Integration and Synthesis Summary for Hawai‘i Species

This Integration and Synthesis Summary includes our jeopardy analysis for any species that we or EPA determined will “likely be adversely affected” by the proposed action. Our jeopardy analysis of the proposed action’s impacts to listed species is split into three major factors: vulnerability, exposure, and toxicity. The tables below contain summaries of our rankings (high, medium, low) for vulnerability, exposure, and toxicity. Data and information used to determine each individual species’ rankings, including environmental baselines, cumulative effects, exposure information, and expected toxic effects for all species, and a template worksheet to show how rankings were assessed and combined are in Appendix E. Status of the species for each species can be found in Appendix B.

Vulnerability

For the listed Hawaiian species that we or EPA determined are “likely to be adversely affected” by the proposed action, we considered several factors for each species to determine the current vulnerability of that species to additional stressors. This effort allows us to consider whether a species’ current condition is stable, moving toward recovery, or in further decline. In general, we expect the species’ vulnerability to additional stressors to be higher if they are moving toward further decline than if their condition is improving. We also identify which species are most (and least) susceptible to additional stressors in general based on information that could be surmised from species listing and recovery documents, or other sources as cited and considered in the Status section of this biological opinion.

Our assessment of vulnerability focuses on seven factors: (1) the species listing status and recent 5-year status review recommendation (if available), (2) distribution, (3) number of populations, (4) species population trends, (5) if pesticides have been noted as a threat, (6) if pollinator loss has been noted as a threat (for listed plant species), and (7) impacts from activities associated with environmental baseline and cumulative effects. We obtained the information to create the vulnerability summary from the Status of the Species accounts (Appendix B), the overarching Environmental Baseline section of this Opinion, 5-year species status reviews, species recovery plans, species status assessments, and other sources containing the best available scientific information for the species.

We scored each of the seven vulnerability components with high, medium, or low scores. We assigned a high vulnerability ranking to a species if all vulnerability components were scored as medium or high. We assigned a medium vulnerability ranking if a species’ scores were a mix of high, medium, and low (though exceptions were allowed for species that have a low status score or an uplisting recommendation). We assigned a low vulnerability ranking to species with only low scores. Considerations regarding specific aspects of the species’ vulnerability or beyond what was included in the vulnerability ranking were applicable for some species depending on unique aspects of their life history. This information is reflected in the rationales for conclusion below.

Exposure

We anticipate the main route of exposure to listed terrestrial invertebrates is through contact with carbaryl residues in the air (from direct applications and spray drift) as well as residues on surfaces. Listed aquatic species will primarily be exposed to carbaryl through contact with dissolved residues in the waterbodies individuals occupy. We expect the primary route of exposure to listed terrestrial vertebrates will be dietary, through the consumption of contaminated food items. We do not anticipate significant exposure through inhalation or dermal contact with residues on surfaces or in the air for listed vertebrate species.

As a result of the 2022 FIFRA Proposed Interim Decision and the 2024 NMFS biological opinion for carbaryl, all carbaryl products registered for agricultural uses are prohibited in the state of Hawaiʻi, with only developed (e.g., residential) and open space developed uses (e.g., turf or golf course uses) remaining as registered uses in Hawai'i. As such, we focus our exposure analyses for Hawaiʻi species on developed and open space developed Use Data Layers (UDLs) only. Data provided by EPA indicate low to high levels of overlap between species' ranges and developed and open space developed UDLs. However, UDLs for non-agricultural uses tend to be less defined than those for agricultural UDLs and may not accurately represent the actual footprint of these use sites on the landscape. As such, we assess exposure of species to non-agricultural uses of carbaryl in a qualitative manner, considering the life history of species, methods of application, past carbaryl usage, and any existing conservation measures to reduce drift and runoff or otherwise limit exposure to species. To facilitate this analysis, for every species in this Appendix, we reviewed species' documents (e.g., 5-Year Reviews, recovery plans, listing rules) to determine if the species and their prey could occur on developed or open space developed carbaryl use sites and the manner in which they may rely on these sites.

For most species, we anticipate developed and open space developed uses will not result in significant levels of exposure. We generally do not expect listed species are likely to be exposed to non-agricultural uses of carbaryl as there are several existing mitigation measures that are protective of listed species. In addition, based on application information, we anticipate most carbaryl uses in these UDLs are restricted to small areas that are treated infrequently over long periods of time. Furthermore, as a result of the 2022 FIFRA Proposed Interim Decision and the 2024 NMFS biological opinion for carbaryl, most treatments in developed areas are limited to spot and crack treatments (defined as a 2-ft^2 area), crack-and-crevice treatment, or narrow perimeter bands around urban structures (from 1 inch to 6 feet). This limitation in application method renders off-site spray drift unlikely and greatly reduces the areal extent that can be treated on many use sites within the developed and open space developed areas. Furthermore, product labels require applicators to use a 25-foot buffer to aquatic habitats (such as, but not limited to, lakes, reservoirs, rivers, permanent streams or ephemeral streams when water is present, wetlands or natural ponds, estuaries, and commercial fish farm ponds), prohibits irrigation to the point of runoff, and restricts application within 48-hours of a forecasted rain event, all of which will reduce the extent of runoff from developed and open space developed use sites.

Toxicity

We characterize the expected toxic effect to species based on the anticipated level of direct and indirect[1] adverse effects to individuals. Our analysis of toxicity assumes individuals are exposed to carbaryl at levels estimated by EPA's environmental exposure modeling and is focused on determining the level of adverse effect expected to occur once exposure has taken place. Direct effects are based on the anticipated level of mortality and sublethal effects (e.g., reduced growth, reproduction, impaired motor activity or behavior) likely to occur in exposed individuals. Indirect effects are based on the impact a listed species is likely to experience when the organisms they rely on, such as those that act as food or habitat resources, are exposed to carbaryl and experience adverse effects.

Based on available toxicity data, we anticipate arthropod species are highly sensitive to carbaryl exposure and are likely to experience high levels of direct adverse effects even at low levels of exposure. In contrast, we anticipate vertebrate species are less sensitive to carbaryl exposure and are only likely to experience direct adverse effects when exposed to relatively high levels of carbaryl. Flowering plants that depend solely on insect pollinators are likely to experience a high level of indirect adverse effects, while plant species that can be pollinated by other taxa groups (such as birds) are likely at less risk of indirect adverse effects. Plants that use abiotic pollination vectors (such as wind pollination) will not likely experience any adverse effects from the proposed action as available toxicity data indicate plants are not likely to experience any adverse effects at estimated environmental concentrations.

Summary of Hawaiian Species Conclusions

After reviewing the current status of the species, the environmental baseline for the action area, the effects of the proposed action, and the cumulative effects, it is our biological opinion that the registration of carbaryl, as proposed, is not likely to jeopardize the continued existence of 89 of the 94 Hawaiian species in this Appendix. For the other five species in this Appendix, we expect the registration of carbaryl, as proposed, to jeopardize the continued existence of the species in the wild and we provide additional information about these species below.

