105001
SHAUGHNESSY NO.

#27
REVIEW NO.

JB

EEB BRANCH REVIEW

DATE: IN 3/20/85 OUT 5/23/85

FILE OR REG. NO. 241-238

PETITION OR EXP. PERMIT NO.

DATE OF SUBMISSION 2-27-85

DATE RECEIVED BY HED 3-19-85

RD REQUESTED COMPLETION DATE 6/7/85

EEB ESTIMATED COMPLETION DATE 5/31/85

RD ACTION CODE/TYPE OF REVIEW 336/Amendment

TYPE PRODUCT(S): I, D, H, F, N, R, S Insecticide/Nematicide

DATA ACCESSION NO(S). 256982

PRODUCT MANAGER NO. W. Miller (16)

PRODUCT NAME(S) Counter

COMPANY NAME American Cyanamid Company

SUBMISSION PURPOSE Submission of data in response to Reregistration Standard (submission of field study) and submission of field data and request to add "broadcast" ground and aerial applications to corn.

SHAUGHNESSY NO.	CHEMICAL & FORMULATION	% A.I.
105001	Terbufos	15

52 pages

100.0 Pesticide Label Information

100.1 Pesticide Use:

It is proposed to amend the existing label for COUNTER 15G with supplemental labeling to permit aerial application (or ground application, without incorporation, over the plants) postemergence on field corn. At present, application is at planting in spring and/or postemergence in late spring by ground equipment only, to the soil, with incorporation and/or press-wheel implanting.

100.2 Formulation Information

Terbufos (S-[[1,1-dimethylethyl) thio] methyl] 0,0-diethyl phosphorodithioate)	15%
Inerts	85%

100.3 Application Methods, Directions, Rates

Supplemental labeling has been submitted as follows:

EPA Reg. No. 241-238

FOR USE IN FIELD CORN ONLY

DIRECTIONS FOR USE

It is a violation of Federal Law to use this product in a manner inconsistent with its labeling.

BEFORE USING, READ PRECAUTIONARY STATEMENTS ON THE EPA REGISTERED LABEL.

Crop	Pests Controlled	Rate of COUNTER 15G	Application	Remarks
FIELD CORN (excluding sweet, pop and seed corn) Post-emergence	European corn borer (1st or 2nd generation) Spider mites	6.7 lbs. per acre (minimum 30-inch row spacing)	Broadcast granules over the top of the plants by ground or air equipment prior to denting.	Limit to 2 applications, or a single application if more than 8 oz/1,000 ft of row were used at planting or if a cultivation time application was also used. DO NOT apply if a postemergence incorporated treatment was used. DO NOT graze, cut forage or harvest for grain within 45 days of treatment. DO NOT enter field until 3 days post treatment. Consult your state experiment station, state extension service, or pest management consultant for proper timing of application.

(See attached full label for existing registered uses).

100.4 Target Organisms:

See Section 100.3.

100.5 Precautionary Labeling:
(appears on existing label accepted by EPA September 20, 1982).

ENVIRONMENTAL HAZARDS

This product is toxic to fish, birds and other wildlife. Treated granules exposed on soil surface may be hazardous to birds and other wildlife. Keep out of any body of water. Do not apply where runoff is likely to occur. Do not contaminate water by cleaning of equipment or disposal of wastes.

101.0 Hazard Assessment

101.1 Discussion:

This review contains hazard assessments for "at planting" soil incorporate applications covered in the published Reregistration Guidance of June 1983, and postemergence broadcast (over the crop) applications (ground and aerial).

Because certain aquatic testing requirements remain unfulfilled, a completed hazard assessment for aquatic organisms cannot be made at this time for the incremental uses such as the aerial broadcast applications on corn. The hazard assessment for currently registered uses under the Reregistration Standard also cannot be completed at this time because of the aquatic data gaps (chronic studies and "reserved" aquatic field study, and aquatic monitoring).

Terbufos is a soil insecticide/nematicide presently registered in a 15 percent ai granular form for use on corn, sugar beets, and sorghum. Maximum application rates are 2.4 oz ai/1000 feet of row for corn and sorghum and 1.35 oz ai/1000 feet of row for sugar beets. Terbufos is applied using ground equipment. [redacted]

Corn is presently the major terbufos use. 9.3 million pounds of terbufos were applied to corn in 1980, 25.5 percent of all insecticide used on this crop (Eichers and Serletis 1982). This makes terbufos the most heavily used corn insecticide in the U.S. Corn rootworm is the principal pest for which terbufos is used. Application is at planting in spring and/or postemergence in late spring or early summer. Planting in the corn belt is at its peak around the middle of May. One to two applications are applied to corn fields that have been planted to corn for more than one season. Granules are applied by a band or an in-furrow application. Incorporation is light, to a maximum of two inches. With a band application, granules are pressed into the soil. Additional incorporation may

or may not be made with the use of drag chains, tines, or other device. The minimum row width specified by the label (May 13, 1982) is 20 inches. The maximum row spacing generally used with corn is 48 inches with an average of 35 to 39 inches (Thomas 1982).

Terrestrial organisms can be exposed to terbufos directly via the granules. Aquatic organisms may be exposed via runoff of the granules or via transport of soil or water containing residues of terbufos or its degradates.

Since corn is by far the principal currently-registered terbufos use, application to this crop can be used to estimate nontarget hazard. The maximum application rate of 2.4 oz ai/1000 feet of row is equivalent to 3.92 lb ai/acre at the minimum permitted row spacing (20"), 1.64 lb ai/acre at the maximum spacing generally used (48"), and 2.24 to 2.01 lb ai/acre at a "typical" spacing (35 to 39").

Granule weight estimates made by R. Balcomb of EEB indicate that there are approximately 4 million terbufos granules/lb of formulated product. Each granule thus weighs approximately 0.1 mg. At 15 percent ai, each granule would contain approximately 0.015 mg active ingredient. With an LD_{50} of 28.6 mg ai/kg (bobwhite quail), it would take approximately 0.4 mg ai, or about 27 granules, to reach the LD_{50} of a small bird such as a field sparrow or grasshopper sparrow (0.0139 kg), if such a bird had the same sensitivity to terbufos as the bobwhite quail. However, in toxicity screening studies by R. Balcomb, using the formulated product (COUNTER™ 15G), it was found that 10 granules were sufficient to kill all five redwinged blackbirds given this dose. Doses of one and five granules did not kill any of the blackbirds and a dose of 20 granules killed four of the five blackbirds receiving this dose. Doses of one and five granules did not kill any of the house sparrows tested and 10 granules killed two of the five birds receiving this dose.

The above results suggest that an approximate LD_{50} for the redwinged blackbird is likely >5 and <10 granules, or > 0.075 and <0.15 mg terbufos. With a red-winged blackbird weight of approximately 0.07 kg, the LD_{50} would be >1.1 and <2.1 mg ai/kg body weight. Since only granules were tested, it is not clear whether the increased toxicity compared to the 28.6 mg/kg value for bobwhite quail (>13X) is due to differences in sensitivity between the two test species or increased toxicity of the formulation, or both.

5

Tentative USFWS results (Elwood F. Hill of the USFWS Patuxent Wildlife Research Center) indicate that technical terbufos has an LD_{50} of 15 (12 to 19) mg/kg and COUNTER 15G has an LD_{50} of 26 (20 to 34) mg/kg, based on active ingredient, for the bobwhite quail. Since the granules were actually less toxic on an ai basis, it appears that the red-winged blackbird results above reflect a greater sensitivity of the species.

Results of a terrestrial field study cited in the ecological effects profile did not indicate any substantial acute effects. However, the application rate was near the present minimum label rate for corn; pre and post-application census data were not taken; searches for dead animals were limited (one per site) and were taken as late as 12 to 13 days posttreatment; and no analyses for cholinesterase inhibition were made. The pen study cited indicated minimal hazard to the species tested (ring-necked pheasant) at up to 5 lb ai/acre, but exposure to COUNTER™ 15G was principally dermal since clean food and water were provided at all times.

When a granular pesticide is applied in front of the planter press wheel, as is done with terbufos (EPA Index 1982), approximately 7.9 percent of applied granules can be expected on the soil surface following incorporation with a drag chain, 5.8 percent incorporation by spring tine, and 14.7 percent without incorporation other than the press wheel (EEB chapter of terbufos Registration Standard; Erbach and Tollefson unpublished). With terbufos applications from 1.6 to 3.92 lb ai/acre depending on row spacing (at 2.4 oz ai/1000 ft of row), there would be 16.7 or 40.8 mg ai/sq ft applied. This is equivalent to 1113 to 2720 granules/sq ft (0.015 mg ai/granule). An average of 9.5 percent of these on the surface would be 106 to 258 granules/sq ft, well over the number needed to achieve an LD_{50} for small birds. Turn rows may get substantially more granules on the surface. The label specifies that these are to be covered by deep discing. Granules could be ingested intentionally by birds as grit, or inadvertently while foraging for insects, seeds, or other food items. Granules could also be stuck to the outer surface of avian prey items such as worms and be ingested in this manner. Residues could also be present within live and/or dead invertebrate or plant food items of birds. In turn, residues within small birds or mammals would be available to larger birds of prey. Because of the relatively low bioaccumulation potential of terbufos, this availability to birds of prey would likely be a temporary phenomenon. However, it could be a frequently repeated one and as such may pose a hazard to these birds; terbufos is up to 17.9X more toxic to small mammals than to birds.

The proposed amendment to allow broadcast applications by ground or air will not increase the number of applications permitted (two), nor increase the application rate (1 lb ai/acre is proposed for aerial or ground broadcast application, less than the maximum possible under existing ground application). However, with aerial application there is a greater application to field borders than with ground application, increasing exposure of nontarget wildlife. Moreover, all existing terbufos registrations involve some form of incorporation or press wheel implanting whereas the proposed amendment strickly involves broadcast application, whether ground or aerial.

The proposed amendment poses a clear potential for increased exposure of terrestrial wildlife. Available data (Erbach and Tollefson, unpublished) indicate an average of 9.5 percent of applied granulars on the soil surface with various forms of incorporation and press wheel implanting when a granular pesticide is applied in front of the planter press wheel, as is done with terbufos (EPA Index 1982). With the proposed applications, there would be no incorporation/implanting at all, likely resulting in a greater number of granules on the ground surface. This clearly increases exposure of terrestrial wildlife. It also increases the potential for runoff to water bodies.

The registrant claimed that "most of the material is trapped by the corn foliage and not available to birds that may be foraging in the fields nor as runoff to aquatic life." However, no justification was provided for this claim. The proposed supplemental labeling permits application any time postemergence prior to "denting." Denting occurs late in the growing season, shortly before maturity and approximately 4 months after planting (Charles Lewis, EEB, personal communication). Hence, applications could be made well before plants were big enough to intercept a sizeable portion of the applied material. Rain could also wash the granules (on the corn) to the ground. It appears that far more than 9.5 percent of applied granules would be on the soil surface. Also, birds (particularly foliage-gleaners) may be exposed to granules stuck in/on the standing corn plants (or insects on the plants). In addition, any granules persisting in corn foliage would appear to be available to waterfowl and other birds using harvested corn fields when this foliage is laying on the ground.

Results of a terrestrial field study in corn (Dingledine 1985) required under the Reregistration Guidance have been received and reviewed by EEB (May 1985). This study was conducted under actual use conditions in

corn. The study was divided into two (2) phases: (1) ground application at planting, soil incorporated or wheel press to fulfill the requirements for existing registrations under the June 1983 Registration Standard guidance; (2) aerial, broadcast postemergence and prior to "denting" - to support an incremental risk assessment of a proposed addition of this use to the registered label, i.e, an amendment to the June 1983 "Standard".

In its review of Dingledine's 1985 field study in corn, EEB reached the following conclusions regarding the use of Counter 15G on corn:

> The study demonstrated, through a systematic quantitative approach, that terbufos 15 percent ai granular pesticide (Counter 15G), when used as directed on registered and proposed labels for treatment of corn fields, causes substantial mortality of nontarget vertebrates including mammals, birds (particularly Passeriformes) and reptiles. The study conclusively demonstrated substantial potential for exposure to terbufos of nontarget wildlife through both soil incorporation, and particularly through unincorporated aerially broadcast methods of application....

The EEB review of the study concluded that because of its simple design, the study addressed only acute mortality of birds and mammals within a short distance of treatment sites. EEB also concluded that the study "could not conclusively make any determination regarding an adequate margin of safety for populations..." and that the study was specifically not a "population effects" or ecosystem study because important parameters such as size, sex and year class distributions, breeding condition, nesting territorial and other behaviors were not or minimally addressed. Also, because of the design, the study did not address secondary mortality potential for raptors or other predators of birds and small mammals (including snakes) because of the limited extent of the mortality search. The experiment strictly studied acute mortality on site. EEB had previously expressed concern that birds of prey may be subject to secondary poisoning. The small mammals killed in this field study showed high levels of terbufos residue. If birds of prey were repeatedly feeding on dead, weak or affected birds, mammals or snakes, they could receive a lethal dose in a relatively short timeframe.

101.2 Liklihood of Adverse Effects to Nontarget Organisms:

Ground Phase - Soil incorporated Counter 15G/Corn.

