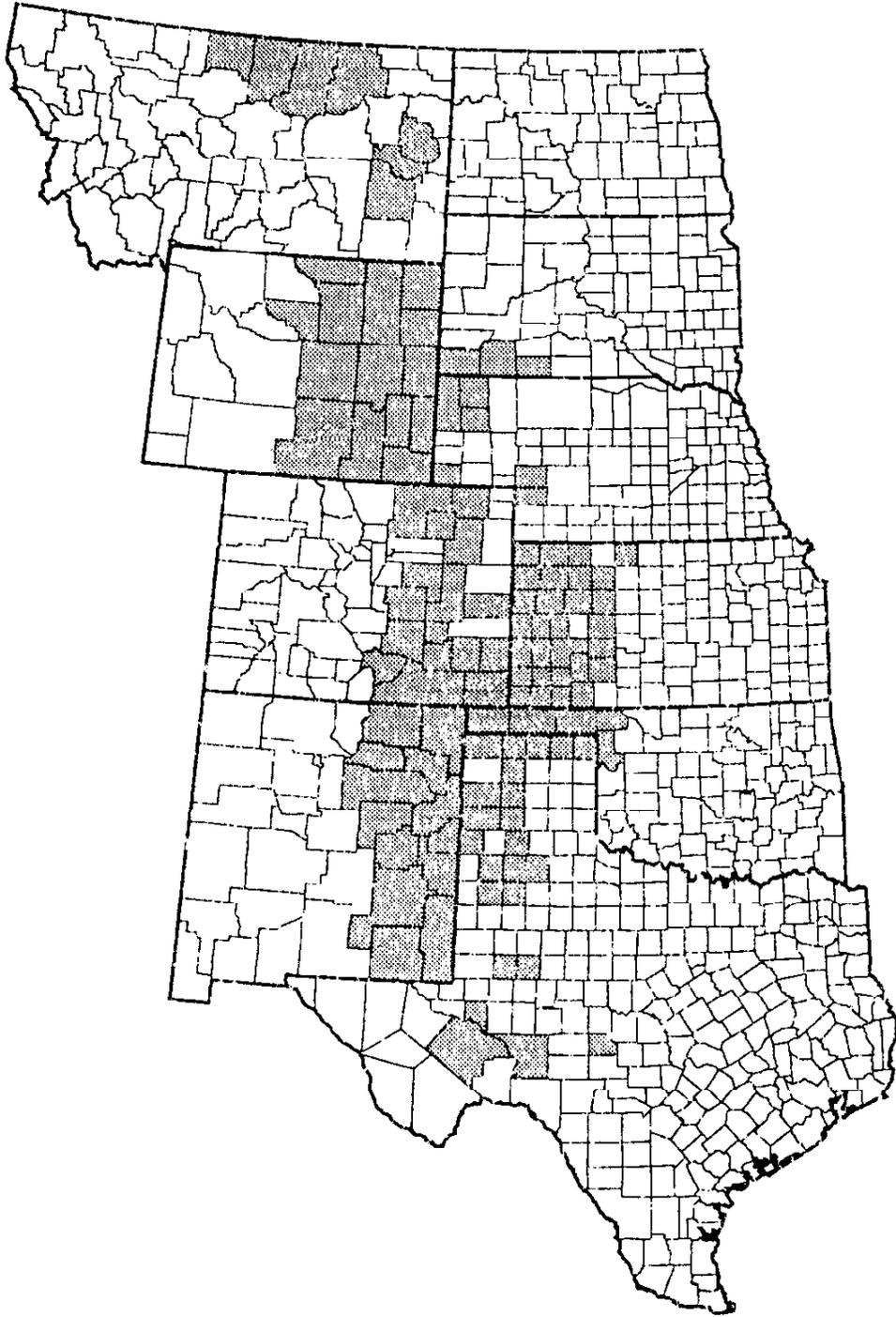


SWIFT FOX Conservation Team



1997 Annual Report



**SWIFT FOX CONSERVATION TEAM
ANNUAL REPORT**

Edited by:

**Brian Giddings
Montana Department of Fish, Wildlife & Parks**

December 1997

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ABSTRACT

Giddings, B., ed. 1997. Swift fox conservation team annual report. Montana Fish, Wild. & Parks. Helena, MT. 105 p.

This document represents a compilation of reports provided by swift fox conservation team (SFCT) members. This is the third annual report produced by the SFCT. The purpose of this document is to provide ongoing species status information and state and agency progress in achieving conservation strategy objectives as outlined in the Conservation Assessment and Conservation Strategy of Swift Fox in the United States (Kahn et al. 1996).

Several conservation strategy objectives (Kahn et al. 1996) have been either completed or where near completion at the end of 1997. Objective one, establishment of a SFCT, has been accomplished. Objective two, determination of current swift fox range in the United States was completed (Fig. 1) in most states by 1997. Several states are now beginning to set up monitoring programs to determine the status of swift fox populations (Obj. 3) and also are beginning to identify existing shortgrass/midgrass prairie habitats and other suitable swift fox habitats (Obj.5).

During 1998, most states will be initiating the formation of state swift fox working groups to facilitate and coordinate monitoring and research needs in their respective state and providing recommendations to state wildlife and federal land management agencies..

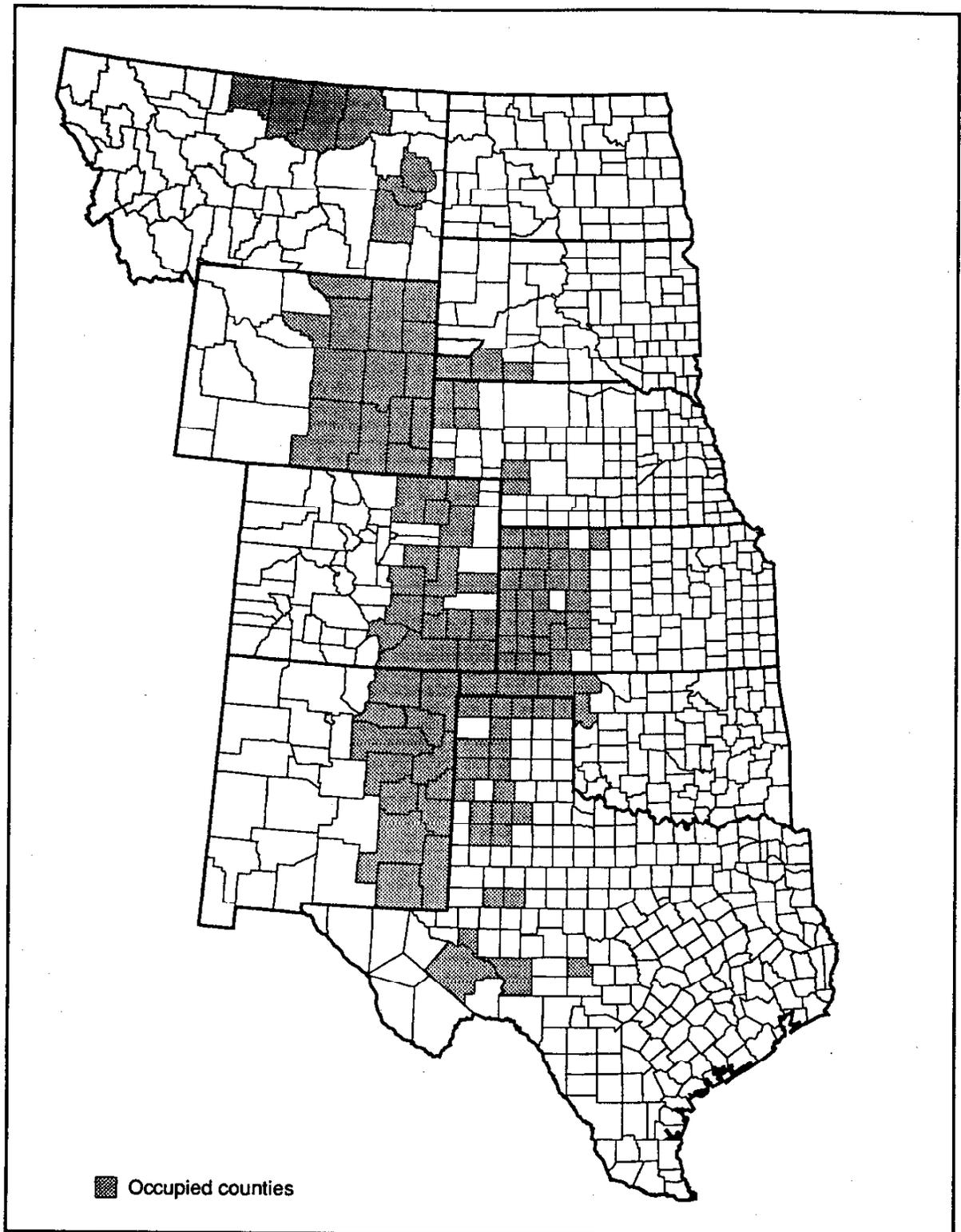


Fig. 1. Current known swift fox distribution by county in the United States, 1997.

**SWIFT FOX CONSERVATION TEAM 1997 ANNUAL MEETING PARTICIPANTS
SNOWMASS, COLORADO (SEPTEMBER 22, 1997)**

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Christiane Roy
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Tulsa USFWS Ecological Services

P.J. White
California Polytechnic State Univ., San Luis Obispo

Amy Zimmerman
Montana State University

**MINUTES OF THE SWIFT FOX CONSERVATION TEAM
1997 ANNUAL MEETING**

*September 22, 1997
Snowmass, Colorado*

The meeting was called to order at 9:10 am by Swift Fox Conservation Team (Team) chair, Eileen Dowd Stukel, at the Wildwood Lodge Campground Meeting Room in Snowmass, Colorado. Introductions were made and thanks were given to the Colorado Division of Wildlife for making the meeting arrangements.

In attendance were: Team members: Eileen Dowd Stukel, South Dakota; Brian Giddings, Montana; Kevin Mote, Texas; Greg Schmitt, New Mexico; Julianne Hoagland, Oklahoma; Christiane Roy, Kansas; Bob Luce, Wyoming; John Seidel, Colorado; Dave Allardyce, USFWS; Marsha Sovada, BRD; Rick Wadleigh, APHIS, WS; and Bob Hodorff, USFS. Also in attendance were: Amy Zimmerman, Skip Ladd, Ken Kuiper, Robert Harrison, Rick Kahn, Kerry Mower, Keith Kintigh, Jon Jenks, Bill Andelt, Fred Lindzey, Lu Carbyn, P.J. White, Noreen Walsh, Dorothy Dateo, Vickie Schafer, Pete Bauman, and Chris DePerno.

John Seidel gave a brief description of the facilities.

Eileen handed out the meeting agenda and asked for any comments or amendments. None were offered.

Dave Allardyce was asked to give an update on the U.S. Fish and Wildlife Service (Service) review of the swift fox status. Dave began by thanking the states he visited during the past summer (Montana, Oklahoma, Texas, and New Mexico) for showing him their swift fox habitat and survey and research methodologies. Dave commented that he did see a lot of swift fox sign and activity while visiting these four states. He stated that his main objective for these visits was to look at the landscape where swift fox occur within these states. He realized the amount of ground that needed to be covered in determining swift fox distribution, and that 90% of this area is on private land. Dave commented that the primary difficulty involved in doing population monitoring and status surveys in these states was getting access to private land.

Dave continued by discussing the highlights of the Service's recent letter of response to the Team that was received by the Team members on September 19, 1997. Dave commented that there are still some misunderstandings of the listing process by the Team. The Service has new candidate listing assignment forms that required a quick briefing that was completed in March, 1997. The swift fox listing status continues to be warranted but precluded with a listing priority of 8. There are currently 21 species of higher priority in this region. Olin Bray at the Regional Service office in Denver will, at the very best, be able to handle three or four species per year. Thus, if the Service does not receive adequate distribution and status information from all the states within the swift fox's range, the swift fox will remain in the warranted but precluded status for probably 4 more years. The Service has said in this letter that an endangered

listing is not warranted, but a threatened listing still may be. The Service cannot tell the Team at what point the Service will say that a threatened listing is not warranted, only that we are not there yet. Dave could not tell the Team how many states will need to have adequate distribution and status information; but he did say that there is currently not adequate status and distribution information from 7 of the 10 states. The Service is not satisfied yet that the information the Team has provided indicates that the swift fox is doing well.

Brian stated that through the strategies in the Conservation Assessment and Conservation Strategy the Team is trying to address the exact concerns the Service has on distribution and status on a state by state basis.

Dave agreed that the Conservation Strategy is working toward that goal but that the information is not there now. Dave stressed the need for the Team to stay the course of action that has been established in the Conservation Strategy. Dave agreed with Colorado's April comments regarding the Conservation Strategy that the Team needs to set the strategy's priorities and stick to them. If the Team does this, the Team should be able to meet the Service's agenda well before the Denver Regional office and addresses the swift fox's priority status.

Skip agreed that from the annual review within the Service, they could make the decision not to list before the Denver Regional office reaches the swift fox priority review.

Dave then reiterated the five threats from the 12-month finding that need to be addressed. He stated that the magnitude of these threats is being reduced by the formation and activities of the Team. Dave also stated that these threats, however, are still occurring; at different rates in different areas. And this was given for the reason for the warranted but precluded finding for the swift fox.

Brian asked if the Service's finding would have to be rewritten if the swift fox does not become listed.

Dave replied yes. It would be rewritten to include listing is not warranted.

Eileen asked for a copy of the last swift fox review on the new Service's forms.

Skip said it was published September 15, 1997 in the Federal Register.

Dave said he could get a copy of the review form to the Team. Dave said that the Service's Washington office was dissatisfied with the information in general to address the criteria for many of the candidate species. He expects they will require more pertinent information in the future. Forms for next year will be out to the listing field offices in January 1998. Therefore, the Team needs to get its annual report to the Service by February 1, 1998. Dave realizes this will be difficult for the Team to accomplish. Dave could accept a formal report through a conference call to pass on pertinent information if a report could not be completed by this deadline.

Eileen asked when Dave needed to have his information completed for the swift fox listing status review.

Dave said he did not know.

Skip said he thought by May 1, 1998.

Dave said he thought it was the end of March or April last year (1997).

Skip asked if the Team annual report was on a calendar basis.

Eileen said the Team annual report deadline has been March 1, each year until now.

Eileen also commented that moving the deadline forward to February 1, was not doable.

Dave said we should then conference call pertinent information to be included in the 1998 Service's swift fox listing status review.

Christiane said conference calls lead to unreliable interpretation of information.

Dave agreed, and said the situation in Oklahoma was a good example. The Service will be more careful in the future on making such assumptions. The Service will, however, take information from all parties.

Christiane asked whether state agency information based on science will be weighted the same as anecdotal information from non-state agency personnel that may not be scientific.

Dave agreed that scientific information will be used and it is the Service's responsibility to verify the accuracy of the information it receives.

Skip said the conference call works well for the black-footed ferret group and encouraged that the Team consider using conference calls.

Eileen asked if the Team should have regular conference calls.

Dave replied that quarterly calls would be sufficient.

Team members generally agreed with the concept of quarterly conference calls.

Kevin asked if accurate notes will be taken on the calls.

Marsha suggested that a memo summarizing notes be sent out after a call is completed.

Eileen said the Team should sponsor the conference calls.

Dave said the Service will pay for the conference calls.

Marsha suggested that maybe twice per year would be sufficient rather than quarterly.

Brian stated that he prefers the annual report format.

Dave said he really needs information by February 1.

Christiane asked about the June 1 receipt of the 1996 report and why the Service did not consider the 1996 report in the September 1997 letter.

Dave said the follow up notes, included with the September 1997 letter, do consider the 1996 report. Dave also included information from informal calls to states and other non-Team members in obtaining information for use in this letter.

Christiane asked Dave to clarify the Service's opinion of the information from Oklahoma.

Dave said that the Team's response information said museum records only occurred in 2 counties. But 1995 report said the historical range was considered to be six counties. The Service accepts the historical range in Oklahoma to be restricted to those six counties. But present distribution in Oklahoma is still unknown. Dave said he doubted the validity of Packsaddle scent station surveys because Mike Shaughnessy of the Oklahoma Natural Heritage Inventory doubts them.

Christiane asked if Julianne could clarify this situation.

Dave said he accepts the Oklahoma Natural Heritage Inventory (ONHI) information but not the Oklahoma Department of Wildlife Conservation (ODWC) information from the Packsaddle Wildlife Management Area. Dave said that the ONHI has submitted a proposal to the Tulsa USFWS office to do a follow up study to complete tracking plate surveys in Harper, Ellis and Woodward counties.

