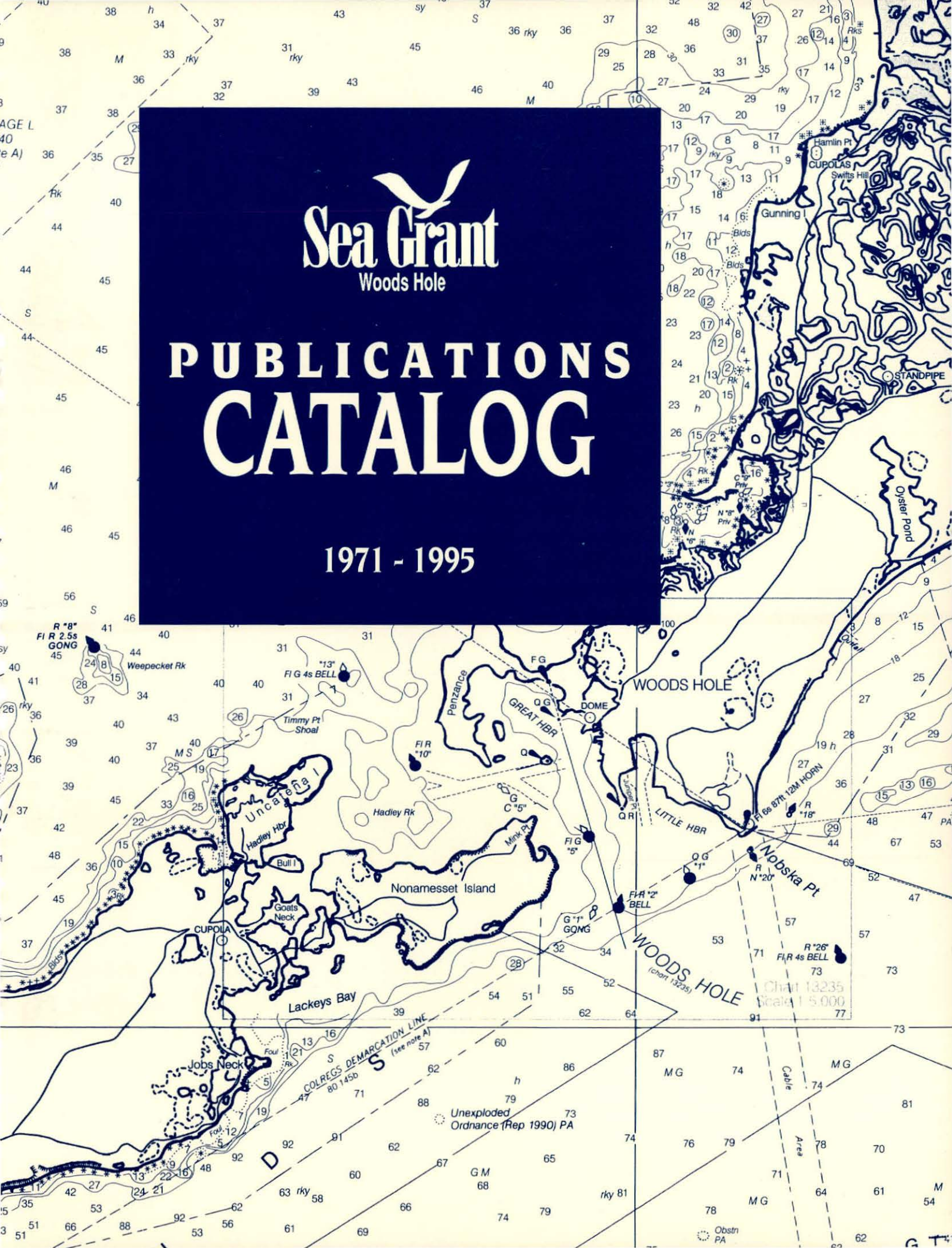
Sea Grant
Woods Hole
PUBLICATIONS
CATALOG
1971 - 1995
WOODS HOLE
Penzance
GREAT HBR
DOME
LITTLE HBR
Oyster Pond
Hamlin Pt
CUPOLAS
Swifts Hill
Gunning
STANDPIPE
Weepecket Rk
Timmy Pt Shoal
Hadley Rk
Uncatena I
Hadley Hbr
Bull I
Mink Pt
Nonamesset Island
Goats Neck
CUPOLA
Lackeys Bay
Jobs Neck
Nobska Pt
WOODS HOLE
(chart 13235)
Chart 13235
Scale 1:5,000
COLREGS DEMARCATION LINE
(see note A)
Unexploded
Ordnance (Rep 1990) PA
Cable
Area

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1971 - 1995

WOODS HOLE OCEANOGRAPHIC INSTITUTION
1930

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Coastal Processes—General

A Comparison of Methods to Determine K in a Shallow Coastal Aquifer
Milham, N.P. and B.L. Howes
Ground Water, Vol. 33, No. 1, pp. 49-57, *1995* WHOI-R-95-001

Nutrient Balance of a Shallow Coastal Embayment: I. Patterns of Groundwater Discharge
Milham, N.P. and B.L. Howes
Marine Ecology Progress Series, Vol. 112, pp. 155-167, *1994* WHOI-R-94-004

Transport of Juvenile Gem Clams (*Gemma gemma*) in a Headland Wake
Rankin, K.L., L.S. Mullineaux, and W.R. Geyer
Estuaries, Vol. 17, No. 3, pp. 655-667, *1994* WHOI-R-94-006
Accumulation of bivalve recruits in the bottom convergence at the center of coastal eddies has been suggested as a possible mechanism resulting in locally abundant adult populations. The authors investigated transport of juvenile gem clams (*Gemma gemma*) in a headland wake to determine whether they accumulated, and where. Velocity measurements during three flood tides showed that a wake consistently formed, but that flow speeds were too slow to transport juvenile clams to the eddy center. Instead, the clams were deposited just inside the wake perimeter, where shear velocities decreased to levels below critical erosion velocities of the clams. This result demonstrated that accumulation in a coastal flow separation can occur even in the absence of a well-defined eddy or a strong bottom convergence. Juvenile gem clams were carried, probably as bedload, to regions in the wake dominated by sediments with similar grain sizes, rather than similar fall velocities, suggesting that bedload transport was particularly dependent on particle diameter in this flow regime. Adult gem clam populations tended to be locally abundant in regions receiving transported juveniles, but clam transport on any specific flood tide was not sufficient to fully predict the adult distributions.

Coastal and Estuarine Studies. Formation and Evolution of Multiple Tidal Inlets
Aubrey, D.G. and G.S. Giese (eds.)
American Geophysical Union, Washington, D.C., Vol. 44, 237 pp., *1993*
This publication is only available from: American Geophysical Union, 2000 Florida Avenue, NW, Washington, DC 20009, U.S.A.

Quantifying Dissolved Nitrogen Flux Through a Coastal Watershed
Weiskel, P.K. and B.L. Howes
Water Resources Research, Vol. 27, No. 11, pp. 2929-2939, *1991* WHOI-R-91-005
Available nitrogen loading models, commonly used to estimate subsurface fluxes of dissolved nitrogen to coastal waters, have not been quantitatively or systematically compared; nor have they generally been field-verified at regional scales. The authors employed three published loading models, a site-specific model based upon water use data, and both Darcian and non-Darcian field approaches to obtain estimates of steady state, dissolved nitrogen flux through a permeable Massachusetts watershed. Loading models, if properly verified by field measurements at the stream tube scale, hold promise for characterizing the effects of land use on subsurface nitrogen flux through coastal watersheds.

Nitrogen Inputs to a Marine Embayment: The Importance of Groundwater √
Giblin, A.E. and A.G. Gaines
Biogeochemistry, Vol. 10, pp. 309-328, *1990* WHOI-R-90-012
The authors examined the importance of nitrogen inputs from groundwater and runoff in a small coastal marine cove on Cape Cod, Massachusetts. Groundwater inputs were evaluated in three different methods: a water budget, assuming discharge equals recharge; direct measurements of discharge using bell jars; and a budget of water and salt

at the mouth of the Cove over several tidal cycles. The lowest estimates were obtained by using a water budget and the highest estimates were obtained using a budget of water and salt at the Cove mouth. Overall there was more than a five fold difference in the freshwater inputs calculated by using these methods. Nitrogen in groundwater appears to be largely derived from on site septic systems. Average nitrate concentrations were highest in the region where building density was greatest. Nitrate in groundwater appeared to behave conservatively in sandy sediments where groundwater flow rates were high (>11/m^2/h), indicating that denitrification was not substantially reducing external nitrogen loading to the Cove. Nitrogen inputs from groundwater were approximately 300 mmol-N/m^3/y of Cove water. Road runoff contributed an additional 60 mmol/m^3/y. Total nitrogen inputs from groundwater and road runoff to this cove were similar in magnitude to river dominated estuaries in urbanized areas in the United States.

Geodetic Fixing of Tide Gauge Bench Marks Δ
Carter, W.E., D.G. Aubrey, T. Baker, C. Boucher, C. LeProvost, D. Pugh, W.R. Peltier, M. Zumberge, R.H. Rapp, R.E. Schutz, K.O. Emery, and D.B. Enfield
Woods Hole Oceanographic Institution Technical Report WHOI-89-31 (CRC-89-5), 44 pp., *1989* WHOI-T-89-009

The Characteristics of the China Coastline
Wang, Y. and D.G. Aubrey
Continental Shelf Research, Vol. 7, No. 4, pp. 329-349, *1987* WHOI-R-87-011

An Improved Loran-C Drifting Buoy and Drogue for Coastal Applications
Burke, W.J.
Ph.D. Thesis. Massachusetts Institute of Technology/Woods Hole Oceanographic Institution Joint Education Program, 1 p. (abstract only), *1983* WHOI-X-83-002

Survey of Shoreline Structures — Popponesset Beach, Massachusetts Δ
Goud, M.R. and D.G. Aubrey
Woods Hole Oceanographic Institution Technical Report WHOI-83-14, 32 pp., *1983* WHOI-T-83-001

Trace Element Enrichments in Decomposing Litter of *Spartina alterniflora*
Breteler, R.J., J.M. Teal, A.E. Giblin, and I. Valiela
Aquatic Botany, Vol. 11, pp. 111-120, *1981* WHOI-R-81-019

Our Dynamic Coastline √
Aubrey, D.G.
Oceanus, Vol. 23, No. 4, pp. 4-13, *1980* WHOI-R-80-019
The beaches of the United States, which include the most extensive barrier beaches in the world, constitute a valuable and delicate resource that must be managed intelligently to avoid loss of their recreational benefits, storm protection, and aesthetic appeal. Beaches are complex systems: they are forced by complex atmospheric and oceanic behavior and respond in an equally complex manner. This article discusses geological factors that control shoreline features, nearshore hydrodynamics, and beach response. The author concludes by pointing out that our scientific understanding of beaches is, in some respects, not sufficient to meet the requirements of coastal zone management in establishing beach policies and guidelines. Dr. Aubrey calls for a continuation of active research in beach processes in general, including barrier beach systems, as well as the need for the scientific community to work closely with the public to educate and communicate various scientific alternatives available for managing our beaches.

Proceedings of a Workshop on Coastal Zone Research in Massachusetts Δ
Aubrey, D.G.
1979 WHOI-W-79-001

Δ Available on loan from NSGD, see p. *v*.
√ Helpful to educators and students.

Grain Size in Laminae of Beach Sand
Emery, K.O.
1978 WHOI-R-78-009

Coastal Processes—Salt Marshes

Salt Marshes: Jewels of the Northeast √
Giese, G.S. and T.I. Crago
Nor'easter, Vol. 6, No. 2, pp. 12-15, *1994* WHOI-R-94-008

Response of a Salt Marsh Microbial Community to Inputs of Heavy Metals: Aerobic Heterotrophic Metabolism
Giblin, A.E., M. Piotrowski, B. Leighty, I. Valiela, and J.M. Teal
Environmental Toxicology and Chemistry, Vol. 2, pp. 343-351, *1983* WHOI-R-83-018

Does Salt Marsh Fertilization Enhance Shellfish Production? An Application of Flow Analysis Δ
Finn, J.T. and T.M. Leschine
Environmental Management, Vol. 4, No. 3, pp. 193-203, *1980* WHOI-R-80-011
The method of flow analysis, which is similar to economic input-output analysis, is presented as a means of making flow models of ecological systems more useful to environmental managers. This paper considers as an illustration the extent to which nitrogen fertilizer added to *Spartina* salt marsh sediments can enhance shellfish growth. Nitrogen flow models of both the Barataria Bay salt marsh complex of coastal Louisiana and the Sippewissett Marsh of western Cape Cod, Massachusetts, are analyzed. The analysis shows the transfer of added nitrogen to shellfish growth via *Spartina* growth, decomposition, and detrital feeding to be considerably less efficient than its transfer to *Spartina* growth itself. These results are similar for both marsh systems, despite their great physical differences and despite the inclusion of considerably more microbial processing of nitrogen in the Barataria Bay model than in the Sippewissett models. The results suggest that the most efficient mechanism by which added nitrogen could enhance shellfish growth in salt marshes may have to bypass the route through the *Spartina* life cycle.

Uptake and Losses of Heavy Metals in Sewage Sludge by a New England Salt Marsh
Δ Giblin, A.E., A. Bourg, I. Valiela, and J.M. Teal
Amer. J. Bot., Vol. 67, No. 7, pp. 1059-1068, *1980* WHOI-R-80-015

Regulation of Primary Production and Decomposition in a Salt Marsh Ecosystem Δ
Valiela, I., B. Howes, R. Howarth, A. Giblin, K. Foreman, J.M. Teal, and J.E. Hobbie
In: Wetlands: Ecology and Management. Proceedings of the First International Wetlands Conf., New Delhi, India, 10-17 September 1980, pp. 151-168, *1980* WHOI-R-80-024
This paper, a result of ten years of research by a large group of colleagues, students, and assistants in the Great Sippewissett salt marsh project (Massachusetts), outlines the authors' ideas as to how primary production and decomposition of organic matter are governed in a salt marsh ecosystem. They consider the fate of carbon fixed in a salt marsh, focusing principally on decay and export to coastal waters. The authors also speculate on the effects of eutrophication on production and decay in salt marsh ecosystems.

Salt Marsh Nitrogen Analysis: Fertilization and the Allocation of Biological Productivity Δ
Leschine, T.M.
1979 WHOI-T-79-001

Input-output Analysis for Salt Marsh Bioproductivity Δ
Leschine, T.M. and L.J. Smith
1978 WHOI-R-78-013

Coastal Processes—Sediment Processes

Effects of Stratification by Suspended Sediments on Turbulent Shear Flows
Villaret, C. and J.H. Trowbridge
Journal of Geophysical Research, Vol. 96, No. C6, pp. 10659-10680, *1991* WHOI-R-91-002
Sediments suspended in turbulent flows of water over plane beds are known to influence the structure of the flows by which they are carried. Past attempts to model this effect have been based almost exclusively on a theoretical framework in which the dense solid particles stratify the flow and have an influence analogous to that of a downward heat flux in the stably stratified atmospheric surface layer. The authors compare results from a model based on this theoretical framework with laboratory measurements of ensemble-averaged velocity and ensemble-averaged particle concentration, obtained by previous investigators, in order to test the applicability of the theoretical approach to dilute suspensions of sand in turbulent flows of water.

Sedimentation Study: Environmental Monitoring and Operations Guidance System (EMOGS) — Kings Bay, Georgia and Florida, Phase III — FY 1989 Δ
Aubrey, D.G., T.R. McSherry, and W.D. Spencer
Woods Hole Oceanographic Institution Technical Report WHOI-90-34, 76 pp., *1990*, WHOI-T-90-001

Sand Transport by Unbroken Water Waves Under Sheet Flow Conditions
Trowbridge, J. and D. Young
Journal of Geophysical Research, Vol. 94, No. C8, pp. 10971-10991, *1989* WHOI-R-89-015

A Simple Technique for Fine-scale, Vertical Sectioning of Fresh Sediment Cores
Fuller, C.M. and C.A. Butman
Journal of Sedimentary Petrology, Vol. 58, No. 4, pp. 763-768, *1988* WHOI-R-88-008

Theoretical and Observational Estimates of Nearshore Bedload Transport Rates
Goud, M.R. and D.G. Aubrey
Marine Geology, Vol. 64, pp. 91-111, *1985* WHOI-R-85-001
Sediment transport rates in a shallow (<3 m) nearshore region are estimated using theoretical models and using bedform migration rates measured from vertical aerial photographs covering a 10-year interval. Theoretical rates based solely on asymmetrical tidal currents are as much as an order of magnitude smaller than the observed rates, but inclusion of storm wave effects in the theoretical predictions brings them into better agreement with observations. This suggests that even in tidally dominated, protected regions with low background wave energy, infrequent storm wave events significantly modify sand transport rates and patterns.

Transport of Trace Metals in Nearshore Sediments Δ
Martin, W.R.
Ph.D. Thesis, Massachusetts Institute of Technology/Woods Hole Oceanographic Institution Joint Program in Oceanography and Oceanographic Engineering, 302 pp., *1985* WHOI-X-85-001

Coastal Sediment Transport — Popponesset Beach, Massachusetts Δ
Aubrey, D.G. and M.R. Goud
Woods Hole Oceanographic Institution Technical Report WHOI-83-26, 132 pp., *1983* WHOI-T-83-004

Sediment Transport in a Tidal Inlet Δ
Aubrey, D.G. and P.E. Speer
Woods Hole Oceanographic Institution Technical Report WHOI-83-20, 112 pp., *1983* WHOI-T-83-003

Δ Available on loan from NSGD, see p. *v*.
√ Helpful to educators and students.

Holocene Sedimentation in the Shallow Nearshore Zone off Nauset Inlet, Cape Cod, Massachusetts
Aubrey, D.G., D.C. Twichell, and S.L. Pfirman
Marine Geology, Vol. 47, pp. 243-259, *1982* WHOI-R-82-007

Movable Bed Roughness in Unsteady Oscillatory Flow
Grant, W.D. and O.S. Madsen
Journal of Geophysical Research, Vol. 87, No. C1, pp. 469-481, *1982* WHOI-R-82-003

Seasonal Patterns of Onshore/Offshore Sediment Movement
Aubrey, D.G.
1979 WHOI-R-79-010

Coastal Processes—Land-level, Sea-level Change

Recent Global Sea Levels and Land Levels
Aubrey, D.G. and K.O. Emery
In: Warrick, R.A., E.M. Barrow, and T.M.L. Wigley (eds.), Climate and Sea Level Change: Observations, Projections and Implications, Proceedings Climate Change Workshop, Norwich, U.K. Cambridge University Press, pp. 45-56, *1993* WHOI-R-93-015

Impacts of Relative Sea-level Rise on Evolution of Shallow Estuaries
Freidrichs, C.T., D.G. Aubrey, and P.E. Speer
In: Cheng, R.T. (ed.), Residual Currents and Long-term Transport. Coastal and Estuarine Studies, Springer-Verlag New York, Inc., Vol. 38, pp. 105-122, *1990* WHOI-R-90-015
This study investigated the potential impact of sea-level rise by utilizing both one-dimensional numerical modeling and seasonal fluctuations in mean sea levels at six shallow estuaries along the U.S. Atlantic Coast. These fluctuations are used as analogues to interannual trends in mean sea-level rise. These findings have implications for the evolution of shallow estuaries as global sea-level rises (an anticipated consequence of increased atmospheric trace gas loading). Whether estuaries import or export increased amounts of sediments as global sea-level rises depends on local estuarine geometry. Some systems will infill faster as sea-level rises, while some will flush more efficiently. These contrasting responses to mean sea-level rise mandate a careful assessment of how any individual estuary may respond to rising water levels.

Changing Coastal Levels of South America and the Caribbean Region from Tide-gauge Records
Aubrey, D.G., K.O. Emery, and E. Uchupi
Tectonophysics, Vol. 154, pp. 269-284, *1988* WHOI-R-88-014

Coastal Neo-tectonics of the Mediterranean from Tide-gauge Records
Emery, K.O., D.G. Aubrey, and V. Goldsmith
Marine Geology, Vol. 81, pp. 41-52, *1988* WHOI-R-88-007

Suspect Terranes in the North American Margins and Relative Sea-levels
Uchupi, E. and D.G. Aubrey
Journal of Geology, Vol. 96, pp. 79-90, *1988* WHOI-R-88-003

Recent Relative Sea-level Change in Eastern North America
Braatz, B.V. and D.G. Aubrey
In: Nummedal, D., O.H. Pilkey, and J.D. Howard (eds.), Sea-level Fluctuation and Coastal Evolution, Special Publication No. 41, The Society of Economic Paleontologists and Mineralogists, pp. 29-46, *1987* WHOI-R-87-010

Relative Sea Level Change from Tide Gauge Records of Western North America
Emery, K.O. and D.G. Aubrey
Journal of Geophysical Research, Vol. 91, No. B14, pp. 13941-13953, *1986* WHOI-R-86-013

Glacial Rebound and Relative Sea Levels in Europe from Tide-gauge Records
Emery, K.O. and D.G. Aubrey
Tectonophysics, Vol. 120, pp. 239-255, *1985* WHOI-R-85-012

Eigenanalysis of Recent United States Sea Levels
Aubrey, D.G. and K.O. Emery
Continental Shelf Research, Vol. 2, No. 1, pp. 21-33, *1983* WHOI-R-83-007

Coastal Processes—Waves, Tides and Currents

Hydrodynamical Modeling of a Multiple-inlet Estuary/Barrier System: Insight into Tidal Inlet Formation and Stability
Friedrichs, C.T., D.G. Aubrey, G.S. Giese, and P.E. Speer
In: Aubrey, D.G. and G.S. Giese (eds.), Formation and Evolution of Multiple Tidal Inlets, Coastal and Estuarine Studies, American Geophysical Union, Washington, D.C., Vol. 44, pp. 95-112, *1993* WHOI-R-93-010

Coastal Seiches
Giese, G.S. and D.C. Chapman
Oceanus, Vol. 36, No. 1, pp. 38-46, *1993* WHOI-R-93-002

Tidal Residual Currents and Sediment Transport Through Multiple Tidal Inlets
Liu, J.T. and D.G. Aubrey
In: Aubrey, D.G. and G.S. Giese (eds.), Formation and Evolution of Multiple Tidal Inlets, Coastal and Estuarine Studies, American Geophysical Union, Washington, D.C., Vol. 44, pp. 113-157, *1993* WHOI-R-93-011

Non-linear Hydrodynamics of Shallow Tidal Inlet/Bay Systems
Speer, P.E., D.G. Aubrey, and C.T. Freidrichs
In: Parker, B.B. (ed.), Tidal Hydrodynamics, John Wiley & Sons, Inc., New York, 883 pp., pp. 321-339, *1991* WHOI-R-91-010
Shallow tidal inlet/bay systems, common along the New England coast and elsewhere, appear to result from a combination of small physical scale and large offshore tidal amplitude relative to distal channel depths. Shoaling channels effectively truncate the lowest portion of the tide, resulting in an extended falling tide and a slow shallow ebb flow. These systems are analogous to tides propagating up rivers, but important distinctions exist. This study investigates tidal distortion in detail at six such systems, using multiple tide records within individual systems, variations in offshore tidal forcing, and numerical modeling.

Tidal Velocity Asymmetries and Bedload Transport in Shallow Embayments
Fry, V. and D.G. Aubrey
Estuarine, Coastal and Shelf Science, Vol. 30, pp. 453-473, *1990* WHOI-R-90-008
Tidal circulation can cause a net transport of sediment when the tidal velocity is asymmetric about a zero mean (flood or ebb dominant) and the sediment transport rate is related nonlinearly to velocity. The relationship between tidal elevation and velocity is elucidated here to permit determination from tide gauge data and sediment transport relations whether tidal asymmetry needs to be considered as a mechanism for net sediment transport in the embayment of interest. A relationship between elevation and velocity in a shallow water, nonlinear system is derived through the continuity equation and shown to be significantly different than the linear relation. Finite difference numerical solutions of the one-dimensional, shallow water nonlinear equations are compared to

the continuity relation and are in agreement especially toward the landward end of the channel. Tide gauge data collected at the landward end of the embayment are most useful for predicting velocity asymmetries throughout a major portion of the embayment channel. The ratio of flood-to-ebb bedload transport and its relation to an asymmetric tidal elevation has been determined for both the linear relation between elevation and velocity and the nonlinear relation. Results show that the ratio of flood-to-ebb bedload transport as calculated from the nonlinear relation between elevation and velocity is similar to the flood-to-ebb ratio calculated from the linear relation because of offsetting effects.

Seasonal Climatology of Tidal Non-linearities in a Shallow Estuary
Aubrey, D.G. and C.T. Freidrichs
In: Aubrey, D.G. and L. Weishar (eds.), Hydrodynamics and Sediment Dynamics of Tidal Inlets, Lecture Notes on Coastal and Estuarine Studies, Springer-Verlag New York, Inc., Vol. 29, pp. 103-124, *1988* WHOI-R-88-022

Non-linear Tidal Distortion in Shallow Well-mixed Estuaries: A Synthesis
Freidrichs, C.T. and D.G. Aubrey
Estuarine, Coastal and Shelf Science, Vol. 27, pp. 521-545, *1988* WHOI-R-88-018

A Finite-depth Wind-wave Model. Part I: Model Description
Graber, H.C. and O.S. Madsen
Journal of Physical Oceanography, Vol. 18, No. 11, pp. 1465-1483, *1988* WHOI-R-88-020

Tide and Wind-forced Currents in Buzzards Bay, Massachusetts Δ
Signell, R.P.
Woods Hole Oceanographic Institution Technical Report WHOI-87-15, 86 pp., *1987* WHOI-T-87-003
The transport and dispersion of waterborne tracers (e.g. pollutants, larvae, and salt) are often of primary interest in shallow bays and estuaries. These processes often depend most importantly on the low-frequency and mean currents even when the instantaneous flow is dominated by tidal currents. This paper describes and explains the mean and low-frequency current response in a typical tidally-dominated coastal embayment with a contamination problem (Buzzards Bay, Massachusetts).

Kinematic and Dynamic Estimates from Electromagnetic Current Meter Data
Aubrey, D.G. and J.H. Trowbridge
Journal of Geophysical Research, Vol. 90, No. C5, pp. 9137-9146, *1985* WHOI-R-85-006
Comprehensive laboratory measurements and a thorough review of applicable literature show that electromagnetic current meters (manufactured by Marsh-McBurney, Inc.) are adequate for many kinematic measurements but may lead to excessive errors when using velocity to calculate dynamical quantities (such as bottom friction, Reynolds stress, or log-layer friction velocities). These studies point out a potential difficulty in using these meters in areas of large ambient turbulence levels (20% turbulent intensities), which are characteristic of many near-bottom shallow water environments. Further study is needed to clarify this behavior.

Use of Radio-controlled Miniature Aircraft for Drifter and Dye Current Studies in a Tidal Inlet
Hess, F.R. and D.G. Aubrey
Limnol. Oceanogr., Vol. 30, No. 2, pp. 426-431, *1985* WHOI-R-85-002
A commercially available radio-controlled miniature aircraft was modified and deployed as part of a field study of the ebbtidal flow characteristics of a natural, unstructured tidal inlet. To complement Eulerian current measurements within the main inlet channel, surface drifter and rhodamine dye patches were observed from the miniature aircraft and recorded with a 35-mm camera. Position reference was provided with an array of precisely located markers on land and in the water. The miniature aircraft is an inexpen-

sive, accurate alternative for Lagrangian studies in tidal inlets and estuaries, with many advantages over alternate techniques (such as hot-air balloons, fixed platforms, manned aircraft, or chaser boats).

