SALINITY FLUCTUATIONS OCCURRING DURING A 60 DAY INTERVAL IN FRESH MEADOW AND SEAL HARBOR ESTUARIES LOCATED ON MOUNT DESERT ISLAND, MAINE

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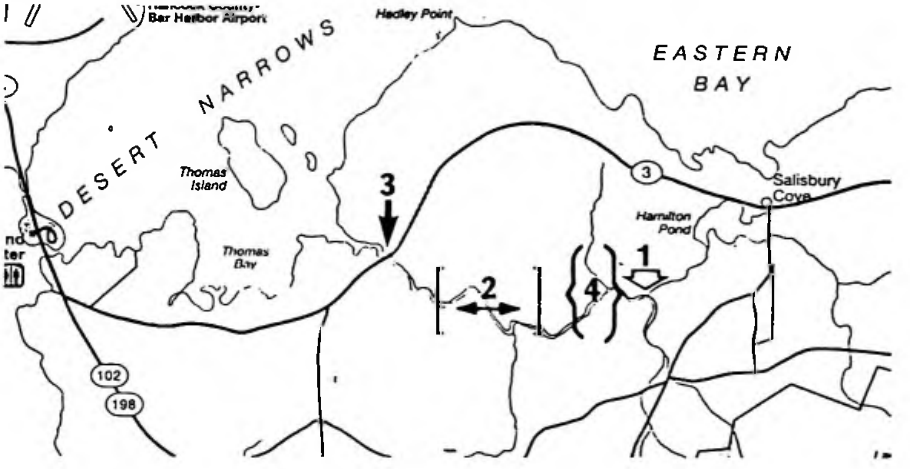
Estuaries are important areas where fresh water intermixes with ocean salt water. Depending on the local topography, the salinity of water at various locations within an estuary may vary depending on the tides as well as season of the year. Organisms that inhabit an estuary are exposed to these varying salinities and their osmoregulatory mechanisms must adapt to these changes. To determine the extent of intertidal variations in salinity present in 2 estuaries on Mount Desert Island during the summer months of July and August, we measured the salinity of surface as well as below surface water samples during various tidal intervals. Water salinity was quantified using a salinity refractometer where multiple samples (n>6) were measured in duplicate at specific locations and tidal intervals. Mean water salinity was expressed as parts per thousand (ppt) where variations in individual samples at a single given location were less than 1%. Fresh water was defined as 0-5 ppt as compared to full strength seawater 33-34 ppt. As detailed below, our data demonstrate that both estuaries possesses unique salinity environments.



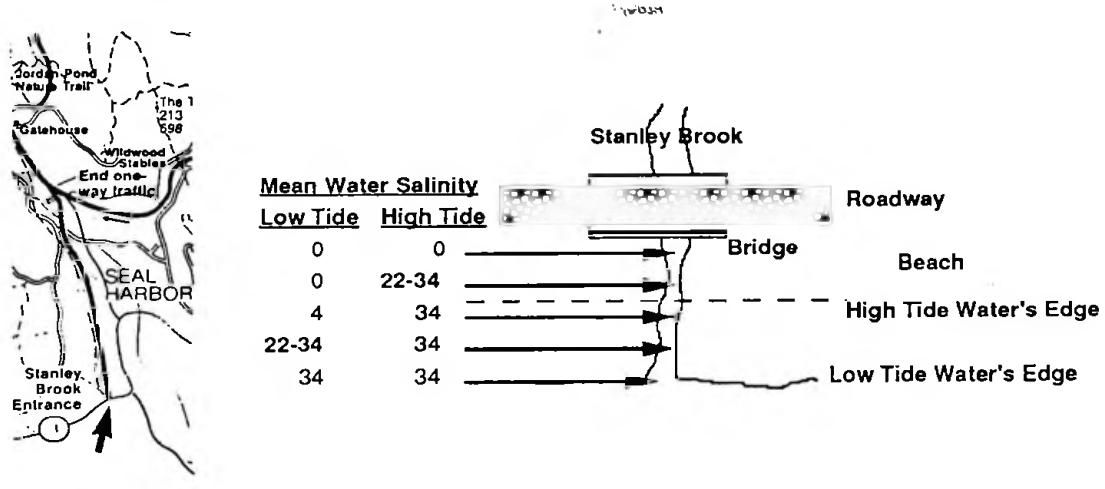
MAP 1: Fresh Meadow Estuary. The Fresh Meadow Estuary is located on the northeastern aspect of Mount Desert Island near the Mount Desert Narrows. As detailed in the text, this estuary contains a large zone of constant intermediate salinity.

