



SECTION II

CHEMICAL

PROFILES

Aluminum and Magnesium phosphide

CHEMICAL INFORMATION

TYPE: Insecticide, rodenticide

FORMULATION: Pellets, tablets, fumi-cel plate, and dust in gas exchange bags or other envelopes.

REGISTERED USES: Used inside enclosures to control insects in bulk grain and peanuts, processed food and animal feed, leaf tobacco stores, cottonseed, and a space fumigant in flour mills, warehouses, and rail cars. They are used as outdoor fumigants in controlling vertebrates that burrow or live in burrows. Specifically, outdoor use registration is limited to the control of marmot species - woodchucks and yellow-bellied marmots (rock chucks), prairie dogs (except Utah prairie dog), Norway and roof rats, house mice, ground squirrels, moles (except in North Carolina), and chipmunks (except in California).

BACKGROUND:

Mode of Action: Causes pulmonary edema or respiratory failure.

Aquatic toxicity : Aluminum and magnesium phosphide are both restricted use fumigant insecticides and vertebrate control agents. They are used inside enclosures which can be made more-or-less air tight to control insects, e.g. warehouses, grain storage, mills, rail cars, etc. They are also used as outdoor fumigants in controlling vertebrates that burrow or live in burrows. The vast majority are used for insect control in storage enclosures. Acute and chronic toxicity data are not applicable to these phosphides because they release deadly phosphine gas when exposed to air. The mechanisms of inhalation toxicity are not well understood, but pulmonary edema and respiratory failure is a common cause of death. Phosphine gas released by these chemicals is highly volatile, dissipates rapidly, and does not accumulate in carcasses of poisoned animals. The after-use residue, a hydroxide (a constituent of clay), is a relatively inert and innocuous material. The only outdoor use is in burrows, and because of their extreme volatility, neither compound has an opportunity to be released into an aquatic environment (and would dissipate almost immediately even if it occurred). Thus there is no effect on listed aquatic species.

Terrestrial toxicity: As indicated, both phosphides release deadly phosphine gas when exposed to air and should be considered as causing 100% mortality in burrows. Thus, the use of both chemicals "may effect" any listed species which might use burrows that may be treated for control of animals listed above. Secondary toxicity is not a concern, however, because toxicity results from inhalation.

Wildlife and Incidents: None reported.

BIOLOGICAL OPINION

CHEMICAL REFERENCE TABLE

(The following table contains only those species for which the Service provided a jeopardy or no jeopardy call. Species not included in this list are either not affected by the chemical or have no chance for exposure. For a complete list of all species considered in this opinion, refer to the master species list on page III-1 of the species profile section.)

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Hualapai Mexican vole	J	4
Morro Bay kangaroo rat	J	5
Point Arena Mountain Beaver	J	5
San Joaquin kit fox	J	6
Stephen's kangaroo rat	J	6
Tipton kangaroo rat	J	4
Utah prairie dog	NJ	9
REPTILES		
Blunt-nosed leopard lizard	J	7
Coachella Valley fringe-toed lizard	NJ	9
Desert tortoise	NJ	10
Eastern indigo snake	J	8
Gopher tortoise	J	8
Island night lizard	NJ	10
San Francisco garter snake	J	7
INSECTS		
El Segundo blue butterfly	J	9

RATIONALE FOR JEOPARDY DETERMINATIONS

Black-footed ferret - These two pesticides will kill anything in a burrow including a black-footed ferret and their prey species the prairie dog. The likelihood of ferrets being found in the wild, while considered low, is still possible. The further loss or fragmentation of prairie dog habitat which has already been reduced by as much as 98 percent (from over 100 million acres to around 2 million acres) as well as the loss of a single ferret in the wild could result in the extinction of the species. Therefore, it is the Service's opinion that the use of aluminum phosphide and magnesium phosphide is likely to jeopardize the continued existence of the black-footed ferret.

Reasonable and Prudent Alternative(s) - If implemented, the following reasonable and prudent alternatives would avoid jeopardy to the black-footed ferret:

1. A black-tailed prairie dog colony or complex of less than 80 acres having no neighboring prairie dog towns may be treated without a ferret survey. A midrange of 102 acres (61 to 294 acres) of occupied black-tailed prairie dog habitat is believed necessary to support a single ferret, so it is highly unlikely that a ferret

would be found in an isolated colony of less than 80 acres. A neighboring prairie dog town is defined as a colony less than 7 kilometers (4.34 miles) from the town to be treated, based on the longest distance that the ferret has been observed to travel during the night.

2. A white-tailed prairie dog colony or complex of less than 200 acres having no neighboring prairie dog towns may be treated without a survey. It is estimated to require between 196 and 475 acres of white-tailed prairie dogs to support a single ferret.
3. Urban situations (e.g., playgrounds, golf courses, etc.) may be treated without conducting ferret surveys. The appropriate Service office will be contacted by the pesticide user in advance of any treatment to determine whether a proposed action fits this situation.
4. For black-tailed prairie dog colonies or complexes over 80 acres but less than 1,000 acres, and white-tailed prairie dog colonies or complexes over 200 acres but less than 1,000 acres, prairie dog control may be allowed after completing a black-footed ferret survey within 30 days of proposed treatments on colonies proposed for treatment, provided no ferrets or their sign are found. Prior to treatment, if all colonies in this complex are surveyed with no sign of ferrets, no future survey for ferrets would be recommended. These surveys will be coordinated with the appropriate State Office of the Fish and Wildlife Service.
5. For prairie dog complexes over 1,000 acres, no control shall be allowed until the complex has been evaluated by appropriate State and/or Federal Agencies (those agencies working on State working groups for ferret recovery) for its potential as a recovery site and until the complex has been block cleared. One thousand acres would be a minimum complex size for consideration as a black-footed ferret reintroduction site and would likely require intensive management of habitat for a ferret population.
6. The EPA shall maintain records which shall be provided to the Service on an annual basis. These records can include the amount of acres of prairie dog towns or complexes controlled (e.g., Federal lands, private lands on a volunteer basis), or the amount of the chemical sold including application rates. The latter could be obtained from either the manufacturer or the vender.

Surveys shall be supervised by biologists trained in ferret survey techniques and ferret biology at a Service-approved training workshop. Currently, only the University of Wyoming has such a course. Ferret surveys shall be reviewed by the Service for compliance with survey standards and Section 7 of the Endangered Species Act.

Incidental Take - With the implementation of the reasonable and prudent alternatives to preclude jeopardy of the black-footed ferret, no incidental take is anticipated and thus none is authorized.

Fresno kangaroo rat, giant kangaroo rat, Tipton kangaroo rat - The primary risk of aluminum and magnesium phosphide exposure for these species would result from registered uses of these compounds as burrow fumigants in the southern San Joaquin Valley, California. The most likely source of exposure would be inadvertent application to kangaroo rat burrows during control of field rodents (primarily ground squirrels and gophers) in occupied habitats. This risk may be minimized by the fact that kangaroo rat burrows differ substantially in appearance from burrows of target species. Nevertheless, adverse effects of aluminum and magnesium phosphide use on Fresno, giant, and Tipton kangaroo rats could be significant because of (1) their high toxicity (100 percent mortality in treated burrows is expected); (2) the frequency of ground squirrel control programs in areas occupied by these species; and (3) the fact that each of these kangaroo rats occupy habitats that are significantly restricted and/or fragmented. For these reasons, it is the Service's biological opinion that use of aluminum and magnesium phosphide is likely to jeopardize the continued existence of these species.

Reasonable and Prudent Alternative(s) - If implemented, the following reasonable and prudent alternatives would avoid jeopardy to the Fresno kangaroo rat, giant kangaroo rat, and Tipton kangaroo rat: To avoid application to kangaroo rat burrows, aluminum and magnesium phosphide shall be used within the occupied habitats of these species only by qualified individuals. Such persons shall be limited to wildlife biologists, certified applicators, or agents of county agricultural commissioner offices, university extension offices, or representatives of California State or Federal agencies, who are trained to distinguish dens and burrows of target species from those of non-target species.

Incidental Take - Despite the reasonable and prudent alternatives described above, the Service anticipates that an unquantifiable level of incidental take may occur as a result of aluminum and magnesium phosphide use within the occupied habitats of these species.

Reasonable and Prudent Measure(s) - To minimize anticipated incidental take, EPA must establish a monitoring enforcement program. The terms and conditions of such programs are outlined in the introduction section on page I-5.

Hualapai Mexican vole - The primary exposure of aluminum phosphide and magnesium phosphide to the Hualapai Mexican vole would be through its application to control ground squirrels in non-crop rights-of-way or recreational areas. Voles are one of a number of target organisms of aluminum phosphide and magnesium phosphide and also is highly toxic to small mammals. The likelihood that aluminum phosphide and magnesium phosphide would be used in the habitat of the vole is small but if it were used because of the very small number of known voles, the consequences would be severe. Therefore, it is the Service's biological opinion that the use of aluminum phosphide and magnesium phosphide is likely to jeopardize the continued existence of the Hualapai Mexican vole.

Reasonable and Prudent Alternative(s) - If implemented, the following reasonable and prudent alternatives would avoid jeopardy to the Hualapai Mexican vole: prohibit the use of aluminum phosphide and magnesium phosphide in occupied habitat of the Hualapai Mexican Vole.

Incidental Take - With the implementation of the reasonable and prudent alternatives to preclude jeopardy of the species, no incidental take is anticipated and therefore none is authorized.

Morro Bay kangaroo rat - The primary exposure of aluminum phosphide and magnesium phosphide from registered uses can occur when the Morro Bay kangaroo rat utilizes the burrows of targeted animals. The extremely limited range of this species and the presence of target control species places the Morro Bay kangaroo rat at risk. It is the biological opinion of the Service that use of aluminum and magnesium phosphide is likely to jeopardize the continued existence of the Morro Bay kangaroo rat.

Reasonable and Prudent Alternative(s) - If implemented, the following reasonable and prudent alternatives would avoid jeopardy to the species: prohibit the use of aluminum and magnesium phosphide within the occupied habitat of this species.

Incidental Take - With implementation of the reasonable and prudent alternative described above, no incidental take is anticipated and therefore none is authorized.

Point Arena mountain beaver - This species is vulnerable to aluminum and magnesium phosphide exposure during registered uses of these burrow fumigants in Mendocino County, California. The primary source of exposure would result from inadvertent application to mountain beaver burrows during control of field rodents, primarily ground squirrels, in occupied habitats. This risk may be especially high for this species because mountain beaver burrows and ground squirrel burrows often have similar dimensions at the ground surface. Adverse effects of aluminum and magnesium phosphide use on the Point Arena mountain beaver also could be significant because (1) of the high toxicity of these fumigants; (2) the frequency of ground squirrel control programs within the occupied habitat of this species; and (3) the fact that the mountain beaver occupies highly restricted and fragmented habitats. For these reasons, it is the Service's biological opinion that use of aluminum and magnesium phosphide within the occupied habitat of the Point Arena mountain beaver is likely to jeopardize the continued existence of this species.

Reasonable and Prudent Alternative(s) - If implemented, the following reasonable and prudent alternatives would avoid jeopardy to the Point Arena mountain beaver: To avoid application to mountain beaver burrows, aluminum and magnesium phosphide shall be used within the mountain beaver occupied habitat only by qualified individuals. Such persons shall be limited to wildlife biologists, certified applicators, or agents of county agricultural commissioner offices, university extension offices, or representatives of California State or Federal agencies, who are trained to distinguish dens and burrows of target species from those of non-target species.

Incidental Take - Because of the possibility of inadvertent application of these compounds to mountain beaver burrows despite the reasonable and prudent alternatives described above, the Service anticipates that an unquantifiable level of incidental take may occur as a result of aluminum and magnesium phosphide use within the occupied habitat of this species.

Reasonable and Prudent Measure(s) - To minimize anticipated incidental take, EPA must establish a monitoring enforcement program. The terms and conditions of such programs are outlined in the introduction section on page I-5.

San Joaquin kit fox - The primary source of kit fox exposure to aluminum and magnesium phosphide would result from erroneous application of these fumigants to kit fox dens during control of rodents, primarily ground squirrels, in the San Joaquin Valley, California. The possibility of such error is especially high for kit foxes because kit fox dens and ground squirrel burrows often have similar dimensions at the ground surface. Although the kit fox is relatively wide-ranging, aluminum and magnesium phosphide use could have significant adverse effects on this species because of: (1) the high toxicity of these fumigants; (2) the frequency of ground squirrel control programs within the kit fox range; and (3) the fact that serious localized effects of aluminum and magnesium phosphide use could occur in areas where the kit fox range is geographically restricted (e.g., the north end of the range where kit foxes are confined to a narrow strip of rangelands, and the Santa Nella area where the range forms a "bottleneck"). For these reasons, it is the Service's biological opinion that aluminum and magnesium phosphide use within the San Joaquin kit fox occupied habitat is likely to jeopardize the continued existence of this species.

Reasonable and Prudent Alternative(s) - If implemented, the following reasonable and prudent alternatives would avoid jeopardy to the San Joaquin kit fox: To avoid application to kit fox dens, aluminum and magnesium phosphide shall be used within the San Joaquin kit fox occupied habitat only by qualified individuals. Such persons shall be limited to qualified wildlife biologists, certified applicators, or agents of county agricultural commissioner offices, university extension offices, or representatives of California State or Federal agencies, who are trained to distinguish dens and burrows of target species from those of non-target species.

Incidental Take - Because of the possibility of inadvertent application of these compounds to kit fox dens despite the reasonable and prudent alternatives described above, the Service anticipates that an unquantifiable level of incidental take of San Joaquin kit foxes may occur as a result of aluminum and magnesium phosphide use within the occupied habitat of this species.

Reasonable and Prudent Measure(s) - To minimize anticipated incidental take, EPA must establish a monitoring enforcement program. The terms and conditions of such programs are outlined in the introduction section on page I-5.

Stephen's kangaroo rat - The primary exposure of aluminum phosphide and magnesium phosphide from registered uses can occur when Stephen's kangaroo rat utilize the burrows of targeted animals. It is the biological opinion of the Service that use of aluminum and magnesium phosphide is likely to jeopardize the continued existence of the Stephen's kangaroo rat.

Reasonable and Prudent Alternative(s) - If implemented, the following reasonable and prudent alternative would avoid jeopardy to the Stephen's kangaroo rat: aluminum and magnesium phosphide shall be used within the occupied habitat of the Stephen's kangaroo rat only by qualified individuals. Such persons shall be limited to qualified wildlife

biologists, certified applicators, or agents of county agricultural commissioner offices, university extension offices, or representatives of California State or Federal agencies, who are trained to distinguish dens and burrows of target species from those of non-target species.

Incidental Take - Despite the reasonable and prudent alternatives described above, the service anticipates that an unquantifiable level of incidental take may occur as a result of aluminum and magnesium phosphide use within the occupied habitat of this species.

Reasonable and Prudent Measure(s) - To minimize anticipated incidental take, EPA must establish a monitoring enforcement program. The terms and conditions of such programs are outlined in the introduction section of page I-5.

Blunt-nosed leopard lizard, San Francisco garter snake - The blunt-nosed leopard lizard and San Francisco garter snake utilize burrows for all or part of their life cycle, and therefore are subject to aluminum and magnesium phosphide exposure during registered uses of these compounds as burrow fumigants. However, because leopard lizards and garter snakes do not construct their own burrows but utilize existing burrows of other species (usually mammals), avoidance of exposure to aluminum and magnesium phosphide through burrow identification is difficult. As a result, intended uses (as opposed to unintended uses) could result in inadvertent exposure. The leopard lizard is subject to such exposure year round, since it utilizes burrows during its activity and hibernation phases. The garter snake utilizes burrows only during its hibernation phase (approximately November through March) and is subject to exposure only during this period. Because of the high toxicity of these burrow fumigants, the likelihood of exposure, and the fact that the blunt-nosed leopard lizard and San Francisco garter snake occupy significantly restricted and/or fragmented habitats, it is the biological opinion of the Service that aluminum and magnesium phosphide use is likely to jeopardize the continued existence of these species.

Reasonable and Prudent Alternative(s) - If implemented, the following reasonable and prudent alternatives would avoid jeopardy to the blunt-nosed leopard lizard: (1) To avoid application to leopard lizard burrows, aluminum and magnesium phosphide shall be used within the blunt-nosed leopard lizard occupied habitat only by qualified individuals; such persons shall be limited to wildlife biologists, certified applicators, or agents of county agricultural commissioner offices, university extension offices, or representatives of California State or Federal agencies, who are trained to distinguish dens and burrows of target species from those of non-target species. (2) From April 15 to September 30, aluminum and magnesium phosphide use within the blunt-nosed leopard lizard occupied habitat shall be limited to daylight hours when air temperatures are between 77 and 95 degrees Fahrenheit (20 to 30 degrees Centigrade). Aluminum and magnesium phosphide use shall be prohibited within occupied leopard lizard habitat during the leopard lizard inactivity period, October 1 to April 14, unless a specific blunt-nosed leopard lizard protection program for this period, approved in writing by the Service, is implemented.

Reasonable and Prudent Alternative(s) - If implemented, the following reasonable and prudent alternatives would avoid jeopardy to the San Francisco garter snake: (1) To avoid application to garter snake burrows, aluminum and magnesium phosphide shall be used within the San Francisco garter snake occupied habitat only by individuals; such persons

shall be limited to qualified wildlife biologists, certified applicators, or agents of county agricultural commissioner offices, university extension offices, or representatives of California State or Federal agencies, who are trained to distinguish dens and burrows of target species from those of non-target species. (2) Aluminum and magnesium phosphide use within occupied garter snake habitat shall be prohibited during the garter snake inactivity period, November 1 to March 30, unless a specific San Francisco garter snake protection program for this period, approved in writing by the Service, is implemented.

Incidental Take - Because of the possibility of inadvertent application of these compounds to burrows inhabited by leopard lizards and garter snakes despite the reasonable and prudent alternatives described above, the Service anticipates that an unquantifiable level of incidental take may occur as a result of aluminum and magnesium phosphide use within the occupied habitats of these species.

Reasonable and Prudent Measure(s) - To minimize anticipated incidental take, EPA must establish a monitoring enforcement program. The terms and conditions of such programs are outlined in the introduction section on page I-5.

