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Via Electronic Docket Submission http://www.regulations.gov

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Martha Williams, Director
U.S. Fish & Wildlife Service
C/o Public Comments Processing
Attn: FWS-R3-ES-2024-0137-0001
U.S. Fish and Wildlife Service, MS: PRB/3W
5275 Leesburg Pike
Falls Church, VA 22041-3803

RE: Comments on the U.S. Fish & Wildlife Service ("USFWS") proposed rule to list the monarch butterfly as a threatened species and designate critical habitat, Docket Number: FWS-R3-ES-2024-0137-0001

Dear Director Williams:

The American Mosquito Control Association (AMCA) is pleased to provide comments on the USFWS threatened species status with Section 4(d) Rule for the monarch butterfly and designation of critical habitat (FWS-R3-ES-2024-0137-0001).

AMCA is a not-for-profit professional association of approximately 1,200 public health officials, academics, county trustees/commissioners, and mosquito control professionals. Our mission is to enhance the **health** and **quality of life** through the suppression of vector-transmitted diseases and the reduction of mosquitoes and other public health pests by providing leadership, information, collaboration, tools, and education. This mission is accomplished by employing integrated mosquito management (IMM) practices, which include using registered public health pesticides when warranted. Many of our members are special districts or other local entities funded through state and/or local taxes. In most places, our membership is mandated by state and local law to suppress populations of mosquitoes that may impact health, agriculture, quality of life and economic development.

AMCA recognizes that a species warrants listing if it meets the definition of an endangered or threatened species and that the USFWS has determined that the monarch butterfly meets the Endangered Species Act's (the Act) definition of a threatened species with critical habitat. AMCA also agrees that we need to work with USFWS to improve future conditions so that monarch migratory populations can stabilize and grow, in part, by avoiding and/or minimizing the impacts to monarchs and their habitat from insecticides that our members may need to apply to fulfill their mission of protecting the health and well-being of their constituents from vector-borne diseases. AMCA appreciates USFWS's request for comments and information that may assist with constructing protective regulations under section 4(d) of the Act that may be necessary and advisable to provide for the conservation of the monarch butterfly.

To achieve their mission, AMCA's member districts rely on an IMM approach. An IMM approach is comprised of a range of interrelated strategies such as community engagement and education, mosquito surveillance, source reduction, habitat modification, biological control and finally, larval and adult pesticide applications as necessary. The application of pesticides is a critical tool within our IMM framework that allows our AMCA membership to protect human health from mosquitoes and mosquito-borne diseases. For this reason, any proposed listing decision for the monarch butterfly or other actions that may affect the ability of our membership to utilize pesticide treatments to protect public health is of vital importance. Given the potentially significant impacts this listing could impart on our members to protect the public's health and welfare, AMCA offers the following comments:

General Considerations

USFWS appears willing to allow some incidental take of individual monarchs under a detailed 4(d) rule. For example, under the proposed 4(d) rule, incidental take caused by activities that may maintain, enhance, remove, or establish milkweed and nectar plants within the breeding and migratory range that do not result in conversion of native or naturalized grassland, shrubland, or forested habitats will not be prohibited. Furthermore, the case has been made in the proposed rule that there will be exceptions for other forms of take. In particular, USFWS states, "At this time the impacts from monarch deaths due to vehicle strikes are considered minimal and not affecting the monarch butterfly at a population or species level. Therefore, we propose that take due to vehicle strikes not be prohibited under this 4(d) rule."

Although monarch populations continue to decrease, they continue to be present through the United States. Because the monarch butterfly can be found in almost every state, it is one of the most recognized species that has been proposed to be listed. It is understood why this species and its migration are dependent upon conservation of habitats. But, it is also clearly understood that given this ubiquitous nature, the USFWS has acknowledged that certain activities should be allowed exceptions from the prohibitions. These activities may cause incidental take; however, they are considered minimal and not likely to affect the monarch butterfly at a population or species level, despite the potential to cause take to individual monarchs.

In the proposed rule, USFWS seeks to gain public comment on how to address pesticide use under a 4(d) rule for the monarch. AMCA proposes that not all pesticide uses and application methods will impact monarchs. Furthermore, there is precedent set in the listing of the Puerto Rican harlequin butterfly pertaining to the agricultural use of pesticides that should be noted (USFWS, Docket ID: FWS-R4-ES-2020-0083).