The Fresh Meadow estuary is supplied by both fresh (2 fresh water streams) and salt (Eastern Bay) water. As shown in Map 1, surface water salinity measurements demonstrate that salt water infiltration of the Fresh Meadow estuary is very extensive such that salinities of 6-7 ppt are present at Point #1 (large open arrow) during low tide at a distance of 3 km from the mouth of Northeast Creek (point #3). A region of the Fresh Meadow estuary encompassing approximately 150,000 square meters centered at the junction of Aunt Betsey's Creek and Northeast Creek (indicated by square brackets and double headed arrow #2) possesses a constant salinity of 17-18 ppt at both high and low tides. In this central region of the estuary, the tidal water level varies approximately 15-20 cm. Near the mouth of the estuary (solid arrow #3), tidal fluctuations in salinity are small (< 5 ppt) and remain approximately 33 ppt at both low and high tides. Sites located at the head of the estuary (parentheses #4) also exhibit a salinity that varies between 4-14

ppt. To determine whether vertical salinity gradients exist at various depths within the mouth (#3) and central portion of this estuary (#2), water samples were obtained at depths up to 5 feet deep and salinities determined as described above. At both locations tested, only small (0-5 ppt) variations in salinity were recorded.

We performed a preliminary survey of the distribution of plant species at specific salinity locations within Fresh Meadow Estuary. These species include abundant rockweed (*Fucus*) and kelp (*Laminaria*) as well as saltmarsh cordgrass (*Spartina*) growing in the central area of the estuary (#2). In contrast, cattails (*Typhacea*) are restricted to regions possessing salinities lower than 8 ppt (#1 and #4).

The Seal Harbor Beach Estuary is located on the southern shore of Mount Desert Island. Fresh water is supplied by Stanley Brook that empties into Seal Harbor. As shown in Map 2, a sharp narrow region of intermediate salinity (26-34 ppt) is present at both high and low tides. At high tide, this region of intermediate salinity is approximately 9 meters long and 3 meters wide and is localized to a area approximately 10-25 meters from the Route 3 bridge. Immediately above this zone of intermediate salinity is fresh water (0-5 ppt). Directly below the intermediate zone is seawater (32-35 ppt). At low tide, this zone of intermediate salinity moves down the beach to an area approximately 100 meters from the bridge.



MAP 2: Seal Harbor Beach Estuary - Intertidal Zone. Seal Harbor Beach is located on the southern aspect of Mount Desert Island (right panel). As shown in the left panel, a zone of intermediate water salinity [(ppt) - shown by bold type] traverses the mouth of Stanley Brook.

Plant species at the Seal Harbor Estuary are similar to those found at Fresh Meadow. At Seal Harbor, kelp (*Laminaria*), mermaid's hair (*Chorda*), tufted green algae (*Cladophora*), and rockweed (*Fucus*) grow in the zone of intermediate salinity. In the fresh water of Stanley Brook, *Fucus* grows abundantly.

We conclude that the Fresh Meadow Estuary possesses a remarkably constant intermediate salinity despite the large tidal fluctuations present in Eastern Bay and the Mount Desert Narrows. Its central region of constant intermediate salinity (17-18 ppt) provides a unique environment for the plant and animal species that inhabit it. In contrast, the Seal Harbor Estuary consists of a narrow intermediate salinity zone (26-35 ppt) that traverses up or down a limited area of the beach

depending on the prevailing tides. The resident plants at Seal Harbor must adapt to extreme variations in salinity (0-35 ppt) produced by the tidal water movements. Thus, variations in the local topography directly effect the osmoregulatory challenges faced by local estuarial animals and plants.

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