CENTER for BIOLOGICAL DIVERSITY
Because life is good.

August 22, 2013

Office of Pesticide Programs
Environmental Protection Agency Docket Center (EPA/DC)
EPA West Building, Room 3334
1301 Constitution Ave NW
Washington, DC 20460-0001

Re: Comments on EPA Reregistration of Atrazine (Docket #: EPA-HQ-OPP-2013-0266)

Please accept the following comments on behalf of the Center for Biological Diversity in response to the Environmental Protection Agency's ("EPA") reregistration review of atrazine. As discussed below in greater detail, given the substantial and well documented environmental and human health impacts from exposure to atrazine at even extremely low levels, atrazine should be banned from use within the United States.

Each year, approximately 60-80 million pounds of atrazine are used across the United States. As a result, atrazine is one of the most commonly detected pesticides in drinking water, surface waters, and ground water across the nation. Such widespread environmental contamination is particularly alarming because research has shown that exposure to atrazine at levels as low as 0.1 parts per billion (ppb) have been shown to affect the development of female sex characteristics in male frogs and cause the development of eggs in male frog testes. Atrazine causes substantial harm in amphibians, reptiles, mammals, birds, and a suite of non-target plant species, including potentially hundreds of threatened and endangered species protected under the Endangered Species Act. In addition to these profound environmental impacts, atrazine causes unacceptable impacts on human health including elevated cancer risks, elevated risks of birth defects, and significant reproductive harm. Because the overwhelming weight of the evidence demonstrates the substantial adverse impacts on the environment from atrazine, EPA should conclude at the end of the FIFRA reregistration process and the Section 7 consultation process that cancelation of atrazine is the most appropriate course of action.

The Center for Biological Diversity ("Center") is a non-profit environmental organization dedicated to the protection of native species and their habitats through science, policy, and environmental law. The Center has more than 625,000 members and online activists dedicated to the protection and restoration of endangered species and wild places. The Center has worked for many years to protect imperiled plants and wildlife, open space, air and water quality, and overall quality of life. The Center's Pesticides Reduction Campaign aims to secure programmatic changes in the pesticide registration process and to stop toxic pesticides from contaminating fish and wildlife habitats. We appreciate the opportunity to provide comment.

Alaska . Arizona . California . Florida . Minnesota . Nevada . New Mexico . New York . Oregon . Vermont . Washington, DC
P.O. Box 710 . Tucson, AZ 85702-0710 tel: (520) 623.5252 fax: (520) 623.9797 www.BiologicalDiversity.org

I. Atrazine's Known Environmental Impacts, Water Quality Impacts, and Human Health Impacts are Unreasonable and Do Not Meet the Minimum Statutory Requirements for Reregistration Under FIFRA.

The Federal Insecticide, Fungicide, and Rodenticide Act ("FIFRA") authorizes the EPA to regulate the registration, use, sale, and distribution of pesticides in the United States. Pursuant to FIFIRA, EPA oversees both initial registration of an active ingredient, the reregistration of an active ingredient, and the registration of any product formulation for a particular use for that active ingredient.

Section 4(a)(2) allows for the reregistration of a pesticide active ingredient if the EPA determines that the pesticide active ingredient will "perform its intended function without unreasonable adverse effects on the environment" and so long as the pesticide "when used in accordance with widespread and commonly recognized practice [] will not generally cause unreasonable adverse effects on the environment."[1] FIFRA defines the "environment" as the "water, air, land, and all plants and man and other animals living therein, and the interrelationships which exist among these."[2] FIFRA defines "unreasonable adverse effects on the environment" as "any unreasonable risk to man or the environment, taking into account the economic, social, and environmental costs and benefits of the use of any pesticide."[3] If EPA finds that the pesticide, without additional regulatory restriction, does cause unreasonable adverse effects on the environment, the EPA may suspend, cancel, or impose stricter regulations on a pesticide registration.[4] Where the EPA chooses to adopt the latter approach and continue to permit the use of such active ingredient, the EPA must classify the active ingredient as a restricted use pesticide, which "shall be applied…only by or under the direct supervision of a certified applicator, or subject to such other restrictions as the Administrator may provide by regulation."[5]

In deciding whether a pesticide presents unreasonable risks, the EPA must find that the risks associated with the use of a pesticide are justified by the benefits of such use.[6] The benefits of the continued registration of atrazine no longer justify the significant environmental impacts that atrazine's usage incurs. Atrazine causes substantial harm in amphibians, reptiles, mammals, birds, and a suite of non-target plant species, including potentially hundreds of threatened and endangered species protected under the Endangered Species Act. Atrazine has been shown in numerous studies to be a potent endocrine disruptor for wildlife. Exposure to atrazine at levels as low as 0.1 ppb have been shown to affect the development of female sex characteristics in male frogs and cause the development of eggs in male frog testes.[7] Short-term exposure to spiking levels of atrazine during critical windows of development, also can have significant consequences. Research demonstrated that exposure to 21 ppb of atrazine during metamorphosis for as little as two days can impair development of the reproductive organs in male and female frogs.[8]

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[1] 7 U.S.C. § 136a(a)(2) & 7 U.S.C. § 136a(c)(5).
[2] 7 U.S.C. §136(j).
[3] 7 U.S.C. §136(bb).
[4] 7 U.S.C. § 136d(b).
[5] 7 U.S.C. § 136a(d)(1)(C)(ii)
[6] *See Defenders of Wildlife v. Administrator, EPA*, 882 F.2d 1294, 1298-99 (8th Cir. 1989) (describing FIFRA's required balancing of risks and benefits).
[7] Hayes TB, et al. 2002. *Atrazine-induced hermaphroditism at 0.1 ppb in American leopard frogs (Rana pipiens): laboratory and field evidence*. Environmental Health Perspectives 111:568–575.
[8] Tavera-Mendoza L., et al. 2002. *Response of the amphibian tadpole (Xenopus laevis) to atrazine during sexual*

More importantly, pesticides interact additively and synergistically in the environment with other pesticides and other pollutants. Laboratory studies—although designed to precisely examine the toxicity of the active ingredient—most likely under estimate the real-world harm that occurs when sensitive species are exposed to atrazine and other pollutants concurrently.[9] For example, tadpole mortality increased in a laboratory study when exposed to multiple pesticides at levels that were non-lethal when occurring individually.[10] Another study found that amphibians were more likely to have a parasitic flatworm, a sign of a compromised immune system, when there was both exposure to atrazine and exposure to phosphate, a commonly used fertilizer for the crops that atrazine is applied upon.[11]

Exposure to atrazine has also been found to cause significant unreasonable impacts on human health, including elevated cancer risk and an elevated risk for several forms of birth defects—chroanal atresia, stenosis, and gastroschisis.[12] Scientific research also suggests significant reproductive harm in male farm workers and rural populations exposed to triazine pesticides including low sperm count and motility.[13] Other research suggests that exposure to atrazine is more likely to cause non-Hodgkin's lymphoma in men when they are exposed to it in combination with other pesticides.[14]

These risks are not insignificant because atrazine is one of the most persistent and heavily used pesticides on the market today, with approximately 60-80 million pounds applied each year. As a result, atrazine is now one of the most commonly detected pesticides in drinking water, surface waters, and ground water across the nation. Approximately 75 percent of stream water and about 40 percent of all groundwater samples from agricultural areas tested in an extensive U.S. Geological Survey study contained atrazine and its primary degradate, deethylatrazine.[15] A 2010 analysis of monitoring data by the Natural Resources Defense Council concluded that many surface waters in the Midwestern and Southern United States are significantly contamination with atrazine and that many public drinking water systems contained elevated levels of atrazine.[16] Specifically, nine of

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differentiation of the testis. Environmental Toxicology and Chemistry 21:527–531; Tavera-Mendoza L, et al. 2002. *Response of the amphibian tadpole Xenopus laevis to atrazine during sexual differentiation of the ovary*. Environmental Toxicology and Chemistry 21:1264–1267

[9] Chevre N., et al. 2006. *Including mixtures in the determination of water quality criteria for herbicides in surface water.* Environ Sci. Technol. 40: 426–35; 60 Christin MS, et al. 2004. *Effects of agricultural pesticides on the immune system of Xenopus laevis and Rana pipiens*. Aquatic Toxicology 67: 33–43

[10] Hayes T.B., et al. 2006. *Pesticide mixtures, endocrine disruption, and amphibian declines: Are we underestimating the impact?* Environmental Health Perspectives 114: 40–50.

[11] Rohr J.R., et al. 2008. *Agrochemicals increase trematode infections in a declining amphibian species.* Nature 455:1235–39

[12] Agopian, A.J., et al. 2013. *Maternal Residential Atrazine Exposure and Risk for Choanal Atresia and Stenosis in Offspring*, Journal of Pediatrics, 162:581-86; Agopian, A.J., et al. 2012. *Maternal Residential Atrazine Exposure and Gastroschisis by Maternal Age*, Maternal and Child Health Journal (November 2012), pp. 1-8,

[13] Swan SH, et al. 2003. *Semen quality in relation to biomarkers of pesticide exposure.* Environ Health Perspectives 111:1478–84; Swan SH. 2006. *Semen quality in fertile US men in relation to geographical area and pesticide exposure.* Int J Androl 29:62–8.

[14] De Roos AJ, et al. 2003. *Integrative assessment of multiple pesticides as risk factors for non-Hodgkin's lymphoma among men.* Occup Environ Med 60:E11

[15] Gilliom RJ, et al. 2006. *The Quality of Our Nation's Waters: Pesticides in the Nation's Streams and Ground Water, 1992–2001*. U.S. Geological Survey Circular 1291

[16] Wu, M., et al. 2010 *Poisoning the Well: How the EPA is Ignoring Atrazine Contamination in Surface and Drinking Water in the Central United States*. Natural Resources Defense Council.

forty monitored watersheds had at least one sample showing atrazine levels above 50 ppb, and four watersheds had peak maximum concentrations of atrazine exceeding 100 ppb. Monitoring data using over 14,000 samples from 139 municipal water systems found that 90 percent had measurable levels of atrazine.

Under the Safe Drinking Water Act (SDWA), EPA has set a Maximum Contaminant Level (MCL) of 3.0 *ppb* for atrazine in public drinking-water supplies.[17] This "safe" level of atrazine is likely being exceeded in 10% of shallow groundwater systems,[18] and is regularly exceeded in surface waters. An analysis by the expert panel commissioned by the EPA in 1994 found that following storm runoff, biota in lower-order streams may be exposed to pulses of atrazine greater than 20 mg/L.[19] The assessment also considered exposures in lakes and reservoirs and found that atrazine residues were widespread in reservoirs (92% occurrence), and the 90^{th} percentile of this exposure distribution for early June to July was about 5 mg/L, far higher than the SWDA standard and far higher than levels where adverse environmental impacts occur.

Although atrazine was banned in the European Union in 2004, significant levels of atrazine are still present in the ambient environment. Even more than 18 years after it was banned in Germany, atrazine and its metabolites remains the most abundant pesticide in groundwater samples.[20] Atrazine use has resulted in widespread contamination of surface waters and dispersal in the atmosphere. Atrazine has been detected in rainwater, fog, ambient air, arctic ice, and seawater at great distances from urban and agricultural areas.[21] As a result, the legacy of atrazine's heavy use in the United States means that it will continue to cause substantial environmental and human health impacts downstream and downwind of the major agricultural areas it is used for decades to come. Because the overwhelming weight of the evidence demonstrates the substantial adverse impacts on the environment from atrazine, EPA should conclude at the end of the FIFRA reregistration process that cancelation of atrazine is the most appropriate course of action. If the EPA, against the weight of the evidence, reregisters atrazine, it must nevertheless utilize all of its authorities to protect threatened and endangered species by developing programs to conserve listed species against the threat of pesticides[22] and by completing a full consultation under Section 7(a)(2) of the Endangered Species Act ("ESA") on the potential impacts of atrazine.