Noreen Walsh of the Tulsa USFWS office said that Mike Shaughnessy reported to her

that he has seen a swift fox in Harper County, Oklahoma.

Julianne stated that the ODWC personnel working on the Packsaddle scent station surveys are competent individuals with over three years of tracking experience.

Dave stated that because the ODWC personnel working on the Packsaddle are not canid biologists, their tracking information was not acceptable.

Christiane asked what the current information in Oklahoma shows.

Julianne said recent sightings have been reported in all six historical distribution counties and verified in 5 counties.

Dave proceeded to talk about continuing habitat degradation in the Oklahoma Panhandle, especially in Texas County.

Kevin said habitat has not changed in the Texas Panhandle in the last 10 years. Kevin asked how Dave is defining continued habitat loss and degradation. Kevin said there has actually been an increase in rangeland through CRP in the Texas Panhandle, and this information is from NRCS records. Only one county has seen a net loss of rangeland in the Texas panhandle.

Dave said that there are large areas of habitat where swift fox cannot live in the Texas and Oklahoma panhandles.

Kevin pointed out that the issue was Dave's statement that there is continuing habitat degradation and loss.

Eileen asked that Dave give us credible information on the issue of continued habitat degradation and loss. She asked if Dave's statements are just perceptions or opinions or based on quantitative information. Eileen stated that the Service wants the Team to provide credible information to them, and the Team would like the same information in return. Eileen suggested that as a courtesy, Dave should speak to the designated Team member when discussing information from a particular point in order to help substantiate the information. Eileen concluded, that this is why she has a problem with informal discussions and prefers the printed annual report that is well thought out and focused.

Brian agreed that the annual report is the best way to present credible information. Brian thinks we could move up the annual report deadline to February 1.

Eileen asked if anyone on the Team could not move up his or her annual report deadline.

Dave thinks that misinformation such as what happened in Oklahoma could be remedied by a conference call.

Brian said that anyone can send information to the Service, but that all information should be coordinated in the state annual report.

Marsha said that the state Team representatives need to review all information submitted to the Service related to their particular state, and that all information needs to go through the state Team representative before it is included in the state's annual report.

Brian said independent information should still be subject to peer review by the Team state representatives before it is included in the annual report.

Bob Luce suggested that in lieu of a conference call, a written interim report would be better than a conference call. Understanding that this is an interim report.

Dave still thinks a conference call is the best way to get the appropriate information needed for the Service annual swift fox listing status review.

Eileen said she didn't think this issue would be resolved today.

Dave will be going to the Service Denver regional office tomorrow (9/23/97) to discuss what happens here today. One of the major points he wants to discuss with the Denver office is how much information will they be satisfied with to say that listing is not warranted.

Christiane asked if we could be talking in terms of percentage of the historical range rather than 7 out of 10 states; basically ignore political state boundaries.

Dave said that in 7 of the 10 states, land use could be a big factor in habitat degradation for the swift fox. He concluded it's difficult to address the listing criteria on a state-by-state basis.

Brian suggested that Dave take the revised strategy with him to Denver and use it to help set specific criteria to be met for listing to be not warranted.

Eileen asked how important is the historical range to the Service.

Dave said the current range is what's important. Dave doesn't know, however, what the Denver office is going to accept, and he wants the Denver office's expertise in determining what criteria must be met before the swift fox listing is considered not warranted. Dave said that maybe what we have is enough.

Bob Luce pointed out that historical range information tells us nothing about historical population densities.

Dave said that Kevin pointed out that in Texas swift fox may never have occurred in high densities.

Kevin stated that it was real popular 20 years ago for people to estimate the number of individuals of a species based on a density estimate and how much habitat was assumed to be available. Kevin concluded that basically no one will ever know what the historical densities of swift fox were, but these unsubstantiated historical densities numbers will still be used as guide posts against which population estimates today will be measured. Kevin said that the Team has the expertise to decide the population distribution and status goals the Team needs to shoot for.

Eileen said the Team already has the goal of occupying 50% of suitable habitat, and suggested that Dave take that to Denver as a goal rather than occupation of so much of the presumed historical range and distribution and density information.

Brian agreed and said the Conservation Strategy document is leading us in this direction, and the annual reports are supposed to reflect that progress.

Eileen asked if the Team needs to address any misinterpretations in the September 1997 Service letter if necessary.

Christiane said that she feels that a readdress needs to be done and that if it takes providing resumes of persons providing the information, that can be accomplished.

Eileen said that the Team will respond to the Service concerning the September 1997 letter.

Skip suggested that maybe the Team would like to take first crack at writing the annual evaluation in time to meet the Service's deadline.

Eileen said the Team will decide whether to do this or not.

BREAK

Eileen stated that there is interest among the Team in having a conference call, with minutes to verify what was said, but that the call will not replace the annual report that will continue to be completed by March 1. Eileen asked the Team members when we should have our first conference call?

After some discussion of when fall field results will be ready, the Team agreed to do first conference call in mid-January, 1998.

Kevin asked if the Team could send a summary memo to Dave before the conference call so that we can then clarify points in the memo during the conference call.

Christiane agreed and Brian concurred. Minutes would still be completed after the call and distributed to all call participants for their review.

Eileen asked for agreement on the procedure to send the summary memo before the call and the minutes after the call. The Team agreed with this strategy. Eileen asked Dave when he wanted the summary memo. Dave replied right before the conference call in mid-January. It was agreed by the Team that the Service will initiate the call and the call will include the 10 state Team representatives.

Dave said notes will be taken during the call.

January 15 was set for the deadline for summary memo to Dave. The conference call will follow shortly after this date.

Discussion of Team Function

Eileen introduced the discussion by stating that the Team has, and will continue to get new members as time goes on, and that new members don't have the background information on the Team's function and purpose. The Guidelines for Operation of Swift Fox Conservation Team (Draft 2: 9/10/97) was passed out and Eileen asked for any discussion.

Christiane suggested that the team leadership extend for 3 years. She pointed out that continuity is important, and suggested that the Team rotate the chair and co-chair every 3 years.

The Team generally agreed that Eileen is doing a great job!

Brian agreed that changing chairs on an annual basis is too often.

There was general consensus among the Team members that 1 year for the chair is not enough. Two years was frequently suggested.

Eileen suggested 2 years total chair and vice chair. Then every two years there would be a new chair and vice chair. The Team agreed.

Rick Wadleigh, under Team Representation, suggested changing the annual meeting participation to the agency representative or its designee. Eileen agreed to make the change.

Eileen asked if there is a need for a central record keeping. Christiane said that she is the designated record keeper. Eileen will add to the guidelines that Kansas will archive all Team documents.

Christiane proposed discussion about whether the Team should affiliate with an umbrella organization to oversee the group. Although she initially considered the Western Governor's Association (WGA), she no longer wants to affiliate with WGA. She did, however, suggest that maybe the International Association of Fish and Wildlife Agencies (IAFWA) would be good. She pointed out that Greg Linscombe, of the IAFWA, said that the Fur Resources Committee of

the IAFWA was responsible for getting the swift fox group going. Christiane stated that having an umbrella like IAFWA would be helpful for legal issues, obtaining funding and funding dispersal. She said there are a lot of good groups within the IAFWA that could help the Team take the conservation strategy forward, including the endangered species, fur resources, and animal damage committees. Christiane then asked for discussion.

Kevin said that the Lesser Prairie Chicken Interstate Working Group (LPCIWG) is affiliated with WGA in order to help administer the High Plains Species at Risk NFWF grant. Kevin agreed that it is good to have a larger voice, but when you bring in a group like the WGA, they bring their own agenda. Kevin believes involvement with WGA has been good for the LPCIWG, but their last meeting was too big and business could not be accomplished. There are benefits if the group that you pick will give you those benefits with no strings attached. Kevin stated that we need to be sure that the goal and mission stay those of the Team and not those of the umbrella group. This needs to be stated right up front.

Eileen proposed that the IAFWA could have a member join the Team.

Christiane said there are already fur resources committee members of IAFWA on the Team.

Marsha asked that the Team define whether it is really necessary to affiliate with a larger group.

Christiane said yes.

Eileen said no.

Bob Luce talked about the western bat working group that has not thought about affiliating with any other group. In his opinion, affiliation with IAFWA or WGA would just mean one more level of bureaucracy. Bob did not feel affiliation was really necessary.

Kevin agreed.

Skip asked if the IAFWA doesn't already provide for legal representation to the states anyway. He also asked if IAFWA has been approached with this idea.

Christiane said she has spoken to Greg Linscombe of the IAFWA Fur Resources committee about it. Greg said Christiane should ask the Team first.

Brian said there is interest in an Endangered Species Act-type candidate species group to go under the Midwest or Western associations of fish and wildlife agencies. The idea has never been formalized but there is interest.

Marsha agreed with Eileen and Bob that adding a layer of bureaucracy that may not be necessary is not a good idea. And if there is a legal issue the states probably already have IAFWA representation.

Kevin asked about having an umbrella group for administering grants.

Marsha said she doesn't see any grants coming the Team's way any time soon.

Eileen said she's not comfortable making a decision about this issue without Nebraska and North Dakota being represented here today.

Christiane said the Fur Resources Committee of the IAFWA would like to have a liaison to keep them apprised of what's going on with the Team.

Eileen said that we could add Greg Linscombe to our mailing list and keep him and the Fur Resources Committee apprised of Team business.

There was general agreement that the Team's need to affiliate with a larger umbrella organization may change in the future. It was suggested that the Team wait and see how LPCIWG does one more year with WGA.

Discussion of Conservation Strategy Document

Brian stated the Conservation Strategy document was somewhat finalized at the last Meeting in December 1996, in Omaha, Nebraska. Colorado, however, had some problems with the document as a whole, and many states had problems with the range maps. Colorado suggested changes to the document in their memo of April 1997. Brian reiterated that we are trying to finalize this document so we can move on with the objectives and annual reports. Brian then proceeded to go through Colorado's comments and the associated changes to the document.

Christiane asked if the comments were those of Colorado or Tom Beck's specifically.

John Seidel said the comments were mostly those of Tom Beck.

Brian ran down the sequence of events: the September 1996 draft went to the December 1996 meeting in Omaha. Comments were received at the Omaha meeting and were reworked into an April 1997 draft. Colorado then had significant comments on the April 1997 draft. The September 1997 revised document reflects Colorado's comments.

There was general confusion over the date on the front page of the document. It was suggested to keep the September 1996 date for the document, but specify the date when revised. Therefore, this copy will have September 1996, revised September 1997.

Brian proceeded to discuss Colorado's April 1997 comments: (1) date changes in the objectives and strategies. Brian asked if it is really realistic to move the timetables up. (2) Editing - these should be all fine now. (3) Team representation and membership. (4) Prioritizing objectives and strategies. This has been done in September 1997 revision. The changing of "will" to "may" and "would" to "should" was the result of comments from the December 1996 Omaha meeting, based on different states needs. These were changed back, however, to their original wording in the September 1997 revision. The only thing item unresolved is target dates and prioritization.

Page 18 of the September 1997 revised Conservation Strategy contains a summary of top, medium and low priority objectives, strategies and actions. The order in which objectives are described in the document, however, did not change. Just put the priorities in the introduction. Brian asked for the Team's opinion on the stated prioritization.

Skip asked if the activities keep the priority of the strategy or objective?

Brian answered yes.

Bob Luce recollected that we didn't have priorities in the past because different states were working at different levels of activities, and that this is neither good nor bad. Monitoring the status of populations was number 1 and now it's number 2.

John said Tom was reordering the objectives and strategies based on what he thought the Service wanted in order to address the listing issue.

Dave agreed.

Brian agreed with Tom's assessment on prioritization for the Team. But, he acknowledged that each state does not necessarily have to follow the Team's prioritization.

Christiane said that at the last two meetings the Team wanted to get away from the numbers and just list the objectives under a top, medium or low priority category.

Marsha suggested that we could use letters instead of numbers to itemize the objectives, strategies and activities.

New Mexico recommended keeping the numbers for the objectives, etc., for organizational purposes.

Brian said the objectives, etc. order will stay the same in the document; they are presented in a logical order but not necessarily in a prioritization order.

Dave asked if the Team was going to make a decision today about priorities of actions and strategies?

Brian answered yes. Brian stated the Team needed to finalize editorial changes; prioritize objectives, strategies and actions; produce final state range maps; and complete the risk assessment section.

Fred Lindzey suggested that we already know that population distribution, status and status monitoring are the Service's priority.

Dave agreed.

Rick Kahn stated that the overall philosophy behind the April 1997 Colorado comments was that the Team wasn't moving forward fast enough. Colorado wanted the Team to do a reality check and decide what's feasible and what we want to do. The top priority items are those the Team has to do and the medium priority items are those we want to do.

Kevin said population monitoring and standardization of monitoring techniques is top priority for the Service and therefore for the Team.

Marsha suggested that maybe what Colorado was getting at with their comments was how tough it is going to be for all 10 states to monitor swift fox populations.

Dave asked Marsha if the states are not able to determine population status on a standardized basis, how else can they monitor populations if they are doing this on an annual basis?

Marsha replied that it is very difficult to standardize population status monitoring methodology because different states have different capabilities.

Dave said that each state needs to have a methodology they are comfortable with that will monitor population status and distribution trends annually.

Rick Kahn said that activities 2.1.1 (states compile data) and 2.1.2. (States generate statewide species distribution maps) address what Dave just said.

Eileen stated that the bottom line is that the Team needs to finish and distribute the document. But she also stressed that the document is not set in stone and can be amended or changed down the road.

Kevin asked if Brian was asking for other Team member opinions or if the Team was just going to go with Colorado's opinions.

Brian said that Colorado wanted to bring their comments up before the Team for discussion.

Kevin suggested switching strategy 3.1 (develop and implement statewide monitoring programs) with objective 8 (Integrate swift fox conservation strategy objectives with

management and habitat objectives of other prairie ecosystem species) in the prioritization level. Strategy 3.1 should be in top priority category.

Rick Kahn said that from the Service's perspective, we must get all our top priorities done in the next three years. Because of lack of funding, the top priority list should be small enough to be completed realistically. Rick suggested that the Team make the Conservation Strategy a worthwhile document that's realistic in its objectives.

Eileen pointed out, however, that the Service's September 1997 letter says that listing will not be determined on what's doable. Julianne read the section from the Service's September 1997 letter that states, "The Service is concerned with the concept and difficulty of 'attainability' as you mentioned but is primarily focused on whether a species is endangered/threatened or is not. It is inappropriate to predetermine the status of a species based on what options are available for its recovery. It should either be listed or not based on its status, and this determination should not be affected by any likelihood that it may be removed as a listed species in the future."

Dave disagreed with Eileen's interpretation of this section of the Service's September 1997 letter; but he did say that distribution and status determinations are top priorities for not listing the swift fox as threatened.

Skip said that there is an opportunity to achieve objective 8 now whether it is in the top or medium priority category or not.

Marsha suggested that by achieving objective 8, this might remove some of the burden from the Team in terms of habitat evaluations by tying in with other species in the high plains, like mountain plover and lesser prairie chicken.

Kevin asked if we only had x-number of dollars to spend, would we choose strategy 3.1 or objective 8?

Christiane said strategy 3.1.

Kevin agreed, saying that objective 8 is still important, but strategy 3.1 is of a higher priority.

Eileen suggested moving strategy 3.1 to the top priority category and leaving objective 8 also in the top priority category, accepting Colorado's comments of making the document workable.

Rick Wadleigh asked why USGS-BRD and APHIS-WS membership on the Team was deleted in the September 1997 revised document.

John Seidel said that Colorado recommended that these agencies be removed from the Team because they have no regulatory authority in this matter.

The consensus by popular vote of the Team is that USGS-BRD and APHIS-WS should be added back to the Team membership.

Brian summarized the changes to be added to the September 1997 revised version of the Conservation Strategy: put APHIS-WS and USGS-BRD back in Objective 1; move strategy 3.1 to the top priority and leave all the others the same.

Christiane asked what the Team has already accomplished in the top priority category.

Eileen said the annual report would have a chapter that documents the progress toward achieving the objectives of the conservation strategy as its subject matter.

Brian asked for dates for initiation or completion of the conservation strategy objectives, strategies and actions.

Christiane ran down a list of activities that are due to be completed in 1997, and asked where the Team is in completing these activities: State working groups - not done, maps - yes, monitoring recommendations - not done. Christiane concluded that there is a lot to say for milestones, but we are not achieving the ones we already have set.

