

AleutBio S0293 – Aleutian Trench Biodiversity Studies

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Summary. The AleutBio expedition (S0293), conducted onboard RV Sonne in summer 2022, established a depth-stratified biodiversity baseline for the abyssal Bering Sea and eastern Aleutian Trench. Here, deep-sea isopod crustaceans are used as a focal taxon to demonstrate how an integrative framework (morphology, molecular-genetics and proteomics) reveals high species diversity, and a substantial proportion of taxa new to science, while resolving depth- and topography-driven patterns of connectivity.

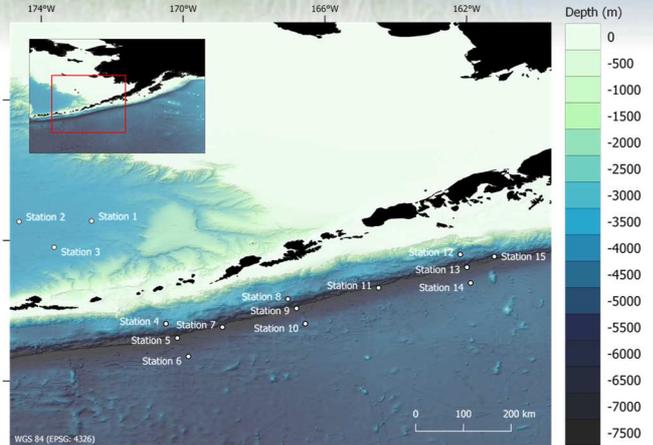


Fig. 1 Sampling (station) areas of the AleutBio expedition (map by AC Wölfl, K. Kessa)

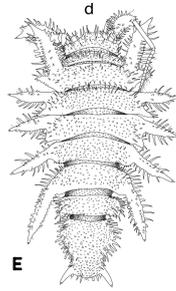
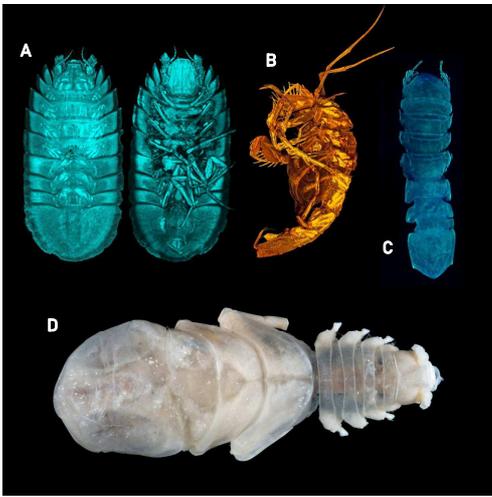


Fig. 2 Selection of new isopod species described from material collected during the AleutBio expedition A) *Austronicus ewa* (in Akdogan et al. in press); B) *Eugerdella* sp. nov. (Kaiser et al., submitted); C) *Heterastis* sp. nov. (Kaiser et al., submitted); D) *Bathyporus sonnei* (Brandt et al. 2025); E) *Kurilosignum cardui* (Kelch et al., in press).

Results. Work on the isopod crustaceans is still ongoing, but so far, we have found a high diversity, with over 100 species, the majority of which are new to science (Fig. 3). Notably, some isopod species—despite being presumed poor dispersers—exhibit extremely broad distributions, spanning distances greater than 3,000 km, whereas many others show limited ranges, often stratified by depth or restricted to specific regions. Geographic features, such as the Aleutian Arc, appear to act as partial barriers to dispersal but are not absolute. The application of an integrative species delimitation approach, combining morphology, genetics, and proteomics, proved effective in defining species boundaries (Figs 4, 5). Overall, these data provide an important baseline for a region experiencing considerable environmental change.

Methods. Isopods were collected using two types of epibenthic sledge (EBS) and a box corer (BC) across 15 station areas (Figs 1-3). Species boundaries and evolutionary relationships were investigated within an integrative framework combining morphological analyses, mitochondrial COI barcoding, selected nuclear markers (e.g. 18S rRNA), and MALDI-TOF mass-spectrometric profiles. These datasets were analysed using complementary sequence-based operational taxonomic unit (OTU), species-delimitation, phylogeographic, and phylogenetic approaches, enabling the formulation of robust species hypotheses, detection of cryptic diversity, and inference of depth-related richness patterns and population connectivity.