AMCA proposes that mosquito control operations, including the application of pesticides for the management of mosquitoes, should be provided an exception from the prohibitions within the 4(d) rule. Specifically, take incidental to an otherwise lawful activity caused by normal mosquito control practices, including pesticide use, which are carried out in accordance with any existing regulations, permit and label requirements, and best management practices, as long as the practices do not include clearing or disturbing monarch habitat; or applying pesticides directly to, or contiguous to, habitat known to be occupied by monarch butterflies.

General Mosquito Control Operations Warranting Exceptions within the 4(d) Rule

As stated previously, modern mosquito control operations incorporate an integrated approach to managing mosquitoes with a variety of tools and strategies being employed. However, for the purposes of these comments, 4 core activities within the IMM approach will be addressed: 1) surveillance of larval and adult mosquitoes necessary to trigger mosquito control applications, 2) larval mosquito control operations (e.g. physical control through manipulation of mosquito habitat and/or larvicide applications), 3) small scale residual adult mosquito control pesticide applications, and, when necessary, 4) wide area ultra low volume (ULV) adult mosquito control pesticide applications.

Each of these 4 activities have unique features that could conceivably result in some level of individual take of the monarch. However, these is no evidence that more than a limited number of individual monarchs will experience negative effects from direct exposure to these practices.

1) Mosquito Surveillance Operations

A scientifically driven surveillance program is the backbone of every mosquito control operation. The primary purpose of mosquito surveillance is to determine the species composition, species abundance, and spatial-temporal distribution within the geographic area of interest through collection of eggs, larvae/pupae, and adult mosquitoes (AMCA 2021). Surveillance also includes the monitoring of pathogens within mosquito populations. Identification of local species capable of transmitting pathogens and setting reasonable thresholds for action when mosquito or pathogen abundance threatens the public is a foundational piece of an IMM approach. Whether conducting surveillance for larval or adult mosquitoes, technicians are required to enter a variety of habitats where larval or adult monarchs may exist to assess local mosquito population abundance. In the Western United States, sporadic rainfall and mountains restrict and limit the extent of land that provides suitable monarch habitats to mostly riparian and floodplain; much of the habitat suitable for monarchs will also overlap with mosquito surveillance activities. In contrast, most of the landscapes in the Eastern United States have greater rainfall which enables monarch habitats to exist in most all landscapes except densely wooded areas. Consequently, milkweed is scattered across the landscape as are mosquito surveillance activities.

The definition of ‘‘take’’, as defined in the Endangered Species Act, is "… to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct". Consequently, "take" can occur while performing lawful activities, such as mosquito surveillance, in support of state and/or local mandates. Because many mosquito control programs are taxpayer funded government programs that conduct highly visible activities, we are keenly aware that frivolous civil litigation is a tool that can be used to hamper the functioning of our programs, and the ESA provides significant opportunities for potential litigation and civil penalties. Although we are unaware of any interaction between the monarch and surveillance activities, it is conceivable that these actions could result in some level of individual take of the monarch. More importantly, this 4(d) rule, if not constructed carefully will expose lawfully mandated mosquito control programs to unnecessary and counterproductive civil ESA litigation. Since the AMCA is unaware of any evidence which shows an interaction of any sort between surveillance activities and the monarch, the AMCA proposes that all surveillance activities necessary to perform pesticide applications be listed as an exception from the prohibitions in the 4(d) rule.

2) Larval Mosquito Control Operations

Larval mosquito control operations can be extremely variable and dependent upon many local conditions, including: climate, weather, mosquito species, etc. While adult mosquito control is often thought of as synonymous with "mosquito control", targeting mosquitoes in the larval stage is a very common compliment to adult mosquito control and is an effective strategy for long-term population management. Mosquito larvae are aquatic and concentrated in specific water sources after the female mosquitoes lay her eggs. Targeting mosquitoes in the larval stage before they can mature into adult mosquitoes and disperse reduces the adult mosquito population in nearby areas. Larval control is commonly performed with mosquito-specific microbial and other biorational pesticides and does not require the use of broad-spectrum pesticides. Therefore, larval mosquito control is one of the most specific and effective strategies for reducing mosquito abundance with minimal, if any, off-target effects. The AMCA is unaware of any interaction between larval control materials or activities and larval or adult Monarch butterflies.

Larval Source Reduction

Larval habitats can vary greatly between and within the multiple genera of mosquitoes. Often, a mosquito species will be adapted to a very specific type of aquatic habitat, such as pools or ponds of fresh or brackish water with characteristic vegetation. To prevent mosquito production, larval source reduction can be the most effective means of vector control. Larval source management involves the removal, modification, and monitoring of aquatic habitats to reduce mosquito breeding and human-vector contact. Interventions for reducing larval habitat range from simple (e.g., removing water-holding containers such as tires), to moderate (e.g., clearing house gutters, roadside ditches and detention basins), to complex (e.g., implementing Rotational Impoundment Management or Open Marsh Water Management techniques) (Lloyd et. alt., 2018). Similar to surveillance operations, it is conceivable but unlikely that these source reduction operations could result in some level of individual take on monarchs. However, there is no evidence that more than a limited number of individual monarchs would experience negative effects from these practices due to the location of these water-holding habitats.

