as a focal species in the raptor pre-assessment effort for two reasons. First, relative to the 35 to 40 raptor species that use the Gulf of Mexico, bald eagles have a relatively high potential for exposure because of their dependence on aquatic habitats and prey. Second, the bald eagle has been studied extensively throughout its range and within the Gulf of Mexico providing pre-spill information regarding baseline conditions for the species.

Objectives

Study objectives include:

1. Estimate the bald eagle breeding population
2. Measure bald eagle productivity

METHODS

Study Area

Two areas have been identified for the purpose of the bald eagle data collection effort: the Area of Potential Impact (API), and the Reference area (REF). A buffer zone of approximately 40 km was established at the interface of these two areas in which nests were surveyed but not included in the final analyses. The API included nearshore areas from Atchafalaya Bay, LA to Apalachicola Bay, FL. The REF included nearshore areas east of Apalachicola Bay, FL to Charlotte Harbor, FL (Figure 1). Nearshore areas included all land and water from the barrier islands to 3 km inland on the mainland of the Gulf of Mexico.

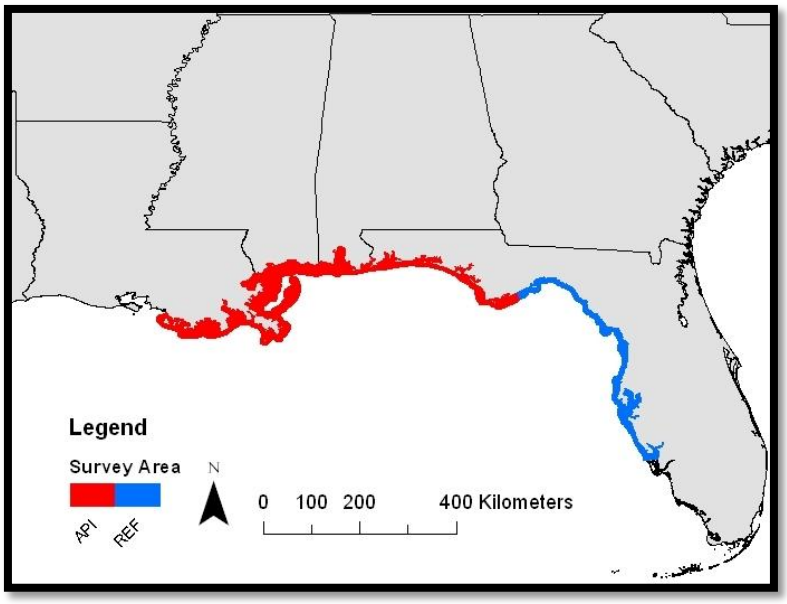

Figure 1. Geographic scope of the Area of Potential Impact (API) and Reference (REF) for the bald eagle study.

Eagle Population Surveys

We conducted aerial surveys during December 2010 – January 2011 to document the location and status of bald eagle nests. Two teams conducted surveys in the study areas. Surveys in Florida were conducted by Stephen Nesbitt and John White with the Florida Fish and Wildlife Conservation Commission. Surveys in Alabama, Mississippi, and Louisiana were conducted by Bryan Watts, Barton Paxton, and Elizabeth Mojica at the College of William and Mary.

Surveys were conducted using two observers in a fixed-wing aircraft per this study's standard operating procedures (Appendix A). We searched for 429 existing nest locations using the most recent nest location data available from state wildlife agencies and the US Fish and Wildlife Service (E. Bjerre, pers. comm.; Table 1). In addition, surveyors systematically searched nearshore areas for new or undocumented nests using transects of approximately 1km within suitable nesting habitat. Nests were mapped and coded according to nest substrate, nest condition, eagle presence, and breeding activity (Postupalsky 1974). Degree of oiling was not assessed during surveys.

Figure 2. Incubating adult Bald Eagle in nest with mate and prey remains.

