5- YEAR LONG-TERM MONITORING OR OPERATIONAL ACTIVITY WORK PLAN

Changes to this Work Plan are only accepted via an Approved Addendum.

General Information

Monitoring Category: *(From OSM long-term plan; choose from drop-down menu)*	Biotic Response Monitoring	
Strategic Monitoring Objective: *(From OSM long-term plan; choose from drop-down menu)*	Objective: Detect and report biotic response in relation to Oil Sands Developments	
Work Plan Unique Identifier:	*B-LTM-E-2-1718*	
Monitoring Activity Title:	Quantifying risk from oil sands mining to endangered whooping cranes	
Geographic Location (*choose from drop-down menu, if Project Location is in more than one area choose from second drop-down***)**	Province of Alberta	More than 2 Locations (Described in Monitoring Schedule
Monitoring Site(s) Coordinates *(latitude and longitude)*	AB, NT and SK, in a region bounded by (61.0° and -117.0°), (61.0° and -108.0°), (50.0° and -102.0°), and (50.0° and -110.0°)	
Monitoring Organization and Responsible Manager:	Environment and Climate Change Canada	**Samantha Song**
Date Monitoring initiated:	**2012**	
Specific Monitoring Objective: *(State the monitoring objective addressed through this monitoring)*	Oil sands mining constitutes a risk to whooping cranes during migration because: (H1) juvenile and sub-adult cranes are at risk of landing at industrial sites, such as tailings ponds; (H2) some industrial sites provide cranes with cues that are similar to natural habitats; and (H3) landing at some industrial sites has deleterious consequences for individual cranes and/or the population.	
Deliverables (Annual): *What Data Reports will be produced and when?*	(1) Three annual, operational reports with cumulative results; (2) Scientific paper describing movement patterns and habitat use of whooping cranes in the oil sands region of Canada; (3) Scientific paper quantifying risk from oil sands mining to whooping cranes; (4) Scientific paper explaining causes of risk from oil sands mining to whooping cranes during migration in the oil sands region of Canada; (5) Scientific paper containing methods and models for mitigation of risk from oil sands mining to whooping cranes; (6) Data on OSM portal on completion of the study. See pages 5-6 for details and expected dates.	

Monitoring Plan Summary: *Please summarize the monitoring including relevant information such as background, objectives, monitoring area, methods/monitoring design, assumptions, outcomes, and references. These should align with the information provided in Appendix 1: Annual Monitoring Schedule.*

Background

This three-year study builds on existing baseline monitoring conducted via satellite telemetry of whooping cranes during migration through Canada's oil sands region. Starting in the first year (2017-18), the proposed activities will be qualitatively similar to JOSM-supported activities we conducted previously. In the second and third years (2018-20), we will quantify risk from oil sands mining to whooping cranes and determine causes and consequences of the risk. Finally, we will create science-based tools to help industry and government mitigate risk from mining to whooping cranes, such as a habitat suitability model and associated spatial products (e.g., maps). An increased budget request from prior years is required because transmitters deployed on cranes previously are no longer providing data, so new capture and banding work is required in each year, starting in July 2017. Specifically, we propose to capture 10 to 15 juvenile whooping cranes per year for three years, and to deploy transmitters on them, in or near Wood Buffalo National Park.

Methods/Monitoring Design

Background and context: The Aransas-Wood Buffalo (AWB) population of whooping cranes (hereafter cranes), migrates through Canada's oil sands region (OSR) twice annually, in spring and fall. This is the last remaining wild and self-sustaining population of this species-at-risk (SAR), with about 330 individuals. Baseline monitoring via satellite telemetry, supported by JOSM since 2012, demonstrated that almost all cranes migrate through the OSR (composed of the Athabasca, Peace River and Cold Lake deposits), most migrate through the mineable area (MOSA) of the Athabasca deposit, especially in spring, and some stop over during migration through the MOSA for 1-2 nights (M. Bidwell, unpublished data). We obtained limited evidence that stopovers may occur in very close proximity to, or actually on, oil sands (OS) tailings ponds or other industrial sites, which are known to constitute a risk to migratory birds (St. Clair, 2014). Moreover, anecdotal evidence suggests that cranes have been oiled during migration through areas including OS mining. Thus, industrial sites associated with OS mining constitute a risk to cranes, although the underlying mechanisms and consequences have not been determined. Furthermore, science-based tools do not exist to quantify or mitigate risk to cranes from existing or expanded OS mines.