Eastern indigo snake - The eastern indigo snake would primarily be exposed to aluminum phosphide and magnesium phosphide through the pesticide's registered uses as pest control in fumigating animal burrows and agricultural storage enclosures. Because indigo snakes inhabit burrows and frequent agricultural areas, exposure to the pesticide is likely to occur when such sites are fumigated. Aluminum and magnesium phosphide produces the deadly gas phosphine when exposed to air. Indigo snakes inhabiting burrows or an agricultural storage facility when the pesticide is used would be killed. Therefore, it is the Service's opinion that the use of aluminum phosphide and magnesium phosphide is likely to jeopardize the continued existence of the eastern indigo snake.

Reasonable and Prudent Alternative(s) - If implemented the following reasonable and prudent alternative would avoid jeopardy to the indigo snake: prohibit the use of these fumigants in animal burrows within habitat types and locales known to support indigo snake populations.

Incidental Take - The Service anticipates that an unquantifiable level of incidental take may occur as a result of the pesticides' use in areas frequented by the snake.

Reasonable and Prudent Measure(s) - To minimize incidental take, EPA must establish a monitoring/enforcement program. The terms and conditions of such programs are outlined in the introduction section on page I-5.

Gopher tortoise - Both aluminum phosphide and magnesium phosphide release deadly phosphine gas when exposed to air and should be considered as causing 100 percent mortality in burrows. Secondary toxicity is not a concern, however, because toxicity results from inhalation. The gopher tortoise is a burrowing species and may be affected by the use of these pesticides within its burrows. Therefore, it is the opinion of the Service that this pesticide is likely to jeopardize the continued existence of the gopher tortoise.

Reasonable and Prudent Alternative(s) - If implemented, the following reasonable and prudent alternatives would avoid jeopardy to this species: prohibit the use of aluminum phosphide and magnesium phosphide within the occupied habitat of this species west of the Mobile and Tombigbee Rivers, Alabama.

Incidental Take - With the implementation of the reasonable and prudent alternative to preclude jeopardy of the species, no incidental take is anticipated and therefore none is authorized.

El Segundo blue butterfly - The primary exposure of aluminum and magnesium phosphide and impact to the El Segundo Blue butterfly is its possible use against rodents such as ground squirrels and gophers. Mortality to larvae could occur due to the insecticide effect of the chemicals in the soil. These populations are very limited in their occupied habitat, one site being a two acre area set aside by a Chevron oil refinery and the other being a 300 acre area at the western end of the Los Angeles International Airport, both located in Los Angeles County. It is the biological opinion of the Service that use of aluminum and magnesium phosphide is likely to jeopardize the continued existence of the El Segundo blue butterfly.

Reasonable and Prudent Alternative(s) - If implemented, the following reasonable and prudent alternatives would avoid jeopardy to the species: prohibit the use of aluminum phosphide and magnesium phosphide within the occupied habitat of El Segundo blue butterfly.

Incidental Take - With implementation of the reasonable and prudent alternative described above, no incidental take is anticipated and therefore none is authorized.

RATIONALE FOR NO JEOPARDY DETERMINATIONS

Utah prairie dog - Both aluminum phosphide and magnesium phosphide are registered to control marmots, prairie dogs (except Utah prairie dogs), rats, house mice, ground squirrels, moles, and chipmunks. EPA states that existing labels specifically prohibit application of these two pesticides where the Utah prairie dog occurs. Provided this restriction remains and the use of these two pesticides are not allowed within the range of the Utah prairie dog, the Service believes that the use of aluminum phosphide and magnesium phosphide is not likely to jeopardize the continued existence of the Utah prairie dog.

Incidental Take - Because the use of aluminum phosphide and magnesium phosphide is prohibited within the occupied habitat of the Utah prairie dog, no incidental take is anticipated and thus none is authorized.

Coachella Valley fringe-toed lizard - There is potential exposure to this species by aluminum phosphide and magnesium phosphide from registered application for rodents due to the use of rodent burrows by the Coachella Valley fringe-toed lizard. It is the Service's biological opinion that use of aluminum phosphide and magnesium phosphide is not likely to jeopardize the continued existence of the Coachella Valley fringe-toed lizard.

Incidental Take - The service anticipates that an unquantifiable level of incidental take may occur as a result of aluminum and magnesium phosphide use within the occupied habitat of this species.

Reasonable and Prudent Measure(s) - If the following reasonable and prudent measures are implemented, incidental take of the Coachella Valley fringe-toed lizard will be minimized: prohibit the use of aluminum phosphide and magnesium phosphide within the occupied habitat of the Coachella Valley fringe-toed lizard.

Desert tortoise - There is potential exposure of aluminum phosphide and magnesium phosphide from registered application for rodents since tortoise burrows, though they are much larger in size, may be accidentally treated. Given that this impact would be expected to be rare, it is the Service's biological opinion that use of aluminum phosphide and magnesium phosphide is not likely to jeopardize the continued existence of this species.

Incidental Take - The service anticipates that an unquantifiable level of incidental take may occur as a result of aluminum and magnesium phosphide use within the occupied habitat of this species.

Reasonable and Prudent Measure(s) - If the following reasonable and prudent measures are implemented, incidental take of the desert tortoise will be minimized: aluminum and magnesium phosphide shall be used within the desert tortoise occupied habitat only by qualified individuals. Such persons shall be limited to wildlife biologists, certified applicators, or agents of county agricultural commissioner offices, university extension offices, or representatives of California State or Federal agencies, who are trained to distinguish dens and burrows of target species from those of non-target species.

Island night lizard - There is potential exposure to this species by aluminum phosphide and magnesium phosphide from registered application for rodents due to the use of rodent burrows by the island night lizard. It is the Service's biological opinion that use of aluminum phosphide and magnesium phosphide is not likely to jeopardize the continued existence of the island night lizard.

Incidental Take - The service anticipates that an unquantifiable level of incidental take may occur as a result of aluminum and magnesium phosphide use within the occupied habitat of this species.

Reasonable and Prudent Measure(s) - If the following reasonable and prudent measures are implemented, incidental take of the island night lizard will be minimized: prohibit the use of aluminum and magnesium phosphide within the occupied habitat of this species.

Brodifacoum

CHEMICAL INFORMATION

TYPE: Rodenticide (coumarin anticoagulant)

FORMULATION: Ready-to-use grain-based pellets, minipellets, and wax blocks (Sine 1992).

REGISTERED USES: Control of Norway rats, roof rats and house mice in and around urban, industrial, commercial, agricultural and public buildings. Brodifacoum also may be used in and around transport vehicles (ships, trains, and aircraft) and related port buildings, but not in sewers. It must be placed in tamper proof bait boxes or in locations not accessible to children, pets, domestic animals or wildlife (d-CON 1989, ICI Americas 1988).

BACKGROUND:

Mode of action: Brodifacoum is a non-restricted anticoagulant rodenticide that acts by depressing the clotting capabilities of the blood while concurrently increasing the permeability of capillaries throughout the body. This action predisposes the exposed animal to widespread internal hemorrhage. Death generally occurs after several days of ingestion. However, as brodifacoum is more toxic than most anticoagulants, it may have lethal effects with only one feeding.

Aquatic toxicity: Brodifacoum is highly toxic to fish and aquatic invertebrates. Laboratory LC₅₀ values for rainbow trout and bluegill are 0.045 and 0.089 ppm, respectively, and the *Daphnia magna* EC₅₀ is 0.89 ppm. However, it is unlikely that normal use of brodifacoum would harm aquatic fauna, as its application methods (tamper-proof bait packets) and its characteristic of being essentially insoluble in water (Sine 1992) should preclude exposure. Therefore, brodifacoum should not be subject to runoff, leaching or drift.

Terrestrial toxicity: Brodifacoum has been shown to be highly toxic to birds and mammals under laboratory conditions. Reported LD₅₀ for rat, opossum, mallard, ring-necked pheasant are 0.27, 0.17, 2.0, and 10.0 mg/kg respectively. Secondary field studies where fox, owls, golden eagles and red-shouldered hawks were fed rats that had died from brodifacoum indicate significant hazard to the predators and scavengers. Since the half-life of brodifacoum is 150 to 200 days in rat carcasses, acute and chronic secondary exposure is a major concern for listed scavengers and predators. These species may be exposed to brodifacoum either as a bait or by feeding on poisoned rodents. It is unlikely that listed plants or known plant pollinators will be affected by use of brodifacoum.

Wildlife incidents: EPA reported no wildlife poisoning incidents associated with brodifacoum. However, laboratory studies have demonstrated secondary poisoning of foxes and raptors. In addition, there are records indicating that a northern spotted owl in Washington may have died from brodifacoum exposure in April 1991 (Thomas 1991a and 1991b). The bird was alive and intoxicated when captured and died shortly thereafter. Laboratory analysis indicated massive hemorrhaging and brodifacoum residues in the liver.

BIOLOGICAL OPINION

CHEMICAL REFERENCE TABLE

(The following table contains only those species for which the Service provided a jeopardy or no jeopardy call. Species not included in this list are either not affected by the chemical or have no chance for exposure. For a complete list of all species considered in this opinion, refer to the master species list on page III-1 of the species profile section.)

Species Name	J/NJ	PAGE
MAMMALS		
Alabama beach mouse	J	12
Anastasia Island beach mouse	J	13
Carolina northern flying squirrel	J	13
Choctawhatchee beach mouse	J	12
Florida salt marsh vole	J	14
Fresno kangaroo rat	J	14
Giant kangaroo rat	NJ	16
Louisiana black bear	NJ	16
Morro Bay kangaroo rat	J	15
Perdido Key beach mouse	J	12
Point Arena mountain beaver	NJ	16
Salt marsh harvest mouse	J	14
San Joaquin kit fox	NJ	17
Southeastern beach mouse	J	13
Stephen's kangaroo rat	NJ	17
Tipton kangaroo rat	NJ	16
BIRDS		
Audubon's crested caracara	J	15
Hawaiian hawk	NJ	18
San Clemente loggerhead shrike	J	16
REPTILES		
Eastern indigo snake	NJ	18

RATIONALE FOR JEOPARDY DETERMINATIONS

Alabama beach mouse, Choctawhatchee beach mouse, and Perdido Key beach mouse - Exposure of these beach mice to brodifacoum could occur through consumption of poisoned baits when used to control rodents within or in close proximity to their occupied habitats. Since all three of these subspecies of beach mice occur in areas that are being encroached upon by various types of human development, there is a high possibility of brodifacoum being used where these mice could come in contact with it. All three mice are restricted to mature coastal barrier dune systems along the Gulf of Mexico. The Choctawhatchee beach mouse is presently known to occur only on Shell Island at St. Andrews Bay in Bay County, Florida, and on approximately 7.9 km of beach dune habitat (coastline up to 150 m inland) near Topsail Hill, from around Morrison Lake eastward to Stalworth Lake, Walton County, Florida. The Alabama beach mouse presently is surviving only on disjunct tracts of the sand dune system from Fort Morgan State Park to the Romar Beach area, Baldwin County, Alabama. The Perdido Key beach mouse occurs only on Perdido Key in Baldwin County, Alabama and Escambia County, Florida. The distance to which occupied habitat of these species extends inland from the beach varies depending upon the configuration of the sand dune system and the vegetation present. There are generally three

types of microhabitats within the dune systems utilized by these three beach mice--frontal and primary dunes sparsely vegetated with grasses (dominated by sea oats and panic grasses), seaside rosemary, beach morning glory, and railroad vine; interdunal areas supporting sedges, rushes, cordgrass, and salt-grass; and dunes further inland (secondary and interior dunes) dominated by growths of scrub oak, sand-live oak, seaside rosemary, and occasional patches of grasses and slash pine and sand pine. Because of the restricted distributions of these species, their limited populations and the likelihood of brodifacoum being used for rodent control within or adjacent to areas which they inhabit, it is the Service's biological opinion that the registered use of brodifacoum is likely to jeopardize the continued existence of the Choctawhatchee beach mouse, the Alabama beach mouse, and the Perdido Key beach mouse.

Reasonable and Prudent Alternative(s) - If implemented, the following reasonable and prudent alternatives would avoid jeopardy to the species: Prohibit use of brodifacoum within 100 yards of occupied habitat of the Choctawhatchee beach mouse, the Alabama beach mouse, and the Perdido Key beach mouse.

Incidental Take - With implementation of the reasonable and prudent alternative to preclude jeopardy to these species, no incidental take is anticipated and therefore none is authorized.

Anastasia Island Beach Mouse and Southeastern Beach Mouse - These two beach mice are endemic to the east coast of Florida. The Anastasia Island beach mouse apparently once occurred from the St. Johns River south to Anastasia Island, St. Johns County, Florida, but the species is now believed to occur only on Anastasia Island. The historic range of the southeastern beach mouse was from Florida's Mosquito (Pounce) Inlet in Volusia County south to Hollywood Beach in Broward County. However, the southeastern beach mouse is believed to have been eliminated from the southern portion of its range and presently occurs only from Mosquito Inlet south to, and including, Hutchinson Island in St. Lucie County. Both subspecies inhabit sand dunes vegetated by sea oats and dune panic grass and the scrub adjoining these dunes, which is vegetated with oaks, sand pine, palmetto, sea grapes, and/or wax myrtle. Since the ranges of both species have been and continue to be encroached upon by human development of various types, it is likely that brodifacoum could be used for pest control in areas where both these beach mice occur. Exposure of these mice to brodifacoum would occur through ingestion of poison baits, which would result in direct mortality of individuals of the species. Accordingly, it is the Service's biological opinion that the registered use of brodifacoum is likely to jeopardize the continued existence of the Anastasia Island beach mouse or the southeastern beach mouse.

Reasonable and Prudent Alternative(s) - If implemented, the following reasonable and prudent alternatives would avoid jeopardy to the species: Prohibit use of brodifacoum within 100 yards of occupied habitat of the Anastasia Island beach mouse and the southeastern beach mouse.

Incidental Take - With implementation of the reasonable and prudent alternative to preclude jeopardy to these species, no incidental take is anticipated and therefore none is authorized.

Carolina northern flying squirrel - This species may be directly exposed to brodifacoum poisoning from its registered use to control rats and mice around agricultural buildings and

structures. The Carolina northern flying squirrel occurs in coniferous and northern hardwood forests, and may occasionally forage on the ground. Where land use changes and development encroach on the species' habitat there is a potential risk of the squirrel coming in contact with brodifacoum bait that is placed outside of buildings (e.g., storage sheds and barns). Brodifacoum is toxic to rodents and would most likely kill a northern flying squirrel if it consumed the bait. Due to the restricted range and small population of the Carolina northern flying squirrel, any poisoning of individuals could threaten the survival of the species. Therefore, it is the Service's opinion that the use of brodifacoum is likely to jeopardize the continued existence of the Carolina northern flying squirrel.

Reasonable and Prudent Alternative(s) - If implemented, the following reasonable and prudent alternative would avoid jeopardy to the Carolina northern flying squirrel: prohibit the outdoor use of the chemical within the species' occupied habitat.

Incidental Take - With the implementation of the reasonable and prudent alternative to preclude jeopardy of the species, no incidental take is anticipated and therefore none is authorized.

Florida salt marsh vole - Exposure of the vole to brodifacoum could occur through consumption of poisoned baits when used to control rodents in close proximity to the vole's occupied marsh habitat. There is a possibility of brodifacoum being used around buildings or other structures adjacent to salt marsh where the vole could come in contact with it. The vole is restricted to a single known site in the salt marsh of Waccasassa Bay, Levy County, Florida. Because of the restricted distribution of the species, its limited population, and the likelihood of brodifacoum being used for rodent control adjacent to areas which the vole inhabits, it is the Service's biological opinion that the registered use of brodifacoum is likely to jeopardize the continued existence of the Florida salt marsh vole.

Reasonable and Prudent Alternative(s) - If implemented, the following reasonable and prudent alternatives would avoid jeopardy to the species: Prohibit use of brodifacoum within 100 yards of the landward edge of the species' habitat in Levy County, Florida.

Incidental Take - With implementation of the reasonable and prudent alternative to preclude jeopardy to these species, no incidental take is anticipated and therefore none is authorized.

Fresno kangaroo rat, salt marsh harvest mouse - Despite the relatively restricted patterns of brodifacoum uses (registered for control of domestic rats and mice in an around urban and agricultural buildings), Fresno kangaroo rats and salt marsh harvest mice are vulnerable to brodifacoum exposure because: (1) both species occupy areas of high human activity in which man-made structures exist near or adjacent to their habitats (agricultural areas in the San Joaquin Valley, California, and the San Francisco Bay area, respectively); (2) both species occupy highly restricted and fragmented habitats, which increases both the risks and potential effects of brodifacoum exposure; (3) some formulations of this compound (bait packs and grain based pellets) could be attractive to kangaroo rats and harvest mice; and (4) brodifacoum is highly toxic to all rodents. Based on these considerations, it is the Service's biological opinion that brodifacoum use within the range of the Fresno kangaroo rat and salt marsh harvest mouse is likely to jeopardize the continued existence of these species.

Reasonable and Prudent Alternative(s) - If implemented, the following reasonable and prudent alternatives would avoid jeopardy to the Fresno kangaroo rat and salt marsh harvest mouse: Prohibit outdoor brodifacoum use within 100 yards of these species' occupied habitats.

Incidental Take - Although possible exposure of the Fresno kangaroo rat and salt marsh harvest mouse to brodifacoum is probably minimal, the Service anticipates that an unquantifiable level of incidental take may occur as a result of brodifacoum use within the ranges of these species.

Reasonable and Prudent Measure(s) - To minimize anticipated incidental take, EPA must establish a monitoring enforcement program. The terms and conditions of such programs are outlined in the introduction section on page I-5.

Morro Bay kangaroo rat - The primary exposure of brodifacoum from registered uses can occur when the Morro Bay kangaroo rat ingests treated bait. The extremely limited range of this species, the presence of target rodents, and the interspersed nature of this species habitat with urban, agricultural, and commercial buildings place the Morro Bay kangaroo rat at risk. While it is required to place the bait boxes in areas not frequented by wildlife, it is probable that this species could access the bait. It is the biological opinion of the Service that use of brodifacoum is likely to jeopardize the continued existence of the Morro Bay kangaroo rat.

Reasonable and Prudent Alternative(s) - If implemented, the following reasonable and prudent alternative would avoid jeopardy to the Morro Bay kangaroo rat: prohibit the use of brodifacoum within 100 yards of the occupied habitat of the Morro Bay kangaroo rat.

Incidental Take - With implementation of the reasonable and prudent alternative described above, no incidental take is anticipated and therefore none is authorized.