A Study of Non-linear Tidal Propagation in Shallow Inlet/Estuarine Systems. Part II: Theory
Speer, P.E. and D.G. Aubrey
Estuarine, Coastal and Shelf Science, Vol. 21, pp. 207-224, *1985* WHOI-R-85-009

Performance of Bottom-mounted Directional Wave Gauges
Aubrey, D.G. and W. Hill
Proceedings of Oceans, IEEE, New York, pp. 705-710, *1984* WHOI-R-84-012

Dynamic Response of Spherical Electromagnetic Current Meters
Aubrey, D.G., J.H. Trowbridge, and W.D. Spencer
Proceedings of Oceans, IEEE, New York, pp. 242-248, *1984* WHOI-R-84-011

Dynamic Response of Electromagnetic Current Meters Δ
Aubrey, D.G., W.D. Spencer, and J.H. Trowbridge
Woods Hole Oceanographic Institution Technical Report WHOI-84-20, 150 pp., *1984* WHOI-T-84-002

Tidal Distortion in Shallow Estuaries Δ
Speer, P.E.
Ph.D. Thesis, Massachusetts Institute of Technology/Woods Hole Oceanographic Institution Joint Program in Oceanography, 210 pp., *1984* WHOI-X-84-001

Beach Changes on Coasts with Different Wave Climates
Aubrey, D.G.
In: McLachland, A. and T. Erasmus, (eds.), Sandy Beaches as Ecosystems, D.W. Junk Publishers, The Hague, Netherlands, pp. 63-85, *1983* WHOI-R-83-017
Seasonal and longer-term beach variability is quantified for seven U.S. beaches exposed to widely varying wave climates. One west coast location (southern California) and six east coast locations (from North Carolina to Massachusetts) form the basis of this study. Wave exposure varies from complete exposure to open waves, to partly sheltered locations, and finally to nearly complete sheltering where locally-generated waves dominate. Magnitude of annual beach variability ranged from 3.3 cubic metres to 0.2 cubic metres per metre of beach, with the greatest variability in regions exposed to open ocean waves and the lowest variability along protected coasts. All open coast locations studied had a seasonal variability which accounted for at least 50% of the beach variability. Protected coastal locations had less pronounced seasonal signatures. These seasonal and aseasonal beach responses mirror corresponding seasonality (or lack thereof) in wave and storm climates. The study re-emphasizes the need for careful measurement or estimation of coastal wave climate to enable predictive modelling of shoreline behaviour, and discusses different analysis techniques for analyzing changes in beach profiles through time.

A Continental Shelf Bottom Boundary Layer Model: The Effects of Waves, Currents, and a Moveable Bed Δ
Glenn, S.M.
Ph.D. Thesis. Massachusetts Institute of Technology/Woods Hole Oceanographic Institution Joint Program in Oceanographic Engineering, 1 p. (abstract only), *1983* WHOI-X-83-001

Field Intercomparison of Nearshore Directional Wave Sensors
Grosskopf, W.G., D.G. Aubrey, M.G. Mattie, and M. Mathiesen
Journal of Oceanic Engineering, Vol. OE-8, No. 4, pp. 254-271, *1983* WHOI-R-83-012

Δ Available on loan from NSGD, see p. *v*.
√ Helpful to educators and students.

Field Evaluation of Sea Data Directional Wave Gage (Model 635-9) Δ
Aubrey, D.G.
Woods Hole Oceanographic Institution Technical Report WHOI-81-28, 53 pp., *1981*
WHOI-T-81-001

Development and Application of a Field Instrumentation System for the Investigation of Surf Zone Hydrodynamics Δ
Greer, M.N.
Woods Hole Oceanographic Institution Technical Report WHOI-80-36, 159 pp., *1980*
WHOI-Y1-80-001

A Laser Velocimeter for Use in Coastal Boundary Layer Studies
Terry, W.E., W.D. Grant, A.J. Williams III, and L.P. Sanford
Oceans '80, IEEE, New York, pp. 216-219, *1980* WHOI-R-80-026

Short Arm Electric Field Measurements of Ocean Currents Δ
Williams, A.J., R.J. Jaffee, P.F. Poranski, and P.J. Simonetti
1972 WHOI-T-72-002

Coastal Processes—Geomorphology, Shoreline Change

The Eroding Shores of Outer Cape Cod √
Giese, G.S. and R.B. Giese
Information Bulletin No. 5, The Association for the Preservation of Cape Cod, Orleans, MA, 15 pp., *1974 (Reprinted 1994)* WHOI-G-94-001

We Have Met the Enemy and It Is Us √
Hendrickson, L. and G.S. Giese
In: Hornig, D. (ed.) State of the Cape 1994: Progress Toward Preservation, Association for the Preservation of Cape Cod, Orleans, MA, pp. 157-174, *1994* WHOI-R-93-008

Coastal Bench Formation at Hanauma Bay, Oahu, Hawaii
Bryan, W.B. and R.S. Stephens
Geological Society of America Bulletin, Vol. 105, pp. 377-386, *1993* WHOI-R-93-001
A coastal bench that developed from 1 to 6 m above sea level in basaltic tuff at Hanauma Bay conforms to the upper limit of wetting by wave wash at high tides associated with present sea level; it does not constitute evidence for a recent Holocene highstand on Oahu. The bench forms as a result of the disintegration and retreat of the unprotected cliff. The same process can satisfactorily explain the formation of Koko Bench, presently submerged at –5 m along the north shore of Hanauma Bay. Use of similar benches as geological indicators of past sea levels requires a detailed understanding of the coastal setting and exposure to waves, and the different responses of specific rock types at and above the air-sea interface.

Morphodynamic Evolution of a Newly Formed Tidal Inlet
Liu, J.T., D.K. Stauble, G.S. Giese, and D.G. Aubrey
In: Aubrey, D.G. and G.S. Giese (eds.), Formation and Evolution of Multiple Tidal Inlets, Coastal and Estuarine Studies, American Geophysical Union, Washington, D.C., Vol. 44, pp. 62-94, *1993* WHOI-R-93-009

Cyclic Spit Morphology in a Developing Inlet System
Weidman, C.R. and J.R. Ebert
In: Aubrey, D.G. and G.S. Giese (eds.), Formation and Evolution of Multiple Tidal Inlets, Coastal and Estuarine Studies, American Geophysical Union, Washington, D.C., Vol. 44, pp. 186-212, *1993* WHOI-R-93-012

December Storm Damages Cape Coastline—Falmouth's Surf Drive Takes Another Hit √
Crago, T.I. and G.S. Giese
Woods Hole Oceanographic Institution Sea Grant Program Marine Advisory Bulletin, No. 1, 2 pp., *1992* WHOI-G-93-001

The Story Behind the New Tidal Inlet at Chatham √
Giese, G.S.
Nor'easter, Vol. 2, No. 1, pp. 28-33, *1990* WHOI-R-90-002
Coastal erosion and the periodic breaching of barrier beaches are relatively common occurrences in the Northeast. Yet, when the new tidal inlet at Chatham Harbor, Massachusetts, first formed—during the winter of 1987—it attracted a lot of attention in Chatham and beyond. The residents of Chatham, however, were not surprised; the question had not been "if there's a breach," but rather where and when. Nevertheless, individuals and the town and state were then faced with the consequences, which were very costly to some. This article recounts the event and offers some suggestions for dealing with such events in the future.

Cyclical Behavior of the Tidal Inlet at Nauset Beach, Chatham, Massachusetts
Giese, G.S.
In: Aubrey, D.G. and L. Weishar (eds.), Hydrodynamics and Sediment Dynamics of Tidal Inlets. Lecture Notes on Coastal and Estuarine Studies, Springer-Verlag New York, Inc., Vol. 29, pp. 269-283, *1988* WHOI-R-88-025
Study of historical data concerning shoreline forms and change on southeastern Cape Cod over the past 200 years revealed a cyclical pattern of change in the barrier beach system off Chatham, Massachusetts, within a period of approximately 150 years. Based on the observed patterns and deduction concerning the processes controlling those patterns, predictions of breaching of the barrier beach and new inlet formation were provided to local coastal resource managers, reducing the negative impacts accompanying the formation of the new inlet when it eventually occurred.

The Quantitative Description of Beach Cycles
Aubrey, D.G. and R.M. Ross
Marine Geology, Vol. 69, pp. 155-170, *1985* WHOI-R-85-013
A quantitative method is developed to describe sequential changes in beach profile morphology. The method provides a uniform way to objectively discriminate energetic beach cycles, and yields a concise representation for beach modeling and prediction. It should be a valuable tool for uniform, quantitative intercomparison of beaches and beach cycles.

Rhythmic Beach Cusp Formation: A Conceptual Synthesis
Seymour, R.J. and D.G. Aubrey
Marine Geology, Vol. 65, pp. 289-302, *1985* WHOI-R-85-017

The Louisiana Response to Land Subsidence and Coastal Erosion
Silva, M. and M. Meo
Ocean Engineering and the Environment, Conference Record, Nov. 12-14, 1985, San Diego, California, pp. 594-599, *1985* WHOI-R-85-008

Updrift Migration of Tidal Inlets
Aubrey, D.G. and P.E. Speer
Journal of Geology, Vol. 92, pp. 531-545, *1984* WHOI-R-84-009
Migration of tidal inlets and the associated changes in adjacent barrier beaches have profound implications on both the geological evolution of inlet/estuary systems and the short-term stability of these features. Past studies have documented many instances of inlets migrating in the direction of the net littoral drift along sandy shores but have uncovered few cases where inlets appear to migrate in directions opposed to the domi-

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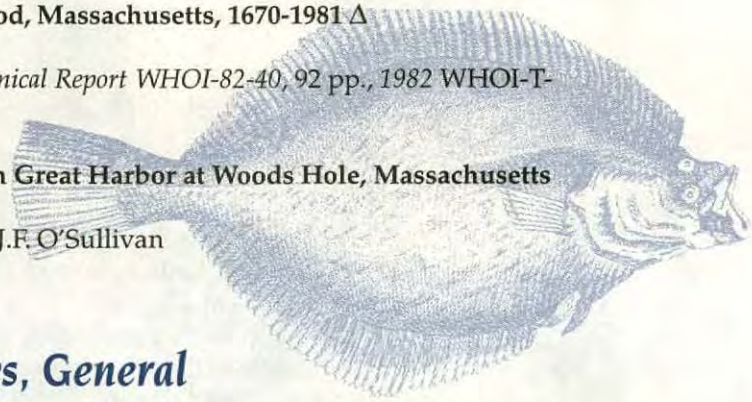
nant longshore transport direction. Previous attempts to explain a reversal in direction of inlet migration suggest a change in direction of net littoral drift, causing a change in migration direction. This explanation is not realistic for some inlets where wave forcing and nearshore bathymetry have remained constant through time. This study presents three alternatives to explain the tendency of some inlets to migrate updrift, each supported by historical observation at a site with a large-volume, directionally-biased littoral drift.

Rapid Formation and Degradation of Barrier Spits in Areas with Low Rates of Littoral Drift
Aubrey, D.G. and A.G. Gaines Jr.
Marine Geology, Vol. 49, pp. 257-278, *1982* WHOI-R-82-018
Three possible mechanisms cause barrier spits to elongate; two are generally known, while a third is presented in this paper. The most commonly cited mechanism for spit elongation, according to the authors, is downdrift buildup on the tip of a barrier spit from sand introduced by longshore transport. A second mechanism is accretion on the end of a barrier spit bordering a tidal inlet; this is generally accompanied by erosion of the spit on the opposite side of the inlet. A third mechanism, proposed in this paper, is self-generative in the sense that it does not require an external sediment source to elongate a barrier spit (although an external source could accelerate the process). This mechanism operates under a restrictive set of conditions, so it is not as common an occurrence as the mechanisms mentioned above. The paper discusses a prototype (Popponesset Beach, MA) used by the authors to illustrate this mechanism and describes, in detail, this unconventional method for increasing barrier spit length. The authors also suggest that, based on this third mechanism, estimates of directions and rates of longshore sand transport based on spit development must be scrutinized on a case-by-case basis.

Recent Evolution of an Active Barrier Beach Complex: Popponesset Beach, Cape Cod, Massachusetts Δ
Aubrey, D.G. and A.G. Gaines Jr.
Woods Hole Oceanographic Institution Technical Report WHOI-82-3, 77 pp., *1982* WHOI-T-82-001

Beach Changes at Nauset Inlet, Cape Cod, Massachusetts, 1670-1981 Δ
Speer, P.E., D.G. Aubrey, and E. Ruder
Woods Hole Oceanographic Institution Technical Report WHOI-82-40, 92 pp., *1982* WHOI-T-82-002

A Preliminary Study of Tidal Erosion in Great Harbor at Woods Hole, Massachusetts Δ
Miller, R.L., C.S. Labro, J.M. Cohen, and J.F. O'Sullivan
1972 WHOI-T-72-001



Fisheries & Aquaculture—Fisheries, General

Tips on Tuna Handling √
White, A.W.
2 pp., *1988* WHOI-G-88-001
The value of the bluefin tuna fishery is driven largely by the high demand for top-quality, fresh tuna for the Japanese market. Fresh bluefin tuna is most valuable when the fat content is high (generally between the end of July and October) and when the fish has been handled properly to maintain its freshness and appearance. Tuna buyers are easily able to recognize when fish have been improperly handled. Step-by-step illustrations offer tips for doing it right; laminated for use on board vessels.

The Atlantic Salmon (*Salmo salar*) Population of the Matamek River, Quebec: 1967-1984 Data Report Δ
Naiman, R.J., R. Morin, H. Caswell, W.L. Montgomery, E. Klopfer, and T. Kana
Woods Hole Oceanographic Institution Technical Report WHOI-86-21, 119 pp., *1986*
WHOI-T-86-002

Physiological Smolt Characteristics of Anadromous and Non-anadromous Brook Trout (*Salvelinus fontinalis*) and Atlantic Salmon (*Salmo salar*)
McCormick, S.D., R.J. Naiman, and E.T. Montgomery
Canadian Journal of Fisheries and Aquatic Sciences, Vol. 42, pp. 529-538, *1985* WHOI-R-85-003

Evaluating the Consequences of Reproduction in Complex Salmonid Life Cycles
Caswell, H., R.J. Naiman, and R. Morin
Aquaculture, Vol. 43, pp. 123-134, *1984* WHOI-R-84-017

Some Determinants of Maturation in Brook Trout, *Salvelinus fontinalis*
McCormick, S.D. and R.J. Naiman
Aquaculture, Vol. 43, pp. 269-278, *1984* WHOI-R-84-019
Size, age, growth rate and photoperiod (the controlling effects of the length of the day on phenomena such as reproductive cycles in mammals, migration patterns in birds, flowering in plants) were examined for their effects on the timing of maturation and the proportion of mature male and female brook trout (*Salvelinus fontinalis*). Photoperiod completely entrained the gonadosomatic index and the timing of functional maturation (spermiation and ovulation). High feed and delayed photoperiod conditions resulted in a greater proportion of mature individuals of each sex in their first year, with percent maturation higher for males. The results indicated that 1) given a positive growth rate, age and growth rate are less important than size in determining maturation of brook trout, and 2) the maturation response to size is sexually divergent. A conceptual model depicting the effects of environmental factors on size and the initiation of maturation is presented in this paper.

Osmoregulation in the Brook Trout, *Salvelinus fontinalis* — I. Diel, Photoperiod and Growth Relation Physiological Changes in Freshwater
McCormick, S.D. and R.J. Naiman
Comp. Biochem. Physiol., Vol. 79A, No. 1, pp. 7-16, *1984* WHOI-R-84-006

Osmoregulation in the Brook Trout, *Salvelinus fontinalis* — II. Effects of Size, Age and Photoperiod on Seawater Survival and Ionic Regulation
McCormick, S.D. and R.J. Naiman
Comp. Biochem. Physiol., Vol. 79A, No. 1, pp. 17-28, *1984* WHOI-R-84-007

The Reproductive Cycle of the Bay Scallop, *Argopecten irradians irradians* (Lamarck), in a Small Coastal Embayment on Cape Cod, Massachusetts
Taylor, R.E. and J.M. Capuzzo
Estuaries, Vol. 6, No. 4, pp. 431-435, *1983* WHOI-R-83-020
The spawning activity of the bay scallop *Argopecten irradians irradians* was monitored during the summer (May through September), 1979, in Waquoit Bay, a small embayment on the south shore of Cape Cod, Massachusetts. The investigators were interested in learning more about the reproductive cycle and early growth and development of bay scallop populations. This paper reports the gonadal development and spawning activity of adult bay scallop populations within this small embayment. Results indicated that spawning activity of the bay scallop populations occurred predominantly before the summer maximum temperature was recorded. After the summer maximum was reached, most of the gonads appeared spent, thus emphasizing the importance of temperature in stimulating spawning as reported in the literature.

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The Seasonal Cycle of Gonadal Development in *Arctica islandica* from the Southern New England Shelf
Mann, R.
Fishery Bulletin, Vol. 80, No. 2, pp. 315-326, *1982* WHOI-R-82-026

Osmoregulation in the Brook Trout, *Salvelinus fontinalis*
McCormick, S.D., R.J. Naiman, and E.T. Montgomery
In: The Matamek Research Program: Annual Report for 1982, Woods Hole Oceanographic Institution Technical Report 83-37, pp. 29-37, *1982* WHOI-R-82-030

The Reproductive Biology of *Arctica islandica*
Mann, R., R.A. Lutz, and M. Castagna
International Council for the Exploration of the Sea, 12 pp., *1981* WHOI-R-81-005

Osmoregulation in the Brook Trout, *Salvelinus fontinalis*
McCormick, S.D. and R.J. Naiman
In: The Matamek Research Program: Annual Report for 1981. Woods Hole Oceanographic Institution Technical Report WHOI-82-29, pp. 169-176, *1981* WHOI-R-81-018

Determining the Osmoregulatory Ability of Anadromous Brook Trout
McCormick, S.D. and R.J. Naiman
In: The Matamek Research Program: Annual Report for 1980. Woods Hole Oceanographic Institution Technical Report WHOI-81-49, pp. 150-152, *1981* WHOI-R-81-002

Small-scale Commercial Fishing in Southern New England Δ
Peterson, S.B. and L.J. Smith
Woods Hole Oceanographic Institution Technical Report WHOI-81-72, 1981 WHOI-T-81-002

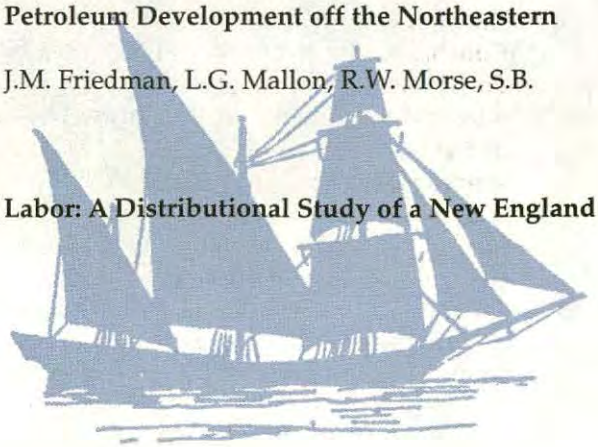
Behavioral Interactions Between Coho Salmon (*Oncorhynchus kisutch*), Atlantic Salmon (*Salmo salar*), Brook Trout (*Salvelinus fontinalis*) and Steelhead Trout (*Salmo gairdneri*) at the Juvenile Fluviatile Stages Δ
Gibson, R.J.
Final Report to The Government of Quebec, Ministere Du Loisir, De La Chasse Et De La Peche, 94 pp., *1980* WHOI-T-80-002

New England Fishing, Processing and Distribution Δ
Peterson, S.B. and L.J. Smith
1979 WHOI-T-79-008

What's Happening at the Fish Pier? Δ
Linskey, M.
1978 WHOI-R-78-011

Effects on Commercial Fishing of Petroleum Development off the Northeastern United States Δ
Allen, D.W., R.B. Allen, R.E. Black, J.M. Friedman, L.G. Mallon, R.W. Morse, S.B. Peterson, and L.J. Smith
1976 WHOI-T-76-003

Fishing Boat Income, Capital and Labor: A Distributional Study of a New England Port Δ
Smith, L.J.
1976 WHOI-R-77-001



The View from New Bedford
Peterson, S.B.
1975 WHOI-R-75-005

Shellfish Closures in Massachusetts — Status and Options. Proceedings of a Sea Grant-sponsored Workshop Held at the Woods Hole Oceanographic Institution on March 22, 1989 Δ √
White, A.W. and L.A. Campbell
Woods Hole Oceanographic Institution Technical Report WHOI-89-35, 60 pp., *1989*
WHOI-W-89-001
This report is a summary of a workshop on the problems of shellfish closures due to microbial contamination in Massachusetts. Its principal aim was to keep the shellfishing community informed about the status of shellfish closures throughout Massachusetts, the results of recent research on microbial contamination of shellfish, and options for shellfisheries in the region in the face of increasing closures of shellfish areas. Topics addressed by invited speakers included the history of shellfish closures in the state, the fecal coliform standard and why it needs to be modified, alternatives to the standard, and shellfish relay and depuration procedures used in other states.

Influence of Fishermen's Preferences on the Success of Commercial Fishery Management Regimes Δ
Healey, M.C.
North American Journal of Fisheries Management, Vol. 5, pp. 173-180, *1985*
WHOI-R-85-004
Fishermen may opt for goals of stock rebuilding and stable yield when fish stocks are depleted and the short-term outlook for catches is poor but reject these goals when a good year class appears. The purpose of this study was to determine whether this apparent ambivalence among fishermen is a consequence of changing preference for short- and long-term returns or can be accounted for by the change in short-term pay-off associated with good recruitment. The researchers derived realistic short- and long-term pay-offs by exploiting a population model of the Gulf of Maine herring (*Clupea harengus*) stock under two regimes. The goal of one regime was to obtain long-term stable yields while the goal of the other was to take windfall yields from occasional good year classes. The researchers used a multi-attribute utility model to determine if there was a set of preference weights for short- and long-term returns that would cause fishermen logically to choose the stable yield regime when the short-term outlook was poor but to choose the windfall yield regime when the short-term outlook was good. Such a set of preference weights did exist. If attributes other than short- and long-term returns were included in the analysis, then ambivalence was logically possible regardless of the weight assigned to these other attributes — provided the other attributes scored higher in the windfall yield regime but not if they scored higher in the stable yield regime. These results suggested that more acceptable management regimes could be designed based on a knowledge of fishermen's preferences.

Multiattribute Analysis and the Concept of Optimum Yield
Healey, M.C.
Can. J. Fish. Aquat. Sci., Vol. 41, pp. 1393-1406, *1984* WHOI-R-84-014

The Introduction of Limited Entry: The New Zealand Rock Lobster Fishery
Annala, J.H.
Marine Policy, pp. 103-108, *1983* WHOI-R-83-022
The rock lobster fishery has traditionally been New Zealand's single most important domestic fishery in terms of the number of vessels and fishermen employed and the value of landings and exports. This paper describes the implementation of a controlled or limited entry fishery for New Zealand rock lobsters. The background to the implementation of limited entry is described and the decrease in annual landings per vessel in the period 1955-1977 is pointed out. The New Zealand licensing system is outlined, attention

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being paid to continuous and seasonal licenses, allocation of licenses, controlled fishing areas, and fishing methods and gear restrictions. The number of rock lobster vessels decreased from 1,574 in 1979 to 970 after the initial round of licensing in 1980-81.

The Potential Collapse of Fish Stocks in a Developing Fishery Δ
Evans, G.T.
North American Journal of Fisheries Management, Vol. 1, pp. 127-133, *1981*
WHOI-R-81-011
In developing a fishery on a stock whose surplus production is governed by a logistic or similar growth law, a policy of steadily increasing the fishing quota and watching the stock carefully is likely to lead to overfishing; at the time of greatest danger, there are no warning signs. Increasing the nominal effort for a schooling fish stock has similar problems. A policy of steadily increasing the fishing mortality, although more difficult to implement, runs less risk of overfishing. This paper discusses possible problems with developing fisheries using management strategies that rely on quota or effort regulation, problems that could lead to overexploitation no matter how carefully the fish stock is monitored.

Bibliography of Socio-economic Studies: Fisheries of the Northeast United States Δ
Ladner, R., L.J. Smith, S. Peterson, and J. Wilson
Woods Hole Oceanographic Institution Technical Report WHOI-81-99, 50 pp., *1981*
WHOI-L-81-002

Mexico's Marginal Inshore Pacific Fishing Cooperatives
McGoodwin, J.R.
Anthropological Quarterly, Vol. 53, No. 1, pp. 39-47, *1980* WHOI-R-81-025

Abstracts of Readings in Fisheries Management and Common Property Resources Δ
Matsuda, Y.
1979 WHOI-T-79-002

Fisheries Policy and the Underdevelopment of Inshore Pacific Mexico Δ
McGoodwin, J.R.
1979 WHOI-T-79-004

Pelagic Shark Fishing in Rural Mexico: A Context for Co-operative Action Δ
McGoodwin, J.R.
1979 WHOI-R-79-015

The Fishery Conservation and Management Act of 1976
Kelly, J.E.
1978 WHOI-R-78-001

The 'Public Face' of the New England Regional Fishery Council: Year 1 Δ
Smith, M.E.
1978 WHOI-T-78-002

The Massachusetts Lobster Fishery: Model Legislation and Management Plans Δ
Peterson, S.B. and J.M. Friedman
1977 WHOI-T-77-002

The New England Fishing Industry: A Basis for Management Δ
Smith, L.J. and S.B. Peterson
1977 WHOI-T-77-004

Fisheries Law: Unilateral or Multilateral Formulation Δ
Graham, N.W.
1976 WHOI-T-76-008

Salmon Management — Myths and Magic Δ
Power, G.
1973 WHOI-R-73-002

Fisheries & Aquaculture—Aquaculture, General

Planning and Policy for Coastal Aquaculture Development
Peterson, S.
In: Proceedings of the International Symposium on Utilization of Coastal Ecosystems: Planning, Pollution and Productivity 21-27 Nov. 1982, Rio Grande, Brazil, Vol. 1, pp. 301-312, *1985* WHOI-R-85-015
Successful aquaculture development in coastal areas depends upon wise planning and a careful balance of resources, institutions, regulations, and policies. This paper reviews aquaculture development, describes constraints on coastal aquaculture development, focusing on pollution, land use problems, and institutions needed to support aquaculture development, and describes government planning and policies important to successful aquaculture development. Determining the feasibility of aquaculture development demands that certain types of information about the natural, social, and economic setting be made available to federal and/or regional government representatives. Ideally, the setting in which aquaculture can flourish is the result of government policies which reflect national interests interpreted appropriately for each region of the country. The paper concludes that aquaculture in coastal areas has certain risks associated with it which can be reduced by a careful balance of resources management, education, research, institutional development, and regulations.

