Risks of Chlorophacinone Use on Black Tailed Prairie Dogs to Federally Endangered and Threatened Species

Pesticide Effects Determinations
PC Code: 067707
CAS Number: 3691-35-8

Environmental Fate and Effects Division
Office of Pesticide Programs
Washington, D.C. 20460

September 29, 2010

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Acknowledgement

We would like to acknowledge the contributions of Garland Waleko and Nathan Miller in compiling detailed life history information on many of the threatened and endangered species. Additionally, the EFED Litigation Steering Committee has provided invaluable guidance toward achieving greater consistency in format and content between chemicals being assessed. Finally we would like to acknowledge members of the review panel for their careful review of this document. The members of the review panel for this assessment were Shannon Borges, Bill Jacobs, Alicia Korol, Ed Odenkirchin, and Ingrid Sunzenauer.

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List of Commonly Used Abbreviations and Nomenclature

ºC	Symbol for "degrees Celsius"
a.i.	Active Ingredient
AIMS	Avian Monitoring Information System
Acc#	Accession Number
Amu	Atomic Mass Unit
BCF	Bioconcentration Factor
BEAD	Biological and Economic Analysis Division
BTPD	Black tailed prairie dog
Bw	Body Weight
CI	Confidence Interval
CL	Confidence Limit
EC_{50}	50% (or Median) Effect Concentration
ECOTOX	EPA managed database of Ecotoxicology data
EEC	Estimated Environmental Concentration
EFED	Environmental Fate and Effects Division
e.g.	Latin *exempli gratia* ("for example")
EIM	Environmental Information Management System
et al.	Latin *et alii* ("and others")
etc.	Latin *et cetera* ("and the rest" or "and so forth")
FIFRA	Federal Insecticide Fungicide and Rodenticide Act
FQPA	Food Quality Protection Act
Ft	Feet
g/day	Grams per day
GENEEC	Generic Estimated Exposure Concentration model
i.e.	Latin for *id est* ("that is")
Kg	Kilogram(s)
Km	Kilometer(s)
Kd	Solid-water Distribution Coefficient
KF	Freundlich Solid-Water Distribution Coefficient
K_{OC}	Organic-carbon Partition Coefficient
K_{OW}	Octanol–water Partition Coefficient
LAA	Likely to Adversely Affect
lb a.i./A	Pound(s) of active ingredient per acre
LC_{50}	50% (or Median) Lethal Concentration

LD_{50}	50% (or Median) Lethal Dose
LOAEC	Lowest Observable Adverse Effect Concentration
LOAEL	Lowest Observable Adverse Effect Level
LOC	Level of Concern
LOD	Level of Detection
LOQ	Level of Quantitation
M	Meter(s)
MA	May Affect
Mg	Milligram(s)
mg/kg	Milligrams per kilogram (equivalent to ppm)
mg/L	Milligrams per liter (equivalent to ppm)
mL/g	Milliliters per gram
Mi	Mile(s)
mmHg	Millimeter of mercury
MRID	Master Record Identification Number
MW	Molecular Weight
n/a	Not applicable
NAWQA	National Water Quality Assessment
NCOD	National Contaminant Occurrence Database
NE	No Effect
NLAA	Not Likely to Adversely Affect
NOAEC	No Observable Adverse Effect Concentration
NOAEL	No Observable Adverse Effect Level
NOEC	No Observable Effect Concentration
OCSPP	Office of Chemical Safety and Pollution Prevention
OPP	Office of Pesticide Programs
ORD	Office of Research and Development
PCE	Primary Constituent Element
ppb	Parts per Billion (equivalent to µg/L or µg/kg)
ppm	Parts per Million (equivalent to mg/L or mg/kg)
PRD	Pesticide Re-Evaluation Division
RQ	Risk Quotient
SLN	Special Local Need
TGAI	Techinical grade active ingredient
USDA	United States Department of Agriculture
USEPA	United States Environmental Protection Agency

USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
Wt	Weight

1. Executive Summary

1.1. Purpose of Assessment

The purpose of this assessment is to evaluate potential direct and indirect effects on federally listed threatened and endangered (listed) species and potential effects to designated critical habitat, arising from FIFRA regulatory actions regarding use of chlorophacinone to control black-tailed prairie dogs (BTPDs). This assessment was completed in accordance with the U.S. Fish and Wildlife Service (USFWS) and National Marine Fisheries Service (NMFS) *Endangered Species Consultation Handbook* (USFWS/NMFS, 1998), procedures outlined in the Agency's Overview Document (USEPA, 2004a). This ecological risk assessment and effects determination is conducted specific to Rozol Prairie Dog Bait (EPA Reg. No. 7173-286) to address potential product-specific risks raised in pending litigation[1].

1.2. Scope of Assessment

1.2.1. Use Assessed

Chlorophacinone is an anticoagulant rodenticide. Chlorophacinone end-use products include tracking powder, bait blocks, pelleted baits, and grain baits. Chlorophacinone is used to control house mice, Norway rats, roof rats, pocket gophers, voles, ground squirrels, mountain beavers, jack rabbits, wood rats, chipmunks, deer mice and BTPDs. This assessment addresses the one chlorophacinone end-use product registered for use to control BTPDs. This use is the federal action evaluated in this assessment. This chlorophacinone product, Rozol Prairie Dog Bait (EPA registration number 7173-286), is formulated as a loose grain bait with a concentration of 50 mg a.i./kg-bait active ingredient (a.i.) chlorophacinone and is only permitted for use on BTPDs in Colorado, Kansas, Montana, Nebraska, New Mexico, North Dakota, Oklahoma, South Dakota, Texas and Wyoming. The bait is applied by hand at a rate of ¼ cup (53 grams) of bait, at least 6 inches down into the active BTPD burrows. Based on the assessed label, two carcass searches are to occur after application, the first being 5 to 10 days post-application and the second being 14-21 days post-application. Primary and secondary exposure to non-target animals is possible based on this use pattern. If all active BTPD burrows receive the application, the effective application rate is 0.00058 lbs a.i./A given a maximum of 100 burrows per acre (King 1959).. No bait is to be left on the soil surface at the time of application. The applicator must retrieve and dispose of any bait that is spilled above ground or placed less than 6 inches down the burrow entrance. A second application may be made if BTPD activity persists several weeks or months after the initial bait application. Chlorophacinone uncouples oxidative phosphorylation depressing hepatic synthesis of prothrombin and clotting factors VII, IX, and X and it causes direct damage to capillary permeability. The ultimate effect is widespread internal hemorrhage. In rodents, this type of rodenticide also causes neurologic and cardiopulmonary injuries which often lead to death before hemorrhage occurs.

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[1] Defenders of Wildlife v. U.S. EPA, Case No. 09-1199 (D.C. Cir., 2009); Defenders of Wildlife v. Jackson, Case No. 09-cv-1814 (D.D.C., 2009); NRDC v. U.S. EPA, Case No. 10-cv-1063, (D.D.C., 2010).

EPA notes that several changes to the label of Rozol Prairie Dog Bait (EPA reg. no. 7173-286) were approved on September 10, 2010. These changes consist of including: (1) a requirement that carcass searches start within 4 days, rather than within 5 to 10 days of application; (2) a requirement that such searches continue at 1-2 day intervals, for two weeks or potentially longer, as opposed to just a second repeat search at the 14-21 day interval; and (3) language that permits alternative carcass disposal to burial, where burial is impractical and the alternative disposal will ensure no access by scavengers. While EPA expects these label changes will reduce the potential for exposure of non-target species to chlorophacinone this potential reduction does not quantitatively alter EPA's ecological risk assessment, nor does it alter EPA's effects determinations relative to the use of Rozol Prairie Dog Bait (EPA reg. no. 7173-286). Adherence to these label changes will reduce the probability that contaminated prairie dogs or carcasses will be available to non-target species. However, these changes will not eliminate such availability nor will these changes eliminate the potential for non-target species to be directly exposed to bait in the burrows or exposed to bait that reaches the surface. While these label changes cannot preclude effects likely to adversely affect individuals of a non-target species, the reduction in the likelihood of such effects occurring should be considered by the US Fish and Wildlife Service when considering whether the potential effects will or will not constitute jeopardy to any of the species potentially exposed.

1.2.2. Environmental Fate Properties of Chlorophacinone

Chlorophacinone is hardly mobile in soils and other organic matrices (K_{OC} = 15600-95745 mL/g) and nearly insoluble (34 mg/L). Chlorophacinone is formulated as a grain bait for this use and is expected to remain within the bait due to its immobility. Chlorophacinone would also be immobile if it were to be soil incorporated. Based on its fate parameters measureable exposure to aquatic environments is not expected to occur. It is the operating assumption of this assessment that the fate of chlorophacinone in the environment from this use is entirely associated with the grain bait formulation.

1.2.3. Evaluation of Degradates and Stressors of Concern

Though degradates (*i.e.* o-phthalic acid and p-chlorophenylphenyl acetic acid) have been detected in environmental fate studies, they will not be considered further in this assessment. These environmental fate studies were performed using the technical grade active ingredient (TGAI) rather than the bait formulation relevant to this assessment. Due to chlorophacinone’s immobility in soil, it is also reasonable to conclude it is immobile within bait formulations. Chlorophacinone baits retain the parent compound even after exposure to wet weather and moisture (Merson and Byers 1985). However, photodegradation occurs in a dry environment and the bait is in a dry environment. Degradates were not evaluated in carcass studies and based on this lack of data, it is assumed that the degradates are equi-toxic to the parent compound. Therefore this risk assessment will be conducted as if the parent is undegraded in the bait.

1.3. Assessment Procedures

1.3.1. Exposure Assessment

All listed species within the U.S. were considered in this assessment. Exposures that may occur are limited to exposure through consumption of chlorophacinone grain bait (primary exposure) or exposure through consumption of animals/prey/carcasses that have consumed chlorophacinone grain bait (secondary exposure). Exposure can only occur if: 1) the species distribution overlaps or borders the distribution area of BTPDs where Rozol Prairie Dog Bait (EPA Reg. No. 7173-286) can be used; and 2) species occur in terrestrial habitats. Twenty one species meet these two criteria. Those species are: grizzly bear (*Ursus arctos horribilis*), American burying beetle (*Nicrophorus americanus*), Salt Creek tiger beetle (*Cicindela nevadica lincolniana*), California condor (*Gymnogyps californianus*), whooping crane (*Grus americana*), Eskimo curlew (*Numenius borealis*), northern Aplomado falcon (*Falco femoralis septentrionalis*), black footed ferret (*Mustela nigripes*), Chiricahua leopard frog (*Rana chiricahuensis*), jaguar (*Panthera onca*), Gulf Coast jaguarundi (*Herpailurus yagouaroundi cacomitli*), Canada lynx (*Lynx Canadensis*), Preble's meadow jumping mouse (*Zapus hudsonius preblei*), ocelot (*Leopardus pardalis*), Mexican spotted owl (*Strix occidentalis lucida*), piping plover (*Charadrius melodus*), New Mexican ridge-nosed rattlesnake (*Crotalus willardi obscurus*), Sonora tiger salamander (*Ambystoma tigrinum stebbinsi*) black-capped vireo (*Vireo atricapilla*), golden-cheek warbler (*Dendroica chrysoparia*), and gray wolf (*Canis lupus*). Species overlap with BTPD range is demonstrated in **Appendix A**. Federally-designated critical habitat[2] has been established for nine of these 21 species. Primary constituent elements[3] (PCEs) were used to evaluate whether chlorophacinone has the potential to modify designated critical habitat.

1.3.1.a. Aquatic Exposure

Based on the physical/chemical properties of Rozol Prairie Dog Bait, chlorophacinone exposure to aquatic environments is not expected to occur. Previous assessments are consistent with this conclusion and are further discussed and referenced in **Section 2.4**.

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[2] 'Critical habitat' is defined in the ESA as the geographic area occupied by the species at the time of the listing where the physical and biological features necessary for the conservation of the species exist, and there is a need for special management to protect the listed species. It may also include areas outside the occupied area at the time of listing if such areas are 'essential to the conservation of the species.' Critical habitat receives protection under Section 7 of the ESA through prohibition against destruction or adverse modification with regard to actions carried out, funded, or authorized by a federal Agency. Section 7 requires consultation on federal actions that are likely to result in the destruction or adverse modification of critical habitat. To be included in a critical habitat designation, the habitat must be 'essential to the conservation of the species.'

[3] Critical habitat designations identify, to the extent known using the best scientific and commercial data available, habitat areas that provide essential life cycle needs of the species or areas that contain certain primary constituent elements (PCEs) (as defined in 50 CFR 414.12(b)). PCEs include, but are not limited to, space for individual and population growth and for normal behavior; food, water, air, light, minerals, or other nutritional or physiological requirements; cover or shelter; sites for breeding, reproduction, rearing (or development) of offspring; and habitats that are protected from disturbance or are representative of the historic geographical and ecological distributions of a species. Information specific to each species is provided in each ESA.

1.3.1.b. Terrestrial Exposure

Terrestrial exposure is assessed based on two exposure routes: 1) exposure to chlorophacinone grain bait; and 2) exposure to animals/prey/carcasses poisoned by chlorophacinone grain bait. The active ingredient concentrations for the two exposure routes are respectively determined from: 1) labeled active ingredient concentration of the grain bait; and 2) conservative residue concentrations from chlorophacinone poisoned carcass studies. For residue concentrations, exposure to BTPDs and non-target granivores exposed to chlorophacinone bait are considered. The estimated environmental concentration (EEC) is derived by multiplying the active ingredient concentration in the food item by the food ingestion rate for a given species.

1.3.2. Toxicity Assessment

Assessment endpoints are limited to direct and indirect effects associated with survival, growth, and reproduction. The effects determination assessment endpoints include direct toxic effects on survival, as well as indirect effects including reduction of the prey base or modification of habitat. Mammalian toxicity data do not characterize growth and reproduction effects because mortality effects occur before these effects are seen in mammals. Data informing effects to avian reproduction are unavailable for this assessment. These data were requested from the registrant but have not been received. As noted in the Overview Document (USEPA, 2004a), the Agency relies on acute and chronic effects endpoints that are either direct measures of impairment of survival, growth, or reproduction or endpoints for which there is a scientifically robust, peer reviewed relationship that can quantify the impact of the measured effect endpoint on the assessment endpoints of survival, growth, and reproduction. Data addressing chronic toxicity are currently not available for chlorophacinone. For the purposes of this assessment, risk cannot be precluded to any assessed bird, mammal or herptile if exposure is expected to occur.

Direct effects to listed species were determined by multiplying the active ingredient concentration in the food item by the ingestion rate for a given species to determine how much of the food item would have to be ingested to attain a toxic dose. There are no direct effects caused by toxicity to aquatic taxa because exposure does not occur. However, indirect effects based on loss of terrestrial prey items and habitat modification based on loss of rodent burrows were assessed.

The Agency evaluated registrant-submitted studies and data from the open literature to characterize chlorophacinone toxicity. The most sensitive toxicity value available from acceptable or supplemental studies for each taxon relevant for estimating potential risks to the listed species and/or their designated critical habitat was used to assess risk. The ecotoxicity data used in this assessment, including ECOTOX data and literature submitted to the public docket during the comment period for “Receipt of Petition Requesting EPA to Suspend the Registration of Rozol Prairie Dog Bait and Cancel Certain Application Sites” (EPA-HQ-OPP-2009-0684-0001), are summarized in **Section 2.8.1.** Literature submitted to the docket is cited in **Appendix D.**

1.3.3. Measures of Risk

Risk quotients (RQs) were compared to the Agency's Levels of Concern (LOC) for terrestrial endangered species to identify instances where chlorophacinone use to control BTPDs has the potential to adversely affect threatened and endangered species or modify their designated critical habitat, if the species has designated critical habitat. When RQs for a particular type of effect are below the LOC, chlorophacinone is considered to have "no effect" (NE) on the species or its designated critical habitat. Where RQs exceed the LOC, a potential to cause adverse effects or habitat modification is identified, leading to a conclusion of "may affect" (MA). If chlorophacinone use to control BTPDs may affect the listed species, and/or may cause effects to designated critical habitat, the best available information is considered to refine the potential for exposure and effects, and distinguish actions that are Not Likely to Adversely Affect (NLAA) from those that are Likely to Adversely Affect (LAA).

1.4. Summary of Conclusions

Geospatial analysis indicates that the chlorophacinone action area which corresponds to BTPD range either overlaps or borders the range of all 21 threatened and endangered species that may be affected by this use. Based on the best available information, the Agency makes a MA determination for the use of chlorophacinone to control BTPDs for the following 21 species based on direct effects: grizzly bear, American burying beetle, Salt Creek tiger beetle, California condor, whooping crane, Eskimo curlew, northern Aplomado falcon, black-footed ferret, Chirichaua leopard frog, jaguar, Gulf Coast jaguarundi, Canada lynx, Preble's meadow jumping mouse, ocelot, Mexican spotted owl, piping plover, New Mexican ridge-nosed rattlesnake, Sonora tiger salamander, black-capped vireo, golden-cheeked warbler, and the gray wolf. Additionally, the Agency has determined that there is the potential for modification of designated critical habitat from the use of the chemical. Potential modification of critical habitat occurs for the following species: Salt Creek tiger beetle, whooping crane, Canada lynx, Preble's meadow jumping mouse, Mexican spotted owl, piping plover, and the New Mexican ridge-nosed rattlesnake.

Based on the predicted environmental exposures, chlorophacinone is likely to adversely affect via direct effects the following species: grizzly bear, American burying beetle, Salt Creek tiger beetle, California condor, whooping crane, Eskimo curlew, northern Aplomado falcon, black-footed ferret, Chirichaua leopard frog, jaguar, Gulf Coast jaguarundi, Canada lynx, Preble's meadow jumping mouse, ocelot, Mexican spotted owl, piping plover, Sonora tiger salamander, black-capped vireo, golden-cheeked warbler, and the gray wolf. Based on the predicted environmental exposures to prey base species, chlorophacinone is likely to adversely affect via indirect effects the following species: grizzly bear, American burying beetle, whooping crane, Eskimo curlew, northern Aplomado falcon, black-footed ferret, Chiricahua leopard frog, Preble's meadow jumping mouse, New Mexican ridge-nosed rattlesnake, Sonora tiger salamander, and the gray wolf. The black footed ferret is likely to be adversely affected via indirect effects due to loss of potential burrow habitat. Preble's meadow jumping mice do not appear to use the burrows of other rodents therefore making it unlikely that this species would be adversely affected by loss of burrow habitat. Chlorophacinone use to control BTPDs is expected to result in modification of the critical habitat PCEs for the following listed species: Salt Creek tiger beetle, California condor, whooping crane, Canada lynx, Preble's meadow jumping mouse, Mexican spotted owl, piping plover, New Mexican ridge-nosed rattlesnake, and gray wolf. A summary of the risk conclusions and effects determinations for the 21 listed species and the critical habitat for the Salt Creek tiger beetle, California condor, whooping crane, Canada lynx, Preble's meadow jumping mouse, Mexican spotted owl, piping plover, New Mexican ridge-nosed rattlesnake, and the gray wolf is presented in **Table 1.1** and **Table 1.2**. Further information on the results of the effects determination is included as part of the Risk Description in **Section 5.2**.

Table 1.1 Effects Determination Summary for Effects of Chlorophacinone to 21 Endangered Species.

Species	Effects Determination	Basis for Determination	
		Direct Effects	**Indirect Effects**
Grizzly bear	LAA[1]	Direct effects are expected for the grizzly bear based on the potential for this species to consume the chlorophacinone bait (RQ of 75.42 which exceeds the LOC of 0.1) or other prey items that may have consumed the chlorophacinone bait (RQ of 3.38 for exposure to BTPDs and RQ of 8.75 for exposure to non-target animals, both which exceed the LOC of 0.1). Growth and reproductive effects cannot be precluded due to the absence of chronic data; however, growth and reproductive effects are not expected because mortality typically occurs as a result of acute exposure.	Indirect effects from the loss of the prey base are also expected because effects to individuals within populations have been demonstrated in mammals ranging in size from 13 to 36,363 grams with RQ ranging from 19 to 41. No indirect effects from habitat loss are expected because this species does not use BTPD burrows.
American burying beetle	LAA	Reproductive effects are expected for the American burying beetle. The American burying beetle uses mammalian and avian carcasses as a food resource during their reproduction cycle. Dosed carcasses negatively affected number of emerged beetles (MRID 47383001).	Indirect effects from the loss of the prey base are expected because effects to individuals within populations have been demonstrated in mammals, birds, and terrestrial invertebrates. No indirect effects from habitat loss are expected because this species does not use BTPD burrows.
Salt creek tiger beetle	LAA	Reproductive effects are expected for the Salt Creek tiger beetle. Salt Creek tiger beetle larvae are potentially exposed to chlorophacinone residues through chlorophacinone exposed terrestrial invertebrates. Dosed carcasses in a burying beetle study negatively affected number of emerged beetles (MRID 47383001). Similar affects are expected for the Salt Creek tiger beetle.	No indirect effects from loss of prey base are expected because this species' habitat is distinct from BTPD habitat. This species uses mud banks of streams and seeps in association with saline wetlands and exposed mud flats of saline wetlands which is distinct from the short grass prairie associated with BTPD habitat. No indirect effects from habitat loss are expected because this species does not use BTPD burrows.
California condor	LAA	Direct effects to the California condor are expected through their potential exposure to prey items that may have consumed the chlorophacinone bait (RQ of 0.104 for exposure to non-target animals which exceeds the LOC of 0.1). Growth and reproductive effects cannot be precluded due to the absence of chronic data.	No indirect effects from the loss of prey base are expected because this species' range does not overlap with the BTPD range. No indirect effects from habitat loss are expected because this species does not use BTPD burrows.
Whooping crane	LAA	Direct effects to the whooping crane are expected to occur based on the potential for this species to consume the chlorophacinone bait (RQ of 0.89 which exceeds the LOC of 0.1) or other prey items that may have consumed the chlorophacinone bait (RQ of 0.104 for	Indirect effects from the loss of the prey base are expected because effects to individuals within populations have been demonstrated in mammals, birds, and terrestrial invertebrates. No indirect effects from habitat loss are expected

		exposure to non-target animals which exceeds the LOC of 0.1). Growth and reproductive effects cannot be precluded due to the absence of chronic data.	because this species does not use BTPD burrows.
Eskimo curlew	LAA	Direct effects to the Eskimo curlew are expected to occur based on the potential for this species to consume prey items that have consumed the chlorophacinone bait (RQ of 0.104 for exposure to non-target animals, which is used as a surrogate for invertebrate prey, which exceeds the LOC of 0.1). Growth and reproductive effects cannot be precluded due to the absence of chronic data.	Indirect effects from the loss of the prey base are expected because effects to individuals within populations have been demonstrated in terrestrial invertebrates. No indirect effects from habitat loss are expected because this species does not use BTPD burrows.
Northern Aplomado falcon	LAA	Direct effects to the northern Aplomado falcon are expected through their potential exposure to prey items that may have consumed the chlorophacinone bait (RQ of 0.104 for exposure to non-target animals which exceeds the LOC of 0.1). Growth and reproductive effects cannot be precluded due to the absence of chronic data	Indirect effects from the loss of the prey base are expected because effects to individuals within populations have been demonstrated in mammals, birds, and terrestrial invertebrates. No indirect effects from habitat loss are expected because this species does not use BTPD burrows.
Black-footed ferret	LAA	Direct effects are expected for the black-footed ferret based on the potential for this species to consume prey items that may have consumed the chlorophacinone bait (RQ of 7.45 for exposure to BTPDs and RQ of 19.29 for exposure to non-target animals, both which exceed the LOC of 0.1). Significant exposure is expected to occur because black-footed ferrets prey primarily on BTPDs. Growth and reproductive effects cannot be precluded due to the absence of chronic data; however, growth and reproductive effects are not expected because mortality typically occurs as a result of acute exposure.	Indirect effects from the loss of the prey base are expected because effects to individuals within populations have been demonstrated in mammals, birds, and terrestrial invertebrates. In addition, this species preys almost exclusively on BTPDs. Indirect effects from habitat loss are expected because this species uses BTPD burrows.
Chirichaua leopard frog	LAA	Direct effects to the Chirichaua leopard frog are expected to occur based on the potential for this species to consume prey items that may have consumed the chlorophacinone bait (RQ of 0.104 for exposure to non-target animals, which is used as a surrogate for invertebrate prey, which exceeds the LOC of 0.1). Growth and reproductive effects cannot be precluded due to the absence of chronic data.	Indirect effects from the loss of the prey base are expected because effects to individuals within populations have been demonstrated in terrestrial invertebrates and birds. No indirect effects from habitat loss are expected because this species does not appear to use BTPD burrows.
Jaguar	LAA	Direct effects are expected for the jaguar based on the potential for this species to consume prey items that may have consumed the chlorophacinone bait (RQ of 12.69 for exposure to BTPDs and RQ of 32.85 for exposure to non-target	No indirect effects from the loss of the prey base are expected because this species' habitat is distinct from the BTPD habitat. Jaguars – particularly males of the northern reaches – are known to have large

		animals, both which exceed the LOC of 0.1). Growth and reproductive effects cannot be precluded due to the absence of chronic data; however, growth and reproductive effects are not expected because mortality typically occurs as a result of acute exposure.	home ranges that encompass a variety of plant communities, including: Maderan evergreen-woodland, subalpine conifer forest, semidesert shrubland, and Sonoran desert scrub. Washes and riparian areas with dense vegetative growth may also be valuable movement corridors. These habitats are distinct from the short grass prairie associated with BTPD habitat. No indirect effects from habitat loss are expected because this species does not use BTPD burrows.
Gulf Coast jaguarundi	LAA	Direct effects are expected for the Gulf Coast jaguarundi based on the potential for this species to consume prey items that may have consumed the chlorophacinone bait (RQ of 9.20 for exposure to BTPDs and RQ of 23.82 for exposure to non-target animals, both which exceed the LOC of 0.1). Growth and reproductive effects cannot be precluded due to the absence of chronic data; however, growth and reproductive effects are not expected because mortality typically occurs as a result of acute exposure.	No indirect effects from the loss of the prey base are expected because this species' habitat is distinct from the BTPD habitat. This species is found in chaparral plant communities and dense brushy areas near streams and rivers which are distinct from the short grass prairie associated with BTPD habitat. No indirect effects from habitat loss are expected because this species does not use BTPD burrows.
Canada lynx	LAA	Direct effects to the Canada lynx are expected to occur based on the potential for this species to consume prey items that may have consumed the chlorophacinone bait (RQ of 23.30 for exposure to non-target animals and RQ of 9.00 for exposure to BTPDs both of which exceed the LOC of 0.1). Growth and reproductive effects cannot be precluded due to the absence of chronic data; however, growth and reproductive effects are not expected because mortality typically occurs as a result of acute exposure.	No indirect effects from loss of prey base are expected because this species' habitat is distinct from BTPD habitat. The Canada lynx is associated with the southern, transitional reaches of the cool and moist boreal forest. Where it occurs at these lower latitudes, the boreal forest forms a mixed conifer and conifer-hardwood landscape. These habitat areas are distinct from the short grass prairie associated with BTPD habitat. No indirect effects from habitat loss are expected because this species does not use BTPD burrows.
Preble's meadow jumping mouse	LAA	Direct effects to the Preble's meadow jumping mouse are expected to occur based on the potential for this species to consume the chlorophacinone bait (RQ of 41.35 which exceeds the LOC of 0.1). Growth and reproductive effects cannot be precluded due to the absence of chronic data; however, growth and reproductive effects are not expected because mortality typically occurs as a result of acute exposure.	Indirect effects from the loss of the prey base are expected because effects to individuals within populations have been demonstrated in terrestrial invertebrates. Although this species makes nests both above and below ground. It does not appear to use other species' burrows.
Ocelot	LAA	Direct effects are expected for the ocelot based on the potential for this species to	No indirect effects from loss of prey base are expected because this

		consume prey items that have may consumed the chlorophacinone bait (RQ of 10.41 for exposure to BTPDs and RQ of 26.96 for exposure to non-target animals, both which exceed the LOC of 0.1). Growth and reproductive effects cannot be precluded due to the absence of chronic data; however, growth and reproductive effects are not expected because mortality typically occurs as a result of acute exposure.	species' habitat is distinct from BTPD habitat. Ocelots appear to use areas of dense cover, and in the northern part of the range hunt in brushy forests and semi-arid deserts. In the southern part of its range, ocelot habitat includes tropical forests, mountain slopes, and pampas (grasslands). These habitat areas are distinct from the short grass prairie associated with BTPD habitat. No indirect effects from habitat loss are expected because this species does not use BTPD burrows.
Mexican spotted owl	LAA	Direct effects to the Mexican spotted owl are expected to occur based on the potential for this species to consume prey items that may have consumed the chlorophacinone bait (RQ of 0.104 for exposure to non-target animals which exceeds the LOC of 0.1). Growth and reproductive effects cannot be precluded due to the absence of chronic data.	No indirect effects from loss of prey base are expected because this species' habitat is distinct from BTPD habitat. Mexican spotted owls are found in old-growth or mature forests with unevenly aged stands of trees, high canopy, multi-storied levels, and high tree density as well as canyons with riparian or conifer communities. In Arizona and New Mexico they are found in habitats associated with mixed conifer, pine-oak, Arizona cypress, oak woodlands, and associated riparian forests. These habitat areas are distinct from the short grass prairie associated with BTPD habitat. No indirect effects from habitat loss are expected because this species does not use BTPD burrows.
Piping plover	LAA	Direct effects to the piping plover are expected to occur based on the potential for this species to consume prey items that may have consumed the chlorophacinone bait (RQ of 0.104 for exposure to non-target animals, which is used as a surrogate for invertebrate prey, which exceeds the LOC of 0.1). Growth and reproductive effects cannot be precluded due to the absence of chronic data.	No indirect effects from loss of prey base are expected because this species' habitat is distinct from BTPD habitat. The plover's home range within BTPD range is usually limited to the wetland, lakeshore, or section of beach where its nest is located. No indirect effects from habitat loss are expected because this species does not use BTPD burrows.
New Mexican ridge-nosed rattlesnake	LAA	No direct effects based on survival to the New Mexican ridge-nosed rattlesnake are expected to occur (see Section 5.1.1.a. RQs of 0.018 for a 50 gram snake and RQ of 0.030 for a 500 gram snake. Neither of these RQs exceeds the LOC of 0.1). However, growth and reproductive effects cannot be precluded due to the absence of chronic data.	Indirect effects from the loss of the prey base are expected because effects to individuals within populations have been demonstrated in mammals, birds, and terrestrial invertebrates. No indirect effects from habitat loss are expected because this species does not appear use BTPD burrows.
Sonora tiger salamander	LAA	Direct effects to the Sonora tiger salamander are expected to occur based on the potential for this species to consume	No indirect effects from the loss of prey base or loss of habitat (BTPD burrow) are expected because this

		prey items that may have consumed the chlorophacinone bait (RQ of 0.104 for exposure to non-target animals, which is used as a surrogate for invertebrate prey, which exceeds the LOC of 0.1). Growth and reproductive effects cannot be precluded due to the absence of chronic data.	species' range does not overlap with BTPD range.
Black-capped vireo	LAA	Direct effects to the black-capped vireo are expected to occur based on the potential for this species to consume prey items that have consumed the chlorophacinone bait (RQ of 0.104 for exposure to non-target animals, which is used as a surrogate for invertebrate prey, which exceeds the LOC of 0.1). Growth and reproductive effects cannot be precluded due to the absence of chronic data.	No indirect effects from loss of prey base are expected because this species' habitat is distinct from BTPD habitat. Black-capped vireos are found in mixed deciduous/evergreen shrub land. Breeding vireos use shrubby growth of irregular height and distribution with spaces the small thickets and clumps and with vegetative extending to ground level. These habitat areas are distinct from the short grass prairie associated with BTPD habitat. No indirect effects from habitat loss are expected because this species does not use BTPD burrows.
Golden-cheeked warbler	LAA	Direct effects to the golden-cheeked warbler are expected to occur based on the potential for this species to consume prey items that have consumed the chlorophacinone bait (RQ of 0.104 for exposure to non-target animals, which is used as a surrogate for invertebrate prey, which exceeds the LOC of 0.1). Growth and reproductive effects cannot be precluded due to the absence of chronic data.	No indirect effects from loss of prey base are expected because this species' habitat is distinct from BTPD habitat. Golden-cheeked warblers are found in mixed Ashe-juniper and oak woodlands in ravines and canyons. They spend summers in open canopy forest and winters in closed canopy forests. These habitat areas are distinct from the short grass prairie associated with BTPD habitat. No indirect effects from habitat loss are expected because this species does not use BTPD burrows.
Gray wolf	LAA	Direct effects to the gray wolf are expected to occur based on the potential for this species to consume prey items that have consumed the chlorophacinone bait (RQ of 24.82 for exposure to non-target animals and RQ of 9.59 for exposure to BTPDs both of which exceed the LOC of 0.1). Growth and reproductive effects cannot be precluded due to the absence of chronic data; however, growth and reproductive effects are not expected because mortality typically occurs as a result of acute exposure.	Indirect effects from the loss of the prey base are expected because effects to individuals within populations have been demonstrated in mammals, birds, and terrestrial invertebrates. No indirect effects from habitat loss are expected because this species does not use BTPD burrows.

[1] LAA=likely to adversely affect.