Audubon's crested caracara - The caracara would be exposed to brodifacoum by consuming a mouse, rat or other animal that had been poisoned by the rodenticide. EPA data indicates that this rodenticide would cause lethal secondary poisoning in birds of prey. Hawks and owls have died, and eagles have suffered sub-lethal effects, from having consumed brodifacoum poisoned rats. The caracara feeds on live prey, as well as, feeding on carrion in areas where the rodenticide may be used. Because of the caracara's small population size, any rodenticide induced mortality could threaten the survival of the species. Therefore, it is the Service's opinion that the use of brodifacoum is likely to jeopardize the continued existence of the Audubon's crested caracara.

Reasonable and Prudent Alternative(s) - If implemented, the following reasonable and prudent alternative would avoid jeopardy to the Audubon's crested caracara: prohibit the use of the pesticide within the occupied habitat of the species.

Incidental Take - With the implementation of the reasonable and prudent alternative to preclude jeopardy of the species, no incidental take is anticipated and therefore none is authorized.

San Clemente Loggerhead Shrike - San Clemente loggerhead shrikes may be exposed secondarily to brodifacoum if they consume rodents that have ingested this chemical from registered rodent control activities. Brodifacoum is highly toxic to birds both directly and secondarily. San Clemente Island contains buildings where brodifacoum can be used and shrikes could then contact dosed rodents. There are less than 20 pairs of these bird in the wild and in captivity. Based on these considerations, it is the Service's biological opinion that brodifacoum use on San Clemente Island is likely to jeopardize the continued existence of the San Clemente loggerhead shrike.

Reasonable and Prudent Alternative(s) - If implemented, the following reasonable and prudent alternatives would avoid jeopardy to the San Clemente loggerhead shrike: Prohibit the use of brodifacoum on San Clemente Island, California.

Incidental Take - With implementation of the reasonable and prudent alternative(s) to preclude jeopardy to this species, no incidental take is anticipated and therefore none is authorized.

RATIONALE FOR NO JEOPARDY DETERMINATIONS

Giant kangaroo rat, Point Arena mountain beaver, and Tipton kangaroo rat - Despite relatively restricted brodifacoum use patterns (registered for control of domestic rats and mice in an around urban and agricultural buildings), giant kangaroo rats, Point Arena mountain beaver, and Tipton kangaroo rats may be subject to periodic brodifacoum exposure because they sometimes occupy habitats that are adjacent to human activities and structures. Tipton kangaroo rats may be found near residential, agricultural, and commercial buildings in the southern San Joaquin Valley of California; mountain beavers near municipal and communication structures in the Point Arena vicinity; and giant kangaroo rats in oil fields and rangelands in the southwest and west central portions of the San Joaquin Valley where industrial and ranch buildings are present. However, both kangaroo rat species occupy a more widespread range than the Fresno kangaroo rat discussed above and much of their ranges are far removed from anticipated brodifacoum use areas. Furthermore, restriction of this compound to use in bait boxes eliminates most avenues of exposure to mountain beaver. Therefore, it is the Services' biological opinion that brodifacoum use within the ranges of the Tipton kangaroo rat, Point Arena mountain beaver, and giant kangaroo rat is not likely to jeopardize the continued existence of these species.

Incidental Take - Although possible exposure of the Tipton kangaroo rat, Point Arena mountain beaver, and giant kangaroo rat to brodifacoum is probably minimal, the Service anticipates that an unquantifiable level of incidental take may occur as a result of brodifacoum use within the ranges of these species.

Reasonable and Prudent Measure(s) - If the following reasonable and prudent measures are implemented, incidental take of the giant and Tipton kangaroo rat will be minimized: Prohibit outdoor brodifacoum use within 100 yards of these species' occupied habitats.

Louisiana black bear - The Louisiana black bear would likely only be exposed to brodifacoum by consuming a mouse, rat or other animal that had been poisoned by the rodenticide. Black bears occasionally venture into agricultural areas where the rodenticide may be used. Although brodifacoum is extremely toxic to mammals, based on EPA data it is very unlikely that a mammal

as large a bear would consume enough poisoned rodents to cause lethal secondary poisoning. Therefore, it is the Service's opinion that the use of brodifacoum is not likely to jeopardize the continued existence of the Louisiana black bear.

Incidental Take - Although the chance of exposure and hazard are considered minimal, because of the high toxicity of brodifacoum to mammals, it is still a matter of concern. Thus, the Service anticipates that an unquantifiable level of incidental take may occur as a result of this chemical's use in areas of or adjacent to bear habitat.

Reasonable and Prudent Measure(s) - The following reasonable and prudent measure for minimizing incidental take must be adopted: prohibit the use of the chemical within the occupied habitat of the Louisiana black bear.

San Joaquin kit fox - Despite the restricted pattern of brodifacoum use (registered for control of domestic rats and mice in and around urban and agricultural buildings), San Joaquin kit foxes may be subject to periodic brodifacoum exposure because they occupy some habitats adjacent to human activities and structures. The kit fox may be found around military structures at Camp Roberts and Fort Hunter-Liggett (Monterey County, California); commercial and residential structures in urban and municipal areas (e.g., Bakersfield, California); industrial structures in the Kern County oil fields; and agricultural and ranch buildings throughout its range. There are two potential sources of kit fox exposure to brodifacoum: (1) direct consumption of brodifacoum baits (possible especially for pellet baits); and (2) secondary poisoning by consuming small mammals killed or incapacitated by brodifacoum exposure. However, because this species has a relatively large range and many of its habitats are far removed from anticipated brodifacoum uses, it is the Service's biological opinion that brodifacoum use is not likely to jeopardize the continued existence of the San Joaquin kit fox.

Incidental Take - Although possible exposure of the San Joaquin kit fox to brodifacoum is probably minimal, the Service anticipates that an unquantifiable level of incidental take may occur as a result of brodifacoum use within the range of this species.

Reasonable and Prudent Measure(s) - If the following reasonable and prudent measures are implemented, incidental take of the San Joaquin kit fox will be minimized: Outdoor application of brodifacoum baits within the range of the San Joaquin kit fox shall be placed in tamper resistant bait boxes and shall not be placed in areas accessible to wildlife.

Stephen's kangaroo rat - The primary exposure of brodifacoum from registered uses can occur when Stephen's kangaroo rat ingests treated bait. Exposure to the chemical can occur from its registered use around agricultural, commercial, industrial buildings, residences, that are interspersed with the habitat of this species. The use of bait boxes placed in areas not usually accessible to wildlife and the large range of the species reduces, but does not eliminate the risk to the Stephen's kangaroo rat. It is the biological opinion of the Service that use of brodifacoum is not likely to jeopardize the continued existence of the Stephen's kangaroo rat.

Incidental Take - The service anticipates that an unquantifiable level of incidental take may occur as a result of brodifacoum use within the occupied habitat of this species.

Reasonable and Prudent Measure(s) - If the following reasonable and prudent measures are implemented, incidental take of the Stephen's kangaroo rat will be minimized: prohibit the use of brodifacoum within 100 yards of occupied habitat.

Hawaiian hawk - Hawaiian hawks range throughout most of the Island of Hawaii below 7000 feet elevation, preferring open, non-urban areas. These raptors feed on birds, insects, reptiles and small mammals (including rats, mice and mongooses). While it is possible that hawks may be exposed to this rodenticide through secondary routes, limitations on the use of brodifacoum to buildings and tamper-proof packets greatly diminish the chances of exposure. Consequently, it is the Service's biological opinion that use of brodifacoum as described above within habitat occupied by the Hawaiian hawk is not likely to jeopardize the continued existence of this species.

Incidental Take- Although the possible exposure of the Hawaiian hawk to brodifacoum is probably minimal, the Service anticipates an unquantifiable level of incidental take may occur as a result of this chemical's use within or adjacent to occupied habitat.

Reasonable and Prudent Measure(s)-The following reasonable and prudent measures for minimizing incidental take must be adopted: prohibit the use of brodifacoum within 100 yards of the Hawaiian hawk's occupied habitat.

Eastern indigo snake - The eastern indigo snake would only be exposed to brodifacoum by eating an animal such as a mouse or rat that had been poisoned by the rodenticide. Indigo snakes occasionally occur in agricultural areas where rodenticides are likely to be used. Although EPA has no toxicity data for reptiles, the data on birds is considered applicable to reptiles. Laboratory studies indicate that brodifacoum poses a lethal secondary poisoning hazard to birds of prey. However, the snake's potential for exposure to poisoned prey is considered minimal. Therefore, it is the Service's opinion that the use of brodifacoum is not likely to jeopardize the continued existence of the eastern indigo snake.

Incidental Take - Although the chance of exposure is considered minimal, because of the high toxicity of brodifacoum, it is still a matter of concern. Thus, the Service anticipates that an unquantifiable level of incidental take may occur as a result of this chemical's use in areas where the eastern indigo snake may occur.

Reasonable and Prudent Measure(s) - The following reasonable and prudent measure for minimizing incidental take should be adopted: conduct laboratory studies using surrogate snake species to obtain toxicity data on the chemical's secondary poisoning hazard to snakes.

Bromadiolone

CHEMICAL INFORMATION

TYPE: Rodenticide

FORMULATION: Concentrates, liquid baits, meal baits, paraffin blocks, ready-to-use grain-based bait pellets and minipellets (Sine 1992).

REGISTERED USES: Control of Norway rats, roof rats, and house mice in urban areas in and around the periphery of homes, industrial, commercial and public buildings, alleys and cargo areas of ships, trains, and aircraft. Bromadiolone can be used in official establishments operating under the Federal meat, poultry, shell egg grading, and egg product inspection program. Use in sewers or public parks is prohibited (Sine 1992).

BACKGROUND:

Mode of action: Bromadiolone is a general use anticoagulant rodenticide that acts by depressing the clotting capabilities of the blood while concurrently increasing the permeability of capillaries throughout the body. This action predisposes the exposed animal to widespread internal hemorrhage. Death generally occurs after several days of ingestion.

Aquatic toxicity: Bromadiolone is highly toxic to fish and aquatic invertebrates. Laboratory LC_{50} values for rainbow trout and bluegill are 1.4 and 3.0 ppm, respectively, and the *Daphnia magna* EC_{50} is 0.24 ppm. However, it is unlikely that normal use of bromadiolone would harm aquatic fauna, as its formulations, application methods, characteristic of being essentially insoluble in water (Sine 1992) should preclude exposure. Therefore, bromadiolone should not be subject to runoff, leaching, or drift.

Terrestrial toxicity: Laboratory data indicate that bromadiolone's LD_{50} for rats is 1.125 mg/kg for the pure compound. However, the rat LD_{50} is 200 g/kg at the 0.005% concentration (the standard bait formulation). Therefore, formulated products containing bromadiolone are only slightly toxic to rodents. The LD_{50} for the northern bobwhite is 100 mg/kg. There are no definitive environmental fate data available for bromadiolone. However, the compound likely persists in carcasses of poisoned rodents. Therefore, potential exposure of listed scavengers and predators to bromadiolone is a significant concern. These species may be exposed to the rodenticide either as a bait or by feeding on poisoned rodents. Bromadiolone is nontoxic to bees (Sine 1992). It is unlikely that listed plants or known plant pollinators will be affected by use of bromadiolone.

Wildlife incidents: EPA reported no known incidents of wildlife poisoning associated with bromadiolone.

BIOLOGICAL OPINION

CHEMICAL REFERENCE TABLE

(The following table contains only those species for which the Service provided a jeopardy or no jeopardy call. Species not included in this list are either not affected by the chemical or have no chance for exposure. For a complete list of all species considered in this opinion, refer to the master species list on page III-1 of the species profile section.)

Species Name	J/NJ	PAGE
MAMMALS		
Alabama beach mouse	J	20
Anastasia Island beach mouse	J	21
Choctawhatchee beach mouse	J	20
Fresno kangaroo rat	NJ	22
Morro Bav kangaroo rat	J	21
Perdido Key beach mouse	J	20
Point Arena mountain beaver	NJ	22
Salt marsh harvest mouse	J	21
San Joaquin kit fox	NJ	22
Southeastern beach mouse	J	21
Stephen's kangaroo rat	NJ	23
Tipton kangaroo rat	NJ	22

RATIONALE FOR JEOPARDY DETERMINATIONS

Alabama Beach Mouse, Choctawhatchee Beach Mouse, and Perdido Key beach mouse - Exposure of these three beach mice to the rodenticide bromadiolone could occur through direct contact with poisoned baits when used within or in close proximity to their occupied habitats. All three subspecies are restricted to mature coastal barrier dune systems along the Gulf of Mexico and occur in areas that are being encroached upon by human development. Therefore, there is a possibility of exposure to bromadiolone. The Choctawhatchee beach mouse is presently known to occur only on Shell Island at St. Andrews Bay in Bay County, Florida, and on approximately 7.9 km of beach dune habitat (coastline up to 150 m inland) near Topsail Hill, from around Morrison Lake eastward to Stalworth Lake, Walton County, Florida. The Alabama beach mouse presently is surviving only on disjunct tracts of the sand dune system from Fort Morgan State Park to the Romar Beach area, Baldwin County, Alabama. The Perdido Key beach mouse occurs only on Perdido Key in Baldwin County, Alabama and Escambia County, Florida. The distance to which occupied habitat of these mice extends inland from the beach varies depending upon the configuration of the sand dune system and the vegetation present. All three beach mice utilize portions of the frontal or primary dunes; interdunal areas; and dunes further inland (secondary or interior dunes). Because of the restricted distributions of these species and the likelihood of bromadiolone being used for rodent control within or adjacent to areas which they inhabit, it is the Service's biological opinion that the registered use of bromadiolone is likely to jeopardize the continued existence of the Choctawhatchee beach mouse, the Alabama beach mouse, and the Perdido Key beach mouse.

Reasonable and Prudent Alternative(s) - If implemented the following reasonable and prudent alternatives would avoid jeopardy to the species: Prohibit use of bromadiolone

within 100 yards of occupied habitat of the Choctawhatchee beach mouse, the Alabama beach mouse, and the Perdido Key beach mouse.

Incidental Take - With implementation of the reasonable and prudent alternative to preclude jeopardy to these species, no incidental take is anticipated and therefore none is authorized.

Anastasia Island Beach Mouse and Southeastern Beach Mouse - These two beach mice are endemic to the east coast of Florida. The Anastasia Island beach mouse is presently believed to occur only on Anastasia Island, St. Johns County, Florida. The southeastern beach mouse is believed to presently occur only from Florida's Mosquito (Pounce) Inlet in Volusia County south to Hutchinson Island in St. Lucie County, Florida. Both species inhabit sand dunes vegetated by sea oats and dune panic grass and the scrub adjoining these dunes, which is vegetated with oaks, sand pine, palmetto, sea grapes, and/or wax myrtle. It is likely that bromadiolone could be used for pest control in areas where both these beach mice occur, since the ranges of both species have been and continue to be encroached upon by human development. Exposure of the mice to bromadiolone would occur through consumption of poison baits, which would result in direct mortality of individuals of the species. Accordingly, it is the Service's biological opinion that the registered use of bromadiolone is likely to jeopardize the continued existence of the Anastasia Island beach mouse and the southeastern beach mouse.

Reasonable and Prudent Alternative(s) - If implemented, the following reasonable and prudent alternatives would avoid jeopardy to the species: Prohibit use of bromadiolone within 100 yards of occupied habitat of the Anastasia Island beach mouse and the southeastern beach mouse.

Incidental Take - With implementation of the reasonable and prudent alternative to preclude jeopardy to these species, no incidental take is anticipated and therefore none is authorized.

Morro Bay kangaroo rat - The primary exposure of bromadiolone from registered uses can occur when the Morro Bay kangaroo rats ingest treated bait. The presence of urban development would allow placement of bait outside of buildings adjacent to occupied habitat where the rat could access the treated bait. The extremely limited range of this species combined with the interspersed building and urban development with occupied habitat, place the species at risk. It is the biological opinion of the Service that use of bromadiolone is likely to jeopardize the continued existence of the Morro Bay kangaroo rat.

Reasonable and Prudent Alternative(s) - If implemented, the following reasonable and prudent alternative would avoid jeopardy to the Morro Bay kangaroo rat: prohibit the use of bromadiolone within 100 yards of the occupied habitat of the Morro Bay kangaroo rat.

Incidental Take - With implementation of the reasonable and prudent alternative described above, no incidental take is anticipated and therefore none is authorized.

Salt marsh harvest mouse - Despite the relatively restricted patterns of bromadiolone uses (registered for outdoor use in urban areas only), the salt marsh harvest mouse could be vulnerable to bromadiolone exposure because: (1) this species occupies areas of high human activity (the San

Francisco Bay area) in which man-made equipment and structures exist near or adjacent to occupied habitats; (2) the species occupies highly restricted and fragmented habitats, which increases both the risks and potential effects of bromadiolone exposure; and (3) bromadiolone is highly toxic to all rodents. Based on these considerations, it is the Service's biological opinion that bromadiolone use within the range of the salt marsh harvest mouse is likely to jeopardize the continued existence of this species.

Reasonable and Prudent Alternative(s) - If implemented, the following reasonable and prudent alternatives would avoid jeopardy to the salt marsh harvest mouse: prohibit outdoor bromadiolone use within 100 yards of all habitats known to be occupied by this species.

Incidental Take - Although possible exposure of the salt marsh harvest mouse to bromadiolone is probably minimal, the Service anticipates that an unquantifiable level of incidental take may occur as a result of bromadiolone use within the occupied habitat of this species.

Reasonable and Prudent Measure(s) - To minimize anticipated incidental take, EPA must establish a monitoring enforcement program. The terms and conditions of such programs are outlined in the introduction section on page I-5.

RATIONALE FOR NO JEOPARDY DETERMINATIONS

Fresno kangaroo rat, Point Arena mountain beaver, and Tipton kangaroo rat - Despite restricted bromadiolone use patterns (registered for use in pellet baits and for outdoor use in urban areas only), the above species may be subject to periodic bromadiolone exposure where they occupy urban or municipal areas in which this compound may be used--e.g., in a few municipal areas in the San Joaquin Valley (Fresno and Tipton kangaroo rats) and in Mendocino County, California (Point Arena mountain beaver). However, exposure of these species to bromadiolone is considered to be unlikely, since relatively few occurrences of these animals in urban or municipal areas are known. It is the Service's biological opinion that bromadiolone use is not likely to jeopardize the continued existence of the Fresno kangaroo rat, Point Arena mountain beaver, or Tipton kangaroo rat.