According to the Dingledine (1985) field study ground application, soil incorporated phase tested on 30" center corn (2 lb. a.i./A), demonstrated potential for acute mortalities of birds and reptiles. No mammal carcasses were found. The 1980 estimated use of terbufos on corn was on 9,300,000 acres (see Registration Standard for EEB chapter). The resultant mortality of birds and reptiles could be on an order of magnitude perhaps reaching millions of these organisms. The registered label also allows corn treatments on 20" centers (30" centers were tested). These treatments are expected to result in even higher mortalities because the effect is to almost double the lbs. a.i./A applied on 30" centers.

Gussey and Maturgo (1972) reported the results of surveys of some state game agencies regarding Wildlife Utilization of Cropland. Following this incomplete listing, EEB has assembled a partial listing of birds and mammals which have been particularly noted for feeding in corn fields specifically on some part of corn plants. This list does not include predators of animals observed feeding in corn fields, hence, no raptors (or snakes) appear on the list, although eagles, vultures and hawks would be primary candidates for secondary terbufos poisoning because of the great likelihood that they will prey on contaminated small mammals and birds. N.B. Piscivorous eagles such as the Bald eagle could prey on contaminated fish, which were also found (twice) in Dingledine's (1985) corn field study.

Partial Listing of Birds and Mammals at Risk of Mortality by Feeding in Corn Fields in Spring, After "At Planting" Applications of Granular Pesticides

Birds

*Mourning dove	- Eastern and Prairie states and particularly in Missouri, where extensive use of corn has been identified.
Sandhill crane	- in Western states.
Hungarian partridge	- N.E. and N. prairies
*Reeves pheasant	- Missouri

Birds (Cont'd)

*Ring-necked pheasant	- Northeast, Mid Atlantic, and Montana
(ES) Attwater's Prairie chicken	- Texas
Greater Prairie chicken	- Northern prairies
California Valley quail	- Nevada
Wild turkey	- Virginia, Georgia
*Brewer's blackbird	- Western states
*Redwing blackbird	- Northeast, Southeast
*Yellow-headed blackbird	- Western States
*Cardinal	- Southern Prairie
*Cowbird	- Western states
*Common crow	- East, Prairie, and Pacific Coast
Fish Crow	- Atlantic Coast
*Boat-tailed grackle	- Southeast
*Common grackle	- East and Prairie
*Blue grosbeak	- N. Prairie, Southwest
*Rose-breasted grosbeak	- Northeast and N. Prairie
*Blue jay	- East. and Gulf states
*Horned lark	- Eastern states
White-breasted nuthatch	- Eastern states
*Raven, American	- Mountain-desert and Pacific
Raven, white-necked	- Texas
Robin	- Southeast
Sparrow, *House	- This study
Sparrow, *Chipping	- This study

Birds (Cont'd)

Sparrow, *English	- Prairie, East, Pacific
Sparrow, Harris	- E. prairie
Sparrow, Lincoln	- E. prairie
Sparrow, White-throated	- Northeast
*Brown Thrasher	- Northeast, Southeast
*Red-eyed Towhee	- Eastern States
Red-bellied Woodpecker	- Eastern States

Mammals

*Fox Squirrel (ES)	- Northeast, Ohio & Michigan
*Common Mole	- Eastern states

* = both spring and summer exposures.

ES = Endangered Species involved.

When applications are made "at-planting" the immature corn crop obviously does not provide good cover for mammals and they do not generally use the tilled area of the crop except those species which use the open field for feeding. However, birds extensively use the open fields and are very much more subject to exposure and poisoning early in the spring.

As the crop matures more species will utilize the tilled portion of the field; e.g., bobwhite quail will extensively use the fields for cover, feeding, nesting and brood rearing. Mammals such as rabbits (Sylvilagus spp.) will use the maturing crop for feeding, cover and loafing in early spring. Likewise, wild turkeys, raccoons, squirrels, opossum, white-tailed deer, as well as all manner of upland game birds and water fowl will visit a maturing crop in spring (Gussey and Matthrgo, 1972). This includes such unexpected corn feeders as muskrat, nutria, beaver and woodchuck. Even Mule deer have also been known to feed in a spring corn crop and use the later season mature crop for cover, brood-rearing and loafing (South Dakota reports from Dept. of Game, Fish and Parks).

Many of the mammal species mentioned above were observed in the 1985 Maryland field study by Dingledine. However, no mammal carcasses were found during the spring "at-planting" phase of the study. EEB assumes that mammals

could be killed,however,by later postemergence applications, as corn field use by the above species increases at the time of postemergence applications. (These are currently registered applications but were not tested.)

Aerial Phase OR Broadcast (ground or aerial applications) -

This section is an Incremental Risk Assessment of adding the proposed supplemental labeling for BROADCAST applications - particularly aerial. The incremental risk assessment is divided into terrestrial and aquatic sections as both risks apply in this case.

Terrestrial Hazard -

The Dingledine (1985) field study of aerial or "broadcast" applications clearly and conclusively demonstrated an extreme increase in exposure, mortality and associated whole-body residues of terbufos in vertebrates, relative to these parameters as observed in the ground phase application. This aerial broadcast application (15G granules at 6.7 lbs per acre) at a late stage in the crop development) exposed and killed small and medium-sized mammals as well as passerine birds, reptiles, and fish. These data were especially strong on the demonstration of mammalian exposure and sensitivity, which, previous to this study, had only been predicted by laboratory studies. The registrant's claim of the crop foliage "capturing" the granules - thus conferring safety - was completely refuted.

The residue studies of vertebrates killed in the field conclusively demonstrated a high degree of exposure to terbufos.

It was also observed that if rainfall occurs immediately upon application some mortalities may be avoided (but fields still remained hazardous in this study).

EEB believes, given the conditions of the test, the limitations of the methods, and other factors, such as predators, scavenging, circumstantial evidence of non-specific mortality, and no control fields, that the study cannot be used to adequately estimate population effects in large-scale corn plantings. However, vertebrate mortality resulting from "broadcast" applications (excluding fish) of terbufos use on 9.3×10^6 acres (1980 use) could be on an order of magnitude reaching millions of these organisms.

The following partial list of species feeding on some part of the corn crop in summer (prior to "denting") was assembled from Gussey & Maturgo (1972) - does not include predators/raptors.

13

Partial Listing of Birds and Mammals at Risk of Mortality by Feeding in Corn Fields in Summer, Prior to "Denting" of Corn, Following BROADCAST Applications of Granular Pesticides

Birds

* Mourning dove	- Eastern and Prairie states, Illinois and Missouri
Eastern white-winged dove	- Texas
* Reeves pheasant	- Missouri
* Ring-necked pheasant	- Northeast, Mid Atlantic, Montana, Northwest
* Greater prairie chicken	- Northern prairies.
* Bobwhite quail	- Mid-Atlantic and Southeast
* Brewer's blackbird	- Califiornia
* Redwing blackbird	- Northeast, Southeast and Prairie
Yellow-headed blackbird	- West
* Cardinal	- Eastern states, Southern Prairie
* Cowbird	- Northeast, Western states
* Common crow	- East, Prairie, and Pacific
Red-shafted flicker	- California
* Boat-tailed grackle	- Southeast
* Common grackle	- Prairie and East
* Blue grosbeak	- N. Prairie, Southwest
Eastern bluebird	- see Dingledine (1985) study
* Rose-breasted grosbeak	- Northeast & N. Prairie
* Blue jay	- East
Scrub jay	- California

Birds (Cont'd)

Pinon Jay	- Mt., Desert states
*Horned lark	- West (excl. Calif.)
*American raven	- Mountain, Desert states and Pacific
Sparrow, *House	- see Dingledine 1985 study
Sparrow, *Chipping	- " " " "
Sparrow, *English	- Pacific
*Brown Thrasher	- Northeast, E. Prairie
*Red-eyed Towhee	- Northeast, Southeast
Ant-eating Woodpecker	- California
Indigo bunting	- see Dingledine 1985 study

Mammals

Red Fox	- Alabama, Iowa
*Fox Squirrel (ES)	- Northeast, Ohio & Michigan
Eastern Chipmunk	- Northeast
*Common Mole	- Washington, Oregon
Raccoon	- all
Skunk	- Maine
Cottontail Rabbit	- all
Beaver	- Louisiana
Squirrel, (Gray)	- Iowa, MD, Maine, PA, SC, TX
Opossum	- GA, Michigan
Jack Rabbit	- Kansas, Minnesota, SD
Nutria	- Louisianna
Porcupine	- Maine

Mammals (Cont'd)

Muskrat	- MD
Woodchuck	- MD
Antelope	- South Dakota, Texas
Deer	- Entire Range
(Peccany) Javelina	- Texas
Aoudad Sheep	- Texas
Coyote	- Texas
Shortail Shrew	- This study
Meadow Jumping Mouse	- This study
Rice Rat	- This study

* = both spring and summer.
ES = endangered species involved.

Aquatic Hazard -

While not an aquatic field study by any means, Dingledine's (1985) Counter 15G field study turned up two (2) cases of fish kills in rivers adjacent to the study sites. In both cases exposure to terbufos was found in these by whole-body residue analysis - the species were not given because these were treated as "incidental" to the avian/mammalian study.

EEB has previously expressed concern for the aquatic nontarget organisms exposed in a proposed aerial application, and under existing registrations (ground use).

EEB requested (November 10, 1982) that estimated environmental concentrations (EECs) of terbufos and its principal degradates in water be calculated by the Environmental Fate Branch (EFB) for the present maximum use rate of COUNTER™ 15G on corn (2.4 oz ai/1000 linear feet of row) with a band treatment. It was requested that EECs be reported for both a "worst-case" row spacing (e.g., 20 inches) and a "typical" row spacing (e.g., 35 to 39 inches) and that the persistence of estimated aquatic concentrations of parent material and principal degrades also be provided.

EFB responded (December 10, 1982) with the results of modeling using both a runoff model (SWRRB) and the Exposure Analysis Modeling System (EXAMS) to estimate expected aquatic concentrations of terbufos. The SWRRB model was used to estimate runoff from two basins containing corn, one located in Coshocton, Ohio and the other in Tifton, Georgia. Calculations of daily runoff values were estimated for three years, 1968-1970. In this initial report, EFB provided only runoff values under the maximum application rate with a "worst-case" row spacing (i.e., 3.92 lb ai/acre),using two applications (May and early June). The SWRRB model predicted measurable runoff events on 3 to 5 days per year at the Coshocton site (0.001 to 0.054 lb ai/acre) and 4 to 5 days per year at the Tifton site (0.001 to 0.067 lb ai/acre).

EFB considered the three runoff events at the Coshocton site in 1970 (0.002, 0.005, and 0.009 lb ai/acre) to be typical and used these values in the EXAMS model to estimate environmental concentrations in the water column and in the benthic sediment of a pond whose drainage area is 15 hectares. A "pulsed" version of EXAMS was used which permits the modeling of "pulses" of pesticide entry to the aquatic system, as might occur under actual rainfall events. EFB (considering the above runoff quantities in lb ai/acre to be roughly equivalent to kg ai/hectare) multiplied the runoff values by 15 to account for the EXAMS basin size and entered the resulting pesticide loads into the pond model as follows: 0.075 kg on Day 5, 0.135 kg on Day 15, and 0.030 kg on Day 35. Residues were modeled for a total of 60 days. Peak residues dissolved in the water column were 7.4 ppb on Day 15, immediately after the second runoff event. Peak residues sorbed to benthic sediments were 3.7 ppb on Day 26. By Day 60, residues dissolved in the water column delined to 0.035 ppb and residues sorbed to the benthic sediments declined to 2.1 ppb. These residues are for parental terbufos only; EFB was not able to consider degradates, certain of which (based on molecular structure) may be as toxic as parental terbufos.

Residue levels of concern to EEB, for fish and aquatic invertebrates, are shown in the following table:

Restricted Use	Fish	Aquatic Invertebrates
($\geq$ 1/10-1/2 LC_{50})	$\geq$ 0.077-0.385 ppb	$\geq$ 0.031-0.155 ppb
RPAR (> 1/2 LC_{50})	> 0.385 ppb	> 0.155 ppb

Endangered Species

1.	$\geq$ 1/10 LC_{10}	$\geq$ 0.051 ppb	$\geq$ 0.021 ppb
2.	$\geq$ 1/20 LC_{50}	$\geq$ 0.0385 ppb	$\geq$ 0.0155 ppb

The lowest validated LC_{50} and LC_{10} values for each taxon are used in this table. These residues are of concern if present in aquatic habitat for $\geq$ 96 hours for fish and $\geq$ 48 hours for aquatic invertebrates. Modeled residues dissolved in the water column (after the first runoff) exceed the above criteria for endangered species continuously through Day 57 (fish, both criteria) and Day 60 (aquatic invertebrates, both criteria); for Restricted Use, continuously through Day 54 (fish) and Day 60 (aquatic invertebrates); for RPAR, continuously through Day 44, except Days 33-34 (fish) and Day 49 (aquatic invertebrates). In sum, residue levels of concern are exceeded for 38-56 days out of 56 days following initial pesticide runoff. It thus appears that there is potential for substantial hazard to aquatic organisms under existing terbufos registrations. Results of further modeling (e.g., of other use patterns/rates) and/or field monitoring of residues will enable an improved hazard assessment.

Since existing registrations are known to provide substantially less exposure than aerial broadcasts, at least the same conclusions can be drawn for the incremental exposure of aerial applications, i.e., more potential hazard is likely for aquatic systems, compared with existing uses.

