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OFFICE OF
CHEMICAL SAFETY AND
POLLUTION PREVENTION

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MEMORANDUM

Subject: Ecological Risk Assessment for the Proposed New Uses of Difenoconazole as a Foliar Spray for Carrot, Chickpea, Soybean, Stone Fruit (Group 12), and Strawberry and as a Seed Treatment for Oat and Rye

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Attached is the Environmental Fate and Effects Division's (EFED) Ecological Risk Assessment in response to Syngenta's Section 3 request to register difenoconazole, formulated into the Inspire, Inspire XT, Quadris Top, Inspire Super, and Dividend end-use products, on several crops (see **Table 2**).

Risks to Non-target Organisms

This assessment includes the parent difenoconazole and its total toxic residues. Based on the results of this screening-level risk assessment for the proposed new uses of difenoconazole, there is potential for risks to birds (chronic) and mammals (chronic) due to the foliar spray applications of difenoconazole. Due to lack of acceptable terrestrial plant data, potential risks were assumed for listed species. For exposures in the aquatic environment, potential risks were predicted for estuarine/marine invertebrates (acute), and freshwater and estuarine/marine invertebrates (chronic) due to exposure to the parent difenoconazole. The total toxic residue

approach predicted potential risks to freshwater fish (chronic), estuarine/marine invertebrates (acute), and freshwater and estuarine/marine invertebrates (chronic). See **Sections 5.1** to **5.3** for details about the specific uses of difenoconazole that are associated with potential risk.

Recommended Label Revisions

On the Quadris Top product label, the registrant should correct the error in the strawberries application information section. The number of ounces applied per application should be "8-14" rather than "8-4".

In addition, as identified in previous assessments, there is uncertainty regarding the length of the application interval due to the use of a different fungicide for the third application. To be conservative, EFED assumed that the interval between the second and third applications would remain either 7 or 10 days; however, it is possible that a longer interval would be used when rotating to another type of fungicide. The registrant should clarify the length of the interval when rotating to a different fungicide on all labels.

Data Gaps

EFED recommends that the following studies, which were identified in previous assessments, be requested from the registrant. The first six studies apply to the parent compound.

1. **Freshwater Fish Acute Toxicity Study (850.1075):** Data that satisfy this requirement were provided for the bluegill sunfish and rainbow trout. However, the fathead minnow was the species used for the freshwater fish early-life stage study (850.1400) requirement. Because this test species is different from the two species used for the freshwater fish acute toxicity tests, a 96-hour LC_{50} for fathead minnow must also be provided.[1]

   MRID 48453201

2. **Freshwater and Estuarine/Marine Fish Early-life Stage Study (850.1400):** No data were available to assess the chronic toxicity of difenoconazole to estuarine/marine fish. A study evaluating the chronic effects of difenoconazole on sheepshead minnow would satisfy this data requirement. The LC_{50}s for estuarine/marine fish were comparable to the LC_{50}s for freshwater fish, suggesting similar acute sensitivity to difenoconazole. However, it was not possible to use the acute to chronic ratio (ACR) to generate an estuarine/marine fish chronic endpoint as the acute and chronic freshwater fish studies utilized two different species. Because of its expected use or mobility patterns, difenoconazole may enter estuarine/marine environments in significant concentrations. In the absence of acceptable data, potential chronic risks to estuarine/marine fish are unknown, but RQs would be assumed to exceed LOCs for listed species. In addition, submitted data for freshwater fish were classified as supplemental; therefore, acceptable data for freshwater fish is also required. The test may be repeated with the fathead

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[1] The submitted fathead minnow early-life stage study was classified as supplemental. The registrant should be advised that if the early-life stage study is repeated with either a rainbow trout (preferred) or bluegill sunfish and found to be acceptable, then the data gap for the fathead minnow acute toxicity test would be eliminated. However, if the early-life stage study is repeated with the fathead minnow, then the data gap for the fathead minnow acute toxicity test remains.

held in reserve pending an analysis of the acute data.

Additionally, the following uncertainties were identified for this risk assessment:

- There is uncertainty associated with risk to sediment dwelling organisms. Pore water concentrations indicated that the concentrations of difenoconazole in the sediment are similar to that in the water column (see **Appendix 2**). Because difenoconazole is persistent, a study evaluating risk to sediment dwelling organisms was previously identified as a data gap. Although a sediment toxicity study determining the effects of difenoconazole residues to benthic organisms has been submitted and reviewed, the numerous deviations in the study limit its use for quantitative purposes.

- Before difenoconazole breaks down to 1,2,4-triazole, it forms CGA-205375, (1-[2-Chloro-4-(4-chlorophenoxy)-phenyl]-2-[1,2,4]triazol-1-yl-ethanol). CGA-205375 has potential to be slightly more mobile in the soil than difenoconazole, based on the registrant-submitted adsorption/desorption study. The potential adverse effect of this degradate on the ecological environment was not addressed in this risk assessment. If this degradate is shown to have potential ecological or human health concerns, additional fate and transport studies may be requested at a later time.

- In this assessment, only the active ingredient difenoconazole was modeled, and exposure and effects from product mixtures containing an additional active ingredient were not taken into consideration. However, effects of mixtures to a full range of taxa are unknown, and effects have the potential to be antagonistic, synergistic, or neutral when two chemicals are premixed, tank-mixed, or residues are mixed in the environment.

- Because it is persistent, difenoconazole and its degradates may accumulate in soil after repeated use. This repeated or continuous exposure may result in significant risks to non-target organisms, especially birds and mammals.

- This risk assessment only considered the most sensitive of the species evaluated in the registrant-submitted studies. The position of the tested species relative to the distribution of all species' sensitivities to difenoconazole is unknown. Extrapolating the risk conclusions from the most sensitive tested species to non-tested species may either underestimate or overestimate the potential risks to those species.

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1. Executive Summary

The Environmental Fate and Effects Division (EFED) has evaluated the Section 3 registration for use of the broad-spectrum fungicide difenoconazole (Inspire, Inspire XT, Quadris Top, Inspire Super, Dividend) on several crops. Difenoconazole is a fungicide in the conazole chemical class. Fungicidal activity of the conazole class is attributed to the inhibition of ergosterol biosynthesis. Inspire, Inspire XT, Quadris Top, and Inspire Super are foliar spray formulations proposed for use on strawberry, chickpea, soybean, carrot, and stone fruit. Dividend is a seed treatment formulation proposed for use on oat and rye seed. Inspire XT, Quadris Top, and Inspire Super are formulations that contain difenoconazole and another active ingredient – either propiconazole, azoxystrobin, or cyprodinil, respectively. This assessment is only for the single active ingredient difenoconazole; exposure and effects from the product mixtures were not evaluated.

A number of risk assessments have been conducted on difenoconazole. Previous assessments have identified potential risks primarily to aquatic invertebrates on a chronic basis (on an acute basis for estuarine/marine invertebrates for certain uses), and birds and mammals on a chronic basis. Potential risks were identified for estuarine/marine fish on a chronic basis and terrestrial plants due to lack of acceptable data. Taxonomic groups for which concern levels were exceeded for the proposed uses are summarized in **Table 1**.

Table 1. Potential Effects Associated with the Proposed New Uses of Difenoconazole

Listed Taxa	Direct Effects[1]	Indirect Effects[2]
Terrestrial and semi-aquatic plants – monocots and dicots	Yes	Yes
Birds	No – Acute Yes – Chronic	Yes
Terrestrial-phase amphibians	No – Acute Yes – Chronic	Yes
Reptiles	No – Acute Yes – Chronic	Yes
Mammals	No – Acute Yes – Chronic	Yes
Aquatic plants	No	Yes
Freshwater fish	No – Acute Yes – Chronic[3]	Yes
Aquatic-phase amphibians	No – Acute Yes – Chronic[3]	Yes
Freshwater invertebrates	No – Acute Yes – Chronic[4]	Yes
Estuarine/marine Mollusks	No	Yes
Estuarine/marine fish	No – Acute Yes – Chronic	Yes
Estuarine/marine invertebrates	Yes – Acute[4]	Yes

Table 1. Potential Effects Associated with the Proposed New Uses of Difenoconazole		
Listed Taxa	**Direct Effects[1]**	**Indirect Effects[2]**
	Yes – Chronic[4]	
Terrestrial invertebrates	No	Yes

[1]The Agency's Level of Concern was exceeded for estuarine/marine invertebrates (chronic), birds (chronic), and mammals (chronic); risks to terrestrial and semi-aquatic plants and chronic risks to estuarine/marine fish were assumed due to the absence of acceptable data.
[2]Indirect effects to a listed species occur when its prey base is reduced or habitat is modified. Due to the lack of acceptable terrestrial plant data, indirect effects are assumed for all taxa.
[3]The LOC was exceeded as a result of exposure to total residues of difenoconazole (includes degradates).
[4]The LOC was exceeded for invertebrates exposed to the parent difenoconazole as well as the total toxic residues.

2. Use Characterization

There are several active registrations for formulations of difenoconazole (including mixtures) and one for the technical grade product. Difenoconazole is already registered for foliar use on fruiting vegetables, pome fruit, tuberous and corm vegetables subgroup, sugar beets, potatoes, all ornamental uses except crops grown commercially in the greenhouse or nursery, and golf course turf. It is registered for seed treatment use on cereals (wheat, barley, triticale), cotton, sweet corn, and canola. The proposed new uses of difenoconazole are summarized in **Table 2**.

Table 2. Proposed Difenoconazole Use Patterns for Inspire, Quadris Top, Inspire XT, and Inspire Super Foliar Sprays and Dividend Seed Treatments					
Crop	**Maximum Individual Application Rate (lb a.i./A)**	**Number of Applications**	**Minimum Application Interval (days)**	**Maximum Application Rate per Season (lb a.i./A/season)**	**Application Method**
Carrot	0.114	4	7	0.46	Ground Spray Aerial Spray+ Chemigation*
Chickpea	0.114	4	7	0.46	Ground Spray Aerial Spray+ Chemigation*
Soybean	0.114	4	7 (14 for Inspire XT)	0.46	Ground Spray# Aerial Spray+# Chemigation*#
Stone Fruit (Group 12)	0.114	4	7 (between applications 1 & 2) 10 (between applications 2 & 3 and 3 & 4)	0.46	Ground Spray Aerial Spray^
Strawberry	0.114	4	7	0.46	Ground Spray Aerial Spray^ Chemigation*
Oat Seed	0.023	NA	NA	NA	Incorporated
Rye Seed	0.034	NA	NA	NA	Incorporated

+Inspire Super label does not allow applications via aerial spray
*Inspire XT and Inspire Super labels do not allow applications via chemigation
#Inspire Super label does not allow applications to soybean
^Inspire Super label allows aerial sprays in California only

2.1. Scope of Assessment

This assessment considers difenoconazole and its total toxic residues for aquatic animals. The total toxic residue approach was used as a conservative estimate of aquatic exposure to the degradates CGA-71019 (1,2,4-triazole) and CGA-142856 (triazole acetic acid). Total toxic residue estimates were compared to the parent difenoconazole toxicity values as part of the aquatic risk estimation. While effects of triazole acetic acid are unknown, a preliminary review of the data shows that 1,2,4-triazole is less toxic than the parent to fish on a chronic basis. Due to lack of acceptable terrestrial toxicity data for both 1,2,4-triazole and triazole acetic acid, the terrestrial assessment is limited to the parent compound only.

This assessment follows an abbreviated format because no new data have been received and a comprehensive assessment was completed recently (DP377719, July 20, 2010).

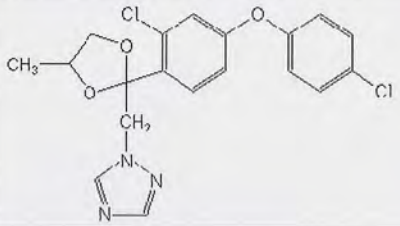
2.2 Nature of the Chemical Stressor

Difenoconazole is a fungicide in the conazole chemical class. Fungicidal activity of the conazole

class of compounds is attributed to the inhibition of ergosterol biosynthesis[2]. Ergosterol, which controls cell membrane permeability, is a critical component in fungal cell membranes[3]. The mechanism of controlling ergosterol biosynthesis is through the disruption of the fungal cytochrome P-450-mediated 14 α-lanosterol demethylation. Accumulation of 14 α-methyl sterols correlates with the subsequent loss of ergosterol in the fungal cell wall.

Based on a low vapor pressure of 2.5×10^{-10} mm Hg and solubility in water of 15 mg/L, difenoconazole has a low propensity to volatilize and generate vapors after application. At test termination in laboratory studies, the residues detected in an organic volatiles trap totaled 0.7% or less; most instances were less than 0.1% of the applied difenoconazole. The concentrations of the applied difenoconazole lost through volatilization were not measured in the terrestrial field dissipation studies. Selected physical and chemical properties are presented in **Table 3**.

Table 3. Physical and Chemical Properties of Difenoconazole

Property	Value	Source
Common Name	Difenoconazole	MRID 469501-04
CAS Registry No.	119446-68-3	
PC Code	128847	
Structure		MRID 469501-04
Chemical Name (CAS)	1-{2-[4-(chlorophenoxy)-2-chlorophenyl-(4-methyl -1,3-dioxolan-2-yl)-methyl]} -1H-1,2,4-triazole	MRID 469501-04
SMILES notation	O1CC(C)OC1(Cn2ncnc2)c3c(Cl)cc(Oc4ccc(Cl)cc4)cc3	EPI Suite, v3.12 SMILES
Molecular Formula	$C_{19}H_{17}Cl_2N_3O_3$	MRID 469501-04
Molecular Weight	406.27	MRID 469501-04
Physical State	Red Liquid	
Vapor pressure	2.5×10^{-10} mm Hg (25 °C)	MRID 465159-01
Henry's Law constant	8.9×10^{-12} atm x m^3/mol	MRID 465159-01
Specific Gravity/ Density	1.14g/cm^3 @ 25 °C	MRID 469501-04

[2] www.centerwatch.com/patient/drugs/dru784.html
[3] www.hull.ac.uk/php/chsanb/fungweb/fungweb7.htm

Table 3. Physical and Chemical Properties of Difenoconazole		
Property	**Value**	**Source**
Solubility in water	15.0 mg/L @ 25 °C	MRID 469501-04
log K_{ow}	4.4 (25 °C)	MRID 469501-05

In soil, difenoconazole is persistent and slightly mobile. Difenoconazole has low potential to reach ground water, except in soils of high sand and low organic matter content. During a runoff event, difenoconazole will potentially enter adjacent bodies of surface water. In an aquatic environment, difenoconazole's main route of dissipation is partitioning into the bottom sediment as shown in an aerobic aquatic metabolism study (MRID 422451-34), in which the distribution ratio of sediment and water phases was 8:1 at 1 day post-treatment and 40:1 at 30 days post-treatment. Difenoconazole has the potential to undergo slow to relatively fast aqueous photolysis in clear water. **Table 4** summarizes the environmental fate data of the parent difenoconazole. Additional environmental fate data, including major degradates and maximum percent formation, can be found in the earlier assessment (DP377719, July 20, 2010).