II. EPA Has an Independent Duty Under the Endangered Species Act to Consult with the U.S. Fish and Wildlife Service and National Marine Fisheries Service on the Reregistration of Atrazine.

Section 7(a)(2) of the ESA requires that "each federal agency *shall*, in consultation with and with the assistance of the Secretary, insure that any action authorized, funded, or carried out by such

[17] U.S. Environmental Protection Agency. 1992. *Drinking water regulations and health advisories.* Washington, D.C., U.S. Environmental Protection Agency, 11 p.
[18] Stackelberg, P.E., et al. 2012. *Regression Models for Estimating Concentrations of Atrazine plus Deethylatrazine in Shallow Groundwater in Agricultural Areas of the United States*, Journal of Environmental Quality 41:March–April 2012.
[19] Solomon, K.R., et al. 1996. *Ecological Risk Assessment of Atrazine in North American Surface Waters*, Environmental Toxicology and Chemistry, 15:31–76.
[20] Jablonowski, N.D., A. Schäffer and P. Burauel, 2011. *Still present after all these years: persistence plus potential toxicity raise questions about the use of atrazine*, Environmental Science Pollution Research 18:328–331.
[21] Chernyak S.M., C.P. Rice and L.L. McConnell. 1996. *Evidence of currently used pesticides in air, ice, fog, seawater and surface microlayer in the Bering Sea and Chukchi Seas*. Marine Pollution Bulletin 32:410–419
[22] 16 U.S.C. § 1536(a)(1).

agency is not likely to jeopardize the continued existence of any endangered species or threatened species or result in the destruction or adverse modification of habitat of such species which is determined by the Secretary… to be critical."[23] Under Section 7(a)(2), the EPA must consult with the U.S. Fish and Wildlife Service and National Marine Fisheries Service (collectively the "Services") to determine whether its actions will jeopardize listed species' survival or adversely modify designated critical habitat, and if so, to identify ways to modify the action to avoid that result.[24] Under the Services' joint regulations implementing the ESA, an action agency such as the EPA must initiate consultation under Section 7 whenever its action "may affect" a listed species or critical habitat.[25] Only where the action agency determines that its action will have "no effect" on listed species or designated critical habitat is the consultation obligation lifted.[26] The consultation requirement applies to any discretionary agency action that may affect listed species.[27] Because the EPA may decline to reregister a pesticide active ingredient, its decision represents a discretionary action that clearly falls within the ESA's consultation requirement.[28]

The EPA must consult with the Services regarding its reregistration review of atrazine in order to fully address and sufficiently minimize the possible harms to listed species from the use of this pesticide. To fully effectuate the consultation process, the EPA is required to review its actions "at the *earliest* possible time" to determine whether the action may affect listed species or critical habitat.[29] To meet this obligation, the EPA should begin informal consultations with the Services *immediately after the work plan is finalized*. As currently envisioned, the EPA plans on conducting the risk assessments at some point between November 2013 and April of 2015, with a final registration decision in 2016.[30] Informal consultation should begin by November 2013 to ensure that an effects determination can be made for each protected species that might be jeopardized by the use of atrazine or have its critical habitat adversely modified as a result of atrazine use.

To make the consultation process successful, the EPA must work with the Services to identify the needed data to make a "no effect" or "may affect" determination for *each* listed species.[31] EPA must also gather the data needed to make a determination as to whether the use of atrazine *may* adversely modify or destroy critical habitat for *each* listed species that has designated critical habitat. To answer these two questions, the EPA must have adequate spatial data regarding the use patterns for atrazine and adequate spatial data regarding the distribution and range of listed species. The Center is deeply concerned by the statement in the EPA draft work plan for atrazine that "[t]here are no remaining data gaps anticipated for the registration review of atrazine."[32] While we certainly hope that this is true, it is a fact that one of the single largest data gaps that the EPA has repeatedly claimed in correspondences regarding attempts to complete consultations with the

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[23] 16 U.S.C. § 1536(a)(2) (emphasis added).
[24] 50 C.F.R. § 402.14.
[25] 50 C.F.R. § 402.14(a).
[26] *Id*.
[27] *National Association of Home Builders v. Defenders of Wildlife*, 551 U.S. 644 (2007).
[28] *See Washington Toxics Coalition v. EPA*, 413 F. 3d 1024 ,1032 (9th Cir. 2005) ("even though EPA registers pesticides under FIFRA, it must also comply with the ESA when threatened or endangered species are affected.").
[29] 50 C.F.R. § 402.14(a) (emphasis added).
[30] Environmental Protection Agency. 2013., Reregistration Review: Initial Docket Case Number 0062 at 11-12, June 2013. Docket #: EPA-HQ-OPP-2013-0266-0008.
[31] U.S. Fish and Wildlife Service and National Marine Fisheries Service. 1998. *Endangered Species Consultation Handbook: Procedures for Conducting Consultation and Conference Activities Under Section 7 of the Endangered Species Act* at 3-12.
[32] Atrazine Preliminary Work Plan at 4

Services is the lack of accurate geospatial data on the location of threatened and endangered species.[33] Therefore, the EPA should make efforts as early as possible in the reregistration process to obtain those data from the Services. Such an approach would comport generally with one of the recommendations from the National Academy of Sciences, which proposes that as part of "Step 1" the Services identify areas of overlap where a pesticide is used and where listed species habitats exist.[34] Despite the EPA's repeated claim that spatial data do not exist or are not available, the Fish and Wildlife Service ECOS website provides GIS-based data layers for each species with critical habitat.[35] These maps are scalable and can achieve the precision needed to make accurate effects determinations regarding whether a pesticide will have "no effect" or "may affect" a listed species and are certainly accurate enough to make determinations as to whether the use of a pesticide may adversely modify critical habitat. Figure One provides an overlay map of all critical habitat that has been designated for listed species thus far. As discussed in detail below, Appendix A demonstrates the simplicity in developing geographically based conservation measures to protect critical habitat.

Other sources provide additional data on the distribution and life history of threatened and endangered species. NatureServe provides detailed life history information, including spatial distribution, for native species across the United States.[36] In addition, many State governments collect detailed information on non-game species through their State Wildlife Action Plans.[37] In short, there are many sources of data that can provide EPA with the detailed information it needs to conduct an effects determination for each species. If there is a subset of species where it believes information is still lacking, EPA should make that clear early in the process such that this information can be collected.

[33] See, e.g., Transmittal Letter from Arthur-Jean B. Williams, Associate Director, Environmental Fate and Effects Division to Bryan Arroyo, Acting Assistant Director for Endangered Species, U.S. Fish and Wildlife Service, available at: www.epa.gov/espp/litstatus/effects/redleg-frog/atrazine/transmittal-ltr.pdf. "(EPA believes the precise geographic scope of potential effects is dependent upon both the specific locations and sizes of populations of each species in relation to actual use of the pesticide and upon the locations and attributes…While the geographic range of the Delta smelt is limited, *specific location information on the California red-legged frog and the attributes of the various types of habitat are not available to EPA*.)

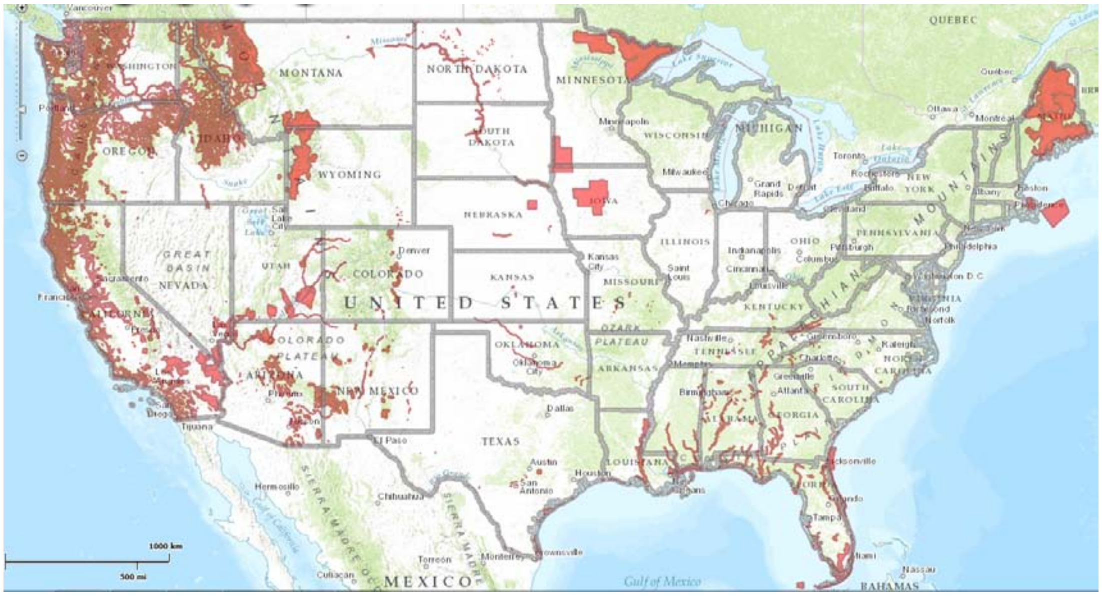
[34] National Academy of Sciences. 2013. *Assessing Risks to Endangered and Threatened Species from Pesticides* (hereafter NAS REPORT) at 37-38, Committee on Ecological Risk Assessment under FIFRA and ESA Board on Environmental Studies and Toxicology Division on Earth and Life Studies Natl. Research Council (April 30, 2013).

[35] US Fish and Wildlife Service Environmental Conservation Online System. http://ecos.fws.gov

[36] NatureServe Get data. http://www.natureserve.org/getData/index.jsp

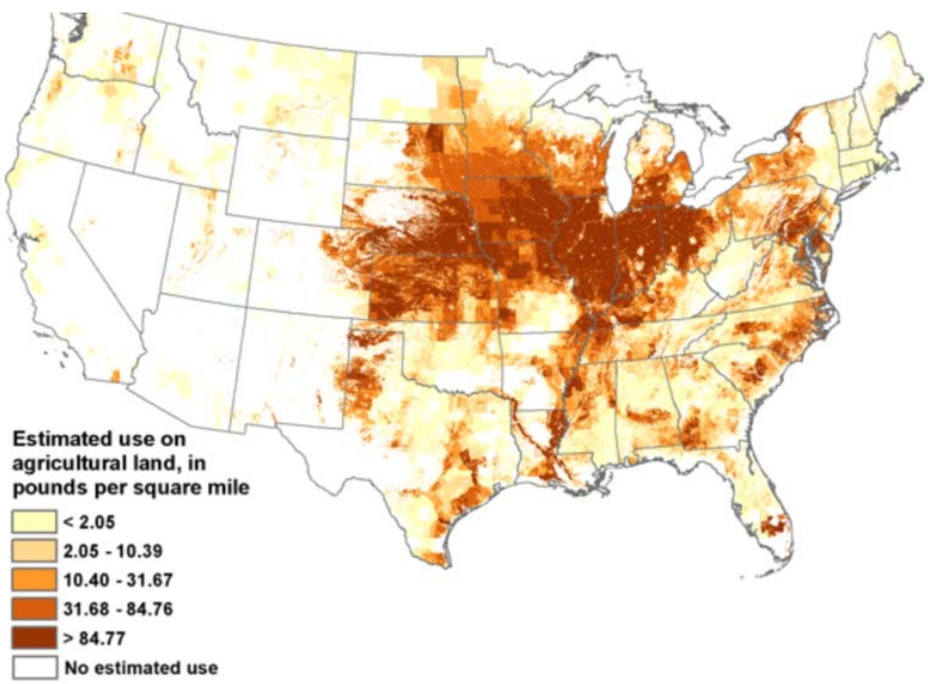
[37] State Wildlife Action Plans. http://teaming.com/state-wildlife-action-plans-swaps

Figure One – Base Composite Map of Critical Habitat in the United States.[38]



To make scientifically valid effects determinations, EPA will also need accurate spatial data regarding the use of pesticides. Much of this data has been collected in various forms and can be used to determine if there is spatial overlap between listed species and the use of a pesticide. As shown in Figure Two, the U.S. Geological Survey has compiled detailed information regarding pesticides as part of its National Pesticide Synthesis Project.

