

Instructions to Observers for Conducting Long-billed Curlew Surveys

Suzanne Fellows
U.S. Fish and Wildlife Service
PO Box 25486, DFC
Denver, CO 80225
303-236-4417
Suzanne_Fellows@fws.gov

March, 2004

Background

The Program for Regional and International Shorebird Monitoring (PRISM) is an attempt to deliver data-based population estimates for trend analysis of shorebirds. The temperate breeding group of PRISM is responsible for developing monitoring protocols for shorebird species which breed in the temperate zone of North America. Long-billed Curlew (LBCU) are designated as a Highly Imperiled species by the U.S. and Canadian Shorebird Conservation plans, as a Bird of Conservation Concern by the U.S. Fish & Wildlife Service (USFWS), a species of Special Concern by the Canadian Wildlife Service (CWS), an Audubon Watch List species, and a species of conservation concern in many states and provinces. Because of the need for an accurate range-wide population estimate for LBCU, this survey has been developed.

The protocol for conducting the Long-billed Curlew Range-wide Breeding Survey is modified from Saunders 2001 and is designed to meet the statistical needs for estimating the breeding population of LBCU across their entire breeding range. Full background on the study is posted at http://mountain-prairie.fws.gov/species/birds/longbilled_curlew/. Routes were chosen according to a stratified random sampling scheme by the U.S. Geological Survey (USGS). More information on the selection of routes can be gotten from your primary regional contact or found at http://mountain-prairie.fws.gov/species/birds/longbilled_curlew/. Maps, route information, survey forms and protocol are provided to the surveyors from the USGS and USFWS. Training is provided for surveyors through the USFWS and USGS.

It is imperative that timing, routes, and data collection are followed as specified. If you are unable to conduct the survey according to the following designated protocol due to weather, road conditions or construction, or other unforeseen circumstances, and your concerns are not addressed here, please contact your local contact immediately (Appendix A). Problems and deviations encountered during the survey should be noted on the data collection forms included with the packet.

Equipment and Training Needed

For the U.S. routes, each team is made up of two observers. Both observers should have binoculars and each team will be required to provide reliable transportation, a watch with a second hand or a timer, GPS unit, professional series compass, thermometer, a spotting scope, and any necessary reference books. A rangefinder and a metric measuring device (e.g., measuring tape) are also helpful so teams can check their distance estimations. Become familiar with the survey codes (Appendix B) and instructions for completing data collection forms (Appendix C). Maps and data sheets will be provided to each team of observers. Observers must be able to identify LBCU by sight and sound and record behavior (Appendix D) and habitat characteristics (Appendix B and E) according to the prescribed categories and protocol. A list of some

guides to assist in plant identification and some illustrations of common species are available at http://mountain-prairie.fws.gov/species/birds/longbilled_curlew/.

Data Collection

Prior to the Start of the Survey

Familiarization with your route: In preparation to conduct the actual LBCU survey, it is suggested that, if possible, at least one of the observers drive the assigned route prior to the actual survey, to become familiar with the route and any possible complications. The routes are each 32 km (@ 20 mi) long with stops every 800 m (@ 1/2 mile) and follow improved roads when possible. Copies of each route map will be provided to each field crew. Place route maps in a protective plastic sheet and avoid contact with water.

Substitute routes have been assigned to make it easier to deal with changes in the field. In the event that inclement weather (snow, muddy roads, etc.) would create a hazard and/or jeopardize the completion of the survey during the specified time frame, please see the section below marked Weather. If a route needs to be moved because of dangerous conditions, because it would involve trespassing on private property, or because the route is impassable, as a last resort it can be altered. In this case, please contact your local contact (Appendix A) and alter it according to the instructions found in Appendix F.

Familiarization with curlew survey forms: For each designated route there is a LBCU survey and a habitat data collection form. These forms will be filled out during the actual survey. As both observers will trade off data recording duties during the survey, both should become comfortable with the survey forms. The form will be used to designate survey conditions, number of curlews and their behavior, and general habitat information.

Equipment calibration: Equipment should be checked to make sure they are in proper working order and set to the right units. You are requested to use metric units when taking measurements. Within the U. S. set your GPS unit to read in UTM coordinates for your position format and map datum option NAD27 CONUS. Within Canada set your GPS unit to UTM coordinates and NAD27 Canada. If your GPS unit does not automatically set your zones with the above information, you will need to do that as well. Compasses should be checked for proper declination at the start of each survey route.

You will need to be able to estimate the distance between yourself and the LBCU in distance bands of 0-400m, 400-800m, and > 800m. Check your distance estimation with a measuring tape or other measurement device, such as a rangefinder regularly, but at least once a route. If you do choose to use a rangefinder, be aware of their limitations and the conditions under which they will not give accurate readings. If you use a rangefinder make sure it is recalibrated at the start of each survey as well as during the survey if there is a chance they are no longer giving accurate readings (change in weather conditions, etc.).

Conducting the Actual Survey

Timing: Surveys are timed to coincide with the preincubation period of LBCU breeding phenology. This is the period of time when LBCU are thought to be most easily detected within their breeding habitat. There are four survey windows based on local conditions. Ideally, each route should be run within the specified preferred two week period. However, an additional week is given as a grace period to insure that the routes are run and can be analyzed according to the protocol. If they cannot be run within this three week period, please contact your local contact (Appendix A) for further instruction.

Depending on the location of the routes, hypothetically, two neighboring routes can be run each day. Surveys should last about 6 hours. Start morning routes no earlier than ½ hour after local sunrise. You may also run a second route in the afternoon provided you can complete the survey without compromising the survey's integrity, or observer safety, and can end by ½ hour before local sunset. Consider how the survey may be affected by sun angle, observer fatigue, and where you need to drive to for overnight accommodations and surveys the following day. A customized sunrise/sunset calendar for your location can be gotten from <http://www.sunrisesunset.com/> or check your GPS unit for the information.