Table 1.2. Effects Determination Summary for the Critical Habitat Impact Analysis

Species with Designated Critical Habitat	Effects Determination	Basis for Determination
Salt Creek tiger beetle	HM[1]	Reproductive effects are expected for the Salt Creek tiger beetle. Salt Creek tiger beetle larvae are potentially exposed to chlorophacinone residues through chlorophacinone exposed terrestrial invertebrates. Dosed carcasses in a burying beetle study negatively affected number of emerged beetles (MRID 47383001). Similar affects are expected for the Salt Creek tiger beetle. No indirect effects from loss of prey base are expected because this species' habitat is distinct from BTPD habitat. This species uses mud banks of streams and seeps in association with saline wetlands and exposed mud flats of saline wetlands which is distinct from the short grass prairie associated with BTPD habitat. No indirect effects from habitat loss are expected because this species does not use BTPD burrows.
California condor	No habitat modification expected	Direct effects to the California condor are expected through their potential exposure to prey items that may have consumed the chlorophacinone bait (RQ of 0.104 for exposure to non-target animals which exceeds the LOC of 0.1. No indirect effects from the loss of prey base are expected because this species' range does not overlap with BTPD range. No indirect effects from habitat loss are expected because this species does not use BTPD burrows. No habitat modification is expected because the critical habitat for the California condor does not overlap with the use area (BTPD habitat). Critical habitat for the California condor has only been designated in California.
Whooping crane	HM	Direct effects to the whooping crane are expected to occur based on the potential for this species to consume the chlorophacinone bait (RQ of 0.89 which exceeds the LOC of 0.1) or other prey items that have consumed the chlorophacinone bait (RQ of 0.104 for exposure to non-target animals which exceeds the LOC of 0.1). Indirect effects from the loss of the prey base are also expected because effects to individuals within populations have been demonstrated in mammals, birds, and terrestrial invertebrates. No indirect effects from habitat loss are expected because this species does not use BTPD burrows. Habitat modification for the whooping crane is expected because the critical habitat for the whooping crane overlaps with the use area (BTPD habitat).
Canada lynx	HM	Direct effects to the Canada lynx are expected to occur based on the potential for this species to consume prey items that have consumed the chlorophacinone bait (RQ of 23.30 for exposure to non-target animals and RQ of 9.00 for exposure to BTPDs both of which exceed the LOC of 0.1). No indirect effects from loss of prey base are expected because this species' habitat is distinct from BTPD habitat. The Canada lynx is associated with the southern, transitional reaches of the cool and moist boreal forest. Where it occurs at these lower latitudes, the boreal forest forms a mixed conifer and conifer-hardwood landscape. These habitat areas are distinct from the short grass prairie associated with BTPD habitat. No indirect effects from habitat loss are expected because this species does not use BTPD burrows. Habitat modification for the Canada lynx is expected because the critical habitat for the Canada lynx overlaps with the use area (BTPD habitat).
Preble's meadow jumping mouse	HM	Direct effects to the Preble's meadow jumping mouse are expected to occur based on the potential for this species to consume the chlorophacinone bait (RQ of 41.35 which exceeds the LOC of 0.1). Indirect effects from the loss of the prey base are expected because effects to individuals within populations have been demonstrated in terrestrial invertebrates. Although this species makes nests both above and below ground, it does not appear to use other species' rodent burrows. Habitat modification for the Preble's meadow jumping mouse is expected because the critical habitat for the Preble's meadow jumping mouse overlaps with the use area (BTPD habitat).

Mexican spotted owl	HM	Direct effects to the Mexican spotted owl are expected to occur based on the potential for this species to consume prey items that have consumed the chlorophacinone bait (RQ of 0.104 for exposure to non-target animals which exceeds the LOC of 0.1). No indirect effects from loss of prey base are expected because this species' habitat is distinct from BTPD habitat. Mexican spotted owls are found in old-growth or mature forests with unevenly aged stands of trees, high canopy, multi-storied levels, and high tree density as well as canyons with riparian or conifer communities. In Arizona and New Mexico they are found in habitats associated with mixed conifer, pine-oak, Arizona cypress, oak woodlands, and associated riparian forests. These habitat areas are distinct from the short grass prairie associated with BTPD habitat. No indirect effects from habitat loss are expected because this species does not use BTPD burrows. Habitat modification for the Mexican spotted owl is expected because the critical habitat for the Mexican spotted owl overlaps with the use area (BTPD habitat).
Piping plover	HM	Direct effects to the piping plover are expected to occur based on the potential for this species to consume prey items that have consumed the chlorophacinone bait (RQ of 0.104 for exposure to non-target animals, which is used as a surrogate for invertebrate prey, which exceeds the LOC of 0.1). No indirect effects from the loss of the invertebrate prey base are expected because this species' habitat is distinct from BTPD habitat. The plover's home range within the BTPD range is usually limited to the wetland, lakeshore, or section of beach where its nest is located. No indirect effects from habitat loss are expected because this species does not use BTPD burrows. Habitat modification for the piping plover is expected because the critical habitat for the piping plover overlaps with the use area (BTPD habitat).
New Mexican ridge-nosed rattlesnake	HM	No direct effects based on survival to the New Mexican ridge-nosed rattlesnake are expected to occur (see Section 5.1.1.a. RQs of 0.018 for a 50 gram snake and RQ of 0.030 for a 500 gram snake. Neither of these RQs exceeds the LOC of 0.1). However, direct effects based on reproduction cannot be precluded because no reproduction data are available. Indirect effects from the loss of the prey base are expected because effects to individuals within populations have been demonstrated in mammals, birds, and terrestrial invertebrates. No indirect effects from habitat loss are expected because this species does not appear to use BTPD burrows. Habitat modification for the New Mexican ridge-nosed rattlesnake is expected because the critical habitat for the New Mexican ridge-nosed rattlesnake overlaps with the use area (BTPD habitat).
Gray wolf	No habitat modification expected	Direct effects to the gray wolf are expected to occur based on the potential for this species to consume prey items that have consumed the chlorophacinone bait (RQ of 24.82 for exposure to non-target animals and RQ of 9.59 for exposure to BTPDs both of which exceed the LOC of 0.1). Indirect effects from the loss of the prey base are also expected because effects to individuals within populations have been demonstrated in mammals, birds, and terrestrial invertebrates. No indirect effects from habitat loss are expected because this species does not use BTPD burrows. No habitat modification is expected because the critical habitat for the gray wolf does not overlap with the use area (BTPD habitat). Critical habitat for the gray wolf has only been designated in Minnesota and Michigan.

[1]Habitat Modification
The assessment endpoint for each species above is the modification of PCEs.

Based on the conclusions of this assessment, formal consultation with the U. S. Fish and Wildlife Service under Section 7 of the Endangered Species Act should be initiated relative to potential effect on the 21 species noted above in Table 1.1, and on the potential for critical habitat modification for the 7 species noted above in Table 1.2

When evaluating the significance of this risk assessment's direct/indirect and adverse habitat modification effects determinations, it is important to note that rodenticide exposures and predicted risks to the species and its resources (*i.e.*, food and habitat) are not expected to be uniform across the action area since BTPDs are not uniformly distributed across action area. Evaluation of the implication of this non-uniform distribution of risk to the species would require information and assessment techniques that are not currently available. Examples of such information and methodology required for this type of analysis would include the following:

- Enhanced information on the density and distribution of BTPDs within the action area and information on the density and distribution of the other 21 listed species within the action area and information on the density and distribution within their critical habitat of the nine species with critical habitat. This information would allow for quantitative extrapolation of the present risk assessment's predictions of individual effects to the proportion of the population extant within geographical areas where those effects are predicted. Furthermore, such population information would allow for a more comprehensive evaluation of the significance of potential resource impairment to individuals of the listed species.
- Quantitative information on prey base requirements for the listed species. While existing information provides a preliminary picture of the types of food sources utilized by the listed species, it does not establish minimal requirements to sustain healthy individuals at varying life stages. Such information could be used to establish biologically relevant thresholds of effects on the prey base, and ultimately establish geographical limits to those effects. This information could be used together with the density data discussed above to characterize the likelihood of adverse effects to individuals.
- Information on population responses of prey base organisms to chlorophacinone. Currently, methodologies are limited to predicting exposures and likely levels of direct mortality, growth or reproductive impairment immediately following exposure to chlorophacinone. The degree to which repeated exposure events and the inherent demographic characteristics of the prey population play into the extent to which prey resources may recover is not predictable. An enhanced understanding of long-term prey responses to chlorophacinone exposure would allow for a more refined determination of the magnitude and duration of resource impairment, and together with the information described above, a more complete prediction of effects to individual species and potential modification to critical habitat.
- Furthermore, additional information is needed on the types of plants in the BTPD range to fully characterize/assess the direct effects on plants that are found within the action area as well as to determine the indirect effects on the threatened and endangered animal species which are assessed in this document. Although, it is known that the BTPD is a keystone species, it is currently unclear what impacts the loss of the BTPD would have both on plant communities within the action area as well as what effects this would have on listed species. Additional information on species occurrence, distribution, life history and species associations would be beneficial to determine potential effects to listed plant species.

2. Problem Formulation

Problem formulation provides a strategic framework for the risk assessment. By identifying the important components of the problem, it focuses the assessment on the most relevant life history stages, habitat components, chemical properties, exposure routes, and endpoints. The structure of this risk assessment is based on guidance contained in U.S. EPA's *Guidance for Ecological Risk Assessment* (USEPA, 1998), the Services' *Endangered Species Consultation Handbook* (USFWS/NMFS, 1998) and is consistent with procedures and methodology outlined in the Overview Document (USEPA, 2004a) and reviewed by the U.S. Fish and Wildlife Service and National Marine Fisheries Service (USFWS/NMFS/NOAA, 2004).

2.1. Purpose

The purpose of this endangered species assessment is to evaluate potential direct and indirect effects on all listed species arising from FIFRA regulatory actions regarding use of chlorophacinone to control BTPDs. In addition, this assessment evaluates whether use to control BTPDs is expected to result in modification of the listed species' designated critical habitat, for those species with designated critical habitat.

In this assessment, direct and indirect effects to listed species and potential modification to designated critical habitat for listed species is evaluated in accordance with the methods described in the Agency's Overview Document (USEPA, 2004a). In accordance with the Overview Document, provisions of the Endangered Species Act (ESA), and the Services' *Endangered Species Consultation Handbook*, the assessment of effects associated with registration of chlorophacinone for BTPDs is based on an action area. The action area is the area directly or indirectly affected by the federal action. The action area for a FIFRA regulatory decision associated with a use of chlorophacinone to control BTPDs involves 532 counties in 10 states (Colorado, Kansas, Montana, Nebraska, New Mexico, North Dakota, Oklahoma, South Dakota, Texas and Wyoming) based on the range of the BTPD and data regarding listed species obtained from NatureServe[4]. However, for the purposes of this assessment, attention will be focused on relevant sections of the action area including those geographic areas associated with locations of listed species that may be affected and their designated critical habitat. As part of the "effects determination," one of the following three conclusions will be reached separately for each of the assessed species regarding the potential use of chlorophacinone in accordance with the assessed label:

- "No effect" or "NE";
- "May affect, but not likely to adversely affect" or "NLAA"; or
- "May affect and likely to adversely affect" or "LAA".

A risk quotient (RQ) is the ratio of the estimated environmental concentration (EEC) to the relevant toxicological endpoint, often the LD_{50} or LC_{50}. RQs were compared to the Agency's LOC for terrestrial endangered species to identify instances where chlorophacinone use to

[4] NatureServe: NatureServe Explorer [web application]. Updated February 2010. Arlington, Virginia (USA): Available: http://www.natureserve.org/explorer. (Accessed: May 12, 2010)

control BTPDs has the potential to adversely affect the assessed species or modify their designated critical habitat. When RQs for an effect endpoint are below the LOC, chlorophacinone is considered to have NE on the species or its designated critical habitat. Where RQs exceed the LOC, a potential to cause adverse effects or habitat modification is identified, leading to a conclusion of May Affect. If chlorophacinone use may affect the assessed species, and/or may cause effects to designated critical habitat, the best available information is considered to refine the potential for exposure and effects, and distinguish actions that are NLAA from those that are LAA. The best available information relative to this assessment includes species life history information which is compiled in **Attachment 1**.

2.2. Scope

The end result of the EPA pesticide registration process (*i.e.*, the FIFRA regulatory action) is an approved product label. The label is a legal document that stipulates how and where a given pesticide may be used. Product labels (also known as end-use labels) describe the formulation type (*e.g.*, liquid or granular), acceptable methods of application, approved use sites, and any restrictions on how applications may be conducted. Thus, the use of chlorophacinone in accordance with the approved product label for BTPDs is "the action" relevant to this ecological risk assessment.

Chlorophacinone end-use products include tracking powder, bait blocks, pelleted baits, and grain baits. The use of chlorophacinone for control of BTPDs only permits use of grain bait formulated with 50 mg a.i./kg-bait active ingredient. This bait is permissible for use only between October 1 and March 15 or spring green-up, whichever occurs later, in active prairie dog burrows. The bait must be placed at least 6 inches into the burrow and below the ground surface. Two carcass searches are to occur after application, the first being 5 to 10 days post-application and the second being 14-21 days post-application. Primary and secondary exposure to non-target animals is possible based on this use pattern. Primary exposure takes place when the grain bait is consumed by non-target species. This type of exposure can occur on the surface, as a result of bioturbation, or while the bait is in the burrow. Secondary exposure takes place when chlorophacinone poisoned/contaminated BTPDs or non-target animals or carcasses, are consumed by non-target species. Dead and dying animals may be exposed on the surface or may be found by predators or scavengers in burrows.

EPA notes that several changes to the label of Rozol Prairie Dog Bait (EPA reg. no. 7173-286) were approved on September 10, 2010. These changes consist of including: (1) a requirement that carcass searches start within 4 days, rather than within 5 to 10 days of application; (2) a requirement that such searches continue at 1-2 day intervals, for two weeks or potentially longer, as opposed to just a second repeat search at the 14-21 day interval; and (3) language that permits alternative carcass disposal to burial, where burial is impractical and the alternative disposal will ensure no access by scavengers. While EPA expects these label changes will reduce the potential for exposure of non-target species to chlorophacinone this potential reduction does not quantitatively alter EPA's ecological risk assessment, nor does it alter EPA's effects determinations relative to the use of Rozol Prairie Dog Bait (EPA reg. no. 7173-286). Adherence to these label changes will reduce the probability that contaminated prairie dogs or carcasses will be available to non-target species. However, these changes will not eliminate such availability nor will these changes eliminate the potential for non-target species to be directly exposed to bait in the burrows or exposed to bait that reaches the surface. While these label changes cannot preclude effects likely to adversely affect individuals of a non-target species, the reduction in the likelihood of such effects occurring should be considered by the US Fish and Wildlife Service when considering whether the potential effects will or will not constitute jeopardy to any of the species potentially exposed.

Although current registrations of the active ingredient chlorophacinone allow for use nationwide, this ecological risk assessment and effects determination addresses only the registered use of the Rozol Prairie Dog Bait ((EPA registration number 7173-286) which is registered only to control BTPD on rangeland and noncrop areas in Colorado, Kansas, Montana, Nebraska, New Mexico, North Dakota, Oklahoma, South Dakota, Texas and Wyoming. Listed species considered in this assessment will occur within and adjacent to counties where BTPDs are known to occur and will be reasonably assumed to have potential for chlorophacinone exposure. Further discussion of the action area, the listed species and their designated critical habitat is provided in **Section 2.7**.

2.2.1. Evaluation of Degradates

Though degradates (*i.e.* o-phthalic acid and p-chlorophenylphenyl acetic acid) have been detected in environmental fate studies, these degradates will not be considered further in this assessment. These environmental fate studies were performed using TGAI rather than the bait formulation relevant to this assessment. Due to chlorophacinone's immobility in soil, it is reasonable to conclude it is immobile within bait formulations. Chlorophacinone baits typically retain the parent compound even after exposure to wet weather and moisture (Merson and Byers 1985). However, photodegradation occurs in a dry environment and the bait is in a dry environment. Degradates were not evaluated in carcass studies and based on this lack of data, it is assumed that the degradates are equi-toxic to the parent compound. Therefore this risk assessment will be conducted as if the parent is undegraded on the bait.

2.2.2. Evaluation of Mixtures

Product toxicity data for Rozol (2% a.i.) indicates that the formulated product is not more toxic than the TGAI compared on a w/w active ingredient basis (MRID 43672005). Rozol Prairie Dog Bait is 50 mg a.i./kg-bait but the approximate amount of inert material is equivalent and composed of the same materials with the exception of the grain base. The formulation of chlorophacinone evaluated in this risk assessment does not contain any other active ingredients.

2.3. Previous Assessments

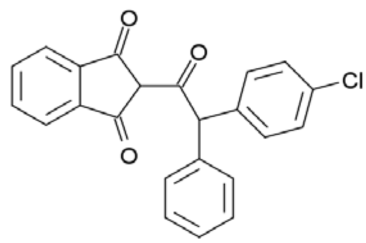
"Potential Risks of Nine Rodenticides to Birds and Nontarget Mammals: a Comparative Approach" (USEPA 2004b) evaluated primary and secondary exposure of chlorophacinone, among other rodenticides, to birds and mammals. This study determined that the greatest risk of chlorophacinone use to non-target animals is via secondary exposure to mammals. Risk associated with primary exposure and exposure to birds, however, is also significant. These elements provide the general framework for this assessment and are supported through the calculation of RQs in this assessment. The study also specified a number of factors contributing to uncertainty in assessing anticoagulant rodenticides. Those factors that contributed the most uncertainty were: (1) missing data, including acute, chronic, and secondary toxicity as well as data regarding retention of some active ingredients in the liver, blood, and other body tissues; (2) the variable quality and quantity of existing data on metabolism and retention times in rodents and nontarget species; (3) specific use information by formulation, including typical amounts applied by use site, seasonally, and annually; distances applied from buildings; amounts used in rural versus urban areas; use by Certified Applicators versus homeowners and other non-certified applicators; and other such relevant information; (4) information on the number and species of birds and nontarget mammals frequenting baited areas and the likelihood of their finding and consuming bait or poisoned primary consumers in the various use areas; (5) methods to determine liver concentration(s) and total body burdens of rodenticide that would corroborate death or even if such a cause-effect relationship is appropriate (e.g., the "threshold of toxicity" concentration); (6) not accounting for the impacts of sublethal effects on reproduction and nontarget mortality (e.g., clotting abnormalities, hemorrhaging, stress factors including environmental stressors, such as adverse weather conditions, food shortages, and predation); (7) not accounting for bioaccumulation of repeated sublethal exposures to bait or poisoned rodents utilized as food by predators and scavengers; and (8) lack of incident reporting. All of the above issues remain as uncertainties for this assessment.

In November 2008, an Ecological Risk Assessment evaluating expanded uses of chlorophacinone for BTPDs was performed. The assessment offered the following recommendations for risk mitigation: (1) requiring carcass searches at 1-to-2 day intervals; (2) requiring non-target animal carcasses be provided to proper authorities for identification and tissue-residue analysis; (3) requiring a discrete application interval so that full monitoring and carcass removal from the initial application may be completed; and (4) taking into consideration the black-footed ferret because it is an endangered species, preys on the target species as a primary food source and utilizes their burrows. The resulting product label reflected recommendations from the assessment in the following ways: (1) requiring an initial carcass search 5 to 10 days after application and a second carcass search 14 to 21 days after application; (2) allowing reapplication "several weeks" after initial application; and (3) stating: "[d]o not use this product within prairie dog towns in the range of the black-footed ferret without first contacting endangered species specialists at a U.S. Fish and Wildlife Service office."

2.4. Environmental Fate Properties

Chlorophacinone is hardly mobile with half-lives ranging from 37 minutes (Direct Aqueous Photolysis) to 45 days (Aerobic Soil Metabolism, sandy clay loam) and the major environmental dissipation processes are photolysis and metabolism. These properties of chlorophacinone are summarized in **Table 2.1**. Chlorophacinone and its degradates are not likely to dissipate from the grain bait formulation due to the chemical's immobility. Chlorophacinone residues can be expected to occur in chlorophacinone exposed animal carcasses (Belleville 1981; Dowding 2010; MRID 47333603). Further discussion of the implications of chlorophacinone residues in carcasses will be limited to **Section 2.4.1**. For the purposes of discussion of environmental fate, discussion will be limited to exposure to the chlorophacinone grain bait formulation only.

Table 2.1 Physical-chemical Properties of chlorophacinone

Study	Value and units	Major Degradates *Minor Degradates*	MRID #	Study Status
Structure				
Hydrolysis	Stable at pH 5, 7, 9		42205501	Acceptable
Solubility	34 mg/L @ 25ºC		EPA 1998 (Rodenticide Cluster RED)	
Direct Aqueous Photolysis	$T_{1/2}$ = 90 minutes		42205502	Acceptable
Soil Photolysis	$T_{1/2}$ = 4 days	*o-phthalic acid; p-chlorophenylphenyl acetic acid*	42452301	Acceptable
Aerobic Soil Metabolism	$T_{1/2}$ = 45 days; sandy clay loam $T_{1/2}$ = 26 days; sandy loam	*o-phthalic acid; p-chlorophenylphenyl acetic acid*	43159801	Acceptable
Anaerobic Soil Metabolism	No Data			
Aerobic Aquatic Metabolism	No Data			
Anaerobic Aquatic Metabolism	No Data			
Soil Water Partition Coefficient	K_{fads} 56 to 1000 mL/g K_{OC} 15600, 26900, 35400, 95745 mL/g (the Koc model appears valid)		42666001	Acceptable
Terrestrial Field Dissipation	No Data			

2.4.1. Environmental Transport Mechanisms

Given chlorophacinone's physical/chemical properties, grain bait formulation and low application rate, it is assumed that negligible amounts of parent chlorophacinone and degradate leach from the original bait. Toxicological data on chlorophacinone degradates are not available and are therefore assumed to be as toxic as the parent, chlorophacinone. Given this, the exposure concentration of 50 mg a.i./kg-bait is assumed to remain constant overtime within the formulation. Chlorophacinone has the potential to be available in significant concentrations via carcass residues. Ecological incident data, carcass residue data and poisoned carcass feeding studies indicate that chlorophacinone poisoned carcasses have the potential to adversely affect scavengers and predators. Chlorophacinone degradates have not been evaluated in carcass studies.

2.4.2. Mechanism of Action

Chlorophacinone is an indandione anticoagulant rodenticide. It uncouples oxidative phosphorylation depressing hepatic synthesis of prothrombin and clotting factors VII, IX and X and, it causes direct damage to capillary permeability. The ultimate effect is widespread internal hemorrhage. In rodents, indandiones also cause neurologic and cardiopulmonary injuries which often lead to death before hemorrhage occurs (World Health Organization, 2010).

2.4.3. Use Characterization

The chlorophacinone product assessed here is registered only as a 50 mg a.i./kg-bait grain bait formulation for control of BTPDs. For each active burrow during a single application, 53 grams of bait are to be applied no less than 6 inches down the burrow. If prairie dog activity persists, a second application at the same use rate can be made "several weeks later". Neither the National Agricultural Statistics Service (NASS) nor the United States Geological Survey (USGS) is able to provide geographical data for chloropacinone use to control BTPDs but species distribution data, provided by NatureServe at the county level, provides a conservative proxy for the area in which chlorophacinone may be used for this purpose. This use area is illustrated in **Figure 2.1**. This species distribution area conservatively represents the use area because it represents the historic range for the BTPD. Current and future range relative to historic range is likely to be smaller and discontinuous but still within the boundaries of this historic range.

Figure 2.1. Chlorophacinone use area for BTPDs

2.5. Assessed Species

This assessment considers all listed species within the U.S. However, the 10 states where chlorophacinone use to control BTPDs is permissible (Colorado, Kansas, Montana, Nebraska, New Mexico, North Dakota, Oklahoma, South Dakota, Texas, and Wyoming) and the adjacent counties (*i.e.*, the action area) are the only areas where exposure is expected to occur. One hundred forty two (85 animals and 57 plants) threatened and endangered species are listed within the action area according to the USFWS Web site[5]. Based on species diet, terrestrial habitat and the distribution of BTPDs, chlorophacinone will have NE on 87 of the 142 species. The list of species for further assessment then is limited to 21 animals (grizzly bear, American burying beetle, Salt Creek tiger beetle, California condor, whooping crane, Eskimo curlew, northern Aplomado falcon, black footed ferret, Chiricahua leopard frog, jaguar, Gulf Coast jaguarundi, Canada lynx, Preble's meadow jumping mouse, ocelot, Mexican spotted owl, piping plover, New Mexican ridge-nosed rattlesnake, Sonora tiger salamander, black-capped vireo, golden-cheek warbler, and the gray wolf). A list of the 34 plant species is included in Section 2.5.1 but not carried through the assessment because it is unclear what impacts the loss of the BTPD may have on these plants.

For the animal species ingestion is the only significant route of exposure and the only exposure route assessed in this document and for that, the species' diet must be that of a granivore or it must be attracted to grain baits to have primary exposure to chlorophacinone; it must be a carnivore or scavenger to have secondary exposure to chlorophacinone. It was also determined that insects may be exposed to the grain bait and may retain residues that are high enough to cause direct mortality to invertivores. As a result, direct effects to invertivores will also be assessed. Based on the potential for exposure, the list of species for further assessment is limited to the 21 terrestrial species noted in **Table 1.1**. **Table 2.2** provides a summary of the current distribution, habitat requirements, and relevant life history parameters for these 21 species. More detailed life-history and distribution information can be found in **Attachment 1**. Maps indicating listed species location relative to historic range of BTPDs can be found in **Appendix A**.

[5] http://www.fws.gov/endangered/

Table 2.2 Summary of Current Distribution, Habitat Requirements, and Life History Information for Listed Species that May be Affected.

Size	Current Range	Habitat Type	Reproductive Cycle	Diet
Grizzly bear (*Ursus arctos horribilis*) – critical habitat has been proposed				
Average weight for males: 181-272 kg (400-600 lbs)	Sections of Washington, Wyoming, Idaho, and Montana.	Spring: Low elevation riparian sites, wet meadows, and alluvial plains.	Mating between May and July. Implantation of blastocyst(s) delayed until hibernation (4-5 months later).	Freshly emergent herbaceous vegetation is preferred.
Average weight for females: 113-158 kg (250-350 lbs)	Grizzly bears have been identified in six areas in the Rocky Mountains: 1) the Greater Yellowstone Ecosystem (GYE); 2) the Northern Continental Divide Ecosystem (NCDE); 3) the Bitterroot Ecosystem (BE); 4) the Cabinet-Yaak Ecosystem (CYE); 5) the Selkirks Ecosystem (SE); and 6) the Northern Cascades Ecosystem (NCE)	Summer and fall: Higher elevation forests, meadows, and open grassy timber sites.	Hibernate between October and December. Exits the den between March and May. Implantation of the embryo is delayed and gestation usually lasts about 26 weeks.	Grasses, sedges, roots, tubers, and berries compose a large part of the diet.
Yellowstone adults: 102-324 kg (225-714 lbs)		Meadows, shrubfields, and low- and high-elevation riparian communities are also important habitat.		Ungulates, ground squirrels, carrion, and garbage.
Length (snout to tail): 170-280 cm (5.5-9.1 ft)				Also prey on mice, ground squirrels, and marmots.
Shoulder height: 90-150 cm (3.1-4.8 ft)				

Size	Current Range	Habitat Type	Reproductive Cycle	Diet
American burying beetle (*Nicrophorus americanus*) – no designated critical habitat				
2.5-3.5 cm (1.0-1.4 inches) in length	Occurs in the following states: Arkansas, Kansas, Massachusetts (statewide), Michigan (statewide), Missouri, Nebraska, Ohio, Oklahoma, Rhode Island (statewide), South Dakota, and Texas.	Eastern deciduous biome. Riparian deciduous forests, grasslands, pastures, and maritime scrub thickets.	Active from April through September but seen as early as February and as late as October. Breeding in the east (Block Island) occurs between June and July. Breeding in the west (Oklahoma) occurs between late April and mid-August.	Broad range of available carrion and possibly live insects. Uses large (100-200 g) (0.2-0.4 lbs) mammal or bird carcasses for brood-rearing. Can use carcasses as small as 35 g (0.08 lbs). Prefer ring-neck pheasant and American woodcock carcasses.
Salt Creek tiger beetle (*Cicindela nevadica lincolniana*) – designated critical habitat				
1.3 cm (0.5 inches) total length	Confined to eastern Nebraska saline wetlands and associated streams and tributaries of Salt Creek in the northern third of Lancaster County.	Mud banks of streams and seeps, and in association with saline wetlands and exposed mud flats of saline wetlands. Larvae have been found only on moist salt flats and salt-encrusted banks of Little Salt Creek in northern Lancaster County and saline wetlands associated with Rock Creek in the southern margin of Saunders County. Salt Creek tiger beetles require open, barren salt flat areas for construction of larval burrows, thermoregulation, foraging, and as dispersal corridors.	Adults are first observed as early as the end of May or as late as mid-June. Their numbers peak about two weeks after the first individuals appear and begin to feed and mate. Females lay their eggs along sloping banks of creeks in areas where the salt layer is exposed in the soil horizon, on barren salt flats of saline wetlands, or along saline stream edges that are found in close association with water, near a seep or stream. It is believed that, during the night, female Salt Creek tiger beetles lay about 50 eggs. The Salt Creek tiger beetle has a two-year life cycle.	Smaller or similar-sized arthropods.

Size	Current Range	Habitat Type	Reproductive Cycle	Diet
California condor (*Gymnogyps californianus*) – designated critical habitat				
Adults weigh up to 10 kg (22 lbs) Average male weight: 8.8 kg (19.4 lbs) Average female weight: 8.1 kg (17.9 lbs)	In Arizona, the condor is known to exist in Apache, Coconino, Mohave, Navajo, and Yavapai counties. This species is also found in several counties in California.	Inhabits a diversity of habitat types. Nesting habitat ranges from scrubby chaparral to forested montane area, mostly on cliffs but also sometimes in cavities in giant sequoia trees. Foraging occurs mostly in open grassland.	Wild condors court and nest between December and spring. They lay one egg between late January and early April. The egg hatches after 56 days. The chick is fed by its parents for 2 months. When the chick is 2-3 months old it leaves the nest but stays in the area to continue to be fed, though less frequently. Chicks begin to fly at 6-7 months of age. Juveniles may not be fully independent until up to a year after they begin to fly.	Carcasses of dead animals one to three days per week. Cattle, domestic sheep, mule deer, horses, and ground squirrels. Deer are preferred. Also prey on smaller to medium sized mammals including coyotes, rabbits, ground squirrels, gray foxes, long tailed weasels, kangaroo rats, Botta's pocket gophers, and occasionally a coachwhip snake or avian carrion.
Whooping crane (*Grus americana*) – designated critical habitat				
Males: 1.5 m (5 ft) and average weight is 7.3 kg (16 lbs) for a captive bird. Females: shorter and average weight is 6.4 kg (14 lbs) for a captive bird. 2.3 m (7.5 ft) wingspan	Three populations of cranes exist in the wild: 1) the Aransas Wood Buffalo Population (AWBP); 2) the Florida Population (FP); and 3) the Eastern Migratory Population (EMP). The AWBP nests in the Wood Buffalo National Park (WBNP) in the Northwest Territories of Canada and in Alberta, Canada. This population migrates south to a stop over location in	Summer: Marshes and prairie potholes. Winter: Coastal marshes and prairies.	The crane is a territorial nester and returns to the same area each year. Eggs are laid from April to mid-May. Incubation last for a month. AWBP cranes migrate in the fall during a period beginning in mid-September and ending by mid-November to winter at the Aransas National Wildlife Refuge (ANWR). The EMP cranes migrate from late October to early December. In spring, the migration begins between March 25 and April 15. This migration takes less time than the fall migration (2-4 weeks) and there is no known stop over. The EMP cranes leave their wintering grounds between the end of	Summer: Larval and nymphal insects, frogs, rodents, berries, small birds, and minnows. Winter: Blue crabs, clams, and wolfberry. Migration: Waste agricultural grains like barley, and also frogs, fish, insects, tubers, and crayfish. Also eat acorns, snails, crayfish, and insects.

Size	Current Range	Habitat Type	Reproductive Cycle	Diet
Max. weights observed in December and January and min. weights observed in July and August.	Saskatchewan, before heading south through eastern MT, ND, SD, NE, KS, OK, and TX to the wintering grounds of Aransas National Wildlife Refuge (ANWR) on the Gulf Coast of TX. The FP is non-migratory and located on the Kissimmee Prairie, south of Orlando in Osceola and Polk counties. The EMP was reintroduced to the Necedah National Wildlife Refuge (NWR) in WI with captive birds trained to migrate to Chassahowitzka NWR on the Gulf Coast of FL. The AWBP is the only self sustaining wild population. The FP and EMP are introduced and are designated experimental non-essential by the USFWS.		February and mid-April.	
Captive whooping crane chicks weigh 100-150 g (0.2-0.3 lbs) when they hatch;				
1.75-2.50 kg (3.9-5.5 lbs) at 40 days;				
4.30-4.95 kg (9.5-10.9 lbs) at 100 days; and				
5.70-6.70 kg (12.6-14.8 lbs) (near adult weight) at 250 days.				

Size	Current Range	Habitat Type	Reproductive Cycle	Diet
Eskimo curlew (*Numenius borealis*) – no designated critical habitat				
Length: About 30 cm (11.8 inches) long with a bill about 5 cm (2.0 inches) long. The length ranges from 32 cm (12.6 inches) to 27 cm (10.6 inches). Weight: 270-454 grams (0.6-1.0 lbs)	The USFWS lists the Eskimo curlew as statewide in Alaska, Kansas, Montana, and Nebraska, as well as in four counties in Oklahoma, two counties in South Dakota, and one county in Texas.	Tundra and woodland transition zones, consisting of dwarf shrub-graminoid tundra complex ("barrens") and grassy meadows for breeding. Coastal and crowberry areas such as those found in Labrador as well as terrestrial habitats were used to feed during the fall migration. Salt marsh, intertidal flats, sand dunes, meadows, pastures, and old fields in Massachusetts. Ericaceous heath habitat in Alaska, the Northwest Territories, northern Ontario, southern Quebec, Newfoundland, Labrador, and the Maritime Provinces. Tallgrass and eastern mixed-grass prairies, usually near a water source, and disturbed by fire or bison or in fields under cultivation during spring migration. Burned prairies and wetlands, plowed fields, clover patches, and beaches.	Migratory birds. Arrive at breeding grounds in May. Breeding age is not known, but related species breed at around three years of age. Clutches of eggs are laid from mid to late June. Eggs hatch from early to mid July and only one brood is raised in a season. Chicks feed themselves beginning on the first or second day post-hatch and migrate at the end of the month. Breeding season is over by July and the adults head south with juveniles to follow. Migrate from July to October and winter over in South America. Arrive at wintering grounds by early September. The return migration in the spring begins in April or May. However, other sources report that the spring migration begins in late February, with the birds arriving in Texas and Louisiana by early March, and then heading north through the Midwestern states to eastern South Dakota and then to breeding grounds in Canada by the end of May.	Berries (blueberries and crowberries), Dipteran larvae and adult snails, coastal invertebrates (amphipods and isopods), earthworms, insects (beetles, young grasshoppers, and grasshopper eggs) before the fall migration. Ants on the breeding grounds and ant egg capsules during spring migration. Grubs and cutworms. Other spring migration food consisted primarily of juvenile grasshoppers and their larvae, particularly the Rocky Mountain grasshopper (now extinct), as well as other insects, berries, and earthworms.