EEB and EAB (Exposure Assessment Branch/HED) have required several monitoring studies of aquatic residues of terbufos (including fish). The requirements for these studies were reaffirmed on October 19, 1984, in a memo to William Miller, RD, regarding the documented aquatic contamination of northwestern Ohio rivers with terbufos and subsequent reevaluation of Aquatic Field Monitoring by EEB. In addition, EEB has several documented fish kill reports for terbufos ranging from 1981-1984 - (pers. comm. Nina Harley, EPA Fish Kill Coordinator). EPA Region V provided the documentation regarding monitoring of pesticides in northwestern Ohio rivers to EAB/HED.

Pending the outcome of EAB-EEB joint requirements for aquatic monitoring EEB may require an aquatic field test (ecosystem testing) to determine potential biological effects, to support existing registrations under the Standard. N.B. - This requirement is "reserved" under the current Registration Standard.

101.3 Endangered Species Considerations:
(OES = Office of Endangered Species, U.S. Fish & Wildlife Service)

The use of terbufos on corn (ground or air) has been found by OES to jeopardize the continued existence of several Federally Endangered Species (Corn Cluster" Endangered Species Review - OES memo May 18, 1983, and amendments of November 2, 1983. The following species are jeopardized; "reasonable and prudent" alternatives may avoid jeopardy.

1. Attwater's Greater Prairie Chicken - (Tympanuchus cupido attwateri).

   "Reasonable and Prudent Alternative" - as per OES opinion.

   - Do not use terbufos within 1/4 mile of the range of this bird - maps provided in OES opinion.

2. Aleutian Canada Goose (Branta canadensis leucopareia)

   "Reasonable and Prudent Alternative" - "Granular Formulations should be prohibited totally" in the "closure" areas for the goose - localities by November 2, 1983, amendments - non-granular formulations should be prohibited between August 30 - mid May in some areas.

3. Everglades kite (Rostrhamus socialbilities plumbeus)

   "Reasonable and Prudent Alternative" - "eliminate aerial applications...." or "provide a buffer zone of 1/4 mile between aerially treated areas and areas draining into the habitat of this species or prohibit ground applications closer than 100 yards from the edge of areas draining into the habitat of this species."

4. Slackwater Darter (Estheostoma boschurgi)

   "Reasonable and Prudent Alternative" - "eliminate aerial applications..." or "provide a buffer zone of 1/4 mile between aerially treated areas and the aquatic habitat of this species" or "prohibit the use"..."by ground application closer than 100 yards from the edge of the aquatic habitats of this species."

5. Freshwater mussels - 12 species

See opinion for list -

"Reasonable and Prudent Alternative" - same as above for Slackwater Darter.

6. Valley Elderbery Longhorn Beetle (Democenus californicus dimporphus) - (VELB)

"Reasonable and Prudent Alternative" - restrict the use of terbufos from the habitat of VELB from late April to mid-May.

7. Delta Green Ground Beetle (Elaphrus viridis)

"Reasonable and Prudent Alternative" - "Prohibit the use of any pesticide toxic to carabid insects within TSN R1E and R2E, Solano County, California (Mt. Diablo Base and Meridian)."

Other species which OES does not believe are jeopardized by corn insecticides are listed in their opinion dated May 13, 1983, as "of special concern" - possibly subject to "some degree of adverse impact" - recommendations are made for protecting said species. The OES opinion referred to is on file in EEB and RD for reference to specific alternative, prohibitions, maps, etc.

In addition to the listings provided by OES, this reviewer advises that some Delmarva Peninsula Fox Squirrels (Sciurus niger cinereus) could be killed by the use of terbufos within its range - eastern shore of the Chesapeake Bay (Delaware, Maryland, Virginia) and SE. Pennsylvania. This species is federally endangered - it is unclear as to why this species is not addressed by USDI in its "corn cluster" opinion.

101.4 Adequacy of Toxicity Data:
Submitted with this action-

Dingledine, J., 1985. An evaluation of Counter 15G to Terrestrial Species under Actual Field Use Conditions. Performed by Wildlife International, Ltd., St. Michaels, Maryland; submitted by American Cyanamid Corp., Princeton, New Jersey; Accession No. 256982.

The study is scientifically sound. This study demonstrates that Counter 15G, when applied with ground equipment at 16 oz per 1000 ft of row, on 30" centers, causes acute mortality of birds and reptiles; when applied

5/2-4/85

aerially at 6.7 lbs per acre (broadcast) significant acute mortality of mammals, birds and reptiles results. Fish are also killed by aerial applications. Exposure to terbufos was conclusively demonstrated by analysis of whole-body residues of terbufos in vertebrates killed in this study.

This study demonstrated vertebrate field kills resulting from actual use exposure to terbufos. This study does not demonstrate an adequate margin of safety for this product vis a vis "population" effects.

This study fulfills requirements for actual use condition testing of acute mortality potential only. (See Section 101.2 for a discussion of some details of this study.)

101.5 Adequacy of Labeling:

The current registered terbufos label for ground applied, soil incorporated use is inadequate. The label must be changed to read:

"This product is extremely toxic to fish, birds and other wildlife. Birds and other wildlife visiting the treated area may be killed. Cover, or incorporate into soil, granules that are spilled.

Do not apply this product to water or wetlands. Runoff from treated areas may be hazardous to aquatic organisms in neighboring areas. Do not contaminate water by cleaning of equipment or disposal of wastes."

101.6 Additional Data Required

A. To support existing registrations of terbufos - (all as per June 1983 reregistration guidance)

72-3 Three (3) Estuarine/Marine Acute LC_{50}'s-(TGAI)
72-4 Fish Early Life-Stage and Aquatic Invertebrate Life-Cycle (TGAI)
72-5 Fish Life-Cycle - "Reserved"* (TGAI)
72-6 Aquatic Organism Accumulation - "Reserved" pending review of ~~other data~~ (TGAI; PAI)
72-7 Simulated or Actual Field Test of Aquatic Organisms - Reserved pending review of lower tier (TEP)

- Special Monitoring studies of soil, water, sediments and fish (TEP) are currently jointly required by EAB and EEB/HED.
Re-registration deadline = June, 1986

5/23/85

(Additional Data Required - con't.)

- 71-5 Field Study of Mammals, Birds and Reptiles -

An field study is now required to determine the impact to populations of birds, mammals, and reptiles. This must be a multi-year, muti-site study of large-scale corn use under operational conditions.
(Protocol is in Review) - 3/14/86

- Plus additional pen-by-pen data on two (2) avian reproduction studies submitted under 71-4.
Re-registration deadline = June, 1986

B. To support addition of aerial or ground broadcast applications not reviewed at the time of reregistration guidance:

- All studies cited above plus an aquatic field study as 72-7 under an approved protocol are now required.

- and additional field study under 71-5 to rebut the presumption of hazard (see RPAR criteria below) by determining the impact to populations of vertebrtates. This must be a mutlti-year, multi-site study of large-scale corn use under operational conditions.

102 Classification:

Currently registered ground-applied, soil-incorporated uses must be classified as "RESTRICTED".

No recommendation is made at this time regarding classification of aerial use.

103 RPAR Criteria

Data reviewed in this report suggests that aerial or ground applied broadcast treatments of terbufos on corn at recommended label rates and in accordance with commonly recognized agricultural practices, may meet or exceed the following RPAR risk criteria:

Pesticide may significantly reduce local, regional, or national populations of nontarget organsims [162.11 (a) (3) (ii) (C)].

103 Conclusions:

Regarding the currently registered ground applied, soil-incorporated uses of terbufos (Counter 15G) or corn, EEB finds that the pesticide, when used under widespread and commonly recognized practice and label directions is expected to cause fatality (acute kills) to birds and reptiles. The extent of this mortality under large-scale corn plantings cannot be estimated by currently available data, however the current extensive use of terbufos under 1980 estimates (9.3 million acres annually) raises great concern. Based on the results of studies reviewed here the mortality of birds and reptiles could be on an order of magnitude perhaps reaching millions of organisms.

The currently registered uses of Counter 15G must be classified as "RESTRICTED" use pesticide.

Additional multi-year, multi-site field studies must be performed to support the current registrations, which will determine the impact on vertebrate populations of large-scale use of terbufos on corn under operational conditions. A protocol must be submitted to EEB for approval by December, 1985.

Because several data requirements regarding testing of aquatic organisms, mandated by the June 1983 EPA publication of reregistration guidance for terbufos remain unfulfilled at this time, EEB cannot complete a hazard assessment for aquatic organisms and ecosystems at this time. However, ecosystem models, actual residue data from EPA Region V, fish kill reports and EEB's current hazard assessment for aquatics all indicate that the potential for damage to aquatic ecosystems, resulting from the use of Counter 15G (or other formulations containing terbufos as an ai), according to registered label directions, is significant. Further aquatic studies are required under section 101.6 to support existing registrations.

Regarding the proposal to add aerial applications and broadcast ground applications of Counter 15G (not soil incorporated) to corn, EEB has partially completed an incremental risk assessment 3(c)(7) finding for this proposal. Based upon the available data EEB concludes that the proposed use provides for a significant increase in exposure and acute risks to nontarget terrestrial vertebrates, especially mammals, and birds but including reptiles.

The extent of mortality and potential to impact populations of vertebrates under large-scale operational use of aerially or ground applied broadcast applications cannot be estimated by currently available data, however, addition of the proposed broadcast applications of terbufos raises great concern. Based on the available data the mortality to birds, reptiles and mammals could be on an order of magnitude reaching millions of these organisms. The data reviewed in this report suggests that aerial or ground applied broadcast treatments of terbufos on corn at recommended label rates and in accordance with widespread and commonly used practices may meet or exceed the following RPAR risk criteria:

> Pesticide may significantly reduce local, regional, or national populations of nontarget organisms [162.11 (a) (3) (ii) (C)].

Because pertinent aquatic organism and field monitoring data are lacking at this time, EEB cannot complete an incremental risk finding for aquatic organisms. Data requirements are indicated in 101.6.

Finally, on the advice of, and in consultation with the United States Dept. of the Interior, Office of Endangered Species (U.S. Fish & Wildlife Service), EEB finds that the proposed aerial and ground broadcast applications provide for "jeopardy" - i.e., jeopardize the continued existence of certain endangered species, as indicated in 101.4 and the attached "corn cluster" review of endangered species.

24

Sign - off sheet for Terbufos review of Field Study
and addition of aerial and ground broadcast to corn.

John Bascietto
Wildlife Biologist, Sec. 3
Ecological Effects Branch/HED

Dave Coppage
Supervisory Biologist, Sec. 3
Ecological Effects Branch/HED

9/27/85

Michael Slimak
Chief
Ecological Effects Branch/HED

Attachments

- Endangered Species Opinion "Corn Cluster"
- Registered Counter 15G Label

25

Appendix I

OCTOBER 1984

COUNTER®

systemic insecticide-nematicide

SPECIMEN

FOR USE IN FIELD CORN, POPCORN, SWEET CORN, SUGAR BEETS AND GRAIN SORGHUM

Active Ingredient:	
terbufos (S-[[(1,1-dimethylethyl)thio]methyl] 0,0-diethyl phosphorodithioate)	15.0%
Inert Ingredients	85.0%

EPA Reg. No. 241-238 EPA Est. No.

CYANAMID

KEEP OUT OF REACH OF CHILDREN

POISON
DANGER

FIRST AID

If swallowed, drink one or two glasses of water and induce vomiting by touching back of throat with finger. Do not induce vomiting or give anything by mouth to an unconscious person. Avoid alcohol. Get medical attention.

If inhaled, remove to fresh air. If not breathing, give artificial respiration, preferably mouth-to-mouth. If breathing is difficult, give oxygen. Get medical attention.

If on skin, wash thoroughly with soap and water. Remove contaminated clothing and shoes. Wash clothing and decontaminate shoes before reuse.

If in eyes, immediately flush eyes with plenty of water. Get medical attention.

Repeated inhalation or skin contact may, without symptoms, progressively increase susceptibility to poisoning. **Antidote:** Atropine is an antidote.

See Back Panel For Additional Precautionary Statements

¡PELIGRO!

PRECAUCION AL USUARIO: Si usted no lee inglés, no use este producto hasta

CALL A PHYSICIAN AT ONCE IN ALL CASES OF SUSPECTED POISONING

NOTE TO PHYSICIANS: Warning symotoms include weakness, headache, tightness in chest, blurred vision, nonreactive pinpoint pupils, salivation, nausea, vomiting, diarrhea and abdominal cramps. Give atropine intramuscularly or intravenously, depending on severity of poisoning, 2 to 4 milligrams every 10 minutes until fully atropinized as shown by dilated pupils, dry flushed skin and tachycardia. Twenty to thirty milligrams, or more, may be required during the first 24 hours. Never give opiates or phenothiazine tranquilizers. Clear chest by postural drainage. Artificial respiration or oxygen administration may be necessary. Observe patient continuously for at least 48 hours. Allow no further exposure to any cholinesterase inhibitor until cholinesterase regeneration has taken place as determined by blood tests.

Pralidoxime chloride (2-PAM; PROTOPAM chloride) may be effective as an adjunct to atropine. Use according to label directions.

PRECAUTIONARY STATEMENTS

DANGER!

HAZARDS TO HUMANS and Domestic Animals

Fatal if swallowed, inhaled, or absorbed through the skin. Do not breathe dust. Do not get in eyes, on skin, or on clothing.