In our analysis below, some species that had the same or very similar rationales for their conclusions were grouped together, to increase efficiency and avoid repetition. Relevant information and data unique to each individual species was considered when assigning species to groups and incorporated into the rationales as appropriate. Species-specific information (e.g.,

[1] While our Opinion considers all consequences of the proposed action (per the definition of effects of the action at 50 CFR Part 402.02), the terms "direct" and "indirect" effects were used in EPA's BE, and are used in environmental risk assessment terminology in general, and do not have the same meaning as used in ESA regulations. As used in the effects analysis section, direct effects to species are those caused by the pesticide itself through dietary, dermal, or inhalation routes of exposure. Indirect effects occur when the pesticide acts on elements of the ecosystem that are required by the species, such as alterations to prey or shelter. Thus, in the effects analysis section, we may use these terms to link back to the analysis in EPA's BE.

environmental baseline, cumulative effects, status of the species, exposure, and toxicity) was considered for all species, including those species in the grouped analyses, and are presented in full in Appendices B and E. Species with rationales that did not fit in a group, or warranted a separate rationale because of their life history, conservation status, or other information indicated that effects could be different, have an individual discussion to provide additional explanation. This approach allowed us to streamline our discussion in this Opinion by avoiding repeating our findings when species in the respective groupings would be expected to be affected similarly. The use of these groupings, therefore, does not mean that our evaluation failed to evaluate each individual species. On the contrary, our process and analysis for each species remained the same, regardless of the format of the discussion presented below.

Terrestrial Vertebrates

This section includes most terrestrial vertebrates addressed in this biological opinion that are found in Hawai‘i. While we present some specific information about the species in Table 1, we provide additional information on vulnerability (including environmental baseline and cumulative effects), exposure, and toxicity in Appendix E. The status of the species accounts can be found in Appendix B.

Table 1. Listed terrestrial vertebrates in Hawai‘i included in this consultation.

Taxa	Scientific Name	Common Name	Vulnerability Ranking	Exposure Ranking	Toxicity Ranking	Determination
Birds	*Anas wyvilliana*	Hawaiian duck	High	Low	High	No Jeopardy
Birds	*Fulica alai*	Hawaiian coot	High	Low	High	No Jeopardy
Birds	*Gallinula galeata sandvicensis*	Hawaiian common gallinule	High	Low	High	No Jeopardy
Birds	*Himantopus mexicanus knudseni*	Hawaiian stilt	High	Low	Low	No Jeopardy

The species listed in Table 1 have a medium or high vulnerability ranking, indicating that the species are likely less robust to any adverse effects that occur to individuals. However, these species have low exposure rankings, indicating that no more than low numbers of individuals of these species are likely to be exposed to carbaryl. While many of these species can be exposed through developed or open space developed uses of carbaryl, we anticipate exposure is unlikely to occur given the specific areas these species are found in. The Hawaiian duck, Hawaiian common gallinule, Hawaiian stilt, and Hawaiian coot can occur on non-agricultural carbaryl use sites, including artificial reservoirs, irrigation ditches, and sewage or wastewater treatment plants (USFWS 2011), all of which are areas where we anticipate low levels of carbaryl usage. Furthermore, we expect existing conservation measures on product labels, such as a restriction to only apply carbaryl using spot, crack-or-crevice, or narrow perimeter bands (from 1-inch to 6-feet wide perimeters) around built structures, most likely using hand-held equipment, greatly reduces the extent of area that can be treated and renders off-site and off-target exposure unlikely. While there are exceptions to these measures for applications to soil, lawn, turf, or vegetation, we do not anticipate these exceptions are relevant to these species as product labels also require a 25-foot application buffer from all aquatic habitats and applications are not registered for reservoirs or treatment plants where these birds are found. Thus, we do not anticipate the Hawaiian duck, Hawaiian common gallinule, Hawaiian stilt, and Hawaiian coot are likely to experience more than low levels of exposure.

Aside from the Hawaiian stilt, all species in Table 1 have a high toxicity ranking. Given that carbaryl is not likely to bioaccumulate in aquatic organisms, and the Hawaiian stilt primarily consumes aquatic invertebrates, we do not anticipate the stilt is likely to accumulate more than low levels of carbaryl nor is it likely to experience mortality or sublethal adverse effects. Dietary exposure will vary depending on the food item consumed, application rate of carbaryl, and whether individuals are foraging directly on use sites or in adjacent areas. Maximum estimated dietary exposures for the Hawaiian duck, Hawaiian common gallinule, and the Hawaiian coot foraging directly on use sites range from 250-364.5 mg/kg-bw, which are associated with carbaryl use on turf, lawns, and golf courses. While we do not anticipate individuals are likely to experience mortality at these exposures, we anticipate individuals are at risk of neurological effects, ranging from hypo-reactivity and reduced muscle coordination to complete immobility. While these neurological effects are temporary, they may negatively impact an individual's long-term survival. As such, the Hawaiian duck, Hawaiian common gallinule, and Hawaiian coot have a high toxicity ranking.

Despite having high toxicity rankings, we anticipate very few individuals are likely to be exposed and adversely affected based on habitat preferences of these waterbirds that generally restrict these species to wetland areas. As such, we do not expect Hawaiian duck, Hawaiian common gallinule, and the Hawaiian coot to be exposed to carbaryl on turf, lawns, or golf courses where carbaryl concentrations are expected to reach concentrations associated with adverse effects. In addition, we expect low levels of usage within the non-agricultural areas these species use, and that existing conservation measures on product levels will limit transport off use sites. After adding the effects of the action and cumulative effects to the environmental baseline, and in light of the status of the species, we have determined the proposed action is not expected to appreciably reduce the survival and recovery of the species in the wild. Therefore, it is our biological opinion that the proposed action is not likely to jeopardize the continued existence of the Hawaiian duck, Hawaiian common gallinule, Hawaiian stilt, and Hawaiian coot.

References:

U.S. Fish and Wildlife Service. 2011. Recovery Plan for Hawaiian Waterbirds, 2nd Revision. Portland, Oregon. 255 pp.

Invertebrates

This section includes most invertebrates addressed in this biological opinion that are found in Hawaiʻi. While we present some specific information about the species in Table 2 below, we provide additional information on vulnerability (including environmental baseline and cumulative effects), exposure, and toxicity in Appendix E. The status of the species accounts can be found in Appendix B.

Table 2. Listed invertebrate species in Hawai'i considered in this consultation.

Taxa	Scientific Name	Common Name	Vulnerability Ranking	Exposure Ranking	Toxicity Ranking	Determination
Arachnids	*Adelocosa anops*	Kauai cave wolf or peʻe peʻe maka ʻole spider	High	Low	High	No Jeopardy
Crustaceans	*Procaris hawaiana*	Anchialine pool shrimp	High	Low	High	No Jeopardy
Crustaceans	*Spelaeorchestia koloana*	Kauai cave amphipod	High	Low	High	No Jeopardy
Crustaceans	*Vetericaris chaceorum*	Anchialine pool shrimp	High	Low	High	No Jeopardy
Insects	*Manduca blackburni*	Blackburn's sphinx moth	High	Low	High	No Jeopardy
Insects	*Megalagrion nesiotes*	Flying earwig Hawaiian damselfly	High	Low	High	No Jeopardy
Insects	*Megalagrion nigrohamatum nigrolineatum*	Blackline Hawaiian damselfly	High	Low	High	No Jeopardy
Insects	*Megalagrion pacificum*	Pacific Hawaiian damselfly	High	Low	High	No Jeopardy
Insects	*Hylaeus facilis*	Easy yellow-faced bee	High	Low	High	No Jeopardy
Snails	*Achatinella* spp.	Oahu tree snails	High	Low	Low	No Jeopardy
Snails	*Erinna newcombi*	Newcomb's snail	High	Low	Low	No Jeopardy

The species in Table 2 have high vulnerability rankings, indicating that the species are likely less robust to any adverse effects that occur to individuals. In addition, most invertebrate species in this group are likely sensitive to carbaryl exposure at estimated environmental concentrations as available toxicity data indicate that arthropod species will likely die even at low exposure concentrations. As such, nearly all species in this group have high toxicity rankings. In contrast, available toxicity data in mollusks show that snails are not likely to experience any adverse effects from carbaryl exposure at estimated environmental concentrations as these species are not sensitive to carbamate insecticides. Thus, the Oahu tree snails and the Newcomb's snail have low toxicity rankings. These species have low exposure rankings, so we expect few individuals will be exposed over the duration of the proposed action.

