**APPENDIX 4-5. Terrestrial species with species range and/or critical habitat overlap only with Mosquito Adulticide Uses**

Both chlorpyrifos and malathion have uses that result in potential overlaps with most listed species ranges and designated critical habitats (*i.e*., mosquito adulticide for malathion; mosquito adulticide and wide area use for chlorpyrifos). Diazinon does not have mosquito adulticide or wide area uses. Mosquito adulticide applications are unique for these chemicals in that the pesticide is applied as an ultra-low volume (ULV) spray designed to target the flying adult vector, with a goal to suspend the pesticide in the air for a prolonged period of time. This type of application generally results in less immediate deposition and increased drift as compared to other conventional application methods. Additionally, the application rates for the mosquito adulticide uses are generally lower than those for other uses (*e.g.* agricultural and non-agricultural uses). Therefore, if a listed species range or critical habitat overlaps with other potential use sites, those uses are expected to be protective of the mosquito adulticide uses (*i.e*., potential exposures are expected to be higher with most of the non-mosquito adulticide uses). A limited number of terrestrial species (listed in **Table A 4-5.1**) are identified where the only buffered use that overlapped with their species range is the mosquito adulticide use for malathion and mosquito adulticide and wide area use (*e.g.,* general outdoor treatments around perimeters and ant mounds for pests) for chlorpyrifos.

**Table A 4-5.1.**  Listed terrestrial species with species range overlap only with mosquito adulticide uses1

|  |  |  |  |
| --- | --- | --- | --- |
| Species ID Number | Common Name | Scientific Name | Group |
| 7731 | Langford's tree snail | *Partula langfordi* | Snails |
| 8166 | Pacific sheath-tailed Bat | *Emballonura semicaudata rotensis* | Mammals |

1 For chlorpyrifos, these species also overlap with wide area use

Due to the unique aspects of the mosquito adulticide applications compared to other conventional application methods (*e.g.*, high release heights and ULV applications), the standard exposure modeling (*e.g.*, assuming 100% of what is applied is deposited on the crop area) employed for agricultural and general non-agricultural applications is not adequate to asses this use. As such, standard modeling methods are modified to account for the unique aspects of the mosquito adulticide use pattern. This is outlined in **APPENDIX 3-3.** Based on the results of the analysis presented in **APPENDIX 3-3**, an application efficiency (*e.g.*, a measure of how much active material lands on the spray block) is determined for malathion and chlorpyrifos and is applied to the modeled rates for terrestrial exposures, as represented in **Table A 4-5.2**. For the mosquito adulticide use, two scenarios are modeled to represent one single application as well as multiple applications based on labeled uses for malathion and chlorpyrifos. The application rate is adjusted using the application efficiency to estimate the fraction of the amount applied that reaches the ground and is available for consumption by terrestrial animals.

**Table A 4-5.2.** Modeled application scenarios for terrestrial exposure through mosquito adulticide uses

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Chemical | Labeled application rate (lb a.i./A) | Application efficiency1 | Modeled rate (lb a.i./A) | Number of applications | Application interval (days) | Application method |
| Malathion | 0.23 | 0.29 | 0.067 | 1 | NA | Aerial |
| 0.067 | 6 | 3 | Aerial |
| Chlorpyrifos | 0.01 | 0.21 | 0.0021 | 1 | NA | Aerial |
| 0.0021 | 26 | 2 | Aerial |

1Details on how the application efficiency was determined are found in **APPENDIX 3-3**

Chlorpyrifos and malathion can also be applied via ground application. EPA has yet to approve the use of the ground modeling algorithm, available in the AGDISP model, for use in assessing ground applications of pesticides. Therefore, modeling of ground applied adulticides could not be conducted. However, in 2013, EPA (DP Barcode 407817, 3/28/2013) conducted a comparison of ground and aerial applications of adulticides using open literature information and other modeling and concluded that the maximum deposition was similar between the two methods of application. Based on this analysis, ground deposition fractions are considered to be the same as those expected for aerial applications.

For all of the species listed in **Table A 4-5.1** terrestrial modeling is completed using the TED tool and a terrestrial weight of evidence matrix is created based on these results. For malathion, modeling is conducted only for mosquito adulticide use, as this is the only use pattern pertaining to these species; however, for chlorpyrifos, modeling is conducted on mosquito adulticide and wide area use. Detailed results for each line of evidence are found in the weight of evidence matrices (**Supplemental Information 1**).

For both species and their critical habitats, an *LAA* call is reached based on all lines of evidence presented in the weight of evidence matrices. For malathion, for the Langford’s tree snail, mortality thresholds are exceeded the dietary pathway, but the risk is low for other direct lines of evidence such as growth and reproduction (although limited sublethal toxicity endpoints are available for comparison) as well as for potential indirect effects. For the bat, potential risk for direct effects is low (medium confidence due to deficiencies in surrogacy of species data), but indirect effects due to the impacts to prey have HIGH risk. Therefore, for malathion, an effects determination of *LAA* is reached for these 2 species. Considering chlorpyrifos, all modeling for mosquito adulticide alone follows the same trends as malathion with some lines of evidence showing higher risk (*i.e.,* effects on reproduction for the snail and effects on behavior for the bat). When wide area use is considered in addition to the mosquito adulticide use for chlorpyrifos, predicted risks are equal to or greater than those predicted through modeling mosquito adulticide use alone. Details for each species, the modeled uses and rates and lines of evidence are provided in **Supplemental Information 1**.

A summary of the effects determinations for the 2 species and their critical habitats are shown below in **Table A 4-5.3**.

**Table A 4-5.3.** Summary of the effects determinations for species with range and/or critical habitat overlap limited to mosquito adulticide uses for malathion and chlorpyrifos1

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Species Common name** | **Species Scientific name** | **ID number** | **Malathion** | **Chlorpyrifos** |
| **Species Call?** | **Critical Habitat Call?2** | **Species Call?** | **Critical Habitat Call?2** |
| Langford's tree snail | *Partula langfordi* | 7731 | **LAA** | **LAA** | **LAA** | **LAA** |
| Pacific sheath-tailed Bat | *Emballonura semicaudata rotensis* | 8166 | **LAA** | **LAA** | **LAA** | **LAA** |

 1 For chlorpyrifos, these species also overlap with wide area use. Detailed weight of evidence matrices are contained in **Supplemental Information 1**.