Incidental Take - Although possible exposure of the Fresno kangaroo rat, Point Arena mountain beaver, and Tipton kangaroo rat to bromadiolone probably is minimal, the Service anticipates that an unquantifiable level of incidental take may occur as a result of bromadiolone use within the ranges of these species.

Reasonable and Prudent Measure(s) - If the following reasonable and prudent measures are implemented, incidental take of the Fresno kangaroo rat, Point Arena mountain beaver, and Tipton kangaroo rat will be minimized: Prohibit outdoor bromadiolone use within 100 yards of all habitats occupied by these species.

San Joaquin kit fox - Despite the restricted pattern of bromadiolone use (registered in pellet baits and for outdoor use in urban areas only), San Joaquin kit foxes may be subject to periodic bromadiolone exposure because they occupy some habitats that are urban or quasi-urban and are

adjacent to human structures. Kit foxes may be found around military structures at Camp Roberts and Fort Hunter-Liggett (Monterey County, California), and around commercial and residential structures in urban and municipal areas (e.g., Bakersfield, California). There are two potential sources of kit fox exposure to bromadiolone: (1) direct consumption of bromadiolone baits (possible especially for pellet formulations); and (2) secondary poisoning by consuming small mammals killed or incapacitated by bromadiolone exposure. However, because this species has a relatively large range and many of its habitats are far removed from anticipated bromadiolone uses, it is the Service's biological opinion that bromadiolone use is not likely to jeopardize the continued existence of the San Joaquin kit fox.

Incidental Take - Although possible exposure of the San Joaquin kit fox to bromadiolone is probably minimal, the Service anticipates that an unquantifiable level of incidental take may occur as a result of bromadiolone use within the range of this species.

Reasonable and Prudent Measure(s) - If the following reasonable and prudent measures are implemented, incidental take of the San Joaquin kit fox will be minimized: Outdoor application of bromadiolone baits within the range of the San Joaquin kit fox shall be placed in tamper resistant bait boxes and shall not be placed in areas accessible to wildlife

Stephen's kangaroo rat - The primary exposure of bromadiolone from registered uses can occur when Stephen's kangaroo rat ingests treated bait. It is the biological opinion of the Service that use of bromadiolone is not likely to jeopardize the continued existence of the Stephen's kangaroo rat.

Incidental Take - The service anticipates that an unquantifiable level of incidental take may occur as a result of bromadiolone use within the occupied habitat of this species.

Reasonable and Prudent Measure(s) - If the following reasonable and prudent measures are implemented, incidental take of the Stephen's kangaroo rat will be minimized: prohibit the use of bromadiolone within 100 yards of occupied habitat.

Bromethalin

CHEMICAL INFORMATION

TYPE: Rodenticide

FORMULATION: 0.005% to 0.01% bait concentration applied in tamper proof bait boxes or in locations inaccessible to children, domestic animals and wildlife.

REGISTERED USES: Control of Norway rats, roof rats and house mice in and around homes, commercial, industrial and agricultural buildings. Also airports, landing strips and urban alleys.

BACKGROUND:

Mode of action: Bromethalin is a rodenticide completely unlike anticoagulants. It is a neurotoxin that increases cerebral pressure blocking off nerve transmission to the lungs resulting in general paralysis and suffocation.

Aquatic toxicity: Bromethalin is almost insoluble in water [<0.01 ppm]. Bromethalin is very highly toxic to fish and aquatic invertebrates. Laboratory tests demonstrated bromethalin LC_{50} s of 0.053 and 0.027 ppm for rainbow trout and *Daphnia magna*, respectively. EPA did not report any aquatic field studies or testing with marine or estuarine organisms. It is highly unlikely that bromethalin will effect listed aquatic species, as the pesticide's use in bait boxes precludes run-off into aquatic systems.

Terrestrial toxicity: Bromethalin has been shown to be highly toxic to birds and mammals under laboratory feeding studies. LD_{50} values for mouse, rat, rabbit, cat, dog, and northern bobwhite are 5.3, 9.1, 2, 18, 4.8, and 4.66 mg/kg, respectively. However, due to the use pattern for this chemical, no impact is expected on birds. However, certain listed species of mammals [rodents] are at risk if their habitat is adjacent to buildings where bromethalin might be used and they are inclined to feed on the bait attractant. No secondary toxicity is possible since bromethalin does not accumulate in bodies of poisoned rodents. There would be no direct or indirect impact on plants and/or pollinators considered in this consultation.

Wildlife incidents: EPA reported no wildlife poisoning incidents associated with bromethalin.

BIOLOGICAL OPINION

CHEMICAL REFERENCE TABLE

(The following table contains only those species for which the Service provided a jeopardy or no jeopardy call. Species not included in this list are either not affected by the chemical or have no chance for exposure. For a complete list of all species considered in this opinion, refer to the master species list on page III-1 of the species profile section.)

Species Name	J/NJ	PAGE
MAMMALS		
Alabama beach mouse	J	27

Species Name	J/NJ	PAGE
Anastasia Island beach mouse	J	28
Carolina northern flying squirrel	J	28
Choctawhatchee beach mouse	J	27
Florida salt marsh vole	J	28
Fresno kangaroo rat	J	29
Giant kangaroo rat	NJ	30
Morro Bay kangaroo rat	J	29
Perdido Key beach mouse	J	27
Point Arena mountain beaver	NJ	30
Salt marsh harvest mouse	J	29
Southeastern beach mouse	J	28
Stephen's kangaroo rat	NJ	30
Tipton kangaroo rat	NJ	30

RATIONALE FOR JEOPARDY DETERMINATIONS

Alabama Beach Mouse, Choctawhatchee Beach Mouse, and Perdido Key Beach Mouse -

Exposure of these beach mice to the rodenticide bromethalin could occur through direct contact with poisoned baits when used within or in close proximity to their occupied habitats. Since, all three subspecies occur in areas that are being encroached upon by various types of human development, there is a high possibility of this pesticide being used where these mice could come in contact with it. All three subspecies are restricted to mature coastal barrier dune systems along the Gulf of Mexico and The Choctawhatchee beach mouse is presently known to occur only on Shell Island at St. Andrews Bay in Bay County, Florida, and on approximately 7.9 km of beach dune habitat (coastline up to 150 m inland) near Topsail Hill, from around Morrison Lake eastward to Stalworth Lake, Walton County, Florida. The Alabama beach mouse presently is surviving only on disjunct tracts of the sand dune system from Fort Morgan State Park to the Romar Beach area in Baldwin County, Alabama. The Perdido Key beach mouse occurs only on Perdido Key in Baldwin County, Alabama and Escambia County, Florida. The distance to which occupied habitat of these species extends inland from the beach varies depending upon the configuration of the sand dune system and the vegetation present. Both subspecies utilize portions of the frontal or primary dunes; interdunal areas; and dunes further inland (secondary or interior dunes). Because of the restricted distributions and limited populations of these species, and the likelihood of bromethalin being used for rodent control within or adjacent to areas which they inhabit, it is the Service's biological opinion that the registered use of bromethalin is likely to jeopardize the continued existence of the Choctawhatchee beach mouse, the Alabama beach mouse, and the Perdido Key beach mouse.

Reasonable and Prudent Alternative(s) - If implemented, the following reasonable and prudent alternatives would avoid jeopardy to the species: Prohibit use of bromethalin within 100 yards of occupied habitat of the Choctawhatchee beach mouse, the Alabama beach mouse, and the Perdido Key beach mouse.

Incidental Take - With implementation of the reasonable and prudent alternative to preclude jeopardy to these species, no incidental take is anticipated and therefore none is authorized.

Anastasia Island Beach Mouse and Southeastern Beach Mouse - These two beach mice are endemic to the east coast of Florida. The Anastasia Island beach mouse is presently believed to occur only on Anastasia Island, St. Johns County, Florida. The southeastern beach mouse is believed to presently occur only from Florida's Mosquito (Pounce) Inlet in Volusia County south to Hutchinson Island in St. Lucie County, Florida. Both subspecies inhabit sand dunes vegetated by sea oats and dune panic grass and the scrub adjoining these dunes, which is vegetated with oaks, sand pine, palmetto, sea grapes, and/or wax myrtle. Since the ranges of both species have been and continue to be encroached upon by human development, it is likely that bromethalin could be used for pest control in areas where both these beach mice occur. Exposure of the mice to bromethalin would occur through consumption of poison baits, which would result in direct mortality of individuals of the species. Accordingly, it is the Service's biological opinion that the registered use of bromethalin is likely to jeopardize the continued existence of the Anastasia Island beach mouse or the southeastern beach mouse.

Reasonable and Prudent Alternative(s) - If implemented, the following reasonable and prudent alternatives would avoid jeopardy to the species: Prohibit use of bromethalin within 100 yards of occupied habitat of the Anastasia Island beach mouse and the southeastern beach mouse.

Incidental Take - With implementation of the reasonable and prudent alternative to preclude jeopardy to these species, no incidental take is anticipated and therefore none is authorized.

Carolina northern flying squirrel - This species may be directly exposed to bromethalin poisoning from its registered use to control rats and mice around agricultural buildings and structures. The Carolina northern flying squirrel occurs in coniferous and northern hardwood forests, and may occasionally forage on the ground. Where land use changes and development encroach on the species' habitat there is a potential risk of the squirrel coming in contact with bromethalin bait that is placed outside of buildings (e.g., storage sheds and barns). Bromethalin is toxic to rodents and would most likely kill a northern flying squirrel if it consumed the bait. Due to the restricted range and small population of the Carolina northern flying squirrel, any poisoning of individuals could threaten the survival of the species. Therefore, it is the Service's opinion that the use of bromethalin is likely to jeopardize the continued existence of the Carolina northern flying squirrel.

Reasonable and Prudent Alternative(s) - If implemented, the following reasonable and prudent alternative would avoid jeopardy to the Carolina northern flying squirrel: prohibit the outdoor use of bromethalin within the species' occupied habitat.

Incidental Take - With the implementation of the reasonable and prudent alternative to preclude jeopardy of the species, no incidental take is anticipated and therefore none is authorized.

Florida salt marsh vole - Exposure of the salt marsh vole to bromethalin could occur through consumption of poisoned baits used to control rodents in close proximity to the vole's occupied marsh habitat. There is a possibility of the rodenticide being used around buildings or other structures adjacent to salt marsh habitat where the vole could come in contact with it. The vole is restricted to a single known area in the salt marsh of Waccasassa Bay, Levy County, Florida. This

rodenticide is highly toxic to mammals. Because of the restricted distribution of the species, its limited population, and the likelihood of this rodenticide being used for rodent control adjacent to areas in which the vole occurs, it is the Service's biological opinion that the use of bromethalin is likely to jeopardize the continued existence of the Florida salt marsh vole.

Reasonable and Prudent Alternative(s) - If implemented, the following reasonable and prudent alternatives would avoid jeopardy to the species: prohibit use of bromethalin within 100 yards of the landward edge of the species' salt marsh habitat in Levy County, Florida.

Incidental Take - With implementation of the reasonable and prudent alternative to preclude jeopardy of the species, no incidental take is anticipated and therefore none is authorized.

Fresno kangaroo rat, salt marsh harvest mouse - Despite the relatively restricted patterns of bromethalin uses (registered for use in bait boxes in and around human structures only), Fresno kangaroo rats and salt marsh harvest mice are vulnerable to bromethalin exposure because: (1) both species occupy areas of high human activity in which man-made structures exist near or adjacent to their habitats (agricultural areas in the San Joaquin Valley, California, and the San Francisco Bay area, respectively); (2) both species occupy highly restricted and fragmented habitats, which increases both the risks and potential effects of bromethalin exposure; and (3) bromethalin is highly toxic to all rodents. Based on these considerations, it is the Service's biological opinion that bromethalin use within the range of the Fresno kangaroo rat and salt marsh harvest mouse is likely to jeopardize the continued existence of these species.

Reasonable and Prudent Alternative(s) - If implemented, the following reasonable and prudent alternatives would avoid jeopardy to the Fresno kangaroo rat and salt marsh harvest mouse: prohibit outdoor bromethalin use within 100 yards of habitats occupied by these species.

Incidental Take - Although possible exposure of the Fresno kangaroo rat and salt marsh harvest mouse to bromethalin probably is minimal, the Service anticipates that an unquantifiable level of incidental take may occur as a result of bromethalin use within the ranges of these species.

Reasonable and Prudent Measure(s) - To minimize anticipated incidental take, EPA must establish a monitoring enforcement program. The terms and conditions of such programs are outlined in the introduction section on page I-5.

Morro Bay kangaroo rat - The primary exposure of bromethalin from registered uses can occur when the Morro Bay kangaroo rat ingests treated bait. The extremely limited range of this species, the presence of target rodents, and the interspersed habitat with urban, agricultural, and commercial buildings place the Morro Bay kangaroo rat at risk. It is the biological opinion of the Service that use of bromethalin is likely to jeopardize the continued existence of the Morro Bay kangaroo rat.

Reasonable and Prudent Alternative(s) - If implemented, the following reasonable and prudent alternative would avoid jeopardy to the Morro Bay kangaroo rat: prohibit the use of bromethalin within 100 yards of the occupied habitat of the Morro Bay kangaroo rat.

Incidental Take - With implementation of the reasonable and prudent alternative described above, no incidental take is anticipated and therefore none is authorized.

RATIONALE FOR NO JEOPARDY DETERMINATIONS

Giant kangaroo rat, Tipton kangaroo rat, Point Arena mountain beaver - Despite relatively restricted bromethalin use patterns (registered for use in bait boxes in and around human structures only), giant kangaroo rats, Tipton kangaroo rats, and Point Arena mountain beaver may be subject to periodic bromethalin exposure because they sometimes occupy habitats that are adjacent to human activities and structures. Tipton kangaroo rats may be found near residential, agricultural, and commercial buildings in the southern San Joaquin Valley of California; giant kangaroo rats in oil fields and rangelands in the southwest and west central portions of the San Joaquin Valley where industrial and ranch building are present; and mountain beaver near municipal and communication structures in the Point Arena vicinity. However, both kangaroo rat species occupy a more widespread range than the Fresno kangaroo rat discussed above and much of their ranges are far removed from anticipated bromethalin use areas. Furthermore, restriction of this compound to use in bait boxes eliminates most avenues of exposure to mountain beaver. It is the Service's biological opinion that bromethalin use within the ranges of the giant kangaroo rat, Tipton kangaroo rat, and Point Arena mountain beaver is not likely to jeopardize the continued existence of these species.

Incidental Take - Although possible exposure of the giant kangaroo rat, Tipton kangaroo rat, and Point Arena mountain beaver to bromethalin is probably minimal, the Service anticipates that an unquantifiable level of incidental take may occur as a result of bromethalin use within the ranges of these species.

Reasonable and Prudent Measure(s) - If the following reasonable and prudent measures are implemented, incidental take of the Tipton and giant kangaroo rat will be minimized: Prohibit outdoor bromethalin use within 100 yards of habitat occupied by these species.

Stephen's kangaroo rat - The primary exposure of bromethalin from registered uses can occur when Stephen's kangaroo rat ingests treated bait. Although this species will likely occasionally contact baits that are located adjacent to agricultural, domestic, commercial, and industrial buildings; also airports and landing strips, its large range and distribution reduce overall risk. It is the biological opinion of the Service that use of bromethalin is not likely to jeopardize the continued existence of the Stephen's kangaroo rat.

Incidental Take - The service anticipates that an unquantifiable level of incidental take may occur as a result of bromethalin use within the occupied habitat of this species.

Reasonable and Prudent Measure(s) - If the following reasonable and prudent measures are implemented, incidental take of the Stephen's kangaroo rat will be minimized: prohibit the use of bromethalin within 100 yards of this specie's occupied habitat.

Chlorophacinone

CHEMICAL INFORMATION

TYPE: Rodenticide (indandione)

FORMULATION: Tracking powder (nuisance baits - can only be used in buildings), pellet-baits (mice/voles/cotton rats/field mice/house mice/pocket gophers), and concentrate ground spray (orchard mice).

REGISTERED USES: Registered for control of Norway rats, roof rats and house mice in and around homes, industrial and agricultural buildings; and for pocket gophers applied as bait in underground runways; also registered for control of mice and voles in Idaho and Delaware; orchard mice in Delaware, Connecticut and Arizona; control of deer mice in non-crop areas in Florida; ground squirrel control in Arizona; control of deer mice, house mice and pocket gophers in California and nuisance bats in Georgia, Connecticut and Colorado, but the last formulation is restricted to domiciles and other buildings.

BACKGROUND:

Mode of action: An anticoagulant, chlorophacinone is in a class of rodenticides known as indandiones. Unlike the coumarin compounds, indandiones may cause symptoms and signs of neurologic and cardiopulmonary injury leading to death before hemorrhage occurs. Death usually occurs after several days ingestion.

Aquatic toxicity: Chlorophacinone is very toxic to fish and other aquatic invertebrates and the use of ground liquid sprays poses a hazard to listed species if applied within or adjacent to their habitat where runoff or drift can occur. Available data indicate chlorophacinone LC₅₀ values of 0.252, 0.692, and 0.426 for rainbow trout, bluegill sunfish, and *Daphnia magna*, respectively. However, this applies only to Arizona, Connecticut and Delaware for ground sprays since Chlorophacinone will have no effect on listed aquatic species when used as a bait.

Terrestrial toxicity: Toxicity varies widely among the indandiones and among species, with some birds and mammals being highly sensitive and others fairly resistant. Massive single exposure or repeated low dosages may cause poisoning (Buck et al. 1982). Total dosage to death will be much lower in anticoagulants with repeated exposures over an extended period than in acute exposures, and the majority of mortalities will occur during or after the second week of exposure (Mendenhall and Pank 1980). Single dose toxicity may be 5-100 times the multiple dose toxicity, depending on species (Jones 1977). The amount of data describing toxicity of indandiones to terrestrial taxa varies, with pival being the least tested compound and diphacinone perhaps the most tested, and most toxic, compound. Laboratory data for chlorophacinone provide avian LD₅₀ values of >100, >100, 430, and 495 mg/kg for mallard, ring-necked pheasant, red-winged blackbird, and northern bobwhite, respectively. Studies described below suggest that raptors are more sensitive to chlorophacinone than those species mentioned above.