Table 4. Summary of the Environmental Fate Properties of Difenoconazole		
Property	**Value**	**Source**
Name	Difenoconazole	
Henry's Law constant	8.9×10^{-12} atm x m^3/mol	MRID 465159-01
Soil adsorption coefficient K_{oc} (L/kg)	3867, 3518, 3471, and 7734 3870, 4587, 4799, and 11202	MRID 422451-35 [A] MRID 469501-21
Hydrolysis half-life pH = 5 pH = 7 pH = 9	 Stable Stable Stable	 MRID 422451-27
Photolysis half-life in water	6 days – ca. 1 ppm in sterile buffer solution (30-day study) ca. 9.2 days – 1mg a.i./L in natural water 228 days – 1.52 ml a.i./L in sterile buffer solution (15-day study)	MRID 422451-28 MRID 469501-04 MRID 469501-05[B]
Photolysis half-life in soil	349 - 823 days	MRID 469501-06[C]
Aerobic soil metabolism half-life	84.5 days – at 0.1 ppm concentration 1600 days – at 10 ppm in loam 1059 days – at 10 ppm in sandy loam 120 days – at 0.13 ppm; Swiss loam 104 days – at 0.13 ppm; Swiss loam 165 (158) days – at 0.23 ppm; Swiss sandy loam 204 (187) days – at 0.23 ppm; Swiss sandy loam/loamy sand 204 (198) days – at 0.23 ppm; French silty clay loam 433 (408) days – at ca. 0.1 ppm in CA loamy sand at 25 °C 533 days – at ca. 0.1 ppm in CA loamy sand at 25 °C	MRID 422451-31 MRID 422451-32[D] MRID 422451-33[D] MRID 469501-09 MRID 469501-10 MRID 469501-11 MRID 469501-12 MRID 469501-14

Table 4. Summary of the Environmental Fate Properties of Difenoconazole		
Property	**Value**	**Source**
Anaerobic soil metabolism half-life	947 days – at 10 ppm in loam	MRID 422451-32
Aerobic aquatic metabolism half-life	860 days (10mg a.i./L) 315 (330) days (nominal 0.1 kg a.i./ha =0.17 mg a.i./L); Swiss pond water-silty clay loam sediment) 335 (301) days (0.17 mg a.i./L; Swiss river water-sandy loam sediment) 565 days (0.04 mg a.i./L)	MRID 422451-34 [E] MRID 469501-16 MRID 469501-17
Anaerobic aquatic metabolism half-life	1245 days (10mg a.i./L) 370 days (433) (0.04 mg a.i./L)	MRID 422451-34 [E] MRID 469501-19
Terrestrial field dissipation half-life	252 days - determined in the 0- to 3-inch depth – CA bare loamy sand 231 days – GA bare loamy sand (four applications of 0.13 lb a.i./A) 139 days – CA bare plot of loam soil (four applications of 0.13 lb a.i./A) 462 days – ND bare sandy clay loam	MRID 422451-40 MRID 469501-26 MRID 469501-27 MRID 469501-29
Laboratory accumulation in fish bioaccumulation factor (*Lepomis macrochirus*) a depuration half-life	170x in edible tissues 570x nonedible tissues 330x for whole body 1 day	MRID 422451-42

[A] There was another adsorption/desorption study (MRID 422451-36) reviewed in which the test soils were autoclaved priorto conducting the study which could distort the mobility characteristic of difenoconazole, thus, the study results were not used for calculation of modeling input parameters.

[B] For the modeling purposes the longest half-life was used as it represents the most conservative scenario. However, there is considerable uncertainty in the photolysis half-lives because the duration of the studies was considerably shorter than the extrapolated half-life (MRIDs 469501-05 and 469501-06).

[C] The soil photolysis half-life under xenon light condition was recalculated to represent the conditions under natural sunlight intensity during 30-day periods between June and September (104.7-246.9 W·min/cm^2), as a result, a range of half-lives was obtained.

[D] In those aerobic soil metabolism studies (MRID 422451-32 and MRID 422451-33) the test application rate was significantly higher than expected under registrant-proposed use condition for difenoconazole.

[E] In those aquatic metabolism studies, the test application rates were significantly higher than expected under registrant-proposed use condition for difenoconazole.

3. Exposure Summary

3.1. Terrestrial Exposures

T-REX v1.4.1 was used to estimate potential exposures to birds and mammals. Estimated concentrations of difenoconazole, applied as a foliar spray, to which birds could be exposed via consumption of contaminated food items are in **Table 5**. **Table 6** includes estimated concentrations of difenoconazole to which mammals could be exposed via consumption of contaminated food items. **Table 7** includes estimated concentrations of difenoconazole to which birds and mammals could be exposed via consumption of treated seed. Additionally, **Table 7** includes an estimate of available active ingredient per square foot to which birds and mammals could be exposed. Sample T-REX inputs and outputs are included in **Appendix 1**.

Table 5. Avian Exposure Concentration Estimates for Proposed Difenoconazole Foliar Spray Applications				
Feeding Category	Dietary-based EECs (mg/kg-food item)	Dose-based EECs (mg/kg-bw)		
		Small (20 g)	Medium (100 g)	Large (1000 g)
Carrot, Chickpea, Soybean, Strawberry		**4 applications @ 0.114 lb a.i./acre (7-day interval)**		
Short grass	89.96	102.46	58.43	26.16
Tall grass	41.23	46.96	26.78	11.99
Broadleaf plants/small insects	50.60	57.63	32.87	14.71
Fruits/pods/seeds/large insects	5.62	6.40	3.65	1.63
Seeds only	-	1.42	0.81	0.36
Stone Fruit		**4 applications @ 0.114 lb a.i./acre (7-day interval between applications 1 & 2; 10-day interval between applications 2 & 3 and 3 & 4)**		
Short grass	84.24	95.94	54.71	24.49
Tall grass	38.61	43.97	25.08	11.23
Broadleaf plants/small insects	47.39	53.97	30.78	13.78
Fruits/pods/seeds/large insects	5.26	5.99	3.42	1.53
Seeds only	-	1.33	0.76	0.34
No more than two consecutive applications of difenoconazole are recommended before alternating to a different fungicide.				

Table 6. Mammalian Exposure Concentration Estimates for Proposed Difenoconazole Foliar Spray Applications				
Feeding Category	Dietary-based EECs (mg/kg-food item)	Dose-based EECs (mg/kg-bw)		
		Small (15 g)	Medium (35 g)	Large (1000 g)
Carrot, Chickpea, Soybean, Strawberry		**4 applications @ 0.114 lb a.i./acre (7-day interval)**		
Short grass	89.96	85.77	59.28	13.74
Tall grass	41.23	39.31	27.17	6.30
Broadleaf plants/small insects	50.60	48.25	33.35	7.73
Fruits/pods/seeds/large insects	5.62	5.36	3.71	0.86
Granivores	-	1.19	0.82	0.19
Stone Fruit		**4 applications @ 0.114 lb a.i./acre (7-day interval between applications 1 & 2; 10-day interval between applications 2 & 3 and 3 & 4)**		
Short grass	84.24	80.32	55.51	12.87
Tall grass	38.61	36.81	25.44	5.90
Broadleaf plants/small insects	47.39	45.18	31.23	7.24
Fruits/pods/seeds/large insects	5.26	5.02	3.47	0.80
Granivores	-	1.11	0.77	0.18
No more than two consecutive applications of difenoconazole are recommended before alternating to a different fungicide.				

Table 7. Avian and Mammalian Exposure Concentration Estimates for Proposed Difenoconazole Seed Treatment Applications					
Crop	Maximum Application Rate (lb a.i./A)	Maximum Seed Application Rate (mg a.i./kg-seed)	Avian Nagy Dose (mg a.i./kg-bw/day)*	Mammalian Nagy Dose (mg a.i./kg-bw/day)*	Available A.I. (mg a.i./ft^2)*
Oat	0.0233	242.19	0.61	0.51	<0.01
Rye	0.03391	242.19	<0.61	<0.51	<0.01
*To account for incorporation of treated seeds during planting, EECs have been multiplied by an incorporation factor of 0.01.					

EECs were not calculated for terrestrial plants because the submitted toxicity study provided only qualitative information (MRID 469502-03). The test included observations of visible effects on seedling emergence and mortality. No phytotoxic effects were observed in any species at the five concentrations tested following pre- or post-emergence application (NOAEC = 0.44 lb a.i./A). However, the study did not measure various growth parameters, which is necessary to adequately determine effects; therefore, the TerrPlant model was not used to estimate exposure of difenoconazole to terrestrial and semi-aquatic plants.

3.2. Aquatic Exposures

The Tier II aquatic assessment was performed using PRZM (v3.12.2)/EXAMS (v. 2.98.04.06) modeling with standard pond scenario. Detailed description of these models can be found in a previous assessment (DP377719, July 20, 1010). The parent difenoconazole was assessed separately, followed by difenoconazole and its total toxic residues.

3.2.1 Exposure Estimates for the Parent Compound

The PRZM/EXAMS input parameters for difenoconazole are shown in **Table 8**. Inputs are equivalent to those used in previous assessments (DP377719, July 20, 2010). Results of the PRZM/EXAMS modeling exercises are in **Table 9**. Sample PRZM/EXAMS outputs are included in **Appendix 2**.

Table 8. PRZM/EXAMS Chemical Specific Input Parameters for Difenoconazole

Parameter	Input Value and Unit	Source/Comments
Scenario	CA Strawberry RLF FL Strawberry STD FL Carrot STD GA Peach STD MI Bean STD MI Cherry STD MS Soybean STD OR Soybean STD ND Wheat STD	All available Scenarios for each uses
Maximum single application rate Foliar Application Seed Treatment	 0.114 lbs ai/A (0.128 kg ai/ha) 0.03 lbs ai/A (0.034 kg ai/ha)	Inspire, Inspire XT, Inspire Super, Quadris Top Labels (EPA Reg. No. 100-1262, 100-1312, 100-1317, 100-1313) Dividend Label (EPA Reg. No. 100-740)
Method of application CAM = 2 CAM = 4	 Foliar Spray Seed Treatment	Product Label as above
Maximum number of applications	4 (Foliar) 1 (Seed treatment)	Product Label as above
Application efficiency	0.99 (Ground Spray) 0.95 (Aerial Spray) 1.00 (Seed Treatment)	EFED Model Input Guidance, Version 2.1 (2009b) [a]
Spray drift	0.01 (Ground Spray) 0.05 (Aerial Spray) None (Seed Treatment)	EFED Model Input Guidance, Version 2.1 (2009b)

Table 8. PRZM/EXAMS Chemical Specific Input Parameters for Difenoconazole		
Parameter	**Input Value and Unit**	**Source/Comments**
Application date and minimum interval between applications (days)	CA Strawberry: September 26 (7,7,7) FL Carrot: January 24 (7,7,7) FL Strawberry: February 15 (7,7,7) GA Peach: August 31 (7,10,10) MI Bean: August 21 (7,7,7) MI Cherry: July 07 (7,10,10) MS Soybean: September 26 (7,7,7) OR Soybean: September 26 (7,7,7) ND Wheat: May 9	A combination of label directions and information related to crop profile in current scenarios for PRZM/EXAM model
Henry's Law constant	8.9×10^{-12} atm x m^3/mol	MRID 46515901
Hydrolysis	Stable	MRID 42245127
Aerobic soil metabolism ($t_{1/2}$)[b]	313 days	MRIDs.: 42245131, 46950109-12, and 46950114
Aerobic aquatic metabolism ($t_{1/2}$)[b]	556 days	MRIDs.: 46950116 & 46950117
Anaerobic aquatic metabolism ($t_{1/2}$)[c]	1110 days	MRID 46950119
Aquatic photolysis $t_{1/2}$ (days)[d]	Stable	MRID 46950105
Vapor pressure	2.5×10^{-10} mm Hg (25 °C)	MRID 46515901
Solubility in water	15 mg/L (25 °C)	MRID 46515901
Molecular Weight	406.27	MRID 46950104
Partition coefficient K_{oc}	5381 mL/g	MRIDs: 42245135 and 46950121

[a] *Guidance for Selecting Input Parameters in Modeling the Environmental Fate and Transport of Pesticides* (Version 2.1; Oct. 22, 2009)
[b] The 90% of the UCL of the mean metabolism half-life.
[b] The 90% of the UCL of the mean metabolism half-life of all available half-lives but those obtained for high test rate.
[c] At proposed application rate only one half-life was available, the half-life was multiplied by three (i.e., 3 x 370 days).
[d] Estimated half-life is beyond the duration of study, thus considered stable.

Table 9. Estimated Environmental Concentrations (EECs) of Difenoconazole for Surface Water Based on Selected Crop Scenarios

Water Source (model)	Use Scenario (rate and interval)	Application Method	Peak EEC (µg/L)	21-Day EEC (µg/L)	60-Day EEC (µg/L)
Surface Water (PRZM/EXAMS)	Carrot: FL Carrots STD (4 apps @ 0.114 lb a.i./acre, 7-day interval)	Aerial	**6.41**	**5.46**	**5.13**
		Ground	6.10	5.11	4.77
	Chickpeas: MI Bean STD (4 apps @ 0.114 lb a.i./acre, 7-day interval)	Aerial	**5.51**	**4.97**	**4.68**
		Ground	4.15	3.76	3.56
	Stone Fruit: GA Peach STD (4 apps @ 0.114 lb a.i./acre, 7-day interval between apps 1 & 2, 10-day interval between apps 2 & 3 and 3 & 4)	Aerial	4.55	2.92	2.50
		Ground	4.08	2.37	1.90

Table 9. Estimated Environmental Concentrations (EECs) of Difenoconazole for Surface Water Based on Selected Crop Scenarios					
Water Source (model)	**Use Scenario (rate and interval)**	**Application Method**	**Peak EEC (µg/L)**	**21-Day EEC (µg/L)**	**60-Day EEC (µg/L)**
	Stone Fruit: MI Cherry STD (4 apps @ 0.114 lb a.i./acre, 7-day interval between apps 1 & 2, 10-day interval between apps 2 & 3 and 3 & 4)	Aerial	**6.48**	**5.29**	**4.91**
		Ground	5.66	4.68	4.31
	Soybean: MS Soybean STD (4 apps @ 0.114 lb a.i./acre, 7-day interval)	Aerial	8.76	7.67	6.97
		Ground	8.30	7.14	6.47
	Soybean: OR Soybean STD (4 apps @ 0.114 lb a.i./acre, 7-day interval)	Aerial	**8.80**	**8.25**	**8.06**
		Ground	7.91	7.36	7.19
	Strawberry: CA Strawberry RLF (4 apps @ 0.114 lb a.i./acre, 7-day interval)	Aerial	6.19	5.65	5.38
		Ground	5.38	4.80	4.54
	Strawberry: FL Strawberry STD (4apps @ 0.114 lb a.i./acre, 7-day interval)	Aerial	**7.40**	**5.66**	**5.35**
		Ground	7.10	5.29	4.93
	Seed treatment[1]: ND Wheat STD 1 application @ 0.03 lb a.i/acre	Ground	**0.24**	**0.20**	**0.19**
[1]EECs in bold used for risk estimation.					

3.2.2. Exposure Estimates for the Total Toxic Residues of Difenoconazole

For screening purposes, the total toxic residue EECs were generated for difenoconazole and its major degradates (1,2,4-triazole and triazole acetic acid), which were assumed to be stable with a low soil partition coefficient in all modeled media. For the total toxic residue GENEEC modeling, all input parameters were the same as listed in **Table 8**, with the exception of the photolysis half-life, aerobic soil metabolism half-life, aerobic and anaerobic aquatic metabolism half-lives, which were assumed to be zero (stable). A soil partition coefficient (Koc) of 1000 mg/L was also assumed for the total toxic residues. The total residue (difenoconazole and 1,2,4-triazole and triazole acetic acid) EECs for the proposed soybean use (selected because this use produced the highest EECs) are listed in **Table 10**. Sample GENEEC output files are located in **Appendix 2**.