Figure Two. Estimated Agriculture Use for Atrazine in 2009.[39]



[38] US Fish and Wildlife Service Environmental Conservation Online System. http://ecos.fws.gov
[39] USGS Pesticide National Synthesis Project.
http://water.usgs.gov/nawqa/pnsp/usage/maps/show_map.php?year=2009&map=ATRAZINE&hilo=L

As part of the initial informal consultation process the EPA should attempt to find as much high-resolution spatial data regarding the distribution and range of all threatened and endangered species and then compare that to the most specific data it possesses regarding pesticide usage to further refine its work plan in anticipation of the draft ecological risk assessment. However, given the importance of having this information during the reregistration process, the Center is providing as a separate CD, the needed GIS data to generate a spatially accurate critical habitat map for the purpose of completing effects determinations and consultations with the Services. It should be relatively straightforward for the EPA to begin to develop geographic prohibitions on the use of atrazine wherever designated critical habitat for a listed species exists. Such geographic labeling restrictions can easily be implemented through the EPA website *Bulletins Live!*

However, because not all threatened and endangered species have critical habitat, the EPA will also have to collect data on the distribution and range of approximately 680 species that do not yet have critical habitat to determine whether the use of atrazine will result in take of listed species or potentially jeopardize the continued existence of those species. Again, the ECOS website does provide in some instances geographic data on the location of threatened and endangered species. Other sources on the natural history of listed species, including data sources such as species breeding atlases and NatureServe, should also be reviewed to obtain the best available scientific data on the distribution and range of these species. Particular attention and effort should be given towards obtaining data on species distribution for those taxa for which atrazine exposure is known to cause harmful effects.

Finally, as part of the formal consultation process, the EPA and Services must consider the environmental baseline as well as all cumulative effects when determining if the reregistration of atrazine will jeopardize any threatened or endangered species. The Services define environmental baseline as "the past and present impacts of all Federal, State, or private actions and other human activities in an action area, the anticipated impacts of all proposed Federal projects in an action area that have already undergone formal or early section 7 consultation, and the impact of State or private actions that are contemporaneous with the consultation in process."[40] Cumulative effects are defined as "those effects of future State or private activities, not involving Federal activities, that are reasonably certain to occur within the action area of the Federal action subject to consultation."[41] Pesticide consultations must consider the interactions between the active ingredient under review and other pollutants in the present in the environment.

Pesticides, and their residues and degradates, do not occur in single exposure situations and many different mixtures of pesticides occur in water bodies at the same time.[42] The mixtures of these chemicals combine to have synergistic effects that are substantially more dangerous and

[40] U.S. Fish and Wildlife Service and National Marine Fisheries Service. 1998. *Endangered Species Consultation Handbook: Procedures for Conducting Consultation and Conference Activities Under Section 7 of the Endangered Species Act* at xiv.
[41] *Id*. at xiii.
[42] NMFS 2011, *Endangered Species Act Section 7 Consultation Draft Biological Opinion for the Environmental Protection Agency's Pesticide General Permit for Discharges from the Application of Pesticides (*hereafter Draft BiOp) at 118-119, lines 4209-31; Gilliom, R.J. et al. 2006. *Pesticides in the Nation's Streams and Ground Water, 1992–2001—A Summary*, available at http://pubs.usgs.gov/fs/2006/3028/.

increase the toxicity to wildlife.[43] Thus, to fully understand the ecological effects and adverse impacts of atrazine, the EPA must consider the pesticide's use in the context of *current* water quality conditions nationwide. In particular, the use of atrazine in watersheds that contain threatened or endangered species and where water quality is already impaired could be particularly problematic. Therefore, the EPA must collect the needed data to fully inform its ecological risk assessment by considering water quality. Appendix B contains an initial list of watershed where endangered and threatened species are present that may be disproportionately affected if atrazine is allowed to be applied in the future.

Beginning the consultation process immediately after the work plan is finalized is critical so that the EPA can assemble all of the essential data regarding the distribution and range of listed species in areas where atrazine usage occurs as well as where atrazine migrates through the environment, both downstream and through atmospheric deposition. Where data gaps are identified, the EPA should consider an expedited data call in process to collect additional data on species range and distribution, and other spatial data needed to inform both the informal consultation process and the formal consultation process. The Center believes that the EPA's current system is inadequate to meet the task of analyzing the spatial relationship between listed species and pesticide use. For example, the Center recently submitted comments regarding the registration of the new pesticide active ingredient, cyantraniliprole, and highlighted the inadequacy of the ecological risk assessment used for that proposed registration. For that ecological risk assessment, the EPA used its *LOCATES* (version 2.2.4) database, which compares the location of listed species at the county level with agricultural census data (from 2007) for crop production at the same county level of resolution.[44] This resulted in a list of 1377 listed species with potential overlap with the areas where cyantraniliprole is proposed for usage—this total represents virtually every listed species within the United States.

While it is important to cast a wide net at the initial risk stage for assessing risks to pesticides, the county-level resolution approach used by EPA is demonstrably inadequate. For example, since each island in the state of Hawaii is also its own county, the *LOCATES* database captures *every* listed species in Hawaii. While it is nice to think that the EPA will consider the critically-endangered, presumed extinct Kauaʹi Oʹo (*Moho braccatus*) in its risk assessment, it is doubtful that any farmers (or for that matter anyone) will be using cyantraniliprole in the remote mountain areas of Kauaʹi, where this species, if it still exists at all, is likely to be present. This is not to say that the EPA can automatically exclude from detailed analysis species that do not have overlap. Many pesticides are transported downstream and downwind of pesticide use areas. However, if the EPA were to acquire GIS-based data on the location of listed species, it could then focus its analytical resources where they were actually needed—lowland areas of the Hawaiian where listed species overlap with pesticide use areas are where listed species are downstream and downwind of agricultural areas.

The LOCATES database does not incorporate sufficiently detailed spatial information for either listed species distribution or agricultural usage patterns at a resolution sufficient to develop meaningful and targeted conservation measures to protect species from the effects of pesticide

[43] Draft BiOp at 127-129, lines 4471-4515; Gilliom, R.J. 2007. *Pesticides in the Nation's Streams and Ground Water*; Environmental Science and Technology, 413408–3414.
[44] U.S. Environmental Protection Agency. 2013. Environmental Fate and Ecological Risk Assessment for the Registration of the New Chemical Cyantraniliprole – Amended. Docket #: EPA-HQ-OPP-2011-0668-0008.

exposure. EPA may not ignore this clear shortcoming. The EPA, like every other agency in the federal government, has the affirmative obligation to insure against jeopardy. The EPA's continuing failure to collect the necessary spatial data to complete a consultation represents jeopardy for listed species.

In conclusion, the EPA should move quickly to assemble the needed spatial data to make an informed "no effect" or "may affect" finding for *each* listed species that will likely be impacted by the use of atrazine or come into contact with its environmental degradates. Where EPA concludes that atrazine "may affect" listed species, it can elect to complete an informal consultation through a biological assessment or it can undergo formal consultation with the Services. If the EPA completes a biological assessment and implements geographically-tailored conservation measures through *Bulletins Live!* to reach NLAA determinations via the informal consultation process, then there would be no need for formal consultations. In the alternative, the EPA can move directly to formal consultation after making "may affect" determinations for species where the impacts to atrazine are more complex and will take additional expertise from the Services to develop sufficient conservation measures to avoid jeopardy.

III. EPA Has an Independent Duty Under the Endangered Species Act to Consult with the U.S. Fish and Wildlife Service and National Marine Fisheries Service on the Approval of All Atrazine End-use Product Labels.

Just as the EPA must consult with the Services regarding the reregistration of an active pesticide ingredient, EPA must also consult with the Services regarding the registration of end use and technical pesticide products that are related to the registration of active ingredient because product registrations also represent discretionary actions within the EPA's control. Such consultations must also occur at the earliest possible time to ensure that specific product formulations do not result in jeopardy for a listed species or adversely modify critical habitat.

EPA has identified approximately 150 end use labels for atrazine as part of the reregistration process. These labels allow a range of atrazine concentrations from 0.97 lb a.i./A to 4.0 lb a.i./A and a range of product formulations including emulsifiable concentrates, water dispersible granules, soluble concentrates, flowable concentrate, and granular.[45] These varying end-use formulations may result in different proportions moving into the ambient environment at different rates and times depending on environmental conditions (e.g. rainfall, wind, evaporation). This may impact listed species in varying ways and in varying intensities. Furthermore, because atrazine may be mixed with other pesticides including metolachlor, gyphophate, simazine, alachlor, paraquat, and propachlor, the EPA must consider how each potential product formulation when mixed with other pesticides may affect listed species.

In addition, because end use formulations result in atrazine being mixed with "other ingredients" before application, the EPA must consider the effects of all ingredients together on listed species. As noted in *Washington Toxics Coalition v. U.S. Dept. of Interior*, "other ingredients" within a pesticide end product may cause negative impact to listed species even if they are less toxic than the active ingredient being reviewed.[46] "Other ingredients," such as emulsifiers,

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[45] Label Data Report: Food/Feed & Non-Food/Non-Feed Uses Considered in Registration Review Work Planning Atrazine (080803)
[46] 457 F. Supp. 2d 1158 (W.D. Wash 2006).

surfactants and anti-foaming ingredients may harm listed species and adversely modify critical habitat. Many of the more than 4,000 potentially hazardous additives allowed for use as pesticide additives are environmental contaminants and toxins that are known neurotoxins and carcinogens.[47] The EPA has routinely failed to consult with the Services on the registration of "other ingredients," potentially compounding harms to listed species by allowing such ingredients to be introduced widely into the environment. EPA must, as part of the consultation process, consider the range of potential impacts by using different concentrations and different formulations of atrazine, as well as the potential negative impacts of "other ingredients" used in these atrazine end use products. The fact that the product labels routinely do not even describe the chemical composition of "other ingredients" makes it more difficult for the Services to conclude that the use of such pesticide product will not jeopardize listed species.

IV. The EPA Must Make Defensible "No Effect," "May Affect," "Not Likely to Adversely Affect," and "Likely to Adversely Affect" Determinations Regarding Atrazine.

Atrazine exposure does not need to result in the death of a single individual member of a listed species for the use of atrazine to represent jeopardy if that exposure causes significant harm to the reproductive ability of individuals of that species or exposure to atrazine interferes with development or disrupts other critical life history stages of the species. Accordingly the threshold for making "may affect" determinations, which trigger the need to conduct informal or formal consultations, is low.

As the Services' joint consultation handbook explains, an action agency such as the EPA may make a "no effect" determination, and thus avoid undertaking informal or formal consultations, when "the action agency determines its proposed action will not affect listed species or critical habitat."[48] To put this in context, the Services define "may affect" as "the appropriate conclusion when a proposed action may pose ***any*** effects on listed species or designated critical habitat."[49] For this initial stage of review, exposure to a pesticide does not require that effects reach a pre-set level of significance or intensity to trigger the need to consult (e.g. effects do not need to trigger population-level responses). If an effect on a listed species is predicted to occur or is documented, then the EPA must undergo consultations with the Services.