Wear freshly laundered, long-sleeved work clothing daily. While transferring from container to equipment, wear a clean cap, gloves (rubber or cotton) and goggles. If cotton gloves are used, they must be laundered or discarded after each day's use. Rubber gloves should be washed with soap and water after each use. Do not wear the same gloves for other work. Destroy and replace gloves frequently.

In case of contact, immediately remove contaminated clothing and wash skin thoroughly with soap and water. Launder clothing and decontaminate shoes before reuse. Wash thoroughly with soap and water before eating or smoking. Bathe at the end of the work day and change clothing.

Do Not Breathe Dust

While emptying bags into equipment, pour downwind and allow as little free fall as possible. Do not pour at face level and do not allow dust to reach the breathing zone.

Do Not Contaminate Food or Feed Products

Once a bag has been opened, use it completely. Make sure the hoppers are emptied while still in the field. Refer to STORAGE AND DISPOSAL statements for further instructions.

Keep All Unprotected Persons Out of Operating Areas.

Do not apply this product in such a manner as to directly or through drift expose workers or other persons.

Keep Out of Reach of Domestic Animals
Not For Use or Storage
In or Around the Home.

RE-ENTRY STATEMENT

Do not enter treated areas without protective clothing until treatments have been completed.

Because certain states may require more restrictive re-entry intervals for various crops treated with this product, consult your State Department of Agriculture for further information.

Written or oral warnings must be given to workers who are expected to be in a treated area or in an area about to be treated with this product. When oral warnings are given, warnings shall be

DIRECTIONS FOR USE

It is a violation of Federal Law to use this product in a manner inconsistent with its labeling. This label must be in the possession of the user at the time of pesticide application.

BEFORE USING, READ PRECAUTIONARY STATEMENTS.

COUNTER should be applied with a granular pesticide applicator properly calibrated to assure accurate placement and proper dosage. Cover granules that may be exposed on the ends of the treated rows and turns and loading areas by deep discing immediately after treating fields.

Crops	Pests Controlled	Rates of COUNTER	Application	Remarks
FIELD CORN, POPCORN, AND SWEET CORN	Corn rootworms Seedcorn maggots Seedcorn beetles	**Banded or In-Furrow** 8 oz. per 1,000 ft. of row for any row spacing (minimum 30-inch row spacing).	**Banded** Place granules in a 7-inch band directly behind the planter shoe in front of press wheel. **In-Furrow** Place granules directly in the seed furrow behind the planter shoe.	For use on conventional and conservation (i.e., minimum and no-till) tillage corn. In conservation tillage systems, where excessive crop debris can prevent proper distribution of banded granular products, in-furrow applications are recommended.
At Planting	Wireworms Symphylans Nematodes: Lance Lesion Spiral Stunt Sting Stubby root Dagger Maize billbugs Southern corn billbugs Corn flea beetles White grubs Suppression of: Cutworms Lesser corn-stalk borers	**Banded or In-Furrow** **Banded** 8-16 oz. per 1,000 ft. of row for any row spacing (minimum 30-inch row spacing). **In-Furrow** 8 oz. per 1,000 ft. of row for any row spacing (minimum 30-inch row spacing).	**Banded** Place granules in a 7-inch band directly behind the planter shoe in front of the press wheel. **In-Furrow** Place granules directly in the seed furrow behind the planter shoe.	Under dry soil conditions or heavy infestations, it may be necessary to apply an insecticide rescue treatment with another registered insecticide after corn emergence to control surviving cutworm larvae.
Post-emergence Incorporated **(Same as crops above)**	Maize billbugs Southern corn billbugs	**Banded** 12-16 oz. per 1,000 ft. of row for any row spacing (minimum 30-inch row spacing).	Apply in a 7-inch band over the row of seedling corn plants and lightly incorporate into the soil when billbugs or damage are observed, usually in the 1-6 leaf stage of growth. Use cultivators or other suitable implement to lightly incorporate granules into soil.	Only one postemergence incorporated or one cultivation time treatment may be used in addition to treatment at planting time. Do not treat if more than 8 oz. per 1,000 ft. of row were applied at planting Do not graze or cut for forage within 30 days of treatment. Consult your state experiment station, state

At Cultivation (Same as crops above)	Corn rootworms	8 oz. per 1,000 ft. of row for any row spacing (minimum 30-inch row spacing).	Apply granules to base of plants or over the top of plants just ahead of cultivation shovels so as to cover granules with soil.	Only one postemergence incorporated or one cultivation time treatment may be used in addition to treatment at planting time. Do not graze or cut for forage within 30 days of treatment.
SUGAR BEETS At Planting	Sugar beet root maggots Wireworms	**Banded** 4-8 oz. per 1,000 ft. of row for any row spacing (minimum 20-inch row spacing).	**Banded** Apply in a 5 to 7-inch band over the row and lightly incorporate into the soil.	**At Planting** Do not place granules in direct contact with the seed as crop injury may occur. Power incorporation may be used. Do not incorporate deeper than 2 inches.
SUGAR BEETS Post-emergence	Sugar beet root maggots			
SUGAR BEETS At Planting	Suppression of: Cutworms	**Banded** 8 oz. per 1,000 ft of row for any row spacing (minimum 20-inch row spacing).		**Postemergence** Apply at the time of first fly emergence. Lightly incorporate into the soil. **Only one application per year may be used.**
GRAIN SORGHUM At Seeding	Greenbugs Corn leaf aphids	**Knifed-in** 8-16 oz. per 1,000 ft. of row for any row spacing (minimum 20-inch row spacing) or no more than 26 lbs. per acre.	**Knifed-in** Drill granules 1-4 inches directly below the seed OR 1-4 inches below the seed and up to 5 inches to the side of the seed.	Do not place granules in direct contact with seed as crop injury may occur.
GRAIN SORGHUM At Planting	Greenbugs Corn leaf aphids	**Knifed-in or Banded** **Knifed-in** 8-16 oz. per 1,000 ft. of row for any row spacing (minimum 20-inch row spacing) or no more than 26 lbs. per acre. **Banded** 8-16 oz. per 1,000 ft. of row for any row spacing (minimum 20-inch row spacing).	**Knifed-in** Drill granules 1-4 inches directly below the seed OR 1-4 inches below the seed and up to 5 inches to the side of the seed. **Banded**[1] Place granules in a 5-7 inch band directly behind the planter shoe in front of the press wheel.	[1]Do not use banded applications for aphid control in New Mexico, West Texas and the Panhandle of Oklahoma. **Only one application per year may be used.**
GRAIN SORGHUM At Planting	Corn rootworms Wireworms White grubs Nematodes	**Banded** 8-16 oz. per 1,000 ft. of row for any row spacing (minimum 20-inch row	**Banded** Place granules in a 5-7 inch band directly behind the	

ENVIRONMENTAL HAZARDS

This product is toxic to fish, birds and other wildlife. Treated granules exposed on soil surface may be hazardous to birds and other wildlife. Do not apply directly to water or wetlands. Runoff from treated areas may be hazardous to aquatic organisms in neighboring areas. Do not contaminate water by cleaning of equipment or disposal of wastes. Cover or incorporate into soil granules that are spilled.

IN CASE OF AN EMERGENCY ENDANGERING LIFE OR PROPERTY INVOLVING THIS PRODUCT, CALL COLLECT, DAY OR NIGHT, AREA CODE 201-835-3100.

STORAGE AND DISPOSAL

Storage
Store pesticide products in a secure locked area where children, unauthorized persons, and animals cannot enter. Do not store in the same area with food or feed. Do not store opened bags.

Prohibitions
Do not contaminate water, food, or feed by storage or disposal. Open burning is prohibited.

Pesticide Disposal
Pesticide wastes are acutely hazardous. Improper disposal of excess pesticide, spray mixture, or rinsate is a violation of Federal Law. If these wastes cannot be disposed of by use according to label instructions, contact your state pesticide or Environmental Control Agency, or the hazardous waste representative at the nearest EPA Regional Office for guidance.

Container Disposal
Completely empty bag into application equipment. Then dispose of empty bag in a sanitary landfill or by incineration, or, if allowed by state and local authorities, by burning. If burned, stay out of smoke.

General
Consult federal, state or local disposal authorities for approved alternative procedures such as limited open burning.

Use Rates as Pounds per Acre* (based on various row spacings and application rates)
Application Rates (Oz./1,000 Ft. of Row)

ROW WIDTH (inches)	4 oz.	6 oz.	8 oz.	10 oz.	12 oz.	14 oz.	16 oz.
40"	3.3	4.9	6.5	8.2	9.8	11.4	13.1
38"	3.4	5.2	6.9	8.6	10.3	12.0	13.7
36"	3.6	5.4	7.3	9.1	10.9	12.7	14.5
34"	3.9	5.6	7.7	9.7	11.6	13.5	15.4
32"	4.1	6.1	8.2	10.2	12.3	14.3	16.3
30"	4.4	8.5	8.7	10.9	13.1	15.2	17.4
28"	4.7	7.1	9.5	11.8	14.2	16.6	18.9
26"	5.0	7.6	10.2	12.7	15.3	17.9	20.4
24"	5.4	8.2	10.9	13.6	16.3	19.1	21.8
22"	5.9	8.9	11.9	14.9	17.9	21.0	24.0
20"	6.5	9.8	13.1	16.3	19.6	22.8	26.1

*See directions for specific use rates on each crop.

DISCLAIMER

The label instructions for the use of this product reflect the opinion of experts based on field use and tests. The directions are believed to be reliable and should be followed carefully. However, it is impossible to eliminate all risks inherently associated with use of this product. Crop injury, ineffectiveness or other unintended consequences may result because of such factors as weather conditions, presence of other materials, or the use or application of the product contrary to label instructions, all of which are beyond the control of American Cyanamid Company. All such risks shall be assumed by the user.

American Cyanamid Company warrants only that the material contained herein conforms to the chemical description on the label and is reasonably fit for the use therein described when used in accordance with the directions for use, subject to the risks referred to above.

Any damages arising from a breach of this warranty shall be limited to direct damages and shall not include consequential or commercial damages such as loss of profits or values or any other special or indirect damages.

CALIBRATION INFORMATION

FIRST READ THE LABEL

It is important that applicator equipment be properly set to deliver the labeled rate. This chart will help determine the desired rate of application.

When label rate is 8 ounces per 1,000 feet of row, use these suggested starting gauge settings, regardless of row spacing:

PLANTING SPEED

APPLICATOR	3 mph	5 mph	7 mph
Gandy	18	24	28
New Noble (Square Hole)	8	12	16
Old Noble (Round Hole)	11	17	23
International Harvester	1/7.0	2/1.5	2/7.5
New International Harvester	1/9.0	2/6.0	3/2.0
New John Deere (Plastic Funnels)	13	19	25
Newest John Deere (Aluminum Funnels)	11	15	19
Old John Deere	1/28	2/6	2/15
Buffalo (Gauged)	9	15	20
Buffalo (Fluted-roll Feed)	All speeds – 5 1/2 revolutions of hexagonal nut		
Allis Chalmers	All Speeds–Gauge 7		

Note: These settings should be used a starting points only. Continually check the amount of COUNTER used against a known length of row or acreage and make further adjustments accordingly. Also, check calibration occasionally to make sure equipment wear, changing moisture conditions, etc., have not caused a change in flow rate.

CYANAMID

Agricultural Division
Crop Protection Chemicals Department
Wayne, NJ 07470

JB

ADDRESS ONLY THE DIRECTOR
FISH AND WILDLIFE SERVICE

United States Department of the Interior

FISH AND WILDLIFE SERVICE
WASHINGTON, D.C. 20240

In Reply Refer To:
FWS/OES EPA-83-2

CORN
CLUSTER

Mr. Clayton Bushong
Chief, Ecological Effects Branch
Hazard Evaluation Division (TS-769c)
Environmental Protection Agency
401 M Street, S.W.
Washington, D.C. 20460

Dear Mr. Bushong:

In our biological opinion on cotton, soybeans, sorghum, and small grain pesticides (EPA-83-3), we indicated that some of the conclusions drawn in our earlier opinion on corn pesticides (EPA-83-2) had been modified due to further analysis. Please amend EPA-83-2 as follows:

1. In our discussion of the potential effects of DDT from contaminated Kelthane, we stated that contamination levels of less than 1 percent were considered insignificant. Obviously a number of additional variables will influence significance, including total pounds of the contaminant applied and the potential for exposure of sensitive species; therefore, significance will have to be determined on a case-by-case basis.

2. The area where pesticide use is to be restricted to protect the Aleutian Canada goose has been greatly reduced (see maps provided with EPA-83-3) in accordance with recommendations made by Dr. Paul Springer, Fish and Wildlife Service.

3. Buffer zones to protect aquatic species have been reduced to 100 yards (aerial application) and 20 yards (ground application) in accordance with recommendations made by R. D. Wauchope, Department of Agriculture.

Distribution of several species will be more specifically defined when information is developed for dissemination to the user level. If you have any additional questions regarding these pesticide opinions, please contact Larry Kline, Office of Endangered Species, 235-2760.

Sincerely yours,

John L. Spinks, Jr.
Chief, Office of Endangered Species

32

CORN CLUSTER

United States Department of the Interior

FISH AND WILDLIFE SERVICE
WASHINGTON, D.C. 20240

ADDRESS ONLY THE DIRECTOR
FISH AND WILDLIFE SERVICE

In Reply Refer To:
FWS/OES EPA-83-2

MAY 18 1983

Mr. Clayton Bushong
Chief, Ecological Effects Branch
Hazard Evaluation Division (TS-769C)
Environmental Protection Agency
401 M Street, S.W.
Washington, D.C. 20460

Dear Mr. Bushong:

By your letter of December 2, 1982, the EPA requested formal Section 7 consultation on the "cluster" approach concerning all chemical pesticides currently registered for use on corn.