Size	Current Range	Habitat Type	Reproductive Cycle	Diet
Northern Aplomado falcon (*Falco femoralis septentrionalis*) – no designated critical habitat				
Length: 35.6-45.7 cm (14-18 inches) in length with a wingspan of 78.7-101.6 cm (31-40 inches) Weight: 410 grams (0.9 lbs)	USFWS lists this species as occurring statewide in Texas.	Desert grasslands and coastal prairies. Open terrain with scattered trees or shrubs. Specifically in the U.S., this species is found along yucca-covered sand ridges in coastal prairies, riparian woodlands in open grasslands, and in desert grasslands with scattered mesquite and yucca. Essential habitat elements include open terrain with scattered trees, relatively low ground cover, an abundance of insects and small to medium-sized birds, and a supply of nest sites.	Nesting occurs from March to June. The clutch size is generally 2 to 3 eggs with a brood size of 1 to 3 chicks. Incubation lasts 31 to 33 days. Young birds leave the nest about 4 to 5 weeks after hatching.	Birds, insects, rodents, small snakes, and lizards.
Black-footed ferret (*Mustela nigripes*) – no designated critical habitat				
Adult length: 48.3-61.0 cm (19-24 inches), including a 12.7 or 15.2 cm (5 or 6 inch) tail. Adult weight: 0.6-1.1 kg (1.4 to 2.5 lbs)	All wild populations have been extirpated. Reintroduced into several counties within the following states: Arizona, Kansas, Nebraska, New Mexico, North Dakota, South Dakota, and Wyoming.	Short midgrass prairie habitat consistent with the North American grassland biome.	Breeding takes place between March and May. Gestation lasts for 41-45 days.	Predominantly prairie dogs and prairie dog carrion. They also prey on lagomorphs, mice, voles, ground squirrels, pocket gophers, birds, and insects.

Size	Current Range	Habitat Type	Reproductive Cycle	Diet
Chirichaua leopard frog (*Rana chiricahuensis*) – no designated critical habitat				
10.9 cm (4.3 inches) in length. Snout-to-vent lengths of adults range from approximately 5.4 to 12.0 cm (2.1 to 4.7 inches)	Central and east-central Arizona into west-central New Mexico, and also in southeastern Arizona, the bootheel of southwestern New Mexico, and south through western Chihuahua and northeastern Sonora, Mexico	Highly aquatic. Found in rocky streams with deep rock-bound pools, ponds, earthen stock tanks, and permanent springs. Surrounding upland vegetation includes oak and mixed oak and pine woodlands, and ranges into areas of chaparral, grassland, and desert. It is known from montane and river valley cienegas, springs, pools, cattle tanks, lakes, reservoirs, streams, and rivers. It is a habitat generalist that historically was found in a variety of aquatic habitat types, but is now limited to the comparatively few aquatic systems that support few or no non-native predators. Permanent or semi-permanent pools are required for breeding. Occurs at elevations of 1,000 to 2,709 meters (3,281 to 8,890 feet).	Breeds primarily from April through October, but egg masses are unusual in June. Populations that are greater than 1,798 meters (5,900 feet) breed from June-August. Tadpoles take three to nine months to metamorphose, and some overwinter. At low elevations, the frog breeds from mid-February through June, while at higher elevations breeding occurs from May until August.	Larval stage is primarily herbivorous (bacteria, diatoms, phytoplankton, filamentous green algae, water milfoil (*Myriophyllum* sp.), duckweed (*Lemna minor*), and detritus). Metamorphs and adults eat a wide variety of aquatic or terrestrial invertebrates as well as other arthropods and small fish, frogs, or toads. Other members of the leopard frog complex from the western United States eat a wide variety of prey items including many types of aquatic and terrestrial invertebrates (e.g., snails, spiders, and insects) and vertebrates (e.g., fish, other anurans (frogs and toads) (including conspecifics), and small birds). Fresh-water shrimp may also be eaten.

Size	Current Range	Habitat Type	Reproductive Cycle	Diet
Jaguar (*Panthera onca*) – no designated critical habitat				
Length: 112-185 cm (44-72 inches), plus a tail length of 45-75 cm (17.5-29 inches). Adult Weight: 36.39-157.9 kg (80-348 lbs) Birth Weight: 700-900 grams (1.5-2.0 lbs)	The USFWS lists Arizona (Cochise, Pima, and Santa Cruz counties) and Hidalgo County in New Mexico as jaguar locations in the U.S.	In the humid tropics of Central America, the jaguar occupies wet, lowland habitat characterized by swampy savannas and tropical rain forests. The northern and southern reaches of current jaguar distribution are marked by far more arid habitat than is found in the areas central to the species' distribution. Jaguars – particularly males of the northern reaches – are known to have large home ranges that encompass a variety of plant communities, including: Maderan evergreen-woodland, subalpine conifer forest, semidesert shrubland, and Sonoran desert scrub. Washes and riparian areas with dense vegetative growth may also be valuable movement corridors.	In captivity breeding takes place year-round. However, there may be a spring mating season in the northern and southern limits of the species' range. Gestation lasts for 93-105 days. In Mexico, most births occur in July, August, and September.	Javelina, deer, livestock, capybara, paca, armadillo, caiman, and various species of turtle, birds, and fish.
Gulf Coast jaguarundi (*Herpailurus yagouaroundi cacomitli*) – no designated critical habitat				
Length: 55-77 cm (21.7-30.3 inches) (combined head and body) and a tail length of 33-60 cm (13.0-23.6 inches) Adult Weight: 4.5-9.0 kg (9.9-19.8 lbs)	26 counties in Texas.	Chaparral plant communities and dense brushy areas near streams and rivers.	Kittens are born around March or August. Kittens are weaned after 2 months and within 10 months the young are fully independent. Gestation last between 70 and 75 days.	Small mammals, birds, and reptiles. Stomach contents have included: lizards, rodents (mice and rats), small birds, and cottontail rabbits, and grass. This species may also prey on fish and other aquatic animals.

Size	Current Range	Habitat Type	Reproductive Cycle	Diet
Canada lynx (*Lynx Canadensis*) – designated critical habitat				
Length: 78.7-99.1 cm (31-39 inches) snout to tail Adult Weight: 5.1-17.2 kg (11.2-37.9 lbs) Birth Weight: 197-211 g (0.4-0.5 lbs)	Listed by the USFWS as occurring in 15 states: Alaska, Colorado, Idaho, Maine, Michigan, Minnesota, Montana, New Hampshire, New York, Oregon, Utah, Vermont, Washington, Wisconsin, and Wyoming.	In the contiguous United States, the lynx is associated with the southern, transitional reaches of the cool and moist boreal forest. Where it occurs at these lower latitudes, the boreal forest forms a mixed conifer and conifer-hardwood landscape. More specific lynx habitat associations vary from state to state.	Mating takes place in February and March. The gestation period is 9-10 weeks. Kittens are born between May and June, in litters of 1-8. Kittens are weaned after 5 months, although some meat may be eaten by kittens as early as the first month. Sexual maturity is reached prior to two years of age.	The snowshoe hare is the lynx's primary prey. If snowshoe hares are not available, the lynx will feed opportunistically on small mammals and birds. Other prey may include rodents and fish. Lynx may also prey on ungulates.

Size	Current Range	Habitat Type	Reproductive Cycle	Diet
Preble's meadow jumping mouse (*Zapus hudsonius preblei*) – designated critical habitat				
Adult Length: 18.7-25.5 cm (7.4-10.0 inches) with a tail length of 10.8-15.5 cm (4.3-6.1 inches). Juvenile Weight: <13 g (0.03 lbs) Sub-adult Weight: 13-14 g (0.03 lbs) Adult Weight: 14-38 g (0.03-0.08 lbs). These mice weigh more in late August to mid-September before hibernation and weigh less in May when they emerge from hibernation.	Widespread in Wyoming but rare or extirpated in Colorado.	Well developed riparian vegetation next to undisturbed grassland, with a water source nearby that can range in size from a river to a small drainage of 1-3 meters (3.3-9.8 feet) wide. Seasonal streams, low moist areas, dry gulches, agricultural ditches, wet meadows, and seeps near streams also provide habitat. Trees, tall shrubs, short shrubs, an herbaceous layer, and ground cover are also necessary habitat components. Upper limit of elevation is 2,360 meters (7,742 feet) in Colorado and 2,317 meters (7,601 feet) in Wyoming. Day nests are constructed under debris at the base of shrubs and trees or in open grasslands, made of grasses, forbs, sedges, rushes, and other plant material. The nests are usually above ground but can be underground, are globular shapes or mats of litter, and are abandoned after a week. These mice do not appear to use burrows of other rodents.	Hibernate from September or October until May. Adults hibernate by the 3rd week in August, while the young of the year enter hibernation in September or October. Meadow jumping mice have 2-3 litters per year. Each litter has 2-8 young, with an average of 5 young. The young mature to adult size in 4 weeks. Mice born in June may reproduce at 2 months of age and mice born later in the summer reproduce the following year.	Arthropods and fungus when they emerge from hibernation. July-August: fungus, moss, and pollen. September: arthropods Lamb's quarters, Russian thistle, sunflower, sedge, mullein, grasses, bladderpod, rushes, and seeds.

Size	Current Range	Habitat Type	Reproductive Cycle	Diet
Ocelot (*Leopardus pardalis*) – no designated critical habitat				
11.3 - 15.8 kg (24.9-34.8 lbs)	3 counties in Arizona (Cochise, Pima, and Santa Cruz) and 26 counties in Texas.	A variety of habitats can be used by ocelots. Ocelots appear to use areas of dense cover, and in the northern part of the range hunt in brushy forests and semi-arid deserts. In the southern part of its range, ocelot habitat includes tropical forests, mountain slopes, and pampas (grasslands).	Births have been recorded from September to January. Births in Texas have been documented in September and October, and also in late summer, late fall, early winter, and late spring. Typically one or two kittens are born, but litters can range up to four kittens.	Small to medium-sized mammals (rabbits, agoutis, & mice), birds, reptiles (snakes & lizards), fish, & invertebrates.
Mexican spotted owl (*Strix occidentalis lucida*) – designated critical habitat				
Adult male average weight: 519±32.6 (SD) g (1.1 lbs) Adult female average weight: 579±31.2 (SD) g (1.3 lbs)	13 counties in Arizona; 33 counties in Colorado; 22 counties in New Mexico; 4 counties in Texas; and 11 counties in Utah.	Old-growth or mature forests with unevenly aged stands of trees, high canopy, multi-storied levels, and high tree density. Canyons with riparian or conifer communities. In Arizona and New Mexico: mixed conifer, pine-oak, Arizona cypress, oak woodlands, and associated riparian forests. Dispersing juveniles move through a variety of habitats before selecting a home range, including: spruce-fir and mixed-conifer forests, pinyon-juniper woodland, mountain shrublands, desert scrubland, and desert grasslands.	Owls defend their breeding territory during the nesting season (March – August). Clutch size: 1-3 eggs. Eggs hatch in early May. A second clutch may be produced if the first clutch fails. Owlets fledge at 4-5 weeks old (early to mid-June). They disperse from the nest in mid-September to early October. Breeding is sporadic. Not all birds nest every year.	Small- and medium-sized rodents including woodrats, peromyscid mice, and microtine voles. They also eat bats, birds, reptiles, and arthropods.

Size	Current Range	Habitat Type	Reproductive Cycle	Diet
Piping plover (*Charadrius melodus*) – designated critical habitat				
Between 42 and 64 grams (1.5 to 2 ounces) 17 centimeters from bill to rump, and its wings measure approximately 35 centimeters from tip to tip	Plover breeding occurs in Montana in Garfield, Sheridan and McCone Counties. In North Dakota, plovers breed in 25 counties located along the Missouri River and in the alkali wetlands located in the center of the state. Plover breeding in South Dakota also occurs on sandbars along the Missouri River, with other isolated nesting sites located in Lake Oahe and saline wetlands in the northeast. In Nebraska, plover breed along the upper Missouri River, the lower Niobrara, and the mid- to lower Platte Rivers, as well as the Middle Loup and Loup Rivers, and Lake McConaughy (USFWS, 1988).	In north-central North America, Piping Plovers nest on barren sand and gravel Great Lakes shorelines, and along sand and gravel shores of rivers and lakes in the Great Plains. Lake habitat generally consists of wide beaches (>20 m) with less than 5% vegetative cover, with highly clumped vegetation and/or with extensive gravel. Lake habitat may vary from these conditions when unavailable in a given shoreline area.	Plovers arrive at breeding sites in the Great Plains between mid-April and mid-May. Egg laying begins the second or third week of May. Incubation lasts for 25-31 days and both adults incubate the egg. Chicks fledge between 21 days after hatching in Manitoba to 30-35 days on Long Island in New York. Adults migrate from breeding grounds beginning in mid-July and ending in early August. Juveniles often depart as late as late August and breeding males are sometimes reported to depart with their young	The diet of the piping plover consists of invertebrates such as marine worms, fly larvae, beetles, crustaceans, and mollusks

Size	Current Range	Habitat Type	Reproductive Cycle	Diet
New Mexican ridge-nosed rattlesnake (*Crotalus willardi obscurus*) – designated critical habitat				
Length: Maximum length of 60 cm (24 inches). The lengths range from 30-61 cm (11.8-24 inches). Weight: 85-113 grams (0.2-0.3 lbs).	Exists in fragmented enclaves occupying a combined total of less than two square miles of habitat in the extreme southwest corner of New Mexico. The USFWS lists the species as known to occur in two counties in the U.S.: Hidalgo County, New Mexico and Cochise County, Arizona.	Narrow mountain canyons at elevations between 1,676 and 2,743 meters (5,500 and 9,000 feet). The snake prefers to hide in leaf litter among cobbles and rocks along canyon floors. Rocks, leaf litter, and mesic conditions are commonalities among all confirmed habitat of this species. The vegetative structure of the habitat is chiefly comprised of open stands of pine-oak forest and associated shrubs and grasses. Specifically, plant species of the typical habitat include Arizona white oak, Alligator juniper, Mexican pinyon, Chihuahua pine, Gambel oak, Arizona Madrone, skunkbush, Manzanita, and birchleaf rhamnus. Bunchgrass is also associated with this species.	Females are ovoviviparous, and give birth to live young. This species is a biennial species: mating occurs in the summer and fertilized eggs are retained in the oviducts until ready to hatch the following summer. The gestation period averages 13 months. Births for most species of rattlesnake occur between August 1^{st} and October 15^{th}, however most births of this species are in April and May.	Small mammals, birds, lizards, other snakes, and arthropods. Diets of small-bodied rattlesnakes including this species generally consist more of lizards than small mammals. Natural feeding of this species might include scavenging as captive individuals have been known to consume carrion.

Size	Current Range	Habitat Type	Reproductive Cycle	Diet
Sonora tiger salamander (*Ambystoma tigrinum stebbinsi*) – no designated critical habitat				
Metamorphosed Sonora tiger salamanders: 4.5-15 cm (1.8-5.9 inches) snout to vent length. Branchiate adults: 6.5-16.5 cm (2.6-6.5 inches) snout to vent length.	This subspecies has been found in 53 ponds in the San Rafael Valley of Arizona. The San Rafael Valley lies between the Hauchuca and Patagonia mountains, is bordered by the Canelo Hills to the north and extends from Santa Cruz County in Arizona south for approximately 30 km (18 miles) into Sonora, Mexico.	Requires standing water from January through June for breeding and larval growth. Adult, metamorphosed salamanders inhabit adjacent grassland and oak woodland terrestrial habitat when not in ponds. The ecology of the Sonora tiger salamander outside of the pond has not been well studied, but other Ambystoma species spend much of their time in mammal burrows or buried in soft earth to avoid environmental extremes common on land.	Begin as eggs laid in water. Then hatch and grow as aquatic larvae with gills, and then either mature as gilled aquatic adults (called branchiate adults, neotenes, or paedomorphs), or metamorphose into terrestrial salamanders without gills. Breed as early as January, and eggs can be found in ponds as late as early May. Terrestrial adults, which are often outside of the pond during the rest of the year, return to the ponds to breed, and branchiate adults in the pond also breed. Eggs take 2-4 weeks to hatch; the colder the water the longer it takes the eggs to develop. Larvae can develop into the minimum size necessary to metamorphose in as few as two months. However, because many sites hold water all year, larvae often remain in the water longer before metamorphosing, or instead, develop into branchiate adults.	Larvae: zooplankton (daphnids, copepods, bosminids, ostracods, etc.), and incorporate larger aquatic macroinvertebrates (chironomids, trichopterans, mollusks, zygopterans, etc.) as they grow. Branchiate adults: zooplankton and a variety of macroinvertebrates, and salamander eggs and larvae during the breeding season. Metamorphosed adults: while still in the pond they eat aquatic macro-invertebrates & terrestrial insects that fall in the water. Once outside the pond they eat terrestrial insects and other macroinvertebrates.

Size	Current Range	Habitat Type	Reproductive Cycle	Diet
Black-capped vireo (*Vireo atricapilla*) – no designated critical habitat				
Length: 11 to 12 cm (about 4.5 inches) Weight: 9 to 10 grams (0.02 lbs)	The USFWS website states that the species is known to occur in 8 counties in Oklahoma and 67 counties in TX. However, the USFWS recovery plan states three locations (Blaine, Comanche, and the border of Canadian and Caddo counties) in Oklahoma and 35 counties in Texas.	Mixed deciduous/evergreen shrub land. Breeding vireos use shrubby growth of irregular height and distribution with spaces the small thickets and clumps and with vegetative extending to ground level. From Oklahoma through most of Texas this type of vegetational configuration occurs most frequently on rocky substrates with shallow soils, in rocky gullies, on edges of ravines, and on eroded slopes.	Territory size mostly 2-4 acres. Nesting begins when females arrive and continues through August. Nest building requires 2-5 days. Complete clutches have been found as early as April 4th in Texas and April 30th in Oklahoma. Latest known nesting start (beginning nest construction) is July 21st. Clutches contain 3-4 eggs. Seasonal clutch size is likely between 12 and 20 eggs allowing up to six nesting attempts per season. One egg is laid per day with the first egg being laid one day after completion of the nest. Incubation requires 14-19 days. Nestling stage is 9-12 days. Fledgling stage is 30-45 days.	These birds are insectivorous. Beetles and caterpillars make up a large part of the diet.
Golden-cheeked warbler (*Dendroica chrysoparia*) – no designated critical habitat				
Length: 12 cm (4.7 inches) long Weight: 10 grams (0.02 lbs)	Nests only in central Texas. Edwards Plateau of Texas and locally north to Palo Pinto County	Mixed Ashe-juniper and oak woodlands in ravines and canyons. Summers in open canopy forest and winters in closed canopy forests. Breeds in juniper-oak woodlands typically in limestone hills and canyons. It is dependent on the bark of the Ashe juniper (*Juniperus ashei*) for nesting materials. In winter it occurs in pine-oak forests at elevations between 1,500 and 3,000 meters (4,921 and 9,842 feet).	One brood with incubation of 12 days and 9 days until fledge. Arrives on breeding ground in early March. Nest built by female and usually in an Ashe juniper tree. Nests are constructed from strips of juniper bark woven together with spider silk and insect cocoons, and lined with grass, hair, or down. 3-5 eggs are incubated for 10-12 days. Young leave the nest at 9-12 days. Young are independent at about 1 month after fledging. Migration to the wintering grounds occurs from June to August.	These birds are insectivorous. Feeds on insects and spiders with caterpillars being an important prey item during the breeding season. Prey is taken directly from foliage or snatched from the air. Less is known about the winter diet.

Size	Current Range	Habitat Type	Reproductive Cycle	Diet
Gray wolf (*Canis lupus*) – designated critical habitat				
Adult weight: 18-80 kg (40-175 lbs)	Found in: Colorado (statewide), Michigan (15 counties), New Mexico (3 counties), North Dakota (53 counties), Oregon (statewide), South Dakota (statewide), Utah (statewide), Washington (statewide), and Wisconsin (32 counties).	Wide range of habitats including temperate forests, mountains, tundra, taiga, and grasslands.	Typically only the alpha male and female breed and produce pups. Breeding begins around age 2 and may continue annually until they are 10 years old or older. Pups are born in April. Litter size ranges from 1-11 pups with an average of 5 pups per litter.	White-tailed deer, mule deer, moose, elk, caribou, bison, muskox, bighorn sheep, Dall sheep, mountain goat, beaver, and snowshoe hare. Small mammals, birds, and large invertebrates are sometimes also taken.

2.5.1. Consideration of Federally Listed Plants

BTPDs may have an effect on the plant communities within their habitat through their feeding habits. Eliminating or reducing the numbers of BTPDs may therefore have an effect on the composition of plant communities within the range of the BTPD. The impact of this effect to listed plants while noted, is not specifically assessed since it is not clear whether such changes would have negative or positive effects on individual listed plant species. Further, impacts from the use of Rozol Prairie Dog Bait to pollinators and seed dispersers could have effects on the viability of listed plants that depend upon those methods of reproduction. Listed plants found within the 10 states where Rozol Prairie Dog Bait may be used are enumerated below:

Penland beardtongue (*Penstemon penlandii*), Colorado butterfly plant (*Gaura neomexicana var. coloradensis*), Chisos Mountain hedgehog cactus (*Echinocereus chisoensis var. chisoensis*), Knowlton's cactus (*Pediocactus knowltonii*), Kuenzler hedgehog cactus (*Echinocereus fendleri var. kuenzleri*), Lee pincushion cactus (*Coryphantha sneedii var. leei*), Lloyd's Mariposa Cactus (*Echinomastus mariposensis*), Mesa Verde cactus (*Sclerocactus mesae-verdae*), Nellie cory cactus (*Coryphantha minima*), Sneed pincushion cactus (*Coryphantha sneedii var. sneedii*), Tobusch fishhook cactus (*Ancistrocactus tobuschii*), Spalding's catchfly (*Silene spaldingii*), Terlingua Creek cat's-eye (*Cryptantha crassipes*), bunched cory cactus (*Coryphantha ramillosa*), Zuni fleabane (*Erigeron rhizomatus*), Holy Ghost Ipomopsis (*Ipomopsis sancti-spiritus*), Ute ladies'-tresses (*Spiranthes diluvialis*), Mancos milk-vetch (*Astragalus humillimus*), Osterhout milk-vetch (*Astragalus osterhoutii*), Penland alpine fen mustard (*Eutrema penlandii*), Hinckley oak (*Quercus hinckleyi*), western prairie fringed orchid (*Platanthera praeclara*), Todsen's pennyroyal (*Hedeoma todsenii*), blowout penstemon (*Penstemon haydenii*), North Park phacelia (*Phacelia formosula*), Davis' green pitaya (*Echinocereus viridiflorus var. davisii*), Sacramento prickly poppy (*Argemone pleiacantha ssp. pinnatisecta*), Texas poppy-mallow (*Callirhoe scabriuscula*), slender rush-pea, (*Hoffmannseggia tenella*), Texas snowbells (*Styrax texanus*), Pecos sunflower (*Helianthus paradoxus*), Sacramento Mountains thistle (*Cirsium vinaceum*), gypsum wild-buckwheat (*Eriogonum gypsophilum*), and desert yellowhead (*Yermo xanthocephalus*).

2.6. Designated Critical Habitat

Critical habitat has been designated for the following nine assessed animal species: Salt Creek tiger beetle, California condor, whooping crane, Canada lynx, Preble's meadow jumping mouse, Mexican spotted owl, piping plover, New Mexican ridge-nosed rattlesnake, and the gray wolf.

Critical habitat is defined in the ESA as the geographic area occupied by the species at the time of the listing where the physical and biological features necessary for the conservation of the species exist, and there is a need for special management to protect the listed species. It may also include areas outside the occupied area at the time of listing if such areas are 'essential to the conservation of the species.' Critical habitat receives protection under Section 7 of the ESA through prohibition against destruction or adverse modification with regard to actions carried out, funded, or authorized by a federal agency. Section 7 requires consultation on federal actions that are likely to result in the destruction or adverse modification of critical habitat.

To be included in a critical habitat designation, the habitat must be 'essential to the conservation of the species.' Critical habitat designations identify, to the extent known using best scientific and commercial data available, habitat areas that provide essential life cycle needs of the species, or areas that contain certain PCEs (as defined in 50 CFR 414.12(b)). PCEs include, but are not limited to, space for individual and population growth and for normal behavior; food, water, air, light, minerals, or other nutritional or physiological requirements; cover or shelter; sites for breeding, reproduction, rearing (or development) of offspring; and habitats that are protected from disturbance or are representative of the historic geographical and ecological distributions of a species. **Table 2.3** describes the PCEs for the critical habitats for the following nine assessed species: Salt Creek tiger beetle, California condor, whooping crane, Canada lynx, Preble's meadow jumping mouse, Mexican spotted owl, piping plover, New Mexican ridge-nosed rattlesnake, and the gray wolf.

Table 2.3 Designated Critical Habitat PCEs

PCEs	Reference
Salt Creek tiger beetle	
(1) Non-vegetated streambanks and mid-channel areas, located adjacent to and between saline stream edges and barren salt flats in saline and freshwater wetlands, in assemblages that are within 4 mi (6 km) of one another.	(USFWS, 2010)
(2) Moist, barren salt flats with:	
(a) Salmo and Saltillo soils or Lamo, Gibbon-Saltine, Obert, and Zoe soils with Salmo and Saltillo inclusions:	
(b) Soil electroconductivity ranging from 2,016.0 mS/m to 2,992.2 mS/m;	
(c) Soil moisture ranging from 43.5 percent to 51.7 percent; and	
(d) Differential hydraulic pressures that create evaporation and result in exposed salt on soil surfaces.	
(3) A natural hydrologic regime resulting in annual high flows in saline streams in the early spring and summer, and natural elevation changes in groundwater levels to hydrate saline wetlands located on the floodplain.	
(4) The presence of abundant and diverse flying and non-flying invertebrate prey species belonging to the orders Coleoptera, Orthoptera, Hemiptera, Hymenoptera, Odonata, Diptera, or Lepidoptera.	

California condor	
PCEs were not described for the California condor. However, several factors were considered in designating critical habitat:	(USFWS, 1976)
The Sespe-Piru, Mantilija, Sisquoc-San Rafael, and the Hi Mountain-Beartrap areas were considered critical for nesting and related year-long activities.	
The Mount Pinos and Blue-Ridge areas were considered critical for roosting.	
The Tejon Ranch, Kern County Rangelands, and Tulare County Rangelands were considered critical for feeding and other related activities; specifically, the Tejon County Rangelands are important because it is the only feeding area close to the Sespe-Piru nesting area.	
Further, areas of open range with limited disturbance that provide food are needed within the designated areas to maintain the species, since food availability is directly related to condor distribution and reproduction.	
Whooping crane	
Although PCEs were not specifically described for the whooping crane it was stated that each of the five factors normally associated with PCEs ((1) Space for individual and population growth and for normal behavior; (2) Food, water, air, light, minerals, or other nutritional or physiological requirements; (3) Cover or shelter; (4) Sites for breeding, reproduction, or rearing of offspring; and generally, (5) Habitats that are protected from disturbances or are representative of the geographical distribution of the listed species) pertain to the whooping crane and are summarized below:	
Whooping cranes are territorial; pairs require hundreds of acres of undisturbed wetland habitat and unmated birds require undefended territory. Refuges in Idaho, Colorado, and New Mexico were originally designated as part of the critical habitat to add space for a growing new flock. However, these refuges were later removed from the critical habitat designation due to the failure of whooping crane reintroduction in these areas.	(USFWS,1978 and 1997)
All of the designated critical habitat areas provide for the nutritional and physiological needs of the cranes. This includes the tidal flats and marshes of Aransas that provide crustaceans and mollusks, the spring migration marshes that provide frogs, fish, crayfish, and other small animals, and the fall migration stopover locations where cranes feed primarily on waste grains and insects.	(USFWS, 1978)
Whooping cranes require open spaces, primarily sand and gravel bars in rivers and lakes, for nightly roosting. These features appear to be one of the major factors in the selection of habitat by cranes.	
With regard to breeding, the Grays Lake National Wildlife Refuge in Idaho was previously designated as critical habitat in order to provide additional nesting habitat. However, all of the designated critical habitat provides areas essential to rearing young. Cranes also require undisturbed wetland roosting sites and do not tolerate disturbance to themselves or their habitat.	
Canada lynx	
Boreal forest of multiple succesional stages.	(USFWS, 2009)
Snowshoe hares and their preferred habitat conditions, which include low and dense vegetation that protrudes above the snow, and mature multistoried stands with conifer boughs at the snow surface.	
Winter snow conditions of deep powder present for extended periods of time.	
Potential den sites characterized by abundant coarse woody debris.	
Matrix habitat (e.g., hardwood forest, dry forest, non-forest, or other habitat types that do not support snowshoe hares) which connect patches of boreal forest foraging sites used by the lynx within a home range	

Preble's meadow jumping mouse	
Riparian corridors formed and maintained by normal, dynamic, geomorphological, and hydrologic processes that create and maintain river and stream channels, floodplains, and floodplain benches and promote patterns of vegetation favorable to the Preble's meadow jumping mouse, containing dense, riparian vegetation consisting of grasses, forbs, and shrubs, or any combination thereof, in areas along rivers and streams, that normally provide open water through the mouse's active season.	(USFWS, 2009)
The riparian areas must also include specific movement corridors that provide connectivity between and within populations.	
These could be riparian corridors with less vegetative cover, or include human disturbances such as erosion control, travel ways under bridges, along ditches and canals, and through culverts.	
Adjacent areas of low disturbance in floodplains and uplands, such as hayed fields, grazed pasture, and other unplowed agricultural fields, restored mine lands, recreational trail areas and urban-wildland interfaces.	
Mexican spotted owl	
A range of tree species, including mixed conifer, pine-oak, and riparian forest types, composed of different tree sizes reflecting different stages of trees, 30-45% of which are trees with a 12 inch or greater trunk diameter when measured 4.5 feet off of the ground.	(USFWS, 2004)
A shade canopy created by the tree branches covering 40 percent or more of the ground	
Large dead trees (snags) with a trunk diameter of at least 12 inches (0.3 meters) when measured at 4.5 feet (1.4 meters) from the ground.	
High volumes of fallen trees and other woody debris;	
A wide range of tree and plant species, including hardwoods; and	
Adequate levels of residual plant cover to maintain fruits, seeds, and allow plant regeneration.	
Presence of water which typically provides cooler temperatures and higher humidity than the nearby areas.	
Clumps of stringers of mixed-conifer, pine-oak, pinyon-juniper, and/or riparian vegetation;	
Canyon wall containing crevices, ledges, or caves; and	
High percent of ground litter and woody debris.	
Piping plover	
The PCEs that support foraging, roosting, and sheltering habitat components for the wintering piping plover are:	(USFWS, 2009)
(1) Intertidal sand beaches (including sand flats) or mud flats (between the MLLW [mean lower low water] and annual high tide) with no, or very sparse, emergent vegetation for feeding. In some cases, these flats may be covered or partially covered by a mat of blue-green algae.	
(2) Unvegetated or sparsely vegetated sand, mud, or algal flats above annual high tide for roosting. Such sites may have debris or detritus and may have micro-topographic relief (less than 20 in (50 cm) above substrate surface) offering refuge from high winds and cold weather.	
(3) Surf-cast algae for feeding.	
(4) Sparsely vegetated backbeach, which is the beach area above mean high tide seaward of the dune line, or in cases where no dunes exist, seaward of a delineating feature such as a vegetation line, structure, or road. Backbeach is used by plovers for roosting and refuge during storms.	
(5) Spits, especially sand, running into water used for foraging and roosting.	
(6) Salterns, or bare sand flats in the center of mangrove ecosystems that are found above mean high water and are only irregularly flushed with seawater.	
(7) Unvegetated washover areas with little or no topographic relief for feeding and roosting. Washover areas are formed and maintained by the action of hurricanes, storm surges, or other extreme wave actions.	
(8) Natural conditions of sparse vegetation and little or no topographic relief mimicked in artificial habitat types (e.g., dredge spoil sites.)	

The following PCEs, taken from the critical habitat designation for the northern Great Plains breeding population of the piping plover, encompass piping plover habitat outside of the designated wintering grounds of the species.	(USFWS, 2002)
The one overriding primary constituent element (biological) that must be present at all sites is the dynamic ecological processes that create and maintain piping plover habitat.	
The biological primary constituent element, *i.e.*, dynamic ecological processes, creates different physical primary constituent elements on the landscape. These habitat types or physical primary constituent elements that sustain the northern Great Plains breeding population of piping plovers are described as follows:	
On prairie alkali lakes and wetlands, the physical primary constituent elements include –	
(1) Shallow, seasonally to permanently flooded, mixosaline to hypersaline wetlands with sandy to gravelly, sparsely vegetated beaches, salt-encrusted mud flats, and/or gravelly salt flats;	
(2) Springs and fens along edges of alkali lakes and wetlands; and	
(3) Adjacent uplands 200 feet (61 m) above the high water mark of the alkali lake or wetland.	
On rivers the physical primary constituent elements include – sparsely vegetated channel sandbars, sand and gravel beaches on islands, temporary pools on sandbars and islands, and the interface with the river.	
On reservoirs the physical primary constituent elements include – sparsely vegetated shoreline beaches, peninsulas, islands composed of sand, gravel, or shale, and their interface with the water bodies.	
On inland lakes (Lake of the Woods) the physical primary constituent elements include – sparsely vegetated and windswept sandy to gravelly islands, beaches, and peninsulas, and their interface with the water body.	
New Mexican ridge-nosed rattlesnake	
PCEs were not described for the New Mexican ridge-nosed rattlesnake by name. However, the critical habitat listing notice identified certain attributes and features of the designated critical habitat area that are grouped as "constituent elements," including:	(USFWS, 1978)
Dens and/or denning habitat that provides shelter during the summer and winter months;	
Vegetation that provides cover for the New Mexican ridge-nosed rattlesnake and habitat for prey;	
Abundance of prey (lizards and rodents)	
Gray wolf	
PCEs were not described for the gray wolf. However, key habitat components were described in the recovery plan:	(USFWS, 1987)
A year-round abundance of ungulate prey and alternate prey,	
Secluded and suitable denning and rendezvous sites, and	
Sufficient space with low human disturbance.	