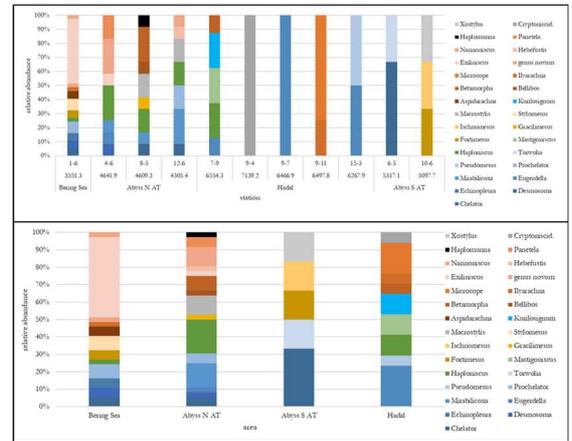


Fig. 3. Relative abundance (%) of isopod genera collected with a box corer during AleutBio. (top) across different stations and depths (m), and (below) across regions in the northeastern Pacific (Preikschart et al. 2025). Abyss N/S AT: Abyssal Northern (Station areas 4, 8 & 12) or Southern rim of the Aleutian trench 6, 10, 14). Hada: Station areas 5, 7, 9, 11, 13, 15 (compare Figure 1)

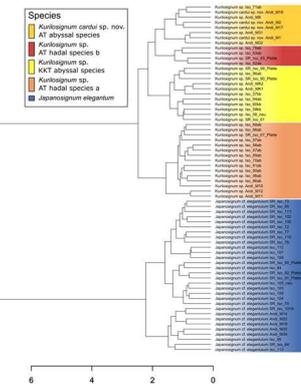


Fig. 4 Results of the protein mass spectra based hierarchical cluster analysis of mesosignid specimens collected during AleutBio, dividing the analysed specimens clearly into genera *Kurilosignum* (yellow-red) and *Japanosignum* (blue), and *Kurilosignum* divides further by region (from Ketch et al. 2026).

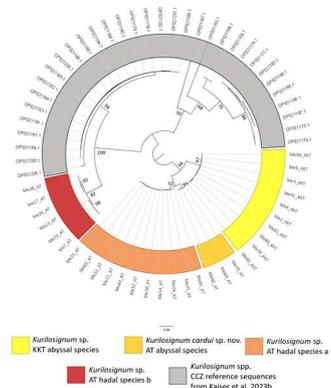


Fig. 5 Phylogenetic tree based on COI of 63 mesosignid specimens collected during the AleutBio expedition, and comparison with data from the adjacent Kuril Kamchatka Trench and Clarion Clipperton Fracture Zone (central N Pacific) (from Kelch et al. 2026).

- Highlights.**
- Substantial undescribed diversity revealed across sampled isopod assemblages.
 - Biogeographic affinity between Aleutian-Bering and Kuril-Kamchatka Trench faunas indicates faunal exchange across the northwestern Pacific.
 - In contrast, strongly restricted distributions, shaped by regional and bathymetric barriers (abyssal vs. hadal), highlight limited dispersal.
 - Pronounced cryptic diversity, consistent with broader patterns observed in marine taxa.

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References: Akdogan D., Brandt A., Kaiser S., in press. A new species of *Austronicus* Vanhöffen, 1914 (Isopoda, Asellota, Nannoniscidae Hansen, 1914) from abyssal depths of the Aleutian Trench, north-eastern Pacific. *Progress in Oceanography*, in press; Brandt, A., Di Franco, D., Knauber, H., Kaiser, S., & Kelch, A. (2025). *Bathyporus sonnei* sp. nov.—A new species of the rare deep-sea isopod genus (Crustacea, Isopoda, Asellota) from the Aleutian Trench, north-eastern Pacific with notes on the Bathyporinae. *Progress in Oceanography*, 234, 103443; Kelch, A., Spies, L., Di Franco, D., Nilsson, M. A., Rossel, S., Arbizu, P. M., et al. (2024). Integrative taxonomy of Mesosignidae Schultz, 1969 (Crustacea, Malacostraca) from North Pacific trenches: new species description and biogeographic insights from morphology, mtDNA, and proteomics. *Progress in Oceanography*, 103482; Preikschart, M., Di Franco, D., Kelch, A., Meißner, K., Brandt, A., & Kaiser, S. (2025). Abyssal and hadal macroinhabiting assemblages in the eastern Aleutian Trench (NE Pacific). *Progress in Oceanography*, 103508.