Table 1. Known Bald Eagle nests within the study area prior to Summer 2010.

	No. Known Nests	Year of Last Aerial Survey	Agency Providing Data
Alabama	4	2006	Alabama Department of Conservation and Natural Resources
Florida	276	2010[a]	Florida Fish and Wildlife Conservation Commission
Louisiana	142	2008	Louisiana Department of Wildlife and Fisheries
Mississippi	7	2009	Mississippi Department of Wildlife, Fisheries, & Parks

[a] Florida rotates the state funded eagle survey by county every three years. Six of the Florida counties within the study area were surveyed in 2010; the remainder was surveyed within the 2008-2009 period (FFWCC http://www.myfwc.com/media/433901/Eagle_Survey_Map.pdf)

Eagle Productivity Surveys

All nests documented on the first aerial survey were resurveyed an additional 1-2 times to document reproductive outcome. Chicks were counted and aged by developmental stage (Bortolotti 1984a, Bortolotti 1984b; Figure 3). Nests with chicks younger than 7-8 weeks old during the second survey were revisited on a third survey to document final productivity. Productivity surveys were conducted during February – April 2011. Nests with eggs or chicks younger than 7 weeks old on the third survey were considered incomplete and excluded from analyses.

RESULTS

Breeding Population

A total of 578 eagle nests were surveyed during the 2010-2011 breeding season, of which 215 and 363 were in the REF and API study areas respectively (Figure 4). Thirty-seven nests were excluded from analysis because of they were located outside the study area boundary or had an incomplete nest status on the third survey (Table 2). A total of 380 occupied territories were documented in the study area. Of these, 356 were active nests documented with eggs or young (Table 3).

Table 2. Summary of Bald Eagle nests surveyed during the 2010-2011 breeding season within the study area.

	API	**REF**	**Total**
# Nests monitored	363	215	578
# Nests excluded: within 40 km buffer zone	10	4	14
# Nests excluded: eggs or nestlings <7 wk. old	16	1	17
# Nests excluded: outside of 3km shoreline buffer	5	1	6
Total nests included in Productivity Analysis	332	209	541

Figure 3. Adult Bald Eagle with a 1 week old chick and egg (top left), two 3-4 week old chicks (top right), two 4-5 week old chick (bottom left) and one 7-8 week old chick (bottom right).