Allocation of Aquaculture Resources Δ
Peterson, S.
In: Smith, L.J. and S. Peterson (eds.), Aquaculture Development in Less Developed Countries: Social Economic and Political Problems, pp. 21-29, *1982* WHOI-R-82-020
The production of food by aquaculture involves many dubious assumptions about man and nature. Descriptions of aquaculture systems abound: almost without exception, they bear on the technological aspects of development and ignore discussion of feasibility of development. Between the two questions of "Can it be done?" and "Should it be done?" —the first technical and the second political—lies a series of questions about methods used to choose and establish an aquaculture system. These intermediate questions have seldom been asked, although they have been approached from a number of directions. Lawson (1974) has used cost/benefit analysis on aquaculture systems, Alexander (1975) has done social impact studies on improved fishing technology, and Kloke and Potaras (1975) have looked at aquaculture as it integrates with other forms of resource exploitation. Peterson and Smith (1979) raise two issues which fall into this middle ground. The first issue, and perhaps most controversial, is wetland valuation (Burbridge 1978). Successful aquaculture development in areas formerly considered of little or no value, such as swamp or marsh, can cause the land to accrue value rapidly. For areas where title or ownership were uncertain before development, a second set of problems is provoked: argument, feud, and litigation. Since many of the world's wetlands are common property, transfer of land from public ownership to private holdings by a family or cooperative may demand changes in land use policy in both developing and developed countries. The purpose of this paper is to address another of those intermediate questions— the question of allocation. The allocation question involves distribution of the products of aquaculture systems and the technology needed to establish them.

Elements in Evaluating Success and Failure in Aquaculture Projects
Pollnac, R.B., S. Peterson, and L.J. Smith
In: Smith, L.J. and S. Peterson (eds.), Aquaculture Development in Less Developed Countries: Social Economic and Political Problems, pp. 131-143, *1982* WHOI-R-82-019

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During the decade since 1970, several hundred aquaculture projects have been developed with agency, foundation, government, or private industry funding. This paper uses examples from projects in Latin America and Africa to describe general requirements of aquaculture development, decision points in a development project, and evaluations of success and failure by the personnel from funding agencies.

Aquaculture Development in Less Developed Countries: Social, Economic, and Political Problems Δ
Smith, L.J. and S. Peterson
1982 WHOI-B-82-001

The Effects of Diet on the Growth Energetics of Postlarval Lobsters (*Homarus americanus*) Δ
Capuzzo, J.M. and B.A. Lancaster
1979 WHOI-T-79-009

The Effects of Dietary Carbohydrate Levels on Protein Utilization in the American Lobster (*Homarus americanus*) Δ
Capuzzo, J.M. and B.A. Lancaster
1979 WHOI-R-79-019

Experimental Lobster Ranching in Massachusetts Δ
Hruby, T.
1979 WHOI-R-79-020

Exotic Species in Aquaculture Δ
Mann, R.
1979 WHOI-G-79-001

Exotic Species in Mariculture Δ
Mann, R.
1979 WHOI-B-79-001

Factors Limiting the Development of Aquaculture: A Japanese Experience Δ
Matsuda, Y.
1979 WHOI-T-79-007

Aquaculture Development in Rural Atomistic Societies Δ
McGoodwin, J.R.
1979 WHOI-T-79-006

Aquaculture Policies in Latin America Δ
Palacio, F.J.
1979 WHOI-R-79-022

Potential Yields from a Waste-recycling Algal Mariculture System
Deboer, J.A. and J.H. Ryther
1978 WHOI-R-78-005

Marine Shrimp Farming in the Western Hemisphere Δ
Hanson, J.A., J.E. Huguenin, S.S. Hugeunin, and H.L. Goodwin
1978 WHOI-T-77-009

Impacts of Large Scale Aquatic Biomass Systems Δ
Hruby, T.
1978 WHOI-T-78-001

Some Aspects of the Growth and Yield of *Gracilaria tikvahiae* in Culture Δ
LaPointe, B.E. and J.H. Ryther
1978 WHOI-R-78-014

Implications of the Japanese Experience in Aquaculture Development for Thirty-three Food-short Countries
Matsuda, Y.
1978 WHOI-R-78-012

The Growth of Aquaculture in Developing Countries: Potentials, Patterns and Pitfalls Δ
Matsuda, Y.
1978 WHOI-R-78-010

Preliminary Results with a Pilot-plant Waste Recycling Marine Aquaculture System
Ryther, J.H.
1977 WHOI-R-77-003

Heat Exchangers for Use in the Culturing of Marine Organisms Δ
Huguenin, J.E.
1976 WHOI-R-76-003

The Mass Outdoor Culture of Macroscopic Marine Algae Δ
LaPointe, B.E., L.D. Williams, J.C. Goldman, and J.H. Ryther
1976 WHOI-R-76-005

Marine Polyculture Based on Natural Food Chains and Recycled Wastes Δ
Ryther, J.H.
1976 WHOI-T-76-005

Preliminary Results With a Pilot Plant Waste Recycling Marine Aquaculture System Δ
Ryther, J.H.
1975 WHOI-T-75-001

Microbes as Food in Mariculture Δ
Ryther, J.H. and J.C. Goldman
1975 WHOI-R-75-002

Physical Models of Integrated Waste Recycling Marine Polyculture Systems Δ
Ryther, J.H., J.C. Goldman, C.E. Gifford, J.E. Huguenin, A.S. Wing, J.P. Clarner, L.D. Williams, and B.E. LaPointe
1975 WHOI-R-75-006

The Economics of Waste Water Aquaculture Systems Δ
Smith, L.J. and J.E. Huguenin
1975 WHOI-R-75-001

Experiences With a Marine Aquaculture Tertiary Sewage Treatment Complex Δ
Huguenin, J.E. and J.H. Ryther
1974 WHOI-R-74-004

Social, Political, Regulatory and Marketing Problems of Marine Waste Food Recycling Systems Δ
Huguenin, J.E. and J.T. Kildow
1974 WHOI-R-74-003

Δ Available on loan from NSGD, see p. *v.*
√ Helpful to educators and students.

A New Method for Culturing *Chironomus tentans* Fabricius Larvae Using Burlap Substrate in Fertilized Pools Δ
McLarney, W.O., S. Henderson, and M.M. Sherman
1974 WHOI-R-74-002

Fisheries & Aquaculture—Aquaculture, Mollusks

Benthic Mariculture and Research Rig Developed for Diver Operations
Hampson, G.R., D.C. Rhoads, and D.W. Clark
Diving for Science...1989, Proceedings of the American Academy of Underwater Sciences, Ninth Annual Scientific Diving Symposium, Woods Hole, MA, pp. 113-117, *1989* WHOI-R-89-017

Shellfish Diseases: Current Concerns in the Northeast — Proceedings of a Sea Grant-supported Workshop Held at the Woods Hole Oceanographic Institution on February 26, 1987 Δ √
White, A.W.
Woods Hole Oceanographic Institution Technical Report No. WHOI-87-13, 38 pp., *1987* WHOI-W-87-001

Growth and Survival of Larvae of *Mercenaria mercenaria* (l.) and *Crassostrea virginica* (gmelin) Relative to Broodstock Conditioning and Lipid Content of Eggs
Gallager, S.M. and R. Mann
Aquaculture, Vol. 56, pp. 105-121, *1986* WHOI-R-86-010

On the Selection of Aquaculture Species: A Case Study of Marine Molluscs
Mann, R.
Aquaculture, Vol. 39, pp. 345-353, *1984* WHOI-R-84-004
An overview of marine mollusc culture in the Pacific Ocean reveals a rich variety of species in culture, physical environments where culture is effected, and technological, social, and economic backgrounds of participating individuals. Despite this variety, a few basic criteria have, until recently, dictated which molluscan species are prime candidates for aquaculture. This paper illustrates how innovative thinking has influenced the historical development of mollusc culture and how advancing culture technology has influenced, and potentially will influence, the future choice of prime aquaculture species.

Bivalve Mollusc Hatcheries: A Critical Appraisal of their Development and a Review of their Potential Value in Enhancing the Fisheries of Developing Nations
Mann, R.
Memorias de la Asociation Latinoamerica de Acuicultura, A.L.A., Vol. 5, pp. 97-105, *1983* WHOI-R-83-023
This paper reviews the historical development of marine bivalve mollusc culture and emphasizes hatchery development. A discussion is made of hatchery development and the applicability of this technology to present problems in bivalve aquaculture throughout the world.

The Role of Introduced Bivalve Mollusc Species in Mariculture
Mann, R.
J. World Maricul. Soc., Vol. 14, pp. 546-559, *1983* WHOI-R-83-025
Premeditated introductions of non-indigenous molluscan shellfish species have been important in establishing several substantial fisheries. For example, the North American fishery for *Crassostrea gigas* developed from active introductions that began in the early part of this century and continued until 1978. More recently, *C. gigas* has been introduced to many sites in Europe, South Africa, South America, the Mediterranean, and the Indian and Pacific Oceans. This paper provides a brief history of the movement of selected bivalve mollusc species around the world, a detailed listing of movements that have

occurred between 1978-1983, and a discussion of future prospects and problems associated with continuing movement of bivalve species for culture purposes.

Public Health Aspects of the Culture of the Japanese Oyster *Crassostrea gigas* (Thunberg) in a Waste Recycling Aquaculture System
Mann, R. and R.E. Taylor
Aquaculture, Vol. 30, pp. 311-327, *1983* WHOI-R-83-001

Growth of the Bay Scallop, *Argopecten irradians*, in a Waste Recycling Aquaculture System
Mann, R. and R.E. Taylor Jr.
Aquaculture, Vol. 24, pp. 45-52, *1981* WHOI-R-81-001
Growth of the bay scallop *Argopecten irradians* in a pilot scale waste recycling aquaculture system was examined over a 32-week-period at 14° C. *A. irradians* increased from initial live and dry weights of 1.15 g and 0.043 g, respectively, to terminal values of 9.08 g and 0.599 g, respectively. This corresponds to instantaneous growth rates for live weight (G) and dry meat weight (M) of 0.009 and 0.013, respectively. High mortalities were evident towards the end of the experiment with a terminal value of 33% giving an instantaneous mortality rate (Z) value of 0.0016. In laboratory experiments of 12 weeks duration at, 12, 15, 18 and 21° C juvenile *A. irradians* gave values of 0.01, 0.013, 0.018 and 0.016 for G; 0.015, 0.015, 0.016 and 0.013 for M; and 0.038, 0.038, 0.037 and 0.040 for Z at the respective temperatures. Shell deformities were evident in laboratory grown individuals. *A. irradians* exhibits specific growth rates comparable to or higher than those previously recorded for other bivalve species cultured in waste recycling systems; however, a considerable reduction in the presently high mortality rate will be required to make *A. irradians* a prime candidate for practical application.

The Effect of Temperature on Growth, Physiology, and Gametogenesis in the Manila Clam *Tapes philippinarum* Δ
Mann, R.
1979 WHOI-R-79-003

Some Biochemical and Physiological Aspects of Growth and Gametogenesis in *Crassostrea gigas* and *Ostrea edulis* Grown at Sustained Elevated Temperatures Δ
Mann, R.
1979 WHOI-R-79-002

Analysis of Methods for the Culture of *Crassostrea virginica* in New England Δ
Matthiessen, G.C. and L.J. Smith
1979 WHOI-R-79-021

Growth of *Mytilus edulis* L. in a Waste Recycling Aquaculture System
Mann, R.
1978 WHOI-R-78-007

Growth of Six Species of Bivalve Molluscs in a Waste Recycling Aquaculture System Δ
Mann, R. and J.H. Ryther
1977 WHOI-R-77-014

Δ Available on loan from NSGD, see p. *v.*
√ Helpful to educators and students.

Bivalve Mollusc Culture in a Waste Recycling Aquaculture System Δ
Ryther, J.H. and R. Mann
1977 WHOI-T-77-005

Food Chain Dynamics of Abalone in a Polyculture System Δ
Tenore, K.R.
1976 WHOI-R-76-006

Marine Policy—General

Historic Shipwreck Management: Meeting of Experts II
Hoagland, P.
51 pp., *1993*, $3.00 WHOI-T-93-002

Historic Shipwreck Management: Meeting of Experts
Hoagland, P.
23 pp., *1992*, $3.00 WHOI-W-92-001
There has been spectacular growth in the demand for and resource value of submerged cultural resources such as historic shipwrecks. The pace at which technology is providing access to submerged cultural resources appears to have outstripped institutional abilities to ensure resource conservation. These events present a dilemma for marine scientists and engineers who develop advanced marine technologies and who may be involved in value conflicts over the conservation of historic shipwrecks.

The Ocean Enterprise Concept: A National Strategy for Resource Development
Ross, D.A., C.E. McLain, and J.E. Dailey
Sea Technology, pp. 15-20, *1989* WHOI-R-89-019
In the late 1980's less than 1% of the annual resources consumed in the United States comes from the sea. Yet the March 1983 Exclusive Economic Zone (EEZ) Proclamation by President Ronald Reagan gave the U.S. exclusive jurisdiction over the resources of the ocean out to 200 nautical miles. To date, the potentially great rewards from the development of marine resources by the private sector have been greatly inhibited by the peculiar nature of the risks involved in such candidate projects.

Ocean Science: Its Place in the New Order of the Oceans
Ross, D.A.
The New Order of the Oceans, pp. 65-84, *1986* WHOI-R-86-011

A Changing Ocean Policy Horizon for Marine Science
Ross, D.A.
Ocean Development and International Law, Vol. 15, Nos. 3/4, pp. 221-232, *1985*
WHOI-R-85-010

UNCLOS and the Redistribution of Ocean Wealth
Wijkman, P.M.
Journal of World Trade Law, Vol. 16, No. 1, pp. 27-48, *1982* WHOI-R-82-002

Managing the Global Commons Δ
Wijkman, P.M.
1982 WHOI-R-82-009

The Panamanian Sea-level Canal: Problems and Prospects from a Policy Perspective Δ
Leschine, T.M.
Oceans 81 Conference Record, Vol. II, pp. 615-619, *1981* WHOI-R-81-009

The Panamanian Sea-level Canal Δ
Leschine, T.M.
Oceanus, Vol. 24, No. 2, pp. 20-30, *1981* WHOI-R-81-008

Outer Space Resources in Efficient and Equitable Use: New Frontiers for Old Principles
Wihlborg, C.G. and P.M. Wijkman
The Journal of Law and Economics, Vol. 24, No. 1, pp. 23-43, *1981* WHOI-R-81-003

Regulation of International Joint Ventures in the Fishery Conservation Zone Δ
Christie, D.R.
Ga. J. Int'l. & Comp. L., Vol. 10, No. 1, pp. 85-100, *1980* WHOI-R-80-008

Interagency Relationships in Marine Resource Conflicts: Some Lessons from OCS Oil and Gas Leasing Δ
Finn, D.P.
The Harvard Environmental Law Review, Vol. 4, No. 2, pp. 359-390, *1980* WHOI-R-80-014

The Common Heritage of Mankind? Regulating the Uses of the Oceans Δ
Peterson, S.B.
Environment, Vol. 22, No. 1, pp. 6-11, *1980* WHOI-R-80-003

The Oceans and U.S. Sewage Sludge Disposal Strategy Δ
Vaccaro, R.F., J.M. Capuzzo, and N.M. Marcus
International Council for the Exploration of the Sea, 8 pp., *1980* WHOI-R-80-013

Effects of Cargo Reservation. A Review of UNCTAD's Code of Conduct for Liner Conferences
Wijkman, P.M.
Marine Policy, pp. 271-289, *1980* WHOI-R-80-020

Global Use and Regulation of Space Activities Under the Common Heritage Principal
Wijkman, P.M. and C.G. Wihlborg
13 pp., *1980* WHOI-R-80-022

The Administration Policy Process for Science: A Case Study of Organizational/ Environmental Dynamics Δ
Hooper, P.F.
1979 WHOI-T-79-010

Threat to the Freedom of Scientific Research in the Deep Sea?
Ross, D.A.
1978 WHOI-R-78-002

Towards a Marine Policy in Latin America Δ
Palacio, F.J.
1977 WHOI-T-77-006

Assessing Impacts of New Ocean Law Δ
Wenk, E.
1976 WHOI-R-76-011

Marine Policy—Coastal Zone Managment/Resource Management

Troubled Waters: Taking Stock of the Gulf of Maine √
Campbell, L.A., K. Lignell, and M. Waterman
Nor'easter, Vol. 3, No. 2, pp. 12-21, *1991* WHOI-R-91-011
Although the Gulf of Maine is one of the world's most productive ecosystems, it is also a resource at risk. This sea within a sea, which extends from Cape Cod Bay in the southwest to the Bay of Fundy in the northeast, has abundant marine and coastal resources, but it is threatened by unprecedented pressures from coastal development, resource use, and pollution. In order to ensure that the Gulf of Maine can sustain its productivity, marine scientists, educators, government agencies, marine-dependent industries, and citizens in the three states and two provinces bordering the Gulf must coordinate research efforts on the Gulf as a total ecosystem, improve marine water quality, develop coastal and marine resources in a responsible manner, encourage public involvement, and strengthen international relations.

Some Initial Effects of Hurricane Hugo on Endangered and Endemic Species of West Indian Birds
Haney, J.C., J.M. Wunderle, and W.J. Arendt
American Birds, Vol. 45, No. 2, pp. 234-236, *1991* WHOI-R-91-004
Hurricane Hugo, a category 4 hurricane with sustained winds of 140-150 miles per hour and gusts over 180 miles per hour, was perhaps the most violent storm ever to hit islands of the eastern Caribbean. The hurricane passed directly over or near Puerto Rico, Montserrat, Guadeloupe, and Dominica. Each of these islands harbor endangered, threatened, or otherwise vulnerable species of endemic forest birds. Hurricane Hugo's initial impacts on and consequences for some West Indian birds following the storm's landfalls during mid-September 1989 are reported, along with damage to each island. Hugo's impacts on birds are contrasted with those of other historical hurricanes, and implications for future conservation strategies for island birds are noted.

Integrating Tourism in Multiple Use Planning for Coastal and Marine Protected Areas
Agardy, M.T.
In: Miller, M.L. and J. Auyong (eds.), Proceedings of the 1990 Congress on Coastal and Marine Tourism. A Symposium and Workshop on Balancing Conservation and Economic Development, Honolulu, Hawaii — 25-31 May 1990, Vol. I, pp. 204-210, *1990* WHOI-R-90-018
Coastal and marine areas the world over provide food, transportation, recreation, and energy resources to increasing numbers of people each year. As demands for these resources rise, the potential for user conflicts is radically heightened. Traditional uses of coastal resources are often displaced by profitable but non-conservative technologies which preclude effective, comprehensive, and long-term management. This situation can even be avoided or counteracted by instigating proactive multiple use planning in which all users can be accommodated in a sustainable way. Tourism is one use which can be encouraged in coastal management plans aimed at achieving sustainability, since it is essentially non-extractive and non-degrading if properly controlled. Tourism can provide economic and political incentives for management and for conservation, and can have additional benefits to local communities and regional economies. Tourism is especially important as a component of planning in tropical coastal areas where ecosystems are heavily burdened with stress and where growth and development are important national priorities. Examples where tourism has been or is becoming successfully integrated into multiple use planning include parts of Quintana Roo, Mexico; the Galapagos Islands in Ecuador; and the Lesser Antilles.

Caribbean Coastal and Marine Tourism: Coping with Climate Change and Its Associated Effects
Gable, F.J.
In: Miller M.L. and J. Auyong (eds.), Proceedings of the 1990 Congress on Coastal and Marine

Tourism. A Symposium and Workshop on Balancing Conservation and Economic Development, Honolulu, Hawaii — 25-31 May 1990, Vol. I, pp. 248-255, *1990* WHOI-R-90-019

Options Prices for Groundwater Protection
Edwards, S.F.
Journal of Environmental Economics and Management, Vol. 15, pp. 475-487, *1988*
WHOI-R-88-012
This paper reports results from a contingent valuation study of households' willingness to pay to prevent uncertain, future nitrate contamination of a portable supply of groundwater. Probability of future demand, change in the probability of future supply, and an attitudinal score for interests in the well-being of future generations are significant, positive determinants of option prices. Several implications of these results for aquifer management policy are highlighted in the paper.

An Economics Primer for Coastal Zone Management: Basic Concepts and Methods from Microeconomics, Public Finance, and Environmental and Resource Economics Δ
Edwards, S.F.
Woods Hole Oceanographic Institution Technical Report WHOI-86-1, 128 pp., *1986*
WHOI-T-86-001
While the economic impacts of resource use pervade discussions of coastal zone management, most discourses tend to be ill-defined and incomplete, and to lack a solid basis in economic theory. This primer was written to eliminate this confusion for non-economists who seek insight into economic thought and into how economic analysis can contribute to coastal zone management. Its contents include: Introduction: Conflicts Between Private and Public Interests in the Coastal Zone; Some Basic Concepts in Economics; Some Analytical Methods in Economics; Thinking Economically; Economic Impact Analysis of Protecting Water Quality in Coastal Ponds: A Case Study in Rhode Island; A Benefit-Cost Analysis of Hypothetical Development on Cape Cod, Massachusetts; Conclusions; and a bibliography and index to key words, as well as figures and tables.

A Bibliographic Listing of Coastal and Marine Protected Areas: A Global Survey Δ
Silva, M.E., E.M. Gately, and I. Desilvestre
Woods Hole Oceanographic Institution Technical Report WHOI-86-11, 156 pp., *1986*
WHOI-L-86-001
A review of existing or proposed marine protected areas was undertaken as part of a larger project to consider the establishment of protected status for the marine area of the Galapagos Archipelago. This bibliographic listing includes over 600 books, articles, technical reports, and personal correspondence reviewing approximately 1,000 coastal and marine protected areas in 87 countries. The bibliography consists of country-by-country listing of marine protected areas, a listing of special topics from the bibliography, and a numerical and alphabetical listing of sources.

Conflict Resolution in the Assignment of Area Entitlements for Seabed Mining
Broadus, J.M. and P. Hoagland
San Diego Law Review, Vol. 21, No. 3, pp. 541-576, *1984* WHOI-R-84-013

Houston's Little Sisters: A Cross-cultural Perspective on Offshore Oil
Nadel, J.H.
Human Organization, Vol. 42, No. 2, pp. 167-172, *1983* WHOI-R-83-008

Wetlands Regulations and Public Perceptions in Massachusetts
Leschine, T.M. and S.R. Casella
Coastal Zone '80, pp. 1789-1808, *1980* WHOI-R-80-023
This paper reports on the results of a 1979 survey of wetlands property owners in two Massachusetts coastal towns (Marshfield and Falmouth). The survey obtained socioeconomic information, as well as information on the characteristics of wetlands property

Δ Available on loan from NSGD, see p. *v*.
√ Helpful to educators and students.

and its ownership, on property owners' perceptions of wetlands and wetlands values, and their perceptions of and experience with wetlands regulations at the state and local level. Among the findings discussed in the paper, the authors concluded that those wetlands resources which are viewed as public may evoke different sympathies than those which are viewed as private. Also, the public sense that wetlands resources are valuable and worth protecting is stronger than the public awareness of what the goals and procedures of existing state and local regulatory programs designed to protect wetlands are.

A Profile of Wetlands Regulations in Coastal Massachusetts Towns: Local Regulatory Activity and the Public Perception of Effects Δ
Leschine, T.M. and S.R. Cassella
1979 WHOI-R-79-023

Environmental Impacts of Industrial Energy Systems in the Coastal Zone Δ
Hall, C.A.S., R.W. Howarth, B. Moore, C.J. Vorosmarty
1978 WHOI-R-78-015

Salt Marshes and the Constitution: An Introduction to Constitutional Issues in Environmental Protection Δ
Friedman, J.M.
1977 WHOI-R-76-012

Some Questions and Answers About the Law of Harbors and Great Ponds Δ
Friedman, J.M., R.A. Donnellan, and G.A. Nickerson
1976 WHOI-G-76-001

Regulation of Harbors and Ponds of Martha's Vineyard Δ
Friedman, J.M., R.A. Donnellan, and G.H. Nickerson
1976 WHOI-T-76-002
In August 1975, the Martha's Vineyard Commission requested assistance from the Woods Hole Oceanographic Institution (WHOI) Sea Grant Program for assistance in problem identification and management prospects for the harbors and great ponds of Martha's Vineyard. James M. Friedman, a lawyer in WHOI's Marine Policy and Ocean Management Program, agreed to undertake the leadership of this project. The objectives of the study, outlined in this technical report, were: 1) to provide a legal analysis of the powers of the Martha's Vineyard Commission and the towns of Martha's Vineyard with regard to the regulation of harbors and great ponds; 2) once these powers have been defined, the Commission will, in cooperation with the towns, shellfish wardens, riparian groups, fishermen, and other interested citizens, identify those problems which result from the increasing and varied use of harbors and ponds; 3) the Commission will propose a management scheme (if possible through existing legislation) to deal with the problems that have been identified.

Marine Policy—Energy & Marine Mineral Resources

China Sea Coastal and Marine Nonfuel Minerals: Investigation and Development
Hoagland, P., J. Yang, J.M. Broadus, and D.K.Y. Chu
In: Marsh, J.B. (ed.), Resources and Environment in Asia's Marine Sector, Taylor & Francis, New York, pp. 219-275, *1992* WHOI-R-92-010

Administrative Discretion in the Management of Outer Continental Shelf Minerals
Hoagland, P.
In: Farrow. R.S. (ed.), Managing the Outer Continental Shelf Lands: Oceans of Controversy. Ocean Policy Studies, 18 pp., *1991* WHOI-R-91-003

Mineral developers face varying kinds of risks and uncertainties associated with the exploration, development, and production of minerals from a marine deposit. These risks can be geologic (e.g., ore grade), environmental (e.g., storm frequency), or legal (e.g., lease suspension). To the miner, these types of risks all have the same result: they raise the private costs of proving-out and working a deposit. Both geologic and environmental risks could be reduced through exploration and meteorological forecasting. This publication is concerned with the special case of legal risks arising from administrative discretion by a resource manager over the rights to work publicly controlled ocean minerals.

Marine Nonfuel Minerals in the U.S. Exclusive Economic Zone: Managing Information as a Resource
Broadus, J.M. and P. Hoagland
Ocean and Shoreline Management, Vol. 13, No. 3 & 4, pp. 275-294, *1990* WHOI-R-90-023

Nonfuel Minerals
Broadus, J.M. and P. Hoagland
In: Farrow, S., J.M. Broadus, T. Grigalunas, P. Hoagland, and J. Opaluch (eds.), Managing the Outer Continental Shelf Lands: Oceans of Controversy, pp. 119-134, *1990* WHOI-R-90-021

Ocean Enterprises: The Ocean and the Economy in the 1990's
Ross, D.A., J. Fenwick, M.A. Champ, and R. Knecht
In: Halsey, S.D. and R.B. Abel (eds.), Coastal Ocean Space Utilization. Proceedings of the International Symposium on Coastal Ocean Space Utilization, Elsevier Press, pp. 369-371, *1990* WHOI-R-90-006
In the late 1980's, less than 1% of the resources consumed annually in the United States came from the ocean. The U.S. Exclusive Economic Zone (EEZ) proclaimed in 1983 gave the United States exclusive jurisdiction over ocean resources out to 200 n. mi. This extensive new zone adds over 3.9 billion acres of resource potential, more than doubling the "territorial size" of the United States. The EEZ offers many opportunities to improve the national economy of the United States. Nevertheless, the potential rewards from the development of ocean resources by the private sector have been greatly inhibited by the risks of candidate projects. Each opportunity or action is laden with different types of risk: technical, economic, environmental and political. Ocean Enterprises is a concept to explore and develop these resources. Among the areas that show the most promise for development are: marine mining of coastal heavy minerals, ocean thermal energy conversion (OTEC), offshore waste treatment plants, mariculture (fish and shellfish) and platforms for air and space operations.