At the informal consultation stage, the EPA must determine whether the use of a pesticide is either "not likely to adversely affect" (NLAA) a listed species or is "likely to adversely affect" (LAA) a listed species.[50] The Services define NLAA as "when effects on listed species are expected to be discountable, insignificant, or completely beneficial." Discountable effects are those that "would not: (1) be able to meaningfully measure, detect, or evaluate insignificant effects; or (2) expect discountable effects to occur."[51] In the context of pesticides such as atrazine, only if predicted negative effects are discountable or insignificant can the EPA avoid the need to enter

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[47] Draft BiOp at 113, lines 4062-68; 120-121, lines 4262-308; 127, lines 4445-4455; Northwest Coalition for Alternatives to Pesticides, et al., Petition to Require Disclosure of Hazardous Inert Ingredients on Pesticide Product Labels. 2006. http://www.epa.gov/opprd001/inerts/petition_ncap.pdf.
[48] U.S. Fish and Wildlife Service and National Marine Fisheries Service. 1998. *Endangered Species Consultation Handbook: Procedures for Conducting Consultation and Conference Activities Under Section 7 of the Endangered Species Act* (hereafter CONSULTATION HANDBOOK) at 3-13.
[49] *Id*. at xvi (emphasis in original).
[50] *Id*. at 3-1.
[51] *Id*. at xv.

formal consultations with the Services. Again, this is not a high threshold for moving on to the formal consultation stage. The EPA is not required to make a determination as to whether exposure to a pesticide results in population level changes in order to request formal consultations. In fact, for the EPA to make a policy judgment whether known, adverse, population-level impacts from a pesticide are significant enough in their opinion to require formal consultations violates the ESA because the EPA is not the expert agency when it comes to evaluating the risks to threatened and endangered species.

Where there is known or predicted geographic overlap between atrazine usage areas and listed species, a "may affect" determination will likely be the most appropriate initial conclusion of the EPA. However, this does not mean that if there is no overlap, EPA may automatically conclude that there will be "no effect" on listed species. Atrazine is mobile in the environment and listed species may come into contact with atrazine even if the application areas are not proximate to the areas where those species occur. Therefore, not only must the EPA assess jeopardy for those species that have direct overlap with atrazine use areas, but EPA must also analyze atrazine applications that will harm species that are located downstream of atrazine use areas. Depending on the ability of atrazine to be transported atmospherically, EPA may also have to analyze potential impacts on listed species downwind of atrazine usage areas. Because of the widespread geographic use of atrazine and the potential deposition of atrazine in the environment downstream and downwind, the EPA must carefully assess the risks to listed species across many portions of the lower 48 states as illustrated in Figures One and Two.

At the NLAA-LAA stage, the EPA must do more to harmonize its risk analyses with the approach used by the Services and recommended by the National Academy of Sciences. As discussed in greater detail below, and as demonstrated in comments filed by the Society for Conservation Biology, EPA's current ecological risk assessment has resulted in effects determinations that are inadequate and generally underprotective of listed species.[52] For example, over the past decade, the EPA has completed approximately 676 effects determinations regarding the registration of pesticides in the Pacific Northwest (counting each pesticide product's effects on a separate listed species as a unique determination). NMFS has completed six biological opinions that have reviewed each of these effects determinations. From these, the NMFS concluded that jeopardy and/or adverse modification of critical habitat to listed salmon and steelhead species would occur for 272 of those pesticide registrations (for the remaining 400, NMFS reached a no jeopardy/no adverse modification conclusion). Of those 272 jeopardy/adverse modification findings by NMFS, the EPA had earlier made 49 "no effect" determinations and 74 NLAA determinations.[53] Thus, 123 different times the EPA found that effects would be insignificant, discountable, or non-existent while NMFS determined that the pesticide would jeopardize the continued existence of a listed species.

Given atrazine's known environmental impacts, it is extremely likely that atrazine is likely to adversely affect and will adversely modify critical habitat for hundreds of listed species, making formal consultations a near necessity. This is especially the case for many of the 853 plant species protected under the ESA. Given atrazine is a potent herbicide, the EPA will need to insure that

[52] SCB Comments on the Pesticide Registration Review and Endangered Species Act Consultation Process and Stakeholder Input available at: www.conbio.org/images/content_policy/2012-10-16_SCB_Comments_on_EPA_Pesticide_Review_Process.pdf
[53] *Id*.

there is no overlap between where atrazine is used and where listed plant species occur and that listed plants downstream and downwind will not be exposed to atrazine. For many of these species, atrazine has the very real potential to result in lethal take of individuals. Formal consultations will almost certainly be necessary where there is geographic overlap between listed plants and the use of atrazine.

V. Given Atrazine's Known Environmental Impacts, the Reregistration of Atrazine Would Likely Represent Jeopardy for, and Result in Take of, a Wide Range of Threatened and Endangered Species.

The Services' joint regulations define jeopardy as an agency action "that reasonably would be expected, direct or indirectly, to reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by *reducing the reproduction, numbers, or distribution of that species*."[54] Atrazine is a powerful, broad spectrum herbicide that is designed to kill broadleaf and grass weed species to protect a variety of crops and has been documented to cause substantial adverse effects on a range of other taxa. It is also critical for the EPA to recognize that setting protective levels for pesticides in the environment based on their ability to prevent increased acute lethality is inadequate for the purposes of Section 7 of the ESA.[55] Atrazine exposure does not need to result in the death of a single individual member of a listed species for the use of atrazine to represent jeopardy if that exposure causes significant harm to the reproductive ability of those individuals or exposure interferes with the development of individuals, or disrupts other critical life history stages of the species. Atrazine is a highly potent endocrine disruptor and persists in the environment after its use. Extensive scientific research has demonstrated that atrazine causes substantial negative reproductive effects in a variety of taxa when exposure occurs, even at concentrations as low as 0.1 ppb. Impairing reproduction through endocrine disruption, lowering reproductive output, chemical castration, disrupting development and immunosuppresion are among the types of harms that atrazine causes, all of which represent significant sublethal effects that must be considered in an eventual formal consultation with the Services.

While there has been significant attention to the negative impacts of atrazine on amphibians, the EPA and the Services must also consider the documented impacts of atrazine on a wide variety of other taxa as part of the consultation process. Scientific research has shown that atrazine inhibits production of testosterone and induces estrogen production in a variety of taxa including amphibians,[56] fish,[57] reptiles,[58] and mammals.[59] The result of this endocrine disruption includes

[54] 50 C.F.R. § 402.02.
[55] *Washington Toxics Coalition v. FWS,* 457 F.Supp 2. 1158 at 1187 (W.D. Wash. 2006).
[56] Hayes, T., et al., *Hermaphroditic, demasculinized frogs after exposure to the herbicide atrazine at low ecologically relevant doses*. Proc. Natl. Acad. Sci. USA, 2002. 99: p. 5476-5480.
[57] Moore, A. and C. Waring, *Mechanistic effects of a triazine pesticide on reproductive endocrine function in mature male Atlantic salmon*. Pesticide Biochem. Physiol., 1998. 62: p. 41-50; Spano, L., et al., *Effects of atrazine on sex steroid dynamics, plasma vitellogenin concentration and gonad development in adult goldfish* (*Carassius auratus*). Aquatic Toxicology (Amsterdam), 2004. 66(4): p. 369-379.
[58] Keller, J. and P. McClellan-Green, *Effects of organochlorine compounds on cytochrome P450 aromatase activity in an immortal sea turtle cell line*. Marine Environmental Research, 2004. 58(2-5): p. 347-351; Crain, D., et al., *Alterations in steroidogenesis in alligators (Alligator mississippiensis) exposed naturally and experimentally to environmental contaminants*. Environ. Health Perspect., 1997. 105: p. 528-533
[59] Babic-Gojmerac, T., Z. Kniewald, and K. J, *Testosterone metabolism in neuroendocrine organs in male rats under atrazine and deethylatrazine influence*. Steroid Biochem., 1989. 33(1): p. 141-146; Šimic, B., et al., *Reversibility of*

chemical castration (demasculinization) and feminization, decreased sperm counts, impaired fertility, and a reduction in masculine features. In amphibians, atrazine exposure impairs immune function and increases susceptibility to viral diseases,[60] bacterial infections,[61] and macroparasites.[62] In salmon, atrazine-induced increase in stress hormones in smolt, impairs the ability of exposed fish to return to the ocean leading to high mortality in these commercially important fish.[63] All of these types of impacts represent sublethal effects can result in jeopardy to listed species and therefore must be considered by the EPA and the Services in formal consultations.

As noted above, many species will not have geographic overlap between where species are actually located and where atrazine is actually applied. However, because atrazine persists in the environment, listed species may come into contact with atrazine even if the application areas are not proximate to the areas where those species occur.[64] Therefore, not only must the EPA and the Services must assess jeopardy for those species that have direct overlap with atrazine use areas, but also analyze atrazine applications that will harm species that are located downstream of atrazine use areas or downwind atrazine use areas.

It is important to note that not every endangered species is going to be downwind or downstream of an atrazine use area. As discussed above, many listed species are found only in mountainous areas of Hawaii,[65] and for these species, it may be possible for the EPA to find that atrazine will have no effect and avoid the need to enter informal or formal consultation because these species are not downstream or downwind of major atrazine use areas. However, only in situations like these where no atrazine runoff or atrazine atmospheric transport occurs can the EPA and the Services safely conclude that atrazine will not jeopardize listed species or adversely modify critical habitat. This statement is not overbroad because atrazine is used in such massive quantities and across an enormous geographic area that runoff and atmospheric transport are substantial concerns. Between 1991 and 2009, between 60-80 million pounds of atrazine were used each year in the United States. Large amounts of this pesticide, not even including its metabolites and degradates, move into the environment beyond the application area each year. Large amounts of atrazine routinely wash away downstream following application. Scientific research from the 1990s concluded that approximately from 0.9-2.9% of the total amount of atrazine used each year in the Mississippi River Basin was deposited in the Gulf of Mexico. This translates to approximately 217-642 tons of atrazine that is annually deposited in the Gulf of Mexico and does not take into account

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inhibitory effect of atrazine and lindane on 5 -dihydrotestosterone receptor complex formation in rat prostate. Bull. Environ. Contam. Toxicol., 1991. 46: p. 92-99.

[60] Forson, D. and A. Storfer, *Effects of atrazine and iridovirus infection on survival and life history traits of the long-toed salamander* (*Ambystoma macrodatylum*). Environ. Toxicol. Chem., 2006. 25(1): p. 168-173; Forson, D. and A. Storfer, *Atrazine increases Ranavirus susceptibility in the tiger salamander, Ambystoma tigrinum.* Ecological Applications. Ecol. Appl., 2006. 16(6): p. 2325-2332.

[61] Hayes, T., et al., *Pesticide mixtures, endocrine disruption, and amphibian declines: Are we underestimating the impact?* Environ. Health Perspect, 2006.

[62] Gendron , A., et al., *Exposure of leopard frogs to a pesticide mixture affects life history characteristics of the lungworm Rhabdias ranae*. Oecologia, 2003. 135: p. 469–476; Christin, M.-S., et al., *Effects of agricultural pesticides on the immune system of Rana pipiens and on its resistance to parasitic infection*. Environ. Toxicol. Chem., 2003. 22(5): p. 1127-1133

[63] Moore, A. and C. Waring, *Mechanistic effects of a triazine pesticide on reproductive endocrine function in mature male Atlantic salmon*. Pesticide Biochem. Physiol., 1998. 62

[64] Thurman, E.M., and A. Cromwell. 2000. *Atmospheric Transport, Deposition, and Fate of Triazine Herbicides and their Metabolites in Pristine Areas at Isle Royale National Park*. Environmental Science & Technology 34:3079-85

[65] *See, e.g.*, *Determination of Endangered Status for 48 Species on Kauai and Designation of Critical Habitat*, 75 Fed. Reg. 18,960 (Apr. 13, 2010).

the degradates of atrazine that also enter the Mississippi watershed.[66] Thus, as a real world example, the EPA and the Services clearly must consult on effects of atrazine on pallid sturgeon, which inhabits the main-stem of the Missouri and Mississippi rivers in the heart of the main atrazine use areas. But they must also consult on the effects of atrazine on species like the Kemp's ridley turtle (*Lepidochelys kempii*) because the turtle feeds on slow moving macroinvertebrates that could be adversely affected by the 200-600 tons of atrazine that is deposited into the Gulf of Mexico on an annual basis.

