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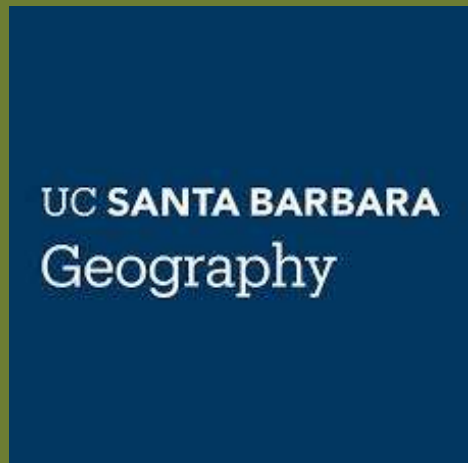


Visualizing Waterbird-Aquatic Invertebrate Linkages in North Campus Open Space

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Introduction

Over 90% of California’s historical wetland area has been lost (Dahl, 1990), making active restoration sites increasingly important refugia for waterbirds and the invertebrate communities they depend on. The North Campus Open Space (NCOS) in Goleta, CA – a large coastal wetland restoration project managed by UCSB’s Cheadle Center – is one such effort. NCOS encompasses the upper portion of the Devereux Slough and includes several neighboring freshwater-estuarine habitats.

Beyond hydrologic and vegetative metrics, faunal communities are recognized as critical indicators of restoration progress (Moss, 2009). Yet, bird use at NCOS is unevenly distributed. This raises the question: how are waterbird assemblages using specific habitat areas related to the aquatic prey available in those areas? The question is addressed by combining geospatial waterbird survey data, quarterly aquatic invertebrate samples, and known bird diets to build trophic networks across four distinct habitat zones.

Methods

Study Site and Habitat Zones

Four zones in NCOS were delineated in ArcGIS referencing a Cheadle Center habitat layer: the main slough channel with adjacent mudflats; Phelps creek confluence; vernal pools; and constructed NCOS ponds.

Bird Data

Aquatic bird observations from monthly Cheadle Center surveys (2023-2025) were spatially filtered to each zone. Total counts were summarized by species and zone.

Aquatic Invertebrate Data

Quarterly sampling data collected across the estuary were filtered to zones and then counts were log-transformed.

