Interim Core Map Documentation for Noel's Amphipod

Posted to EPA's Geoplatform: June 2025
Core Map Developer: Center for Biological Diversity (CBD) [1]
Documentation and analysis supplemented by the U.S. Environmental Protection Agency's (EPA) Office of Pesticide Programs

Species Summary

Noel's amphipod (*Gammarus desperatus*) (EntityID 1261) is an endangered invertebrate. Gammarid amphipods typically are found in shallow, cool, well-oxygenated waters of small streams, ponds, ditches, sloughs, and springs (Holsinger 1976: 3; Smith 2001: 574). There is a designated critical habitat for this species.

Description of Core Map

The core map for Noel's amphipod is based on critical habitat. All known occurrences of this species fall within the critical habitat of desert grassland spring systems within southeastern New Mexico. EPA did not find evidence that any key areas for this species exist outside of the designated critical habitat. A recovery strategy is underway to preserve, restore, and manage the species' aquatic habitat. Recovery implementation is also underway to eradicate non-native invasive plants and to focus on threats that most impact water quantity and quality. **Figure 1** depicts the interim critical habitat core map for Noel's amphipod (green areas on map). The core map represents approximately 76 acres.

The core map developed for Noel's amphipod is considered interim. This core map will be used to develop pesticide use limitation areas (PULAs) that include Noel's amphipod. This core map incorporates information developed by the U.S. Fish and Wildlife Service (FWS) and made available to the public; however, the core map has not been formally reviewed by FWS. This interim core map may be revised in the future to incorporate expert feedback from FWS. This interim core map has a "limited" best professional judgment classification because it consists of the species' critical habitat without additions or subtractions; however, the core map is limited to just the designated critical habitat based on review and interpretation of FWS documents This core map does not replace or revise any range or designated critical habitat developed by FWS for this species.

[1] CBD sent EPA the core map for this species before EPA released its mapping process document and example documentation. EPA supplemented the documentation and supporting analysis for consistency with EPA's most recent documentation examples made available after CBD developed this core map.

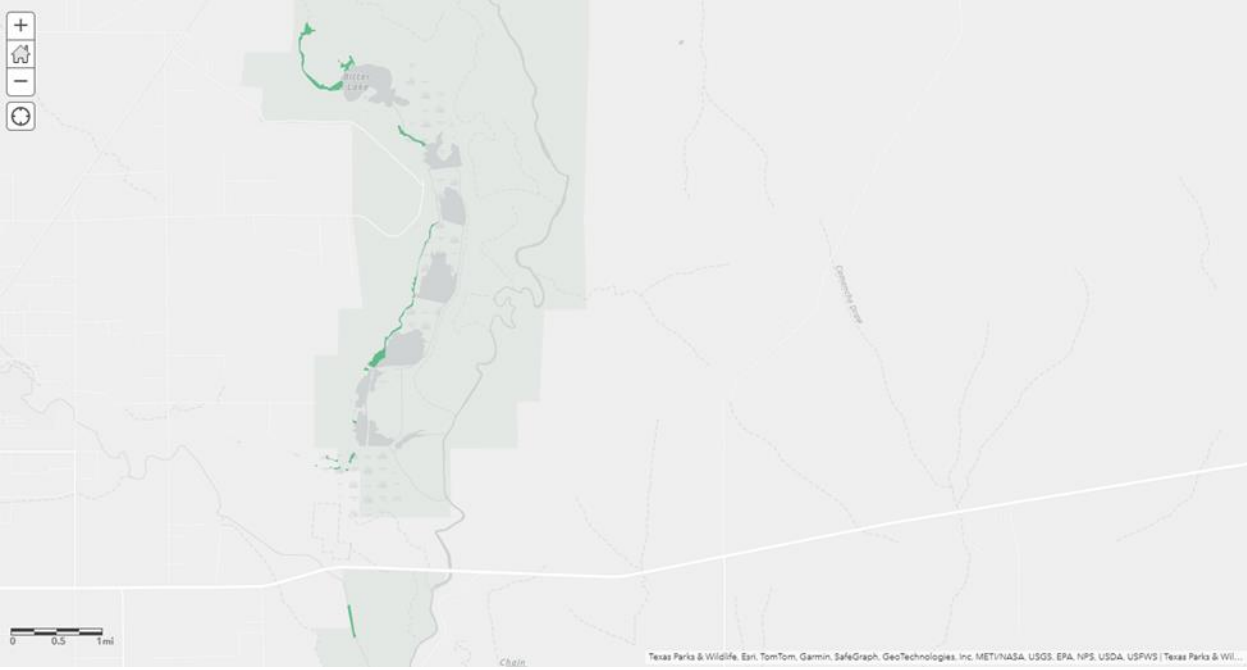

Figure 1. Interim core map for Noel's amphipod. Total acreage of core map is approximately 76 acres.