Radvanyi et al. (1988) demonstrated that American kestrels treated with chlorophacinone for 21 days showed physical and behavioral changes, including massive internal hemorrhaging. Wing

drooping was the first observed sign. Adult and juvenile kestrels subjected to 53.0 mg chlorophacinone/day died after a mean of 16.5 and 10.3 days, respectively. In the 18 mg/day juvenile group, three of the four birds died after a mean of 11 days of treatment. The surviving bird in this low dose group manifested signs consistent with anticoagulant poisoning, but recovered within ten days of removal from the treatment. In the wild, however, a ten day recovery period is likely to result in eventual mortality.

Mendenhall and Pank (1980) describe a study whereby barn owls were fed one of several anticoagulants including the indandiones diphacinone and chlorophacinone. Barn owls exposed to these compounds via treated rats did not die. These findings suggest that barn owls may be less sensitive to indandiones than are other raptors. However, sample sizes were small and interspecific differences in toxicity remain poorly quantified. Mendenhall and Pank (1980) noted that more severe effects may be expected under field conditions because of potential stress, changes in diet, increased activity, or high susceptibility to injuries. These studies suggest that, under some circumstances, indandiones may present a hazard to raptors that consume poisoned rodents.

Available data indicate chlorophacinone LD₅₀ values of 0.49 and 7.5 mg/kg for deer mouse and vampire bat, respectively. While diphacinone generally appears to be more toxic to dogs than chlorophacinone, there are insufficient data to generalize about the relative toxicity of different indandiones to raptors.

Wildlife incidents: Documented deaths - 4 San Joaquin kit foxes

BIOLOGICAL OPINION

CHEMICAL REFERENCE TABLE

(The following table contains only those species for which the Service provided a jeopardy or no jeopardy call. Species not included in this list are either not affected by the chemical or have no chance for exposure. For a complete list of all species considered in this opinion, refer to the master species list on page III-1 of the species profile section.)

Species Name	J/NJ	PAGE
MAMMALS		
Alabama beach mouse	J	31
Amargosa vole	J	32
Anastasia Island beach mouse	J	32
Carolina northern flying squirrel	J	32
Choctawhatchee beach mouse	J	31
Florida panther	J	33
Florida salt marsh vole	J	33
Fresno kangaroo rat	J	34
Giant kangaroo rat	J	34
Gray wolf	NJ	38
Grizzly bear	NJ	38
Hualapai Mexican vole	J	34
Jaguarundi	J	35
Louisiana black bear	NJ	38
Morro Bay kangaroo rat	J	35

Species Name	J/NJ	PAGE
Ocelot	J	35
Perdido Key beach mouse	J	31
Point Arena mountain beaver	J	36
Salt marsh harvest mouse	J	36
San Joaquin kit fox	J	36
Southeastern beach mouse	J	32
Stephen's kangaroo rat	J	37
Tipton kangaroo rat	J	34
Utah prairie dog	NJ	39
BIRDS		
Audubon's crested caracara	J	37
REPTILES		
Eastern indigo snake	NJ	39
Puerto Rican boa	NJ	39
Virgin Islands tree boa	NJ	40

RATIONALE FOR JEOPARDY DETERMINATIONS

Alabama beach mouse, Choctawhatchee beach mouse, and Perdido Key beach mouse - Exposure of these beach mice to the chlorophacinone could occur through direct contact with the chemical when used within or in close proximity to their occupied habitats. All three subspecies are restricted to mature coastal barrier dune systems along the Gulf of Mexico and occur in areas that are being encroached upon by various types human development. Therefore, there is a high possibility of chlorophacinone being used where these mice could come in contact with it. The Choctawhatchee beach mouse is presently known to occur only on Shell Island at St. Andrews Bay in Bay County, Florida, and on approximately 5 miles of beach dune habitat (coastline up to 500 feet inland) near Topsail Hill, from around Morrison Lake eastward to Stalworth Lake, Walton County, Florida. The Alabama beach mouse presently is surviving only on disjunct tracts of the sand dune system from Fort Morgan State Park to the Romar Beach area in Baldwin County, Alabama. The Perdido Key beach mouse occurs only on Perdido Key in Baldwin County, Alabama and Escambia County, Florida. The distance to which occupied habitat of these mice extends inland from the beach varies depending upon the configuration of the sand dune system and the vegetation present. All three subspecies utilize portions of the frontal or primary dunes; interdunal areas; and dunes further inland (secondary or interior dunes). Because of the restricted distributions of these species and the likelihood of chlorophacinone being used for rodent control within or adjacent to areas which they inhabit, it is the Service's biological opinion that the registered use of chlorophacinone is likely to jeopardize the continued existence of the Choctawhatchee beach mouse, the Alabama beach mouse, and the Perdido Key beach mouse.

Reasonable and Prudent Alternative(s) - If implemented the following reasonable and prudent alternatives would avoid jeopardy to the species: Prohibit use of chlorophacinone within 100 yards of occupied habitat of the Choctawhatchee beach mouse, the Alabama beach mouse, and the Perdido Key beach mouse.

Incidental Take - With implementation of the reasonable and prudent alternative to preclude jeopardy to these species, no incidental take is anticipated and therefore none is authorized.

Amargosa vole - The primary exposure of chlorophacinone from registered uses can occur when the Amargosa vole consumes bait from bait boxes used for muskrat control. It is the Service's biological opinion that use of chlorophacinone is likely to jeopardize the continued existence of the Amargosa vole.

Reasonable and Prudent Alternative(s) - If implemented, the following reasonable and prudent alternatives would avoid jeopardy to the Amargosa vole: prohibit the use of chlorophacinone within 100 yards of the occupied habitat of the Amargosa vole.

Incidental Take - With implementation of the reasonable and prudent alternative described above, no incidental take is anticipated and therefore none is authorized.

Anastasia Island beach mouse and Southeastern beach mouse - These two beach mice are endemic to the east coast of Florida. The Anastasia Island beach mouse is presently believed to occur only on Anastasia Island, St. Johns County, Florida. The southeastern beach mouse is believed to presently occur only from Florida's Mosquito (Pounce) Inlet in Volusia County south to Hutchinson Island in St. Lucie County, Florida. Both subspecies inhabit sand dunes vegetated by sea oats and dune panic grass and the scrub adjoining these dunes, which is vegetated with oaks, sand pine, palmetto, sea grapes, and/or wax myrtle. It is likely that chlorophacinone could be used for pest control in areas where both these beach mice occur, since the ranges of both species have been and continue to be encroached upon by human development. Exposure of the mice to chlorophacinone would occur through ingestion of poison baits, which would result in direct mortality of individuals of the species. Accordingly, it is the Service's biological opinion that the registered use of chlorophacinone is likely to jeopardize the continued existence of the Anastasia Island beach mouse or the southeastern beach mouse.

Reasonable and Prudent Alternative(s) - If implemented, the following reasonable and prudent alternatives would avoid jeopardy to the species: Prohibit use of chlorophacinone within 100 yards of occupied habitat of the Anastasia Island beach mouse and the southeastern beach mouse.

Incidental Take - With implementation of the reasonable and prudent alternative to preclude jeopardy to these species, no incidental take is anticipated and therefore none is authorized.

Carolina northern flying squirrel - This species may be directly exposed to chlorophacinone poisoning from its registered use to control rats and mice around agricultural buildings. The Carolina northern flying squirrel occurs in coniferous and northern hardwood forests, and may occasionally forage on the ground. Where land use changes and development encroach on the species' habitat there is a potential risk of the squirrel coming in contact with chlorophacinone bait that is placed outside of buildings (e.g., storage sheds and barns). Chlorophacinone is toxic to rodents and would most likely kill a northern flying squirrel if it consumed the bait. Due to the restricted range and small population of the Carolina northern flying squirrel, any poisoning of individuals could threaten the survival of the species. Therefore, it is the Service's opinion that the use of chlorophacinone is likely to jeopardize the continued existence of the Carolina northern flying squirrel.

Reasonable and Prudent Alternative(s) - If implemented, the following reasonable and prudent alternative would avoid jeopardy to the Carolina northern flying squirrel: prohibit the outdoor use of the chemical within the species' occupied habitat.

Incidental Take - With the implementation of the reasonable and prudent alternative to preclude jeopardy of the species, no incidental take is anticipated and therefore none is authorized.

Florida panther - The Florida panther may be exposed to chlorophacinone by feeding on rodents that are dead or incapacitated from this rodenticide poison. Panthers on occasion venture into agricultural areas where rodenticides are likely used and poisoned target animals would be found. In mammals, following oral administration of chlorophacinone which is an anticoagulant, 90 percent of the rodenticide is eliminated in the feces within 48 hours in the form of metabolites. Although EPA provided no hazard ratios for mammals of any size, they concluded that secondary poisoning mortality of larger mammals may not occur because large quantities of contaminated prey items would have to be consumed to produce a significant adverse effect. However, rodenticide induced internal hemorrhaging could weaken a panther to the degree that the animal would be very susceptible to disease and fatal infections. Because of the critically small panther population, the loss of even one panther could threaten the survival of the species. Therefore, it is the opinion of the Service that the use of chlorophacinone is likely to jeopardize the continued existence of the Florida panther.

Reasonable and Prudent Alternative(s) - If implemented, the following reasonable and prudent alternative would avoid jeopardy to the Florida panther: prohibit the use of the chemical within 20 miles of the boundary of any Federal and State lands (e.g., National Wildlife Refuge, National Park, National Preserve, State Park, State Preserve, State Wildlife Management Areas, etc.) and Indian Reservations that provide suitable panther habitat south of Charlotte, Glades and Martin counties, Florida.

Incidental Take - Although the chance of exposure is considered minimal, because individuals of the species may disperse beyond a given home range, the use and toxicity of the pesticide is still a concern. Consequently the Service anticipates that an unquantifiable level of incidental take may occur as a result of sub-lethal or lethal effects following the use of the pesticide outside of the prohibited use zone.

Reasonable and Prudent Measure(s) - The following reasonable and prudent measure for minimizing incidental take must be adopted and implemented: within and including the area extending 5 miles from the edge of the prohibited use zone, the user should remove and properly dispose of any dead or incapacitated animal likely to have been poisoned during the period of rodenticide use.

Florida salt marsh vole - Exposure of the salt marsh vole to chlorophacinone could occur through consumption of poisoned baits used to control rodents in close proximity to the vole's occupied marsh habitat. There is a possibility of the rodenticide being used around buildings or other structures adjacent to salt marsh habitat where the vole could come in contact with it. The vole is restricted to a single known area in the salt marsh of Waccasassa Bay, Levy County, Florida. This rodenticide is highly toxic to mammals. Because of the restricted distribution of the species, its limited population, and the likelihood of this rodenticide being used for rodent control

adjacent to areas in which the vole occurs, it is the Service's biological opinion that the use of chlorophacinone is likely to jeopardize the continued existence of the Florida salt marsh vole.

Reasonable and Prudent Alternative(s) - If implemented, the following reasonable and prudent alternatives would avoid jeopardy to the species: prohibit use of chlorophacinone within 100 yards of the landward edge of the species' salt marsh habitat in Levy County, Florida.

Incidental Take - With implementation of the reasonable and prudent alternative to preclude jeopardy of the species, no incidental take is anticipated and therefore none is authorized.

Fresno kangaroo rat, giant kangaroo rat, Tipton kangaroo rat - These species are highly susceptible to chlorophacinone exposure because of the wide variety of registered uses of this compound, and the high likelihood of such uses in and around kangaroo rat habitats in the San Joaquin Valley, California. The primary exposure risk for kangaroo rats would occur during chlorophacinone use to control field rodents, such as ground squirrels, pocket gophers, and deer mice. Kangaroo rats could encounter chlorophacinone during use within their habitats (e.g., grasslands, saltbush scrub, fallow agricultural lands); in agricultural lands adjacent to their habitats; in bait boxes or as spillage from baitboxes; and when broadcast on the ground or inadvertently applied to their burrows. Furthermore, some chlorophacinone formulations would be highly attractive to kangaroo rats if encountered, especially grain baits. Exposure also could occur during chlorophacinone use to control domestic rodents around agricultural buildings and industrial structures (e.g., in the Kern County oil fields), though these risks are considered less likely than field exposure. Because of these numerous exposure factors, the high toxicity of this compound to rodents, and the fact that these species occupy significantly restricted and fragmented habitats, it is the biological opinion of the Service that chlorophacinone use within the ranges of the Fresno kangaroo rat, giant kangaroo rat, and Tipton kangaroo rat is likely to jeopardize the continued existence of these species.

Reasonable and Prudent Alternative(s) - If implemented, the following reasonable and prudent alternatives would avoid jeopardy to the Fresno, giant, and Tipton kangaroo rat: Prohibit outdoor chlorophacinone use within 100 yards of the occupied habitat of these species unless specific kangaroo rat protection programs for chlorophacinone use are implemented. Such programs shall integrate San Joaquin kit fox protection measures and shall be approved by the Service in writing.

Incidental Take - If the reasonable and prudent alternatives described above are implemented, no incidental take of these species is anticipated and therefore none is authorized.

Hualapai Mexican vole - The primary exposure of chlorophacinone to the Hualapai Mexican vole would be through its application to control ground squirrels in non-crop rights-of-way or recreational areas. Voles are one of a number of target organisms of chlorophacinone and also highly toxic to small mammals. The likelihood that chlorophacinone would be used in the habitat of the vole is small but if it were used because of the very small number of known voles the consequences would be severe. Therefore, it is the Service's biological opinion that the use of chlorophacinone is likely to jeopardize the continued existence of the Hualapai Mexican vole.

Reasonable and Prudent Alternative(s) - If implemented, the following reasonable and prudent alternatives would avoid jeopardy to the Hualapai Mexican vole: prohibit the use of chlorophacinone within 100 yards of known Hualapai Mexican vole occupied habitat.

Incidental Take - With the implementation of the reasonable and prudent alternatives to preclude jeopardy of the species, no incidental take is anticipated and therefore none is authorized.

Jaguarundi and Ocelot - The primary exposure of chlorophacinone to the jaguarundi and ocelot is through its use to control field rodents in orchards, cropland, pasture, rangeland and ditch banks and rights-of-way. There is little probability of the ocelot or jaguarundi directly consuming the chlorophacinone baits, however it is probable that secondary poisoning may occur as a result of these species consuming target rodents that have ingested chlorophacinone. This chemical is used in areas that are adjacent to or interspersed with known ocelot and jaguarundi habitat. Therefore, it is the Service's opinion that the use of chlorophacinone is likely to jeopardize the continued existence of these species.

Reasonable and Prudent Alternative(s) - If implemented, the following reasonable and prudent alternative will avoid jeopardy to the ocelot and jaguarundi: prohibit use within three miles of occupied habitat.

Incidental Take - Despite the implementation of the reasonable and prudent alternatives described above, the Service anticipates that an unquantifiable level of incidental take of ocelot and jaguarundi may occur as a result of chlorophacinone use within the range of these species.

Reasonable and Prudent Measure(s) - If implemented, the following reasonable and prudent measures will minimize incidental take: prior to use of chlorophacinone in potential ocelot or jaguarundi habitat, conduct survey to determine if habitat is occupied. If habitat is unoccupied, no further restrictions are applicable. If habitat is occupied, prohibit use within three miles.

Morro Bay kangaroo rat - The primary exposure of chlorophacinone from registered uses can occur when the Morro Bay kangaroo rat ingests treated bait. The extremely limited range of this species, the presence of target rodents, and the interspersed habitat with urban, agricultural, and commercial buildings place the Morro Bay kangaroo rat at risk. It is the biological opinion of the Service that use of chlorophacinone is likely to jeopardize the continued existence of the Morro Bay kangaroo rat.

Reasonable and Prudent Alternative(s) - If implemented, the following reasonable and prudent alternative would avoid jeopardy to the Morro Bay kangaroo rat: prohibit the use of chlorophacinone within 100 yards of the occupied habitat of the Morro Bay kangaroo rat.

Incidental Take - With implementation of the reasonable and prudent alternative described above, no incidental take is anticipated and therefore none is authorized.

Point Arena mountain beaver, salt marsh harvest mouse - The primary risk of exposure of these species to chlorophacinone would occur during registered uses of this compound to control rodent pests within or adjacent to occupied habitats. Mountain beaver exposure to this compound might occur during control of most target species for which chlorophacinone is registered--both domestic and non-domestic--since this species occupies a variety of habitats within their coastal range in Mendocino County, California, including natural lands, disturbed sites, and some areas adjacent to residences. The harvest mouse is limited to remaining salt marshes in the San Francisco Bay area, where adjacent man-made structures may exist; therefore, exposure of this species to chlorophacinone primarily would occur during control of domestic rodents. Because of these exposure factors, and the fact that the Point Arena mountain beaver and salt marsh harvest mouse occupy highly restricted and fragmented habitats, it is the biological opinion of the Service that chlorophacinone use is likely to jeopardize the continued existence of these species.

Reasonable and Prudent Alternative(s) - If implemented, the following reasonable and prudent alternatives would avoid jeopardy to the salt marsh harvest mouse and Point Arena mountain beaver: prohibit outdoor chlorophacinone use within 100 yards of the occupied habitats of these species, unless specific salt marsh harvest mouse and Point Arena mountain beaver protection programs for chlorophacinone use, approved by the Service in writing, are implemented.

Incidental Take - If the reasonable and prudent alternatives described above are implemented, no incidental take of these species is anticipated and therefore none is authorized.

San Joaquin kit fox - The San Joaquin kit fox likely would be subject to chlorophacinone exposure during numerous registered uses of this compound to control a variety of rodent pests within and adjacent to occupied habitats in the San Joaquin Valley, California. The primary exposure risk for kit foxes would occur during control of field rodents, especially California ground squirrels; though control of domestic rodents around industrial, residential, and agricultural sites also poses an exposure risk. The most likely source of exposure is expected to be secondary poisoning should kit foxes feed on rodents killed or incapacitated by chlorophacinone poisoning. However, kit foxes also may consume chlorophacinone baits directly, and intensive rodent control programs utilizing chlorophacinone (as well as other compounds) also may adversely affect kit foxes through depletion of prey species. Adverse effects of chlorophacinone use on the San Joaquin kit fox could be highly deleterious to this species for the following reasons: (1) chlorophacinone is extremely toxic to mammals; (2) it is used in numerous areas occupied or frequented by kit foxes, including rangelands, agricultural areas, and the banks of aqueducts, canals, and levees; (3) the opportunistic feeding habits of kit foxes increase the likelihood of both primary and secondary poisoning; (4) serious localized effects of chlorophacinone use could occur in areas where the kit fox range is geographically restricted; (5) current chlorophacinone use restrictions are difficult to implement and enforce; and (6) several incidents of kit fox deaths from chlorophacinone use have been documented. For these reasons, it is the Service's biological opinion that chlorophacinone use within the range of the San Joaquin kit fox is likely to jeopardize the continued existence of this species.