Biological Larval Control

Biological control of mosquito larvae involves introducing other living organisms into the larvae's aquatic environment to reduce the mosquito numbers through predation. Local laws must be considered prior to any biological control action, as the introduction of new species to an area is often regulated or prohibited. Fish, such as *Gambusia affinis* (the mosquito fish) or various minnow and sunfish species are all excellent biological controls for mosquito larvae and perhaps the most well-known biological control mechanism.

Biological control of container-inhabiting mosquitoes can pose significant challenges as these sources of water can be cryptic and ephemeral. Thus, identifying sources then introducing and sustaining biocontrol agents is difficult. For these mosquitoes, simply removing water sources from the environment is generally more effective. However, smaller predators (e.g., *Mesocyclops longisetus* [predacious copepods]) have been used with some success. Mosquito larvae in the genus *Toxorhynchites* are predatory on small aquatic organisms including other mosquitoes and have been associated with reduced populations of *Aedes albopictus* when both species coexist in the same habitat. Bats, birds, and dragonfly nymphs have been suggested as voracious predators of mosquitoes; however, evidence suggests that this is not entirely true. The species are not selective predators of mosquitoes and generally not effective at reducing adult mosquito populations. Hence, the ability to use biological agents, exclusively to control mosquitoes varies widely from excellent to none. There is no evidence that any of these biological agents, if potentially employed, would affect monarch populations.

Larvicide Applications

Insecticide applications conducted to manage immature mosquitoes may be necessary when data from surveillance efforts justifies use or there is a public health need. Despite many program's efforts to remove habitat through their actions or educating the public and the use of biological control measures, applications of various pesticides is the most common form of larval control. The most frequently used larvicide across the country is *Bacillus thuringiensis israelensis* (Bti), a naturally occurring soil bacterium that is both target-specific and environmentally sound. Other common and effective larvicides include another bacterium *Lysinibacillus sphaericus* (also known as *Bacillus sphaericus*), methoprene and pyriproxyfen (both biorational insect growth regulators), spinosad (derived the bacterium *Saccharopolyspora spinosa)*, and several larvicide oils (primarily for control of mosquito pupae).

It should be noted that there are 34 recognized subspecies of *B. thuringiensis* with two distinct groups of toxin proteins, Cry (crystal delta-endotoxins) and Cyt (cytolysins), pathogenic to insect pests. The subspecies used to control mosquito larvae was first described in the late 1970s. Since its discovery *B. thuringiensis* subsp. *israelensis* has been widely used for its targeted and environmentally benign control of several dipteran species, primarily mosquitoes and select fly species (Ramírez-Lepe and Ramírez-Suero, 2012; Kahn et. al., 2016). There is no reported toxicity of Bti to monarch larvae.

Larvicides are applied with a variety of application methods and range from simple hand applications directly into water sources such as cemetery vases or catch basins. In other habitats, compressed air sprayers or manual pump backpacks may be used to apply liquid larvicides to septic ditches, sewage lagoons, log ponds, and dairy waste ponds. Granules or pellets may be applied by hand, rotary disk spreaders, or sling seeders on the back of ATVs. Larger habitats such as wetlands, duck clubs, brackish marshes and coastal habitats are often treated using motorized backpacks, vehicle-mounted, or aerial application (UAS, helicopter or fixed-wing aircraft) equipment. Recently, to combat container-breeding Aedes capable of transmitting the viruses responsible for Zika or Dengue, area-wide, low volume (LV) larvicide spraying has been used to deliver larvicides to large areas effectively and efficiently. Area-wide LV application of larvicides generally uses aqueous suspensions of Bti or slow-release S-methoprene formulations.

Because larvicide products and formulations are specifically designed to target mosquito (and some dipteran) larvae in specific water-holding habitats, there is no reported evidence that monarch populations are impacted by these pesticide applications. Of course, the mere act of traversing the landscape could result in some level of individual take on monarchs present in the landscape. However, these is no evidence that more than a limited number of individual monarchs would experience negative effects from direct exposure to these practices and this take is not likely to affect the monarch butterfly at a population or species level. For this reason, AMCA proposes that all pesticide applications targeting larval mosquitoes be listed as an exception from the prohibitions in the 4(d) rule.

