

ECOLOGY OF A NEW ENGLAND SALT MARSH¹

SCOTT W. NIXON AND CANDACE A. OVIATT

Graduate School of Oceanography

University of Rhode Island, Kingston, Rhode Island 02881

TABLE OF CONTENTS

ABSTRACT	463	General characteristics	471
INTRODUCTION	464	Tidal patterns	473
Bissel Cove	464	Diurnal curves and system metabolism	473
METHODS	466	Plankton	475
Production and metabolism	466	Benthic plants	478
Marsh grass production	466	Sediments	479
Animal respiration	466	Infauna and epifauna	480
Plankton metabolism	466	Grass shrimp	481
Benthic plant metabolism	466	Fish	484
Sediment respiration	467	Birds	488
Total system metabolism of the embayment ..	467	COMMUNITY ENERGY FLOW	490
Population estimates	468	A SIMULATION MODEL OF DIURNAL	
Animals in the emergent marsh	468	DISSOLVED OXYGEN	492
Plankton in the embayment	468	Dissolved oxygen models	492
Benthic plants and sediments	468	The Bissel Cove model	492
Infauna and epifauna	468	Simulation and verification	494
Grass shrimp	469	Effect of the tide	495
Fish	469	Simulation of sewage input	495
THE EMERGENT MARSH	470	Simulated temperature increases	495
Grass and detritus	470	ACKNOWLEDGMENTS	496
Animals	471	LITERATURE CITED	496
THE TIDAL EMBAYMENT.....	471		

ABSTRACT

Measurements of the abundance of major populations, their metabolism, and the seasonal patterns of total system metabolism throughout a year were used to develop energy-flow diagrams for a New England salt-marsh embayment. The annual ecological energy budget for the embayment indicates that consumption exceeds production, so that the system must depend on inputs of organic detritus from marsh grasses. Gross production ranged from almost zero in winter to about 5 g O₂ m⁻² day⁻¹ in summer. Respiration values were similar, but slightly higher, with the maximum difference observed in fall. Populations of shrimp and fish were largest in fall, with a much smaller peak in spring. Few animals were present in the embayment from May to July, but fall populations of shrimp ranged from 250 to 800 m⁻² and fish averaged over 10 m⁻². Birds were most abundant in winter and spring. In spite of high numbers, no evidence was found that the marsh embayment exported large amounts of shrimp or fish to the estuary. Production of aboveground emergent grasses on the marsh equaled 840 g m⁻² for tall *Spartina alterniflora*, 432 g m⁻² for short *S. alterniflora*, and 430 g m⁻² for *S. patens*. These values are similar to those for New York marshes, but substantially lower than the southern marsh types. The efficiency of production of marsh grasses in the New England marsh was lower than reported for southern areas.

A simulation model based on the laboratory and field metabolism and biomass measurements of parts of the embayment system was developed to predict diurnal patterns of dissolved oxygen in the marsh. The model was verified with field measurements of diurnal oxygen curves. The model indicated the importance of the timing of high tides in determining oxygen levels and was used to explore simulated additions of sewage BOD and increases in temperature.

Key words: New England, salt marsh, ecosystem, embayment, oxygen, model, *Spartina*, *Palaeomonetes*, *Fundulus*, detritus, production, energy

¹ Received August 29, 1972; accepted March 15, 1973.