Brian suggested giving the top priority categories 3 years for completion, the medium priority activities, 6 years; and 9 years for lower priority activities. Colorado agreed. This is the GOAL for the Team.

John said this goal was needed to put pressure on states in the core swift fox range to get moving or let the Service list the species as threatened.

Bob agreed with 3 years for top priority. But he stressed that what we need is agency momentum not necessarily Team momentum. Bob stated that we have already diverged from what we agreed to start on 3 years ago.

Dave said that looking at the currently defined top priority activities, if the states are able to meet these objectives and strategies, particularly those that address the 5 listing criteria, it's very likely that we will be looking at a non-listing situation.

Brian said that if we follow the conservation strategy, we would have 50 % of objectives met by 2005. Brian continued summarizing the document's changes by stating that the editorial changes from the Colorado April 1997 memo have been corrected. Brian then brought up Colorado's questions on page 7, paragraph 3 of September 1996 document regarding "stable population."

Christiane said it means a stable population TREND.

Fred Lindzey suggested that Christiane probably means a stationary population.

Christiane reiterated what was meant was a stable population trend in a stable distribution. The term has nothing to do with population numbers.

Brian then addressed Colorado's risk assessment comments.

Rick Kahn stated that the risk assessment section is too speculative and we should err on the side of caution and remove the section entirely. It's good information, but removing it will not affect the plan.

Eileen asked if the risk assessment section is key to what the Service is doing in its annual evaluation.

Rick Kahn questioned the need for the risk assessment to be in the Conservation Strategy document. He suggested that we need to be cognizant of it, but once it is in the document it will be 'carved in stone'; and we'll be hung or not based on the information in this section. Rick again asked if we really need it in the document?

Brian focused the Team's choices to eliminate it, modify it, or keep it in as is; and then asked for discussion.

Eileen asked if a risk assessment chapter was usually a part of other conservation strategies for other species.

The general answer was yes.

Brian said he hated to see it left out completely. He feels it makes the conservation

strategy makes sense (i.e., why we are doing what we are).

Kevin asked if we could use a disclaimer paragraph stating that this is what we know from the best available information at this time. Kevin agreed that we want to feel good about the information that's in there.

Rick Kahn gave an example: On page 16 there is a statement that swift fox spend time along roads to avoid predation by coyotes. Rick asked if we know this to be true and whether it may be different in different areas. Rick stated that some of the statements in the risk assessment might or may not apply to swift fox.

Eileen pointed out that there are no literature citations on pages 16 and 17 and recommended that statements need to be backed up by literature citations.

Christiane said we could back up the statements in the risk assessment with citations, but she also pointed out that there is a lot of published information regarding swift fox that may not be accurate as well. There is also good information that has not yet been published in the literature.

Rick Kahn said that Tom Beck recommended that a small group of people rewrite the risk assessment section. Rick stated that all Colorado wants to do is make the information in the risk assessment section defensible.

Brian asked if we wanted to create a small group to finish this within the next 4 weeks?

Christiane stated firmly that we must finish the overall document at this meeting.

Eileen asked if Colorado could draft a few statements that would fix their problems with the risk assessment section.

Christiane asked if we could vote on whether to include the risk assessment section in the strategy or not.

Eileen took a vote. Colorado and the USFS from South Dakota said that the risk assessment section should be removed from the Conservation Strategy.

Christiane asked who would sit down after this meeting to work on the risk assessment section to make it work so it can be kept in the Conservation Strategy.

Eileen said Colorado needs to work on this since they have the greatest concerns regarding this section. Eileen designated Christiane, Bob, John, and Eileen to meet Tuesday morning at 8:00 am in the Silvertree lounge to rewrite the risk assessment section and have it finished. The Team as a whole will have to accept this subgroup's revisions to the risk assessment section. Brian suggested that the subgroup review Colorado's comments before meeting tomorrow.

Brian continued with Colorado's comments. On page 26, objective 10.1.3. was an entirely new objective (the collection of blood for genetic work) that was brought up by Wyoming at last year's annual coordination meeting. Colorado had an objection to this objective and thought the Team should discuss it before being added to the document.

Eileen asked if there is a protocol for doing the blood work for either serology or DNA analysis.

Christiane said she has comments from Beth Williams on protocol. Some states don't have enough blood, however, to do serology and DNA.

Eileen asked if we needed to get some specific protocols on how to collect blood samples.

Christiane answered yes. Then she asked if the Team wanted to do serology and DNA analysis. The Team as a whole needs to decide. Tom Beck last year had said yes to serology but no to DNA. Christiane pointed out that if you're already collecting blood for serology why not collect for DNA.

Eileen reiterated the need for having a standard protocol.

Brian pointed out that under objective 10 there is already a strategy to assign members to a technical committee to develop a protocol.

Colorado agreed to leave this objective in the Conservation Strategy.

Bob Luce said he was willing to work on a protocol for serology and DNA, based on what the black-footed ferret group is doing.

Keith Kintigh stated there were problems with drawing blood by technicians, and that some animals were hemorrhaging. He pointed out that field technicians are not veterinarians.

Eileen agreed that there are different levels of expertise, so we need a protocol.

Brian asked if development of a protocol is covered under the research committee?

Marsha said she didn't know.

Eileen said that there was no need for committee. Bob and Christiane will work on developing the protocol.

Skip said that the black-footed ferret group just developed a disease committee that Beth Williams chairs.

Brian continued with Colorado's comments. On objective 4 (page 21), defining genetic integrity, "interteam" was removed from "interteam technical committee." Brian asked if the Team still wanted to do this objective. Colorado asked to define genetic integrity. Colorado agreed to leave as is. Last item is the range maps.

Brian introduced four major nationwide maps that have depicted historical range.

Christiane stated that she would prefer to see in this document what the Team feels is an accurate historical map that is based on information that we know is valid. Christiane asked why we could accept historical records from the 1800s from Joe Blow trapper and not current information from biologists today who say they see swift fox.

Dave agreed that the old unknown historical map is wrong.

Brian asked if the Team wants to create a new historical range map.

Greg Schmitt asked why we couldn't take Hall's map and just qualify it. Brian said that was the whole point.

Eileen pointed out that the Conservation Strategy is based on available suitable habitat so why are we even worried about historical range?

LUNCH BREAK!

Eileen resumed the historical map discussion by stating that many Team members are uncomfortable putting old historical maps into the document even if we cite them as "presumed" or "previously accepted." An alternative offered by Eileen is to cite Hall and Scott-Brown and state our problems with these maps without actually including these map figures in the Conservation Strategy document. Thus we would include no historical map in the current

version of the swift fox Conservation Strategy document.

Greg Schmitt asked if we have to do state maps by county.

Dave asked where the state maps are going.

Eileen said that the state maps would be in the current revision of the Conservation Strategy document; and then they would be joined together into a regional map in the 1997 annual report.

Brian pointed out that the current maps will reflect only up to 1995 information.

Christiane asked why we could not include new information up to this very minute in the revised Conservation Strategy state maps.

It was generally agreed that current distribution maps should contain the most recent information.

Brian said Colorado, Oklahoma and South Dakota all said they have changes to be made to their state maps.

Marsha suggested that in order to avoid confusion, each state submit new maps to Brian by October 6.

Brian said it would take 2 to 4 weeks to redo the maps and get the final Conservation Strategy version document printed.

Marsha will check with Steve Allen in North Dakota on his map and Eileen will check with Nebraska.

Committee Reports

Habitat Criteria

Bob Luce reported that Mark Lomolino has removed himself from the committee. There was no progress to report.

Eileen recalled that a literature review needed to be completed to determine swift fox habitat preferences.

Rick Kahn suggested the literature review product be put into the 1997 annual report.

Eileen asked if anyone would assist Bob on this committee. Julianne volunteered to assist on this committee.

Bob was unclear on what his charge was from last year's meeting for this committee. He thought it was to determine what was typical and atypical swift fox habitat using GIS and GAP analysis.

Lu Carbyn said it might be easier to define what is **NOT** swift fox habitat. We can then determine what the range of swift fox habitat could be. Lu suggested we investigate this issue based on our collective experiences. He said we already know that generalizations for swift fox habitat do not apply region-wide. So we have to start to build a model based on geographic region, predator and prey base, etc.

Marsha pointed out that there are a lot of other factors that can make perfectly good swift fox habitat not suitable for swift fox. Thus not all available habitat really is suitable habitat for swift fox.

Brian suggested that swift fox habitat availability vs. habitat use studies would be helpful. Christiane pointed out that the Conservation Strategy objective 5.1 (develop swift fox

habitat criteria) is slated to be completed in the next 3 years.

Skip said there are two things the Team should be aware of: 1) there is a north to south objective to map active prairie dog complexes being conducted. Doug Johnson is heading up this effort. Doug is documenting existing landuse classification mapping for the prairie dog project. This effort is occurring within the swift fox's range, so the Team can maybe get some information from the prairie dog group.

Marsha volunteered to help Bob and Julianne on the habitat committee.

Skip said he thought that Doug Johnson was digitizing aerial photography from the Canadian border to Texas.

Marsha said that they have just begun this new work and will find out more about what the prairie dog group has from Doug Johnson.

Education Committee

Eileen introduced Tarren Wagener, Conservation Science Manager, and Michael Fouraker, Director of Animal Collections, at the Fort Worth Zoo and asked Julianne to give an update on the education committee activities.

Julianne said Tarren Wagener had approached the Team to discuss ways in which the captive community can aid in swift fox conservation from an education perspective. Julianne said she discussed the Conservation Strategy's education objective with Tarren, particularly education efforts to target private landowners. Julianne had asked Tarren to give a proposal to the Team at the annual meeting.

Tarren Wagener stated that the Fort Worth Zoo has been designated by the American Zoological Association's (AZA) Canid Taxon Advisory Group (TAG, the national zoological advisory team that oversees conservation of canids) to lead the cooperative effort for the swift fox. The Fort Worth zoo's initial focus for the swift fox will be conservation education and awareness through cooperation with the 35 member zoos that occur within the swift fox's 10-state range. Tarren explained the process of developing species survival plans (SSP) that include management objectives for the targeted species. Then she ran down a list of carnivore conservation efforts the Fort Worth Zoo is involved in, including initiation of a swift fox conservation awareness program: a multi-agency effort. Proposed project to assist in the initiation of a conservation awareness program for the swift fox in the U.S. Although a proposal was submitted for funding, the funding was not allocated this past year. But Tarren is pursuing other funding avenues at this time and anticipates that the proposal will be funded, possibly as soon as next year. In the meantime, Tarren suggested that the Team provide newsletter articles on swift fox for Canid TAG's newsletter "CHAT." She also showed several education products they have produced.

The main idea Tarren presented is that there are 35 AZA zoos in the 10 swift fox states and 175 nationwide. Zoos have a super attendance! Publication education based initiatives she described included: ID posters/pamphlets; WWW page; teacher resource manuals; species fact sheets; integration of swift fox efforts into zoo-based education programs; distribute to the 35 zoos in the swift fox range; conservation based graphics and exhibition.

Mike said that right now they are administering \$350,000 in grant money. AZA wants

zoos to work in cooperative programs with governmental agencies. The Fort Worth zoo is trying to coordinate zoos on their swift fox education efforts rather than every zoo doing their own thing on swift fox education and information. They are used to dealing with national programs and this would be a first opportunity for the zoos to work with state wildlife agencies.

Marsha agreed that there is obviously a great deal of interest by zoos regarding swift fox.

Tarren mentioned that the zoo field raised the swift fox issue several years ago but it was tabled and only resurfaced in March 1996.

Tarren also said she has worked with Kevin Mote and TPWD.

There was a question as to where the three zoos that have swift fox are. The answer was Kansas, North Dakota and Calgary. Also mentioned that Edmonton has swift fox. There was a general discussion regarding the sources of captive swift fox. Bob Luce said Clio Smeeton in Canada has swift foxes available.

Mike emphasized that the zoos were only interested in captive swift fox for education and display purposes. Their focus is not to breed swift foxes for release.

Tarren concluded by stating that the species survival plans have dedicated funds and she asked for feedback from the Team regarding coordinating educational programs for the swift fox.

Rick Kahn asked if the zoo had any dollars available right now.

Mike said that the Fort Worth zoo focuses in education materials funding.

Rick expressed the need to work with the zoo.

Mike stated that with a species survival plan program the zoo would focus on education and research. Then they would go to state agencies to work with them. They are currently trying to do this with TPWD and Kevin Mote, but they haven't gotten any funding yet.

Skip said the Team needs to be providing information to this zoo group.

Eileen stated that public education is the key to success of swift fox conservation efforts. Eileen asked the if the Team wanted the education technical committee to go ahead and begin working with Tarren and Mike.

The collective answer was yes. Julianne said the education committee will coordinate with Tarren after the annual meeting.

Christiane asked if the Team wants to provide zoos with some animals? If so, where will they come from?

Mike replied that the AZA has challenged the zoos to develop the species survival plan for swift fox.

Bob Luce suggested that the species survival plan needs to be completed for swift fox first before it is decided that swift fox should be provided to zoos.

Eileen asked if developing a species survival plan needs funding.

Mike answered no.

Rick Kahn asked if Mike and Tarren want a technical representative from the Team to advise them on swift fox conservation issues.

Mike replied eventually.

Rick supported the idea that until the species survival plan is done, the Team should resist putting swift foxes in zoos.

Mike suggested that the Team not get that restrictive since some zoos already have

sources for captive swift foxes. The grant submitted for swift fox, although it was not funded this past year, got high reviews and will likely be funded in the future.

Tarren suggested that as the Team gets requests for captive swift foxes for zoos that the Team touch base with her so she can help coordinate.

Tarren summarized that what she wants from the Team is a needs assessment for swift fox education efforts. Private landowners have already been identified as a target for education efforts.

Kevin brought up the LPCIWG newsletter and landowner survey. He suggested it would be worthwhile for the swift fox Team to do a similar project. The LPCIWG sent out their information through the Farm Services Agency (FSA) mailings. Kevin said that this is a good way to touch a lot of people in an inexpensive and non-threatening way, and you can get information back. The Service helped with the return postage and all the states did their own printing. 20,000 newsletters and surveys were sent out in Texas and 8,000 in Oklahoma. From the information they have received so far with the survey, the LPCIWG has found new lesser prairie chicken leks they didn't know existed. This was a surprise since Texas has been surveying for prairie chickens since 1942. Kevin suggested that maybe the zoos could mail out information the Team provides.

Tarren said there are 7000 individuals on the Fort Worth zoo mailing list. Multiply that by the 35 zoos in the 10-state swift fox region and there could be a very large audience targeted through the zoo groups.

Kevin thinks the LPCIWG's first newsletter was very successful. Oklahoma's Colin Berg of the ODWC, got the LPCIWG newsletter camera ready and each state then did its own printing.

Christiane, Julianne, and Kevin will prepare a newsletter for the swift fox Team by Christmas.

Research Committee

Marsha stated that the research committee would like to see some priorities from the states on what direction research should go. There is, however, no funding available for swift fox research at this time.

Eileen asked if the Team's state members would send their research ideas to Marsha by January 15, 1998.

Marsha continued saying that she is currently analyzing Kansas' data and she is getting ready to present that information at the swift fox symposium in February 1998.

Christiane asked what is the purpose of the research committee?

Rick Kahn refreshed everyone's memory by stating that it kind of began when there was some money available for some region-wide work two years ago.

Marsha said that if she has the research ideas from the states available, that when proposals come up she can get them in quickly and maybe get some funding so we can meet some of the Conservation Strategy deadlines.

Eileen asked if the proposals can be tied to the conservation strategy

Marsha said that's what we should be doing. Also she has been coordinating research

equipment needed by different states and researchers like transmitters, traps, etc.

Christiane asked to know what research needs to be done by the Team, so that when a student comes and wants to work on swift fox she has a direction for that research to go.

Marsha said that the Team needs to utilize the kit fox information from P.J. White.

Kevin asked about the kit/swift fox DNA work?

Marsha said there are a couple of recent papers out there on this topic.

P.J. White said that Katherine Ralls (Smithsonian Institution) has a proposal that is going to be funded to look at kit/swift fox issue.

Kevin said he'd be willing to take the extra 3 mls of blood from the swift fox he captures if it would help determine this issue.

It was suggested that maybe the research committee should investigate what research is being done out there on swift and kit fox and compile that information for the Team.

Marsha agreed.

Christiane asked about having a standardizing field methodology update.