Overview: Marine Mineral Reserves and Resources — 1988
Emery, K.O. and J.M. Broadus
Marine Mining, Vol. 8, pp. 109-121, *1989* WHOI-R-89-008
Marine mining has been conducted on local and generally small scales for thousands of years. Large-scale recovery from beaches and piers began only about 40 years ago, and soon afterward powered ships and tools and new exploration methods revealed the presence of economic concentrations of oil and gas, sand and gravel, and some heavy minerals beyond the beach. These materials are in relatively shallow waters of the continental shelf and now are known well enough to be considered reserve ores. Rapid success for them led to immediate expectation of marine mining of many other minerals that have higher value per unit weight, but they occur in deeper waters beyond the shelf where conditions are more difficult and costs are higher. They include phosphorite, ferromanganese nodules and crusts, and (less than a decade ago) polymetallic sulfides. All are still potential resources that cannot yet be considered reserve ores. Increased knowledge of the deep ocean floor and its natural processes is likely to be applied first to expanding the reserves of similar deposits now on land and perhaps later to ocean floor mining. Moreover, ocean floor mining must compete economically with improved methods of recovery from existing low-grade resources on land and from waste piles left from earlier and less efficient methods of mineral recovery.

Δ Available on loan from NSGD, see p. *v*.
√ Helpful to educators and students.

The Ocean Enterprise Concept Δ
Ross, D.A. and J.E. Dailey
Report to the National Science Foundation on the Ocean Enterprise Workshop, February 20-24, 1989, 198 pp., *1989* WHOI-W-89-003

The Ocean Enterprise Concept
Ross, D.A., M.A. Champ, J.E. Dailey, and C.E. McLain
In: Report to the National Science Foundation on the Ocean Enterprise Workshop, February 20-24, 1989, 13 pp., *1989* WHOI-R-89-018

The Conservation and Disposal of Ocean Hard Minerals: A Comparison of Ocean Mining Codes in the United States
Hoagland, P.
Natural Resources Journal, Vol. 28, pp. 451-508, *1988* WHOI-R-88-024

Seabed Materials
Broadus, J.M.
Science, Vol. 235, pp. 853-860, *1987* WHOI-R-87-004
A large catalog of materials has been proposed as potential seabed resources, and some seabed materials such as hydrocarbons and tin already contribute to the world's economy. Scientific advances have increased our knowledge of other seabed prospects, but realization of their potential will be determined by their relative economic accessibility compared to rival resources on land. Examination of existing stocks of conventional resources, and of the economic process by which new resources are added, suggests that most potential sources of seabed materials will not be exploited in the near future. Strategic behavior in seabed materials development, however, implies that investment in exploration and R&D could proceed on a larger scale and at a more rapid pace than might be expected solely on the basis of apparent commercial potential.

Performance Requirements in Ocean Mineral Development
Hoagland, P.
Marine Policy Reports, Vol. 9, No. 3, pp. 5-10, *1987* WHOI-R-87-001

Seabed Material Commodity and Resource Summaries Δ
Hoagland, P. and J.M. Broadus
Woods Hole Oceanographic Institution Technical Report WHOI-87-43, 235 pp., *1987* WHOI-T-87-002

Asian Pacific Marine Minerals and Industry Structure
Broadus, J.M.
Marine Resource Economics, Vol. 3, No. 1, pp. 63-88, *1986* WHOI-R-86-006

Seabed Mining Patent Activity: Some First Steps Toward an Understanding of Strategic Behavior
Hoagland, P.
Journal of Research Management and Technology, Vol. 14, No. 3, pp. 211-222, *1986* WHOI-R-86-005

Patent Activity in the Seabed Mining Industry Δ
Hoagland, P.
Woods Hole Oceanographic Institution Technical Report No. WHOI-85-20, 71 pp., *1985* WHOI-T-85-001

Rivalry and Coordination in Marine Hard Minerals Regulation
Broadus, J.M. and P. Hoagland
In: Proceedings of Oceans '84 Conference & Exposition, 10-12 September 1984, Washington, D.C., pp. 415-420, *1984* WHOI-R-84-015

Evaluating the Economic Significance of Polymetallic Sulfides Deposits
Broadus, J.M. and R.E. Bowen
15th Annual Offshore Technology Conference in Houston, Texas, May 2-4, 1983, pp. 419-426, *1983* WHOI-R-83-010

Evaluating the Risks of Offshore Oil Development Environmental Impact
Lahey, W.L. and T.M. Leschine
Assessment Review, Vol. 4, No. 3/4, pp. 271-286, *1983* WHOI-R-83-024

Effective Use of the Sea — Overcoming the Law of the Sea Problems
Ross, D.A.
Proceedings of Oceans, 3 pp., *1983* WHOI-R-83-021

Alternative Regimes for Future Mineral Resource Development in Antarctica
Westermeyer, W.E.
Ocean Management, Vol. 8, pp. 197-232, *1983* WHOI-R-83-011

Deep Ocean Mining Δ
Knecht, R.W.
Oceanus, Vol. 25, No. 3, pp. 3-11, *1982* WHOI-R-82-012

Resources of the Deep Sea other than Manganese Nodules
Ross, D.A.
1979 WHOI-R-79-006

Marine Policy—International Program

International Profiles on Marine Scientific Research Δ
Fenwick, J.
214 pp., *1992* WHOI-B-92-001
This monograph provides for each coastal country: its law of the sea treaty status; approximate marine area; maritime zones claimed and their breadth; maritime boundaries with other coastal countries (both potential and resolved boundaries); jurisdiction and regulations over marine scientific research specifying national legislation and extent of jurisdiction; and the coastal country history with U.S. research clearance requests, including the number of U.S. research clearance requests, the number of U.S. requests submitted annually to each country (1972-90), the outcome of those requests, and anecdotes where available describing any glitch in the process for each clearance request. (*Companion publication: world map, "Maritime Claims and Marine Scientific Research Jurisdiction Δ" by D.A. Ross and J. Fenwick, WHOI-M-92-001*)

Maritime Claims and Marine Scientific Research Jurisdiction Δ
Ross, D.A. and J. Fenwick
24" x 37" five-color map, *1992* WHOI-M-92-001
The Woods Hole Oceanographic Institution International Marine Science Program has been tracking maritime claims and evolving jurisdiction over marine scientific research for the world's coastal countries covering the past 20 years. This world map illustrates the variety of national maritime claims on an equal area, Robinson projection. (*Companion publication: "International Profiles on Marine Scientific Research Δ" by J. Fenwick, WHOI-B-92-001*)

U.S. Strategies for Cooperation with the Soviets on Ocean Science — Report of a Workshop held 29-31 October 1991 Δ
Dorman, C.E.
181 pp., *1991* WHOI-W-91-001
The idea of a workshop to discuss U.S.-Soviet ocean science cooperation was first

broached during February 1991. Individual and institutional contacts between the two nations' oceanographic communities were increasing dramatically. By the time of the workshop it was clear that the Union of Soviet Socialist Republics was disintegrating. In spite of the uncertainties, the sponsors (in the U.S., NOAA, NSF, and Navy) determined that it would still be worthwhile to hold the workshop. The workshop format basically consisted of seven thematic panels, each dealing with an area of mutual U.S. and Soviet interest: physical oceanography, geology and geophysics, biogeochemistry, acoustics, space/remote sensing, the Arctic, and marine policy. The reports of these thematic panels form the body of this workshop report.

Science Willing & Politics Permitting — Oceanographic Research in an International Setting √
Fenwick, J.
Nor'easter, Vol. 3, No. 1, 6 pp., *1991* WHOI-R-91-001
Conducting marine research in the international arena means coping with increasing legal and political constraints. Research in foreign waters is now subject to tighter control by coastal countries, and the areas under control have grown enormously in the past few decades. Stringent regulations on marine research impose more formality and additional funding requirements on scientists. But along with these constraints come opportunities for improving international collaboration in marine science.

International Marine Science Research Projects — 1990 Δ
Fenwick, J., D.A. Ross, and C.T. Schramm
Woods Hole Oceanographic Institution Technical Report WHOI-91-04, 157 pp., *1991*
WHOI-T-91-001
This inventory of marine science projects at Sea Grant institutions was completed in order to gauge the level and enhance a database of U.S./foreign collaboration in international marine research initiated at U.S. Sea Grant institutions. The inventory analyzes data from 122 international projects initiated at 20 Sea Grant institutions by profiling and explicating the extent of project foreign locations, sources of funding, areas of expertise for principal investigators, and contact at foreign and U.S. agencies and institutions. It presents one-page summaries of the 122 projects along with indexes by geographic location, funding source, P.I. discipline, P.I. name, and keywords. In addition, this report compares the data from the 1989-1990 inventory with that of the 1985 inventory.

Global Environmental Change Issues in the Western Indian Ocean Region
Gable, F.J., D.G. Aubrey, and J.H. Gentile
Geoforum, Vol. 20, No. 4, pp. 401-419, *1991* WHOI-R-91-007

International Marine Science Funding Guide Δ
Fenwick, J., D.A. Ross, and C.T. Schramm
176 pp., *1990* WHOI-H-90-001
This funding guide provides information for potential funding sources for both marine scientists and social scientists and is an introduction to a variety of sources: private foundations, educational institutions, corporations, government agencies, national, multinational, and international organizations. The IMS Funding Guide is geared primarily toward scholars who have recently obtained the doctoral degree and established scholars who wish to expand their research in an international direction, although some information is contained about funding for pre-doctoral work as well. Funding is available for a variety of applicants including individuals, for-profit and non-profit organizations, universities and colleges, and industry.

Marine Scientific Research: U.S. Perspective on Jurisdiction and International Cooperation
Ross, D.A. and J. Fenwick
In: New Developments in Marine Science and Technology: Economic, Legal and Political Aspects of Change, Proceedings of the 22nd Annual Law of the Sea Institute Conference of 1988, pp. 308-321, *1989* WHOI-R-88-023

U.S. Marine Scientific Research and Access to Foreign Waters
Ross, D.A. and J. Fenwick
Oceanography, pp. 37-39, *1988* WHOI-R-88-015

Marine Scientific Research Boundaries and the Law of the Sea. Discussion and Inventory of National Claims Δ
Ross, D.A. and T.A. Landry
173 pp., *1987* WHOI-T-87-001

Marine and Coastal Protected Areas in Latin America: A Preliminary Assessment
Silva, M. and I. Desilvestre
Coastal Zone Management Journal, Vol. 14, No. 4, pp. 311-347, *1986* WHOI-R-86-014

International Marine Science Research Projects: Inventory and Analysis of Selected Projects at Sea Grant Institutions-1985 Δ
Ross, D.A. and J. Fenwick
Woods Hole Oceanographic Institution Technical Report No. WHOI-85-22, 171 pp., *1985* WHOI-T-85-002

International Jurisdictional Issues in the Arctic Ocean
Shusterich, K.M.
Ocean Development and International Law, Vol. 14, No. 3, pp. 235-272, *1984* WHOI-R-84-016
Awareness in the United States of the strategic value of the Arctic has been prevalent for many years. Appreciation of the Arctic's economic, political, and scientific value, as well as its jurisdictional importance, is rapidly increasing. For several years, both the Soviet Union and Canada have had more ongoing commercial, scientific, and policy activities in the Arctic regions than the United States. Resource development, national security, and marine boundary issues promise to raise the level of awareness and importance of the Arctic regions to the United States over the next twenty years. The purpose of this article is to indicate the range and complexity of marine boundary jurisdiction issues in the Arctic.

United States Arctic Interests — The 1980's and 1990's Δ
Westermeyer, W.E. and K.M. Shusterich
1984 WHOI-B-84-001

The Shelfbreak: Some Legal Aspects
Ross, D.A. and K.O. Emery
SEPM Special Publication No. 33, pp. 437-441, *1983* WHOI-R-83-006
Conferences on Law of the Sea have had the objective of increasing the area of ocean floor subject to control by adjacent coastal countries. These extensions of jurisdiction have paid little attention to carefully defined and relatively easily identified geological boundaries, such as the shelfbreak, or shelfedge. Indeed, a geological term often is used in a legal sense that far exceeds the geological meaning, resulting in unnecessary confusion. The Third United Nations Conference on the Law of the Sea (UNCLOS III) adds an area of the ocean subject to national control equal to that of the land area of the world. Certain aspects of the remaining area of deep-ocean floor, such as mining, will also be controlled and taxed by an international authority. It is possible that future oceanographers may have little opportunity for research without permission and regulation by governments of either coastal nations or the United Nations. One result could be increased research and knowledge of the ocean floor that is under the jurisdiction of industrialized countries and decreased effort in the rest of the ocean.

International Marine Science: An Opportunity for the Future
Ross, D.A. and M.C. Healey
Oceanus, Vol. 25, No. 4, pp. 13-19, *1983* WHOI-R-83-002

Δ Available on loan from NSGD, see p. *v*.
√ Helpful to educators and students.

The Impact of the Law of the Sea Conference on U.S. Marine Scientific Research: Report on a Questionnaire Δ
Ross, D.A., R.C. Ladner, and J.A. Early
Woods Hole Oceanographic Institution Technical Report WHOI-83-15, 36 pp., *1983*
WHOI-T-83-002

Workshop on Cooperative International Marine Affairs Δ
Broadus, J.M., R.W. Knecht, D.A. Ross, K. Shusterich, and M. Silva
1982 WHOI-W-82-001

How the Law of the Sea Treaty will Affect U.S. Marine Science
Ross, D.A. and J.A. Knauss
Science, Vol. 217, pp. 1003-1008, *1982* WHOI-R-82-010

Marine Science and the Law of the Sea
Ross, D.A.
EOS, Vol. 62, No. 35, pp. 650-652, *1981* WHOI-R-81-004

The Human Costs of Development
McGoodwin, J.R.
Environment, Vol. 22, No. 1, pp. 25-42, *1980* WHOI-R-80-004
Anticipating the conclusion of the Third United Nations Conference on the Law of the Sea (UNCLOS III) in 1975, 80 coastal nations extended their jurisdictional claims over ocean economic resources to 200 nautical miles from their shores. Most of these countries are enthusiastically promoting new maritime developments, and in less developed countries the mood seems particularly bullish. Many of these nations — struggling with domestic food shortages and scarce capital for development — look to their fisheries as a source of protein-rich foods, and for substantial income from their exports. However, before the less developed countries surge ahead with the development of their fisheries, they need to consider the possible consequences of the strategies available to them, benefiting from the past experiences of other countries which have preceded them in fisheries development.

Coastal Energy Impact Program Boundaries on the Atlantic Coast: A Case Study of the Law Applicable to Lateral Seaward Boundaries Δ
Christie, D.R.
1979 WHOI-R-79-017

The Extent to Which Marine Transportation Within the Economic Zone Will be Affected by Enforcement of the Proposed Pollution Controls Δ
Graham, N.W.
1976 WHOI-T-76-007

The Oceans: The National and International Policy Frontier Δ
McElvey, V.E.
1976 WHOI-R-76-007

Report of the Workshop on Extended Jurisdiction Δ
Peterson, S.B.
1976 WHOI-W-76-001

Marine Technology Transfer as Foreign Aid to Less Developed Nations from Oceanographic Institutions in Industrialized Countries: A Search for an Effective Mechanism in the Educational Sector Δ √
Sarr, M.L.
1976 WHOI-T-76-006

Marine Scientific Research and the Law of the Sea Δ
Winer, R.
1976 WHOI-T-76-004

Oceanography—General

Diving for Science...1989 Δ
Lang, M.A. and W.C. Jaap
Proceedings of the American Academy of Underwater Sciences Ninth Annual Scientific Diving Symposium, Woods Hole, MA, Sept. 28-Oct. 1, 1989, 341 pp., *1989* WHOI-W-89-004

Georges Bank Δ
Backus, R.H. and D.W. Bourne
593 pp., *1987*, $225.00* WHOI-B-87-001
This book is a result of a project undertaken by the Coastal Research Center at the Woods Hole Oceanographic Institution in the late 1970s and early 1980s to determine why Georges Bank is so productive. It looks at all aspects of the natural science of the bank, describes its rich resources, and considers the public policy questions surrounding the exploitation of these resources. This book is of interest not only to oceanographers and social scientists interested in the ocean, but also students, legislators, fishermen, resource managers, engineers, lawyers — indeed anyone interested in Georges Bank. **Available for purchase from: MIT Press, Massachusetts Institute of Technology, Cambridge, MA 02139.*

Buzzards Bay Bibliography: A Reference Collection of Scientific and Technical Reports Published on Buzzards Bay Δ
Tripp, B.W.
Woods Hole Oceanographic Institution Technical Report No. WHOI-85-27, 96 pp., *1985* WHOI-L-85-001

Oceanography: The Present and Future Δ
Brewer, P.G.
392 pp., *1983* WHOI-B-83-001

Replication in Controlled Marine Systems: Presenting the Evidence
Smith, W., V.R. Gibson, and J.F. Grassle
In: Grice, G.D. and M.R. Reeve (eds.), Marine Mesocosms, pp. 217-225, *1982* WHOI-R-82-001
The basic reason for replicating experiments is to answer the question: If a competent experimenter were to reconstruct this experiment with approximately the same experimental manipulation and environmental conditions, what range of results would he observe? Attempting to answer this question for large-scale experiments introduces two problems not encountered in small-scale laboratory experiments: 1) Replicate experiments are performed under different environmental conditions, and 2) the cost and size of an experiment make large numbers of replicate experiments impractical. This paper discusses these two problems in general and then considers the evidence for replicability in two large-scale marine experiments: the MERL No. 2 fuel oil experiments at the Marine Ecosystems Research Laboratory, Narragansett, R.I., and the CEPEX mercury pollution experiments (Controlled Environmental Pollution Experiment), Saanich Inlet, British Columbia.

Relating Oceanography to Antillean Archaeology: Implications from Oceania
Watters, D.R.
Journal of New World Archaeology, Vol. 5, No. 2, 9 pp., *1982* WHOI-R-82-024
The purpose of this paper is to bring to the attention of Caribbean archaeologists some pertinent studies concerning maritime adaptations and ocean processes in Oceania, a region where research linking oceanography and prehistoric archaeology is further advanced. This paper briefly reviews prior maritime-related work in the Antilles, demonstrates the applicability of Oceanic studies to the Caribbean, provides a credible theoretical framework, and addresses the need for re-evaluating previously gathered data. The paper also builds upon links between the disciplines, ocean processes affecting the archaeological record, reasons for the pervasive terrestrial bias, and the aspects of maritime adaptations that Antillean archaeologists currently are neglecting. This discussion more directly pertains to the insular part of Caribbean America, especially to the smaller islands of the Lesser Antilles and Bahamas, than to fronting continental landmasses in South and Central America.

Georges Bank: An Annotated Bibliography of Atlases, Inventories and Map Series Δ
Price, R.L.
Woods Hole Oceanographic Institution Technical Report WHOI-81-46, 71 pp., *1981*
WHOI-L-81-001

Future of U.S. Oceanography
Ross, D.A.
In: International Cooperation in Marine Technology, Science, and Fisheries: The Future U.S. Role in Development, National Academy Press: Washington, D.C., pp. 117-130, *1980* WHOI-R-80-021

Oceanography—Biological

Organic Aggregates in Detrital Food Webs: Incorporation by Bay Scallops *Argopecten irradians*
Alber M. and I. Valiela
Marine Ecology Progress Series, Vol. 121, pp. 117-124, *1995* WHOI-R-95-002

Midgut-gland Development During Early Life-history Stages of the American Lobster *Homarus americanus*
Biesiot, P.M. and J.E. McDowell
Journal of Crustacean Biology, Vol. 15, No. 4, pp. 679-685, *1995*, WHOI-R-95-003

Tetrachlorobiphenyl Metabolism, Toxicity, and Regulation of Cytochrome P450 Expression in a Marine Teleost Fish
White, R.D
Ph.D. Thesis, Massachusetts Institute of Technology/Woods Hole Oceanographic Institution Joint Program in Oceanography/Applied Ocean Science and Engineering, 2 pp. (abstract only), *1995*, WHOI-X-95-001

Biochemical Composition of Organic Aggregates Produced from Marine Macrophyte-derived Dissolved Organic Matter
Alber, M. and I. Valiela
Limnol. Oceanogr., Vol. 39, No. 3, pp. 717-723, *1994* WHOI-R-94-002

Incorporation of Organic Aggregates by Marine Mussels
Alber, M. and I. Valiela
Marine Biology, Vol. 121, pp. 259-265, *1994* WHOI-R-94-007

Production of Microbial Organic Aggregates from Macrophyte-derived Dissolved Organic Material
Alber, M. and I. Valiela.
Limnol. Oceanog., Vol. 39, No. 1, pp. 37-50, *1994*, WHOI-R-94-010

Social Behaviour of Captive Belugas, *Delphinapterus leucas*
Recchia, C.A.
Ph.D. Thesis, Massachusetts Institute of Technology/Woods Hole Oceanographic Institution Joint Program in Oceanography/Applied Ocean Science and Engineering, 1 p. (abstract only), *1994* WHOI-X-94-001

Seasonal Distribution of Nutrients and Primary Productivity on the Eastern Continental Shelf of Venezuela as Influenced by the Orinoco River
Bonilla, J., W. Senior, J. Bugden, O. Zafiriou, and R. Jones
Journal of Geophysical Research, Vol. 98, No. C2, pp. 2245-2257, *1993* WHOI-R-93-005

Getting to Why: Understanding Leukemia in Soft-shell Clams
Crago T.I.
Nor'easter, Vol. 5, No. 1, pp. 20-23, *1993* WHOI-R-93-007

Marine Biotechnology: Sea Grant's Role
Crago, T.I.
Nor'easter, Vol. 5, No. 2, pp. 28-31, *1993* WHOI-R-93-014

Application of rRNA-based Probes for Observing Marine Nanoplanktonic Protists
Lim, E.L., L.A. Amaral, D.A. Caron, and E.F. DeLong
Applied and Environmental Microbiology, May 1993, pp. 1647-1655, *1993* WHOI-R-93-004

Growth Dynamics of Juvenile Copepods Exposed to Simulated Patches of Food Δ
Shumate, A.M.
Bachelor of Arts with Honors in Biological Sciences Thesis, Wellesley College, 33 pp., *1993* WHOI-X-93-001

The Behavioral Physiology of Labroid Fishes
Curran, M.C.
Ph.D. Thesis, Massachusetts Institute of Technology/Woods Hole Oceanographic Institution Joint Program in Oceanography/Applied Ocean Science and Engineering, 4 pp. (abstract only), *1992* WHOI-X-92-001

Sounds Produced by Spawning Fishes
Lobel, P.S.
Environmental Biology of Fishes, Vol. 33, pp. 351-358, *1992* WHOI-R-92-004
Low frequency sounds are shown to be associated with the spawning of two Caribbean coral reef fishes, the hamlet, *Hypoplectrus unicolor* (Serranidae) and the striped parrotfish, *Scarus iserti* (Scaridae). Both fishes produce distinctive sounds while broadcasting gametes in midwater. *H. unicolor* produces sounds via muscle stimulation of the swim bladder. Fin movements among group spawning *S. iserti* produce hydrodynamic noise. Although reproductive behaviors of these two species have been previously studied in detail, the association of sounds with mating is new. The mating sounds cannot be easily detected by human hearing underwater but are recordable using a hydrophone. The sounds are distinct and recognizable enough to allow counting and acoustic mapping of mating events in these species.

Nitrogen Assimilation from Amorphous Detritus by Two Coastal Consumers
D'Avanzo, C., M. Alber, and I. Valiela
Estuarine Coastal and Shelf Science, Vol. 33, pp. 203-209, *1991* WHOI-R-91-009

Δ Available on loan from NSGD, see p. *v*.
√ Helpful to educators and students.

Cultivation of Smbiotic Pigment-producing Bacteria from the Accessory Midamental Glands of the Squid *Loligo palei*
Dunlap, P.V.
Abstracts from the 56th Annual Meeting of the American Malacological Union, 1990, 1 p. (abstract only), *1990* WHOI-R-90-020

Sediment-trap Experiments on the Importance of Hydrodynamical Processes in Distributing Settling Invertebrate Larvae in Near-bottom Waters
Butman, C.A.
J. Exp. Mar. Biol. Ecol., Vol. 134, pp. 37-38, *1989* WHOI-R-89-021

Spawning Behavior of *Chaetodon multicinctus* (chaetodontidae); Paris and Intruders
Lobel, P.S.
Environmental Biology of Fishes, Vol. 25, No. 1-3, pp. 125-130, *1989* WHOI-R-89-014

Comparison of Terrestrial and Marine Ecological Systems Δ
Steering Committee (J. Steele, S. Carpenter, J. Cohen, P. Dayton, and R. Ricklefs)
Report of a Workshop held in Santa Fe, New Mexico, 14 pp., *1989* WHOI-W-89-005

Eelgrass in Buzzards Bay: Distribution, Production and Historical Changes in Abundance Δ
Costa, J.E.
EPA 503/4-88-002, Buzzards Bay Project, 204 pp., *1988* WHOI-X-88-004

Periodicity in Fecal Pellet Production by the Capitellid Polychaete *Mediomastus ambiseta* throughout the Day
Fuller, C.M., C.A. Butman, and N.M. Conway
Ophelia, Vol. 29, No. 1, pp. 83-91, *1988* WHOI-R-88-009

Visual Observations of Particle Manipulation During Feeding in Larvae of a Bivalve Mollusc
Gallager, S.M.
Bulletin of Marine Science, Vol. 43, No. 3, pp. 344-365 *1988* WHOI-R-88-019
Observations presented by the author address three basic questions concerning the feeding behavior of bivalve larvae: 1) How does the rate of particle encounter by the pre-oral cilia of the velum influence feeding activity over a wide range of particle concentrations? 2) How efficiently are particles captured and transported to the mouth after being encountered in the medium? and 3) What mechanism(s) are available for decoupling particle encounter, capture and ingestion at satiating food levels? Using normal and high-speed video microscopic techniques and frame-by-frame analysis, the fate of individual particles was traced through the steps of capture, transport to the mouth by the food groove, accumulation at the mouth, and ingestion and rejection from the esophagus.

Larval Settlement of Soft-sediment Invertebrates: The Spatial Scales of Pattern Explained by Active Habitat Selection and the Emerging Role of Hydrodynamical Processes
Butman, C.A.
Oceanogr. Mar. Biol. Ann. Rev., Vol. 25, pp. 113-165, *1987* WHOI-R-87-007

Effect of Irradiances up to 2000 μE m^{-2} s^{-1} on Marine *Synechococcus* WH7803-I. Growth, Pigmentation, and Cell Composition
Kana, T.M. and P.M. Glibert
Deep-Sea Research, Vol. 34, No. 4, pp. 479-495, *1987* WHOI-R-87-012

Effect of Irradiances up to 2000 μE m^{-2} s^{-1} on Marine *Synechococcus* WH7803-II. Photosynthetic Responses and Mechanisms
Kana, T.M. and P.M. Glibert
Deep-Sea Research, Vol. 34, No. 4, pp. 497-516, *1987* WHOI-R-87-013

Changes in Midgut Gland Morphology and Digestive Enzyme Activities Associated with Development in Early Stages of the American Lobster *Homarus americanus* Δ
Biesiot, P.M.
Ph.D. Thesis, Massachusetts Institute of Technology/Woods Hole Oceanographic Institution Joint Program in Oceanography and Oceanographic Engineering, 1 p. (abstract only), *1986* WHOI-Y-86-001

Larval Settlement of Soft-sediment Invertebrates: Some Predictions Based on an Analysis of Near-bottom Velocity Profiles
Butman, C.A.
In: Nihoul, J.C.J. (ed.), Marine Interfaces Ecohydrodynamics, Elsevier Oceanography Series, Vol. 42, pp. 487-513, *1986* WHOI-R-86-002

Two-sex Models: Chaos, Extinction, and Other Dynamic Consequences of Sex
Caswell, H. and D.W. Weeks
The American Naturalist, Vol. 128, No. 5, pp. 707-735, *1986* WHOI-R-86-012

Individual Variability in Lipid Content of Bivalve Larvae Quantified Histochemically by Absorption Photometry
Gallager, S.M. and R. Mann
Journal of Plankton Research, Vol. 8, No. 5, pp. 927-937, *1986* WHOI-R-86-009

Lipid as an Index of Growth and Viability in Three Species of Bivalve Larvae
Gallager, S.M., R. Mann, and G.C. Sasaki
Aquaculture, Vol. 56, pp. 81-103, *1986* WHOI-R-86-008

Nutritional and Bioenergetic Considerations in the Development of the American Lobster *Homarus americanus*
Sasaki, G.C., J.M. Capuzzo, and P. Biesiot
Canadian Journal of Fisheries and Aquatic Sciences, Vol. 43, No. 11, pp. 2311-2319, *1986* WHOI-R-86-007
To better understand the early life history of the American lobster, *Homarus americanus*, nutritional and bioenergetic aspects of development have been investigated. These studies focused on physiological and biochemical processes during transitional periods between extrusion of the eggs, hatching, larval development, molting, metamorphosis, and attainment of the juvenile stage and the findings of the investigators are described in this paper.