Weather: Please be aware of any predicted weather patterns which could affect the survey or make it hazardous for observation. Try not to conduct the surveys in high winds (>25 km/hr, >15 mi/hr, Beaufort Scale > 4), moderate rainfall and/or snowstorm conditions. Local "normal" conditions may dictate the necessity to survey during higher wind periods in some parts of the range. Use your judgment on whether or not to discontinue a route if any of these conditions begin during the survey. Consider the type and severity of weather event and how much longer you need to complete the survey route. You can "wait out" certain weather events, such as rainsqualls, if they will be brief in duration and you can complete the route within the day. Under no circumstances should you put your safety at risk. Discontinue the survey if the weather is hampering your ability to detect curlews or otherwise affecting their behavior. Be aware that driving on wet unimproved roads can be both dangerous as well as destructive (e.g. tearing up roads) and in some areas illegal.

If you complete at least 12 stops of the route before the weather changes, and those stops fall within the randomly selected township, the data can still be used. For routes where less than 20 stops have been completed, re-start and finish the route from the stop point later in the day if the weather conditions become more conducive or finish the route within the next three days, if practicable. Return forms from both the discontinued and the completed surveys.

Double observer and removal methodology: The double observer protocol (Nichols et al. 2000) and removal model (Farnsworth et al. 2002) are being followed during this study to test detection probabilities. The double observer technique is not used in the Canadian surveys and in some situations in the U.S. Contact your local contact if this becomes an issue.

Observers must alternate being designated as the "primary" and the "secondary" observer. The primary observer's duties are to observe any and all curlews detected and point them out to the secondary observer who will be recording the data at the stop point. It is important that the primary observer scan all four quadrants of the circle within the first 2 minutes of the 5 minute survey (otherwise the "depletion curve" may be aberrant and difficult to model properly). The secondary observer records all the information collected at the point from what the primary observer indicates as well as surveys the area independently to see if the primary observer has missed any curlews.

LBCUs the secondary observer detects are also recorded. However, one of the assumptions of the double-observer approach is that observations of the primary and secondary observers are independent. Therefore, the secondary observer should not point out or otherwise give any clues to the primary observer of any LBCU they may have missed prior to the completion of the 5 minute observation period. The secondary observer should mentally note the position of curlews undetected by the primary observer and take their measurements and record their observation only after the 5 minute observation period is completed.

The observers must alternate between being the primary and secondary observers. Having the same individual as the primary observer for all the odd numbered stop points and the secondary observer for all the even numbered stop points will cut down on confusion.

For all surveys, for each bird, the observers should ascertain the distance between the bird and observer (distance band of 0-400m, 400-800m, or >800m) and compass direction between the observer and the LBCU. Note the identity of the observer and whether they were the primary or secondary observer at that stop. Record either the exact time or the time period (1-5 minute interval) within which the bird was first seen. Indicate how the LBCU was detected (sight, sound, or both).

Where possible and where the observer is certain, the sex of the LBCU should be noted. Males are generally smaller and have shorter bills than females. However, in most cases it will be unknown. Although most birds will be adults, if any downy young or juveniles are detected they must be noted. Behavior codes (Appendix D) and flock size can also be recorded in the comment section of the survey data sheet.

Driving the route: The routes do not have specified start or stop positions, and some of the routes are discontinuous. Surveyors may choose for themselves the best way to run a route. If bad weather is imminent, priority should be placed on portions of the route falling within the randomly selected township (this applies to routes that spill over into adjacent townships). Routes were drawn to cover a distance of at least 32 km (20 mi), though for practical purposes they represent only an approximation of this distance. Surveyors may find the prescribed route is longer than 32 km. In this case, they should terminate the survey once they have surveyed 40 stop points. If surveyors find the route is too short they should extend the route using the criteria specified in Appendix F until 40 stops are completed. The starting point for a route will be designated as "Stop #1" and will be mile/km 0. Survey the designated route, as specified on the accompanying map, for 32 km/20 miles (40 stops). It is recommended to use the vehicle trip meter or GPS in conjunction with the map to keep track of the stops. Stop on the side of the road every 800 m (1/2 mile).

Be respectful of private property and do not attempt to cross locked gates or posted roads. In the event that surveying from the designated stop point could endanger you, skip the stop, make a note, and continue to the next stop. In the event that a stop point proves to have limited visibility because of visual obstructions (e.g., railroad beds, trees, etc.), it is still necessary to spend the time surveying it. In this case you will still be able to detect presence of LBCU by sound. Please note any deviations or problems on the data collection form. In the event that the entire route is unsafe or inaccessible, or other problems are encountered, choose from the alternate routes provided or contact your local contact (Appendix A).

Field Forms: All data collected is to be entered on these form, available from your local contact. There are complete directions and examples to assist you in completing the survey in Appendix D. Please familiarize yourself with the information needed at the start and end of the survey and the codes for LBCU, incidental species, and habitat data prior to the start of the survey. Fill in the required weather and observer information at the start of the survey. This information is also requested at the end of the survey.

Spend five (5) minutes listening and looking for curlews at each stop. Make all observations from the outside of your vehicle no more than 10 m from where the point is located. Do not walk into the field to collect data. Scan in all directions. You must spend the entire 5 minute period scanning and searching for LBCU, even if you "know" there are none there.

At each stop, regardless of whether a curlew is detected at that stop, you will complete at least one row on each of the field forms (habitat and survey data). If no curlews are detected at that stop fill in "NONE" under the species column. For each individual LBCU observed, complete a row on the field form. Record the time interval, observer, how detected, distance band between the LBCU and observer (0-400m, 400-800m, > 800m), and habitat type and height the curlew is in (5 m radius) for each sighting on the survey data sheet. Other information such as flock size, age, sex, and behavior will be used to answer assumptions regarding LBCU detection and survey timing. Records should reflect the distance, how the bird was behaving, and the habitat it was using based on when it was first sighted.

Although data analysis will be limited to birds seen within 400 m of the observer, all birds seen should be recorded. Recording distances beyond 400 m will assist in describing the distribution of LBCU on the landscape. Count all birds seen or heard at the stop. In the case that a curlew follows you (its movements are dependent upon yours; e.g., a LBCU which is doing a distraction display) from stop to stop, only count it at the first stop you detect it. All observations of LBCU must be independent. Be aware of any movement of individual curlews and do not count them twice on any route. See Appendix D for additional information on LBCU behavioral codes.

