3008

The Cycle of Organic Matter in the Sea

Contract AT(11-1)-3564

- Final Report

for the period

MASTER

June 1, 1967 - May 31, 1970

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Under the terms of AT(11-1)-3564, a study was undertaken of the cycle of organic matter in the sea. The objective of the study was to determine the rate of production of organic matter, its utilization by the marine biota in the various components of the food chain or food web, its rate of deposition on the sea floor, and its rate of flux through the large reservoirs of non-living organic matter present as suspended particulate matter (detritus) and dissolved organic matter.

During the four-year period of this contract (June, 1967 - May, 1970), significant progress was made towards the objectives stated above. However, many problems remained unsolved and several essential components of the organic cycle could not be successfully assessed due to limitations in state-of-the-art techniques of quantitative sampling of the oceanic biota (particularly the larger organisms), and the lack of time and opportunity to pursue all aspects of the program simultaneously and in depth within the limitations of the four-year period.

The investigations were approached by selecting for study a variety of ocean environments in which the cycle of organic matter could be studied in relation to two important controlling variables--the rate of production of organic matter and the depth of water. Both of these variables were believed to influence the pathways, the rates of flux, and the final reservoirs of organic matter in the marine ecosystems.

Accordingly, oceanographic cruises were made to deep and relatively unproductive oceanic regions (the Sargasso Sea, the central Gulf of Mexico, the Mediterranean), highly-productive regions of coastal

upwelling (Peru, South-West Africa, and North-West Africa), and moderately-productive coastal areas influenced by land drainage and human wastes (the Gulf of Mexico influenced by the Mississippi River drainage, and the North Atlantic bight between Cape Cod and Cape Hatteras influenced by waste discharges from the Eastern U.S. megolopolis).

Following is a list of the oceanographic cruises that were undertaken under contract AT(11-1)-3564:

1. ATLANTIS II Cruise 31. Recife, Brazil - Buenos Aires, Argentina. February - March, 1967.
2. ATLANTIS II Cruise 42. Woods Hole - Walvis Bay, South-West Africa. March - May, 1968.
3. ATLANTIS II Cruise 48. Gulf of Mexico. November, 1968.
4. GOSNOLD Cruise 140. Peru - Equador. April, 1969.
- *5. GOSNOLD Cruise 151. Hudson Canyon, N.Y. October, 1969.
6. ATLANTIS II Cruise 52. U.S. Continental Shelf, Cape Cod - Cape Hatteras. September, 1969.
- *7. GOSNOLD Cruise 152. Mississippi River - Gulf of Mexico. December, 1969.
8. ATLANTIS II Cruise 59. Mediterranean - North-West Africa. August - September, 1970.
- *9. KNORR Cruise 19. Sargasso Sea. March - April, 1971.

Those cruises marked by asterisks were special-purpose cruises on which a complete sampling program was not carried out. With those exceptions, special reports have been prepared for each cruise describing

the cruise track, the station positions, the sampling methods employed, and the reduced data for each measurement or analysis completed. Cruise reports have been submitted together with the annual progress reports with the exception of ATLANTIS II Cruise 59, which report is submitted herewith.

Listed below is a three-part bibliography of (1) papers which have been published and credited in whole or part to AT(11-1)3564, (2) papers which are in press or preparation similarly credited to this contract, and (3) unpublished cruise reports which have been submitted to AEC and are available on limited distribution from the Woods Hole Oceanographic Institution.

I. Published Reports

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- NYO-3862-3. Lorenzen, C. J. 1968. Carbon/chlorophyll relationships in an upwelling area. Limnol. Oceanog. 13: 202-204.
- NYO-3862-4. Hobson, L. A. and D. W. Menzel. 1969. The distribution and chemical composition of organic particulate matter in the sea and sediments off the East Coast of South America. Limnol. Oceanog. 14: 159-163.
- NYO-3862-5. Menzel, D. W. and J. H. Ryther. 1968. Organic carbon and the oxygen minimum in the South Atlantic. Deep-Sea Res. 15: 327-337.
- NYO-3862-6. Ryther, J. H., D. W. Menzel, E. M. Hulburt, C. J. Lorenzen and N. Corwin. 1970. The production and utilization of organic matter in the Peru coastal current. ANTON BRUUN Report No. 4, Southeastern Pacific Program, March. 4.2-4.12.