Reasonable and Prudent Alternative(s) - If implemented, the following reasonable and prudent alternatives would avoid jeopardy to the San Joaquin kit fox: Prohibit

chlorophacinone use within the kit fox range as determined by the Service. Exceptions to this prohibition are as follows: (1) Agricultural areas that are one mile or more from any kit fox habitat, such areas to be determined and mapped by the California Environmental Protection Agency in consultation with the Service, or to be determined by the Service; OR (2) Areas for which kit fox surveys have been conducted within a one mile radius of proposed treatment sites and have yielded negative results, provided such surveys are conducted by qualified individuals utilizing methods acceptable to the Service, and that such results are submitted to the Service for review and approval.

Incidental Take - Despite the reasonable and prudent alternatives described above, the Service anticipates that an unquantifiable level of incidental take of the San Joaquin kit fox may occur as a result of chlorophacinone use within the range of this species.

Reasonable and Prudent Measure(s) - To minimize anticipated incidental take, EPA must establish a monitoring enforcement program. The terms and conditions of such programs are outlined in the introduction section on page I-5.

Stephen's kangaroo rat - The primary exposure of the Stephen's kangaroo rat to chlorophacinone is the ingestion of the many bait formulations. It is the biological opinion of the Service that use of chlorophacinone is likely to jeopardize the continued existence of the Stephen's kangaroo rat.

Reasonable and Prudent Alternative(s) - If implemented, the following reasonable and prudent alternative would avoid jeopardy to the Stephen's kangaroo rat: prohibit the use of chlorophacinone within 100 yards of the occupied habitat of this species.

Incidental Take - With implementation of the reasonable and prudent alternative described above, no incidental take is anticipated and therefore none is authorized.

Audubon's crested caracara - Audubon's crested caracara would be exposed to chlorophacinone by secondary poisoning from consuming contaminated rodents. Caracaras feed both on carrion and live prey. Studies document secondary poisoning of raptors that were fed chlorophacinone contaminated rodents. Chlorophacinone is registered for control of deer mice in non-crop areas of Florida. Caracaras occur in open prairies and frequently use improved pastures. Since it takes several days for death to occur from Chlorophacinone ingestion, it is conceivable that poisoned rodents may travel away from the baited area to die. Because of the caracara's small population size, any rodenticide induced mortality could threaten the survival of the species. Therefore, it is the Service's opinion that the use of chlorophacinone is likely to jeopardize the continued existence of the Audubon's crested caracara.

Reasonable and Prudent Alternative(s) - If implemented, the following reasonable and prudent alternative would avoid jeopardy to the Audubon's crested caracara: prohibit the use of the pesticide within the occupied habitat of the species.

Incidental Take - With the implementation of the reasonable and prudent alternative to preclude jeopardy of the species, no incidental take is anticipated and therefore none is authorized.

RATIONALE FOR NO JEOPARDY DETERMINATIONS

Gray wolf - Chlorophacinone is an anticoagulant rodenticide. In mammals, following oral administration, 90 percent is eliminated in the feces within 48 hours in the form of metabolites. Less than 5000 pounds of active ingredient are formulated annually with more than 70 percent (3500 pounds) used for industrial/commercial structural pest control. Exposure to the wolf could occur by the wolf feeding on dead pocket gophers and in Idaho feeding on dead mice and voles in orchards. Most of the pocket gophers and well as many of the mice and voles would die in their burrows or runways so many of them would likely not be detected by the gray wolf. No hazard ratios were given for mammals but EPA calculated the hazard ratio of less than one for a 10 gram bird. EPA concluded that adverse effects on larger mammals may be precluded because of their need to consume larger quantities of poisoned target animals. According to the information provided by EPA, the largest mammals known to have died from chlorophacinone have been mongoose and the San Joaquin kit fox which is much smaller than a wolf. Therefore, because of the restricted use of chlorophacinone and because it is highly unlikely that the wolf would be able to consume enough of the target species to cause a mortality, it is the Service's opinion that the use of chlorophacinone is not likely to jeopardize the continued existence of the gray wolf.

Incidental Take - Because it is unlikely that mortality will occur to the gray wolf, no incidental take of the gray wolf is anticipated and thus no take is authorized.

Grizzly bear - In mammals, following oral administration of chlorophacinone which is an anticoagulant, 90 percent of the pesticide is eliminated in the feces within 48 hours in the form of metabolites. Only about 1500 pounds of active ingredient is formulated annually for non-industrial/commercial structural pest control (e.g., control of pocket gophers). As with the wolf, exposure to grizzly bears may occur by a grizzly bear feeding on dead pocket gophers and, in Idaho, feeding on dead mice and voles in orchards. Many of these target species likely would die in burrows or runways thus reducing the number that the grizzly bear may dig up and consume. EPA provided no hazard ratios for mammals of any size but they concluded that adverse effects on larger mammals may not occur because of their need to consume larger quantities of poisoned target animals. Therefore, because of the limited use of chlorophacinone expected and because it is highly unlikely that the grizzly bear would consume enough of the target species to cause mortality, it is the Service's opinion that the use of chlorophacinone is not likely to jeopardize the continued existence of the grizzly bear.

Incidental Take - Because it is unlikely that mortality will occur to the grizzly bear, no incidental take of the grizzly bear is anticipated and thus no take is authorized.

Louisiana black bear - The Louisiana black bear would likely only be exposed to chlorophacinone by consuming a mouse, rat or other animal that had been poisoned by the rodenticide. Black bears occasional venture into agricultural areas where the rodenticide may be used. Although chlorophacinone is extremely toxic to mammals, based on EPA data it is very unlikely that a mammal as large a bear would consume enough poisoned rodents to cause lethal secondary poisoning. Therefore, it is the Service's opinion that the use of chlorophacinone is not likely to jeopardize the continued existence of the Louisiana black bear.

Incidental Take - Although the chance of exposure and hazard are considered minimal, because of the high toxicity of chlorophacinone to mammals, it is still a matter of concern. Thus, the Service anticipates that an unquantifiable level of incidental take may occur as a result of this chemical's use in areas of or adjacent to bear habitat.

Reasonable and Prudent Measure(s) - The following reasonable and prudent measure for minimizing incidental take should be adopted: prohibit the use of chlorophacinone in occupied habitat of the black bear.

Utah prairie dog - The EPA has determined that the use of chlorophacinone may affect this species because they may consume bait set out to kill other species (e.g., pocket gophers). The only registered use that could possibly overlap with Utah prairie dog habitat is control of pocket gophers. The registration requires that tamper-proof bait boxes be placed in underground runways inaccessible to wildlife. It is highly unlikely that the Utah prairie dog would be digging into these pocket gopher runways and thus obtaining the bait. It is, therefore, the Service's opinion that the use of chlorophacinone is not likely to jeopardize the continued existence of the Utah prairie dog.

Incidental Take - Because of the very low risk of exposure, no incidental take of the Utah prairie dog is anticipated and thus no take is authorized.

Eastern indigo snake - The eastern indigo snake would only be exposed to chlorophacinone by eating an animal such as a mouse or rat that had been poisoned by the rodenticide. Indigo snakes hunting for prey may occur in agricultural or non-crop areas where rodenticides are likely to be used. In Florida the rodenticide is used in non-crop areas for field mice and cotton rats. Although EPA has no toxicity data for reptiles, one study indicated that gopher snakes did not die from eating poisoned rodents but did regurgitate the poisoned prey. Other snakes however, may not regurgitate poisoned prey. The indigo snake's potential for exposure to poisoned prey is considered minimal. Therefore, it is the Service's opinion that the use of chlorophacinone is not likely to jeopardize the continued existence of the eastern indigo snake.

Incidental Take - Although the chance of exposure is considered minimal, because of the toxicity of chlorophacinone, it is still a matter of concern. Thus, the Service anticipates that an unquantifiable level of incidental take may occur as a result of this chemical's use in areas where the eastern indigo snake may occur.

Reasonable and Prudent Measure(s) - The following reasonable and prudent measure for minimizing incidental take should be adopted: conduct laboratory studies using surrogate snake species, such as the black racer (*Coluber c. priapus*), to obtain toxicity data on the chemical's secondary poisoning hazard to snakes. Based on the data generated by the studies, the Service will develop and revise the reasonable and prudent measures. (Because of the status and relatively broad geographic range of this species of indigo snake, the Service believes at this time that prohibiting the use of chlorophacinone within the species occupied habitat would not be reasonable and prudent).

Puerto Rican boa - The boa would only be exposed to chlorophacinone by eating an animal such as a mouse or rat that had been poisoned by the rodenticide. Boas hunting for prey may occur in agricultural or non-crop areas where rodenticides could be used. Although EPA has no toxicity

data for reptiles, one study indicated that gopher snakes did not die from eating poisoned rodents but did regurgitate the poisoned prey. Other snakes however, may not regurgitate poisoned prey. The boa's potential for exposure to poisoned prey is considered minimal because the snake usually hunts for prey in trees. Therefore, it is the Service's opinion that the use of chlorophacinone is not likely to jeopardize the continued existence of the Puerto Rican boa.

Incidental Take - Although the chance of exposure is considered minimal, because of the toxicity of chlorophacinone, it is still a matter of concern. Thus, the Service anticipates that an unquantifiable level of incidental take may occur as a result of this chemical's use in areas where the Puerto Rican boa may occur.

Reasonable and Prudent Measure(s) - The following reasonable and prudent measure for minimizing incidental take should be adopted: prohibit the use of the chemical within the known occupied habitat of the species.

Virgin Island tree boa - The boa would only be exposed to chlorophacinone by eating an animal such as a mouse or rat that had been poisoned by the rodenticide. Boas hunting for prey may occur in agricultural or non-crop areas where rodenticides could be used. Although EPA has no toxicity data for reptiles, one study indicated that gopher snakes did not die from eating poisoned rodents but did regurgitate the poisoned prey. Other snakes however, may not regurgitate poisoned prey. The boa's potential for exposure to poisoned prey is considered very minimal because the snake usually hunts for prey in trees. Therefore, it is the Service's opinion that the use of chlorophacinone is not likely to jeopardize the continued existence of the Virgin Islands tree boa.

Incidental Take - Although the chance of exposure is considered minimal, because of the toxicity of chlorophacinone, it is still a matter of concern. Thus, the Service anticipates that an unquantifiable level of incidental take may occur as a result of this chemical's use in areas where the boa may occur.

Reasonable and Prudent Measure(s) - The following reasonable and prudent measure for minimizing incidental take should be adopted: prohibit the use of the chemical within the known occupied habitat of the species.

Diphacinone

CHEMICAL INFORMATION

TYPE: Rodenticide (indandione)

FORMULATION: Used mainly in the form of a flavored and weather resistant bait; also in the form of a tracking powder (Ditrac), but this formulation is limited to indoor use only.

REGISTERED USES: Commensal and field rodent control in and around buildings, in orchards, cropland, pasture, rangeland, ornamentals, forest, rights-of-way, along ditches and banks of waterways, in garbage dumps and sewers. Existing label restrictions for diphacinone include Endangered Species Considerations for pocket gophers and black-footed ferrets within prairie dog towns and use restrictions within one mile of active dens of the San Joaquin kit fox in certain counties of California. In addition, this chemical has certain other state registration restrictions as follows-when formulated as a 0.2% tracking powder for nuisance bats in Georgia, Connecticut and Colorado. As a 0.2% powder, diphacinone can only be used in domiciles and other buildings and carries a specific warning against use in caves or natural areas. Diphacinone is also registered for control of mice and voles in orchards as a bait and in Delaware, Connecticut and in Arizona as a concentrate spray to bare ground. Furthermore, this chemical when formulated as a bait can be used to control chipmunks, jackrabbits and muskrats. For muskrats, the bait must be placed on a floating bait box designed and approved by the California Department of Food and Agriculture.

BACKGROUND:

Mode of action: An anticoagulant, diphacinone is in a class of rodenticides known as indandiones. Unlike the coumarin compounds, indandiones may cause symptoms and signs of neurologic and cardiopulmonary injury leading to death before hemorrhage occurs.

Aquatic toxicity: Diphacinone is very toxic to fish and other aquatic invertebrates and the use of ground liquid sprays poses a hazard to listed species if applied within or adjacent to their habitat where runoff or drift can occur. EPA (1991) data indicate LC₅₀s for technical grade chlorophacinone of 2.09, 2.82, 7.61, and >10 ppm for channel catfish, rainbow trout, bluegill sunfish, and pink shrimp, respectively. However, this applies only to Arizona, Connecticut and Delaware for ground sprays since Diphacinone will have no effect on listed aquatic species when used as a bait.

Terrestrial toxicity: Toxicity varies widely among the indandiones and among species, with some birds and mammals being highly sensitive and others fairly resistant. Massive single exposure or repeated low dosages may cause poisoning (Buck et al. 1982). Total dosage to death will be much lower in anticoagulants with repeated exposures over an extended period than in acute exposures, and the majority of mortalities will occur during or after the second week of exposure (Mendenhall and Pank 1980, Bennett et al.). Single dose toxicity may be 5-100 times the multiple dose toxicity, depending on species (Jones 1977). The amount of data describing toxicity of indandiones to terrestrial taxa varies, with pival being the least tested compound and diphacinone perhaps the most tested, and most toxic, compound.

EPA has determined diphacinone will have no effect on avian species due to direct ingestion of bait. However, data published by Mendenhall and Pank (1980) indicate that diphacinone may present hazards to raptors that consume poisoned rodents. They described trials whereby 3 great-horned owls and 1 saw-whet owl were fed mice (*Peromyscus maniculatus*) that had consumed a lethal diphacinone dose during a 10-day, free-choice test using an oat-groat 0.01% bait. All 4 owls showed signs consistent with anticoagulant poisoning, and 3 died from massive hemorrhaging during days 7-14.

In a second feeding study, barn owls were fed one of several anticoagulants including the indandiones diphacinone and chlorophacinone (Mendenhall and Pank 1980). Barn owls exposed to these compounds via treated rats did not die and received a higher maximum potential dose of diphacinone overall than did the other species. These findings suggest that barn owls may be less sensitive to indandiones than other raptors. However, sample sizes were small and interspecific differences in toxicity remain poorly quantified. Mendenhall and Pank (1980) noted that more severe effects may be expected under field conditions because of potential stress, changes in diet, increased activity, or high susceptibility to injuries.

For listed mammals, diphacinone poses a risk due to its use in a wide variety of locations. Large mammals [deer, antelope, bison] will not be affected if ingestion of baits occurs due to their large size. Further, listed bats will not be effected since the tracking powder is applied only inside of buildings. Because diphacinone has a 90 day half-life in soil, risks to secondary toxicity exists for predatory and scavenging mammals which feed on poisoned target animals. Also secondary poisoning may effect listed snakes where their habitat overlaps that of target species. The following table summarizes available acute oral toxicity data of diphacinone to mammals.

<u>Species</u>	<u>LD₅₀ (mg/kg)</u>	<u>Source</u>
rat	1.5	NIOSH (1990)
rat	1.86-2.88	Sine (1992)
dog	3	NIOSH (1990)
cat	15	NIOSH (1990)
rabbit	35	NIOSH (1990)
pig	150	NIOSH (1990)
mouse	340	NIOSH (1990)
deer mouse	0.49	EPA (1991)

Diphacinone acute oral toxicity tests with captive and free-ranging coyotes yielded an LD₅₀ of 0.6 mg/kg (CI = 0.3-1.2; Savarie 1979). These data indicate that coyotes are more sensitive to diphacinone than most other taxa tested.

Using EPA's approach of a safety factor of 1/10 of the LD₅₀ as a "risk threshold", and assuming an oral LD₅₀ of 15 mg/kg for cats, the risk threshold for diphacinone is 13.5 mg for a 9 kg ocelot, 10.5 mg for a 7 kg jaguarundi, and 21 mg for a 14 kg Florida panther.

Free choice exposure for five days in rats to be fed to owls (Mendenhall and Pank, 1980) resulted in maximum diphacinone consumption by rats of 11.69 mg. EPA did not provide field residue concentrations. However, it is clear that the risk thresholds could easily be approached with consumption of 1 or 2 poisoned prey.

Based on available toxicity data, the calculated risk thresholds will be even lower for canids than for felids. Assuming an oral LD₅₀ of 3 mg/kg for dogs is applicable to a 25 kg gray wolf, the risk threshold is 7.5 mg. If one uses the lower confidence interval for a coyote (0.3 mg/kg), then 0.75 mg is the threshold for a gray wolf. Stresses associated with life in the wild may increase susceptibility of wild species to toxicants over that of laboratory species. Therefore, the lower confidence interval for the coyote data may be a more realistic estimate of toxicity to wild canids than the LD₅₀ value. Consistent with use pattern and nature of chemical, diphacinone will have no direct or indirect impact on listed plants and/or plant pollinators considered in this consultation.

Wildlife incidents: Known deaths implicated by diphacinone: rabbits, raccoon, mountain lion and San Joaquin kit fox.

BIOLOGICAL OPINION

CHEMICAL REFERENCE TABLE

(The following table contains only those species for which the Service provided a jeopardy or no jeopardy call. Species not included in this list are either not affected by the chemical or have no chance for exposure. For a complete list of all species considered in this opinion, refer to the master species list on page III-1 of the species profile section.)