3) Small Scale Adult Mosquito Control Applications

Adulticides are applied to control adult mosquitoes in flight or at rest. Often, the most visible component of a mosquito control program is adult mosquito control or “adulticiding”, which can overshadow the effort expended by a mosquito control program on the many other strategies within the IMM approach. However, the decision to use an adulticide occurs after a pre-established action threshold has been reached which is, in turn, based on mosquito and/or pathogen surveillance data. Adulticide applications are simply one more tool used in a complete IMM program and often occur only after other control efforts have been exhausted. Adulticides can be applied as a ULV spray (discussed below) or as a “barrier” treatment, which involves application of a residual insecticide to structures (or, when necessary, vegetation) where mosquitoes are known to rest (AMCA, 2021).

Small scale mosquito control applications typically utilizehand pump or electric (battery operated) sprayers, handheld ULV or thermal foggers, or backpack mist blowers. These applications are intended to target resting mosquitoes around residential homes and commercial buildings. In some cases, recreational areas and other places of public gathering would employ residual applications to the perimeter areas when mosquito populations have reached defined action thresholds and control is warranted during an event when ULV applications would be less practical. With all application types, synthetic pyrethroids (e.g. bifenthrin, deltamethrin, lambda cyhalothrin, permethrin) are most commonly used. However other products such as the organophosphate malathion and some neonicotinoids (e.g. Imidacloprid) are labeled for mosquito control in these situations and may be used by either homeowners, landscapers, mosquito control professionals or residential pest control operators.

There have been numerous studies to demonstrate that foliar applications of pesticides can be hazardous to a wide variety of insect pests, including monarch butterflies. It has long been known that, both as larvae and adults, monarchs are likely to be killed if exposed to residues of permethrin after barrier treatments for mosquito control (Oberhauser et al, 2006). Because each of the products labeled for residual mosquito control applications are broad spectrum pesticides, it is reasonable to conclude that any direct application to monarch habitat could result in individual mortality. However, the extent of mortality in a field population of monarch butterflies will depend, among other things, on the size of the application and on the proportion of host plants that are treated in a given area.

These smaller residual sprays are typically used when a longer-term population reduction is required. Studies also suggest that barrier spraying of residual insecticides is effective in reducing biting populations of *Aedes* (Trout et. al., 2007; Cilek 2008). These anthropophilic, invasive *Aedes* mosquitoes often require management during a disease outbreak such as during the Zika outbreak in Miami. These applications are primarily applied to vegetation, unmovable large containers, external walls of homes and sheds, fences, etc. in residential backyards and commercial settings. Although this method of application may be effective against the targeted species, it is usually highly focused to specific areas due to the labor and time issues associated with any door-to- door application plan (Faraji et. al., 2016). Furthermore, the possibility of interactions between lepidopterans with these materials has been explicitly recognized by the EPA and pollinator protection warning language can be found on all adult mosquito control, FIFRA-approved product labels intended for use as barriers. If a product is used as labelled by the EPA, the habitats that monarchs are likely to visit are not likely to have been exposed.

Although it is difficult, if not impossible, to quantify the number of individual butterflies that could be impacted by a small scall application to a single property; the USFWS has determined that if other activities (e.g. research or collection) are conducted on a small scale (limited to 250 or fewer monarchs in a given year), the potential for negative impacts to the population would be minimal. AMCA recognizes that these small scale pesticide applications are more likely to have indirect effects on monarchs. However, as stated on page 26 of the listing proposal, the USWS even states that insecticide application using hand-held sprayers are unlikely to result in significant pesticide exposure to monarchs. Similarly, AMCA does not expect the low number of individuals affected from indirect exposure resultant from these applications of pesticides to impact the monarch butterfly at a population or species level. Hence, AMCA proposes that all small-scale pesticide applications that utilize handheld pump or battery operated sprayers, hand held ULV or thermal foggers or backpack mist blowers targeting adult mosquitoes in be listed as an exception from the prohibitions in the 4(d) rule.

4) Wide-Area Mosquito Control Applications

Wide-area adult mosquito control applications are the most visible and, because of their high visibility, can be the most contentious form of mosquito control operation conducted. These applications are often referred to as ultra-low volume (ULV) applications due to the extremely small volume of pesticide utilized (frequently 1.0 oz/acre or less) and are applied with specialized equipment and nozzles via all-terrain vehicle (ATV) mounted, truck mounted, or mounted on aircraft (UAS, helicopter, fixed wing). ULV applications rely on atomizing a liquid insecticide to form millions of very fine droplets and dispersing them through the air.