Marsha said that Eric Gese will have more information. She said they decided that 1 year of swift fox data was not enough to determine methodology protocols, so they went to the kit fox researchers, and their data are close to final analysis. To summarize briefly, Marsha said it looks as if fall surveys for scent post are the best for detection rate vs. spring and summer scent post surveys. She attributes the fall success to pups being out there. The fall survey, however, is not good for detecting population trends. For detecting population trends with scent post surveys, the spring and summer seasons were better. When comparing earthen stations vs. smoke plates, earthen stations work better than plates. Swift fox have an aversion to stepping on the metal plates. When looking rangewide, Marsha said there are some things we can't do. In some areas, access to private land is a problem, in others, trapping is problem, and still others political issues confound standardized monitoring techniques. Overall, the Research Committee recommends roadside surveys, using natural substrate and not scent posts, using search time per township for detection for determining distribution of swift fox. Hopefully the Research Committee will develop some models that can use these techniques to monitor population trends as well.

Kevin agreed that every area is different and that he uses 2 methods in each area be it scent posts, spotlighting, search, or trapping.

Greg said he wants to see the protocol standardized for the region as best as possible. He said that if we're all doing it differently that would be a real limiting factor for the Service.

Marsha pointed out that for Dave's timeline, monitoring population trends is a long-term program and will take some time.

Dave asked PJ if their studies recommended the standard use of more than 1 technique on a seasonal basis.

PJ replied that they try to get the agencies to use 2 or more "standardized" techniques in each area of the kit fox region. He stated, however, that it is difficult to assess the reliability in the trends because they usually weren't correlated with relative abundance in order to validate the index. Most weren't telling anything about relative abundance. P.J. stated that telemetry studies to get demographic information were better than monitoring surveys. He suggested that we need to initiate telemetry studies with the monitoring studies and to correlate the results. We

also need the population demographic parameter information.

Dave asked P.J. if they tied in their kit fox data with GIS or GAP analysis.

PJ replied no, but that they were looking into that now.

Lu said that in Canada they are looking at different techniques to establish absolute numbers rather than population trends.

Marsha added that declines in the reproductive rates reported by Jim Fitzgerald had sent a flag up. But, she continued, we don't have a lot of reproductive rate information from elsewhere for comparison.

Christiane asked the Team that if Marsha is recommending roadside surveys as the best monitoring technique, are the states willing to change their methodology to that.

Marsha said she wants the states to call her and discuss how to use the appropriate methodology that will work for that particular state.

Rick Kahn/Bruce said that Colorado is doing a mark recapture study with remote cameras acting as the recapture. It's expensive but shows promise.

Christiane said she felt it didn't matter what the Research Committee recommended, that each state will continue to operate as they have using whatever method they choose.

Several states responded no, that they do want recommendations couched in terms of what will work for each state.

Rick Kahn asked the Research Committee what they want and what they are going to give back to the states.

Marsha asked that the states that do have information and data on assessing surveys, give a summary that could be provided to the states that don't have that information, including expenditures and what the surveys might mean (i.e., what is it the survey is indexing). Without this the research committee can not really make a recommendation to the Team as a whole.

Eileen asked the Team members to provide Marsha with research summaries, assessments, and research ideas by January 1, 1998.

Marsha said the problem has been assessment of the work that's being done. It's easy to find out what people are doing but it is not easy to determine what it means.

Brian pointed out that there are many states that just want techniques for starting distribution work on a habitat wide basis.

Kerry asked to hear from Dave about this discussion.

Dave said the Service will be satisfied if the states can get this distribution survey information within their historical ranges.

Marsha said she would like to bring in the kit fox data and look at their assessments.

Bob Luce said that in Wyoming, they concentrated their monitoring survey effort within their telemetry study area.

Skip asked that if the upcoming swift fox symposium in February there could be room for a paper on assessments for survey methodology. Would Marsha direct this information she's gathering from the states into a paper for presentation at the symposium.

Marsha replied the symposium is trying to do just that. There is a section devoted to this topic.

Canadian swift fox symposium

Marsha updated the Team on the Swift Fox Symposium scheduled for February 18 - 19, 1998 in Saskatoon, Saskatchewan, Canada. The symposium is being held in conjunction with the Fifth Prairie Conservation and Endangered Species Workshop. 35 papers and posters have been submitted so far. Deadline for abstracts is December 15, 1997. All papers will be peer reviewed and published in symposium proceedings.

Lu stated that this is an opportunity to put together relevant swift fox information that may not be available in other peer reviewed literature sources. He stressed that what is published will be peer reviewed. Papers will cover subjects relative to the conservation of the species. The information will be credible scientific information. He said that members of the Team may be asked to peer review some of the papers.

On any other business, Amy suggested that the Education Committee may want to do a video compiling all the swift fox related footage from every one who has it, and then if the Ft. Worth zoo gets their swift fox program funded they could package the video and it could go out in the conservation packages.

New editors for the 1997 report. Brian Giddings in Montana will do the 1997 annual report, which is due February 1, 1998. Marsha said she will assist with editing if she has the time. Christiane volunteered Kansas for 1998 report (due in 1999).

Eileen asked if the Team needed a two-day meeting in 1998. Bob Luce commented that since the Conservation Strategy is done, a one-day meeting in the future should suffice. The Team agreed that one day should be fine.

Brian brought up that the Team has previously talked about having a business meeting and field trip. Marsha reminded everyone that easy access is necessary for getting travel approved. Amarillo, Texas was chosen for the 1998 annual coordination meeting, and Kevin will host. The date has tentatively been chosen for sometime the week of November 30, through December 5, 1998.

CRP program changes NRCS Ken Kuiper

Ken Kuiper gave a brief presentation regarding the CRP sign ups. He said that the next sign up will only take points in a mixed-grass mix. In western Kansas, they were using tallgrass species in CRP, which was inappropriate for that ecoregion. Under a new application, landowners will be asked to seed a short grass mix if they want to take the ranking points. But there is a trade off, landowners can get 50 points for ring-necked pheasant cover, which conflicts for short grass needs for swift fox, which only has 15 points.

Christiane said that in the future we should try to make Candidate species receive as many points as game species do, especially since pheasants are an exotic species and swift fox are endemic.

Eileen asked if the ranking points are done on a state by state basis.

Ken replied that the ranking is national. What qualifies, however, varies from state to

state.

Brian suggested that the Team needs to have NRCS biologists represented on the state working groups.

Ken said he didn't know about the Team or Kansas' swift fox research until they got into this CRP enrollment problem. He suggested the Team members get into contact with their state NRCS biologists at least just for sharing this information. For the new sign-ups NRCS will use the information provide by the Kansas Parks and Wildlife Department. Unfortunately, there isn't a lot of time - the next sign up is October 4, 1997.

Rick Wadleigh recommended that Team members get on the NRCS list server. It's a good way to find out what's coming up.

Eileen asked Ken for his recommendations.

Ken suggested that Team members get in touch with their state NRCS biologist and let them know about the Team and that the Team state representatives are available for input into CRP sign up in order to facilitate CRP enrollment to benefit swift fox and other candidate and endangered species points.

Eileen asked how the Team could tie into other habitat conservation initiatives like CRP. She asked for a Team member to investigate this and then report back to the team. For example, Eileen asked about the Service's Candidate Conservation Agreements with landowners.

Dave said he didn't have a lot of information on this program.

Noreen said that there is a draft policy that would protect a landowner if the species were listed in the future. If they work on an agreement now, they won't have any restrictions in the future. Examples for swift fox might be planting areas back into shortgrass prairie. The point is to promote affirmative management action.

Eileen said this might be information that the Team would like to get out to landowners through the newsletter.

Skip suggested that the Team come up with some ideas of what they could do for swift fox. There are none currently in place with swift fox. The Service has to initiate these agreements, but states can collaborate. Noreen also said there is an umbrella policy where the state can oversee all the agreements that occur in their state. Noreen has some information that she will provide to Eileen who will share with the rest of the group.

Eileen gave an update on Nebraska's trapping effort from Frank Andelt. In December 1996, six different swift fox were live-trapped and blood samples were collected in western Sioux County, Nebraska. Trapping began on 2 December and traps were picked up on 15 December. Effort totaled 319 trap-nights. About 250 trap-nights of additional trapping was conducted in northeastern Sioux County on Oglala Grasslands property near the South Dakota border between 12 August and 21 August 1997. No swift fox were caught. All trapping in December and August was done by USDA-APHIS-ADC personnel in a cooperative agreement involving that agency as well as the Nebraska Game and Parks Commission. Funding was from the U.S. Forest Service.

Lu gave an update on reproductive success of Canadian foxes. He stated that they have had good reproductive success. Lu guesses that the population will be self sustaining at least for

awhile. He then thanked Wyoming and the other states directly involved in the Canadian reintroduction effort for their support. He also stated that swift foxes are dispersing into Montana.

Eileen adjourned the meeting at 5:00 pm.

1997 meeting minutes taken by Julianne Whitaker Hoagland.

GUIDELINES FOR OPERATION OF SWIFT FOX CONSERVATION TEAM

Team Purpose:

- To identify major limiting factors to swift fox populations.
- To cooperatively develop management strategies and techniques to minimize effects of these limiting factors.
- To serve as a forum for sharing information on swift fox management techniques and research results.

Team leadership:

The chair and vice-chair positions will rotate between participating agencies. The chair and vice-chair will serve two-year terms.

Team representatives:

Each participating agency will appoint one representative. The representative or their designee will participate in annual meetings, pertinent working groups, assist with preparation of their agency's annual report, and serve as their state or agency contact person.

Team products and information outlets:

The Swift Fox Conservation Team (SFCT) will produce an annual report of swift fox research and management activities. The annual report will also contain annual meeting minutes and minutes of any working groups. Editorship of the annual report will rotate between participating agencies.

The SFCT will prepare a Conservation Assessment and Conservation Strategy for the Swift Fox in the United States. This document will serve as the basis for the development of a Conservation Agreement with cooperating entities. The SFCT will revise the Conservation Assessment and Conservation Strategy document as needed as a result of research findings and distribution surveys.

Kansas Wildlife and Parks Department will serve as the site of archived SFCT information.

Basis for SFCT formation:

August 1, 1994 correspondence to Ralph Morgenweck, Regional Director, Region 6, U.S. Fish and Wildlife Service, Denver, Colorado. Signatories: Perry D. Olson, Colorado; Francis E. Petera, Wyoming; Douglas R. Hansen, South Dakota; Rex Amack, Nebraska; Andrew Sansom, Texas; Pat Graham, Montana; Joe Kramer, Kansas; K. L. Cool, North Dakota; Bill Montoya, New Mexico; and Greg Duffy, Oklahoma.

(Draft 3; 9/22/97)

SUMMARY OF ASSIGNMENTS GENERATED AT 1997 ANNUAL SFCT MEETING:

#	ASSIGNMENT	PERSON(S) RESPONSIBLE	DEADLINE	COMPLETED ?
1	Copy of Fed. Reg. announcement, 9-15-97, to SFCT	Allardyce		no
2	Copy of USFWS listing review form to SFCT	Allardyce		no
3	Report on Allardyce visit to Reg. 2 USFWS to determine when swift fox listing will no longer be warranted	Allardyce		no
4	SFCT decision on drafting USFWS annual listing evaluation	SFCT	?	no
5	Summary memo to Allardyce before first swift fox conference call	SFCT, Stukel coordinate	1-15-98	no
6	Make changes in SFCT Guidelines for inclusion in meeting minutes	Stukel	11-14-97	yes
7	Add Greg Linscombe, IAFWA, to mailing list	Stukel		yes
8	Add chapter in 1997 annual report to address progress towards meeting Cons. Strategy document objectives	Giddings	ann. rept. deadline	no
9	Develop blood collection protocols for disease analysis and DNA	Roy and Luce		no
10	Join state range maps into regional map for 1997 annual report	Giddings	ann. rept. deadline	no
11	Literature review of swift fox habitat preferences for 1997 annual report	Hab. criteria comm. (Hoagland)	ann. rept. deadline	no
12	Determine progress of prairie dog mapping by Doug Johnson, NPSC	Sovada		in progress (requested proposal from John Sidle, USFS).
13	Communicate Tarren Wagener's offer to set up SFCT list server discussion group	Stukel		yes
14	Submit article(s) to Tarren Wagener for her newsletter "CHAT"; swift fox newsletter will provide options for choices by Tarren	Education Subcomm.	Feb. 1, 1998	no
15	Develop a needs assessment for education efforts, with private landowners as a priority	Education Subcomm.?		no

16	Develop a newsletter on swift fox, following example of lesser prairie chicken	Mote, Roy and Hoagland	Christmas 1997	?
17	Send research ideas to Marsha Sovada	SFCT	1-15-98	
18	Compile information on swift/kit fox genetics resolution studies	Research Comm.	?	no
19	Compile survey assessment data and summarize research to date; send to Marsha Sovada	SFCT	1-1-98	
20	Submit abstracts for Swift Fox Symposium, Saskatchewan	SFCT	12-15-97	yes
21	Share USFWS information from Noreen Walsh	Stukel		yes
22	1998 assignments: 1997 Annual Report Editor: Brian Giddings and Marsha Sovada, if available 1998 Ann. Rpt. Ed.: Christiane Roy 1998 meeting arrangements: Kevin Mote 1998 meeting site: Amarillo, TX			

Draft 2, 1-13-98

PRELIMINARY FINDINGS OF SWIFT FOX STUDIES IN MONTANA

Amy L. Zimmerman, Dept. of Fish and Wildlife Management, Montana State University, Bozeman, MT 59717 (406-994-3032).

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ABSTRACT

Swift fox (*Vulpes velox*) occurrence and distribution were investigated during a graduate research study in northcentral Montana between August 1996 and December 1997. This state report is an edited summary of that study, which is presented fully in a thesis by Zimmerman (1998). Recent information has suggested that swift fox from a reintroduced population in Canada have been dispersing into northcentral Montana to recolonize additional areas. This study focused on northern Blaine county, Montana, with limited surveys conducted in northern Phillips and Valley counties, using a systematic grid trapping design to determine presence and to radio-collar any captured swift foxes. Data was collected to determine home range size, food habits, and survival rates of marked swift fox. Habitat comparisons, land ownership patterns, and the degree of topographical roughness, for each sampled township, were also investigated.

A total of 16 swift fox were trapped in 1996 and 1997 with this sample comprised of five juveniles and 11 adults. During the spring of 1997, radio-collared foxes were used to locate natal den sites which resulted in three known litters being produced in northern Blaine county. The average home range size of marked swift fox was estimated to be between 10.4 km² (Minimum Convex Polygon) to 12.3 km² (Adaptive Kernal). Survivorship was estimated at 51.6%. Food habits determined through scat analysis indicated mammal material (*Microtus spp.*) was highest in percent occurrence. No relationships were found in habitat composition, land ownership patterns, or topographical roughness in townships with and without swift foxes. This study documented that the swift fox has reestablished a resident population in northcentral Montana, and field evidence suggests that the population is surviving and reproducing. A wider range of habitats in northcentral Montana need to be surveyed to determine statewide swift fox distribution and population size.

INTRODUCTION

The swift fox was declared extinct in Montana in 1969 as a consequence of a 16-year absence of swift fox in fur harvest records (Hoffman et al. 1969). No swift foxes were reported in Montana until 1978, when a male fox was incidentally trapped in Custer county (Moore and Martin 1980). This animal, however, may have been dispersing from northeastern Wyoming or southwestern South Dakota. In Canada, the last known swift foxes in Saskatchewan and Alberta were collected in 1928 and 1938, respectively (Soper 1964, Banfield 1974). The species was designated as extirpated by the Committee on the Status of Endangered Wildlife in Canada in 1978 due to the lack of observations since 1938 (Brechtel et al. 1996).

A reintroduction program began in southern Alberta and Saskatchewan in 1983-1984, with swift foxes being released annually through 1998 (Brechtel et al. 1996). Objectives of the national recovery plan for the swift fox include: 1) establishing two geographically distinct, yet genetically connected core populations with an average spring-season density of five adult foxes per township; 2) ensuring the long-term security of prairie habitat in two main regions of the Canadian prairie; and 3) to establish swift fox in at least 50 percent of the suitable habitat that remains on the Canadian prairie (Brechtel et al. 1996). The plan's overall goal is to establish a target population of 420 foxes by the year 2000.