Species Name	J/NJ	PAGE
MAMMALS		
Alabama beach mouse	J	44
Amargosa vole	J	44
Anastasia Island beach mouse	J	45
Black-footed ferret	J	45
Carolina northern flying squirrel	J	46
Choctawhatchee beach mouse	J	44
Delmarva fox squirrel	NJ	55
Florida panther	J	47
Florida salt marsh vole	J	47
Fresno kangaroo rat	J	48
Giant kangaroo rat	J	48
Gray wolf	J	48
Grizzly bear	J	49
Hualapai Mexican vole	J	50
Jaguarundi	J	50
Key Largo cotton mouse	J	50
Key Largo woodrat	J	50
Louisiana black bear	J	51
Lower Keys rabbit	J	51
Morro Bay kangaroo rat	J	52
Ocelot	J	50
Perdido Key beach mouse	J	44
Point Arena mountain beaver	J	52
Salt marsh harvest mouse	J	52
San Joaquin kit fox	J	53
Silver rice rat	J	53
Southeastern beach mouse	J	45

Species Name	J/NJ	PAGE
Stephen's kangaroo rat	J	54
Tipton kangaroo rat	J	48
Utah prairie dog	J	54
BIRDS		
Audubon's crested caracara	J	54
REPTILES		
Eastern indigo snake	NJ	55
Puerto Rican boa	NJ	56
Virgin Islands tree boa	NJ	56

RATIONALE FOR JEOPARDY DETERMINATIONS

Alabama beach mouse, Choctawhatchee beach mouse, and Perdido Key beach mouse - Exposure of these beach mice to diphacinone could occur through consumption of poisoned baits when used within or in close proximity to their occupied habitats. All three subspecies are restricted to mature coastal barrier dune systems along the Gulf of Mexico and occur in areas that are being encroached upon by various types of human development. Therefore, there is a high possibility of diphacinone being used where these mice could come in contact with it. The Choctawhatchee beach mouse is presently known to occur only on Shell Island at St. Andrews Bay in Bay County, Florida, and on approximately 7.9 km of beach dune habitat (coastline up to 150 m inland) near Topsail Hill, from around Morrison Lake eastward to Stalworth Lake, Walton County, Florida. The Alabama beach mouse presently is surviving only on disjunct tracts of the sand dune system from Fort Morgan State Park to the Romar Beach area in Baldwin County, Alabama. The Perdido Key beach mouse occurs only on Perdido Key in Baldwin County, Alabama and Escambia County, Florida. The distance to which occupied habitat of these species extends inland from the beach varies depending upon the configuration of the sand dune system and the vegetation present. Both subspecies utilize portions of the frontal or primary dunes; interdunal areas; and dunes further inland (secondary or interior dunes). Because of the restricted distributions of these species, their limited populations and the likelihood of diphacinone being used for rodent control within or adjacent to areas which they inhabit, it is the Service's biological opinion that the registered use of diphacinone is likely to jeopardize the continued existence of the Choctawhatchee beach mouse, the Alabama beach mouse, and the Perdido Key beach mouse.

Reasonable and Prudent Alternative(s) - If implemented, the following reasonable and prudent alternatives would avoid jeopardy to the species: Prohibit use of diphacinone within 100 yards of occupied habitat of the Choctawhatchee beach mouse, the Alabama beach mouse, and the Perdido Key beach mouse.

Incidental Take - With implementation of the reasonable and prudent alternative to preclude jeopardy to these species, no incidental take is anticipated and therefore none is authorized.

Amargosa vole - The primary exposure of diphacinone from registered uses can occur when the Amargosa vole eat bait from bait boxes used for muskrat control. It is the Service's biological opinion that use of diphacinone is likely to jeopardize the continued existence of the Amargosa vole.

Reasonable and Prudent Alternative(s) - If implemented, the following reasonable and prudent alternatives would avoid jeopardy to the Amargosa vole: prohibit the use of diphacinone within 100 yards of the occupied habitat of the Amargosa vole.

Incidental Take - With implementation of the reasonable and prudent alternative described above, no incidental take is anticipated and therefore none is authorized.

Anastasia Island beach mouse and Southeastern beach mouse - These two beach mice are endemic to the east coast of Florida. The Anastasia Island beach mouse is presently believed to occur only on Anastasia Island, St. Johns County, Florida. The southeastern beach mouse is believed to presently occur only from Florida's Mosquito (Pounce) Inlet in Volusia County south to Hutchinson Island in St. Lucie County, Florida. Both subspecies inhabit sand dunes vegetated by sea oats and dune panic grass and the scrub adjoining these dunes, which is vegetated with oaks, sand pine, palmetto, sea grapes, and/or wax myrtle. It is likely that diphacinone could be used for pest control in areas where both these beach mice occur, since the ranges of both species have been and continue to be encroached upon by various types of human development. Exposure of the mice to diphacinone would occur through ingestion of poison baits, which would result in direct mortality of individuals of the species. Accordingly, it is the Service's biological opinion that the registered use of diphacinone is likely to jeopardize the continued existence of the Anastasia Island beach mouse or the southeastern beach mouse.

Reasonable and Prudent Alternative(s) - If implemented, the following reasonable and prudent alternatives would avoid jeopardy to the species: Prohibit use of diphacinone within and in close proximity (100 yards) to the current known range of the Anastasia Island beach mouse and the southeastern beach mouse.

Incidental Take - With implementation of the reasonable and prudent alternative to preclude jeopardy to these species, no incidental take is anticipated and therefore none is authorized.

Black-footed ferret - Diphacinone's registered uses include commensal and field rodent control (rats, mice, voles, gophers, ground squirrels) in and around buildings, orchards, cropland, pasture, rangeland, ornamentals, forest, rights-of-way, along ditches and banks of waterways, in garbage dumps, and sewers. Diphacinone is extremely toxic to mammals both directly and indirectly (secondary effects). The ferret likely would not be impacted directly. Known deaths implicated by this pesticide include rabbits, raccoon, mountain lion, and San Joaquin kit fox. Diphacinone could be used to kill rodents such as ground squirrels occurring near prairie dog towns inhabited by black-footed ferret. Mortality to the ferret would likely result if the ferret fed on the nearby ground squirrels or prairie dogs which also would likely feed on diphacinone bait. Therefore, it is the Service's opinion that the wide use of diphacinone is likely to jeopardize the continued existence of the black-footed ferret.

Reasonable and Prudent Alternative(s) - If implemented, the following reasonable and prudent alternatives would avoid jeopardy to the black-footed ferret: prohibit the use of diphacinone within 7 kilometers (4.34 miles) from a prairie dog town. The 7 kilometers is based on the longest distance that the ferret has been observed to travel during the night. Diphacinone bait may be used within the 7 kilometers provided:

1. A black-tailed prairie dog colony or complex of less than 80 acres having no neighboring prairie dog towns may be treated within the 7 kilometers without a ferret survey. A midrange of 102 acres (61 to 294) of occupied black-tailed prairie dog habitat is believed necessary to support a single ferret, so it is highly unlikely that a ferret would be found in an isolated colony of less than 80 acres.
2. A white-tailed prairie dog colony or complex of less than 200 acres having no neighboring prairie dog towns may be treated within the 7 kilometers without a ferret survey. It is estimated to require between 196 and 475 acres of white-tailed prairie dogs to support a single ferret.
3. Urban situations (e.g., playgrounds, golf courses, etc.) may be treated without conducting ferret surveys. The appropriate Service office will be contacted by the pesticide user in advance of any treatment to determine whether a proposed action fits this situation.
4. For black-tailed prairie dog colonies or complexes over 80 acres but less than 1,000 acres, and white-tailed prairie dog colonies or complexes over 200 acres but less than 1,000 acres, the use of diphacinone may be allowed within 7 kilometers after completing a black-footed ferret survey within 30 days of proposed use of diphacinone, provided no ferrets or their sign are found. These surveys will be coordinated with the appropriate State Office of the Fish and Wildlife Service.
5. For prairie dog complexes over 1,000 acres, diphacinone shall not be used within 7 kilometers until the complex has been evaluated by appropriate State and/or Federal Agencies (those agencies working on State working groups for ferret recovery) for its potential as a recovery site and until the complex has been block cleared. One thousand acres would be minimum complex size for consideration as a black-footed ferret reintroduction site and would likely require intensive management of habitat for a ferret population.

Surveys shall be supervised by biologists trained in ferret survey techniques and ferret biology at a Service-approved training workshop. Currently, only the University of Wyoming has such a course. Ferret surveys shall be reviewed by the Service for compliance with survey standards and Section 7 of the Endangered Species Act.

Incidental Take - With the implementation of the reasonable and prudent alternatives to preclude jeopardy of the black-footed ferret, no incidental take is anticipated and thus none is authorized.

Carolina northern flying squirrel - This species may be directly exposed to diphacinone poisoning from its registered use to control commensal and field rodents in and around agricultural buildings, forests and rights-of-way. The Carolina northern flying squirrel occurs in coniferous and northern hardwood forests, and may occasionally forage on the ground. Where land use changes, development, rights-of-way and forestry activities encroach on the species' habitat there is a potential risk of the squirrel coming in contact with diphacinone bait that is placed outside in such areas. Diphacinone bait formulated with apple, meat or peanut flavors would likely be very attractive and palatable to the squirrel. Diphacinone is toxic to rodents and would most likely kill

a northern flying squirrel if it consumed the bait. Due to the restricted range and small population of the Carolina northern flying squirrel, any poisoning of individuals could threaten the survival of the species. Therefore, it is the Service's opinion that the use of diphacinone is likely to jeopardize the continued existence of the Carolina northern flying squirrel.

Reasonable and Prudent Alternative(s) - If implemented, the following reasonable and prudent alternative would avoid jeopardy to the Carolina northern flying squirrel: prohibit the outdoor use of the chemical within the species' occupied habitat.

Incidental Take - With the implementation of the reasonable and prudent alternative to preclude jeopardy of the species, no incidental take is anticipated and therefore none is authorized.

Florida panther - The Florida panther may be exposed to diphacinone by feeding on rodents or other animals that are dead or incapacitated from this rodenticide poison. Exposure may also occur by ingestion of meat and fish flavored baits. Panthers venture into agricultural and other areas where this rodenticide is likely used and poisoned target animals would be found. This poison has been implicated in the deaths of raccoons, fox, rabbits, and mountain lion. Even if a panther ingested a sub-lethal dose of poison, rodenticide induced internal hemorrhaging could weaken a panther to the degree that the animal would be very susceptible to fatal disease or infections. Because of the critically small panther population, the loss of even one panther could threaten the survival of the species. Therefore, it is the Service's opinion that the use of diphacinone is likely to jeopardize the continued existence of the Florida panther.

Reasonable and Prudent Alternative(s) - If implemented, the following reasonable and prudent alternative would avoid jeopardy to the Florida panther: prohibit the use of the chemical within 20 miles of the boundary of any Federal and State lands (e.g., National Wildlife Refuge, National Park, National Preserve, State Park, State Preserve, State Wildlife Management Areas, etc.) and Indian Reservations that provide suitable panther habitat south of Charlotte, Glades and Martin counties, Florida.

Incidental Take - Because individuals of the species may disperse beyond a given home range, the use and toxicity of the pesticide is still a concern. Consequently the Service anticipates that an unquantifiable level of incidental take may occur as a result of the use of the pesticide outside of the prohibited use zone.

Reasonable and Prudent Measure(s) - The following reasonable and prudent measure for minimizing incidental take should be adopted and implemented: within an area extending 5 miles from the edge of the prohibited use zone, the user should remove and properly dispose of any dead or incapacitated animal likely to have been poisoned during the period of rodenticide use.

Florida salt marsh vole - Exposure of the vole to diphacinone could occur through consumption of poisoned baits used to control rodents in close proximity to the vole's occupied marsh habitat. There is a possibility of the rodenticide being used around buildings or other structures, banks of waterways, or along ditches, adjacent to salt marsh habitat where the vole could come in contact with it. The vole is restricted to a single known site in the salt marsh of Waccasassa Bay, Levy County, Florida. This rodenticide is highly toxic to mammals, and has been implicated in wildlife

kills. Because of the restricted distribution of the species, its limited population, and the likelihood of this rodenticide being used for rodent control adjacent to areas in which the vole occurs, it is the Service's biological opinion that the use of diphacinone is likely to jeopardize the continued existence of the Florida salt marsh vole.

Reasonable and Prudent Alternative(s) - If implemented, the following reasonable and prudent alternatives would avoid jeopardy to the species: Prohibit use of diphacinone within 100 yards of the landward edge of the species' salt marsh habitat in Levy County, Florida.

Incidental Take - With implementation of the reasonable and prudent alternative to preclude jeopardy to these species, no incidental take is anticipated and therefore none is authorized.

Fresno kangaroo rat, giant kangaroo rat, Tipton kangaroo rat - These species are highly susceptible to diphacinone exposure because of the wide variety of registered uses of this compound, and the high likelihood of such uses in and around kangaroo rat habitats in the San Joaquin Valley, California. The primary exposure risk for kangaroo rats would occur during diphacinone use to control field rodents, such as ground squirrels, pocket gophers, and deer mice. Kangaroo rats could encounter diphacinone during use within their habitats (e.g., grasslands, saltbush scrub, fallow agricultural lands); in agricultural lands adjacent to their habitats; in bait boxes or as spillage from bait boxes; and when broadcast on the ground or inadvertently applied to their burrows. Furthermore, some diphacinone formulations, such as grain pellets, could be highly attractive to kangaroo rats if encountered. Exposure also could occur during diphacinone use to control domestic rodents around agricultural buildings and industrial structures (e.g., in the Kern County oil fields), though these risks are considered less likely than field exposure. Because of these numerous exposure factors, the high toxicity of this compound to rodents, and the fact that these species occupy significantly restricted and fragmented habitats, it is the biological opinion of the Service that diphacinone use within the ranges of the Fresno kangaroo rat, giant kangaroo rat, and Tipton kangaroo rat is likely to jeopardize the continued existence of these species.

Reasonable and Prudent Alternative(s) - If implemented, the following reasonable and prudent alternatives would avoid jeopardy to the Fresno, giant, and Tipton kangaroo rat: Prohibit outdoor diphacinone use within 100 yards of the occupied habitats of these species, unless specific kangaroo rat protection programs for diphacinone use are implemented. Such programs shall integrate San Joaquin kit fox protection measures and shall be approved by the Service in writing.

Incidental take - If the reasonable and prudent alternatives described above are implemented, no incidental take of these species is anticipated and therefore none is authorized.

Gray wolf - Diphacinone's registered uses include commensal and field rodent control (rats, mice, voles, gophers, ground squirrels) in and around buildings, orchards, cropland, pasture, rangeland, ornamentals, forest, rights-of-way, along ditches and banks of waterways, in garbage dumps, and sewers. Diphacinone is extremely toxic to mammals both directly and indirectly (secondary effects). Diphacinone acute oral toxicity tests with captive and free-ranging coyotes indicate that

coyotes are more sensitive to diphacinone than most other taxa tested. The susceptibility of wild species may be greater than laboratory species because of the stress of life in the wild. EPA concluded that the size of the larger predators may preclude adverse effects because of their need to consume larger quantities of poisoned target animals. No information was given to backup those conclusions. In EPA's incident reports of fish and wildlife kills, they included rabbits, raccoon, mountain lion, and San Joaquin kit fox as being implicated as diphacinone caused deaths. EPA also suggests that the mortality of the mountain lion and raccoon were the result of illegal uses of the pesticide. Maximum application rates for ground or broadcast applications, e.g., orchards and other outdoor uses is 10 pounds of bait per acre. It would, therefore, appear that the use of diphacinone, especially when used on rangeland and forests, could result in mortality to the gray wolf as it has to other mammals. Thus, it is the Service's opinion that the use of diphacinone is likely to jeopardize the continued existence of the gray wolf.

Reasonable and Prudent Alternative(s) - If implemented, the following reasonable and prudent alternatives would avoid jeopardy to the gray wolf: prohibit the use of diphacinone in the geographic range of the gray wolf until after the user has contacted the local Fish and Wildlife Service and that office has determined that there are no known wolves in the general vicinity of where diphacinone is going to be applied.

Incidental Take - With the implementation of the reasonable and prudent alternatives to preclude jeopardy to the gray wolf, no incidental take is anticipated and thus none is authorized.

Grizzly bear - As stated for the gray wolf, EPA concluded that adverse impacts to the larger predators would be precluded because of their need to consume larger quantities of poisoned animals. This appears to conflict with the EPA incident reports of mortality to larger animals including raccoon, mountain lion, and the San Joaquin kit fox. However, EPA suggests that the mortality of the mountain lion and raccoon were the result of illegal uses of the pesticide. Data shows that canids are quite sensitive to diphacinone but no information is available on species the size of a grizzly bear, particularly as a result of secondary poisoning. Diphacinone's registered uses include commensal and field rodent control (rats, mice, voles, gophers, ground squirrels) in and around buildings, orchards, cropland, pasture, rangeland, ornamentals, forest, rights-of-way, along ditches and banks of waterways, in garbage dumps, and sewers. Grizzly bears are opportunistic feeders and could be found feeding in a number of the above habitats. Maximum application rates for ground or broadcast applications, e.g., orchard and other outdoor uses is 10 pounds of bait per acre. While some of the target animals could die underground and not be dug up by the grizzly bear, from the little information provided to the Service by EPA, it appears that the grizzly bear could be at substantial risk particularly by ground squirrel control. Therefore, it is the Service's opinion that the use of diphacinone is likely to jeopardize the continued existence of the grizzly bear.

Reasonable and Prudent Alternative(s) - If implemented, the following reasonable and prudent alternatives would avoid jeopardy to the grizzly bear: prohibit the application of diphacinone in the geographic range of the grizzly bear until after the user has contacted the local Fish and Wildlife Service office and that office has determined that there are no known grizzly bears in the general vicinity of where diphacinone is going to be applied.

Incidental Take - With the implementation of the reasonable and prudent alternatives to preclude jeopardy to the grizzly bear, no incidental take is anticipated and thus none is authorized.

Hualapai Mexican vole - The primary exposure of diphacinone to the Hualapai Mexican vole would be through its application to control ground squirrels in non-crop rights-of-way or recreational areas. Voles are one of a number of target organisms of diphacinone and also is highly toxic to small mammals. The likelihood that diphacinone would be used in the habitat of the vole is small but if it were used because of the very small number of known voles, the consequences would be severe. Therefore, it is the Service's biological opinion that the use of diphacinone is likely to jeopardize the continued existence of the Hualapai Mexican vole.

Reasonable and Prudent Alternative(s) - If implemented, the following reasonable and prudent alternatives would avoid jeopardy to the Hualapai Mexican vole: Prohibit the use of diphacinone within 100 yards of known Hualapai Mexican vole occupied habitat.

Incidental Take - With the implementation of the reasonable and prudent alternatives to preclude jeopardy of the species, no incidental take is anticipated and therefore none is authorized.

Jaguarundi and Ocelot - The primary exposure of diphacinone to the ocelot and jaguarundi is through its use to control field rodents in orchards, cropland, pasture, rangeland and ditch banks and rights-of-way. There is little probability of the ocelot or jaguarundi directly consuming the diphacinone baits, however it is probable that secondary poisoning may occur as a result of these species consuming target rodents that have ingested diphacinone. This chemical is used in areas that are adjacent to or interspersed with known ocelot and jaguarundi habitat. Therefore, it is the Service's opinion that the use of diphacinone is likely to jeopardize the continued existence of these species.