Table 10. Estimated Environmental Concentrations (EECs) of Total Toxic Residues (Difenoconazole and Its Degradates) for Surface Water Based on the Proposed Soybean Use					
Water Source (model)	**Use Scenario**	**Application Method**	**Peak EEC (µg/L)**	**21-Day EEC (µg/L)**	**60-Day EEC (µg/L)**
Surface Water (GENEEC)	Soybean: 4 apps @ 0.114 lb a.i./acre, 7-day interval	Aerial	**14.88**	**14.50**	**13.80**

4. Ecological Effects Summary

4.1. Toxicity Data for the Parent Compound

A summary of toxicity data, including data used to calculate RQs, is provided in **Tables 11** and **12**. Additional discussion of the data can be found in a previous assessment (DP377719, July 20, 2010). For acute toxicity, difenoconazole is classified as slightly toxic to birds, non-toxic to honeybees, and slightly toxic to mammals; difenoconazole is moderately to highly toxic to freshwater fish and highly toxic to freshwater invertebrates, estuarine/marine fish, and estuarine/marine invertebrates. Five aquatic plant toxicity studies, which demonstrated difenoconazole toxicity to aquatic plants, were submitted. A visible phytotoxicity (including emergence and mortality) test was carried out on seedling emergence and vegetative vigor of terrestrial plant species.

Table 11. Summary of Most Sensitive Aquatic Acute and Chronic Toxicity Endpoints				
Type of Study	**Species**	**Toxicity Value (µg a.i./L)**	**Toxicity Classification**	**MRID**
Acute – Freshwater Fish	Rainbow trout (*Oncorhynchus mykiss*)	96-hr LC_{50} = 810	Highly toxic	422451-07
Chronic – Freshwater Fish	Fathead minnow (*Pimephales promelas*)	NOAEC = 8.7 LOAEC = 19.0 (larval length at 30 days post-hatch)	NA	422451-15
Acute – Freshwater Invertebrate	Water flea (*Daphnia magna*)	48-hr EC_{50} = 770	Highly toxic	422451-10
Chronic – Freshwater Invertebrate	Water flea (*Daphnia magna*)	NOAEC = 5.6 LOAEC = 13.0 (number of young/adult/reproductive day and adult length)	NA	422451-14
Chronic – Freshwater Invertebrate (Sediment)	Midge (*Chironomus riparius*)	EC_{50}: >50 mg a.i./kg-sediment (nominal) NOAEC (emergence rate & development rate): 5 mg a.i./kg-sediment (nominal)	NA	476486-01
Acute – Estuarine/Marine Fish	Sheepshead minnow (*Cyprinodon variegates*)	96-hr LC_{50} = 819	Highly toxic	422451-12
Acute – Estuarine/Marine Mollusk	Eastern oyster (*Crassostrea virginica*)	96-hr EC_{50} = 424	Highly toxic	429067-01

Table 11. Summary of Most Sensitive Aquatic Acute and Chronic Toxicity Endpoints				
Type of Study	**Species**	**Toxicity Value (µg a.i./L)**	**Toxicity Classification**	**MRID**
Acute – Estuarine/Marine Invertebrate	Mysid shrimp (*Americamysis bahia*)	96-hr LC_{50} = 150	Highly toxic	422451-11
Chronic – Estuarine/Marine Invertebrate	Mysid shrimp (*Americamysis bahia*)	NOAEC < 0.115 (number of young/adult/reproductive day)	NA	469501-33
Vascular Plant – Freshwater	Duckweed (*Lemna gibba*)	EC_{50} = 1900 EC_{05} = 110	NA	469205-04
Non-vascular Plant – Freshwater	Diatom (*Navicula pelliculosa*)	EC_{50} = 98 NOAEC = 53	NA	469205-08

Table 12. Summary of Most Sensitive Terrestrial Acute and Chronic Toxicity Endpoints				
Type of Study	**Species**	**Toxicity Value**	**Toxicity Classification**	**MRID**
Acute – Avian Oral Dose	Mallard duck (*Anas platyrhynchos*)	LD_{50} > 2150 mg a.i./kg-bw	Practically non-toxic	422451-05
Acute – Avian Dietary	Bobwhite quail (*Colinus virginianus*)	LC_{50} = 4579 mg a.i./kg-diet	Slightly toxic	422451-03
Chronic – Avian Dietary	Bobwhite quail (*Colinus virginianus*)	NOAEC = 21.9 mg a.i./kg-diet LOAEC = 108 mg a.i./kg-diet (reduction in hatchling body weight observed at 108 mg a.i./kg-diet, reduction in eggs laid observed at 539 mg a.i./kg-diet)	NA	469502-02
Acute – Mammalian Oral Dose	Laboratory rat (*Rattus norvegicus*)	LD_{50} = 1453 mg a.i./kg-bw	Slightly toxic	420900-06
Two Generation Reproduction – Mammalian	Laboratory rat (*Rattus norvegicus*)	NOAEC = 25 mg a.i./kg-diet LOAEC = 250 mg a.i./kg-diet	NA	420900-18
Acute – Contact	Honey bee (*Apis mellifera*)	LD_{50} = >100 µg a.i./bee	Practically non-toxic	422451-24
Acute – Contact	Earthworm	LC_{50} > 610 mg a.i./kg-dw		422451-25
Terrestrial Plants	Corn, Oat, Turnip, Cucumber, Soybean, Tomato	NOAEC = 0.44 lb a.i./A	NA	469502-03

4.2. Evaluation of Aquatic and Terrestrial Toxicity Data for Major Degradates (1,2,4-Triazole and Triazole Acetic Acid)

No data that evaluated the effects of the degradate triazole acetic acid (CGA-142856) were available.

Syngenta Crop Protection, Inc. and Bayer AG have submitted two studies in support of 1,2,4-triazole (PC code 600074). One supplemental study (MRID 458804-05) evaluated the effects of 1,2,4-triazole on the growth of juvenile rainbow trout (*Oncorhynchus mykiss*). This 28-day study yielded an LC_{50} > 100 mg/L. Growth was not affected at concentrations up to 100 mg/L. However, significant sublethal effects were observed; from day 23 to day 28, three to five fish were observed to be inactive or have abnormally low activity, to have labored respiration, and to be lying inactive at the bottom of the aquarium in each of the 10, 32, and 100 mg/L test concentrations. The NOAEC for these sublethal effects was 3.2 mg/L. This study suggests that rainbow trout are less sensitive to 1,2,4-triazole on an acute basis relative to difenoconazole because the 96-hour LC_{50} in rainbow trout was considerably lower than 1,2,4-triazole concentrations that did not produce mortality over a 28-day period. However, the data are not comparable to early life stage studies submitted on difenoconazole.

In addition, a summary of ecotoxicity data has been submitted (MRID 453427-01). This summary presented data from several submitted studies including data in birds (45284015), earthworms (MRID 45297201), daphnids (MRID 00133381), fish (MRID 45284017), and algae (MRID 00133382). The data suggest that 1,2,4-triazole may be less toxic than difenoconazole to fish, daphnids, and aquatic plants, but more toxic to earthworms. However, these studies were typically non-GLP compliant studies or journal articles and are not considered to be reliable to make definitive conclusions regarding the toxicity of the 1,2,4-triazole degradate. In some cases, the available study reports are not legible or the study designs were markedly different than guideline protocols such that they provided little useful information. Therefore, these data will not be used in risk assessment. Submission of studies listed as data gaps in **Section 6** would reduce uncertainties associated with potential risks from both of the degradates.

In addition, no data on the triazole acetic acid (CGA-142856) degradate were located. Therefore, until reliable data are submitted on the degradates, EFED will assume that the degradates are of equal toxicity as the parent chemical. If the degradates are found to be less toxic than the parent, then this assumption would result in an overestimation of potential risks.

4.3. Incidents

EFED maintains an incident database system called the Ecological Incident Information System (EIIS) to track and evaluate accidental kills associated with pesticide use. Based on the information contained in the incident report, the likelihood of a particular pesticide causing the incident is classified as highly probable, probable, possible, or unlikely. If there are incidents, the information will be reviewed and considered in conjunction with the degree to which the LOCs were exceeded, information on sales, local use practices, and monitored levels in the environment to determine whether the predicted effect based on labeled use of the product is likely to occur or not.

A search of the EIIS database on January 31, 2011 did not identify any adverse ecological incidents involving difenoconazole. Although incident reporting is required under FIFRA Section 6(a)(2), the absence of reports in EIIS does not indicate that the chemical has no effects on wildlife; rather, it is possible that incidents have gone unreported.

5. Ecological Risks Summary

5.1. Potential Risks of Difenoconazole Exposure to Terrestrial Organisms

This assessment assumes that birds and mammals consume 100% of their diet as either contaminated food items or treated seeds. Only 1% of seeds are available to be consumed as labels specify incorporation of treated seed to a depth of at least one inch. RQs were not calculated for the major degradates because there are no reliable toxicity endpoints for the degradates. If the degradates are substantially more toxic than difenoconazole, this risk assessment could underestimate potential risks.

5.1.1. Birds

Difenoconazole is classified as slightly toxic to birds on a dietary basis and practically non-toxic on an acute oral dose basis (RQs were not calculated on an acute oral dose basis). Chronic effects at the LOAEC (108 mg a.i./kg-diet) included a reduction in hatchling body weight. None of the acute RQs exceeded levels of concern for birds exposed to food items contaminated with difenoconazole applied as a foliar spray (**Table 13**). However, chronic dietary-based RQs exceeded LOCs for birds consuming short grass, tall grass, and broadleaf plants and small insects. RQs did not exceed acute or chronic LOCs for birds consuming treated seed (**Table 14**).

Table 13. Summary of Avian Acute and Chronic Risk Quotients for Proposed Difenoconazole Foliar Spray Applications

Feeding Category	Acute Dietary-based RQs	Chronic Dietary-based RQs
Carrot, Chickpea, Soybean, Strawberry	**4 applications @ 0.114 lb a.i./A (7-day interval)**	
Short grass	0.02	**4.11+**
Tall grass	0.01	**1.88+**
Broadleaf plants/small insects	0.01	**2.31+**
Fruits/pods/seeds/large insects	<0.01	0.26
Stone Fruit	**4 applications @ 0.114 lb a.i./acre (7-day interval between applications 1 & 2; 10-day interval between applications 2 & 3 and 3 & 4)**	
Short grass	0.02	**3.85+**
Tall grass	0.01	**1.76+**
Broadleaf plants/small insects	0.01	**2.16+**
Fruits/pods/seeds/large insects	<0.01	0.24

+Exceeds chronic LOC (1.0).

Table 14. Summary of Avian and Mammalian Risk Quotients for Proposed Difenoconazole Seed Treatments

Crop	Risk Quotients†					
	Avian (20 g)			Mammalian (15 g)		
	Acute (# 1)	Acute (# 2)	Chronic	Acute (# 1)	Acute (# 2)	Chronic
Oats	N/A	N/A	0.11	<0.01	<0.01	0.10
Rye	N/A	N/A	0.11	<0.01	<0.01	0.10

*To account for incorporation of treated seeds, RQs have been multiplied by an incorporation factor of 0.01.

5.1.2. Mammals

Difenoconazole is classified as slightly toxic to mammals on an acute oral basis. Chronic effects were observed at a LOAEC of 250 mg a.i./kg-diet. None of the acute RQs exceeded LOCs for food items contaminated with difenoconazole applied as a foliar spray (**Table 15**). However, chronic dose-based RQs exceed the LOC for small, medium, and large mammals consuming short grass, tall grass, and broadleaf plants and small insects, as well as small and medium mammals consuming the aforementioned food items and fruits, pods, seeds, and large insects. Chronic dietary-based RQs exceed the LOC for mammals consuming short grass, tall grass, and broadleaf plants and small insects. RQs did not exceed acute or chronic LOCs for mammals consuming treated seed (**Table 14**).

Table 15. Summary of Mammalian Acute and Chronic Risk Quotients for Proposed Difenoconazole Foliar Spray Applications

Risk Quotients Based on Kenaga Upper Bound EEC	Dose-Based RQs						Chronic Dietary-Based RQs
	15 g		35 g		1000 g		
	Acute	Chronic	Acute	Chronic	Acute	Chronic	
Carrot, Chickpea, Soybean, Strawberry	**4 applications @ 0.114 lb a.i./A (7-day interval)**						
Short grass	0.03	**31.22+**	0.02	**26.67+**	0.01	**14.30+**	**3.60+**
Tall grass	0.01	**14.31+**	0.01	**12.22+**	0.01	**6.55+**	**1.65+**
Broadleaf plants/small insects	0.02	**17.56+**	0.01	**15.00+**	0.01	**8.04+**	**2.02+**
Fruits/pods/seeds/lg insects	<0.01	**1.95+**	<0.01	**1.67+**	<0.01	0.89	0.22
Seeds only	<0.01	0.43	<0.01	0.37	<0.01	0.20	-
Stone Fruit	**4 applications @ 0.114 lb a.i./acre (7-day interval between applications 1 & 2; 10-day interval between applications 2 & 3 and 3 & 4)**						
Short grass	0.03	**29.24+**	0.02	**24.97+**	0.01	**13.39+**	**3.37+**
Tall grass	0.01	**13.40+**	0.01	**11.45+**	0.01	**6.14+**	**1.54+**
Broadleaf plants/small insects	0.01	**16.45+**	0.01	**14.05+**	0.01	**7.53+**	**1.90+**
Fruits/pods/seeds/lg insects	<0.01	**1.83+**	<0.01	**1.56+**	<0.01	0.84	0.21
Seeds only	<0.01	0.41	<0.01	0.35	<0.01	0.19	-

+Exceeds chronic LOC (1.0).

5.1.3. Terrestrial Plants

A non-GLP study (MRID 469502-03; supplemental) was carried out as a part of routine discovery screening and efficacy test to investigate the potential for adverse effects of difenoconazole on terrestrial non-target higher plants (corn, oat, turnip, cucumber, soybean, tomato). No phytotoxic effects were visually observed in any species at the five treatments tested following pre- or post-emergence application (NOAEC = 0.44 lb a.i./A). Because there were a limited number of species tested and various growth and endpoints were not included in this study, the results cannot be used quantitatively in this risk assessment. Because effects on growth parameters cannot be precluded due to lack of an acceptable study, potential risks to non-target terrestrial and semi-aquatic plants are unknown, but RQs are assumed to exceed LOCs for listed species.

5.1.4. Terrestrial Invertebrates

EFED currently does not routinely quantify risks to terrestrial non-target invertebrates. Difenoconazole is classified as practically non-toxic (LD_{50} > 100 µg a.i./bee) based on the acute contact honey bee study. This toxicity classification does not warrant the need for additional pollinator studies or precautionary bee labeling language. However, the extent of exposure and subsequent effects to non-target terrestrial invertebrates, including other beneficial insects, remain unknown; EFED recognizes this as an uncertainty in its risk assessment process.

Acute contact testing of difenoconazole on earthworms resulted in an LC_{50} greater than 610 mg a.i./kg-dw of substrate, as survival was >95% in all treatment groups. No significant differences were detected in any treatment groups relative to the negative control for survival or weight change. The NOAEC and LOAEC based on survival and weight change, were 610 and > 610 mg a.i./kg-dw of substrate. The proposed use does not exceed the highest registered annual application rate (ornamentals, 0.56 lb a.i./acre/season). Previous assessments presented EECs in soil of 0.28 mg/kg-dry soil. Because predicted EECs (0.280 mg a.i./kg-dry soil) were over three orders of magnitude below the NOAEC, potential risks did not trigger concerns (see previous assessment for calculations; DP333319, July 12, 2007). Because the highest annual proposed rate (0.46 lb a.i./acre) is lower than the ornamentals rate, potential risks to earthworms are not of concern at this time for any of the proposed uses.

5.2. Potential Risks of Difenoconazole Exposure to Aquatic Organisms

5.2.1. Fish

Although difenoconazole is classified as highly toxic to freshwater and estuarine/marine fish, none of the acute RQs exceeded LOCs for any of the proposed uses (**Table 16**). For freshwater fish, none of the chronic RQs exceeded the LOC; however, it was not possible to use the acute-to-chronic ratio (ACR) to estimate RQs for estuarine/marine fish because the most sensitive freshwater acute (rainbow trout) and chronic (fathead minnow) tests utilized two different species. Therefore, potential chronic risks to estuarine/marine fish are unknown.