The products (e.g. pyrethrins, synthetic pyrethroids and organophosphates) used in a ULV application are intended to drift through the target zone, persist in the air, and contact flying mosquitoes. Droplet sizes ranging from 5 to 25 µm for ground and 25 to 35 µm volume median diameter for aerial ULV applications are considered optimal (Mount et. al., 1996; Bonds 2012). Most often, these mosquito adulticide applications are conducted in the evening after sunset or before sunrise, when a thermal inversion has occurred to keep the insecticide from dispersing upward, and in light winds to aid in dispersing the droplets. These droplets are designed to resist impinging on solid surfaces thus minimizing deposition while staying airborne long enough to contact flying mosquitoes. Furthermore, the materials intended for this application methodology have chemical half-lives that are usually measured in hours further minimizing the potential for off-target exposures. These wide area ULV applications are the only effective means of reducing adult mosquitoes and breaking a cycle of disease transmission during epidemics (AMCA 2021) and have been demonstrated to be effective in reducing mosquito vector abundance and lower human WNV case numbers when applied intensively and early in an outbreak (Carnet et. al., 2008; Chung et. al., 2013; Nasci and Mutebi 2019). Therefore, wide-area ULV is a critical tool in the IMM approach for protecting public health and is often the only method available for curtailing an ongoing disease outbreak.

Confronting Wide Area ULV Misconceptions

In many ways, wide area adult mosquito control applications are the most misunderstood form of pesticide application for mosquito control. Hence, it is important to address some of the misconceptions surrounding this ULV application strategy. The first misconception is that ULV mosquito control applications often occur over large areas; therefore, there is significant exposure to nontarget species. We see this expressed in the Monarch Butterfly (*Danaus plexippus*) Species Status Assessment Report, version 2.3b (FWS SSA), Chapter 5, Risk from Insecticides Section, where it is stated that, "Use of insecticides in vector control, especially pyrethroids and organophosphates, may be significant in areas of the country where mosquitoes pose a public health threat or reach nuisance levels." This misstatement is also highlighted in Appendix 5, Monarch Insecticide Exposure Pathways, pg 126, where it is stated, "One significant scenario for this occurrence [*in reference to monarch direct exposure to pesticides*] is in areas subject to mosquito control with pyrethroid and organophosphate insecticides (used as mosquito adulticides)." However, these statements are completely unsubstantiated in the literature. In fact, the best data that we have regarding pesticide use concludes that vector control applications or public health uses of pesticide represents a vastly insignificant amount of pesticides in comparison to total pesticide use.

Although there is not good nationwide data for the amount of pesticide used for mosquito control in comparison to other application types, the state of California does have a rigorous pesticide use reporting mechanism and gives us this information for one of the larger states in the US that is actively managing mosquitoes through a network of independent IMM programs. Vector control in California is conducted statewide by 70 special districts or other local government agencies. These agencies encompass approximately 70,000 square miles, almost half the land area of the state, and provide services to 85% of Californians. With this much of the state conducting mosquito control, it would make sense that the use of insecticides in vector control would be significant. However, the state's pesticide use reporting shows us that during the 15-year period 1993–2007, public health pesticide use averaged 1.75 million lbs (0.79 million kg) of active ingredient. This use accounted for less than 1% of reportable pesticide use statewide and ranked below major crop uses and many other nonagricultural uses (Howard et. al., 2010). In looking at the California state pesticide use reports, we see similar numbers for recent years as well. In 2022 (the latest data available), total Public Health pesticide use (as pounds applied) was just under 0.3% of the total amount of pesticides used in the State. This same trend was reported in 2021 with public health pesticides totaling approximately 0.26% of the state's pesticide use. It should also be noted that these numbers reflect all public health pesticides, including larvicides and a small amount of usage for non-mosquito applications. In fact, agricultural use of naled (a pesticide highly correlated with mosquito control applications programs) exceeded the amount used for mosquito control (72% used in agricultural applications vs 28% by mosquito control districts; CDRP Data, 2022). Hence, the best available data we have does not support the misconception that the use of insecticides in vector control may be significant in areas of the country where mosquitoes pose a public health threat or reach nuisance levels.