Effects of Copper and Zinc on Two Planktonic Ciliates
Stoecker, D.K., W.G. Sunda, and L.H. Davis
Marine Biology, Vol. 92, pp. 21-29, *1986* WHOI-R-86-004
Copper and zinc are essential for plant and animal growth, but both can be toxic at elevated concentrations. The availability of these and other trace metals to marine organisms has been shown to be controlled by free metal ion activity rather than the total metal concentration. There is evidence that both copper and zinc may occur at levels in marine waters which are limiting or inhibitory to some organisms. In this study, the authors examined the effects of free cupric and zinc ion activities on ciliates in a model food web consisting of a single phytoplankton species and two species of ciliates and results of both short-term and long-term experiments are reported in this paper.

Δ Available on loan from NSGD, see p. *v*.
√ Helpful to educators and students.

Copper Complexation During Spring Phytoplankton Blooms in Coastal Waters
Anderson, D.M., J.S. Lively, and R.F. Vaccaro
Journal of Marine Research, Vol. 42, pp. 677-695, *1984* WHOI-R-84-005

The Functions of Nematocysts in Prey Capture by Epipelagic Siphonophores (*Coelenterate, Hydrozoa*)
Purcell, J.E.
Biol. Bull., Vol. 166, pp. 310-327, *1984* WHOI-R-84-002

Fine Scale Spatial Correlations Between Planktonic Ciliates and Dinoflagellates
Stoecker, D.K., L.H. Davis, and D.M. Anderson
Journal of Plankton Research, Vol. 6, No. 5, pp. 829-842, *1984* WHOI-R-84-020

Characterization of Feeding Activity Patterns in the Planktonic Copepod *Centropages typicus* Kroyer Under Conditions
Cowles, T.J. and J.R. Strickler
Limnol. Oceanogr., Vol. 28, No. 1, pp. 106-115, *1983* WHOI-R-83-003

Swimming Behaviour of Larvae of the Ocean Quahog *Arctica islandica* in Response to Pressure and Temperature
Mann, R. and C.C. Wolf
Marine Ecology, Vol. 13, pp. 211-218, *1983* WHOI-R-83-016
Trochophore larvae of the ocean quahog *Arctica islandica* swim continuously. At a constant temperature of 12°C they are negatively geotactic, have no phototactic response and exhibit no change in swimming behaviour in the pressure range 1 to 3 bar. In a vertical thermal gradient from 9 to 25°C the trochophores swim throughout the experimental chamber and show no temperature preference. Veliger larvae of *A. islandica* alternate between periods of active upward swimming in vertically oriented helices, that is a negative geotaxis, and periods of passive sinking with the velum either trailing or retracted between closed valves. They do not swim in the horizontal plane and, in the length range 160 to 202 µm, show no phototactic response. When exposed to sequential increases and decreases in hydrostatic pressure at 12°C, larvae in the length range 160 to 196 µm consistently exhibited a net upward movement following an increase in pressure and a net downward movement following a decrease in pressure. The threshold pressure change to elicit response is <0.5 bar. Larvae of 170 µm length respond to increased pressure by increasing height gain per rotation. Larvae of 202 µm length exhibit no significant change in swimming behaviour with increased pressure. In a vertical thermal gradient early veligers swim in the range 7 to 23°C with preferential aggregation, depending upon size, in the range 12 to 18°C. Larvae of 204 µm length show no temperature preference in the range 6 to 20°C. The implication of the observed behaviour on seasonal depth distribution of *A. islandica* larvae in the Middle Atlantic Bight is discussed.

Effects of Size, Age and Photoperiod on Hypoosmoregulation in Brook Trout, *Salvelinus fontinalis* Δ
McCormick, S.D.
Ph.D. Thesis, Woods Hole Oceanographic Institution/Massachusetts Institute of Technology Joint Program in Oceanography and Ocean Engineering, 181 pp., *1983* WHOI-X-83-003

Growth of *Favella sp.* (Ciliata: Tintinnina) and Other Microzooplanketers in Cages Incubated In Situ and Comparison to Growth In Vitro
Stoecker, D., L.H. Davis, and A. Provan
Marine Biology, Vol. 75, pp. 293-302, *1983* WHOI-R-83-015

Instrumentation for the Measurement of Phytoplankton Production
Taylor, C.D., J.J. Molongoski, and S.E. Lohrenz
Limnol. Oceanogr., Vol. 28, No. 4, pp. 781-787, *1983* WHOI-R-83-009
Automated instrumentation performs time-course incubation experiments directly in

situ where natural conditions of temperature, light, hydrostatic pressure, etc., can be maintained. The sampler incubation device (SID) takes a 1-liter sample from the water and simultaneously introduces an appropriate radiotracer. During subsequent in situ incubation, 50-ml subsamples are withdrawn from the main sample at equally spaced intervals and preserved for laboratory analysis. Representative experiments revealed nonlinear carbon uptake within 0.5-1.0 h, emphasizing that even brief end-point analyses can lead to large errors in estimating phytoplankton production rates. Studies of the rapid fluctuation in phytoplankton activity resulting from cloud-induced variations in light intensity and the application of cellular fractionation methods for measuring the intracellular distribution of newly fixed carbon illustrated the utility of instrumental time-course techniques for studying phytoplankton physiology and community metabolism in situ.

Selective Grazing by the Mud Snail *Ilyanassa obsoleta*
Connor, M.S. and R.K. Edgar
Oecologia, Vol. 53, pp. 271-275, *1982* WHOI-R-82-008
Mud snails (*Ilyanassa obsoleta*) starved for 48 h were allowed to feed on sediments in laboratory microcosms. Sediment cores sliced at 2 mm intervals were compared to snail stomach contents for percent carbon and nitrogen, plant pigment contents and species composition of benthic diatoms. Concentrations of carbon, nitrogen, phaeopigments, phycocyanin and chlorophyll were enriched in the top 2 mm of the sediments compared to 7-10 mm depth by a factor of 2-10. In turn, these materials were 20-40 times more concentrated in snail guts than in the surface sediments. Snail feces were enriched for carbon and nitrogen by 5-7 times over the surface sediments. Bacterial chlorophyll peaked at about 3-4 mm in the sediments and was not detectable in the snail stomach contents. The C/N ratio of the snail stomach contents was only 6 compared to a ratio of 8.5 for their feces and 12 for the surface sediments. The percentage of migratory diatoms (e.g. Nitzschia and Navicula) decreased with depth where non-migratory species, such as Fragilaria pinnata, dominated. These migratory species were more common in the snails than in the sediments on which they were feeding. A comparison of daily ingestion rates to the animal's energy budget shows that this selective ingestion is sufficient to meet *Ilyanassa's* energy needs.

The Effect of Feeding by Mud Snails, *Ilyanassa obsoleta* (Say), on the Structure and Metabolism of a Laboratory Benthic Algal Community
Connor, M.S., J.M. Teal, and I. Valiela
J. Exp. Mar. Biol. Ecol., Vol. 65, pp. 29-45, *1982* WHOI-R-82-013

Linearizing Ecological Models with Time-varying Parameters
Evans, G.T.
Mathematical Biosciences, Vol. 61, pp. 155-161, *1982* WHOI-R-82-011

The Effect of pH in Intensive Microalgal Cultures — I. Biomass Regulation
Goldman, J.C., Y. Azov, C.B. Riley, and M.R. Dennett
J. Exp. Mar. Biol. Ecol., Vol. 57, pp. 1-13, *1982* WHOI-R-82-016

The Effect of pH in Intensive Microalgal Cultures — II. Species Competition
Goldman, J.C., C.B. Riley, and M.R. Dennett
J. Exp. Mar. Biol. Ecol., Vol. 57, pp. 15-24, *1982* WHOI-R-82-017

Effect of Nitrogen-mediated Changes in Alkalinity on pH Control and CO_2 Supply in Intensive Microalgal Cultures
Goldman, J.C., M.R. Dennett, and C.B. Riley
Biotechnology and Bioengineering, Vol. XXIV, pp. 619-631, *1982* WHOI-R-82-004

Benthic Filter Feeding: A Natural Eutrophication Control Δ
Officer, C.B., T.J. Smayda, and R. Mann

Δ Available on loan from NSGD, see p. *v*.
√ Helpful to educators and students.

Marine Ecology, Vol. 9, pp. 203-210, *1982* WHOI-R-82-029
The importance of the benthic filter feeding community as a natural control on eutrophication is considered. The important environmental factors favorable for such a control are relatively shallow water depths and a dense benthic filter feeding community of small animals. The criteria are summarized in the equivalence of the water recycling time for phytoplankton growth. The criteria are applied specifically to the conditions that exist in South San Fransisco Bay.

Effects of Temperature and Light on the Feeding Rate of *Favella sp.* (Ciliated Protozoa, Suborder Tintinnina)
Stoecker, D. and R.R.L. Guillard
Ann. Inst. Oceanogr., Vol. 58, pp. 309-318, *1982* WHOI-R-82-028

Effects of *Olisthodiscus luteus* on the Growth and Abundance of Tintinnids
Verity, P.G. and D. Stoecker
Marine Biology, Vol. 72, pp. 79-87, *1982* RIU-R-82-003

Grazing by Canada Geese and Related Aspects of the Chemistry of Salt Marsh Grasses Δ
Buchsbaum, R., I. Valiela, and J.M. Teal
Colonial Waterbirds, Vol. 4, pp. 126-131, *1981* WHOI-R-81-017
Birds have generally been overlooked in research involving the response of herbivores to naturally-occurring feeding stimulants and inhibitors on the assumption that they are poorly endowed with chemical senses. Research in the past 15 years, however, has shown that some groups of birds have quite well developed chemical senses and use these abilities to find food and locate nests. These reports point to a much more significant role for chemoreception in waterfowl than has generally been assumed in the past and raises the possibility that grazing waterfowl, like insects and mammals, are responsive to natural plant substances. With this in mind, the authors have investigated the role of secondary plant substances in the feeding behavior of geese.

Test for Allelopathic Interactions Between Two Marine Microalgal Species Grown in Intensive Cultures
Goldman, J.C., M.R. Dennett, and C.B. Riley
Current Microbiology, Vol. 6, pp. 275-279, *1981* WHOI-R-81-013

A Critique of Benthos — A Simulation Model by J.R. Albanese Δ
Hahm, W. and T.M. Leschine
Laboratory Reference Document No. 81-26, 19 pp., *1981* WHOI-T-81-003

Effect of Nitrogen Source and Growth Rate on Phytoplankton-mediated Changes in Alkalinity
Goldman, J.C. and P.G. Brewer
Limnol. Oceanogr., Vol. 25, No. 2, pp. 352-357, *1980* WHOI-R-80-005

Temperature-influenced Variations in Speciation and Chemical Composition of Marine Phytoplankton in Outdoor Mass Cultures Δ
Goldman, J.C. and R. Mann
J. Exp. Mar. Biol. Ecol., Vol. 46, pp. 29-39, *1980* WHOI-R-80-012

Factors Involved in Herbivore Food Preference
Nicotri, M.E.
J. Exp. Mar. Biol. Ecol., Vol. 42, pp. 13-26, *1980* WHOI-R-80-002

Survey Design in Marine Environment: Three Examples Δ
Smith, W.
In: Deemer, F.P., F.J. Verberg, and D.Z. Merkes (eds.), Advanced Concepts in Ocean Measure-

ment for Marine Biology, pp. 505-520, *1980* WHOI-R-80-006
Three examples are used to illustrate the range of statistical design problems encountered in marine research. The first example uses nonlinear design methods to find the optimum survey pattern for accurately locating the positions of acoustic beacons used in precision navigation. In the second example, time series methods are used to evaluate environmental survey designs and to determine the number of times to repeat a survey over time. The third example shows that a variation of double sampling procedures can be implemented quickly in response to an oil spill, providing greater flexibility in evaluating the effect of the oil spill.

Sex Differences in Cytochrome P-450 and Mixed-function Oxygenase Activity in Gonadally Mature Trout
Stegeman, J.J. and M. Chevion
Biochemical Pharmacology, Vol. 29, pp. 553-555, *1980* WHOI-R-80-001

Some Physiological and Biochemical Considerations of Larval Development in the American Lobster, *Homarus americanus* Δ
Capuzzo, J.M. and B.A. Lancaster
1979 WHOI-R-79-012

Larval Development in the American Lobster: Changes in Metabolic Activity and the O:N Ratio Δ
Capuzzo, J.M. and B.A. Lancaster
1979 WHOI-R-79-009

Growth and Competition of the Marine Diatoms *Phaeodactylum tricornutum* and *Thalassiosira pseudonan*. Nutrient Effects
D'Elia, C.F., R.R.L. Guillard, and D.M. Nelson
1979 WHOI-R-79-001

Steady-state Growth and Chemical Composition of the Marine Chlorophyte *Dunaliella tertiolecta* in Nitrogen-limited Continuous Cultures
Goldman, J.C. and D.G. Peavey
1979 WHOI-R-79-014

Growth Rate Influence on the Chemical Composition of Phytoplankton in Oceanic Waters
Goldman, J.C., J.J. McCarthy, and D.G. Peavey
1979 WHOI-R-79-004

The Filter-feeding Rates and Particle Retention Efficiencies of Three Species of *Cyclosalpa* (Tunicata, Thaliacea) Δ
Harbison, G.R. and V.L. McAlister
1979 WHOI-R-79-008

Measures of Diversity with Unbiased Estimates Δ
Smith, W., J.F. Grassle, and D. Kravitz
1979 WHOI-R-79-016
The results of Smith and Grassle (1977) for the family of expected species diversity measures are reviewed. These results are applied to estimating variability in local diversity in the deep sea from small benthic cores. These results are extended to a wider class of diversity indices including a modification of Brillouin's index. Finally, unbiased estimation methods are applied to the estimation of species-area diversity.

A Comparison of Morphometric, Biochemical, and Physiological Indexes of Condition in Marine Bivalve Molluscs
Mann, R.
1978 WHOI-R-77-016

The Effect of Temperature on Growth and Ammonia Excretion of the Manila Clam *Tapes japonica* Δ
Mann, R. and S.J. Glomb
1978 WHOI-R-78-003

Environmental Survey Design — A Time Series Approach
Smith, W.
1978 WHOI-R-78-004

Productivity and Nitrogen Balance in Large Scale Phytoplankton Cultures Δ
D'Elia, C.F., J.H. Ryther, and T.M. Losordo
1977 WHOI-R-77-007

Temperature Effects on Phytoplankton Growth in Continuous Culture
Goldman, J.C.
1977 WHOI-R-77-010

Biomass Production in Mass Cultures of Marine Phytoplankton at Varying Temperatures Δ
Goldman, J.C.
1977 WHOI-R-77-005

The Impact of Crustacean Herbivores on Cultured Seaweed Populations
Nicotri, M.E.
1977 WHOI-R-77-015

Isolation and Purification of the Molting Hormones from the American Lobster (*Homarus americanus*) Δ
Gagosian, R.B. and R.A. Bourbonniere
1976 WHOI-R-76-001

Temperature-influenced Species Competition in Mass Cultures of Marine Phytoplankton Δ
Goldman, J.C. and J.H. Ryther
1976 WHOI-R-76-008
Investigation of and results from seasonal (cold water) shifts in species domination in outdoor ponds supplied with a mixture of waste water and sea water.

A Similarity Measure Sensitive to the Contribution of Rare Species and its Use in Investigation of Variation in Marine Benthic Communities Δ
Grassle, J.F. and W. Smith
1976 WHOI-R-76-009

Behavior of Lobsters (*Homarus americanus*) in a Semi-natural Environment at Ambient Temperatures and Under Thermal Stress Δ
Stein, L., S. Jacobson, and J. Atema
1976 WHOI-T-75-002

Nutrient Transformations in Mass Cultures of Marine Algae Δ
Goldman, J.C. and J.H. Ryther
1975 WHOI-R-75-003

Synopsis of the Biology of the White Marlin *Tetrapturus albidus* Poey (1861) Δ
Mather, F.J., H.L. Clark, and J.M. Mason Jr.
1975 WHOI-R-75-004

Lobster Molting Hormones: Isolation and Biosynthesis of Ecdysterone Δ
Gagosian, R.B., R.A. Bourbonniere, W.B. Smith, E.F. Couch, C. Blanton, and W. Novak
1974 WHOI-R-74-001

Behavioral Responses of Male Lobsters to Ecdysone Metabolites Δ
Gagosian, R.B. and J. Atema
1973 WHOI-R-73-001

Migration and Distribution of White Marlin and Blue Marlin in the Atlantic Ocean Δ
Mather, F.J., A.C. Jones, and G.L. Beardsley
1972 WHOI-R-72-001

Results of Sailfish Tagging in the Western North Atlantic Ocean Δ
Mather, F.J., D.C. Tabb, J.M. Mason, and H.L. Lawrence
1972 WHOI-R-72-002

Migrations of White Marlin and Blue Marlin in the Western North Atlantic Ocean — Tagging Results Since May 1970 Δ
Mather, F.J., J.M. Mason, and H.L. Clark
1972 WHOI-R-72-003

Final Report of the Working Party on Tuna and Billfish Tagging in the Atlantic and Adjacent Seas Δ
Mather, F.J.
1971 WHOI-R-71-002

***Seriola carpenteri*, A New Species of Amberjack (Pisces: Carangidae) from Tropical Western Africa Δ**
Mather, F.J.
1971 WHOI-R-71-001

Oceanography—Biological/Harmful Algal Blooms

Marine Toxins: Studies Unravel Mystery of Public Health Threat
2 pp., *1994* WHOI-G-94-002

Red Tides
Anderson, D.M.
Scientific American, Vol. 271, No. 2, pp. 62-68, *1994* WHOI-R-94-001

Biogeography of Toxic Dinoflagellates in the Genus *Alexandrium* from the Northeastern United States and Canada
Anderson, D.M., D.M. Kulis, G.J. Doucette, J.C. Gallagher, and E. Balech
Marine Biology, Vol. 120, pp. 467-478, *1994* WHOI-R-94-005

An Immunofluorescent Survey of the Brown Tide Chrysophyte *Aureococcus anophagefferens* Along the Northeast Coast of the United States
Anderson, D.M., B.A. Keafer, D.M. Kulis, R.M. Waters, and R. Nuzzi
Journal of Plankton Research, Vol. 15, No. 5, pp. 563-580, *1993* WHOI-R-93-006
Surveys were conducted along the northeast coast of the U.S.A., between Portsmouth, New Hampshire, and the Chesapeake Bay in 1988 and 1990, to determine the population distribution of *Aureococcus anophageefferens*, the chrysophyte responsible for massive and

destructive brown tides in Long Island and Narragansett Bay beginning in 1985. Both years, *A. anophagefferons* was detected at numerous stations in and around Long Island and Barnegat Bay, New Jersey, typically at high cell concentrations. To the north and south of this 'center,' nearly half of the remaining stations were positive for *A. anophagerrons*, but the cells were always at very low cell concentration. Many of the positive identifications in areas distant from Long Island were in waters with no known history of harmful brown tides. The species was present in both open coastal and estuarine locations, in salinities between 18 and 32 practical salinity units (PSU). The observed population distributions apparently still reflect the massive 1985 outbreak when this species first bloomed, given the number of positive locations and high abundance of *A. anophagerrons* in the immediate vicinity of Long Island. However, the frequent occurrence of this species in waters far from the population 'center' is disturbing. *Aureococcus anophagerrons* is more widely distributed than was previously thought. Numerous areas thus have the potential for destructive brown tides such as those associated with the sudden appearance of the species in 1985.

Use of Remotely-sensed Sea Surface Temperatures in Studies of Alexandrium tamarense Bloom Dynamics
Keafer, B.A. and D.M. Anderson
In: Smayda, T.J. and Y. Shimizu (eds.), Toxic Phytoplankton Blooms in the Sea, Elsevier Science Publishers B.V., pp. 763-768, *1993* WHOI-R-93-003
Remote sensing of sea surface temperatures (SST) has proven to be a useful tool in studies of the bloom dynamics of *Alexandrium tamarense* and the onset of PSP in the southwestern Gulf of Maine. A warm coastal current (= plume) formed from spring runoff that is believed to be responsible for the southerly transport of *A. tamarense* along the coast in this region was easily resolved in SST imagery. Coastal upwelling, which moved the warmer *A. tamarense*-containing buoyant plume offshore and away from nearshore shellfish, was detected in two of the three years of this study. The imagery provides valuable insights into the short-term oceanographic processes responsible for the development and behavior of the plume and the distribution of *A. tamarense*. Remotely-sensed SST has great promise as a tool to provide early warning of the conditions conductive for bloom development, transport, and the initiation of PSP in the region.

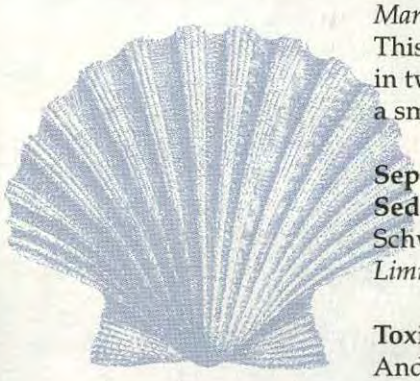
Paralytic Shellfish Poisoning on Georges Bank: In Situ Growth or Advection of Established Dinoflagellate Population?
Anderson, D.M. and B.A. Keafer
In: Wiggin, J. and C.N.K. Mooers (eds.), Proceedings of the Gulf of Maine Scientific Workshop, 8-10 January 1991, Woods Hole, MA. Gulf of Maine Council on the Marine Environment. Urban Harbors Institute, University of Massachusetts, Boston, pp. 217-223, *1992*
WHOI-R-91-014

Toxic Phytoplankton Blooms in the Southwestern Gulf of Maine: Testing Hypotheses of Physical Control Using Historical Data
Franks, P.J.S. and D.M. Anderson
Marine Biology, Vol. 112, pp. 165-174, *1992* WHOI-R-92-002

Alongshore Transport of a Toxic Phytoplankton Bloom in a Buoyancy Current: *Alexandrium tamarense* in the Gulf of Maine
Franks, P.J.S. and D.M. Anderson
Marine Biology, Vol. 112, pp. 153-164, *1992* WHOI-R-92-003
The authors examined the mechanisms controlling blooms of the toxic dinoflagellate *Alexandrium tamarense* Lebour and the concomitant patterns of shellfish toxicity in the southwestern Gulf of Maine, U.S.A. During a series of cruises from 1987 to 1989, hydrographic parameters were measured to elucidate the physical factors affecting the distribution and abundance of dinoflagellates along this coast. In 1988 and 1989 when toxicity was detected in the southern part of this region, *A. tamarense* cells were apparently transported into the area between Portsmouth, New Hampshire, and Cape Ann, Massachusetts, in a coastally trapped buoyant plume. This plume appears to have been formed

by the outflow from the Androscoggin and Kennebec Rivers. Flow rates of these rivers, hydrographic sections, and satellite images led the authors to conclude that the plume persisted for about a month, and extended alongshore for several hundred kilometers.

Burial of Living Dinoflagellates Cysts in Estuarine and Nearshore Sediments
Keafer, B.A., K.O. Buesseler, and D.M. Anderson
Marine Micropaleontology, Vol. 20, pp. 147-161, *1992* WHOI-R-92-009
This paper describes research into the deposition and burial of living dinoflagellate cysts in two different environments — the nearshore waters of the southern Gulf of Maine and a small, shallow pond on Cape Cod, Massachusetts.



Separation and Concentration of Living Dinoflagellate Resting Cysts from Marine Sediments via Density-gradient Centrifugation
Schwinghamer, P., D.M. Anderson, and D.M. Kulis
Limnol. Oceanogr., Vol. 36, No. 3, pp. 588-592, *1991* WHOI-R-91-012

Toxin Variability in Alexandrium Species
Anderson, D.M.
In: Graneli, E., B. Sundstroem, L. Edler, and D.M. Anderson (eds.), Toxic Marine Phytoplankton, Elsevier, pp. 41-51, *1990* WHOI-R-90-022

Toxin Composition Variations in One Isolate of the Dinoflagellate *Alexandrium fundyense*
Anderson, D.M., D.M. Kullis, J.J. Sullivan, and S. Hall
Toxicon, Vol. 28, No. 8, pp. 885-893, *1990* WHOI-R-90-017

Dynamics and Physiology of Saxitoxin Production by the Dinoflagellate *Alexandrium spp.*
Anderson, D.M., D.M. Kullis, J.J. Sullivan, S. Hall, and C. Lee
Marine Biology, Vol. 104, pp. 511-524, *1990* WHOI-R-90-001

Biochemical Composition and Metabolic Activity of *Scrippsiella trochoidea* (Dinophyceae) Resting Cysts
Binder, B.J. and D.M. Anderson
Journal of Phycol., Vol. 26, pp. 289-298, *1990* WHOI-R-90-004

Uptake Kinetics of Paralytic Shellfish Toxins from the Dinoflagellate Alexandrium fundyense in the Mussel *Mytilus edulis*
Bricelj, V.M., J.H. Lee, A.D. Cembella, and D.M. Anderson
Mar. Ecol. Prog. Ser., Vol. 63, pp. 177-188, *1990* WHOI-R-90-026

Dinoflagellate Blooms and Physical Systems in the Gulf of Maine Δ
Franks, P.J.S.
Ph.D. Thesis, Massachusetts Institute of Technology/Woods Hole Oceanographic Institution Joint Program in Oceanography and Oceanographic Engineering, 253 pp., *1990* WHOI-X-90-003

Changes in Cell Composition During the Life Cycle of *Scrippsiella trochoidea* (Dinophyceae)
Lirdwitayaprasit, T., T. Okaichi, S. Montani, T. Ochi, and D.M. Anderson
Journal of Phycology, Vol. 26, pp. 299-306, *1990* WHOI-R-90-025

Anatomical Distribution of Paralytic Shellfish Toxins in Soft Shell Clams
Martin, J.L., A.W. White, and J.J. Sullivan
In: Graneli, E., B. Sundstroem, L. Edler and D.M. Anderson (eds.), Toxic Marine Phytoplankton, Elsevier, pp. 379-384, *1990* WHOI-R-90-024
Blooms of *Alexandrium fundyense* are an annual summer occurrence in the Bay of Fundy

Δ Available on loan from NSGD, see p. *v*.
√ Helpful to educators and students.

and are responsible for soft shell clams, *Mya arenaria*, accumulating paralytic shellfish toxins while filter feeding which result in the closure of most areas to harvesting. Shellfish toxicities for the southern Bay of Fundy behave as a unit and follow the *Alexandrium* bloom closely due to the tremendous turbulence and mixing within the system. Since 1980, several soft shell clam sites have remained closed year-round due to low, but unacceptable levels of PSP toxins. Although prior reports suggested the use of ozone for detoxifying clams, the authors' efforts to do so from a permanently closed area such as the one in the study (Crow Harbour), with toxins stored for long periods, proved unsuccessful. This study was undertaken by the investigators to determine whether clams from an area where natural detoxification does not occur behave in a similar manner to those from an area where detoxification occurs, and how the toxins are transformed or retained.