Table 16. Acute and Chronic Risk Quotients for Freshwater and Estuarine/Marine Fish Exposed to the Proposed Difenoconazole Applications

Proposed Use	Peak EEC (µg/L)	Freshwater Acute RQ (LC_{50} = 810 µg/L)	Estuarine/Marine Acute RQ (LC_{50} = 819 µg/L)	60-day EEC (µg/L)	Freshwater Chronic RQ (NOAEC = 8.7 µg/L)
Carrot	6.41	0.01	0.01	5.13	0.59
Chickpea	5.51	0.01	0.01	4.68	0.54
Stone Fruit	6.48	0.01	0.01	4.91	0.56
Soybean	8.80	0.01	0.01	8.06	0.93

Table 16. Acute and Chronic Risk Quotients for Freshwater and Estuarine/Marine Fish Exposed to the Proposed Difenoconazole Applications					
Proposed Use	**Peak EEC (µg/L)**	**Freshwater Acute RQ (LC_{50} = 810 µg/L)**	**Estuarine/Marine Acute RQ (LC_{50} = 819 µg/L)**	**60-day EEC (µg/L)**	**Freshwater Chronic RQ (NOAEC = 8.7 µg/L)**
Strawberry	7.40	0.01	0.01	5.35	0.61
Oat & Rye Seed	0.24	<0.01	<0.01	0.19	0.02

5.2.2 Aquatic Invertebrates

A summary of risk quotients based on acute exposure of freshwater daphnid and estuarine/marine mysid to difenoconazole is presented in **Table 17**, below. There were no acute LOC exceedances for freshwater invertebrates. The proposed soybean and strawberry uses caused acute endangered species LOC exceedances for estuarine/marine invertebrates. The proposed soybean and strawberry uses caused chronic LOC exceedances for freshwater invertebrates. All proposed uses caused chronic LOC exceedances for estuarine/marine invertebrates. There were no acute LOC exceedances for molluscs. Risk quotients for benthic invertebrates were not calculated because the midge NOAEC was three orders of magnitude greater than the freshwater invertebrate NOAEC, while pore water EECs were similar to water column EECs (see **Appendix 2**). In addition, uncertainties remain regarding the submitted benthic invertebrate toxicity data (MRID 476486-01) because of the numerous guideline deviations (see previous assessment DP377719, July 20, 2010).

Table 17. Acute and Chronic Risk Quotients for Freshwater and Estuarine/Marine Invertebrates Exposed to the Proposed Difenoconazole Applications							
Proposed Use	**Peak EEC (µg/L)**	**Freshwater Acute RQ (LC_{50} = 770 µg/L)**	**Estuarine/ Marine Acute RQ (LC_{50} = 150 µg/L)**	**Mollusk Acute RQ (EC_{50} = 424 µg/L)**	**21-day EEC (µg/L)**	**Freshwater Chronic RQ (NOAEC = 5.6 µg/L)**	**Estuarine/Marine Chronic RQ (NOAEC = <0.115 µg/L)**
Carrot	6.41	0.01	0.04	0.02	5.46	0.98	**>47.48+**
Chickpea	5.51	0.01	0.04	0.01	4.97	0.89	**>43.22+**
Stone Fruit	6.48	0.01	0.04	0.02	5.29	0.94	**>46.00+**
Soybean	8.80	0.01	**0.06***	0.02	8.25	**1.47+**	**>71.74+**
Strawberry	7.40	0.01	**0.05***	0.02	5.66	**1.01+**	**>49.22+**
Oat & Rye Seed	0.24	<0.01	<0.01	<0.01	0.24	0.04	**>2.09+**

Table 17. Acute and Chronic Risk Quotients for Freshwater and Estuarine/Marine Invertebrates Exposed to the Proposed Difenoconazole Applications							
Proposed Use	**Peak EEC (µg/L)**	**Freshwater Acute RQ (LC_{50} = 770 µg/L)**	**Estuarine/ Marine Acute RQ (LC_{50} = 150 µg/L)**	**Mollusk Acute RQ (EC_{50} = 424 µg/L)**	**21-day EEC (µg/L)**	**Freshwater Chronic RQ (NOAEC = 5.6 µg/L)**	**Estuarine/Marine Chronic RQ (NOAEC = <0.115 µg/L)**
*Exceeds acute endangered species LOC of 0.05 +Exceeds chronic LOC of 1.0							

5.2.3. Aquatic Plants

A summary of non-listed and listed RQs for vascular and non-vascular aquatic plants exposed to difenoconazole in surface water is included in **Table 18**. There were no LOC exceedances for any of the proposed uses.

Table 18. Risk Quotients for Aquatic Plants Exposed to Difenoconazole in Surface Water					
Proposed Use	**Peak EEC (µg/L)**	**Vascular Plant Non-listed RQ (EC_{50} = 1900 µg/L)**	**Vascular Plant Listed RQ (EC_{05} = 110 µg/L)**	**Non-vascular Plant Non-listed RQ (EC_{50} = 98 µg/L)**	**Non-vascular Plant Listed RQ (NOAEC = 53 µg/L)**
Carrot	6.41	<0.01	0.06	0.06	0.12
Chickpea	5.51	<0.01	0.05	0.06	0.10
Stone Fruit	6.48	<0.01	0.06	0.07	0.12
Soybean	8.80	<0.01	0.08	0.09	0.17
Strawberry	7.40	<0.01	0.07	0.08	0.14
Oat & Rye	0.24	<0.01	<0.01	<0.01	<0.01

5.3. Potential Risks for Aquatic Organisms Exposed to Total Toxic Residues of Difenoconazole

The total toxic residue approach was used as a conservative estimate of aquatic exposure to two major degradates, CGA-71019 (1,2,4-triazole) and CGA-142856 (triazole acetic acid). While effects of triazole acetic acid are unknown, a preliminary review of the data shows that 1,2,4-triazole is less toxic than the parent to fish on a chronic basis. Total toxic residue estimates were compared to the parent difenoconazole toxicity values as part of the aquatic risk estimation. Soybean was selected as the representative crop because PRZM/EXAMS modeling produced the highest EECs for the parent difenoconazole. There were no acute freshwater or estuarine/marine fish LOC exceedances, but the freshwater fish chronic RQ exceeded the LOC (**Table 19**).

Table 19. Acute and Chronic Risk Quotients for Freshwater and Estuarine/Marine Fish Exposed to Total Toxic Residues of Difenoconazole in Surface Water					
Proposed Use	**Peak EEC (µg/L)**	**Freshwater Acute RQ (LC_{50} = 810 µg/L)**	**Estuarine/ Marine Acute RQ (LC_{50} = 819 µg/L)**	**60-day EEC (µg/L)**	**Freshwater Chronic RQ (NOAEC = 8.7 µg/L)**
Soybean	14.88	0.02	0.02	13.80	**1.59+**
+Exceeds chronic LOC of 1.0					

The acute freshwater invertebrate RQ did not exceed any LOCs, but the acute estuarine/marine invertebrate RQ exceeded the acute endangered species and acute restricted use LOCs (**Table 20**). The mollusk RQ did not exceed any LOCs. The freshwater and estuarine/marine invertebrate chronic RQs exceeded the chronic LOC.

Table 20. Acute and Chronic Risk Quotients for Freshwater and Estuarine/Marine Invertebrates Exposed to Total Toxic Residues of Difenoconazole in Surface Water							
Proposed Use	**Peak EEC (µg/L)**	**Freshwater Acute RQ (LC_{50} = 770 µg/L)**	**Acute RQ (LC_{50} = 150 µg/L)**	**Mollusk Acute RQ (EC_{50} = 424 µg/L)**	**21-day EEC (µg/L)**	**Freshwater Chronic RQ (NOAEC = 5.6 µg/L)**	**Estuarine/Marine Chronic RQ (NOAEC = <0.115 µg/L)**
Soybean	14.88	0.02	**0.10****	0.04	14.50	**2.59+**	**>96.67+**
**Exceeds acute endangered species LOC of 0.05 and acute restricted use LOC of 0.10 +Exceeds chronic LOC of 1.0							

Neither the non-listed or listed vascular plant RQs nor the non-vascular plant RQs exceeded the LOC for aquatic plants (**Table 21**).

Table 21. Risk Quotients for Aquatic Plants Exposed to Total Toxic Residues of Difenoconazole in Surface Water					
Proposed Use	**Peak EEC (µg/L)**	**Vascular Plant Non-listed RQ (EC_{50} = 1900 µg/L)**	**Vascular Plant Listed RQ (EC_{05} = 110 µg/L)**	**Non-vascular Plant Non-listed RQ (EC_{50} = 98 µg /L)**	**Non-vascular Plant Listed RQ (NOAEC = 53 µg/L)**
Soybean	14.88	0.01	0.14	0.15	0.28

Although these RQs are based on conservative aquatic exposure estimates, there is still uncertainty about the toxicity of the degradates. Therefore, this risk estimation may result in the over- or under- estimation of potential risk. Studies identified as data gaps (see **Section 6**) for the degradates would be useful in refining this risk characterization.

6. Data Gaps and Uncertainties

EFED recommends that the following studies, which were identified in previous assessments, be requested from the registrant.

1. **Freshwater Fish Acute Toxicity Study (850.1075):** Data that satisfy this requirement were provided for the bluegill sunfish and rainbow trout. However, the fathead minnow was the species used for the freshwater fish early-life stage study (850.1400) requirement. Because this test species is different from the two species used for the freshwater fish acute toxicity tests, a 96-hour LC_{50} for fathead minnow must also be provided.[4]

2. **Freshwater and Estuarine/Marine Fish Early-life Stage Study (850.1400):** No data were available to assess the chronic toxicity of difenoconazole to estuarine/marine fish. A study evaluating the chronic effects of difenoconazole on sheepshead minnow would satisfy this data requirement. The LC_{50}s for estuarine/marine fish were comparable to the LC_{50}s for freshwater fish, suggesting similar acute sensitivity to difenoconazole. However, it was not possible to use the acute to chronic ratio (ACR) to generate an estuarine/marine fish chronic endpoint as the acute and chronic freshwater fish studies utilized two different species. Because of its expected use or mobility patterns, difenoconazole may enter estuarine/marine environments in significant concentrations. In the absence of acceptable data, potential chronic risks to estuarine/marine fish are unknown, but RQs would be assumed to exceed LOCs for listed species. In addition, submitted data for freshwater fish were classified as supplemental; therefore, acceptable data for freshwater fish is also required. The test may be repeated with the fathead minnow or be conducted using a rainbow trout (preferred) or bluegill sunfish.[4]

3. **Estuarine/Marine Invertebrate Life Cycle Study (850.1350):** Because of its expected use or mobility patterns, difenoconazole may enter estuarine/marine environments in significant concentrations. The two submitted mysid shrimp studies (one of which was reviewed and included for the first time in this assessment) were classified as supplemental because reproductive effects were observed at all treatment levels and because of other issues as described in **Section 4.1.1**. Acceptable estuarine/marine invertebrate data, which establishes a definitive NOAEC, is required.

4. **Avian Acute Oral Toxicity Study (850.2100):** Data that assess the effects of difenoconazole for one passerine species and either one waterfowl species or one upland game bird species for terrestrial, aquatic, forestry, and residential outdoor uses are required. The current method of calculating a weight-adjusted LD_{50} using bobwhite quail or mallard duck data may over- or under-estimate risks to passerines because these birds may metabolize the chemical differently. Because the 850.2100 guideline has not yet been finalized, protocols for the study of passerine species should be submitted to EPA for approval prior to study initiation.

5. **Terrestrial Plant Toxicity, Tier I (seedling emergence) (850.4100):** Testing of a typical end-use product (TEP) is required for all pesticides having outdoor uses at the proposed maximum application rate. Tier II studies are not required unless Tier I studies indicate a $\geq$ 25% effect to various growth parameters relative to the control. The submitted non-GLP

[4] The submitted fathead minnow early-life stage study was classified as supplemental. The registrant should be advised that if the early-life stage study is repeated with either a rainbow trout (preferred) or bluegill sunfish and found to be acceptable, then the data gap for the fathead minnow acute toxicity test would be eliminated. However, if the early-life stage study is repeated with the fathead minnow, then the data gap for the fathead minnow acute toxicity test remains.

study (MRID 469502-03; supplemental), which tested multiple concentrations, does not measure growth or other required endpoints. Currently, the lack of acceptable data causes habitat modification to be assumed as an indirect effect to all listed species.

6. **Terrestrial Plant Toxicity, Tier I (vegetative vigor) (850.4150):** Testing of a TEP is required for all pesticides having outdoor uses at the proposed maximum application rate. Tier II studies are not required unless Tier I studies indicate a $\geq$ 25% effect to various growth parameters relative to the control. The submitted non-GLP study (MRID 469502-03; supplemental), which tested multiple concentrations, does not measure growth or other required endpoints. Currently, the lack of acceptable data causes habitat modification to be assumed as an indirect effect to all listed species.

7. Due to the degradation of difenoconazole to the major degradates CGA-71019 (1,2,4-triazole) and CGA-142856 (triazole acetic acid), which are of toxicological concern, potential risks resulting from exposure to these degradates needs to be evaluated as part of the ecological risk assessment for difenoconazole. Therefore, studies evaluating the acute effects of these two degradates on fish, birds, and daphnids are required. These data requirements can be satisfied by the following guidelines:
   Avian Acute Oral Toxicity Study (850.2100)
   Acute Freshwater Fish Toxicity Study (850.1075)
   Acute Freshwater Invertebrate Toxicity Study (850.1010)

   In addition, chronic studies may also be needed. A request for chronic studies is being held in reserve pending an analysis of the acute data.

Additionally, the following uncertainties were identified for this risk assessment:

- There is uncertainty associated with risk to sediment dwelling organisms. Pore water concentrations indicated that the concentrations of difenoconazole in the sediment are similar to that in the water column (see **Appendix 2**). Because difenoconazole is persistent, a study evaluating risk to sediment dwelling organisms was previously identified as a data gap. Although a sediment toxicity study determining the effects of difenoconazole residues to benthic organisms has been submitted and reviewed, the numerous deviations in the study limit its use for quantitative purposes.

- Before difenoconazole breaks down to 1,2,4-triazole, it forms CGA-205375, (1-[2-Chloro-4-(4-chlorophenoxy)-phenyl]-2-[1,2,4]triazol-1-yl-ethanol). CGA-205375 has potential to be slightly more mobile in the soil than difenoconazole, based on the registrant-submitted adsorption/desorption study. The potential adverse effect of this degradate on the ecological environment was not addressed in this risk assessment. If this degradate is shown to have potential ecological or human health concerns, additional fate and transport studies may be requested at a later time.

- In this assessment, only difenoconazole solo active ingredient was modeled and exposure effects from the product mixture were not taken into consideration. However, effects of mixtures to a full range of taxa are unknown, and effects have the potential to be

antagonistic, synergistic, or neutral when two chemicals are premixed, tank-mixed, or residues are mixed in the environment.

- Because it is persistent, difenoconazole and its degradates may accumulate in soil after repeated use. This repeated or continuous exposure may result in significant risks to non-target organisms, especially birds and mammals.

- This risk assessment only considered the most sensitive of the species evaluated in the registrant-submitted studies. The position of the tested species relative to the distribution of all species' sensitivities to difenoconazole is unknown. Extrapolating the risk conclusions from the most sensitive tested species to non-tested species may either underestimate or overestimate the potential risks to those species.