Likewise, atrazine deposited by rainfall has been estimated at approximately 0.6% of the atrazine applied in the United States in a given year.[67] If an average of 70,000,000 pounds of atrazine are used each year, then over 420,000 pounds of atrazine is deposited elsewhere in the United States each year by rainfall alone. A 2000 study at Isle Royal National Park detected trace concentrations in rainfall at concentrations between 0.005 to 1.8 *ppb*. Trace levels of pesticide were being transported atmospherically hundreds of kilometers and deposited on to pristine National Park lands where no pesticide usage is permitted.[68] In some of Isle Royal's deeper lakes, the half life of atrazine in the environment was estimated to be approximately 10 years. This problem continues today. A recent study found that a variety of pesticides are accumulating in the Pacific chorus frogs (*Pseudacris regilla*) through atmospheric deposition at remote, high-elevation locations in the Sierra Nevada mountains, including in Giant Sequoia National Monument, Lassen Volcanic National Park, and Yosemite National Park.[69]

In conclusion, because of the widespread use of atrazine and the widespread deposition of atrazine in the environment downstream and downwind, the EPA and the Services must carefully assess the risks to listed species across nearly every portion of the lower 48 states (as well as lowland areas of Hawaii where listed species actually occur near agricultural zones). Because concentrations as low as 0.1 ppb have been documented to result in significant sublethal effects, it is likely that the only safe level of atrazine in the ambient environment for listed species is zero. As a result, without substantial geographic restrictions on the use of atrazine and additional restrictions on when and how much atrazine permitted for agricultural use, the only likely defensible outcome of a consultation will be a jeopardy conclusion for many listed species.

VI. Given Atrazine's Known Environmental Impacts, the Reregistration of Atrazine Would Likely Represent Adverse Modification of Critical Habitat for a Wide Range of Threatened and Endangered Species.

Section 7 of the ESA prohibits agency actions that would result in the "destruction or adverse modification of [critical] habitat."[70] As three federal circuit courts have made abundantly clear, avoiding a species' immediate extinction is not the same as bringing about its recovery to the

[66] Clark, G.M., et al. 1999. *Seasonal and Annual Load of Herbicides from the Mississippi River Basin to the Gulf of Mexico*. Environmental Science and Technology 33:981-86.
[67] Goolsby, D.A., et al. 1997. *Herbicides and Their Metabolites in Rainfall: Origin, Transport, and Deposition Patterns across the Midwestern and Northeastern United States, 1990-1991*. Environ. Sci. Technol. 31:1325-33.
[68] Thurman, E.M., and A. Cromwell. 2000. *Atmospheric Transport, Deposition, and Fate of Triazine Herbicides and their Metabolites in Pristine Areas at Isle Royale National Park*. Environmental Science and Technology 34:3079-85.
[69] Smalling, K.L., et al. 2013. *Accumulation of Pesticides in Pacific Chorus Frogs (Pseudacris regilla) from California's Sierra Nevada Mountains*, Environmental Toxicology and Chemistry, 32:2026–2034.
[70] 16 U.S.C. § 1536(a)(2).

point where listing is no longer necessary to safeguard the species from ongoing and future threats. And, therefore, the Section 7 mandate requires that critical habitat not be adversely modified in ways that would hamper the recovery of listed species.[71] As a potent herbicide, atrazine has the potential to adversely modify critical habitat for a vast number of listed species by changing the plant community structure, negatively impacting the prey base for listed species, and by other changes to the physical and biological features of critical habitat. The ecological risk assessment for atrazine must separately evaluate whether atrazine will adversely modify critical habitat regardless of whether atrazine jeopardizes a particular listed species.

EPA consultations with the Services, whether formal or informal, must analyze *separately* whether atrazine's reregistration will result in jeopardy to any listed species and whether atrazine's use would result in the adverse modification or destruction of critical habitat. A no jeopardy finding (or a Not Likely to Adversely Affect finding in an informal consultation) is *not* equivalent to a finding that critical habitat will not be adversely modified. While there is much overlap between these two categories (for example, as in *Tennessee Valley Authority v. Hill*[72] where the proposed agency action to build a dam would both destroy a species' habitat and kill individual members of the species in the same time), many agency actions do result in adverse modification to critical habitat without causing direct harms to species that do rise to the level of jeopardy.[73] Indeed, the ESA's prohibition on "destruction or adverse modification" of critical habitat does not contain any qualifying language suggesting that a certain species-viability threshold must be reached prior to the habitat modification prohibition coming into force.

To demonstrate a recent real-world example, in NMFS's biological opinion on 2,4-D, Triclopyr BEE, Diuron, Linuron, Captan, and Chlorothalonil ("Biological Opinion 4"), NMFS concluded that neither diuron (a herbicide) nor chlorothalonil (a fungicide) would result in jeopardy to listed salmon and steelhead species.[74] However, for both of these pesticides, NMFS found they would adversely modify critical habitat by affecting water quality, changing vegetation composition, and prey composition for listed salmonid species. As a result, Biological Opinion 4 set forth reasonable and prudent alternatives to avoid adverse modification of critical habitat from the use of diuron and chlorothalonil. Given the documented effects of atrazine, it is a near certainty that the use of atrazine will have significant direct effects on the physical characteristics of many species' critical habitat and will have indirect effects on critical habitat by changing the prey abundance and composition in a given area to the detriment of protected species. Because critical habitat includes biological and physical features that are essential to the conservation of protected species, consultations must address impacts to critical habitat even if the pesticide falls below a particular Level of Concern for direct effects in atrazine's ecological risk assessment process.

Atrazine will likely cause adverse modification of critical habitat by changing plant communities and by changing prey composition. As a potent herbicide, atrazine will kill and otherwise harm many terrestrial and aquatic plants as atrazine moves off the application areas and

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[71] *See Gifford Pinchot Task Force v. FWS*, 378 F.3d 1059, 1069-71 (9th Cir. 2004) (finding a FWS regulation conflating the requirements of survival and recovery to be unlawful); *see also N.M. Cattle Growers Ass'n v. FWS*, 248 F.3d 1277, 1283 n.2 (10th Cir. 2001); *Sierra Club v. FWS*, 245 F.3d 434, 441-42 (5th Cir. 2001)
[72] 437 U.S. 153 (1978)
[73] Owen, D. 2012. *Critical Habitat and the Challenge of Regulating Small Harms*. Florida Law Review 64:141-199.
[74] National Marine Fisheries Service, 2011. *Endangered Species Act Section 7 Consultation Biological Opinion on the Registration of Pesticides 2,4-D, Triclopyr BEE, Diuron, Linuron, Captan, and Chlorothalonil* at 773-74. Available at: www.nmfs.noaa.gov/pr/pdfs/consultations/pesticide_opinion4.pdf

into the larger environment. If plant communities change, for example, through increased mortality alongside a water body that has been designated as critical habitat, such changes could result in increased temperatures and increased sedimentation. If the plants that are killed provide important sheltering habitats, then those changes would represent an adverse modification to critical habitat. Prey composition and quality can be negatively altered through atrazine exposure. For example, scientific research has shown that atrazine inhibits photosynthesis in microalgae species and likely has the same impact on phytoplankton. Atrazine concentrations as low as 25 *ppb* can impact the protein structure of microalgae species and hence diminish the nutritional value of phytoplankton for a variety of aquatic animals.[75] This type of change in the food web is a clear example of something that would qualify as an adverse modification to critical habitat.

Given the extensive research on atrazine's negative impacts to non-target species in both the animal and plant kingdoms, substantial conservation measures must be implemented to avoid the adverse modification or destruction of critical habitat for listed species. While the Center believes that an outright ban of atrazine is the most appropriate conclusion from the reregistration process, should atrazine continue to be registered in the United States either as a restricted use pesticide, substantial use buffers must be imposed around all critical habitat. The Center recommends, as a minimum standard, an outright prohibition on the use of atrazine with 1000 feet of any designated critical habitat. Doing so provides all listed species with the benefit of the doubt when it comes to striking the proper balance for environmental protection as is required by the ESA.[76] Additional scientific research should then be undertaken to determine whether additional buffers are required to avoid jeopardizing species or adversely modifying critical habitat. To provide examples of how such buffers should be applied, several are provided as examples in Appendix A. As discussed above, the Center is providing a CD that contains GIS-based data for the location of critical habitat for listed species of concern and shape-files that map out the needed buffer zones for each listed species in order to facilitate the development of geographically-targeted conservation measures designed to protect listed species.

VII. The Current EPA Ecological Risk Assessment Fails to Meet the Best Available Science and is Under-protective of Listed Species.

On April 30, 2013 the EPA and the Services received a report from the National Academy of Sciences (NAS) outlining recommendations on specific scientific and technical issues related to the development of endangered and threatened species risk assessments for pesticides that are compliant with the both the ESA and FIFRA.[77] This report provided detailed recommendations on ways that the Services and the EPA could best incorporate considerations of the sub-lethal, indirect and cumulative effects of pesticide exposure; the effects of chemical mixtures and inert ingredients; the ability to use geospatial information, and how to incorporate uncertainty into the risk assessment process.[78] While the report outlines areas for all three agencies to improve, the NAS report made several significant conclusions about the current EPA ecological risk assessment process and in particular the EPA's use of risk quotients [RQs], including:

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[75] Weiner, J.A., et al. 2007. *Atrazine induced species-specific alterations in the subcellular content of microalgal cells*. Pesticide Biochemistry and Physiology 87:47–53
[76] *Connor v. Burford*, 848 F.2d 1441, 1454 (9th Cir. 1988).
[77] http://www.epa.gov/oppfead1/cb/csb_page/updates/2013/nas-report.html
[78] NAS REPORT at 1.

- The EPA "concentration-ratio approach" for its ecological risk assessments "is ad hoc (although commonly used) and has unpredictable performance outcomes."[79]
- "RQs are not scientifically defensible for assessing the risks to listed species posed by pesticides or indeed for any application in which the desire is to base a decision on the probabilities of various possible outcomes."[80]
- "The RQ approach does not estimate risk…but rather relies on there being a large margin between a point estimate that is derived to maximize a pesticide's environmental concentration and a point estimate that is derived to minimize the concentration at which a specified adverse effect is not expected."[81]
- "Adding uncertainty factors to RQs to account for lack of data (on formulation toxicity, synergy, additivity, or any other aspect) is unwarranted because there is no way to determine whether the assumptions that are used overestimate or underestimate the probability of adverse effects."[82]

According to the NAS, the EPA concentration-ratio approach contrasts sharply with a probabilistic approach to assessing risk, which the NAS describes as "technically sound." The NAS's underlying conclusion is that EPA should move towards a probabilistic approach based on population modeling, an approach that the NMFS already utilizes.[83] The NAS also recommends that the FWS move towards a probabilistic approach in its consultations. Given the significant changes to the EPA's ecological risk assessment that are likely required to conform with the NAS recommendations, it is arbitrary and capricious for EPA to proceed with atrazine's reregistration using a risk assessment process that does not truly estimate risk, if in doing so, it avoids the need to enter into consultations with the Services regarding the effects on any listed species.