Population models indicate that survival of juveniles (<1 year old) and sub-adults (2-3 years) is a main driver of growth in the AWB population (Wilson et al., 2016) and baseline monitoring demonstrated empirically that cranes in these age classes have lower survival rates than older cranes (Pearse et al., submitted ms). Inexperienced cranes, such as juveniles and sub-adults (hereafter young cranes), may be especially at risk of being exposed to tailings ponds or other industrial sites during migration. Baseline monitoring indicates that young cranes are more likely to stop over in the MOSA than older birds (M. Bidwell, unpublished data). In two cases, monitoring provided evidence that cranes stopped at or near an OS tailings pond; one of these was a young crane. In contrast, albeit with low sample sizes, our preliminary assessment of habitat selection suggests that cranes tend to select for natural areas and against anthropogenic ones in the OSR. These patterns could be linked if cranes select natural habitats with structural or biophysical characteristics that are similar to tailings ponds or adjacent wetlands. If cranes normally select natural habitats but occasionally use tailings ponds that provide similar cues, oil sands mining could have deleterious consequences for individual cranes and for the population.

Sample sizes from baseline monitoring of juvenile and sub-adult cranes were insufficient to allow strong inference about these age classes, so here we propose to collect additional data to characterize and quantify risk from tailings ponds to cranes <3 years old. Adding to these past efforts, we will collect and analyse data on movement patterns and habitat use of young cranes during migration through the OSR, to increase understanding of the probabilities, mechanisms and consequences of landing on tailings ponds. Specifically, we will test the hypotheses that OS mining constitutes a risk to whooping cranes during migration because: (H1) juvenile and sub-adult cranes are at risk of landing at industrial sites, such as tailings ponds; (H2) some industrial sites provide cranes with cues that are similar to natural habitats; and (H3) landing at some industrial sites has deleterious consequences for individual cranes and/or the population.

Our study will result in the creation of a habitat suitability model (and associated spatial products, e.g., maps) that will allow industrial land managers to predict where cranes are most likely to stop over during spring and fall migration. The model could be used to further quantify risk to cranes from OS mining, by comparing areas where cranes are predicted to occur to those areas proposed for expansion of OS mining. The model could also be used to mitigate risk to cranes, by allowing industry to manage habitat to reduce risk in areas with a higher probability of use by cranes.

Methods – capture and banding: We will capture, band and deploy transmitters on 10 to 15 pre-fledged, juvenile cranes annually, in or near Wood Buffalo National Park (WBNP), in late July or early August from 2017-19. We will capture cranes before they are capable of flight (about 40-60 days old) at breeding sites by locating family groups via helicopter and positioning personnel nearby for ground pursuit and hand capture (as described in Kuyt, 1979). The capture team will consist of five wildlife biologists and one veterinarian, all experienced in crane capturing and handling, and will ensure safety and health of cranes by using techniques reviewed and approved previously by ECCC's Animal Care Committee (Hartup 2005, see Appendix D). Bands and transmitters will be placed on the tibiotarsus of captured birds. Transmitters will be GPS/GSM devices (Global Positioning System/Global Systems for Mobile communication; Cellular Tracking Technology LLC, Rio Grande, NJ) mounted on a two-piece leg band (Haggie Engraving, Crumpton, MD) which in combination weigh 80 g or about 1.5% of body mass of adult cranes. Transmitters have solar panels integrated on exposed surfaces, and should have a lifespan of at least three years. If it is not possible to band juveniles at WBNP in a particular year, given unexpected operational difficulties, we will cooperate with US partners to capture adults in Texas and monitor their migration, and that of their juveniles, through the OSR. In that event, capture techniques will vary from those described above but cranes will be handled in accordance with US animal care regulations and required permits; banding techniques and transmitters will be identical to those used on juveniles.