Three primary release sites were established in Alberta and Saskatchewan which include the Milk River ridge area in southern Alberta, the Cypress Hills area along the Alberta-Saskatchewan border, and the Wood Mountain Plateau site south of Mankota, Saskatchewan. The swift fox population located along the Alberta/Saskatchewan border is currently the largest. Approximately 70 to 100 swift fox have been reintroduced annually since 1983, with releases comprised of Canadian captive-reared foxes and Wyoming captured wild foxes (Brechtel et al. 1996). In 1993, the wildlife directors of Alberta, Saskatchewan and Canadian Wildlife Service decided to continue the reintroduction program for an additional five year period (Brechtel et al. 1996). A population assessment, conducted during the winter of 1996-1997, estimated the Canadian swift fox population at 289 animals (95% C.I.; range 179-412) (Cotterill 1997).

Observations of swift fox have been reported recently in northcentral and southeastern Montana. An increase in the frequency and intensity of reports since 1992 suggests that swift fox may be recolonizing northcentral Montana as a result of the Canadian reintroduction program (Giddings and Knowles 1995). Brechtel et al. (1993) documented instances of Canadian released swift fox dispersing into northcentral Montana between 1989 through 1992. It was unclear, however, if these dispersing individuals were surviving to establishing a resident population in Montana.

The goal of this study was to verify and document evidence of swift fox presence in northcentral Montana. One primary study objective was to locate natal den sites as a means of documenting that breeding and reproduction is occurring in Montana. Additional study objectives included an investigation of relative distribution, home range size, reproductive success, survival rates and food habits of radio-collared swift foxes. Habitat composition, land ownership/management, and the degree of topographical roughness of areas that swift foxes currently occupy were also analyzed to determine if these attributes affected the probability of swift fox presence. The null hypothesis was that there would be no difference in the probability of capturing swift fox in areas of different habitat compositions, land ownership/management, or topographical roughness.

STUDY AREA

The study area was portions of northcentral Montana, with the primary study site located in northern Blaine county, approximately 25 miles northeast of Havre, Montana. Secondary study sites were located in northern Phillips and northern Valley counties. The landscape consists of large blocks of gently rolling, glaciated, short and midgrass prairie habitat with agricultural areas interspersed on upland sites. Moderate relief is created from creek drainages that dissect the prairie grassland. Annual mean temperature ranges from -1.78° C to 13.9° C. Mean annual

precipitation is 32 cm and ranges from 19 cm to 52 cm.

Dominant grasses on the study area were: western wheatgrass (*Agropyron smithii*), prairie junegrass (*Koeleria pyramidata*), blue gramma (*Bouteloua gracilis*), buffalo grass (*Buchloe dactyloides*), and Sandberg bluegrass (*Poa secunda*). Some localized areas have been seeded to crested wheatgrass (*Agropyron cristatum*). The main shrub occurring on the prairie is silver sagebrush (*Artemisia cana*). Dominant forbs include: American vetch (*Astragalus spp.*), scarlet globemallow (*Sphaeralcea coccinea*), fringed sagewort (*Artemisia frigida*), cudweed sagewort (*Artemisia ludoviciana*), toadflax (*Linaria spp.*), plains clubmoss (*Seluginella spp.*), and prickly pear (*Opuntia spp.*). Upland sites in the study area were characterized by loam or clay loam soil surfaces and clay or clay loam subsoil types (National Cooperative Soil Survey 1976). Elevation on the study area ranged from ranges from 670 m to 2,103 m. Twenty-eight percent of the study area was managed by the Bureau of Land Management (BLM) and six percent was controlled by the state of Montana. Sixty-six percent of the study area was in private land ownership.

METHODS

Fourteen townships that comprised 92 km² were systematically trapped using Tomahawk live-traps placed in a block-grid sampling design (Smith et al. 1975). Cage trap dimensions were 42x12x12 cm and 32x10x12 cm. Traps were placed at corners of the nine, four mi² blocks, in each township. The base number of traps per township grid therefore would equal 16 traps with each trap located approximately two miles apart. The basic block design for trap placement was modified according to road and trail accessibility within each township sampled so that traps were placed as close to a corner as existing roads or trails would allow. This method was used to increase the efficiency and ease of surveying a large area. Loy (1981) found that placement of traps along roads or trails increased the ease of setting and checking traps and proved more successful for capturing swift fox than a random placement of traps over the landscape. Each sampled township was trapped for 3 to 7 days with traps checked daily between the hours of 05:30 to 10:00. Trapping occurred from 12 August to 29 November, 1996 and from 7 July to 15 August, 1997. A short-term trapping effort also occurred from 12 October to 18 October, 1997. Trapping success was recorded as the number of foxes captured per 100 trap-nights of trapping effort.

Standard and modified (Zimmerman 1998) methods were used to capture, handle and monitor swift fox on the study area. Radio-collars were manufactured by Wildlife Materials (WM) and Advanced Telemetry Systems (ATS) which weighed approximately 40-50 grams and contained a mortality sensor that was activated after 4 hours (WM) or 8 hours (ATS) of inactivity.

Animal relocations used for home range and movement data were sampled approximately four times per week during the primary field seasons (fall 1996; summer 1997). Radio locations were sampled most frequently by ground between the hours of 20:30 to 02:00 and from 03:00 to 05:30. Hines and Case (1991) reported that 90 to 96 percent of swift fox activity occurred between the hours of 20:00 and 04:00. Locations were also obtained from fixedwing aircraft. An H antenna was mounted to the wing strut of a Bellanca Scout 53819. Flights were made during the day, from 07:00 to 14:00 or between 18:00 to 19:30. During the winter of 1996-1997,

regular flights were made every 10 to 14 days to document movements and survival. Flights were also used to describe dispersal distances of radio-collared juvenile swift fox.

In the spring of 1997, potential natal den sites were located and observed. Swift fox pups emerge from the den at 3 to 4 weeks of age (Kilgore 1969). Dens were observed several times per week in the morning or evening beginning in June, until pups were seen outside the den. Natal dens were then observed twice a week to count the number of pups present. All natal dens were described and measured to record the number of entrances, dimensions of openings, opening exposure, slope, distance to the nearest road, and dominant vegetation.

Home ranges were estimated using the triangulation program LOCATE II (Nams 1990) and home ranges were estimated with the program CALHOME (Kie et al. 1994). Home ranges are reported for the Minimum Convex Polygon (MCP) method (Mohr 1947) and the Adaptive Kernel method (Worton 1989).

Annual survivorship was estimated by hand, using the Kaplan-Meier, or Product Limit procedure, modified for a staggered entry design (Pollock et al. 1989). This method allows for new animals to be added after the study has begun and lends itself well to a study where the exact number of individuals to be captured is not known at the beginning of the study. Mortalities were indicated from the mortality signals in the radio-collars being activated and retrieval of the carcass and/or radio-collar was then initiated.

Scat analysis was used to investigate swift fox food habits in northcentral Montana. Swift fox scats were collected in each township trapped during regular field activities. Searching occurred along fence lines, trails and gates. Scat was also collected from captured animals or at den sites when available. Each scat was placed into a separate, plastic zip-lock bag, labeled with the date, location, swift fox frequency number, and immediately frozen. Scat was later placed into a strip of nylon hosiery and washed by hand in a 5 gallon bucket with a tablespoon of laundry detergent. Scats were rinsed until the rinse water appeared clear and were air dried. Dried scats were placed on a sieve and separated into seven categories: hair, bones, teeth, insect, feathers, vegetation, and other. Teeth were used to identify small mammals to genus. Insects were identified to order; feathers were simply classified as "bird"; and plant material was labeled as vegetation. Fecal items were reported in percent occurrence.

Habitat types occurring in a 200 m radius around each trap site were recorded during trapping efforts. Habitat types were classified as rangeland, cropland, Conservation Reserve Program (CRP) land, or a mixture of these. Therefore the 200 m radius was either 100% range, 100% crop, 100% CRP, or contained a mixture of these habitat types. Trapping success for each habitat type was recorded as the number of foxes captured per 100 trap-nights of effort.

The habitat composition and pattern of land ownership/management of townships where foxes were captured were compared with townships having no captures using a Mann-Whitney t-test (Ott 1988). Habitat attributes consisted of classified habitat types, land ownership/management category, and topographical roughness factor.

RESULTS

Trapping Success - Fourteen townships were block trapped over the course of the study. Swift foxes were captured in six of the 14 townships (Fig. 1). A total of 1,205 trap nights resulted in nine swift fox captures in 1996. Trapping success for 1996 was 0.75 foxes/100 trap-nights. Trapping efforts in 1997 resulted in seven captures in 511 trap-nights, for a trapping success of 1.37 foxes/100 trap-nights. The overall trapping success for the study was 0.93 foxes/100 trap-nights.

In 1996 there were three adult females, 3 adult males and 3 juvenile males captured in the study area. During 1997, a new adult male and female were captured in northern Blaine county and an adult male and female and two female pups were captured in Phillips county, just north of Whitewater, Montana. An adult male swift fox was captured in northwest Valley county, over 30 miles east of Whitewater, Montana. An ear tattoo indicated that this swift fox originated from the captive breeding program at the Valley Zoo in Edmonton, Alberta, was born in May of 1995, and was released in the fall into Grasslands National Park (A. Moehrensclager, pers. comm.).

Standard Measurements - Captured males weighed slightly more than females, with the average weight of males being 2.9 kg compared to 2.5 kg for females. Average ear lengths and hind foot lengths were equal for males and females (5.8 cm and 12.0 cm, respectively). Males had longer average tail length and total body length compared to females. Average tail length for males was 26.9 cm and 24.9 cm for females while average total body length was 72.1 cm for males and 67.9 cm for females. Juvenile body measurements fell in between adult male and female measurements.

Home Range - Annual home range estimates were calculated for five radio-collared swift foxes (Table 1). The number of radio locations per fox ranged from 28 to 72. Using the MCP method, home range size ranged from 7.3 km² to 16.9 km², with an average size of 10.4 km². Using the AK method, home range size ranged from 8.7 km² to 20.3 km², with an average size of 12.3 km². A sample of thirty known locations from several radio-transmitters were used to determine the degree of error in ground triangulation relocations. The overall standard deviation of the error angle was 12.87° with a 95% confidence interval of -9.03° to 34.77° (n=30, df=28).

Population Dynamics: Survival - Of the nine swift fox captured in the fall of 1996, five of these foxes died over the winter and four foxes survived to breed and reproduce in the spring of 1997. Of the surviving four, there were two males and two females. The average number of days survived in 1 year for the nine radio-collared foxes was 249 days, with a range of between 77 and 365 days (Table 2). Time was divided into 2 week intervals, since flights during the winter were done on a biweekly basis. The Kaplan-Meier survival function is based on the probability of an individual animal surviving x unit of time from the beginning of the study. In this study, this time interval was 2 weeks. Mean survivorship over the 1 year period was 51.6% with a standard deviation of 37.0%. The staggered entry survival curve for nine swift foxes in northcentral Montana is illustrated in Fig. 2.

Den Characteristics and Reproduction - Eleven separate natal dens were documented during this study. Two of the swift fox pairs had four different natal dens through the summer, and the third

pair occupied three separate dens. All natal dens were located less than 500 m from a dirt road or two-track trail. All natal dens were located in areas with slopes less than 15° and 73% were located in areas with slopes of 0-5°. Over half (54%) of den openings were exposed to a south or southeast direction. A north or northeast exposure was the next most common opening at 36%. One den site had an opening toward the southwest, but no openings were exposed to the west or northwest. The average dimension for den openings was 24.6 cm x 42.0 cm (n=34, sd=6.8 cm x 17.8 cm). Each of the two pairs of radio-collared swift fox that survived the winter of 1996-1997 produced offspring. One pair produced a litter of five, the other a litter of three. The swift fox pair captured in July of 1997 produced a litter of seven. Also, two pups were captured in northern Phillips county, indicating that reproduction had occurred in this area.

Food Habits - Scat or fecal analysis indicated that small mammals were the most common item found in the diet of swift fox. Mammal remains were found in 91% (n=59) of the 65 scats analyzed. The second most common food item was insects, which occurred in 66% (n=43) of the scats. Vegetation occurred in 48% (n=31) of the scats, while bird remains occurred in 32% (n=21) of the scats. Seven of the 65 scats analyzed contained unidentified mammal material (11%).

The most common mammals occurring in scats were *Microtus spp.* (68%), followed by *Peromyscus spp.* (18%), *Spermophilus richardsonii* (9%), *Perognathus spp.* (3%), and *Sorex spp.* (2%). *Microtus*, *Peromyscus*, and *Perognathus* often occurred in combination while *Spermophilus richardsonii* was usually found alone in a scat sample. Only one instance of *Sorex spp.* was encountered in the 65 samples analyzed.

Insect material was mainly composed of the classes Coleoptera (beetles) and Orthoptera (grasshoppers). Coleopterans were found in 49% (n=32) of the samples, and Orthopterans were found in 43% (n=28) of the scats. Seven different families of beetle were found in scats, including: tiger beetle (*Cicindelidae*), weevil (*Curculionidae*), pill beetle (*Byrrhidae*), dung beetle (*Scarabaeidae*), ground beetle (*Carabidae*), darkling beetle (*Tenebrionidae*), and carrion beetle (*Silphidae*). Two families of Orthoptera were found in scats: *Acrididae* (grasshopper) and *Gryllidae* (cricket). *Formicidae* (ants) from the order Hymenoptera, occurred in 14% of the scats. A few samples contained material from the order Hemiptera (stink bug), Lepidoptera (caterpillar skins) and Odonata (damselfly adults).

Percent occurrence of food items, by season (spring/summer/fall), is presented in Table 3. Mammals were represented evenly throughout the three seasons. Insects occurred in all three seasons, peaking in the fall season at 75% occurrence. Vegetation occurrence was highest in the summer (65%) but was present in scats in all three seasons. Occurrence of bird parts was highest in the spring (60%), was present in the summer (39%), and dropped off in occurrence in the fall (20%).

Habitat Use - There were a total of 1,716 trap-nights over the course of the study. Of these, 1,394 trap-nights occurred in rangeland, 43 were in cropland, 8 were in CRP land, and 271 were in a mixed habitat. There were 16 individual swift fox captured. Fifteen captures occurred in rangeland, one occurred in mixed habitat, and no captures occurred in cropland or CRP land.

Trapping success for rangeland was 1.08 foxes/100 trap-nights while success in mixed habitat was 0.37/100 trap-nights.

Statistical tests indicated no significant difference in the habitat composition of townships with (n=6) and without (n=8) swift foxes. The average amount of rangeland was 9,680 ha in townships with foxes and 7,615 ha in townships without foxes, with the average amounts of cropland being 2,754 ha and 780 ha, respectively. The proportion of rangeland (p=0.747) and cropland (p=0.175) did not differ significantly between the two groups. There was no evidence that the probability of capturing swift foxes was different for townships of different habitat compositions. The average amount of private land in townships with swift foxes was 44,786 ha and 53,630 ha in townships without foxes. The average amount of BLM managed land in townships with swift foxes was 42,253 ha and 29,750 ha in townships without swift foxes. State managed land represented an average of 4,800 ha in townships with foxes and an average of 7,900 ha in townships without foxes. No significant difference was found for the area of private land (p=1.000), BLM managed land (p=0.95), or state owned land (p=0.213) between townships with and without swift foxes. The average roughness factor for townships with foxes was 1.0 and for townships without foxes was 0.9. No significant difference was found in the overall roughness factors for the two groups of townships (P=0.401). Thus, there was no evidence to suggest that the probability of capturing swift foxes would be different for townships of different roughness.

DISCUSSION

A small percentage of the potential available swift fox habitat in northcentral Montana was surveyed through live-trapping in this study. There are approximately 688,000 ha of prairie rangeland in northcentral Montana, primarily located in Blaine, Phillips and Valley counties (Giddings and Knowles 1995, C. Knowles, pers. comm.). The total area surveyed during this study was 129,024 ha or 19% of estimated prairie rangeland available in northcentral Montana. In 1996, trapping success was 0.75 foxes/100 trap-nights and 1.37 foxes/100 trap-nights in 1997. Success rates in Kansas, where swift fox are considered common, were 1.75 fox/100 trap-nights (Matlack 1997). If the success rate observed in this study was representative for Montana, then fox densities in occupied habitats may be comparable to other regions in swift fox range. Physical measurements of captured fox in northcentral Montana appeared to be similar to those in other ecological studies. Scott-Brown et al. (1987) and Kilgore (1969) found adult male swift fox to be slightly larger and heavier than adult females. Overall, Montana study animals appeared to be in good physical condition.