The current ecological risk assessment fails to account for the full impacts to listed species and their populations. At its most basic, the EPA approach is deficient because it fails to give the "benefit of the doubt"[84] to listed species during its risk assessment process as is required by the ESA.[85] The EPA risk assessment bases nearly all its conclusions about the effects on listed species based on the pesticide dosage level needed to kill 50% of organisms (LC_{50}) from a single exposure to the pesticide active ingredient in a laboratory setting.[86] After determining this toxicity dosage, the EPA risk assessment then establishes Levels of Concern (LOCs) and Risk Quotients (RQs) for threatened and endangered species based on the results from the LC_{50} testing. This approach represents nothing more than arbitrary policy choices by the EPA that are not grounded in the best available science. In fact, when the Services reviewed the EPA's use of LC_{50}, it concluded that "setting protective levels for pesticides in the environment based on their ability to prevent increased acute lethality is an inadequate level of protection" for listed species because "[a] pesticide may have multiple modes of action (or toxicity)" and the narrow focus on acute toxicity excludes considerations of "essential physiological and behavioral systems."[87] In other words, the

[79] *Id*. at 107.
[80] *Id*. at 11.
[81] *Id*.
[82] *Id*.
[83] *Id*. at 107.
[84] House Conference Report 96-697, 1979 U.S.C.C.A.N. 2576.
[85] *Connor v. Burford*, 848 F.2d 1441, 1454 (9th Cir. 1988)
[86] Draft BiOp at 150, lines 5246-47.
[87] *Washington Toxics Coalition v. FWS*, 457 F.Supp 2. 1158 at 1187 (W.D. Wash. 2006).

use of LC_{50} limits the ability to meaningfully consider sublethal effects. The National Academy panel concluded similarly:

> for the purposes of population modeling as discussed below, the effects must be estimated at a range of concentrations that includes all values that the populations that are being assessed might plausibly experience. Therefore, the committee concludes that test results expressed only as threshold values or point estimates—for example, the no-observed-adverse-effect level, the lowest observed adverse-effect level, or the LC50—provide insufficient information for a population-level risk assessment.[88]

It is also important to recognize that the EPA never consulted with the Services regarding either the use of risk quotients or the *values* set for each risk quotient. For example, the EPA unilaterally decided that the risk quotient for endangered aquatic animals should be set at 0.05, the risk quotient for endangered mammals and birds should be set at 0.1, and the risk quotient for chronic harm should be set at 1.0 for all listed animal species. It is likely that the Services would never endorse such an approach because the conservation status of listed species varies widely. While aquatic species are generally at more risk to pesticide exposure, there may be critically endangered terrestrial invertebrate species such as butterflies that would clearly be put at jeopardy if exposed to certain pesticides. Yet, the EPA risk assessment process does not even state what the proper level of concern should be set at for endangered terrestrial invertebrates. It does not make biological or scientific sense that in *all* cases, the risk quotient for an endangered bird or mammal (or reptile) should be twice as high as an endangered aquatic species if the goal is to develop species-specific conservation measures to ensure against jeopardy. A critically endangered mammal species could be at greater risk from a lower atrazine exposure level than a more widely distributed amphibian species that only "threatened" under the ESA. The EPA risk assessment process does not account for any of these types of nuances. And it certainly makes no sense that the risk quotient for endangered plants is set at the same level as non-endangered plants. Over half of the species protected under the ESA are plants, and when dealing with herbicides in particular, the decision to leave the RQ > 1 for endangered plants is simply arbitrary and capricious.

In reality, risk quotients are nothing more than an arbitrary point on an indefinable spectrum with unknowable end points that mean almost nothing in the real world for endangered species. As a result, the EPA's current approach to assessing risk is simply inadequate for the task of assessing the population-level consequences of pesticide exposure in terms of jeopardy and assessing whether critical habitat would be destroyed or adversely modified by pesticide usage. It is not surprising then that in the few situations where the EPA has completed risk assessments for atrazine that the Services were unable to figure out an analytical approach that was compatible with the information received from the EPA to complete biological opinions. For example, in 2007, the EPA completed an effects determination for pallid sturgeon (*Scaphirhynchus albus*) concluding that atrazine would likely adversely affect the pallid sturgeon only through impacts to the species' habitat; not through direct effects to the species.[89] This contrasts with the conclusions from a 2006 report by the Fish

[88] NAS REPORT at 75.

[89] U.S. Environmental Protection Agency. 2007. *Risks of Atrazine Use to Federally Listed Endangered Pallid Sturgeon (Scaphirhynchus albus): Pesticide Effects Determination* August 31, 2007. Available at: www.epa.gov/espp/litstatus/effects/pallid_sturgeon_eff_deter_08-31-07.pdf

and Wildlife Service that found atrazine levels above levels of concern in the shovelnose sturgeon and concluded:

> Although the effects of atrazine exposure to shovelnose sturgeon are unknown, results of this study and previous work by others indicate that it may be disrupting steroidogeneisis. Gross observations and condition indices seem to indicate that shovelnose sturgeon from the lower Platte River are healthy; however, reproductive biomarkers and histological examination of gonads indicate potential reproductive impairment as indicated by ovicular atresia, abnormal estrogen to testosterone ratios, and high concentrations of vitellogenin in males. *Pallid sturgeon may be especially at risk to contaminants in the lower Platte River that bioaccumulate and cause reproductive impairment* because they have a more piscivourus diet, greater maximum life-span, and a longer reproductive cycle than shovelnose sturgeon.[90]

In other words, the EPA concluded that atrazine was not likely to adversely affect (NLAA) a highly endangered species, while a year earlier, the Fish and Wildlife Service concluded that atrazine might be causing reproductive impairment. The Services' joint consultation handbook defines NLAA as "when effects on listed species are expected to be discountable, insignificant, or completely beneficial."[91] Discountable effects are those that "would not: (1) be able to meaningfully measure, detect, or evaluate insignificant effects; or (2) expect discountable effects to occur." Despite substantial literature documenting the sublethal impacts of atrazine on many fish species, despite contemporary conclusions from the FWS regarding the potential reproductive impacts of atrazine on pallid sturgeon, and despite the fact that the EPA estimated that 56,000,000 pounds of atrazine was applied in the main watershed of the pallid sturgeon,[92] the EPA concluded that atrazine would have only insignificant or non-detectable impacts on the species. Such a result is simply not credible, and again highlights the failures of the EPA to conceptually grasp the meaning of key provisions of the ESA and the requirement to give species the benefit of the doubt when making effects determinations.

For example, the EPA risk assessment states that its own LOCs were exceeded for pallid sturgeon based on its modeling. However, when the EPA considered "flow-adjusted [environmental exposure concentrations] and detected concentrations of atrazine in available monitoring data]" it was able to conclude that no take would occur based on predicted chronic or acute effects.[93] This analytical approach is flawed for several reasons. First, as the National Academy of Sciences report concluded "general monitoring data cannot be used to estimate pesticide concentrations after a pesticide application or to evaluate the performance of fate and transport model" because monitoring efforts are not associated with the use of specific pesticides at specific times. Thus, even if some data suggests that atrazine levels were low at a particular point in time, no correlation should be drawn as to whether atrazine levels would always

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[90] U.S. Fish and Wildlife Service. 2006. *A Health Risk Evaluation for Pallid Sturgeon (Scaphirhynchus albus) in the Lower Platte River Using the Shovelnose Sturgeon (Scaphirhynchus platorynchus) as a Surrogate: Final Report*. USFWS Nebraska Field Office, FFS: 200260004.

[91] U.S. Fish and Wildlife Service and National Marine Fisheries Service. 1998. *Endangered Species Consultation Handbook: Procedures for Conducting Consultation and Conference Activities Under Section 7 of the Endangered Species Act* at xv.

[92] *Risks of Atrazine Use to Federally Listed Endangered Pallid Sturgeon (Scaphirhynchus albus): Pesticide Effects Determination* at 20.

[93] *Id*. at 8

be low enough to make a scientifically credible conclusion. And, since there is no indication that the EPA knows where any pallid sturgeon actually are located at a given moment, such assumptions become quite dubious. Second, because EPA exclusively relies on modeling, there is no way to ensure that the lack of acute or chronic effects on species tested in the lab (bluegill sunfish, rainbow trout, and fathead minnow) means that no effects will occur for pallid sturgeon. The EPA defines "chronic effects" as any "adverse effect on any living organism in which symptoms develop slowly over a long period of time or recur frequently."[94] Pallid sturgeon can live for 40 years, thus the EPA would have to conclude that over a 40 year span, not a single individual pallid sturgeon would ever be exposed to a high enough concentration anywhere in the species' range such that not a single adverse effect ever occurred in order to reach its NLAA finding. But rather than giving the pallid sturgeon the benefit of the doubt after finding that LOCs could be exceeded at both the acute and choric levels, the EPA used ad hoc modeling of river hydrology to conclude that no adverse effects would occur.

As another example, in 2006 the EPA completed an effects determination regarding the downstream effects of atrazine on five species found in the Chesapeake Bay, loggerhead turtle *(Caretta caretta),* green turtle *(Chelonia mydas),* the shortnose sturgeon *(Acipenser brevirostrum),* Kemp's ridley turtle *(Lepidochelys kempii),* and leatherback turtle *(Dermochelys coriacea)*. The EPA concluded that atrazine was not likely to adversely affect any listed species.[95] NMFS did not concur with the EPA's assessment and instead found that atrazine was likely to adversely affect (LAA) all of the above species. In making its non-concurrence determination, NMFS identified information "that was discarded, discounted, or otherwise not considered by EPA."[96] This included monitoring data that indicated that concentrations of atrazine up to 98 *ppb* in surface waters in the Chesapeake Bay and data that indicated potentially higher peak concentrations. Based on the use of over 500,000 lbs/year in Maryland, 1.5 million lbs/year in Pennsylvania and 600,000 lbs/year in Virginia on corn and sorghum crops, NMFS predicted regular exposure of at least 30 *ppb* of atrazine on listed species.

NMFS raised specific concerns regarding the EPA's conclusion that acute exposure to atrazine at concentrations below 100 *ppb,* and chronic exposure of less than 65 *ppb* atrazine would result in no direct effects to shortnose sturgeon. NMFS noted that EPA's own toxicity database demonstrated "an array of other adverse effects to fishes were observed at atrazine concentrations (0.5-10 *ppb*) well below the acute threshold of 100 *ppb*."[97] NMFS concluded that "adverse effects likely occur at concentrations of atrazine well below 65 and 100 *ppb.* Consequently, the actual risk to listed species of atrazine use in the Chesapeake Bay watershed may be significantly underestimated in the current assessment."[98] NMFS predicted that exposure to atrazine included would likely "reduce a sturgeon's ability to migrate from freshwater to saltwater…impair olfactory

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[94] EPA Pesticide Glossary. 2013. http://www.epa.gov/pesticides/glossary/index.html#c
[95] U.S. Environmental Protection Agency. 2007. Potential for Atrazine Use in the Chesapeake Bay Watershed to Affect Six Federally Listed Endangered Species: Shortnose Sturgeon (*Acipenser brevirostrum*); Dwarf Wedgemussel (*Alasmidonta heterodon*); Loggerhead Turtle (*Caretta caretta*); Kemp's Ridley Turtle (*Lepidochelys kempii*); Leatherback Turtle (*Dermochelys coriacea*); and Green Turtle (*Chelonia mydas*), available at: www.epa.gov/espp/litstatus/effects/atrazine/2007/determination-cheasp.pdf
[96] National Marine Fisheries Service. 2007. *Atrazine Nonconcurrence Letter to EP: Request for Endangered Species Act Section 7 Informal Consultation on the Environmental Protection Agency's Re-Registration and Use of Atrazine in the Chesapeake Bay Watershed, September 1, 2006* at 1. Available at: www.nmfs.noaa.gov/pr/pdfs/consultations/atrazine_letter_epa.pdf
[97] *Id*. at 2.
[98] *Id*.

mediated behaviors important to survival, growth and reproduction…and in some sensitive individuals potentially lead to acute lethality." [99]

For sea turtles, EPA concluded that adverse sublethal effects in sea turtles would likely include endocrine mediated effects and effects to olfaction which would impair growth, survival, and reproduction. In addition, atrazine's effects on aquatic primary producers including periphyton, algae, and macrophytes would result in adverse cascading ecological responses of exposed aquatic habitats. Concentrations of atrazine would also likely reduce benthic macroalgae and sea grasses that the herbivorous green turtles feed on in shallow water habitats. This wide divergence in conclusions reached by these two agencies regarding the effects of atrazine demonstrate the clear inadequacies regarding EPA's current ecological risk assessment process.