Methods –data collection: Transmitters will be programmed to collect up to 48 GPS locations daily at equal time intervals and to upload location data to the GSM system every 24 hours. These data will be used in two main ways. (1) During periods of active fieldwork, we download and use positional data from individual cranes to determine their location for visual re-sighting during surveys. In the breeding season, we will conduct two aerial surveys (May, July) via helicopters, given the remote and widely-dispersed range of breeding cranes in and near WBNP. In the fall, we will conduct ground-based surveys in Saskatchewan (SK) using trucks and on foot. The objective of surveys in May (WBNP) and fall (SK) is to determine the survival, and presence or absence of oil-based staining on feathers, of cranes recently having migrated through the OSR. When possible, we will obtain feathers opportunistically from living birds, for subsequent contaminants analysis (e.g., bitumen, PAHs). Surveys at WBNP (May, July) also serve to locate nesting pairs and to locate and select their pre-fledged juveniles for capture and banding. (2) Twice annually, after completion of spring and fall migration, we will clean and error-check the data before using them to conduct analyses of movement, habitat use and survival through the OSR. Data with spatial error >10 m will be censored to ensure inference is made on positional information of the highest quality.

Methods – data analysis and hypothesis testing: We will conduct analyses using all available, error-free data collected from individual juvenile and sub-adult cranes, combined and by age class and separately by migration number. To increase the quality of our inference, we will incorporate data obtained during baseline monitoring. We will test three hypotheses to describe and quantify risk from OS mining to cranes.

(H1) We will test the first hypothesis (i.e., that juvenile and sub-adult cranes are at risk of landing at industrial sites, such as tailings ponds) by investigating the movement patterns of cranes during migration through the OSR. This hypothesis predicts that a large proportion of young cranes migrates through the OSR and the MOSA in spring and fall; that their timing of migration may increase probability of landing on tailings ponds due to inclement weather, especially in spring; that some young cranes stop over for at least one night in the MOSA; and that some stopovers occur on tailings ponds or near other industrial sites. Additionally, we will estimate the migration-specific (i.e., spring, fall) and combined probabilities of landing on tailings ponds or near other industrial sites. These patterns were investigated during baseline monitoring, but sample sizes were insufficient to allow strong inference about movement patterns of young cranes, survival of which is a principal driver of the AWB population growth rate.

(H2) To learn about the mechanisms underlying use of tailings ponds by young cranes, we will test the second hypothesis (i.e., that some industrial sites provide cranes with cues that are similar to natural habitats) by investigating habitat selection of young cranes using a multi-scale approach (e.g., Thompson and McGarigal, 2002). This hypothesis predicts that young cranes select natural habitats with cues that may occur in some industrial sites, resulting in increased risk of landing on tailings ponds or adjacent wetlands. At multiple scales, we will compare structural (e.g., size, shape, depth and configuration of wetlands) and biophysical (e.g., habitat composition) features of (a) all stopover sites vs. randomly-selected, available sites to determine if cranes tend to select for or against natural or anthropogenic habitats and (b) stopover sites on or adjacent to tailings ponds or other industrially modified sites vs. natural sites to determine if modified and natural sites provide similar cues to cranes. Results of these analyses will be used to construct a habitat suitability model for cranes in the OSR, which could be used to inform planning of new or expanded OS developments or to mitigate risk.