Following receipt of your request, we asked our regional offices to provide detailed species distribution information as related to corn growing areas. We also requested their assessment of the magnitude of the effects of corn pesticides on listed species within their respective Regions. Because of the complexity and comprehensive scope of this consultation, there was and remains considerable difficulty in applying the available data to actual effects on listed species under field conditions. To achieve an improved and more consistent understanding of what was required to complete this biological opinion, a meeting was held in Washington, D.C., on March 8 and 9, 1983, involving staff of the Office of Endangered Species (OES), Research, representatives from each of our regional offices (except Alaska), and yourself and Rick Stevens from EPA. Representatives of the National Agricultural Chemical Association attended a portion of the meeting to make available additional industry data. Prior to this meeting, on February 28, 1983, we requested and you agreed to an extension of the consultation period.

Proposed Action

For some time, the EPA has been concerned with problems created when only applications for new registrations of agricultural chemicals are subject to Section 7 consultation. The EPA started requesting consultations on registration actions in 1978. Thus, chemicals registered prior to 1978 have not been reviewed in accordance with Section 7. This may create situations where restrictions are placed on a new chemical or chemical use which would necessitate the use of a more harmful alternative. It also places those chemicals which have endangered species restrictions placed on them at a competitive

33

disadvantage with those that have not been subject to Section 7 review. To resolve this problem, the EPA has developed a review process that will provide Section 7 consideration for all currently registered pesticides associated with a variety of crops and other land use types. This has been referred to as a "cluster" approach. The first "cluster" to be considered and the subject of this biological opinion involves all pesticides currently registered for use on corn. The EPA identified more than 100 chemical pesticides that are registered for this crop, some of which are covered by several separate registrations. Of these, 33 chemicals exceeded a listed species trigger, i.e., the aquatic Estimated Environmental Concentration (EEC) exceeded 1/20 aquatic organism LC_{50} for aquatic species; and/or predicted residues on food items exceeded 1/10 LC_{50} for avian species. For granular pesticides, which may be ingested as grit, if the number of granules required to reach 1/10 LD_{50} for avian species will be exposed per square foot of soil surface, this would trigger concern. However, if the number of granules required to reach 1/10 LD_{50} is more than a representative avian species would conceivably ingest, no concern was expressed. Granular chemicals with LD_{50} values of 10 mg/kg or lower are of particular concern.

The EPA found "no affect" to mammals, insects, reptiles, or plants. They determined that listed mammals, insects, and reptiles would not be exposed since their habitats and food habits would not place them in close proximity to corn fields during critical periods. "No affect" was found to listed plants based on the rationale that they are not associated with cultivated areas. We have taken exception with the above determination for a few species as will be discussed under the section on effects which follows. The EPA made a "may affect" determination for a number of avian and molluscan species and one amphibian, the Houston toad (see administrative record).

Effects on Listed Species

It is my biological opinion that the use of certain pesticides on corn is likely to jeopardize the continued existence of the following species and result in the destruction or adverse modification of the critical habitat of the Everglade kite, slackwater darter, valley elderberry longhorn beetle, and Delta green ground beetle. See Table 1 to determine which pesticides are implicated for each taxonomic group.

Peregrine falcon (Falco peregrinus)

One insecticide registered for use on corn (Kelthane) contains as high as 6 percent - 9 percent DDT as a contaminant according to information provided by EPA (Pesticides and Toxic Chemical News, Vol. 10 No., 43 pp. 6 & 7, 1982).

DDT and its principal metabolites, when accumulated in the food chain, cause reproductive failure in raptors and certain fish-eating birds. The widespread use of this chemical was responsible for the total elimination of the peregrine falcon from the eastern half of the United States. Since the use of DDT was cancelled in 1972, this situation has improved, and reintroduced peregrines are once again breeding in limited numbers in the East.

However, there are strong indications that DDT is currently being introduced into the environment in the southwestern United States (memo from Region 2 dated 3-22-83). The following discussion summarizes the current DDT contaminant problem in New Mexico and Texas as it pertains to the peregrine falcon.

In 1976, three eyries were active in the Guadalupe Mountain range of New Mexico and Texas although suitable habitat exists for more than three eyrie locations. These three eyries are called Palace, Lloyd's Ledge, and Agua Dulce. Palace eyrie produced 14 young from 1975 to 1978 but has failed since then and has subsequently been abandoned. Lloyd's Ledge produced one young in 1975 and three young in 1976, but has been abandoned since 1976. Agua Dulce eyrie was occupied by a pair in 1976, 1977, and 1979, but no young were produced.

In 1977, two eggs from the Agua Dulce eyrie were found to contain 30 and 51 ppm of DDE. Eggshells taken from Texas eyries in 1976 averaged over 20 percent thinner than pre-1947 (pre-DDT era) eggshells.

Evidence for reproductive problems in the area of Big Bend National Park, Texas, is not as clear as for the Guadalupe Mountains. In 1982, two of five pairs did not produce young. Some data is available to indicate that prey species have elevated DDE levels. In 1977, eggshell fragments from one eyrie in the Guadalupe Mountains ranged from 4.7 to 16 percent thinner than pre-1947 eggshells.

In 1982, putative prey of the peregrine falcon were analyzed for pesticide contamination. High levels of DDE for pooled samples of various species collected from the lower Pecos and Rio Grande Valleys are as follows: mourning dove, 4.25 ppm; red-winged blackbird, 74.8 ppm; western kingbird, 82.4 ppm; killdeer, 24.0 ppm; great-tailed grackle, 24.1 ppm; rough-winged swallow, 0.56 ppm; and barn swallow, 2.16 ppm. Of the above species, the killdeer, red-winged blackbird, and great-tailed grackle are presumed to be year-round residents of Texas, so it is believed the pesticide burdens were obtained locally.

Other collections of prey species by various individuals in the Guadalupe Mountain Range have revealed a consistently high level of contamination. For example, in 1979 a mourning dove contained 5.28 ppm DDE; a poorwill, 3.51 ppm DDE; a Say's phoebe, 7.10 ppm DDE; and a Cassin's kingbird, 4.57 ppm DDE. There are a number of other reports which reveal similar contamination levels, even in species such as scrub jay and mountain chickadee, which are definitely residents of these mountainous areas.

DDT has been implicated in the recent decline of the peregrine falcon in the Guadalupe Mountains of Texas and New Mexico. The falcons nesting in Big Bend National Park may be similarily affected, but not as severely. Peregrine falcons within other parts of Region 2 are affected by DDT contamination (although not as severely as in the Guadalupe Mountains), as revealed by thin eggshells and low reproductive rates. DDT or its metabolites appear with alarming frequency in prey species, which is the mechanism by which peregrine falcons are contaminated.

Applications of Kelthane in corn alone may not create a jeopardy situation; however, it is applied to a variety of crops which creates a cumulative effect sufficient to support a jeopardy opinion. It is well documented that DDT and

its metabolites are long-lived, can be transported long distances, and are biomagnified, which operates to the detriment of the peregrine falcon. It is difficult, without further study, to separate out the source of DDT contamination since it is also used south of the United States border, and both the peregrine falcon and many of its prey species are known to migrate south of the United States. The most severe problem appears to be along the Rio Grande and Pecos River systems in southern New Mexico and western Texas; however, DDT contamination is still present in the American peregrine falcon throughout the West as well as in the F.p. tundrius population which migrates through the region.

Therefore, we must conclude that the use of Kelthane, or any other pesticide containing high levels (in excess of 1 percent) of a DDT compound, is likely to jeopardize the continued existence of the peregrine falcon. We have reports that a number of Kelthane samples contained only insignificant (less than 1 percent) levels of DDT. However, unless the very high levels of DDT reported by EPA are shown to be isolated incidents our jeopardy opinion will stand. The Service offers the following alternative, which if implemented, would avoid jeopardy: Kelthane should be manufactured to eliminate the DDT component or a substitute for Kelthane should be used.

Note: Two other species have historically been affected by DDT; these are the bald eagle and the brown pelican. These species have not been addressed at this time since no contamination problem adversely affecting reproduction has been linked to current DDT uses. However, continued use of compounds contaminated by DDT, may change this.

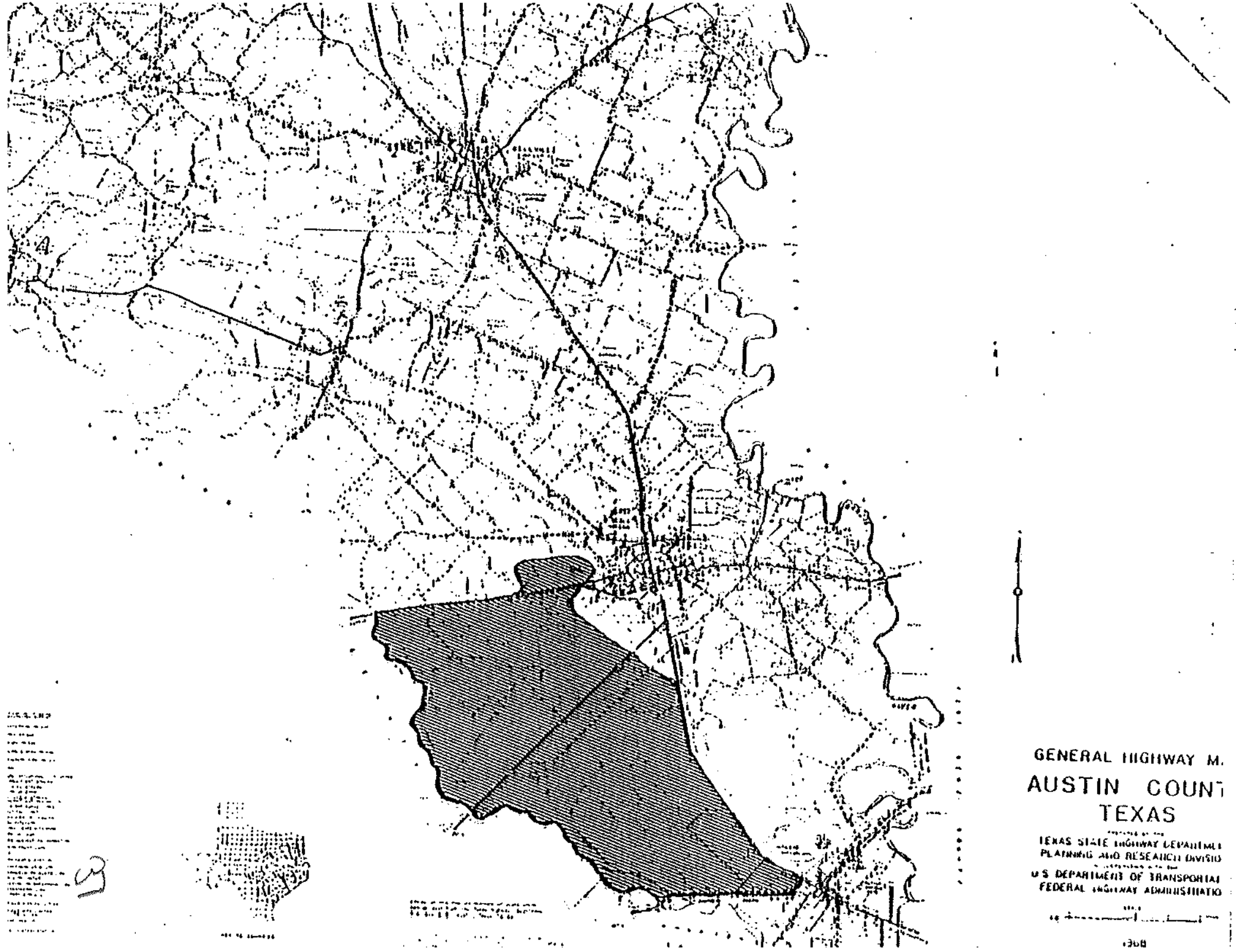
Attwater's Greater Prairie Chicken (Tympanuchus cupido attwateri)

The 1982 prairie chicken census recorded 1282 Attwater's prairie chickens distributed in nine Texas Counties as follows: Aransas, 20; Austin, 246; Brazoria, 20; Colorado, 280; Fort Bend, 48; Galveston, 104; Goliad, 62; Refugio, 438; and Victoria, 64 (memo from Region 2, dated 3-22-83). It is extirpated in Louisiana.

To our knowledge, within the range of the Attwater's prairie chicken, corn is grown only in Austin and Colorado Counties. Grassland habitat supporting Attwater's prairie chickens is juxtaposed to corn croplands in these counties.

Corn fields are used by prairie chickens between May and September for foraging for insects and for cover. At this time these birds are potentially exposed to granular and liquid pesticides. In addition, prairie chickens have been observed foraging in harvested corn fields and some booming grounds have been reported as occurring in corn fields. The extent of the population which utilizes corn fields is not known; however, assuming that Austin and Colorado County birds use corn fields to some degree, the use on corn of pesticides with known toxicity to birds creates a potential of affecting up to 41 percent of the total prairie chicken population.

As a reasonable and prudent alternative, if the chemicals designated in Table 1 (Attachment) as being toxic to avian species are not used within 1/4 mile of the range of the Attwater's greater prairie chicken in Austin and Colorado Counties (see attached maps), jeopardy will be avoided.