- NYO-3862-8. Menzel, D. W. and J. H. Ryther. 1970. Distribution and cycling of organic matter in the oceans. Proceedings of Symposium on organic matter in natural water, Univ. Alaska. Pub. No. 1: 31-54.
- NYO-3862-9. Barber, R. T. and J. H. Ryther. Organic chelators: Factors affecting primary production in the Cromwell current upwelling. J. exp. mar. Biol. Ecol. 3: 191-199.
- NYO-3862-10. Barber, R. T. and R. L. Haedrich. Gobies associated with a scattering layer off South-West Africa. Deep-Sea Res. 16: 105-106.
- NYO-3862-11. Barber, R. T. and A. W. White. Evidence for a cryptomonad symbiont in the ciliate, Cyclotrichium meunieri. J. of Phycology 5: 86-88.
- NYO-3862-12. Hulburt, E. M. and R. S. MacKenzie. Distribution of phytoplankton species at the western margin of the North Atlantic Ocean. Bull. Mar. Sci. 21: 603-612.
- NYO-3862-13. Lawson, T. J., Jr. and G. D. Grice. The developmental stages of Centropages typicus Kroyer (Copepoda: Calanoida). Crustaceana. 18: 187-208.
- NYO-3862-14. Ryther, J. H. The potential of the estuary for shellfish production. NSA Proceedings - National Shellfisheries Association. 59: 12-22.
- NYO-3862-15. Menzel, D. W. The role of in situ decomposition of organic matter on the concentration of non-conservative properties in the deep-sea. ANTON BRUUN Report No. 17: 751-764.
- NYO-3862-16. Hobson, L. A. and Robert J. Parisher. 1971. The effect of inorganic nitrogen on the synthesis of protein, chlorophyll a, RNA, and DNA by Thalassiosira fluviatilis Hustedt and Cyclotella nana Hustedt grown in batch culture. J. exp. mar. Biol. Ecol. 6: 71-78.
- NYO-3862-19. Lorenzen, Carl J. 1972. Continuity in the distribution of surface chlorophyll. J. Cons. int. Explor. Mer 34: 18-23.
- NYO-3862-20. Ryther, John H. The relationship of photosynthesis to fish production in the sea. Science. 166: 72-76.
- NYO-3862-22. Rowe, G. T. and D. W. Menzel. 1971. Quantitative benthic samples from the deep Gulf of Mexico with some comments on the measurement of deep-sea biomass. Bull. Mar. Sci. 21: 556-566.

- NYO-3862-24. 1971. Rowe, G. T. Benthic biomass and surface productivity. International Symposium in the Fertility of the Sea. Sao Paulo, Brazil: 441-454.
- NYO-3862-25. Menzel, Davids W., Judith Anderson and Ann Randtke. 1970. Marine phytoplankton vary in their response to chlorinated hydrocarbons. Science 167: 1724-1726.
- NYO-3862-26. Lorenzen, Carl J. 1970. Surface chlorophyll as an index of the depth, chlorophyll content, and primary productivity of the euphotic layer. Limnol. Oceanog. 15: 479-480.
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- NYO-3862-28. Schoener, A. and G. T. Rowe. 1970. Pelagic Sargassum and its presence among the deep-sea benthos. Deep-Sea Res. 17: 923-935.
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- NYO-3862-34. Hulburt, Edward M. 1970. Relation of heat budget to circulation in Casco Bay, Maine. J. Fish. Res. Bd. Canada 27: 2255-2260.
- NYO-3862-36. Hulburt, Edward and Nathaniel Corwin. 1970. Relation of the phytoplankton to turbulence and nutrient renewal in Casco Bay, Maine. J. Fish. Res. Bd. Canada 27: 2081-2090.
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- NYO-3862-39. Ryther, John H. 1970. Is the world's oxygen supply threatened? Nature 227: 374-375.
- NYO-3862-40. Ryther, John H. and William M. Dunstan. 1971. Nitrogen, phosphorus, and eutrophication in the coastal marine environment. Science 171: 1008-1013.

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- NYO-3862-37. Hulburt, Edward M. and Nathaniel Corwin. A note on the phytoplankton distribution in the offshore water of the eastern and central Gulf of Mexico. Caribbean Journal of Science.
- NYO-3862-46. Lorenzen, Carl J. Observations on the stability of deep particulate organic matter. Deep-Sea Res.
- NYO-3862-48. Rowe, Gilbert T., Pamela T. Polloni and Judith I. Rowe. Benthic community parameters in the lower Mystic River. Water Research.
- NYO-3862-49. Wiebe, Peter H. and Louis D'Abramo. Distribution of euphausiid assemblages in the Mediterranean Sea. Marine Biology.

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NYO-3862-51. Kerfoot, William B. and G. Gregory White. Mercury content of modern and old striped bass (Morone saxatilis). Env. Sci. Technol.

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COO-3564-3. Grice, George D., Peter H. Wiebe and Elaine Hoagland. 1972. Acid-iron waste as a factor affecting the distribution and abundance of zooplankton in the New York Bight. I. Laboratory studies on the effects of acid waste on copepods. J. Coastal Mar. Sci.

COO-3564-4. Wiebe, Peter H., George D. Grice and Elaine Hoagland. 1972. Acid-iron waste as a factor affecting the distribution and abundance of zooplankton in the New York Bight. II. Spatial variations in the field and implications for monitoring studies. J. Coastal Mar. Sci.

III. Unpublished Cruise Reports

NYO-3862-17. Reduced data reports for ATLANTIS II 31, 42 and 48. N. Corwin, Ed. W.H.O.I. Ref. No. 69-20. April, 1969.

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COO-3564-5. Reduced data reports for ATLANTIS 59. N. Corwin, Ed. N. Corwin, Ed. W.H.O.I. Ref. No. 72-46. June, 1972.