Table 1. Percentage of Interim Core Map Represented by NLCD[1] Land Covers and Associated Example Pesticide Use Sites/Types.

Example pesticide use sites/types	NLCD Class/Value	% Area	Total area for landcover type
Forestry	Deciduous Forest (41)	0%	0%
Forestry	Evergreen Forest (42)	0%	0%
Forestry	Mixed Forest (43)	0%	0%
Agriculture	Pasture/Hay (81)	0%	0%
Agriculture	Cultivated Crops (82)	0%	0%
Mosquito adulticide, residential	Open space, developed (21)	17%	88%
Mosquito adulticide, residential	Developed, Low intensity (22)	0%	88%
Mosquito adulticide, residential	Developed, Medium intensity (23)	4%	88%
Mosquito adulticide, residential	Developed, High intensity (24)	67%	88%
Invasive species control	Woody Wetlands (90)	0%	12%
Invasive species control	Emergent Herbaceous Wetlands (95)	0%	12%
Invasive species control	Open water (11)	12%	12%
Invasive species control	Grassland/herbaceous (71)	0%	12%
Invasive species control	Scrub/shrub (52)	0%	12%
Invasive species control	Barren land (rock/sand/clay; 31)	0%	12%
Total Acres	Interim Core Map Acres	76	

Evaluation of Known Location Information

There are four datasets with known location information for this species:

- Descriptions of locations provided by FWS,
- Occurrence locations in iNaturalist;
- Occurrence locations in the Global Biodiversity Information Facility (GBIF); and
- Occurrence locations in NatureServe.

EPA evaluated these four sets of data before selecting the type of and developing the core map. FWS' most recent 5-year review (2020) detailed known locations of this species in Chaves County, New Mexico, on Bitter Lake National Wildlife Refuge. iNaturalist had one research grade observation. NatureServe provided one documented location. GBIF contained 83 observations (60 in New Mexico, 23 in Kansas). The iNaturalist, GBIF, and NatureServe data had coarse resolution, and these data fell within and/or to the west of the critical habitat/range. Although GBIF showed occurrences in Kansas, those occurrences were not considered reliable as described in Appendix 1.

Approach Used to Create Core Map

The core map was developed using the "Process EPA Uses to Develop Core Maps for Draft Pesticide Use Limitation Areas for Species Listed by the U.S. Fish & Wildlife Service (FWS) and their Designated Critical Habitats"[2] (referred to as "the process"). This core map was developed by CBD and was developed using the 4 steps described in the process document:

1. Compile available information for a species;
2. Identify core map type;
3. Develop the core map for the species; and
4. Document the core map.

For step 1, the developer compiled available information for Noel's amphipod from FWS as well as observational information available from various publicly available sources (discussed in previous section). The information compiled for Noel's amphipod is included in **Appendix 1**. Influential information that impacted the development of the core map included descriptions of where existing populations occur relative to the critical habitat.

For step 2, the developer used the compiled information to identify the core map type, including the species range, critical habitat, and known location information. Comparison of known location data to the range and critical habitat found that the FWS' descriptions of locations of existing (extant) populations are consistent with the location of the designated critical habitat. Based on this information, EPA used the designated critical habitat as the core map.

For step 3, EPA used the designated critical habitat provided by FWS for Noel's amphipod. EPA downloaded the critical habitat from FWS's ECOS (https://ecos.fws.gov/ecp/).

[2] Dated 2024, available online at: https://www.epa.gov/endangered-species/process-epa-uses-develop-core-maps-pesticide-use-limitation-areas

Discussion of Approaches and Data that were Considered but not Included in Core Map

Alternative approaches and data other than those described in this documentation were not explored in the development of this interim core map.