7. Listed Species

To determine whether difenoconazole use sites are geographically associated with known locations of listed species, a screening-level search of the LOCATES (version 2.10.3) database was conducted. The database compares county-level location data for listed species with county-level crop production data (as available in the 2002 agricultural census) to identify any coarse overlaps of listed species with the proposed labeled uses of difenoconazole. Listed species are those that are currently on the Federal list of endangered and threatened wildlife and plants.

For direct effects, birds, mammals, and freshwater and estuarine/marine invertebrates were considered, since these were the taxa to have RQs above chronic LOC (**Section 5.2**); in addition, the total toxic residue approach predicted potential chronic risks to freshwater fish. Terrestrial and semi-aquatic plants and estuarine/marine fish (chronic) were considered because risks were assumed in the absence of data. Since birds are surrogate species for terrestrial-phase amphibians and reptiles, direct effects to these taxa were also considered. Indirect effects were determined by assessing the potential for reduction of prey base or habitat modification of listed taxa (**Table 22**). In the absence of acceptable data, risks to terrestrial plants were assumed. Because of this, there is potential for habitat modification to indirectly affect all listed taxa.

Table 22. Listed Species Risks Associated with the Proposed New Use of Difenoconazole

Listed Taxa	Direct Effects[1]	Indirect Effects[2]
Terrestrial and semi-aquatic plants – monocots and dicots	Yes	Yes
Birds	No – Acute Yes – Chronic	Yes
Terrestrial-phase amphibians	No – Acute Yes – Chronic	Yes
Reptiles	No – Acute Yes – Chronic	Yes
Mammals	No – Acute	Yes

Table 22. Listed Species Risks Associated with the Proposed New Use of Difenoconazole		
Listed Taxa	**Direct Effects[1]**	**Indirect Effects[2]**
	Yes – Chronic	
Aquatic plants	No	Yes
Freshwater fish	No – Acute Yes – Chronic3	Yes
Aquatic-phase amphibians	No – Acute Yes – Chronic3	Yes
Freshwater invertebrates	No – Acute Yes – Chronic[4]	Yes
Estuarine/marine Mollusks	No	Yes
Estuarine/marine fish	No – Acute Yes – Chronic	Yes
Estuarine/marine invertebrates	Yes – Acute[4] Yes – Chronic[4]	Yes
Terrestrial invertebrates	No	Yes

[1]The Agency's Level of Concern was exceeded for estuarine/marine invertebrates (chronic), birds (chronic), and mammals (chronic); risks to terrestrial and semi-aquatic plants and chronic risks to estuarine/marine fish were assumed due to the absence of acceptable data.
[2]Indirect effects to a listed species occur when its prey base is reduced or habitat is modified. Due to the lack of acceptable terrestrial plant data, indirect effects are assumed for all taxa.
[3]The LOC was exceeded as a result of exposure to total residues of difenoconazole (includes degradates).
[4]The LOC was exceeded for invertebrates exposed to the parent difenoconazole as well as the total toxic residues.

LOCATES was used on January 31, 2011 to determine co-occurrence of listed species and the proposed uses of difenoconazole. These species are included in **Appendix 3**.

Appendix 1: Sample T-REX Outputs

Carrot, Chickpea, Soybean, Strawberry
4 apps @ 0.114 lb a.i./acre (7-day interval)

Summary of Risk Quotient Calculations Based on Upper Bound Kenaga EECs

Table A. Upper Bound Kenaga, Acute Avian Dose-Based Risk Quotients

Size Class (grams)	Adjusted LD50	EECs and RQs									
		Short Grass		Tall Grass		Broadleaf Plants/ Small Insects		Fruits/Pods/ Seeds/ Large Insects		Granivore	
		EEC	RQ	EEC	RQ	EEC	RQ	EEC	RQ	EEC	RQ
20	0.00	102.46	#DIV/0!	46.96	#DIV/0!	57.63	#DIV/0!	6.40	#DIV/0!	1.42	#DIV/0!
100	0.00	58.43	#DIV/0!	26.78	#DIV/0!	32.87	#DIV/0!	3.65	#DIV/0!	0.81	#DIV/0!
1000	0.00	26.16	#DIV/0!	11.99	#DIV/0!	14.71	#DIV/0!	1.63	#DIV/0!	0.36	#DIV/0!

Table B. Upper Bound Kenaga, Subacute Avian Dietary Based Risk Quotients

	EECs and RQs							
	Short Grass		Tall Grass		Broadleaf Plants/ Small Insects		Fruits/Pods/ Seeds/ Large Insects	
LC50	EEC	RQ	EEC	RQ	EEC	RQ	EEC	RQ
4579	89.96	0.02	41.23	0.01	50.60	0.01	5.62	0.00

Size class not used for dietary risk quotients

Table C. Upper Bound Kenaga, Chronic Avian Dietary Based Risk Quotients

	EECs and RQs							
	Short Grass		Tall Grass		Broadleaf Plants/ Small Insects		Fruits/Pods/ Seeds/ Large Insects	
NOAEC (ppm)	EEC	RQ	EEC	RQ	EEC	RQ	EEC	RQ

22	89.96	4.11	41.23	1.88	50.60	2.31	5.62	0.26

Size class not used for dietary risk quotients

Table D. Upper Bound Kenaga, Acute Mammalian Dose-Based Risk Quotients

Size Class (grams)	Adjusted LD50	EECs and RQs									
		Short Grass		Tall Grass		Broadleaf Plants/ Small Insects		Fruits/Pods/ Seeds/ Large Insects		Granivore	
		EEC	RQ	EEC	RQ	EEC	RQ	EEC	RQ	EEC	RQ
15	3193.45	85.77	0.03	39.31	0.01	48.25	0.02	5.36	0.00	1.19	0.00
35	2583.84	59.28	0.02	27.17	0.01	33.35	0.01	3.71	0.00	0.82	0.00
1000	1117.59	13.74	0.01	6.30	0.01	7.73	0.01	0.86	0.00	0.19	0.00

Table E. Upper Bound Kenaga, Acute Mammalian Dietary Based Risk Quotients

LC50 (ppm)	EECs and RQs							
	Short Grass		Tall Grass		Broadleaf Plants/ Small Insects		Fruits/Pods/ Seeds/ Large Insects	
	EEC	RQ	EEC	RQ	EEC	RQ	EEC	RQ
0	89.96	#DIV/0!	41.23	#DIV/0!	50.60	#DIV/0!	5.62	#DIV/0!

Size class not used for dietary risk quotients

Table F. Upper Bound Kenaga, Chronic Mammalian Dietary Based Risk Quotients

NOAEC (ppm)	EECs and RQs							
	Short Grass		Tall Grass		Broadleaf Plants/ Small Insects		Fruits/Pods/ Seeds/ Large Insects	
	EEC	RQ	EEC	RQ	EEC	RQ	EEC	RQ
25	89.96	3.60	41.23	1.65	50.60	2.02	5.62	0.22

Size class not used for dietary risk quotients

Table G. Upper Bound Kenaga, Chronic Mammalian Dose-Based Risk Quotients

Size Class (grams)	Adjusted NOAEL	EECs and RQs									
		Short Grass		Tall Grass		Broadleaf Plants/ Small Insects		Fruits/Pods/ Seeds/ Large Insects		Granivore	
		EEC	RQ	EEC	RQ	EEC	RQ	EEC	RQ	EEC	RQ

15	2.75	85.77	31.22	39.31	14.31	48.25	17.56	5.36	1.95	1.19	0.43
35	2.22	59.28	26.67	27.17	12.22	33.35	15.00	3.71	1.67	0.82	0.37
1000	0.96	13.74	14.30	6.30	6.55	7.73	8.04	0.86	0.89	0.19	0.20

Appendix 2: Sample PRZM/EXAMS and GENEEC Outputs

stored as ORsoy_A7.out
Chemical: Difenconazole
PRZM environment: modified Tueday, 29 May 2007 at
ORsnbeansSTD.txt 13:01:06
EXAMS environment:
pond298.exv modified Tueday, 26 August 2008 at 05:14:08
Metfile: w24232.dvf modified Tueday, 26 August 2008 at 05:15:54
Water segment concentrations (ppb)

Year	Peak	96 hr	21 Day	60 Day	90 Day	Yearly
1961	1.09	0.97	0.69	0.50	0.49	0.13
1962	1.99	1.83	1.52	1.28	1.25	0.73
1963	2.38	2.27	2.11	2.01	1.93	1.49
1964	4.09	3.92	3.16	2.74	2.58	2.15
1965	4.12	4.02	3.43	3.29	3.20	2.87
1966	4.47	4.39	4.16	3.92	3.79	3.46
1967	4.84	4.75	4.43	4.20	4.15	3.85
1968	5.54	5.40	5.18	4.91	4.87	4.38
1969	5.91	5.79	5.65	5.35	5.26	4.91
1970	6.45	6.11	5.97	5.78	5.71	5.45
1971	6.42	6.34	6.28	6.09	6.06	5.82
1972	7.20	7.04	6.59	6.29	6.24	6.07
1973	8.27	7.98	7.51	7.16	6.86	6.32
1974	7.91	7.78	7.40	7.25	7.13	6.92
1975	7.81	7.68	7.41	7.33	7.25	7.03
1976	7.61	7.54	7.38	7.29	7.28	7.05
1977	8.09	7.92	7.51	7.16	7.03	6.76
1978	7.48	7.40	7.25	7.15	7.10	6.90
1979	7.98	7.78	7.51	7.30	7.22	6.93
1980	8.57	8.35	7.80	7.52	7.37	7.13
1981	8.60	8.38	8.09	7.90	7.79	7.39
1982	8.35	8.26	8.12	7.87	7.84	7.64
1983	8.50	8.37	8.19	8.06	7.99	7.80
1984	8.91	8.72	8.45	8.28	8.14	7.82
1985	8.30	8.23	8.02	7.98	7.97	7.80
1986	8.51	8.39	8.13	7.97	7.92	7.72
1987	9.30	9.07	8.72	8.02	7.93	7.72
1988	8.73	8.58	8.26	8.07	8.01	7.80
1989	8.81	8.61	8.14	7.89	7.90	7.70
1990	8.41	8.31	8.21	8.10	8.03	7.80

Sorted results

Prob.	Peak	96 hr	21 Day	60 Day	90 Day	Yearly
0.03	9.30	9.07	8.72	8.28	8.14	7.82
0.06	8.91	8.72	8.45	8.10	8.03	7.80
0.10	8.81	8.61	8.26	8.07	8.01	7.80
0.13	8.73	8.58	8.21	8.06	7.99	7.80
0.16	8.60	8.39	8.19	8.02	7.97	7.80
0.19	8.57	8.38	8.14	7.98	7.93	7.72
0.23	8.51	8.37	8.13	7.97	7.92	7.72
0.26	8.50	8.35	8.12	7.90	7.90	7.70
0.29	8.41	8.31	8.09	7.89	7.84	7.64
0.32	8.35	8.26	8.02	7.87	7.79	7.39
0.35	8.30	8.23	7.80	7.52	7.37	7.13
0.39	8.27	7.98	7.51	7.33	7.28	7.05
0.42	8.09	7.92	7.51	7.30	7.25	7.03
0.45	7.98	7.78	7.51	7.29	7.22	6.93
0.48	7.91	7.78	7.41	7.25	7.13	6.92
0.52	7.81	7.68	7.40	7.16	7.10	6.90
0.55	7.61	7.54	7.38	7.16	7.03	6.76
0.58	7.48	7.40	7.25	7.15	6.86	6.32
0.61	7.20	7.04	6.59	6.29	6.24	6.07
0.65	6.45	6.34	6.28	6.09	6.06	5.82
0.68	6.42	6.11	5.97	5.78	5.71	5.45
0.71	5.91	5.79	5.65	5.35	5.26	4.91
0.74	5.54	5.40	5.18	4.91	4.87	4.38
0.77	4.84	4.75	4.43	4.20	4.15	3.85
0.81	4.47	4.39	4.16	3.92	3.79	3.46
0.84	4.12	4.02	3.43	3.29	3.20	2.87
0.87	4.09	3.92	3.16	2.74	2.58	2.15
0.90	2.38	2.27	2.11	2.01	1.93	1.49
0.94	1.99	1.83	1.52	1.28	1.25	0.73
0.97	1.09	0.97	0.69	0.50	0.49	0.13
0.10	8.80	8.60	8.25	8.06	8.01	7.80
					Average of yearly averages:	5.78

Inputs generated by pe5.pl - Novemeber 2006

Data used for this run:
Output File: ORsoy_A7
Metfile: w24232.dvf

PRZM scenario:	ORsnbeansSTD.txt			
EXAMS environment file:	pond298.exv			
Chemical Name:	Difenconazole			
Description	Variable Name	Value	Units	Comments
Molecular weight	mwt	406.27	g/mol	
Henry's Law Const.	henry	8.90E-12	atm-m^3/mol	
Vapor Pressure	vapr	2.50E-10	torr	
Solubility	sol	15	mg/L	
Kd	Kd		mg/L	
Koc	Koc	5381	mg/L	
Photolysis half-life	kdp	0	days	Half-life
Aerobic Aquatic Metabolism	kbacw	556	days	Halfife
Anaerobic Aquatic Metabolism	kbacs	1110	days	Halfife
Aerobic Soil Metabolism	asm	313	days	Halfife
Hydrolysis:	pH 7	0	days	Half-life
Method:	CAM	2	integer	See PRZM manual
Incorporation Depth:	DEPI		cm	
Application Rate:	TAPP	0.128	kg/ha	
Application Efficiency:	APPEFF	0.95	fraction	
Spray Drift	DRFT	0.05	fraction of application rate applied to pond	
Application Date	Date	26-09	dd/mm or dd/mmm or dd-mm or dd-mmm	
Interval 1	interval	7	days	Set to 0 or delete line for single app.
app. rate 1	apprate		kg/ha	
Interval 2	interval	7	days	Set to 0 or delete line for single app.
app. rate 2	apprate		kg/ha	
Interval 3	interval	7	days	Set to 0 or delete line for single app.
app. rate 3	apprate		kg/ha	
Record 17:	FILTRA			
	IPSCND	1		
	UPTKF			
Record 18:	PLVKRT			
	PLDKRT			
	FEXTRC	0.5		
Flag for Index Res. Run	IR	EPA Pond		
Flag for runoff calc.	RUNOFF	none	none, monthly or total(average of entire run)	

Estimated Environmental concentrations (EECs)