Encystment of Chattonella Antique in Laboratory Cultures
Nakamura, Y., T. Umemori, M. Watanabe, D.M. Kulis, and D.M. Anderson
Journal of the Oceanographic Society of Japan, Vol. 46, pp. 35-43, *1990* WHOI-R-90-016

Has There Been a Global Expansion of Algal Blooms? If so, is There a Connection with Human Activities? √
Smayda, T.J. and A.W. White
In: Graneli, E., B. Sundstroem, L. Edler and D.M. Anderson (eds.), Toxic Marine Phytoplankton, Elsevier, pp. 516-517, *1990* WHOI-R-90-014

International Red Tide Information and Assistance Service
White, A.W.
In: Graneli, E., B. Sundstroem, L. Edler and D.M. Anderson (eds.), Proceedings of the Fourth International Conference on Toxic Marine Phytoplankton, Elsevier, New York, pp. 509-511, *1990*
WHOI-R-90-013

Toxic Algal Blooms: An International Directory of Experts in Toxic and Harmful Algal Blooms and Their Effects on Fisheries and Public Health Δ
White, A.W.
216 pp., *1990* WHOI-D-90-001
Toxic and harmful algal bloom events are increasing in frequency, intensity and geographic distribution around the world. They now constitute a global problem for fisheries, mariculture and public health. Developing countries are especially vulnerable to these occurrences because they lack the scientific and managerial expertise and infrastructure to deal with the resulting fisheries and public health emergencies. There is a pressing need for international coordination and cooperation on toxic phytoplankton blooms and their effects. This international directory lists scientists, fisheries managers, public health officials and physicians who are experienced in dealing with toxic and harmful algal bloom episodes and their impact on fisheries and public health. The directory is intended to improve and accelerate international information exchange on toxic and harmful algal blooms and to foster international assistance with red tide emergencies, particularly in developing countries. It is hoped that it will facilitate rapid access to experts who can respond quickly to toxic algal bloom outbreaks and thus help in reducing the consequences to fisheries and public health.

Toxic Algal Blooms and Red Tides: A Global Perspective
Anderson, D.M.
In: Okaichi, T., D.M. Anderson, and T. Nemoto (eds.), Red Tides: Biology, Environmental Science and Toxicology, Elsevier Science Publishing Co., Inc., New York, pp. 11-16, *1989*
WHOI-R-89-001

Toxic Dinoflagellates and Marine Mammal Mortalities: Proceedings of an Expert Consultation Held at the Woods Hole Oceanographic Institution on May 8-9, 1989 Δ
Anderson, D.M. and A.W. White (eds.)
Woods Hole Oceanographic Institution Technical Report WHOI-89-36 (CRC89-6), 65 pp., *1989*
WHOI-W-89-002

Two events in 1987-1988 involved unprecedented mortalities of humpback whales and bottlenose dolphins, species that have never been associated with typical mass strandings. The unusual characteristics of these two events were such that standard protocols for examining stranded animals were expanded to include analysis for dinoflagellate neurotoxins that have, in the past, been associated with mass kills of fish and other marine mammals. The circumstantial evidence presently available has sufficient implications with respect to marine mammal mortalities, commercial fisheries, and public health to justify future investigations into the impact of dinoflagellate toxins on higher trophic levels. A series of research and monitoring programs is suggested.

Paralytic Shellfish Poisoning in Northwest Spain: The Toxicology of the Dinoflagellate *Gymnodinium catenatum*
Anderson, D.M., J.J. Sullivan, and B. Reguera
Toxicon, Vol. 27, No. 6, pp. 665-674, *1989* WHOI-R-89-013

Trophic Interactions Between Nano- and Microzooplankton and the "Brown Tide"
Caron, D.A., E.L. Lin, H. Kunze, E.M. Cosper, and D.M. Anderson
In: Cosper, E.M., E.J. Carpenter, and M. Bricelj (eds.) Novel Phytoplankton Blooms: Causes and Impacts of Recurrent Brown Tide and Other Unusual Blooms. Coastal and Estuarine Studies, Springer-Verlag, New York, Vol. 35, pp. 265-294, *1989* WHOI-R-89-023

Chain-forming Dinoflagellates: An Adaptation to Red Tides
Fraga, S., S.M. Gallager, and D.M. Anderson
In: Okaichi, T., D.M. Anderson, and T. Nemoto, (eds.) Red Tides: Biology, Environmental Science and Toxicology, pp. 281-284, *1989* WHOI-R-89-003

Sampling Coastal Dinoflagellate Blooms: Equipment, Strategies, and Data Processing
Franks, P.J.S. and D.M. Anderson
In: Hallegraeff, G.M. and J.L. McLean (eds.), Biology, Epidemiology, and Management of Prodinium Red Tides, pp. 235-254, *1989* WHOI-R-89-020

Fronts, Upwelling and Coastal Circulation: Spatial Heterogeneity of Ceratium in the Gulf of Maine
Franks, P.J.S., D.M. Anderson, and B.A. Keafer
In: Okaichi, T., D.M. Anderson, and T. Nemoto, (eds.) Red Tides: Biology, Environmental Science and Toxicology, pp. 153-156, *1989* WHOI-R-89-002

Ultrastructural Aspects of Sexual Reproduction in the Red Tide Dinoflagellate *Gonyaulax tamarensis*
Fritz, L., D.M. Anderson, and R.E. Triemer
J. Phycol., Vol. 25, pp. 95-107, *1989* WHOI-R-89-006

Humpback Whales Fatally Poisoned by Dinoflagellate Toxin
Geraci, J.A., D.M. Anderson, R.J. Timperi, D.J. St. Aubin, G.A. Early, J.A. Prescott, and C.A. Mayo
Canadian Journal of Fisheries and Aquatic Sciences, Vol. 46, pp. 1895-1898, *1989* WHOI-R-89-024

Variation Among Congeneric Dinoflagellates from the Northeastern United States and Canada
Hayhome, B.A., D.M. Anderson, D.M. Kulis, and D.J. Whitten
Marine Biology, Vol. 101, pp. 427-435, *1989* WHOI-R-89-012

Testing and Application of Biomonitoring Methodologies for Assessing Environmental Effects of Noxious Algal Blooms
Tracey, G.A., R.L. Steele, J. Gatzke, D.K. Phelps, R. Nuzzo, R.M. Waters, and D.M. Anderson

Δ Available on loan from NSGD, see p. *v*.
√ Helpful to educators and students.

In: Cosper, E.M., E.J. Carpenter, and M. Bricelj (eds.) Novel Phytoplankton Blooms: Causes and Impacts of Recurrent Brown Tide and Other Unusual Blooms. Coastal and Estuarine Studies, Springer-Verlag, New York, Vol. 35, pp. 557-574, *1989* WHOI-R-89-025

"...And All the Waters Were Turned to Blood...": Red Tide in the Northeast √
White, A.W.
Nor'easter, Vol. 1, No. 1, pp. 27-31, *1989* WHOI-R-89-010
For hundreds of years people in some parts of the world have known about red tides and their connection with mass kills of marine animals, contamination of shellfish with deadly toxins, and human illness and death. Toxic red tides have become a problem of global dimensions. They now occur in one form or another nearly throughout the world's oceans. This article describes the red tide phenomenon: the organisms that cause it, the effects of red tide, the research being conducted on red tide, and the need for international cooperation in addressing this important coastal problem.

Mortality of Fish Larvae from Eating Toxic Dinoflagellates or Zooplankton Containing Dinoflagellate Toxins
White, A.W., O. Fukuhara, and M. Anraku
In: Okaichi, T., D.M. Anderson, and T. Nemoto, (eds.) Red Tides: Biology, Environmental Science and Toxicology, pp. 395-398, *1989* WHOI-R-89-004
First-feeding red sea bream (*Pagrus major*) and Japanese anchovy (*Engraulis japonica*) larvae were fed the toxic dinoflagellate *Gonyaulax excavata*. Older larvae were fed zooplankton (mostly copepods) that had eaten *G. excavata*. Despite low toxin content of the dinoflagellates relative to field conditions, effects of the toxins were apparent. The mortality rates of first-feeding red sea bream larvae feeding on *Gonyaulax* was about three times that of starved controls. First-feeding Japanese anchovy larvae fed poorly on *Gonyaulax*, and no difference in mortality between treatments and controls was observed. Older larvae of both species showed symptoms typical of paralytic shellfish poisoning (PSP) within a few hours after eating zooplankton that contained *Gonyaulax* toxins; 20 to 30% of the larvae died. Results indicate that fish larvae, like adult fish, are sensitive to paralytic shellfish toxins and suggest that blooms and red tides of *G. excavata* and its toxic relative cause kills of larval, as well as adult, fish.

Intracellular Localization of Saxitoxins in the Dinoflagellate *Gonyaulax tamarensis*
Anderson, D.M. and T.P.O. Cheng
J. of Phycology, Vol. 24, pp. 17-22, *1988* WHOI-R-88-004

The Unique, Microreticulate Cyst of the Naked Dinoflagellate *Gymnodinium catenatum*
Anderson, D.M., D.M. Jacobson, I. Bravo, and J.H. Wrenn
J. of Phycology, Vol. 24, pp. 255-262, *1988* WHOI-R-88-006

Influence of Upwelling Relaxation on Dinoflagellates and Shellfish Toxicity in Ria De Vigo, Spain
Fraga, S., D.M. Anderson, I. Bravo, B. Reguera, K.A. Steidinger, and C.M. Yentsch
Estuarine, Coastal and Shelf Science, Vol. 27, pp. 349-361, *1988* WHOI-R-88-011

Photosynthetic Response of *Gonyaulax tamarensis* During Growth in a Natural Bloom and in Batch Culture
Glibert, P.M., T.M. Kana, and D.M. Anderson
Marine Ecology Progress Series, Vol. 42, pp. 303-309, *1988* WHOI-R-88-002

Assessment of Ciguatera Dinoflagellate Populations: Sample Variability and Algal Substrate Selection
Lobel, P.S., D.M. Anderson, and M. Durand-Clement
Biol. Bull., Vol. 175, pp. 94-101, *1988* WHOI-R-88-010

Distribution and Abundance of the Toxic Dinoflagellate *Gonyaulax excavata* in the Bay of Fundy
Martin, J.L. and A.W. White
Canadian Journal of Fisheries and Aquatic Sciences, Vol. 45, pp. 1968-1975, *1988*
WHOI-R-88-016

Blooms of Toxic Algae Worldwide: Their Effects on Fish Farming and Shellfish Resources √
White, A.W.
In: Proceedings of the International Conference on Impact of Toxic Algae on Mariculture, Aqua-Nor '87 International Fish Farming Exhibition, 13-18 August, 1987, Trondheim, Norway, pp. 9-14, *1988* WHOI-R-88-005
Discolored water and its association with kills of fish and other animals has been noted since Biblical times. Ship's logs from hundreds of years ago document discolorations of the sea in many places around the world. The discolorations resulting from high concentrations of microalgae are often of a reddish hue, and hence referred to by the generic term "red tide." Certain bloom-forming algae are toxic; they produce compounds that are toxic to fish or that accumulate in shellfish causing serious illness and sometimes death to humans who eat them. Blooms and red tides of these toxic algae have had significant economic impact on fish and shellfish farming industries in much of the world. Further, the incidence of these toxic blooms appears to be on the increase around the world. This paper, from a presentation at an international conference on the impact of toxic algae on mariculture, is a summary of the major organisms responsible for toxic blooms and red tides in various parts of the world and their effects on fish and shellfish resources, with special reference to mariculture.

PSP: Poison for Fundy Shellfish Culture √
White, A.W.
World Aquaculture, Vol. 19, No. 4, pp. 23-26, *1988* WHOI-R-88-021
FACT: The risk of molluscan shellfish contamination by paralytic shellfish toxins is high nearly everywhere in Canada's southern Bay of Fundy, one of the richest shellfish areas in the world. FACT: *Gonyaulax excavata* blooms and paralytic shellfish toxins do not impair the growing of shellfish in the Bay of Fundy because *Gonyaulax* is a satisfactory food organism and the toxins have little effect on the shellfish. However, the toxins have a major impact on the marketing of all filter-feeding shellfish except the sea scallop, from which only the toxin-free adductor muscle is marketed. FACT: There is no economically viable method for detoxifying or depurating paralytic shellfish toxins in molluscan shellfish, nor is there any known antidote for the toxic effects in humans. Thus the cost of inspecting shellfish for paralytic shellfish toxins must be taken into account in the cost/benefit analysis of shellfish culture operation in areas affected by the dinoflagellate *Gonyaulax*. This paper looks at these and other important issues relating to PSP in the Bay of Fundy and presents what is currently known about the disease.

An Endogenous Annual Clock in the Toxic Marine Dinoflagellate *Gonyaulax tamarensis*
Anderson, D.M. and B.A. Keafer
Nature, Vol. 325, No. 6105, pp. 616-617, *1987* WHOI-R-87-002
Blooms of the toxic dinoflagellate *Gonyaulax tamarensis* cause outbreaks of paralytic shellfish poisoning (PSP) in coastal waters throughout the world. In this paper, the authors present the discovery of a new factor controlling germination of cysts of *G. tamarensis* from deep coastal waters — an endogenous annual clock that can override an otherwise favorable environment for germination. Similar annual variability in germination has not been observed for cysts of this species from shallow estuaries. The results presented in this paper represent the first conclusive demonstration of an endogenous circannual rhythm in a marine plant. They are evolutionarily and ecologically significant because an endogenous annual clock can lead to the release of motile cells into deep and relatively invariant bottom waters at those times when temperature and light at the

surface are suitable for growth. In shallow waters where seasonal variability is large and extends to bottom sediments, a strategy similar to that of the seeds of terrestrial plants would be more appropriate, namely a direct coupling between germination and the external environment.

The Continuing Enigma of Ciguatera
Anderson, D.M. and P.S. Lobel
Biol. Bull., Vol. 172, pp. 89-107, *1987* WHOI-R-87-008

Relationships of Environmental Factors to Toxic Dinoflagellate Blooms in the Bay of Fundy
White, A.W.
Rapp. P.-v Reun. Cons. int. Explor. Mer, Vol. 187, pp. 38-46, *1987* WHOI-R-87-006

Dinoflagellate Cyst Dynamics in Coastal and Estuarine Waters
Anderson, D.M. and B.A. Keafer
Toxic Dinoflagellates, pp. 219-224, *1985* WHOI-R-85-018
Gonyaulax tamarensis cyst dynamics were studied in a shallow estuarine embayment and in deeper nearshore waters. In these two locations, the cysts accumulate in basins with other fine particulate materials, they are buried below the sediment surface such that the majority are found in anoxic sediments which can inhibit germination. Their total abundance is very high, and their germination is restricted to surface sediments and therefore is small relative to the number of cells in a bloom. The major differences are in the timing and duration of germination. A tight temporal coupling between excystment and bloom initiation is apparent in the estuary where cysts germinate during a one month interval coinciding with the motile cell bloom. Germination begins at a lower temperature in the deeper coastal waters, precedes the motile cell bloom by several months and lasts eight months in total. The Gulf of Maine is thus seeded by the gradual germination of cysts over many months, providing multiple opportunities for bloom development. In the estuary, bloom success hinges on favorable conditions during a short period of active germination.

Selective Retention of Two Dinoflagellates in a Well-mixed Estuarine Embayment: The Importance of Diel Vertical Migration and Surface Avoidance
Anderson, D.M. and K.D. Stolzenbach
Marine Ecology, Vol. 25, pp. 39-50, *1985* WHOI-R-85-007

Comparison of Toxicity Between Populations of *Gonyaulax tamarensis* of Eastern North American Waters
Maranda, L., D.M. Anderson, and Y. Shimizu
Estuarine, Coastal and Shelf Science, Vol. 21, pp. 401-410, *1985* WHOI-R-85-011

Sexuality and Cyst Formation in the Dinoflagellate *Gonyaulax tamarensis*: Cyst Yield in Batch Cultures
Anderson, D.M., D.M. Kulis, and B.J. Binder
J. Phycol., Vol. 20, pp. 418-425, *1984* WHOI-R-84-010

The Abundance and Distribution of the Toxic Dinoflagellate *Gonyaulax tamarensis* in Long Island Estuaries
Schrey, S.E., E.J. Carpenter, and D.M. Anderson
Estuaries, Vol. 7, No. 4B, pp. 472-477, *1984* WHOI-R-84-018

Importance of Life Cycle Events in the Population Dynamics of *Gonyaulax tamarensis*
Anderson, D.M., S.W. Chisholm, and C.J. Watras
Marine Biology, Vol. 76, pp. 179-189, *1983* WHOI-R-83-019

Vertical and Horizontal Distributions of Dinoflagellate Cysts in Sediments
Anderson, D.M., D.G. Aubrey, M.A. Tyler, and D.W. Coats
Limnol. Oceanogr., Vol. 27, No. 4, pp. 757-765, *1982* WHOI-R-82-022

Distribution of the Toxic Dinoflagellate *Gonyaulax tamarensis* in the Southern New England Region Δ
Anderson, D.M., D.M. Kulis, J.A. Orphanos, and A.R. Ceurvels
Estuarine, Coastal and Shelf Science, Vol. 14, pp. 447-458, *1982* WHOI-R-82-005

Regulation of Growth in an Estuarine Clone of *Gonyaulax tamarensis* Lebour: Salinity-dependent Temperature Responses
Watras, C.J., S.W. Chisholm, and D.M. Anderson
J. Exp. Mar. Biol. Ecol., Vol. 62, pp. 25-37, *1982* MIT-R-82-002

Effects of Temperature Conditioning on Development and Germination of *Gonyaulax tamarensis* (Dinophyceae) Hypnozygotes
Anderson, D.M.
J. Phyl., Vol. 16, pp. 166-172, *1980* MIT-R-80-002

The Environmental and Climatic Distribution of Dinoflagellate Cysts in Modern Marine Sediments from Regions in the North and South Atlantic Oceans and Adjacent Seas
Wall, D., B. Dale, G.P. Lohmann, and W.K. Smith
1977 WHOI-R-77-012
The distribution of dinoflagellate cysts in modern marine sediments is of interest for two main reasons. First, it provides specialized marine biological information concerning the biogeography and ecology of the living dinoflagellate species which form resistant encysted stages during their life histories. Second, it represents a major source of information for palynologists who are concerned with dinoflagellate paleoecology and paleoenvironmental research. This study reports on the distribution of dinoflagellate cysts from fourteen regions in the North and South Atlantic Oceans, the Caribbean and Mediterranean Seas, and one area in the southeastern Pacific Ocean near Peru. The four main goals of the study, presented in this paper in detail, were: 1) to analyze the environmental-climatic distribution of extant cyst-based dinoflagellate species in marine sediments; 2) to attempt an ecologic-environmental classification of these taxa on the basis of this analysis; 3) to identify important factors which determine the distribution of these cysts in modern sediments; and 4) to provide a quasi-theoretical model to account for the observed distribution of cysts which will be useful in the future development of paleoecological and paleoenvironmental studies with fossil dinoflagellates (cysts).

Oceanography—Chemistry

Analysis of Acid Volatile Sulfide and Metals to Predict the Toxicity of Boston Harbor Sediments
Zago, C. and A.E. Giblin
Biol. Bull., Vol. 187, pp. 290-291, *1994* WHOI-R-94-009

Short Residence Time of Colloids in the Upper Ocean Estimated from ^{238}U-^{234}Th Disequilibria
Moran, S.B. and K.O. Buesseler
Nature, Vol. 359, pp. 221-223, *1992* WHOI-R-92-006

Nutrient and Phosphorous Geochemistry in the Taunton River Estuary, Massachusetts Δ
Boucher, J.M.
Ph.D. Thesis, University of Rhode Island, School of Oceanography, 316 pp., *1991* RIU-X-91-002

In-situ Chemical Sensors for Detecting and Exploring Ocean Floor Hydrothermal Vents — Report of a Workshop Δ
Hennet, R.J-C. and J.K. Whelan
Woods Hole Oceanographic Institution Technical Report No. WHOI-88-53, 69 pp., *1988*
WHOI-W-88-001

Carbon Dioxide Exchange Between Air and Seawater: No Evidence for Rate Catalysis
Goldman, J.C. and M.R. Dennett
Science, Vol. 220, pp. 199-201, *1983* WHOI-R-83-004

Analyses of Organic Particulates from Boston Harbor by Thermal Distillation-pyrolysis
Whelan, J.K., M.G. Fitzgerald, and M. Tarafa
Environmental Science & Technology, Vol. 17, pp. 292-298, *1983* WHOI-R-83-005

Volatile Organic Compounds at a Coastal Site — 1. Seasonal Variations
Gschwend, P.M., O.C. Zafiriou, R.F.C. Mantoura, R.P. Schwarzenbach, and R.B. Gagosian
Environ. Sci. Technol., Vol. 16, pp. 31-38, *1982* WHOI-R-82-015

Technique for Simultaneous Determination of [^{35}S] Sulfide and [^{14}C] Carbon Dioxide in Anaerobic Aqueous Samples
Taylor, C.D., P.O. Ljungdahl, and J.J. Molongoski
Applied and Environmental Microbiology, Vol. 41, No. 3, pp. 822-825, *1981* WHOI-R-81-006

Volatile Organic Compounds in Seawater from the Peru Upwelling Region
Gschwend, P.M., O.C. Zafiriou, and R.B. Gagosian
Limnol. Oceanogr., Vol. 25, No. 6, pp. 1,044-1,053, *1980* WHOI-R-80-018

Applications of Thermal Distillation-pyrolysis to Petroleum Source Rock Studies and Marine Pollution Δ
Whelan, J.K., J.M. Hunt, and A.Y. Huc
1980 WHOI-R-80-010

Volatile Organic Compounds in Seawater Δ
Gschwend, P.M.
1979 WHOI-X1-79-001

Determination of Total Nitrogen in Aqueous Samples Using Persulfate Digestion
D'Elia, C.F., P.A. Steudler, and N. Corwin
1977 WHOI-R-77-008

The Cycling of Labile Organic Compounds: Sterols in the North Atlantic Ocean
Gagosian, R.B.
1977 WHOI-R-77-004
Sterols, a class of biochemicals, are among the most important hormone regulators of growth, respiration, and reproduction in organisms. Cholesterol and related steroid alcohols are not only the immediate biosynthetic precursors for all steroidal hormones, but they also have hormonal activity themselves. These steroidal alcohols, the sterols, are of special interest from a geochemical point of view. Their chemical stability and structural diversity, along with their inherent optical activity, allow them to be used as indicators of biological activity in the oceans. This paper documents the results of three oceanographic cruises concerned with the sterol concentrations and individual sterol distributions in the North Atlantic Ocean. From the vertical profiles of these compounds, along with particulate organic carbon (POC), hydrographic and total particulate matter data, an attempt to understand sterol distributions in the ocean and the transport mechanisms governing their movement into the deep sea was undertaken.

Oceanography—Ocean Engineering

Techniques for Nearshore Oceanographic Instrument Installations
Spencer, W.D.
Diving for Science...89, Proceedings of the American Academy of Underwater Sciences, Ninth Annual Scientific Diving Symposium, Woods Hole, MA, pp. 297-308, *1989* WHOI-R-89-016

A CCD Chirp-Z FFT Doppler Signal Processor for Laser Velocimetry
Agrawal, Y.C.
J. Phys. E: Sci. Instrum., Vol. 17, pp. 458-461, *1984* WHOI-R-84-003

Directional Laser Velocimetry without Frequency Biasing — Part 2
Agrawal, Y.C. and J.B. Riley
Applied Optics, Vol. 23, pp. 57-60, *1984* WHOI-R-84-001

Directional Pedestal-free Laser Doppler Velocimetry without Frequency Biasing — Part I
Agrawal, Y.C. and J.R. McCullough
Applied Optics, Vol. 20, pp. 1553-1556, *1981* WHOI-R-81-012

Jointing of Armored Polyethylene-insulated Cable to Neoprene Jacketed Connectors
Spencer, W.D. and D.G. Aubrey
Oceans, pp. 180-185, *1981* WHOI-R-81-007

Mooring Dynamics Δ
Berteaux, H.O.
Air-Sea Interaction, pp. 681-699, *1980* WHOI-R-80-017

The Design, Construction and Testing of Loran-C from a Drifting Buoy Δ
Collins, C.W. and R.G. Walden
Woods Hole Oceanographic Institution Technical Report WHOI-80-79, 32 pp., *1980*
WHOI-T-80-006

Remote Acoustic Sensing of Oceanic Fluid and Biological Processes Δ
Orr, M.H.
Woods Hole Oceanographic Institution Technical Report WHOI-80-2, 51 pp., *1980*
WHOI-T-80-005

Seasonal Performance of a Brine Pond Solar Heat Collector in New England Δ
Von Arx, W.S.
Woods Hole Oceanographic Institution Technical Report WHOI-80-16, 30 pp., *1980*
WHOI-T-80-003

Handbook of Oceanographic Engineering Materials
Dexter, S.C.
1979 WHOI-B-79-002
This volume consists of two sections. Part A is a series of tabulations of metallic materials ranked according to selected mechanical and physical properties, corrosion resistance, and cost. Part B consists of one page of more detailed data on each of the materials covered. Composition, mechanical and physical properties, corrosion resistance, forms available, fabricability, typical uses and base cost are treated for each material. Part B also groups the materials are grouped into alloy classes according to the base metal of the alloy.

Dynamics of the Inclining Spar Current Sensor — Final Report Δ
Rodenbusch, G. and J.W. Mavor Jr.
1977 WHOI-T-77-007

Δ Available on loan from NSGD, see p. *v*.
√ Helpful to educators and students.

Development of an Acoustic Probe for Detailed Ocean Bottom and Sub-bottom Surveys Δ
Dow, W.
1976 WHOI-T-76-001

A Digital Recording System for Marine Experimentation Δ
Vandiver, J.K.
1973 WHOI-T-73-001

Handbook of Oceanographic Engineering Materials: Volume 1 — Metals and Alloys Δ
Dexter, S.C.
1972 WHOI-T-72-004

Motion Sensitivity of Flame Ionization Detectors Δ
Gularte, R.C.
1972 WHOI-T-72-003

Report of the Oceanographic Engineering Summer Project Δ
Daubin, S.C. and A.J. Williams III
1971 WHOI-T-71-001

Ocean Engineering Lecture Notes Δ
Daubin, S.C.
WHOI-E-68-001

Oceanography—Geology

Past and Future Evolution of Marine Geology √
Emery, K.O. and D.A. Ross
SEPM Special Volume, pp. 11-14, *1991* WHOI-R-91-006
An attempt is made to understand some of the ways that marine geology developed during the past 50 years, essentially the working lifespan of an active but venerable scientist. This interpretation is aided by comparing marine geology with the development of land geology during a longer period, and by attempting to understand the relative roles of science and technology in the field of marine geology. Excursions from simple straight-line advance for all geology (and also for other fields) are provided by the unexpected appearances of broad generalizations, or paradigms, that commonly are developed by a few scientists and opposed by many, at least for a time. These sudden advances await the accumulation of critical masses of knowledge that, in turn, depend upon exceptional opportunities, partly in the form of adequate funding and partly by transfer of technology. These unusual circumstances make accurate prediction of future advances in marine geology (and in other scientific and technical fields) unreliable but still worthy of thought.