While pesticides in runoff from urban, resort, and commercial development are noted as specific threats to both anchialine pool shrimp species, we anticipate existing conservation measures will effectively reduce runoff exposure to them. Similarly, the Pacific Hawaiian damselfly and the flying earwig Hawaiian damselfly can occur in streams located near developed areas. Despite this close proximity to potential use sites, we expect exposure will be low as product labels require most developed uses to be applied only using spot, crack-or-crevice, or narrow perimeter bands (from 1-inch to 6-feet wide perimeters) around built structures, most likely using hand-held equipment, greatly reducing the extent of area that can be treated and rendering off-site and off-target exposure unlikely. Furthermore, product labels require a 25-foot application buffer from all aquatic habitats and prohibit the use of carbaryl within 48-hours of a forecasted rain event, further decreasing the likelihood that a runoff event will expose these species. Thus, we anticipate low exposure rankings for the anchialine pool shrimps, Pacific Hawaiian damselfly, and flying earwig Hawaiian damselfly, with very few individuals likely to be exposed over the duration of the proposed action.

The Kaua‘i cave wolf spider and the Kaua‘i cave amphipod are both cave species and are not likely to experience direct exposure to carbaryl residues from spray drift. They may experience exposure through residues contained in surface water that penetrates into their cave habitats. Given carbaryl's rapid degradation rate, we anticipate most carbaryl residues will degrade before surface water enters these species' habitats, suggesting a low likelihood that individuals will be exposed to carbaryl. Furthermore, conservation measures on product labels designed to reduce off-target exposure through runoff (as described in the previous paragraph, including the 48-hour rain restriction, mandatory buffers to aquatic habitats, and treatment footprint reduction for most residential uses to spot, crack-and-crevice, or narrow perimeter bands using hand-held equipment) further reduces the likelihood that the cave spider and cave amphipod will be exposed to carbaryl.

A thorough assessment of the habitat and distribution of the blackline Hawaiian damselfly and Blackburn's sphinx moth indicate that these species are not likely to be found in developed or open space developed areas. The blackline Hawaiian damselfly is found in stream systems in lowland ecosystems of the Ko‘olau and Wai‘anae Mountains (USFWS 2023) and is not likely to occur on or near developed or open space developed areas as these use sites do not represent suitable habitat for the species. Similarly, while the Blackburn's sphinx moth has previously been incidentally found along rights of ways, parking lots, and other highly degraded areas

(USFWS 2019), we do not anticipate carbaryl is likely used in these areas in Hawaiʻi. While there has been one recorded instance of the easy yellow-faced bee found in a residential area, the species has not been seen in these use sites since. Based on the species' life history and known locations, we do not anticipate individuals are likely to occur in developed or open space developed use sites. Given that these species' habitat preferences and known occurrences are in areas that are not likely to be treated with carbaryl, we expect these species are unlikely to experience more than low levels of exposure.

Despite high vulnerability and toxicity rankings, we anticipate the listed arthropods in Table 2 are not likely to experience more than low levels of exposure as they either do not occur in areas on or near developed or open space developed use sites or are sufficiently protected by existing conservation measures on product labels. Thus, we do not anticipate the Kauai cave wolf spider, Kauai cave amphipod, anchialine pool shrimps, blackline Hawaiian damselfly, Blackburn's sphinx moth, Pacific Hawaiian damselfly, easy yellow-faced bee, and flying earwig Hawaiian damselfly are likely to experience more than low levels of exposure to carbaryl. Similarly, we do not anticipate the Oahu tree snails and the Newcomb's snail will experience more than low levels of exposure to carbaryl. After adding the effects of the action and cumulative effects to the environmental baseline, and in light of the status of the species, we have determined the proposed action is not expected to appreciably reduce the survival and recovery of these species in the wild. Thus, it is our biological opinion that the proposed action is not likely to jeopardize the continued existence of the species in Table 2.

References:

U.S. Fish and Wildlife Service. 2023. 5-Year Review Short Form Summary Blackline Hawaiian damselfly (*Megalagrion nigrohamatum nigrolineatum*). Honolulu, Hawaiʻi. 8 pp.

U.S. Fish and Wildlife Service. 2019. 5-Year Review Short Form Summary Blackburn's Sphinx Moth (*Manduca blackburni*). Honolulu, Hawaiʻi. 20 pp.

U.S. Fish and Wildlife Service. 2021. Easy or facilis yellow-faced bee (*Hylaeus facilis*) 5-Year Review Summary and Evaluation. Honolulu, Hawaiʻi. 32 pp.

Flowering Plants: Assessment Groups 4 & 8 – Abiotic Pollination

This section includes all listed plants in Assessment groups 4 and 8 (i.e., monocot and dicot flowering plants with abiotic pollination vectors) addressed in this biological opinion that are found in Hawai‘i. While we present some specific information about the species in Table 3 below, we provide additional information on vulnerability (including environmental baseline and cumulative effects), exposure, and toxicity in Appendix E. The status of the species accounts can be found in Appendix B.

Table 3. Listed Hawaiian plants in assessment groups 4 and 8 considered in this consultation.

Assessment Group	Scientific Name	Common Name	Vulnerability Ranking	Exposure Ranking	Toxicity Ranking	Determination
4	*Cenchrus agrimonioides*	Kamanomano	High	Low	Low	No Jeopardy
4	*Cyrtandra waiolani*	Haiwale	High	Low	Low	No Jeopardy
4	*Eragrostis fosbergii*	Fosberg's love grass	High	Low	Low	No Jeopardy
4	*Ischaemum byrone*	Hilo ischaemum	High	High	Low	No Jeopardy
4	*Neraudia sericea*	No common name	High	Low	Low	No Jeopardy
4	*Panicum fauriei* var. *carteri*	Carter's panicgrass	High	Low	Low	No Jeopardy
4	*Poa sandvicensis*	Hawaiian bluegrass	High	Low	Low	No Jeopardy
4	*Calamagrostis hillebrandii*	Hillebrand’s reedgrass	High	Low	Low	No Jeopardy
8	*Schiedea kealiae*	Ma‘oli‘oli	High	Low	Low	No Jeopardy
8	*Schiedea sarmentosa*	No common name	High	Low	Low	No Jeopardy
8	*Urera kaalae*	Opuhe	High	Low	Low	No Jeopardy

All species in Table 3 have high vulnerability, indicating that the species are likely less robust to additional stressors in their environment. While there is overlap between non-agricultural use sites and the species ranges, with the exception of the Hilo ischaemum, we do not anticipate these species are likely to be exposed to carbaryl as they are not located near developed or open space developed use sites where carbaryl is registered for use. While the Hilo ischaemum is known to occur near golf courses and residential areas, we do not anticipate the species will experience adverse effects because it does not rely on insect pollinators. The species in Table 3 have abiotic pollination vectors, and thus will not experience indirect adverse effects from carbaryl exposure. After adding the effects of the action and cumulative effects to the environmental baseline, and in light of the status of the species, we have determined the proposed action is not expected to appreciably reduce the survival and recovery of these species in the wild. Thus, it is our biological opinion that the proposed action is not likely to jeopardize the continued existence of the species listed in Table 3.