(H3) We will test the third hypothesis (i.e., that landing at some industrial sites has deleterious consequences for individual cranes and/or the population) by investigating mortality and oiling rates of young cranes that (a) migrate through the MOSA or (b) migrate through the MOSA and stop over on a tailings pond, and the anticipated population-level consequences of these rates. This hypothesis predicts that these cranes are more likely to die during migration or be detected with oil-based staining on their feathers. When possible, to gain greater insight, cause of death will be determined via necropsy and feathers collected opportunistically from living birds will be submitted for contaminants analysis (e.g., bitumen, PAHs) at the Canadian Wildlife Health Cooperative, University of Saskatchewan. To predict potential population-level effects, we will incorporate estimates of oil sands-related mortality rates (and proportion of marked birds exposed to oil sands) into simulations of the expected population response, using an integrated population model of the AWB population (Wilson et al., 2016).

Assumptions

Given insufficient sample sizes from baseline monitoring, we are not certain that the probability of young cranes landing on tailings ponds or near other industrial sites will be high enough to test the second and third hypotheses with high precision, especially predictions relating to tailings ponds. However, if we determine the probability of landing on tailings ponds is not high, even with a larger sample, that itself would be a useful result, indicating that risk from OS mining is low to whooping cranes.

During baseline monitoring, we tested all of the field methods and most of the analytical methods proposed here. We created or adapted SOPs (e.g., Appendix D) for crane capture, data collection, and data management/analysis. We have demonstrated that we can capture, band and deploy transmitters on young cranes, and that methods used during baseline monitoring will allow us to study their movement patterns and habitat selection. Thus, we are confident we have the expertise required to conduct this study.

As a multi-agency, collaborative study, we will cooperate with partners (e.g., Parks Canada, Calgary Zoo, US Fish and Wildlife Service, US Geological Survey) to secure funding for purchase of transmitters. Using data from this study, partners will collaborate with us to investigate additional questions. We request 41% of the cash budget from JOSM, 22% is confirmed from ECCC-CWS, and partners will contribute the remaining 37%. We also rely on partners to contribute in-kind expertise to banding operations.

References

St. Clair, CC. 2014. Final report on the Research on Avian Protection Project. Prepared for Alberta Justice, Edmonton, Canada, 95 pp. Accessed on 15 November 2016 from http://rapp.biology.ualberta.ca.

Hartup BK. 2005. Guidelines for field capture and safe handling of whooping cranes to avoid capture-related stress and injury. International Crane Foundation, 6 pp.

Kuyt, E. 1979. Banding of juvenile Whooping Cranes on the breeding range in the Northwest Territories, Canada. North American Bird Bander 4, 24–25.

Pearse AT, Brandt DA, Hartup B, and Bidwell, M. (Submitted) Mortality in Aransas-Wood Buffalo Whooping Cranes: Timing, Location and Causes. In "Biology and Conservation of the Whooping Crane (*Grus americana*)", J. French and S. Converse, Eds. Elsevier Press, 27 manuscript pages.

Thompson and McGarigal. 2002. The influence of research scale on bald eagle habitat selection along the lower Hudson River, New York (USA). Landscape Ecology 17: 569-586.

Wilson S, Gil-Weir KC, Clark RG, Robertson GJ, and Bidwell M. 2016. Integrated population modeling to assess demographic variation and contributions to population growth for endangered whooping cranes. Biological Conservation 197: 1-7.

Data Management

If this work generates data please summarize your project-level data management plan.

Deliverables	Timeframe
Data Collection Period: *Telemetry and field-based data collection will be conducted annually from Apr 1 to Nov 30, for three years from Apr 2017 to Nov 2019*	Start : 2017-04-01 End: 2019-11-30
Data Analysis Period: *QA/QC of data and data analysis will be conducted twice annually in June and Dec (after spring and fall migration, respectively) and data analysis will be conducted annually from Dec-Feb, for three years from Dec 2017 to Feb 2020*	Start : 2017-12-01 End: 2020-01-31
Data Release Date: *Metadata and data consistent, complete and meet basic standard format for publication in Open Data; on or linked to JOSM portal, by end of Q1 of 2020-21*	2020-03-31