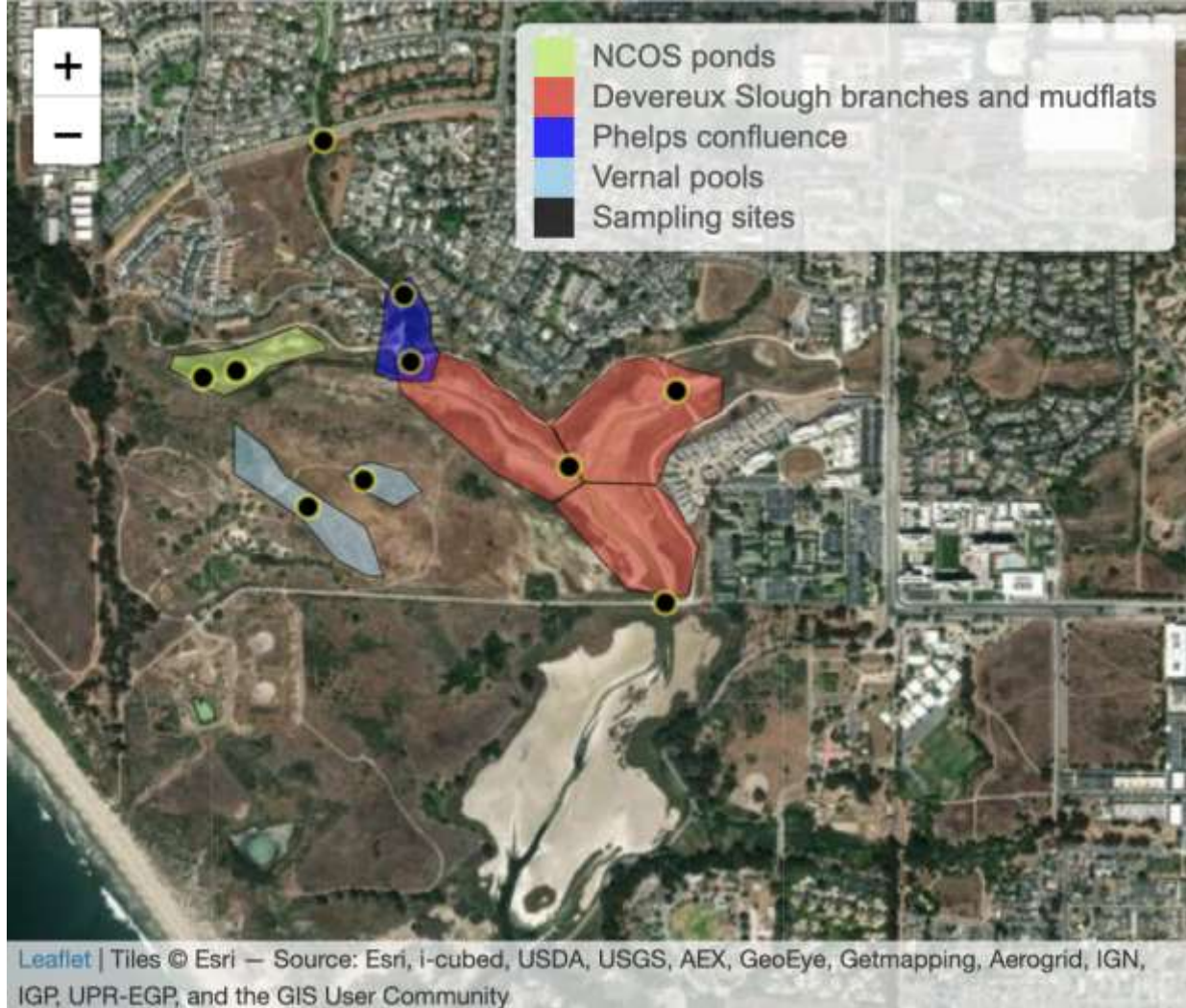


Figure 1. Study focus area including zones and sampling sites.

Trophic Networks

Potential diet linkages between bird species and invertebrate taxa were inferred from the literature. I visualized linkage data by creating networks using the 'bipartite' R package. Node heights are proportional to log-transformed taxa abundances. Network-level analysis is done to compare complexity, uniqueness, and similarity in potential foraging behavior across zones.

Results

Devereux Slough supports greater diversity of waterbirds and a larger trophic network while a saline-fresh water confluence provides vital prey for specialist species