Diffuse Flow from Hydrothermal Vents Δ
Trivett, D.A.
Ph.D. Thesis, Massachusetts Institute of Technology/Woods Hole Oceanographic Institution Joint Program Dissertation for Sc. D. in Ocean Engineering, 216 pp., *1991* WHOI-X-91-001
The effluent from a collection of diffuse hydrothermal vents was modelled to determine the fate of this source of flow under typical environmental conditions at seafloor spreading centers. A laboratory simulation was conducted to test an analytic model of diffuse plume rise. The results showed that diffuse plumes are likely to remain near the seafloor, with their maximum rise height scaled with the diameter of the source of diffuse flow. The entrainment of ambient seawater into these plumes is limited by the proximity to the seafloor, thus slowing the rate of dilution. The model of diffuse plume behaviour was used to guide the design and implementation of a scheme for monitoring the flow from

diffuse hydrothermal vents in the ocean. A deployment of an array at the Southern Juan de Fuca Ridge yielded measurements of a variety of diffuse plume properties, including total heat output.

The Sound Field Near Hydrothermal Vents on Axial Seamount, Juan De Fuca Ridge
Little, S.A., K.D. Stolzenbach, and G.M. Purdy
Journal of Geophysical Research, Vol. 95, No. B8, pp. 12927-12945, *1990* WHOI-R-90-009

The Geologic Enigma of the Red Sea Rift
Uchupi, E. and D.A. Ross
In: Ittekkot, V., S. Kempe, and W. Michaelis (eds.), Facets of Modern Biogeochemistry, Springer Verlag, pp. 52-61, *1990* WHOI-R-90-011

Tectonic Development of the Western Branch of the East African Rift System
Ebinger, C.J.
Geological Society of America Bulletin, Vol. 1, pp. 885-903, *1989* WHOI-R-89-009

Geometric and Kinematic Development of Border Faults and Accommodation Zones, Kivu-rusizi Rift, Africa
Ebinger, C.J.
Tectonics, Vol. 8, No. 1, pp. 117-133, *1989* WHOI-R-89-005

Chronology of Volcanism and Rift Basin Propagation: Rungwe Volcanic Province, East Africa
Ebinger, C.J., A. Deino, R. Drake, and A. Tesha
Journal of Geophysical Research, Vol. 94, pp. 15785-15803, *1989* WHOI-R-89-022

Thermal and Mechanical Development of the East African Rift System Δ
Ebinger, C.J.
Ph.D. Thesis, Massachusetts Institute of Technology/Woods Hole Oceanographic Institution Joint Program in Oceanography and Oceanographic Engineering, 180 pp., *1988* WHOI-X-88-002

Fluid Flow and Sound Generation at Hydrothermal Vent Fields Δ
Little, S.A.
Ph.D. Thesis, Massachusetts Institute of Technology/Woods Hole Oceanographic Institution Joint Program in Oceanography and Oceanographic Engineering, 152 pp., *1988* WHOI-X-88-001
Several experiments are presented in this thesis which examine methods to measure and monitor fluid flow from hydrothermal vent fields. Simultaneous velocity, temperature, and conductivity data were collected in the convective flow emanating from a hydrothermal vent field located on the East Pacific rise. The horizontal profiles obtained indicate that the flow field approaches an ideal plume in the temperature and velocity distribution. Such parameters as total heat flow and maximum plume height can be estimated using either the velocity or the temperature information. The results of these independent calculations are in close agreement. The nonlinear effects of large temperature variations on heat capacity and volume changes slightly alter the calculations applied to obtain these values.

Post-miocene Rifting and Diapirism in the Northern Red Sea
Mart, Y. and D.A. Ross
Marine Geology, Vol. 74, pp. 173-190, *1987* WHOI-R-87-003

The Geology of the Persian Gulf — Gulf of Oman Region: A Synthesis
Ross, D.A., E. Uchupi, and R.S. White
Review of Geophysics, Vol. 24, No. 3, pp. 537-556, *1986* WHOI-R-86-003

The Tectonic Style of the Northern Red Sea
Uchupi, E. and D.A. Ross

Δ Available on loan from NSGD, see p. *v*.
√ Helpful to educators and students.

Geo-Marine Letters, Vol. 5, pp. 203-209, *1986* WHOI-R-86-015
Multichannel seismic reflection profiles recorded in the northern Red Sea show structures that are interpreted to be the result of the intrusion of uppermost Miocene salt. The authors believe that the evaporites are underlaid by attenuated continental crust and the flow of salt is due to renewed faulting of basement in the Pliocene when sea floor spreading began between latitudes 21°N and 15°30'N.

Continental-oceanic Crustal Transition off Southwest Africa
Austin, J.A. and E. Uchupi
The American Association of Petroleum Geologists Bulletin, Vol. 66, No. 9, pp. 1328-1347, *1982* WHOI-R-82-027

Salt Diapirism and Associated Faulting Beneath the Eastern End of Georges Bank
Uchupi, E., J.A. Austin Jr., and D.H. Gever
Northeastern Geology, Vol. 4, No. 1, pp. 20-22, *1982* WHOI-R-82-006

Mesozoic-cenozoic Regressions and the Development of the Margin off Northeastern North America
Uchupi, E., J.P. Ellis, J.A. Austin Jr., G.H. Keller, and R.D. Ballard
In: Scrutton, R.A. and M. Taiwani (eds.), The Ocean Floor, John Wiley & Sons, Ltd., Chichester, pp. 81-95, *1982* WHOI-R-82-023

Mesozoic Lithofacies Development and Economic Potential of the Georges Bank Basin off Southern New England
Austin, J.A. and E. Uchupi
Northeastern Geology, Vol. 2, No. 2, pp. 55-61, *1980* WHOI-R-80-016

Geology of New England Passive Margin
Austin, J.A., E. Uchupi, D.R. Shaughnessy, and R.D. Ballard
The American Association of Petroleum Geologists Bulletin, Vol. 64, No. 4, pp. 501-526, *1980* WHOI-R-80-009

The Use of the Coastal Oceans in the 80's: Opportunities for Marine Geology Δ
Ross, D.A. and D.G. Aubrey
Woods Hole Oceanographic Institution Technical Report WHOI-80-19, 63 pp., *1980* WHOI-T-80-004

Continental Margin Subsidence and Heat Flow: Important Parameters in Formation of Petroleum Hydrocarbons
Royden, L., J.G. Sclater, and R.P. Von Herzen
The American Association of Petroleum Geologists Bulletin, Vol. 64, No. 2, pp. 173-187, *1980* WHOI-R-80-007

Geology of the Passive Margin off New England Δ
Austin, J.A.
1979 WHOI-Y1-79-002

Particulate Calcium Carbonate in New England Shelf Waters: Result of Shell Degradation and Resuspension Δ
Fitzgerald, M.G., C.M. Parmenter, and J.D. Milliman
1979 WHOI-R-79-018

The Geologic History of the Passive Margin off New England and the Canadian Maritime Provinces
Uchupi, E. and J.A. Austin Jr.
1979 WHOI-R-79-007

The 17-meter Flume at the Coastal Research Laboratory. Part I: Description and User's Manual Δ
Butman, C.A. and R.J. Chapman
Woods Hole Oceanographic Institution Technical Report WHOI-89-10 (CRC-89-2), 31 pp., *1989* WHOI-T-89-007
The growing interest in coastal ocean processes during the last decade has accentuated the need for laboratory facilities where various aspects of the coastal ocean environment can be simulated under controlled conditions. The 17-meter flume, a re-circulating, temperature-controlled, seawater channel constructed in the Coastal Research Laboratory at the Woods Hole Oceanographic Institution, was specifically designed for studies of biogeochemical and fluid-dynamical questions which can be adequately addressed in a steady-flow environment. Part I of a two-part report, this technical report provides comprehensive descriptions of the flume and associated instrumentation, examples of flume settings to achieve selected flow regimes, and detailed instructions for the use of this facility.

The 17-meter Flume at the Coastal Research Laboratory. Part II: Flow Characteristics Δ
Trowbridge, J.H., W.R. Geyer, C.A. Butman, and R.J. Chapman
Woods Hole Oceanographic Institution Technical Report No. WHOI-89-11 (CRC-89-3), 37 pp., *1989* WHOI-T-89-008
Part II of a two-part report, this technical report evaluates measured characteristics of flow in the 17-meter flume relative to theoretical and empirical expectations.

On the Circulation of the Upper Waters in the Western Equatorial Pacific Ocean Δ
Toole, J.M., E. Zou, and R.C. Millard
Deep-Sea Research, Vol. 35, No. 9, pp. 1451-1482, *1988* WHOI-R-88-013

Hydrography Study of Buzzards Bay, 1982-1983 Δ
Rosenfeld, L.K., R.P. Signell, and G.G. Gawarkiewicz
Woods Hole Oceanographic Institution Technical Report WHOI-84-5, 134 pp., *1984* WHOI-T-84-001

Recent Observations of the Mean Circulation on Georges Bank
Butman, B., R.C. Beardsley, B. Magnell, D. Frye, J.A. Vermersch, R. Schlitz, R. Limeburner, W.R. Wright, and M.A. Noble
Journal of Physical Oceanography, Vol. 12, No. 6, pp. 569-591, *1982* WHOI-R-82-021

The Seasonal Hydrography and Circulation Over Nantucket Shoals
Limeburner, R. and R.C. Beardsley
Journal of Marine Research, Vol. 40, pp. 371-406, *1982* WHOI-R-82-025
Nantucket Shoals is a submerged sand and gravel shallow ridge which extends southeastward from Nantucket Island, Massachusetts. In general, the shoals are the southwestern boundary of the Gulf of Maine and the New England continental shelf. To the east of Nantucket Shoals is a 60 m deep channel, the Great South Channel, and then Georges Bank extends toward Nova Scotia. The Gulf of Maine, with depths greater than 200 m, is located a few kilometers to the northeast of Nantucket Shoals but water depths are generally less than 100 m on the shelf to the south and southwest of the shoals. Increased interest in protecting regional fishery resources and development of offshore oil resources have motivated a new effort to understand the ecology of the northeast U.S. shelf and coastal environment. This paper presents an overview of previous physical oceanographic measurements made near Nantucket Shoals, describes hydrographic and moored current measurements made over the shoals during 1978-1979, and offers an improved circulation scheme for the shoals based on the authors' surveys and analysis.

Biological and Hydrographic Station Data Obtained in the Vicinity of Nantucket Shoals, May 1978 - May 1979 Δ
Limeburner, R., R.C. Beardsley, and W. Esaias
Woods Hole Oceanographic Institution Technical Report WHOI-80-7, 87 pp., *1980*
WHOI-T-80-001

Hydrographic Station Data Obtained in the Vicinity of Nantucket Shoals, May, July, September 1978 Δ
Limeburner, R. and R.C. Beardsley
1979 WHOI-T-79-003

Response of a Pendulum Spar to 2-dimensional Random Waves and a Uniform Current Δ
Rodenbusch, G.
1979 WHOI-Y1-79-001

Review of the Physical Oceanography of Georges Bank
Bumpus, D.F.
1976 WHOI-R-76-010

Pollution—General

Using Biomarkers to Detect Contamination of the Marine Environment √
Hahn, M.E.
Nor'easter, Vol. 6, No. 1, pp. 8-11, *1994* WHOI-R-94-003

A Visual Test for Hepatic EROD Activity as a Marker for Exposure to Aromatic and Halogenated Aromatic Hydrocarbons
Lindstrom-Seppa, P., L. Farmanfarmaian, L., and J. Stegeman
Chemosphere, Vol. 27, No. 11, pp. 2183-2195, *1993* WHOI-R-93-013

The International Mussel Watch. A Global Assessment of Environmental Levels of Chemical Contaminants Δ
Goldberg, E.D., J.W. Farrington, R. Dawson, E. Schneider, A.B. Jernelov, and L.D. Mee
122 pp., *1992* WHOI-T-92-002

Plastics are Forever √
Campbell, L.A.
Nor'easter, Vol. 1, No. 2, pp. 11-15, *1989* WHOI-R-89-011
We have become a society enamored of disposables — food packaging, beverage containers, utensils, and even diapers. But somewhere in our rush for consumption we forgot to look ahead to an impending problem: the disposal of discarded plastic. The problem of plastic pollution has become particularly acute in the sea. The biodegradable nature of early trash made it seem invisible. Floatables—buoyant waterborne waste materials and debris—are not invisible. Discarded plastic materials, some of which may persist for up to 400 years, are starting to fill up the world's oceans. This article describes the growing problem, including its sources and effects, legislation to combat it, and potential solutions for it.

The Relationship Between Lipid Composition and Seasonal Differences in the Distribution of PCBs in *Mytilus edulis* L. √
Capuzzo, J.M., J.W. Farrington, P. Rantamaki, C.H. Clifford, B.A. Lancaster, and D.F. Leavitt
Marine Environmental Research, Vol. 28, pp. 259-264, *1989* WHOI-R-89-007

Effects of Toxic Chemicals in the Marine Environment: Predictions of Impacts from Laboratory Studies √
Capuzzo, J.M., M.N. Moore, and J. Widdows
Aquatic Toxicology, Vol. 11, pp. 303-311, *1988* WHOI-R-88-001
The degree to which toxicity testing can lead to predictions of long-term environmental consequences of contaminant exposure has been widely debated. Laboratory approaches designed to address both chemical concerns of contaminant bioavailability and persistence in addition to biological concerns of sublethal effects on marine organisms would be most useful in providing the linkage between laboratory and field evaluations. This paper discusses examples of bioenergetic, developmental, and reproductive abnormalities observed with exposure to lipophilic organic contaminants in reference to consequences at higher levels of biological organization. Alterations in bioenergetics linked with observations of reduced fecundity and viability of larvae, abnormalities in gamete and embryological development, and reduced reproductive effort provide a strong empirical basis for examination of population responses. Such empirical data can be incorporated into population models to assess the effects of energetic, reproductive, and developmental aberrations on population success and provide the basis for further examining the predictive value of toxicity testing.

The Role of Colloidal Organic Matter in the Marine Geochemistry of PCBs Δ
Brownawell, B.J.
1986 WHOI-Y-86-002

Biogeochemistry of PCBs in Interstitial Waters of a Coastal Marine Sediment
Brownawell, B.J. and J.W. Farrington
Geochimica et Cosmochimica Acta, Vol. 50, pp. 157-169, *1986* WHOI-R-86-001

Partitioning of PCBs in Marine Sediments
Brownawell, B.J. and J.W. Farrington
In: Sigleo, A.C. and A. Hattori (eds.), Marine and Estuarine Geochemistry, pp. 97-120, *1985* WHOI-R-85-005

The Biogeochemistry of Polychlorinated Biphenyls in the Acushnet River Estuary, Massachusetts
Farrington, J.W., A.C. Davis, B.J. Brownawell, B.W. Tripp, C.H. Clifford, and J.B. Livramento
Organic Marine Geochemistry (ACS Symposium Series), No. 305, pp. 174-197, *1985* WHOI-R-85-016

Bioavailability of Mercury in Several Northeastern U.S. *Spartina* Ecosystems
Breteler, R.J., I. Valiela, and J.M. Teal
Estuarine, Coastal and Shelf Science, Vol. 12, pp. 155-166, *1981* WHOI-R-81-014

The Fate of Pollutants in American Salt Marshes Δ
Teal, J.M., A. Giblin, and I. Valiela
In: Wetlands: Ecology and Management, Proceedings of the First International Wetlands Conference, New Delhi, India, 10-17 September 1980, pp. 357-366, *1980* WHOI-R-80-027
Studies of the consequences of pollutants added to salt marshes and coastal wetlands have been made all along the coasts of the United States. The motives for these studies have varied from interest in the fates and effects of pollutants introduced into coastal waters inadvertently, to consequences of various disposal methods for dredge spoils, and to the possibility of using coastal wetlands for waste treatment. This study involved experimentally applying sewage sludge to a New England salt marsh for 10 years. Sludge contains plant nutrients and a wide range of heavy metals, halogenated hydrocarbons (including PCBs and pesticides), and hydrocarbons (including polynuclear aromatic hydrocarbons). When the authors considered just the effects of sewage contamination, they found that production is increased and with it the export of heavy metals from the

Δ Available on loan from NSGD, see p. *v*.
√ Helpful to educators and students.

wetland sediments. Most of the added amounts of metals such as lead are retained in marsh sediments for periods that are very long in human terms and have no demonstrable effect on the marsh organisms. Metals such as cadmium are only temporarily retained but still have apparently relatively little effect on the marsh biota except possibly for the infauna of the sediments. Shellfish can take up copper and turn green in color, which makes them unusable but does not necessarily kill them. The fates of organic pollutants are much less well understood but are apparently also closely retained within the sediments and, to some extent at least, broken down by microbial activity.

Uptake of Heavy Metals, Organic Trace Contaminants and Viruses by the Japanese Oyster, *Crassostrea gigas*, Grown in a Waste Recycling Aquaculture System Δ
Mann, R., J.M. Vaughn, E.F. Landry, and R.E. Taylor
1979 WHOI-T-79-005

Diversity as an Indicator of Pollution: Cautionary Results from Microcosm Experiments
Smith, W., V.R. Gibson, L.S. Brown-Leger, and J.F. Grassle
1979 WHOI-R-79-005

Hepatic and Extrahepatic Microsomal Electron Transport Components and Mixed-function Oxygenases in the Marine Fish *Stenotomus versicolor*
Stegeman, J.J., R.L. Binder, and A. Orren
1979 WHOI-R-79-011

Influence of Environmental Contamination on Cytochrome P-450 Mixed-function Oxygenases in Fish: Implications for Recovery in the Wild Harbor Marsh
Stegeman, J.J.
1978 WHOI-R-78-006

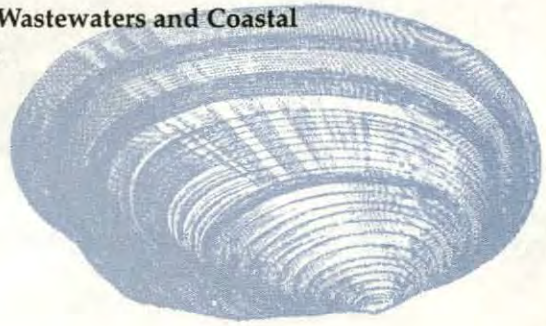
High Benzo[a]pyrene Hydroxylase Activity in the Marine Fish *Stenotomus versicolor*
Stegeman, J.J. and R.L. Binder
1978 WHOI-R-78-016

Electron Paramagnetic Resonance Studies on Hepatic Microsomal Cytochrome P-450 from a Marine Teleost Fish Δ
Chevion, M., J.J. Stegeman, J. Paisach, and W.E. Blumberg
1977 WHOI-R-77-002

Data File: New Bedford Harbor, Massachusetts Δ
Ellis, J.P., B.C. Kelley, P. Stoffers, M.G. Fitzgerald, and C.P. Summerhayes
1977 WHOI-T-77-008

Copper and Other Heavy Metal Contamination in Sediments from New Bedford Harbor, Massachusetts: A Preliminary Note
Stoffers, P., C. Summerhayes, U. Forstner, and S.R. Patchineelam
1977 WHOI-R-77-006

Identification of Nitrogen as a Growth-limiting Nutrient in Wastewaters and Coastal Marine Waters Through Continuous Culture Algal Assays Δ
Goldman, J.C.
1976 WHOI-R-76-002



The Effects of Petroleum Hydrocarbons on Lipid Metabolism and Energetics of Larval Development and Metamorphosis in the American Lobster (*Homarus americanus* Milne Edwards)
Capuzzo, J.M., B.A. Lancaster, and G.C. Sasaki
Marine Environmental Research, Vol. 14, pp. 201-228, *1984* WHOI-R-84-008

Bioactivation of Polynuclear Aromatic Hydrocarbons to Cytotoxic and Mutagenic Products by Marine Fish
Stegeman, J.J., T.R. Spopek, and W.G. Thilly
In: Symposium: Carcinogenic Polynuclear Aromatic Hydrocarbons in the Marine Environment, EPA-600/9-82-013, pp. 201-211, *1982* WHOI-R-82-014

The Marine Environment and Maritime Security in Southeast Asia: Controlling Oil Tanker Traffic in the Strait of Malacca Δ
Finn, D.P.
Naval War College Review, pp. 49-59, *1981* WHOI-R-81-010

An Oil Spill Sampling Strategy
Smith, W.
1979 WHOI-R-79-013
A strategy for estimating the effect of an oil spill from a sample survey in the context of formal sampling theory is outlined in this paper. The investigator found that the conclusions that can be drawn from an oil spill survey are necessarily weaker than those that can be drawn from a carefully designed experiment. Although the survey can evaluate the differences in the properties of the control and affected areas selected, unlike a carefully designed experiment, survey data alone cannot assign a direct or indirect causal relationship between the oil spill and differences observed in the survey. One must turn to scientific results from controlled experiments of the effects of oil to show the probable relationship between the impact of oil on the survey area and the results of the survey analysis. The investigator concludes his analysis by stating that both the scientific evidence of the effect of oil in the environment and the survey results for a particular oil spill are necessary components in establishing the impact of an oil spill.

No. 2 Fuel Oil Spill in Bourne, Massachusetts: Immediate Assessment of Effects on Marine Invertebrates and a 3-year Study of Growth and Recovery of a Salt Marsh Δ
Hampson, G.R. and E.T. Moul
1978 WHOI-R-78-008

The Effects of Oil on Lobsters Δ
Atema, J.
1977 WHOI-R-77-017

Potential Effects of Oil Production on Georges Bank Communities: A Review of the Draft Environmental Impact Statement for Outer Continental Shelf Oil and Gas Lease No. 42 Δ
Connor, M.S. and R.W. Howarth
1977 WHOI-T-77-001

A Three-year Study at Winsor Cove. Salt Marsh Grasses and #2 Fuel Oil
Hampson, G.R. and E.T. Moul
1977 WHOI-R-77-009

Some Metabolic Effects of Petroleum Hydrocarbons in Marine Fish Δ
Sabo, D.J. and J.J. Stegeman
1977 WHOI-R-77-011

Δ Available on loan from NSGD, see p. v.
√ Helpful to educators and students.

Fate and Effects of Oil in Marine Animals Δ
Stegeman, J.J.
1977 WHOI-R-77-013

Pollution—Waste Disposal & Treatment

The Boston Harbor Cleanup Project: Current Research Supported by WHOI Sea Grant √
Crago, T.I. (ed.)
2 pp., *1993* WHOI-A-93-001

International Law and Scientific Consultation on Radio Active Waste Disposal in the Ocean
Finn, D.P.
Wastes in the Ocean, Vol. 3, pp. 65-104, *1983* WHOI-R-83-013

Nuclear Waste Management Activities in the Pacific Basin and Regional Cooperation on the Nuclear Fuel Cycle
Finn, D.P.
Ocean Development and International Law Journal, Vol. 13, No. 2, pp. 213-246, *1983* WHOI-R-83-014
Pacific Ocean and island sites have been used since World War II for nuclear activities, including effluent discharges from nuclear facilities, sea dumping of packaged radioactive wastes, and testing of nuclear explosives. In the future, the amounts of radioactive wastes deliberately released into the Pacific Ocean may increase in connection with planned commercial-scale nuclear fuel processing operations, recommencement of plutonium production for weapons purposes, and resumption of sea dumping of low-level wastes. Proposed storage of spent nuclear fuel on Pacific island sites or disposal of high-level wastes in the deep seabed of the Pacific could also expose the ocean to a risk of contamination by long-lived radionuclides. The consequences of all these activities should be assessed in practical terms — their likely effects on the living marine resources of the Pacific and the economic development of the societies benefited by them; in terms of the legal principles which govern activities such as marine radioactive waste disposal that could pollute the marine environment; and in relation to current and future organizational arrangements that could achieve political resolution of outstanding international nuclear energy issues. Despite the prospective dangers of marine nuclear activities, the use of relatively remote or extraterritorial marine locations including those in the Pacific basin for nuclear operations could provide a basis for international cooperation on management of the "back end" of the nuclear fuel cycle, including storage and reprocessing of spent fuel and high-level waste disposal. A broadly recognized international regime for the nuclear fuel cycle could be based on regional organization of such back-end operations, provided local acceptance could be obtained.

International Cooperation to Protect the Marine Environment: The Case of Radioactive Waste Disposal
Finn, D.P.
Oceans, pp. 601-604, *1981* WHOI-R-81-016

Ocean Disposal of Radioactive Wastes: The Obligation of International Cooperation to Protect the Marine Environment
Finn, D.P.
Virginia Journal of International Law, Vol. 21, No. 4, pp. 621-690, *1981* WHOI-R-81-015

Sub-seabed Disposal of Radioactive Waste: Prevention or Management Δ
Deese, D.A.
1977 WHOI-Y1-77-001

Pollution—Pollutant Transport

Stable Isotope Evidence for Entry of Sewage-derived Organic Material Into a Deep-sea Food Web
Van Dover, C.L., J.F. Grassle, B. Fry, R.H. Garritt, and V.R. Starczak
Nature, Vol. 360, pp. 153-156, *1992* WHOI-R-92-007

Differential Transport of Sewage-derived Nitrogen and Phosphorus Through a Coastal Watershed
Weiskel, P.K. and B.L. Howes
Environmental Science and Technology, Vol. 26, No. 2, pp. 352-360, *1992* WHOI-R-92-001

Biogeochemical Processes Governing Exposure and Uptake of Organic Pollutant Compounds in Aquatic Organisms
Farrington, J.W.
Environmental Health Perspectives, Vol. 90, pp. 75-84, *1991* WHOI-R-91-008

Anthropogenic Influence of the Sedimentary Regime of an Urban Estuary — Boston Harbor Δ
Fitzgerald, M.G.
Woods Hole Oceanographic Institution Technical Report WHOI-80-38, 297 pp., *1980* WHOI-Y1-80-002

Fine-grained Sediment and Industrial Waste Distribution and Dispersal in New Bedford Harbor and Western Buzzards Bay, Massachusetts Δ
Summerhayes, C.P., J.P. Ellis, P. Stoffers, S.R. Briggs, and M.G. Fitzgerald
1977 WHOI-T-77-003

Outreach & Advisory Services—Communication, Public Outreach and Education

***Nor'easter* Articles Available from Sea Grant** √
5 pp., *1995* WHOI-L-95-001
A brochure which includes brief descriptions of, and ordering information for, all articles appearing in *Nor'easter*, the magazine published twice per annum by the Sea Grant programs of the Northeast: Connecticut, Maine/New Hampshire, Massachusetts (MIT and WHOI), New York, and Rhode Island.

A Storm Drain Painting Project √
Crago, T.I. (ed.)
2 pp., *1995* WHOI-G-93-003
Distributed during WHOI Sea Grant's annual Storm Drain Painting Project, this fact sheet lists items typically placed in storm drains and offers solutions for proper disposal.

Directory of Cape & Islands Coastal Outreach Organizations √
Hahn, E., S. DeRosa, T.I. Crago, and G.S. Giese
125 pp., *1995*, $10.00 WHOI-D-92-001
This directory provides information for organizations located on Cape Cod, Massachusetts, including the islands of Nantucket and Martha's Vineyard, that share the Sea Grant objective of providing the public with information to aid in the preservation and wise utilization of our local coastal and marine resources. The directory, which is updated annually, includes private organizations, town departments, as well as county, state, and federal agencies.