Flowering Plants: Assessment Groups 5 & 9 – Outcrossers with Biotic Pollination vectors

Table 4 includes all listed plants in Assessment groups 5 and 9 (i.e., monocot and dicot flowering plants that require outcrossing with biotic pollination vectors) addressed in this biological opinion that are found in Hawai‘i. While we present some specific information about the species in Table 4 below, we provide additional information on vulnerability (including environmental baseline and cumulative effects), exposure, and toxicity in Appendix E. The status of the species accounts can be found in Appendix B.

Table 4. Listed Hawaiian plants in assessment groups 5 and 9 considered in this consultation.

Assessment Group	Scientific Name	Common Name	Vulnerability Ranking	Exposure Ranking	Toxicity Ranking	Determination
9	*Argyroxiphium kauense*	Mauna Loa (=Ka‘u) silversword	High	Low	High	No Jeopardy
9	*Argyroxiphium sandwicense ssp. sandwicense*	‘Ahinahina	High	Low	High	No Jeopardy
9	*Brighamia insignis*	Olulu	High	Low	High	No Jeopardy
9	*Dubautia herbstobatae*	Na‘ena‘e	High	Low	High	No Jeopardy
9	*Euphorbia haeleeleana*	‘Akoko	High	Low	High	No Jeopardy
9	*Gardenia brighamii*	Hawaiian gardenia	High	Low	High	No Jeopardy
9	*Geranium arboretum*	Nohoanu	High	Low	High	No Jeopardy
5	*Geranium hillebrandii*	Nohoanu	High	Low	High	No Jeopardy
9	*Gouania meyenii*	No common name	High	Low	High	No Jeopardy
9	*Hibiscadelphus distans*	Kauai hau kuahiwi	High	Low	High	No Jeopardy
9	*Remya mauiensis*	Maui remya	High	Low	High	No Jeopardy
9	*Schiedea haleakalensis*	No common name	High	Low	High	No Jeopardy

Assessment Group	Scientific Name	Common Name	Vulnerability Ranking	Exposure Ranking	Toxicity Ranking	Determination
9	*Schiedea salicaria*	No common name	High	Low	High	No Jeopardy
9	*Vicia menziesii*	Hawaiian vetch	High	Low	High	No Jeopardy
9	*Viola helenae*	No common name	High	Low	High	No Jeopardy

The species in Table 4 have high vulnerability rankings, indicating that the species are likely less robust to additional stressors in their environment. However, these species also have low exposure rankings. For each of these species, we evaluated habitat use, occurrence information, and existing protections from recent Service documents to determine whether exposure to developed and open space developed uses of carbaryl is expected to occur based on the species' life histories, stressors, threats, and conservation measures in place as described above. Even though there is overlap between the species' ranges and non-agricultural use sites where carbaryl may be used in Hawaiʻi, we expect that these species and their pollinator communities are unlikely to occur on or near non-agricultural use sites of carbaryl. For example, the kaʻu (Mauna Loa silversword) occurs in two major forest reserves (the Upper Waiakea Forest Reserve and the Kapāpala Forest Reserve) in wet forest or bog habitats, which we do not anticipate occur near developed or open space developed use sites. Similarly, the known locations of Kauai hau kuahiwi (*Hibiscadelphus distans*) populations are on state lands (including the Koaʻie Canyon within the Na Pali Kona Forest Reserve), where we do not anticipate developed or open space developed uses of carbaryl are likely to occur. Some species in this group, like the Maui remya, olulu, Hawaiian gardenia, and nohoanu (*Geranium arboreum*), grow in remote or difficult to access areas, like moist forests on steep gulch slopes, where we do not anticipate carbaryl is likely to be used. After adding the effects of the action and cumulative effects to the environmental baseline, and in light of the status of the species, we have determined the proposed action is not expected to appreciably reduce the survival and recovery of these species in the wild. Thus, it is our biological opinion that the proposed action is not likely to jeopardize the continued existence of the species in Table 4.

Flowering Plants: Assessment Groups 6 & 10 – Biotic Pollination vectors; asexual reproduction or self-fertilization

This section includes all listed plants in Assessment groups 6 and 10 (monocot and dicot flowering plants addressed in this biological opinion that are found in Hawai'i that can reproduce using asexual reproduction or self-fertilization in addition to biotic pollination vectors). While we present some specific information about the species in Table 5 below, we provide additional information on vulnerability (including environmental baseline and cumulative effects), exposure, and toxicity in Appendix E. The status of the species accounts can be found in Appendix B.

Table 5. Listed Hawaiian plants in assessment groups 6 and 10 considered in this consultation.

Assessment Group	Scientific Name	Common Name	Vulnerability Ranking	Exposure Ranking	Toxicity Ranking	Determination
10	*Mezoneuron kavaiense*	Uhiuhi	High	Low	Medium	No Jeopardy
10	*Schiedea obovata*	No common name	High	Low	Medium	No Jeopardy
10	*Solanum sandwicense*	ʻAiakeakua, popolo	High	Low	Medium	No Jeopardy
10	*Stenogyne kanehoana*	No common name	High	Low	Medium	No Jeopardy
10	*Tetramolopium arenarium*	No common name	High	Low	Medium	No Jeopardy
10	*Tetramolopium rockii*	No common name	High	Low	Medium	No Jeopardy
10	*Viola kauaiensis* var. *wahiawaensis*	Nani waiʻaleʻale	High	Low	Medium	No Jeopardy
10	*Stenogyne kauaulaensis*	No common name	High	Low	Medium	No Jeopardy

The species in Table 5 have high vulnerability rankings, indicating that they are likely less robust to additional stressors in their environment. However, they also have low exposure rankings. For each species, we evaluated habitat use, occurrence information, and existing protections from recent Service documents to determine whether exposure to developed and open space developed uses of carbaryl is expected to occur based on the species' life histories, stressors, threats, and conservation measures in place as described above. We expect these species, and their pollinator communities, are unlikely to occur on or near non-agricultural use sites of carbaryl. For example, we do not anticipate *Tetramolopium arenium* is likely to be exposed to carbaryl as the only extant locality of this species is on the northwestern side of the U.S. Army's Pohakuloa Training

Area, which we expect is not likely to use carbaryl. Others, like the uhiuhi (*Mezoneruon kavaiense*), only occur on rough, steep substrates with stony soil, and, as such, are not likely located in areas near developed or open space developed use sites. Similarly, the nani wai‘ale‘ale (*Viola kauaiensis* var. *wahiawaensis*) only occurs in lowland bog or mixed wet shrubland and adjacent wet forest habitat, and as such, its populations (and pollinators) are not likely to occur on or near developed or open space developed carbaryl use sites. Other species in this group, like the popolo‘aiakeakua, grow in remote areas or in locations that are difficult to access, such as talus slopes and gulches, where we do not anticipate carbaryl is likely to be applied for developed or open space developed uses.