Home range information was rather limited in this study. The ground telemetry system used was apparently inadequate to locate marked animals consistently due to spatial constraints resulting from difficult and remote road and trail access, which was characteristic of the study area. Often, a fox could not be located during a sampling night because of an inability to get close enough (1.6 km) to receive the signal. Therefore it may be assumed that home range sizes in this study could have been underestimated. Swift fox home range estimates in this study averaged 10.4 km² with a range from 7.3 km² to 20.3 km² compared to Canadian studies which have estimated home range sizes up to 34.1 km² (A. Moehrensclager, pers. comm.). Hines (1980) found average home range sizes of 17.3 km² for males and 12.4 km² for females in Nebraska, which is more

comparable to the average home range size found in this study. More recently, Hines and Case (1991) estimated home range sizes (up to 32.3 km²) in Nebraska and speculated that the large home range sizes may have been the result of low population densities or prey availability.

The estimated survival rate for swift foxes in this study (51.6%) was comparable to reported survival estimates elsewhere. Sharps and Witcher (1984) reported a 50% mortality rate among 14 radiomarked swift fox over 1 year in South Dakota. Zumbaugh (1984) also reported a 50% mortality rate among adults based on 2 years of harvest data in Kansas. Minimum annual survival rates for wild-born Canadian swift foxes have been estimated at 46% for adults and 36% for juveniles during their first year (Brechtel et al. 1993). Montana estimates were based on all nine foxes captured in the fall of 1996. Of these, six were adults and three were juveniles (young of the year).

Natal den sites in this study were similar to den sites described in other ecological studies in that they were close to roads and trails. Other studies have shown the tendency for den sites to be located 500 m or less from a road (Hines 1980, Hines and Case 1991, Loy 1981, and Jackson (1997) observed den sites less than 1 km from a road. Den sites in northcentral Montana were located in open, level areas, often near the crest of a small rise or ridge. The majority of den sites in this study were located in areas with a slope of less than 15° which is a similar finding of other studies (Hillman and Sharps 1978, Loy 1981, Jackson 1997). Other common characteristics include selection for a eastern or southern exposure, a loamy soil and areas of sparse vegetation (Kilgore 1969, Hillman and Sharps 1978, Hines and Case 1991, Loy 1981, Uresk and Sharps 1981, Jackson 1997). In this study, the number of den entrances seemed to be tied to the number of pups in the litter. Dens of the litter of three had one or two entrances while the dens with litters of five and seven pups had four den entrances.

One of the primary objectives of this study, to document evidence of swift fox reproduction, was accomplished by identifying natal den sites and observing active litters, which ranged in size from three, five and up to seven animals. Reports of litter sizes in the reintroduced Canadian population have ranged from one to seven pups, with an average litter size of 3.9 (Brechtel et al. 1993). A record litter size of eight pups was recorded during the spring of 1997 (A. Moehrenschrager, pers. comm.). Covell (1992) recorded the average litter size for swift fox at 2.4 pups/pair without a helper and at 4.2 pups/pair with a helper. Larger average litter sizes of four and five were reported for swift foxes by Hillman and Sharps (1978) and Kilgore (1969), respectively.

Mammals were the most frequent food item found in the scats collected during this study. Uresk and Sharps (1981) also found mammals to be the most frequent food item (49%) in the diets of swift fox in South Dakota, followed by insects (27%), vegetation (13%), and birds (6%). Rodents, particularly voles, were found to be the most important food item for the swift fox in northcentral Montana. Hines (1980) found that Cricetidae rodents, especially *M. ochrogaster*, increased in occurrence in the spring. Hines and Case (1991) also found *M. ochrogaster* to be the most common mammal species found in 52 scat samples in Nebraska. Cameron (1984) reported that rodents were important food items in spring and summer on the Pawnee National Grassland in Colorado.

Leporidae were not found in any of the 65 scat samples in this study, even though they seemed to be quite abundant on the study area. Cottontails and jackrabbits have been found to be important food items in other studies, especially in winter (Cameron 1984, Hines and Case 1991, Kilgore 1969, Zumbaugh et al. 1985). Hines (1980) and Kilgore (1969) documented that *Leporidae* species decreased in occurrence in the spring, but were important in winter and early spring. The scats from the Montana study were collected from late spring, summer and fall. This may explain the absence of *Leporidae*.

A high percentage of scats examined had at least some insect material present. In a study in Nebraska, Hines and Case (1991) found that 56% of the swift fox scats had insect remains, most of which consisted of Orthoptera (37%) and Coleoptera (25%). This result is quite similar to Montana results of 66% occurrence of insect material in collected scats. In South Dakota, Uresk and Sharps (1981) reported that insects were present in 27% of scats.

Vegetation was found in 48% of the scats, consisting mainly of grass in only trace amounts, suggesting vegetation may have been ingested incidentally. However, three scat samples were composed entirely of vegetation with one of grass, a second was an unidentified moss and the third was comprised entirely of berries, probably currants or gooseberries (*Ribes spp.*). Other vegetation present in scats included spike moss (*Selaginella spp.*) and nutlets from the family *Borinaceae*. Hines and Case (1991) found that 54% of the scats they examined contained vegetation. Uresk and Sharps (1981) described vegetation in 13% of the scats they collected. It is unknown whether swift fox ingest vegetation as they consume prey or if vegetation is consumed purposely. Zumbaugh et al. (1985) examined only one stomach sample that contained enough grass to indicate that it had been purposely ingested. Hines and Case (1991) concluded that vegetation was eaten intentionally in some instances. The three scat samples composed entirely of vegetation collected during this study suggest that vegetation was intentionally consumed.

Birds remains occurred in 32% of the scats examined during this study. Most feathers were found in scats deposited in late spring and early summer. This occurrence is consistent with studies reporting that both bird and insect remains increase from winter to summer as their availability increases (Hines 1980, Hines and Case 1991). Feathers found in scats were usually too small to identify, although mallard (*Anas platyrhynchos*) and horned lark (*Eremophila alpestris*) remains were often observed at den sites during the summer of 1997. On a single occasion, a willet (*Catoptrophorus semipalmatus*) was found lying beside a live-trap that held a juvenile female swift fox south of Whitewater Lake in Phillips county.

Swift fox in northcentral Montana seemed to be the most strongly associated with rangeland habitat, based on the high trapping success in this type when compared to other available habitat types. Den site locations and home range locations supported this association. No den sites were observed in any habitat other than native rangeland and only one out of 291 telemetry locations occurred near cropland habitat. The high proportion of trap sites located in rangeland habitat reflects the dominance of grassland prairie (118,997 ha) over cropland (22,761) in the study area and may also indicate that these foxes are selecting habitats in proportion to availability rather than simply keying in on rangeland habitat.

No significant differences were found in the habitat composition or land ownership patterns and management practices between townships with and without swift fox. It was hypothesized that townships with a greater amount of rangeland may be more attractive to swift fox, and thus, habitat composition would influence where swift fox were captured. It was also hypothesized that the pattern of land ownership may play a role in the presence or absence of swift foxes, considering that there may be certain vegetation cover types that attracted foxes to areas as a consequence of land management practices. However, the study data did not support these hypotheses. There are several possible explanations why land management practices or habitat composition did not effect the probability of swift fox presence. Trapping was probably not preformed over a wide enough area to detect a gradient of swift fox densities that could be attributed to differences in the amount of rangeland versus cropland habitats across townships (or accordingly, the amount of private, BLM, or state land across townships). Other explanations may be that sampling effort was simply not intense enough and therefore did not have enough power to detect a difference (power ranged from 5%-29%) or that these attributes do not have an effect on whether swift fox are present or absent in a specific area. A final explanation could be that the swift fox population is still colonizing the area and has simply not yet filled all of the most desirable habitats.

Habitat quality was also hypothesized to be related to landscape characteristics such as roughness (coulees and breaks). This factor could influence swift fox presence if rough terrain maintained higher coyote densities (Pyrah 1984) or diminished a foxes ability to chase and capture prey (Samuel and Nelson 1982). Habitat quality and landscape selection by swift fox in northcentral Montana is likely related to habitat that minimizes encounters with coyotes. Pyrah (1984) reported that surveys indicated consistently higher coyote densities in breaks habitats as compared to the adjacent upland prairie habitats in central Montana. Coyotes are the primary cause of direct mortality for swift fox, both in the reintroduced Canadian population (S. Black, pers. comm.) and in other swift fox populations within the U.S. (Covell 1992, Matlack 1997). Statistical tests on the differences in landscape roughness within townships with and without swift fox did not indicate any relationship between large scale topographical complexity or relief and the presence or absence of swift foxes.

LITERATURE CITED

- Banfield, A.W.F. 1974. The mammals of Canada. Univ. of Toronto Press, Toronto, Ontario
- Brechtel, S.H., L.N. Carbyn, D.Hjertaas, and C. Mamo. 1993. Canadian swift fox reintroduction feasibility study: 1989 to 1992. Scientific and Technical Documents Division, Canadian Wildlife Service, Ottawa, Ontario.
- Brechtel, S.H., L.N. Carbyn, G. Erikson, D. Hjertaas, C. Mamo, and P. McDougall. 1996. National Recovery Plan for the Swift Fox. Report No. 15. Ottawa: Recovery of Endangered Wildlife Committee. Scientific and Technical Documents Division, Canadian Wildlife Service, Ottawa, Ontario.
- Cameron, M.W. 1984. The swift fox (*Vulpes velox*) on the Pawnee National Grassland: Its food habits, population dynamics, and ecology. M.A. Thesis. Univ. of Northern Colorado, Greeley.
- Cotterill, S.E. 1997. Population census of swift fox (*Vulpes velox*) in Canada: winter 1996-1997. Unpubl. Report for the swift fox national recovery team. Alberta Environmental Protection (Natural Resources Service), Edmonton, Alberta.
- Covell, D.F. 1992. Ecology of the swift fox (*Vulpes velox*) in southeastern Colorado. M.S. thesis, Univ. of Wisconsin, Madison, WI.
- Giddings, B. and C. J. Knowles. 1995. The current status of swift fox in Montana. Pages 101-120 in Allen, S.H., J. W. Hoagland, and E. D. Stukel, eds. Report of the swift fox conservation team, 1995. ND Game and Fish Dept., Bismark, ND. 170 pp.
- Hillman, C.N. and J.C. Sharps. 1978. Return of the swift fox to northern great plains. Proceedings of the South Dakota Academy of Science. 57:154-162.
- Hines, T.D. 1980. Home range and movements of swift fox (*Vulpes velox*) as determined by radio telemetry. Proceedings of the Nebraska Academy of Science. 90:5-7.
- Hines, T.D. and R.M. Case. 1991. Diet, home range, movements, and activity periods of swift fox in Nebraska. Prairie Nat. 23:131-138.
- Hoffman, R.S., P.L. Wright, and R.E. Newby. 1969. The distribution of some mammals in Montana. I. Mammals other than bats. J.Mamm. 50:579-604.
- Jackson, V. 1997. Denning ecology of swift foxes (*Vulpes velox*) in western Kansas: Final report. Kansas Dept. of Wildlife and Parks, Hays, KS.

- Kie, J.G., J.A. Baldwin, and C.J. Evans. 1994. CALHOME: Home range analysis program, user's manual. U.S. Forest Service, Fresno, CA.
- Kilgore, D.L., Jr. 1969. An ecological study of swift fox (*Vulpes velox*) in the Oklahoma panhandle. Amer. Midland Nat. 81(2):512-534.
- Loy, R.R. 1981. An ecological investigation of the swift fox (*Vulpes velox*) on the Pawnee National Grasslands, Colorado. M.S. thesis. Univ. of Northern Colorado, Greeley, CO.
- Matlack, R. 1997. The swift fox in rangeland and cropland in western Kansas: relative abundance, mortality, and body size. M.S. thesis, Kansas State Univ., Manhattan, KS.
- Mohr, C.O. 1947. Table of equivalent populations of North American mammals. Amer. Midland Nat. 37:223-249.
- Moore, R.E., and N.S. Martin. 1980. A recent record of swift fox (*Vulpes velox*) in Montana. J. Mamm. 61:161.
- Nams, V.O. 1990. Locate II: User's guide. Pacer Publ. Inc., Truro, Nova Scotia.
- Ott, L. 1988. An introduction to statistical methods and data analysis. PWS-Kent Publ. Co., Boston, MA.
- Pollock, K., S.R. Winterstein, C.M. Bunck, and P.D. Curtis. 1989. Survival analysis in telemetry studies: The staggered entry design. J. Wildl. Manage. 53(1):7-15.
- Pyrah, D. 1984. Social distribution and population estimates of coyotes in north-central Montana. J. Wildl. Manage. 48:679-690.
- Samuel, D.E. and B.B. Nelson. 1992. Foxes. Pages 475-490 in J.A. Chapman and G.A. Feldhamer, eds. Wild mammals of North America: biology, management, and economics. John Hopkins Univ. Press. Baltimore, MD.
- Scott-Brown, J.M., S. Herrero, and J. Reynolds. 1987. Swift fox. Pages 432-441 in M. Novak, J.A. Baker, M.E. Obbard, and B. Malloch, eds. Wild furbearer management and conservation in North America. Ontario Trapper's Association, North Bay, Ontario.
- Sharps, J.C. and M.F. Witcher. 1984. Swift fox reintroduction techniques. South Dakota Dept. of Game, Fish and Parks. Rapid City, SD.
- Smith, M.H., R.H. Cardner, J.B. Gentry, D.W. Kaufman, and M.H. O'Farrell. 1975. Density estimations of small mammal populations. Pages 25-53 in F.B. Golley, K. Petruszewicz, and L. Ryszkowski, eds. Small mammals: their productivity and population dynamics. Cambridge Univ. Press, Cambridge, MA.

Soper, J.D. 1964. The mammals of Alberta. Hamyly Press, Edmonton, Alberta.

Uresk, D.W. and J.C. Sharps. 1981. Denning habitat and diet of the swift fox in western South Dakota. Great Basin Nat. 46(2):249-253.

Worton, B.J. 1989. Kernel methods for estimating the utilization distribution in home range studies. Ecology. 70:164-168.

Zimmerman, A.L. 1998. Reestablishment of swift fox in northcentral Montana. M.S. thesis. Montana State Univ., Bozeman, MT. 43 pp.

Zumbaugh, D.M. 1984. Natural history of foxes in Kansas. M.S. thesis. Fort Hays State Univ. Hays, KS.

Zumbaugh, D.M., J.R. Choate, and L.B. Fox. 1985. Winter food habits of the swift fox on the central high plains. Prairie Nat. 17(1):41-47.

Table 1. 1996-1997 Annual home range size in km² estimated by the Minimum Convex Polygon Method and Adaptive Kernel Method and time periods tracked of 5 swift fox in northcentral Montana.

Swift Fox	Sex	Age	Period Tracked	No. Locations	Minimum Convex Polygon Home Range	Adaptive Kernel Home Range
150.133	M	Juv.	21 Oct. 1996--13 Sept. 1997	58	7.27	11.28
150.826	F	Adult	6 Nov. 1996--9 Oct. 1997	63	16.94	20.27
150.152	F	Adult	8 Oct. 1996--9 Oct. 1997	72	8.06	8.71
150.844	M	Adult	21 Oct. 1996--11 Sept. 1997	70	9.39	9.64
151.272	F	Adult	8 Oct. 1996--7 April 1997	28	10.09	11.34

Table 2. 1996-1997 Staggered entry design, Kaplan-Meier survival table. Time periods are 2 week intervals. The survivorship estimate for swift foxes in northcentral Montana was based on an average of the survival rates for each period over 1 year.