Appendix 1. Information Compiled for Species

1. **FWS Documents/Links**

- Noel's Amphipod 5-Year Review - (5/5/2020)
- Final Recovery Plan for Four Invertebrate Species of the Pecos River Valley: Noel's Amphipod (Gammarus desperatus), Koster's springtail (Juturnia kosteri), Roswell springsnail (Pyrgulopsis roswellensis), and Pecos assiminea (Assiminea pecos) - (10/17/2019)
- Endangered and Threatened Wildlife and Plants; Review of Native Species That Are Candidates or Proposed for Listing as Endangered or Threatened; Annual Notice of Findings on Resubmitted Petitions; Annual Description of Progress on Listing Actions; Proposed Rule – (5/11/2005)

2. **Background information**
    - Status: Federally listed as endangered in 2005.
    - Resiliency, redundancy, and representation (the 3Rs) (Source: Final Recovery Plan)
        - As a localized endemic, the invertebrate depends on regional groundwater that often originates at depths and distances far from the habitat protected. The primary threats to the invertebrate are diminished water quantity due to groundwater pumping and drought (which lowers aquifer levels and subsequently reduces outflow from springs and seeps), and water quality contamination; secondary threats include inadequate existing regulatory mechanisms, localized range, limited mobility, fragmented habitat, and climate change, and tertiary threats may include invasive species, disease, and predation.
        - Management unit (MU) conservation provides redundancy to the species by providing enough occupied sites to provide a margin of safety for this species. Redundancy is important for these species since it cannot easily move long distances to other areas to reestablish itself, and having adequate representation will provide the species with more flexibility and resiliency in coping with loss of habitat and/or catastrophic events.
        - A minimal level of redundancy is essential for long-term viability of a species (Shaffer and Stein 2000: 307, 309-310; Groves et al. 2002: 506). The invertebrate species needs to persist within multiple MUs throughout its range for adequate redundancy. In addition, these MUs, should be distributed such that the impacts from any single catastrophic event are minimized. The strategy of ensuring the persistence of multiple MUs for the species across its range creates a margin of safety for these species to withstand catastrophic events (Service and NOAA 2014: 37,578) by decreasing the chance of any one event affecting the entire species. To manage risk, the five MUs on Bitter Lake National Wildlife Refuge (BLNWR) should be maintained at all times. The species should be distributed across multiple sites throughout the species' ranges.
        - Because of the extremely limited range of the invertebrate species, and the inability to expand the specie's range except for surveying new sites on and adjacent to the refuge,

the probability of persistence will greatly depend on the ability to maintain and increase existing habitat and water resources on BLNWR.

- Maintaining persistence in existing MUs strengthens the possibility that the representation and, thus, the adaptive capabilities (Service and NOAA 2014: 37,578) of the invertebrate species are conserved. Protecting multiple MUs across a species range may also contribute to its resiliency, especially if some populations MUs or habitats are more susceptible to certain threats than others (Service and NOAA 2014: 37,578). The four invertebrate species on BLNWR occur together in several MUs on the Refuge, though they utilize various resources and microhabitats within those units. This species is known to occur in Bitter Creek, Sago Springs, Snail Unit, Hunter Marsh/City of Roswell, and Rio Hondo. Other MUs on BLNWR contain various combinations of the four invertebrate species. Because a species' genetic makeup is shaped through natural selection by the environments it has experienced (Shaffer and Stein 2000: 308), all environments (springs, creeks, sinkholes and ditches) that the species occur in will be protected to ensure conservation of the species. Most of the occupied locations are located on BLNWR; however, several potential locations are off Refuge on private lands. If off refuge locations are discovered, efforts should be made to protect sites through the use of permanent conservation easements, and management agreements.