Toxicity is expected to be medium for the plant species in this group, mainly due to their ability to rely, at least in part, on self-fertilization and/or vegetative reproduction to reproduce successfully, thus decreasing their reliance on biotic pollination vectors, and decreasing the adverse effects on their reproduction due to exposure of their pollinators to carbaryl. In addition, all the plants in this group use abiotic vectors for some or all seed dispersal and are likely to use a variety of insect species for pollination and/or seed dispersal (i.e., they are pollinator generalists). Therefore, they are likely to recover more quickly from temporary losses of some insect pollinators in a small portion of their range.

While all species listed in this group have high vulnerability rankings and their toxicity rankings are medium, given that exposure is anticipated to be low (as demonstrated by our assessment of each species’ individual habitat requirements and available information on known locations), the risk of indirect adverse reproductive effects to the listed plants from loss of pollinators and/or seed dispersers is low. As a result, while we anticipate minimal adverse effects to these species due to the loss of insect pollinators and seed dispersers and resultant loss of reproductive success from carbaryl exposure, we do not expect that these adverse effects will cause species-level effects due to low expected exposure, partial ability to reproduce successfully without using insect pollinators, reliance on a variety of insect pollinator species for successful reproduction, and use of abiotic vectors for some or all seed dispersal. Therefore, we anticipate the proposed action is not expected to appreciably reduce the survival and recovery of the plant species in this group in the wild, and it is not likely to jeopardize their continued existence.

Flowering Plants: Assessment Groups 7 & 11 – Biotic Pollination vectors; other reproductive mechanisms unknown

This section includes all listed plants in Assessment groups 7 and 11 (i.e., monocot and dicot flowering plants addressed in this biological opinion that rely on biotic pollination vectors and additional reproductive characteristics are unknown) found in Hawaiʻi. While we present some specific information about the species in Table 6 below, we provide additional information on vulnerability (including environmental baseline and cumulative effects), exposure, and toxicity in Appendix E. The status of the species accounts can be found in Appendix B.

Table 6. Listed Hawaiian plants in assessment groups 7 and 11 considered in this consultation.

Assessment Group	Scientific Name	Common Name	Vulnerability Ranking	Exposure Ranking	Toxicity Ranking	Determination
11	*Abutilon eremitopetalum*	No common name	High	Low	Medium	No Jeopardy
11	*Abutilon menziesii*	Koʻoloaʻula	High	Low	Medium	No Jeopardy
11	*Clermontia drepanomorpha*	ʻOha wai	High	Low	Medium	No Jeopardy
11	*Clermontia pyrularia*	ʻOha wai	High	Low	Medium	No Jeopardy
11	*Cyanea dolichopoda*	Haha	High	Low	Medium	No Jeopardy
11	*Cyanea magnicalyx*	Haha	High	Low	Medium	No Jeopardy
11	*Cyanea pinnatifida*	Haha	High	Low	Medium	No Jeopardy
11	*Cyanea profuga*	Haha	High	Low	Medium	No Jeopardy
11	*Cyanea shipmanii*	Haha	High	Low	Medium	No Jeopardy
11	*Cyrtandra crenata*	Haʻiwale	High	Low	Medium	No Jeopardy
11	*Cyrtandra subumbellata*	Haʻiwale	High	Low	Medium	No Jeopardy
11	*Exocarpos menziesii*	Heau	High	Low	Medium	No Jeopardy
11	*Gardenia mannii*	Nanu	High	Low	Medium	No Jeopardy
11	*Isodendrion laurifolium*	Aupaka	High	Low	Medium	No Jeopardy
11	*Kadua coriacea*	Kioʻele	High	Low	Medium	No Jeopardy

Assessment Group	Scientific Name	Common Name	Vulnerability Ranking	Exposure Ranking	Toxicity Ranking	Determination
11	*Kadua degeneri*	No common name	High	Low	Medium	No Jeopardy
11	*Labordia triflora*	Kamakahala	High	Low	Medium	No Jeopardy
11	*Lipochaeta fauriei*	Nehe	High	Low	Medium	No Jeopardy
11	*Lobelia monostachya*	No common name	High	Low	Medium	No Jeopardy
11	*Melanthera kamolensis*	Nehe	High	Low	Medium	No Jeopardy
11	*Melicope balloui*	Alani	High	Low	Medium	No Jeopardy
11	*Melicope lydgatei*	Alani	High	Low	Medium	No Jeopardy
11	*Myrsine linearifolia*	Kolea	High	Low	Medium	No Jeopardy
11	*Neraudia ovata*	No common name	High	Low	Medium	No Jeopardy
11	*Nototrichium humile*	Kulu‘i	High	Low	Medium	No Jeopardy
11	*Phyllostegia pilosa*	No common name	High	Low	Medium	No Jeopardy
7	*Pritchardia aylmer-robinsonii*	Lloulu	High	Low	Medium	No Jeopardy
7	*Pritchardia munroi*	Loulu	High	Low	Medium	No Jeopardy
11	*Pseudognaphalium sandwicensium var. molokaiense*	‘Ena‘ena	High	Low	Medium	No Jeopardy
11	*Sanicula purpurea*	No common name	High	Low	Medium	No Jeopardy
11	*Schenkia sebaeoides*	Awiwi	High	Low	Medium	No Jeopardy
11	*Schiedea hawaiiensis*	Ma‘oli‘oli	High	Low	Medium	No Jeopardy
11	*Schiedea trinervis*	No common name	High	Low	Medium	No Jeopardy
11	*Silene alexandri*	No common name	High	Low	Medium	No Jeopardy

Assessment Group	Scientific Name	Common Name	Vulnerability Ranking	Exposure Ranking	Toxicity Ranking	Determination
11	*Stenogyne kealiae*	No common name	High	Low	Medium	No Jeopardy
11	*Vigna o-wahuensis*	No common name	High	Low	Medium	No Jeopardy
11	*Viola chamissoniana* ssp. *chamissoniana*	Pamakani	High	Low	Medium	No Jeopardy
11	*Viola lanaiensis*	No common name	High	Low	Medium	No Jeopardy
11	*Zanthoxylum hawaiiense*	A‘e	High	Low	Medium	No Jeopardy

The species in Table 6 have high vulnerability rankings, indicating that the species are likely less robust to additional stressors in the environment. However, these species also have low exposure rankings. For each of these species, we evaluated habitat use, occurrence information, and existing protections from recent Service documents to determine whether exposure to developed and open space developed uses of carbaryl is expected to occur based on the species' life histories, stressors, threats, and conservation measures in place as described above. We expect these species, and their pollinator communities, are unlikely to occur on or near non-agricultural use sites of carbaryl. For example, we do not anticipate the *Neruadia ovata*, kio‘ele, a‘e, ma‘oli‘oli, or heau are likely to be exposed to carbaryl as these species are known to occur on the U.S. Army's Pohakuloa Training Area, where we do not expect carbaryl is likely to be used. Other species, like the aupaka, kamakahala, kolea, *Abutilon eremitopetalum*, ko‘oloa‘ula, ha‘iwale (both *Cyrtandra subumbellata* and *Curtandra crenata*), *Kadua degeneri*, nehe (*Lipochaeta fauriei*), kulu‘i, loulu, *Viola lanaiensis*, nanu, and haha (*Cyanea magnicalyx*) occur in remote areas like forested gulch slopes where we do not anticipate developed or open space developed uses of carbaryl are likely to occur. Similarly, species like *Kadua degeneri*, pamakani, *Lobelia monostachya*, awiwi (*Schenkia sebaeoides*), *Stenogyne kealiae*, and haha (*Cyanea dolichopoda*) occur in remote habitats associated with cliff faces, including steep slopes, cliff ledges, or vertical faces, where we also do not anticipate developed or open space developed uses of carbaryl are likely to take place.