Devereux Slough channel and mudflats

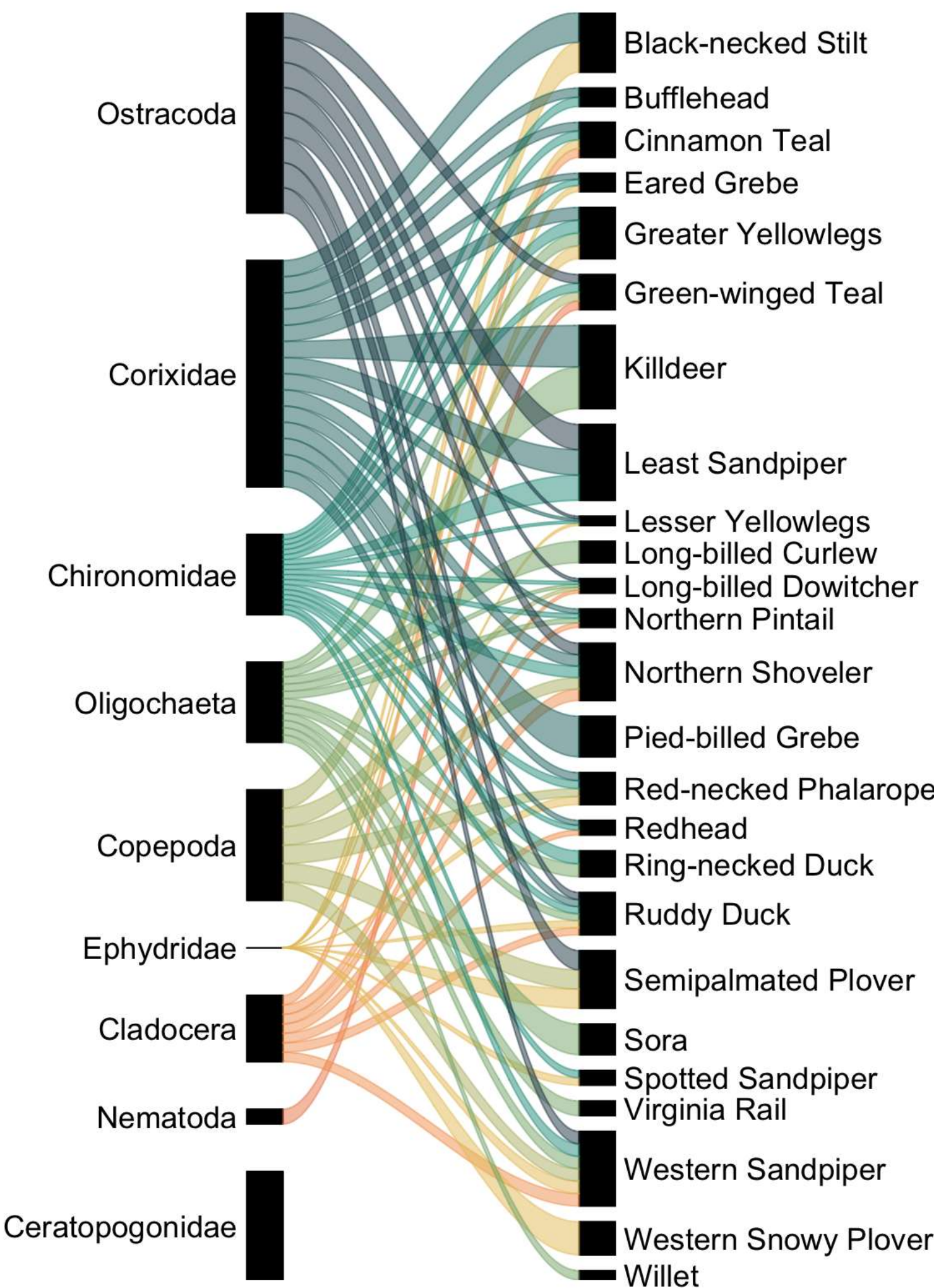


Figure 2. Node height proportional to log-transformed abundance. Link color indicates prey taxon.