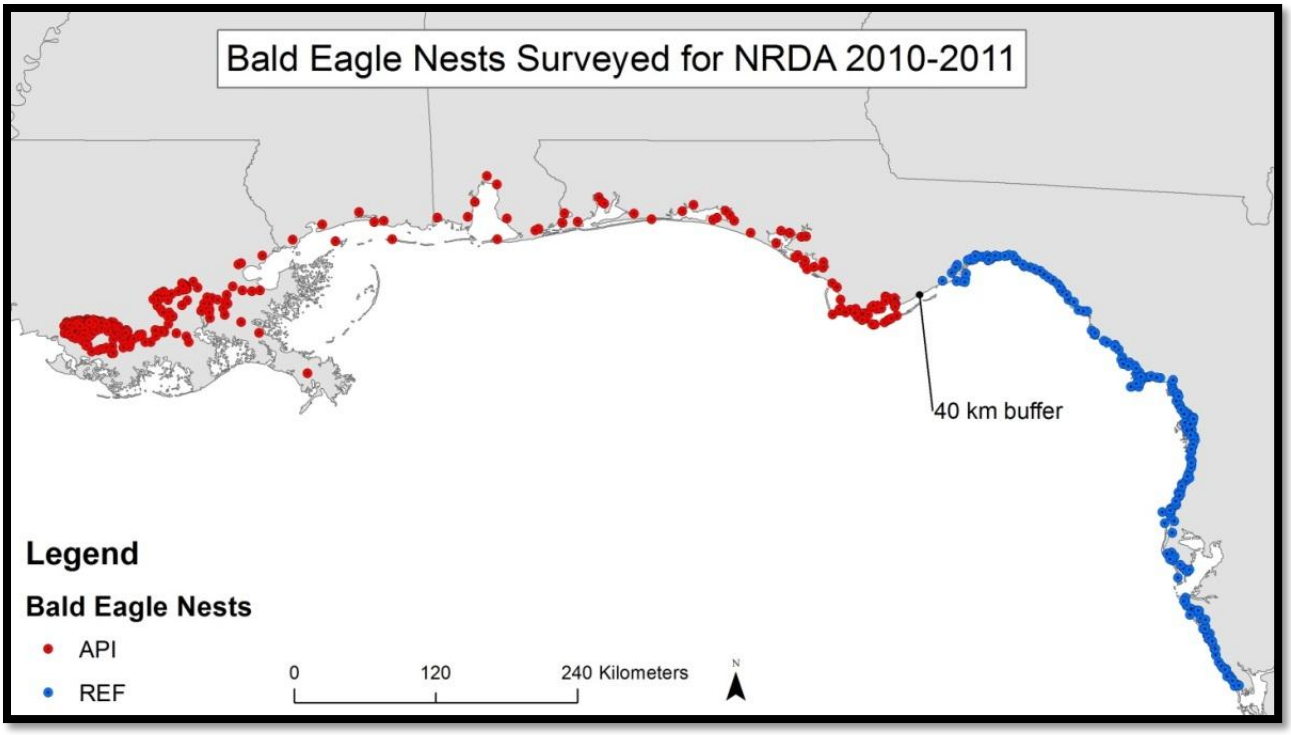

Figure 4. Bald eagle nests in the study area monitored with aerial surveys.

Table 3. List of bald eagle nests surveyed within the study area by state and county.

	No. Nests	Occupied Nest	Active Nest
Alabama	**7**	**7**	**7**
Baldwin County	4	4	4
Mobile County	3	3	3
Florida	**286**	**172**	**153**
Bay County	15	12	10
Charlotte County	12	0	0
Citrus County	24	8	6
Dixie County	10	6	4
Escambia County	3	2	2
Franklin County	41	28	24
Gulf County	9	6	6
Hernando County	12	8	7
Jefferson County	4	4	4
Levy County	31	25	23
Manatee County	9	2	1
Okaloosa County	2	1	1
Pasco County	16	9	7
Pinellas County	19	7	6
Santa Rosa County	5	3	3
Sarasota County	23	15	15
Taylor County	22	17	16
Wakulla County	23	16	15
Walton County	6	3	3
Louisiana	**241**	**196**	**192**
Jefferson Parish	11	8	7
Lafourche Parish	21	20	19
Orleans Parish	4	3	3
Plaquemines Parish	8	7	7
Saint Bernard Parish	2	2	2
Saint Charles Parish	21	19	19
Saint Mary Parish	13	11	11
Terrebonne Parish	161	126	124
Mississippi	**7**	**5**	**4**
Hancock County	1	0	0
Harrison County	4	3	2
Jackson County	2	2	2
Grand Total	**541**	**380**	**356**

Productivity

A total of 457 eagle chicks were counted during the aerial surveys (Table x). The average reproductive rate for both the API (1.31 chicks/active nest) and REF (1.22 chicks/active nest) were both above population maintenance levels estimated for the species (0.7 chicks/active nest; Sprunt et al. 1973). There was no difference between the number of chicks per active territory in the API ($\bar{x}$ = 1.31, 95% CI: 1.21-1.41, *n* =249) and REF ($\bar{x}$ = 1.22, 95% CI: 1.07-1.38, *n* =107; one-way ANOVA $F_{1, 354} = 0.85$, $P = 0.356$) areas. Chicks per occupied territory between the API ($\bar{x}$ = 1.25, 95% CI: 1.15-1.35, *n* =260) and REF ($\bar{x}$ = 1.09, 95% CI: 0.94-1.24, *n* =120; one-way ANOVA $F_{1, 378} = 3.15$, $P = 0.076$) was different but not significant at the α = 0.05 level. Nest success did differ significantly with higher success in the API ($\bar{x}$ = 1.68, 95% CI: 1.61-1.75, *n* =194) than REF area ($\bar{x}$ = 1.46, 95% CI: 1.35-1.56, *n* =90; one-way ANOVA $F_{1, 282} = 12.09$, $P < 0.001$).