Reasonable and Prudent Alternative(s) - If implemented, the following reasonable and prudent alternative will avoid jeopardy to the ocelot and jaguarundi: Prohibit use within three miles of occupied habitat.

Incidental Take - Despite the implementation of the reasonable and prudent alternatives described above, the Service anticipates that an unquantifiable level of incidental take of ocelot and jaguarundi may occur as a result of diphacinone use within the range of these species.

Reasonable and Prudent Measure(s) - If implemented, the following reasonable and prudent measures will minimize incidental take: Prior to use of diphacinone in potential ocelot or jaguarundi habitat, conduct survey to determine if habitat is occupied. If habitat is unoccupied, no further restrictions are applicable. If habitat is occupied, prohibit use within three miles.

Key Largo cotton mouse and Key Largo woodrat - Both the Key Largo woodrat and Key Largo cotton mouse occur in subtropical, evergreen, hardwood forests on the northern half of Key Largo, Monroe County, Florida, north of the point where U.S. Highway 1 enters Key Largo. Populations of both species may also occur in similar habitat on Lignumvitae Key, Monroe

County, where the species were introduced in 1970. The Key Largo woodrat is primarily herbivorous, feeding mostly on buds, leaves, fruits, and seeds, but invertebrates occasionally are included in its diet. The diet of the Key Largo cotton mouse has not been documented, but it is believed to be very similar to that of the woodrat. The use of diphacinone baits within or adjacent to habitat of these two species is likely due the close proximity of various types of human development to the areas where these species occur. Exposure of the woodrat and cotton mouse to diphacinone would result in direct mortality of individuals of the species. The most likely means of exposure of the woodrat and the cotton mouse to diphacinone would be ingestion of the treated baits. Accordingly, it is the Service's biological opinion that the registered use of diphacinone is likely to jeopardize the continued existence of the Key Largo woodrat or Key Largo cotton mouse.

Reasonable and Prudent Alternative(s) - If implemented, the following reasonable and prudent alternatives would avoid jeopardy to the species: prohibit use of diphacinone within 100 yards of occupied habitat of the Key Largo woodrat and the Key Largo cotton mouse.

Incidental Take - With implementation of the reasonable and prudent alternative to preclude jeopardy to these species, no incidental take is anticipated and therefore none is authorized.

Louisiana black bear - The black bear may be exposed to diphacinone by feeding on rodents or other animals that are dead or incapacitated from this rodenticide poison. Exposure may also occur by ingestion of flavored baits. Bears venture into agricultural and other areas (e.g., along waterways, ditches, orchards, garbage dumps, and rights-of-way) where this rodenticide is likely used and where poisoned target animals and baits would be found. This poison has been implicated in the deaths of raccoons, fox, rabbits, and mountain lion. Even if a bear ingested a sub-lethal dose of poison, rodenticide induced internal hemorrhaging could weaken a bear to the degree that the animal would be very susceptible to fatal disease or infections. Because of the bear's small population and restricted range, mortality resulting from rodenticide poisoning could threaten the survival of the species. Therefore, it is the opinion of the Service that the use of diphacinone is likely to jeopardize the continued existence of the Louisiana black bear.

Reasonable and Prudent Alternative(s) - If implemented, the following reasonable and prudent alternative would avoid jeopardy to the Louisiana black bear: prohibit the use of the pesticide within the current known occupied habitat of the species.

Incidental Take - With the implementation of the reasonable and prudent alternative to preclude jeopardy of the species, no incidental take is anticipated and therefore none is authorized.

Lower Keys rabbit - The Lower Keys rabbit could be exposed to diphacinone when the rodenticide is used around buildings, rights-of-way, ditches, along waterways, and garbage dumps that are adjacent to the rabbit's marsh habitat. The rabbit is likely to forage in some treated areas. Continued rapid development in the lower Keys greatly increases the potential that the rabbit would come in contact with rodenticide treated areas. Broadcast applications of flavored baits would pose a serious threat to the species. Diphacinone has been implicated in the poisoning deaths of rabbits, raccoons, fox and mountain lions. This rodenticide would be lethal to

Lower Keys rabbits if it were ingested. Because of the extremely restricted range of the species and its small population, any rodenticide induced poisonings could threaten the survival of the species. Therefore, it is the opinion of the Service that the use of diphacinone is likely to jeopardize the continued existence of the Lower Keys rabbit.

Reasonable and Prudent Alternative(s) - If implemented, the following reasonable and prudent alternative would avoid jeopardy to the Lower Keys rabbit: prohibit the outdoors use of the chemical within 100 yards of the current known occupied habitat of the species.

Incidental Take - With the implementation of the reasonable and prudent alternative to preclude jeopardy of the species, no incidental take is anticipated and therefore none is authorized.

Morro Bay kangaroo rat - The primary exposure of diphacinone from registered uses can occur when the Morro Bay kangaroo rat ingests treated bait. The extremely limited range of this species, the presence of target rodents, and the interspersed habitat with urban, agricultural, and commercial buildings place the Morro Bay kangaroo rat at risk. It is the biological opinion of the Service that use of diphacinone is likely to jeopardize the continued existence of the Morro Bay kangaroo rat.

Reasonable and Prudent Alternative(s) - If implemented, the following reasonable and prudent alternative would avoid jeopardy to the Morro Bay kangaroo rat: prohibit the use of diphacinone within 100 yards of the occupied habitat of the Morro Bay kangaroo rat.

Incidental Take - With implementation of the reasonable and prudent alternative described above, no incidental take is anticipated and therefore none is authorized.

Point Arena mountain beaver, salt marsh harvest mouse - The primary risk of exposure of these species to diphacinone would occur during registered uses of this compound to control rodent pests within or adjacent to occupied habitats. Mountain beaver exposure to this compound might occur during control of most target species for which diphacinone is registered--both domestic and non-domestic--since this species occupies a variety of habitats within their coastal range in Mendocino County, California, including natural lands, disturbed sites, and some areas adjacent to residences. The harvest mouse is limited to remaining salt marshes in the San Francisco Bay area, where adjacent man-made structures may exist; therefore, exposure of this species to diphacinone primarily would occur during control of domestic rodents. Because of these exposure factors, and the fact that the Point Arena mountain beaver and salt marsh harvest mouse occupy highly restricted and fragmented habitats, it is the biological opinion of the Service that diphacinone use is likely to jeopardize the continued existence of these species.

Reasonable and Prudent Alternative(s) - If implemented, the following reasonable and prudent alternatives would avoid jeopardy to the salt marsh harvest mouse and Point Arena mountain beaver: prohibit outdoor diphacinone use within 100 yards of the occupied habitat of these species, unless specific salt marsh harvest mouse and Point Arena mountain beaver protection programs for diphacinone use, approved by the Service in writing, are implemented.

Incidental Take - If the reasonable and prudent alternatives described above are implemented, no incidental take of these species is anticipated and therefore none is authorized.

San Joaquin kit fox - The San Joaquin kit fox likely would be subject to diphacinone exposure during numerous registered uses of this compound to control a variety of rodent pests within and adjacent to occupied habitats in the San Joaquin Valley, California. The primary exposure risk for kit foxes would occur during control of field rodents, especially California ground squirrels; though control of domestic rodents around industrial, residential, and agricultural sites also poses an exposure risk. The most likely source of exposure is expected to be secondary poisoning should kit foxes feed on rodents killed or incapacitated by diphacinone exposure. However, kit foxes also may consume diphacinone baits directly (especially flavored pellets), and intensive rodent control programs utilizing diphacinone (as well as other compounds) may adversely affect kit foxes through depletion of prey species. Adverse effects of diphacinone use on the San Joaquin kit fox could be highly deleterious to this species for the following reasons: (1) diphacinone is extremely toxic to all mammals tested; (2) it is used in numerous areas occupied or frequented by kit foxes, including rangelands, agricultural areas, and the banks of aqueducts, canals, and levees; (3) the opportunistic feeding habits of kit foxes increase the likelihood of both primary and secondary poisoning; (4) serious localized effects of diphacinone use could occur in areas where the kit fox range is geographically restricted; (5) current diphacinone use restrictions are difficult to implement and enforce; and (6) at least one kit fox death resulting from diphacinone poisoning is known. For these reasons, it is the Service's biological opinion that diphacinone use within the range of the San Joaquin kit fox is likely to jeopardize the continued existence of this species.

Reasonable and Prudent Alternative(s) - If implemented, the following reasonable and prudent alternatives would avoid jeopardy to the San Joaquin kit fox: Prohibit diphacinone use within the kit fox range as determined by the U.S. Fish and Wildlife Service. Exceptions to this prohibition are as follows: (1) Agricultural areas that are one mile or more from any kit fox habitat. Such areas to be determined and mapped by the California Environmental Protection Agency in consultation with the Service, or to be determined by the Service; OR (2) Areas for which kit fox surveys have been conducted within a one mile radius of proposed treatment sites and have yielded negative results, provided such surveys are conducted by qualified individuals utilizing methods acceptable to the Service, and that such results are submitted for Service review and approval.

Incidental Take - Despite the reasonable and prudent alternatives described above, the Service anticipates that an unquantifiable level of incidental take of the San Joaquin kit fox may occur as a result of diphacinone use within the range of this species.

Reasonable and Prudent Measure(s) - To minimize anticipated incidental take, EPA must establish a monitoring enforcement program. The terms and conditions of such programs are outlined in the introduction section on page I-5.

Silver rice rat - The silver rice rat could be exposed to diphacinone when the rodenticide is used (for control of black and Norway rats, and house mice) around buildings, rights-of-way, ditches, along waterways, and garbage dumps that are adjacent to the rat's wetland habitat. The rat is likely to forage in some treated areas. Continued rapid development in the lower Keys greatly

increases the potential that the rat would come in contact with rodenticide treated areas. Broadcast applications of flavored baits would pose a serious threat to the species. Diphacinone has been implicated in the poisoning deaths of rabbits, raccoons, fox and mountain lions. This rodenticide would be lethal to silver rice rats if it were ingested. Because of the extremely restricted range of the species and its small population, any rodenticide induced poisonings could threaten the survival of the species. Therefore, it is the opinion of the Service that the use of diphacinone is likely to jeopardize the continued existence of the silver rice rat.

Reasonable and Prudent Alternative(s) - If implemented, the following reasonable and prudent alternative would avoid jeopardy to the silver rice rat: prohibit the outdoors use of the chemical within 100 yards of the current known occupied habitat of the species.

Incidental Take - With the implementation of the reasonable and prudent alternative to preclude jeopardy of the species, no incidental take is anticipated and therefore none is authorized.

Stephen's kangaroo rat - The primary exposure of the Stephen's kangaroo rat to diphacinone is the ingestion of the many bait formulations. It is the biological opinion of the Service that use of diphacinone is likely to jeopardize the continued existence of the Stephen's kangaroo rat.

Reasonable and Prudent Alternative(s) - If implemented, the following reasonable and prudent alternative would avoid jeopardy to the Stephen's kangaroo rat: prohibit the use of diphacinone within 100 yards of the occupied habitat of this species.

Incidental Take - With implementation of the reasonable and prudent alternative described above, no incidental take is anticipated and therefore none is authorized.

Utah prairie dog - Diphacinone is registered for use to control commensal and field rodents (rats, mice, voles, gophers, ground squirrels) in and around buildings, orchards, cropland, pasture, rangeland, ornamentals, forest, rights-of-way, along ditches and banks of waterways, in garbage dumps, and sewers. Diphacinone is extremely toxic to mammals and its use to control any of the above species in croplands, pastures, or rangeland in and adjacent to Utah prairie dog colonies would result in the loss of these threatened species. It is, therefore, the Service's opinion that the wide use of diphacinone is likely to jeopardize the continued existence of the Utah prairie dog.

Reasonable and Prudent Alternative(s) - If implemented, the following reasonable and prudent alternatives would avoid jeopardy to the Utah prairie dog: prohibit the application of bait of diphacinone within 100 yards of occupied habitat of the Utah prairie dog.

Incidental Take - With the implementation of the reasonable and prudent alternatives to preclude jeopardy to the Utah prairie dog, no incidental take is anticipated and thus none is authorized.

Audubon's crested caracara - Audubon's crested caracara would be exposed to diphacinone by secondary poisoning from consuming contaminated rodents. Caracaras feed both on carrion and live prey. Studies document secondary poisoning of raptors that were fed diphacinone contaminated rodents. Diphacinone is registered for use in pastures and rangeland. Caracaras

occur in open prairies and frequently use improved pastures. Since it takes several days for death to occur from diphacinone ingestion, it is conceivable that poisoned rodents may travel away from the baited area to die. Because of the caracara's small population size, any rodenticide induced mortality could threaten the survival of the species. Therefore, it is the Service's opinion that the use of diphacinone is likely to jeopardize the continued existence of the Audubon's crested caracara.

Reasonable and Prudent Alternative(s) - If implemented, the following reasonable and prudent alternative would avoid jeopardy to the Audubon's crested caracara: prohibit the use of the pesticide within the occupied habitat of the species.

Incidental Take - With the implementation of the reasonable and prudent alternative to preclude jeopardy of the species, no incidental take is anticipated and therefore none is authorized.

RATIONALE FOR NO JEOPARDY DETERMINATIONS

Delmarva Fox Squirrel - Diphacinone is extremely toxic to mammals and the registered uses for outdoor rodent control could result in exposure and incidental consumption by Delmarva fox squirrels, possibly causing death.

Incidental Take - The Service estimates that no more than two squirrels per year may succumb to diphacinone poisoning.

Reasonable and Prudent Measure(s) - To minimize incidental take, the Service recommends that any diphacinone used within the range of the Delmarva fox squirrel should be placed in bait boxes small enough to exclude fox squirrels.

Eastern indigo snake - The eastern indigo snake would only be exposed to diphacinone by eating an animal such as a mouse or rat that had been poisoned by the rodenticide. Indigo snakes hunting for prey may occur in agricultural or non-crop areas where rodenticides are likely to be used. Although EPA has no toxicity data for reptiles, avian toxicity data may be applicable to reptiles. Compared to mammals, birds are not very sensitive to anticoagulants, and the reptile blood clotting process is similar to that of birds. Therefore, exposure to the anticoagulant by ingestion of a poisoned rodent may not pose a significant hazard to snakes. The indigo snake's potential for exposure to poisoned prey is expected to be minimal. Therefore, it is the Service's opinion that the use of diphacinone is not likely to jeopardize the continued existence of the eastern indigo snake.

Incidental Take - Although the chance of exposure is considered minimal, the undocumented toxicity of diphacinone to reptiles is still a matter of concern. Thus, the Service anticipates that an unquantifiable level of incidental take may occur as a result of this chemical's use in areas where the eastern indigo snake may occur.

Reasonable and Prudent Measure(s) - The following reasonable and prudent measure for minimizing incidental take should be adopted: conduct laboratory studies using surrogate snake species, such as the black racer (*Coluber c. priapus*), to obtain toxicity data on the

chemical's secondary poisoning hazard to snakes. Based on the data generated by the studies, the Service will develop and revise the reasonable and prudent measures. (Because of the status and relatively broad geographic range of this species of indigo snake, the Service believes at this time that prohibiting the use of diphacinone within the species' occupied habitat would not be reasonable and prudent).

Puerto Rican boa - The boa would only be exposed to diphacinone by eating an animal such as a mouse or rat that had been poisoned by the rodenticide. Boas hunting for prey may occur in agricultural or non-crop areas where rodenticides are likely to be used. Although EPA has no toxicity data for reptiles, avian toxicity data may be applicable to reptiles. Compared to mammals, birds are not very sensitive to anticoagulants, and the reptile blood clotting process is similar to that of birds. Therefore, exposure to the anticoagulant by ingestion of a poisoned rodent may not pose a significant hazard to snakes. The snake's potential for exposure to poisoned prey is expected to be minimal. Therefore, it is the Service's opinion that the use of diphacinone is not likely to jeopardize the continued existence of the Puerto Rican boa.

Incidental Take - Although the chance of exposure is considered minimal, the undocumented toxicity of diphacinone to reptiles is still a matter of concern. Thus, the Service anticipates that an unquantifiable level of incidental take may occur as a result of this chemical's use in areas where the Puerto Rican boa may occur.

Reasonable and Prudent Measure(s) - The following reasonable and prudent measure for minimizing incidental take should be adopted: prohibit the use of the chemical in the known occupied habitat of the species.

Virgin Islands tree boa - The boa would only be exposed to diphacinone by eating an animal such as a mouse or rat that had been poisoned by the rodenticide. Boas hunting for prey may occur in agricultural or non-crop areas where rodenticides are likely to be used. Although EPA has no toxicity data for reptiles, avian toxicity data may be applicable to reptiles. Compared to mammals, birds are not very sensitive to anticoagulants, and the reptile blood clotting process is similar to that of birds. Therefore, exposure to the anticoagulant by ingestion of a poisoned rodent may not pose a significant hazard to snakes. The snake's potential for exposure to poisoned prey is expected to be minimal. Therefore, it is the Service's opinion that the use of diphacinone is not likely to jeopardize the continued existence of the Virgin Island tree boa.

Incidental Take - Although the chance of exposure is considered minimal, the undocumented toxicity of diphacinone to reptiles is still a matter of concern. Thus, the Service anticipates that an unquantifiable level of incidental take may occur as a result of this chemical's use in areas where the Virgin Island tree boa may occur.

Reasonable and Prudent Measure(s) - The following reasonable and prudent measure for minimizing incidental take should be adopted: prohibit the use of the chemical within the known occupied habitat of the species.

Methyl bromide

CHEMICAL INFORMATION

TYPE: Rodenticide, fungicide, herbicide, insecticide, acaricide, nematicide.

FORMULATION: Gas or liquid fumigant

REGISTERED USES: Used as a soil fumigant on a variety of field, fruit and vegetable crops. Also used for manure, mulch and compost fumigation, stored commodities (both raw agricultural commodities and processed foods and feeds), greenhouses, homes, grain elevators, milk, ships, transportation vehicles.

BACKGROUND:

Mode of action: Inhalation or exposure to vapors.

Toxicity levels: Moderately to highly toxic based on toxicity to laboratory rats. No data are available on toxicity to nontarget organisms.

Wildlife incidents: None reported.

BIOLOGICAL OPINION

Methyl bromide as currently registered, is not anticipated to impact any federally listed threatened or endangered species. Therefore, it is the Service's opinion that if methyl bromide is applied according to label directions, for the above registered uses, there will be no effect on listed species.