Δ Available on loan from NSGD, see p. *v.*
√ Helpful to educators and students.

Falmouth Pond Watchers. Water Quality Monitoring of Falmouth's Coastal Ponds — Results from the 1993 Season Δ √
Howes, B.L. and D.D. Goehringer
65 pp., *1994* WHOI-T-94-001

Falmouth Pond Watchers. Water Quality Monitoring of Falmouth's Coastal Ponds: Report from the 1992 Season Δ √
Howes, B. and D.D. Goehringer
89 pp., *1993* WHOI-T-93-001

The Falmouth Pond Watchers — A Case Study in Volunteer Monitoring Programs √
Crago, T.I. and A. Frater
Nor'easter, Vol. 4, No. 1, pp. 28-32, *1992* WHOI-R-92-005
Like so many coastal ponds in Massachusetts and throughout New England, salt ponds in the Town of Falmouth are showing signs of diminished water quality and ecological stress. With their extensive shorelines and generally restricted circulation and flushing patterns, these ponds are usually the first indicators of nutrient pollution along the coast. Since 1987, the Citizen Volunteer Monitoring Effort for Falmouth's Coastal Ponds (better known as the "Pond Watchers") has been providing much needed water quality data for the development of data-based management plans for now five coastal ponds in Falmouth, Massachusetts. This project represents a unique partnership between local citizens, town government, and WHOI scientists whereby scientific information generated through the efforts of citizen volunteers under the guidance of WHOI scientists is applied directly (and immediately) to planning decisions for the town. The success of this project depends largely upon the efforts of a group of private citizens with wide ranging backgrounds and educational pursuits, all sharing a common interest in maintaining the health of their nearshore coastal waters.

Falmouth Pond Watchers: Update on 1991 Citizen Volunteer Monitoring of Water Quality in Falmouth's Coastal Ponds Δ √
Howes, B.L. and D.D. Goehringer
63 pp., *1992* WHOI-T-92-001

Falmouth Pond Watchers: Interim Report on Citizen Volunteer Monitoring of Water Quality in Falmouth's Coastal Ponds Δ √
Howes, B.L., D.D. Goehringer, and A.W. White
35 pp., 1991 WHOI-T-91-002
The 1990 field season of the Citizen's Monitoring Project for Falmouth's Coastal Ponds proved to be highly successful, due primarily to the enthusiasm and dedication of Falmouth's Volunteer "Pond Watchers." Through their continued efforts, data from four years of sampling on three of Falmouth's ecologically fragile coastal salt ponds (Oyster, Little, and Green Ponds) have been compiled. A major expansion of the volunteer effort, coupled with a more focused temporal sampling scheme based upon the experience in these three ponds, has enabled a major project expansion in 1990 to include two additional ponds (Bournes and Great) in the sampling program.

Final Report on Citizen Volunteer Monitoring of Water Quality in Falmouth's Coastal Ponds Δ √
Howes, B.L., A.W. White, and D.D. Goehringer
Woods Hole Oceanographic Institution Technical Report, WHOI-Q-90-001, 45 pp., *1990*
WHOI-Q-90-001

Outreach & Advisory Services—General Sea Grant

Woods Hole Oceanographic Institution Sea Grant Program, Project Guide: 1994-1996 √
Crago, T.I.
6 pp., *1994* WHOI-A-95-001

Woods Hole Oceanographic Institution Sea Grant Program, Project Guide: 1992-1994 √
Crago, T.I.
4 pp., *1992* WHOI-A-92-001

Woods Hole Oceanographic Institution Sea Grant Program, Project Guide: 1991-1992 √
Campbell, L.A
2 pp., *1991* WHOI-A-91-001

Sea Grant — A National Investment for the Future √
Ross, D.A.
Oceanus, Vol. 31, No. 3, pp. 6-11, *1988* WHOI-R-88-017

Outreach & Advisory Services—Marine/Environmental Education

Marine Science Careers: A Sea Grant Guide to Ocean Opportunities √
Adams, S. and T.I. Crago
40 pp., *1996*, $5.00, WHOI-E-96-001
Students thinking about careers in the marine sciences often picture themselves working with marine mammals. Within the marine science fields, however, very few scientists specialize in this area. Today's marine scientists pursue a great variety of wide-ranging careers, using the latest in technology to address the problems and issues that face our marine resources. Marine Science Careers is a guide to the probabilities for this field for today and the years to come. The guide focuses on four major career areas — marine biology, oceanography, ocean engineering, and closely related fields — as well as on careers that involve both the oceans and the Great Lakes. It is intended for high school students, but it will also be of interest to college undergraduates, middle school students, and the parents, teachers, and guidance counselors who will be helping them plan their futures.

Surfing the Net: How Sea Grant Programs Have Jumped on the Information Superhighway and Why You Should Too √
Crago, T.I.
Nor'easter, Vol. 7, No. 1, pp. 24-27, *1995*, WHOI-R-95-004
From the terminal at the next desk to the World Wide Web, from informal memos to full text-and-photo publications, Sea Grant programs are linking electronically to each other and to the world through the Internet. Find out how you can too.

Marine Science Reading List √
Marine Biological Laboratory/Woods Hole Oceanographic Institution (MBL/WHOI) Library 52 pp., *1995*, $2.00 WHOI-L-95-002
Compiled by the joint MBL/WHOI Library, this comprehensive reading list is geared for students and adults and features hundreds of marine science references — including books, articles, videos, films, and on-line information — on topics ranging from aquaculture to underwater exploration.

Over the Wedge—Where Fresh and Saltwater Meet √
Waters, B.S.
Poster, 2 pp. *1993* WHOI-G-93-002

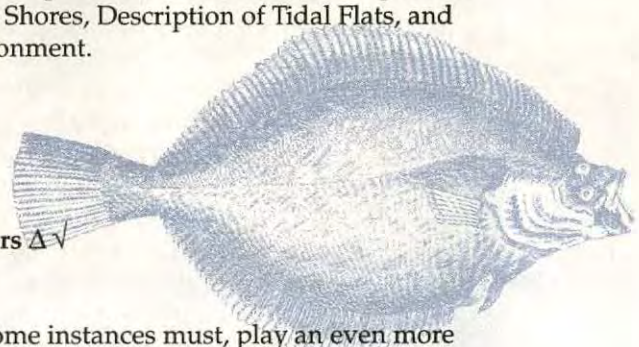
Δ Available on loan from NSGD, see p. *v.*
√ Helpful to educators and students.

Recycling Marine Science √
Crago, T.I. and L.A. Campbell
Nor'easter, Vol. 4, No. 2, pp. 42-46, *1992* WHOI-R-92-008
The community of Woods Hole-Falmouth, Massachusetts, is fortunate to have numerous programs that contribute to the recycling of marine science and education. The article, which originally appeared in the Fall/Winter 1992 issue of *Nor'easter* magazine, highlights various institutions, programs, and organizations in the Falmouth area which are examples of creative linkages and networking among local scientific establishments and the greater community. Similar networks between research and outreach can be set up in virtually any town, and the articles includes a side-bar featuring a checklist of activities that can be undertaken in your community.

All About Oceanography — A Fun-filled Activity Book √
Crago, T.I. and L.A. Campbell (eds.)
33 pp., *1992*, $2.00* WHOI-E-92-002
Features factual tidbits and trivia about the various disciplines of oceanography (biological, chemical, and physical oceanography, marine geology and geophysics, and applied ocean physics and engineering), as well as coastal oceanography and marine policy. Illustrations of hydrothermal vent communities, coastal erosion, the hydrologic cycle, red tide, remotely operated vehicles, the Gulf Stream, and many others are included in the booklet's 32 pages, as are crossword and word search puzzles. **Discounts available for large quantities.*

Expanding the Collection through Bibliographic Control of Institution Desk References
Rioux, M.
In: The Aquatic Environment: Description, Management, Conservation. Proceedings of the 17th Annual Conference - IAMSLIC - October 7-11, 1991, Galveston, Texas, pp. 97-105, *1992*
WHOI-R-91-013

Field Guides for Eastern Shore Marine Environments √
Waters, B.S.
10 pp., *1992*, $1.00 WHOI-H-78-001
Set of five includes the following field guides: Description of a Salt Marsh, Description of Salt Ponds, Description of Rocky and Man-Made Shores, Description of Tidal Flats, and Description of the Sandy Shore and Dunes Environment.



The Raindrop Journey Δ √
Waters, J.F. and B.S. Waters
2 pp., *1992* WHOI-E-92-001

Environmental Guide for New England Mariners Δ √
McConnell, M.
12 pp., *1991* WHOI-H-89-001
This booklet describes how boaters can, and in some instances must, play an even more active role in keeping coastal waters clean and healthy. To date there haven't been enough pump-out stations, or knowledge of where they are, to help mariners dispose of their waste responsibly. Now, however, more pump-out facilities are coming on line, more floating 'honey wagons' are in use, and more enforcement is becoming apparent throughout the region. Whether you have a canoe, a cabin cruiser, or something in between, what you do on - and to - your boat makes a difference to all of us!

A Resource Book for Educators, 1991-1992 Δ √
Network for Environmental Science Education in Southeastern Massachusetts
16 pp., *1991* WHOI-D-91-001

This booklet is designed as a resource for educators. It lists the 1991-92 members of the Network for Environmental Science Education in Southeastern Massachusetts and provides basic information about their goals and programs. The booklet may be of help to teachers and group-leaders who are planning environmental field trips or seeking specific information. A complete listing of member organizations of the Network and a map showing their locations in southeastern Massachusetts is located in the centerfold of this booklet. More detailed descriptions are given, in alphabetical order, on the accompanying pages. The name of one contact person for each organization is also provided.

Women in Marine Science...Good Girls Don't? √
Campbell, L.A.
Nor'easter, Vol. 2, No. 1, pp. 26-31, *1990* WHOI-R-90-010
Though women have succeeded in breaking into many previously male-dominated fields in recent years, it is still unusual to find them in science and technology careers. This article describes some of the specific trials faced by women in science, as well as the changes taking place in attitudes and institutions. The personal stories presented here illustrate the wide variety of marine science careers that exist and the uniqueness of the women who pursue them.

Groundwater Resource Guide Δ √
Cape Cod Environmental Education Resource Center (CCEERC)
Vol. 1, No. 1, 8 pp., *1990* WHOI-H-90-002
Imagine a life where the water you use is unsafe to drink. Imagine a time when there is not enough water available. And imagine what it would be like to use only bottled water for your needs. In order to prevent these problems from becoming reality, we must learn to protect and conserve our limited and valuable water supply. This groundwater resource guide, published by a group of educators on Cape Cod, Massachusetts, discusses the water cycle, the water budget, zones of aeration and saturation, hydrogeology, and how groundwater gets polluted. Complete with illustrations and activities for the classroom, as well as a glossary and bibliography, this 8-page guide can be a valuable teaching tool.

Depositing "Grey Literature" in the U.S. Technical Information System — Who is Responsible? √
Putnam, S.S.
Report from the IAMSLIC '90 Conference, 1990, 9 pp., *1990* WHOI-R-90-007
A large percentage of current technical information falls into the category of "grey literature" which is difficult to identify and acquire. It is typically unpublished or quasipublished material that cannot be obtained through the usual bookselling channels and is rarely incorporated into the large databases and standard reference sources. A portion of this critical body of technical information can be located in online databases such as NTIS. Presumably government depositories collect the information published by their agencies....or do they? It is apparent that not all of the literature issued by agencies and their contractors has actually been received by the depositories. How does the "grey literature" get into the government depositories such as NTIS, DTIC, NASA, GPO, Sea Grant, and the municipal, state and Federal depository libraries? Who is responsible for depositing this material? This paper answers these questions for a non-government, marine research facility and describes some of the responsibilities librarians must assume to ensure timely dissemination of information through the technical information network.

Sea Grant's Role in Marine Education √
Wildman, R.D. and D.A. Ross
Oceanus, Vol. 33, No. 3, pp. 39-45, *1990* WHOI-R-90-005
Never before have scientific and environmental issues dominated the actions of countries and the concerns of individuals as they do today. Despite the fact that these issues are covered almost daily on the front pages of our newspapers and featured on the evening

Δ Available on loan from NSGD, see p. *v*.
√ Helpful to educators and students.

TV news. There are only a few programs in the United States that are striving to increase the numbers of marine scientists and engineers. One that is active in the marine area is the National Sea Grant College Program, which is part of the National Oceanic and Atmospheric Administration (NOAA) in the U.S. Department of Commerce.

International Directory of Marine Science Libraries and Information Centers √
Winn, C.P.
160 pp., *1987,** $22.00 WHOI-D-87-001
This directory identifies a network of more than 300 cooperating libraries, information centers, and other units in 50 countries which are willing to provide assistance not only to other cooperating members, but to any investigator seeking information in the marine sciences. This directory represents a new beginning in establishing an active program of international exchange of marine science information. Pre-paid orders should be sent to: Office of the Research Librarian, Woods Hole Oceanographic Institution, 360 Woods Hole Road, Woods Hole, MA 02543-1541. **Includes updated information as of 1992.*

Directory of Marine Science Libraries and Information Centers Δ √
Woods Hole Oceanographic Institution
1981 WHOI-D-81-001

Directory of Marine Science Libraries on the East Coast of the United States and Canada Δ √
Winn, C.P. and C. Hurter
1976 WHOI-D-76-001

Audio

The audio cassettes listed below are from WHOI Sea Grant's popular lecture series "Oceans Alive: Plain Talk on Current Topics in Marine Science Presented for the General Public." Cassettes are approximately 60 minutes each, and are available on a loan basis only.

The Central America Shipwreck: New Studies √
Herdendorf, E.
March 3, 1992

Marine Science in the Middle East: Experiences on Land and Water √
Ross, D.A.
February 18, 1992

The Ashumet Valley Sewage Plume: Progress in Understanding the Fate of Pollutants in Groundwater √
LeBlanc, D.
February 11, 1992

Winslow Homer's Sea √
Millinger, J.
February 4, 1992

The Reproductive Sounds of Fishes: Their Cries of Ecstasy Fall on Our Deaf Ears √
Lobel, P.S.
April 16, 1991

The Flushing of Boston Harbor and Massachusetts Bay √
Geyer, W.R.
April 9, 1991

A Recollection of 40 Years of Marine Life and Changes on Cape Cod √
Valois, J.J.
April 2, 1991

Fate and Effects of Oil in the Ocean √
Farrington, J.
March 26, 1991

The Stuff of Science Fiction: An Alvin Pilot's View of the Abyss √
Van Dover, C.L.
March 19, 1991

New York Harbor Herons: Testing the Waters √
Parsons, K.
March 12, 1991

Ancient Mariners/Modern Victims: The Plights and Future of Sea Turtles √
Agardi, M.T.
April 17, 1990

Plasti-coating the Ocean: Plastic Pollution in the North Atlantic √
Wilber, R.J.
March 27, 1990

Is there a Global Warming Problem √
Solow, A.R.
March 20, 1990

Recreational Fishing Around Cape Cod √
Sabo, D.J.
November 9, 1989

Argo-Jason: An Educational Opportunity √
Gallo, D.G.
November 2, 1989

Red Tide: Killers Along the Coast √
White, A.W.
October 26, 1989

Whale Talk: Communication in Whales and Dolphins √
Tyack, P.L.
October 19, 1989

Video

Unless otherwise noted, the following videos are from WHOI Sea Grant's popular lecture series "Oceans Alive: Plain Talk on Current Topics in Marine Science Presented for the General Public." Videos are approximately 60 minutes each, and are available on a loan basis for a $3.00 fee, or for purchase at $10.00 each. Great for classroom use.

The Westport Scallop Project: An Example of University and Grass-roots Community Cooperation √
April 4, 1995 WHOI-F-95-006

In this video presentation, Dr. Michael A. Rice, associate professor at the University of Rhode Island, Dept. of Fisheries, Animal and Veterinary Science, highlights the tremendous community participation involved in an effort to generate interest in the Westport River estuary and its water quality. The Bay Scallop Restoration Project began in 1993. The main objective of the project is to enhance scallop stocks by applying a modified Japanese technique of placing artificial spat collectors near adult scallops held in rafts at various locations within the estuary. Dr. Rice describes how the tremendous success of the effort is due in large part to all involved: middle and high school students, local businesses, local volunteers, the Westport Fishermen's Association, and college students, for a total of over 15,000 volunteer hours.

Understanding the Fate of Contaminants in the Coastal Ocean: Massachusetts Bay and Deepwater Dump Site 106 √
March 28, 1995 WHOI-F-95-005
During his presentation, Dr. Brad Butman, Chief, Branch of Atlantic Geology, U.S. Geological Survey, highlights two examples of pollution and waste disposal in the coastal ocean: studies in Massachusetts Bay and the long-term monitoring effort at Dump Site 106, located 160 kilometers off the coast of New Jersey.

Student Science in Falmouth—1995 √
March 21, 1995 WHOI-F-95-004
Students from Falmouth High School and Falmouth Academy (Massachusetts) present results of the following science fair projects: "The Effects of Ultraviolet-B Radiation on Soil Microbes: Phase II"; "A Marsh History through Cores"; "Wings: Their Shape and Lift"; and, "Cryopreservation of Marine Dinoflagellates."

Biomarkers and Bioassays: Assessing the Risks of Environmental Pollutants √
March 14, 1995 WHOI-F-95-003
This video features Dr. Mark Hahn, an assistant scientist in the WHOI Biology Dept. Dr. Hahn discusses the risk assessment process used by regulatory agencies to determine safe levels of contaminants in food, including seafood. He goes on to talk about biomarkers, his field of expertise. Biomarkers are indicators which signify an exposure to chemical pollutants. The main portion of Dr. Hahn's talk concentrates on his research with the biomarker cytochrome P4501A which has been used extensively as an indicator of environmental contamination since 1976.

Science Under Sail: History of Scientific Voyages √
March 7, 1995 WHOI-F-95-002
During her presentation, Dr. Mary Malloy, maritime historian and faculty member at the Sea Education Association, discusses the relationship between seafaring and science, from ancient times to the present. She focuses most of her presentation on the 18th century, describing a number of different voyages, including those by Captain Cook. Dr. Malloy also mentions some of the institutions in England and the United States that collected materials from such voyages, what she describes as the "phenomena of bringing the world home" from seagoing voyages.

Would Your Rather be an Old Maid or a Fisherman's Wife? Social Impacts of Changing Fisheries √
February 28, 1995 WHOI-F-95-001
Dr. Madeleine Hall-Arber, an anthropologist and marine advisor at MIT Sea Grant, has studied the social implications of the declining New England fisheries for several years and has authored several articles on the subject. Dr. Hall-Arber explores how changes in the fisheries stocks have affected management and how that, in turn, has affected the wives, families, and communities of fishermen. While the principal focus of the lecture is on the women of Gloucester, Massachusetts, some comparisons are drawn with wives of New Bedford, Mass., and Stonington, Maine, fishermen.

Look What the Currents Dragged In: Coastal Currents and Their Effect on Marine Debris √
Special Lecture in Celebration of "Coastweeks '94"
Sept. 20, 1994 WHOI-F-94-006
Dr. Wayne (Rocky) Geyer, an Associate Scientist at the Woods Hole Oceanographic Institution, discusses his research on currents and their effect on moving marine debris along the shore.

The Caspian Sea: Jewel of Two Continents √
April 26, 1994 WHOI-F-94-005
During his presentation, Dr. David G. Aubrey, a senior scientist in the WHOI Geology and Geophysics Department, describes some of the reasons why the Caspian Sea (located just east of the Black Sea) is important to the region and to the world. Aubrey also discusses a comprehensive research program he is helping to formulate with the government of Kazakhstan and the other four countries that border the Caspian Sea (Russia, Turkmenistan, Iran, and Azerbaijan).

Clams and Climate √
April 19, 1994 WHOI-F-94-004
Chris Weidman, a doctoral candidate in the WHOI/MIT Joint Program in Marine Geology and Geophysics, discusses how he uses clam shells to decipher information about past climate conditions. Though the connection may at first seem unclear, there are a number of different pathways researchers may take to understand how clams can give clues about climate change. During his presentation, Mr. Weidman describes his research using isotope analysis to capture important information on the life history of *Arctica*, a commercially important shellfish species.

Communications in Whales and Dolphins √
April 12, 1994 WHOI-F-94-003
Dr. Laela Sayigh's presentation features slides and audio tapes of actual dolphin and whale "whistles" recorded during her research. While all dolphins have distinctive "signature whistles," studies indicate the majority of male dolphins learn vocalization through their mother, while female dolphins do not. Understanding how the animals learn these whistles is an important part of Dr. Sayigh's research and is discussed during the lecture.

Saltwater Fly Fishing for Striped Bass
April 4, 1994 WHOI-F-94-002
This video presentation features Rhode Island fisherman Kenney Abrames. Mr. Abrames, author of *Striper Moon*, discusses his experiences as well as the age-old traditions of fly fishing.

Student Science in Falmouth—1994 √
March 29, 1994 WHOI-F-94-001
Students from Falmouth High School and Falmouth Academy (Massachusetts) present results of the following science fair projects: "The Effects of Ultraviolet-B Radiation on Cape Soil Microbes (Phase II)"; "The Detectable Threshold for Lifted Weights"; "The Impact of Ultraviolet Light on Aquatic Microbial Population"; and "The Effect of Phosphates in Freshwater."

The Maritime Muse: Songs & Poetry of the Sea √
April 20, 1993 WHOI-F-93-005
Featuring Tom Goux, coordinator of music faculty for Falmouth, Massachusetts, Public Schools, and co-founder and director of the Greater Falmouth's Mostly All-Male Men's Chorus, singing and reciting an "especially historical" program featuring maritime poets.

Geology of Cape Cod √
April 13, 1993 WHOI-F-93-004
Robert N. Oldale, geologist with the U.S. Geological Survey in Woods Hole, Massachusetts, discusses the important role the last continental glacier played in forming the glacial part of Cape Cod and the islands of Martha's Vineyard and Nantucket, Massachusetts, and how the glacial materials have been eroded, transported, and redeposited by the sea to form the Cape and Islands as they are today.

Poisons in Your Seafood: The Myths & Realities of Marine Biotoxins & Red Tides √
April 6, 1993 WHOI-F-93-003
World-renowned Woods Hole Oceanographic Institution biologist and red tide specialist Dr. Donald M. Anderson addresses the sensitive issue of marine biotoxins and seafood safety. Dr. Anderson's presentation features slides and a discussion of the various types of biotoxins that occur in waters around the globe. While remaining and avid — albeit cautious — consumer of fish and seafood, Dr. Anderson points out that exercising a degree of care in choosing where you buy your seafood and where it was landed is essential. He also offers his thoughts on an issue of genuine concern to many scientists, that is, have marine biotoxins and red tide events become more widespread, and if so, can this be attributed to man's effect on the environment?

Clammy Wynette & the Steamers: Clam Farming on Cape Cod √
March 30, 1993 WHOI-F-93-002
Molly Benjamin, a biologist by training and writer of the Outdoors column for the Cape Cod Times, presents slides and discusses her experiences raising hard clams, or quahogs, inside Provincetown Harbor, Massachusetts. Also discussed is the relationship between shellfish abundance and water quality, a link that Ms. Benjamin has observed first-hand on the outer area of Cape Cod, Massachusetts, over the past several years.

Student Science in Falmouth—1993 √
March 23, 1993 WHOI-F-93-001
Students from Falmouth High School and Falmouth Academy present results of their winning science fair projects. Projects include cigarette smoke and radon; the effects of heeling on yacht performance; the effects of acid rain on Daphnia pulex, a small freshwater crustacean; and measuring how much air slows down the speed of light using a Michelson interferometer.

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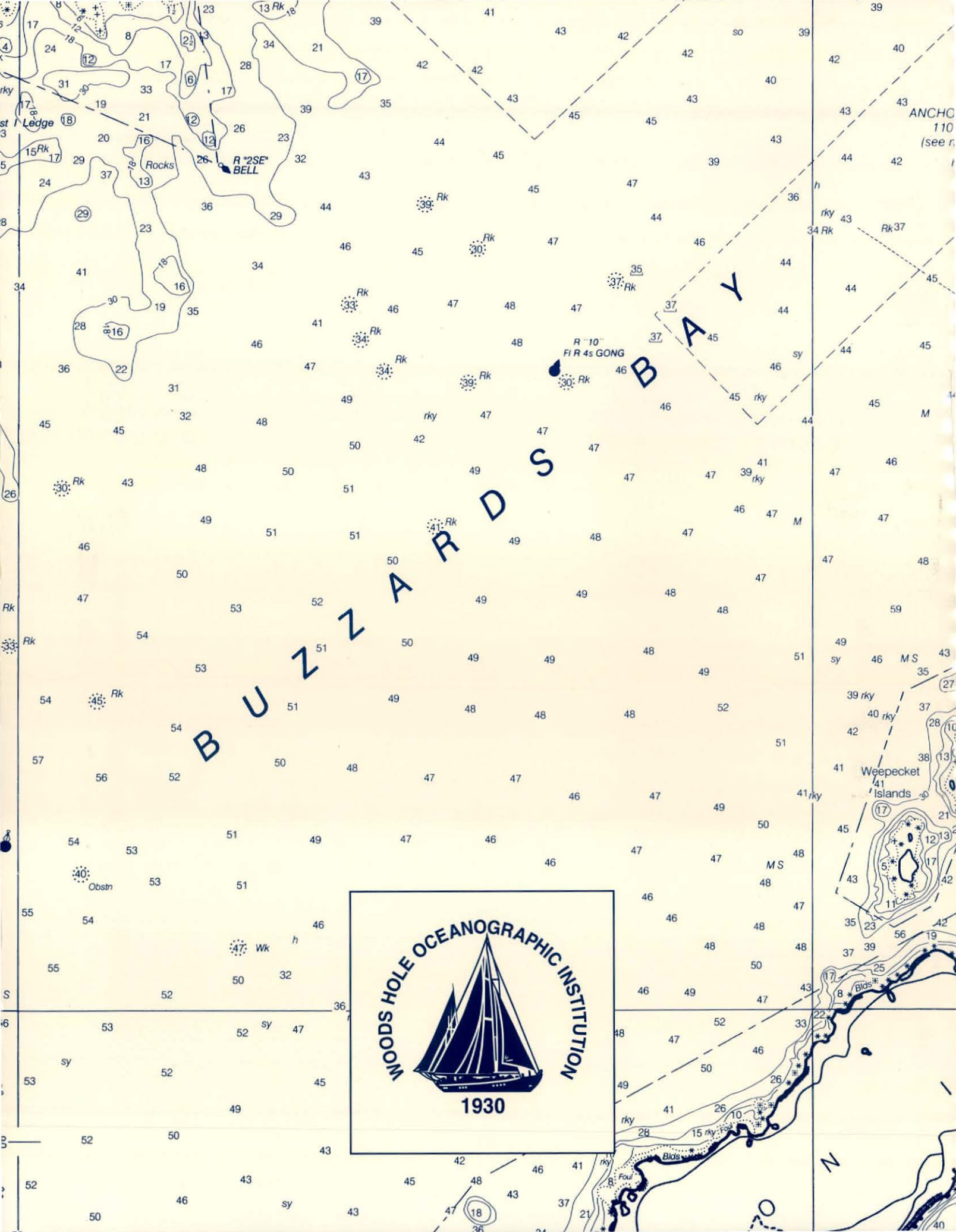
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