Table 4. Summary of 2010-2011 Bald Eagle survey results by study area.

	API	**REF**	**Total**
# Occupied Nest	260	120	380
# Active Nest	249	107	356
# Successful Nests	194	90	284
# Chicks reaching fledging age	326	131	457
# Chicks per Occupied Nest	1.25	1.09	
# Chicks per Active Nest	1.31	1.22	
# Chicks per Successful Nest	1.68	1.46	
Breeding Success Rate	0.78	0.84	

There was no difference detected between pre-spill and post-spill nest success in either the API or REF areas ($\chi^2 = 0.0006$, df = 1, p <0.975).

Table 5. Productivity pre and post oil spill for Bald Eagle nests in the study area.

		Pre- Spill			Post-Spill		
State	Survey Date	No. Active Nests	Chicks/ active nest	Chicks/ successful nest	No. Active Nests	Chicks/ active nest	Chicks/ successful nest
Alabama	2006	4	1.50	1.50	7	1.86	2.17
Florida	2008 &2009[a]	61	1.31	1.67	286	1.24	1.47
Louisiana	2008	107	1.25	1.61	241	1.30	1.72
Mississippi	2009	3	2.00	2.00	7	1.50	1.50

[a] Florida rotates their survey to different geographic regions of the state each year. Two years of survey data were combined to cover all nests in the study area.

Table 6. Percent nest success for the study areas pre and post-oil spill.

	Pre-spill	Post-spill
API	77.9%	77.9%
REF	81.8%	84.1%

DISCUSSION

This represents a 35% increase in occupied territories since the last breeding surveys were conducted in the region.

ACKNOWLEDGMENTS

We thank the following state trustee biologists for sharing their eagle nest records: Nickolas Winstead (Mississippi Department of Wildlife, Fisheries and Parks, Museum of Natural Science), George Melancon and Thomas Hess (Louisiana Department of Wildlife and Fisheries), Keith Hudson (Alabama Department of Conservation and Natural Resources), and Janell Brush (Florida Fish and Wildlife Conservation Commission). These US Fish and Wildlife Service staff assisted with contracting and implementation of the eagle plan: Alfredo Begazo, Pete Tuttle, Emily Bjerre, Sue Cameron, Cindy Kane, Robyn Cobb, Resee Collins, Anne Condon, Amy Defreese, Cindy Fury, Anne Hecht, Chuck Hunter, Mark Koneff, Craig Koppie, Karen Marlowe, Carolyn Marn, Candace Martino, Brian Millsap, Mark Otto, John Schmerfeld, Anne Secord, Brenda Smith, Mark Snyder, Brian Spears, Veronica Varela, Carol Aron, Mike Pixely, Tim Breen, Angela Matz, Cara Collins, Vincent Chua, Dan Reinkensmeyer, Dave Mosby, Dan Sparks, Jean Calhoun, Tammy Johnson, Tina Moran, Karen Nelson, Megan Boldenow , Peggy Guyton, Denise Klimas, Brenda Zaun. Our highly skilled survey pilots were Erik Himmel and Charlie Hammond of Hammond Air Service, Ron Towater of Ocala Aviation, and Brokaw Van Anda of Van Anda Aviation.

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APPENDIX A. Summary of 2010-2011 Bald Eagle survey results by state and county.