After the 5 minute survey period is completed, begin collecting the habitat data. Do not start collecting habitat data before the 5 minute survey period is completed. At each stop, record UTM units from your GPS unit and topography data. Record habitat data, regardless of whether or not there are any curlews at that point, using the codes found on the data code sheet (Appendix B) and information provided in the other appendices.

Incidental species: If, during your survey, you encounter any of the incidental species at any of the points, please include them on the data forms. Each incidental species will also merit its own line. The incidental species of concern include temperate breeding shorebirds, grassland breeding owls, grouse, and mammalian predators (see list Appendix B). Include at least the stop number and species code. Behavioral, habitat and other data is optional for incidental species.

Return field forms: At the completion of each route, please make a copy of the data forms before sending in the original completed data sheets and route maps. This will ensure that there is a back-up copy of the data if it is needed. Please indicate any problems or deviations from the assigned route on the data sheet cover. Completed forms should be sent to your local contact or Dr. Thomas Stanley, USGS Fort Collins Science Center, 2150 Centre Ave., Bldg. C, Fort Collins, CO, 80525.

Equipment List

Required Equipment

Binoculars (one per observer)
 Reliable transportation
 Watch with a second hand and/or Timer
 GPS unit
 Compass (must be able to set declination)
 Thermometer
 Spotting scope

Optional Equipment

Reference books
 Rangefinder

Metric measuring device (tape)
Cell phone
Plastic page protectors to keep maps from getting wet
Area maps or gazetteers

Provided by USGS/USFWS

Route maps
Implementation Guidelines (http://mountain-prairie.fws.gov/species/birds/longbilled_curlew/)
Data collection forms (http://mountain-prairie.fws.gov/species/birds/longbilled_curle)

Acknowledgements

This implementation plan would not have been possible without the discussions and comments from Sue Thomas, J. S. Dieni, Jon Bart, and Stephanie Jones. It was also reviewed by Thomas Stanley, Susan Skagen, and Bill Howe. Thank you all for making this portion of the Long-billed Curlew survey a reality.

Literature Cited

- Farnsworth, G. L., K. H. Pollock, J. D. Nichols, T. R. Simons, J. E. Hines, and J. R. Sauer. 2002. A removal model for estimating detection probabilities from point-count surveys. *Auk* 119(2):414-425.
- Nichols, J. D., J. E. Hines, J. R. Sauer, F. W. Fallon J. E. Fallon, and P. J. Heglund. 2000. A double-observer approach for estimating detection probability and abundance from point counts. *Auk* 117(2):393-408.
- Saunders, E. J. 2001. Population estimate and habitat associations of the long-billed curlew (*Numenius americanus*) in Alberta. Alberta Sustainable Resource Development, Fish and Wildlife Division, Alberta Species at Risk Report No. 25, Edmonton, AB. http://mountain-prairie.fws.gov/species/birds/longbilled_curlew/

Appendix A Contact List

In the event of any problems with routes, need for alternate routes, assistance in altering routes, or questions about timing, please contact your local contact, below. Contact Suzanne Fellows for any questions or clarifications of these instructions.

United States

USGS

Thomas R. Stanley
Fort Collins Science Center
2150 Centre Ave, Bldg C
Fort Collins, CO 80526-8118
970-226-9360
Tom_Stanley@fws.gov

or

Susan Skagen
Fort Collins Science Center
2150 Centre Ave, Bldg C
Fort Collins, CO 80526-8118
970-226-9461
Susan_Skagen@usgs.gov

Fish and Wildlife Service

CA, ID, NV, OR, WA

Sue Thomas
U.S. Fish and Wildlife Service
911 NE 11th Ave
Portland, OR 97232
503-231-6164
sue_thomas@fws.gov

NM, OK, TX

Bill Howe
U.S. Fish & Wildlife Service
PO Box 1306
Albuquerque, NM 87103
505-248-6875
Bill_Howe@fws.gov

CO, KS, MT, ND, NE, SD, UT, WY and U.S. contacts for Canada (AB, BC, SK)

Stephanie Jones
U.S. Fish & Wildlife Service
PO Box 25486, DFC
Denver, CO 80225
303-236-4409
Stephanie_Jones@fws.gov

or

Suzanne Fellows
U.S. Fish & Wildlife Service
PO Box 25486, DFC
Denver, CO 80225
303-236-4417
Suzanne_Fellows@fws.gov

Canada

Canadian Wildlife Service

Garry Donaldson

Canadian Wildlife Service

Shorebird Conservation Biologist/ Biologiste de conservation des oiseaux de rivage/

Biólogo de Conservación de las Aves Playeras

St. Joseph Blvd., 3rd Floor

Gatineau, Québec K1A 0H3

Tel: (819) 953-3166, Fax: (819) 994-4445

Garry.Donaldson@ec.gc.ca

Saskatchewan

Ursula Banasch

Wildlife Biologist

Environment Canada

Wildlife Management - Edmonton

4999 - 98 Avenue

Edmonton, Alberta Canada T6B 2X3

Tel: (780) 951-8678, Fax: (780) 495-2615

Ursula.Banasch@EC.gc.ca

Alberta

Richard Quinlan

Wildlife Biologist

Biodiversity and Species at Risk Program

Alberta Fish and Wildlife Division

2nd Flr, YPM Place

530 - 8 St. South

Lethbridge, Alberta Canada T1J 2J8

Tel: (403) 381-5397

Richard.Quinlan@gov.ab.ca

British Columbia

John Surgenor

970-A Camosun Cres.