Reporting and Publications

Provide information on the anticipated reports / publications. (Insert additional rows if needed)

Expected Subject/Titles of Publications or Reports	Short Description of Publication or Report	Expected Year of Publication
Annual Report: Quantifying, explaining and mitigating risk from oil sands mining to whooping cranes	Three annual, operational reports (for 2017-18, 2018-19 and 2019-20) with cumulative results	By end of Q1 of 2018-19, 2019-20, 2020-21
Movement patterns and habitat use of endangered whooping cranes in the oil sands region of Canada	Scientific paper describing movement patterns and habitat use of whooping cranes in the oil sands region of Canada, based on analysis of data obtained during baseline monitoring (2012-16).	2018-19
Quantifying risk from oil sands mining to endangered whooping cranes	Scientific paper quantifying risk from oil sands mining to whooping cranes, based on quantitative and qualitative analyses of stopovers at industrial and non-industrial sites during migration through Canada's oil sands region.	2021-22
Causes and population-level consequences of risk from oil sands mining to endangered whooping cranes	Scientific paper explaining causes of risk from oil sands mining to whooping cranes during migration in the oil sands region of Canada, including predictions of population-level consequences of stopovers industrial sites.	2021-22
Methods and models for mitigation of risk from oil sands mining to endangered whooping cranes	Scientific paper containing methods and models for mitigation of risk from oil sands mining to whooping cranes by government and industry, including a habitat suitability model and associated spatial products (e.g., maps).	2021-22

Technical / Professional Roles and Responsibilities

Identify members of the monitoring team/organization, their roles and responsibilities. Identify monitoring organization leads if different from overall monitoring activity lead. (Insert additional rows if needed)

Role	Responsibilities	Resource Name/Organization
Principal Investigator	Direct and implement the study; assist with fieldwork as required; design, supervise and conduct analytical work; write scientific manuscripts.	BI-03, Senior Wildlife Biologist, ECCC-CWS
Wildlife Technician	Plan and conduct fieldwork; manage data and provide additional technical support; prepare maps and figures for, and contribute to writing to, annual reports.	EG-04, Wildlife Technician, ECCC-CWS
Capture, banding and deployment team	Capture, band and deploy transmitters on 10 to 15 pre-fledged, juvenile cranes annually from 2017-20.	Five biologists and 1 veterinarian from partner organizations

Deliverables – Year 1

See **Appendix C** for multi-year deliverables breakdown.

Deliverable(s) (please provide enough information to support status reporting)	**Budget**
Q1 – April to June	$134,054
Number and location of crane nests at and near WBNP determined, via aerial survey (May)	
Cleaned and error-checked dataset produced after spring migration, via QA/QC (June)	
Q2 – July to September	$119,054
GPS locations of banded cranes obtained during breeding, via telemetry (Jul-Aug)	
Number and location of crane young at and near WBNP determined, via aerial survey (Jul-Aug)	
10 to 15 pre-fledged, juvenile cranes captured and banded with transmitters (Jul-Aug); if this is not possible (see text for details) then we will capture/band 10 to 15 breeding adults in Texas during Q4	
GPS locations of cranes obtained during fall migration, via telemetry (Sept)	
Re-sighting data obtained from banded cranes in SK, via ground surveys (Sept)	
Q3 – October to December	$26,554
GPS locations of banded cranes obtained during fall migration, via telemetry (Oct-Nov)	
Re-sighting data obtained from banded cranes in SK, via ground surveys (Oct-Nov)	
Cleaned and error-checked dataset produced after fall migration, via QA/QC (Nov)	
Q4 – January to March	$26,554
If required (see Q2 above) 10 to 15 breeding adult cranes captured and banded with transmitters (Jan)	
Draft annual operational report completed, with cumulative results	
Total Annual Budget (cash only, see Appendix B for in-kind contributions)	$306,216