2.7. Action Area and LAA Effects Determination Area

2.7.1. Action Area

The action area is defined by the Endangered Species Act as, "all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action" (50 CFR §402.2). The Federal action is the authorization or registration of pesticide use or uses as described on the label(s) of pesticide products containing a particular active ingredient. Based on an analysis of the Federal action, the action area is defined by the actual and potential use of the pesticide and areas where that use could result in effects. Specific measures of ecological effect for the assessed species that define the action area include any direct and indirect toxic effect to the assessed species and any potential modification of its critical habitat, including reduction in survival, growth, and reproduction as well as the full suite of sublethal effects available in the effects literature. The overall action area for the national registration of chlorophacinone is likely to encompass considerable portions of the United States based on the large array of agricultural and non-agricultural uses. However, the scope of this assessment limits consideration of the overall action area to reflect the BTPD use pattern and the potential for this use to affect listed species.

For this assessment, BTPD range within the states of Colorado, Kansas, Montana, Nebraska, New Mexico, North Dakota, Oklahoma, South Dakota, Texas and Wyoming and counties adjacent to this range is considered to be the action area. The action area considered for direct effects includes the BTPD range within the 10 states listed above as well as counties adjacent to this range. The action area considered for indirect effects includes only the BTPD range with the 10 states listed above and does not include counties adjacent to this range. This distinction was made because indirect effects are not expected to extend beyond the use area. However, direct effects may extend beyond the use area due to exposure to individuals or via prey items with chlorophacinone residues that could be found outside of their described range.

It is important to note that the historic range-wide action areas do not imply that direct and/or indirect effects and/or critical habitat modification are expected or are likely to occur over the full extent of the action area, but rather to identify all areas that may potentially be affected by the action. The Agency uses more rigorous analysis including consideration of available land cover data, toxicity data, and exposure information to determine areas where listed species and their designated critical habitats may be affected or modified via endpoints associated with reduced survival, growth, or reproduction.

2.7.2. MA Effects Determination Area

A stepwise approach is used to define the May Affect (MA) Effects Determination Area. A MA effects determination applies to those areas where chlorophacinone use may directly or indirectly affect the species and/or modify its designated critical habitat. As a result, this is the area where the BTPD range overlaps with the range and/or designated critical habitat for the listed species. If there is no overlap between the BTPD range and the habitat or occurrence areas of the listed species and the listed species is not found in a county adjacent to the BTPD range then a no effect "NE" determination is made. Counties adjacent to the BTPD range are considered to account for potential migration of listed species out of their historic ranges. However, for habitat modification effects, adjacent counties will not be considered. The first step in defining the MA Effects Determination Area is to understand the federal action. The federal action is defined as the use of 50 mg a.i./kg-bait chlorophacinone grain bait to control BTPDs on rangelands and noncrop areas within the noted 10 state area. An analysis of this use and review of the product label was completed.

Following a determination of the assessed use, an evaluation of the potential "footprint" of chlorophacinone use for BTPDs (*i.e.*, the area where pesticide application may occur) is determined. This "footprint" represents the initial area of concern and comes from the range of the BTPD obtained from NatureServe. The initial area of concern is defined as all land cover types within the range of the BTPD.

Initial Area of Concern for use of Rozol Prairie Dog Bait

Figure 2.2. Initial area of concern, or "footprint" of potential use, for chlorophacinone use to control BTPDs.

As previously discussed, the action area is defined by the most sensitive measure of direct and indirect ecological toxic effects including reduction in survival, growth, reproduction, and the entire suite of sublethal effects from valid, peer-reviewed studies. Once the initial area of concern is defined, the next step is to define the boundaries of the potential MA Effects

Determination Area by determining the extent of offsite transport via chlorophacinone exposed animals ranging distances from chlorophacinone use sites. The Agency does not have a method for modeling this type of off-site transport but will include listed species not just overlapping in the range of the BTPD but those species occurring in counties adjacent to counties within the historic BTPD range as well.

2.8. Assessment Endpoints and Measures of Ecological Effect

2.8.1. Assessment Endpoints

A complete discussion of all of the toxicity data available for this risk assessment, including resulting measures of ecological effect selected for each taxonomic group of concern, is included in **Section 4** of this document. Registrant submitted data, data from ECOTOX, and data received during the comment period for "Receipt of Petition Requesting EPA to Suspend the Registration of Rozol Prairie Dog Bait and Cancel Certain Application Sites" (EPA-HQ-OPP-2009-0684-0001) were all considered. **Table 2.4** identifies the taxa relevant to assessing direct effects via primary or secondary exposure for each species of concern. The taxa relevant to primary exposure are those animals that directly consume the chlorophacinone bait. The taxa relevant to secondary exposure are those species of concern that prey upon or scavenge the primary consumers of the cholorphacinone bait.

Table 2.4 Taxa Used in the Analyses of Direct Effects from Primary (Bait) and Secondary Exposure for the Listed Species that May be Affected

Listed Species	Terrestrial Invertebrates	Mammals	Birds
Grizzly bear	N/A	Primary and Secondary	N/A
American burying beetle	Secondary	Secondary	Secondary
Salt creek tiger beetle	Secondary	N/A	N/A
California condor	N/A	Secondary	Secondary
Whooping crane	Secondary	Secondary	Primary and Secondary
Eskimo curlew	Secondary	N/A	N/A
Northern Aplomado falcon	Secondary	Secondary	Secondary
Black-footed ferret	Secondary	Secondary	Secondary
Chirichaua leopard frog	Secondary	N/A	Secondary
Jaguar	N/A	Secondary	Secondary
Gulf Coast jaguarundi	N/A	Secondary	Secondary
Canada lynx	N/A	Secondary	Secondary
Preble's meadow jumping mouse	Secondary	Primary	N/A
Ocelot	Secondary	Secondary	Secondary
Mexican spotted owl	Secondary	Secondary	Secondary
Piping plover	Secondary	N/A	N/A
New Mexican ridge-nosed rattlesnake	Secondary	Secondary	Secondary
Sonora tiger salamander	Secondary	N/A	N/A
Black-capped vireo	Secondary	N/A	N/A
Golden-cheeked warbler	Secondary	N/A	N/A
Wolf, Gray	Secondary	Secondary	Secondary

N/A Not Applicable

The taxa used to assess the potential for indirect effects from the uses of chlorophacinone for each listed species are indentified in Table 2.5. Indirect effects consist of modifications to critical habitat or loss of prey base. The specific assessment endpoints used to assess the potential for direct and indirect effects to each listed species are provided in **Section 2.1.**

Table 2.5 Taxa Used in the Analyses of Indirect Effects for the Listed Species that May be Affected

Listed Species	Terrestrial Invertebrates	Mammals	Birds
Grizzly bear	N/A	loss of prey base	N/A
American burying beetle	loss of prey base	loss of prey base	loss of prey base
Salt creek tiger beetle	loss of prey base	N/A	N/A
California condor	N/A	loss of prey base	loss of prey base
Whooping crane	loss of prey base	loss of prey base	loss of prey base
Eskimo curlew	loss of prey base	N/A	N/A
Northern Aplomado falcon	loss of prey base	loss of prey base	loss of prey base
Black-footed ferret	loss of prey base	loss of prey base and habitat	loss of prey base
Chirichaua leopard frog	loss of prey base	N/A	loss of prey base
Jaguar	N/A	loss of prey base	loss of prey base
Gulf Coast jaguarundi	N/A	loss of prey base	loss of prey base
Canada lynx	N/A	loss of prey base	loss of prey base
Preble's meadow jumping mouse	loss of prey base	N/A	N/A
Ocelot	loss of prey base	loss of prey base	loss of prey base
Mexican spotted owl	loss of prey base	loss of prey base	loss of prey base
Piping plover	loss of prey base	N/A	N/A
New Mexican ridge-nosed rattlesnake	loss of prey base	loss of prey base	loss of prey base
Sonora tiger salamander	loss of prey base	N/A	loss of habitat
Black-capped vireo	loss of prey base	N/A	N/A
Golden-cheeked warbler	loss of prey base	N/A	N/A
Wolf, Gray	loss of prey base	loss of prey base	loss of prey base

N/A Not Applicable

1 EFED uses avian toxicity data to assess for exposure to and risks from reptiles and amphibians.

Table 2.6 identifies the most conservative toxic endpoints relevant to each taxa and the most conservative residue concentrations. These endpoints and concentrations will be carried through the assessment to quantitatively assess risk to the species listed in **Table 2.4** and **Table 2.5.**

Table 2.6 Taxa and Assessment Endpoints Used to Evaluate the Potential for Use of Chlorophacinone to Result in Direct and Indirect Effects to the Listed Species or Modification of Critical Habitat that May be Affected

Taxa Used to Assess Direct and Indirect Effects to Listed Species and/or Modification to Critical Habitat or Habitat	Direct or Indirect Effect to Listed Species	Assessment Endpoints	Measures of Ecological Effects	Measures of Ecological Exposures
1. Mammals	**Direct and Indirect Effect**	Survival, growth, and reproduction of individuals or modification of critical habitat via direct and indirect effects	Primary Exposure: Most sensitive mammal acute LD_{50} (5-day)[1]: **Norway rat LD_{50} = 0.80 mg a.i./kg-bw**[2]	Secondary Exposure: Highest whole body BTPD average concentration (MRID 47333603): **BTPD= 2.24 mg a.i./kg-bw** and highest whole body non-target average concentration (Anonymous, 1981): **Deer Mouse = 5.8 mg a.i./kg-bw**
2. Birds and Herptiles	**Direct and Indirect Effect**	Survival, growth, and reproduction of individuals or modification of critical habitat via direct and indirect effects	Primary Exposure: Most sensitive bird LC_{50} (MRID 41513102): **Bobwhite LC_{50} = 56 mg a.i./kg-diet**[2] **Bobwhite LD_{50} = 258 mg a.i./kg-bw**	Secondary Exposure: Highest whole body BTPD average concentration (MRID 47333603): **BTPD= 2.24 mg a.i./kg-bw** and highest whole body non-target average concentration (Anonymous, 1981): **Deer Mouse = 5.8 mg a.i./kg-bw**
3. Terrestrial Invertebrates	**Direct and Indirect Effect**	Survival, growth, and reproduction of individuals or modification of critical habitat via direct and indirect effects		Secondary Exposure: Unquantified sublethal effects to *Nicrophorus orbicollis* (MRID 47383001)

[1] Jackson, W.B. and A.D. Ashton. 1992. A review of available anticoagulants and their use in the United States. Proc. Vertebr. Pest Conf. 15:156-160..

[2] The most sensitive endpoint was used in calculations and is displayed in bold font.

2.8.2. Assessment Endpoints for Designated Critical Habitat

As previously discussed, designated critical habitat is assessed to evaluate actions related to the use of chlorophacinone to control BTPDs that may alter the PCEs of the listed species' designated critical habitat. PCEs for the listed species were previously described in **Section 2.6**. Actions that may modify critical habitat are those that alter the PCEs and jeopardize the continued existence of the listed species. Therefore, these actions are identified as assessment endpoints. It should be noted that evaluation of PCEs as assessment endpoints is limited to those of a biological nature (*i.e.*, the biological resource requirements for the listed species associated with the critical habitat) and those for which chlorophacinone effects data are available.

Assessment endpoints used to evaluate potential for direct and indirect effects are equivalent to the assessment endpoints used to evaluate potential effects to designated critical habitat. If a potential for direct or indirect effects is found, then there is also a potential for effects to designated critical habitat. Some components of these PCEs are associated with physical abiotic features (*e.g.*, presence of a water body, limits of species ranges or physical geographic features), which are not expected to be measurably altered by use of pesticides.

2.9. Conceptual Model

2.9.1. Risk Hypotheses

Risk hypotheses are specific assumptions about potential adverse effects (*i.e.*, changes in assessment endpoints) and may be based on theory and logic, empirical data, mathematical models, or probability models (USEPA, 1998). For this assessment, the risk is stressor-linked, where the stressor is chlorophacinone bait placed in BTPD burrows. The following risk hypotheses are presumed in this assessment:

The labeled use of chlorophacinone for control of BTPDs within the action area may:

- directly affect listed species by causing mortality or by adversely affecting growth or reproduction through primary exposure to grain bait;
- directly affect listed species by causing mortality or by adversely affecting growth or reproduction through secondary exposure to chlorophacinone poisoned animals, BTPDs or non-target animals, or carcasses.
- indirectly affect listed species and/or modify their designated critical habitat by reducing or changing the composition of their food supply due to a reduction in available BTPDs and non-target animals;
- indirectly affect listed species and/or modify their designated critical habitat by reducing populations of BTPDs which provide burrows for shelter

2.9.2. Diagram

The conceptual model is a graphic representation of the structure of the risk assessment. It specifies the chlorophacinone release mechanisms, biological receptor types, and effects endpoints of potential concern. The conceptual model for all listed species is shown in **Figure 2.3**. Although the conceptual models for direct/indirect effects and modification of designated critical habitat PCEs are shown on the same diagram, the potential for direct/indirect effects and modification of PCEs will be evaluated separately in this assessment. Not included in the risk hypotheses but included in the conceptual diagram is effects to plant communities as a result of reduced or loss of BTPD activity. It is uncertain whether this alteration to plant community composition would have beneficial and/or detrimental effects to assessed listed species.

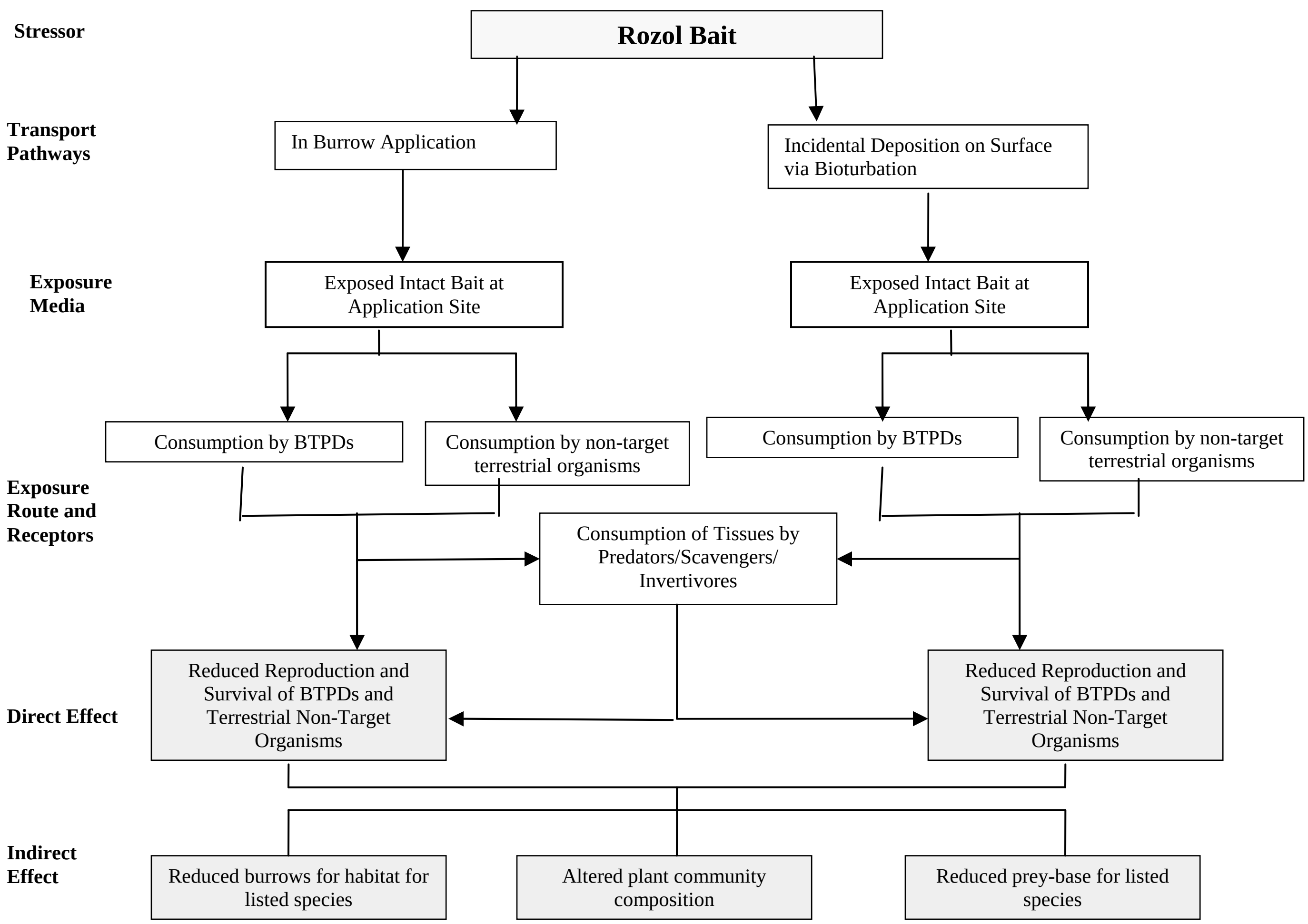


Figure 2.3 Conceptual model depicting stressors, exposure pathways, and potential effects to terrestrial organisms from the use of chlorophacinone on BTPDs.

2.10. Analysis Plan

In order to address the risk hypotheses, the potential for direct and indirect effects to the assessed species, prey items, and loss of burrows is estimated based on a taxon-level approach. In the following sections, the use, environmental fate, and ecological effects of chlorophacinone are characterized and integrated to assess the risks. This is accomplished using a RQ (ratio of exposure concentration to effects concentration) approach. Although risk is often defined as the likelihood and magnitude of adverse ecological effects, the RQ-based approach does not provide a quantitative estimate of likelihood and/or magnitude of an adverse effect. However, as outlined in the Overview Document (USEPA, 2004a), the likelihood of effects to individual organisms from the BTPD use of chlorophacinone to control BTPDs is estimated using the probit dose-response slope and either the LOC (discussed below) or actual calculated RQ value.

2.10.1. Measures of Exposure

Given the environmental fate properties of chlorophacinone and its grain-based bait formulation subject to this assessment, only primary exposure to bait and secondary exposure to chlorophacinone poisoned carcasses and invertebrates will be considered for measures of exposure.

2.10.1.a. Estimating Primary Exposure

EFED's exposure assessment for the rodenticides differs from that for most other pesticides. For a rodenticide, the bait itself is the potential food item of concern. Thus, the amount of active ingredient in the formulated bait is used as an EEC. This information is used to estimate the amount of grain bait that birds and mammals of various sizes need to consume to obtain a dose expected to be lethal to 50% of the individuals in the population (i.e., LD_{50} dose). Estimates of food-ingestion rates (g dry matter per day) are determined from established allometric equations presented in EPA's Wildlife Exposure Factors Handbook (EPA 1993). The concentration of chlorophacinone in grain bait is also used to estimate initial dietary exposure (mg a.i. per kg in bait) which in turn is used to calculate avian and mammalian dietary RQs.

Acute and chronic LD_{50} doses are typically used for determining EECs; however, a subacute 5-day LD_{50} will be used in this instance. Due to chlorophacinone's delayed mode of action, subacute LD_{50} values are lower than calculations from acute LD_{50} endpoints would predict. The acute single-dose LD_{50} for mammals is 0.49 mg a.i./kg bw/day whereas the subacute 5-day LD_{50} value is 0.16 mg a.i./kg bw/day. Comparisons between acute and subacute data for birds are not as straightforward but the subacute data proves more conservative through discussions in **Section 4.2.1** and calculations performed in **Appendix J.** Additionally, grain bait applications provide temporary but locally abundant new food sources. Consequently, exposure over a five day period is highly probable. However, primary exposure can potentially occur over a longer period of time than five days. Toxicity resulting from chronic exposure exceeding five days cannot be determined based on current data.

2.10.1.b. Estimating Secondary Exposure

Secondary exposure analysis (from carcass) requires consideration of residues in tissues of target and non-target organisms that are commonly consumed by predators and scavengers, as well as knowledge of what residue level will result in mortality or adverse chronic effects. Moreover, it is important to know how long the residue persists in body tissues. Registrant submitted BTPD residue data address these issues, in part, but do not directly determine residues when BTPDs are most vulnerable to predation and/or scavenging. Additionally, carcass handling may not have allowed a conservative determination of residue concentrations. Residue concentrations for non-target animals fed chlorophacinone supplement the registrant submitted data. Additionally, a number of laboratory tests using avian and mammalian predators and scavengers are available to assess mortality from secondary exposure resulting from consumption of prey animals that had been exposed to chlorophacinone and related anticoagulant rodenticides. These studies are summarized in **Table 4.3** and **Table 4.4**. Design and methodology vary among studies, adding unknown variability to the results and analysis. Pending development of standard methods and testing requirements for such studies, these tests provide the best data available. A discussion of residue levels in tissues of target species is included in the assessment.

2.10.2. Measures of Effect

Data identified in **Section 2.8** are used as measures of effect for direct and indirect effects. Data were obtained from registrant submitted studies or from literature studies identified by ECOTOX.

2.10.2.a. Integration of Exposure and Effects

Risk characterization is the integration of exposure and ecological effects characterization to determine the potential ecological risk from the use of chlorophacinone to control BTPDs, and the likelihood of direct and indirect effects to the assessed species in terrestrial habitats. The exposure and toxicity effects data are integrated in order to evaluate the risks of adverse ecological effects on non-target species. The RQ method is used to compare exposure and measured toxicity values. EECs are divided by acute and chronic toxicity values. The resulting RQs are then compared to the Agency's LOCs (USEPA, 2004a; **Appendix B**).

2.10.3. Data Gaps

An avian reproduction study and a terrestrial field study for the use of chlorophacinone to control BTPDs have been required as conditions of registration of Rozol Prairie Dog Bait (7173-286). The registrant submitted a study, "Field Efficacy and Hazards of Rozol Bait for Controlling Black-Tailed Prairie Dogs (*Cynomys ludovicianus*)" (MRID 47333602), to support the requirement for a terrestrial field study for BTPDs but the component of the study addressing field hazards was invalid. The BTPD chlorophacinone residue study (MRID 47333603) is supplemental but potentially upgradeable after consideration of carcass handling methods.

3. Exposure Assessment

Chlorophacinone, for this assessed use to control BTPDs, is formulated as a grain-bait composed of 50 mg a.i./kg-bait. The assessed label (EPA 7173-286) permits in-burrow application of bait in active BTPD colonies only.

3.1. Label Application Rates and Intervals

The label permits hand application of bait in burrows by Certified Applicators or by persons under their direct supervision. One quarter cup of 50 mg a.i./kg-bait (53 grams) is to be placed at least 6 inches down into active prairie dog burrows. Given a maximum of 100 prairie dog burrows per acre, this equals an effective maximum application rate of 0.265 g a.i./A[6] (King 1959). Any bait scattered on the surface or less than 6 inches into the burrow is to be retrieved and disposed.

Fifty-three grams of bait per burrow and 0.265 g a.i./A will be used to generate RQs in this assessment. It can also be expected that some bait will be exposed above ground from the movement of the target and non-target animals in and out of the burrow (bioturbation). To account for this potential, it will be assumed that 1% of applied bait will be exposed above ground. This is a conservative estimate considering field trials of Rozol Prairie Dog Bait found only one out of 55 samples each containing 50 burrows to have more than 100 grains on the surface (MRID 47333602). Because only one sample out of 55 was found to have more than 100 grains exposed, it is assumed that the number of actual grains is near 100 and therefore 100 grains is used. Based on a maximum of 100 burrows per acre (King 1959), this means 200 grains per acre on the surface are possible. Given one grain of bait is 0.2 grams, 0.75% of applied grain will be exposed on the ground surface given this conservative scenario[7]. Because the analysis produced an estimate less than 1%, 1% of applied bait on the surface is a conservative assumption.

Following application, the label stipulates that the applicator must return to the site initially 5 to 10 days post application to collect and properly dispose of bait or dead or dying prairie dogs and again 14 to 21 days post-application. Carcass collection and burial are to occur in the late afternoon, near sundown, in order to reduce the potential of scavenging animals finding prairie dog carcasses. Carcasses buried on site must be in holes dug at least 18 inches deep, or in inactive burrows, to avoid scavenging by non-target animals. Burial includes covering and packing the hole or burrow with soil.

If prairie dog activity persists “several weeks or months” after the bait was initially applied, the label allows a second application by treating burrows in the same manner as the first application.

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[6] 100 burrows/A * 53 g bait/burrow * 0.00005 = 0.265 g a.i./A

[7] 100 burrows/acre * 53 g/burrow * 1 grain/0.2 g = 26,500 total grains applied/acre
(200 exposed grains)/(26,500 total grains applied/acre) = **0.75 % grains exposed**

3.2. Aquatic Exposure Assessment

3.2.1. Aquatic Exposure in Previous Assessment

A previous assessment (EPA 2008) modeled aquatic exposure of chlorophacinone for this use and found that negligible concentrations of chlorophacinone could occur in the water column relative to the toxicity to aquatic organisms. Model results indicated a peak concentration of 0.92 parts per trillion in surface waters for this use. This result is driven by chlorophacinone's immobility within its grain bait formulation. The most sensitive aquatic endpoint is an LC_{50} of 450 parts per billion for the rainbow trout (*Oncorhynchus mykiss*). This endpoint is more than five orders of magnitude greater than the EEC. Given this, risk to aquatic listed species and risk to aquatic habitats and PCEs of designated critical habitats will not be further assessed.

3.3. Terrestrial Exposure Assessment

Pesticide residues, other than those in poisoned animals and carcasses, are not of environmental concern because the active ingredient is not mobile and will remain sorbed to the grain bait. The RQ method of assessment is used to make risk determinations. The RQ method is preferred because it is quantitative, thus providing concrete justification for risk determinations. However, this method is supplemented by data gathered from chlorophacinone-poisoned carcass feeding studies.

3.3.1. Ingestion Rate Determination

RQs are generated by dividing daily dietary exposure of chlorophacinone for a given species by the most conservative toxicity endpoint for the relevant taxa adjusted for body weight of the given species. Dietary exposure estimates were derived using allometric equations from Wildlife Exposure Factors Handbook (EPA 1993). Allometric equations are distinct by taxon and can be refined within a taxon as well. For the purposes of this assessment, generic taxon allometric equations will be used. The following equations require input of animal weight (Wt) and produce an estimate of daily food intake (FI).

$FI\ (g/day) = 0.648 * Wt^{0.651}$	all birds
$FI\ (g/day) = 0.235 * Wt^{0.822}$	all mammals

The animal weight input is determined using the lowest relevant[8] weight for juveniles and adults of a given listed species. For species that do not exceed the LOC based on this determination, a weight range sensitivity analysis will be performed to account for lower metabolic rates of larger animals. Refinements can also be made, as needed, for RQs approaching the LOC based on other relevant allometric equations within the Wildlife Exposure Factors Handbook. These refinements will be made only if the outcome would change a MA determination from NLAA to LAA.

[8] An animal weight is only relevant if it can be expected that exposure to chlorophacinone will occur at the given life stage.

3.3.2. Food Intake Assumptions Relevant to Terrestrial Exposure

For the calculation of RQs, it is assumed the exposed animal consumes chlorophacinone bait or chlorophacinone poisoned animals and/or carcasses, depending upon the species diet, exclusively for the relevant period of exposure. For assessment of taxa with 5-day LD_{50} or LC_{50} values, it is assumed that the exposed animal consumes chlorophacinone bait or chlorophacinone poisoned animals and/or carcasses exclusively for five consecutive days. The subacute (5-day) LD_{50}s and LC_{50}s are both discussed on a single day exposure basis because RQs are calculated based on single day ingestion rates.

3.3.2.a. Chlorophacinone Concentrations in Food Items

The proportion of chlorophacinone in Rozol bait is 50 mg a.i./kg-bait. Assuming exclusive consumption of bait, listed species are exposed to chlorophacinone at the following rate:

Chlorophacinone intake (mg/time) = 0.05 mg/g * FI (g/time)

All inputs for determining the chlorophacinone dose-based EEC are presented in the following tables. Only dose-based EECs for mammals are used for calculating RQs. Avian RQs are calculated from an LC_{50} which is dose independent and more conservative than avian LD_{50} data. **Appendix J** demonstrates this through the calculation of avian RQs using LD_{50} data.

Table 3.1 Calculation of chlorophacinone intake for birds and herptiles using most conservative secondary exposure scenario. Calculations based on FI (g/day) = 0.648 * Wt (dry) $^{0.651}$ (EPA 1993); ingestion rate in terms of wet weight is calculated using the following equation: Ingestion Rate (wet weight) (invertivores) = Ingestion Rate (dry weight)/(1-0.84) (EPA 1993) Ingestion Rate (wet weight) (carnivores) = Ingestion Rate (dry weight)/(1-0.68) (EPA 1993) Dose-based EEC = (Residue*FI)/(Wt/1000)

Species	Weight (Wt)(g)	Food Ingestion (FI) (g [ww]/day)	Residue (mg/kg-diet [ww])[1]	Dose-based EEC (mg/kg-bw/day)
California condor (carnivore)	8,100	709.33	5.8	0.508
Whooping crane (carnivore)	4,300	150.30[2]	50	1.748
Eskimo curlew (invertivore)	270	155.0	5.8	3.329
Northern Aplomado falcon	410	101.71	5.8	1.439
Chirichaua leopard frog (invertivore)	100	81.18	5.8	4.709
Mexican spotted owl (carnivore)	519	118.58	5.8	1.325
Piping plover (invertivore)	42	46.15	5.8	6.373
New Mexican ridge-nosed rattlesnake (carnivore)	85	36.52	5.8	2.492
Sonora tiger salamander (invertivore)	50	51.70	5.8	5.997

Black-capped vireo (invertivore)	9	16.93	5.8	10.91
Golden-cheeked warbler (invertivore)	10	18.13	5.8	10.52

[1] The residues for birds and herptiles are either 50 for bait or 5.8 for non-target animals. The residues in mice were used as a surrogate for invertebrate residues.
[2] This value was not converted to wet weight because the value is for bait which is in dry weight.

Table 3.2 Calculation of chlorophacinone intake for mammals using most conservative secondary exposure scenario. Calculations based on FI (g/day) = 0.235 * $Wt^{0.822}$ (EPA 1993); ingestion rate in terms of wet weight is calculated using the following equation: Ingestion Rate (wet weight) = Ingestion Rate (dry weight)/(1-0.68) (EPA 1993); Dose-based EEC = (Residue*FI)/(Wt/1000)

Species	Weight (Wt) (g)	Food Ingestion (FI) (g [ww]/day)	Residue (mg/kg-diet [ww])[1]	Dose-based EEC (mg/kg-bw/day)
Grizzly bear	102,000	3077.07[2]	50	1.508
Black-footed ferret	635	147.84	5.8	1.350
Jaguar	36,363	4118.89	5.8	0.657
Gulf Coast jaguarundi	4,500	739.36	5.8	0.953
Canada lynx	5,100	819.48	5.8	0.932
Preble's meadow jumping mouse	13	1.94[2]	50	7.443
Ocelot	11,300	1575.97	5.8	0.809
Gray wolf	18,000	2310.74	5.8	0.745

[1] The highest residue concentration (either bait [50 mg a.i./kg-bait] or non-target animals [5.8 mg a.i./kg-bw]) was used.
[2] These values were not converted to wet weight because the value is for bait which is in dry weight.

The determination of chlorophacinone intake for listed species consuming chlorophacinone poisoned animals or carcasses is calculated similarly but relies on carcass residue data. BTPD carcass residue data is derived from a registrant sponsored study performed by the United States Department of Agriculture National Wildlife Research Center (MRID 47333603). This study was reviewed and determined to be used as supplemental. This decision was made because the study did not describe carcass handling methods. However, the study can be used quantitatively. The mean whole body average corrected wet weight concentration of chlorophacinone for prairie dogs fed Rozol to mortality is 1.03 mg a.i./kg-bw with a maximum concentration of 2.24 mg a.i./kg-bw in a single carcass. To be protective and to account for the supplemental nature of the data, a residue concentration of 2.24 mg a.i./kg-bw will be used to assess exposure to chlorophacinone poisoned prairie dogs and prairie dog carcasses. Assuming exclusive consumption of chlorophacinone poisoned prairie dogs and prairie dog carcasses, listed species are exposed to chlorophacinone at the following rate:

Chlorophacinone intake (mg/time) = 0.00224 mg/g * FI (g/time)

Other granivores aside from BTPDs (*i.e.* mice, rabbits, birds, invertebrates *etc.*) have the potential to consume chlorophacinone bait. These non-target granivores also have the potential for different mean and maximum chlorophacinone residue concentrations than those determined for BTPDs. To characterize these differences, carcass residue concentration data from open literature was considered (see **Table 3.3**). Because formulation concentration can affect carcass residue concentration, only studies using bait with chlorophacione concentrations of 50 mg a.i./kg-bait were considered. Residue concentrations resulting from other bait formulations are also presented in Table 3.3 for context. The highest whole-carcass residue concentration reported matching this criterion is 5.8 mg a.i./kg-bw for laboratory mice (Anonymous, 1981). It is uncertain whether this residue concentration is presented in wet weight or dry weight. For the purposes of this assessment, it is assumed that 5.8 mg a.i./kg-bw represents a wet weight concentration. For secondary exposure RQs approaching the listed species LOC and for animals likely to prey upon non-target species, this residue concentration can be used to address predation and scavenging of non-target primary consumers. Further, food ingestion rates do not necessarily reflect actual ingestion patterns as predators and scavengers may engorge themselves prior to and following hibernation and during migration. In addition, some species (e.g., California condor) may not eat every day.

Residue concentrations in invertebrates that may be preyed upon by invertivores are not as well characterized as residue concentrations in mammals that may be preyed upon by carnivores. However, secondary exposure to anticoagulant exposed invertebrates has been attributed to the poisoning of birds. Godfrey (1985) cited an incident at an aviary where several birds (avocets, pitas, plovers, finches, thrushes, warblers, crakes, honey creepers) died after being exposed to brodifacoum. Brodifacoum concentrations of 0.081 to 1.69 mg a.i./kg-bw were reported in tissues of dead birds. Because bait was applied in bait stations, it was assumed that the birds were exposed by feeding on pavement ants and cockroaches that had eaten bait. One study evaluating diphacinone residues in slugs exposed to grain bait similar to Rozol found maximum wet weight residue concentrations of 4.0 mg a.i./kg-bw (Primus *et al.* 2006). Because the body of literature is limited and available maximum invertebrate residue concentrations are lower than better characterized mammal residue concentrations, the 5.8 mg a.i./kg-bw residue value for mice will be used as a surrogate value for invertebrate residue exposure. This surrogate value will result in a more conservative assessment.