Time Period	Dates	No. At Risk	No. Deaths	No. Censored	No. New	Survival	95% Confidence Interval	
							Upper	Lower
1	24 Sept.-7 Oct. 96	5	0	0	0	1.000	1.000	1.000
2	8 Oct.-21 Oct. 96	5	0	0	3	1.000	1.000	1.000
3	22 Oct.-4 Nov. 96	8	0	0	0	1.000	1.000	1.000
4	5 Nov.-18 Nov. 96	8	0	0	1	1.000	1.000	1.000
5	19 Nov.-2 Dec. 96	9	0	0	0	1.000	1.000	1.000
6	3 Dec.-16 Dec. 96	9	0	0	0	1.000	1.000	1.000
7	17 Dec.-30 Dec. 96	9	0	0	0	1.000	1.000	1.000
8	31 Dec.-13 Jan. 97	9	1	0	0	0.889	0.696	1.082
9	14 Jan.-27 Jan. 97	8	1	0	0	0.778	0.524	1.032
10	28 Jan.-10 Feb. 97	7	0	0	0	0.778	0.506	1.050
11	11 Feb.-24 Feb. 97	7	1	0	0	0.593	0.313	0.873
12	25 Feb.-10 Mar. 97	6	0	0	0	0.593	0.290	0.896
13	11 Mar.-24 Mar. 97	6	0	0	0	0.593	0.290	0.896
14	25 Mar.-7 Apr. 97	6	1	0	0	0.342	0.120	0.564
15	8 Apr.-21 Apr. 97	5	0	0	0	0.342	0.099	0.585
16	22 Apr.-5 May 97	5	0	0	0	0.342	0.099	0.585
17	6 May-19 May 97	5	0	0	0	0.342	0.099	0.585
18	20 May-2 June 97	5	0	0	0	0.342	0.099	0.585
19	3 June-16 June 97	5	1	0	0	0.112	0.019	0.205
20	17 June-30 June 97	4	0	0	0	0.112	0.009	0.215
21	1 July-14 July 97	4	0	0	2	0.112	0.009	0.215
22	15 July-28 July 97	6	0	0	0	0.112	0.027	0.197
23	29 July-11 Aug. 97	6	0	1	0	0.112	0.027	0.197
24	12 Aug.-25 Aug. 97	5	0	0	0	0.112	0.019	0.205
25	26 Aug.-8 Sept. 97	5	0	0	0	0.112	0.019	0.205
26	9 Sept.-22 Sept. 97	5	0	0	1	0.112	0.019	0.205
27	23 Sept.-6 Oct. 97	6	0	0	0	0.112	0.027	0.197
				Mean		0.516		
				Standard Deviation		37.0		

Table 3. 1996-1997 Number (in parentheses) and percent occurrence of food items found in 65 swift fox feces in the spring, summer, and fall in northcentral Montana.

	Spring	Summer	Fall	Total
Total No. of Samples	10	23	32	65
Mammals:	90 (9)	91 (21)	91 (29)	91 (59)
Cricetidae	90 (9)	48 (11)	84 (27)	72 (47)
<i>Microtus spp.</i>	80 (8)	43 (10)	81 (26)	68 (44)
<i>Peromyscus spp.</i>	40 (4)	4 (1)	22 (7)	18 (12)
Sciuridae	10 (1)	22 (5)	0	9 (6)
<i>Spermophilus spp</i>	10 (1)	22 (5)	0	9 (6)
Heteromyidae	10 (1)	0	3 (1)	3 (2)
<i>Perognathus spp.</i>	10 (1)	0	3 (1)	3 (2)
Soricidae	0	4 (1)	0	2 (1)
<i>Sorex spp.</i>	0	4 (1)	0	2 (1)
Unidentified Mammal	0	22 (5)	6 (2)	11 (7)
Insects	50 (5)	61 (14)	75 (24)	66 (43)
Orthoptera	10 (1)	17 (4)	72 (23)	43 (28)
Coleoptera	50 (5)	57 (13)	44 (14)	49 (32)
Lepidoptera	10 (1)	4 (1)	3 (1)	5 (3)
Hemiptera	0	9 (2)	0	3 (2)
Hymenoptera	10 (1)	22 (5)	9 (3)	14 (9)
Odonata	0	0	3 (1)	2 (1)
Vegetation	60 (6)	65 (15)	31 (10)	48 (31)
Bird	60 (6)	39 (9)	19 (6)	32 (21)

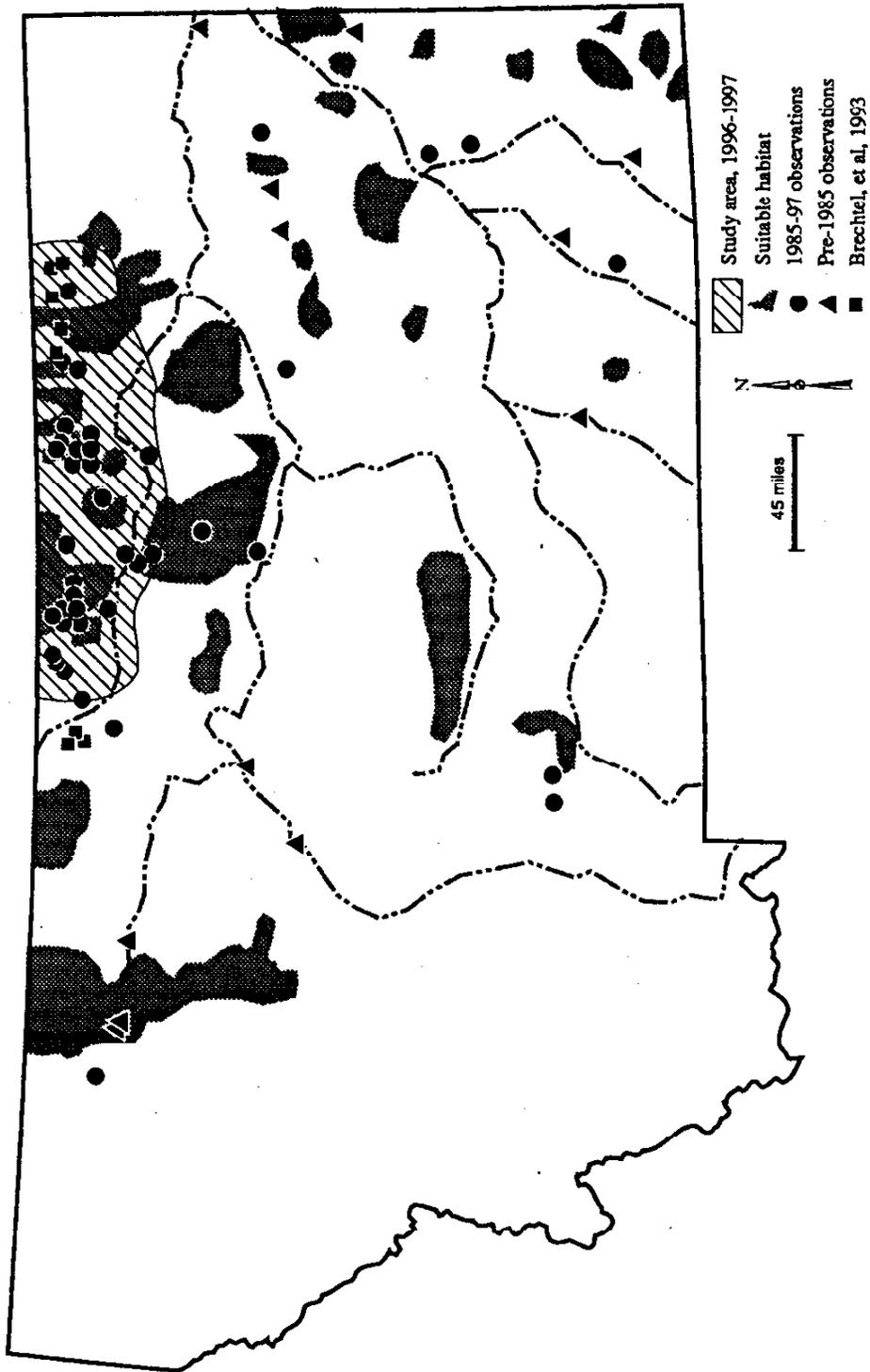


Figure 1. Location of study area and distribution of potential swift fox habitat in Montana based on vegetation and topography (map modified from Montana Natural Heritage Program records) with documented observations of swift foxes. Observations of swift foxes include pre-1985 observations, 1985-1997 observations, and observations from Brechtel et al. 1993.

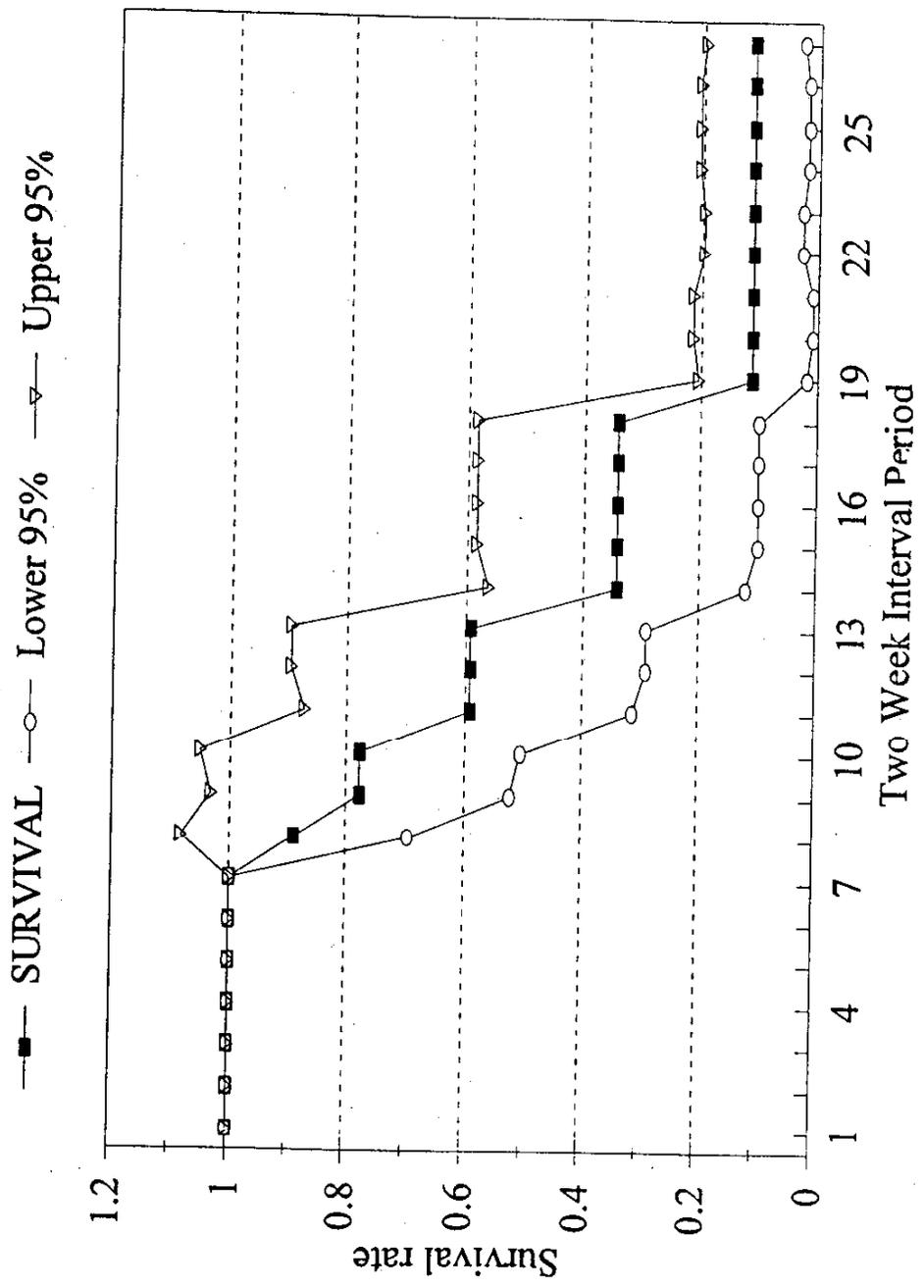


Figure 2. 1996-1997 Annual survivorship curve for 9 swift foxes in northcentral Montana. Survivorship curve generated from the staggered entry Kaplan-Meier survivorship analysis data in Table 3.

INVESTIGATION OF FURBEARER OCCURRENCE WITH SPECIAL REFERENCE TO SWIFT FOX IN NORTH DAKOTA-1997

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ABSTRACT

Sections were selected randomly and optimal quarter-sections within those sections were selected on site for survey (n=34). Furbearer occurrence was determined by identifying tracks to species. No swift fox were detected. Differential reporting rates for red fox and coyote harvests and confirmed swift fox observations indicate swift fox exist at extremely low densities if at all in North Dakota. An additional 10 quarter-sections and a corresponding non-paved public thoroughfare were selected and examined for furbearer tracks. No difference in occurrence of furbearer tracks by species in quarter-sections compared to roadsides.

INTRODUCTION

Interest in swift fox (*Vulpes velox*) has increased greatly in recent years. Swift fox were common in North Dakota during pre-settlement times (Bailey 1926, Thwaites 1953); however, the species became very rare about 1880-1900 (Bailey 1926). Swift fox are known to be very rare in North Dakota; however, data are being collected annually with which to make inference concerning the occurrence of the species. Initially southwestern North Dakota has been selected for study, because of occasional reports of possible swift fox in these areas. The objective of this report is to present the results of a survey to determine relative occurrence of all furbearer species in this area with special reference to swift fox.

STUDY AREA AND METHODS

Surveys were conducted in southwestern North Dakota in 1997. This area is primarily semi-arid prairie grassland with some intermixed cropland and hayland. Topography is generally rolling grassland to rough broken badlands; native hardwoods trees and shrubs occur in the many of the deeper coulees. Climate in North Dakota is typical of sub-arctic continental interiors with hot summers and cold winters.

Track surveys were conducted to determine relative occurrence of furbearers in each quarter section surveyed. The survey was modified from one developed by Sargeant et al. (1993). Timing of the survey minimizes errors in correctly identifying species caused by movement of young, especially in the canids.

Sections were selected randomly for study; within each section one quarter-section study area was selected at the site which had the best potential for identifying furbearer tracks. Some randomly selected sections had to be relocated to improve field logistics due to remoteness and inaccessibility of some of the original selections or proximity to human habitations. All study areas were surveyed

no sooner than 48 hours after a rain. The search pattern consisted of visiting as many locations on each study area as possible on foot within 30 minutes that had potential to reveal furbearer tracks.

Data collected for each quarter-section visited consisted of relative abundance of tracks identified by species (none, scarce, common, abundant), predominant cover type (pasture, hayland, cropland, marsh, idle), relative amount of available track sites (many, moderate, few, almost none), relative soil condition for holding tracks (excellent, good, fair, poor), and the track accumulation period (1 day, 2-3 days, 4-6 days, 7 or more days). Coyote and red fox tracks were distinguished based on size (Allen, unpubl. data). Swift fox tracks are easily distinguished from other canids, because they average about 10 mm shorter than the smallest red fox tracks (Orloff et al., 1993). Data analysis consisted of the examining the number of study areas with furbearer track occurrence by species.

A sample of 10 quarter-sections were selected and examined as above for furbearer tracks to a sample from the nearest public access roadside to that quarter-section for furbearer tracks. No paved roads were included in this testing. Search pattern consisted in examining each sample type for 30 minutes for furbearer tracks. Tracks were identified to species when possible. Differences in numbers of quarter-sections with furbearer tracks were compared to roadsides with furbearer tracks by species with Chi-square.

RESULTS

Densities of furbearer species were not determined in this study. Relative occurrence of furbearer species identified on the 34 study areas in 1997 (Table 1) consisted of coyotes (Canis latrans-6 areas), red fox (Vulpes vulpes-8 areas), raccoon (Procyon lotor-7 areas) and skunk (Mephitis mephitis-4 areas). No swift fox tracks were identified on any of the 34 study areas. No visual observation of any furbearer was made on any study area. Twenty-four of the 34 study areas contained tracks of at least 1 furbearer species.

No differences were found in the number of quarter-sections with furbearer tracks compared to corresponding roadsides for red fox ($X^2=2.028$, $df=1$, $P=0.311$) for coyotes ($X^2=2.170$, $df=1$, $P=0.141$) for raccoons ($X^2=0.608$, $df=1$, $P=0.435$), or for skunks ($X^2=0.0003$, $df=1$, $P=0.960$).

Other relative occurrence data for canids are also available in North Dakota. Since 1970 we have obtained 4 confirmed observations of swift fox in North Dakota. During that same time period there have been 695,585 red fox and 204,970 coyotes sold to North Dakota furbuyers.

DISCUSSION

Interspecific competition has been well documented between wolves (Canis lupus) and coyotes (Carbyn 1982) and between coyotes and red foxes (Sargeant et al., 1987) in the northern plains. Interspecific competition from other canids (especially coyotes) may be a significant limiting factor in currently existing swift fox populations in Kansas (L. Fox, 1994 Midwest Furbearer Workshop), and in efforts at reintroduction of swift fox in Saskatchewan (L. Carbyn, 1994 Midwest Furbearer Workshop). Ralls and White (1995) noted that although coyote predation on kit fox in California

can be severe, they found indications that red fox predation on kit fox may be catastrophic to the population. Data collected in this study indicate that many quarter-section study areas selected in North Dakota probably have red fox or coyotes or both species present. Track surveys should represent a minimum distribution, because some quarter-sections with no canid tracks observed likely had canids present. Conditions for observing tracks in North Dakota are often far from perfect; however, a few good sites in most quarter sections are all that is often needed to identify one or more species of furbearer present. Considering the hypothesis the observations of Ralls and White (1995) suggest and the density and distribution of red fox and coyotes in North Dakota, the potential for viable swift fox populations may be quite remote. This hypothesis certainly warrants further investigation.