- Habitat, Life History, and Ecology (Source: 2019 Recovery Plan and 2020 5-Year Review)

  Habitat: Noel's amphipod is known to occur in five management units (MUs) in BLNWR, in New Mexico. Noel's amphipod is associated with desert grassland spring systems in the Roswell Basin in southeastern New Mexico. The basin is found have abundant karst topography, such as sinkholes, caverns, springs, and underground springs, which have created unique settings harboring diverse assemblages of flora and fauna. Within these karst formations, the invertebrate is found in isolated limestone and gypsum springs, seeps, and wetlands located in and around Roswell, New Mexico. These aquatic invertebrates require clean, moist habitats. Noel's amphipod requires permanent, flowing water. Each invertebrate needs algae, detritus, and bacteria associated with native vegetation and natural spring and seep systems. BLNWR staff collaborated to develop a monitoring methodology for use at Sago Springs, Bitter Creek, Snail Unit, and subsequently for the Rio Hondo translocation site (Johnson et al. 2019). This work supported implementation of the endemic invertebrate monitoring program currently in use at BLNWR.

  High population densities in gammarid amphipods are not uncommon and cannibalism may occur at density extremes when food supply becomes limiting (Smith 2001: 575). Amphipods are omnivorous, feeding on a wide variety of plant and animal matter and detritus. Noel's amphipod is often found in beds of submerged aquatic plants, which indicates that they probably browse on a surface film of algae, diatoms, bacteria, and fungi (Smith 2001: 572).

  Freshwater amphipods are typically nocturnal, as they are extremely light-sensitive, and are strongly oriented to the substrate (Smith 2001: 574). Amphipods respire primarily through gills (Smith 2001: 572). Predation by fish, birds, and aquatic insects (Smith 2001: 576) may also play a role in regulating population size of Noel's amphipod. Seasonal or long-term movements of amphipods have been reported, indicating that hydrologically connected habitats may be recolonized following local extirpation (Smith 2001: 575).

Amphipods generally do not tolerate habitat desiccation or other adverse environmental conditions and are thus sensitive to habitat degradation (Smith 2001: 575). Lang (2002: A2) found this to be true in Noel's amphipod. For example, the Sandhill Fire burned over Dragonfly Spring in March 2000. The fire eliminated vegetation shading at the spring and generated a substantial amount of ash input to the system. Subsequently, water temperature fluctuations increased and dissolved oxygen levels decreased at the location (Lang 2002: B4; Haan 2012: 40). Dense algal blooms occurred, forming thick floating mats and blankets on the substrate at the spring. A monotypic, dense stand of common reed (Phragmites australis), an invasive grass (Allred 2005: 258), colonized the burned area. This stand of common reed replaced the pre-fire submerged aquatic macrophyte community as the dominant vegetation, perhaps making the location no longer suitable for Noel's amphipod. After these changes in vegetation, temperature, and dissolved oxygen, Noel's amphipod, which requires cool, well-oxygenated water, was absent at many post-fire sample locations (Haan 2012: 22).

Gammarid amphipods typically are found in shallow, cool, well-oxygenated waters of small streams, ponds, ditches, sloughs, and springs (Holsinger 1976: 3; Smith 2001: 574). Acidity is a limiting factor for amphipods, with a pH of 6.0 generally constituting a lower threshold and 8.0 an upper threshold (Smith 2001: 574). Typically, amphipods are found beneath stones and in aquatic vegetation during daylight hours (Smith 2001: 572-574). Noel's amphipod was found mainly on rubble and rubble-sand substrate at Lander Springbrook and less frequently on silt substrate or vegetation (Noel 1954: 124). Habitats on BLNWR range from dense beds of emergent aquatic macrophytes to clear, flowing spring-brooks with submerged aquatic vegetation, vegetated banks and margins, and clean substrates. Noel's amphipod occurs in Hunter Marsh where permanent spring sources are located (NMDGF 2010:9). Standing water and silt accumulation appear to constitute unsuitable habitat for the species (NMDGF 2000: A1). Lang (2002: A2) suggested that the addition of stones, which increased stream gradient and current velocity, seemed to improve habitat for Noel's amphipod in the Unit 6 spring ditch. Salinity in habitats occupied by amphipods of the Gammarus-pecos complex is low to moderate, ranging from 0.1 to 5.9 parts per thousand (ppt) (Cole 1985: 95; Seidel et al. 2010: 1,165). Comparison among species within the Gammarus-pecos complex indicated that this species is in the medium to low maximum salinity range (2.7 to 5.9 ppt) (Seidel et al. 2010: 1,165). Cole (1981: 27) reported chemical composition of the water at North Spring to be like that described at Lander Springbrook (Noel 1954: 123): impure gypsum substrate, sulfate- and chloride-rich waters, and calcium as the primary cation.