Kamloops, BC Canada V2C 6G2

Phone: 250-371-6306

Fax: 250-828-4000

john.surgenor@gems6.gov.bc.ca

Appendix B Long-billed Curlew Survey Codes

<u>Sky Codes</u>	
0	Clear or few clouds
1	Partly cloudy
2	Cloudy (broken, overcast)
3	Rain
4	Fog or smoke
5	Drizzle
6	Snow
7	Showers (intermittent rain)

<u>Topography</u>	
F	Flat
R	Rolling
P	Pocketed

<u>Beaufort Wind Scale</u>	
0	Smoke rises vertically (<1 mph)
1	Wind direction shown by smoke drift (1-3 mph)
2	Wind felt on face, leaves rustle (4-7 mph)
3	Leaves, twigs in motion; light flag extended (8-12 mph)
4	Dust, loose paper blow; small branches in motion (13-18 mph)
5	Small trees sway, wavelets on water (19-24 mph)

<u>Vegetation Height</u>		
<u>Category</u>	<u>Height</u>	<u>In relation to LBCU</u>
1	bare ground-4 cm (1 ½ in)	can see foot
2	4-10 cm (4 in)	covers foot to "knee"
3	10-15 cm (6 in)	up to base of belly
4	15-45 cm (17 ½ in)	up to back
5	45-65 cm (25 in)	up to eye level
6	≥ 65 cm (25 in)	above head

<u>Species Codes</u>	
LBCU	Long-billed Curlew
<u>Incidental Species Codes</u>	
MOUP	Mountain Plover
WILL	Willet
UPSA	Upland Sandpiper
MAGO	Marbled Godwit
SEOW	Short-eared Owl
BUOW	Burrowing Owl
LPCH	Lesser Prairie-Chicken
GPCH	Greater Prairie-Chicken
STGR	Sharp-tailed Grouse
GSGR	Greater Sage-Grouse
CANLA	Coyote
VULVU	Red Fox
VULVE	Swift/Kit Fox
UROCI	Gray Fox
TAXTA	American Badger
MEPME	Striped Skunk
PROLO	Raccoon

<u>LBCU Age & Sex Codes</u>	
AHY	after hatch year (adults)
HY	young of the year
DY	downy young
M	male
F	female
U	unknown sex

<u>LBCU Flock Codes</u>	
1	Single
2	Pair
3	Flock: more than 1 bird and/or more than one obvious pair

<u>LBCU Activity Codes</u>	
F	Feeding: Actively pursuing food
R	Roosting: Actively roosting (eyes closed, one leg up, head under wing, etc.)
FO	Flying overhead: passing over area, not involved in territorial displays or other behaviors
T	Territorial displays: encounters between 2 or more LBCU, mate advertisement
N	Nesting: Includes copulating, scrape/nest building, egg laying, incubation, brooding young
D	Distraction displays: aerial or ground displays associated with nesting or young defense
M	Mobbing: specify observer, raptor, etc.

Habitat Codes

On Habitat Data Sheet: estimate the % (use increments of 25% or greater) in broad habitat classification categories by quarters (NE, NW, SE, SW) within the 400 m radius of the stop point. Record up to four (4) primary habitat codes in each quadrant and include secondary codes where they are easily determined. On Survey Data Sheet: put code best describing where LBCU is, at first detection, within a 5-m radius

PRIMARY CODES

Structure of grassland foliage: do not include seedheads

- SHRT** short grass < 5" (< 12 cm)
MEDM mid grass between 5"-15" (12-38 cm)
TALL tall grass >15" (> 38 cm)

Cultivated:

- RCWS** rural cultivated woodlands, scattered farm buildings, associated grounds, shelterbelts, orchard tree farms
CROP cropland, planted growing crops, post-harvest stubble (indicate if irrigated (**IR**) or dryland (**DY**))
BARE barren ground, plowed not yet replanted, planted not yet growing

Shrublands:

- SHRB** shrubs, clumped
STEP steppe, widely dispersed, \geq 50% grass

Forests:

- WOOD** woodlands

Other:

- OTHR** Urban residential and industrial miscellaneous

Water:

- EMWL** wetland/wet meadows
OWWL open water wetlands, rivers, lakes, reservoirs
STOK stockpond, windmill

For all primary habitat types note if present:

- GRAZ** grazed (cattle currently on, fresh cow pies)
BURN burned (presence of ash or soot, black ground)
INVA invasive species, particularly grasses, e.g. cheat grass (*Bromus tectorum*), Kentucky blue-grass (*Poa pratensis*), other bromes (*Bromus* spp.), etc. indicate species if possible and estimate %
PDOG prairie dog town (also other burrowing mammals--specify species)
AC active town (# mounds total)
IA inactive town (# mounds total)

SECONDARY CODES

Grasslands: Species where determined

Native Grasslands:

- SHTG** shortgrass prairie: blue grama-buffalo grass, includes cactus and small shrubs
MIXG mixed grass prairie: wheatgrass-needlegrass
TALG tallgrass prairie: wheatgrass-bluestem, needlegrass
TUND alpine tundra-montane grassland

Tame (non-native) Grasslands:

- PAST** pasture/rangelands (indicate if irrigated (**IR**) or dryland (**DY**))

Either Tame or Native Grasslands:

- CRPC** Conservation Reserve/Permanent Cover Program

Shrublands:

- SAGE** sagebrush *Artemisia-Agropyron*
SALT saltbrush-shadscale-greasewood *Atriplex-Sarcobatus* alkaligrass
OAKS oak shrub *Quercus gambelli*
MTSG mountain shrublands mixed species *Cercocarpes*
WILC highland willow carr *Salix*

Forests:

- CONF** conifer forests
RIPA lowland riparian and hardwood bottomland *Populus-Salix-Acer*
ASPE aspen *Populus tremuloides*
DECW deciduous woodlands
MXFO mixed deciduous-conifer woodlands

Other:

- URCP** urban residential and parks
UIND urban industrial, downtown, commercial districts
MISC miscellaneous: specify rocks, mining pits, oil wells/pipes, towers, etc.