Scenario	Prob.	Peak	96 hr	21 Day	60 Day	90 Day	Yearly	Average of yearly averages
Concentration in Water Column (µg/L)								
FL Carrot-Aerial	0.10	6.41	6.03	5.46	5.13	5.09	4.75	3.81
FL Carrot-Ground	0.10	6.10	5.71	5.11	4.77	4.71	4.37	3.45
MI Bean-Aerial	0.10	5.51	5.32	4.97	4.68	4.61	4.45	2.96
MI Bean-Ground	0.10	4.15	4.06	3.76	3.56	3.54	3.43	2.18
GA Peach-Aerial	0.10	4.55	4.02	2.91	2.50	2.44	2.30	1.87
GA Peach-Ground	0.10	4.08	3.54	2.37	1.90	1.86	1.65	1.30
MI Cherry-Aerial	0.10	6.48	6.09	5.29	4.91	4.79	4.55	3.61
MI Cherry-Ground	0.10	5.66	5.32	4.68	4.31	4.23	3.97	3.11
MS Soybean-Aerial	0.10	8.76	8.35	7.67	6.97	6.90	6.58	4.65
MS Soybean-Ground	0.10	8.30	7.87	7.14	6.47	6.40	6.06	4.19
OR Soybean-Aerial	0.10	8.80	8.60	8.25	8.06	8.01	7.80	5.78
OR Soybean-Ground	0.10	7.91	7.71	7.36	7.19	7.13	6.91	5.12
CA Strawberry-Aerial	0.10	6.19	6.02	5.65	5.38	5.27	5.12	3.85
CA Strawberry-Ground	0.10	5.38	5.19	4.80	4.54	4.44	4.24	3.15
FL Strawberry-Aerial	0.10	7.40	6.84	5.66	5.35	5.24	4.79	3.88
FL Strawberry-Ground	0.10	7.10	6.52	5.29	4.93	4.80	4.36	3.50
ND Wheat-Ground	0.10	0.24	0.22	0.20	0.19	0.19	0.18	0.12
Concentration in Benthic Column (µg/L)								
FL Carrot-Aerial	0.10	4.57	4.57	4.57	4.56	4.54	4.38	3.50
FL Carrot-Ground	0.10	4.19	4.19	4.18	4.17	4.15	4.03	3.18
MI Bean-Aerial	0.10	4.14	4.13	4.13	4.12	4.10	4.03	2.68
MI Bean-Ground	0.10	3.15	3.15	3.15	3.14	3.13	3.07	1.95
GA Peach-Aerial	0.10	2.26	2.26	2.26	2.25	2.25	2.14	1.72
GA Peach-Ground	0.10	1.67	1.67	1.67	1.67	1.64	1.56	1.19
MI Cherry-Aerial	0.10	4.52	4.52	4.51	4.48	4.48	4.24	3.36
MI Cherry-Ground	0.10	3.96	3.96	3.96	3.93	3.93	3.71	2.90
MS Soybean-Aerial	0.10	6.25	6.25	6.25	6.23	6.21	5.94	4.13
MS Soybean-Ground	0.10	5.76	5.76	5.75	5.73	5.72	5.46	3.71
OR Soybean-Aerial	0.10	7.65	7.65	7.64	7.59	7.57	7.40	5.45
OR Soybean-Ground	0.10	6.79	6.79	6.79	6.74	6.73	6.58	4.83
CA Strawberry-Aerial	0.10	4.96	4.96	4.95	4.94	4.94	4.83	3.59
CA Strawberry-Ground	0.10	4.14	4.14	4.14	4.13	4.13	4.00	2.95
FL Strawberry-Aerial	0.10	4.61	4.61	4.61	4.59	4.58	4.44	3.57
FL Strawberry-Ground	0.10	4.24	4.24	4.24	4.22	4.21	4.06	3.22
ND Wheat-Ground	0.10	0.17	0.17	0.17	0.17	0.17	0.17	0.12