Historically, interspecific competition may not have been as severe on swift fox prior to settlement in the region. At that time wolves were the dominant canid, and coyotes were probably very rare (Johnson and Sargeant 1977). With removal of wolves during and after settlement the canid composition changed and coyotes became more abundant, and conditions for swift fox survival may have deteriorated dramatically. If this hypothesis is correct, the probability for existence of viable natural or reintroduced swift fox populations in this area is extremely limited without major alterations to the present canid community. Alteration of the current canid community to include wolves is not a viable management option in an agricultural environment due to conflicts with livestock. Alteration of the canid community to physically remove the coyotes or red fox is not a viable management option due to prohibitive costs of neutralizing canid dispersal into the control area (Allen, unpubl. data).

Numbers of red fox and coyotes sold to North Dakota furbuyers is the minimum number of these species taken, annually. Not all animals are sold after they are taken, and not all pelts sold are sold to North Dakota furbuyers. Given the magnitude of differences of red fox and coyotes taken as compared to confirmed swift fox observations, we again question if swift fox have very much potential for survival in North Dakota considering the number and distribution of these other canids at present.

The present study also illustrates the paucity of data that is obtained from diurnal observations of live furbearers. Few are seen because of the secretive behavior of these species; however, most randomly selected quarter-section study areas with favorable conditions for locating tracks had furbearer tracks present indicating occurrence of one or more species. in the case of swift fox; however, a visual observation would be required in addition to a track observation to confirm their occurrence, and to eliminate any possible error caused by misidentification of a red fox or coyote pup track. This experimental investigation indicates that various species of furbearers occur on almost all quarter-section study areas, and occurrence of coyotes or red fox or both species is likely on many areas. Other species such as swift fox may be present, but they appear to exist at extremely low levels.

At this point it looks feasible to search public thoroughfare roadsides for tracks of furbearer species and ascertain reliable data on species composition and distribution similar to what would be found on quarter-sections or some other parcel of real estate. This would allow states with problems of access to distribution along public thoroughfares without receiving unnecessary abuse from local

private landowners. However, more data needs to be gathered from North Dakota and probably several other locations to reliably determine the potential for this method.

We identify several research needs for swift fox. We hypothesize that most survey procedures for swift fox that require a behavioral response on the part of the animal to detect this presence in an area will be shown to underestimate distributions compared to control data. This occurs because of shyness behavior in canids especially to foreign objects, lures and placed baits. The potential bias is this: if a lure (e.g. some type of bait, etc.) or object (e.g. live trap or track plate, etc.) is placed in the field and the observer does not detect the animals presence from it, does that mean the animal is not present? The answer is obviously no. In effect, then, the investigator has actually measured the response rate of the animal to the lure or object, and not necessarily the presence of the animal in the area. In addition, sample sizes are restricted, because each sample site requires 2 or more visits by the investigator to collect data effectively multiplying the man-days needed to collect data by the number of visits.

We encounter some problems with track surveys as well, because we do not always detect tracks of a species even though that species is present, and there is potential for error in correctly identifying tracks to species if inexperienced observers are used. The advantage of track surveys is that nothing special is done that requires a behavioral response on the part of the animal to detect his presence; thus, the potential for behavioral bias in the data on the part of the animal is absent. In addition, sample sizes are maximized, because the investigator only needs to visit a sample site once to obtain the desired data. We suspect that all surveys will show swift fox distributions smaller than the true distribution. However, because behavioral bias is lacking, we suspect track surveys will consistently show larger swift fox distributions with the least bias in the data.

We suggest that determining a standardized survey method that eliminates behavioral bias that can be used by all states to determine maximum distribution of swift fox should receive high priority by the SFCT. This is needed in order to make reliable comparisons of maximum distribution, and to interpret differences in distributions over broad physiographic regions or jurisdictions.

We also suggest that geneticists need to demonstrate definitively if swift fox and kit fox are separate species or merely variations of the same species living in different areas. If the 2 species are separate the case for additional research is very strong. If, however, they are the same species the data base for management increases dramatically with inclusion of all the kit fox data, and the case for endangered species classification in any form becomes very weak with inclusion of several other widely spaced life zones in the species distribution.

The most pressing research need for North Dakota is identifying the role of canid interspecific competition on swift fox. If this behavior is as strong as expected for canids in general and red fox in particular, the potential for a future population of swift fox in North Dakota is remote at best. Other data we will need to have determined from areas that have viable populations are detailed information on reproductive performance (litter sizes) by female age class, population age structure at some point during the year, and annual survival rates by age class group and sex.

LITERATURE CITED

- Allen, S. H. 1983. Comparison of red fox litter sizes determined from counts of embryos and placental scars. *J. Wildl. Manage.* 47: 860-863.
- Allen, S. H. 1987. Composition and stability of coyote families and territories in North Dakota. *Prairie Nat.* 19: 107-114.
- Bailey, V. 1926. A biological survey of North Dakota. USDA, Bur. Biol. Surv. N. Amer. Fauna No. 49, 226 pp.
- Brussard, P. F. 1985. Minimum viable populations: how many are too few? *Restoration and Manage. Notes* 3:21-25.
- Carbyn, L. N. 1982. Coyote population fluctuations and spatial distribution in relation to wolf territories in Riding Mountain National Park, Manitoba. *Can. Field Nat.* 96:176-183.
- Johnson, D. H. and A. B. Sargeant. 1977. Impact of red fox predation on the sex ratio of prairie mallards. *USFWS Wildl. Res. Rept.* 6, 56 pp.
- Orloff, S. G., A. W. Flannery, and K. C. Belt. 1993. Identification of San Joaquin kit fox (*Vulpes macrotis mutica*) tracks on aluminum tracking plates. *Calif. Fish and Game.* 79:45-53.
- Ralls, K. and P. J. White. 1995. Predation on San Joaquin kit foxes by larger canids. *J. Mammal.* 76:723-729.
- Sargeant, A. B., S. H. Allen, and J. O. Hastings. 1987. Spatial relations between sympatric coyotes and red foxes in North Dakota. *J. Wildl. Manage.* 51: 285-293.
- Sargeant, A. B., R. J. Greenwood, M. A. Sovada, and T. L. Shaffer. 1993. Distribution and abundance of predators that affect duck production-prairie pothole region. U. S. Dept. Interior, Fish and Wildl. Serv. Res. Public. 194., 96 pp.
- Thwaite, R. G. 1953. Original journals of the Lewis and Clark expedition. Arno Press (Houghton Mifflin Co.)

Table 1. Number and percent occurrence of furbearer tracks by species and county on randomly selected study sites in southwestern North Dakota - 1997

Species	County and number (%) of quarter-sections with tracks found			
	Bowman (n=19)	Slope (n=14)	Golden Valley (n=1)	Total (n=34)
Red Fox	6 (31.6)	2 (14.3)	0	8 (23.5)
Coyotes	3 (15.8)	3 (21.4)	0	6 (17.6)
Striped Skunk	4 (21.1)	0	0	4 (11.8)
Badger	1 (5.3)	0	0	1 (2.9)
Raccoon	5 (26.3)	2 (14.3)	0	7 (20.6)

SURVEY OF SWIFT FOX (*VULPES VELOX*) IN BENNETT COUNTY, SOUTH DAKOTA

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ABSTRACT

We surveyed for swift fox (*Vulpes velox*) in Bennett county, South Dakota from 24 November 1997 through 7 February 1998. Search efforts were conducted within a 900 km² (350 mi²) portion of the county. Spotlighting was conducted along six survey routes, each 8 km (5 mi) in length, that were established on unpaved, county roads using a 1.5 million candlepower commercial spotlight. No swift foxes were observed on survey routes or on roads traveled between routes. Seven species of mammals were identified during spotlight surveys: raccoon (*Procyon lotor*), black-tailed jackrabbit (*Lepus californicus*), cottontail rabbit (*Sylvilagus floridanus*), deer (*Odocoileus virginianus*, *O. hemionus*), coyote (*Canis latrans*), domestic cat (*Felis catus*), and badger (*Taxidea taxus*). Present distribution of swift fox in Bennett county may be related to the presence of other canids.

INTRODUCTION

Historically the swift fox ranged over much of the Great Plains. Although currently abundant in some portions of its range (e.g., Colorado, Kansas, and Wyoming), it is listed as a state threatened species in South Dakota (Luce and Lindzey 1996).

Over the past two years, only two adult and three juvenile swift fox were visually observed during South Dakota State University-directed search efforts in Fall River (1995) and Shannon counties (1995, 1996) in southwestern South Dakota (Dateo et al. 1996, Kruse et al. 1995). The purpose of this study was to determine and document the presence/absence of swift fox in Bennett county during winter 1997-1998, using spotlighting as the survey method.

STUDY AREA

Search efforts were conducted within a 900 km² (350 mi²) portion of Bennett county, South Dakota (Fig. 1). Sampled area reflected the typical landscape of Bennett county, which consists primarily of agricultural crops such as wheat (*Triticum aestivum*), sunflower (*Helianthus annuus*), corn (*Zea mays*), hayfields, and pasture. Native prairie and woody vegetation associated with

small creeks and streams constitute <10% of the landscape. Most agricultural fields within Bennett county range from 129-258 ha (320-640 ac) in size. Ungrazed grassland habitat is relatively rare and is primarily restricted to right-of-ways along gravel and paved section line roads. LaCreek National Wildlife Refuge is located in the southwest corner of the county. This 6,311 ha (16,410 ac) refuge has approximately 1,923 ha (5,000 ac) of wetlands with the remainder comprised of native mixed and shortgrass prairie.

Topography varies throughout the study area. The western most portion ranges from flat to moderately rolling hills. The central and eastern sections also are predominately flat. The amount of intensive, row crop farming is greatest (over 70%) in the central and eastern portions, compared to the western third of the study area (50%).

METHODS

Verified sightings and associated information for swift foxes were obtained for Bennett county (T. Beck, South Dakota Dept. Game, Fish and Parks, Martin, SD; pers. comm.). Six survey routes, each 8 km (5 mi) in length, were established near locations of verified sightings of swift fox, with the last verified sighting occurring in 1993 (T. Beck, South Dakota Dept. Game, Fish and Parks, Martin, SD; pers. comm.). Routes consisted exclusively of unpaved section roads. These routes were located at least 3.2 km (2.0 mi) from Martin, South Dakota, in rural areas; the number of residences per route ranged from 1-3 (mean = 2.2). Local residents, LaCreek NWR employees, sheriff's department employees, and the Bennett county wildlife conservation officer were notified prior to conducting surveys.

Spotlighting was conducted using a 1.5 million candlepower commercial spotlight. The field of vision ranged from 25-100 m (27.3-109.4 yd) depending upon topography and height of vegetation. Over 75% of each route had vegetation <20 cm (7.8 in) in height. One side of the road was scanned and the opposite side of the road was scanned on the return trip. Travel speed ranged from 40-48 kph (25-30 mph). When animals were detected, the vehicle was stopped and species and number of individuals documented with the aid of binoculars. All mammalian species observed, as well as the time and location on the route (to the nearest 0.16 km (0.1 mi), were recorded.

Swift fox activity usually commences at sunset and ceases at sunrise with considerable variation noted throughout the night (Morrell 1972, Hines and Case 1991). Greatest activity, as measured by distance moved, generally takes place between 2000 hr and 2100 hr (Hines and Case 1991). Our surveys were conducted between 1645 hr and 0100 hr.

All routes were surveyed each night spotlighting was conducted. Surveys were conducted for three consecutive nights per week. Starting time and order in which routes were surveyed varied each night; during a week each route was usually surveyed 0.5 hr to 2.0 hr earlier or later than the previous night.

RESULTS AND DISCUSSION

Spotlighting surveys were conducted from 24 November 1997 through 7 February 1998. A total of 2,528 km were traveled on survey routes. No swift foxes were observed on survey routes or on roads traveled between routes. However, seven species of mammals were identified during spotlight surveys (Table 1). Deer (*Odocoileus virginianus*, *O. hemionus*) (n = 311) were the most frequently encountered species during surveys. The most frequently observed mammalian carnivores were coyotes (*Canis latrans*) (n = 37). Many observations of mammals were likely repeat sightings due to the method of data collection.

Coyotes were observed on all survey routes, which confirmed that these canids were common within the area. Coyotes likely influence the distribution of swift foxes via direct contact (i.e., predation) or through competition for food resources (see Ralls and White 1995). Other researchers have documented that coyotes can negatively impact red fox (*Vulpes vulpes*) (Sargeant et al. 1987, Sovada et al. 1995) and speculated they also may influence swift fox distribution (Sovada and Roy 1996).

It is possible that swift foxes went undetected during spotlighting efforts. However, we did observe several similar sized mammals such as cats (*Felis catus*), badgers (*Taxidea taxus*), and lagomorphs (*Sylvilagus floridanus*, *Lepus californicus*) at distances of 25-50 m. Thus, even if rare, it seemed unlikely that any swift fox in the area would have gone undetected during this survey. However, because of the occurrence of swift fox in Bennett county during recent years, followup surveys, using additional techniques, should be conducted to corroborate these results.

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LITERATURE CITED

- Dateo, D. M., J. A. Jenks, E. Dowd Stukel, and C. S. DePerno. 1996. Survey of swift fox (*Vulpes velox*) on Pine Ridge Oglala Sioux Indian Reservation, Shannon county, South Dakota. Misc. Report. South Dakota State Univ., Dept. of Wildlife and Fisheries Sciences. 7pp.
- Hines, T. D., and R. M. Case. 1991. Diet, home range, movements, and activity periods of swift fox in Nebraska. *Prairie Naturalist* 23:131-138.
- Kruse, K. W., J. A. Jenks, and E. Dowd Stukel. 1995. Presence of swift fox (*Vulpes velox*) in southwestern South Dakota. Pages 91-99 in Allen, S.H., J.W. Hoagland, and E. Dowd Stukel, eds. Report of the swift fox conservation team, 1995. North Dakota Game and Fish Dept., Bismarck, ND 170pp.
- Luce, B. and F. Lindzey. 1996. Annual report of the swift fox conservation team, 1996. Wyoming Game and Fish Dept., Lander, WY. 110pp.
- Morrell, S. 1972. Life history of The San Joaquin kit fox. *Calif. Fish Game* 58:162-174.
- Ralls, K., and P. J. White. 1995. Predation on San Joaquin kit foxes by larger canids. *J. Mammal.* 76:723-729.
- Scott-Brown, J. M., S. Herrero, and J. Reynolds. 1987. Swift fox. Pages 433-441 in Novak, M., J. A. Baker, M. E. Obbard, and B. Mallo, eds., *Wild furbearer management and conservation in North America*. Ministry of Natural Resources, Toronto, Ontario.
- Sargeant, A.B., S.H. Allen, and J.O. Hastenings. 1987. Spatial relationships between sympatric coyotes and red foxes in North Dakota. *J. Wildl. Manage.* 39:30-39.
- Sovada, M. A. and C. C. Roy. 1996. Summary of swift fox research activities conducted in western Kansas - annual report. Northern Prairie Science Center, Biological Resources Division, U.S. Geological Survey. Jamestown, ND.
- Sovada, M. A., A. B. Sargeant, and J. W. Grier. 1995. Differential effects of coyotes and red foxes on duck nest success. *J. Wildl. Manage.* 59:1-9.

Table 1. Mammalian species observed during spotlight surveys in Bennett County, South Dakota, 24 November 1997 to 7 February 1998.

Species	Frequency	Number/1000km
Swift Fox (<i>Vulpes velox</i>)	0	0.000
Raccoon (<i>Procyon lotor</i>)	8	3.165
Black-tailed Jackrabbit (<i>Lepus californicus</i>)	9	3.560
Deer (<i>Odocoileus virginianus</i> / <i>O. hemionus</i>)	311	123.022
Coyote (<i>Canis latrans</i>)	37	14.636
Cottontail Rabbit (<i>Sylvilagus floridanus</i>)	10	3.956
Domestic cat (<i>Felis catus</i>)	7	2.769
Badger (<i>Taxidea taxus</i>)	4	1.582