These species have medium toxicity rankings as each species' reliance on insect pollinators and/or seed dispersers varies. Species like *Neraudia ovata* and the loulu (*Pritchardia aylmer-robinsonii* and *Pritchardia munroi*) and use abiotic pollination vectors in addition to biotic vectors, indicating that these species will likely be able to successfully reproduce even in scenarios where a pesticide causes insect pollinator mortality. Similarly, species like *Abutilon eremitopetalum*, ‘oha wai, haha (including *Cyanea shipmanii, Cyanea pinnatifida, Cyanea profuga, Cyanea dolichopoda,* and *Cyanea magnicalyx*), ha‘iwale (including *Cyrtandra* *subumbellata* and *Cyrtandra crenata*), and *Lobelia monostachya* use birds in addition to insects as biotic pollination vectors. Available toxicity data indicate that birds are much less sensitive to carbaryl than insects and are not likely to die when exposed to carbaryl at estimated environmental concentrations, indicating that these plants will still have some biotic pollinators available to support reproduction.

While all species in this group have high vulnerability rankings and medium or high toxicity rankings, exposure is anticipated to be low (as demonstrated by our assessment of each species' individual habitat requirements and available information on known locations) and the risk of indirect adverse reproductive effects to the listed plants from loss of pollinators and/or seed dispersers is low. As a result, while we anticipate minimal adverse effects due to the loss of insect pollinators and seed dispersers and resultant loss of reproductive success from carbaryl exposure, we do not expect that these adverse effects will cause species-level effects due to low expected exposure to carbaryl, reliance on a variety of pollinator species for successful reproduction, and use of abiotic or bird vectors for some or all seed dispersal. Therefore, we anticipate the proposed action is not expected to appreciably reduce the survival and recovery of the plant species in this group in the wild, and it is not likely to jeopardize their continued existence.

Species with Individual Integration and Synthesis Summaries

For the species in Table 7, our preliminary vulnerability, exposure, and toxicity rankings indicate that the proposed action may result in moderate to high adverse effects. As such, we discuss each species in more detail in individual Rationales for Conclusion.

Table 7. Hawaiian species with moderate to high adverse effects anticipated from the proposed action.

Taxa	Scientific Name	Common Name	Determination
Mammals	*Lasiurus cinereus semotus*	Hawaiian hoary bat	Jeopardy
Birds	*Branta (=Nesochen) sandvicensis*	Hawaiian goose	Jeopardy
Insects	*Hylaeus longiceps*	Hawaiian yellow-faced bee	Jeopardy
Insects	*Megalagrion xanthomelas*	Orangeblack Hawaiian damselfly	Jeopardy
Plants	*Euphorbia skottsbergii* var. *skottsbergii*	ʻAkoko	No Jeopardy
Plants	*Scaevola coriacea*	Dwarf naupaka	Jeopardy

Rationale for Species Conclusion: Hawaiian hoary bat

Scientific Name:	Common Name:	Entity ID:
Lasiurus cinereus semotus	Hawaiian hoary bat	15

Conclusion

The Hawaiian hoary bat (ʻōpeʻapeʻa) has a high vulnerability ranking because the species has a narrow range, declining populations, and pesticides noted as a threat. They are endemic to Hawaiʻi and occur in coastal, rainforest, and dry forest habitats and above wetlands and streams. No historical or current population estimates exist for this subspecies, although recent studies and ongoing research have shown the bats to be distributed across the Hawaiian archipelago. They primarily feed on nocturnal moths and beetles, which they hunt in flight across a wide array of habitat types and plant communities from sea level to at least 3,600 meters elevation. Threats to the species include habitat loss and destruction, mortality from anthropogenic structures (e.g., barbed wire fences, wind turbines), limited knowledge of its distribution and life history, and effects of climate change, timber harvest, and pesticides (USFWS 2021). The bat's foraging habitats can include urban and suburban areas, suggesting that exposure to carbaryl through developed and open space developed uses is reasonably certain to occur. As such, we expect a large number of individuals are likely to be exposed over the proposed action's duration.

While dietary exposure estimates vary by application rate, we expect individual bats consuming contaminated prey on carbaryl use sites can accumulate up to 171.2 mg carbaryl/kg-bw, which can cause high levels of mortality of the bat. We expect this high level of exposure is mostly associated with uses on turf and golf courses. Exposed individuals that do not die are at risk of sublethal adverse effects, including severe behavioral abnormalities and reproductive effects. Given that exposure is reasonably certain to occur, we expect a large number of individuals are likely to die. Additionally, we anticipate carbaryl will cause high levels of mortality in the bat's arthropod prey base, resulting in high levels of indirect effects as well.

In summary, the Hawaiian hoary bat is vulnerable to adverse effects, including those related to pesticide exposure. We anticipate a large number of individuals are likely to be exposed to carbaryl as they are known to forage in and travel through developed and open space developed sites where carbaryl may be used. We anticipate individuals consuming contaminated prey on carbaryl use sites are likely to die or experience sublethal effects and that individuals not occurring on use sites will experience high levels of indirect effects through prey loss. We have determined the proposed action is expected to appreciably reduce the survival and recovery of the species in the wild. Thus, it is our biological opinion that the proposed action is likely to jeopardize the continued existence of the Hawaiian hoary bat.

References:

U.S. Fish and Wildlife Service. 2021. 5-Year Status Review ʻōpeʻapeʻa or Hawaiian hoary bat (*Lasiurus cinereus semotus*). Honolulu, Hawaiʻi. 46 pp.

Rationale for Species Conclusion: Hawaiian goose

Scientific Name:	Common Name:	Entity ID:
Branta (=Nesochen) sandvicensis	Hawaiian goose	73

Conclusion

The Hawaiian goose (nēnē) has a medium vulnerability ranking. While the species has a small, endemic range and pesticides are listed as a threat, all populations are stable with none known to be increasing or decreasing. They are terrestrial and nest primarily in leeward lowlands. Hawaiian geese appear to be adaptable and now occur in a variety of habitats (e.g., non-native grasslands, cinder deserts, alpine grasslands, shrublands). The species was captively propagated, and now individuals are translocated to other islands from the increasing Kauai population when available. As of 2022, there were about 3,500 birds in the state-wide population (USFWS 2024). Threats to the species include predation by non-native mammals (e.g., mongooses, rats, cats, dogs, and pigs), lack of suitable habitat from urbanization and agriculture, habitat degradation, drought, and conflicts with human activities (USFWS 2019). The Hawaiian goose is known to use a variety of non-agricultural areas, including carbaryl use sites like golf courses. As such, we anticipate exposure to the species is reasonably certain to occur and that a large number of individuals are likely to be exposed over the duration of the proposed action.

Given the high application rate allowed for golf courses on product labels, we anticipate individuals exposed to carbaryl on golf courses can accumulate up to 250 mg/kg-bw. While we do not anticipate any mortality is likely to occur at these exposures, we anticipate individuals are at risk of neurological impacts, including hypo-reactivity, reduced muscle coordination, and complete immobility. While these effects are temporary, given their potential severity, there may be significant adverse effects to the long-term survival of exposed individuals. We do not anticipate carbaryl will adversely affect plant food items at estimated environmental concentrations, indicating that no indirect adverse effects are likely to occur.