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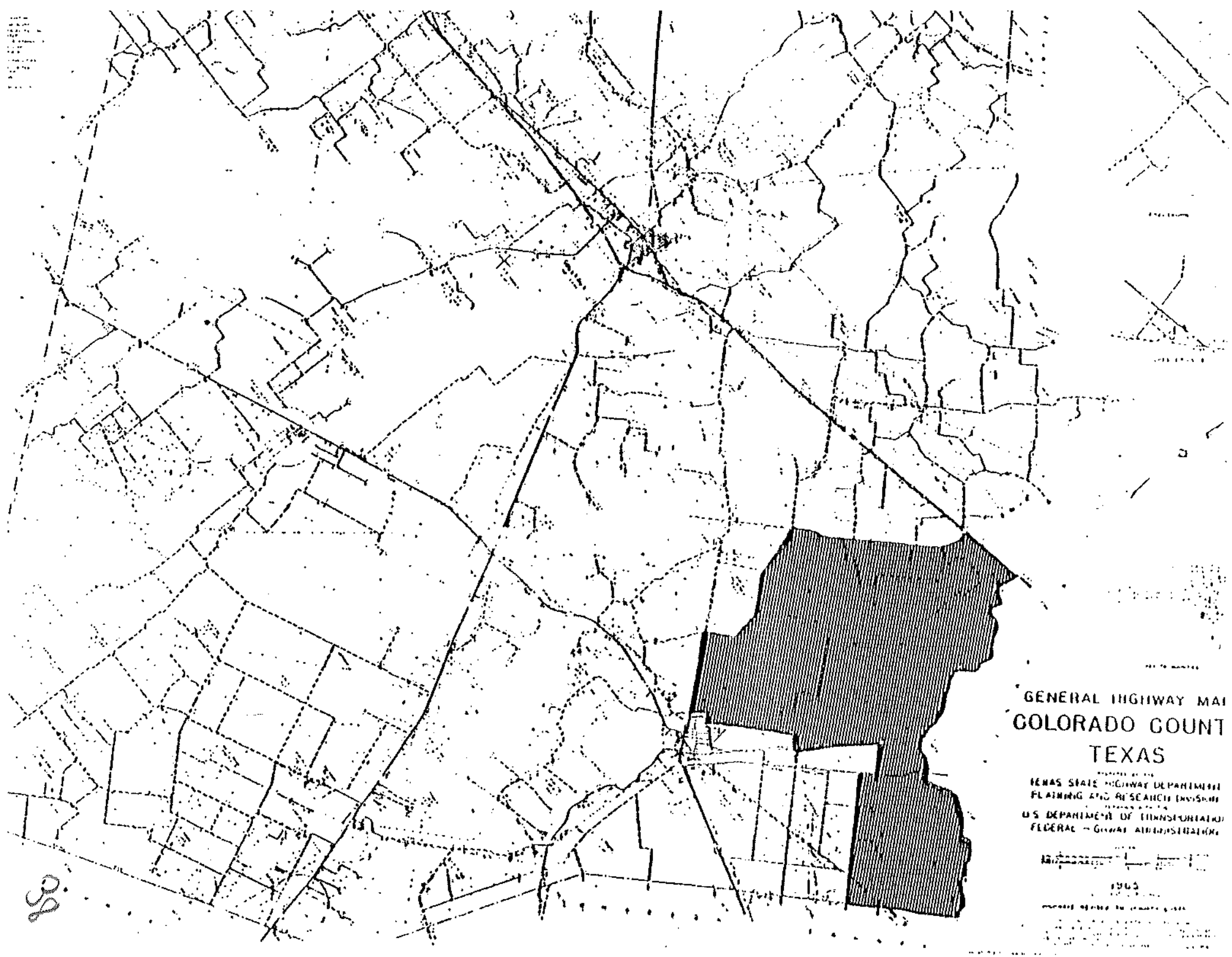
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Aleutian Canada Goose (Branta canadensis leucopareia)

Presently the only known breeding population of this species occurs on Buldir Island in the western Aleutians and on Chagulak Island in the eastern Aleutians.

The Aleutian Canada goose migrates through Del Norte and Humboldt Counties, California, and winters in the Central Valley and Delta in Butte, Colusa, Glenn, Merced, San Joaquin, Solano, Stanislaus, Sutter, and Yolo Counties. In Oregon, the Aleutian Canada Goose winters in Coos, Curry, and Tillamook Counties. The wintering birds generally congregate in several large flocks and feed extensively in local croplands (particularly lima beans, rice, small grains, alfalfa, and corn) and irrigated pasturelands. The geese can also be found in marshes and grasslands.

Poisoning could occur as a result of feeding on contaminated insects, browsing on emerging corn plants, or picking up concentrated pesticide granules. Granular formulations of a pesticide are often more hazardous to birds than other formulations because birds may specifically seek out and consume the granules as grit. In such cases, birds may ingest toxic doses of a granular pesticide when the application rate of the pesticide is below that which would cause concern for other formulations. Granules apparently can be expected to be available still on the soil surface 8 to 9 months following application. In a letter to Dr. William Stickel (U.S. FWS Patuxent), P. Whitehead, Biologist, Canadian Wildlife Service, Vancouver, British Columbia, reported that 150 mallard and pintail ducks died after ingesting carbofuran granules. These deaths reportedly occurred between November and December following spring applications of carbofuran. Granules were found in the crops of the dead birds.

To avoid jeopardy to the Aleutian Canada goose, the following reasonable and prudent alternative should be implemented: the EPA should prohibit the use on corn of non-granular formulations of those chemicals found in Table 1 which are toxic to birds, between August 30 and mid-May in those areas closed to the hunting of Canada geese in the Central Valley of California and in Coos, Curry, and Tillamook Counties in Oregon. Granular formulations should be prohibited totally in the above closure areas.

Everglade kite (Rostrhamus sociabilis plumbeus)

The endangered Everglade kite once ranged over most of peninsular Florida. The present breeding range of the kite is restricted to several locales from Osceola County south to Everglades National Park. Critical Habitat has been designated in Glades, Palm Beach, Broward, and Dade Counties. Everglade kite habitat consists of relatively open freshwater marshes which support adequate populations of the apple snail, its principal food. Recent population declines are attributed to loss of marsh habitat through drainring, fire, and drought, indiscriminate shooting and excessive human disturbance, and loss of access to food sources caused by the screening effects of water hyacinths.

The principal threat to the Everglade kite from the use of pesticides on corn would be contamination and possible further reduction of apple snail populations. Runoff from the sweet corn and seed corn producing areas quickly enters Florida's system of canals and water storage (conservation) areas where it is subject to various water management manipulations including backpumping and

To preclude jeopardy, the following reasonable and prudent alternatives are recommended: eliminate aerial applications of implicated pesticides or provide a buffer zone of 1/4 mile between aerially treated areas and areas draining into the habitat of this species, and/or prohibit the use of implicated pesticides by ground application closer than 100 yards from the edge of areas draining into the habitat of this species.

Slackwater Darter (Etheostoma boschungi)

The distribution of this threatened species is known in five tributary streams to the south bend of the Tennessee River on both sides of the Tennessee-Alabama State line. These are: Buffalo River, Lawrence County, Tennessee; Shoal Creek, Lawrence County, Tennessee; Flint River, Madison County, Alabama; Swan Creek, Limestone County, Alabama; Cypress Creek Watershed, Wayne County, Tennessee; and Lauderdale County, Alabama. The slackwater darter occurs in two distinctly different, but adjacent nonbreeding and breeding habitats. The nonbreeding habitat is in small to moderately large streams (0.6 to 12 m wide and 0.15 to 2m deep), usually having a slow current. The substrate may vary from silt and mud to relatively clean gravel. The breeding habitat is seepage water in open fields and woods. All known breeding sites are in the Cypress Creek Watershed. The water is shallow, flows slowly, and breeding sites are generally from 0.3 - 0.45 m above the adjacent stream level, therefore, the stream level must rise periodically (due to heavy rains) to carry ready-to-spawn adults into the breeding sites. Adults are on the breeding sites in mid-February, spawning occurs in March, and larvae may be present through April to early May. Degradation of surface and ground water caused by the intrusion of toxins, pesticides, and fertilizers, as well as industrial and domestic wastes from sewage lines and septic tank seepage and feedlot runoff are very real threats to the slackwater darter. Farming (including corn) is the principal industry surrounding the darter's habitat. Since the breeding habitat is so limited, even a small chemical spill or biological pollutant could completely exterminate a breeding population.

To preclude jeopardy, the following reasonable and prudent alternatives are recommended: eliminate aerial applications of implicated pesticides or provide a buffer zone of 1/4 mile between aerially treated areas and the aquatic habitat of this species, and/or prohibit the use of implicated pesticides by ground application closer than 100 yards from the edge of the aquatic habitats of this species.

Freshwater Mussels

Alabama lamp pearly mussel (Lampsilis virescens), Appalachian monkey-face pearly mussel (Quadrula sparsa), Cumberland monkey-face pearly mussel (Q. intermedia), dromedary pearly mussel (Dromus dromas), birdwing pearly mussel (Conradilla caelata), Cumberland bean pearly mussel [Villosa (=Micromya) trabalis], green-blossom pearly mussel [Epioblasma (=Dysnomia) torulosa gubernaculum], turgid-blossom pearly mussel [E. (=Dysnomia) turgidula], tan riffle shell (E. walkeri), pale lilliput pearly mussel [Toxolasma (=Carunculina) cylindrella], fine-rayed pigtoe (Fusconaia cuneolus), and shiny pigote (F. edgariana).

The diversity of the mussel fauna in the Cumberland and Tennessee River systems make this geographical area perhaps the most prolific region in the world for this particular group of animals. However, the two river systems where this Cumberlandian mussel fauna evolved have been dammed, channelized, polluted, and its mussel populations over harvested, some to the verge of extinction. When the two river systems were developed for navigation, flood control, and hydroelectric power, they became essentially a series of long lakes. Much of the riverine habitat was lost and the rivers' mussel diversity declined. The impact on mussels was greatest in the impounded river sections where few mussel species were able to reproduce. Although the riverine habitat which still remains between the impoundments provides habitat resembling pre-impoundment conditions, these areas have also apparently suffered mussel fauna depletion.

Although accurate up-to-date distribution data is not available for many of these mussel species, most seem to be currently limited to a relatively small portion of their previous range in the Cumberland and Tennessee River systems. Also, individual populations are often very small.

Of all the mussels, the Cumberlandian mussel forms are apparently the most sensitive to environmental changes, and these mussel species were the most severely impacted as the valley was developed. The TVA in their 1979 Cumberlandian Mollusk Conservation Program Work Plan addressed the plight of this group.

> "Wherever declines in freshwater mussel diversity have occurred in the Valley, the species that disappeared first typically have been members of the Cumberlandian fauna. This group of freshwater mussel species, recognized as a unit because they are all essentially restricted to parts of streams that drain the Cumberland Plateau, apparently can exist only in relatively high gradient streams typical of headwaters. Once the mainstem Tennessee River and many of the tributaries began to be impounded, were polluted, or modified in other ways, these species started to die out. Now many Cumberlandian species persist only in relatively unmodified stream reaches such as parts of the Powell and Clinch Rivers, and the North Fork of the Holston River above Saltville, Virginia. However, increasing urbanization, changes in agricultural practices, industrial, and mining activity in these valleys pose increasing threats to these last remnants of this endemic molluscan fauna."

Past declines in naiad mussel diversity and abundance resulted primarily from impoundment of their habitat in the Cumberland and Tennessee River systems for hydroelectric power, navigation, and flood control. The present continued decline is occurring mainly in the Upper Tennessee River tributaries and is due to deterioration of water and substrate quality resulting from coal mining wastes (coal fines and siltation), land use changes, and from toxic waste (both chronic and accidental spills). A rough estimate of the percent that these various problems impact the rivers is given in the following table:

	Coal Fines & Silt	Agricultural Runoff (silt, pesticides & fertilizers)	Urban Runoff (toxic chem. & silt)	Industrial Pollutants & Toxic Wastes
Powell River	80%	10%	5%	5%
Clinch River	20%	25%	5%	50%
North Fork Holston River	0%	35%	minimal	65%
South Fork Holston River	0%	65%	minimal	35%
Middle Fork Holston River	0%	65%	minimal	35%

All 12 of the mussel species for which there is a likelihood of jeopardy are considered to be part of the Cumberlandian mussel fauna, and as such, are characteristically found in headwaters or small rivers in the middle and upper drainage of the Cumberland and Tennessee Rivers. Should runoff of a pesticide into one of these rivers or streams occur, dilution to an acceptable concentration may not be sufficient to eliminate concern for listed mussel species in the immediate vicinity. The effect of flow rates on dilution in some of these streams and rivers is not known.

The freshwater mussels considered here all exhibit a life cycle that involves an intermediate and, at least temporarily, independent larval form, the glochidium. Also, as far as is known, glochidia must become attached to the surface, characteristically a gill surface of a host fish shortly after being released from the adult female mussel. Here they remain encysted on the surface of the host fish for a variable incubation period, after which they drop onto the river bottom. If they chance to fall onto suitable substrate, growth continues as an independent juvenile mussel. Our concern regarding the potential impact of pesticides on mussels is not so much for the direct affect on adults, but for their toxic affect on the larval glochidia and on the host fish, both of which are essential for a life cycle to be completed. The identity of host fish for most listed mussel species is not known, but some confirmed and suspected examples are: the banded darter (Etheostoma zonale) and the green-side darter (E. blennioides) for the birdwing pearly mussel and the whitetail shiner (Notropis galacturus) for the shiny pigtoe. Shiner, catfish, madtom, and sunfish species are suspected host fish for other listed mussels.