Detailed Financial Breakdown – Year 1 of 3 (2017-2018)

Also complete **Appendix B** for the multi-year financial breakdown

Budget requirements – List areas that require budget expenditures: (ADD OR DELETE BUDGET CATEGORIES AS REQUIRED)	JOSM Funding (cash only[2])	External Funding[1] (cash only[2])
O&M - Operations and Maintenance:		
Transmitters (GPS-GSM devices)	-	$60,000
Aerial surveys via helicopter (NMSO)	-	$80,000
Deployment of transmitters via helicopter (NMSO)	11,870	$33,130
Transmitter data charges	-	-
Overhead on all JOSM O&M (including travel)	$9,915	-
Sub-Total	$21,785	$173,130
O&M – Travel		
Field work (surveys, capture and banding)	$7,914	$7,086
Sub-Total	$7,914	$7,086
O&M - External Contracts :		
Sub-Total	-	-
Salaries:		
Principal Investigator (BI-03)	-	-
Technical/Professional Assistants (EG-04)	$70,027	-
Overhead on JOSM salary	$26,274	-
Sub-Total	$96,301	-
Total Salaries	$96,301	-
Total O&M	$29,699	$180,216
2017-2018 GRAND TOTAL*	$126,000	$180,216

[1]External (non-JOSM) funding is anticipated from the Canadian Wildlife Service, Parks Canada, the United States Fish and Wildlife Service, and the United States Geological Survey.
[2]See Appendix B for in-kind contributions.

Appendix 1 – Annual Monitoring Schedule

(Please provide detailed information on the specifics of your monitoring schedule including – locations, schedule, methods, SOPs, QA/QC data release, references)

Sampling Locations/Sites	Sampling Schedule *(timing/frequency)*	Compounds to be Analyzed	SOPs to be Consulted (*hyperlinks accepted*)	QA/QC Complete & Date Data to be Released
Not applicable				

APPENDIX 2 – Detailed Multi-year Financial Breakdown:

if changes are to be made then an Addendum must be Complete and Approved.
(Complete the following detailed financial breakdown; add or delete categories as required)

Budget requirements	Year 1 (2017-18)			Year 2 (2018-19)			Year 3 (2019-20)		
	OSM	Non-OSM[1]	In-Kind	OSM	Non-OSM[1]	In-Kind	OSM	Non-OSM[1]	In-Kind
1) Salaries and benefits									
a) Investigators (BI-03, in kind contribution of 40% of his salary plus salary overhead)	-	-	$45,141	-	-	$45,141	-	-	$45,141
b) Technical/professional assistants (EG-04; plus in-kind contribution of staff time from partners for capture)	$70,027	-	$18,052	$72,830	-	$18,052	$72,830	-	$18,052
c) Overhead on OSM salary	$26,274	-	-	$27,326	-	-	$27,326	-	-
2) Operations and maintenance									
a) Equipment (transmitters)	-	$60,000	-	-	$60,000	-	-	$60,000	-
b) Aerial surveys via helicopter (NMSO)		$80,000	-		$80,000	-		$80,000	-
c) Deployment of transmitters via helicopter (NMSO)	$11,870	$33,130	-	$11,870	$33,130	-	$11,870	$33,130	-
d) Transmitter data charges	-	-	-	-	$6,000	-	-	$11,000	-
e) Overhead on all JOSM O&M (including travel)	$9,915	-	-	$10,279	-	-	$10,279	-	-
3) Consumable Materials and supplies									
4) Travel									
a) Field work (surveys, deployment of transmitters)	$7,914	$7,086	$10,000	$7,914	$7,086	$10,000	$7,914	$7,086	$10,000
5) Dissemination & Engagement									
a) Publications/Reports (page charges)	-	-	-	-	-	-	-	-	$7,500
Grand Total	$126,000	$180,216	$73,193	$130,219	$186,216	$73,193	$130,219	$191,216	$80,693

[1]External (non-OSM) funding is anticipated from the Canadian Wildlife Service, Parks Canada, the United States Fish and Wildlife Service, and the United States Geological Survey.

