Sea Grant California

Roundworms as Bioindicators of Sediment Ecology at Bolsa Chica Wetlands

// Paul De Ley, UC Riverside

SUMMARY

Nematodes, also known as roundworms, are among the most abundant groups of animals on the planet. If you had pinworms as a child, you've experienced nematodes firsthand – and are not alone, as at any given time, about a third of the world's population is believed to be infected by some kind of nematode parasite. Nematodes, many species of which are not parasitic, are also incredibly common denizens of coastal sediments, and an important source of nourishment for shellfish and bigger worms, which themselves are forage species for other animals. Because of this, roundworms are critical components of the coastal food web, and hence a meaningful "bottom-up" indicator of coastal ecosystem functioning.

More to the point for the region's coastal wetlands projects, rounworm communities – the species present and absent at a site, and their relative numbers – may shed light on the pace, progress and success of multi-million dollar earth-moving projects such the construction of the Bolsa Chica Wetlands in Huntington Beach, Orange County, a former coastal oil field that was closed to tidal flushing for more than a century.

The head of a nematode (*Spilophorella candida*) magnified 960 times with interference contrast microscopy. The specimen was collected in fine intertidal mud at Bolsa Bay in Huntington Beach. Image: P. De Ley

Sea Grant Trainee Ian Wm. King collects sediment cores from the Bolsa Chica Wetlands in Huntington Beach. Back in the lab, scientists ID and count the different types of nematodes in the samples, to gain insights into the progress of the restoration effort. Image: P. De Ley

PROJECT

This project's main goals were to catalog, characterize and compare nematode communities in sediment cores collected at five sites at the Bolsa Chica Wetlands, one site at Bolsa Chica State Beach and three sites at the Carpinteria Salt Marsh Reserve in Santa Barbara County, repeatedly for a two-year period beginning in 2007. Ideally, sampling would have taken place before, during and after the opening of the mouth of Bolsa Bay; however, funding constraints made this impossible and so sampling began after the earthen dam holding back the sea was bulldozed in 2006.

The Carpinteria Salt Marsh was selected as a control site for the study, as it is a relatively natural, large estuary that has never been closed to tidal flows. The marsh is also part of the University of California Natural Reserve System, which was established, in part, to facilitate field studies. In addition, while the Bolsa Chica Wetlands sits atop a hydrocarbon-rich geologic formation, Carpinteria does not. This is noteworthy because nematodes are known to be selectively sensitive to toxic hydrocarbons. Because of this, their absence can reflect exposure to low-levels of hydrocarbon pollution. With Carpinteria as a control site, researchers were able test for biological indications of natural seepage at the restored wetland.

FINDINGS

1. The return of tidal flushing to Bolsa Chica appears to have re-established a sediment ecology comparable to other local lagoons, at least as inferred by the similarities of nematode communities at the two wetlands under study.

2. Toxic hydrocarbons were not detected to be affecting the restored wetland, at least as inferred from the healthy nematode communities.

3. Nematode communities varied within the restored wetland, but were not directly linked to exposure to tidal flows. There was a paucity of nematodes at one of the farthest inland sites, where tidal influence was minimal, and at the beach site, which is fully exposed to the tides. The beach site also had the highest number of nematode species. These observations are noteworthy because scientists had *a priori* hypothesized an inverse correlation between the degree of tidal exposure and species richness.

4. During the two-year sampling period, the diversity of nematode species increased at Bolsa Chica, suggesting ongoing progress in re-creating wildlife habitat there.

Microscopy image of the male reproductive system of a newly discovered nematode species of the genus Camacolaimus. The roundworm probably feeds on diatoms and was discovered in beach sand at Bolsa Chica State Beach, near the new tidal inlet to the wetlands. Image: P. De Ley

IMPACTS

During the course of this project, researchers counted 45,000 individual nematode specimens and identified 15,000 of these, in the process discovering two new species. The images of representative specimens are being cataloged in NemATOL, the nematode component of the National Science Foundation's Tree of Life project, while diagnostic DNA sequences are being deposited into the National Institutes of Health's genetic sequence database known as GenBank.

In terms of resource management, the data collected for this project begin the process of cataloging the marine nematodes in coastal California, thereby establishing a baseline for long-term monitoring of sediment quality and food web structure at restored and natural wetlands.

Sea Grant Trainee Ian Wm. King collecting sediment cores from one of the control sites in Santa Barbara County. Image: P. De Ley

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