	Study Area	No. Nests	Occupied Nests	Active Nests	Total chicks produced	Chicks /active nest	Chicks /productive nest
Alabama		**7**	**7**	**7**	**13**	**1.86**	**2.17**
Baldwin County	API	4	4	4	**6**	1.50	2.00
Mobile County	API	3	3	3	7	2.33	2.33
Florida		**286**	**172**	**153**	**189**	**1.24**	**1.47**
Bay County	API	15	12	10	10	1.00	1.43
Charlotte County	REF	12	0	0	0	-----	-----
Citrus County	REF	24	8	6	10	1.67	1.67
Dixie County	REF	10	6	4	2	0.50	1.00
Escambia County	API	3	2	2	5	2.50	2.50
Franklin County	API	41	28	24	31	1.29	1.48
Gulf County	API	9	6	6	6	1.00	1.20
Hernando County	REF	12	8	7	9	1.29	1.50
Jefferson County	REF	4	4	4	4	1.00	1.33
Levy County	REF	31	25	23	29	1.26	1.53
Manatee County	REF	9	2	1	1	1.00	1.00
Okaloosa County	API	2	1	1	0	0.00	-----
Pasco County	REF	16	9	7	11	1.57	1.57
Pinellas County	REF	19	7	6	8	1.33	1.33
Santa Rosa County	API	5	3	3	4	1.33	1.33
Sarasota County	REF	23	15	15	21	1.40	1.50
Taylor County	REF	22	17	16	16	1.00	1.23
Wakulla County	REF	23	16	15	18	1.20	1.64
Walton County	API	6	3	3	4	1.33	1.33
Louisiana		**241**	**196**	**192**	**249**	**1.30**	**1.72**
Jefferson Parish	API	11	8	7	10	1.43	2.00
Lafourche Parish	API	21	20	19	21	1.11	1.62
Orleans Parish	API	4	3	3	3	1.00	1.50
Plaquemines Parish	API	8	7	7	10	1.43	1.67
Saint Bernard Parish	API	2	2	2	1	0.50	1.00
Saint Charles Parish	API	21	19	19	26	1.37	1.86
Saint Mary Parish	API	13	11	11	9	0.82	1.29
Terrebonne Parish	API	161	126	124	169	1.36	1.74
Mississippi		**7**	**5**	**4**	**6**	**1.50**	**1.50**
Hancock County	API	1	0	0	0	-----	-----
Harrison County	API	4	3	2	3	1.50	1.50
Jackson County	API	2	2	2	3	1.50	1.50
Grand Total		**541**	**380**	**356**	**457**	**1.28**	**1.61**