Appendix 3 – Staffing Plan

(Complete the following detailed staffing plan; add or delete categories as required)

	Year 1 – Budget Allocation		Year 2 – Budget Allocation		Year 3 – Budget Allocation		Year 4 – Budget Allocation		Year 5 – Budget Allocation	
Responsible Role	OSM Funding	External Funding	OSM Funding	External Funding	OSM Funding	External Funding	OSM Funding	External Funding	OSM Funding	External Funding
Science Expertise		$45,141		$45,141		$45.141				
Technical/Field Staff	$96,301	$18,052	$100,156	$18,052	$100,156	$18,052				
Administrative and Program Coordination										
Grand Total (*inserted into Appendix 2*)	**$96,301**	**$63,193**	**$100,156**	**$63,193**	**$100,156**	**$63,193**		**$**		**$**

Appendix 4 - Approvals

Project Submitted by:

Name:		
Organization:	Signature:	Date:

Project Approved by:

Dr. Monique Dubé (AEP)		**Dr. Kevin Cash (ECCC)**
Signature		Signature
Date		Date

APPENDIX 5 –Years 2 and 3 Deliverables

(Complete the following detailed breakdown. Provide a summary of tangible quarterly deliverables and your anticipated expenditures. Identify major project areas (deliverables) and results that can be identified as a tangible goal.

Year 2 (2018- 2019)	
Deliverable(s) (please provide enough information to support status reporting)	**Budget**
Q1 – April to June	$136,609
GPS locations of cranes obtained, via telemetry, during spring migration (Apr-May) and breeding (May-Jun)	
Number and location of crane nests at and near WBNP determined, via aerial survey (May)	
Cleaned and error-checked dataset produced after spring migration, via QA/QC (June)	
Q2 – July to September	$121,609
GPS locations of banded cranes obtained during breeding, via telemetry (Jul-Aug)	
Number and location of crane young at and near WBNP determined, via aerial survey (Jul-Aug)	
10 to 15 pre-fledged, juvenile cranes captured and banded with transmitters (Jul-Aug); if this is not possible (see text for details) then we will capture/band 10 to 15 breeding adults in Texas during Q4	
GPS locations of cranes obtained during fall migration, via telemetry (Sept)	
Re-sighting data obtained from banded cranes in SK, via ground surveys (Sept)	
Q3 – October to December	$29,109
GPS locations of banded cranes obtained during fall migration, via telemetry (Oct-Nov)	
Re-sighting data obtained from banded cranes in SK, via ground surveys (Oct-Nov)	
Cleaned and error-checked dataset produced after fall migration, via QA/QC (Nov)	
Data analysis completed to test hypothesis 1, using cumulative data (Dec)	
Q4 – January to March	$29,109
If required (see Q2 above) 10 to 15 breeding adult cranes captured and banded with transmitters (Jan)	
Data analysis completed to test hypotheses 2 and 3, using cumulative data (Jan)	

Draft annual operational report completed, with cumulative results; draft manuscripts prepared (Feb-Mar)	
Total Annual Budget (cash only, see Appendix B for in-kind contributions)	$316,436