In summary, we anticipate a large number of individuals are likely to be exposed as the species is known to frequent non-agricultural carbaryl use sites. While we do not anticipate exposed individuals will die, we expect individuals are likely to experience high levels of sublethal adverse effects in the form of temporary neurological effects that could negatively influence their long-term survival. Thus, while the species has a medium vulnerability ranking, the high exposure and toxicity ranking indicate that the species is at a high risk of adverse effects from the proposed action. We have determined the proposed action is expected to appreciably reduce the survival and recovery of the species in the wild. Thus, it is our biological opinion that the proposed action is likely to jeopardize the continued existence of the Hawaiian goose.

References*:*

U.S. Fish and Wildlife Service. 2024. 5-Year Review Short Form Summary Species Reviewed: Nēnē or Hawaiian Goose (*Branta sandvicensis*). Honolulu, Hawai‘i. 13 pp.

U.S. Fish and Wildlife Service. 2019. Endangered and Threatened Wildlife and Plants; Reclassifying the Hawaiian Goose From Endangered to Threatened With a Section 4(d) Rule. Federal Register 84(244):69918-69947.

Rationale for Species Conclusion: Hawaiian yellow-faced bee

Scientific Name:	Common Name:	Entity ID:
Hylaeus longiceps	Hawaiian yellow-faced bee	5333

Conclusion

Much is unknown about the Hawaiian yellow-faced bee. Presuming they are ground-nesters like other yellow-faced bees, their nests occur within existing burrows or small natural cavities under bark or rocks. They appear to nest at sandy or ashy sites and have not been found at strictly rocky sites where sympatric anthracinan yellow-faced bees are often found. Adults consume pollen and nectar, primarily from native coastal shrubland plants, and they rarely visit non-native plants. The presence of diverse, simultaneously available native pollen sources that support the adults and are used for provisioning the nest are likely a necessary part of suitable habitat for longiceps yellow-faced bee survival and reproduction. They are restricted to small populations on O‘ahu, Moloka‘i, Lāna‘i, and Maui. The Hawaiian yellow-faced bee has a high vulnerability ranking on account of its endangered status, small and endemic distribution, and low population numbers.

While the species largely inhabits coastal and shrubland dry forest habitat and typically nests on sandy areas (e.g., sand dunes), some populations are known to occur on or near non-agricultural carbaryl use sites, including developed areas associated with several golf courses and residential areas on Maui and Oahu. While we anticipate existing conservation measures restricting most developed uses to spot, crack-and-crevice, or narrow perimeter band treatments using hand-held equipment will greatly reduce the level of anticipated exposure to the species, given that some developed and open space developed uses of carbaryl (like treatments to lawns, turf, or golf courses) can be applied using ground broadcast applications, we anticipate individuals may still be exposed to carbaryl. As such, we anticipate exposure to carbaryl through non-agricultural uses (e.g., open space developed uses in areas like golf courses in particular) is reasonably certain to occur.

Available toxicity data indicate that arthropod species are likely highly sensitive to carbaryl exposure. As such, we expect any individuals that are exposed carbaryl are likely to die, even at low exposure concentrations. We do not anticipate carbaryl will cause any adverse effects to plant food resources, indicating no indirect adverse effects are likely to occur.

In summary, the Hawaiian yellow-faced bee is highly vulnerable to additional stressors. We anticipate a large number of individuals are likely to be exposed to carbaryl as they are known to occur in and adjacent to areas that may be treated with carbaryl (i.e., open space developed use sites like golf courses). Exposed individuals are likely to die because arthropod species are sensitive to carbaryl, and we expect species-level effects to occur from the loss of a large number of Hawaiian yellow-faced bees. We have determined the proposed action is expected to appreciably reduce the survival and recovery of the species in the wild. Thus, it is our biological opinion that the proposed action is likely to jeopardize the continued existence of the Hawaiian yellow-faced bee.

References*:*

U.S. Fish and Wildlife Service. 2021. Longiceps or long head yellow-faced bee (*Hylaeus longiceps*) 5-Year Review Summary and Evaluation. Honolulu, Hawaiʻi. 33 pp.

Rationale for Species Conclusion: Orangeblack Hawaiian damselfly

Scientific Name:	Common Name:	Entity ID:
Megalagrion xanthomelas	Orangeblack Hawaiian damselfly	6867

Conclusion

The orangeblack Hawaiian damselfly is found sheltering in vegetation along low-elevation streams, coastal wetlands, lower mid-reaches of perennial streams, ephemeral pools, and anchialine pools. We presume female adults likely spend much of their time several hundred meters into riparian forests near their aquatic habitats. Naiads consume zooplankton and aquatic invertebrates, and adults eat terrestrial invertebrates like fruit flies, mosquitos, crane flies, small moths, leafhoppers, plant bugs, and sometimes other species of damselflies. There are no quantitative population estimates for this species, but it is now only found on the islands of Hawaiʻi, Maui, Molokaʻi and Oʻahu. *Megalagrion xanthomelas* is considered extirpated from Kauaʻi and Lānaʻi, and its status on Niʻihau is unknown. They are only considered locally abundant on Hawaiʻi and Molokaʻi; they are uncommon elsewhere. The orangeblack Hawaiian damselfly has a high vulnerability ranking on account of its endangered status, small and endemic distribution, and declining population trends.

Some populations are known to occur near human developed habitat (e.g., ornamental ponds, reservoirs, and pipeline seepages), which could include developed and open space developed areas like golf courses (USFWS 2021). Given that the species has an aquatic nymph stage, individuals may be exposed to carbaryl through off-site transport in the form of drift or runoff. We anticipate existing conservation measures, including a rain restriction, mandatory buffers from aquatic habitats, and limitations on most residential uses to spot, crack-and-crevice, or narrow perimeter band treatments using hand-held equipment, will minimize off-site transport and exposure to the orangeblack Hawaiian damselfly from these uses. However, other uses, such as applications to lawns, turf, or golf courses, can be made using broadcast applications, which can still result in exposure to individuals. As such, despite the minimization of runoff exposure through existing conservation measures that will minimize exposure to aquatic-stage nymphs, we anticipate exposure to terrestrial-phase adults from some developed and open space developed uses will occur.

Available toxicity data indicate that arthropod species are likely highly sensitive to carbaryl exposure. As such, we expect any individuals that are exposed carbaryl are likely to die, even at low exposure concentrations. Additionally, we anticipate individuals that do not die are likely to experience high levels of indirect adverse effects because adults eat terrestrial insects (i.e., fruit flies, mosquitos, crane flies, small moths, leafhoppers, plant bugs, and sometimes other species of damselflies) that will also experience high levels of mortality from carbaryl exposure.

In summary, the orangeblack Hawaiian damselfly is highly vulnerable to additional stressors. We anticipate a large number of individuals are likely to be exposed to carbaryl as they are known to occupy human developed habitats, including potential non-agricultural carbaryl use sites. We expect exposed individuals are likely to die because arthropod species are sensitive to carbaryl exposure. Because adults consume other arthropods, we also anticipate individuals that do not die from carbaryl exposure will still experience high levels of indirect adverse effects from prey loss. Because we expect a large number of individuals will die and more will experience indirect effects from prey loss, we expect species-level effects to occur. We have determined the proposed action is expected to appreciably reduce the survival and recovery of the species in the wild. Thus, it is our biological opinion that the proposed action is likely to jeopardize the continued existence of the orangeblack Hawaiian damselfly.