Phelps Creek Confluence

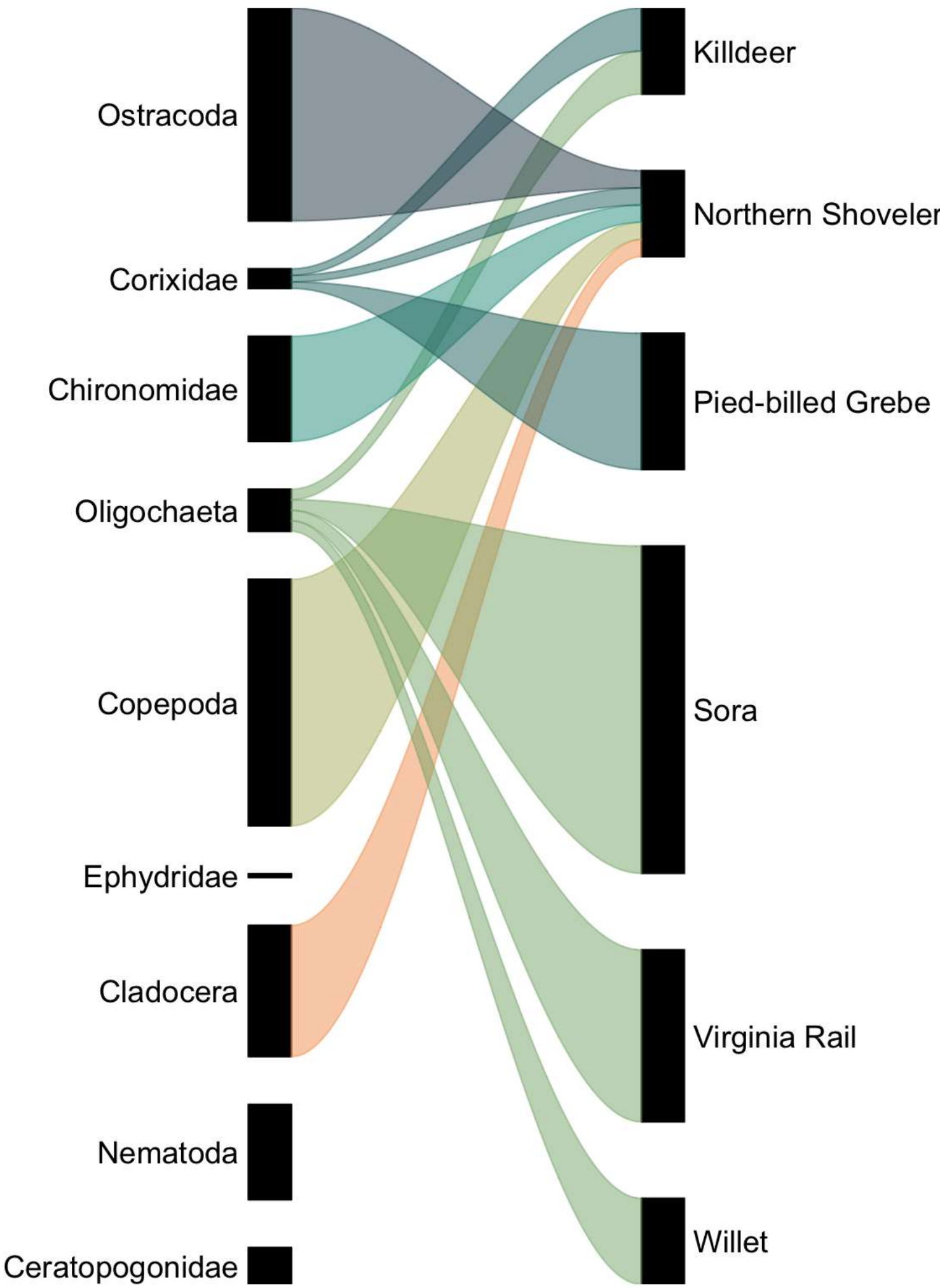
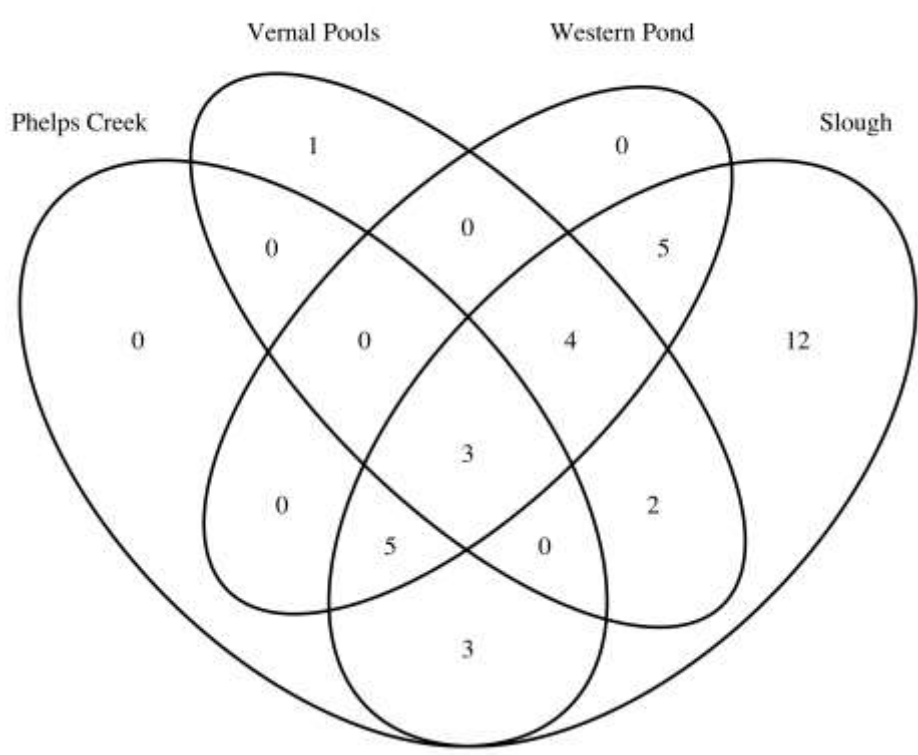


Figure 3. Node height proportional to log-transformed abundance. Link color indicates prey taxon.

Shared waterbird species across NCOS habitat zones



Devereux Slough supports the highest waterbird diversity, sharing species mostly with pond and confluence habitats. Nearly all vernal pools species occur elsewhere at NCOS, with one species exclusively recorded at this habitat.

Discussion & Next Steps

Interpretation:

Slough network is dense and dominated by generalists, with 25 bird species foraging across all taxa. Phelps has a more divided network - Sora, Virginia Rail, and Willet focus on Oligochaeta while the N. Shoveler, the zone’s generalist, connects to a broad prey range. The conditions at Phelps thus may support the specialized diets of some co-occurring birds because of a reduction in competition for prey.

Implications:

Fine-scale monitoring reveals ecologically meaningful variations in habitat use by birds that site-level observations will miss. Monthly bird surveys and quarterly invertebrate sampling allowed for indicative snapshots of restoration progress, strengthening the case for implementing these monitoring practices at NCOS to wetlands across CA.

Next Steps:

Seasonality: Do aquatic invertebrate communities change with seasons in ways that predict bird use? Vegetation structure, water depth, salinity, and tidal dynamics at NCOS all impact invertebrate availability that in turn may shape foraging habitats.

References

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