It is true that for single species, as the NAS report explains, single chemical studies are still required as the baseline to understand the basic mechanisms of toxicity for a particular pesticide. However, the NAS also recognized that without real-world considerations of where listed species are located, the relative conservation status of listed species, the environmental baseline, and the interaction of pesticides with other active ingredients, pesticide degrades, and other pollutants, the EPA risk assessment process will not be able to make meaningful predictions about which endangered species will be adversely affected. Until the EPA can conduct realistic assessments, it should take a precautionary approach and enter into informal or formal consultations with the Services for almost every species in the lower 48 States. Given what is known about atrazine at exposure levels as low as 0.1 ppb, formal consultations must occur with the Services as early as possible in the reregistration process to ensure that species receive the benefit of the doubt throughout the EPA reregistration review of atrazine.

VIII. Conclusion

The benefits of the continued registration of atrazine no longer justify the significant environmental impacts that atrazine's usage incurs. Atrazine causes substantial harm in amphibians, reptiles, mammals, birds, and a suite of non-target plant species, including potentially hundreds of threatened and endangered species protected under the Endangered Species Act. Atrazine has been shown in numerous studies to be a potent endocrine disruptor for wildlife. Exposure to atrazine at levels as low as 0.1 ppb have been shown to affect the development of female sex characteristics in male frogs and cause the development of eggs in male frog testes. As a result, any concentration of atrazine in the environment above zero now likely represents jeopardy to dozens, if not hundreds, of listed species. Already, atrazine is one of the most commonly detected pesticides in drinking water, surface waters, and ground water across the nation. Even if a ban were enacted tomorrow, it would continue to contaminate the water and land for decades to come. In addition to these profound environmental impacts, atrazine causes unacceptable impacts on human health including elevated cancer risks, elevated risks of birth defects, and significant reproductive harm. Because the overwhelming weight of the evidence demonstrates the substantial adverse impacts on the environment from atrazine, EPA should conclude at the end of the FIFRA reregistration process and the Section 7 consultation process that cancelation of atrazine is the most appropriate course of action.

[99] *Id*.

Respectfully submitted,

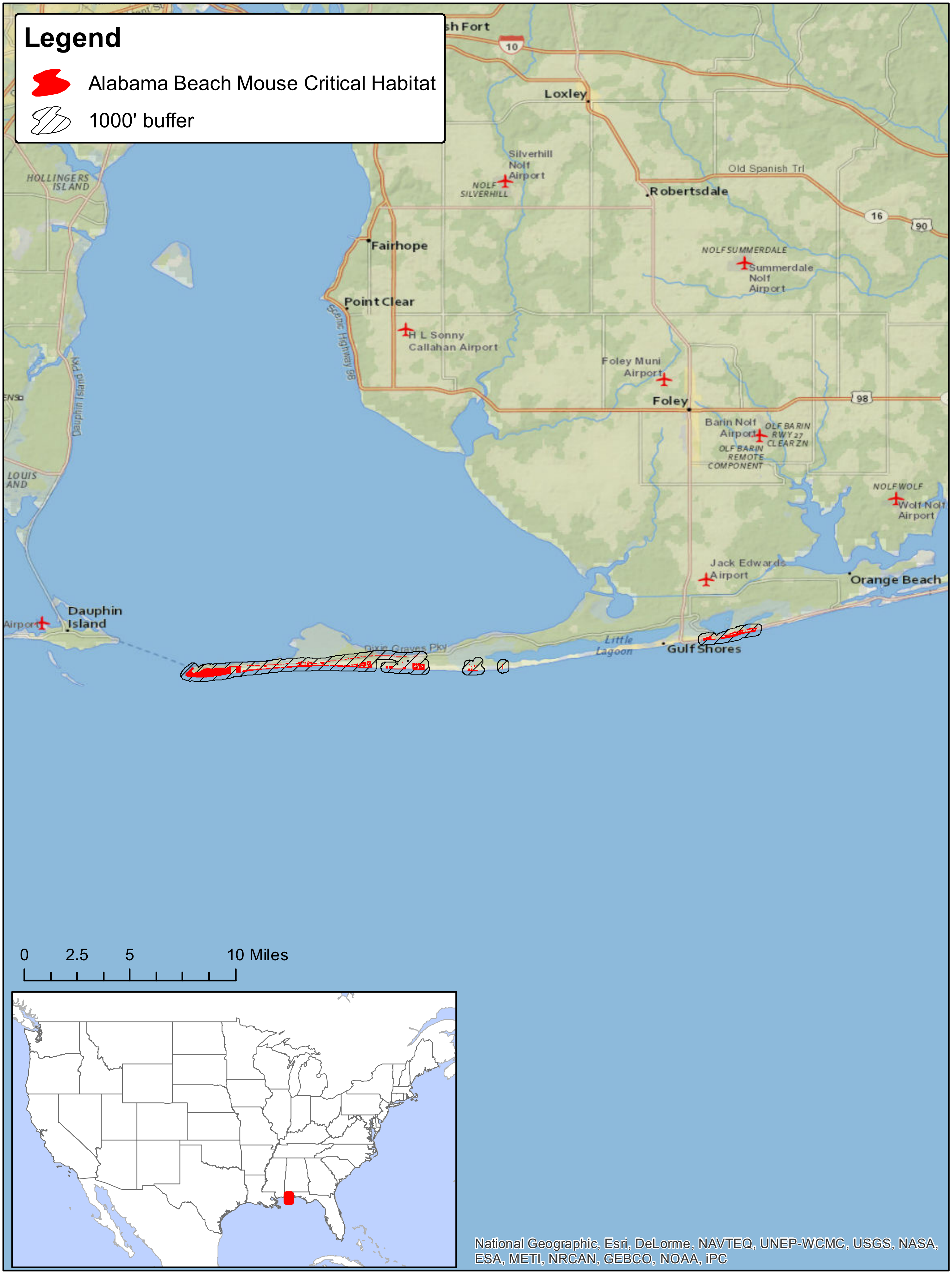
Brett Hartl
Endangered Species Policy Director
Center for Biological Diversity
Washington, D.C. 20008

Cc: Gary Frazer
Assistant Director for Endangered Species
U.S. Fish and Wildlife Service
1849 C Street NW
Washington, D.C. 20240

Rick Sayers
Chief, Division of Consultation, HCPs, Recovery, and State Grants
Endangered Species Program
4401 N. Fairfax Drive, Room 420
Arlington, VA 22203

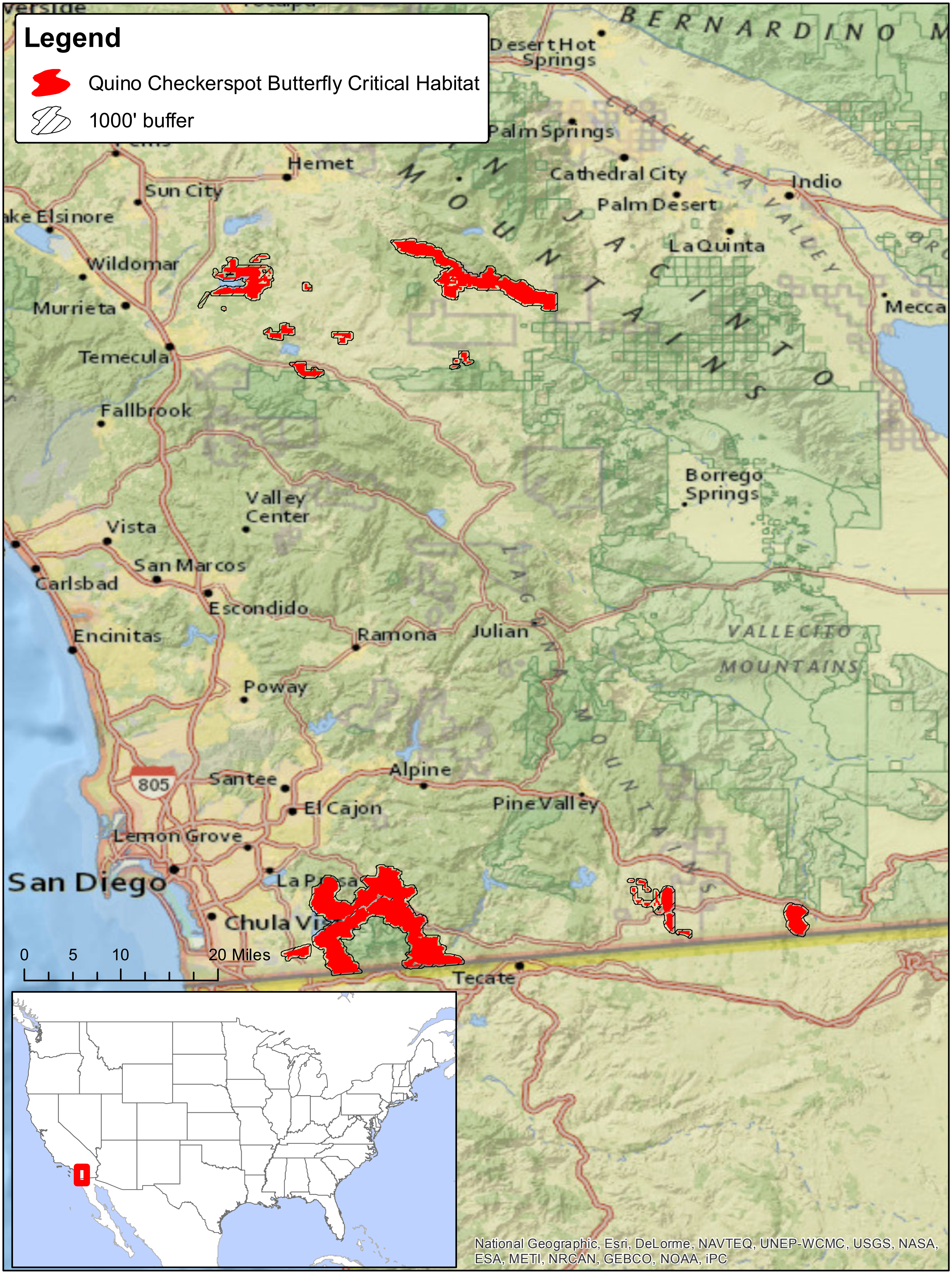
Angela Somma
Division Chief
Endangered Species Conservation Division
Office of Protected Resources
1315 East-West Highway
Silver Spring, MD 20910-3225

Kristine Petersen
Acting Division Chief
Endangered Species Act Interagency Cooperation Division
Office of Protected Resources
1315 East-West Highway
Silver Spring, MD 20910-3225


Legend
Alabama Beach Mouse Critical Habitat
1000' buffer
Loxley
Silverhill Nolf Airport
NOLF SILVERHILL
Old Spanish Trl
Robertsdale
HOLLINGERS ISLAND
Fairhope
NOLF SUMMERDALE
Summerdale Nolf Airport
Point Clear
Scenic Highway 98
H L Sonny Callahan Airport
Foley Muni Airport
Dauphin Island Pkwy
Foley
Barin Nolf Airport
OLF BARIN RWY 27 CLEAR ZN
OLF BARIN REMOTE COMPONENT
NOLF WOLF
Wolf Nolf Airport
Jack Edwards Airport
Orange Beach
Dauphin Island
Airport
Dixie Graves Pky
Little Lagoon
Gulf Shores
10
16
90
98
0 2.5 5 10 Miles
National Geographic, Esri, DeLorme, NAVTEQ, UNEP-WCMC, USGS, NASA, ESA, METI, NRCAN, GEBCO, NOAA, iPC