Table 3.3 Chlorophacinone Residue Levels in Primary Consumers

mg ai/kg bait	Target species	Site	Sample size	Days exposed	Whole-carcass residue (mg a.i./kg-bw)	Reference
100	ground squirrel	field	10	unknown	1.27 ± 0.56 (sd)	Baroch 1996b
75[b]	mouse	laboratory	?	3	6.0	Riedel et al. 1991[a]
50	ground squirrel	field	10	unknown	0.57 ± 0.27 (sd)	Baroch 1996a
50	ground squirrel	field	10	unknown	0.52 + 0.31(sd)	Baroch 1996b
50	rat	laboratory	5	5	0.47 (0.21-0.93)	Baroch 1997

mg ai/kg bait	Target species	Site	Sample size	Days exposed	Whole-carcass residue (mg a.i./kg-bw)	Reference
50	rat	laboratory	4	5	0.45 (0.18-0.81)	Ahmed et al. 1996
50	vole	laboratory	10	≤9	3.2	Askham and Poché 1992
50 or 100[c]	ground squirrel	field	62	unknown	0.264	Primus et al. 2001
50 or 100[c]	vole	field	3	unknown	1.58 (0.26-4.1)	Primus et al. 2001
50	mouse	laboratory	?	3	5.8	Anonymous 1981[a]
50 or 100[c]	pocket gopher	field	8	unknown	0.518	Primus et al. 2001
50 and 100[d]	ground squirrel	field	53	unknown	0.93	Goodall et al. 2002

[a] cited in Joermann 1998
[b] chlorophacinone baits registered in the U. S. are either 0.005% or 0.01% ai
[c] carcasses were collected in the field in CA, where both 50 mg a.i./kg-bait and 100 mg a.i./kg-bw chlorophacinone baits are registered
[d] the study did not distinguish between ground squirrels exposed to 50 mg a.i./kg-bait and 100 mg a.i./kg-bait baits

3.3.2.b. Adjusting for Snake Food Intake

Though avian toxicity data are used as a surrogate for assessing toxicity to snakes, dietary exposure is distinct and is assessed using methods that reflect snake feeding habits. Avian food intake equations may underestimate exposure to snakes when birds are used as a surrogate and are assumed to eat similar dietary items because of the large meal size a snake may consume on a single day. This equation is modified to estimate exposure to snakes based on the maximum size prey item they could consume and is used to refine a risk estimate. The following allometric equation developed by King (2002) was used to estimate the maximum size prey items for snakes.

$$\text{Prey Size (g)} = \text{Snake Mass}^{1.015}\,\text{(g)}$$

The 95% confidence limits on the coefficient are 0.959 and 1.071 (King, 2002). The upper limit is used to estimate exposure to snakes (*i.e.*. 1.071*)*.

4. Effects Assessment

This assessment evaluates the potential for chlorophacinone formulated as Rozol Prairie Dog Bait (EPA registration number 7173-286) to directly or indirectly affect listed species or modify their designated critical habitat. Assessment endpoints for the effects determination for each assessed species include direct toxic effects on the survival, reproduction, and growth, as well as indirect effects, including reduction of the prey base or modification of its habitat. In addition, potential modification of critical habitat is assessed by evaluating effects to the PCEs, which are components of the critical habitat areas that provide essential life cycle needs of each assessed species.

As described in the Agency's Overview Document (USEPA, 2004a), the most sensitive endpoint for each taxon is used for risk estimation. For this assessment evaluated taxa include birds, mammals and terrestrial invertebrates. Birds are used as the surrogate taxa to assess for herptiles. Acute (short-term) toxicity information is characterized based on registrant-submitted studies and a comprehensive review of the open literature on chlorophacinone. Chronic toxicity information is not available and has not been requested for mammals because mortality occurs at low doses in acute tests. Chronic toxicity information is not available for birds either but an avian reproduction study has been requested. There is more potential for chronic effects to birds because mortality occurs at doses high enough to allow for longer term exposures. In the absence of an avian reproduction study, effects to birds and herptiles cannot be precluded.

4.1. Ecotoxicity Study Data Sources

Toxicity endpoints are established based on data generated from guideline studies submitted by the registrant and from open literature studies that meet the criteria for inclusion into the ECOTOX database maintained by EPA/Office of Research and Development (ORD) (USEPA, 2004a). Open literature data presented in this assessment were obtained from the Comparative Assessment (USEPA, 2004b), as well as ECOTOX information obtained on May 14, 2010. In order to be included in the ECOTOX database, papers must meet the following minimum criteria:

1. toxic effects are related to single chemical exposure;
2. toxic effects are on an aquatic or terrestrial plant or animal species;
3. a biological effect is identified on live, whole organisms;
4. a concurrent environmental chemical concentration/dose or application rate is reported; and
5. the duration of exposure is explicit.

Data that pass the ECOTOX screen are evaluated along with the registrant-submitted data, and may be incorporated qualitatively or quantitatively into this endangered species assessment. In general, effects data in the open literature that are more conservative than the registrant-submitted data are considered. The degree to which open literature data are quantitatively or qualitatively characterized for the effects determination is dependent on whether the information is relevant to the assessment endpoints (*i.e.*, survival, reproduction, and growth) identified in **Section 2.8**. For example, endpoints such as behavior modifications are likely to be qualitatively evaluated, because quantitative relationships between behavior modifications and reduction in species survival, reproduction, and/or growth are not available. Although the effects determination relies on endpoints that are relevant to the assessment endpoints of survival, growth, or reproduction, it is important to note that the full suite of sublethal endpoints potentially available in the effects literature (regardless of their significance to the assessment endpoints) are considered, as they are relevant to the understanding of potential effects, as defined for the action area. Sublethal lethal endpoints of internal bleeding and hemorrhaging are considered equivalent to lethality in the consideration of avian secondary exposure data.

Citations of all open literature not considered as part of this assessment because they were either rejected by the ECOTOX screen or accepted by ECOTOX but not used (*e.g.*, the endpoint is less sensitive) are included in **Appendix F. Appendix F** also includes a rationale for rejection of those studies that did not pass the ECOTOX screen and those that were not evaluated as part of this endangered species risk assessment.

A detailed spreadsheet of the available ECOTOX open literature data, including the full suite of lethal and sublethal endpoints is presented in **Appendix G**.

In addition to registrant-submitted and open literature toxicity information, other sources of information, including use of the acute probit dose response relationship to establish the probability of an individual effect and reviews of ecological incident data, are considered to further refine the characterization of potential ecological effects associated with exposure to chlorophacinone. A summary of the available terrestrial ecotoxicity information and the incident information for chlorophacinone are provided in **Sections 4.2** through **4.3**.

4.2. Toxicity of Chlorophacinone to Terrestrial Organisms

A brief summary of registrant-submitted and open literature data considered relevant to this ecological risk assessment is presented in **Appendix E**. Studies submitted during the comment period relevant to "Receipt of Petition Requesting EPA to Suspend the Registration of Rozol Prairie Dog Bait and Cancel Certain Application Sites" (EPA-HQ-OPP-2009-0684) are discussed in **Appendix D.** All endpoints are expressed in terms of the active ingredient unless otherwise specified.

Table 4.1 summarizes the most sensitive terrestrial toxicity endpoints, based on an evaluation of both the registrant-submitted studies and the open literature, as previously discussed. When data are available, it was found that the most conservative 5-day LD_{50} value is more protective than the most conservative single dose LD_{50} value.

Table 4.1. Toxicity Profile for Chlorophacinone

Assessment Endpoint	Acute/ Chronic	Species Tested	Toxicity Value Used in Risk Assessment	Citation or MRID	Comment
Bird Toxicity to listed species	Acute	Northern bobwhite *Colinus virginianus*	LD_{50} = 258 mg a.i./kg bw Slope = 2.88	41513101	
	5-day Sub-Acute	Northern bobwhite *Colinus virginianus*	LC_{50} = 56 mg a.i./kg-diet Slope = 1.49	41513102	
Mammal	Acute	Deer mouse *Peromyscus*	LD_{50} = 0.49 mg a.i./kg-bw	Clark 1994	

Assessment Endpoint	Acute/ Chronic	Species Tested	Toxicity Value Used in Risk Assessment	Citation or MRID	Comment
Toxicity to listed species		*maniculatus*			
	5-day Sub-Acute	Norway Rat *Rattus norvegicus*	5-day LD_{50} = 0.8 mg a.i./kg-bw	Jackson and Ashton 1992	Doses of 0.16 mg a.i./kg bw were administered daily for 5 consecutive days equal the LD_{50} dose
Terrestrial Invertebrate Toxicity to listed species	Chronic	Burying beetle *Nicrophorus orbicollis*	Carcasses fed 50 mg a.i./kg-bait for 5-10 days affected number of beetles emerged	47383001	This study was classified as supplemental.

4.2.1. Toxicity to Birds

Chlorophacinone is moderately toxic to birds with the most sensitive endpoints being an acute LD_{50} of 258 mg a.i./kg bw and a 5-day sub-acute LC_{50} of 56 mg a.i./kg-diet. Birds are more sensitive to sub-acute exposure than single-dose acute exposure.

An avian reproduction study for chlorophacinone has been required but has yet to be submitted. In the absence of this study and any open literature study that may supplement it, risk of adverse effects to avian and herptile reproduction cannot be precluded.

4.2.1.a. Sublethal Effects and Additional Open Literature Information

The effects of chlorophacinone poisoned carcasses on predatory and scavenging birds have been evaluated in many studies. This information was previously compiled (USEPA, 2004b) (see **Table 4.2**). The current ECOTOX bibliography (updated May 2010) does not indicate any new studies relevant to the effects of chlorophacinone poisoned animals and/or carcasses on predatory and scavenging birds. Though no mortalities were reported in these studies, sublethal effects including external bleeding, internal hemorrhaging and increased blood coagulation time were noted. Previous assessments have considered these effects to be analogous to lethality. Though these studies do not allow for quantification of effect, they confirm that secondary exposure can result in effect.

Table 4.2 Secondary Hazards of Chlorophacinone to Birds in Laboratory Studies

Predator/ scavenger (p/s)	Prey offered to p/s	No. prey offered daily per p/s	No. days p/s exposed	No. p/s exposed	No. p/s dead	No. survivors with signs of chlorophacinone toxicity[a]	Reference
Barn owl	rats fed choice of 0.005% bait or untreated bait for 5 days	1-2	10	2	0	0	Mendenhall and Pank 1980

Predator/ scavenger (p/s)	Prey offered to p/s	No. prey offered daily per p/s	No. days p/s exposed	No. p/s exposed	No. p/s dead	No. survivors with signs of chlorophacinone toxicity[a]	Reference
Black-billed magpie	rats fed 0.005% bait for 5 days	ad lib.	5	20	0	0	Baroch 1997
American kestrel	voles fed 0.01% bait until dead	1 1 every 3 days	21 61	10 10	0 0	10 (eb/ih) 10 (eb/ih)	Radvanyi et al. 1988
Red-tailed hawk	voles fed 10 g 0.005% bait daily for up to 9 days	2	6	5	0	0	Askham and Poché 1992
Great horned owl	voles fed 10 g 0.005% bait daily for up to 9 days	2	6	1	0	0	Askham and Poché 1992
Red-tailed hawk	voles fed 0.005% bait for up to 9 days	2	6	5	0	0	Askham 1988
Great horned owl	voles fed 0.005% bait for up to 9 days	2	6	1	0	0	Askham 1988
Tawny owl	mice fed 0.0075% bait[b]	ad lib.	10	4	0	(ct)	Riedel et al. 1991[c]
Eurasian buzzard	mice fed 0.0075% bait[b]	ad lib.	7 10 5+5+5[d] 40	4 6 3 3	0 0 0 0	(ct) (ct) (ct) (ct)	Riedel et al. 1991[c]
Eurasian buzzard	mice fed 0.0075% bait[b]	4	7	4	0	0	Anonymous 1978[c]
Carrion crow	mice fed 0.0075% bait[b]	ad lib.	10	4	0	(ct)	Riedel et al. 1991[c]
Carrion crow	mice fed 0.0075% bait[b]	3-4	3 5	12 12	0 0	0 0	Sterner 1978[c]
White stork	mice fed 0.0075% bait[b]	ad lib. (treated /untreated)	3 14	3 3	0 0	1 or 2 (ct) 1 or 2 (ct)	Sterner 1981[c]

[a] eb = external bleeding; ih = internal hematoma; bl = bleeding (unspecified); ct = increased blood coagulation time; nr = not reported
[b] baits registered in the U.S. are either 0.005% or 0.01% ai
[c] cited in Joermann 1998
[d] the 3 5-day treatment periods are separated by 3 days when the birds were fed untreated mice

Based on the information in **Table 4.2**, the observed sublethal effects (e.g., external bleeding, internal hematoma, and increased blood coagulation time) occurred at levels close to but above the % a.i. used for BTPD control. Sublethal effects were seen for 0.0075 and 0.01% a.i. bait whereas the bait used for BTPD control is 0.005%.

4.2.2. Toxicity to Mammals

Chlorophacinone is very highly toxic to mammals with the most sensitive endpoints being an acute LD_{50} of 0.49 mg a.i./kg bw and a 5-day LD_{50} of 0.8 mg a.i./kg bw (0.16 mg a.i./kg bw dose daily for five days). Mammals are most sensitive to sub-acute exposure due to the chemical's mode of action. A given mammal would need one-third of the single day acute LD_{50} dose each day for five days to achieve a 5-day subacute LD_{50} dose. A five day exposure is reasonable considering the bait application is intended to provide multiple exposures to individual BTPDs.

4.2.2.a. Sublethal Effects and Additional Open Literature Information

The effects of feeding chlorophacinone poisoned carcasses to predatory and scavenging mammals have been evaluated in many studies. This information was compiled (USEPA, 2004b) (see **Table 4.3**). The current ECOTOX bibliography (updated May 2010) does not indicate any new studies relevant to the effects of feeding chlorophacinone poisoned carcasses to predatory and scavenging mammals. Of 55 mammals tested, 32 died before the end of the study period. Considering these studies as a whole, secondary exposure of chlorophacinone to mammals consistently causes a lethal effect. Sublethal effects of bleeding and increased blood coagulation time were also reported. Previous assessments have considered these effects to be analogous to lethality. Though these studies do not allow for quantification of effect, they confirm that secondary exposure results in effect

Table 4.3 Secondary Hazards of Chlorophacinone to Mammals in Laboratory Studies

Predator/ scavenger (p/s)	Prey offered to p/s	No. prey offered daily per p/s	No. days p/s exposed	No. p/s exposed	No. p/s dead	No. survivors with signs of chlorophacinone toxicity[a]	Reference
Mongoose	rats fed 0.005% bait for 5 days	1	1 3 5 6 7 9 10	1 1 2 1 1 1 1	0 1 2 1 1 1 1	nr no survivors no survivors no survivors no survivors no survivors no survivors	Pank and Hirata 1976
Coyote	ground squirrels fed 15 g of 0.01% bait for 6 days[b]	1	5	7	3	0	Marsh and Howard 1986

Predator/ scavenger (p/s)	Prey offered to p/s	No. prey offered daily per p/s	No. days p/s exposed	No. p/s exposed	No. p/s dead	No. survivors with signs of chlorophacin one toxicity[a]	Reference
Red fox	mice fed 0.0075% bait[c]	20 total	4	1	1[d]	no survivors	Bachhuber and Beck 1988[e]
European ferret	rats fed 0.005% bait for 5 days	ad lib.	5	20	11	nr	Ahmed et al. 1996
European ferret	prairie dogs fed 25 g of 0.0025% bait daily for 6 days[c]	4 (1 every other day)	8	6	5	nr	Fisher and Timm 1987
European ferret	voles/mice fed 0.0075% bait[c]	5 total	4	2	1[f]	(ct)	Bachhuber and Beck 1988[e]
European ferret	muskrats fed 0.005% bait	ad lib.	4 8	2 1	0 1	1 (bl) no survivors	Jobsen 1978[e]
European ferret	voles fed 0.0075% bait[c]	ad lib.	3	4	0	(ct)	Anonymous 1983[e]
Weasel	mice fed 0.005% bait	ad lib.	90	4	3	0	Anonymous 1981[e]

[a] eb = external bleeding; ih = internal hematoma; bl = bleeding (unspecified); ct = increased blood coagulation time; nr = not reported
[b] ground squirrels were fed no-choice for 3 days followed by 3 days in which they had a choice of bait or untreated laboratory chow
[c] baits registered in the U.S. are either 0.005% or 0.01% ai
[d] individual was sacrificed but considered 'dead' based on coagulation index

4.2.3. Toxicity to Terrestrial Invertebrates

The endangered American burying beetle (*Nicrophorus americanus*), uses mammalian and avian carcasses as food resource during their reproduction cycle. A study on a related, abundant congeneric species, *Nicrophorus orbicollis*, was performed to assess the impacts of chlorophacinone on the survival and larval growth of burying beetles (MRID 47383001). There were two phases to this study. The first phase investigated effects of chlorophacinone on the emergence (number of beetles produced), growth, and sex ratio of burying beetles raised on chlorophacinone-dosed rat carcasses. The second phase of the study investigated effects on the survival and reproductive success of burying beetle adults fed chlorophacinone-dosed meat for 28 days prior to being provided an undosed quail carcass for brooding of young.

In the first phase of the study each of twenty reproductively mature male-female pairs of field-collected *N. orbicollis* was offered a chlorophacinone-dosed rat carcass. Each of an additional twenty reproductively mature male-female pairs was offered an undosed rat carcass as a control. In the wild a carcass is usually buried in less than a day, and the female oviposits eggs in the surrounding soil within about 48 hours (Wilson and Knollenberg, 1984). Upon emergence of offspring (approximately one month later), the total number of young produced per brood was counted, sexed, and weighed. The chlorophacinone-dosed carcasses were a group of 20 rats fed exclusively 50 mg a.i./kg chlorophacinone bait for a period of 5 to 10 days until death. This is same bait concentration which would be used in the environment. A group of 20 undosed rats which were fed a standard laboratory rodent diet were used as controls. Upon death all rats were frozen and shipped to the study location where they were thawed for 24 hours prior to use. While it was indicated in the study that the control rats were selected to be of similar body size as the treatment group, reported control carcass weights (mean 102.8 grams) used in the study were significantly greater ($P<0.001$) than those used in the chlorophacinone treatment group (mean 89.6 grams). No conclusions about the difference in carcass body weights being attributable to the chlorophacinone-bait diet should be drawn from this aspect of the study; rats during the pretest period were not from a paired study designed to evaluate effects to rats.

Number of emerged beetles, the male-female ratio, and individual beetle and total brood weights of treatment and control broods were compared using nonpaired t-tests. Significantly ($P<0.01$) fewer beetles emerged from the chlorophacinone-dosed carcasses (mean 12.7 beetles) than from control carcasses (mean 22.5 beetles). There was some conjecture that this difference might be attributable to the difference in carcass weight rather than the presence of chlorophacinone. However, an evaluation of the relationship between brood size and carcass weight in the open literature indicates that both the control and chlorophacinone carcass weights are outside the range that limits brood size and therefore the reduction observed is attributed to chlorophacinone. A significant positive relationship between reproductive success and increasing carcass size has been observed in the range of 7 to 35 grams (Wilson and Fudge, 1984; Trumbo, 1990; Trumbo and Fernandez, 1995; Creighton, 2005), average brood size in the rat-carcass controls from this chlorophacinone study (mean 22.5 beetles) was on par with brood size observed in the upper size range of this relationship (average of 14.4 – 22 beetles at 30 – 35 g). A similar pattern has been observed with a different burying beetle species wherein at smaller carcass sizes a positive relationship between brood size and carcass size were observed but above a given size no further gain occurred. Additionally, it has been conjectured that above a given carcass size brood size for a single pair of beetles might be reduced due to cost of maintenance, or lack of ability to maintain the carcass. Total biomass, which is not independent of brood size, was also found to be significantly reduced ($P<0.01$) on chlorophacinone-dosed carcasses. But growth of individuals (total biomass adjusted for brood size) in chlorophacinone-dosed carcasses was not significantly different from control weights ($P=0.25$). Additionally no effect was observed on the male-female ratio. Thus, this phase of the study showed that chlorophacinone-dosed carcasses have effects on larval survival at concentrations relevant to this assessment.

The second phase of the study investigated effects on the survival and reproductive success of burying beetle adults fed chlorophacinone-dosed meat for 28 days prior to being provided an undosed quail carcass for brooding of young. A preliminary study conducted by the National Wildlife Research Center found that chlorophacinone residues in whole body prairie dog carcasses ranged from 0.85 mg a.i./kg-bw to 2.25 mg a.i./kg-bw. Based on this information, laboratory raised adult *N. orbicollis* beetles were provided a no-choice test diet consisting of 3.0 ppm chlorophacinone in ground beef, which exceeded the high end of this range, for 28 days. Control adult beetles were fed undosed ground beef. Beetles were segregated by gender during this feeding period.

After the feeding period, surviving male-female paired beetles were offered a thawed non-dosed Japanese quail carcass. Upon emergence of offspring (approximately one month later), the total number of young produced per brood were counted, sexed, and weighed. Number of emerged beetles, male-female ratio, and individual beetle and total brood weights of the treatment and control broods were compared using nonpaired t-tests. During the 28 day no-choice feeding trial, 12.5% of control adults died compared to 4.7% mortality of adults in the treatment group. It appears from these results that chlorophacinone has no direct negative impact on survival of adult beetles. No significant differences were found between treatment and control groups in the test for evaluating the subsequent ability of adults fed no-choice diets to brood and produce normal progeny. The following variables were evaluated: quail carcass weight (in grams), number of beetles produced/brood, number of beetles/carcass weight, weight/beetle, estimated total brood weight/brood, brood weight/carcass weight, number of females/brood, number of males/brood, male-female ratio/brood, and proportion of males/brood. The study authors believed that the lower number of broods produced in this experiment, relative to the first which used rat carcasses, may be due to either the age of the beetles and/or the use of a different type/condition of carcass.

The results of the study performed on *N. orbicollis* to assess the impacts of chlorophacinone on burying beetles showed that adult burying beetle survival and fecundity is not affected at environmentally relevant residue levels but that larvae brooding on chlorophacinone residues have reduced survival (MRID 47383001). Therefore, it is expected that any insect with exposure to chlorophacinone residues during its developmental early life stage will have significant effects. This effect is considered a reproductive effect. However, no other effects to insects are expected since chlorophacinone exposure to adults resulted in more of the control beetles dying when compared with those in the treatment group who were fed a no-choice diet of chlorophacinone dosed ground beef. Furthermore, once these adults, both the control group fed non-dosed ground beef and the treatment group fed chlorophacinone dosed ground beef, were offered non-dosed quail carcasses no significant effects were seen in the treatment group.

A 14-day toxicity test on the earthworm (*Eisenia foetida*) found a LOAEL at soil concentrations of 556 mg a.i./kg-soil chlorophacinone (MRID 47383002). This concentration is more than ten times the concentration of Rozol Prairie Dog Bait (50 mg a.i./kg-bait). It is outside the realm of possibility that concentrations approaching the LOAEL concentration will occur in the environment. Additionally, an open literature study in which the Wellington tree weta (*Hemideina crassidens*) was exposed to and consumed diphacinone bait for up to 64 days found no effect (Fisher *et al.* 2007). Diphacinone shares the same mode of action as chlorophacinone and is very similar in chemical structure. Based on these studies and the study described above, only reproductive effects to terrestrial invertebrates are expected to occur.

Table 4.4 Evaluation of the Terrestrial Invertebrate Reproduction Study.

Study Description	**A.I. Concentration**	**Study parameters**	**Test Results**	**MRID**	**Classification Category**
Phase 1: Poisoned carcasses fed to burying beetles (*Nicrophorus orbicollis*)	Rats fed exclusively 50 mg a.i./kg chlorophacinone bait for a period of 5-10 days until death resulting in unknown residue concentrations.	Each of 20 female-male pairs of field collected *N. orbicollis* was offered a chlorophacinone-dosed rat carcass and each of another 20 female-male pairs was offered a non-dosed rat carcass. Upon emergence of offspring the total number of young produced per brood was counted, sexed, and weighed. Numbers, male-female ratio, and individual beetle and total brood weights of treatment and control broods were compared.	Significant differences between control and treatment groups were found for the following endpoints: carcass weight, number of beetles produced, estimated total brood weight (g). Based on open literature the differences in carcass weight between the control and treatment groups are not expected to have influenced study results. Total brood weight is not independent of number of beetles produced, and analysis of individual beetle weight shows no significant effect on growth. There was no significant effect on the male-female ratio. Therefore, the main effect was larval survival.	473830 -01	Supplemental/ non-guideline
Phase 2: Dosed ground meat feed for 28 days to burying beetles (*N. orbicollis*) followed by brooding of young on a clean carcass	Adult *N. orbicollis* were fed chlorophacinone-dosed (3.0 ppm chlorophacinone) ground beef.	64 adult laboratory reared *N. orbicollis* (36 females/28 males) were fed a no-choice diet of chlorophacinone-dosed (3.0 ppm chlorophacinone) ground beef. Another 64 adult *N. orbicollis* (36 females/28 males) were fed a no-choice diet of non-dosed ground beef. After the feeding trial, surviving adult male-female pairs were offered a thawed non-dosed Japanese quail carcass. Upon emergence of offspring the total number of young produced per brood was counted, sexed, and weighed. Numbers, male-female ratio, and individual/total brood weights of the treatment and control broods were compared.	During the 28 day no-choice feeding trial, 12.5% of the control adults died compared to the 4.7% mortality of the adults in the treatment group, demonstrating chlorophacinone has no direct negative impact on survival of adult beetles. No significant differences were found between the treatment and control groups in the second part of the second phase of the study (subsequent ability of adults fed no-choice diets to brood and produce normal progeny). The following variables were evaluated: quail carcass weight (in grams), number of beetles produced/brood, number of beetles/carcass weight, weight/beetle, estimated total brood weight/brood, brood weight/carcass weight, number of females/brood, number of males/brood, male-female ratio/brood, and proportion of males/brood. The study states that the authors believed that the lower number of broods produced in this experiment, relative to the first which used rat carcasses, may be due to either the age of the beetles and/or the use of a different type/condition of carcass.	473830 -01	Supplemental/ non-guideline

4.3. Incident Database Review

A review of the Ecological Incident Information System (EIIS, version 2.1), the 'Aggregate Incident Reports' (v. 1.0) database, and the Avian Monitoring Information System (AIMS) for ecological incidents involving chlorophacinone was completed on June 14, 2010. The results of this review for terrestrial, plant, and aquatic incidents are discussed below in **Section 4.3.1**. A complete list of the incidents involving chlorophacinone including associated uncertainties is included as **Appendix I**.

4.3.1. Terrestrial Incidents

Nine incidents, involving 87 mammals and birds, have been reported that can be reasonably attributed to chlorophacinone poisoning as the primary cause of death. Four of these incidents, involving five mammals and birds, can be attributed to use of chlorophacinone to control BTPDs. The incidents can be found under the reports: I020607-001, I019311-001, I012972-001 and FWS 2007600155R003. The five animals included two badgers, two turkeys, and a bald eagle. Liver concentrations for these incidents range from 0.30 mg a.i./kg-bw for the bald eagle to 4.4 mg a.i./kg-bw for one of the badgers. For all five animals, the primary indication of anticoagulant poisoning (*i.e.*, internal hemorrhaging) was reported.

One additional incident (FWS 2009600498), involving a ferruginous hawk and a great horned owl, is not attributed to chlorophacinone use although residues were detected below the level of quantitation (LOQ) of 0.25 mg a.i./kg-bw. The ferruginous hawk mortality is attributed to interspecific/intraspecific fighting and the great horned owl mortality is attributed to a car collision. However, both animals appeared anemic during examination indicating blood loss, possibly accelerated by chlorophacinone, as cause of death. Further, hemorrhaging that may have occurred may not have been detectable due to the freezing of carcasses prior to examination. Some evidence indicates that micro-hemmorhaging can be detected prior to carcass freezing but cannot be detected otherwise (personal communication, Scott Larson, USFWS, June 25, 2010).

4.4. Use of Probit Slope Response Relationship to Provide Information on the Endangered Species Levels of Concern

As part of the risk characterization, an interpretation of acute RQs for listed species is discussed. This interpretation is presented in terms of the chance of an individual event (*i.e.*, mortality or immobilization) should exposure at the EEC actually occur for a species with sensitivity to chlorophacinone on par with the acute toxicity endpoint selected for RQ calculation. To accomplish this interpretation, the Agency uses the slope of the dose response relationship available from the toxicity study used to establish the acute toxicity measures of effect for each taxonomic group that is relevant to this assessment. The individual effects probability associated with the acute RQ is based on the mean estimate of the slope and an assumption of a probit dose response relationship. In addition to a single effects probability estimate based on the mean, upper and lower estimates of the effects probability are also provided to account for variance in the slope, if available.

Individual effect probabilities are calculated based on an Excel spreadsheet tool IECV1.1 (Individual Effect Chance Model Version 1.1) developed by the U.S. EPA, OPP, Environmental Fate and Effects Division (June 22, 2004). The model allows for such calculations by entering the mean slope estimate (and the 95% confidence bounds of that estimate) as the slope parameter for the spreadsheet. In addition, the acute RQ is entered as the desired threshold.

5. Risk Characterization

Risk characterization is the integration of the exposure and effects characterizations. Risk characterization is used to determine the potential for direct and/or indirect effects to listed species or for modification to designated critical habitat from the use of chlorophacinone to control BTPDs. The risk characterization provides an estimation (**Section 5.1**) and a description (**Section 5.2**) of the likelihood of adverse effects; articulates risk assessment assumptions, limitations, and uncertainties; and synthesizes an overall conclusion regarding the likelihood of adverse effects to the assessed species or their designated critical habitat (*i.e.*, NE; LAA; NLAA). In the risk estimation section, RQs are calculated using standard EFED procedures explained in the following section. In the risk description section, additional analyses may be conducted to help characterize the potential for risk.

5.1. Risk Estimation

Risk is estimated by calculating the ratio of exposure to toxicity. The endpoints in Table 4.1 are used to calculate RQs based on conservative terrestrial exposure assumptions. The most sensitive species among avian and mammalian species tested are used to calculate RQs and characterize the direct risk to listed species. This ratio is the RQ, which is then compared to acute LOCs for each category evaluated (USEPA, 2004a). For acute exposure to terrestrial listed species the LOC is 0.1. For details regarding the methods, parameter selection and equations for this risk estimation, see **Section 3.3.**

Exposure to terrestrial animals is considered for two general conditions: 1) primary exposure to bait and 2) secondary exposure to carcasses or poisoned animals. In the case of primary exposure, the concentration of active ingredient within the bait is considered to be the EEC. Therefore, the primary exposure EEC is 50 mg/kg-diet. To determine secondary exposure EECs, available literature concerning carcass residue concentrations were considered. In previous assessments, open literature sources of chlorophacinone residue concentrations were referenced. Erickson and Urban (USEPA, 2004b) compiled this data (see **Tables 4.2** and **4.3**) and the latest ECOTOX bibliography (updated May 2010) did not indicate any additions. Based on the highest whole body residue concentrations, the EEC for secondary exposure to chlorophacinone via BTPD carcass is 2.24 mg a.i./kg-bw. The EEC for secondary exposure via incidentally exposed non-target granivores (*e.g.* mice) is 5.8 mg a.i./kg-bw. For the complete rationale as to why these concentrations are used, see **Section 3.3.**

5.1.1. Risk to Birds and Herptiles

Based on an LD_{50} value of 258 mg a.i./kg bw (calculations explained in **Appendix J)** and the acute listed species LOC of 0.1, no exceedences of the LOC occur for listed avian species based on a single acute dose**.** However, based on an LC_{50} value of 56 mg a.i./kg-diet exceedences of the LOC occur for five-day consumption of the grain bait or chlorophacinone poisoned non-target animals (**Table 5.1**). Single dose LD_{50} calculations are made in **Appendix J** for two species (California condor and New Mexican ridge-nosed rattlesnake) representing the range of sizes of species assessed as birds. RQs based on exposure to non-target animals from this analysis (0.0003 and 0.0035) are lower than RQs based on exposure to non-target animals for the sub-acute LC_{50} endpoint (0.104). Thus, the LC_{50} value is the more conservative value. Therefore, risk to listed birds and herptiles is evaluated using the most sensitive LC_{50} value based on avian toxicity tests. Exposure to chlorophacinone at concentrations below LOCs based on LC_{50}s will be considered a risk based on this uncertainty.

Because residue concentrations for invertebrates are not as well characterized as residue concentrations in rodents and available invertebrate residue data does not exceed rodent residue concentrations, the mouse residue concentration is used as a surrogate for invertebrate residues. Five-day consumption of chlorophacinone poisoned BTPDs does not exceed the LOC based on the LC_{50}.

An avian reproduction study for chlorophacinone has been required but has yet to be submitted. In the absence of this study and any open literature study that may supplement it, risk of adverse effects to avian and herptile reproduction cannot be precluded.

Table 5.1 Summary of RQ Values for Avian Species. RQs were calculated with an LC_{50} of 56 mg a.i./kg-diet and RQs are presented for diet as tested.