Reproduction:
Most amphipods breed between February and October (Smith 2001: 572). Gammarus males and females pair for one to seven days, feeding and swimming together prior to copulation which lasts less than 1 minute (Smith 2001: 573). Fertilized eggs are retained in the female's brood pouch, or marsupium, where they incubate for 1 to 3 weeks (Smith 2001: 573). Young remain in the marsupium for another 1 to 8 days before being released (Smith 2001: 573). The breeding season for Noel's amphipod is likely from February through October and is dependent on water temperature. Most amphipods live 1 year or less (Smith 2001: 574).

Taxonomy

- FWS Category: Aquatic invertebrate

- **Relevant Pesticide Use Sites in FWS Documents** (Source: Final Recovery Plan)
  - Future research should determine sensitivity to commonly used pesticides that may be used to control nonnative terrestrial vegetation adjacent to occupied habitat.

- **Relevant Recovery Criteria and Actions** (Source: Final Recovery Plan)
  - Objective 1 – Secure and maintain the long-term survival of the species with the appropriate number, size, and distribution of resilient management units.
    - Downlisting Criterion 1: Maintain the presence of the species in the occupied management units as of the start of this plan, with a stable or increasing average trend in density over 10 years at currently monitored management units (1 and 3).
    - Delisting Criterion 1: Maintain the presence of the species in the occupied management units as of the start of this plan, with a stable or increasing average trend in density over 20 years in management units (1 and 3).
  - Objective 2 – Protect water quantity
    - Downlisting Criterion 2: Develop, implement, and fulfill a water management plan or equivalent conservation agreement, supported by the local irrigation district and other partners, that ensures adequate surface and groundwater levels to 1) sustain downlisting criteria measured by Criterion 1 above, and 2) meet or exceed BLNWR's minimum federally reserved water right flow (0.0042 m3 /s (0.15 cfs) for 10 years.
    - Delisting Criterion 2: Develop, implement, and fulfill a water management plan or equivalent conservation agreement, supported by the local irrigation district and other partners, that ensures adequate surface and groundwater levels to 1) sustain delisting criteria measured by Criterion 1 above, and 2) ensure that the flows in Bitter Creek as measured at the Bitter Creek Flume are greater than 0.007 m3 /s (0.25 cfs) for 20 years.
  - Objective 3 – Protect water quality
    - Downlisting Criterion 3a: Long-term commitments (e.g., Conservation Agreements) are in place and will continue to maintain sufficient water quality protections for 10 years, and water quality sustains each species as measured by Criterion 1 above.
    - Delisting Criterion 3a: Long-term commitments (e.g., Conservation Agreements) are in place and will continue to maintain sufficient water quality protections for 20 years, and water quality sustains each species as measured by Criterion 1 above.
    - Downlisting Criterion 3b: Long-term commitments (e.g., Conservation Agreements) are in place that would specifically address the four invertebrates and reduce the risk of a catastrophic vii spill occurring within a drainage or recharge area occupied by any of the four invertebrates for 10 years.
    - Delisting Criterion 3b: Long-term commitments (e.g., Conservation Agreements) are in place that would specifically address the four invertebrates and reduce the risk of a catastrophic spill occurring within a drainage or recharge area occupied by any of the four invertebrates for 20 years.
  - Objective 4 – Protect and restore habitat that supports invertebrate populations

- Downlisting Criterion 4: A habitat management plan is developed and implemented that ensures that the environment remains as suitable habitat that sustains each species for 10 years.

  Delisting Criterion 4: A habitat management plan is developed and implemented that ensures that the environment remains as suitable habitat that sustains each species for 20 years.

3. **Description of the range (Source: Final Recovery Plan)**
   - This invertebrate is constrained to karst water features including sink holes and springs, reliant on clean groundwater sources, in localized areas of New Mexico. Noel's amphipod is known to occur in five management units (MUs) in New Mexico.
   - The species range is approximately 101,091 acres.
   - Figure A1-1 depicts the current FWS species range (last updated 12/28/2023).