Year 3 (2019- 2020)	
Deliverable(s) (please provide enough information to support status reporting)	**Budget**
Q1 – April to June	$137,859
GPS locations of cranes obtained, via telemetry, during spring migration (Apr-May) and breeding (May-Jun)	
Number and location of crane nests at and near WBNP determined, via aerial survey (May)	
Cleaned and error-checked dataset produced after spring migration, via QA/QC (June)	
Q2 – July to September	$122,859
GPS locations of banded cranes obtained during breeding, via telemetry (Jul-Aug)	
Number and location of crane young at and near WBNP determined, via aerial survey (Jul-Aug)	
10 to 15 pre-fledged, juvenile cranes captured and banded with transmitters (Jul-Aug); if this is not possible (see text for details) then we will capture/band 10 to 15 breeding adults in Texas during Q4	
GPS locations of cranes obtained during fall migration, via telemetry (Sept)	
Re-sighting data obtained from banded cranes in SK, via ground surveys (Sept)	
Q3 – October to December	$30,359
GPS locations of banded cranes obtained during fall migration, via telemetry (Oct-Nov)	
Re-sighting data obtained from banded cranes in SK, via ground surveys (Oct-Nov)	
Cleaned and error-checked dataset produced after fall migration, via QA/QC (Nov)	
Data analysis completed to test hypothesis 1, using cumulative data (Dec)	
Q4 – January to March	$30,359
If required (see Q2 above) 10 to 15 breeding adult cranes captured and banded with transmitters (Jan)	
Data analysis completed to test hypotheses 2 and 3, using cumulative data (Jan)	
Draft annual operational report completed, with cumulative results; draft manuscripts updated (Feb-Mar)	
Total Annual Budget (cash only, see Appendix B for in-kind contributions)	$321,436

APPENDIX 6 – Standard Operating Procedure (SOP) for Capture and Banding of Cranes (double click to launch embedded PDF)

Guidelines for Field Capture and Safe Handling of Whooping Cranes to Avoid Capture-Related Stress and Injury

Barry K. Hartup, DVM, PhD
International Crane Foundation

Introduction

This report is intended to provide a general set of guidelines for the safe capture and handling of free-ranging whooping cranes in North America. The target audience consists of aviculturists, biologists and veterinarians that work directly to capture whooping cranes for various purposes. This report is not intended to provide exhaustive information on specific capture techniques; it is assumed that the methods chosen by the biologists concerned meet the standards of the profession and are appropriate for the situation at hand (for further information, numerous articles on crane capture are referenced by Hayes et al., 2003)[5]. The intentions of this document are to reinforce a standard set of conditions that should be adhered to when choosing and implementing a particular capture technique and to offer tips on how to minimize stress in birds while in hand. The goal is to achieve maximum safety for the cranes and people involved and keep capture-related morbidity to less than 2%.

Etiology of Capture Morbidity in Cranes

Musculoskeletal trauma and repercussions from severe physiological stress, often manifested as exertional myopathy (aka capture myopathy), are common negative impacts on cranes captured for management purposes. With greater numbers of free-ranging whooping cranes subjected to direct manipulation, such negative impacts are likely to arise with increasing frequency in these programs.

Capture and handling techniques should be designed to minimize the risks of direct trauma, as many complications and stressors are exacerbated by pre-existing tissue damage. Contingency plans must be available in the event of injury during capture/handling, including prompt treatment and potential rehabilitation.

Exertional myopathy (EM) is an insidious non-infectious disease that may present as an acute capture shock syndrome that develops within minutes to hours, or a debilitating, necrotizing muscle condition that takes days to manifest[10]. The disease has been described in a wide array of mammals and birds (reviewed by Williams and Thorne, 1996)[13]. Long-legged birds may be more susceptible to EM than other birds as suggested by a disproportionate number of published case reports involving Mississippi sandhill cranes,[3] greater sandhill cranes,[5,14] whooping cranes,[5] grey crowned cranes,[2] emus,[11] ostriches,[8,9] a white stork,[13] and greater and lesser flamingos.[15]

Several factors have been associated with the onset of EM in animals, including fear, anxiety, stress, overexertion, hyperthermia, metabolic acidosis, and vitamin E/selenium deficiency.[1,3,7,10-13] Genetic predisposition has also been suggested as a potential risk factor.[3] Certain plant and chemical toxicants can induce disease similar to EM.[13] Anthropogenic factors, such as capture and handling conditions, are recognized risk factors for EM, including rate and length of pursuit, prolonged manual restraint with extended muscle tension, repeated handling, and transportation