References*:*

U.S. Fish and Wildlife Service. 2021. Orangeblack Hawaiian Damselfly (*Megalagrion xanthomelas*) 5-Year Review Summary and Evaluation. Honolulu, Hawai‘i. 32 pp.

Rationale for Species Conclusion: ‘Akoko

Scientific Name:	Common Name:	Entity ID:
Euphorbia skottsbergii var. *skottsbergii*	‘Akoko	665

Conclusion

The ‘akoko is a perennial shrub endemic to the Ewa plains area on the island of O‘ahu, a broad plain of low relief consisting largely of a reef formed during the Pleistocene when sea level was higher than at present. Currently, wild plants remain at the U.S. Navy Base Realignment and Closure (BRAC) area at Barbers Point and the Department of Hawaiian Homelands land proposed for development of a solar power project. In total, there are fewer than 200 wild individuals remaining, but the Service is working to create a stable reintroduced population within the Pearl Harbor National Wildlife Refuge. Almost 1,000 individuals have been outplanted at this site since 2016, with 233 surviving in 2019. In addition, the Service is working with the Navy to protect the existing plants on its property and augment and maintain the population (USFWS 2019). By 2024, 22% of the outplanted individuals died with only 96 individuals surviving (USFWS 2024).

While the species does not necessarily favor developed areas as habitat, given the intensive development of residential spaces within the species' historic range, we anticipate remnant individuals are likely in close proximity to developed use sites. However, we anticipate existing conservation measures on product labels will minimize exposure to individuals and their pollinators. For instance, as a result of the 2022 Proposed Interim Decision on carbaryl and the 2024 NMFS biological opinion on carbaryl, most residential uses of carbaryl are limited to spot, crack-and-crevice, or narrow perimeter band treatments using hand-held equipment. This limitation on carbaryl applications in residential areas greatly limits the spatial footprint of carbaryl usage in areas near ʻakoko populations and renders off-site transport and off-target exposure unlikely. Thus, despite being located near potential carbaryl use sites, we anticipate exposure to the species is low.

The ʻakoko requires outcrossing to reproduce successfully and relies on insect pollinators for successful reproduction. While toxicity data indicate that insects are likely sensitive to carbaryl exposure, the ʻakoko's insect pollinators are non-native 'generalists' and are widespread and not host-specific. This further decreases our concern that the level of carbaryl exposure expected within the species' range will result in appreciable adverse effects to the species because it relies on insects for successful reproduction that are varied and abundant. Seeds of the species are dispersed by explosive discharge from their capsules; thus, we do not expect adverse effects to reproduction from loss of seed dispersers.

Because of the species' ability to rely on a variety of abundant pollinators and abiotic methods for seed dispersal and most individuals occur in protected areas where carbaryl exposure is unlikely (on the NWR or on BRAC where protections are underway), we do not anticipate species-level effects from reduced reproductive success from pollinator mortality due to carbaryl exposure. We have determined the proposed action is not expected to appreciably reduce the survival and recovery of the species in the wild. Thus, it is our biological opinion that the proposed action is not likely to jeopardize the continued existence of the ʻakoko.

References*:*

U.S. Fish and Wildlife Service. 2024. 5-Year Review Short Form Summary *Euphorbia skottsbergii* var. *skottsbergii* (ʻakoko). Honolulu, Hawaiʻi. 9 pp.

U.S. Fish and Wildlife Service. 2019. 5-Year Review Short Form Summary *Euphorbia skottsbergii* var. *skottsbergii* (ʻakoko). Honolulu, Hawaiʻi. 11 pp.

Rationale for Species Conclusion: Dwarf naupaka

Scientific Name:	Common Name:	Entity ID:
Scaevola coriacea	Dwarf naupaka	820

Conclusion

The dwarf naupaka is a low, flat-lying perennial herb that occurs in relatively hot, dry coastal sites on low, consolidated sand dunes near sea level. The species is endemic to Niʻihau, Kauaʻi, Oʻahu, Lānaʻi, Maui, Hawaiʻi, and two islets off Maui and Molokaʻi. It is currently only found on Maui and the islets off Maui and Molokaʻi. There are five wild populations totaling 85 individuals, and 11 outplanted populations totaling 47 individuals. The two largest wild populations are both located on Maui, and account for 72 of the wild individuals. The Plant Extinction Prevention Program also reported seven wild individuals on ʻŌkala Islet and two on Moku Hoʻoniki Islet, both islets off of Molokaʻi in 2018. This represents a declining species trend as there were 350 known individuals at the time of listing. Given this declining trend, low population numbers, and its narrow, endemic range, the dwarf naupaka has a high vulnerability ranking.

While we do not anticipate individuals are likely to grow in developed or open space developed use sites, encroachment of human developments and subdivisions is a noted threat to the species, suggesting that individuals and populations may still be found near developed or open space developed use sites. Populations of the species are near golf courses and residential areas in particular. Existing conservation measures limit most residential applications of carbaryl to spot, crack-and-crevice, and narrow perimeter bands around buildings, using hand-held equipment. We anticipate this restriction in residential applications will greatly reduce the footprint of treatable area near the species' range. Furthermore, we anticipate this restriction will greatly reduce the amount of carbaryl residues that are transported off-site through spray drift as we do not expect hand-held application equipment is likely to produce significant spray drift, thus reducing the extent of exposure to the species and its required pollinators from most residential uses. However, other uses, such as applications to lawns, turf, or golf courses, can be made using broadcast applications, which can result in exposure to the dwarf naupaka's insect pollinators that occur on or near use sites. Given this proximity to potential use sites, we anticipate exposure to the species and its pollinators is reasonably certain to occur.

Little is known about the dwarf naupaka's reproductive biology, but we presume it requires insect pollinators for successful reproduction. Toxicity data indicate that most insects are sensitive to carbaryl and are likely to die with exposure (even at low concentrations). As such, we anticipate the species is likely to experience high levels of indirect adverse effects from reduced reproductive success should carbaryl exposure occur, indicating that the species has a high toxicity ranking.

While existing conservation measures will reduce the likelihood of exposure to the species from certain non-agricultural uses of carbaryl (such as residential uses), we still anticipate exposure is reasonably certain to occur as we anticipate the species and its pollinators likely occur on or near other use sites that do not have sufficient existing conservation measures to minimize off-target exposure (i.e., open space developed use sites). Given that the species has a high vulnerability, exposure is reasonably certain to occur, and carbaryl exposure is likely to cause high levels of indirect adverse effects to the species, we anticipate the risk of adverse effects to the species is high. We have determined the proposed action is expected to appreciably reduce the survival and recovery of the species in the wild. Thus, it is our biological opinion that the proposed action is likely to jeopardize the continued existence of the dwarf naupaka.

References*:*

U.S. Fish and Wildlife Service. 2021. 5-Year Review Short Form Summary *Scaevola coriacea* (dwarf naupaka). Honolulu, Hawaiʻi. 8 pp.

U.S. Fish and Wildlife Service. 1997. Recovery Plan for the Maui Plant Cluster (Hawaiʻi). Portland, Oregon. 198 pp.