The second misconception concerns the correlation between pesticide use and monarch (and other species) declines. Pesticides, rightfully so, are routinely cited as a stressor to species such as the monarch. The misconception is that mosquito control uses pesticides; therefore, mosquito control applications are readily attributed to the decline of monarchs, among a host of other species. For example, in an Earth Justice press release (2024), they make the common statement that "the monarch is a species whose decline has been linked to pesticides". Of course, the public and conservation-minded individuals easily connect that statement of pesticide use to mosquito control. However, the reference cited for that statement (Van Deynze et. al., 2024) looked at 17 years of land use, climate, multiple classes of pesticides, and butterfly survey data across 81 counties in five states in the US Midwest. They determined that community-wide declines in total butterfly abundance and species richness was most strongly associated with insecticides, in general. However, for butterfly species richness the use of neonicotinoid-treated seeds was the primary pesticide use type of concern. Van Deynze et. al. (2024) properly concludes that three most widely recognized global drivers of insect declines are land conversion, climate change, and agricultural pesticides (insecticides and herbicides). "In fact, agricultural chemical applications are, alone, the only putative driver of herbivorous insect declines specifically formulated to be either directly lethal to insects (insecticides) or to reduce the cover of plant species (herbicides) in the immediate or surrounding landscape on which many insects depend (Li et. at., 2023)". A fact that appears supported by Hasch et. al. (2020), see below.

The many sub-lethal effects of pesticides, along with the potential interactions of numerous environmental factors that can occur in different combinations makes it difficult to isolate the impact of any single factor that affects a species' decline (Wagner 2020). When we consider all the various formulations and use types for a single pesticide or class of pesticides, it is impossible to test for all possible combinations for effects. Hence, broad generalizations are often made, such as seen above. For instance, pyrethroids have been found to be among the most potent agents of toxicity for monarchs, much more so than neonicotinoids (Krishnan et. al., 2021). However, pyrethroids were not as strongly associated with lower monarch abundances or for the larger butterfly community declines as neonicotinoids (Van Deynze et. al., 2024). One potential explanation for this is that many of these pesticides, especially synthetic pyrethroids, are used reactively and not preemptively, i.e. seed-treated pesticides, so there is less potential for build-up in the environment.

Recent studies demonstrate the widespread exposure of monarchs and other insects to pesticides in agricultural areas through consumption of milkweed and nectar contaminated at sublethal levels (James 2024; Wagner 2020; Van Deynze et. al., 2024). Furthermore, in a summary of 26 studies that tested the direct effect of pesticides on monarchs or exposure potential, 18 indicated pesticides had a negative effect on at least one, if not multiple, monarch fitness metrics at a specific life stage (James 2019; Knight et al., 2021; Krishnan et al., 2020). Clearly pesticides are stressors for monarch survival, yet to experience these affects they must first be exposed to the pesticide. And research shows that agricultural use types, not ULV mosquito control applications, result in the vast majority of that exposure.

The idea of significant exposure from ULV applications leads to our third major misconception and can found in research as cited in Chapter 7 of the FWS SSA, in which mosquito control applications are improperly implicated as resulting in widespread exposure over a variety of land use sector. There it states, "In addition, insecticide exposure is occurring across a wide variety of land use sectors. A study in the central valley of California, for example, detected pesticides in all land use types (Halsch et. al. 2020, p. 13). Insecticides are used by: homeowners to control pests in yards and gardens or planting neonicotinoid-treated ornamentals from garden centers; municipalities to control mosquito populations (WAFWA 2019, p. 16) to prevent the spread of infectious diseases (i.e., West Nile virus, Zika virus)". Halsch et. al. (2020) is cited in numerous research articles as evidence that monarchs are exposed to a variety of pesticides. The investigators looked at a suite of pesticides that could potentially contaminate milkweeds in the Central Valley of California which covers a large amount of agricultural and urban habitats. Their results demonstrated that a total of 64 separate compounds were on at least one leaf sample collected. Of these compounds, 25 were insecticides (including two insecticide metabolites), 27 were fungicides, 11 were herbicides, and 1 was a common adjuvant. However, only one of those 64 compounds is labeled for ULV mosquito control applications, Etofenprox. Both detections of Etofenprox occurred at agricultural sites.

Hasch et. al. (2020) sampled leaves from a variety of land use types, including agriculture, wildlife refuges, urban parks and gardens, and plants sold in retail nurseries in six different counties. It should be noted that there are mosquito control programs that routinely conduct ULV mosquito control applications in each of the counties that were sampled in the study. Hence, if mosquito control applications were a significant source of exposure, it would only stand to reason that more pesticides labeled for mosquito control would have been detected. There is one caveat that we should address. Pyrethroid insecticides and some fungicides could not be detected with the laboratory methods used. Mosquito control applications in this area would have used pyrethroid insecticides; however, these programs also rely on the application of organophosphates (malathion and naled) which were not detected.