APPENDIX B. Bald Eagle Aerial Nest Survey Standard Operating Procedures

January 2011, revised March 28 2011

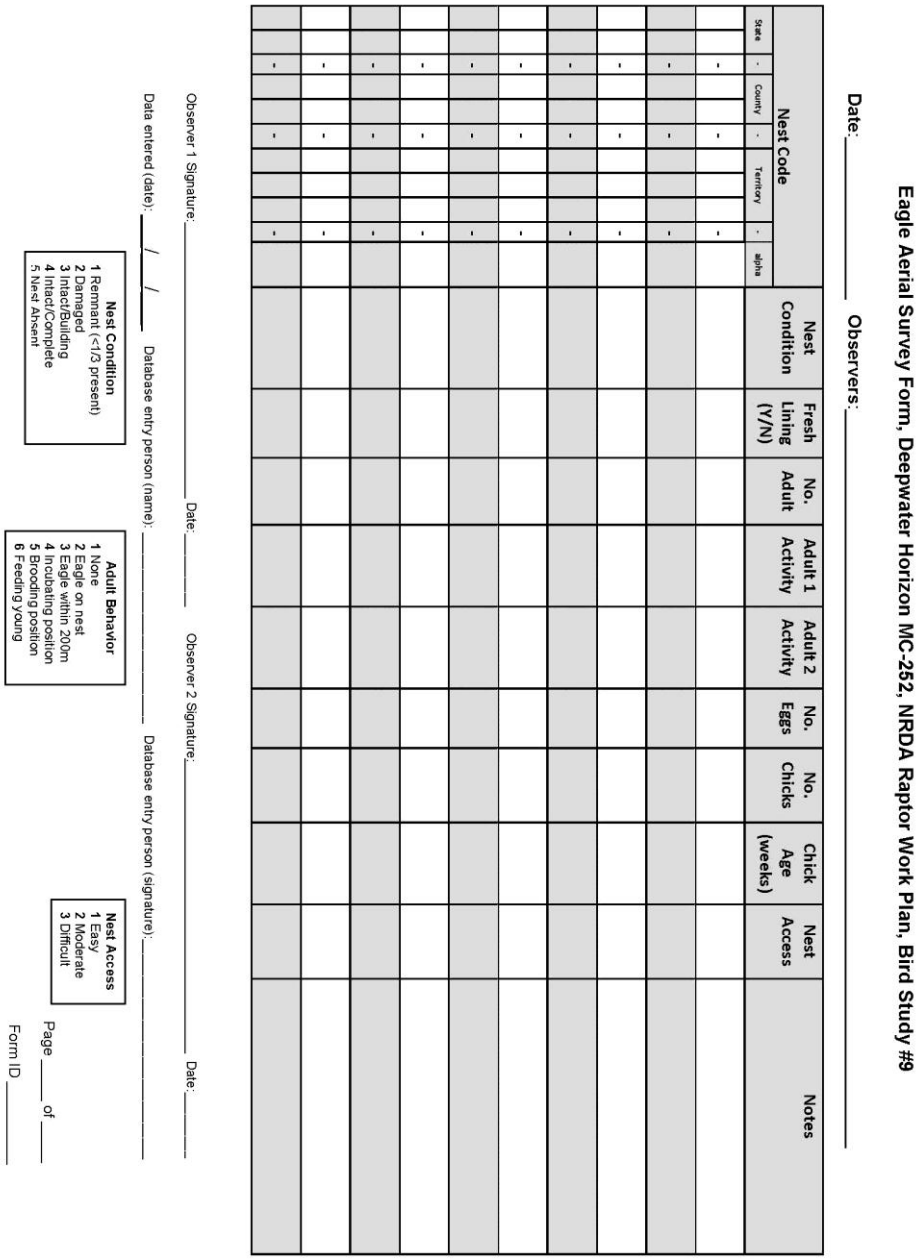
1. The general purpose of the bald eagle nest survey is to locate, map, and determine productivity of existing bald eagle nests occupied during the 2010-2011 breeding season, in the Area of Potential Impact (API) and the Reference Study Area (REF).
2. All activities will conform to "Safety requirements and check in protocols for NRDA field team tracking in Houma Sector for MS Canyon 252" dated 4 September 2010.
3. Permission will be requested from the appropriate National Park Service (NPS) manager, National Wildlife Refuge (NWR) manager, and State Wildlife Management Areas/Refuges or DOD natural resources representative when necessary.
4. Research permits to operate within state or federally-owned lands will be requested as needed.
5. At the end of each aerial survey, each data form will be signed by all observers. Original data sheets will remain in the possession of the Principle Investigator (PI) until all field data collection has been completed. At the end of field data collection for the study, the original data forms will be provided to a designated Trustee representative.
6. Data from the completed Eagle Aerial Survey Forms will be entered into the DOI - ERDC database.