The pesticides implicated in this section of the opinion are those that generally exhibit relatively high levels of toxicity to fish and/or aquatic invertebrate species. The potential exists for one or more of these to be involved in a runoff event at a time and place such that recently released glochidia or, perhaps more importantly, significant numbers of one or more host fish species would be lost due to the toxic affect of the pesticide.

To preclude jeopardy, the following reasonable and prudent alternatives are recommended: eliminate aerial applications of implicated pesticides or provide a buffer zone of 1/4 mile between aerially treated areas and the aquatic habitat of these species, and/or prohibit the use of these pesticides by ground application closer than 100 yards from the edge of the aquatic habitats of these species. It would also be highly desirable if studies would be initiated to produce data regarding the toxicity of certain pesticides to freshwater mussels and on actual EEC values in the habitat of Cumberlandian mussels.

Woundfin (Plagopterus argentissimus)

The present distribution of the woundfin extends about 40 miles above and 40 miles below the Virgin narrows on the Virgin River, Washington County, Utah.

The prime limiting factor for woundfin today is modification and loss of habitat. The building of dams and associated reservoirs, water diversion structures, canals, laterals, aquaducts, dewatering of streams, and the return of physically, chemically, and biologically (i.e., exotic species) polluted water to the main channel are the main contributors to this problem (Woundfin Recovery Plan, 1981). Water diversions are so extensive that some parts of the Virgin River (the Narrows) are intermittant because of upstream withdrawals. The quality of the water returned to the river after being used for irrigation must be considered suspect since the potential for pesticide contamination is very high.

Fifty percent of the population of this fish is found below the area where agricultural runoff is returned to the river. (Consultation EPA-82-7, 1982). Since the woundfin depends, to a large extent, upon the return of irrigation water to the river, it is important to insure that the water is not contaminated with pesticides toxic to fish. Corn is one of the crops grown in close proximity to woundfin habitat, and the woundfin could be exposed to the corn cluster pesticides through runoff.

Jeopardy to the woundfin may be precluded by not using those chemicals toxic to fish in the Virgin River drainage 40 miles either side of the Virgin Narrows as a reasonable and prudent alternative.

Insects

Many of the corn cluster pesticides are registered as insecticides. We must assume that they are highly toxic to listed insects unless data is presented to demonstrate that this is not the case. Most listed insects are not found in close proximity to corn fields. Two listed beetles are found in agricultural areas, however.

Valley Elderberry Longhorn Beetle (Desmocerus californicus dimorphus)

The valley elderberry longhorn beetle (VELB) is restricted to elderberry (Sambucus spp.) thickets in riparian areas of the Central Valley of California. Many riparian areas have been converted directly to agriculture or have been destroyed during bank stabilization to protect adjacent agricultural fields. Aerial spraying is very likely to soak riparian vegetation, as well as pollute the streams.

Critical Habitat for the VELB has been established along the American River in Sacramento County. The Draft VELB Recovery Plan, however, lists other areas of essential habitat, including McConnell State Park Recreation Area, Merced County, California. Agriculture surrounds the recreation area on all sides. Corn is grown on a rotating basis near Cressey, California (2 miles to the east), and it is quite likely that corn is, or will be, planted near the recreation area.

An examination of the life cycle of the VELB reveals that it is only susceptible to insecticide exposure during its adult stage (late April to mid-May). The majority of its life cycle is spent hidden within the elderberry wood. A review of the life cycle may help to clarify this point.

Eggs are deposited in cracks and crevices of the bark of the elderberry. Shortly thereafter the eggs hatch and the larvae bore their way into the pith of larger stems and roots. When the larvae are ready to pupate they bore up through the pith of the elderberry, open an emergence hole, and return to the pith for pupation. Adult emergence occurs about the same time as the elderberry flowers. The VELB is believed to forage on both the flowers and the leaves. The entire life cycle takes 2 years.

As a reasonable and prudent alternative to avoid jeopardy to the VELB, insecticides should be restricted from VELB habitat from late April to mid-May. Since the VELB life cycle is tied to the host plant (Sambucus spp.), precautions must be taken to protect the elderberry. Herbicides should be prohibited in VELB habitat. These restrictions apply to the following areas: A two township closure would be T6S R11E and R12E, providing up to 6 miles of clearance for the habitat. A section closure would be T6S R11E S. 11, 12, 13, 14, 23, 24, and T6S R12E S. 7, 18, 19 (Mt. Diablo Base and Meridian).

Delta Green Ground Beetle (Elaphrus viridis)

The Delta green ground beetle (DGGB) occurs in east central Solano County, California, in an area of intensive agriculture. Critical Habitat for the species was designated August 8, 1980. The beetle is believed to be associated with vernal pools in the general vicinity of Dozier, California, but recent collections of the species have occurred in areas well away from vernal pools (1/2 to 1 mile).

Agricultural conversion of vernal pools in central California was the primary reason supporting the listing of the DGGB as a threatened species. A portion of the Critical Habitat has already been converted to agriculture, potentially corn, since the species was listed. Thus, agricultural pesticide use may be an important present and future threat to the species.

To avoid jeopardy to the Delta green ground beetle, we suggest the following reasonable and prudent alternatives should be employed:

Prohibit the use of any pesticide toxic to carabid insects within T5N R1E and R2E, Solano County, California (Mt. Diablo Base and Meridian). This provides a minimum 1-mile (to the north) and maximum 6-mile (to the east) clearance around Critical Habitat. A significant amount of agricultural activity occurs to the east within the 6-mile closure. The foregoing restriction is probably larger than necessary to protect DGGB, but is easy to convey to county agents, put on labels, and enforce in the field. A more specific restriction would be T5N R1E S.1, 2, 3, 10, 11, 12, 13, 14, 15, 22, 23, 24, 25, 26, 27, and T5N R2E S. 6, 7, 18, 19, 30. This provides a minimum 1-mile, maximum 1½-mile clearance around Critical Habitat. This represents what we assume to be adequate clearance to allow for wind drift, but is, of course, more difficult to understand, convey, and enforce.

Solano Grass (Orcuttia mucronata)

Solano grass occurs in a single location in east central Solano County, California, in an area of intensive agriculture. It occurs in vernal pools and is associated with the Delta green ground beetle in the general vicinity of Dozier.

Spring rains and agricultural runoff supply the only source of water to the pools, which may dry up by mid to late summer. Seeds of this species germinate in March and April in deep vernal pools. Full growth is obtained and individual plants flower in late spring to early summer with seed production occurring shortly thereafter. The seeds then lie dormant until the following April.

Agricultural conversion of vernal pools in central California was the primary reason supporting the listing of Solano grass as an endangered species. Thus, agricultural pesticide use (herbicides) may be an important present and future threat to the species. No herbicide toxicity data was provided but some of the herbicides are toxic to grass species and therefore may be a problem.

Herbicide use may pose several threats to this species from both aerial spraying and runoff. Those chemicals hindering germination may potentially pose the greatest problem. Solano grass is wind pollinated, so insecticides should not affect this species.

The following reasonable and prudent alternative is recommended to avoid jeopardy to Solano grass: the use of any herbicides toxic to graminoides should be prohibited within the following sections; T5N R1E S. 1 through 3, 10 through 15, and 25 through 27. This area is included within that recommended earlier for the Delta green ground beetle.

Species of Special Concern

For the following listed species, there is likelihood of some degree of adverse impact, but we believe that this impact is not likely to jeopardize their continued existence or result in the destruction or adverse modification of the Critical Habitat of the Indiana bat, whooping crane, Cape Sable seaside sparrow, slender chub, spotfin chub, snail darter, yellowfin madtom, Alabama cavefish, pine barrens treefrog, Houston toad, and Antioch Dunes evening-primrose. In most cases we have included recommendations that we feel have the potential of eliminating adverse impacts to the species. Pesticides that may be implicated in these impacts are listed on Table 1.

Gray Bat (Myotis grisescens) and Indiana Bat (Myotis sodalis)

Bats prey on flying insects, many of which have soil or aquatic larval stages. In fact, bats may feed upon the adult forms of several lepidopterous crop pest species. When insect larvae that are exposed to sublethal doses of pesticides metamorphose, they may be ingested by bats. Since a single bat may consume, as many as 3,000 insects per night, the potential for bioaccumulation is high. Juvenile bats are particularly susceptible to the toxic effects of pesticides that are concentrated in their mother's milk. Pesticide related mortality in bats is associated with times of stress, such as migration and late hibernation, when fat reserves are metabolized. Recent studies have documented mortality and probable population decline in [illegible]

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Gray bat maternity colonies are especially vulnerable to the adverse effect of pesticides since they are composed of a large number of individuals, contain a high proportion of young of the year, and are active thoroughout the spring and summer when pesticide usage is at its peak. Gray bats usually feed over large bodies of water near their maternity colonies but have been observed feeding as far as 20 miles from their maternity sites.

Because the pesticides that are the subject of this consultation are already registered and many have been in use for a long time, it is difficult to delineate areas in which their use should be restricted. Also, the bioaccumulation potential of many of these pesticides is unknown. We suggest the establishment of an on-going, low-level monitoring program (bat guano samples and incidentally found dead or moribund individuals) at eight caves for at least the top eight insecticides used on corn. If any of these insecticides begin to show up in the guano, more intensive sampling, perhaps of some live individuals, could be undertaken.

Such a program would maximize our probability of detecting any incipient pesticide problems before they reached a critical level. At the same time, this approach would permit continued use of those pesticides that are currently being used to protect crops in the vicinity of bat colonies. This monitoring program should be extended to include pesticides used on other crops in the vicinity of important endangered bat colonies.

Whooping Crane (Grus americana)

The only natural breeding population of whooping cranes nests in Wood Buffalo National Park in Canada and winters on or near the Aransas National Wildlife Refuge in coastal Texas. The primary migration of this flock is a narrow band from northeastern Montana south through western and central North and South Dakota, and central Nebraska, Kansas, and Oklahoma to coastal Texas. During spring migration, confirmed whooping crane sightings have occurred primarily in April with a few sightings the last of March and into May. Fall sightings have been primarily in October.

In addition, whooping cranes from Gray's Lake NWR, Idaho, migrate through western Wyoming, northeastern Utah, and western Colorado to wintering grounds mostly in the vicinity of Bosque del Apache NWR in central New Mexico. They also have summered (May-October) in western Wyoming.

Cranes generally feed on molluscs and aquatic invertebrates in wetland areas, but during migration, especially in the fall, they may be found feeding in grain fields, including corn. During the spring migration, they are less likely to feed in corn fields.

While a number of corn pesticides are known to be toxic to birds (see Table 1), it is not believed that they are likely to cause any significant adverse effect on whooping cranes. During the fall migration when whoopers feed frequently on waste grain, the residue of pesticides is not believed to be very great because residues on grain must meet tolerance levels established by EPA for each pesticide. These tolerance levels are believed to be safe levels for consumption by either humans or domestic animals. During the winter, cranes at Aransas NWR

of Bosque del Apache NWR feed on mature corn and milo in addition to aquatic invertebrates. During spring migration when farmers may be using pesticides again, the cranes generally are not found in corn fields and therefore would not be exposed to toxic pesticides.

Cape Sable Seaside Sparrow (Ammospiza maritima mirabilis)

This bird, one of nine subspecies of seaside sparrows, occurs in four areas in south Florida. Most of the known population is within lands administered by the National Park Service.

The principal threat to the species from pesticides used on corn is through food contamination for the population occupying wetland prairies adjacent to the east Everglades agricultural area west of Miami, Florida. The area supports winter crops of sweet corn and most of the seed corn produced in the State.

The species is primarily insectivorous, although ingestion of plant material and snails have been documented. Provided that land use patterns and agricultural and water management practices do not change radically, remaining wetland buffers will probably continue to insulate the species from significant pesticide effects. This assumption is based on lack of evidence that pesticides have contributed to the endangered status of the species.

Blunt-nosed Leopard Lizard [Gambelia (=Crotaphytus) silus]

The endangered blunt-nosed leopard lizard (BNLL) occurs in the San Joaquin Valley and adjacent foothills from Stanislaus County south to Santa Barbara County, California. It is usually found in association with low foothills, canyons, washes, and arroyos, in areas of sparse vegetation. However, this lizard has become increasingly difficult to locate throughout most of its range because of agricultural development and urbanization. The few remaining areas of prime habitat along the western side of the San Joaquin Valley are undergoing rapid development following the recent completion of a major new aqueduct.

The BNLL usually hibernates from October through April. Adults tend to be less active above ground in the late summer; however, hatchlings tend to be active until mid-October. While active, individual lizards apparently range over an extensive area. It has been estimated that one adult may require up to one section (640 acres) to maintain an adequate food supply (Blunt-nosed Leopard Lizard Recovery Plan, 1980).

The BNLL is an active predator and an opportunistic feeder, subsisting primarily on large insects and small lizards. In the search for food, an individual may come into contact with agricultural areas where pesticides may be used. Any agricultural pest control activities in these areas may be detrimental to BNLL populations. A reduction or loss in the BNLL's primary food source (insects) or the ingestion of poisoned prey provide the most serious threats. For example, entomologists working in Kern County reported finding leopard lizards killed by the insecticides DDT and malathion (Blunt-nosed Leopard Lizard Recovery Plan, 1980).