The fourth, and final, misconception AMCA would like to address is that large, wide area applications lead to large amounts of pesticide use and environmental exposure. This point was, in part, discussed above and we have excellent data from California demonstrating that wide area ULV applications are attributed to less than 1% of the pesticide used in the state. As toxicologists and mosquito control professionals well understand, exposure is a result of toxicity and dose. One of the primary methods that mosquito control professionals use to decrease exposure to all nontarget organisms (e.g. honey bees, people, listed species) is by conducting ultra-low volume applications. But few people understand exactly how low this volume is when used for truck or aircraft-mounted mosquito control applications. If we look at just a couple of common synthetic pyrethroids used in area wide mosquito control applications, we can compare public health application rates to agricultural use application rates.

For most synthetic pyrethroids labeled for ULV mosquito control applications, the maximum application rate is 0.007 lbs of active ingredient (AI) per acre (as per EPA-approved labels). A few have lower maximum application rates. If we just compare EPA-approved label application rates for the use of permethrin for an agricultural pest versus in a mosquito control application; agricultural operators are able to apply 21.4 to 42.8 times more permethrin per acre (agricultural application rates vary considerably based on crop and pest; many corn labels list a 0.3 lb AI/ac max rate). Another commonly used pyrethroid, deltamethrin, yields a similar disparity. With a maximum application rate of 0.00134 lbs AI/ac; mosquito control ULV applications use 24.6 time less deltamethrin in comparison to agricultural use of deltamethrin per acre. These extremely low application rates, although effective for managing mosquitoes, vastly decreases the exposure to nontarget organism, such as the monarch.

Exposure Data for Monarchs Supports a Lack of Population Level Take

Given the data cited above, AMCA strongly believes that ULV wide area mosquito control applications that are conducted in accordance with any existing regulations, permit and label requirements, and best management practices will not result in population or species level take to the monarch butterfly. There are studies, however, that demonstrate at least some level of individual harm caused by mosquito control applications (Salvato 2001).

As previously stated, AMCA acknowledges that the insecticides currently used to conduct adult mosquito control are broad spectrum and toxic to most insects. As discussed, these pesticides are applied over large areas, but with improved application technology applicators are able to use smaller amounts of product atomized into very fine droplets that remain aloft enabling these droplets into contact flying mosquitoes. Peterson (2024) provides an overview of the published data examining the risks to nontarget insects or their relatives from exposure to mosquito adulticides. Of particular interest for this Comment, Peterson determines that risks to butterfly species need more study and, in particular, more operational-level before-and-after studies are needed.

Nevertheless, mosquito control applications are commonly attributed to the decline of native and imperiled pollinators. The reality is far from that simple. Kim et. al. (2022) assessed the influence of natural behaviors and ecological interactions of select pollinators and monarch butterflies on their exposure and mortality to ULV adulticides. The authors concluded that monarchs roosting above 4 meters and bumblebee access to hives at night reduced ULV adulticide mortality, respectively, while roosting among vegetation did not. Their results suggests that there may be a benefit to butterflies with increased plant diversity, habitat structure, or age leading to more elevated roosting sites. Habitat structure could be one of the influential factors determining the level of nontarget effects. In addition, malathion-treated host plants provided some protection against egg parasitoids, but increased predation of monarch caterpillars by *Polistes* paper wasps suggesting that pollinators may not always be negatively impacted by operational mosquito control practices. These findings would be hard to discern from strictly laboratory susceptibility or caged specimen assays and reinforce the value of performing mosquito adulticide spray missions at night after diurnal pollinators are inactive. Similarly, several of the studies reported by Peterson (2024) did not conclusively determine that butterfly populations in nature are adversely impacted by mosquito control adulticides. For example, butterfly diversity has continued to persist in areas (e.g., Key West) that are treated with mosquito adulticides while reduced diversity has been found in unsprayed areas, e.g., Everglades National Park (Kim et. al., 2022).

In another study, researchers observed the effects of deltamethrin exposure on monarch butterflies through ingestion of contaminated foliage. Monarch caterpillars that had fed on leaves exposed to the adulticide DeltaGard exhibited increased mortality compared with control insects, with generally greater impacts on larvae at closer spray distances (Giordano et. al., 2020). These findings suggest that larval mortality is more likely to occur on host plants closest to a vehicle's spray path, which supports the findings of Oberhauser et al. (2009) that highest mortality rates were observed in monarch larvae directly exposed to pyrethroids closest to the truck path (<100 feet). Because, truck ULV applications are typically conducted in residential areas, backyard milkweed gardens could become important monarch reproduction sites (Geest et al., 2019) and provide a refuge if they are of sufficient quality and distance from spray paths. For mosquito ULV applications, exposure seems to be relatively low because it is greatly reduced by night applications of the adulticides (Kim et. al., 2022), as well as through the application of ultralow-volume droplets that do not readily deposit on foliage beyond a relatively close distance to an application vehicle (Oberhauser et. al., 2009; Geest et. al., 2019).