Species	RQ Bait	RQ BTPD	RQ mouse[1]	Probability of Individual Effect at RQ[2]
California condor	*	0.04	**0.104**	1 in 14
Whooping crane	**0.89**	0.04	**0.104**	1 in 2.13
Eskimo curlew	*	**	**0.104**	1 in 14
Northern Aplomado falcon	*	0.04	**0.104**	1 in 14
Chirichaua leopard frog	*	**	**0.104**	1 in 14
Mexican spotted owl	*	0.04	**0.104**	1 in 14
Piping plover	*	**	**0.104**	1 in 14

Sonora tiger salamander	*	**	**0.104**	1 in 14
Black-capped vireo	*	**	**0.104**	1 in 14
Golden-cheeked warbler	*	**	**0.104**	1 in 14

RQ = (Residue Concentration)/(LC_{50})
[1] The mouse residue concentration of 5.8 mg a.i./kg-bw is used as a surrogate for invertebrate residues.
[2] Highest RQ value was used to calculate the probability of individual effect. The LC_{50} of 56 ppm was used as well as the slope of 1.49 obtained from the study (MRID 41513102). The generic probability of individual effect for birds and herpitiles calculated using the LC_{50} of 56 mg a.i./kg-diet, the slope of 1.49, and the LOC of 0.1 was ~1 in 14.7. Therefore, if any of the probabilities of individual effect are less than 1 in 14.7 there is an exceedance of the LOC. The probabilities of individual effect for each species exceeded the LOC.
Exceedances of LOC are in bold
* does not eat bait
** does not eat BTPDs

5.1.1.a. Risk to New Mexican Ridge-nosed Rattlesnake

It is not appropriate to assess dietary exposure to a rattlesnake using a 5-day LC_{50} because based on life history information dietary exposure will not occur on a daily basis. Rather, it is more appropriate to use a single dose LD_{50} value because rattlesnakes feed up to a few times per year (Howard, 2005). Weight information is not available for this species but for the purposes of this analysis, weights for a small rattlesnake will be assumed to be 50 grams and 500 grams. As discussed in **Section 3.3.2.b**, maximum snake prey size can be related to snake mass. From this equation, maximum prey sizes are 66 grams and 777 grams for the 50 gram and 500 gram snake, respectively[9]. Because the New Mexican ridge-nosed rattlesnake is a small rattlesnake, it is more likely that it would prey upon a small non-target granivore like a mouse rather than a BTPD. Therefore, a residue concentration of 5.8 mg a.i./kg-bw will be assumed for the prey item.

50 gram snake:

Dose of chlorophacinone:	66,000 mg * 0.0000058 = 0.383 mg a.i.
Weight normalized dose:	0.383 mg a.i. ÷ 0.1 kg bw = 3.83 mg a.i./kg bw
Adjusted LD_{50} (Minaeu *et al*, 1996)	(50 g/178 g) * 258 mg a.i./kg bw = 213 mg a.i./kg bw
Risk Quotient:	3.83 mg a.i./kg bw ÷ 213 mg a.i./kg bw = 0.018

500 gram snake:

Dose of chlorophacinone:	777,000 mg * 0.0000058 = 4.51 mg a.i.
Weight normalized dose:	4.51 mg a.i. ÷ 0.5 kg bw = 9.02 mg a.i./kg bw
Adjusted LD_{50} (Minaeu *et al*, 1996)	(500 g/178 g) * 258 mg a.i./kg bw = 301 mg a.i./kg bw
Risk Quotient:	9.02 mg a.i./kg bw ÷ 301 mg a.i./kg bw = 0.030

[9] Prey size (g) = Snake mass$^{1.071}$ (g)

RQs do not vary significantly with a range of body sizes. Both RQs calculated are below the LOC for terrestrial endangered species (LOC=0.1). Although the RQs indicate that no effect is expected, risk to reproduction cannot be precluded due to lacking avian reproduction data. Indirect effects will be discussed separately and a separate determination will be made.

5.1.2. Risk to Mammals

Exposure to listed mammals is evaluated using the most sensitive LD_{50} value based on mammalian toxicity tests. Ingestion rates and weight-adjusted LD_{50}s are calculated and presented in **Table 5.2.** Wet weight ingestion rates are used for assessing secondary exposure. Grain bait is assumed to be dry and therefore dry weight ingestion rates are used for assessing primary exposure. These ingestion rates and LD_{50}s are used, in part, to calculate RQs presented in **Table 5.3**. Exceedences of the LOC are indicated in bold. RQs for all mammals for all assessed exposure pathways exceed the Acute Listed Species LOC of 0.1.

Table 5.2 Calculation of Ingestion Rate and Adjusted LD_{50} for mammals

Listed Mammalian Species	Body Weight	Ingestion Rate (dry weight) (g/day)[1]	Ingestion Rate (wet weight) (g/day)[2]	Adjusted LD_{50} (mg a.i./kg bw)[3]
Mammals with potential to consume grain bait				
Grizzly bear	102000	3077.07	*	0.02
Preble's meadow jumping mouse	13	1.94	*	0.18
Carnivores				
Black-footed ferret	635	47.31	147.84	0.07
Jaguar	36363	1318.04	4118.89	0.02
Gulf Coast jaguarundi	4500	236.60	739.36	0.04
Canada lynx	5100	262.23	819.48	0.04
Ocelot	11300	504.31	1575.97	0.03
Gray wolf	18000	739.44	2310.74	0.03

* no wet weight to dry weight conversion was calculated because it is assumed that the bait is in dry weight.
[1] Dry weight ingestion rate is calculated using the "all mammals" allometric equation from EPA 1993.
[2] The ingestion rate in terms of wet weight is calculated using the following equation:
Ingestion Rate (wet weight) = Ingestion Rate (dry weight)/(1-0.68)
[3] The Adjusted LD_{50} is calculated using the following equation:
Adjusted LD_{50} = LD_{50}*[(body weight (in grams) of the test animal used in the study)/(body weight of the listed mammalian species)]^0.25
In this case, the LD_{50} is 0.16 and the body weight (in grams) of the test animal used in the study was 20 grams.

Table 5.3 Summary of RQ Values for Mammalian Species. RQ descriptions are qualified with the associated toxicity value. RQs were calculated with an LD_{50} of 0.16 mg a.i./kg bw.

Species	Ingestion Rate (wet weight) (g/day)	Dose-based EEC for bait (mg/kg-bw/day)[1]	RQ Bait[2]	Dose-based EEC for BTPD (mg/kg-bw/day)[1]	RQ BTPD[2]	Dose-based EEC for mouse (mg/kg-bw/day)[1]	RQ mouse[2]	Probability of Individual Effect at RQ[3]
Grizzly bear	3,077.07	1.508	**75.42**	0.068	**3.38**	0.175	**8.75**	1 in 1
Black-footed ferret	47.31	*	*	0.522	**7.45**	1.350	**19.29**	1 in 1
Jaguar	1,318.04	*	*	0.254	**12.69**	0.657	**32.85**	1 in 1
Gulf Coast jaguarundi	236.60	*	*	0.368	**9.20**	0.953	**23.82**	1 in 1
Canada lynx	262.23	*	*	0.360	**9.00**	0.932	**23.30**	1 in 1
Preble's meadow jumping mouse	1.94	7.443	**41.35**	**	**	**	**	1 in 1
Ocelot	504.31	*	*	0.312	**10.41**	0.809	**26.96**	1 in 1
Gray wolf	739.44	*	*	0.288	**9.59**	0.745	**24.82**	1 in 1

* does not eat bait
** does not eat BTPDs or non-target animals
[1] The Dose-based EEC is calculated using the following equation:
(Residue (mg/kg-diet [ww])*FI (kg-diet [ww]/day))/(body weight of the listed species (in grams)/1000)
Residues are: 50 mg a.i./kg for bait; 2.24 kg-diet [ww]/day for BTPDs; 5.8 kg-diet [ww]/day for non-target animals
FI (kg-diet [ww]/day) is calculated by the following equation:
Ingestion Rate (wet weight) (g/day)/1000
[2] RQ is calculated using the following equation:
RQ=Dose-based EEC/Adjusted LD_{50}
[3] The highest RQ value was used to calculate the probability of individual effect. The LD_{50} of 0.16 mg a.i./kg bw was used as well as the generic slope of 4.5 as per original Agency assumptions of typical slope cited in Urban and Cook (1986). The generic probability of individual effect for mammals calculating using the LD_{50} of 0.16 mg a.i./kg bw, the generic slope of 4.5, and the LOC of 0.1 was ~1 in 294,000. Therefore, if any of the probabilities of individual effect are less than 1 in 294,000 there is an exceedance of the LOC. The probabilities of individual effect for each species exceeded the LOC.
Exceedances of LOC are in bold

5.1.3. Risk to Terrestrial Invertebrates

Toxicity to listed terrestrial invertebrates (specifically the American burying beetle and the Salt Creek tiger beetle) was evaluated qualitatively (as chlorophacinone residues in the dosed rat carcasses in the study discussed in Section 4.2.3 (MRID 47383001) were not available). The study described in Section 4.2.3 (MRID 47383001) showed larval survival effects to *N. orbicollis* which is supposedly the nearest extant relative to the American burying beetle (MRID 47383001). Based on this information, it was assumed that the listed American burying beetle would also experience larval survival effects if exposed to chlorophacinone residues. Since the American burying beetle is found within the action area, it may be exposed to chlorophacinone-dosed carcasses. Furthermore, the larvae of the Salt Creek tiger beetle eat insects and may also experience survival effects due to chlorophacinone residues. Since the Salt Creek tiger beetle is also found within the action area and therefore has the potential to feed on chlorophacinone contaminated insects, this species may also experience larval survival effects due to chlorophacinone residues.

5.1.4. Primary Constituent Elements of Designated Critical Habitat

For chlorophacinone use, the assessment endpoints for designated critical habitat PCEs involve the same endpoints as those being assessed for potential direct and indirect effects above. Therefore, the preliminary effects determinations for direct and indirect effects are used as the basis of the effects determination for potential modification to designated critical habitat.

All of the assessment endpoints for the PCEs of designated critical habitat for the Salt Creek tiger beetle, California condor, whooping crane, Canada lynx, Preble's meadow jumping mouse, Mexican spotted owl, piping plover, New Mexican ridge-nosed rattlesnake, and the gray wolf involve potential direct effects to the organism. Through the risk determinations made for listed bird, mammal, herptile and invertebrate species, the potential for effects to prey base were evaluated. Indirect effects through loss of the prey base or habitat loss (burrows) are seen for the Salt Creek tiger beetle, California condor, whooping crane, Canada lynx, Preble's meadow jumping mouse, Mexican spotted owl, piping plover, New Mexican ridge-nosed rattlesnake, and the gray wolf. Effects to the prey base are expected because the Acute Risk LOC of 0.5 (the LOC used to evaluate risk to non-listed species) is exceeded for mammals, birds and herptiles[10] (EPA 2004a). Invertebrate toxicity data indicate that there are direct effects on reproduction for invertebrate species whose larvae are exposed to chlorophacinone residues. This exposure is possible and therefore direct effects to invertebrates including the Salt Creek tiger beetle are expected. Based on these data, effects to the prey base are possible for listed species that prey upon birds, mammals, herptiles, or invertebrates. The Agency does not currently have a method to analyze effects to populations based on effects to individuals. Because this effect cannot be analyzed, risk is presumed and effects to mammal, bird, herptile, and invertebrate prey populations is presumed. Therefore prey base effects are presumed for Salt Creek tiger beetle, California condor, whooping crane, Canada lynx, Preble's meadow jumping mouse, Mexican spotted owl, piping plover, New Mexican ridge-nosed rattlesnake, and the gray wolf. The only

[10] Maximum RQ for mammals = 75.42; Maximum RQ for birds (and herptiles) = 0.89;

impact to habitat would be the loss of BTPD burrows. Based on the life history information available, none of the species that may be affected with designated critical habitat use BTPD burrows therefore this loss of burrows is not expected to have an adverse impact on these species (**Attachment 1**). The preliminary effects determination for all PCEs for all species that may be affected is provided in **Table 5.5**

5.2. Risk Description

The risk description synthesizes overall conclusions regarding the likelihood of adverse impacts leading to a preliminary effects determination (*i.e.*, NE, NLAA, or LAA) for the assessed species and the potential for modification of their designated critical habitat based on analysis of RQs and a comparison to the LOC. The final determination is made after the spatial analysis is completed at the end of the risk description, **Section 5.2**. In **Section 5.2.3**, a discussion of any potential overlap between areas where potential usage may occur and areas where species are expected to occur (including any designated critical habitat) is presented. If there is no overlap of the species habitat and occurrence sections with the Potential Area of MA Effects a NE determination is made.

If the RQs presented in the Risk Estimation (**Section 5.1**) show no direct effects for the assessed species and no modification to PCEs of the designated critical habitat, which was already described in **Section 5.1.4**, a NE determination is made, based on the use of chlorophacinone to control BTPDs within the action area. However, if the LOC for direct effects is exceeded the Agency concludes a preliminary MA determination for the FIFRA regulatory action regarding the use of chlorophacinone to control BTPDs.

A summary of the risk estimation results are provided in **Table 5.4** for direct and indirect effects to the listed species that may be affected and in **Table 5.5** for the PCEs of their designated critical habitat.

Table 5.4. Risk Estimation Summary for Chlorophacinone

Species	LOC Exceedences (Yes/No)	Description of Results of Risk Estimation
Grizzly bear	Direct effects[1]: yes	Direct effects are expected for the grizzly bear based on the potential for this species to consume the chlorophacinone bait (RQ of 75.42 which exceeds the LOC of 0.1) or other prey items that may have consumed the chlorophacinone bait (RQ of 3.38 for exposure to BTPDs and RQ of 8.75 for exposure to non-target animals, both which exceed the LOC of 0.1). Growth and reproductive effects cannot be precluded due to the absence of chronic data; however, growth and reproductive effects are not expected because mortality typically occurs as a result of acute exposure.
	Indirect effects[2]: yes	Indirect effects from the loss of the prey base are also expected because effects to individuals within populations have been demonstrated in mammals ranging in size from 13 to 36,363 grams with RQs ranging from 19 to 41. No indirect effects from habitat loss are expected because this species does not use BTPD burrows.
American burying beetle	Direct effects: yes	Reproductive effects are expected for the American burying beetle. The American burying beetle uses mammalian and avian carcasses as a food resource during their reproduction cycle. Dosed carcasses negatively affected number of emerged beetles (MRID 47383001).
	Indirect effects: yes	Indirect effects from the loss of the prey base are expected because effects to individuals within populations have been demonstrated in mammals, birds, and invertebrates. No indirect effects from habitat loss are expected because this species does not use BTPD burrows.
Salt creek tiger beetle	Direct effects: yes	Reproductive effects are expected for the Salt Creek tiger beetle. Salt Creek tiger beetle larvae are potentially exposed to chlorophacinone residues through chlorophacinone exposed terrestrial invertebrates. Dosed carcasses in a burying beetle study negatively affected number of emerged beetles (MRID 47383001). Similar affects are expected for the Salt Creek tiger beetle.
	Indirect effects: no	No indirect effects from loss of prey base are expected because this species' habitat is distinct from BTPD habitat. This species uses mud banks of streams and seeps in association with saline wetlands and exposed mud flats of saline wetlands which is distinct from the short grass prairie associated with BTPD habitat. No indirect effects from habitat loss are expected because this species does not use BTPD burrows.
California condor	Direct effects: yes	Direct effects to the California condor are expected through their potential exposure to prey items that may have consumed the chlorophacinone bait (RQ of 0.104 for exposure to non-target animals which exceeds the LOC of 0.1). Growth and reproductive effects cannot be precluded due to the absence of chronic data.
	Indirect effects: no	No indirect effects from the loss of prey base are expected because this species' range does not overlap with BTPD range. No indirect effects from habitat loss are expected because this species does not use BTPD burrows.
Whooping crane	Direct effects:	Direct effects to the whooping crane are expected to occur based on the potential for this species to consume the

Species	LOC Exceedences (Yes/No)	Description of Results of Risk Estimation
	yes	chlorophacinone bait (RQ of 0.89 which exceeds the LOC of 0.1) or other prey items that may have consumed the chlorophacinone bait (RQ of 0.104 for exposure to non-target animals which exceeds the LOC of 0.1). Growth and reproductive effects cannot be precluded due to the absence of chronic data.
	Indirect effects: yes	Indirect effects from the loss of the prey base are also expected because effects to individuals within populations have been demonstrated in mammals, birds, and invertebrates. No indirect effects from habitat loss are expected because this species does not use BTPD burrows.
Eskimo curlew	Direct effects: yes	Direct effects to the Eskimo curlew are expected to occur based on the potential for this species to consume prey items that have consumed the chlorophacinone bait (RQ of 0.104 for exposure to non-target animals, which is used as a surrogate for invertebrate prey, which exceeds the LOC of 0.1). Growth and reproductive effects cannot be precluded due to the absence of chronic data.
	Indirect effects: yes	Indirect effects from the loss of the prey base are expected because effects to individuals within populations have been demonstrated in terrestrial invertebrates. No indirect effects from habitat loss are expected because this species does not use BTPD burrows.
Northern Aplomado falcon	Direct effects: yes	Direct effects to the northern Aplomado falcon are expected through their potential exposure to prey items that may have consumed the chlorophacinone bait (RQ of 0.104 for exposure to non-target animals which exceeds the LOC of 0.1). Growth and reproductive effects cannot be precluded due to the absence of chronic data.
	Indirect effects: yes	Indirect effects from the loss of the prey base are also expected because effects to individuals within populations have been demonstrated in mammals, birds, and invertebrates. No indirect effects from habitat loss are expected because this species does not use BTPD burrows.
Black-footed ferret	Direct effects: yes	Direct effects are expected for the black-footed ferret based on the potential for this species to consume prey items that may have consumed the chlorophacinone bait (RQ of 7.45 for exposure to BTPDs and RQ of 19.29 for exposure to non-target animals, both which exceed the LOC of 0.1). Significant exposure is expected to occur because black-footed ferrets prey primarily on BTPDs. Growth and reproductive effects cannot be precluded due to the absence of chronic data; however, growth and reproductive effects are not expected because mortality typically occurs as a result of acute exposure.
	Indirect effects: yes	Indirect effects from the loss of the prey base are also expected because effects to individuals within populations have been demonstrated in mammals, birds, and invertebrates. In addition, this species preys almost exclusively on BTPDs. Indirect effects from habitat loss are expected because this species uses BTPD burrows.
Chirichaua leopard frog	Direct effects: yes	Direct effects to the Chirichaua leopard frog are expected to occur based on the potential for this species to consume prey items that may have consumed the chlorophacinone bait (RQ of 0.104 for exposure to non-target animals, which is used as a surrogate for invertebrate prey, which exceeds the LOC of 0.1). Growth and reproductive effects cannot be precluded due to the absence of chronic data.
	Indirect effects: yes	Indirect effects from the loss of the prey base are expected because effects to individuals within populations have been demonstrated in terrestrial invertebrates and birds. No indirect effects from habitat loss are expected because this species does not appear to use BTPD burrows.

Species	LOC Exceedences (Yes/No)	Description of Results of Risk Estimation
Jaguar	Direct effects: yes	Direct effects are expected for the jaguar based on the potential for this species to consume prey items that may have consumed the chlorophacinone bait (RQ of 12.69 for exposure to BTPDs and RQ of 32.85 for exposure to non-target animals, both which exceed the LOC of 0.1). Growth and reproductive effects cannot be precluded due to the absence of chronic data; however, growth and reproductive effects are not expected because mortality typically occurs as a result of acute exposure.
	Indirect effects: no	No indirect effects from loss of prey base are expected because this species' habitat is distinct from BTPD habitat. Jaguars – particularly males of the northern reaches – are known to have large home ranges that encompass a variety of plant communities, including: Maderan evergreen-woodland, subalpine conifer forest, semidesert shrubland, and Sonoran desert scrub. Washes and riparian areas with dense vegetative growth may also be valuable movement corridors. These habitats are distinct from the short grass prairie associated with BTPD habitat. No indirect effects from habitat loss are expected because this species does not use BTPD burrows.
Gulf Coast jaguarundi	Direct effects: yes	Direct effects are expected for the Gulf Coast jaguarundi based on the potential for this species to consume prey items that may have consumed the chlorophacinone bait (RQ of 9.20 for exposure to BTPDs and RQ of 23.82 for exposure to non-target animals, both which exceed the LOC of 0.1). Growth and reproductive effects cannot be precluded due to the absence of chronic data; however, growth and reproductive effects are not expected because mortality typically occurs as a result of acute exposure.
	Indirect effects: no	No indirect effects from loss of prey base are expected because this species' habitat is distinct from BTPD habitat. This species is found in chaparral plant communities and dense brushy areas near streams and rivers which are distinct from the short grass prairie associated with BTPD habitat. No indirect effects from habitat loss are expected because this species does not use BTPD burrows.
Canada lynx	Direct effects: yes	Direct effects to the Canada lynx are expected to occur based on the potential for this species to consume prey items that may have consumed the chlorophacinone bait (RQ of 23.30 for exposure to non-target animals and RQ of 9.00 for exposure to BTPDs both of which exceed the LOC of 0.1). Growth and reproductive effects cannot be precluded due to the absence of chronic data; however, growth and reproductive effects are not expected because mortality typically occurs as a result of acute exposure.
	Indirect effects: no	No indirect effects from loss of prey base are expected because this species' habitat is distinct from BTPD habitat. The Canada lynx is associated with the southern, transitional reaches of the cool and moist boreal forest. Where it occurs at these lower latitudes, the boreal forest forms a mixed conifer and conifer-hardwood landscape. These habitat areas are distinct from the short grass prairie associated with BTPD habitat. No indirect effects from habitat loss are expected because this species does not use BTPD burrows.
Preble's meadow jumping mouse	Direct effects: yes	Direct effects to the Preble's meadow jumping mouse are expected to occur based on the potential for this species to consume the chlorophacinone bait (RQ of 41.35 which exceeds the LOC of 0.1). Growth and reproductive effects cannot be precluded due to the absence of chronic data; however, growth and reproductive effects are not expected because mortality typically occurs as a result of acute exposure.

Species	LOC Exceedences (Yes/No)	Description of Results of Risk Estimation
	Indirect effects: yes	Indirect effects from the loss of the prey base are expected because effects to individuals within populations have been demonstrated in terrestrial invertebrates. Although this species makes nests both above and below ground, it does not appear to use other species' burrows.
Ocelot	Direct effects: yes	Direct effects are expected for the ocelot based on the potential for this species to consume prey items that have may consumed the chlorophacinone bait (RQ of 10.41 for exposure to BTPDs and RQ of 26.96 for exposure to non-target animals, both which exceed the LOC of 0.1). Growth and reproductive effects cannot be precluded due to the absence of chronic data; however, growth and reproductive effects are not expected because mortality typically occurs as a result of acute exposure.
	Indirect effects: no	No indirect effects from loss of prey base are expected because this species' habitat is distinct from BTPD habitat. Ocelots appear to use areas of dense cover, and in the northern part of the range hunt in brushy forests and semi-arid deserts. In the southern part of its range, ocelot habitat includes tropical forests, mountain slopes, and pampas (grasslands). These habitat areas are distinct from the short grass prairie associated with BTPD habitat. No indirect effects from habitat loss are expected because this species does not use BTPD burrows.
Mexican spotted owl	Direct effects: yes	Direct effects to the Mexican spotted owl are expected to occur based on the potential for this species to consume prey items that may have consumed the chlorophacinone bait (RQ of 0.104 for exposure to non-target animals which exceeds the LOC of 0.1). Growth and reproductive effects cannot be precluded due to the absence of chronic data.
	Indirect effects: no	No indirect effects from loss of prey base are expected because this species' habitat is distinct from BTPD habitat. Mexican spotted owls are found in old-growth or mature forests with unevenly aged stands of trees, high canopy, multi-storied levels, and high tree density as well as canyons with riparian or conifer communities. In Arizona and New Mexico they are found in habitats associated with mixed conifer, pine-oak, Arizona cypress, oak woodlands, and associated riparian forests. These habitat areas are distinct from the short grass prairie associated with BTPD habitat. No indirect effects from habitat loss are expected because this species does not use BTPD burrows.
Piping plover	Direct effects: yes	Direct effects to the piping plover are expected to occur based on the potential for this species to consume prey items that may have consumed the chlorophacinone bait (RQ of 0.104 for exposure to non-target animals, which is used as a surrogate for invertebrate prey, which exceeds the LOC of 0.1). Growth and reproductive effects cannot be precluded due to the absence of chronic data.
	Indirect effects: no	No indirect effects from loss of prey base are expected because this species' habitat is distinct from BTPD habitat. The plover's home range within BTPD range is usually limited to the wetland, lakeshore, or section of beach where its nest is located. No indirect effects from habitat loss are expected because this species does not use BTPD burrows.
New Mexican ridge-nosed rattlesnake	Direct effects: yes	No direct effects based on survival to the New Mexican ridge-nosed rattlesnake are expected to occur (see Section 5.1.1.a. RQs of 0.018 for a 50 gram snake and RQ of 0.030 for a 500 gram snake. Neither of these RQs exceeds the LOC of 0.1). However, growth and reproductive effects cannot be precluded due to the absence of chronic data.

Species	LOC Exceedences (Yes/No)	Description of Results of Risk Estimation
	Indirect effects: yes	Indirect effects from a loss of the prey base are expected because effects to individuals within populations have been demonstrated in mammals, birds, and invertebrates. No indirect effects from habitat loss are expected because this species does not appear to use BTPD burrows.
Sonora tiger salamander	Direct effects: yes	Direct effects to the Sonora tiger salamander are expected to occur based on the potential for this species to consume prey items that may have consumed the chlorophacinone bait (RQ of 0.104 for exposure to non-target animals, which is used as a surrogate for invertebrate prey, which exceeds the LOC of 0.1). Growth and reproductive effects cannot be precluded due to the absence of chronic data.
	Indirect effects: no	No indirect effects from the loss of prey base or loss of habitat (BTPD burrows) are expected because this species' range does not overlap with BTPD range.
Black-capped vireo	Direct effects: yes	Direct effects to the black-capped vireo are expected to occur based on the potential for this species to consume prey items that have consumed the chlorophacinone bait (RQ of 0.104 for exposure to non-target animals, which is used as a surrogate for invertebrate prey, which exceeds the LOC of 0.1). Growth and reproductive effects cannot be precluded due to the absence of chronic data.
	Indirect effects: no	No indirect effects from loss of prey base are expected because this species' habitat is distinct from BTPD habitat. Black-capped vireos are found in mixed deciduous/evergreen shrub land. Breeding vireos use shrubby growth of irregular height and distribution with spaces the small thickets and clumps and with vegetative extending to ground level. These habitat areas are distinct from the short grass prairie associated with BTPD habitat. No indirect effects from habitat loss are expected because this species does not use BTPD burrows.
Golden-cheeked warbler	Direct effects: yes	Direct effects to the golden-cheeked warbler are expected to occur based on the potential for this species to consume prey items that have consumed the chlorophacinone bait (RQ of 0.104 for exposure to non-target animals, which is used as a surrogate for invertebrate prey, which exceeds the LOC of 0.1). Growth and reproductive effects cannot be precluded due to the absence of chronic data.
	Indirect effects: no	No indirect effects from loss of prey base are expected because this species' habitat is distinct from BTPD habitat. Golden-cheeked warblers are found in mixed Ashe-juniper and oak woodlands in ravines and canyons. They spend summers in open canopy forest and winters in closed canopy forests. These habitat areas are distinct from the short grass prairie associated with BTPD habitat. No indirect effects from habitat loss are expected because this species does not use BTPD burrows.
Gray wolf	Direct effects: yes	Direct effects to the gray wolf are expected to occur based on the potential for this species to consume prey items that have consumed the chlorophacinone bait (RQ of 24.82 for exposure to non-target animals and RQ of 9.59 for exposure to BTPDs both of which exceed the LOC of 0.1). Growth and reproductive effects cannot be precluded due to the absence of chronic data; however, growth and reproductive effects are not expected because mortality typically occurs as a result of acute exposure.
	Indirect effects: yes	Indirect effects from the loss of the prey base are also expected because effects to individuals within populations have been demonstrated in mammals, birds, and invertebrates. No indirect effects from habitat loss are expected because this species does not use BTPD burrows.

[1] Direct effects are survival, growth, and reproduction effects to the individuals (juveniles and adults) of each listed species (terrestrial phase only if the species is aquatic or semi-aquatic)
[2] Indirect effects are survival, growth, and reproduction effects to the individuals of each listed species via effects on prey or habitat (burrows).

Table 5.5. Table 5.5 Risk Estimation Summary for Chlorophacinone - Effects to Designated Critical Habitat (PCEs)

Species Associated with a Designated Critical Habitat	PCEs	LOC Exceedances (yes/no)	Description of Results of Risk Estimation
Salt Creek tiger beetle	(1) Non-vegetated streambanks and mid-channel areas, located adjacent to and between saline stream edges and barren salt flats in saline and freshwater wetlands, in assemblages that are within 4 mi (6 km) of one another.	Yes	Reproductive effects are expected for the Salt Creek tiger beetle. Salt Creek tiger beetle larvae are potentially exposed to chlorophacinone residues through chlorophacinone exposed terrestrial invertebrates. Dosed carcasses in a burying beetle study negatively affected number of emerged beetles (MRID 47383001). Similar affects are expected for the Salt Creek tiger beetle. No indirect effects from loss of prey base are expected because this species' habitat is distinct from BTPD habitat. This species uses mud banks of streams and seeps in association with saline wetlands and exposed mud flats of saline wetlands which is distinct from the short grass prairie associated with BTPD habitat. No indirect effects from habitat loss are expected because this species does not use BTPD burrows.
	(2) Moist, barren salt flats with:		
	(a) Salmo and Saltillo soils or Lamo, Gibbon-Saltine, Obert, and Zoe soils with Salmo and Saltillo inclusions:		
	(b) Soil electroconductivity ranging from 2,016.0 mS/m to 2,992.2 mS/m;		
	(c) Soil moisture ranging from 43.5 percent to 51.7 percent; and		
	(d) Differential hydraulic pressures that create evaporation and result in exposed salt on soil surfaces.		
	(3) A natural hydrologic regime resulting in annual high flows in saline streams in the early spring and summer, and natural elevation changes in groundwater levels to hydrate saline wetlands located on the floodplain.		

	(4) The presence of abundant and diverse flying and non-flying invertebrate prey species belonging to the orders Coleoptera, Orthoptera, Hemiptera, Hymenoptera, Odonata, Diptera, or Lepidoptera.		
California condor	PCEs were not described for the California condor. However, several factors were considered in designating critical habitat: The Sespe-Piru, Mantilija, Sisquoc-San Rafael, and the Hi Mountain-Beartrap areas were considered critical for nesting and related year-long activities. The Mount Pinos and Blue-Ridge areas were considered critical for roosting. The Tejon Ranch, Kern County Rangelands, and Tulare County Rangelands were considered critical for feeding and other related activities; specifically, the Tejon County Rangelands are important because it is the only feeding area close to the Sespe-Piru nesting area. Further, areas of open range with limited disturbance that provide food are needed within the designated areas to maintain the species, since food availability is directly related to condor distribution and reproduction.	Yes	Direct effects to the California condor are expected through their potential exposure to prey items that may have consumed the chlorophacninone bait (RQ of 0.104 for exposure to non-target animals which exceeds the LOC of 0.1). Growth and reproductive effects cannot be precluded due to the absence of chronic data. No indirect effects due to prey base loss are expected because this species only occurs in areas adjacent to BTPD range. No indirect effects from habitat loss are expected because this species does not use BTPD burrows.
Whooping crane	Although PCEs were not specifically described for the whooping crane it was stated that each of the five factors normally associated with PCEs ((1) Space for individual and population growth and for normal behavior; (2) Food, water, air, light, minerals, or other nutritional or physiological requirements; (3) Cover or shelter; (4) Sites for breeding, reproduction, or rearing of offspring; and generally, (5) Habitats that are protected from disturbances or are representative of the geographical distribution of the listed species) pertain to the whooping crane and are summarized below: Whooping cranes are territorial; pairs require hundreds of acres of undisturbed wetland habitat and unmated birds require undefended territory. Refuges in Idaho, Colorado, and New Mexico were originally designated as part of the critical habitat to add space for a growing new flock. However, these refuges were later removed from the critical habitat designation due to the failure of whooping crane reintroduction in these areas.	Yes	Direct effects to the whooping crane are expected to occur based on the potential for this species to consume the chlorophacninone bait (RQ of 0.89 which exceeds the LOC of 0.1) or other prey items that have consumed the chlorophacninone bait (RQ of 0.104 for exposure to non-target animals which exceeds the LOC of 0.1). Growth and reproductive data cannot be precluded due to the absence of chronic data. Indirect effects from the loss of the prey base are also expected because effects to individuals within populations have been demonstrated in mammals, birds, and invertebrates. No indirect effects from habitat loss are expected because this species does not use BTPD burrows.

	All of the designated critical habitat areas provide for the nutritional and physiological needs of the cranes. This includes the tidal flats and marshes of Aransas that provide crustaceans and mollusks, the spring migration marshes that provide frogs, fish, crayfish, and other small animals, and the fall migration stopover locations where cranes feed primarily on waste grains and insects.		
	Whooping cranes require open spaces, primarily sand and gravel bars in rivers and lakes, for nightly roosting. These features appear to be one of the major factors in the selection of habitat by cranes.		
	With regard to breeding, the Grays Lake National Wildlife Refuge in Idaho was previously designated as critical habitat in order to provide additional nesting habitat. However, all of the designated critical habitat provides areas essential to rearing young. Cranes also require undisturbed wetland roosting sites and do not tolerate disturbance to themselves or their habitat.		

Canada lynx	Boreal forest of multiple succesional stages. Snowshoe hares and their preferred habitat conditions, which include low and dense vegetation that protrudes above the snow, and mature multistoried stands with conifer boughs at the snow surface. Winter snow conditions of deep powder present for extended periods of time. Potential den sites characterized by abundant coarse woody debris. Matrix habitat (e.g., hardwood forest, dry forest, non-forest, or other habitat types that do not support snowshoe hares) which connect patches of boreal forest foraging sites used by the lynx within a home range	Yes	Direct effects to the Canada lynx are expected to occur based on the potential for this species to consume prey items that have consumed the chlorophacninone bait (RQ of 23.30 for exposure to non-target animals and RQ of 9.00 for exposure to BTPDs both of which exceed the LOC of 0.1). Growth and reproductive effects cannot be precluded due to the absence of chronic data; however, growth and reproductive effects are not expected because mortality typically occurs as a result of acute exposure. No indirect effects from loss of prey base are expected because this species' habitat is distinct from BTPD habitat. The Canada lynx is associated with the southern, transitional reaches of the cool and moist boreal forest. Where it occurs at these lower latitudes, the boreal forest forms a mixed conifer and conifer-hardwood landscape. These habitat areas are distinct from the short grass prairie associated with BTPD habitat. No indirect effects from habitat loss are expected because this species does not use BTPD burrows.
Preble's meadow jumping mouse	Riparian corridors formed and maintained by normal, dynamic, geomorphological, and hydrologic processes that create and maintain river and stream channels, floodplains, and floodplain benches and promote patterns of vegetation favorable to the Preble's meadow jumping mouse, containing dense, riparian vegetation consisting of grasses, forbs, and shrubs, or any combination thereof, in areas along rivers and streams, that normally provide open water through the mouse's active season. The riparian areas must also include specific movement corridors that provide connectivity between and within populations. These could be riparian corridors with less vegetative cover, or include human disturbances such as erosion control, travel ways under bridges, along ditches and canals, and through culverts. Adjacent areas of low disturbance in floodplains and uplands, such as hayed fields, grazed pasture, and other unplowed agricultural fields, restored mine lands, recreational trail areas and urban-wildland interfaces.	Yes	Direct effects to the Preble's meadow jumping mouse are expected to occur based on the potential for this species to consume the chlorophacninone bait (RQ of 41.35 which exceeds the LOC of 0.1). Growth and reproductive effects cannot be precluded due to the absence of chronic data; however, growth and reproductive effects are not expected because mortality typically occurs as a result of acute exposure. Indirect effects from loss of prey are expected because effects to individuals within populations have been demonstrated in terrestrial invertebrates. Although this species makes nests both above and below ground, it does not appear to use other species' rodent burrows.