GENEEC OUTPUTS FILE

```
RUN No.   1 FOR Tot Difenconazol ON   Soybean       * INPUT VALUES *
--------------------------------------------------------------------
 RATE (#/AC)   No.APPS &   SOIL  SOLUBIL   APPL TYPE NO-SPRAY INCORP
  ONE(MULT)    INTERVAL    Koc   (PPM )    (%DRIFT)   (FT)     (IN)
--------------------------------------------------------------------
.114(   .456)   4   7    1000.0   15.0   AERL_A( 24.1)     .0    .0

FIELD AND STANDARD POND HALFLIFE VALUES (DAYS)
--------------------------------------------------------------------
METABOLIC  DAYS UNTIL  HYDROLYSIS   PHOTOLYSIS   METABOLIC  COMBINED
 (FIELD)   RAIN/RUNOFF   (POND)     (POND-EFF)    (POND)     (POND)
--------------------------------------------------------------------
    .00        2          N/A       .00-     .00      .00       .00

GENERIC EECs (IN MICROGRAMS/LITER (PPB))     Version 2.0 Aug 1, 2001
--------------------------------------------------------------------
    PEAK      MAX 4 DAY     MAX 21 DAY    MAX 60 DAY    MAX 90 DAY
    GEEC      AVG GEEC       AVG GEEC      AVG GEEC      AVG GEEC
--------------------------------------------------------------------
    14.88       14.83         14.50         13.80         13.30
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Appendix 3: LOCATES Run

Species Listing by State with Use Criteria

No species were excluded
Minimum of 1 Acre.
All Medium Types Reported
Mammal, Marine mml, Bird, Amphibian, Reptile, Fish, Crustacean, Bivalve, Gastropod, Arachnid, Insect, Dicot, Monocot, Ferns, Conf/cycds, Coral, Lichen
carrots, beans - dry edible, excluding limas, soybeans for beans, strawberries, apricots, cherries, sweet, cherries, tart, nectarines, peaches, all, plums and prunes

Alabama (91) species:

		Taxa	Critical Habitat
Salamander, Flatwoods *(Ambystoma cingulatum)*	Threatened	Amphibian Freshwater, Vernal pool, Terrestrial	No
Salamander, Red Hills *(Phaeognathus hubrichti)*	Threatened	Amphibian Freshwater, Terrestrial	No
Plover, Piping *(Charadrius melodus)*	Endangered	Bird Terrestrial	Yes
Stork, Wood *(Mycteria americana)*	Endangered	Bird Terrestrial	No
Woodpecker, Red-cockaded *(Picoides borealis)*	Endangered	Bird Terrestrial	No
Combshell, Southern (=Penitent mussel) *(Epioblasma penita)*	Endangered	Bivalve Freshwater	No
Combshell, Upland *(Epioblasma metastriata)*	Endangered	Bivalve Freshwater	Yes
Kidneyshell, Triangular *(Ptychobranchus greenii)*	Endangered	Bivalve Freshwater	Yes
Mucket, Orangenacre *(Lampsilis perovalis)*	Threatened	Bivalve Freshwater	Yes
Mucket, Pink (Pearlymussel) *(Lampsilis abrupta)*	Endangered	Bivalve Freshwater	No
Mussel, Acornshell Southern *(Epioblasma othcaloogensis)*	Endangered	Bivalve Freshwater	Yes
Mussel, Alabama Moccasinshell *(Medionidus acutissimus)*	Threatened	Bivalve Freshwater	Yes
Mussel, Coosa Moccasinshell *(Medionidus parvulus)*	Endangered	Bivalve Freshwater	Yes
Mussel, Cumberland Combshell *(Epioblasma brevidens)*	Endangered	Bivalve Freshwater	Yes
Mussel, Dark Pigtoe *(Pleurobema furvum)*	Endangered	Bivalve Freshwater	Yes
Mussel, Fine-lined Pocketbook *(Lampsilis altilis)*	Threatened	Bivalve Freshwater	Yes

Alabama (91) species:

		Taxa	Critical Habitat
Mussel, Fine-rayed Pigtoe *(Fusconaia cuneolus)*	Endangered	Bivalve Freshwater	No
Mussel, Flat Pigtoe (=Marshall's Mussel) *(Pleurobema marshalli)*	Endangered	Bivalve Freshwater	No
Mussel, Heavy Pigtoe (=Judge Tait's Mussel) *(Pleurobema taitianum)*	Endangered	Bivalve Freshwater	No
Mussel, Heelsplitter Inflated *(Potamilus inflatus)*	Threatened	Bivalve Freshwater	No
Mussel, Ovate Clubshell *(Pleurobema perovatum)*	Endangered	Bivalve Freshwater	Yes
Mussel, Ring Pink (=Golf Stick Pearly) *(Obovaria retusa)*	Endangered	Bivalve Freshwater	No
Mussel, Rough Pigtoe *(Pleurobema plenum)*	Endangered	Bivalve Freshwater	No
Mussel, Shiny Pigtoe *(Fusconaia cor)*	Endangered	Bivalve Freshwater	No
Mussel, Shiny-rayed Pocketbook *(Lampsilis subangulata)*	Endangered	Bivalve Freshwater	No
Mussel, Southern Clubshell *(Pleurobema decisum)*	Endangered	Bivalve Freshwater	Yes
Mussel, Southern Pigtoe *(Pleurobema georgianum)*	Endangered	Bivalve Freshwater	Yes
Pearlymussel, Alabama Lamp *(Lampsilis virescens)*	Endangered	Bivalve Freshwater	No
Pearlymussel, Cracking *(Hemistena lata)*	Endangered	Bivalve Freshwater	No
Pearlymussel, Cumberland Monkeyface *(Quadrula intermedia)*	Endangered	Bivalve Freshwater	No
Pearlymussel, Orange-footed *(Plethobasus cooperianus)*	Endangered	Bivalve Freshwater	No
Pearlymussel, Pale Lilliput *(Toxolasma cylindrellus)*	Endangered	Bivalve Freshwater	No
Pearlymussel, Turgid-blossom *(Epioblasma turgidula)*	Endangered	Bivalve Freshwater	No
Pearlymussel, White Wartyback *(Plethobasus cicatricosus)*	Endangered	Bivalve Freshwater	No
Stirrupshell *(Quadrula stapes)*	Endangered	Bivalve Freshwater	No
Shrimp, Alabama Cave *(Palaemonias alabamae)*	Endangered	Crustacean Freshwater	No
Amphianthus, Little *(Amphianthus pusillus)*	Threatened	Dicot Freshwater	No

Alabama (91) species:

		Taxa	Critical Habitat
Barbara Buttons, Mohr's *(Marshallia mohrii)*	Threatened	Dicot Terrestrial	No
Bladderpod, Lyrate *(Lesquerella lyrata)*	Threatened	Dicot Terrestrial	No
Clover, Leafy Prairie *(Dalea foliosa)*	Endangered	Dicot Terrestrial	No
Harperella *(Ptilimnium nodosum)*	Endangered	Dicot Freshwater	No
Leather-flower, Alabama *(Clematis socialis)*	Endangered	Dicot Terrestrial	No
Leather-flower, Morefield's *(Clematis morefieldii)*	Endangered	Dicot Terrestrial	No
Pitcher-plant, Alabama Canebrake *(Sarracenia rubra alabamensis)*	Endangered	Dicot Freshwater, Terrestrial	No
Pitcher-plant, Green *(Sarracenia oreophila)*	Endangered	Dicot Terrestrial, Freshwater	No
Potato-bean, Price's *(Apios priceana)*	Threatened	Dicot Terrestrial	No
Fern, Alabama Streak-sorus *(Thelypteris pilosa var. alabamensis)*	Threatened	Ferns Terrestrial	No
Fern, American hart's-tongue *(Asplenium scolopendrium var. americanum)*	Threatened	Ferns Terrestrial	No
Quillwort, Louisiana *(Isoetes louisianensis)*	Endangered	Ferns Freshwater, Terrestrial	No
Cavefish, Alabama *(Speoplatyrhinus poulsoni)*	Endangered	Fish Freshwater	Yes
Chub, Spotfin *(Erimonax monachus)*	Threatened	Fish Freshwater	Yes
Darter, Boulder *(Etheostoma wapiti)*	Endangered	Fish Freshwater	No
Darter, Goldline *(Percina aurolineata)*	Threatened	Fish Freshwater	No
Darter, Slackwater *(Etheostoma boschungi)*	Threatened	Fish Freshwater	Yes
Darter, Snail *(Percina tanasi)*	Threatened	Fish Freshwater	No
Darter, Vermilion *(Etheostoma chermocki)*	Endangered	Fish Freshwater	No
Darter, Watercress *(Etheostoma nuchale)*	Endangered	Fish Freshwater	No
Madtom, Yellowfin *(Noturus flavipinnis)*	Threatened	Fish Freshwater	Yes

Alabama (91) species:

		Taxa	Critical Habitat
Sculpin, Pygmy *(Cottus paulus (=pygmaeus))*	Threatened	Fish Freshwater	No
Shiner, Blue *(Cyprinella caerulea)*	Threatened	Fish Freshwater	No
Shiner, Cahaba *(Notropis cahabae)*	Endangered	Fish Freshwater	No
Shiner, Palezone *(Notropis albizonatus)*	Endangered	Fish Freshwater	No
Sturgeon, Alabama *(Scaphirhynchus suttkusi)*	Endangered	Fish Freshwater	No
Sturgeon, Gulf *(Acipenser oxyrinchus desotoi)*	Threatened	Fish Saltwater, Freshwater	Yes
Campeloma, Slender *(Campeloma decampi)*	Endangered	Gastropod Freshwater	No
Elimia, Lacy *(Elimia crenatella)*	Threatened	Gastropod Freshwater	No
Pebblesnail, Flat *(Lepyrium showalteri)*	Endangered	Gastropod Freshwater	No
Riversnail, Anthony's *(Athearnia anthonyi)*	Endangered	Gastropod Freshwater	No
Rocksnail, Painted *(Leptoxis taeniata)*	Threatened	Gastropod Freshwater	No
Rocksnail, Plicate *(Leptoxis plicata)*	Endangered	Gastropod Freshwater	No
Rocksnail, Round *(Leptoxis ampla)*	Threatened	Gastropod Freshwater	No
Snail, Armored *(Pyrgulopsis (=Marstonia) pachyta)*	Endangered	Gastropod Freshwater	No
Snail, Lioplax Cylindrical *(Lioplax cyclostomaformis)*	Endangered	Gastropod Freshwater	No
Snail, Tulotoma *(Tulotoma magnifica)*	Endangered	Gastropod Terrestrial	No
Bat, Gray *(Myotis grisescens)*	Endangered	Mammal Subterraneous, Terrestrial	No
Bat, Indiana *(Myotis sodalis)*	Endangered	Mammal Subterraneous, Terrestrial	Yes
Mouse, Alabama Beach *(Peromyscus polionotus ammobates)*	Endangered	Mammal Terrestrial, Coastal (neritic)	Yes
Mouse, Perdido Key Beach *(Peromyscus polionotus trissyllepsis)*	Endangered	Mammal Coastal (neritic)	Yes
Whale, Finback *(Balaenoptera physalus)*	Endangered	Marine mml Saltwater	No

Alabama (91) species:

		Taxa	Critical Habitat
Whale, Humpback *(Megaptera novaeangliae)*	Endangered	Marine mml Saltwater	No
Grass, Tennessee Yellow-eyed *(Xyris tennesseensis)*	Endangered	Monocot Terrestrial	No
Trillium, Relict *(Trillium reliquum)*	Endangered	Monocot Terrestrial	No
Water-plantain, Kral's *(Sagittaria secundifolia)*	Threatened	Monocot Freshwater	No
Sea turtle, hawksbill *(Eretmochelys imbricata)*	Endangered	Reptile Saltwater	Yes
Sea turtle, Kemp's ridley *(Lepidochelys kempii)*	Endangered	Reptile Saltwater	No
Sea turtle, leatherback *(Dermochelys coriacea)*	Endangered	Reptile Saltwater	Yes
Sea turtle, loggerhead *(Caretta caretta)*	Threatened	Reptile Saltwater	No
Snake, Eastern Indigo *(Drymarchon corais couperi)*	Threatened	Reptile Terrestrial	No
Tortoise, Gopher *(Gopherus polyphemus)*	Threatened	Reptile Terrestrial	No
Turtle, Alabama Red-bellied *(Pseudemys alabamensis)*	Endangered	Reptile Terrestrial, Freshwater	No
Turtle, Flattened Musk *(Sternotherus depressus)*	Threatened	Reptile Freshwater, Terrestrial	No

Alaska (2) species:

		Taxa	Critical Habitat
Fern, Aleutian Shield *(Polystichum aleuticum)*	Endangered	Ferns Terrestrial	No
Otter, Northern Sea *(Enhydra lutris kenyoni)*	Threatened	Marine mml Saltwater	No

Arizona (57) species:

		Taxa	Critical Habitat
Frog, Chiricahua Leopard *(Rana chiricahuensis)*	Threatened	Amphibian Freshwater, Terrestrial	No
Salamander, Sonora Tiger *(Ambystoma tigrinum stebbinsi)*	Endangered	Amphibian Vernal pool, Freshwater, Terrestrial	No
Bobwhite, Masked *(Colinus virginianus ridgwayi)*	Endangered	Bird Terrestrial	No
Condor, California *(Gymnogyps californianus)*	Endangered	Bird Terrestrial	Yes
Eagle, Bald *(Haliaeetus leucocephalus)*	Threatened	Bird Terrestrial	No
Falcon, Northern Aplomado *(Falco femoralis septentrionalis)*	Endangered	Bird Terrestrial	No

Arizona (57) species:

			Taxa	Critical Habitat
Flycatcher, Southwestern Willow	Endangered		Bird	Yes
(Empidonax traillii extimus)		Terrestrial		
Owl, Mexican Spotted	Threatened		Bird	Yes
(Strix occidentalis lucida)		Terrestrial		
Pygmy-owl, Cactus Ferruginous	Endangered		Bird	No
(Glaucidium brasilianum cactorum)		Terrestrial		
Rail, Yuma Clapper	Endangered		Bird	No
(Rallus longirostris yumanensis)		Terrestrial		
Blue-star, Kearney's	Endangered		Dicot	No
(Amsonia kearneyana)		Terrestrial		
Cactus, Arizona Hedgehog	Endangered		Dicot	No
(Echinocereus triglochidiatus var. arizonicus)		Terrestrial		
Cactus, Brady Pincushion	Endangered		Dicot	No
(Pediocactus bradyi)		Terrestrial		
Cactus, Cochise Pincushion	Threatened		Dicot	No
(Coryphantha robbinsorum)		Terrestrial		
Cactus, Nichol's Turk's Head	Endangered		Dicot	No
(Echinocactus horizonthalonius var. nicholii)		Terrestrial		
Cactus, Peebles Navajo	Endangered		Dicot	No
(Pediocactus peeblesianus peeblesianus)		Terrestrial		
Cactus, Pima Pineapple	Endangered		Dicot	No
(Coryphantha scheeri var. robustispina)		Terrestrial		
Cactus, Siler Pincushion	Threatened		Dicot	No
(Pediocactus (=Echinocactus,=Utahia) sileri)		Terrestrial		
Cliffrose, Arizona	Endangered		Dicot	No
(Purshia (=cowania) subintegra)		Terrestrial		
Cycladenia, Jones	Threatened		Dicot	No
(Cycladenia jonesii (=humilis))		Terrestrial		
Fleabane, Zuni	Threatened		Dicot	No
(Erigeron rhizomatus)		Terrestrial		
Groundsel, San Francisco Peaks	Threatened		Dicot	Yes
(Senecio franciscanus)		Terrestrial		
Milk-vetch, Holmgren	Endangered		Dicot	No
(Astragalus holmgreniorum)		Terrestrial		
Milk-vetch, Sentry	Endangered		Dicot	No
(Astragalus cremnophylax var. cremnophylax)		Terrestrial		
Milkweed, Welsh's	Threatened		Dicot	Yes
(Asclepias welshii)		Terrestrial		
Umbel, Huachuca Water	Endangered		Dicot	Yes
(Lilaeopsis schaffneriana var. recurva)		Terrestrial, Freshwater		
Catfish, Yaqui	Threatened		Fish	Yes
(Ictalurus pricei)		Freshwater		

Arizona (57) species:

		Taxa	Critical Habitat
Chub, Bonytail	Endangered	Fish	Yes
(Gila elegans)		Freshwater	
Chub, Gila	Endangered	Fish	Yes
(Gila intermedia)		Freshwater	
Chub, Humpback	Endangered	Fish	Yes
(Gila cypha)		Freshwater	
Chub, Sonora	Threatened	Fish	Yes
(Gila ditaenia)		Freshwater	
Chub, Virgin River	Endangered	Fish	Yes
(Gila seminuda (=robusta))		Freshwater	
Chub, Yaqui	Endangered	Fish	Yes
(Gila purpurea)		Freshwater	
Minnow, Loach	Threatened	Fish	Yes
(Tiaroga cobitis)		Freshwater	
Pupfish, Desert	Endangered	Fish	Yes
(Cyprinodon macularius)		Freshwater	
Shiner, Beautiful	Threatened	Fish	Yes
(Cyprinella formosa)		Freshwater	
Spikedace	Threatened	Fish	Yes
(Meda fulgida)		Freshwater	
Spinedace, Little Colorado	Threatened	Fish	Yes
(Lepidomeda vittata)		Freshwater	
Squawfish, Colorado	Endangered	Fish	Yes
(Ptychocheilus lucius)		Freshwater	
Sucker, Razorback	Endangered	Fish	Yes
(Xyrauchen texanus)		Freshwater	
Topminnow, Gila (Yaqui)	Endangered	Fish	No
(Poeciliopsis occidentalis)		Freshwater	
Trout, Apache	Threatened	Fish	No
(Oncorhynchus apache)		Freshwater	
Trout, Gila	Endangered	Fish	No
(Oncorhynchus gilae)		Freshwater	
Woundfin	Endangered	Fish	Yes
(Plagopterus argentissimus)		Freshwater	
Ambersnail, Kanab	Endangered	Gastropod	No
(Oxyloma haydeni kanabensis)		Freshwater, Terrestrial	
Bat, Lesser (=Sanborn's) Long-nosed	Endangered	Mammal	No
(Leptonycteris curasoae yerbabuenae)		Subterraneous, Terrestrial	
Ferret, Black-footed	Endangered	Mammal	No
(Mustela nigripes)		Terrestrial	
Jaguar	Endangered	Mammal	No
(Panthera onca)		Terrestrial	

Arizona (57) species:

		Taxa	Critical Habitat
Jaguarundi, Sinaloan *(Herpailurus (=Felis) yagouaroundi tolteca)*	Endangered	Mammal Terrestrial	No
Ocelot *(Leopardus (=Felis) pardalis)*	Endangered	Mammal Terrestrial	No
Pronghorn, Sonoran *(Antilocapra americana sonoriensis)*	Endangered	Mammal Terrestrial	No
Squirrel, Mount Graham Red *(Tamiasciurus hudsonicus grahamensis)*	Endangered	Mammal Terrestrial	Yes
Vole, Hualapai Mexican *(Microtus mexicanus hualpaiensis)*	Endangered	Mammal Terrestrial	No
Ladies'-tresses, Canelo Hills *(Spiranthes delitescens)*	Endangered	Monocot Terrestrial	No
Sedge, Navajo *(Carex specuicola)*	Threatened	Monocot Terrestrial	Yes
Rattlesnake, New Mexican Ridge-nosed *(Crotalus willardi obscurus)*	Threatened	Reptile Terrestrial	Yes
Tortoise, Desert *(Gopherus agassizii)*	Threatened	Reptile Terrestrial	Yes

Arkansas (22) species:

		Taxa	Critical Habitat
Tern, Interior (population) Least *(Sterna antillarum)*	Endangered	Bird Terrestrial	No
Woodpecker, Red-cockaded *(Picoides borealis)*	Endangered	Bird Terrestrial	No
Fatmucket, Arkansas *(Lampsilis powelli)*	Threatened	Bivalve Freshwater	No
Mucket, Pink (Pearlymussel) *(Lampsilis abrupta)*	Endangered	Bivalve Freshwater	No
Mussel, Scaleshell *(Leptodea leptodon)*	Endangered	Bivalve Freshwater	No
Mussel, Speckled Pocketbook *(Lampsilis streckeri)*	Endangered	Bivalve Freshwater	No
Pearlymussel, Fat Pocketbook *(Potamilus capax)*	Endangered	Bivalve Freshwater	No
Rock-pocketbook, Ouachita (=Wheeler's pm) *(Arkansia wheeleri)*	Endangered	Bivalve Freshwater	No
Crayfish, Cave (Cambarus aculabrum) *(Cambarus aculabrum)*	Endangered	Crustacean Freshwater	No
Crayfish, Cave (Cambarus zophonastes) *(Cambarus zophonastes)*	Endangered	Crustacean Freshwater	No
Bladderpod, Missouri *(Lesquerella filiformis)*	Threatened	Dicot Terrestrial	No
Fruit, Earth (=geocarpon) *(Geocarpon minimum)*	Threatened	Dicot Terrestrial	No

Arkansas (22) species:

		Taxa	Critical Habitat
Harperella *(Ptilimnium nodosum)*	Endangered	Dicot Freshwater	No
Pondberry *(Lindera melissifolia)*	Endangered	Dicot Terrestrial	No
Cavefish, Ozark *(Amblyopsis rosae)*	Threatened	Fish Freshwater	No
Darter, Leopard *(Percina pantherina)*	Threatened	Fish Freshwater	Yes
Sturgeon, Pallid *(Scaphirhynchus albus)*	Endangered	Fish Freshwater	No
Shagreen, Magazine Mountain *(Mesodon magazinensis)*	Threatened	Gastropod Terrestrial	No
Beetle, American Burying *(Nicrophorus americanus)*	Endangered	Insect Terrestrial	No
Bat, Gray *(Myotis grisescens)*	Endangered	Mammal Subterraneous, Terrestrial	No
Bat, Indiana *(Myotis sodalis)*	Endangered	Mammal Subterraneous, Terrestrial	Yes