Aerial Mapping of Bald Eagle Nests

7. All flights will follow National Park Service (NPS) and National Wildlife Refuge (NWR) protocols when crossing over their lands.
8. Before each flight, the equipment checklist will be reviewed to ensure all equipment is present, working properly and replacement batteries are available and charged. A pre-flight briefing with observers and the pilot will be conducted to review the flight plan and protocols.
9. Aerial surveys will be used to estimate the number of active nests within the API and REF. Both the API and REF will be systematically surveyed by using a 3 flight approach. The first flight will optimally be scheduled during the period of peak incubation. Aerial surveys will be conducted from a Cessna 172 with 2 observers. The aircraft will be maneuvered to survey all suitable nesting habitat between the shoreline and a distance of 3 km inland from the "upland edge" (upland edge refers to the continuous wooded edge). Bald eagle nests located will be mapped using GPS-enabled notebooks, given unique 3-element codes, and evaluated for adult activity. Standard activity types include, but are not limited to, adults present, evidence of eggs (eggs observed or adult in incubating posture), and chicks present. Nests with no eagle activity will be considered unoccupied. Nests with eagle activity will be considered to represent an "occupied territory". Nests with evidence of eggs or chicks will be considered "active nests" following standard definitions in use for raptor populations. Two additional aerial surveys will be used to estimate productivity within both the API and REF study areas during the 2010/2011 breeding season. All territories determined to be occupied during the first flight will be checked in the late winter or early spring to determine reproductive rate (chicks fledged per breeding attempt), brood size (chicks per successful nest), breeding success (pairs fledging $\geq$1 chick per breeding attempts), and productivity (fledgling produced per breeding pair). During the over flights, observers will count chicks in the nest and broods will be aged to the nearest 7 days based on plumage and stage of development. Some nests may be excluded due to airspace restrictions.
10. All mapping flights will occur at altitudes of approximately 100 meters when flying over open water, unpopulated shoreline, and marsh. In accordance with The Federal Aviation

Regulation, Sec. 91.119, minimum altitude will increase to 500 feet over sparsely populated areas and 1000 feet over any congested area of a city, town, or settlement, or over any open air assembly of persons.

11. Observations will be conducted by two biologists. Upon locating a nest, the pilot will circle the nest allowing one biologist to map the nest on a GPS-enabled notebook computer or other GPS device, while the other biologist characterizes the nest.
12. A copy of the data form to be used for the aerial mapping flights is shown below. The number of data forms completed each day will depend on the number of nests observed. Each form will be filled out on paper, in ink.
13. Nest waypoints and GPS track will be downloaded from the GPS unit and uploaded onto the DOI - ERDC information infrastructure.



Eagle Aerial Survey Form, Deepwater Horizon MC-252, NRDA Raptor Work Plan, Bird Study #9

Date:_____ Observers:_____

Nest Code					Nest Condition	Fresh Lining (Y/N)	No. Adult	Adult 1 Activity	Adult 2 Activity	No. Eggs	No. Chicks	Chick Age (weeks)	Nest Access	Notes
State	County	Territory	alpha											
-	-	-	-											
-	-	-	-											
-	-	-	-											
-	-	-	-											
-	-	-	-											
-	-	-	-											
-	-	-	-											
-	-	-	-											
-	-	-	-											
-	-	-	-											
-	-	-	-											
-	-	-	-											

Observer 1 Signature:_____ Date:_____ Observer 2 Signature:_____ Date:_____

Data entered (date):___/___/___ Database entry person (name):_____ Database entry person (signature):_____

Nest Condition
1 Remnant (<1/3 present)
2 Damaged
3 Intact/Building
4 Intact/Complete
5 Nest Absent

Adult Behavior
1 None
2 Eagle on nest
3 Eagle within 200m
4 Incubating position
5 Brooding position
6 Feeding young

Nest Access
1 Easy
2 Moderate
3 Difficult

Page ____ of ____

Form ID _____

Eagle Nest Form Completion Guidance

[Date] Date observation was made

[Observers] Print names of both observers

[Nest code] The combination of these codes produces a unique nest code for each nest structure

State - Two digit state abbreviation (LA, MS, AL, FL)
County – Two digit county code (see appendix A in this document for full list)
Territory – Three digit numerical code, usually assigned sequentially throughout survey within an individual county
Alpha – a single letter code assigned to a nest if a new nest is found in the same territory within the 2010-2011 breeding season, otherwise leave blank

