

MONTHLY REPORT
ON
MESA-FUNDED RESEARCH
MARCH 1979

by

NATIONAL MARINE FISHERIES SERVICE
NORTHEAST FISHERIES CENTER
SANDY HOOK LABORATORY
HIGHLANDS, NEW JERSEY 07732

Report No. SHL 79-19 (April 1979)

Title of Study: Source of and Environmental Concentrations of Organic Compounds (I.C.7) and Organic Contaminants of Fish, Shellfish, and Plankton (I.E.1)

Principal Investigator: Vincent S. Zdanowicz

Institution or Agency: National Marine Fisheries Service
Northeast Fisheries Center
Sandy Hook Laboratory
Highlands, New Jersey 07732

Period Reported: March 1979

Planned Activity: Actual Accomplishments:

Sample collection.

Samples of striped bass, blue mussels and sediments were obtained from the south shore of Long Island. Surf clams and sea scallops were obtained from Ocean City, Md. fishermen and plankton samples from a Delaware II cruise. All were shipped to Seattle.

Forecast of Activities for April:

Completion of collections: surf clams from apex, mussels from L. I. and N. J., lobsters and striped bass.

Title of Study: Water Column Respiration and Release of
Dissolved Organic Matter from Natural
Populations of Phytoplankton (II.D.5)

Principal Investigator: Dr. James P. Thomas

Institution or Agency: National Marine Fisheries Service
Northeast Fisheries Center
Sandy Hook Laboratory
Highlands, New Jersey 07732

Period of Report: March 1979

Planned Activity: Actual Accomplishments:

(1) Continue data
analysis as proposed.

(1) Underway.

(2) Begin manuscript pre-
paration.

(2) Statistical analyses continued.

Forecast of Activities for April:

- (1) Continue data analyses as proposed in FY'79 proposal.
- (2) Awaiting revised data tape from Dr. Garside (BLOS).
Much of our analysis is held in abeyance until receipt
of data tape.

Title of Study: Environmentally Induced Mutagenesis -
Cytotoxicity and Related Teratogenicity
in Planktonic Fish Eggs (III.5)

Principal Investigator: Dr. A. Crosby Longwell

Institution or Agency: National Marine Fisheries Service
Northeast Fisheries Center
Milford Laboratory
Milford, Connecticut 06460

Period of Report:

Planned Activity:

(1) Continue dissection of embryos from '78 cruise.

(2) Continue cytological examination of embryos from '78 cruise.

(3) Continue examination of mackerel egg chorion.

(4) Present summary findings of '74 and '77 cruises to an ICES-, FAO-, etc., sponsored symposium in a poster display.

Actual Accomplishments:

(1) About three-quarters completed.

(2) About half-way completed.

(3) As scheduled.

(4) Presented. "Abstract" of poster distributed at symposium attached to this report.

Significant Developments:

Because a paper was presented at the ICES Workshop on Monitoring Biological Effects of Pollution in the Sea, another full paper was not presented at the "Symposium on the Early Life History of Fish" held at Woods Hole, April 2-5. Instead, a poster display was prepared with an abstract distributed. At least seven different groups (in U.S. and Europe) plan to utilize our MESA-sponsored approaches in studies of their own. This includes direct study of eggs from plankton, eggs stripped from fish caught in nature, and laboratory experimentation on fish.

The poster display can be available for any other uses deemed appropriate.

Recommendations being made by the Genetics Committee of the ICES Biological Effects Monitoring Workshop include approaches as the one undertaken in the New York Bight on mackerel. A difference between our approach and the one this group (of which A. Longwell was a member) is in the reliance on the Ames test for appraising presence of mutagens in the water.

Since our biological appraisals were not exclusively mutagenic, but included teratogenic and cellular effects, analytical chemical measures of contaminant levels were overall more appropriate to our work than the Ames test alone would have been.

Public interest in the mackerel egg studies has been expressed as a result of publicity given the work at the "Early Life History of Fish Symposium" last week.

This paper not to be cited without prior reference to the authors

International Council for
the Exploration of the Sea

ICES/ELH Sympo./Poster:4

CELLULAR, MITOTIC-CHROMOSOMAL AND EMBRYOLOGIC DEVELOPMENT OF EARLY-STAGE
FISH EGGS FROM PLANKTON COLLECTIONS IN RELATION TO POLLUTION AND EARLIEST
LIFE HISTORY

by

A. Crosby Longwell and James B. Hughes

National Marine Fisheries Service, Northeast Fisheries Center, Milford
Laboratory, Milford, Connecticut 06460 U.S.A.

ABSTRACT

Among common groups of chemicals polluting ocean waters are cytotoxins, mutagens, and teratogens with the likelihood under some conditions of adversely affecting early-stage development of pelagic fish eggs. This is in addition to effects on the embryos of any body or gonad burden of such contaminants in parent fish.

In a study of such impacts on early embryos of plankton-collected fish eggs the embryo is first dissected from the egg envelope and yolk sac. It is then stained and prepared in a monolayer of cells on a microscope slide. Every embryo cell in these preparations can be examined and mitotic indices (indicators of development rate) determined. Mitotic abnormalities indicative of cytotoxicity, chromosome breakage, and irregular distribution of chromosomes can be scored over whole embryos from late cleavage to the tail-free development stage.

The yolk-sac membrane of embryos from the early embryo through tail-bud development stages provides large mitotic-chromosomal configurations comparable to those of some intensely studied mammalian cells. This is even in untreated ordinarily-fixed plankton samples. With pre-fixation treatments commonly used in chromosome research there are possibilities for exacting chromosome studies directly on ichthyoplankton. Methodology is even more easily applied to laboratory-cultured eggs or with on-vessel cultures of eggs stripped from fish caught at sea. In related studies the meiotic metaphase II configuration of ripe unspawned eggs is also observable in light microscope preparations of the egg envelope. This configuration is attached near the micropylar opening in the egg envelope through which the fertilizing sperm enters the egg.

Cytologic, cytogenetic, and embryologic measures were made on about 10,000 early-stage (cleavage through tail-free embryo) Atlantic mackerel (Scomber scombrus) embryos. These were from surface waters at a total of about 80 sites in the pollution-stressed New York Bight. This analysis provides some evidence for field associations between egg health and toxic hydrocarbon and heavy metal pollution of surface water and plankton (May '77 cruise). Station parameters measured on the embryos included: 1) general cell and nuclear state; 2) mitotic index; 3) mitotic-chromosomal abnormalities; 4) cell differentiation difficulties; and 5) gross embryo malformation. Temperature and salinity associated with some of the egg variables though not necessarily in the direction expected.

Estimates of egg moribundity based on cell state, mitotic-chromosomal irregularities, and division arrest at gastrulation and the stage immediately following further show statistically lower egg viability in presumed more impacted Bight areas relative to less impacted areas (May '74 cruise). Generally, there were significant correlations between measures on chronologically related development stages, and in '74 between all stages, excluding cleavage.

Regarded most important presently is demonstration of the feasibility of measuring a technically sublethal effect of pollution directly on a reproductive phase of a fishery resource species.