Wetlands:

- EPHW** ephemeral/temporary ponds, wetlands, low wet prairie
SPLW semipermanent lakes and ponds, shallow marsh
PLPW permanent lakes and ponds, deep marsh
AKLW alkali ponds and lakes, intermittent alkali
FENW fen (alkaline) bog, wet meadow, low prairie

Appendix C

Data Instructions for Completing Survey Data Sheets

Recalibrate and test your range finders or your distance estimation technique each morning and in new habitat types. You must be able to accurately assign a distance band (0-400m, 400-800m, > 800m) for every LBCU detected. Check the declination of your compass.

At the start of each route:

Route State and Number (from map)

Date (day, month abbreviation, year)

Observers: Each observer enters their name and (initials)

Start Time, Start GPS Reading (use UTM units and datum NAD27 CONUS), and

Temperature (indicate C or F). Use the cheat sheet codes to complete **Wind** and **Sky**.

At each stop point: For each stop, you will use at least one line on the data sheet. Each point is considered the middle of the circle. Do not walk farther than 10 m to gather information. Include all Long-billed Curlews regardless of distance from stop point when first sighted. If there is more than one curlew, use at least one line for each individual. Brackets should be used to group pairs and flocks at the same stop.

Stop #s are sequential. Begin with 1 at mile 0/km 0. End with stop number 40 at mile 20/km 32

Min record the time frame (1-5minutes) when LBCU are found

Obs record the initials of the observers & if they are the primary or secondary observer at that stop (e.g., XYZ-1).

Species is NONE, LBCU, or one of the Incidental Species Codes listed on the cheat sheet

How Detected: write **V**(isual), **A**(ural) or **B**(oth) depending on how the LBCU was detected.

Distance: place a check mark under the appropriate column to indicate the distance between you and the LBCU (0-400 m, 400-800m, > 800m). This distance should represent the site where the LBCU is first detected.

Degree/Quad: compass reading to LBCU from observer or quadrant (NE, NW, SE, SW).

This will be used to tie the LBCU and the habitat quadrant together.

Habitat Code: use the survey data codes (Appendix B "**Habitat Codes**") to classify the habitat in a 5 m radius where the LBCU is sighted. Use survey data codes)

"**Vegetation Height**" to classify **Habitat Height**. These measurements should be in relation to where the LBCU is first detected.

Comments: the following must be included (use data survey codes) downy young or young of the year (DY, HY); all behaviors associated with courtship or nesting (T, N, D); any LBCU flying over the point but not landing (FO); flock size; sex if it can be positively determined; other comments pertaining to LBCU sited at the stop.

Incidental Species: Collect and record information on incidental species after the 5 minute LBCU count has been completed. Seventeen (17) species are of interest. The minimal amount of data needed is the stop number and species detected. Use one line per sighting.

Supplemental Pages: include the route name and number, date, observers' names and the sequential page number on each supplemental page used.

At the end of each route: on the first page for the route enter the following:

End Time, End GPS Reading (use UTM units), and **Temperature** (indicate C or F). Use cheat sheet codes to complete **Wind** and **Sky**.

Fill in the number of total pages used for the route. Attach all notes and data pages for the route together.

Instructions for Completing Habitat Data Sheet

This information will be collected after the 5 minute survey period at each stop. Each point is considered the middle of the circle. Only record habitat information within a 400 m radius of the middle of the circle at each stop point. You should not walk more than 10 m from the stop point to gather the data. Use your compass to divide the circle into 4 quadrants, NE (between 0-90o), SE (91-180o), SW (181-270o) and NW (271-359o).

At the start of each route:

Route State and Number (the 4 or 5 digit number of the selected township from the provided maps)

Date (day, month abbreviation, year)

Observer

At each stop point: After completion of 5 minute LBCU survey begin to collect the habitat data. You will use at least one line at each stop.

Stop #s are sequential. Begin with 1 at km 0/mile 0. End at stop number 40 at km32/mile 20

GPS Reading: please use UTM coordinates

Topography: specify if the stop is flat, rolling, or pocketed.

Habitat Classification by Quadrant: use the Habitat Codes to classify the habitat in all four quadrants within the 400 m radius circle of the stop point. For each quadrant (NE, SE, SW, NW) estimate the % of the primary habitat (> 25%) found in the quadrant. It will be assumed that if there are no numbers following a habitat classification then that quadrant contains 100% of the indicated habitat classification. Note if grazing, burning, invasive species, or prairie dogs are present. Secondary codes for some grasslands, shrublands, woodland, and other habitat types are also given. Where it is possible to identify these habitat codes, please include the secondary habitat types. Please limit the habitat classifications to no more than 4 per quadrant.

Additional comments: include on the lines following the stop number and initial observation.

Supplemental Pages: include the route name and number, date, observer and the sequential page number on each supplemental page used.

Appendix D

LBCU Behavior

The following behavior descriptions are adapted from descriptions reported in Dugger and Dugger (2002) and Saunders (2001). Please be aware that for purposes of this study, the behaviors described by these authors may have been reclassified.

F Feeding: Actively pursuing food

LBCU eat a variety of species of invertebrates (primarily crustaceans, bivalves, arthropods, insects, and a variety of worms) and will also feed on small vertebrates (they have been observed to take bird nestlings and eggs and fish).

They will peck, burrow probe (probing in burrows until prey is detected then rapidly probing to capture it), probe in the substrate, pause-probe (involves standing motionless for 5-10 secs, holding bill partially submerged and slightly agape, when prey is detected bill slowly moved down until with a sudden lurch it captures the prey), hawk for insects, flip dung piles, look and chase, and walk to nests where a parent bird has flushed to depredate nestlings and eggs.

Forage singly, in pairs, and in groups of 3-14 individuals.

LBCU have been recorded feeding in firm mud, high-tidal areas, soft mud, sand, low-tidal areas, on grasslands, freshly plowed fields, and wet pastures.

R Roosting: Actively roosting

There are many positions for roosting, loafing, sleeping, and sunbathing, include preening, stretching, scratching, bathing and anting activities which will be considered roosting behavior for this study.

LBCU may have one or both eyes closed, one leg tucked up under its breast feathers, and/or its head under wing. Often the tail droops below the level of its primaries, neck may be retracted into its shoulders, and its feathers are fluffed.