Mexican spotted owl	A range of tree species, including mixed conifer, pine-oak, and riparian forest types, composed of different tree sizes reflecting different stages of trees, 30-45% of which are trees with a 12 inch or greater trunk diameter when measured 4.5 feet off of the ground. A shade canopy created by the tree branches covering 40 percent or more of the ground Large dead trees (snags) with a trunk diameter of at least 12 inches (0.3 meters) when measured at 4.5 feet (1.4 meters) from the ground. High volumes of fallen trees and other woody debris; A wide range of tree and plant species, including hardwoods; and Adequate levels of residual plant cover to maintain fruits, seeds, and allow plant regeneration. Presence of water which typically provides cooler temperatures and higher humidity than the nearby areas. Clumps of stringers of mixed-conifer, pine-oak, pinyon-juniper, and/or riparian vegetation; Canyon wall containing crevices, ledges, or caves; and High percent of ground litter and woody debris.	Yes	Direct effects to the Mexican spotted owl are expected to occur based on the potential for this species to consume prey items that have consumed the chlorophacninone bait (RQ of 0.104 for exposure to non-target animals which exceeds the LOC of 0.1). Growth and reproductive effects cannot be precluded due to the absence of chronic data. No indirect effects from loss of prey base are expected because this species' habitat is distinct from BTPD habitat. Mexican spotted owls are found in old-growth or mature forests with unevenly aged stands of trees, high canopy, multi-storied levels, and high tree density as well as canyons with riparian or conifer communities. In Arizona and New Mexico they are found in habitats associated with mixed conifer, pine-oak, Arizona cypress, oak woodlands, and associated riparian forests. These habitat areas are distinct from the short grass prairie associated with BTPD habitat. No indirect effects from habitat loss are expected because this species does not use BTPD burrows.
Piping plover	The PCEs that support foraging, roosting, and sheltering habitat components for the wintering piping plover are: (1) Intertidal sand beaches (including sand flats) or mud flats (between the MLLW [mean lower low water] and annual high tide) with no, or very sparse, emergent vegetation for feeding. In some cases, these flats may be covered or partially covered by a mat of blue-green algae. (2) Unvegetated or sparsely vegetated sand, mud, or algal flats above annual high tide for roosting. Such sites may have debris or detritus and may have micro-topographic relief (less than 20 in (50 cm) above substrate surface) offering refuge from high winds and cold weather. (3) Surf-cast algae for feeding. (4) Sparsely vegetated backbeach, which is the beach area above mean high tide seaward of the dune line, or in cases where no dunes exist, seaward of a delineating feature such as a vegetation line, structure, or road. Backbeach is used by plovers for roosting and refuge during storms. (5) Spits, especially sand, running into water used for foraging and roosting.	Yes	Direct effects to the piping plover are expected to occur based on the potential for this species to consume prey items that have consumed the chlorophacinone bait (RQ of 0.104 for exposure to non-target animals, which is used as a surrogate for invertebrate prey, which exceeds the LOC of 0.1). Growth and reproductive effects cannot be precluded due to the absence of chronic data. No indirect effects are expected because this species' habitat is distinct from BTPD habitat. The plover's home range with BTPD range is usually limited to the wetland, lakeshore, or section of beach where its nest is located. No indirect effects from habitat loss are expected because this species does not use BTPD burrows.

	(6) Salterns, or bare sand flats in the center of mangrove ecosystems that are found above mean high water and are only irregularly flushed with seawater.		
	(7) Unvegetated washover areas with little or no topographic relief for feeding and roosting. Washover areas are formed and maintained by the action of hurricanes, storm surges, or other extreme wave actions.		
	(8) Natural conditions of sparse vegetation and little or no topographic relief mimicked in artificial habitat types (e.g., dredge spoil sites.)		
	The following PCEs, taken from the critical habitat designation for the northern Great Plains breeding population of the piping plover, encompass piping plover habitat outside of the designated wintering grounds of the species.		
	The one overriding primary constituent element (biological) that must be present at all sites is the dynamic ecological processes that create and maintain piping plover habitat.		
	The biological primary constituent element, *i.e.*, dynamic ecological processes, creates different physical primary constituent elements on the landscape. These habitat types or physical primary constituent elements that sustain the northern Great Plains breeding population of piping plovers are described as follows:		
	On prairie alkali lakes and wetlands, the physical primary constituent elements include –		
	(1) Shallow, seasonally to permanently flooded, mixosaline to hypersaline wetlands with sandy to gravelly, sparsely vegetated beaches, salt-encrusted mud flats, and/or gravelly salt flats;		
	(2) Springs and fens along edges of alkali lakes and wetlands; and		
	(3) Adjacent uplands 200 feet (61 m) above the high water mark of the alkali lake or wetland.		
	On rivers the physical primary constituent elements include – sparsely vegetated channel sandbars, sand and gravel beaches on islands, temporary pools on sandbars and islands, and the interface with the river.		
	On reservoirs the physical primary constituent elements include – sparsely vegetated shoreline beaches, peninsulas, islands composed of sand, gravel, or shale, and their interface with the water bodies.		
	On inland lakes (Lake of the Woods) the physical primary constituent elements include – sparsely vegetated and windswept sandy to gravelly islands, beaches, and peninsulas, and their interface with the water body.		

New Mexican ridge-nosed rattlesnake	PCEs were not described for the New Mexican ridge-nosed rattlesnake by name. However, the critical habitat listing notice identified certain attributes and features of the designated critical habitat area that are grouped as "constituent elements," including:	Yes	No direct effects based on survival to the New Mexican ridge-nosed rattlesnake are expected to occur (see Section 5.1.1.a. RQs of 0.018 for a 50 gram snake and RQ of 0.030 for a 500 gram snake. Neither of these RQs exceeds the LOC of 0.1). However, growth and reproductive effects cannot be precluded due to the absence of chronic data. Indirect effects from a loss of the prey base are also expected because effects to individuals within populations have been demonstrated in mammals, birds, and invertebrates. No indirect effects from habitat loss are expected because this species does not appear to use BTPD burrows.
	Dens and/or denning habitat that provides shelter during the summer and winter months;		
	Vegetation that provides cover for the New Mexican ridge-nosed rattlesnake and habitat for prey;		
	Abundance of prey (lizards and rodents)		
Gray wolf	PCEs were not described for the gray wolf. However, key habitat components were described in the recovery plan:	Yes	Direct effects to the gray wolf are expected to occur based on the potential for this species to consume prey items that have consumed the chlorophacninone bait (RQ of 24.82 for exposure to non-target animals and RQ of 9.59 for exposure to BTPDs both of which exceed the LOC of 0.1). Growth and reproductive effects cannot be precluded due to the absence of chronic data; however, growth and reproductive effects are not expected because mortality typically occurs as a result of acute exposure. Indirect effects from the loss of the prey base are also expected because effects to individuals within populations have been demonstrated in mammals, birds, and invertebrates. No indirect effects from habitat loss are expected because this species does not use BTPD burrows.
	A year-round abundance of ungulate prey and alternate prey,		
	Secluded and suitable denning and rendezvous sites, and		
	Sufficient space with low human disturbance.		

Following a preliminary MA determination, additional information is considered to refine the potential for exposure at the predicted levels based on the life history characteristics (*i.e.*, habitat range, feeding preferences, *etc*.) of the assessed species. Based on the best available information, the Agency uses the refined evaluation to distinguish those actions that MA - NLAA from those actions that are MA - LAA the assessed species and its designated critical habitat.

The criteria used to make determinations that the effects of an action are NLAA the assessed species or modify its designated critical habitat include the following:

- Significance of Effect: Insignificant effects are those that cannot be meaningfully measured, detected, or evaluated in the context of a level of effect where "take" occurs for even a single individual. "Take" in this context means to harass or harm, defined as the following:
    - Harm includes significant habitat modification or degradation that results in death or injury to listed species by significantly impairing behavioral patterns such as breeding, feeding, or sheltering.
    - Harass is defined as actions that create the likelihood of injury to listed species to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to, breeding, feeding, or sheltering.
- Likelihood of the Effect Occurring: Discountable effects are those that are extremely unlikely to occur.
- Adverse Nature of Effect: Effects that are wholly beneficial without any adverse effects are not considered adverse.

A description of the risk and effects determinations for each of the established assessment endpoints for the listed species that may be affected and their designated critical habitat is provided in **Sections 5.2.1** through **5.2.3**. The effects determination section will start with a discussion of the potential for direct effects, followed by a discussion of the potential for indirect effects. These discussions consider the spatial analysis. For those listed species that have designated critical habitat, the section will end with a discussion on the potential for modification to the critical habitat from the use of chlorophacinone to control BTPDs. Finally, in **Section 5.2.3**, a discussion of any potential overlap between the area of concern and the species that may be affected (including any designated critical habitat) is presented. If there is no overlap or the counties with/containing the species' habitat are not adjacent to the use area/BTPD habitat a NE determination is made.

5.2.1. Direct Effects to Listed Species

Those species that may be affected through direct effects are those with RQs that exceed the acute listed species LOC of 0.1. All species (*i.e.* birds and mammals) that have the potential to consume chlorophacinone bait or chlorophacinone poisoned animals smaller than a prairie dog have RQs that exceed this LOC. Additionally, mammals that have the potential to consume chlorophacinone poisoned prairie dogs or larger granivorous prey items have RQs that exceed the acute listed species LOC. All of the 21 listed species are expected to have direct effects. The New Mexican ridge-nosed rattlesnake is the only species that is not expected to have direct effects based on survival; however, growth and reproductive effects to this species cannot be precluded in the absence of chronic data. Furthermore, direct effects to invertebrates based on reproductive effects are expected resulting in direct effects to the American burying beetle and the Salt Creek tiger beetle.

5.2.1.a. Grizzly Bear

The use of chlorophacinone to control BTPDs is LAA the grizzly bear because the RQ for exposure to chlorophacinone bait (75.42) exceeds the LOC (0.1) and significant exposure is likely to occur. The range of this species overlaps with the action area (BTPD habitat). Rozol Prairie Dog Bait application season for control of BTPDs overlaps periods during which grizzly bears are active and not hibernating. Although grizzly bears will be hibernating during most of this time. Chlorophacinone can be applied between October 1 and March 15 or spring green-up, whichever occurs later. Grizzly bears typically enter hibernation between October and December and exit their dens at some point between March and May. A single day exposure to chlorophacinone bait or prey items exposed to chlorophacinone bait is likely because grizzly bears range over very large areas (1,000 to 1,500 mi^2) that can include prairie dog towns and will feed opportunistically on items including chlorophacinone poisoned prey items or chlorophacinone bait. A grizzly bear would only need to consume 4 grams of bait to reach the LOC[11]. If a grizzly bear encounters an area where chlorophacinone is applied, it is highly likely that at least this amount of bait would be consumed. A grizzly bear is most likely to encounter a Rozol application area shortly before or after hibernation at which time the bear is engorging itself. This only increases the likelihood that the bait would be consumed.

5.2.1.b. American Burying Beetle

The use of chlorophacinone to control BTPDs is LAA the American burying beetle based on direct reproductive effects. The reproductive effects are due to lower carcass size in chlorophacinone treated carcasses and effects to larvae. An acute toxicity test for the earthworm (MRID 47383002) and an open literature study (Fisher *et al.* 2007) indicate that there is no risk to invertebrates at exposure levels relevant to this use. Furthermore, the second phase of the burying beetle study (MRID 47383001) that showed reproductive effects to burying beetles based on lower carcass weights showed that there were no direct acute effects to adult burying beetles fed chlorophacinone treated ground beef. In fact, those exposed to the chlorophacinone faired better than the control group.

Chlorophacinone use is expected to affect reproduction of the American burying beetle through effects to emerged beetles. Number of emerged beetles is negatively affected by use of chlorophacinone poisoned carcasses in burying beetles (MRID 47383001). This type of effect is considered to be a direct effect.

[11] RQ for bait consumption = 75.42; dry weight ingestion rate = 3,077 g/day; Acute Listed Species LOC = 0.1. (3,077 g/day)/(75.42)*0.1 = 4 g/day

5.2.1.c. Salt Creek Tiger Beetle

The use of chlorophacinone to control BTPDs is LAA the Salt Creek tiger beetle based on direct reproductive effects. The reproductive effects are due to lower carcass size in chlorophacinone treated carcasses and effects to larvae. An acute toxicity test for the earthworm (MRID 47383002) and an open literature study (Fisher *et al.* 2007) indicate that there is no risk to invertebrates at exposure levels relevant to this use. Furthermore, the second phase of the burying beetle study (MRID 47383001) that showed reproductive effects to burying beetles based on lower carcass weights showed that there were no direct acute effects to adult burying beetles fed chlorophacinone treated ground beef. In fact, those exposed to the chlorophacinone faired better than the control group.

Chlorophacinone use is expected to affect reproduction of the Salt Creek tiger beetle through effects to emerged beetles. Number of emerged beetles is negatively affected by use of chlorophacinone poisoned carcasses in burying beetles (MRID 47383001). Exposure can potentially occur in the larval stage through chlorophacinone insect residues. This type of effect is considered to be a direct effect.

5.2.1.d. California Condor

The use of chlorophacinone to control BTPDs is LAA the California condor. California condors are known to occur in four counties in Arizona as well as several counties in California. One of the four counties in Arizona where the California condor is known to occur, Apache County, is adjacent to a county in New Mexico in which BTPDs are known to occur, Catron County. It is conceivable since California condors are wide ranging species that they may prey on animals in an adjacent county. Although California condors typically prey on the carcasses of large mammals (cattle, sheep, deer, horses) they also have been known to prey on ground squirrels and other small to medium sized prey including coyotes, rabbits, foxes, weasels, rats, and pocket gophers. The California condor would have to consume 34 poisoned mice or almost two BTPDs every day for five days to reach the LOC[12]. Although consumption of 34 mice by a California condor is not likely, consumption of other exposed non-target granivores is more likely and can result in similar exposure. Additionally, consumption of two BTPD carcasses is likely if the condor finds a Rozol Prairie Dog Bait application site. Furthermore, effects including external bleeding, internal hemorrhaging and increased blood coagulation time were seen in secondary exposure studies to birds. Previous assessments have considered these effects analogous to lethality thereby supporting this LAA determination. Finally, growth and reproductive effects cannot be precluded due to the absence of chronic data.

5.2.1.e. Whooping Crane

The use of chlorophacinone to control BTPDs is LAA the whooping crane. Rozol Prairie Dog Bait application season for the control of BTPDs overlaps, spatially and temporally, with the fall

[12] RQ for non-target animal consumption = 0.104; RQ for BTPD consumption = 0.04; wet weight ingestion rate = 709 g/day; BTPD weight = 1000 g; mouse weight = 20 g; Acute Listed Species LOC = 0.1. [(709 g/day)/(RQ)*0.1]/[prey weight] = 34.2 mice or 1.8 BTPDs

migration of the Aransas Wood Buffalo Population. Whooping cranes will eat waste agricultural grains during their migration, and therefore it can be expected that the grain-based chlorophacinone bait (on or close to the surface) would be consumed as well. The RQ for consumption of chlorophacinone grain bait (0.89) exceeds the LOC for endangered species (0.1). A whooping crane would need to eat 26 grams of bait to reach the LOC[13]. This is possible as the whooping crane's ingestion rate (in grams dry weight/day) is 227 g/day. The LC_{50} on which this RQ is based is from a five day feeding study. Whooping cranes are likely to be migrating when they are exposed to chlorophacinone bait,. During migration, the cranes engorge themselves when they have the opportunity to feed. This only increases the likelihood that the bait will be consumed. According to the life history information whooping cranes also consume rodents. It was determined that a whooping crane would have to eat 23 poisoned mice or more than one poisoned BTPD every day for five days to reach the LOC[14]. This is possible based on the life history information. It is possible that the whooping crane could eat 23 mice per day. However, it seems unlikely that the whooping crane would eat more than one BTPD every day. Furthermore, effects including external bleeding, internal hemorrhaging and increased blood coagulation time were seen in secondary exposure studies to birds. Previous assessments have considered these effects analogous to lethality thereby supporting this LAA determination. Finally, reproductive effects cannot be precluded based on the absence of chronic data.

5.2.1.f. Eskimo Curlew

The use of chlorophacinone to control BTPDs is LAA the Eskimo curlew. The range of this species overlaps with BTPD habitat. Eskimo curlews prey on invertebrates which may be exposed to chlorophacinone bait. This assessment assumes invertebrates exposed to chlorophacinone will have the same maximum residue concentration as the deer mouse (5.8 mg a.i./kg-bw). The curlew would have to consume 149 grams of poisoned invertebrates every day for five days to reach the LOC[15]. The curlew's ingestion rate is 155 g/day. Given this, it is possible that the Eskimo curlew would be exposed at levels exceeding the LOC. Furthermore, effects including external bleeding, internal hemorrhaging and increased blood coagulation time were seen in secondary exposure studies to birds. Previous assessments have considered these effects analogous to lethality thereby supporting this LAA determination. Finally, reproductive effects cannot be precluded based on the absence of chronic data.

5.2.1.g. Northern Aplomado Falcon

The use of chlorophacinone to control BTPDs is LAA the northern Aplomado falcon. The range of this species overlaps with BTPD habitat. Northern Aplomado falcons prey on birds and rodents which may be exposed to chlorophacinone bait. The falcon would have to consume 5

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[13] RQ for bait consumption = 0.89; dry weight ingestion rate = 227 g/day; Acute Listed Species LOC = 0.1. (227 g/day)/(0.89)*0.1 = 25.5 g/day

[14] RQ for non-target animal consumption = 0.104; RQ for BTPD consumption = 0.04; wet weight ingestion rate = 470 g/day; BTPD weight = 1000 g; mouse weight = 20 g; Acute Listed Species LOC = 0.1. [(470 g/day)/(RQ)*0.1]/[prey weight] = 22.6 mice or 1.2 BTPDs

[15] RQ for invertebrate consumption = 0.104; wet weight ingestion rate = 155 g/day; Acute Listed Species LOC = 0.1. (155 g/day)/(0.104)*0.1 = 149 g/day

poisoned mice or less than one BTPD to reach the LOC[16]. According to life history information the average weight of their preferred prey (birds) is around 67 grams. The majority of the birds weighed less than 100 grams. However, falcons are capable of taking larger prey with weights around 300-570 grams. Based on this information it seems unlikely but possible that a falcon would prey on a prairie dog but they may consume mice. Given this, it is possible that the northern Aplomado falcon would be exposed at levels exceeding the LOC. Furthermore, effects including external bleeding, internal hemorrhaging and increased blood coagulation time were seen in secondary exposure studies to birds. Previous assessments have considered these effects analogous to lethality thereby supporting this LAA determination. Finally, reproductive effects cannot be precluded based on the absence of chronic data.

5.2.1.h. Black Footed Ferret

The use of chlorophacinone to control BTPDs is LAA black footed ferrets. The black footed ferret RQs (7.45 for exposure to BTPDs and 19.29 for exposure to non-target animals) exceed the LOC for endangered species (0.1). Exposure is likely considering the black footed ferret predominantly preys on prairie dogs. The Rozol Prairie Dog Bait label indicates that the "product [is not to be used] within prairie dog towns in the range of the black-footed ferret without first contacting endangered species specialists at a U.S. Fish and Wildlife Service." However, if chlorophacinone was used in a BTPD town near black-footed ferrets there would be direct effects to the black-footed ferret. The black-footed ferret would need to eat less than one poisoned BTPD or one poisoned mouse to reach the LOC[17].

5.2.1.i. Chiricahua Leopard Frog

The use of chlorophacinone to control BTPDs is LAA the Chiricahua leopard frog. The range of this species overlaps with BTPD habitat. Chiricahua leopard frog prey on invertebrates which may be exposed to chlorophacinone bait. This assessment assumes many types of insects exposed to chlorophacinone will have the same maximum residue concentration as the deer mouse (5.8 mg a.i./kg-bw). The Chiricahua leopard frog would have to consume 78 grams of poisoned invertebrates every day for five days to reach the LOC[18]. The Chiricahua leopard frog's ingestion rate is 81 g/day. Given this, it is possible that the Chiricahua leopard frog would be exposed at levels exceeding the LOC. Furthermore, effects including external bleeding, internal hemorrhaging and increased blood coagulation time were seen in secondary exposure studies to birds. Previous assessments have considered these effects analogous to lethality thereby supporting this LAA determination. Finally, reproductive effects cannot be precluded based on the absence of chronic data. Herptiles are assessed using avian toxicity data; therefore, these results are relevant to the Chiricahua leopard frog.

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[16] RQ for non-target animal consumption = 0.104; RQ for BTPD consumption = 0.04; wet weight ingestion rate = 102 g/day; BTPD weight = 1000 g; mouse weight = 20 g; Acute Listed Species LOC = 0.1. [(102 g/day)/(RQ)*0.1]/[prey weight] = 4.9 mice or 0.3 BTPDs

[17] RQ for non-target animal consumption = 19.29; RQ for BTPD consumption = 7.45; wet weight ingestion rate = 147.84 g/day; BTPD weight = 1000 g; mouse weight = 20 g; Acute Listed Species LOC = 0.1. [(148 g/day)/(RQ)*0.1]/[prey weight] = 0.04 mice or 0.002 BTPDs

[18] RQ for invertebrate consumption = 0.104; wet weight ingestion rate = 81 g/day; Acute Listed Species LOC = 0.1. (81 g/day)/(0.104)*0.1 = 78 g/day

5.2.1.j. Jaguar

The use of chlorophacinone to control BTPDs is LAA the jaguar. Jaguars are known to occur in three counties in Arizona as well as one county in New Mexico. The county in New Mexico, Hidalgo County, where the jaguar is known to occur is also a county in which BTPDs are known to occur. Although jaguars typically prey on javelina (a wild boar), deer, and livestock, they also have been known to prey on large rodents including capybaras and paca as well as armadillos and caimans. They have also been known to take various species of turtles, birds, and fish. Thus, although it is unlikely, it is possible that a jaguar might take a poisoned BTPD. The jaguar would have to consume less than one poisoned mouse or less than one poisoned BTPD every day for five days to reach the LOC[19]. Although there is evidence in the life history that they forage on rodents, the rodents that they tend to consume are much larger than a BTPD (*e.g.* capybara and paca, both weighing more than 20 pounds). However, it is possible that a jaguar could consume poisoned BTPDs. Although, it seems unlikely that a jaguar would feed on a BTPD every day for a five day period, if a jaguar encountered a chlorophacinone poisoned BTPD town, consumption at this level could possibly occur.

5.2.1.k. Gulf Coast Jaguarundi

The use of chlorophacinone to control BTPDs is LAA the Gulf Coast jaguarundi. The Gulf Coast jaguarundi occurs in the southern part of Texas but is known to occur in counties as far north in Texas as Atascosa County. Atascosa County is adjacent to Bexar County, Texas in which BTPDs are known to occur. It is conceivable that the Gulf Coast jaguarundi may prey on animals in an adjacent county. Jaguarundis typically prey on small mammals, birds, and reptiles. Stomach contents have included: lizards, rodents (mice and rats), small birds, and cottontail rabbits, and grass. The Gulf Coast jaguarundi would have to consume less than one poisoned mouse or less than one poisoned BTPD every day for five days to reach the LOC[20]. Consumption at this level could reasonably occur.

5.2.1.l. Canada Lynx

The use of chlorophacinone to control BTPDs is LAA the Canada lynx. The range of this species overlaps with BTPD habitat. Canada lynx typically prey on the snowshow hare but have also been known to prey opportunistically on small mammals and birds. Other prey may include rodents and fish and lynx may also prey on ungulates. The Canada lynx would have to consume less than one poisoned mouse or less than one poisoned BTPD every day for five days to reach the LOC[21]. There is evidence in the life history that the Canada lynx forages on small to

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[19] RQ for non-target animal consumption = 32.85; RQ for BTPD consumption = 12.69; wet weight ingestion rate = 4119 g/day; BTPD weight = 1000 g; mouse weight = 20 g; Acute Listed Species LOC = 0.1. [(4119 g/day)/(RQ)*0.1]/[prey weight] = 0.6 mice or 0.03 BTPDs

[20] RQ for non-target animal consumption = 23.82; RQ for BTPD consumption = 9.2; wet weight ingestion rate = 739 g/day; BTPD weight = 1000 g; mouse weight = 20 g; Acute Listed Species LOC = 0.1. [(739 g/day)/(RQ)*0.1]/[prey weight] = 0.2 mice or 0.008 BTPDs

[21] RQ for non-target animal consumption = 23.3; RQ for BTPD consumption = 9.0; wet weight ingestion rate = 819 g/day; BTPD weight = 1000 g; mouse weight = 20 g; Acute Listed Species LOC = 0.1. [(819 g/day)/(RQ)*0.1]/[prey weight] = 0.2 mice or 0.009 BTPDs

medium size prey and further it seems possible that they could consume one BTPD every day for five days.

5.2.1.m. Preble's Meadow Jumping Mouse

The use of chlorophacinone to control BTPDs is LAA the Preble's meadow jumping mouse. The range of this species overlaps with BTPD habitat. Rozol Prairie Dog Bait application season for the control for BTPDs overlaps periods during which the Preble's meadow jumping mouse is active and not hibernating. However, Preble's meadow jumping mice will be hibernating during most of this time. Chlorophacinone can be applied between October 1 and March 15 or spring green-up, whichever occurs later. Preble's meadow jumping mice typically enter hibernation between late August and October and come out of hibernation in May. Based on the life history information it seems reasonable that the Preble's meadow jumping mouse could be exposed to the chlorophacinone bait. A Preble's meadow jumping mouse would have to eat less than one grain of Rozol Prairie Dog Bait per day for five days to reach the LOC[22]. It is possible that a Preble's meadow jumping mouse could consume this amount of bait. The Preble's meadow jumping mouse is most likely to encounter a Rozol application area shortly before or after hibernation at which time the mouse is engorging itself. This only increases the likelihood that the bait would be consumed.

5.2.1.n. Ocelot

The use of chlorophacinone to control BTPDs is LAA the ocelot. The ocelot occurs in the southern part of Texas but is known to occur in counties as far north in Texas as Atascosa County. Atascosa County is adjacent to Bexar County, Texas in which BTPDs are known to occur. It is conceivable since the ocelot is a wide ranging species that they may prey on animals in an adjacent county. Ocelots typically prey on small to medium-sized mammals (rabbits, agoutis, and mice), birds, reptiles (snakes and lizards), fish, and invertebrates. Ocelots would have to consume less than one poisoned mouse or less than one poisoned BTPD every day for five days to reach the LOC[23]. There is evidence in the life history that they forage on mice and if it were intoxicated and easily captured, a BTPD could be a prey item as well. It is possible that they would consume a mouse or BTPD every day for five days.

5.2.1.o. Mexican Spotted Owl

The use of chlorophacinone to control BTPDs is LAA the Mexican spotted owl. The range of this species overlaps with the BTPD habitat. Mexican spotted owls typically prey on small- and medium-sized rodents including woodrats, peromyscid mice, and microtine voles. They also eat bats, birds, reptiles, and arthropods. The Mexican spotted owl would have to consume almost

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[22] RQ for bait consumption = 41.35; dry weight ingestion rate = 1.94 g/day; mass of one grain = 0.2 g; Acute Listed Species LOC = 0.1; [(1.94 g/day)/(41.35)*0.1]/(0.2 g) = 0.02 grain

[23] RQ for non-target animal consumption = 26.96; RQ for BTPD consumption = 10.41; wet weight ingestion rate = 1576 g/day; BTPD weight = 1000 g; mouse weight = 20 g; Acute Listed Species LOC = 0.1. [(1576 g/day)/(RQ)*0.1]/[prey weight] = 0.3 mice or 0.02 BTPDs

six poisoned mice or less than one poisoned BTPD every day for five days to reach the LOC[24]. There is evidence in the life history that they forage on small to medium size prey. However, based on the Mexican spotted owl's ingestion rate (41 g/day), it seems unlikely that they would consume 20 mice or one BTPD every day for five days. Nonetheless, lacking avian reproduction data, risk cannot be precluded at any dose level. Furthermore, effects including external bleeding, internal hemorrhaging and increased blood coagulation time were seen in secondary exposure studies to birds. Previous assessments have considered these effects analogous to lethality thereby supporting this LAA determination.

5.2.1.p. Piping Plover

The use of chlorophacinone to control BTPDs is LAA the piping plover. The range of this species overlaps with BTPD habitat. Piping plover prey on invertebrates which may be exposed to chlorophacinone bait. This assessment assumes invertebrates exposed to chlorophacinone will have the same maximum residue concentration as the deer mouse (5.8 mg a.i./kg-bw). The piping plover would have to consume 44 grams of poisoned invertebrates every day for five days to reach the LOC[25]. The piping plover's ingestion rate is 46 g/day. Given this, it is possible that the piping plover would be exposed at levels exceeding the LOC. Furthermore, effects including external bleeding, internal hemorrhaging and increased blood coagulation time were seen in secondary exposure studies to birds. Previous assessments have considered these effects analogous to lethality thereby supporting this LAA determination. Finally, reproductive effects cannot be precluded at any exposure level in the absence of chronic data.

5.2.1.q. New Mexican Ridge-nosed Rattlesnake

The use of chlorophacinone to control BTPDs is LAA the New Mexican ridge-nosed rattlesnake. The RQ does not exceed the LOC for the New Mexican ridge-nosed rattlesnake. See **Section 5.1.1.a** above for the rationale. However, direct growth and reproductive effects cannot be precluded in the absence of avian reproduction data. Furthermore, effects including external bleeding, internal hemorrhaging and increased blood coagulation time were seen in secondary exposure studies to birds. Previous assessments have considered these effects analogous to lethality thereby supporting this LAA determination. Herptiles are assessed using avian toxicity data, therefore, these results are relevant to the New Mexican ridge-nosed rattlesnake.

5.2.1.r. Sonora Tiger Salamander

The use of chlorophacinone to control BTPDs is LAA the Sonora tiger salamander. The range of this species is adjacent to the BTPD habitat. Sonora tiger salamanders are known to occur in two counties in Arizona (Cochise and Santa Cruz counties). One of the two counties in Arizona where the Sonora tiger salamander is known to occur, Cochise County, is adjacent to a county in New Mexico in which BTPDs are known to occur, Hidalgo County. Metamorphosed Sonora

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[24] RQ for non-target animal consumption = 0.104; RQ for BTPD consumption = 0.04; wet weight ingestion rate = 118 g/day; BTPD weight = 1000 g; mouse weight = 20 g; Acute Listed Species LOC = 0.1. [(118 g/day)/(RQ)*0.1]/[prey weight] = 5.6 mice or 0.4 BTPDs

[25] RQ for invertebrate consumption = 0.104; wet weight ingestion rate = 46 g/day; Acute Listed Species LOC = 0.1. (46 g/day)/(0.104)*0.1 = 44 g/day

tiger salamanders prey on terrestrial insects and other macroinvertebrates which may be exposed to chlorophacinone bait. This assessment assumes invertebrates exposed to chlorophacinone will have the same maximum residue concentration as the deer mouse (5.8 mg a.i./kg-bw). The Sonora tiger salamander would have to consume 50 grams of poisoned invertebrates every day for five days to reach the LOC[26]. The Sonora tiger salamander's ingestion rate is 52 g/day. Given this, it is possible that the Sonora tiger salamander would be exposed at levels exceeding the LOC. Lacking avian reproduction data, risk cannot be precluded at any dose level. Furthermore, effects including external bleeding, internal hemorrhaging and increased blood coagulation time were seen in secondary exposure studies to birds. Previous assessments have considered these effects analogous to lethality thereby supporting this LAA determination. Herptiles are assessed using avian toxicity data; therefore, these results are relevant to the Sonora tiger salamander.

5.2.1.s. Black-capped Vireo

The use of chlorophacinone to control BTPDs is LAA the black-capped vireo. The range of this species overlaps with BTPD habitat. Black-capped vireos prey on invertebrates, primarily beetles and caterpillars, which may be exposed to chlorophacinone bait. This assessment assumes invertebrates exposed to chlorophacinone will have the same maximum residue concentration as the deer mouse (5.8 mg a.i./kg-bw). The black-capped vireo would have to consume 16.3 grams of poisoned invertebrates every day for five days to reach the LOC[27]. The black-capped vireo's ingestion rate is 16.9 g/day. Given this, it is possible that the black-capped vireo would be exposed at levels exceeding the LOC. Furthermore, effects including external bleeding, internal hemorrhaging and increased blood coagulation time were seen in secondary exposure studies to birds. Previous assessments have considered these effects analogous to lethality thereby supporting this LAA determination. Finally, reproductive effects cannot be precluded at any exposure level in the absence of chronic data.