Another factor that perhaps leads to less exposure for monarchs is their mobility. Grant et. al. (2022) concluded that breeding monarchs in the North Central states should be resilient to pesticide use and habitat fragmentation. This conclusion is a promising when we consider that that Minnesota (13.1%–13.6%), Texas (5.6%–5.9%), and Ontario (5.0%–5.4%) are the states/provinces with the highest abundances of monarchs during peak mosquito control months - 15th July to 15th August (Momeni-Dehaghi et. al., 2021). Even though foliar applications of insecticides could impact monarch larvae and eggs downwind of treated crop fields and from mosquito applications because of insecticide spray drift, Grant et. al. (2022) conclude that these areas would likely be recolonized by other mobile females in the landscape and these treatment areas would not become population sinks. Kim et. al. (2022) also found monarch caterpillars to be surprisingly resilient to feeding on malathion ULV spray-treated host plants, and mortality of caterpillars from all size classes and treatments did not exceed 25%.

There is little doubt that the primary driver of monarch decline is thought to be driven by habitat loss of the breeding grounds. Furthermore, the increased usage of pesticides in conventional agriculture has been implicated as the leading causative pesticide-related factor of monarch population declines (Belsky and Joshi 2018). Yet there is indirect evidence to suggest that migration-related mortality does affect the wintering population size (Saunders et. al., 2019). Moreover, studies (Flockhart et. al., 2015; Oberhauser et. al., 2017) suggests high rates of migration-related mortality and substantial regional differences in mortality rates can vary across latitude and longitude due to a variety of factors. AMCA would suggest that the best scenario to limit the impact of pesticides on migrating monarchs would be to avoid applications to identified roosts. Furthermore, for the larger eastern migrating population, models are in general agreement in identifying similar areas in the Atlantic Coastal Plain and Appalachian Mountain ridges that contained the greatest amount of potential roosting habitat, accounting for <3% of the study region (Boxler et. al., 2024). Determining an effective means for identifying these migratory roosts could provide more targeted avoidance or mitigation areas and lead to greater conservation and protection of the species while allowing incidental take from mosquito control applications.

Concluding Comments

Finally, AMCA would like to acknowledge and thank the USFWS for requesting comments on the proposed Monarch listing. It is vital for the nation's public health infrastructure that mosquito control applications remain a viable tool and that registrants are encouraged to develop new products labeled for public health mosquito control. We hope to work with the USFWS further as they consider proposed exceptions to the prohibition within the 4(d) rule and hope to improve the approach all applicators must use to protect endangered species while considering the gravity these decisions may have for public health. Additionally, if the comment period is extended or reopened, AMCA may submit further comments as we discover new or relevant information.

AMCA has detailed 4 relatively broad actions or application types that are important components to our member's IMM operations:

1. Mosquito Surveillance Operations
2. Larval Mosquito Control Operations
3. Small Scale Adult Mosquito Control Applications
4. Wide Area Mosquito Control Applications

Each action is necessary to manage mosquitoes and reduce the risk of mosquito-borne disease outbreaks in the United States. Hopefully, USFWS agrees with our stance that although some incidental take may be resultant from each of these mosquito control operations, the level of take would be minimal and not likely to affect the monarch butterfly at a population or species level. With the support of the various studies cited, AMCA proposes that not all mosquito control pesticide uses or application methods will impact monarchs.

AMCA seeks a ruling that would provide mosquito control applications an umbrella for incidental take regarding the Monarch butterfly. There is precedent for determining that pesticide applications will not cause population level take to a butterfly species, and it is set in the listing of the Puerto Rican harlequin butterfly pertaining to the agricultural use of pesticides (USFWS, Docket ID: FWS-R4-ES-2020-0083). For these reasons, AMCA proposes that mosquito surveillance and control operations, in particular the application of pesticides for the management of mosquitoes, should be provided an exception from the prohibitions within the 4(d) rule. Specifically, take incidental to an otherwise lawful activity caused by normal mosquito control practices, including pesticide use, which are carried out in accordance with any existing regulations, permit and label requirements, and best management practices, as long as the practices do not include clearing or disturbing monarch habitat; or applying pesticides directly to, or contiguous to, critical habitat known to be occupied by monarch butterflies.

Sincerely,

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