Corn is produced in only 30 percent of BNLL historic range. Crop rotation makes it more difficult to pinpoint specific areas of concern. Though there may be an

Pine Barrens Treefrog (Hyla andersonii)

Until 1978, the Florida population of this species was known to occur in only 12 localities in Okaloosa and Walton Counties, Florida. Recent surveys have documented a larger range than originally thought, and has resulted in a proposal by the Service on September 15, 1982, to delist the species. The final rulemaking will probably be published by October 1983.

The pine barrens treefrog is found in acidic hillside seepage bogs of the upland stream valleys in Okaloosa, Santa Rosa, Walton, and Holmes Counties, Florida; and Escambia and Covington Counties, Alabama. The primary threat to the species in the Florida panhandle is drainage and subsequent destruction of its highly specific wetland habitat due to land development.

The principal threats to the species which may result from use of pesticides on corn are (1) contamination of prey insect species and (2) water quality degradation of tadpole habitat due to pesticide runoff. The adult treefrogs have unspecialized feeding habits including almost any small insect ranging from grasshoppers to ants. Tadpoles feed on algae.

To the extent that any of the pesticides which exceed "aquatic species triggers" may enter the treefrog's habitat, adverse effects may result to local individuals. While a "jeopardy" determination may not be warranted, we recommend that pesticides which pose a hazard to aquatic species be used only after consultation with a county extension agent who will recommend their use concerning location, form, and rate to prevent aquatic contamination in watersheds within the six-county area.

Houston Toad (Bufo houstonensis)

This species occurs in sandy vegetated areas in Bastrop and Burleson Counties, Texas. Its decline is attributed to destruction of habitat from urban expansion. It is not considered likely that the species will come in contact with corn pesticides.

Colorado River Squawfish (Ptychocheilus lucius)

The primary reason for listing the Colorado River squawfish as endangered was the modification and loss of riverine habitat from the development of water resource projects.

The present range of the Colorado squawfish is restricted to the upper Colorado River basin. It inhabits about 360 miles of the mainstem of the Green River from the mouth of the Yampa River to its confluence with the Colorado River. Its range extends 108 miles up the Yampa River and 150 miles up the White River, both of which are tributaries of the Green River. In the mainstem Colorado River, it is found from above Lake Powell and extends 200 miles upstream. The squawfish is also found in the lower 33 miles of the Gunnison River which is a tributary of the Colorado River.

Our information indicates that there is only a small amount of corn grown in these areas of the Colorado River basin. The fish is relatively widespread and

The use of several pesticides (see Table 1) may adversely affect individual squawfish or very localized portions of squawfish habitat from time to time.

Alabama Cavefish (Speoplatyrhinus poulsoni)

This threatened species is known only from Key Cave, Lauderdale County, Alabama. Key Cave is located on the north bank of Pickwick Reservoir. It is a small, blind cave dweller which apparently displays a depressed reproductive potential. Although population estimates are difficult to determine for this species, a reasonable estimate is that there are currently fewer than 100 individuals. One threat to the species is the possibility of groundwater pesticide pollution due to agricultural operations. To further the conservation of this species, pesticides toxic to fish should not be used within the watershed affecting Key Cave.

Slender Chub (Hybopsis cahni)

This threatened species is endemic to the upper Tennessee River in Tennessee and Virginia. Presently, five populations are known to exist in the Powell River on the Tennessee-Virginia line and four in the Clinch River in Tennessee. Two populations once known from the Clinch River have been extirpated and the only population known from the Holston River is gone. These populations were lost primarily from the effects of impoundments. The remaining populations are threatened primarily by coal related siltation, poor land use practices, gravel, dredging, and toxic chemical spills.

To further the conservation of this species, the following measures are recommended: eliminate aerial applications of implicated pesticides or provide a buffer zone of 1/4 mile between aerially treated areas and the aquatic habitat of this species, and/or prohibit the use of implicated pesticides by ground application closer than 100 yards from the edge of the aquatic habitat of this species.

Spotfin Chub (Hybopsis monacha)

The threatened spotfin chub presently occurs in the Tennessee River drainage in the States of North Carolina, Tennessee, and Virginia. Once occurring widely in 12 tributary systems in five States, it now is extant in only four systems: Little Tennessee River, North Carolina; Duck and Emory Rivers, Tennessee; and North Fork of Holston River, Tennessee and Virginia. Reasons for the reduction or extirpation of the spotfin populations from most of their former range were likely due to adverse impacts on their habitat due to impoundments, channelization, pollution, turbidity or siltation, temperature change, and interspecific competition.

To further the conservation of this species, the following measures are recommended: eliminate aerial applications of implicated pesticides or provide a buffer zone of 1/4 mile between aerially treated areas and the aquatic habitat of this species, and/or prohibit the use of implicated pesticides by ground application closer than 100 yards from the edge of the aquatic habitat of this species.

Bayou Darter (Etheostoma rubrum)

The bayou darter, listed as a threatened species, is known only from Bayou Pierre and its tributaries (White Oak Creek, Foster Creek, and Turkey Creek) in Claiborne, Copiah, and Hinds Counties, Mississippi. Potentially suitable yet unoccupied habitat exists in Little Bayou Pierre and in some sections of the Homochitto River System which lies south of Bayou Pierre. The bayou darter is not known to exist outside of the limits of the stable gravel riffles in the Bayou Pierre System. The darter is apparently limited by the availability of this microhabitat. Open fields and pasture land border Bayou Pierre and White Oak Creek for more than 50 percent of their course. Land use changes that encourage extensive use of fertilizers and pesticides would pose the threat of increased nutrient loading and higher levels of toxic chemicals. Use of herbicides in timber management has been observed near Foster Creek.

To further the conservation of this species, the following measures are recommended: eliminate aerial applications of implicated pesticides or provide a buffer zone of 1/4 mile between aerially treated areas and the aquatic habitat of this species, and/or prohibit the use of implicated pesticides by ground application closer than 100 yards from the edge of the aquatic habitat of this species.

Yellowfin Madtom (Noturus flavipinnis)

This threatened species was probably once widely distributed in many of the lower gradient streams of the Tennessee River drainage upstream of the Chattanooga, Tennessee, area. The species' present distribution is represented by only three known populations (Citico Creek, Monroe County, Tennesse; Powell River, Hancock County, Tennessee; and Copper Creek, Scott and Russell Counties, Virginia). The other three historically known populations of the yellowfin madtom are gone primarily because of human related factors (impoundments, pollution, habitat modification, etc.) and the remaining known existing populations are threatened.

To further the conservation of this species, the following measures are recommended eliminate aerial applications of implicated pesticides or provide a buffer zone of 1/4 mile between aerially treated areas and the aquatic habitat of this species and/or prohibit the use of implicated pesticides by ground application closer than 100 yards from the edge of the aquatic habitat of this species.

Snail darter (Percina tanasi)

The snail darter was listed as an endangered species in November 1975, and at that time its total known distribution was a relatively short stretch of the Little Tennessee River, Tennessee. Since its listing under the Endangered Species Act, there have been several transplants of the fish to other rivers, as well as intensive surveys for additional natural populations. Currently, the known distribution is in the Tennessee River, Marion, Loudon, and Hamilton Counties, Tennessee; Sewee Creek, Meigs County, Tennessee; Hiwassee River, Polk County, Tennessee; South Chickamauga Creek, Hamilton County, Tennessee and Catoosa County, Georgia; Seguatchie River, Marion County, Tennessee; and the Paint Rock River, Jackson and Madison Counties, Alabama. However, the viability of these newly discovered populations needs further verification. The species is still threatened by habitat degradation due to potential stream alterations and pollution from agricultural chemicals and municipal wastes.

To further the conservation of this species, the following measures are recommended: eliminate aerial applications of implicated pesticides or provide a buffer zone of 1/4 mile between aerially treated areas and the aquatic habitat this species, and/or prohibit the use of implicated pesticides by ground application closer than 100 yards from the edge of the aquatic habitat of this species.

Salt Marsh Bird's Beak (Cordylanthus maritimus ssp. maritimus) and Antioch Dunes Evening-Primrose (Oenothera deltoides ssp. howellii)

The salt marsh bird's beak and the Antioch Dunes evening-primrose are both found in areas of extensive agricultural activity. The bird's beak (SMBB) is located in coastal salt marshes, some which are adjacent to and downstream of agricultural areas. The habitat of the evening primrose has been largely destroyed by agricultural and industrial growth. One population of this species, probably the most vulnerable to pesticide use, is found on an island that is surrounded by agricultural lands. Corn is grown in those agricultural areas associated with both species. Therefore, both may be vulnerable to the use of corn pesticides. However, because of the protected nature of the habitats of both species (SMBB is located in tidal marshes and the most vulnerable population of the evening primrose is found on an island) the impact from the use of pesticides on corn may be negligible. It should be noted, though, that there is a lack of data on the effects of herbicides on these or similar species and more importantly, it is not known what effect insecticides may have on the pollinators of either species. The accumulated use of the same or similar pesticides may have an additive effect that may severely impact both species. Therefore, it is recommended that county extension agents be contacted regarding the use of herbicides and insecticides in and adjacent to the following habitats of these two species: 1. Point Mugu Marsh in Ventura County, California (SMBB); and 2. Brannan Island State Park, Solano County, California (ADEP).

We would like to thank you for your cooperation and diligence in working with the OES staff to provide protection for listed species.

Should this action, as now planned, be modified or altered, or should new species be listed that may be affected you must reinitiate consultation.

Sincerely yours,

Robert A. Gantzel

Director

Attachments

51

ATTACHMENT

Table 1: Pesticides used or proposed for use on corn that are likely to jeopardize or may affect listed species

Code#	Pesticide	Mammal		Avian		Aquatic fish		Aquatic invertebrates		Reptiles	
		G	$\overline{G}$	G	$\overline{G}$	G	$\overline{G}$	G	$\overline{G}$	G	$\overline{G}$
010501	Kelthane	-	X	-	X	-	X	-	X	-	X
015801	*Phosdrin	-	X	-	X	-	-	-	-	-	X
019101	Propachlor	-	-	-	-	X	X	X	X	-	-
030065	2,4-D(ester)	-	-	-	-	X	X	X	X	-	-
032501	Disyston	X	X	-	-	X	X	X	X	-	-
032701	Dasanit	-	-	X	X	X	X	X	X	X	X
034001	Methoxychlor	-	-	-	-	-	X	-	X	-	-
035001	Dimethoate	-	-	-	X	-	X	-	X	-	X
036101	Trifluralin	-	-	-	-	-	X	-	X	-	-
037505	Dinoseb**	-	X	-	X	-	X	-	X	-	X
037056	Dinoseb(triethanolamine)	-	X	-	X	-	X	-	X	-	X
037513	Dinoseb(alkanolamine)	-	X	-	X	-	X	-	X	-	X
039107	Dinoseb(ammonium)	-	X	-	X	-	X	-	X	-	X
041101	*Ethoprop	X	-	X	-	X	-	X	-	X	-
041701	Dyfonate	X	X	X	X	X	X	X	X	X	X
041801	EPN	X	X	-	X	X	X	X	X	-	X
053501	Methyl Parathion	-	X	-	X	-	X	-	X	-	X
056801	Carbaryl	-	-	-	-	-	-	-	X	-	-
057201	*Phorate	X	-	X	-	X	-	X	-	X	-
057501	*Ethyl Parathion	X	X	X	X	X	X	X	X	X	X
057701	Malathion	-	-	-	-	-	X	-	X	-	-
057801	*Diazinon	-	-	X	X	X	X	X	X	X	X
057901	Trichlorfon	-	-	-	-	X	X	X	X	-	-
058001	Guthion	-	X	-	X	-	X	-	X	-	X
058102	Carbophenothion	-	X	-	-	-	X	-	X	-	-
058401	Ethion	-	X	-	-	-	X	-	X	-	-
059101	*Chlorpyrifos	X	X	X	X	X	X	X	X	X	X
059301	Bufencarb	-	-	-	-	X	X	X	X	-	-
061601	Paraquat	X	X	X	X	-	-	-	-	X	X
069201	Avitrol	X	-	X	-	-	-	-	-	X	-
079401	Endosulfan	X	X	-	X	X	X	X	X	-	X
080501	Toxaphene	X	X	-	X	X	X	X	X	-	X
090301	Methomyl	-	-	-	-	-	-	X	X	-	-
090601	*Carbofuran	X	X	X	X	X	X	X	X	X	X
097601	Propargite	-	-	-	-	-	X	-	X	-	-
105001	Terbufos	-	X	-	-	X	-	X	-	-	-
109401	Isofenphos	X	X	X	X	X	X	X	X	X	X
111601	Oxyfluorfen	-	-	-	X	-	X	-	X	-	X
114501	Thiodicarb	-	-	-	-	-	X	-	X	-	-

Plants - Include all herbicides used or proposed for use
Insects - Include all insecticides used or proposed for use

* - data exists implicating these pesticides in major avian kills (E.Hill, Patuxent Wildlife Research Center, pers. comm.)
** - there was not enough data to distinguish between the four registered compounds of Dinoseb

G - granular $\overline{G}$ - non-granular
NOTE: The above data is based upon the best available data supplied by EPA (analysis in subject