Legend
June Sucker Critical Habitat
1000' buffer
Orem
Provo
Provo River
Provo Municipal Airport
Big Dry Creek
0 0.5 1 2 Miles
National Geographic, Esri, DeLorme, NAVTEQ, UNEP-WCMC, USGS, NASA, ESA, METI, NRCAN, GEBCO, NOAA, iPC


Legend
Morro Shoulderband Snail Critical Habitat
1000'
Paso Robles
Templeton
Salinas River
Atascadero
Cayucos
Morro Bay
SANTA LUCIA RANGE
Vineyard Dr
Santa Rita Rd
46
Cabrillo
318 m
Morro Rd
849 m
Atascadero Rd
Cabrillo Hwy
El Camino Real
CAMP SAN LUIS OBISPO
BLACK BUTTE
LOS OSOS VALLEY
San Luis Obisp
MONTAÑA DE ORO
IRISH HILLS
554 m
San Luis Co Rgnl Airport
1
Pismo Beach
Grover Beach
Arroyo Grande
Oceano
Guadalup
0
2.5
5
10 Miles
National Geographic, Esri, DeLorme, NAVTEQ, UNEP-WCMC, USGS, NASA, ESA, METI, NRCAN, GEBCO, NOAA, iPC



Legend
Quino Checkerspot Butterfly Critical Habitat
1000' buffer
Desert Hot Springs
Palm Springs
Cathedral City
Palm Desert
Indio
La Quinta
Mecca
Hemet
Sun City
Lake Elsinore
Wildomar
Murrieta
Temecula
Fallbrook
Valley Center
Vista
San Marcos
Carlsbad
Escondido
Encinitas
Ramona
Julian
Poway
Borrego Springs
VALLECITO MOUNTAINS
SAN JACINTO MOUNTAINS
COACHELLA VALLEY
Alpine
Santee
El Cajon
Pine Valley
Lemon Grove
San Diego
Chula Vista
Tecate
805
0 5 10 20 Miles
National Geographic, Esri, DeLorme, NAVTEQ, UNEP-WCMC, USGS, NASA, ESA, METI, NRCAN, GEBCO, NOAA, iPC


Legend
Willamette Valley Daisy Critical Habitat
1000' buffer
Salem
Dallas
INDEPENDENCE STATE AIRPORT
Monmouth
Independence
SALEM HILLS
SILETZ RESERVATION
99
NG CAMP ADAIR (CORVALLIS)
638 m
Albany
ALBANY MUNI
20
Corvallis
34
CORVALLIS MUNI AIRPORT
1248 m
5
Harrisburg
Junction City
36
MAHLON SWEET FLD
FERN RIDGE LAKE
Fern Ridge Lake
Eugene
Willamette River
0 5 10 20 Miles
National Geographic, Esri, DeLorme, NAVTEQ, UNEP-WCMC, USGS, NASA, ESA, METI, NRCAN, GEBCO, NOAA, iPC

APPENDIX B

WATERSHEDS THAT CONTAIN SPECIES OF CONERN AND DOCUMENTED ELEVATED ATRAZINE CONCENTRATIONS

Watershed Name	HUC Code
Piscataqua–Salmon–Falls	01060003
Middle Merrimack	01070002
Middle Connecticut	01080201
Lower Connecticut	01080205
Farmington	01080207
Charles	01090001
Quinnipiac	01100004
Housatonic	01100005
Saugatuck	01100006
Hudson–Hoosic	02020003
Middle Hudson	02020006
Rondout	02020007
Hudson–Wappinger	02020008
Lower Hudson	02030101
Hackensack–Passaic	02030103
Sandy Hook–Staten Island	02030104
Raritan	02030105
Upper Delaware	02040101
M. Delaware–Mongaup–Brodhead	02040104
M. Delaware–Musconetcong	02040105
Lehigh	02040106
Crosswicks–Neshaminy	02040201
Lower Delaware	02040202
Schuylkill	02040203
Brandywine–Christina	02040205
Cohansey–Maurice	02040206
Mullica–Toms	02040301
Great Egg Harbor	02040302
Upper Susquehanna–Lackawanna	02050107
Lower Susquehanna–Penns	02050301
Upper Juniata	02050302
Raystown	02050303
Lower Juniata	02050304
Lower Susquehanna–Swatara	02050305
Lower Susquehanna	02050306
Upper Chesapeake Bay	02060001
Chester–Sassafras	02060002

Watershed Name	HUC Code
Gunpowder–Patapsco	02060003
Chincoteague	02060010
South Branch Potomac	02070001
North Branch Potomac	02070002
Cacapon–Town	02070003
Conococheague–Opequon	02070004
South Fork Shenandoah	02070005
North Fork Shenandoah	02070006
Middle Potomac–Catoctin	02070008
Monocacy	02070009
M. Potomac–Anacostia–Occoquan	02070010
Lower Potomac	02070011
Chowan	03010203
Albemarle	03010205
Upper Tar	03020101
Fishing	03020102
Lower Tar	03020103
Pamlico	03020104
Upper Neuse	03020201
Middle Neuse	03020202
Contentnea	03020203
Lower Neuse	03020204
Haw	03030002
Deep	03030003
Upper Yadkin	03040101
Saluda	03050109
Congaree	03050110
Edisto	03050205
Four Hole Swamp	03050206
Broad-St. Helena	03050208
Canoochee	03060203
Upper Oconee	03070101
Lower Oconee	03070102
Lower Ocmulgee	03070104
Little Ocmulgee	03070105
Altamaha	03070106
Little Satilla	03070202

Watershed Name	HUC Code
St. Marys	03070204
Upper St. Johns	03080101
Lower St. Johns	03080103
Kissimmee	03090101
Everglades	03090202
Peace	03100101
Hillsborough	03100205
Tampa Bay	03100206
Crystal–Pithlachascotee	03100207
Little	03110204
Apalachee Bay - St. Marks	03120001
Upper Ochlockonee	03120002
Lower Ochlockonee	03120003
M. Chattahoochee–Lake Harding	03130002
M. Chattahoochee–Walter George Reservoir	03130003
Lower Chattahoochee	03130004
Upper Flint	03130005
Middle Flint	03130006
Kinchafoonee–Muckalee	03130007
Lower Flint	03130008
Ichawaynochaway	03130009
Spring	03130010
Apalachicola	03130011
Chipola	03130012
Oostanaula	03150103
Upper Coosa	03150105
Middle Coosa	03150106
Lower Coosa	03150107
Upper Alabama	03150201
Cahaba	03150202
Lower Alabama	03150204
Middle Tombigbee–Lubbub	03160106
Locust	03160111
Upper Black Warrior	03160112
Beartrap–Nemadji	04010301
Manitowoc–Sheboygan	04030101
Door–Kewaunee	04030102
Duck–Pensaukee	04030103
Menominee	04030108
Pike–Root	04040002
St. Joseph	04100003
Auglaize	04100007
Cuyahoga	04110002

Watershed Name	HUC Code
French	05010004
Middle Allegheny–Redbank	05010006
Lower Allegheny	05010009
Lower Monongahela	05020005
Upper New	05050001
Middle New	05050002
Upper Great Miami	05080001
Lower Great Miami	05080002
Little Miami	05090202
Middle Ohio–Laughery	05090203
Upper White	05120201
Lower White	05120202
Eel	05120203
Driftwood	05120204
Upper East Fork White	05120206
Muscatatuck	05120207
Lower East Fork White	05120208
North Fork Holston	06010101
South Fork Holston	06010102
Watauga	06010103
Holston	06010104
Upper French Broad	06010105
Pigeon	06010106
Nolichucky	06010108
Watts Bar Lake	06010201
Upper Clinch	06010205
Powell	06010206
Emory	06010208
Middle Tennessee–Chickamauga	06020001
Wheeler Lake	06030002
Lower Elk	06030004
Lower Duck	06040003
Crow	07010204
Twin Cities	07010206
Chippewa	07020005
Middle Minnesota	07020007
Blue Earth	07020009
Le Sueur	07020011
Lower Minnesota	07020012
Upper St. Croix	07030001
Namekagon	07030002
Lower St. Croix	07030005
Rush–Vermillion	07040001
Lower Wapsipinicon	07080103

Watershed Name	HUC Code
South Skunk	07080105
Skunk	07080107
Upper Cedar	07080201
Shell Rock	07080202
Winnebago	07080203
Upper Iowa	07080207
Middle Iowa	07080208
Lower Iowa	07080209
Upper Rock	07090001
Upper Fox	07120006
Lower Illinois–Senachwine Lake	07130001
Spoon	07130005
La Moine	07130010
Lower Illinois	07130011
Obion	08010202
Wolf	08010210
Lower White-Bayou Des Arc	08020301
Coldwater	08030204
Big Sunflower	08030207
Lower Yazoo	08030208
Deer–Steele	08030209
Bayou Macon	08050002
Tensas	08050003
Amite	08070202
Lake Maurepas	08070204
Tangipahoa	08070205
Lower Grand	08070300
Mermentau	08080202
Liberty Bayou–Tchefuncta	08090201
East Central Louisiana Coastal	08090301
West Central Louisiana Coastal	08090302
Bois De Sioux	09020101
Mustinka	09020102
Western Wide Rice	09020105
Clarks Fork Yellowstone	10070006
Lower Yellowstone	10100004
Upper South Platte	10190002
M. South Platte-Cherry Creek	10190003
Clear	10190004
St. Vrain	10190005
Big Thompson	10190006
Cache La Poudre	10190007
Lone Tree–Owl	10190008
Crow	10190009

Watershed Name	HUC Code
Kiowa	10190010
Middle South Platte–Sterling	10190012
Lower South Platte	10190018
Middle Platte–Buffalo	10200101
Lower Platte–Shell	10200201
Salt	10200203
Dismal	10210002
lower Middle Loup	10210003
Lower North Loup	10210007
Loup	10210009
Upper Elkhorn	10220001
Lower Elkhorn	10220003
Sac	10290106
Pomme De Terre	10290107
Beaver Reservoir	11010001
Middle White	11010004
Buffalo	11010005
Upper White–Village	11010013
Illinois	11110103
San Marcos	12100203
Alamosa–Trinchera	13010002
Rio Chama	13020102
Rio Grande–Albuquerque	13020203
El Paso-Las Cruces	13030102
Colorado headwaters–Plateau	14010005
Lower Gunnison	14020005
Uncompahange	14020006
Las Vegas Wash	15010015
Upper San Pedro	15050202
Lower Gila- Painted Rock Reservoir	15070101
Hassayampa	15070103
Middle Bear	16010202
Lower Bear–Malad	16010204
Lower Weber	16020102
Provo	16020203
Jordan	16020204
Bitterroot	17010205
Hangman	17010306
Lower Spokane	17010307
Upper Columbia–Entiat	17020010
Upper Yakima	17030001
Lower Yakima Washington	17030003
Upper Snake–Rock	17040212
Salmon Falls	17040213

Watershed Name	HUC Code
Big Wood	17040219
Palouse	17060108
Lower Columbia–Sandy	17080001
Upper Willamette	17090003
Yamhill	17090008
Molalla–Pudding	17090009
Tualatin	17090010
Lower Willamette	17090012
Nooksack	17110004

Watershed Name	HUC Code
lake Washington	17110012
Duwamish	17110013
Puyallup	17110014
Puget Sound	17110019
Sacramento–Stone Corral	18020104
Lower Sacramento	18020109
Middle San Joaquin–Lower	18040001
Middle San Joaquin–Lower	18040002
Lower Cosumnes–Lower Mokelumne	18040005