[Nest Condition] Select one of the choices

(1) Remnant: <1/3 of nest remaining in tree
(2) Damaged
(3) Intact/building: evidence the nest is being repaired or constructed with new sticks
(4) Intact/complete: nest appears structurally complete
(5) Nest absent

[Fresh Lining]

Y = if fresh nest lining is present
N = old nest lining present
N/E = not evaluated

[No. adult] Number of adults counted in the breeding territory, can be used to assess territory occupancy

[Adult 1 Activity] Select one of the choices. Usually the Adult 1 gets the main breeding behavior of incubating, brooding, or feeding young. This field should always be completed.

(1) None – adult not seen in territory
(2) Eagle on nest – eagle perched on nest but not incubating, brooding, or feeding young
(3) Eagle within 200m of nest
(4) Incubating position – an adult is sitting low and tight in the nest incubating eggs, assume $\geq$1 eggs present

(5) Brooding position – and adult is sitting or standing in the nest covering young in a raised brooding posture, assume ≥1 chicks

(6) Feeding Young – Adult standing in nest feeding young

[Adult 2 Activity] Select one of the choices. This field should always be completed.

(1) None – second adult not seen in territory

(2) Eagle on nest – eagle perched on nest but not incubating, brooding, or feeding young

(3) Eagle within 200m of nest

(4) Incubating position – an adult is sitting low and tight in the nest incubating eggs, assume ≥1 eggs present

(5) Brooding position – and adult is sitting or standing in the nest covering young in a raised brooding posture, assume ≥1 chicks

(6) Feeding Young – Adult standing in nest feeding young

[No. Eggs] If possible, count the number of eggs in nest. If no eggs are seen, use zero. If adult in incubating position and obscuring view of the eggs, list ≥1 eggs.

[No. Chicks] If possible, count the number of chicks in nest. If no chicks are seen, use zero. If adult is in brooding position and obscuring view of the chicks or chicks are clumped and individuals cannot be counted, list ≥1 chicks.

[Chick Age (weeks)] If No. Chicks field is completed, then age chicks by weeks.

[Nest Access] Select one of the choices for accessing nests on the ground for future field work.

(1) Easy

(2) Moderate

(3) Difficult

N/E Not Evaluated

[Notes] Additional notes on observations, new nest coordinates, notation of great-horned owl nest occupation, etc.

[Observer 1 signature and date] Form signed and dated on day of survey

[Observer 2 signature and date] Form signed and dated on day of survey

[Date entered (date)] Date data entered into ERDC. Use mm/dd/yy.

[Database entry person name and signature] person who entered data into ERDC

[Page __ of __] Write in page numbers for each day surveyed

[Form ID] ID assigned to form when entered into ERDC

List of county abbreviations for each state in the study area.

State	County	County Name
AL	BA	Baldwin County
AL	ML	Mobile County
FL	BA	Bay County
FL	CH	Charlotte County
FL	CI	Citrus County
FL	DI	Dixie County
FL	ES	Escambia County
FL	FR	Franklin County
FL	GU	Gulf County
FL	HN	Hernando County
FL	JE	Jefferson County
FL	LV	Levy County
FL	MN	Manatee County
FL	OL	Okaloosa County
FL	PI	Pinellas County
FL	PS	Pasco County
FL	SA	Sarasota County
FL	SR	Santa Rosa County
FL	TA	Taylor County
FL	WK	Wakulla County
FL	WL	Walton County
LA	BD	Saint Bernard Parish
LA	CH	Saint Charles Parish
LA	JE	Jefferson Parish
LA	LA	Lafourche Parish
LA	MR	Saint Mary Parish
LA	OR	Orleans Parish
LA	PQ	Plaquemines Parish
LA	TA	Saint Tammany Parish
LA	TE	Terrebonne Parish
MS	HA	Harrison County
MS	HK	Hancock County
MS	JK	Jackson County