May also be seen roosting by sitting on the ground with both legs tucked under its breast. Do not confuse this with nest incubation or brooding of young.

Preening: may involve feather ruffling, rubbing top of head over back and sides and scratching.

Feather shaking: general shaking of body-feathers.

Two-wing stretch: slowly and deliberately stretches head, neck, and wings to full extent over back into the air.

Stretches legs backward, extended and held as wing on same side is partially extended and stretched backward and downward next to leg.

LBCU may "wing-raise" to maintain distance among individual flock members during loafing. While this has been described as being a territorial display, if it is not done as a nesting territory defense or mate advertisement, and is done in the context of roosting/loafing, please count it as a roosting behavior.

FO Flying overhead

LBCU are strictly passing over an area, are not involved in territorial displays, agonistic encounters, or mobbing or fleeing observers or potential predators. Do not use this code if other behaviors occur during their passage. This is strictly for birds which are,

independent from the observer, other LBCU, and other species, moving across the airspace of the stop point.

T Territorial displays

Agonistic encounters or displays between 2 or more LBCU and displays for the purpose of mate advertisement and defense of a territory against conspecifics. Also early nesting behavior such as copulating, scrape/nest building, and egg laying.

Several different behaviors have been described including "hovering", "crouch-run", "upright-run", "concealment", "supplanting", and "feather-raising". The following are some of the cues to look for: aerial displays used by aggressive male to locate an opponent hiding on the ground, concluding with landing on the ground near the opponent. Lowered head, bill forward, body feathers fluffed, legs crouched, wings slightly raised, often running at an opponent. Neck extended, head held high, body angled above horizontal, often running toward a conspecific. Aggressor approaches opponent, suddenly disappears from sight by dropping to the ground, flattens body including bill to the ground, while opponent searches for concealed aggressor who periodically springs up at opponent in a crouched run. Aggressor flies or runs to a position of another trying to get it to give up its position. Males competing for a female will raise their body feathers, fan their tail and then terminate the action by shaking their feathers.

"Wing-raising", if one bird raises its wings over its back while in an upright position, among individual flock members to maintain distance between themselves, this is not to be considered in this study as a territorial display if the birds are loafing (roosting). Remember, here territorial display refers to the active agonistic *encounters or displays between 2 or more LBCU and displays for the purpose of mate advertisement and defense of a territory against conspecifics*.

Post-pairing territory defense is primarily done by the male. Territorial defense after pairing may include aerial pursuits and vocalization.

The "soft kerr-kerr" flight occurs when the male ascends vertically and then glides slowly down toward the ground with his wings curved downwards and calls a series of soft "kerr kerr" notes. Counter calling between neighboring curlew territories will also be considered here as territorial behavior.

The long "curluoo" call, also described as a "curl---e-e-e-u-u-u" and "purt-bur-bur-bur-e-e", is most frequently heard during prenesting periods. It is always given on the ground, frequently after alighting near other LBCU and frequently reciprocated. If bill sparring and chasing sequences result, consider that it may be a territory maintenance call and count it as a territorial behavior. It has also been suggested to serve a pair-bond maintenance function.

"Bounding SKK Flight" or "Undulating Flight Display" are described as the male climbing silently and steeply into the air with rapid, fluttering wing-beats to a height of 10-15 m then sets wings in a downward curvature and head is elevated slightly above body plane, slightly extended neck, legs tucked into body and slowly gliding down into this position, often coming within 0.3 m of the ground before ascending again. Soft "kerr-kerr" or "hee-who" calls during descent.

Unpaired males ground call.

Ritualized courtship scraping is performed by both pairs and tossing where both sexes stand inside or near scrape and toss bits of vegetation, sticks, rocks or other nesting materials into scrape.

Copulation and precopulatory behavior including "courtship run" (male runs at female with neck retracted and back angled above horizontal, wings may be slightly raised and fan primaries) and "shaking" (male stands behind female with wings raised out to the side, tail cocked upward, neck outstretched and angle of back horizontal, male begins paddling feet rapidly moving side to side behind female, male simultaneously shakes head and bill out front ruffling female's feathers, display becomes more frenzied and may progress to with wings raised into bent position above back, where they are fluttered). Female may assume a more horizontal body position and male then mounts and copulates.

N Nesting

Lump all behaviors which indicate LBCU are no longer in the preincubation stage, incubation, and brooding young.

If at any time during a survey, young of the year LBCU are observed please indicate this on the survey form. This is imperative as it will indicate that our surveys are not during the preincubation stage and must be altered to an earlier time period.

The "curluoo" call may be given as an anxiety note after being flushed from the ground or when a potential predator threatens a nest.

D Distraction displays

Aerial or ground displays associated with nesting or young defense.

The "arc display call" consists of a long, harsh note, "guaaah", and a shorter "kieee" note ending with an undulating quality. Usually given in conjunction with defense of young or a late incubation nest against predators.

The "ki-keck" call, a trill with syllables most often grouped in twos or threes is almost always given in flight as a defense against a predator. This call is also given during mobbing.

"Wheet" call given during periods of anxiety when researchers approached pair too closely, within 50m of nest, vicinity of chicks or when flushed from ground.

M Mobbing

Mobbing behavior is characterized by one or more LBCU dive bombing or attacking usually avian predators during flight. If not associated with chick or nest defense specify as mobbing. Indicate the subject of mobbing (gulls, raptors, etc.).

The "ki-keck" call, a trill with syllables most often grouped in twos or threes is almost always given in flight during mobbing. This call is also given during distraction displays and in response to chicks.

Dugger, B. D. and K. M. Dugger. 2002. Long-billed curlew (*Numenius americanus*). In *The Birds of North America*, No. 628 (A. Poole and F. Gill, eds.) *The Birds of North America*, Inc., Philadelphia, PA.

Saunders, Elizabeth J. 2001. Population estimate and habitat associations of the long-billed curlew (*Numenius americanus*) in Alberta. Alberta Sustainable Resource Development, Fish and Wildlife Division, Alberta Species at Risk Report No. 25. Edmonton, AB.