5.2.1.t. Golden-Cheeked Warbler

The use of chlorophacinone to control BTPDs is LAA the golden-cheeked warbler. The range of this species overlaps with BTPD habitat. Golden-cheeked warblers prey on invertebrates (*e.g.* insects, spiders and caterpillars) which may be exposed to chlorophacinone bait. This assessment assumes invertebrates exposed to chlorophacinone will have the same maximum residue concentration as the deer mouse (5.8 mg a.i./kg-bw). The golden-cheeked warbler would have to consume 17.4 grams of poisoned invertebrates every day for five days to reach the LOC[28]. The golden-cheeked warbler's ingestion rate is 18.1 g/day. Given this, it is possible that the golden-cheeked warbler would be exposed at levels exceeding the LOC. Lacking avian reproduction data, risk cannot be precluded at any dose level. Furthermore, effects including external bleeding, internal hemorrhaging and increased blood coagulation time were seen in

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[26] RQ for invertebrate consumption = 0.104; wet weight ingestion rate = 52 g/day; Acute Listed Species LOC = 0.1. (52 g/day)/(0.104)*0.1 = 50 g/day

[27] RQ for invertebrate consumption = 0.104; wet weight ingestion rate = 16.9 g/day; Acute Listed Species LOC = 0.1. (16.9 g/day)/(0.104)*0.1 = 16.3 g/day

[28] RQ for invertebrate consumption = 0.104; wet weight ingestion rate = 18.1 g/day; Acute Listed Species LOC = 0.1. (16.9 g/day)/(0.104)*0.1 = 17.4 g/day

secondary exposure studies to birds. Previous assessments have considered these effects analogous to lethality thereby supporting this LAA determination.

5.2.1.u. Gray Wolf

The use of chlorophacinone to control BTPDs is LAA the gray wolf. The range of this species overlaps with the BTPD habitat. Although gray wolves typically prey on white-tailed deer, mule deer, moose, elk, caribou, bison, muskox, bighorn sheep, Dall sheep, mountain goat, beaver, and snowshoe hare. Small mammals, birds, and large invertebrates are sometimes also taken. The gray wolf would have to consume less than one poisoned mouse or less than one poisoned BTPD every day for five days to reach the LOC[29]. There is evidence in the life history that the gray wolf forages on small to medium size prey and further it seems possible that they could consume mice and/or BTPDs over a five day period.

5.2.2. Indirect Effects to Listed Species

The use of chlorophacinone to control BTPDs is LAA the grizzly bear, American burying beetle, whooping crane, Eskimo curlew, northern Aplomado falcon, black-footed ferret, Chiricahua leopard frog, Preble's meadow jumping mouse, New Mexican ridge-nosed rattlesnake, and the gray wolf with respect to indirect effects. The potential for indirect effects comes from loss of prey base (BTPDs or other exposed non-target animal populations) and loss of habitat (BTPD burrows).

Grizzly bears, American burying beetles, whooping cranes, northern Aplomado falcons, black-footed ferrets, Chiricahua leopard frog, New Mexican ridge-nosed rattlesnakes, and gray wolves have potential to prey upon BTPDs and/or other non-target exposed mammals affected by chlorophacinone. Effects to individuals have been demonstrated in mammals ranging in size from 13 g to 36,363 g with RQs ranging from 19 to 41. The Agency does not currently have a method to extrapolate risk from individuals to a prey-base level effect. In the absence of this level of analysis, risk cannot be precluded and effects to mammalian prey bases are presumed. For this prey-base level effect, use of chlorophacinone to control BTPDs is LAA.

American burying beetles, whooping cranes, northern Aplomado falcons, black-footed ferrets, New Mexican ridge-nosed rattlesnakes, and gray wolves have potential to prey upon birds or herptiles affected by chlorophacinone. The diet based RQ for birds consuming chlorophacinone bait is 0.89. This RQ exceeds the endangered species Acute Risk LOC and effects to individuals are, therefore, expected. The Agency does not currently have a method to extrapolate risk from individuals to a prey-base level effect. In the absence of this level of analysis, risk cannot be precluded and effects to avian and herptile prey bases are presumed. For this prey-base level effect, use of chlorophacinone to control BTPDs is LAA.

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[29] RQ for non-target animal consumption = 24.82; RQ for BTPD consumption = 9.59; wet weight ingestion rate = 2311 g/day; BTPD weight = 1000 g; mouse weight = 20 g; Acute Listed Species LOC = 0.1. [(2311 g/day)/(RQ)*0.1]/[prey weight] = 0.5 mice or 0.02 BTPDs

Those species that consume invertebrates (*i.e.* American burying beetle, whooping crane, Eskimo curlew, northern Aplomado falcon, black-footed ferret, Chiricahua leopard frog, Preble's meadow jumping mouse, New Mexican ridge-nosed rattlensnake, and the gray wolf) may have indirect effects from a loss of their invertebrate prey base because larvae consuming chlorophacinone residues have reproductive effects (MRID 47383001). The Agency does not currently have a method to extrapolate risk from individuals to a prey-base level effect. In the absence of this level of analysis, risk cannot be precluded and effects to invertebrate prey bases are presumed. For this prey-base level effect, use of chlorophacinone to control BTPDs is LAA.

There are indirect effects to the black footed ferret due to habitat (burrow) loss. The black-footed ferret is a prairie dog obligate species (USFWS, 1988). It has been known to take advantage of prairie dog burrows for shelter and travel, and "may modify prairie dog burrows for its own use" (Nowak, 1999).

5.2.3. Modification of Designated Critical Habitat

5.2.3.a. Potential Areas of MA Effect - Overlap or Adjacent BTPD Habitat and Occurrence of the Assessed Listed Species

This assessment analyzes the use of chlorophacinone grain bait to control BTPDs. As a result, the action area was identified as the range of the BTPD obtained from NatureServe. The initial area of concern is defined as all land cover types within the range of the BTPD. **Appendix A** provides an overview of where the action area overlaps with species range as described in **Section 2.5**. Only species with habitat that overlapped or were found in adjacent counties (direct effects only) with the BTPD habitat were included in this assessment. For habitat modification and prey base effects, adjacent counties were not considered.

Pesticide exposures and predicted risks to the species and its resources (i.e., food and habitat) are not expected to be uniform across the action area since BTPDs are not uniformly distributed across action area.

5.3. Effects Determinations Summary

The Agency makes a **may affect, and likely to adversely affect** determination for the grizzly bear, American burying beetle, Salt Creek tiger beetle, whooping crane, Eskimo curlew, northern Aplomado falcon, black-footed ferret, Chirichaua leopard frog, jaguar, Gulf Coast jaguarundi, Canada lynx, Preble's meadow jumping mouse, ocelot, Mexican spotted owl, piping plover, New Mexican ridge-nosed rattlesnake, Sonora tiger salamander, black-capped vireo, golden-cheeked warbler, and the gray wolf and a **habitat modification** determination for the Salt Creek tiger beetle, whooping crane, Canada lynx, Preble's meadow jumping mouse, Mexican spotted owl, piping plover, and New Mexican ridge-nosed rattlesnake. The California condor and gray wolf are not included in the list of species for which habitat modification was determined because the critical habitat for these species do not overlap with the BTPD range.

5.3.1. Addressing the Risk Hypotheses

In order to conclude this risk assessment, it is necessary to address the risk hypotheses defined in **Section 2.9.1**. Based on the conclusions of this assessment, all four hypotheses represent concerns in terms of direct and indirect effects of chlorophacinone on some of the listed assessed species and their designated critical habitat.

The labeled use of chlorophacinone for BTPDs within the action area will:

- directly affect listed species by causing mortality or by adversely affecting growth or reproduction through primary exposure to/consumption of chlorophacinone bait;
- directly affect listed species by causing mortality or by adversely affecting growth or reproduction through secondary exposure to chlorophacinone poisoned animals, BTPDs and other non-target animals, and/or carcasses.
- indirectly affect listed species and/or modify their designated critical habitat by reducing or changing the composition of their food supply;
- indirectly affect listed species and/or modify their designated critical habitat by reducing populations of BTPDs which provide burrows for shelter

6. Uncertainties

This section describes uncertainties specific to this assessment.

6.1. Exposure Assessment Uncertainties

6.1.1. Maximum Use Scenario

The screening-level risk assessment focuses on characterizing potential ecological risks resulting from a maximum use scenario, which is determined from labeled statements of maximum application rate and number of applications with the shortest time interval between applications. The frequency at which actual uses approach this maximum use scenario may be dependant on pest resistance, timing of applications, cultural practices, and market forces.

6.1.2. Usage Uncertainties

Usage data is unavailable for chlorophacinone though anecdotal evidence and the breadth of the registrant's advertising campaign indicate that use is highly prevalent. Uncertainty regarding intensity of chlorophacinone use affects exposure to species of concern with expansive ranges (*e.g.* grizzly bear, California condor, whooping crane, jaguar, Gulf Coast jaguarundi, Canada lynx, piping plover, ocelot, black-capped vireo, golden-cheeked warbler, and the gray wolf). Whether chlorophacinone is used on one prairie dog town within a given animal's range or many will influence the probability that the animal is affected. To account for this uncertainty, RQs are based on a food intake of 100% chlorophacinone grain bait and/or chlorophacinone-poisoned carcasses.

6.2. Effects Assessment Uncertainties

6.2.1. Data Gaps and Uncertainties

Data gaps include:

- Avian reproduction study for chlorophacinone (guideline 850.2300).
- Terrestrial field study for use of chlorophacinone bait to control BTPDs (guideline 850.2500 in conjunction with protocol discussions).

Due to these data gaps, risk cannot be precluded to birds and exposure cannot be fully characterized.

6.2.2. Carcass Residue Concentration

All carcass residue concentration data discussed in this assessment is based on animals that have been fed chlorophacinone bait to mortality. Determining residue concentrations at mortality does not necessarily capture the highest concentration. Metabolism of toxicants can continue for a period of time post-mortem, therefore, residue concentrations are likely highest just prior to or concurrent with animal mortality. Poisoned prey items are highly vulnerable to predation before succumbing to anticoagulant poisoning. Given this, listed predators and scavengers may be exposed to higher residue concentrations than are reflected in carcass residue studies. To account for this uncertainty, the highest whole body concentration was used to characterize prairie dog chlorophacinone concentrations and the highest relevant concentration was used to characterize residue concentrations in non-target granivores.

6.2.3. Sublethal Effects

When assessing acute risk, the screening risk assessment relies on the acute mortality endpoint as well as a suite of sublethal responses to the pesticide, as determined by the testing of species response to chronic exposure conditions and subsequent chronic risk assessment. Consideration of additional sublethal data in the effects determination is exercised on a case-by-case basis and only after careful consideration of the nature of the sublethal effect measured and the extent and quality of available data to support establishing a plausible relationship between the measure of effect (sublethal endpoint) and the assessment endpoints. However, the full suite of sublethal effects from valid open literature studies is considered for characterization purposes, including defining the action area.

Though no mortalities were reported in the raptor feeding studies, sublethal effects were indicated that could affect the likelihood of survival in the wild. These sublethal effects were external bleeding, internal hemorrhaging and increased blood coagulation time. Incidents involving a bald eagle, a ferruginous hawk, and a great horned owl indicate the potential for chlorophacinone poisoning to cause mortality or contribute to mortality of predatory birds. Sublethal effects are also seen in mammals.

7. Risk Conclusions

In fulfilling its obligations under Section 7(a)(2) of the Endangered Species Act, the information presented in this endangered species risk assessment represents the best data currently available to assess the potential risks of chlorophacinone to the all listed species and their designated critical habitat in the action area for registered uses of Rozol Prairie Dog Bait (EPA registration number 7173-286).

Based on the best available information, the Agency makes a **Likely to Adversely Affect** determination for the following species: grizzly bear, American burying beetle, Salt Creek tiger beetle, California condor, whooping crane, Eskimo curlew, northern Aplomado falcon, black-footed ferret, Chirichaua leopard frog, jaguar, Gulf Coast jaguarundi, Canada lynx, Preble's meadow jumping mouse, ocelot, Mexican spotted owl, piping plover, New Mexican ridge-nosed rattlesnake, Sonora tiger salamander, black-capped vireo, golden-cheeked warbler, and the gray wolf from the use of chlorophacinone to control BTPDs. Additionally, the Agency has determined that there is the potential for modification of habitat for the following species with designated critical habitat: Salt Creek tiger beetle, whooping crane, Canada lynx, Preble's meadow jumping mouse, Mexican spotted owl, piping plover, and the New Mexican ridge-nosed rattlesnake.

A summary of the risk conclusions and effects determinations for the listed species and their critical habitat, given the uncertainties discussed in **Section 6**, is presented in **Table 7.1**. and **Table 7.2.**

Table 7.1 Effects Determination Summary for Effects of Chlorophacinone to 21 Endangered Species.

Species	Effects Determination	Basis for Determination	
		Direct Effects	Indirect Effects
Grizzly bear	LAA[1]	Direct effects are expected for the grizzly bear based on the potential for this species to consume the chlorophacinone bait (RQ of 75.42 which exceeds the LOC of 0.1) or other prey items that may have consumed the chlorophacinone bait (RQ of 3.38 for exposure to BTPDs and RQ of 8.75 for exposure to non-target animals, both which exceed the LOC of 0.1). Growth and reproductive effects cannot be precluded due to the absence of chronic data; however, growth and reproductive effects are not expected because mortality typically occurs as a result of acute exposure.	Indirect effects from the loss of the prey base are also expected because effects to individuals within populations have been demonstrated in mammals ranging in size from 13 to 36,363 grams with RQ ranging from 19 to 41. No indirect effects from habitat loss are expected because this species does not use BTPD burrows.
American burying beetle	LAA	Reproductive effects are expected for the American burying beetle. The American burying beetle uses mammalian and avian carcasses as a food resource during their reproduction cycle. Dosed carcasses negatively affected number of emerged beetles (MRID 47383001).	Indirect effects from the loss of the prey base are expected because effects to individuals within populations have been demonstrated in mammals, birds, and terrestrial invertebrates. No indirect effects from habitat loss are expected because this species does not use BTPD burrows.
Salt creek tiger beetle	LAA	Reproductive effects are expected for the Salt Creek tiger beetle. Salt Creek tiger beetle larvae are potentially exposed to chlorophacinone residues through chlorophacinone exposed terrestrial invertebrates. Dosed carcasses in a burying beetle study negatively affected number of emerged beetles (MRID 47383001). Similar affects are expected for the Salt Creek tiger beetle.	No indirect effects from loss of prey base are expected because this species' habitat is distinct from BTPD habitat. This species uses mud banks of streams and seeps in association with saline wetlands and exposed mud flats of saline wetlands which is distinct from the short grass prairie associated with BTPD habitat. No indirect effects from habitat loss are expected because this species does not use BTPD burrows.
California condor	LAA	Direct effects to the California condor are expected through their potential exposure to prey items that may have consumed the chlorophacinone bait (RQ of 0.104 for exposure to non-target animals which exceeds the LOC of 0.1). Growth and reproductive effects cannot be precluded due to the absence of chronic data.	No indirect effects from the loss of prey base are expected because this species' range does not overlap with the BTPD range. No indirect effects from habitat loss are expected because this species does not use BTPD burrows.
Whooping crane	LAA	Direct effects to the whooping crane are expected to occur based on the potential for this species to consume the chlorophacinone bait (RQ of 0.89 which exceeds the LOC of 0.1) or other prey items that may have consumed the chlorophacinone bait (RQ of 0.104 for	Indirect effects from the loss of the prey base are expected because effects to individuals within populations have been demonstrated in mammals, birds, and terrestrial invertebrates. No indirect effects from habitat loss are expected

		exposure to non-target animals which exceeds the LOC of 0.1). Growth and reproductive effects cannot be precluded due to the absence of chronic data.	because this species does not use BTPD burrows.
Eskimo curlew	LAA	Direct effects to the Eskimo curlew are expected to occur based on the potential for this species to consume prey items that have consumed the chlorophacinone bait (RQ of 0.104 for exposure to non-target animals, which is used as a surrogate for invertebrate prey, which exceeds the LOC of 0.1). Growth and reproductive effects cannot be precluded due to the absence of chronic data.	Indirect effects from the loss of the prey base are expected because effects to individuals within populations have been demonstrated in terrestrial invertebrates. No indirect effects from habitat loss are expected because this species does not use BTPD burrows.
Northern Aplomado falcon	LAA	Direct effects to the northern Aplomado falcon are expected through their potential exposure to prey items that may have consumed the chlorophacinone bait (RQ of 0.104 for exposure to non-target animals which exceeds the LOC of 0.1). Growth and reproductive effects cannot be precluded due to the absence of chronic data	Indirect effects from the loss of the prey base are expected because effects to individuals within populations have been demonstrated in mammals, birds, and terrestrial invertebrates. No indirect effects from habitat loss are expected because this species does not use BTPD burrows.
Black-footed ferret	LAA	Direct effects are expected for the black-footed ferret based on the potential for this species to consume prey items that may have consumed the chlorophacinone bait (RQ of 7.45 for exposure to BTPDs and RQ of 19.29 for exposure to non-target animals, both which exceed the LOC of 0.1). Significant exposure is expected to occur because black-footed ferrets prey primarily on BTPDs. Growth and reproductive effects cannot be precluded due to the absence of chronic data; however, growth and reproductive effects are not expected because mortality typically occurs as a result of acute exposure.	Indirect effects from the loss of the prey base are expected because effects to individuals within populations have been demonstrated in mammals, birds, and terrestrial invertebrates. In addition, this species preys almost exclusively on BTPDs. Indirect effects from habitat loss are expected because this species uses BTPD burrows.
Chirichaua leopard frog	LAA	Direct effects to the Chirichaua leopard frog are expected to occur based on the potential for this species to consume prey items that may have consumed the chlorophacinone bait (RQ of 0.104 for exposure to non-target animals, which is used as a surrogate for invertebrate prey, which exceeds the LOC of 0.1). Growth and reproductive effects cannot be precluded due to the absence of chronic data.	Indirect effects from the loss of the prey base are expected because effects to individuals within populations have been demonstrated in terrestrial invertebrates and birds. No indirect effects from habitat loss are expected because this species does not appear to use BTPD burrows.
Jaguar	LAA	Direct effects are expected for the jaguar based on the potential for this species to consume prey items that may have consumed the chlorophacinone bait (RQ of 12.69 for exposure to BTPDs and RQ of 32.85 for exposure to non-target	No indirect effects from the loss of the prey base are expected because this species' habitat is distinct from the BTPD habitat. Jaguars – particularly males of the northern reaches – are known to have large

		animals, both which exceed the LOC of 0.1). Growth and reproductive effects cannot be precluded due to the absence of chronic data; however, growth and reproductive effects are not expected because mortality typically occurs as a result of acute exposure.	home ranges that encompass a variety of plant communities, including: Maderan evergreen-woodland, subalpine conifer forest, semidesert shrubland, and Sonoran desert scrub. Washes and riparian areas with dense vegetative growth may also be valuable movement corridors. These habitats are distinct from the short grass prairie associated with BTPD habitat. No indirect effects from habitat loss are expected because this species does not use BTPD burrows.
Gulf Coast jaguarundi	LAA	Direct effects are expected for the Gulf Coast jaguarundi based on the potential for this species to consume prey items that may have consumed the chlorophacinone bait (RQ of 9.20 for exposure to BTPDs and RQ of 23.82 for exposure to non-target animals, both which exceed the LOC of 0.1). Growth and reproductive effects cannot be precluded due to the absence of chronic data; however, growth and reproductive effects are not expected because mortality typically occurs as a result of acute exposure.	No indirect effects from the loss of the prey base are expected because this species' habitat is distinct from the BTPD habitat. This species is found in chaparral plant communities and dense brushy areas near streams and rivers which are distinct from the short grass prairie associated with BTPD habitat. No indirect effects from habitat loss are expected because this species does not use BTPD burrows.
Canada lynx	LAA	Direct effects to the Canada lynx are expected to occur based on the potential for this species to consume prey items that may have consumed the chlorophacinone bait (RQ of 23.30 for exposure to non-target animals and RQ of 9.00 for exposure to BTPDs both of which exceed the LOC of 0.1). Growth and reproductive effects cannot be precluded due to the absence of chronic data; however, growth and reproductive effects are not expected because mortality typically occurs as a result of acute exposure.	No indirect effects from loss of prey base are expected because this species' habitat is distinct from BTPD habitat. The Canada lynx is associated with the southern, transitional reaches of the cool and moist boreal forest. Where it occurs at these lower latitudes, the boreal forest forms a mixed conifer and conifer-hardwood landscape. These habitat areas are distinct from the short grass prairie associated with BTPD habitat. No indirect effects from habitat loss are expected because this species does not use BTPD burrows.
Preble's meadow jumping mouse	LAA	Direct effects to the Preble's meadow jumping mouse are expected to occur based on the potential for this species to consume the chlorophacinone bait (RQ of 41.35 which exceeds the LOC of 0.1). Growth and reproductive effects cannot be precluded due to the absence of chronic data; however, growth and reproductive effects are not expected because mortality typically occurs as a result of acute exposure.	Indirect effects from the loss of the prey base are expected because effects to individuals within populations have been demonstrated in terrestrial invertebrates. Although this species makes nests both above and below ground. It does not appear to use other species' burrows.
Ocelot	LAA	Direct effects are expected for the ocelot based on the potential for this species to	No indirect effects from loss of prey base are expected because this

		consume prey items that have may consumed the chlorophacinone bait (RQ of 10.41 for exposure to BTPDs and RQ of 26.96 for exposure to non-target animals, both which exceed the LOC of 0.1). Growth and reproductive effects cannot be precluded due to the absence of chronic data; however, growth and reproductive effects are not expected because mortality typically occurs as a result of acute exposure.	species' habitat is distinct from BTPD habitat. Ocelots appear to use areas of dense cover, and in the northern part of the range hunt in brushy forests and semi-arid deserts. In the southern part of its range, ocelot habitat includes tropical forests, mountain slopes, and pampas (grasslands). These habitat areas are distinct from the short grass prairie associated with BTPD habitat. No indirect effects from habitat loss are expected because this species does not use BTPD burrows.
Mexican spotted owl	LAA	Direct effects to the Mexican spotted owl are expected to occur based on the potential for this species to consume prey items that may have consumed the chlorophacinone bait (RQ of 0.104 for exposure to non-target animals which exceeds the LOC of 0.1). Growth and reproductive effects cannot be precluded due to the absence of chronic data.	No indirect effects from loss of prey base are expected because this species' habitat is distinct from BTPD habitat. Mexican spotted owls are found in old-growth or mature forests with unevenly aged stands of trees, high canopy, multi-storied levels, and high tree density as well as canyons with riparian or conifer communities. In Arizona and New Mexico they are found in habitats associated with mixed conifer, pine-oak, Arizona cypress, oak woodlands, and associated riparian forests. These habitat areas are distinct from the short grass prairie associated with BTPD habitat. No indirect effects from habitat loss are expected because this species does not use BTPD burrows.
Piping plover	LAA	Direct effects to the piping plover are expected to occur based on the potential for this species to consume prey items that may have consumed the chlorophacinone bait (RQ of 0.104 for exposure to non-target animals, which is used as a surrogate for invertebrate prey, which exceeds the LOC of 0.1). Growth and reproductive effects cannot be precluded due to the absence of chronic data.	No indirect effects from loss of prey base are expected because this species' habitat is distinct from BTPD habitat. The plover's home range within BTPD range is usually limited to the wetland, lakeshore, or section of beach where its nest is located. No indirect effects from habitat loss are expected because this species does not use BTPD burrows.
New Mexican ridge-nosed rattlesnake	LAA	No direct effects based on survival to the New Mexican ridge-nosed rattlesnake are expected to occur (see Section 5.1.1.a. RQs of 0.018 for a 50 gram snake and RQ of 0.030 for a 500 gram snake. Neither of these RQs exceeds the LOC of 0.1). However, growth and reproductive effects cannot be precluded due to the absence of chronic data.	Indirect effects from the loss of the prey base are expected because effects to individuals within populations have been demonstrated in mammals, birds, and terrestrial invertebrates. No indirect effects from habitat loss are expected because this species does not appear use BTPD burrows.
Sonora tiger salamander	LAA	Direct effects to the Sonora tiger salamander are expected to occur based on the potential for this species to consume	No indirect effects from the loss of prey base or loss of habitat (BTPD burrow) are expected because this

		prey items that may have consumed the chlorophacinone bait (RQ of 0.104 for exposure to non-target animals, which is used as a surrogate for invertebrate prey, which exceeds the LOC of 0.1). Growth and reproductive effects cannot be precluded due to the absence of chronic data.	species' range does not overlap with BTPD range.
Black-capped vireo	LAA	Direct effects to the black-capped vireo are expected to occur based on the potential for this species to consume prey items that have consumed the chlorophacinone bait (RQ of 0.104 for exposure to non-target animals, which is used as a surrogate for invertebrate prey, which exceeds the LOC of 0.1). Growth and reproductive effects cannot be precluded due to the absence of chronic data.	No indirect effects from loss of prey base are expected because this species' habitat is distinct from BTPD habitat. Black-capped vireos are found in mixed deciduous/evergreen shrub land. Breeding vireos use shrubby growth of irregular height and distribution with spaces the small thickets and clumps and with vegetative extending to ground level. These habitat areas are distinct from the short grass prairie associated with BTPD habitat. No indirect effects from habitat loss are expected because this species does not use BTPD burrows.
Golden-cheeked warbler	LAA	Direct effects to the golden-cheeked warbler are expected to occur based on the potential for this species to consume prey items that have consumed the chlorophacinone bait (RQ of 0.104 for exposure to non-target animals, which is used as a surrogate for invertebrate prey, which exceeds the LOC of 0.1). Growth and reproductive effects cannot be precluded due to the absence of chronic data.	No indirect effects from loss of prey base are expected because this species' habitat is distinct from BTPD habitat. Golden-cheeked warblers are found in mixed Ashe-juniper and oak woodlands in ravines and canyons. They spend summers in open canopy forest and winters in closed canopy forests. These habitat areas are distinct from the short grass prairie associated with BTPD habitat. No indirect effects from habitat loss are expected because this species does not use BTPD burrows.
Gray wolf	LAA	Direct effects to the gray wolf are expected to occur based on the potential for this species to consume prey items that have consumed the chlorophacinone bait (RQ of 24.82 for exposure to non-target animals and RQ of 9.59 for exposure to BTPDs both of which exceed the LOC of 0.1). Growth and reproductive effects cannot be precluded due to the absence of chronic data; however, growth and reproductive effects are not expected because mortality typically occurs as a result of acute exposure.	Indirect effects from the loss of the prey base are expected because effects to individuals within populations have been demonstrated in mammals, birds, and terrestrial invertebrates. No indirect effects from habitat loss are expected because this species does not use BTPD burrows.

[1] LAA=likely to adversely affect.

Table 7.2. Effects Determination Summary for the Critical Habitat Impact Analysis

Species with Designated Critical Habitat	Effects Determination	Basis for Determination
Salt Creek tiger beetle	HM[1]	Reproductive effects are expected for the Salt Creek tiger beetle. Salt Creek tiger beetle larvae are potentially exposed to chlorophacinone residues through chlorophacinone exposed terrestrial invertebrates. Dosed carcasses in a burying beetle study negatively affected number of emerged beetles (MRID 47383001). Similar affects are expected for the Salt Creek tiger beetle. No indirect effects from loss of prey base are expected because this species' habitat is distinct from BTPD habitat. This species uses mud banks of streams and seeps in association with saline wetlands and exposed mud flats of saline wetlands which is distinct from the short grass prairie associated with BTPD habitat. No indirect effects from habitat loss are expected because this species does not use BTPD burrows.
California condor	No habitat modification expected	Direct effects to the California condor are expected through their potential exposure to prey items that may have consumed the chlorophacinone bait (RQ of 0.104 for exposure to non-target animals which exceeds the LOC of 0.1. No indirect effects from the loss of prey base are expected because this species' range does not overlap with BTPD range. No indirect effects from habitat loss are expected because this species does not use BTPD burrows. No habitat modification is expected because the critical habitat for the California condor does not overlap with the use area (BTPD habitat). Critical habitat for the California condor has only been designated in California.
Whooping crane	HM	Direct effects to the whooping crane are expected to occur based on the potential for this species to consume the chlorophacinone bait (RQ of 0.89 which exceeds the LOC of 0.1) or other prey items that have consumed the chlorophacinone bait (RQ of 0.104 for exposure to non-target animals which exceeds the LOC of 0.1). Indirect effects from the loss of the prey base are also expected because effects to individuals within populations have been demonstrated in mammals, birds, and terrestrial invertebrates. No indirect effects from habitat loss are expected because this species does not use BTPD burrows. Habitat modification for the whooping crane is expected because the critical habitat for the whooping crane overlaps with the use area (BTPD habitat).
Canada lynx	HM	Direct effects to the Canada lynx are expected to occur based on the potential for this species to consume prey items that have consumed the chlorophacinone bait (RQ of 23.30 for exposure to non-target animals and RQ of 9.00 for exposure to BTPDs both of which exceed the LOC of 0.1). No indirect effects from loss of prey base are expected because this species' habitat is distinct from BTPD habitat. The Canada lynx is associated with the southern, transitional reaches of the cool and moist boreal forest. Where it occurs at these lower latitudes, the boreal forest forms a mixed conifer and conifer-hardwood landscape. These habitat areas are distinct from the short grass prairie associated with BTPD habitat. No indirect effects from habitat loss are expected because this species does not use BTPD burrows. Habitat modification for the Canada lynx is expected because the critical habitat for the Canada lynx overlaps with the use area (BTPD habitat).

Preble's meadow jumping mouse	HM	Direct effects to the Preble's meadow jumping mouse are expected to occur based on the potential for this species to consume the chlorophacinone bait (RQ of 41.35 which exceeds the LOC of 0.1). Indirect effects from the loss of the prey base are expected because effects to individuals within populations have been demonstrated in terrestrial invertebrates. Although this species makes nests both above and below ground, it does not appear to use other species' rodent burrows. Habitat modification for the Preble's meadow jumping mouse is expected because the critical habitat for the Preble's meadow jumping mouse overlaps with the use area (BTPD habitat).
Mexican spotted owl	HM	Direct effects to the Mexican spotted owl are expected to occur based on the potential for this species to consume prey items that have consumed the chlorophacinone bait (RQ of 0.104 for exposure to non-target animals which exceeds the LOC of 0.1). No indirect effects from loss of prey base are expected because this species' habitat is distinct from BTPD habitat. Mexican spotted owls are found in old-growth or mature forests with unevenly aged stands of trees, high canopy, multi-storied levels, and high tree density as well as canyons with riparian or conifer communities. In Arizona and New Mexico they are found in habitats associated with mixed conifer, pine-oak, Arizona cypress, oak woodlands, and associated riparian forests. These habitat areas are distinct from the short grass prairie associated with BTPD habitat. No indirect effects from habitat loss are expected because this species does not use BTPD burrows. Habitat modification for the Mexican spotted owl is expected because the critical habitat for the Mexican spotted owl overlaps with the use area (BTPD habitat).
Piping plover	HM	Direct effects to the piping plover are expected to occur based on the potential for this species to consume prey items that have consumed the chlorophacinone bait (RQ of 0.104 for exposure to non-target animals, which is used as a surrogate for invertebrate prey, which exceeds the LOC of 0.1). No indirect effects from the loss of the invertebrate prey base are expected because this species' habitat is distinct from BTPD habitat. The plover's home range within the BTPD range is usually limited to the wetland, lakeshore, or section of beach where its nest is located. No indirect effects from habitat loss are expected because this species does not use BTPD burrows. Habitat modification for the piping plover is expected because the critical habitat for the piping plover overlaps with the use area (BTPD habitat).
New Mexican ridge-nosed rattlesnake	HM	No direct effects based on survival to the New Mexican ridge-nosed rattlesnake are expected to occur (see Section 5.1.1.a. RQs of 0.018 for a 50 gram snake and RQ of 0.030 for a 500 gram snake. Neither of these RQs exceeds the LOC of 0.1). However, direct effects based on reproduction cannot be precluded because no reproduction data are available. Indirect effects from the loss of the prey base are expected because effects to individuals within populations have been demonstrated in mammals, birds, and terrestrial invertebrates. No indirect effects from habitat loss are expected because this species does not appear to use BTPD burrows. Habitat modification for the New Mexican ridge-nosed rattlesnake is expected because the critical habitat for the New Mexican ridge-nosed rattlesnake overlaps with the use area (BTPD habitat).
Gray wolf	No habitat modification expected	Direct effects to the gray wolf are expected to occur based on the potential for this species to consume prey items that have consumed the chlorophacinone bait (RQ of 24.82 for exposure to non-target animals and RQ of 9.59 for exposure to BTPDs both of which exceed the LOC of 0.1). Indirect effects from the loss of the prey base are also expected because effects to individuals within populations have been demonstrated in mammals, birds, and terrestrial invertebrates. No indirect effects from habitat loss are expected because this species does not use BTPD burrows. No habitat modification is expected because the critical habitat for the gray wolf does not overlap with the use area (BTPD habitat). Critical habitat for the gray wolf has only been designated in Minnesota and Michigan.

[1]Habitat Modification

The assessment endpoint for each species above is the modification of PCEs.

Based on the conclusions of this assessment, a formal consultation with the U. S. Fish and Wildlife Service under Section 7 of the Endangered Species Act should be initiated.

When evaluating the significance of this risk assessment's direct/indirect and adverse habitat modification effects determinations, it is important to note that pesticide exposures and predicted risks to the listed species and its resources (*i.e.*, food and habitat) are not expected to be uniform across the action area since BTPDs are not uniformly distributed across action area. Evaluation of the implication of this non-uniform distribution of risk to the species would require information and assessment techniques that are not currently available. Examples of such information and methodology required for this type of analysis would include the following:

- Enhanced information on the density and distribution of BTPDs within the action area and information on the density and distribution of the other 21 listed species within the action area and information on the density and distribution within their critical habitat of the nine species with critical habitat. This information would allow for quantitative extrapolation of the present risk assessment's predictions of individual effects to the proportion of the population extant within geographical areas where those effects are predicted. Furthermore, such population information would allow for a more comprehensive evaluation of the significance of potential resource impairment to individuals of the listed species.
- Quantitative information on prey base requirements for the listed species. While existing information provides a preliminary picture of the types of food sources utilized by the listed species, it does not establish minimal requirements to sustain healthy individuals at varying life stages. Such information could be used to establish biologically relevant thresholds of effects on the prey base, and ultimately establish geographical limits to those effects. This information could be used together with the density data discussed above to characterize the likelihood of adverse effects to individuals.
- Information on population responses of prey base organisms to chlorophacinone. Currently, methodologies are limited to predicting exposures and likely levels of direct mortality, growth or reproductive impairment immediately following exposure to chlorophacinone. The degree to which repeated exposure events and the inherent demographic characteristics of the prey population play into the extent to which prey resources may recover is not predictable. An enhanced understanding of long-term prey responses to chlorophacinone exposure would allow for a more refined determination of the magnitude and duration of resource impairment, and together with the information described above, a more complete prediction of effects to individual species and potential modification to critical habitat.

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