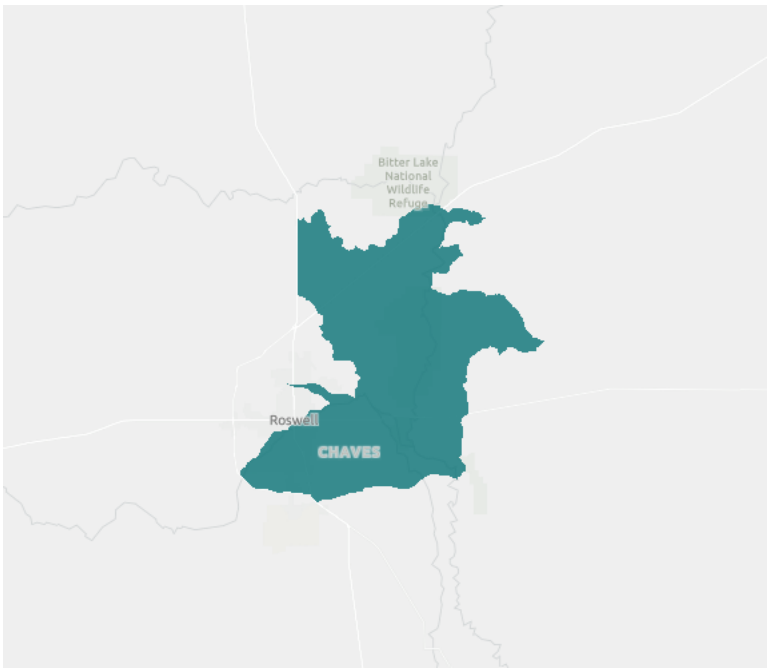

Figure A1-1. FWS range of the Noel's amphipod.

4. **Critical Habitat (Source: Final Recovery Plan)**

All known locations identified by FWS for this species lie within the critical habitat of desert grassland spring systems within southeastern New Mexico.

- Figure A1-2 depicts the current critical habitat.

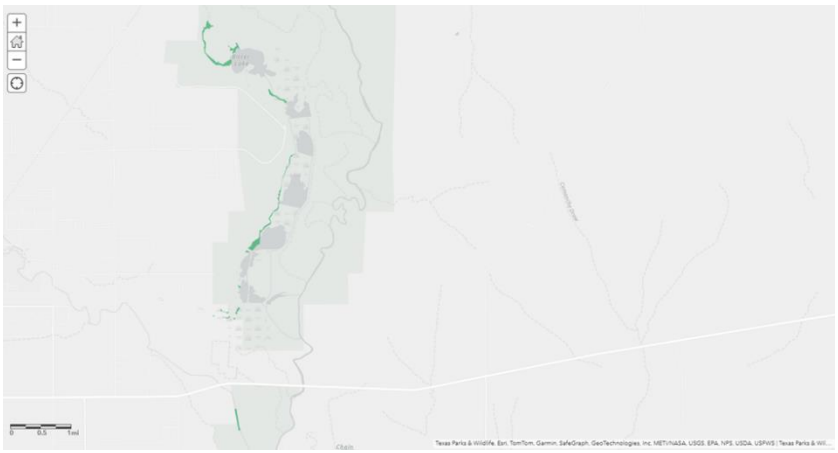

Figure A1-2. FWS critical habitat of Noel's amphipod.

5. **Known Locations**
    - **Known Locations** (Source: Final Recovery Plan)
        - Noel's amphipod is known to occur in five management units (MUs) in Bitter Lake National Refuge, New Mexico.

    - **Occurrences in iNaturalist**
        - Searched on 3/6/2025
        - https://www.inaturalist.org/observations/260820260
        - There is one research grade observations available from February 2025.

Occurrences in GBIF

- GBIF was searched on 6/24/2025
- https://www.gbif.org/occurrence/map?q=noel%27s%20amphipod&taxon_key=2219866GBIF contained 1observation with coordinates.

Occurrences in NatureServe

- NatureServe was searched on 3/6/2025 https://explorer.natureserve.org/Taxon/ELEMENT_GLOBAL.2.106890/Gammarus_desperatus
- The occupied areas overlap the area where this species is known to live, consistent with the critical habitat given the data resolution.

Collectively, the occurrence data from iNaturalist, GBIF, and NatureServe do not support expanding the core map beyond the designated critical habitat.