Appendix E

Habitat Codes Explained

Refer to survey codes (Appendix B) and LBCU survey and habitat forms

Observers will need to be able to identify the broad habitat classifications below. They will be used on the survey data sheet to estimate the immediate habitat the LBCU is using (5-m radius around each LBCU) and on the habitat data sheet to estimate the habitat found all four quadrants around the stop point (400 m radius around the stop point).

Habitat data should be taken after the 5 minute survey period has been completed. Make all observations from the stop point; do not walk into the field. The collection of the data is not intensive and should not take more than 2 minutes/stop. Look at each quadrant (NE, SE, NW, SW) separately. For the landscape characteristics which contain $\geq 25\%$ of any of the classifications, include up to four. Designate the percentage (25-100%) of each classification.

Primary Codes: These can be completed even if you do not know anything about individual plant species.

Structure/height of grassland foliage:

Looking only at the height of grass foliage, as it is now, indicate if the grass is **SHRT** (short < 5"), **MEDM** (medium 5-15") or **TALL** (tall > 15") in height. In this case do not include seedheads in your estimation. You do not need to know the species of grasses--this is just a estimation of height.

Cultivated:

In rural areas, use the code **RCWS** to indicate a farmstead, orchard/tree farms (regardless of species), shelterbelts, etc. **CROP** indicates planted growing crops and post-harvest stubble. Please indicate if it is irrigated (**IR**-center pivot or other mechanical watering device is present, evidence of water on field that is clearly not from natural precipitation) or dryland (**DY**). Indicate irrigated grasslands based on observed irrigation systems, whether or not currently irrigating. For cropland which has been plowed but not planted or planted but nothing is above ground, classify it as **BARE**.

Shrublands:

Use one of two codes for the primary classification of the basic structures of shrublands: if shrubs are clumped and there is less than 49% grass within the area use **SHRB**. For an area in which grass makes up at least 50% of the cover and the shrubs are widely dispersed classify it as steppe (**STEP**).

Forests:

Any noncultivated area with naturally occurring trees is classified as woodland (**WOOD**). Use the codes under Cultivated or Other to indicate treed areas that are either associated with rural or urban development.

Other:

Urban residential and industrial areas as well as miscellaneous areas such as rock piles, cemeteries, etc. can be classified as **OTHR**.

Water:

There are three primary codes to use for water habitats found in the quadrants. Wet meadows, ephemeral, temporary, semipermanent, alkali wetlands, bogs, and marshes are all shallow water areas and should be coded **EMWL**. Reservoirs, lakes, rivers and large, deep open water wetlands should be classified as open water areas, **OWWL**. In the case of stock ponds and tanks and windmills indicate their presence as **STOK**.

For the primary habitat types please note the following:

If there are cattle in the quadrant or there is evidence of recent cattle grazing as indicated by fresh cow pies or other cues, please indicate **GRAZ** after the primary code. If the quadrant has recently been burned as indicated by black ground or the presence of ash or soot indicate **BURN**.

If you find invasive species ("weeds") please indicate **INVA** and include the species and estimate the % in the quadrant. We will define an "invasive species" as one that is a) non-native (alien) to the ecosystem under consideration and b) causes or is likely to cause economic or environmental harm or harm to human health (www.invasivespecies.gov). Some of the more common species may include cheat grass/downy brome (*Bromus tectorum*), Kentucky blue-grass (*Poa pratensis*), thistles, knapweeds, leafy spurge, salt cedar, Russian olive, pepperweeds, mustards, and whitetops. There are several illustrations of different species at http://mountain-prairie.fws.gov/species/birds/longbilled_curlew/.

If the quadrant includes a prairie dog or other burrowing mammal town please indicate **PDOG** (note if other species) and indicate if the town is active (**AC**) or inactive (**IA**) and a rough number of mounds seen within the quadrant. A town is considered active if prairie dogs are present or if there are fresh signs of prairie dog activity (fresh diggings, fresh droppings, vegetation is clipped, etc.). A town is considered inactive if it is overgrown or there is no sign of any of the burrows being used by prairie dogs. You do not have to distinguish between active and inactive burrows, this is just a measurement of the activity of the town as a whole.

Secondary Codes: Where more details can be quickly gathered please use the following classifications. These can be used to augment the primary codes where appropriate. There are several illustrations of different species at http://mountain-prairie.fws.gov/species/birds/longbilled_curlew/. In many cases the identification of these species may be difficult especially during early season surveys where warm season grass seedheads have not yet appeared.

Native Grasslands:

Shortgrass prairies (**SHTG**) consist of grass species such as grama (*Bouteloua*), needle (*Stipa*), wheatgrass (*Agropyron*), fescue (*Festuca*), and buffalo (*Buchloe*) and are often interspersed with cactus (*Opuntia spp.*), yucca (*Yucca*), forbs and small shrubs. Tallgrass prairies (**TALG**) consist of species of grasses such as bluestem (*Andropogon*), switch (*Panicum*), Indian (*Sorghastrum*), needle (*Stipa*), and wheatgrass (*Agropyron*), many forbs (especially Asteraceae and Fabaceae) and even trees. Mixed-grass prairies (**MIXG**) show a combination of both tall- and shortgrass prairie species. Alpine tundra and montane grasslands (**TUND**) are found in high elevation areas generally over 7000' (2100 m).

Tame (Non-native) Grasslands:

Planted pasture and rangelands (**PAST**) consist of many non-native species commonly crested

wheatgrass (*Agropyron cristatum*). They can be either irrigated (**IR**) or dry (**DY**). Indicate irrigated grasslands based on observed irrigation systems, whether or not currently irrigating.

Tame or Native Grasslands:

Conservation Reserve Program (U.S.) and Permanent Cover Program (Canada) grasslands (**CRPC**) can be either planted in native or non-native species.