Bat, Ozark Big-eared *(Corynorhinus (=Plecotus) townsendii ingens)*	Endangered	Mammal Terrestrial, Subterraneous	No

California (297) species:

		Taxa	Critical Habitat
Frog, California Red-legged *(Rana aurora draytonii)*	Threatened	Amphibian Terrestrial, Freshwater	Yes
Frog, Mountain Yellow-legged *(Gopherus agassizii)*	Endangered	Amphibian Terrestrial, Freshwater	No
Salamander, California Tiger *(Ambystoma californiense)*	Endangered	Amphibian Terrestrial, Vernal pool	No
Salamander, Desert Slender *(Batrachoseps aridus)*	Endangered	Amphibian Freshwater, Terrestrial	No
Salamander, Santa Cruz Long-toed *(Ambystoma macrodactylum croceum)*	Endangered	Amphibian Freshwater, Vernal pool, Terrestrial	No
Toad, Arroyo Southwestern *(Bufo californicus (=microscaphus))*	Endangered	Amphibian Freshwater, Terrestrial	Yes
Condor, California *(Gymnogyps californianus)*	Endangered	Bird Terrestrial	Yes
Flycatcher, Southwestern Willow *(Empidonax traillii extimus)*	Endangered	Bird Terrestrial	Yes
Gnatcatcher, Coastal California *(Polioptila californica californica)*	Threatened	Bird Terrestrial	Yes
Murrelet, Marbled *(Brachyramphus marmoratus marmoratus)*	Threatened	Bird Freshwater, Terrestrial, Saltwater	Yes
Owl, Northern Spotted *(Strix occidentalis caurina)*	Threatened	Bird Terrestrial	Yes

California (297) species:

		Taxa	Critical Habitat
Plover, Western Snowy	Threatened	Bird	Yes
(Charadrius alexandrinus nivosus)		Terrestrial	
Rail, California Clapper	Endangered	Bird	No
(Rallus longirostris obsoletus)		Terrestrial	
Rail, Light-footed Clapper	Endangered	Bird	No
(Rallus longirostris levipes)		Terrestrial	
Rail, Yuma Clapper	Endangered	Bird	No
(Rallus longirostris yumanensis)		Terrestrial	
Shrike, San Clemente Loggerhead	Endangered	Bird	No
(Lanius ludovicianus mearnsi)		Terrestrial	
Sparrow, San Clemente Sage	Threatened	Bird	No
(Amphispiza belli clementeae)		Terrestrial	
Tern, California Least	Endangered	Bird	No
(Sterna antillarum browni)		Terrestrial	
Towhee, Inyo Brown	Threatened	Bird	Yes
(Pipilo crissalis eremophilus)		Terrestrial	
Vireo, Least Bell's	Endangered	Bird	Yes
(Vireo bellii pusillus)		Terrestrial	
Cypress, Gowen	Threatened	Conf/cycds	No
(Cupressus goveniana ssp. goveniana)		Terrestrial	
Cypress, Santa Cruz	Endangered	Conf/cycds	No
(Cupressus abramsiana)		Terrestrial	
Crayfish, Shasta	Endangered	Crustacean	No
(Pacifastacus fortis)		Freshwater	
Fairy Shrimp, Conservancy Fairy	Endangered	Crustacean	Yes
(Branchinecta conservatio)		Vernal pool	
Fairy Shrimp, Longhorn	Endangered	Crustacean	Yes
(Branchinecta longiantenna)		Vernal pool	
Fairy Shrimp, Riverside	Endangered	Crustacean	Yes
(Streptocephalus woottoni)		Vernal pool	
Fairy Shrimp, San Diego	Endangered	Crustacean	Yes
(Branchinecta sandiegonensis)		Vernal pool	
Fairy Shrimp, Vernal Pool	Threatened	Crustacean	Yes
(Branchinecta lynchi)		Vernal pool	
Shrimp, California Freshwater	Endangered	Crustacean	No
(Syncaris pacifica)		Freshwater	
Tadpole Shrimp, Vernal Pool	Endangered	Crustacean	Yes
(Lepidurus packardi)		Vernal pool	
Adobe Sunburst, San Joaquin	Threatened	Dicot	No
(Pseudobahia peirsonii)		Terrestrial	
Allocarya, Calistoga	Endangered	Dicot	No
(Plagiobothrys strictus)		Vernal pool	

California (297) species:

			Taxa	Critical Habitat
Ambrosia, San Diego	Endangered		Dicot	No
(Ambrosia pumila)		Terrestrial		
Baccharis, Encinitas	Threatened		Dicot	No
(Baccharis vanessae)		Terrestrial		
Barberry, Island	Endangered		Dicot	No
(Berberis pinnata ssp. insularis)		Terrestrial		
Barberry, Nevin's	Endangered		Dicot	No
(Berberis nevinii)		Terrestrial		
Bedstraw, El Dorado	Endangered		Dicot	No
(Galium californicum ssp. sierrae)		Terrestrial		
Bedstraw, Island	Endangered		Dicot	No
(Galium buxifolium)		Terrestrial		
Bird's-beak, Palmate-bracted	Endangered		Dicot	No
(Cordylanthus palmatus)		Terrestrial		
Bird's-beak, Pennell's	Endangered		Dicot	No
(Cordylanthus tenuis ssp. capillaris)		Terrestrial		
Bird's-beak, salt marsh	Endangered		Dicot	No
(Cordylanthus maritimus ssp. maritimus)		Saltwater		
Bird's-beak, Soft	Endangered		Dicot	No
(Cordylanthus mollis ssp. mollis)		Brackish, Saltwater		
Bladderpod, San Bernardino Mountains	Endangered		Dicot	Yes
(Lesquerella kingii ssp. bernardina)		Terrestrial		
Bluecurls, Hidden Lake	Threatened		Dicot	No
(Trichostema austromontanum ssp. compactum)		Terrestrial		
Broom, San Clemente Island	Endangered		Dicot	No
(Lotus dendroideus ssp. traskiae)		Terrestrial		
Buckwheat, Cushenbury	Endangered		Dicot	Yes
(Eriogonum ovalifolium var. vineum)		Terrestrial		
Buckwheat, Ione (incl. Irish Hill)	Endangered		Dicot	No
(Eriogonum apricum (incl. var. prostratum))		Terrestrial		
Buckwheat, Southern Mountain Wild	Threatened		Dicot	No
(Eriogonum kennedyi var. austromontanum)		Terrestrial		
Bush-mallow, San Clemente Island	Endangered		Dicot	No
(Malacothamnus clementinus)		Terrestrial		
Bush-mallow, Santa Cruz Island	Endangered		Dicot	No
(Malacothamnus fasciculatus var. nesioticus)		Terrestrial		
Butterweed, Layne's	Threatened		Dicot	No
(Senecio layneae)		Terrestrial		
Button-celery, San Diego	Endangered		Dicot	No
(Eryngium aristulatum var. parishii)		Terrestrial		
Cactus, Bakersfield	Endangered		Dicot	No
(Opuntia treleasei)		Terrestrial		

California (297) species:

			Taxa	Critical Habitat
Ceanothus, Coyote	Endangered		Dicot	No
(Ceanothus ferrisae)		Terrestrial		
Ceanothus, Pine Hill	Endangered		Dicot	No
(Ceanothus roderickii)		Terrestrial		
Ceanothus, Vail Lake	Threatened		Dicot	No
(Ceanothus ophiochilus)		Terrestrial		
Centaury, Spring-loving	Threatened		Dicot	Yes
(Centaurium namophilum)		Terrestrial		
Checker-mallow, Keck's	Endangered		Dicot	Yes
(Sidalcea keckii)		Terrestrial		
Checker-mallow, Kenwood Marsh	Endangered		Dicot	No
(Sidalcea oregana ssp. valida)		Terrestrial		
Checker-mallow, Pedate	Endangered		Dicot	No
(Sidalcea pedata)		Terrestrial		
Clarkia, Pismo	Endangered		Dicot	No
(Clarkia speciosa ssp. immaculata)		Terrestrial		
Clarkia, Presidio	Endangered		Dicot	No
(Clarkia franciscana)		Terrestrial		
Clarkia, Springville	Threatened		Dicot	No
(Clarkia springvillensis)		Terrestrial		
Clarkia, Vine Hill	Endangered		Dicot	No
(Clarkia imbricata)		Terrestrial		
Clover, Fleshy Owl's	Threatened		Dicot	Yes
(Castilleja campestris ssp. succulenta)		Vernal pool		
Clover, Monterey	Endangered		Dicot	No
(Trifolium trichocalyx)		Terrestrial		
Clover, Showy Indian	Endangered		Dicot	No
(Trifolium amoenum)		Terrestrial		
Coyote-thistle, Loch Lomond	Endangered		Dicot	No
(Eryngium constancei)		Terrestrial		
Crownbeard, Big-leaved	Threatened		Dicot	No
(Verbesina dissita)		Terrestrial		
Crownscale, San Jacinto Valley	Endangered		Dicot	No
(Atriplex coronata var. notatior)		Terrestrial		
Daisy, Parish's	Threatened		Dicot	Yes
(Erigeron parishii)		Freshwater		
Dudleya, Conejo	Threatened		Dicot	No
(Dudleya abramsii ssp. parva)		Terrestrial		
Dudleya, Marcescent	Threatened		Dicot	No
(Dudleya cymosa ssp. marcescens)		Terrestrial		
Dudleya, Santa Clara Valley	Endangered		Dicot	No
(Dudleya setchellii)		Terrestrial		

California (297) species:

			Taxa	Critical Habitat
Dudleya, Santa Cruz Island	Threatened		Dicot	No
(Dudleya nesiotica)		Terrestrial		
Dudleya, Santa Monica Mountains	Threatened		Dicot	No
(Dudleya cymosa ssp. ovatifolia)		Terrestrial		
Dudleya, Verity's	Threatened		Dicot	No
(Dudleya verityi)		Terrestrial		
Dwarf-flax, Marin	Threatened		Dicot	No
(Hesperolinon congestum)		Terrestrial		
Evening-primrose, Antioch Dunes	Endangered		Dicot	Yes
(Oenothera deltoides ssp. howellii)		Terrestrial		
Evening-primrose, Eureka Valley	Endangered		Dicot	No
(Oenothera avita ssp. eurekensis)		Terrestrial		
Evening-primrose, San Benito	Threatened		Dicot	No
(Camissonia benitensis)		Terrestrial		
Fiddleneck, Large-flowered	Endangered		Dicot	Yes
(Amsinckia grandiflora)		Terrestrial		
Flannelbush, Mexican	Endangered		Dicot	No
(Fremontodendron mexicanum)		Terrestrial		
Flannelbush, Pine Hill	Endangered		Dicot	No
(Fremontodendron californicum ssp. decumbens)		Terrestrial		
Fringepod, Santa Cruz Island	Endangered		Dicot	No
(Thysanocarpus conchuliferus)		Terrestrial		
Gilia, Hoffmann's Slender-flowered	Endangered		Dicot	No
(Gilia tenuiflora ssp. hoffmannii)		Terrestrial		
Gilia, Monterey	Endangered		Dicot	No
(Gilia tenuiflora ssp. arenaria)		Terrestrial		
Golden Sunburst, Hartweg's	Endangered		Dicot	No
(Pseudobahia bahiifolia)		Terrestrial		
Goldfields, Burke's	Endangered		Dicot	No
(Lasthenia burkei)		Terrestrial		
Goldfields, Contra Costa	Endangered		Dicot	Yes
(Lasthenia conjugens)		Terrestrial		
Grass, Hairy Orcutt	Endangered		Dicot	Yes
(Orcuttia pilosa)		Vernal pool		
Grass, Sacramento Orcutt	Endangered		Dicot	Yes
(Orcuttia viscida)		Vernal pool		
Grass, Slender Orcutt	Threatened		Dicot	Yes
(Orcuttia tenuis)		Vernal pool		
Gumplant, Ash Meadows	Threatened		Dicot	Yes
(Grindelia fraxino-pratensis)		Terrestrial		
Ivesia, Ash Meadows	Threatened		Dicot	Yes
(Ivesia kingii var. eremica)		Terrestrial		

California (297) species:

			Taxa	Critical Habitat
Jewelflower, California	Endangered		Dicot	No
(Caulanthus californicus)		Terrestrial		
Jewelflower, Tiburon	Endangered		Dicot	No
(Streptanthus niger)		Terrestrial		
Larkspur, Baker's	Endangered		Dicot	Yes
(Delphinium bakeri)		Terrestrial		
Larkspur, San Clemente Island	Endangered		Dicot	No
(Delphinium variegatum ssp. kinkiense)		Terrestrial		
Larkspur, Yellow	Endangered		Dicot	Yes
(Delphinium luteum)		Terrestrial		
Layia, Beach	Endangered		Dicot	No
(Layia carnosa)		Terrestrial, Coastal (neritic)		
Lessingia, San Francisco	Endangered		Dicot	No
(Lessingia germanorum (=L.g. var. germanorum))		Terrestrial		
Liveforever, Laguna Beach	Threatened		Dicot	No
(Dudleya stolonifera)		Terrestrial		
Liveforever, Santa Barbara Island	Endangered		Dicot	No
(Dudleya traskiae)		Terrestrial		
Lupine, Clover	Endangered		Dicot	No
(Lupinus tidestromii)		Coastal (neritic)		
Lupine, Nipomo Mesa	Endangered		Dicot	No
(Lupinus nipomensis)		Coastal (neritic)		
Malacothrix, Island	Endangered		Dicot	No
(Malacothrix squalida)		Terrestrial		
Malacothrix, Santa Cruz Island	Endangered		Dicot	No
(Malacothrix indecora)		Terrestrial		
Mallow, Kern	Endangered		Dicot	No
(Eremalche kernensis)		Terrestrial		
Manzanita, Del Mar	Endangered		Dicot	No
(Arctostaphylos glandulosa ssp. crassifolia)		Terrestrial		
Manzanita, Ione	Threatened		Dicot	No
(Arctostaphylos myrtifolia)		Terrestrial		
Manzanita, Morro	Threatened		Dicot	No
(Arctostaphylos morroensis)		Terrestrial		
Manzanita, Pallid	Threatened		Dicot	No
(Arctostaphylos pallida)		Terrestrial		
Manzanita, Santa Rosa Island	Endangered		Dicot	No
(Arctostaphylos confertiflora)		Terrestrial		
Meadowfoam, Butte County	Endangered		Dicot	Yes
(Limnanthes floccosa ssp. californica)		Vernal pool		
Meadowfoam, Sebastopol	Endangered		Dicot	No
(Limnanthes vinculans)		Freshwater, Terrestrial		

California (297) species:

		Taxa	Critical Habitat
Milk-vetch, Braunton's *(Astragalus brauntonii)*	Endangered	Dicot Terrestrial	No
Milk-vetch, Clara Hunt's *(Astragalus clarianus)*	Endangered	Dicot Terrestrial	No
Milk-vetch, Coachella Valley *(Astragalus lentiginosus var. coachellae)*	Endangered	Dicot Terrestrial	Yes
Milk-vetch, Coastal Dunes *(Astragalus tener var. titi)*	Endangered	Dicot Terrestrial	No
Milk-vetch, Cushenbury *(Astragalus albens)*	Endangered	Dicot Terrestrial	Yes
Milk-vetch, Fish Slough *(Astragalus lentiginosus var. piscinensis)*	Threatened	Dicot Terrestrial	No
Milk-vetch, Lane Mountain *(Astragalus jaegerianus)*	Endangered	Dicot Terrestrial	Yes
Milk-vetch, Pierson's *(Astragalus magdalenae var. peirsonii)*	Threatened	Dicot Terrestrial	Yes
Milk-vetch, Triple-ribbed *(Astragalus tricarinatus)*	Endangered	Dicot Terrestrial	No
Milk-vetch, Ventura Marsh *(Astragalus pycnostachyus var. lanosissimus)*	Endangered	Dicot Terrestrial, Freshwater	Yes
Mint, Otay Mesa *(Pogogyne nudiuscula)*	Endangered	Dicot Terrestrial	No
Mint, San Diego Mesa *(Pogogyne abramsii)*	Endangered	Dicot Terrestrial	No
Monardella, Willowy *(Monardella linoides ssp. viminea)*	Endangered	Dicot Terrestrial	No
Morning-glory, Stebbins *(Calystegia stebbinsii)*	Endangered	Dicot Terrestrial	No
Mountainbalm, Indian Knob *(Eriodictyon altissimum)*	Endangered	Dicot Terrestrial	No
Mountain-mahogany, Catalina Island *(Cercocarpus traskiae)*	Endangered	Dicot Terrestrial	No
Mustard, Slender-petaled *(Thelypodium stenopetalum)*	Endangered	Dicot Terrestrial	No
Navarretia, Few-flowered *(Navarretia leucocephala ssp. pauciflora (=N. pauciflora))*	Endangered	Dicot Vernal pool, Terrestrial	No
Navarretia, Many-flowered *(Navarretia leucocephala ssp. plieantha)*	Endangered	Dicot Terrestrial, Vernal pool	No
Navarretia, Spreading *(Navarretia fossalis)*	Threatened	Dicot Vernal pool	No
Niterwort, Amargosa *(Nitrophila mohavensis)*	Endangered	Dicot Terrestrial	Yes

California (297) species:

		Taxa	Critical Habitat
Spineflower, Howell's	Endangered	Dicot	No
(Chorizanthe howellii)		Terrestrial	
Spineflower, Monterey	Threatened	Dicot	Yes
(Chorizanthe pungens var. pungens)		Terrestrial	
Spineflower, Orcutt's	Endangered	Dicot	No
(Chorizanthe orcuttiana)		Terrestrial	
Spineflower, Robust	Endangered	Dicot	Yes
(Chorizanthe robusta var. robusta)		Terrestrial	
Spineflower, Scotts Valley	Endangered	Dicot	Yes
(Chorizanthe robusta var. hartwegii)		Terrestrial	
Spineflower, Slender-horned	Endangered	Dicot	No
(Dodecahema leptoceras)		Terrestrial	
Spineflower, Sonoma	Endangered	Dicot	No
(Chorizanthe valida)		Terrestrial	
Spurge, Hoover's	Threatened	Dicot	Yes
(Chamaesyce hooveri)		Vernal pool	
Stickyseed, Baker's	Endangered	Dicot	No
(Blennosperma bakeri)		Vernal pool	
Stonecrop, Lake County	Endangered	Dicot	No
(Parvisedum leiocarpum)		Vernal pool	
Sunflower, San Mateo Woolly	Endangered	Dicot	No
(Eriophyllum latilobum)		Terrestrial	
Taraxacum, California	Endangered	Dicot	No
(Taraxacum californicum)		Terrestrial	
Tarplant, Gaviota	Endangered	Dicot	Yes
(Deinandra increscens ssp. villosa)		Terrestrial	
Tarplant, Otay	Threatened	Dicot	Yes
(Deinandra (=Hemizonia) conjugens)		Terrestrial	
Tarplant, Santa Cruz	Threatened	Dicot	Yes
(Holocarpha macradenia)		Terrestrial	
Thistle, Chorro creek Bog	Endangered	Dicot	No
(Cirsium fontinale var. obispoense)		Terrestrial, Freshwater	
Thistle, Fountain	Endangered	Dicot	No
(Cirsium fontinale var. fontinale)		Terrestrial	
Thistle, La Graciosa	Endangered	Dicot	Yes
(Cirsium loncholepis)		Coastal (neritic), Freshwater,	
Thistle, Suisun	Endangered	Dicot	No
(Cirsium hydrophilum var. hydrophilum)		Brackish, Terrestrial	
Thornmint, San Diego	Threatened	Dicot	No
(Acanthomintha ilicifolia)		Terrestrial	
Thornmint, San Mateo	Endangered	Dicot	No
(Acanthomintha obovata ssp. duttonii)		Terrestrial	

California (297) species:

		Taxa	Critical Habitat
Tuctoria, Green's	Endangered	Dicot	Yes
(Tuctoria greenei)		Vernal pool	
Vervain, California	Threatened	Dicot	No
(Verbena californica)		Terrestrial	
Wallflower, Ben Lomond	Endangered	Dicot	No
(Erysimum teretifolium)		Terrestrial	
Wallflower, Contra Costa	Endangered	Dicot	Yes
(Erysimum capitatum var. angustatum)		Terrestrial	
Wallflower, Menzie's	Endangered	Dicot	No
(Erysimum menziesii)		Terrestrial	
Watercress, Gambel's	Endangered	Dicot	No
(Rorippa gambellii)		Terrestrial, Brackish, Freshwater	
Woodland-star, San Clemente Island	Endangered	Dicot	No
(Lithophragma maximum)		Terrestrial	
Woolly-star, Santa Ana River	Endangered	Dicot	No
(Eriastrum densifolium ssp. sanctorum)		Terrestrial	
Woolly-threads, San Joaquin	Endangered	Dicot	No
(Monolopia (=Lembertia) congdonii)		Terrestrial	
Yerba Santa, Lompoc	Endangered	Dicot	Yes
(Eriodictyon capitatum)		Terrestrial	
Chub, Bonytail	Endangered	Fish	Yes
(Gila elegans)		Freshwater	
Chub, Hutton Tui	Threatened	Fish	No
(Gila bicolor ssp.)		Freshwater	
Chub, Mohave Tui	Endangered	Fish	No
(Gila bicolor mohavensis)		Freshwater	
Chub, Owens Tui	Endangered	Fish	Yes
(Gila bicolor snyderi)		Freshwater	
Dace, Ash Meadows Speckled	Endangered	Fish	Yes
(Rhinichthys osculus nevadensis)		Freshwater	
Goby, Tidewater	Endangered	Fish	Yes
(Eucyclogobius newberryi)		Freshwater	
Pupfish, Desert	Endangered	Fish	Yes
(Cyprinodon macularius)		Freshwater	
Pupfish, Owens	Endangered	Fish	No
(Cyprinodon radiosus)		Freshwater	
Salmon, Chinook (California Coastal Run)	Threatened	Fish	Yes
(Oncorhynchus (=Salmo) tshawytscha)		Freshwater, Saltwater, Brackish	
Salmon, Chinook (Central Valley Fall Run)	Threatened	Fish	No
(Oncorhynchus (=Salmo) tshawytscha)		Brackish, Freshwater, Saltwater	
Salmon, Chinook (Central Valley Spring Run)	Threatened	Fish	Yes
(Oncorhynchus (=Salmo) tshawytscha)		Brackish, Saltwater, Freshwater	