Shrublands:

Shrublands can be dominated by sagebrush (**SAGE**) *Artemisia spp.* and wheatgrasses *Agropyron spp.* Communities of saltbrush (*Atriplex spp.*) and greasewood (*Sarcobatus vermiculatus*) should be designated **SALT**. Designate oak (*Quercus gambelli*) shrublands **OAKS**. Mountain shrubland communities dominated by mountain mahogany species (*Cercocarpus spp.*) are designated **MTSG**. Highland willow carr areas are dominated by willow (*Salix spp.*) and designated **WILC**.

Forests:

Conifer (**CONF**) forests are natural wooded areas composed of *Pinus*, *Psuedotsuga*, *Abies*, *Picea*, *Larix*, *Juniperus*, and/or *Tsuga*. Lowland riparian and hardwood bottomlands (**RIPA**) are streamside woodlands dominated by *Populus*, *Salix* and *Acer* species. **ASPE** consist of aspen (*Populus tremoides*) stands. Deciduous woodlands (**DECW**) are composed of other deciduous forests not classified above. Use the code **MXFO** for mixed woodlands of both deciduous and coniferous species.

Other:

Urban residential and park areas (**URCP**) and urban industrial, down town and commercial districts (**UIND**) could be encountered along the survey routes. A miscellaneous (**MISC**) code is also provided for coding of rocks, mining pits, oil wells and pipes, communication towers, wind farms, cemeteries, and any other structures which do not fit into any of the other classifications.

Wetlands:

Where it is possible, please distinguish between ephemeral/temporary ponds and low wet prairies (**EPHW**) and semipermanent lakes and ponds, and shallow marshes (**SPLW**). Differences in vegetation will be your biggest key. Alkali ponds and lakes and intermittent alkali areas, as determined by salt deposits, should be designated **AKLW**. Permanent lakes and ponds as well as deep marshes should be coded **PLPW**. Use the primary code **OWWL** for reservoirs, rivers, lakes and other open water areas. Fen areas can be designated **FENW**.

Do not worry if you have problems designating the secondary habitat codes, use of the primary codes is the minimum required.

Appendix F

Instructions and Examples for Moving Routes

Tom Stanley, USGS Fort Collins Science Center

Background – Maps will be provided for one or more townships that will be surveyed for Long-billed Curlews (LBCUs). One map is a "township map" that shows certain features of the randomly selected township. This would include roads, elevation contours, a numeric township identifier, place names, and UTM coordinates (in the margins). In the upper right corner of the township map there may be handwritten numbers (e.g., p 85 or pg 69). These numbers identify the page number of the DeLorme Gazetteer we used to determine a suitable route (except for OR, we use a "Benchmark Maps" map for that state). There will be one or more pink circles (solid or open) on the township map also. These denote distinct features that are visible on the Gazetteer, and helped us to rapidly locate where on the Gazetteer the township was. You can ignore these, but it should be stressed the pink circles do not denote the start point of the route. The survey route has been drawn onto the township map with a yellow highlighter. In some cases the entire 32 km (20 mi) route could be fit onto the township map, but in other cases it could not. If it was necessary to extend the route beyond the boundaries of the township map, this will be indicated by arrows or dots or some other mark. The routes are non-directional, meaning the terminal ends are not marked "begin" or "end." The surveyor can choose how they want to run the route.

A second map you should have is a "context map." The map shows the randomly selected township in the center, surrounded by the 8 (sometimes more) adjacent townships. Many of the same features on the township map will also be found on the context map. The purpose of the context map is to make it easier to find the general location of the route using a Gazetteer or roadmap. In cases where the survey route extends beyond the boundary of the township map, the context map shows where the route goes. We strongly suggest surveyors have a Gazetteer to refer to if their route has been drawn on the context map (when the entire route fit on the township map, the route was not drawn on the context map).

One important piece of additional information on the context maps is the stratum to which the townships belong (there are 4 strata). We have marked the context map by placing a number (1-4) in red pen near the numeric township identifier, or have denoted it using a "tic-tac-toe" grid (usually lower right corner) where the cells of the grid show the stratum of the township (the randomly selected township is in the center). The stratum to which a township belongs becomes important if you need to alter a route. Note that the survey route must always stay in the same stratum. If a route crosses into a township belonging to a different stratum than the randomly selected township, then the yellow line will be discontinuous, and will resume in yellow after the route re-enters a township that is of the same stratum as the randomly selected township. For discontinuous routes, only the portion of the route denoted by yellow highlighter should be surveyed.

Alternate routes – Surveyors may find while running a survey route that parts of the specified route can not be completed because, for example, a road segment is private, there's a locked gate, weather conditions have made the road impassable, or the road is closed for some reason. In such cases surveyors will need to alter the route so as to complete as much of the original survey route as possible, and document the change. Below are guidelines for choosing and documenting alternate routes.

Routes were specified on the basis of these criteria:

1. The route is 32 km (20 mi) in length, at least 10 km (6.25 mi) of the route must be in the randomly selected township, or the township is discarded.
2. The entire route should be placed in the randomly selected township, but if this is not possible the route may extend into adjacent townships belonging to the same stratum as the randomly selected township.
3. Parallel segments of a route must be separated by at least 1.6 km (1 mi).
4. Never put the route on an interstate.
5. Avoid state highways or primary roads whenever possible (this is a safety issue, there may be exceptions where such roads are acceptable if the area is remote and it is not unsafe).
6. Try to avoid roads that are likely to be impassable or where there is a high probability the surveyor will become stuck.
7. Try to avoid dead ends, where the surveyors must backtrack to continue the survey.

If a surveyor needs to draw out an alternative route, they should stick to these guidelines as closely as possible. If criterion 1 can not be met, the surveyor should check to see if they have been supplied with context and route maps for townships designated as "alternates". If they have, then the surveyor should substitute an alternate township that is nearby geographically. If several alternates are nearby, then preference should be given to those in the same stratum and same sampling window as the discard.

Documenting alternate routes – Record UTM coordinates for all stops on the alternate routes on the data sheets. The alternate route should be drawn on the township and context maps. When surveys are completed, the annotated maps should be sent to your local contact or Tom Stanley, USGS Fort Collins Science Center, 2150 Centre Ave., Bldg. C, Fort Collins, CO, 80525.